



Impacts on Small and Medium Enterprises



Risk Assessment

The Yorkshire and Humber Regional Adaptation Study highlighted that the largest proportion of businesses across all sectors in the region are SMEs. Due to their small size and likelihood that they operate from a single or small number of sites they are often more vulnerable to any disruptions and changes in markets.

Impacts on businesses and the economy were identified as a key priority in Yorkshire by a review of the West Yorkshire Adaptation Action Plan and by C02 Sense. Funded by the Regional Improvement and Efficiency Partnership 'YoHr Space' a partnership project was set up between C02 Sense and Kirklees Council (lead local authority) and delivered by the consultants WSP.

The partnership's aims were to:

- Develop a business engagement model
- Provide climate change action planning support to businesses
- Help businesses minimise the risks
- Respond to the opportunities of climate change

Approach

Small and medium sized enterprises (SMEs) from all sectors were targeted across Yorkshire and Humber and offered free support. It was recognised that it can be difficult to engage with the business sector, especially SMEs, on adaptation to climate change. Therefore the UKCIP BACLIAT model was used to structure engagement, but the traditional 'language' of climate change was avoided.

Food production illustration

One business to use the service was a privately owned company that was established over 25 years ago. Their business was in the development of a new, innovative process of micronizing cereals and pulses for the animal feed and brewing industries. The consultants helped the company understand the potential risk and the actions and opportunities available to them.

It is a good example of how global macroeconomic and climate conditions can have an indirect impact for the regional economy. Current food crop volatility is affecting liquidity in these businesses – due to the price of available raw materials. The market price of these crops includes the impact of climate change built in. This insight helped the food production company understand a key focus for their own adaptation would need to be the company's own site.

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Impact example: Yorkshire and Humber

Impacts on Small and Medium Enterprises

Risk		Opportunity	
Description	Adaptive measure	Description	Adaptive measure
Market volatility in raw material prices as agricultural commodities are explicitly linked to climate change	Diversification of merchant suppliers can help to minimise this.	Future crops grown in the south east of England due to climate change reduce reliance on international merchant risk	Aim to increase product mix domestically.
The processing of the grains is in a metal warehouse that has no temperature control.	Projected temperature increases regionally would require change to building fabric.	Maintaining key customers. Brewers are actively looking to map their supply chain risk associated with climate change.	Dialogue with existing clients is a key next step
No flood risk analysis of office and process site	Logistics movements (30 artic lorries per day) require business continuity understanding from flood risk.	Access to future credit – lending activity in the future for small businesses will be dependent on how well managed climate change risks are.	Taking action early through demonstrating commitment to understanding climate change will improve credit worthiness.

How is the risk being addressed?

As a result of the project a risk and opportunity matrix was produced for each participant to highlight key areas for adaptive measures.



West Yorkshire Adaptation Action Plan

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C02 Sense

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Your Climate

www.yourclimate.org.uk

Impact example: Yorkshire and Humber

Marsden Moor, South Pennines



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Risk Assessment

Marsden Moor is located in the South Pennines, close to the A670 and around 7 miles west of Huddersfield. At Marsden the National Trust cares for around 2,300 hectares of moorland that feature a diverse range of birds, insects, plants and mammals.

The estate is designated a Site of Special Scientific Interest (SSSI) and a Special Protection Area (SPA) due to the high numbers of moorland birds, such as Grouse, that breed there. Peat lies below a thin layer of grasses, sedges, rushes and mosses.

Weathering the Storm, the Yorkshire and Humber regional adaptation study, was published in 2009. It highlighted that the number of dry spells across the South Pennines and Yorkshire Dales area was projected to have at least doubled by 2050.

Weathering the Storm projected that future drought conditions combined with an expected

increase in outdoor leisure was likely to increase the occurrence of fires in forests, parks and moorlands. In addition to direct economic impacts this also has implications for Fire and Rescue Services, and in particular on resourcing. Tackling rural fires can be more challenging in areas experiencing a shortage and limited access to water. Moorland fires can also be dangerously unpredictable and move rapidly in high winds. Peat fires can smoulder underground for days and damage vitally important restoration projects.

The West Yorkshire Adaptation Action Plan (WYAAP) that covers all five local authorities in the sub-region was originally published in 2010 and updated in 2011.

It also identified a raised fire risk in moorland bogs resulting from increased summer temperatures and decreased summer rainfall.

The consequences of these were

identified as a loss of biodiversity, erosion, and reduced water storage. This can lead to poorer water quality and increased downstream flash flooding in the many towns and cities along rivers that flow from the Pennines.

Following a very dry spell in the Spring of 2011 a serious wildfire broke out on Marsden Moor leaving a significant area charred and blackened. Whilst it is suspected that this fire was started deliberately, it highlights the acute risk of fire in tinder-dry moorland grasses that may also affect the underlying peat bog.

Fire engines from Marsden, Slaithwaite, Huddersfield, Elland, Meltham, Halifax, Brighouse and Dewsbury were dispatched to the scene and were supported by specialist wildfire units from nearby Holmfirth and Todmorden.



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Impact example: Yorkshire and Humber



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Marsden Moor, South Pennines



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How is the risk being addressed?

Partners involved:

- West Yorkshire Fire & Rescue
- Peak District National Park
- The National Trust
- Natural England
- Kirklees Council
- Moors for the Future Partnership

The key principle identified in both Weathering the Storm and the WYAAP were to ensure raised public awareness of the increased risk of moorland fire. The West Yorkshire Fire & Rescue service's communications department plays a key role in disseminating information through a range of media. Additionally, strategically placed signage and advice is also located in moorland areas to warn of the dangers.

Partnership working is critical to ensuring the risks are managed. Advanced training, pre-arranged Fire Plans, pooling of specialist equipment and vehicles is led through the Peak District Fire Operations Group 'FOG' as part of the Moors for the Future Partnership.

For more information:

Saddleworth News
www.saddleworthnews.com

West Yorkshire Fire & Rescue
www.westyorksfire.gov.uk

Marsden Moor Estate,
National Trust
www.nationaltrust.org.uk

Moors for the Future Partnership
www.moorsforthefuture.org.uk

Yorkshire & Humber Regional
Adaptation Study
www.adaptyh.gov.uk

Your Climate Adaptation Resources
www.yourclimate.org

Swish Building Products Tamworth, Staffordshire



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Weathering the Storm

Saving and Making Money in a Changing Climate

Weathering the storm – saving and making money in a changing climate, a recently published guide to provide advice to small businesses on how to be prepared for future climate impacts.

Risk Assessment

Based in Tamworth Staffordshire, Swish Building Products manufacture PVC fascias, soffits, guttering, cladding and window board systems for the social housing, new build and trade construction markets. The company is located near to the River Tame in Tamworth which has a history of flooding.

In 2007, heavy rain caused the river to burst its banks and overwhelm the flood defence systems resulting in widespread flooding across the river catchment area. As a result, the extreme weather event encouraged them to consider the risk to their organisation, with their main motivation preparing their business for a future extreme weather event and ensuring they limited their financial and reputational risk.

The extreme weather also caused significant damage to the surrounding area and had a big impact on the local community and other businesses in the area.

To help them identify the risks their business faced, Swish Building products contacted the Environment Agency and by working with them, were able to use the Environment Agency Flood map tool to understand the risks to the business and how to develop their business continuity plan.

“...The extreme weather also caused significant damage to the surrounding area”

Impact example: West Midlands



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Swish Building Products Tamworth, Staffordshire

How is the risk being addressed?

In response to the potential for future flooding events, Swish Building Products have developed a detailed flood risk management plan using a risk based approach. The plan covers a number of areas including the potential impact on the workforce, utilities, manufacturing (critical plant and machinery), warehousing operations, IT systems and critical communications, procedures for informing insurers, clean up after the flood and extra security.

Understanding how the business could potentially be affected by a flooding event has been a crucial first step in developing plans for business continuity. As a result of developing their flood emergency response plan the company are now more confident that they would be able to continue to operate, in spite of the weather. The key learning points they identified have included;

- Identify your risk to flooding by visiting the Environment Agency flood map tool.
- Develop robust business continuity / emergency plan and update on a frequent basis to ensure all aspects of the business are included.
- Check that you have adequate insurance policies in place to cover the full value of your business.

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Impact example: West Midlands



Business

Hotel Shop, Worcestershire



Risk Assessment

Hotel Shop UK is a privately owned business based in Droitwich, Worcestershire that was established in 1999. The company specialises in booking 2-5 star accommodation and short breaks throughout the UK for both the leisure and corporate traveller. They were based on the high street and had developed a business continuity plan.

The West Midlands has experienced a number of severe weather events over the last ten years, many of which have had a major impact on the local business community.

These severe weather events are increasing as a result of climate change.

In July 2007, the centre of Droitwich was flooded resulting in significant damage to the town centre and business premises.

Based on the High Street, the Hotel Shop UK premises was completely flooded out and the company lost 7 years worth of data due to the computer system not backing up when the flood waters hit. This caused dramatic consequences with their main business area of the shop and all materials destroyed and high financial costs.

“...severe weather events are increasing as a result of climate change.”

Faced with the impact of a severe weather event the company had to quickly deploy their business continuity plan. The main motivation for their business continuity plan was to ensure they did not lose business for too many days which could potentially cost the business financially and damage their reputation.

With the flooding of the entire high street, the impact on the local community was high, limiting access to local amenities and damaging local businesses.



