

Appendix I: Climate Change



Appendix I.1: Climate Change National Legislation, Policy and Guidance

Appendix I.1 Climate Change National Legislation, Policy and Guidance

To satisfy the requirements of the Environmental Impact Assessment (EIA) Regulations, a Greenhouse Gas (GHG) Emissions Assessment and Climate Change Risk Assessment has been undertaken for the Proposed Development. This Appendix sets out the guidance and standards that have been used to inform the scope, methodology, identification of likely significant effects and potential mitigation measures for both assessments.

GHG Emissions Assessment

International Agreements

COP (UNFCCC)

The COP26 summit brought parties together to accelerate action towards the goals of the Paris Agreement and the UN Framework Convention on Climate Change. COP26 increased ambition and action from countries to keep the hope of limiting the rise in global temperature to 1.5°C. Glasgow focused on driving action across the globe on mitigation, adaptation, finance and collaboration.

COP27 was held in Sharm el Sheikh, Egypt, between 6-18th November 2022. Four key themes were identified which were mitigation, adaptation, finance and collaboration. One of the key outcomes was agreement to compensate nations for loss and damage from climate change through establishing a fund.

Paris Agreement 2015

The 2015 Paris Agreement declared a long-term temperature target to strengthen the global response to the threat of climate change. The aim of the agreement is to prevent global temperature rise within *this century to “well below 2 degrees Celsius above pre-industrial levels and to limit the temperature increase even further to 1.5 degrees Celsius”*. This is often referred to as the 1.5 Degree Target.

In 2015 the UK Government signed the Paris Agreement, and in 2016, ratified it. Ratifying the Paris Agreement formally bound the UK to the “*below 2 degrees*” target (which in 2018 was reduced further to the 1.5 Degrees Target) and requires the UK Government to translate that commitment into legislative requirements. Through national legislation, the responsibility to realise the 1.5 Degrees Target disseminates from the UK Government to Local Planning Authorities (LPAs) and, ultimately, developers.

Legislation

Climate Change Act (2008) (2050 Target Amendment) Order 2019

The Climate Change Act (CCA) 2008 established the context for government action on climate change, providing a legally binding framework for the UK to reduce GHG emissions and develop the UK’s ability to adapt to climate change. The CCA 2008 requires the Government to compile a Climate Change Risk Assessment every 5 years and develop a National Adaptation Programme to address risks and opportunities from climate change.

In 2019, the CCA 2008 was amended to include a revision of the previous aim of 80% reduction of GHG emissions compared to 1990 levels by 2050. The CCA 2008 now mandates a net zero target by 2050:

“the net UK carbon account for the year 2050 is at least 100% lower than the 1990 baseline.”

To reach net zero carbon emissions, the UK government has set legally binding carbon budgets, capping the amount of GHG emitted in the UK over a 5-year period.

Carbon Budget Orders 2009, 2011, 2016 and 2021

The Carbon Budget Orders (CBOs) are made in accordance with the duty to set carbon budgets as required by the CCA 2008. The CBOs provide the legal requirement to meet the carbon budgets set out in the table below:

Carbon Budget	Carbon Budget Level	Reduction Below 1990 Level
3 rd carbon budget (2018- 2022)	2,544 MtCO ₂ e	37% by 2020
4 th carbon budget (2023- 2027)	1,950 MtCO ₂ e	51% by 2025
5 th carbon budget (2028- 2032)	1,725 MtCO ₂ e	57% by 2030
6 th carbon budget (2033-2037)	965 MtCO ₂ e	78% by 2035

EIA Regulations 2017

Schedule 4 of the 2017 EIA Regulations requires an Environmental Statement to include:

“4. A description of the factors specified in regulation 4(2) likely to be significantly affected by the development, climate (for example greenhouse gas emissions, impacts relevant to adaptation.)

5. A description of the likely significant effects of the development on the environment resulting from, inter alia:

(f) 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;”.

Policy

National Planning Policy Framework (NPPF) 2023

In terms of planning, addressing climate change is one of the core planning principles which the National Planning Policy Framework (NPPF, updated in 2023) expects plan-making and decision-taking to underpin. The NPPF recognises that planning plays a key role in reducing GHG emissions.

Paragraph 152 states:

“The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure”

Paragraph 154 states:

“New development should be planned for in ways that:

b) can help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards."

Planning Practice Guidance (PPG)

The Planning Practice Guidance (PPG) supports the NPPF. Regarding climate change, the PPG advises how to identify suitable mitigation measures in the planning process to address the impacts of climate change.

Paragraph: 007 Reference ID: 6-007-20140306 discusses how local planning authorities can identify appropriate mitigation measures in plan-making:

"Every area will have different challenges and opportunities for reducing carbon emissions from new development such as homes, businesses, energy, transport and agricultural related development.

...The distribution and design of new development and the potential for servicing sites through sustainable transport solutions, are particularly important considerations that affect transport emissions. Sustainability appraisal should be used to test different spatial options in plans on emissions.

Different sectors may have different options for mitigation. For example, measures for reducing emissions in agricultural related development include anaerobic digestion, improved slurry and manure storage and improvements to buildings. In more energy intensive sectors, energy efficiency and generation of renewable energy can make a significant contribution to emissions reduction."

Clean Growth Strategy

The Clean Growth Strategy, published in 2017, sets out the UK's policies and proposals to accelerate the delivery of increased economic growth and decreased emissions. The strategy aims to improve productivity across the UK to provide the best place for innovators and new businesses to start-up and grow. The Strategy also seeks to deliver on social and economic benefits, including higher quality more efficient buildings, rolling out emissions vehicles, and delivering a diverse and reliable energy mix. Key policies and proposals include: developing green finance capabilities, support businesses to improve energy productivity, set out action plans for industrial decarbonisation, phasing out fossil fuel heating, improve energy efficiency of homes and support low carbon heating, support the update of ultra-low emissions vehicles, support clean energy innovation, and work towards zero avoidable waste.

