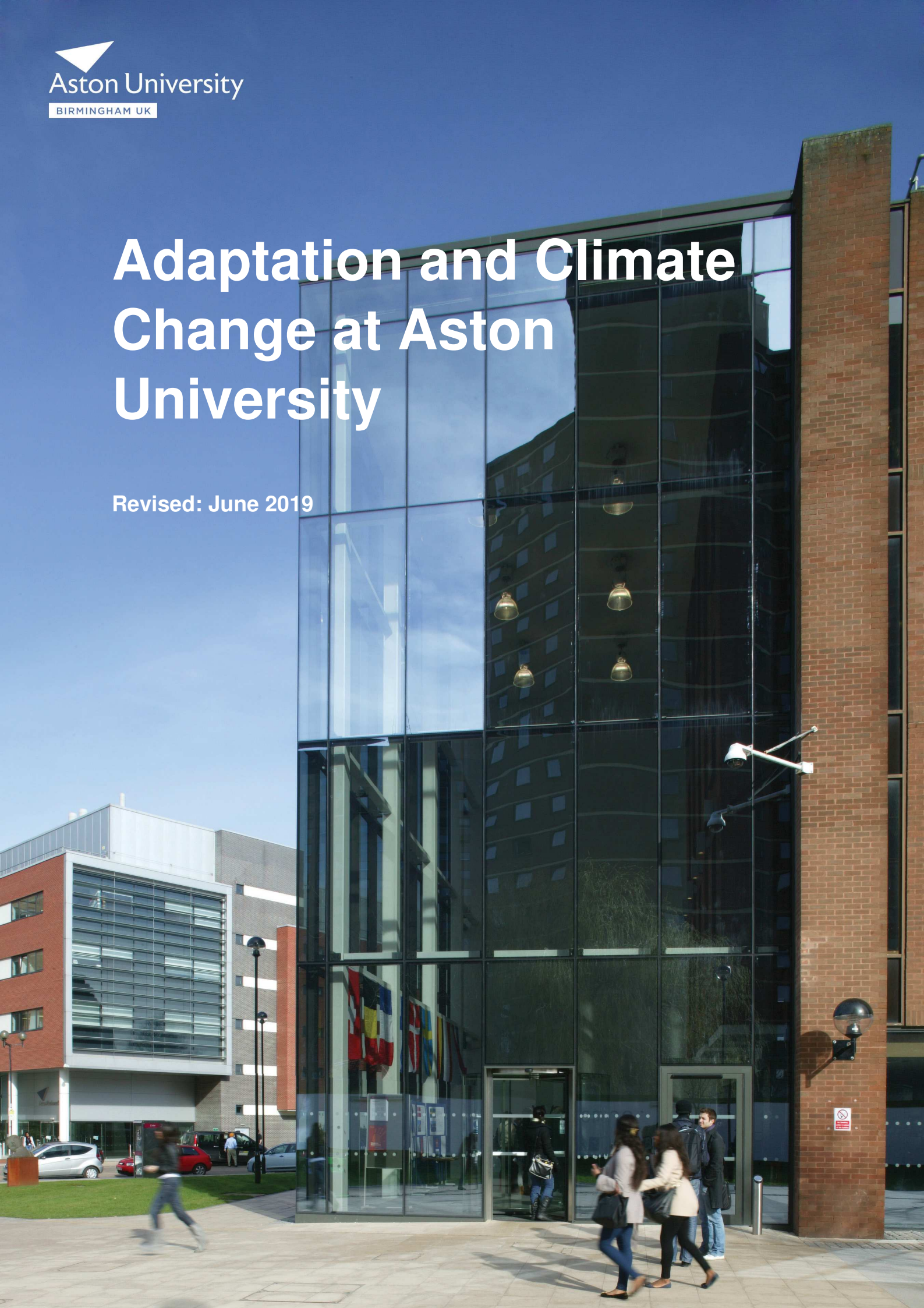
Aston University
BIRMINGHAM UK

Adaptation and Climate Change at Aston University

Revised: June 2019



Summary

Climate change is one of the greatest and costly challenges we all face. Aston University is already making strong progress towards reducing its reliance on fossil fuels through mitigation. However, even if we were to completely end our carbon emissions today the climate would continue to change for about 30 years, thanks to our historic emissions and a lag in the climate system.

The earth's climate is changing so that there will be more frequent and intense extreme weather events than we have been used to in the past. Current extreme weather will no longer be exceptional, but will become the norm and Aston University needs to be aware of this and prepared to adapt to new circumstances.

Aston's Climate Change Adaptation Action Plan has been developed to help the University prepare for the impacts of climate change. The Action Plan focuses on the risks and opportunities within various functions that make up Birmingham including;

- Built and critical infrastructure
- Business and the economy
- Community
- Health and wellbeing

By outlining the strategic processes for developing and embedding evidence and taking action, it will improve services, increase resilience and reduce the economic impact. Adapting to climate change now will have a long-term direct economic benefit.

