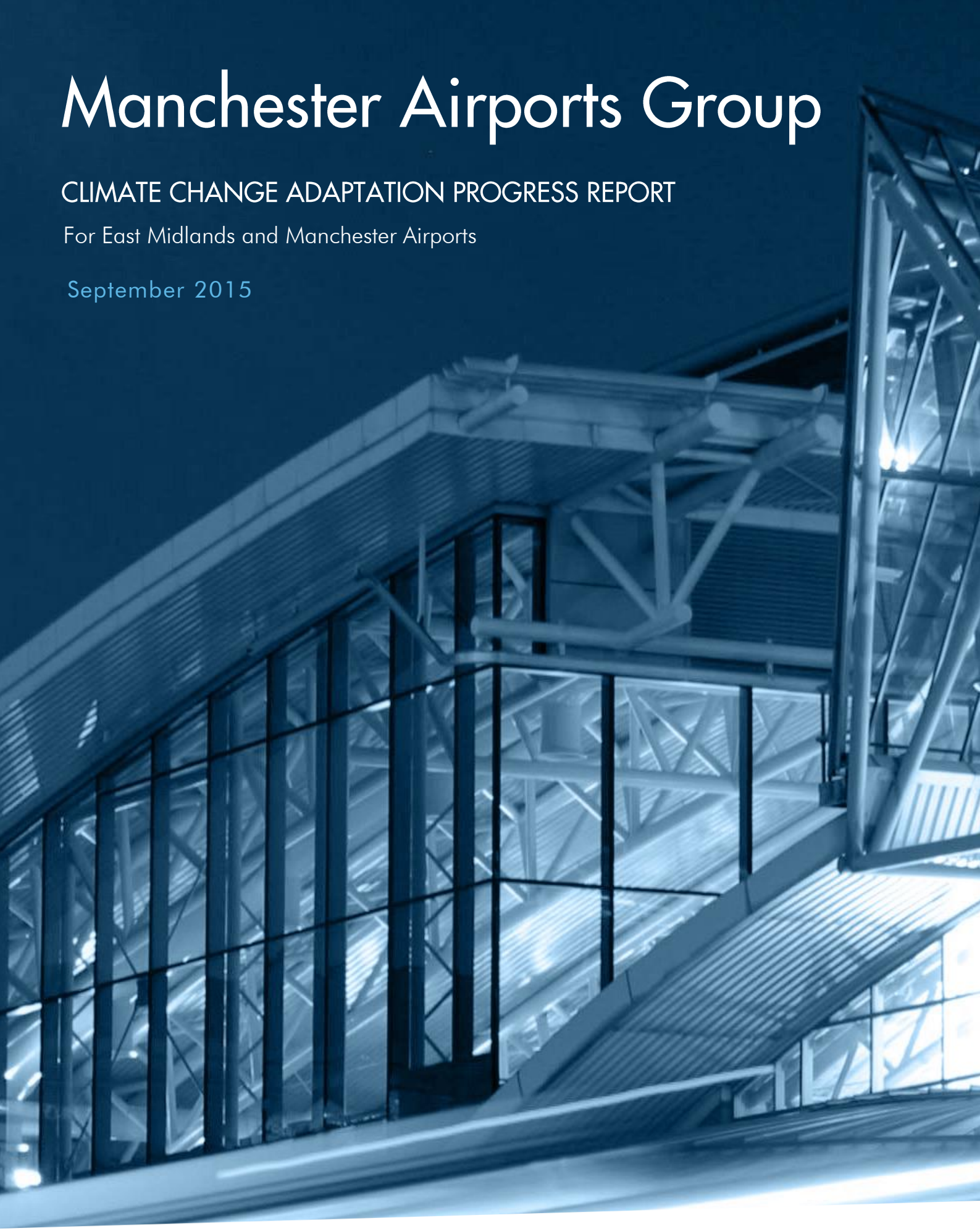
Manchester Airports Group

CLIMATE CHANGE ADAPTATION PROGRESS REPORT

For East Midlands and Manchester Airports

September 2015



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September 2015

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INTRODUCTION

Purpose and scope

In 2011 Manchester Airports Group (M.A.G) produced our first Climate Change Adaptation Report for East Midlands Airport and Manchester Airport.

Fulfilling a voluntary commitment, and later regulatory requirement, our 2011 report identified risks posed to East Midlands Airport and Manchester Airport by a changing climate. As well as assisting our business in preparing for climate change, our submission to the Department for Environment, Food and Rural Affairs (Defra) contributed to Government's first round of national adaptation reporting. This process considered East Midlands Airport and Manchester Airport due to their importance to the national economy and to the transportation of people and cargo.

Ahead of an update to national adaptation reports, Defra have requested voluntary progress reports from organisations which were required to submit earlier adaptation reports.

This report outlines the progress made at East Midlands Airport and Manchester Airport since 2011 and should be read in conjunction with the original report[1].

As well as preparing for climate change we are also engaged in climate change mitigation. We have wide ranging environmental programmes which reduce energy demands and generate or source energy from renewable sources. To this end, we achieved carbon neutrality in our ground operation at East Midlands Airport in April 2012 and will follow at Manchester Airport this year. Although this progress report focuses exclusively on climate change adaptation, information regarding our climate change mitigation activities can be found in the M.A.G Corporate Social Responsibility Report[2].

[1] Climate change adaptation reports submitted to Government by M.A.G and other reporting organisations are available online at: https://www.gov.uk/government/publications/adaptation-reporting-power-received-reports

[2] Our Corporate Social Responsibility report is published annually, and available online at: http://www.magworld.co.uk/magweb.nsf/Content/CSRHome

Manchester Airports Group

We are a leading UK based airport company – serving the whole community. M.A.G is the largest UK-owned airport operator, serving more than 48 million passengers and handling 600,000 tonnes of air freight every year, through our ownership and operation of Manchester, London Stansted, East Midlands and Bournemouth airports. M.A.G also includes the commercial property company, M.A.G Property, which has £571m property assets across our four airports and is leading the £650m major Enterprise Zone development, Airport City, at Manchester.

We also run thriving businesses in car parking, airport security, fire fighting, engineering, advertising and motor transport. We strongly support the Government's commitment to the principles of sustainable development in the aviation industry, striking a balance between economic, social and environmental considerations.