UK Government Ten Point Plan

The Government's Ten Point Plan for a Green Revolution, published in 2020, sets out a series of points to help the UK build back better after the impact of coronavirus. This includes the following points:

- Point 4: Accelerating the Shift to Zero Emission Vehicles;
- Point 5: Green Public Transport, Cycling and Walking.

This includes targets for carbon savings through a combination of supporting manufacturing and uptake of Electric Vehicles, and delivery of safe and direct cycle and walking networks within England.

Powering our Net Zero Future

The UK Government's Energy White Paper 'Powering our Net Zero Future', published in 2020, builds on the Ten Point Plan to set out a strategy for providing cleaner, greener energy, supporting a green recovery through new green jobs and delivers opportunities to save money on bills for customers. The paper provides an illustrative example of what UK energy use may look like in 2050, which is

anticipated to use more decarbonised electricity and hydrogen, incorporation of Direct Air Carbon Capture and Storage, with a markedly less reliance on oil and gas. Cumulatively, the emissions savings to 2032 from implementing the Energy White Paper will be 230 MtCO₂e. This will be achieved by targeting increase in offshore wind output, deploying, and investing in Carbon Capture, Usage and Storage, growing the installation of electric heat pumps, and developing 5GW of low-carbon hydrogen production capacity by 2030.

Powering Up Britain

After the creation of the Department for Energy Security and Net Zero in February 2023, Powering Up Britain presents the departments approach to energy and net zero, and comprises of *Powering Up Britain: Energy Security Plan*, and *Powering Up Britain: Net Zero Growth Plan*.

The former develops the goals set out in the British Energy Security Strategy and the Net Zero Strategy to ensure secure, economical, and low carbon nature of the energy transition. Focussing on how the UK can hold a competitive position on its long-term decarbonisation trajectory, it is complemented by *Powering Up Britain: Net Zero Growth Plan*, which clarifies how economic opportunities will be employed to enhance the UKs energy security alongside its commitments to net zero.

UK Government Road to Zero

The Road to Zero, published in 2018, sets out the Governments ambitions to reduce emissions associated with the transport industry. This document sets out how the UK Government will reduce emissions from vehicles on the road, promote the uptake of clean vehicles and support the necessary infrastructure, reduce emissions from HGVs and support local action.

Transport Decarbonisation Plan

'Decarbonising Transport A Better, Greener Britain', published in 2021, sets out additional commitments, actions and timings on decarbonising all forms of transport, including measures to increase cycling and walking, and delivering zero emissions buses and coaches, and zero emission fleets of cars, vans, motorcycles and scooters. This document sets out what consultation the Government will undertake to bring these measures forward, key milestones and available funding. The Government will support the delivering of 4,000 new zero emission buses and the infrastructure to support them, a net zero railway network by 2050, stimulate the demand for zero emission trucks, and deliver over £12 billion for decarbonising local transport systems.

Net Zero Strategy 2021

The Net Zero Strategy: Build Back Greener sets out policies and proposals for decarbonising all sectors of the UK economy to meet the net zero target by 2050. The strategy highlights some of the urgent global action, which is required to avoid catastrophic climate change, including ending coal fired power generation, retiring petrol and diesel engines from all cars, and halting deforestation.

Proposals in the Net Zero Strategy include fully decarbonising the UK power system by 2035, setting a path for all new low carbon heating in homes and workplaces from 2035 and removing all road emissions at the tailpipe and kickstarting zero emissions international travel. The UK Government also has the ambition to deploy at least 5 MtCO₂/year of engineered greenhouse gas removals by 2030.

Review of Net Zero

Provoked by the recent transformation to the economic landscape and published in January 2023, Review of Net Zero is an independent evaluation of the governments approach to delivering its commitments to net zero to assess the current trajectory and ensure that the accompanying economic opportunities are being maximised.

Describing net zero as “the growth opportunity of the 21st century” the review acknowledged the widespread changes to the global economy that net zero will result in and encouraged decisiveness within government policy and intervention. Its main recommendations include a 10-year delivery plan for hydrogen energy, enforcement of nature-based solutions, and a review of green transition opportunities within the banking sector.

Local Planning Policy

Rochdale Core Strategy

The Core Strategy was adopted by RBC on 19th October 2016. The policies of the Core Strategy have been superseded by the Places for Everyone Joint Development Plan 2022-2039.

Places for Everyone (PfE) Joint Development Plan

The PfE Plan took effect and become part of the statutory development plan for each of the nine PfE authorities on 21st March 2024. The following policies are relevant to the proposed development.

Policy JP-S7: Resource Efficiency

“The achievement of a circular economy and a zero-waste economy will play a key role in meeting Greater Manchester’s ambition of becoming a leading green city region by 2038. The following measures will help achieve this:

...Using sustainable design and construction techniques to reduce carbon emissions, adapt and future proof to the impact of climate change, reduce and recycle waste and minimise water use.”

Policy JP-S1: Sustainable Development and **JP-S2: Carbon and Energy** are also relevant to the proposed development.

Climate Emergency

In July 2019, RBC declared a climate emergency. This acknowledges that the council have a responsibility to take meaningful action to reduce carbon emissions, alongside preparing the borough for the impacts of a changing climate.

Climate Change Adaptation Supplementary Planning Document (SPD)

RBC published the Climate Change Adaptation SPD in June 2012, to facilitate the implementation of necessary adaptation measures.

The document outlines actions for development to help climate change adaptation under eight broad headings: location, layout and orientation, materials / structure, environmental performance, green roofs and walls, rainwater harvesting, Sustainable Drainage Systems (SUDs) and green and blue infrastructure.