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Impact example: West Midlands



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Hotel Shop, Worcestershire



How is the risk being addressed?

Hotel Shop were fortunate as they did have a business continuity plan and through this emergency plan, they were quickly able to transfer phone lines, borrow IT equipment and move to temporary premises, and overall the business was only closed for one day.

Since the flooding in 2007, the business has since found new premises, changed their entire business strategy and as a result has significantly grown their business over the last 3 years. This helps to address the direct risk and enables the business to be better prepared and more resilient to future impacts and highlights the importance for businesses of developing robust business continuity plans to help respond to the potential impacts of climate change and extreme weather events.

For more information:

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Impact example: South West

Wiltshire Council



© WSP

Risk Assessment

Wiltshire Council undertook an exercise to look at the implications of climate change on the long term resilience of one of their buildings, Trowbridge County Hall.

The study looked at the climate risks and opportunities for the building, both in the old county hall which was built in the 1930s and the 1970s extension to the hall. The objectives of the study were to gain a comprehensive understanding of the risks that climate change posed to the site, gain an understanding of the severity of the risks, and to look at opportunities to reduce or eliminate risks. Funding from the project was received from the Technology Strategy Board.

The three factors that were studied for climate risks were:

- Design for comfort
- Construction
- Managing water

A risk rating was produced by looking at climate change impacts on a business as usual basis, and the probability of future events occurring taking into account climate projections. Using UKCP09 climate scenarios, future risks were identified looking forward to 2030, 2050 and 2080. This resulted in the identification of low, medium, high and extreme risks to the building.

Risks identified for thermal comfort included maintaining comfortable air temperature and radiant temperature. Construction risks included soil subsidence due to changes in soil moisture, wind driven rain and pooling of water on the building. The risks from water management included the increased cost of water in the future, fluvial flood risk from the nearby river and surface water flood risk.

Using the risk rating for the three factors a number of opportunities were identified. For example considering design for comfort,

opportunities to manage risks included a night purge of heat, exposing existing thermal mass, shading of windows and landscaping by planting trees.

Managing construction risks identified the need to check the ability of the building foundations to withstand subsidence, to check the resistance of wall tiles to withstand wind driven rain and to manage on-site drainage.

Opportunities to manage the risks due to water management included looking at using rainwater or greywater harvesting, increasing education around water management, using Sustainable Urban Drainage Systems (SuDS), erecting flood barriers and relocating and raising equipment above the level of potential flood risk.



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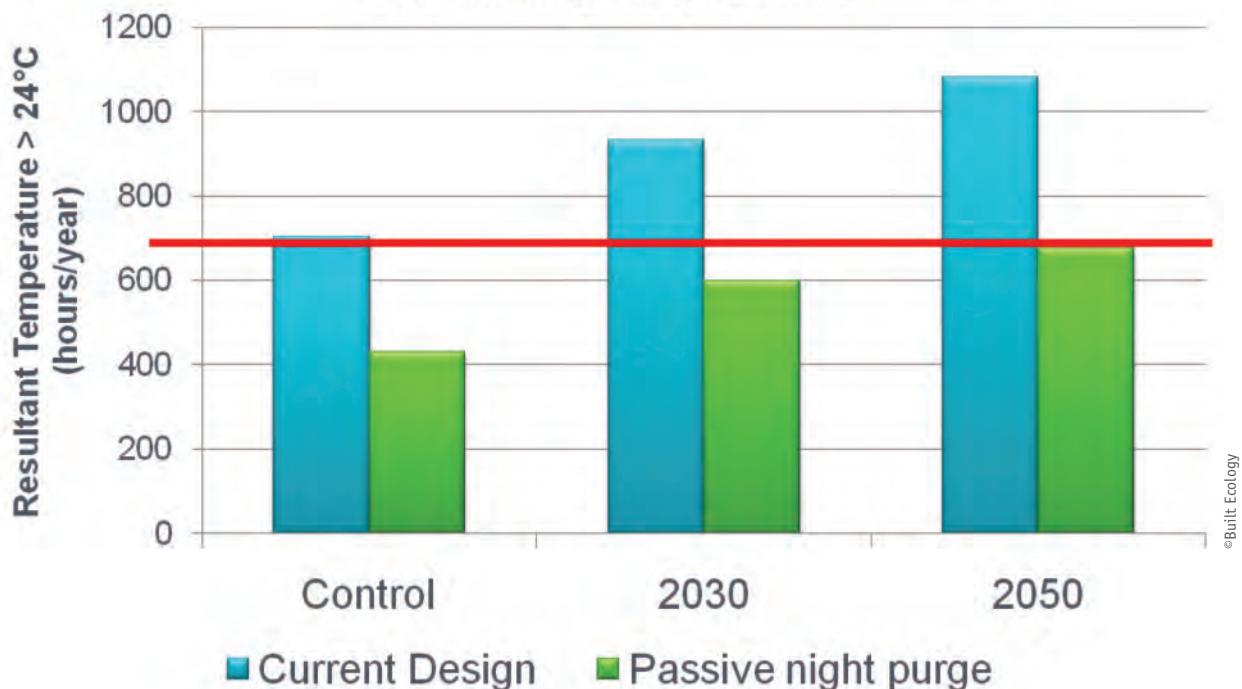
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Wiltshire Council

Occupied Hours where Resultant Temperature $> 24^{\circ}\text{C}$ OCH Building, 50th percentile



©Built Ecology

How is the risk being addressed?

Strategies that were adopted immediately included improvements to the external fabric of the building and undertaking an assessment of the strength of the wall tiles, a water awareness campaign for staff in the building, rainwater recycling, and moving communications equipment from the basement to the ground floor. Possible additional measures were highlighted for future consideration including the use of trees as shading for the building.

The constraint of the study is that it is site specific, so the specific results are not transferable to other locations. However, the risk assessment process is transferable. There were also uncertainties around the potential risks and their measurement, for example uncertainties around the impacts of climate change on water resources and assessing availability.

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Peatland Restoration



© Environment Agency

Risk Assessment

Mires are internationally important peat producing habitats such as bogs and fens. On Exmoor and Dartmoor, blanket bog occurs at the South West limit of its European extent. Centuries of moorland drainage and peat-cutting have dried-out much of this peatland which is now vulnerable to future climate changes.

Blanket peat is dependent on cool climates and high rainfall throughout the year to retain saturated conditions. These habitats are sensitive to changes in temperature and rainfall patterns, and damaged peatlands are at greater risk. They can be made more resilient by blocking drainage ditches to maintain a higher water table.

Peatlands retain water within their mass (over 50% of peat is water). Damaged peatlands have less water holding potential, but re-wetted peatlands have an

increased potential to absorb and retain water following precipitation and to release it more slowly into upland streams. Locally this helps maintain stream-flow during dry periods and locally reduce downstream erosion and flooding risks.

As our climate changes with predicted drier summers and wetter winters, healthy peatlands will become increasingly important for the management of water supplies, due to their regulating effect on water resources.

Peatlands accumulate plant materials and act as a carbon store, preventing carbon entering the atmosphere. Drainage halts peat accumulation and allows oxygen to enter peat stores turning them into Carbon dioxide, which escapes into the atmosphere.

Most peatland in the South West have been drained or modified to some extent and climate change may increase oxidation, as prolonged dry periods make the peat more vulnerable.

Mire restoration was undertaken on Exmoor between 2006 and 2010 through a public-private partnership. South West Water has secured funding for a further five year programme of work on Exmoor and Dartmoor under its Mires on the Moors Project. Other partners include Natural England, Environment Agency, Exmoor and Dartmoor National Park Authorities, English Heritage, Duchy of Cornwall, and the MoD.

The project used historic aerial photography and LIDAR techniques to identify damaged sites and target restoration activity, focusing on parts of the moorland significantly affected by drainage and agricultural improvement.



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Peatland Restoration

How is the risk being addressed?

The Mire Restoration project is re-wetting and restoring damaged peatlands by blocking drainage ditches, and allowing the bogs to recover. This will encourage wildlife such as bog plants and bird species to return.

On Exmoor 50 km of ditch has now been blocked. As a result over 350 hectares of damaged mire has now been re-wetted.

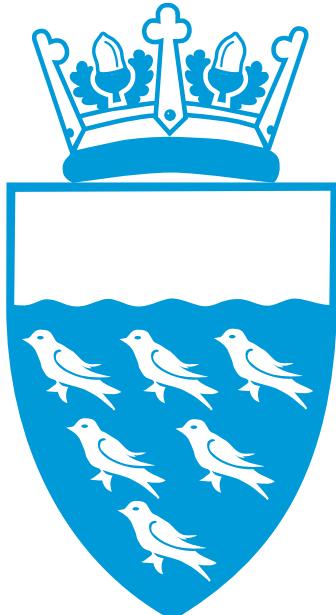
A programme of monitoring and research is being undertaken by Bristol and Exeter Universities and the Environment Agency to look at the impact of this type of mire restoration on water resources and flood risk management.

For more information:

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Durban House, Bognor Regis



west sussex county council

Risk Assessment

Durban House in Bognor Regis, West Sussex houses some of the county council's most critical services, including its Meals on Wheels Kitchen and its Customer Contact Centre. The site is prone to surface water flooding after heavy rain and fluvial flooding from the Aldingbourne Rife, which runs near the site.