M.A.G is privately managed on behalf of its shareholders, who include IFM Investors (35.5% ownership), Manchester City Council (35.5% ownership) and the other 9 Greater Manchester Councils (29% ownership).

East Midlands Airport

East Midlands Airport connects over 4 million passengers each year with more than 80 leisure and business destinations, ranging from Glasgow to Geneva and Fuerteventura to Florida. The airport supports a range of charter and scheduled flights and is also an important part of the European low cost network as a major base for operators including Ryanair and Jet2.com. In cargo terms, East Midlands Airport handles more than 300,000 tonnes each year and is the second busiest cargo airport in the UK after London Heathrow. The airport is the UK base for three of the major global integrated freight airlines (DHL, UPS and TNT) and the largest air hub of Royal Mail.

East Midlands Airport is in a strategic location in the centre of the UK with direct access to the national motorway system, with 90% of England and Wales within a 4 hour lorry drive. The airport's location and its catchment area provide an opportunity for future growth and the development of passenger and cargo operations.

East Midlands Airport makes a major economic contribution to the local economy, particularly the three cities of Nottingham, Leicester and Derby. The airport is estimated to generate some £239m of gross value added (GVA) annually. The airport is also the largest single employment site in Leicestershire with 6,730 people employed on the site in a range of businesses.

Manchester Airport

Manchester Airport is the third busiest airport in the UK, and the largest outside London, handling some 22 million passengers in 2014. Over 100 airlines serve more than 200 destinations from the airport, including many which are only served in the UK from London or Manchester – such as Singapore, Hong Kong, Washington, Philadelphia, Boston and Los Angeles. Manchester is the only airport in the UK other than London Heathrow to have two full-length runways but also significant spare capacity. It is estimated that there are over 22 million people that live within a two hour travel-time of Manchester Airport. The airport's scale, location and the strength of its catchment area provide significant opportunities for future growth and development.

As the global gateway to the north of England, the airport is also an important part of the North West and the Greater Manchester economy. The benefits that the airport brings are in the form of passenger and cargo connectivity, economic activity, inward investment, tourism and in direct and indirect employment. Manchester Airport is estimated to contribute some £918m of GVA to the Northern Powerhouse. The airport is an important employment generator. It supports 20,600 direct on-site jobs with a further 45,000 jobs in the wider region that are directly attributable to the airport's operation

PROGRESS IN ADAPTING FOR CLIMATE CHANGE

Overview

Since our first round adaptation report was prepared, we have made significant progress in preparing our business for climate change.

We recognise that climate change should not be considered in isolation or responded to by us alone. To this end, our understanding of interdependencies in relation to climate change has significantly advanced. At both East Midlands Airport and Manchester Airport we actively contribute to local Resilience Development Groups and Resilience Forums. These strategically important platforms are supported by the Department for Communities and Local Government and the Environment Agency.

In addition to our work to prepare for climate change at a regional level, at Manchester Airport we have worked with Eurocontrol to develop a European specification for Collaborative Environmental Management (CEM) at airports[3]. Manchester was subsequently the first European airport to sign up to this specification and our CEM Group has been active for several years. This group includes the airport, airlines, handling agents and air traffic control and has already delivered environmental improvement projects and actively discussed climate change adaptation. Following the success of CEM at Manchester we have committed publically, through our 2015 Sustainable Development Plan[4], to form a similar group at East Midlands Airport.

The concept of climate change is now firmly embedded within all areas of our business. Kick started by the risk workshops held in 2011 as part of our first round adaptation report, leaders within the business have developed an awareness of climate change and are now considering its implications on their area of the business on a day-to-day basis. This concept is lead from the top of our business through our Chief Strategy Officer who chairs the Transport Sub Group of the Greater Manchester Low Carbon Hub – the group tasked by the Association of Greater Manchester Authorities to prepare Greater Manchester for the unavoidable effects of climate change.

Our 2011 adaptation report identified a number of actions required in order to prepare our business for a changing climate, or for us to better understand the likely impact of climate change. We have made significant progress against these actions, and this is discussed later.

We have also maintained our climate change risk registers, and have reviewed our assessment of climate change risk at both East Midlands Airport and Manchester Airport. This has been achieved through risk workshops which engaged colleagues from across our businesses. Since our first round adaptation report, we have updated our climate change risk register to reflect changes to our business processes for risk and assurance, to reflect progress against previously identified actions, changes at our airports and development in our understanding of climate change.

[3]Details of the Eurocontrol Collaborative Environmental Management specification are available online at: https://www.eurocontrol.int/articles/collaborative-environmental-management-cem-specification

[4]Our Sustainable Development Plan sets out the high level strategic objectives for growth and development at East Midlands Airport, it is available online at: http://www.eastmidlandsairport.com/developmentplan

Reviewing our assessment of climate change risk

In spring 2015 workshops were held with business stakeholders at East Midlands Airport and Manchester Airport to review our 2011 climate change risk registers.

Participants from key areas of the business were asked to review risks previously identified, and to consider any new climate change risks. The basis of the review was the UK Climate Impacts Programme (UKCIP) 'UKCIP09' climate change projections previously used as part of our first round adaptation report. These and the later 2010 UKCIP weather projections are summarised in Table 1 and 2.

East Midlands Airport			Manchester Airport	
2020's	2050's		2020's	2050's
		Temperature (°C)		
1.3	1.9	Winter average	1.2	1.9
1.4	2.3	Summer average	1.5	2.6
1.9	3.1	Summer daily max.	1.9	3.3
		Pricipitation (mm or %)		
5	11	Winter average	6%	13%
-6	-12	Summer average	-8%	-18%

Table 1. UKCIP09 Climate change projections considered by us in the preparation of our climate change risk registers.