Standards and Guidance

The following standards and guidance documents have been used to inform the carbon scope, methodology, identify likely significant effects and potential mitigation measures.

Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emission and Significance (IEMA, 2022)

The IEMA guidance defines significance of GHG emissions:

“The crux of significance is not whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050.

Often a project will cause a change in GHG emissions compared to the baseline which should be assessed. When setting this impact into context to determine significance, it is important to consider the net zero trajectory in line with the Paris Agreement’s 1.5°C pathway”

World Business Council for Sustainable Development (WBCSD) and World Resources Institute (WRI) Greenhouse Gas Protocol guidance (WBCSD and WRI, 2004)

The Greenhouse Gas Protocol identifies emissions sources as falling under three “scopes”, which are defined to enable GHG accounting and reporting. These scopes are defined below:

- **Scope 1: Direct GHG emissions:** direct GHG emissions occur from sources that are owned or controlled by the company, for example, emissions from combustion in owned or controlled boilers, furnaces, vehicles, etc.; emissions from chemical production in owned or controlled process equipment. GHG emissions not covered by the Kyoto Protocol, e.g. CFCs, NOx, etc. shall not be included in scope 1 but may be reported separately.
- **Scope 2: Electricity indirect GHG emissions:** Scope 2 accounts for GHG emissions from the generation of purchased electricity consumed by the company. Purchased electricity is defined as electricity that is purchased or otherwise brought into the organizational boundary of the company. Scope 2 emissions physically occur at the facility where electricity is generated.
- **Scope 3: Other indirect GHG emissions:** Scope 3 is an optional reporting category that allows for the treatment of all other indirect emissions. Scope 3 emissions are a consequence of the activities of the company, but occur from sources not owned or controlled by the company. Some examples of scope 3 activities are extraction and production of purchased materials; transportation of purchased fuels; and use of sold products and services.

Publicly Available Standard 2080: Carbon Management in Infrastructure (BSI, 2016)

PAS 2080 sets out a carbon management process for the delivery of infrastructure. PAS 2080 defines the life cycle stages of an infrastructure project and the primary sources of GHG emissions. The PAS 2080 life cycle stages have been used in this GHG emissions assessment, as shown in Figure 1 below.

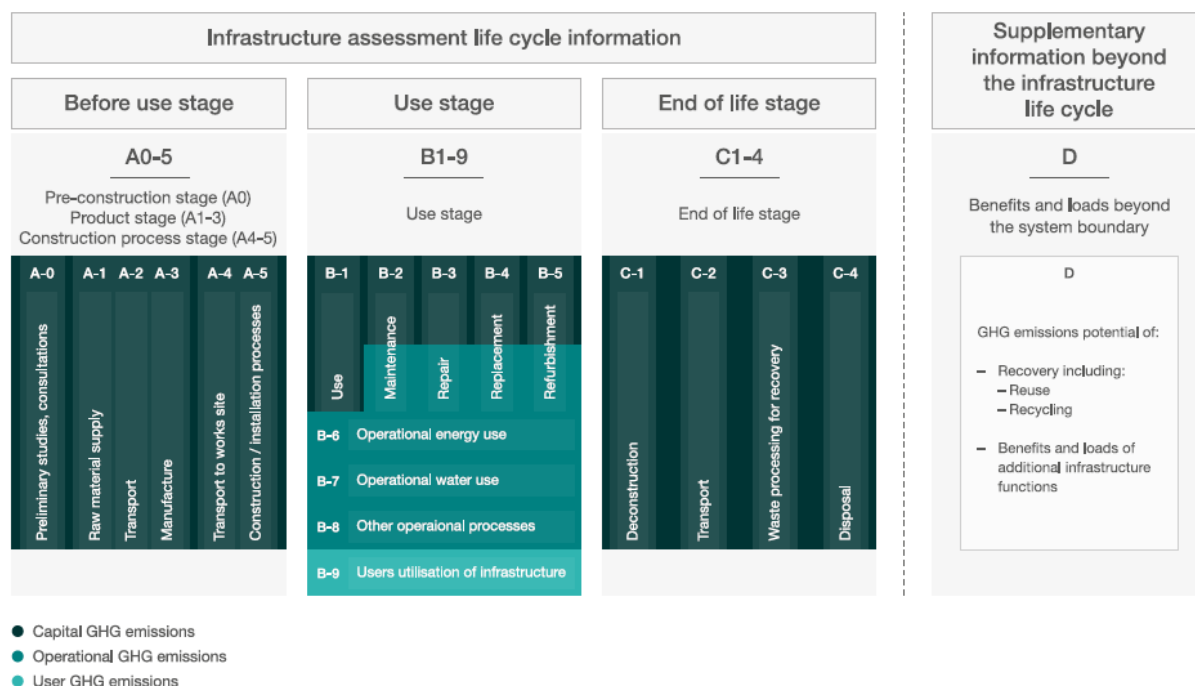


Figure 1: Infrastructure life cycle stages. Copy of PAS 2080 Figure 7.

Climate Change Risk Assessment

Legislation

Climate Change Act (2008) (2050 Target Amendment) Order 2019

The Climate Change Act (CCA) 2008 established the context for government action on climate change, which sets out the requirement to prepare National Adaptation Programmes that set out the actions that government and others will take to adapt to the challenges of climate change in the UK over the next 5 years.

Third National Adaptation Programme (Defra, 2023)

The third national adaptation programme was published by the Department for Environment, Food and Rural Affairs in July 2023 and presents the actions the government will take to adapt to the impacts of climate change from 2023 to 2028. As the government's strategy to address the key risk and opportunities associated with climate adaptation, the following topics are identified: terrestrial and freshwater habitats, soil health, natural carbon stores, food supply, and human health.