Contents

Climate Change Impacts at Aston– risks, opportunities and overarching strategic actions

It is anticipated that there will be:

- Periods of hotter weather and longer periods of hot weather
- An increase in winter rainfall and more intense rainfall
- Periods of colder weather and longer periods of cold weather
- An increase in average annual temperatures
- Changes in the timing of seasons

Figure 1: An illustration of extreme weather events, their consequences and possible impacts over time for the UK

Source and a sample of consequences	Possible impacts	Potential likelihood		
		0-5 years	5-15 years	Over 15 years
Prolonged or heavy rain Heavy Rainfall, Flooding, Land instability, Hail, Lightning,	Property damage Infrastructure damage (roads, rail, trees) Transport disruption Increased hospital admissions Long term mental health impacts	Medium	High	High
Gales Strong winds, Tornadoes, Wildfire	Damage to buildings Injury Business disrupted Open spaces burnt Loss of biodiversity	Low	Low	Medium
Prolonged hot weather Heat, Thunderstorms Drought Dust/Smog/ Haze, Land instability Wildfire, Poor water quality	Increased mortality and sickness Building damage from soil shrinkage Water shortage Poor water quality damaging aquatic wildlife Air pollution leading to health problems	Low	Medium	High
Excessive cold with snow Cold, Snow and ice	Damage to property and infrastructure Increased mortality and injury Problems getting to work Fuel poverty	Low	Medium	Medium
Global impacts More vulnerable food supply chains, Additional migration/ refugees Spread of diseases	Food shortages and price fluctuations New human and animal disease epidemics	Low	Medium	Medium

Derived from Keeping the Country Running: Natural Hazards and Infrastructure – consultation guidance, Cabinet Office 2011 and Adapting Energy, Transport and Water Infrastructure to the Long-term Impacts of Climate Change, 2010 Ref. No RMP/5456 cross-departmental Infrastructure and Adaptation project, URS

Flooding

The risk of flooding is increasing and it is anticipated that more people in the UK, including Birmingham will become at risk as floods occur more frequently and with greater intensity.

The Environment Agency calculates that the flooding events are likely to be more frequent and intense, with some areas currently free from flooding, at risk in the future.

Flooding results in a whole series of social and economic impacts including damaged building to people suffering shock and grief.

Flooding is caused by any or a combination of rising river water levels, surface water run-off, sewer overflow from flash storms and rising groundwater levels. Birmingham city is at considerable risk of flooding from a range of sources, mainly river (fluvial) flooding and surface water (pluvial) flooding. The city is part of a large conurbation at the top of a river catchment. This means that when heavy rain occurs, it reaches the city very quickly and with urbanisation means there is little opportunity for the water to drain naturally.

Figure 2 and 3 looks at the flood risk from rivers or the sea for land around the University campus and the Outdoor Recreational Centre. Figures 4 and 5 and looks at the flood risk from surface water again for the same areas. From this the University is at a very low risk from flooding from the nearby river sources but a low to medium risk for floods from surface water.