Variable	Change
Storms	No change.
Wind-speed	Very small changes to seasonable average wind speed. Summer: $<0.2ms^{-1}$ reduction Winter: No change
Fog	Winter/spring: >50% decrease in fog events Autumn: 10-30% decrease in fog events Summer: Large decrease in fog events
Lightning	Winter: Similar Summer: Increase from average of 2-3 days lightning to 4-5 days
Snow	Days of snowfall: Autumn/spring: >70% less Winter: 40-70% less Heavy snow events: Spring: >40% reduction Autumn/winter: >80% reduction

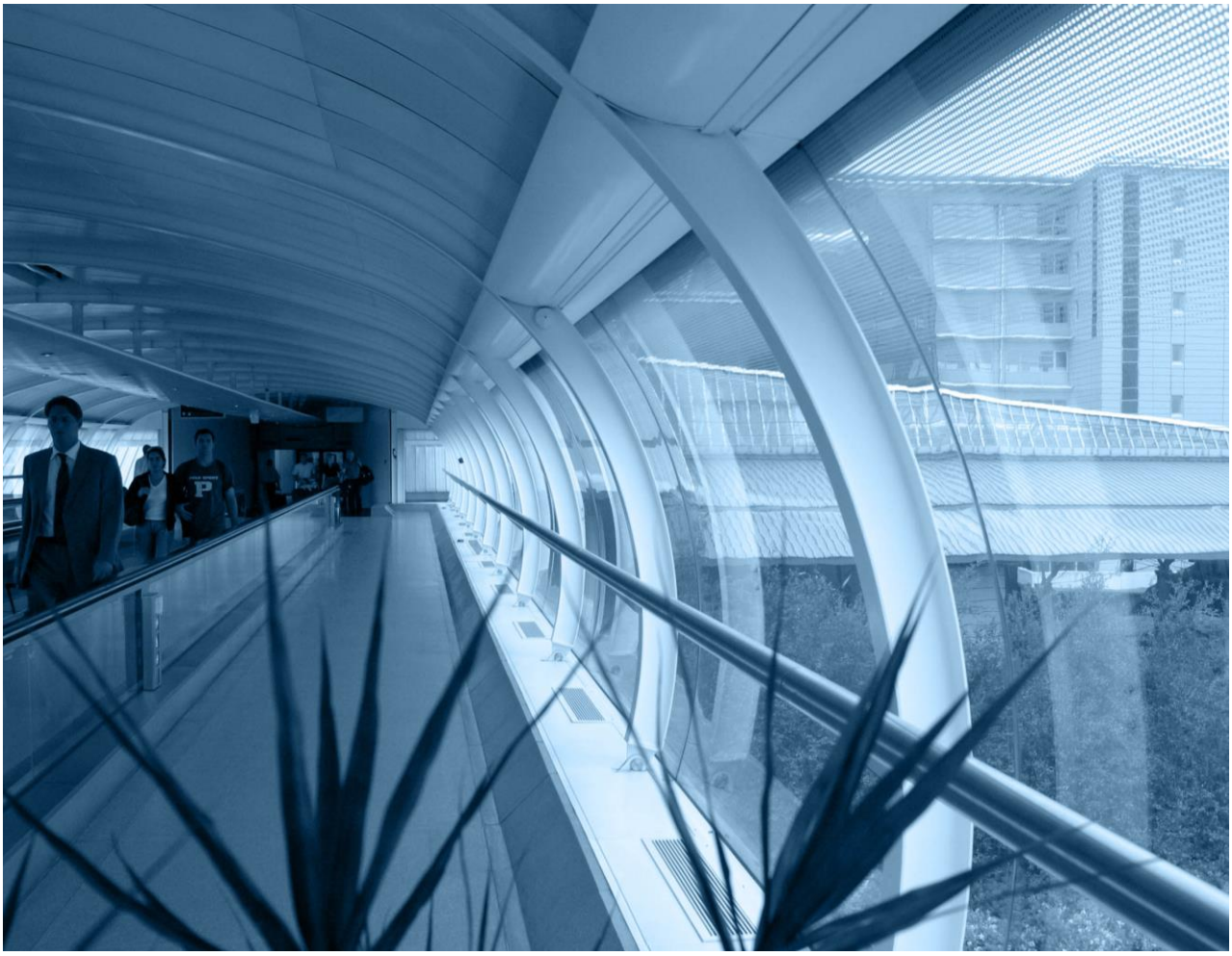
Table 2. UKCIP Climate change projections for storms, wind-speed, fog, lightning and snow considered by us in the preparation of our climate change risk registers.

Changes to our corporate risk and assurance processes are reflected in our updated risk registers. Our risk assessment processes have significantly changed since the first round adaptation report was prepared. Specifically, our assessment now considers impact and likelihood of potential risk consequences on a scale of 1 (minimal) to 5 (critical). Because the impact and likelihood scores for each risk are multiplied to calculate risk exposure the maximum exposure rating for any risk is now 25. Our 2011 register considered impact and likelihood on a scale of 0 to 10. The maximum exposure any risk can record has therefore reduced from 100 to 25.

Our risk registers also now consider risk on both a gross and net basis. This dual assessment is particularly helpful to this progress report as the net risk reflects our assessment of the benefit our actions are expected to have.

In 2011 some risks were not quantitatively assessed. This is because they were considered to be low. Our 2015 workshops considered previously unscored risks against the current risk assessment methodologies, so all risks are now scored.

Our 2015 climate change adaptation risk registers for East Midlands Airport and Manchester Airport are included as appendices 1 and 2 respectively.



East Midlands Airport 2015 climate change risk register

Participants in the workshops identified little change to the risks of most significance to the business. These continue to be the impact of changes to rainfall on the capacity of our drainage systems. The risk posed to underground utilities by increased ground movement was regarded as relatively high in the short term, this is because several instances of damage to underground utilities have already occurred and work is required to resolve vulnerabilities.

No new risks were identified.

When reviewing the 2011 risk assessment, stakeholders at East Midlands Airport took the opportunity to rationalise the number of risks. It was agreed that a number of similar risks should be combined and recorded as a single entry in the 2015 risk register. For example, it was considered that the impact of increased temperatures on the comfort of passengers within buildings and the impact of increased temperatures on the comfort of staff within buildings should be viewed as one rather than two risks.

Four risks were removed from the risk register following extensive discussion at the workshop. These included risks relating to:

- UV degradation of materials and equipment;
- Warmer temperatures requiring aircraft to make a longer take off run;
- Cabin comfort on board aircraft; and
- Increased de-icing requirements.

Manchester Airport 2015 climate change risk register

The workshops recorded similar significant risks to those identified in 2011, however the progress made in regards to the management of surface water recorded a reduced exposure to the business. The risk of aircraft cabins overheating whilst on stand during warm weather was highlighted. This risk was not scored in 2011 but was felt to be significant at this review due to the increasing size of aircraft and range of flights operating from Manchester Airport resulting in longer turn-around times for some aircraft.