Climate Change Risk Assessment 2021

The CCA 2008 also requires Government to prepare a five-yearly assessment of the risks for the UK of the current and predicted impacts of climate change. The UK Climate Risk Independent Assessment (CCRA3), published in 2021, sets out the six priority risk areas requiring further action in the UK. These areas are:

- Risks to the viability and diversity of terrestrial and freshwater habitats and species from multiple hazards;
- Risks to soil health from increased flooding and drought;
- Risks to natural carbon stores and sequestration from multiple hazards leading to increased emissions;

- Risks to crops, livestock and commercial trees from multiple hazards;
- Risks to supply of food, goods and vital services due to climate-related collapse of supply chains and distribution networks;
- Risks to people and the economy from climate-related failure of the power system;
- Risks to human health, wellbeing and productivity from increased exposure to heat in homes and other buildings; and
- Multiple risks to the UK from climate change impacts overseas.

EIA Regulations 2017

Schedule 4 of the 2017 EIA Regulations requires an Environmental Statement to include:

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5. A description of the likely significant effects of the development on the environment resulting from, inter alia:

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Policy

National Planning Policy Framework (NPPF)

In terms of planning, addressing climate change is one of the core planning principles which the National Planning Policy Framework (NPPF, updated in 2023) expects plan-making and decision-taking to underpin. The NPPF recognises that planning plays a key role in minimising vulnerability, providing resilience and managing the risks associated with climate change.

Paragraph 153 states:

“Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure.”

Paragraph 154 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.”

Planning Practice Guidance (PPG)

The Planning Practice Guidance (PPG) supports the NPPF. Regarding climate change, the PPG advises how to identify suitable mitigation and adaptation measures in the planning process to address the impacts of climate change.

Paragraph 004 Reference ID: 6-004-20140612 provides guidance on how adaptation and mitigation approaches should be integrated as follows:

“When [preparing Local Plans and] taking planning decisions local planning authorities should pay particular attention to integrating adaptation and mitigation approaches and looking for ‘win-win’ solutions that will support sustainable development. This could be achieved in a variety of ways, for example:

...through the provision of multi-functional green infrastructure, which can reduce urban heat islands, manage flooding and help species adapt to climate change - as well as contributing to a pleasant environment which encourages people to walk and cycle.

Local planning authorities should be aware of and avoid the risk of maladaptation (adaptation that could become more harmful than helpful).”

Paragraph: 005 Reference ID: 6-005-20140306 provides guidance on dealing with the uncertainty of climate risks when promoting adaptation in particular developments:

“The impact of climate change needs to be taken into account in a realistic way. In doing so, local planning authorities will want to consider:

- identifying no or low cost responses to climate risks that also deliver other benefits, such as green infrastructure that improves adaptation, biodiversity and amenity;
- *building in flexibility to allow future adaptation if it is needed, such as setting back new development from rivers so that it does not make it harder to improve flood defences in future; and*
- *the potential vulnerability of a development to climate change risk over its whole lifetime”*

Local Policy

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“The achievement of a circular economy and a zero-waste economy will play a key role in meeting Greater Manchester’s ambition of becoming a leading green city region by 2038. The following measures will help achieve this:

...Using sustainable design and construction techniques to reduce carbon emissions, adapt and future proof to the impact of climate change, reduce and recycle waste and minimise water use.”

Standards and Guidance

The following standards and guidance documents have been used to inform the climate change resilience and adaptation scope, methodology, identify likely significant effects and potential mitigation measures.

Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation (IEMA, 2020)

The IEMA guidance sets out the factors that the assessment should establish the baseline conditions. IEMA guidance states:

“The current baseline is defined by historic climate conditions and the prevailing conditions at the time of the assessment. ... The practitioner needs to consider a range of factors including:

- *Extremes in short-term weather events that produce sudden shocks that can have substantial effects on some baseline receptors, such as: heat waves; extreme flooding and freezing conditions; gales and hurricane force windstorms; storm surges along coastlines.*
- *Extremes in longer-term climatic variability including: variations in precipitation over one or more seasons resulting in drought or extremely wet conditions; variations in average temperature which might affect receptors reliant on temperature to, for example, time when breeding cycles commence or end (which may be affected by availability of specific food sources); potential changes in prevailing wind directions as the weather system over central Europe changes.*
- *Changes in average climate norms resulting in: sea level rise; increases in freezing/thawing; changes in seasonal rainfall patterns.”*

This guidance has also been used to select the appropriate assessment scenario for defining the future baseline. IEMA guidance states:

“The recommended approach is to use a high emissions scenario, in the UK this would be RCP 8.5”

UKCP18 Guidance: How to use the UKCP18 Land Projections (Met Office, 2018)

The UKCP18 Guidance has been used to determine the correct application of the land projections data and to reference the uncertainty and limitations associated with its use.

“We recommend that you place any analysis using the global, regional and derived projections in the broader uncertainty context of the probabilistic projections, where the information is available.”



Appendix I.2: Summary of Evolving Baseline Climate Projections

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This document summarises the UK Climate Change Projections 2018 (UKCP18), produced by the UK Met Office, under the RCP 8.5 probabilistic land projections for the 25 km grid cell within which the Site is located (387500, 412500). This Appendix presents the climate projections for 2036, 2050, 2075 and 2099. For context, 2023 figures have also been provided.

Average Climatic Norms

Temperature

Figure 1.1 and **Table 1.1** show the projections for annual average mean air temperature. The projections show an almost continuous increase in annual average temperature over the next 80 years.