Figure 2: Flood risk from rivers or the sea around Aston University campus

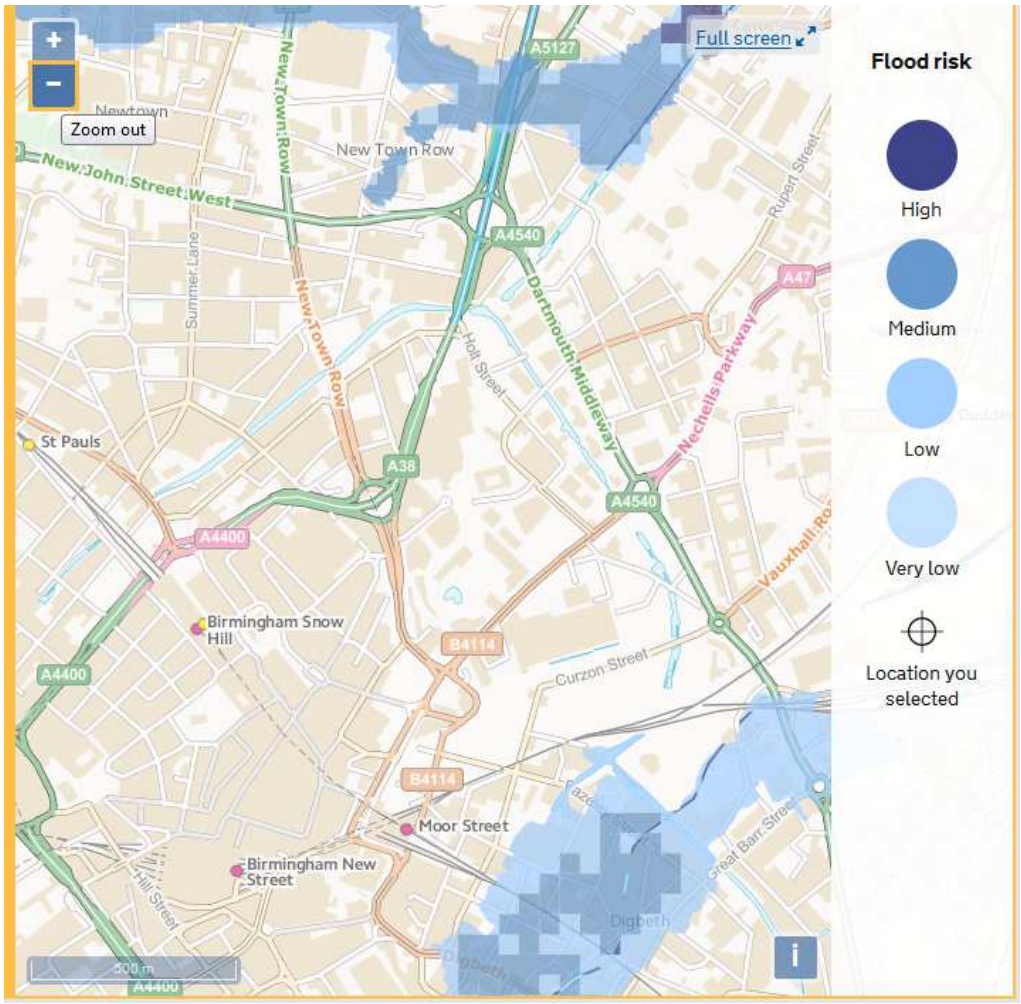


Figure 3: Flood risk from surface water around Aston University campus

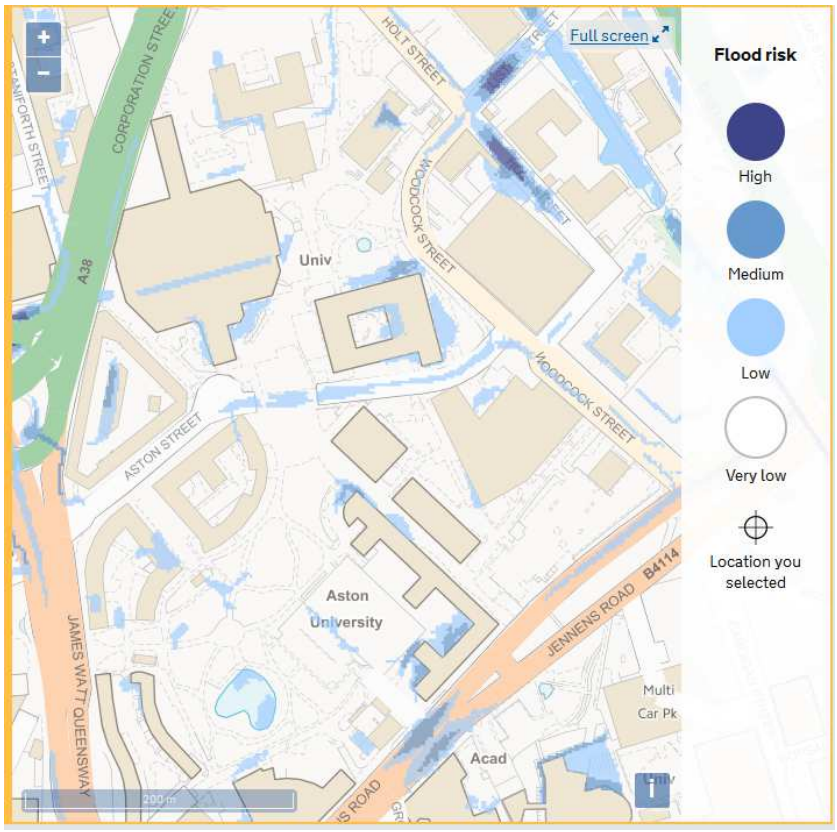


Figure 4: Flood risk from rivers or the sea around the Outdoor Recreational Centre