During the past year, the West Sussex County Council (WSCC) Sustainability team has been working to complete adaptation risk assessments for priority services across the council (priority is defined as those services that would require additional support to return to normal after an extreme weather event).

The risk assessment process looked at key weather impacts around sea level, temperature, water availability, rainfall, and storm impacts. WSCC used the UK Climate Projections specifically for West Sussex, to assess the likelihood and severity of future flood events.

“...The site is prone to surface water flooding after heavy rain and fluvial flooding”

Working internally with various council service teams, the Sustainability team assessed the threats and opportunities, scored the impact on the service, and then suggested actions.

Each service team was provided with a single summary sheet reflecting the positive actions already being taken, and suggesting further adaptive action.



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Impact example: South East



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Durban House, Bognor Regis

How is the risk being addressed?

Working with the Facilities and Property team on the risk assessment and subsequent business continuity planning, WSCC identified a number of robust adaptation measures, including:

- Evacuation procedures: The Customer Contact Centre can be relocated and operational within two hours.
- Flood Plan: This has been developed with the WSCC Facilities team and the Environment Agency. The council signed up to the Environment Agency's Flood Warnings system.
- On-site measures: A supply of sandbags is held on site. Lighting in corridors and toilets is connected to the emergency generators' electricity supply. Most offices are on the first floor, and there are two key rooms that have 30-minute back up before the emergency generator starts. This generator is outside of the building.
- Flexible working: new ways of working are promoting different technologies and reduce the need to be office based. Staff travel to their nearest alternative office during bad weather.

The Environment Agency is now clearing the Aldingbourne Rife on a regular basis to mitigate against potential flooding. It has been decided that the strategic and economic importance of this site to the local area outweighs the short-term disruption to services and therefore the risk is accepted and suitably managed.

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Thames Basin Heaths, Berkshire/Hampshire/Surrey



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Risk Assessment

The South East faces a particular threat from wildfires because of the proximity of high-risk areas (such as forestry and heathland) to areas of dense residential and commercial development and critical infrastructure, that can be damaged or disrupted by wildfire incidents.

For example, the Thames Basin Heaths covers about 8,400 hectares in parts of Berkshire, Hampshire, and Surrey. It has both European and United Kingdom designations for nature including 13 Sites of Special Scientific Interest (SSSI) and Special Protection Area under the European Birds Directive in 2005 for three rare species of bird: the Dartford Warbler, Woodlark, and Nightjar.

The area is also home to highly-valued sensitive habitats and other rare species, including snakes, lizards, and butterflies. It surrounds or borders areas of dense residential and high tech commercial areas in the large urban towns of Woking, Bracknell, Frimley, Farnborough and Aldershot, as well as nationally critical transport links to London and energy infrastructure.

"...The South East England Wildfire Group (SEEWG) noted numerous major fires affecting the area between 1999 and 2011"

The South East England Wildfire Group (SEEWG) noted numerous major fires affecting the area between 1999 and 2011, damaging thousands of hectares of sensitive habitats and species and causing transport disruption, evacuation of buildings, and damage to infrastructure.

Most recently, Swinley Forest in Berkshire was affected in May 2011, when a fire lasting more than a week caused major road closures, evacuations of homes, and school closures. Affected buildings included Transport Research Laboratories and Broadmoor high-security hospital.

Impact example: South East



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Thames Basin Heaths, Berkshire/Hampshire/Surrey



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How is the risk being addressed?

The SEEWG and the Home Counties Wildfire Group (HCWG) identified climate change as a factor in the incidence of wildfires, along with land use and population changes. In April 2010 they produced a report and project plan that sets out a framework for partnership working on prevention and preparation activities to reduce the impact of wildfires on the environment, the economy, and society. The report found climate and weather impacts to be a significant factor in the number and scale of wildfires, noting an increase during periods of unseasonably dry weather and hotter temperatures, as in 1995 and 2003. The SEEWG/HCWG have incorporated the UK Climate Projections into their assessment of wildfire risk in coming decades.

According to the SEEWG, its partnership approach proved successful in May 2011, when partners were able to put forward an immediate plan to contain and extinguish the Swinley Forest Fire. Despite being the largest fire ever fought by the Royal Berkshire Fire & Rescue Service in terms of impact (cost estimates total around £1million), no injuries to people, including firefighters were sustained. The total cost of the activities outlined in the plan was about £116,000 – significantly less than the cost of one significant wildfire incident.

For more information:

Rob Gazzard

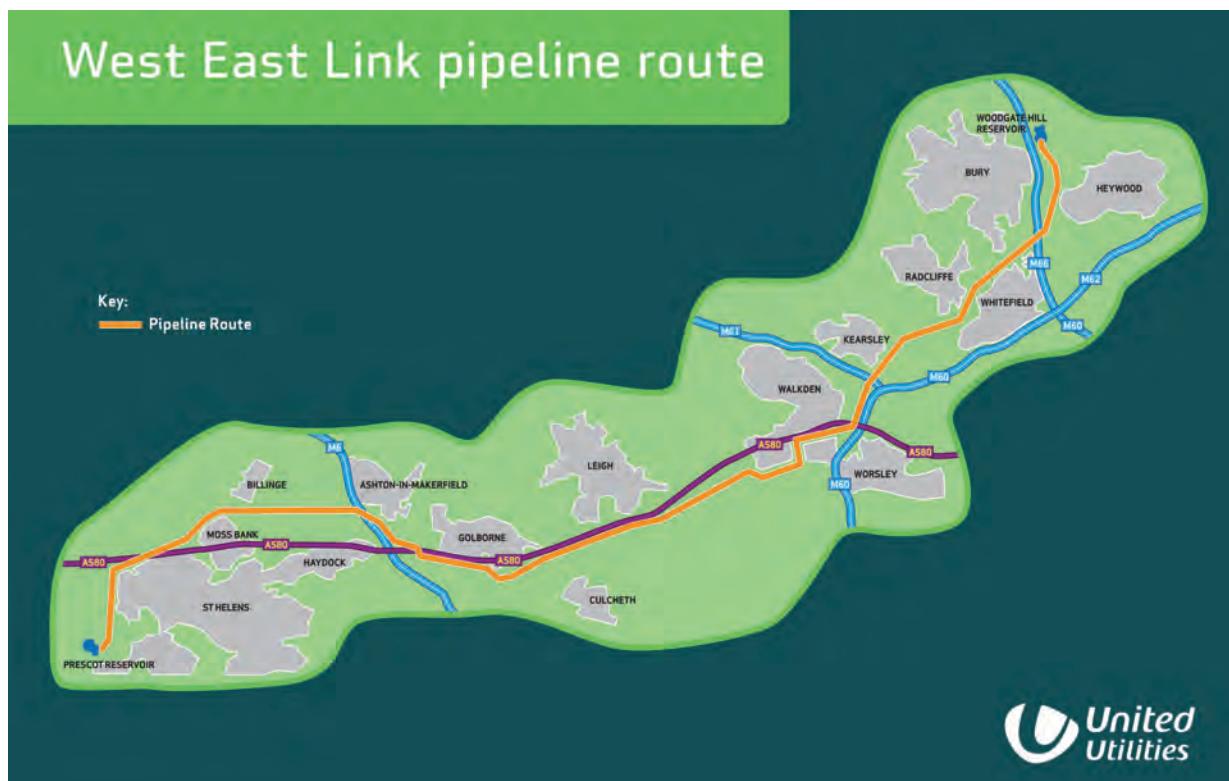
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United Utilities - Delivering Climate Change Adaptation Through Investment in its Strategic Water Supply Network



Risk Assessment

UUW supplies water to around 7 million people in the North West through its integrated supply network, which already provides a high degree of resilience to extreme weather events, notably droughts (e.g. summer 2010) and floods (e.g. Cumbria, November 2009), but also "freeze-thaw" events (e.g. January 2010).

Resilience has long been a key facet of UUW's investment strategy. Since the early 1990s, the impact of climate change on resilience of UUW's water supply networks has been carefully considered.

The effects of climate change on flows and demand were modelled using UUW's sophisticated water resource modelling tools.

This determined the consequent impacts on the reliable yields of its water sources and on levels of service to customers (as measured by frequency and duration of hosepipe bans, drought permits and restrictions on non-essential water use).

Additional climate change risks such as flooding and disruption of strategic water supply assets were considered within UUW's business strategy and planning processes. Changes to other drivers of supply and demand such as EU environmental legislation were also factored in.

As a result, multiple strategic drivers pointed towards the need for major investment into further increasing the flexibility and resilience of the North West's integrated water supply network. These included:

- EU legislation, which is likely to reduce the future water resources available to the company.
- The potential impact of climate change on water source reliability.
- Risk to security of supply from planned and unplanned outages of strategic supply assets.



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United Utilities - Delivering Climate Change Adaptation Through Investment in its Strategic Water Supply Network



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UUW response - The West-East Link Pipeline:

Costing £125m, this is one of the largest engineering projects ever undertaken by a UK water company. The new water pipeline runs 55km from Prescot Reservoir in Merseyside to Woodgate Hill Reservoir in Bury and will help secure water supplies for future generations.

UUW used the UKCIP02 climate scenarios to incorporate climate change into the scheme's cost-benefit analysis. The forecast impact of climate change on water resources suggested a need for a pipeline with a capacity of 60 million litres per day. However, in response to the security of supply driver, the pipeline was built with a capacity of 100 million litres per day.