Annual average Mean air temperature anomaly at 1.5m (°C) for years 1961 up to and including 2099, for grid square 387500, 412500, using baseline 1981-2000, and scenario RCP 8.5, showing the 5th, 10th, 25th, 50th, 75th, 90th and 95th percentiles

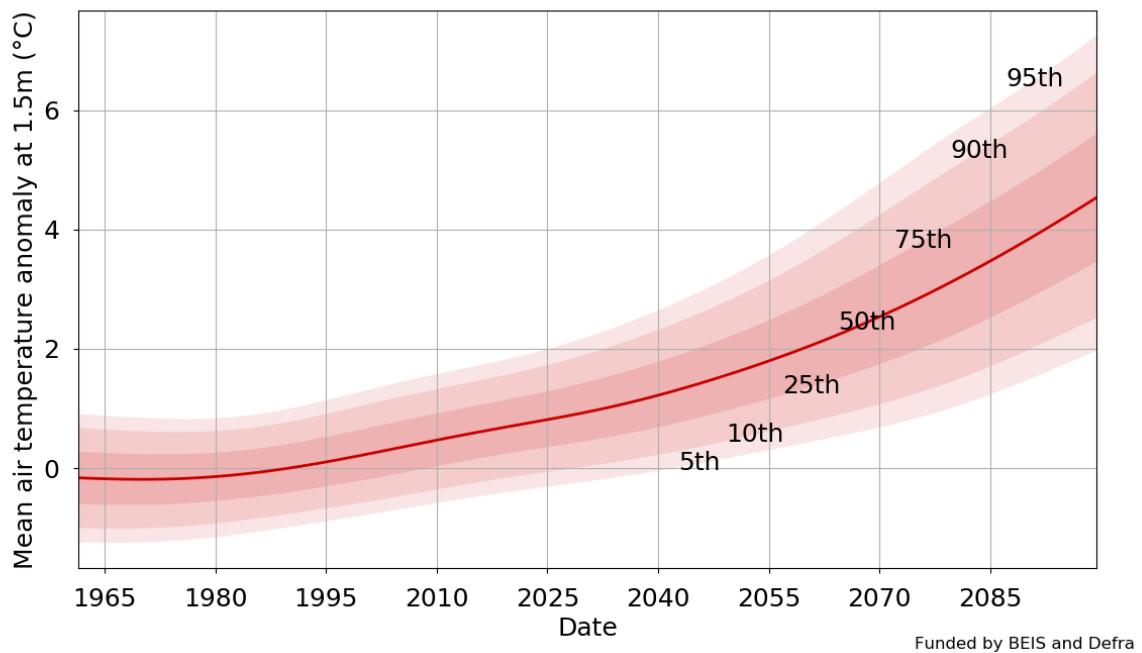


Figure 1.1 Annual average mean air temperature anomaly at 1.5m(°C) for years 1965-2099

Table 1.1: Mean average anomaly at 1.5 m (°C)

Date	Percentile						
	5th	10th	25th	50th	75th	90th	95th
2023	-0.3367	-0.0906	0.3180	0.7770	1.2448	1.6787	1.9430
2036	-0.1144	0.1449	0.5924	1.1070	1.6467	2.1534	2.4640
2050	0.1911	0.4854	1.0017	1.6042	2.2447	2.8598	3.2488
2075	0.8496	1.2670	1.9927	2.8513	3.7770	4.6752	5.2432
2099	1.9677	2.5157	3.4613	4.5348	5.6087	6.6322	7.2484

Precipitation

Figure 1.2 and **Table 1.2** shows the projections for the annual average precipitation rate. The projections show that annual precipitation is likely to vary from year to year, with both increases and decreases over the next 80 years.



Annual average Precipitation rate anomaly (%) for years 1961 up to and including 2099, for grid square 387500, 412500, using baseline 1981-2000, and scenario RCP 8.5, showing the 5th, 10th, 25th, 50th, 75th, 90th and 95th percentiles

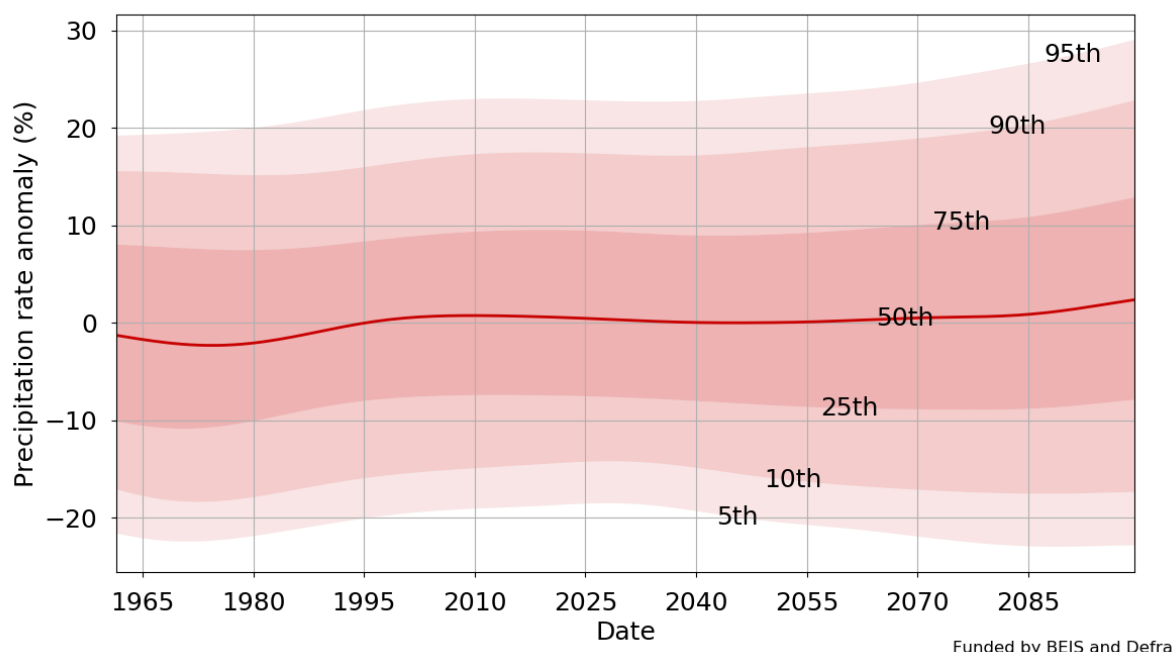


Figure 1.2: Annual average precipitation rate anomaly (%) for years 1965-2099.