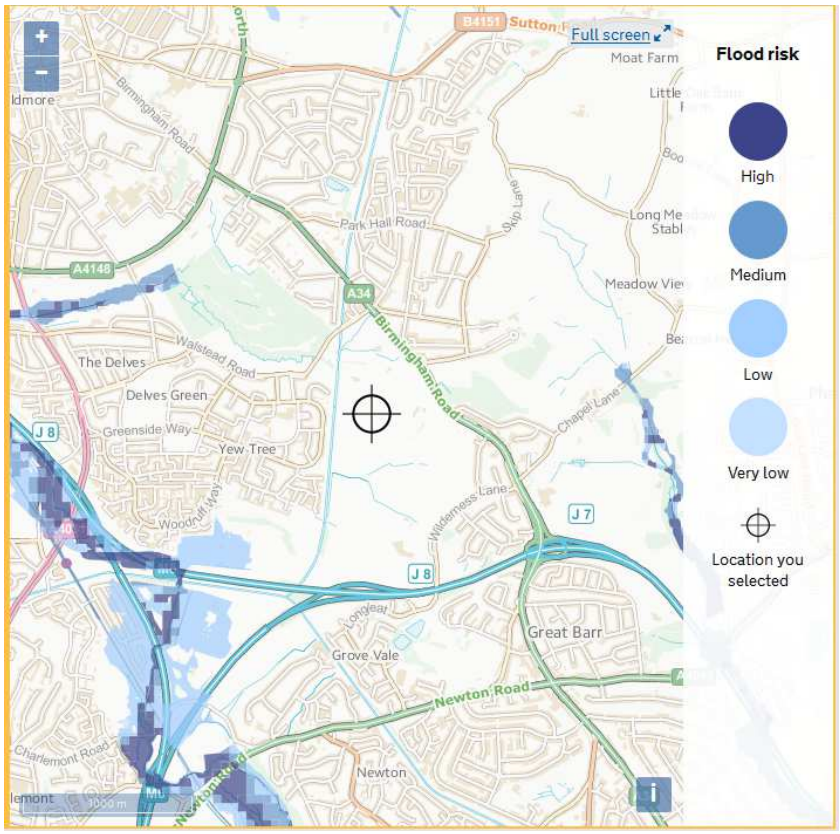
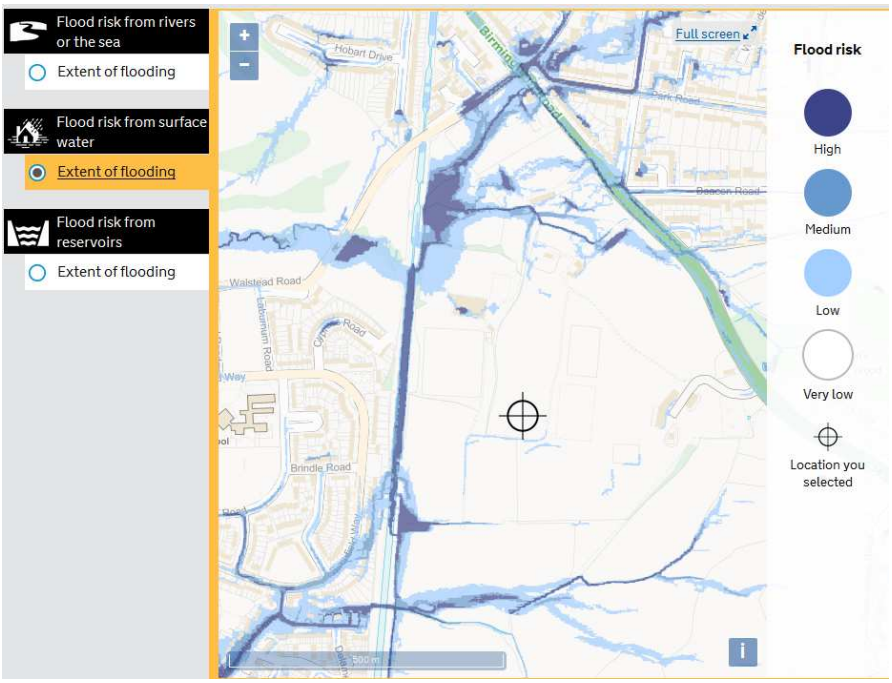