The Regulatory and planning framework:

In UUW's view, a scheme was unlikely to have been funded through the regulatory price review process if it had been purely driven by climate change risk considerations. Funding was due to the successful combination of the climate change risk with more certain drivers, such as the EU legislation and the supply security risks. The regulatory framework provided challenging but not insurmountable barriers, requiring UUW to demonstrate a positive cost-benefit alongside sound economic and practical rationale.

For more information:

<http://welm.unitedutilities.com>



'Think, Plan, Act' -Building the Adaptive capacity of SME's in Sefton

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BUSINESS SAVINGS IN A CHANGING CLIMATE

PLANNING AHEAD FOR A CHANGING CLIMATE MAKES GOOD BUSINESS SENSE.

Extreme weather in Sefton, the UK and internationally is likely to affect your business. Floods, droughts or heat waves could damage your premises, affect your staff and customers, disrupt your logistics and suppliers and affect your bottom line.

Businesses affected by the 2007 floods took an average 26 weeks to return to normal operating capacity.

Climate change will also offer commercial opportunities for developing new products and services and reaching new customers.

The 'green economy' in the North West is expected to grow by over 5% per annum, with an increase of 3,000 jobs in Merseyside between 2011 and 2015.



BY THINKING AHEAD AND TAKING ACTION NOW YOU CAN HELP YOUR BUSINESS REDUCE LOSSES, MAKE MONEY AND ENHANCE YOUR COMPANY'S EFFICIENCY AND CREDIBILITY WITH CUSTOMERS.

THINK

PLAN

ACT

To find out more about how your business may be affected and what you can do to prepare for a changing climate, click on the links above.

CLASP.

Climate Change
Local Area
Support
Programme

Sefton Council

www.investsefton.com/climatechange/



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Risk Assessment

The Sefton Borough Partnership comprehensive risk-based assessment on its climate change vulnerabilities suggested that impacts such as floods, droughts and heatwaves, both locally and internationally, could affect Sefton's businesses through:

"...They lack adequate insurance for climate impacts"

- damage and disruption to transport and logistical infrastructure
- impacts on staff and customer safety and health
- changes to customers' demand for products and services, including some opportunities, especially in the key investment areas of tourism and construction.

Unlike larger businesses, Small and Medium-sized Enterprises (SMEs) are often less aware of the potential risks and opportunities of climate change, the actions they can take, or the support available. They are also often less likely to have the capacity to take the steps needed and have other competing priorities for their limited time and resources. They also generally lack comprehensive risk management structures or adequate insurance for current or future climate impacts.

Impact example: North West



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'Think, Plan, Act' -Building the Adaptive capacity of SME's in Sefton

How is the risk being addressed?

Because of this, the 'Building Adaptive Capacity of SME's in Sefton' project developed. This was supported by resources from the North West Climate Change Local Area Support Programme (CLASP) and aimed to deliver increased adaptive capacity to Sefton's businesses by:

- Engaging with five key local businesses which were particularly well-positioned (e.g. their products, services or processes were weather-dependent, they were involved in making decisions with long-term consequences; they had already been affected by extreme weather; they could share learning and solutions).
- developing an adaptation toolkit which included:
 - (i) An A4 leaflet providing concise information on the impacts of climate change on businesses
 - (ii) A simple three-step self-assessment Business Climate Checklist structured around five key business areas of finance and insurance, premises, people, markets, and logistics
 - (iii) Web pages expanding upon the leaflet and providing information on the business case for adaptation and the three-step checklist.

Several key findings from the project were:

- (i) The risks of extreme weather to businesses' premises, logistics and supply chains are most easily recognized by businesses.
- (ii) The key drivers for businesses taking action are the costs of disruption and the opportunity to develop points of difference on their products.
- (iii) Many businesses had already taken adaptive actions which they did not necessarily recognise as 'climate change adaptation.' These included developing new products capable of withstanding extreme temperatures and monitoring world markets and supply chains. However, none of the five key businesses had a formal business continuity plan in place.

Businesses also requested future support around:

- (i) Quick (profitable) wins – identifying key actions to help reduce costs and improve productivity and profit.
- (ii) Funding opportunities – signposting to what is available to businesses to help them adapt their premises or logistics.
- (iii) Marketing opportunities – investigating how existing standards and certifications could help businesses market their environmental credentials as points of difference in the marketplace.

For more information:

[www.investsefton.com/
climatechange/index.asp](http://www.investsefton.com/climatechange/index.asp)

[http://www.claspinfo.org/
resources/building-adaptive-
capacity-businesses](http://www.claspinfo.org/resources/building-adaptive-capacity-businesses)

Fenton Farm, near Wooler, Northumberland



A dust storm at Fenton farm

Risk Assessment

Simon Henderson is an arable crop tenant farmer based in West Fenton, near Wooler in Northumberland.

One of the main impacts affecting Fenton farm is the erosion of soil, caused through wind combined with long dry periods and drought, and increased rainfall intensity, leading to flooding. This is a problem projected to worsen due to climate change. This has already had significant impacts on the farm.

The loss of the soil through water and wind erosion has exacerbated the loss of valuable and necessary nutrients, which significantly has impacted the productivity of the arable crops.

Dust storms not only damaged the crops but also affected local water sources, damaging the aquatic environment and blocked nearby drainage systems.

These impacts mean that the farm is under increasing financial pressure mainly due to reduction in yield, cleaning up blocked drainage systems and other ancillary damages. Other costs included expenses associated with addressing soil structure and nutrient losses as well as irrigation. This is particularly difficult as using conventional agricultural fertilisers is not only expensive but is becoming a limited commodity. Simon has also extensively engaged with a local climate change project, Cheviot Futures, which commissioned a comprehensive study of the likely impact of climate change

“...Simon recognised that to continue in business he would need to address these climatic issues”

on North Northumberland; the outcomes were intended to be used to identify potential impacts and practical steps that can be undertaken by land-based businesses.

At an early stage in this process, Simon recognised that to continue in business he would need to address these climatic issues. A wide range of soil conservation measures and management, including crop rotation, wind breakers and so on, were put in place.

Local farmers have also been very supportive and recognise, particularly with the evidence developed through the Cheviot Futures project, that they must prepare their businesses for the future. The nature of the West Fenton farm meant that it would cease to remain viable if these impacts were left unchecked.



Business



Health
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& Forestry



Natural
Environment

Impact example: North East



Business



Health & Well-being



Buildings & Infrastructure



Agriculture & Forestry



Natural Environment

Fenton Farm, near Wooler, Northumberland



Intense rainfall led to the flooding of Fenton farm

How is the risk being addressed?

Simon completely changed the management of the farm and converted to organic production; this included increasing soil organic matter components to retain moisture and improve structures. Other adaptation measures include planting hedgerows and trees to form windbreaks to reduce wind erosion, and installing a network of ditches with margins, sediment traps, reedbed filters and sluices to control water levels. Excess water containment areas, also known as leaky ponds, have been installed as a low-cost and environmentally supportive response to hold runoff water after heavy rainfall and release it slowly over a period of about a week reducing the likelihood of soil erosion and downstream flooding.

A river flood plain has been reinstated by the removal of flood banks in partnership with the Environment Agency. At the same time the main stream from the farm to the river was meandered, which added approximately 1.5km in length; sluices to control water flow were also installed. This allows more time for sediment removal from the water and encourages more water to permeate through the soil rather than rush headlong into the river where it is of no benefit to the farm.

For more information:

Climate North East

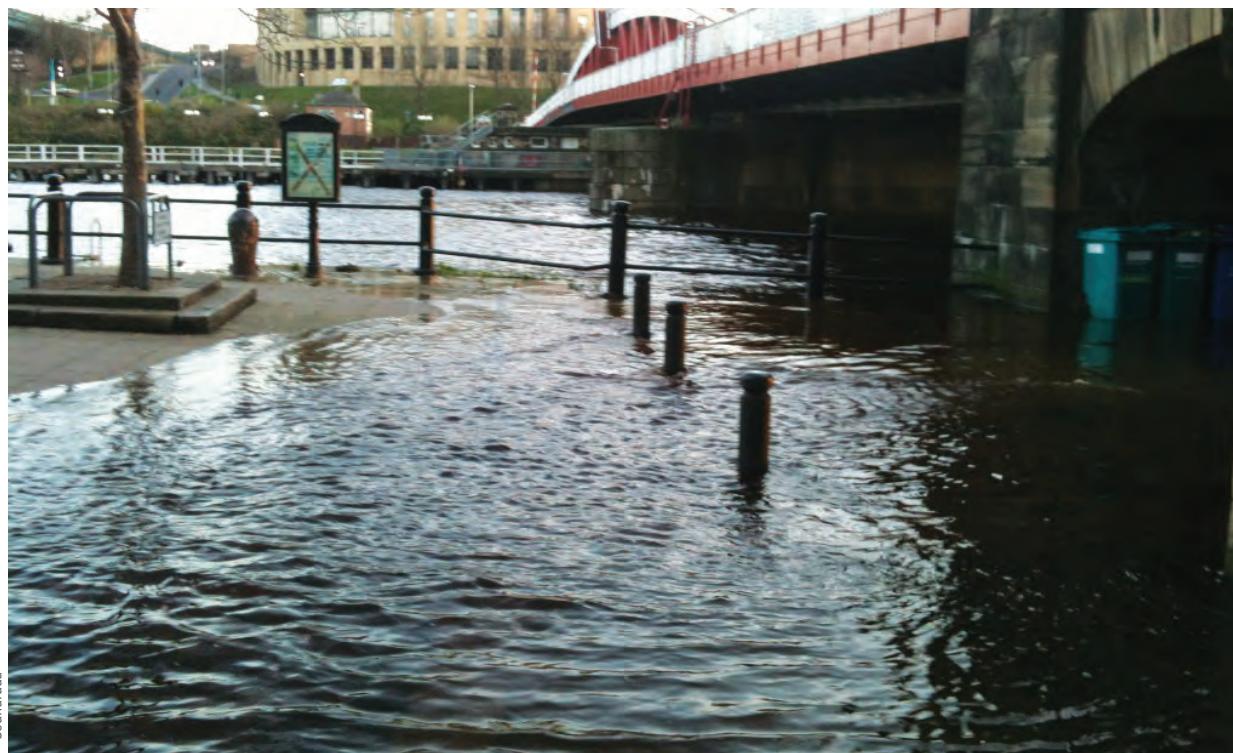
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ClimateNE

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The Guildhall, Quayside,
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Charlie's Champagne Bar and Restaurant, Newcastle upon Tyne



© Soundtrud

Flood water at Newcastle's Quayside threatens Charlie's Champagne Bar and Restaurant.