Table 1.2: Annual Precipitation rate anomaly (%)

Date	Percentile						
	5th	10th	25th	50th	75th	90th	95th
2023	-18.5934	-14.2994	-7.4999	0.5008	9.4831	17.4105	22.8460
2036	-18.9199	-14.5346	-7.8686	0.0964	9.0369	17.1261	22.6783
2050	-20.3958	-15.9394	-8.4622	0.0202	9.0505	17.7064	23.2531
2075	-22.3805	-17.3159	-8.9109	0.5799	10.2552	19.3187	25.2758
2099	-22.8167	-17.3309	-7.8969	2.3556	12.8352	22.7930	29.9194

Seasonal Changes

Summer

Figure 1.3 and **Table 1.3** show the projections for average summer (June, July, August) maximum air temperature. The projections show an overall increase in maximum temperature over the next 80 years.



Seasonal average Maximum air temperature anomaly at 1.5m (°C) for June July August in years 1961 up to and including 2099, for grid square 387500, 412500, using baseline 1981-2000, and scenario RCP 8.5, showing the 5th, 10th, 25th, 50th, 75th, 90th and 95th percentiles

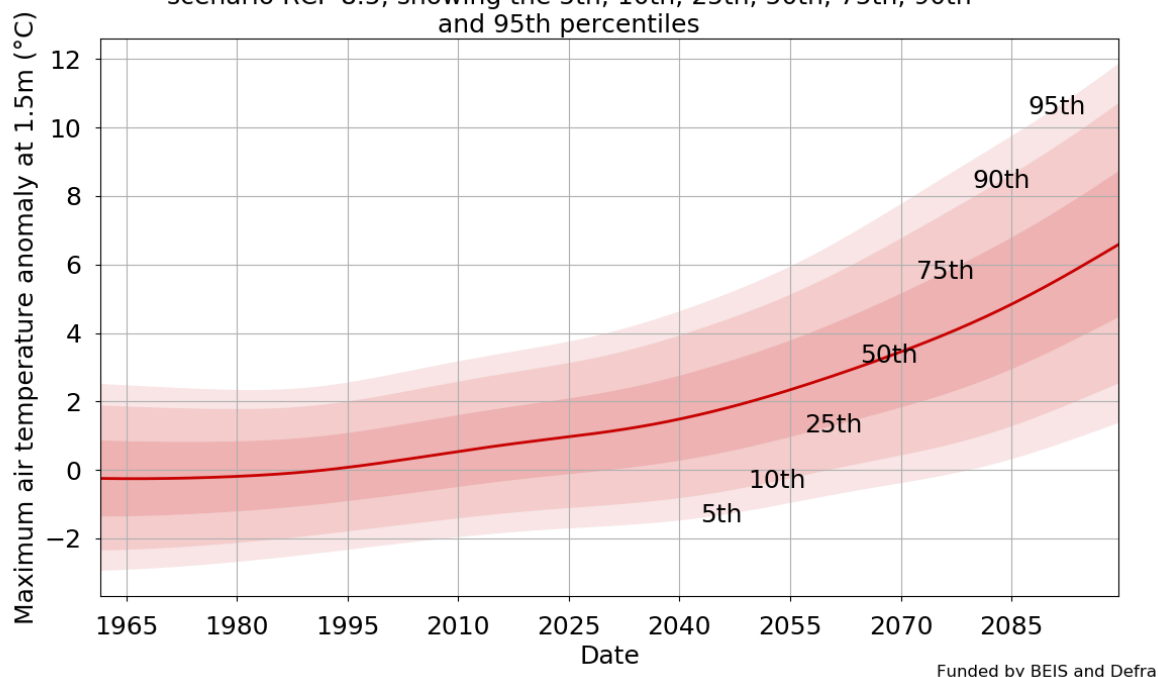


Figure 1.3 Summer average maximum air temperature anomaly at 1.5m (A°C) between 1965-2099.

Table 1.3 Maximum Summer air temperature anomaly at 1.5m (A°C)

Date	Percentile						
	5th	10th	25th	50th	75th	90th	95th
2023	-1.7253	-1.1361	-0.1575	0.9297	2.0415	3.0662	3.6845
2036	-1.5478	-0.9095	0.1565	1.3358	2.5621	3.6964	4.3820
2050	-1.1441	-0.4478	0.7234	2.0512	3.4389	4.7182	5.4986
2075	-0.1733	0.6835	2.1773	3.9136	5.7192	7.4386	8.4955
2099	1.3710	2.5240	4.4572	6.5818	8.7216	10.7062	11.8601

Figure 1.4 and **Table 1.4** show the projections for average summer precipitation rate. The projections show an overall decline in precipitation over the next 80 years.

