

case study

2007 Summer floods

Tackling surface water flooding in Hull

Hull hit the headlines in June when many thousands of homes and businesses were flooded after some extremely wet weather. The floods highlighted major issues with the city's drainage systems. As climate change makes the chance of extreme flooding ever more likely, this case study describes the changes needed to better protect Hull in the future.



Extensive flooding across Hull

SEVERE WEATHER - June 2007 was the wettest month recorded in Yorkshire since 1882. Severe weather on 15 and 25 June brought heavy and sustained rain to the region, resulting in widespread flooding. Over 100mm of rain fell around Hull on 25 June. The intensity and sheer amount of rain caused such runoff from urban areas that road gullies, sewers and drainage ditches were soon overwhelmed. The resulting floods were made worse by Hull's low-lying position, preventing the floodwaters from draining away.

Soon after the floods, Hull City Council commissioned an independent review, led by Professor Tom Coulthard of Hull University. This case study draws on the data and initial findings of that independent review (available at www.hull.ac.uk/geog).

WHAT HAPPENED - Hull's location makes it particularly vulnerable to flooding. Much of the city is low-lying, reclaimed marshland with over 90 per cent of its area below high tide level. On 25 June flood waters flowed overland from the higher western fringes of the city, around Cottingham and Hessle, towards the lower areas of the city.

We took part in a major relief effort, working with other organisations, to combat the floods. Staff such as Lizzie Brown, a floods engineer, worked around the clock in the East Ridings area to keep pumps operating to reduce the flood waters. She said:

'Although a lot of homes flooded it could have been a lot worse. We worked 12 hour shifts manning the pump house trying to get rid of as much water as possible.'

The floods had a devastating impact on the people of Hull. As floodwaters rose, the fire service received over 1,500 calls from distressed residents, and evacuations were organised in many areas. Flooding in east Hull was largely concentrated around the areas of Bransholme and Kingswood, and very low-lying areas such as East Carr. Flooding was more extensive in west Hull, with large areas of Orchard Park, Newland Avenue and Anlaby Park affected.

Commercial properties and important public buildings didn't escape the flooding, including Hull's new police station. Only 8 of Hull's 99 schools escaped flooding, affecting over three quarters of the city's 36,000 school children. Most schools were able to reopen over the following days, but several were severely damaged and closed for many weeks.

Flood damage to Hull City Council properties, including schools and council houses, is estimated to exceed £200 million. Initial confusion over estimates of properties flooded put the number at 14,000. Floodwaters took several days to retreat and large areas of standing water remained in many of the city's parks and open areas for weeks. We now believe that over 8,600 homes and 1,300 businesses were flooded and tragically one person died in the events of 25 June.

CAUSE AND EFFECT - The flooding was a result of the city's drainage network being totally overwhelmed by heavy and prolonged rain. Hull is at particular risk from surface water flooding, as it is low-lying with limited natural drainage. Whilst localised flooding might be expected from such extreme events, the scale of the June floods raises important questions over the adequacy and performance of Hull's drainage system. In some cases the flooding and relief efforts were hampered by system failures, as shown when Bransholme pumping station was flooded and stopped working on 26 June. This delayed efforts to drain away the flood waters, increasing the misery for residents. Relying on pumping makes the city even more vulnerable.



Main features of Hull's drainage system

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Hull's low-lying position also makes it vulnerable to tidal and river flooding, although tides and river levels did not have a significant impact on the June floods. Tidal water levels in the River Humber were not at their peak on 25 June, and water levels in the River Hull, although high, did not threaten to overtop the banks and cause further flooding. Had the heavy rains fallen on the river catchment upstream of Hull, however, the position might have been different.

PROBLEMS ROOTED IN THE PAST - Hull's drainage system has developed significantly over the last 50 years and past decisions had a considerable impact on this summer's floods.

Before the 1950s, Hull was drained by a network of open channels and ditches that flowed into the River Humber at low tide. Tidal gates were closed at high tide to prevent flooding. As the city grew, there was a major overhaul of the drainage system and many open channels were either filled in or replaced with underground sewers. These sewers collect both storm and waste water, taking the flows to two large pumping stations at West and East Hull. Filling in the open channels and combining storm and waste flows means there is little space for flood water to be managed above ground, leaving Hull with an inadequate drainage system.

In the 1990s Yorkshire Water carried out major improvements to the drainage system through the 'Humber Care' project. They built a 10km sewer between the West and East Hull pumping stations, taking flows to a new treatment works to the east of the city at Saltend. Here all of the city's waste water flows are treated. When storms hit, the pumps at East and West Hull take over and pump storm waters into the river. The recent investment has not solved the root causes of flooding, such as the loss of drainage capacity and the combining of storm and waste flows. Only one area of the city, Bransholme, has separate storm and waste water systems. New approaches and new solutions are needed to improve the city's drainage system.