Risk Background

Charlie's Champagne Bar and Restaurant is situated in the heart of Newcastle's world-famous Quayside and has been struck by at least four flood events since 2010.

The floods were caused by a combination of factors. These included high tide levels in combination with melt water from the heavy snowfall plus rain. A further feature was tidal 'lock out', which prevented the drainage system from discharging properly. Lack of valves and flaps on parts of the drainage system also meant that the storage capacity of the drains became compromised by tidal water entering the system. Finally, the pumping station, designed to drain away water, was

also overwhelmed by the extensive inputs from the various sources.

There is also uncertainty as to the position, composition and condition of the drainage network in this area of Newcastle as the original, elderly system has been added to over time. Clarity is required to ensure resilience in the future.

Each event resulted in the water, which was frequently contaminated with sewerage, flooding the bar's basement. The area comprises the staff room, office and storage space. Rising to approximately three feet in a very short space of time, the water damaged floors and walls and destroyed equipment and belongings.

The first flood destroyed computers, amplifiers and a coffee machine. It also leaked into the fridges and freezers that are kept in the basement, ruining a significant amount of stock.

"The staff didn't know who to turn to for help..."

The staff didn't know who to turn to for help (with flooding from complex sources there is often confusion as to whether the Environment Agency, Council or Water Company can help). They weren't sure who could help them pump the water out. They considered calling the Fire Brigade and did call their insurance company immediately but they didn't provide any help – it actually took nearly five months to process the claim from the first flood.

Despite receiving compensation from the insurance company, the floods meant that the company lost at least £20,000. This was mainly because they were forced to close the restaurant while cleaning and repairs took place and equipment was recovered or replaced.



Impact example: North East



Business



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Agriculture
& Forestry



Natural
Environment

Charlie's Champagne Bar and Restaurant, Newcastle upon Tyne



Charlie's Champagne Bar and Restaurant is situated at Newcastle's world famous Quayside

How is the risk being addressed?

In the immediate aftermath of the first flood the staff salvaged what they could from the mess. But it wasn't until flooding struck again they realised longer-term measures needed to be put in place to protect equipment and belongings and ensure business continuity.

They stopped storing electrical equipment on the floor and started using shelves where possible. They moved electric sockets higher up the walls and replaced carpets with tiles. Now when flooding occurs, equipment, belongings and stock are not affected and rooms can be cleaned easily and swiftly. These measures mean that business is not interrupted and costs are kept minimal.

For more information:

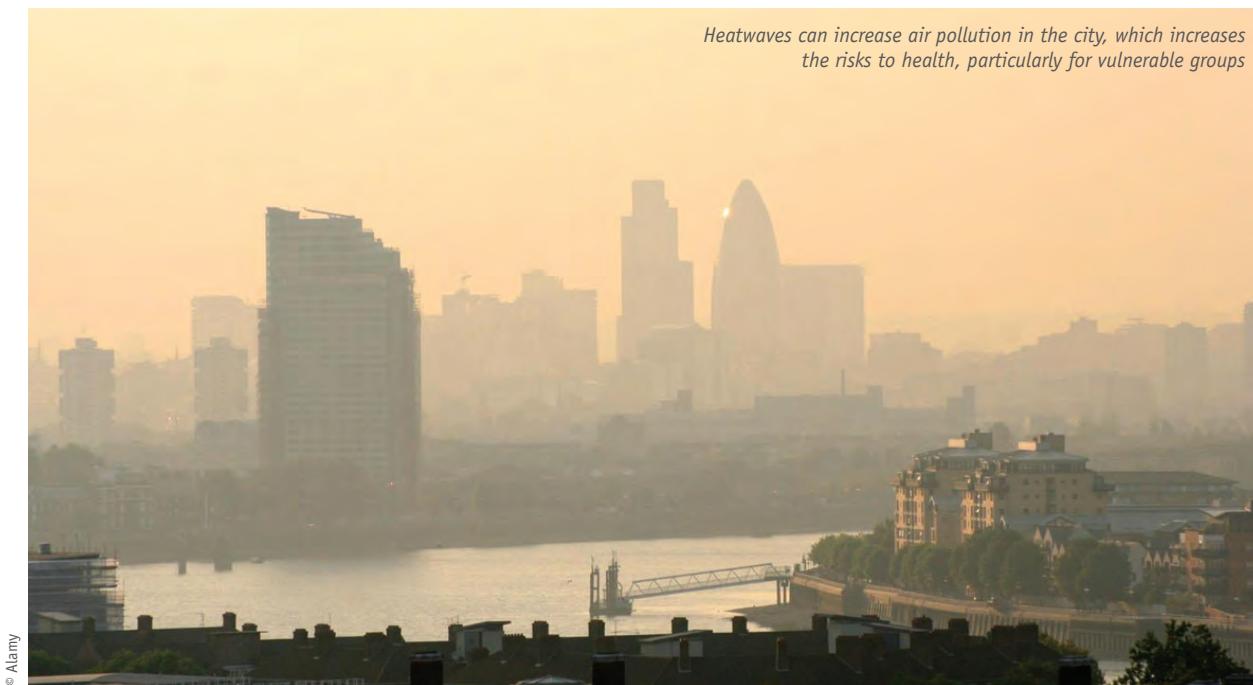
Climate North East

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London CCRA Equinox Care



Business



Health & Well-being



Buildings & Infrastructure



Agriculture & Forestry



Natural Environment

Risk Assessment

Climate change is expected to have a range of impacts on human health in the UK, mainly due to higher average temperatures and an increase in the frequency and severity of extreme weather, such as heat waves and flood. Groups with pre-existing vulnerabilities are expected to be most affected by these impacts. London, with its dense urban environment and lack of green space, is particularly susceptible to heat.

Equinox is a social care organisation offering a range of accommodation and community based services for people with alcohol, drug and mental health problems. The organisation operates across London and the South East.

Sharon Bye, Director of Operations at Equinox, said: "Many of our service users are marginalised, experience social exclusion and have complex needs. In 2009 we took part in the Big Response Project and worked with the National Council for Voluntary Organisations (NCVO) to understand how climate change would impact upon us."

Our decision to do this was partly due to our commissioners requiring us to address sustainability issues with more rigour but also through the leadership of our Board of Trustees who considered it a priority. Through this process we looked at the existing risks that heat poses to our services and users, and the ways in which they are likely to increase."

Through facilitated focus groups (staff and service users) Equinox identified a number of specific risks to service users:

- Those without a home would be at increased risk of significant health problems, such as sunstroke, infection to wounds due to lack of bathing facilities and food poisoning due to scavenged food spoiling more quickly.
- Dependant drinkers would not be able to hydrate easily.
- Vulnerable people on low incomes cannot afford to purchase bottled water with ease, meaning that they would be less able to stay cool and hydrated while out and about.
- Service users may lack the means and knowledge to adequately cool their buildings. Hot weather could cause increased conflict within day centres and residential projects with communal spaces as heat can cause stress.
- Low awareness of the risks was likely due to lack of access to media announcements, drug and alcohol use or mental health issues, which may make it more difficult to recognise the physical symptoms of overheating.
- Perception of marginalisation would make some less likely to seek medical attention, and cause a reluctance to use mainstream public spaces such as community centres, that could be used as cool refuges during a heat wave.

