

# Protection of WTW & WwTW from flooding

## flood risk study of United Utilities water & wastewater assets

by Nicola Cowell, Emma S Johnson, Paul Swift & Kate Zabatis

**T**he inundation of Mythe Water Treatment Works in July 2007 was certainly a wake up call for the UK water industry. The high profile incident, which was associated with some of the worst flooding in the UK since the devastating floods of 1947, resulted in approximately 150,000 people in Cheltenham, Gloucester and Tewkesbury losing access to tap water; the incident made national headlines. United Utilities had been fortunate to receive an early warning two years prior to the Mythe flooding, which resulted in the commissioning of one of the UK's first flood risk studies for an entire region's water assets. By the time the flooding had hit central England in the summer of 2007, United Utilities had nearly completed its full review.



*WTW's are just one type of asset that were assessed for flood risk during 6 month period by United Utilities*

*photo courtesy Mouchel*

The storms of January 2005 affected 10,000 homes in Cumbria, leaving hundreds homeless and causing significant financial hardship. Carlisle suffered the most damage, with the River Caldew breaking its banks and cascading through the town centre. The scale of the flooding required United Utilities to employ 450 engineers around the clock to minimise its impact. Despite this effort it took months for normality to return to the region.

The flooding of Carlisle caused particular consternation. A wastewater treatment works had been flooded and a water carrying pipe bridge that belonged to a neighbouring water company had been fractured, causing a loss of drinking water. In response United Utilities carried out an immediate internal review, which raised concerns about the threat from flooding to key regional assets. United Utilities decided to undertake a full water study but, with no previous methodology in place for what was being proposed, the water company brought in consultant Mouchel to develop a viable process.

The result was a study called 'Protection of Water Facilities from Flooding' which involved the assessment of 180 water supply assets

in North West England during a six month period. The assets, which are all at risk of fluvial or tidal flooding, included service reservoirs, water treatment works, pipe bridges, pumps and boreholes.

### The review

Mouchel started the review in early 2007 by engaging with the Environment Agency to determine the extent of existing flood studies for the North West. The Environment Agency had mapped all of England and Wales' rivers using one of two models.: ISIS which results in detailed river models, and JFLOW, which provides more generalised river model assessments that allow for greater flood tolerance. These were then applied to United Utilities' water asset areas to provide base data from which river flooding could be determined. Prior to the study a small percentage of existing sites were recognised as having flood protection facilities, typically recently constructed sites. The majority of older assets had limited flood protection for more frequent flooding and were positioned a nominal distance from the watercourse.

By April 2007 Mouchel had started its site visits. All 180 sites were visited by an engineer, with each assessment taking between two and



## Creating a better environment

Every one of us has a responsibility for the environment.

At Mouchel, we work at the heart of the water industry delivering innovative and totally integrated solutions across this increasingly vital sector.

Working closely with clients from public and private sectors, the scope of our work is considerable. It spans regulated water utilities, rivers, ports and coastlines and impacts on millions of people's lives throughout the UK and around the world every day.

We pride ourselves on overcoming the challenges confronting our industry, which are among the most formidable faced by society today. We embrace everything from maximising the efficiency of our water supply to minimising carbon emissions into our atmosphere.

Mouchel tackles it all - from policy development, feasibility, planning and design and asset management, to delivery out in the field - managing, monitoring, building, repairing and maintaining the infrastructure that shapes our environment.

For further information please contact Louise Elliott,  
Sales and Marketing Manager, Utilities

**T** 0207 874 7700

**F** 0207 383 7593

**M** 0797 634 3810

[www.mouchel.com](http://www.mouchel.com)

**mouchel** 



*Intake pumping station in Chester, which draws water from the River Dee, with a view of flood defence (earth embankment) under construction. photo courtesy Mouchel*

four hours to complete. A pro forma was developed for consistent appraisal, covering such factors as flood source and route, topography and probable extent of flood water, and measures that could be implemented to alleviate the flood effects. The inspection also assessed the implications that any future measures might have on nearby property in line with Planning Policy Statement 25 guidelines.

#### **Proposed options**

Mouchel completed its site visits at the end of the summer, allowing it to propose flood defence options for a one-in-100 year flood event and a one-in-1,000 year flood event, and to develop cost estimates that incorporated both capital and operational/maintenance costs for flood protection measures for all sites.

In total **three different flood defence measures were considered**. The preferred option was to construct embankments on existing land; although a softer and more cost effective measure it was generally only found to be suitable for a minority of sites due to the location of assets in densely populated areas.

A second option involved the construction of traditional flood defences, such as reinforced concrete walls. However the expensive nature of wall solutions made it unviable for smaller assets. The third option involved the provision of flood resilient solutions such as water-proof doors and renders and replacing air proofing bricks.

The water study provided an insight into the expenditure required to minimise the impacts of flooding on customers' water supplies. In late 2007, and with the PRO9 pricing review process on the near horizon, United Utilities asked Mouchel to carry out a similar study for its wastewater assets, primarily wastewater treatment works, wastewater pumping stations and combined sewer outfalls.

The wastewater review benefited from the processes developed during the water review. However, from the outset it was clear that the second review had significant differences, not least that wastewater assets are more susceptible to flooding than water sites,

which are largely located close to watercourses and coastlines to facilitate discharge.

#### **Remedial options**

Six remedial options for each wastewater site were developed by the United Utilities/Mouchel project team, the most advanced of which was a full 'belts and braces' approach involving flood defences to protect the site and mechanisms to control the inflow to the works, along with an overpumping facility to ensure that a site can still operate in flood conditions.

The intermediate options ranged from providing protection for only key equipment, such as motor control centres and biological process equipment, with a final low-cost option involving the sole provision of replacement parts, which can be fitted when flood waters subside. An option to do nothing was also considered which, for sites which result in no significant damage or disruption when flooded, was occasionally viable. Timing constraints for the PRO9 review process meant that Mouchel could only carry out a sample of site visits, approximately 50 in total, with the results from these site visits being extrapolated across the sites not inspected.

Parallel to United Utilities' flood risk study, Ofwat had appointed Halcrow to develop an industry wide framework for assessing critical water and sewerage infrastructure. The framework could then be used as a benchmark set of guidelines for assessing the flood risk to water-related assets. The early groundwork and strategy put in place by United Utilities' has fed into this process, helping to guide the way for other water companies to benefit in the future.

**Note: The Editor & Publishers wish to thank Nicola Cowell, United Utilities' project manager for the flood risk study, Emma S.Johnson, United Utilities' treatment strategy development manager, Paul Swift, team leader for Mouchel's Flooding and Environmental Management business, and Kate Zabatis United Utilities' network strategy manager, all for producing the above article for publication. ■**



*The close proximity of WTWs to watercourses mark such facilities as being at risk of flooding*

*photo courtesy Mouchel*



*A large pipe bridge over the River Ribble*

*photo courtesy Mouchel*