Figure 5: Flood risk from surface water around the Outdoor Recreational Centre



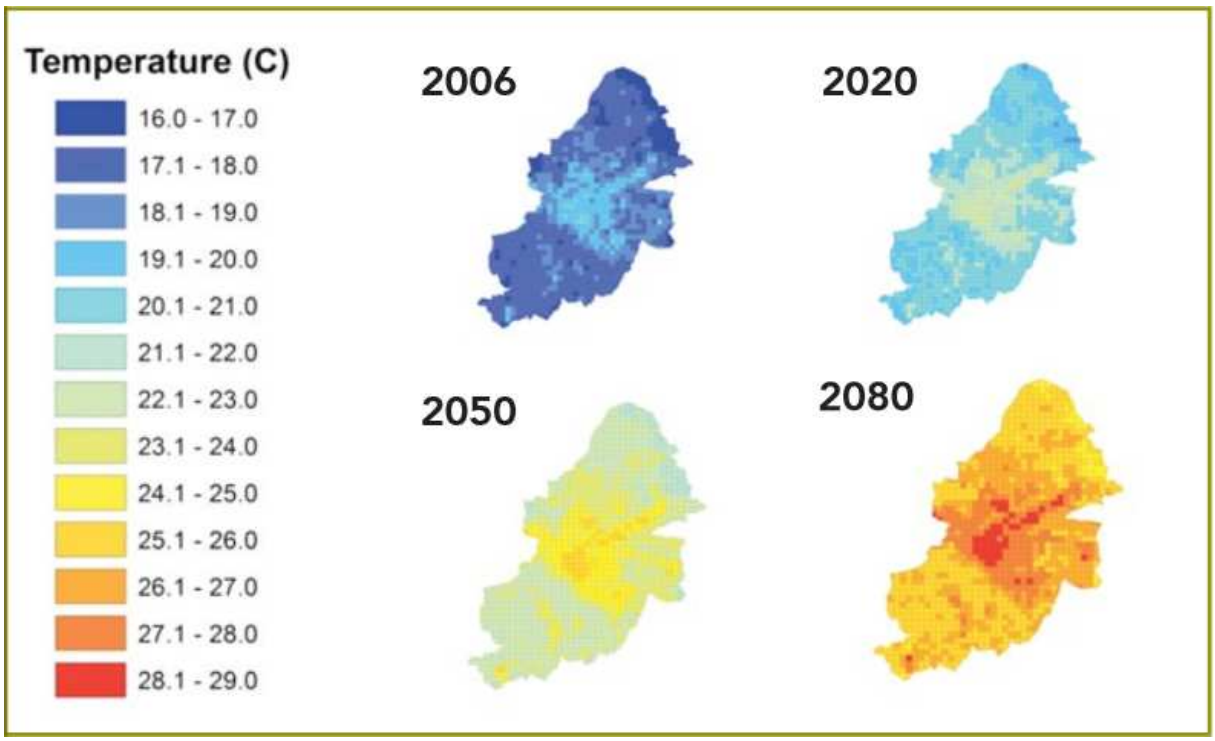
Heat

Climate projections show that there will be an increase in heat waves throughout the UK, leading to an increase in deaths, particularly for the elderly and vulnerable. High temperatures also have a direct impact on road surfaces, railway networks, air conditioning and machinery, as well as creating uncomfortable conditions in houses, factories, offices and public areas.

High temperatures are often associated with low water flows and a reduction in water quality in ponds and rivers. During these periods sudden rainfall can flush heavy metals and sooty deposits from roads and sewage from misconnected drains into streams and rivers, killing off fish and other wildlife.

The 2080 projections of a possible 5.2 temperature rise in the summer daily maximum temperature are further complicated by the impact of the urban heat island (UHI). The UK projections are based upon Birmingham having an agricultural landscape and therefore underestimate the temperature fluctuations caused by the UHI.

Figure 6: Birmingham's 3am urban heat island with climate change projections.



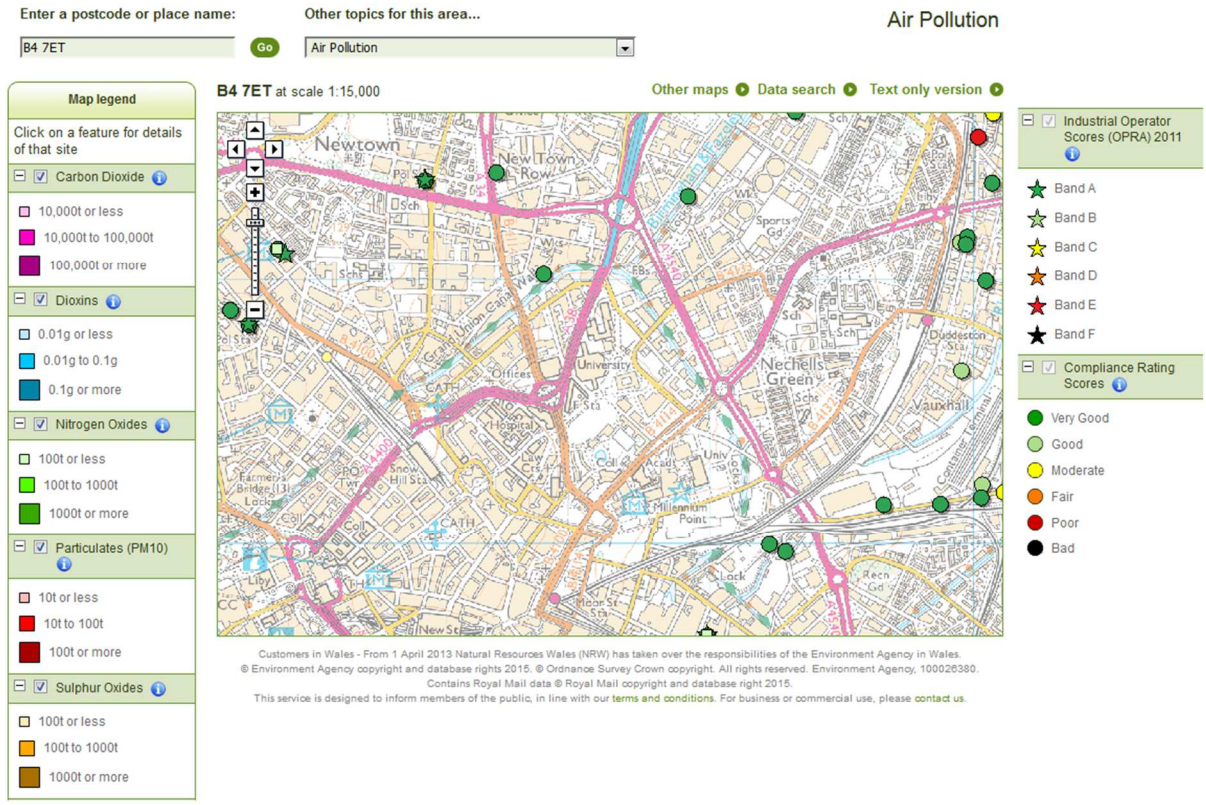
The urban heat island from the 2006 heatwave represents the baseline above. A high emissions scenario has been used to highlight the extent to which Birmingham's climate will change in the future, and how the urban heat island exacerbates that change. The risk of serious impacts to Birmingham from heat is often perceived as a long-term issue, but as many of the investments require long term planning, delivering them now makes practical and financial sense.