Impact example: London



Business



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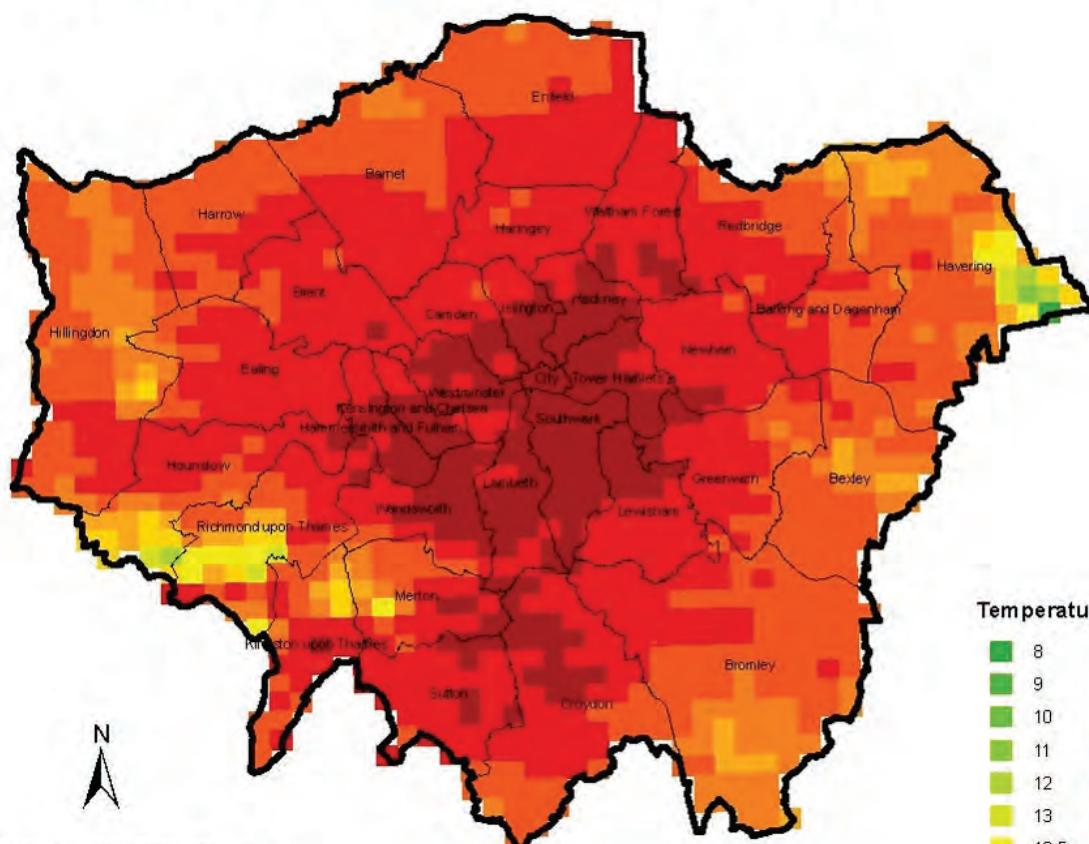
Agriculture & Forestry



Natural Environment

London CCRA Equinox Care

Temperature distribution in London, August 2003



MODIS 7.08.2003 21:30

A thermal image of London. The Urban Heat Island effect can make it up to 10°C warmer than surrounding areas. (GLA)

How is the risk being addressed?

In response to these issues, Equinox has taken a number of steps. These have included the installation of water coolers and stocking of water for emergencies; assessing cooling of buildings; health awareness work as part of life skills training for users; and developing Business Continuity Plans which take account of the need for day centres to open at different times during hot weather episodes.

Equinox has identified that by using the organisation's own sites as designated emergency sites for the most vulnerable, this is less daunting for users, many of whom have historically faced issues accessing mainstream services.

Some issues prove harder to address, but the current risks posed by hot weather and future risks of climate change are now considered as part of the corporate plan.

For more information:

Juliette Daniels

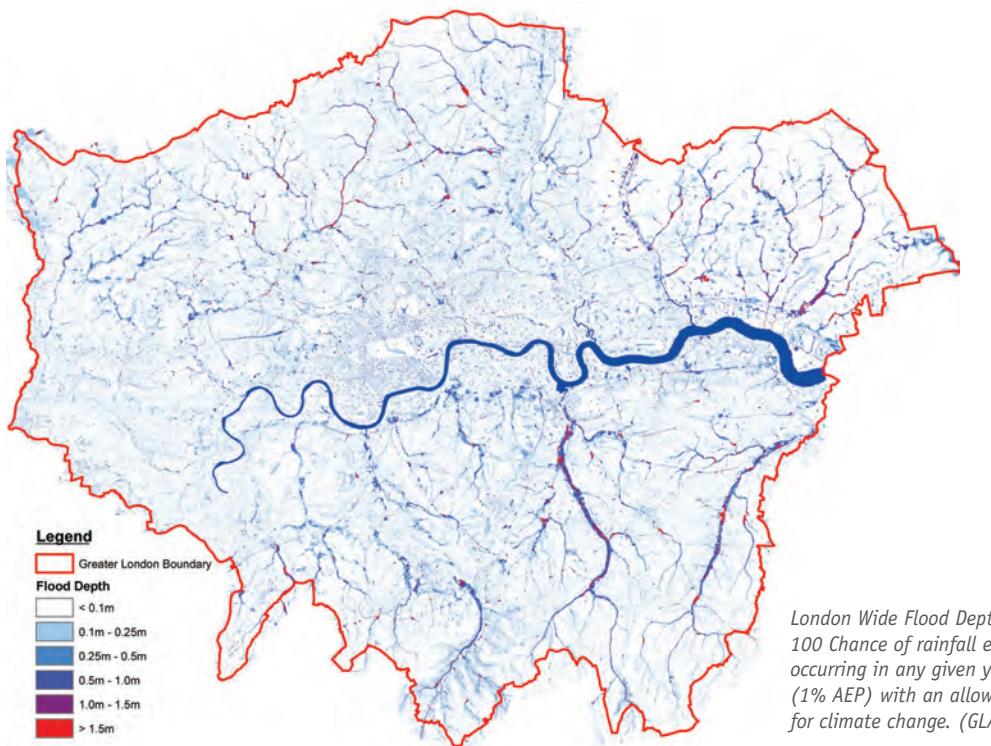
Manager, London Climate Change Partnership

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London CCRA Drain London



Risk Assessment

Surface Water flood risk has for a long time been poorly understood, recorded and mapped. For London with its combination of predominantly underlying clay soils and extensive impermeable surfaces, it is recognised that the risk of surface water flooding is high.

This risk is generally expected to be increasing due to two factors. Firstly London's population is increasing within the existing built footprint. Therefore there are more people and we are living at higher densities, meaning that any flood is likely to have a greater impact. Secondly, climate change predictions are that storms will become more intense, therefore the type of storm that cause surface water flooding are becoming more likely.

There is some evidence to show that these more intense storms have already increased in frequency over the past few decades compared with a longer time horizon.

The risk was identified initially through the Greater London Authority's Regional Flood Risk Appraisal where the relatively well documented history and models of tidal and fluvial flooding illustrated the lack of any consistent records or models of surface water flood risk.

The Greater London Authority set up a partnership group with other key organisations responsible for managing surface water flood risk and drainage assets, called the Drain London Forum.

Climate change was not the main driver, rather it was the lack of knowledge about an existing risk coupled with the expectation that the risk is likely to get worse with climate change.

Drain London Commissioned consultants to undertake a tiered approach to assessing the risks across London. This means that an intermediate assessment has been carried out for all of London and the areas showing up with high priority risks are then being investigated in more detail and detailed options for addressing the risks are being investigated for those areas.

High priority areas can be identified either due to the number of properties affected, the impact of those properties being flooded – eg subway systems, major roads, power supplies or hospitals.

Four different consultant firms have been used so that we can compare different practices and we have built in a peer review process where consultants actively check each other's work.



Impact example: London



Business



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Natural
Environment

London CCRA Drain London



© Alamy

How is the risk being addressed?

Adaptation options are currently being identified for the high priority risk areas. In some cases these will involve engineering works, and in others a more sustainable approach to rainwater management will be taken, by more closely mimicking natural systems.

In some cases it is recognised that there are no specific measures that can be taken to reduce the likelihood of flooding. In these cases the focus will be on preparing those at risk of flooding so that they can best cope and recover from the effects.

In parallel with the work to assess the risk, Drain London has also commissioned work to illustrate the impact of flooding on people who have experienced it, setting up Community Flood Plans and a smartphone App to report flooding and drainage defects.

For more information:

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Tel: 020 7983 5781



Peak District

Business



Monsall Dale in the White Peak area of the Peak District National Park



Health & Well-being



Buildings & Infrastructure



Agriculture & Forestry



Natural Environment

Risk Assessment

Over 30% of the Peak District National Park's rich and diverse landscape is designated of international wildlife importance. The National Park provides many essential services, including providing supplies of fresh water, the storage of carbon in the soils, and economic activities, such as farming, tourism and mineral extraction.

The Peak District National Park Authority (PDNPA) and its stakeholders assessed climate risks to the National Park. Addressing climate change is essential to delivering the PDNPA's statutory purposes.

Many of the important Peak District species and habitats are already at the extremes of their climatic envelope. An increase in temperatures will mean that more southern species are likely to be found within the National Park with a subsequent loss of species currently at their northern extreme.

There is likely to be an increase in flooding due to wetter winters and more extreme rain events, creating a demand for flood water storage.

Hotter, drier summers will lead to an increased risk of wildfires which have a devastating effect resulting in habitat loss, threat to human and animal life and lead to a significant loss of carbon contained within the soils. Drought will put additional pressures on the viability of blanket bog and the drying out of the moorland.

The White Peak non-moorland areas already experiences water deficit which has current consequences for land management and this will be further exacerbated by hotter, drier summers.

There may also be changes in moorland management as a result of reduced water availability, decline in grouse numbers and changes in recreational pressures. These changes can affect the overall landscape character, biodiversity, and the cultural

heritage component within and beneath the peat. Changes in moorland management also have economic and social impacts resulting from any changes in recreation, tourism and farming practices.

