

Water, water, everywhere

Climate change modelling predicts there will be rises in peak river flows and sea levels in the UK. Exacerbated by sinking land in some areas, it seems likely we will face more severe and frequent flooding. Will we be ready to hold back the water?

The UK's summer of 2007 was the wettest since records began, more than 240 years ago. Swathes of England and Wales were paralysed by floods, leaving 48,000 homes and 7,000 businesses damaged. Motorways were closed, railways disrupted, and power and water supplies lost.

"The scale, damage and impact of the flooding surprised me," says Sir Michael Pitt, who is leading a government-commissioned review of the flooding emergency. "It wasn't only the scale of the damage, but the emotional impact it had on residents, business owners and farmers – and the fact that, in many cases, buildings in high flood-risk areas weren't in any way resilient."

Part of the problem, says Mike Woolgar, Atkins' director of water management, is insufficient public understanding about flood risk. "Because flooding is a relatively rare event for most people – even those living on flood plains – they might have no experience of the devastation it can cause," says Woolgar. "As a result, they may have little or no direct incentive to protect themselves, through insurance, moving or making their property more resilient until after they have been hit with disaster." The UK's Environment Agency is currently undertaking research into the public's perception of flood risk, with a view to finding better ways to

communicate the threat and the options open to people.

Disturbingly, the 2007 floods may be a sign of things to come. Government figures suggest peak river flows in the UK could increase by up to 20 per cent in the next two decades. If that happened, many of Britain's flood defences would be woefully inadequate.

"You can't put any single event down to climate change," says David King, director of water management at the UK's Environment Agency. "But we are seeing hotter, drier summers and wetter winters. Each iteration in the science tells us that climate change is biting faster and harder than previously thought."

On the surface

The expectation of bigger and more frequent floods is forcing a reappraisal of protection measures. "Following the devastating floods that hit Carlisle in 2005, we've completed the first phase of a major scheme designed to protect the city," says Dominic Bradley, a principal engineer with Atkins' rivers and coastal team. "Essentially, it provides a combination of embankments, retaining walls, flood storage and pumping to control a one in two hundred years flood, which could otherwise affect about 1,500 homes and businesses."

If the climate really is changing, a higher level of flood protection such as

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ACCORDING TO THE **UN-BACKED** INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, **SEA LEVELS COULD RISE BY UP TO 59CM BY THE END OF THE CENTURY**

this may need to become the rule, rather than the exception. But, as the 2007 floods demonstrated, it isn't only homes and businesses that are vulnerable. "Critical infrastructure, such as switching stations and water treatment works, was less defended against the floods than we expected," says Sir Michael, whose interim report emphasises the need for increased levels of preparedness for individuals and organisations.

The initial findings also highlight the impact of surface water flooding. While a high proportion of rainfall is normally soaked up by the ground, in the weeks up to June 2007, persistent, heavy rain saturated it. Sir Michael believes the country is poorly prepared: "The Environment Agency is well geared up for river and coastal flooding, but we now need to strengthen its role to cover surface water."

Managing the risk

While the Environment Agency is currently responsible for the UK's rivers, other sources of inland water that can contribute to inland flooding are managed separately. Sewers are looked after by water companies, and road and railway drainage is managed independently. Co-ordinating drainage management by expanding the Environment Agency's remit could make a big difference. It's a role the Environment Agency would welcome, says King. "We'd see ourselves as advisers, providing the necessary tools, methodologies and techniques to local authorities, water companies and others," he explains. "However, many of the solutions are very local, so local authorities would have to be at the heart of it."

"The extent of the problem is better understood now," says Ian Heijne, director of Atkins' rivers and coastal business, which works closely with the Environment Agency. Flood protection funding in the UK has increased significantly in the last seven years and is set to rise to around £800 million annually. But, adds Heijne, so has the need.

Planning policy is now considered very important. Recent government guidance (PPS25) aims to ensure that flood risk is taken into account at every stage, although it stops short of banning construction on floodplains.