No new risks were identified.

As at East Midlands Airport, participants in the Manchester Airport risk assessment workshop identified a number of similar risks they felt should be combined.

Stakeholders decided that two risks should be removed from the risk register. These included the risk of:

- Pollution from a build-up of debris in pipework; and
- Increased requirements for de-icing activities.

Required actions

Following the approach taken in our first round adaptation report, new actions were assigned one of three categories:

- Watching brief –
  To to be maintained in the short term using the latest information on climate projections and the situation at the airport;

- Action –
  Identify what actions are needed to adapt to a climate change risk ; and

- Investigate –
  A risk to more fully understand it, associated impacts, likelihood and it to be taken to a risk.

Details of our new adaptation actions are included in our risk registers.

Progress against previously identified actions

The progress we have made towards fulfilling the actions detailed in our first round climate change adaptation report is discussed below. Actions identified at East Midlands Airport and Manchester Airport are considered seperately.

As a result of the long term nature of the timeframes considered by our risk assessment, and because of the uncertainties highlighted in our first round climate change adaptation report, it was not appropriate to set specific completion dates for the actions identified.

Some of the actions we previously identified have now been closed, and others remain open.

Progress against actions identified at East Midlands Airport

Action	Consider future climate variables in proposed runway refurbishment project to reduce risk of airfield surface and sub-surface structural damage to runway and aprons from extreme heat.
Progress	The anticipated refurbishment project has been reprogrammed. The action identified remains relevant, and was discussed at the 2015 risk assessment workshop. The action was retained and will be addressed when the project is delivered.
Current status	Action open.

Action	Look at requirement to increase surface water drainage system capacity to reduce the risk of changes in flow rates of surface water discharges and increased demand for balancing capacity as a result of increased winter rainfall.
Progress	Modelling of the surface water drainage system is being undertaken. We have also introduced commitments to our 2015 Sustainable Development Plan that ensure we include adequate attenuation for future developments and also review drainage capacity with consideration for proposed developments and the impacts of climate change.
Current status	Action open.

Investigate	Look in more detail at the risk posed by increased winter rainfall leading to changes to the water table, subsidence and water ingress to underground services.
Progress	Annual surveys of the airfield have been commissioned. These have not identified any areas where ground movement has occurred. We have undertaken condition surveys on utility supplies to the terminal and identified actions required to improve resilience of this supply. This action was discussed in our 2015 workshops, it was decided that this action should be closed and two new actions opened to mitigate this risk.
Current status	Investigation closed.

Investigate	Research the risk of a changing climate leading to an increase in disease vectors at the airport, resulting from a change in their distribution.
Progress	Work has been undertaken at Manchester Airport to better understand this risk. Progress is reported later, against the same action at Manchester Airport.
Current status	Investigation open.

Investigate	To maintain passenger and staff comfort within airport buildings, investigate thresholds for new heating, ventilation and air-conditioning plant and equipment against predicted temperature increases during the asset's lifetime. Amend specifications if required.
Progress	This is a long term project to better understand the thresholds witin buildings so that they can be amended to maintain comfort when climate change occurs. This action was discussed at the risk assessment workshop and remains open.
Current status	Investigation open.

Investigate	Consider the impact of aircraft noise and warmer summer temperatures on neighbouring residents to fully understand the risk, existing controls and those that may be required.
Progress	Significant progress has been made in reducing aircraft noise, both through the introduction of quieter aircraft and by implementing operational techniques which minimise noise. As such, the area impacted by aircraft noise has reduced, and accordingly the number of people. We are currently working to develop a trial which will assess ways in which our existing sound insulation grants scheme could be adapted to mitigate this risk.
Current status	Investigation open.

Progress against actions identified at Manchester Airport

Action	**Prepare a business case to increase capacity of the surface water drainage system, to accommodate anticipated changes to winter rainfall.**
Progress	The models we use to understand capacity within our drainage systems have been reviewed and updated, including consideration for climate change and expected developments at the airport. We are now aware of the areas where additional capacity may be required, and business cases can be prepared to facilitate this when appropriate. We have also implemented some key actions to provide additional capacity, these include contributions to the work United Utilities have undertaken to increase regional resilience through their strategic plan. We have also upgraded our systems to increase the rate at which we can discharge to the sewer, and to ensure that all uncontaminated water is diverted away from the public sewer and returned to natural watercourses. We have also agreed a contingency plan with the Environment Agency which delivers a release valve within the system in the event that rainfall exceeds anticipated rates.
Current status	Action open.

Investigate	**Look in more detail at the risk posed by increased winter rainfall leading to changes to the water table, subsidence and water ingress to underground services.**
Progress	We have not recorded any occasions where this risk has materialised. During the 2015 risk workshops the risk was reviewed and downgraded. The action has now been closed and a watching brief assigned.
Current status	Investigation closed.

Investigate	**Research the risk of a changing climate leading to an increase in disease vectors at the airport, resulting from a change in their distribution.**
Progress	We have working with our partners at the University of Salford, University of Central Lancashire and local Environmental Health Officers to investigate this risk. We have undertaken surveys at the airport to better understand mosquito populations and the suitability of the airport as mosquito habitat. These identified areas within and around the airport where mosquitos are present. We will continue to monitor this risk moving forward.
Current status	Investigation open.

Investigate	To maintain passenger and staff comfort within airport buildings, investigate thresholds for new heating, ventilation and air-conditioning plant and equipment against predicted temperature increases during the asset's lifetime. Amend specifications if required.
Progress	This is a long term project to better understand the thresholds witin buildings so that they can be amended to maintain comfort when climate change occurs. This action was discussed at the risk assessment workshop and remains open. We recently announced significant re-development of the terminals at Manchester Airport[5], this project will consider the requirements of the new terminal and any climate change impacts.
Current status	Investigation open.

Investigate	Consider the impact of aircraft noise and warmer summer temperatures on neighbouring residents to fully understand the risk, existing controls and those that may be required.
Progress	Work has been undertaken at East Midlands Airport to better understand this risk. Progress is reported above, against the same action at East Midlands Airport.
Current status	Investigation open.

[5] Details of our £1bn Manchester Airport Transformation Programme are available online at www.mantp.co.uk

INTERDEPENDENCIES

Our first round adaptation report identified a number of interdependencies. These were considered as part of our 2015 climate change risk register review. Atendees of the risk workshops did not identify any further interdependencies and felt those detailed in our first round climate change adaptation report remain relevant.