With drier summers predicted, the water flow in limestone rivers and streams may become more seasonal, concentrating pollutant levels.

Drier summers may also result in agricultural changes such as increased suitability for arable crops or, with wetter winters, increased demand for winter housing for livestock. All these issues have the potential to change the character and visual diversity of the landscape and the economic viability of upland farming.

Tourism businesses may benefit from warmer drier summers which lead to an increase in visitor numbers to the Peak District. This may result in additional pressures on the natural environment.

Impact example: East Midlands



Business



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Natural
Environment

Peak District

Peat erosion on Kinder Scout in the Dark Peak area of the Peak District National Park



How is the risk being addressed?

Potential adaptation actions have been identified in the PDNPA's report "Adapting to Climate Change in the Peak District National Park: First assessment of climate change risks, opportunities and actions". The support by the utility companies to large partnership projects such as Moors for the Future demonstrates their concerns relating to water quality. Increased soil erosion from drier summers and heavy rainfall leads to additional costs at water treatment works along with a silting up of reservoirs.

For more information:

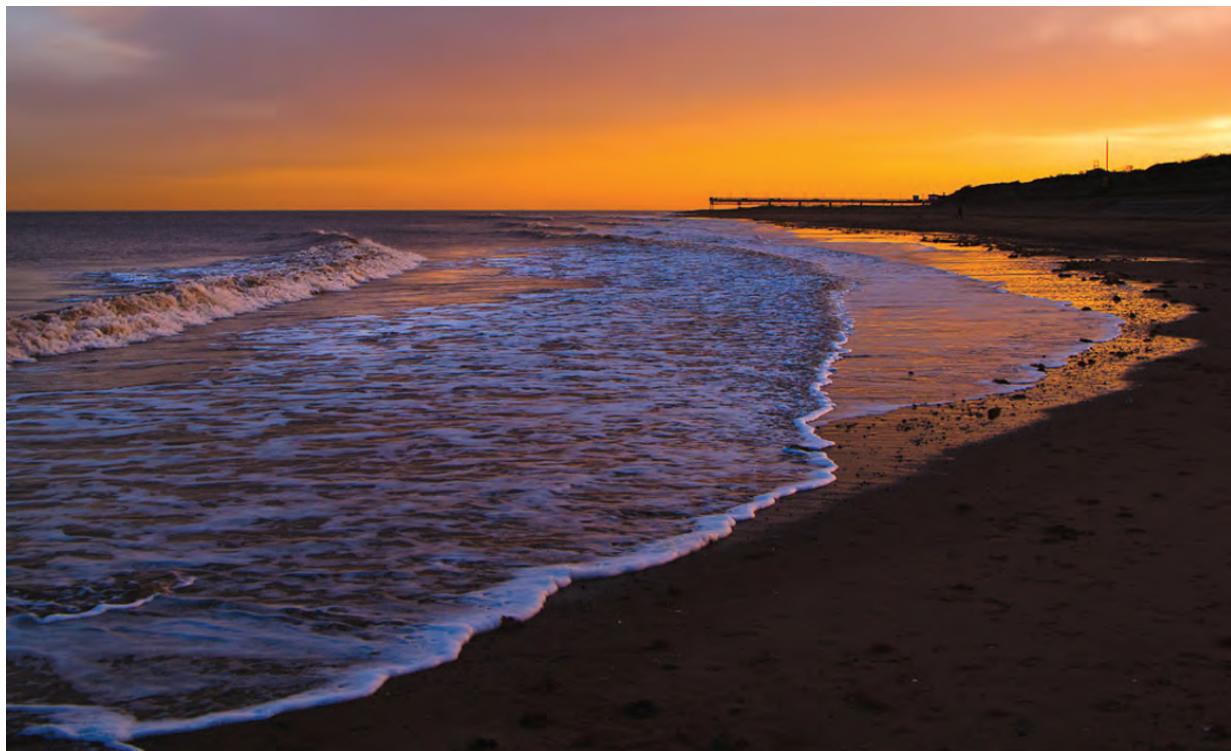
The PDNPA's report "Adapting to Climate Change in the Peak District National Park: First assessment of climate change risks, opportunities and actions" presents the risk assessment matrices with potential actions.

[National Park Landscape Strategy & Action Plan](#)

[Moors for the Future](#)

There is a history of wildfires in the area with their resulting impact on habitats, species, water quality, release of carbon and restrictions on access.

Lincolnshire Coast



Risk Assessment

Rising sea levels due to climate change pose major long term risks to the people and places along the Lincolnshire Coast. The majority of this huge coastal floodplain is below mean sea level and extends over 10km inland in places. As there are no cliffs, the area depends entirely on man made flood defences

Behind these defences are:

- Over 103,000 properties
- 220,000 people
- 6,000 businesses
- 40,000 caravans (the largest concentration in Europe)
- 170,000 hectares of mostly Grades 1 & 2 agricultural land producing & processing up to 40% of the UK's fruit and vegetables.
- Internationally and nationally important nature conservation sites.

How were the risks identified?

The Lincolnshire coast is naturally low-lying and is highly exposed to the North Sea. Therefore the risk of coastal flooding has historically been a significant issue for this coastline.

In 2008 Central government asked for more research about that risk and the implications for sustainable development on the coast, particularly in the face of predicted sea level rises, as a result of climate change.

The Lincolnshire Coastal Study was commissioned to look into these matters, and work was undertaken by a multi-stakeholder steering group (Lincolnshire County Council, East Lindsey District Council, Boston Borough Council, South Holland District Council, the Environment Agency, Natural England and the Regional Assembly). Atkins Consultants were employed between January 2009 and March 2010 to lead this work.

The Great Flood of 1953

On the eve of 31 January 1953 Lincolnshire's coastal sea defences were overtapped and washed away by a tidal surge. There were 22 major breaches in the flood defences, and more than 100 smaller breaches. Water depths reached 2.1 metres in some locations and spread nine km inland. Wind speeds reached nearly 120mph. 42 people died in Lincolnshire and the financial cost ran into millions. Thousands of people were unable to return to their homes for many months.

This event was the worst recorded civil disaster this country has seen (other than war), affecting not only Lincolnshire but numerous other communities along England's east coast. Since 1953 there has been similar high tides and wind speeds hitting the east coast, resulting in localized flooding (for example Great Yarmouth 2007). Because of the investment in sea defences there has not been a repeat of the 1953 flood since.



Business



Health & Well-being



Buildings & Infrastructure



Agriculture & Forestry



Natural Environment

Impact example: East Midlands



Business



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Natural
Environment

Lincolnshire Coast

The Current Level of Risk

The Lincolnshire coastline is generally well protected to a good standard, with the majority of defences reducing the risk of flooding to 0.5% (1 in 200) chance in any given year.

Flood hazard mapping of the Lincolnshire coast and its communities has assessed the current (2006) and future (2015) levels of hazard to people if the coastal and tidal defences were breached or overtopped.

Over 40,000 properties are located in the 'Danger for All' and 'Danger for Most' hazard rated areas (Red and Orange zones).

What changes are expected?

The latest UK Climate Projections (UKCP09) highlight that climate change will increase sea levels. The absolute sea level rise by 2095 attributed to climate change is a range between 13–76 cm (based on a medium emissions scenario not including land movement).

How are people affected?

The areas at greatest flood hazard are located directly behind the defences. These areas contain large numbers of people, properties, communities, tourist resorts and caravans. A multiple breach scenario in the defences could potentially bring loss of life and widespread destruction.

The Lincolnshire coast has a very large proportion of retired and elderly residents. This is likely to increase the risk of fatalities in an event.

How is the risk being addressed?

The Lincolnshire Coastal Study produced and evaluated a set of long-term options for the sustainable spatial development of Lincolnshire's coastal communities. A series of principles to guide spatial development and options

for new development in the study area, taking into account flood risk, have been developed and evaluated using sustainability criteria. The principles and options were generated through a series of workshops with a wide range of stakeholders. The Lincolnshire Coastal Study is being used as a scientific evidence base in the development of local plans for the areas concerned.

The Lincolnshire Coastal Pathfinder

Lincolnshire County Council were awarded £810,000 from central government for a series of coastal change pathfinder projects that ran from 2009 - 11. These involved:

- Working with the local community to equip them with knowledge and information on flood risk.
- Undertaking a project with the community of Mablethorpe to improve involvement in adaptation planning.
- Improving knowledge of the "hidden" community of caravan occupants to improve ways of engaging with them in future.
- Adaptation planning: developing potential spatial planning options through the Lincolnshire Coastal Study.
- Developing comprehensive evacuation plans.
- Introducing a single 'Innovation Learning and Development' programme to bring together expertise and innovation on coastal change adaptation.
- Delivering adaptive solutions: promoting uptake of property resilience measures for future and existing development.

What are the next steps?

Lincolnshire County Council, local coastal Authorities, the Environment Agency and partners

For more information:

Lincolnshire Coastal Study
<http://www.lincolnshire.gov.uk>

Lincolnshire Coastal Change Pathfinder
<http://www.defra.gov.uk>

are continuing to work together to support coastal communities, businesses and caravan parks to help take steps to prepare themselves for coastal flooding.