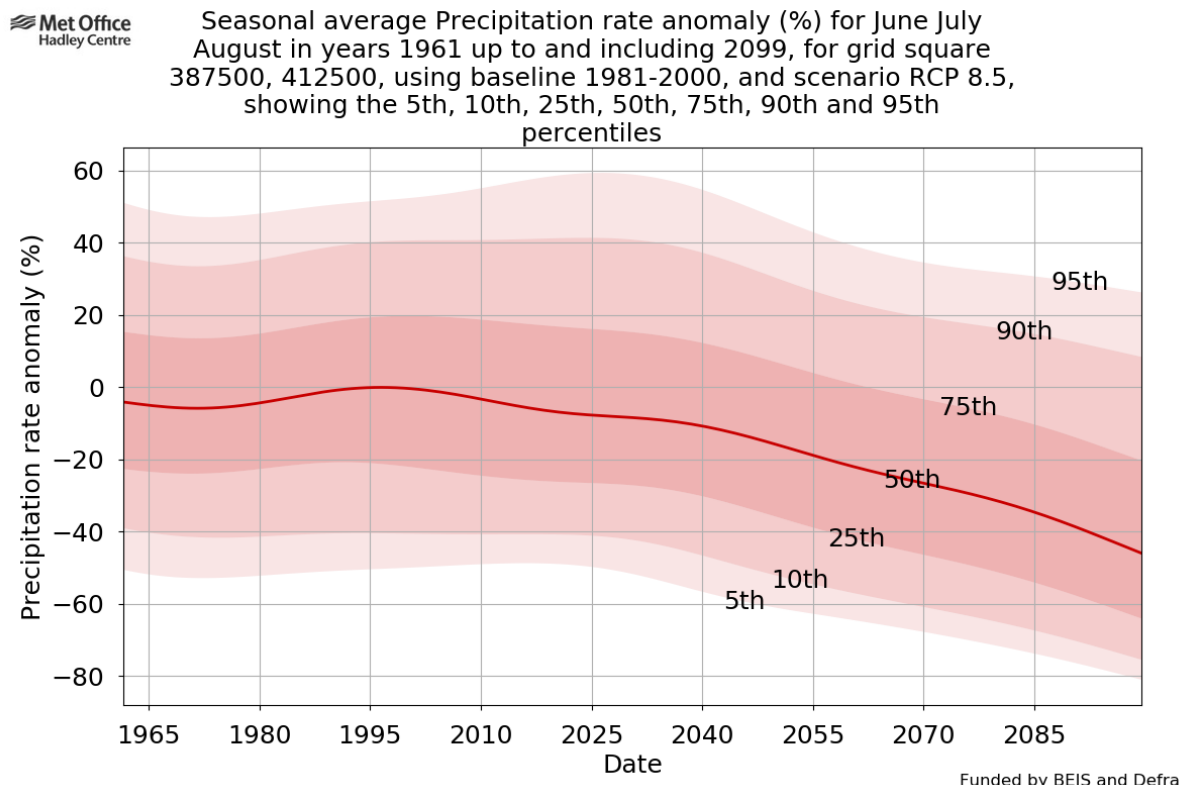


Figure 1.4 Summer average precipitation rate anomaly (%) for years 1965-2099.

Table 1.4: Average Summer Precipitation rate anomaly (%)

Date	Percentile						
	5th	10th	25th	50th	75th	90th	95th
2023	-49.3693	-40.9022	-26.3948	7.4604	16.3800	41.3894	59.2189
2036	-54.7000	-44.6976	-28.6772	-9.5678	13.6667	39.0566	56.7662
2050	-61.2022	52.3317	-36.1269	-16.1179	6.6520	29.9177	46.4633
2075	-69.771	-63.0259	-48.8960	-29.0882	-5.5542	17.7515	32.9044
2099	-80.9537	-75.3994	-64.0143	-45.9137	-20.2746	8.4305	26.2914

Together, the above projections suggest that summers will become warmer and drier. Natural variations may mean that some cooler and/or wet summers will occur.

Winter

Figure 1.5 and **Table 1.5** show the projections for average winter (December, January, February) minimum air temperature. The projections show an overall increase in minimum temperature over the next 80 years.