Our understanding of the collaborative approach required to enable our airports to fully prepare for climate change has significantly advanced. At Manchester Airport we have developed a better understanding of how our climate change adaptation actions will impact upon other stakeholders, and the roles other stakeholders have in enabling us to prepare for a changing climate. Our collaborative approach to environmental management has greatly assisted this learning. We will continue to develop existing relationships, and through our Sustainable Development Plan have committed to create similar platforms for knowledge sharing at East Midlands Airport. We will also continue to support regional resilience forums.

At a Group level, M.A.G contributes to climate change adaptation discussions within the wider industry. Our membership of Sustainable Aviation and Airports Council International enable us to share our learning and reflect on actions taken by others. We also have strong links with National Air Traffic Services (NATS) and Eurocontrol who are responsible for the movement of aircraft within the UK and Europe respectively.

MONITORING AND REVIEW

The risk registers for both East Midlands Airport and Manchester Airport contribute to our corporate assessment of risk. An overall assessment of the risk climate change poses to M.A.G is included within our corporate risk register. This ensures that climate change risk is discussed at the highest level within the organisation.

We plan to undertake a full review of our climate change adaptation risk registers in five years. If new information becomes available sooner, or if newer climate change projections are published by Government we will undertake our review at an earlier time.

In the interim period, progress against the actions identified in our climate change adaptation risk registers will be regularly reviewed.

CLIMATE CHANGE ADAPTATION RISK REGISTERS

Appendix 1 – East Midlands Airport climate change adaptation risk register

East Midlands Airport - Climate Change Adaptation Risk Register

Version 5.1 | September 2015

Risk No	Airport	Business Unit	Risk Owner	Climate variable	Risk Narrative	Consequences	Gross Risk Short term - 2020s			Gross Risk Medium/long term - 2050s			Control Strategy	Net Risk Short term - 2020s			Net Risk Medium/long term - 2050s			Further Actions (if required) (including owner & timescale)
							Impact	Likelihood	Exposure	Impact	Likelihood	Exposure		Impact	Likelihood	Exposure	Impact	Likelihood	Exposure	
CCA021	EMA	Assets	Asset Management Director	Summer temperature	**Thermal expansion of temporary building infrastructure**, such as concrete and steel, leading to failures and reduced longevity	- Financial costs to repair/replace affected infrastructure - Operational disruption - Airport closure	3	1	3	3	1	3	- Maintenance programme - Additional spend may be required	1	1	1	1	1	1	Watching brief
CCA022	EMA	Assets	Asset Management Director	Summer temperature	**Airfield surface and sub-surface structural damage** to runway and aprons caused by extreme heat *Runway surface buckling has already occurred during extreme high summer temperatures - risk rated for this*	- Financial costs to repair damage - Operational disruption - Airport closure - Reputational damage - Consequential damage	3	1	3	3	1	3	- Runway, taxiway and apron maintenance programme - Inspections	3	1	3	3	1	3	Action: CCA022.2011.1 - Consider future climate variables in proposed runway refurbishment project
CCA023	EMA	Assets	Asset Management Director	Summer temperature	**Landside surface and sub-surface structural damage** to bitumous surfaces, such as car parks, landside roads caused by extreme heat *Tarmac loses integrity above 32°C. Structural failures and reduced longevity. Some impact during hot spells*	- Financial costs to repair damage - Operational disruption - Reputational damage	1	1	1	1	1	1	- Maintenance programme - Additional spend may be required	1	1	1	1	1	1	Watching brief
CCA024	EMA	Assets	Asset Management Director	Summer temperature Summer rainfall Winter rainfall	**Increased ground movement**, leading to: - instability of surrounding objects / buildings / structures - damage to underground infrastructure (drainage and utility pipes, cables and chambers) - changes to tree stability *Risk expected due to warmer, dryer summers and increased variance between summer and winter water levels* *Short term 2020 exposure reflects age of infrastructure at time of assessment*	- Financial costs to repair damage / replace affected asset - Operational disruption - Airport closure - Health & Safety incident - Reputational damage	3	3	9	1	2	2	- Maintenance programme - Completion of Civil Aviation Authority 'CAP 232' annual airside survey - Additional spend may be required	1	2	2	1	2	2	Investigate: CCA024.2015.1 - Consider assessment of existing condition of underground utility infrastructure Action: CCA024.2015.2 - Escalation of issues identified during annual 'CAP 232' survey to Head of Engineering CCA024.2015.3 - Revise and adapt maintenance regime as required
CCA025	EMA	Assets	Asset Management Director	Summer rainfall Winter rainfall	**Release of contaminated surface water** as a result of storm event exceeding balancing capacity *Requirement to hold water due to de-icer contaminants*	- Regulatory notification/fines - Reputational damage - Restriction of future development	2	3	6	3	4	12	- Surface water drainage system - Capacity study undertaken for consideration of future site development	1	1	1	1	1	1	Action: CCA025.2011.1 - Look at requirement to increase surface water drainage system capacity CCA025.2015.1 - Investigate requirement to increase surface water drainage system capacity for developments, deliver capacity where requirement identified. CCA025.2015.2 - Deliver sustainable drainage solutions as part of future site developments
CCA026	EMA	Assets	Asset Management Director	Winter rainfall	**Inadequate site drainage system capacity,** due to increased demand from changes in flow rates of surface water discharges. Key drainage includes: - runway and apron - car parks	- Operational disruption due to excess surface water - Restriction of future development	2	3	6	2	3	6	- Surface water drainage system - Capacity study undertaken for consideration of future site development	1	1	1	1	1	1	Action: CCA026.2015.1 - Model future developments and implement controls where requirement identified CCA026.2015.2 - Deliver sustainable drainage solutions as part of future site development.
CCA027	EMA	Assets	Airfield Technical Manager	Winter rainfall	**Flood damage to aircraft navigation systems/buildings and instrument landing system (ILS),** leading to equipment shut down due water exposure and/or unavailability of critical navigational aid systems	- Financial costs to repair/replace equipment - Operational disruption - Reduced aircraft movements	2	1	2	2	1	2	- Regular equipment monitoring of known wet and boggy areas - Daily checks - Maintenance regime - Equipment installed on higher ground to mitigate against water damage	2	1	2	2	1	2	Watching brief
CCA028	EMA	Assets	Airfield Technical Manager	Summer rainfall Winter rainfall	**Extremities of wet & dry affecting ground reflection of navigation aids** *Extreme raising and lowering of water table, leading to incorrect instrument landing system (ILS) beam formation and possible shut down of ILS equipment*	- Financial costs to repair/replace equipment - Operational disruption - Reduced aircraft movements	1	1	1	1	1	1	- Equipment monitoring - Daily checks - Maintenance regime - Business Continuity processes in place	1	1	1	1	1	1	Action: CCA028.2015.1 - Develop Performance Based Navigation (PBN) arrival and departure routes as part of future airspace strategy.
CCA029	EMA	Operations	Senior Fire Officer	Summer temperature Summer rainfall Lightning	**Greater fire risk** due to hotter, dryer summers and increased incidence of lightning in summer *Grass and vegetation fires could cause poor visibility due to fire smoke and possible fire damage to outlying structures. Risk of fires off airport site impacting upon aircraft operations to/from the airport*	- Financial costs for damage caused - Operational disruption - Health & Safety incident	3	1	3	3	1	3	- Onsite fire brigade - Fire hydrants - Airfield and landscape management plans and activities	1	1	1	1	1	1	Watching brief
CCA030	EMA	Assets	Engineering Manager	Summer temperature Summer rainfall	**Increased build up of rubber on runway** *Requirement to maintain appropriate friction level*	- Operational disruption due to runway closure - Runway excursion - Health & Safety incident/accident	3	1	3	3	1	3	- Runway inspections regime - Rubber removal contractor retained	1	1	1	1	1	1	Action: CCA030.2015.1 - Revise and adapt runway inspection regime as required.
CCA031	EMA	Operations	Operations Director	Summer temperature Winter temperature Summer rainfall Winter rainfall	**Increase in disease vectors** at the airport resulting from changes to their distribution, leading to tropical and other diseases *E.g West Nile Virus*	- Increased staff absence - Operational disruption	1	2	2	1	2	2	- Regular liaison with Port Health - Occupational Health department	1	1	1	1	1	1	Investigate: CCA031.2011.1 - Research this risk in more detail to more fully understand the risk, existing controls and those that may be required