Lincolnshire has also created a Flood Risk and Drainage Management Framework, which is designed to provide co-ordinated management and delivery of flood risk and drainage functions of all relevant organisations across Lincolnshire. The framework implements the recommendations of the Pitt Review and the provisions of the Flood and Water Management Act 2010 in a way that is tailored to suit the geographical, social, economic and environmental characteristics of Lincolnshire. Its purpose is to ensure that local communities and infrastructure are better protected from all types of flooding, and that improved resilience towards flooding is built into all aspects of planning and service provision in the future.

Information sources: Lincolnshire County Council, Environment Agency and Defra



Stansted Airport, Essex



Risk Assessment

London Stansted is the UK's fourth-busiest airport, currently serving around 19 million passengers a year. It is vital to the economy of the UK contributing £400 million a year and employing 10,200 people at the site in Essex.

Weather has always been a significant factor in relation to the overall productivity of the site. Understanding the risks and opportunities that changing weather may present to our operations and longer-term business plans is crucial to the future sustainability of the airport. Whilst Stansted has always kept a business risk register, we are now in the process of fully integrating potential climate risks through the delivery of our Climate Change Adaptation Plan. This plan was written in consultation with other members of BAA, key airport business partners, the local

planning authority and academic experts in the field of climate modelling.

Significant changes to rainfall, snow or peak summer temperatures present the most significant risks to the airport's operation. Changes in the intensity and duration of precipitation events have been identified as a specific risk. These events increase the likelihood of flooding both onsite and downstream of our operation. Clearly this could present us with threats to business continuity and reputation.

Intense rainfall events also present issues for our pollution control. Our collection pond capacity is becoming constrained and additional heavy rain in winter, at the time when more de-icer fluid is

applied to aircraft and pavements, could mean that the pond limit is exceeded. In addition, during the summer we have seen very heavy rainfall during storms, which does put our surface water drainage system under significant pressure. Worst-case scenario shows that on the wettest summer day we could see a 123% increase in rainfall by the 2050's compared to today.

This has led the team to implement new practice on monitoring and stress testing our balancing pond system, actively relating changes in rainfall patterns to the flows on site and the capacity of the ponds. It is vital that we avoid costly interruptions to service or possible pollution incidents and our climate risk assessment is helping us put in place efficient and proportionate responses.

“...Significant changes to rainfall, snow or peak summer temperatures present the most significant risks to the airport's operation”

Impact example: East England



Business



Health & Well-being



Buildings & Infrastructure

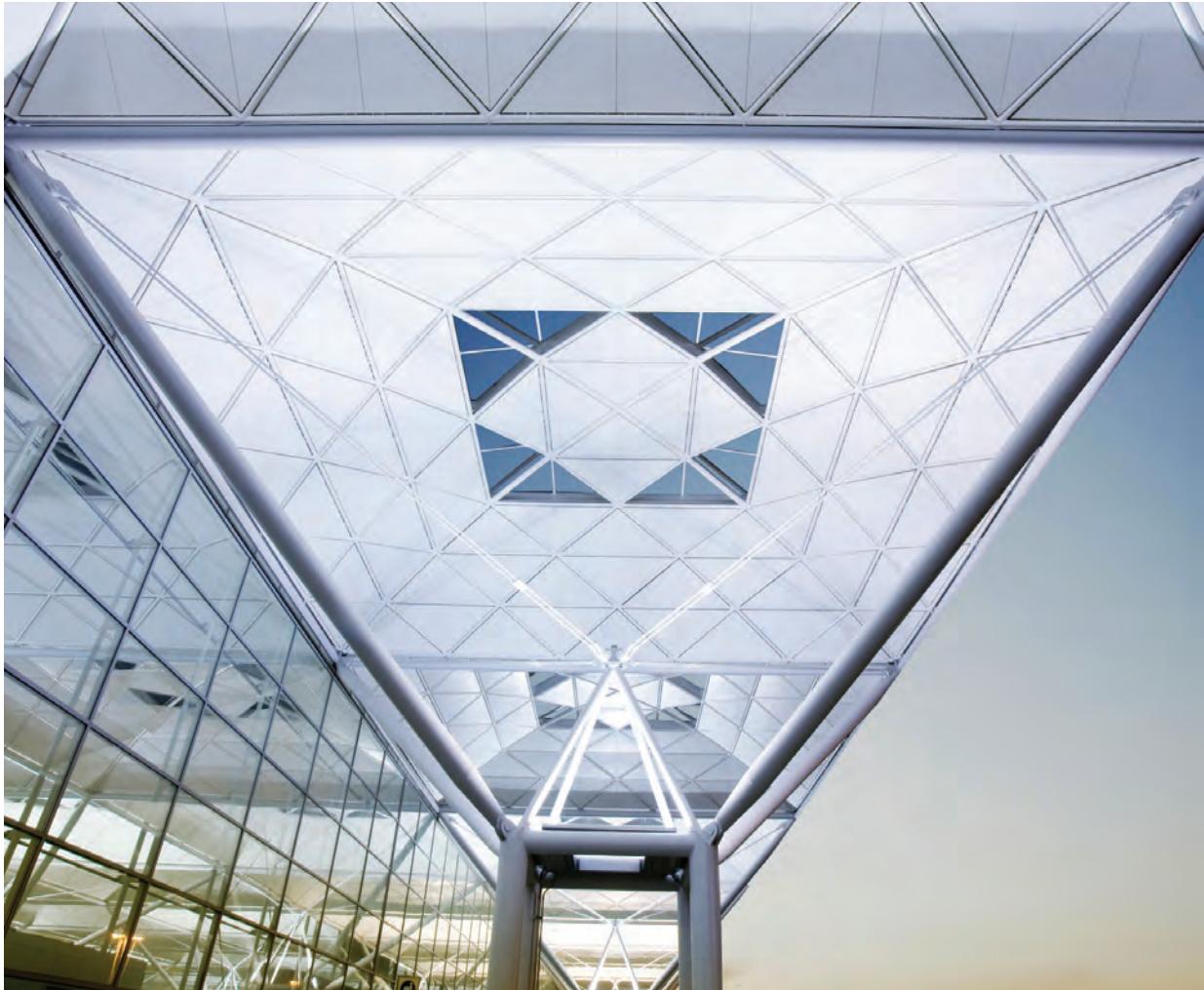


Agriculture & Forestry



Natural Environment

Stansted Airport, Essex



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How is the risk being addressed?

Overall, using our risk assessment matrix has helped us identify 35 risks for Stansted Airport. 2 have been rated as needing immediate action, 14 tell us that we should monitor and prepare for change and 19 signify that we should have a 'watching brief'.

The airport is committed to exploring wider partnership approaches to share best practice techniques on the other risks identified and has initially commenced this through the aviation industry trade associations and more specifically with Sustainability East and their adaptation network at the more local level.

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The Broads, Norfolk and Suffolk



Risk Assessment

The Norfolk and Suffolk Broads is Britain's largest protected wetland and third largest inland waterway. Encompassing an area of 303 km², the Broads sits between the peripheral urban areas of Norwich, Great Yarmouth and Lowestoft. It is home to some of the rarest animals and plants in the UK and provides crucial economic input to the area welcoming over 7 million visitors per year.

The 'Broads Plan 2011' sets out a vision for the Broads to 2030 under three key themes. One of those themes is to respond to the challenges presented by climate change and sea level rise.

"...It is home to some of the rarest animals and plants in the UK "

The major risks are related to water management with flooding being the greatest potential risk. With limited housing on the flood plain, the impacts will be on habitats and farmland and will affect biodiversity, food and fibre production. Flooding also presents a major economic risk, impacting on tourism and recreation facilities, local businesses and infrastructure. The Broads has always been coping with change. The need now is to demonstrate that a new coping range is required to limit the impacts of a flooding risk that is likely to be exacerbated by climate change.

Evaluating this new coping range will mean opening dialogue and debate with all stakeholders to test assumptions and identify society's priorities for adaptation while underpinning the approach with the latest evidence.

A recent 'Biodiversity Audit' carried out by a team from UEA's School of Environmental Sciences, is the first complete assessment of the biodiversity of the Broads.

It confirmed the outstanding importance of freshwater peat fens, wet grassland habitats, grazing marshes and ditches that support large numbers of rare species and their vulnerability to climate change.

The research found that 63% of the 1,500 rarest species in the Broads rely on freshwater, which has major implications if sea level rises, as predicted. Only 13% of rare species would tolerate mild to moderately brackish conditions.



Business



Health & Well-being



Buildings & Infrastructure



Agriculture & Forestry



Natural Environment

Impact example: East England



Business



Health
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& Forestry



Natural
Environment

The Broads Norfolk and Suffolk



How is the risk being addressed?

The Broads Authority's work to date has produced a preliminary adaptation approach. This 'approach' will be used for an extensive period of engagement with the residents and users of the Broads. Adaptation options to deal with the predicted increased flooding risk have been simplified into three scenarios:

Scenario 1

What might happen if no changes are made to current policies and practices

Scenario 2

Every effort is made to control and direct increasing water levels (e.g. more effective water control structures)

Scenario 3

Consideration of water holding options to protect more natural floodplains (with important biodiversity areas) higher up the rivers.

The aim of these scenarios is to stimulate debate about what people might want to see for the future of the Broads. Next steps will consider specific localities, identify gaps and consider trigger points in order to initiate actions for adaptation options.

For more information:

Simon Hooton
Broads Authority

www.broads-authority.gov.uk

The Preliminary Draft Adaptation Approach

<http://www.broads-authority.gov.uk/authority/publications/general-publications.html>

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