Air Quality

Many of the pollutants that have the greatest effect on air quality, such as nitrogen dioxide and particulates are emitted by transport, particularly heavy vehicles and buses. Poor air quality impacts on health by leading to respiratory problems. Modelling shows that hotter summers in the future will exacerbate the issue and will have an impact on people's health.

Emissions are concentrated in certain neighbourhoods, the city centre and around major transport routes, as the map for nitrogen dioxide emissions below shows. Poor air quality can lead to significant adverse health effects, particularly in those sections of the population that are more susceptible such as the young, the elderly, or those suffering from heart or lung related disease. The societal cost of the health impacts of poor air quality in Birmingham is in the region of £182 million a year (House of Commons, 2010).

Figure 7: Highlights pollution released into the environment by industrial sites under the EC Integrated Pollution Prevention and Control Directive (IPPC)



Compliance Scores is the Environment Agency's report of the level of permit breaches we've recorded at sites during the year. It includes both the number of breaches and also our assessment of the severity of these breaches, as determined by the Compliance Classification Scheme (CCS).

Birmingham declared the whole city as an Air Quality Management Area in respect of Nitrogen Dioxide and Particulate matter since 2004. Birmingham City Council's Air Quality Action Plan 2011 highlights the detailed assessment of air quality with a package of short, medium and long term actions to tackle air pollution. It also highlights the synergies between air quality and climate change, mainly in terms of the role actions from each discipline will have on the other.

Extreme weather events

Birmingham's Local Climate Impacts Profile systematically recorded weather related incidents such as the tornado in 2005, flooding, droughts, heatwaves and cold events. Extreme weather events are projected to increase in frequency and severity. Such events would affect staff and students getting to and from the campus, as well as potential damage to its buildings.

Critical Infrastructure and cascade failure

Increasingly, cities rely on critical infrastructure networks to function properly, such as telecommunications, water supply and drainage, road and rail, gas and electricity. These are all dependent upon energy (mostly electricity) to operate, and therefore failures in one part of one system can impact on other systems elsewhere, known as "cascade failures". All of these systems can be affected by extreme weather impacts.

Infrastructure UK estimates that an average of £40-50 billion will need to be spent every year between now and 2030. As a substantial proportion of new infrastructure will be in use long after 2030, the risks from climate change should be factored in to the design and location so that adaptation measures are incorporated where necessary to help ensure infrastructure resilience.

Why is a strategic approach needed?

A problematic characteristic of weather related events and environmental issues is that those who would bear the costs of adaptation measures are not always the same organisations or individuals that would benefit from them:

- A building with better thermal mass will protect vulnerable staff and students from temperature extremes, but requires a capital investment. Health and social services may incur additional treatment and support costs if the investment is not made;
- Developers are responsible for installing appropriate infrastructure such as culverts and drains from the outset. As the risk of flooding increases over time, the responsibility for any mitigation will be with the University rather than the developer of the site. The local authority and Environment Agency may use their powers to make improvements through the planning process
- The University has a large number of international students, whose relocation and travel to the UK will be affected by all these aspects and the University will need to consider alternative teaching methods
- Staff and students will also be affected my flooding and extreme weather events when commuting to and from site, where a flexible working and teaching methods would help potential issues
- Respiratory problems can be exacerbated by poor air quality, but because treatment has an immediate effect and is within the control of health services, improving air quality through reducing emissions and enhancing green infrastructure is less prioritised, even though the approaches may be more efficient and cost effective in the long term
- The downsides of not adapting to a particular issue may become more grave and more probable several decades into the future.
- Sports Aston needs to reseed and water the playing fields more often in hotter conditions. They also have a higher chance of losing customers during high levels of rain fall that increases the chances of pitch flooding.

Built and Critical Infrastructure

Built and critical infrastructure consists of the physical and organisational structures required for a society and economy to function, including:

- the built environment –offices, lecture theatres, labs and social spaces
- the transport network – roads, pedestrian areas and cycle paths
- the energy network – electricity and gas supplies
- the water and drainage network
- the communication network – telephone, broadband
- green and blue spaces – gardens, parks, street trees, lakes, green roofs and walls

Cities are built and developed with increasing dependence on the successful operation of the built and critical infrastructure. As all of these forms of infrastructure are susceptible to extreme weather events, strategic planning for future climate change is essential, particularly where long term investment is required.