East Midlands Airport - Climate Change Adaptation Risk Register

Version 5.1 | September 2015

Risk No	Airport	Business Unit	Risk Owner	Climate variable	Risk Narrative	Consequences	Gross Risk Short term - 2020s			Gross Risk Medium/long term - 2050s			Control Strategy	Net Risk Short term - 2020s			Net Risk Medium/long term - 2050s			Further Actions (if required) (including owner & timescale)
							Impact	Likelihood	Exposure	Impact	Likelihood	Exposure		Impact	Likelihood	Exposure	Impact	Likelihood	Exposure	
CCA032	EMA	Operations	Health & Safety Manager	Summer temperature Winter rainfall	**Health & wellbeing of outside workers.** Failure to exercise appropriate duty of care for outside workers caused by changes in climate *Such as increased protection for outside workers e.g. breaks, sun protection, de-icing*	- Increase in Health & Safety incidents/accidents - Reputational damage	1	1	1	1	2	2	- Occupational Health department	1	1	1	1	1	1	Watching brief
CCA033	EMA	Operations	Operations Director	Summer temperature	**Decrease in passenger and staff comfort** within airport terminals caused by inadequate cooling systems	- Decline in revenue and passenger numbers - Reputational damage - Increased staff absence - Increase in Health & Safety incidents/accidents	1	2	2	1	3	3	- Existing heating, ventilation and air-conditioning systems - Capital funding secured for replacement of chiller during 2015 - Maintenance regime of chilling infrastructure - Air handling unit upgraded - Conformance to 'BREEAM' standards	1	1	1	1	1	1	Investigate: CCA033.2011.1 - Thresholds for new plant and equipment against predicted temperature increases during the asset's lifetime. Amend specifications if required, install alternative equipment if requirement identified.
CCA034	EMA	Operations	Community Relations Manager	Summer temperature	**More residents' windows open, particularly at night**, leading to greater disturbance from aircraft operations	- Requirement for additional noise mitigation - Operational restrictions imposed - Reputational damage	1	2	2	2	2	4	- Noise Action Plan - Current Sound Insulation Grants Scheme	1	1	1	1	1	1	Investigate: CCA034.2011.1 - Research this risk in more detail to more fully understand the risk, existing controls and those that may be required
CCA035	EMA	Assets	Engineering Manager	Summer rainfall	**Pollution of local watercourses** due to debris accumulated in pipework during longer dry spells being washed out	- Regulatory notification/fines - Reputational damage	1	1	1	1	1	1	- Water quality monitoring and review programme - Maintenance of key parts and equipment	1	1	1	1	1	1	Watching brief
CCA036	EMA	Assets	Engineering Manager	Summer temperature Winter temperature Summer rainfall Winter rainfall	**Changes to airfield habitats and wildlife control**	- Changes to bird populations causing additional management of wildlife - Health & Safety incident - Reputational damage	3	1	3	3	1	3	- Wildlife and airfield grassland management plan in place - Habitat management regime in line with Civil Aviation Authority 'CAP 772' requirements	1	1	1	1	1	1	Action: CCA036.2015.1 - Revise and adapt Landscape management regime as required.
CCA037	EMA	Assets	Operations Director	Winter rainfall	**Increase in rainfall and heavy rain events** causes additional exposure to airfield related safety events due to: - Reduced visibility - Icy or wet conditions	- Operational disruption due to drainage capacity - Aircraft/vehicle collision - Health & Safety incident - Costs to meet additional de-icing volume requirements	3	1	3	3	1	3	- Winter operations plan and activities - Airfield safety plan and activities	1	1	1	1	1	1	Watching brief
CCA038	EMA	Finance	Financial Controller	Lightning	**Increase in lightning events** leading to: - asset damage due to strike/fire - decrease in ground handling agents operational performance - Decrease in airfield/airspace availability	- Operational disruption caused by decrease in aircraft movements - Increased insurance claims - Reputational damage - H&S incident	3	1	3	3	1	3	- Existing operational controls - Increased insurance claims - Reputational damage - Health & Safety incident - Legal claims against the group	1	1	1	1	1	1	Watching brief
CCA039	EMA	Operations	Environment Manager	Summer temperature	**Increase in local air quality pollutants**, such as ozone	- Environmental damage due to increase in pollutants - Restrictions on future planning & development activity	1	1	1	1	1	1	- Airport air quality monitoring for range of pollutants in place - Airport emissions reduction plan	1	1	1	1	1	1	Watching brief