WHO'S IN CHARGE? - Many organisations are responsible for different parts of the drainage system and this makes overall management difficult. This was highlighted by the Independent Review Board who said:

'In short no single agency accepts responsibility for any elements outside their terms of reference. This is a recurring theme - one of inadequate consultation, co-operation and unity between the agencies. These practices must end.'

We manage the open channels and infrastructure that form part of the main river network, including the river and tidal flood defences for the rivers Hull and Humber. We are also responsible for providing effective forecasts and warnings for river and sea flooding, and have an important emergency response role. Yorkshire Water is largely

responsible for underground drainage, culverts and sewers. They also manage the main pumping stations and treatment works. Feeding into the sewers at street level are gullies and drains that are either the responsibility of the local authority, Hull City Council, or private landowners. The overlap of responsibilities is confusing and makes it very difficult to manage the drainage system in a coordinated way.

A NEW APPROACH - The dramatic events in June clearly show the need for a more co-ordinated approach to flooding in Hull. We believe that one organisation, taking a strategic overview of inland flooding, will improve how we plan, fund and manage flooding that takes account of the challenges of climate change in the future. The Independent Review Board for Hull also recommended this approach. We welcome this and believe we are best placed to take on this role.

To effectively control urban flooding at a strategic level, we need to address two main issues. Firstly, there must be an assessment of risk from all types of flooding that is shared by all key organisations. This is critical if we are to identify where the greatest risks are and therefore where intervention is most urgently needed. Secondly, we need to agree a common planning process that can coordinate responses and investments across the many organisations involved, but which also has sanctions to make sure everyone complies and standards are maintained. We do not seek a significant delivery role, and see that local authorities are best placed to coordinate planning and delivery.



Urban floods need an integrated response

We would expect a strategic role to have three parts. As an **advisor** on strategic flood assessments, as a **regulator** on plans to manage flood risk, and continuing as a **provider** of flood risk management, forecasts, and warnings for river and sea flooding.

GIVING ADVICE - We propose that we take responsibility for developing an industry standard toolkit of methods for preparing strategic flood risk assessments (SFRAs). This would require the provision of data and models held by water utility companies. We should determine the approach to mapping, forecasting and warning for surface water planning as part of the toolkit. We should be able to object to Local Development Frameworks (LDFs) that are not accompanied by an SFRA that is fit for purpose. We understand this approach is broadly supported by Government and representatives of the water industry.

REGULATING OTHERS - It is likely that a voluntary, collaborative approach would be successful in Hull, given the momentum generated by the June floods. In other cases however, we may need to adopt a tougher approach to make sure the right choices are made. Our role could include advising owners and operators of critical national infrastructure on flood risk issues. The need for this was highlighted in Hull when Yorkshire Water's Bransholme pumping station was out of action due to flooding. This issue was highlighted by the Independent Review Board who felt it was unacceptable that there were no contingency plans in place for pump failure, or protection from flood water, at this key site. Since the event, Yorkshire Water has committed to carrying out urgent short-term work to protect the pump station and is considering longer-term improvements. We welcome this approach.

PROVIDING EXPERTISE - Together with our advisory and legal duties, a key part of our strategic role would still be to provide flood forecasting, warning and mapping services. We would not expect to significantly increase our role in planning and managing urban flood risk, as local authorities are best placed to take the lead role in this area. We would explore further if developing a new flood forecast and warning service for surface water flooding is feasible. Our work to date has shown that urban systems are complex. Providing the same service as for rivers and the sea may not be possible. Developing an integrated plan for managing all forms of flooding in Hull is a priority.

We are looking forward to working with Hull City Council and Yorkshire Water to reduce flood risk in the city. We are already successfully doing this elsewhere, working closely with United Utilities in Carlisle to address both the surface water and river flooding issues in a co-ordinated way. Hull needs this same approach.

SUMMARY - The dramatic events in Hull this summer were caused by the extreme weather, but the scale of flooding was influenced by weaknesses in the drainage system and the lack of a strategic approach to reducing risk.

Thousands of homes and businesses in Hull remain at risk of flooding from extreme events, which may become more frequent with climate change. Whilst Hull is particularly vulnerable, many other UK cities are also at risk.

All flood risk management organisations need to work together to find integrated and sustainable ways of reducing flood risk. We have a major role to play and welcome a future strategic role.

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For more information go to:

www.environment-agency.gov.uk/2007summerfloods/