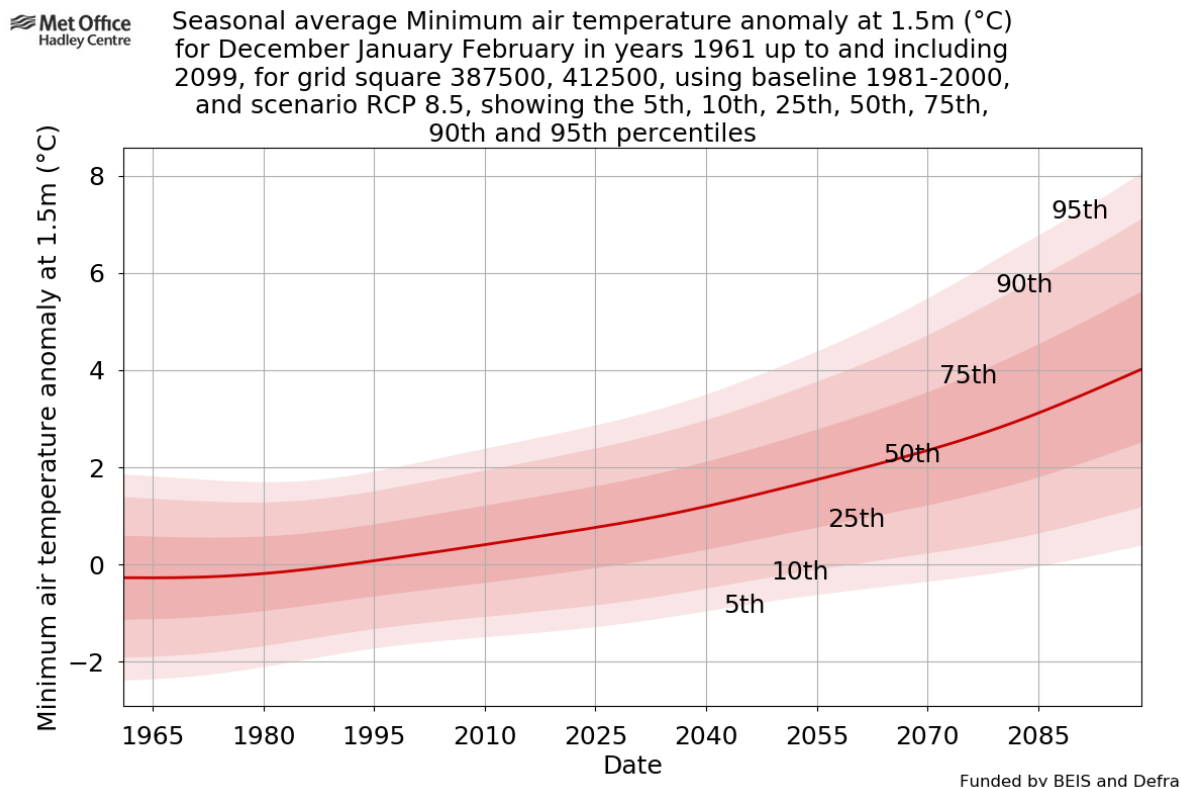


Figure 1.5 Winter average minimum air temperature anomaly at 1.5m (A°C) between 1965-2099.

Table 1.5: Minimum Winter air temperature anomaly at 1.5m (A°C)

Date	Percentile						
	5th	10th	25th	50th	75th	90th	95th
2023	-1.3234	-0.8775	-0.1253	0.7118	1.5537	2.3226	2.7924
2036	-1.0653	-0.6038	0.1874	1.0636	1.9593	2.7926	3.2910
2050	-0.7335	-0.2353	0.6045	1.5553	2.5442	3.4813	4.0661
2075	-0.2679	0.3417	1.3837	2.5769	3.8472	5.0968	5.8984
2099	0.3841	1.1776	2.5079	4.0178	5.6185	7.1110	8.0591

Figure 1.6 and **Table 1.6** shows the projections for average winter precipitation rate. The projections show an overall increase in precipitation over the next 80 years.



Seasonal average Precipitation rate anomaly (%) for December January February in years 1961 up to and including 2099, for grid square 387500, 412500, using baseline 1981-2000, and scenario RCP 8.5, showing the 5th, 10th, 25th, 50th, 75th, 90th and 95th percentiles

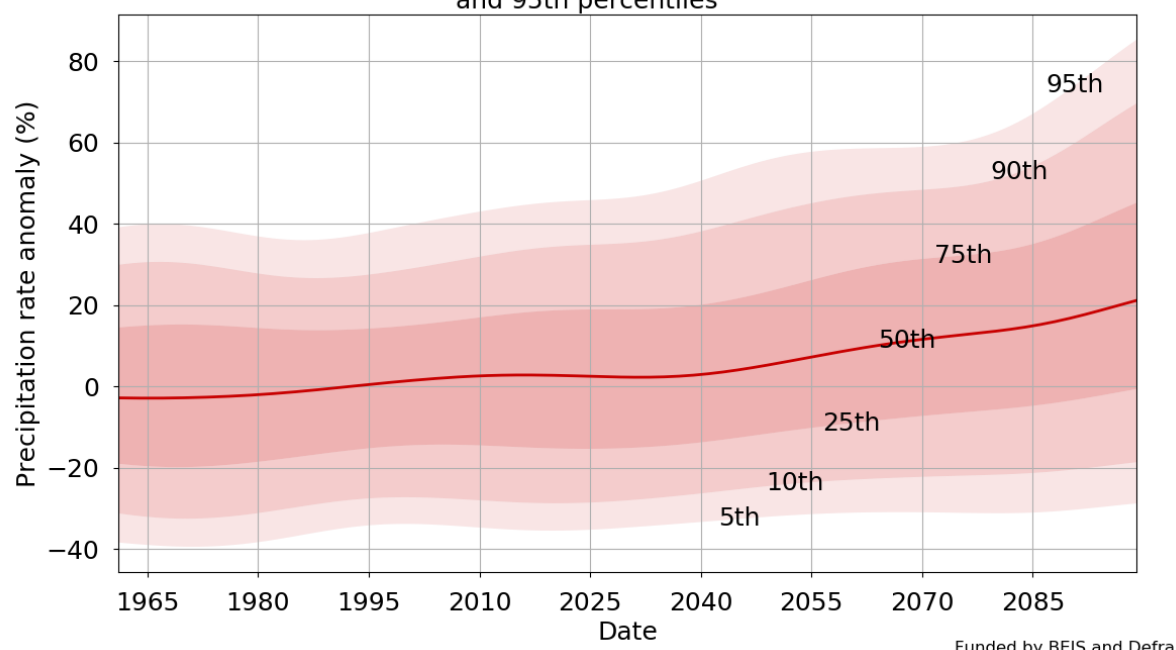


Figure 1.6 Winter average precipitation rate anomaly (%) between 1965-2099

Table 1.6: Average Winter Precipitation rate anomaly (%)

Date	Percentile						
	5th	10th	25th	50th	75th	90th	95th
2023	-35.3479	-28.6428	-15.3115	2.6049	18.8753	34.6734	45.636
2036	-33.8655	-27.0376	-14.459	2.4342	19.3441	36.5754	48.4060
2050	-31.9016	-24.3097	-11.3369	5.5789	23.7647	42.9565	56.1431
2075	-31.0522	-21.942	-6.4411	12.6119	31.1300	49.1455	59.9780
2099	-28.7482	-18.6092	-0.6252	21.1396	45.1345	69.5525	85.2079

In the UK, the heaviest snowfalls tend to occur when the air temperature is between zero and 2°C¹. There is less certainty in the magnitude of change to snow occurrence and amount, although climate models do show a downward trend in both falling and lying snow over time.

Together, the above projections suggest that winters will become milder and wetter. Natural variations may mean that some cold and/or dry winters may still occur.

¹ <https://www.metoffice.gov.uk/weather/learn-about/weather/types-of-weather/snow/how-does-snow-form>