Appendix 2 – Manchester Airport climate change adaptation risk register

Manchester Airport - Climate Change Adaptation Risk Register

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Risk No	Airport	Business Unit	Risk Owner (Head of)	Climate variable	Risk Narrative	Consequences	Gross Risk Short term - 2020s			Gross Risk Medium/long term - 2050s			Existing Controls	Net Risk Short term - 2020s			Net Risk Medium/long term - 2050s			Further Actions (if required) (including owner & timescale)
							Impact	Likelihood	Exposure	Impact	Likelihood	Exposure		Impact	Likelihood	Exposure	Impact	Likelihood	Exposure	
CCA001	MAN	Assets	Asset Management Director	Summer temperature	**Thermal expansion of building infrastructure**, such as concrete and steel, leading to failures and reduced longevity	- Financial costs to repair/replace affected infrastructure - Operational disruption - Airport closure	3	1	3	3	1	3	- Maintenance programme. Structures can cope with projected climate variable - Conformance with building regulations will consider climate change for all future builds	1	1	1	1	1	1	Action: CCA001.2015.1 - Ensure specifications considers future climate change predictions.
CCA002	MAN	Assets	Asset Management Director	Summer temperature	**Airfield surface and sub-surface structural damage** to runway and aprons caused by extreme heat	- Financial costs to repair damage - Operational disruption - Airport closure - Reputational damage - Consequential damage	3	1	3	3	1	3	- Runway inspections carried out to ensure safe operations. - Structures can cope with projected climate variable	2	1	2	2	1	2	Watching brief
CCA003	MAN	Assets	Asset Management Director	Summer temperature	**Landside surface and sub-surface structural damage** to bitumous surfaces, such as car parks, landside roads caused by extreme heat *Tarmac loses integrity above 32°C. Structural failures and reduced longevity. Some impact during hot spells*	- Financial costs to repair damage - Operational disruption - Reputational damage	3	1	3	3	1	3	- Maintenance programme. - Additional spend may be required	3	1	3	3	1	3	Watching brief
CCA004	MAN	Assets	Asset Management Director	Summer temperature Summer rainfall Winter rainfall	**Increased ground movement**, leading to: - instability of surrounding objects / buildings / structures *Risk expected due to warmer, dryer summers and increased variance between summer and winter water levels*	- Financial costs to repair damage / replace affected asset - Operational disruption - Airport closure - Health & Safety incident - Reputational damage	1	1	1	1	1	1	- Maintenance programme. - Additional spend may be required	1	1	1	1	1	1	Watching brief
CCA005	MAN	Assets	Asset Management Director	Summer temperature Summer rainfall Winter rainfall	**Increased ground movement due to clay soil changes** on which the airport is built, leading to: - damage to underground infrastructure (drainage and utility pipes, cables and chambers) *Risk expected due to warmer, dryer summers and increased variance between summer and winter water levels* *Short term 2020 exposure reflects age of infrastructure at time of assessment*	- Financial costs - Regulatory notification/fines - Reputational damage	3	1	3	3	1	3		1	1	1	1	1	1	Watching brief
CCA006	MAN	Assets	Asset Management Director	Winter rainfall Summer Rainfall	**Release of contaminated surface water** as a result of storm event exceeding balancing capacity *Requirement to hold water due to de-icer contaminants*	- Regulatory notification/fines - Reputational damage - Restriction of future development - Operational disruption due to excess surface water, resulting in reduced runway capacity	2	4	8	2	4	8	- Surface water drainage system, but already can reach capacity - Input to United Utilities strategic plan, as they handle surface water from the airport when contaminated with winter de-icing chemicals - Upgraded our surface water systems to increase the rate at which we can discharge to the sewer - Modified our drainage system to ensure that all uncontaminated water is diverted away from the public sewer and returned to natural watercourses, reducing the impact of rainfall events on our drainage infrastructure - Agree a contingency plan with the Environment Agency which delivers a release valve within the system in the event that rainfall exceeds anticipated rates	2	2	4	2	2	4	Action: CCA006.2011.1 - Prepare a business case to increase capacity of surface water drainage system balancing ponds CCA006.2015.1 - Consider surface water capacity as part of Modernising Manchester Airport project CCA006.2015.2 - Consider standard design requirements as part of future development design criteria
CCA007	MAN	Assets	Engineering Operations Manager	Winter rainfall	**Flood damage to aircraft navigation systems/buildings,** leading to equipment shut down due water exposure and/or unavailability of critical navigational aid systems	- Financial costs to repair/replace equipment - Operational disruption - Reduced aircraft movements	2	1	2	2	1	2	- Equipment monitoring - Flood detection - Daily checks - Maintenance regime - Design requirements consider potential impacts of flooding	2	1	2	2	1	2	Watching brief
CCA008	MAN	Operations	Head of Airfield Strategy & Compliance	Summer rainfall Winter rainfall	**Extremities of wet & dry affecting ground reflection of navigation aids, surface movement radar and air traffic control surveillance equipment** *Extreme raising and lowering of water table, leading to incorrect instrument landing system (ILS) beam formation and possible shut down of ILS equipment*	- Financial costs to repair/replace equipment - Operational disruption - Reduced aircraft movements - Increase in potential safety incidents	1	1	1	1	2	2	- Equipment monitoring - Daily checks - Maintenance regime - Safety management system to reflect climate change	1	1	1	1	1	1	Action: CCA008.2015.1 - Incorporate climate change as part of reviews undertaken with ANSP. CCA008.2015.2 - Develop Performance Based Navigation (PBN) arrival and departure routes as part of future airspace strategy.
CCA009	MAN	Operations	Head of Airfield Operations	Summer temperature Summer rainfall Lightning	**Greater fire risk** due to hotter, dryer summers and increased incidence of lightning in summer *Grass and vegetation fires could cause poor visibility due to fire smoke and possible fire damage to outlying structures. Risk of fires off airport site impacting upon aircraft operations to/from the airport*	- Financial costs for damage caused - Operational disruption - Health & Safety incident	3	1	3	3	1	3	- Onsite fire brigade - Fire hydrants - Airfield and landscape management plans and activities	1	1	1	1	1	1	Watching brief
CCA010	MAN	Operations	Head of Airfield Operations	Summer temperature Summer rainfall	**Increased build up of rubber on runway** *Requirement to maintain appropriate friction level*	- Operational disruption due to runway closure - Runway excursion - Health & Safety incident/accident	1	1	1	1	1	1	- Runway inspections regime - Friction monitoring undertaken - Rubber removal contractor retained	1	1	1	1	1	1	Watching brief