Green infrastructure

Green Infrastructure is a network of multi-functional green space, both new and existing, both rural and urban, which supports the natural and ecological processes and is integral to the health and quality of life of sustainable communities.

It provides a wide range of benefits to society, including:

- Shade and cooling for urban centres
- Reducing the impact of heavy rain by absorbing water and slowing run-off
- Improving air and water quality by absorbing pollutants
- A positive effect on property prices and perceptions of an area
- Increased wildlife and biodiversity
- Improved wellbeing, through promoting good health and aiding recovery from illness

Having high quality green infrastructure is therefore important in all areas, but especially where there are particular risks. Investing in the natural environment helps to manage and reduce risks from extreme weather.

Regeneration and Development

Regeneration and development is critical to Aston University's success as a leading University; as an engine of economic growth and for the wellbeing of our communities. The redevelopment of the campus an our buildings in recent years has produced wide ranging benefits through attracting students nationally and internationally, encouraging business and research investment and creating jobs and prosperity as well as an attractive environment and services for the community.

The climate change challenge is to maximise the opportunities that climate change presents and minimise the risks. Warmer summer temperatures, particularly when the UHI effect is taken into account, may lead buildings and street environments needing to be designed to remain pleasant working environments in these temperatures.

New developments should take account of anticipated changes in the frequency and intensity of weather events over time as the decisions made now will have

consequences for several decades. The climate change impacts mentioned in the previous section should be incorporated into a master planning approach, both on new sites and in areas of multiple ownership to ensure climate change impacts are minimised and opportunities maximised.

What is Birmingham City Council doing regarding flooding?

Birmingham City Council is already working to ensure that its key policies are appropriate through the planning system. The Emerging Core Strategy policies SP6 Adapting to Climate Change, SP10 Managing Flood Risk and SP11 Green Infrastructure Network for example are specifically designed to address this. The supplementary planning document 'Places for the Future' provide Aston University developers with guidance on sustainable development by building upon policies dealing with sustainability in the Emerging Core Strategy 2026 and provides additional guidance for applicants seeking to develop in the City.

Birmingham's critical infrastructure, regeneration and development will need to incorporate these planning policies and approaches if it is to ensure that communities and businesses are resilient in the future and that deprivation is not encouraged through poor design. In particular it will need to actively consider floodplain management, Sustainable Urban Drainage Systems (SUDS), predicted discharge rates to water courses, culverting policy, street scene and green infrastructure.

The Flood and Water Management Act will lead to new duties for the City Council as a Local Flood Authority, including responsibilities for managing third party assets and producing and delivering local flood management plans, as well as establishing and managing Sustainable Urban Drainage Approval Boards.

The Government has said that Birmingham needs a Clean Air Zone by January 2020 and that we need to reduce levels of NO2 in the air to a maximum average of 40µg/m3 as soon as possible. A CAZ is an area where targeted action is taken to improve air quality, in particular by discouraging the most polluting vehicles from entering the zone. No vehicle is banned in the zone, but those which do not have clean enough engines will have to pay a daily charge if they travel within the area.

Birmingham plans to introduce a Clean Air Zone covering all roads within the A4540 Middleway Ring Road (but not the Middleway itself), with an estimated start date of July 2020.

What is Aston University doing already?

Through the campus redevelopment and Aston 2020 the University has gone through a number of significant changes that will help it reduce its current carbon emissions and improve on its environmental credentials but also adapt for future climate changes.

New Building and refurbishment

From 2010 to 2015 the University's new Building projects had to meet BREEAM Excellent rating. BREEAM is an established method of assessing, rating, and certifying the sustainability of buildings. A large number of adaptation initiatives were put into practice with these building in line with this methodology such as drainage; energy efficient temperature controls and ventilation and finally the material it uses and building methods to withstand extreme weather conditions.

- The ASV halls of residence have a number of green and brown roofs
- Natural lighting is used in a number of areas including Library main foyers and Woodcock Sports Centre, to reduce increase temperatures from lighting
- Key areas are on generator or UPS backup like the server rooms and hospital clinics
- Free cooling has been installed in our server rooms reducing the load on the AC units
- Insulation has been upgraded throughout most refurbished buildings
- Newly designed drainage areas around central campus
- Heat pumps in a number of key areas to provide efficient cooling

Energy security

The University is a member of the Birmingham District Energy Company (BDEC), which consists of Cofely GDF Suez, the Children's Hospital, NIA group and Birmingham City Council. The BDEC scheme has a number of energy centres around the city that will look to have a centralised heat (and in some areas cooling) network. The scheme uses combined heat and power (CHP) technology, with Aston University having a 3MW CHP scheme.

Aston's CHP district heating scheme provides heat to the majority of its campus, ASV accommodation as well as a number of third parties. The generated electricity makes up between 60-70% of the site's consumption with the remaining purchased through the grid.

Such a scheme and connection to the whole Birmingham network brings heat resilience to the campus and potential cost savings. It also takes some strain of the electrical network. Furthermore, this is a low carbon technology compared to gas boilers.