Strategic planning tools, such as Catchment Flood Management Plans developed by the Environment Agency, will take a more holistic approach to long-term flood management for individual river catchment areas. Local initiatives, including

sustainable drainage systems (SUDs), could also help. Traditional urban drainage is designed to channel water away from towns as quickly as possible, but this can increase the risk of flooding elsewhere. With SUDs, rainwater run-off is handled locally. And then there are practical measures, such as London's tideway tunnel. Today, if the capital's Victorian sewers overflow, untreated sewage is forced into the Thames, but the 30km tideway super sewer will capture offending flows to help keep the river clean.

Sea change

Inland flooding isn't the only problem. Defending Britain's coastal communities from the sea is a much greater challenge, and one that in some areas of the UK will be compounded by a sinking of the land. During the Ice Age, areas of Europe were weighed down by glaciers, while land on the perimeter, including southern England, rose up in a see-saw effect. Since the glaciers melted, this raised land has been gradually sinking back down, causing concern over the future impact on flood risk.

But when it comes to protecting our coastal communities, the fiscal rules are tough. "Government funding is only coming through with a benefit-to-cost ratio of 6 or 7 to 1," says Atkins' Heijne. "Most businesses would bite your hand off for that level of return on investment."

It is estimated that, in Britain, at risk coastal assets are worth around £130 billion. "Many coastal defences will be renewed and raised without question," says King. "But we have a limited budget and so will need to prioritise certain stretches of coast. We face some difficult choices in managing the change."

Coastal realignment – which often means surrendering reclaimed land to the sea – goes against five centuries of orthodoxy. But, cradled between the rivers Crouch and Roach on the Essex coast, Wallasea Island paints a more positive picture of coastal realignment. The island is at the centre of an ambitious multi-agency landscape restoration plan.

The Royal Society for the Protection of Birds (RSPB), which has a lead role in the project, hopes to revert the island, now largely farmland, to its original state: a mosaic of tidal mudflats, creeks and saltmarshes. Creating a wildlife habitat is only one of many benefits. "Hydrodynamic assessments show that by allowing the area to flood on a one in a 100-year

48,000

HOMES WERE DAMAGED IN THE UK FLOODS OF SUMMER 2007

event, we could lower water levels further up the estuary, where there are built assets," explains Mark Dixon, project manager with the RSPB.

Water quality may also improve, as salt-loving marsh plants help to strip out chemical pollutants and heavy metals. And fisheries could benefit – saltmarshes provide a vital nursery for commercial fish fry. Creating coastal marshland could even help to cut CO₂. "Recent research shows new areas of saltmarsh and mudflat soak up 2.2 tonnes of carbon per hectare per year," says Dixon.

Warning signs

In the long term, emphasis is shifting from flood defences to flood management, including strategic reflooding of reclaimed land and better alert systems.

Predicting where and when river floods are likely to happen is supported by the EU Flood GIS system – a €2 million pan-European data collection and management network being developed by Atkins to support the continent-wide European Flood Alert System (EFAS). The system pulls together historic and real-time data, including weather forecasts, to

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provide medium-term flood simulations. Bill Oates, associate director in Atkins' geospatial team, explains, "Using traditional national modelling techniques, warning time was only three days. Today it is 10 days, but we hope this will rise to 15 when the EFAS becomes operational next year."

In the seven years up to 2005, flooding on mainland Europe – including along the rivers Danube and Elbe – caused 700 deaths and displaced 500,000 people. Better information won't prevent such floods, but, in the long term, could save many lives.

A bigger threat to the UK's economic security, meanwhile, comes not from rivers but from the sea. The evidence is alarming: according to the UN-backed Intergovernmental

Panel on Climate Change, sea levels could rise by up to 59cm by the end of the century.

Official government advice paints an even bleaker picture: planners should consider a relative sea level rise of more than 102cm for east and south-east England by the beginning of the next century. Rising sea levels are redrawing the map of Britain and, in the long term, higher tides threaten everything from coastal settlements to critical infrastructure.

"We can't stop the sea rising, but we can manage it," says Heijne. "If we don't, we will lose communities that are economically important to us."

Like the fabled King Cnut, we may be unable to hold back the waters. But can we afford to do nothing?