Manchester Airport - Climate Change Adaptation Risk Register

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Risk No	Airport	Business Unit	Risk Owner (Head of)	Climate variable	Risk Narrative	Consequences	Gross Risk Short term - 2020s			Gross Risk Medium/long term - 2050s			Existing Controls	Net Risk Short term - 2020s			Net Risk Medium/long term - 2050s			Further Actions (if required) (including owner & timescale)
							Impact	Likelihood	Exposure	Impact	Likelihood	Exposure		Impact	Likelihood	Exposure	Impact	Likelihood	Exposure	
CCA011	MAN	Operations	Head of Environment	Summer temperature Winter temperature Summer rainfall Winter rainfall	**Increase in disease vectors** at the airport resulting from changes to their distribution, leading to tropical and other diseases *E.g West Nile Virus*	- Increased staff absence - Operational disruption	1	2	2	1	2	2	- Port Health services at the Airport - Occupational health department	1	2	2	1	2	2	Investigate: CCA011.2011.1 - Research this risk in more detail to more fully understand the risk, existing controls and those that may be required
CCA012	MAN	Health and Wellbeing	Head of Health & Safety	Summer temperature Winter rainfall	**Health & wellbeing of outside workers.** Failure to exercise appropriate duty of care for outside workers caused by changes in climate *Such as increased protection for outside workers e.g. breaks, sun protection, de-icing*	- Increase in Health & Safety incidents/accidents - Reputational damage	1	1	1	1	2	2	- Occupational health department	1	1	1	1	1	1	Watching brief
CCA013	MAN	Assets	Engineering Operations Manager	Summer temperatures	**Decrease in passenger and staff comfort** within airport terminals caused by inadequate cooling systems	- Decline in revenue and passenger numbers - Reputational damage - Increased staff absence - Increase in Health & Safety incidents/accidents	1	2	2	1	3	3	- Existing heating, ventilation and air-conditioning systems - Ongoing maintenance programme undertaken	1	1	1	1	1	1	Investigate: CCA013.2011.1 - Thresholds for new plant and equipment against predicted temperature increases during the asset's lifetime. Amend specifications if required. Action: CCA013.2015.1 - Identify and incorporate climate change requirement for future design standards.
CCA014	MAN	Corportate Affairs	Community Relations Manager	Summer temperatures	**More residents' windows open, particularly at night**, leading to greater disturbance from aircraft operations	- Requirement for additional noise mitigation - Operational restrictions imposed - Reputational damage	2	2	4	2	2	4	- Noise Action Plan - Night Noise Policy - Current Sound Insulation Grants Scheme	1	1	1	1	1	1	Investigate: CCA014.2011.1 - Research this risk in more detail to more fully understand the risk, existing controls and those that may be required
CCA015	MAN	Assets	Engineering Operations Manager	Summer temperature Summer rainfall Winter temperature Winter rainfall	**Changes to airfield habitats and wildlife control**	- Changes to bird populations causing additional management of wildlife - Health & Safety incident - Reputational damage	2	1	2	2	1	2	- Wildlife and airfield grassland management plan in place - Habitat management regime in line with Civil Aviation Authority 'CAP 772' requirements	1	1	1	1	1	1	Action: CCA015.2015.1 - Revise and adapt Habitat Management regime as required.
CCA016	MAN	Operations	Head of Airfield Operations	Winter rainfall	**Increase in rainfall and heavy rain events** causes additional exposure to airfield related safety events due to: - Reduced visibility - Icy or wet conditions	- Operational disruption due to drainage capacity - Aircraft/vehicle collision - Health & Safety incident - Costs to meet additional de-icing volume requirements	1	1	1	1	1	1	- Winter operations plan and activities	1	1	1	1	1	1	Watching brief
CCA017	MAN	Operations	Head of Airfield Operations	Lightning	**Increase in lightning events** leading to: - asset damage due to strike/fire - decrease in ground handling agents operational performance - Decrease in airfield/airspace availability	- Operational disruption caused by decrease in aircraft movements - Increased insurance claims - Reputational damage - H&S incident	3	1	3	3	1	3	- Existing operational controls - Increased insurance claims - Reputational damage - Health & Safety incident - Legal claims against the group	1	1	1	1	1	1	Watching brief
CCA018	MAN	Operations	Head of Environment	Summer temperatures	**Increase in local air quality pollutants**, such as ozone	- Environmental damage due to increase in pollutants - Restrictions on future planning & development activity	1	1	1	1	1	1	- Airport air quality monitoring for range of pollutants in place. - Airport emissions reduction plan	1	1	1	1	1	1	Watching brief
CCA019	MAN	Operations	Head of Airfield Operations	Summer temperature	**Longer aircraft take-off run** due to 'thin air' and reduced aircraft engine efficiency	To continue to operate, aircraft increase power settings for take-off which increases fuel use and noise. Aircraft also reduce payload. Some aircraft may not be able to operate.	1	1	1	1	1	1	- Cost of increasing runway length high. - Payload restrictions on hotter days only.	1	1	1	1	1	1	Action: CCA019.2015.1 - Review historic data and identify potential issues for escalation.
CCA020	MAN	Operations	Head of Airfield Operations	Summer temperature	**Reduced cabin comfort on-board aircraft during turnaround**	Warmer temperatures will require increased use of aircraft's auxiliary power unit (APU) or installation of pre-conditioned air (PCA). Installation of PCA by us is a significant project and investment. APU use currently discouraged for noise and emissions reasons	2	2	4	2	3	6	- Liaison between ourselves and airlines through groups such as Airport Operators Committee and Flight Operators Safety Committee.	1	1	1	1	1	1	Watching brief