Within the contract BDEC must also invest in greener technologies to be included into the scheme.

Temperature control

Currently, the law does not state a minimum or maximum temperature for the workplace. The University has a Space Heating and Ventilation Code of practice that highlights heating and cooling temperatures dependant on areas around campus. The majority of staff or student occupied spaces must meet a heating average of 20 °C during operational hours.

The University has a complex building management system (BMS) which controls the heating and ventilation in the majority of spaces around campus. Most areas are set to heat to 21°C so the average is met.

Within the Space Heating Code of Practice, states that the University does not provide comfort cooling and therefore only a number of areas have air condition or air sourced heat pumps.

Where these areas exist, a set point of 23ºC is set so that the devices will not provide cooling until this temperature is met.

It is known that certain buildings, in particular the South Wing and North Wing suffer from areas of overheating and areas that do not reach an adequate temperature. Within the campus redevelopment plan the heating system of the North Wing will be replaced as the wing gets refurbished closer to 2020. The South Wing is also scheduled to be demolished, so implementing any new heating strategies is not economically viable.

As surface temperatures rise, key areas will need to be investigated to determine if their current temperature / ventilation controls are still adequate for the space use.

Site Drainage

During the redevelopment of the central campus, the Estates and Capital Development team took the opportunity to improve the sites drainage network and install any new drainage where required. Furthermore, after the site was developed work proceeded to improve any issues that were unforeseen until the work was complete. Where possible SUDS (Sustainable Urban Drainage System) was installed along with new access points to the drainage system.

Furthermore, the University's Capital Development Photonics project in the Main Building, the opportunity was taken to fit attenuation tanks to hold a large portion of rain water that comes off the roof during heavy rain. This will elevate the large volumes of water that go out to the wider drainage system, typically causing water to return back into the building. The tanks were sized in line with climate change predictions.

With any new builds, the design team need to investigate drainage issues and implement a strategy to make sure that the current system is capable of withstanding any additions, taking into consideration climate change.

Transport

The University is near the city centre providing many transport opportunities to staff as well as encouraging the use of sustainable transport through the following methods:

- The University is in walking distance to three main train stations in Birmingham
- There are main cycle routes around the University campus
- There are main bus links from around the University campus
- There is a main road links near the University for access to and from the city
- The University supports a salary sacrifice cycle scheme for staff to purchase a bicycle
- The University has a Brompton bicycle rental pod on campus for staff and students to use
- The University has a short cycle hire scheme for staff and students
- There are a number of electric car charging points as well as an electric car that staff can use for short journeys
- There is the Aston Bicycle User Group (AstBUG) that supports the cyclists of the University

Health and Wellbeing

The University has a number of health and wellbeing opportunities available to staff and students that include:

- A wide range of sports and recreational activities that one can be involved in through Sports Aston;

- The School of Life & Health Sciences operates a number of specialist clinical services including an optometry, dyslexia and audiology clinics;
- University counselling service;
- A University Health and Wellbeing group who organise events throughout the year;
- Onsite dentist;
- Regular wellbeing walks around the neighbouring areas.

Flexible Working and Working from home

The University recognises the benefits from supporting initiatives which may help employees to achieve a balance in their work commitments and their life outside of work.

The University has a legal duty to consider all applications from employees who are eligible under the Statute and to establish whether the desired work pattern can be accommodated within the needs of the business. The University will consider each application objectively on this basis, and not attempt to judge whether one applicant's need for flexible working is greater than another's.

Aston's commitment to staff flexible working hours will support the potential for more staff to work from home and come in during non-peak traffic times. This will be important when the use of sustainable transport, such as trains and buses are utilised more. Moreover, during extreme weather events have the option of working from home will help staff who may struggle to get to work.

Online teaching

A number of Aston University's courses are now available online. These are fully accredited coursed, but help students study at their own pace. With increase pressure on transport networks and rise in extreme weather events, plus general rise in course and accommodation fees having the opportunity to be educated from home will be beneficial. The University will almost certainly expand on its number of online programmes in line with such demands.

Making it Happen and Keeping on Track

In order for the University to carry on its work on adapting to the impacts of climate change, the University has agreed to use the SKA HE Sustainability Scheme for refurbishment projects with an aim of obtaining a Gold, minimum of Silver for all the projects that are above £1million. Projects between £150,000 and £1million will be informally assessed using the SKA HE methodology. For all refurbishment projects that cost below this value, they will work in line with our current electrical and mechanical specifications. Any short falls have been identified within the University's Building Refurbishment Guide and extract of this is below.

Details of the SKA HE scheme can be found here:

http://www.rics.org/uk/knowledge/ska-rating-/ska-he/

The following is taken from Aston's Building Refurbishment Guidelines – Appendix F, which can be found here: http://www.aston.ac.uk/EasySiteWeb/GatewayLink.aspx?alId=228652

All new build projects will be designed in line with the University's Sustainable Construction Specification.