

Strategies to Keep the Taps Running, Whatever Happens

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SUMMARY

Climate change is just one more factor making the unpredictable world of fresh water supply and demand even more uncertain. Dr Sarah Cotterill is interested in finding ways of ensuring continuity of supply when, not if, water systems fail. Despite everyone's best efforts this will happen, she says, possibly resulting from two or more things occurring at the same time or in swift succession. "That's where resilience comes into play." The arrival of just such an event, the COVID pandemic, provided her and a team of researchers from Ireland and the UK with the opportunity to examine how well existing water company risk management strategies performed in response to the challenges presented by a high impact, unpredictable threat. This information is of immense value in helping the water industry and policymakers devise better, more adaptable, approaches to risk management in an increasingly uncertain world.

"Every year water companies prepare for potential threats and make new drought and water resource management plans."

Resilience Makes Systems "Safe to Fail"

For Dr Sarah Cotterill, Assistant Professor of Civil Engineering, the COVID pandemic provided a rare opportunity to progress her research interest in the resilience of water services in both the UK and Ireland.

This particular piece of COVID-related research was conceived in March 2020 when Dr Cotterill and a colleague the University of Exeter's Centre for Water Systems, Dr Peter Melville-Shreeve, recognised the major implications that sudden changes in work practices caused by the lockdown would have for the providers of an essential service such as water. The unexpected nature of this event was of particular importance from their perspective.

"We're interested in the resilience of water systems, how they respond to failure," Dr Cotterill explains. "Sometimes when people talk about resilience they really mean reliability - how to ensure that failures don't occur. There is always merit in taking appropriate steps to prevent failure, that's a first line of defence for any system.

"However, there's also a need to accept that, despite everyone's best efforts, failures will occur that have the potential to disrupt a system. This may result from possibly two or more things happening at the same time or in swift succession. That's where resilience comes into play. Our interest is in how a system can be made 'safe to fail', that there's enough capacity to continue service provision even



when things happen that could not have been predicted. That, to me, is what resilience is all about.”

The two lead researchers Cotterill and Melville-Shreeve, engaged with the UK’s Chartered Institution for Water and Environmental Management (CIWEM) to conduct a UK-wide survey of how water companies were responding to the threat presented by the lockdown. Working with sector experts from CIWEM technical working groups, detailed survey design was undertaken in May and 500 replies were subsequently received from a range of roles, including executives with responsibility for COVID response management in the UK’s water companies – a good response level for a specialised piece of research in a niche area.

“We had worked previously with CIWEM on a survey to do with sustainable drainage systems so we knew this approach would work, bringing in different industry partners and helping us get the participation rate that we wanted,” Dr Cotterill says.



With the benefit of the UK research and its findings, Dr Cotterill is keen to engage with organisations such as An Fórum Uisce, the independent statutory body established in June 2018 to advise the government on water issues, to participate in similar research here in Ireland.

The UK research was undertaken using a framework developed at the University of Exeter (Safe & SuRe) to assess how the initial response to COVID affected operational delivery during the first wave of the pandemic. Eight major themes emerged. “Quite a few of our key learnings reinforced what has been found by researchers looking at other sectors, but a number were specific to the water sector,” Dr Cotterill says.

Putting Water Systems Under Pressure

Changes in the pattern of water demand resulting from people working from home has been significant. Prior to lockdown less than 10% of people worked from home but that figure soared to over 80% in a matter of days. Demand shifted away from urban commercial centres, for example, to residential suburban locations. So some water suppliers experienced a steep fall in demand while neighbouring suppliers saw a sharp rise.

The management of pressure within systems, needed to ensure adequate supply at times of peak demand, was also challenged. Typically in more normal times there is a high demand for water early in the morning as people rise and shower before going to work and again later in the evening. So domestic demand typically peaks between 7am and 9am and 5pm and 9pm. But demand became more constant throughout the day, a pattern more commonly associated with weekends.

Change in demand from commercial to domestic properties also presented a financial challenges for water suppliers, particularly in the UK where charges based on metred water consumption are common. But it also applies in Ireland, where business users pay for their water while domestic users generally pay through taxation.

Another issue to emerge was downstream of supply. The rapid onset of a national lockdown resulted in cafes, pubs and restaurants pouring huge quantities of liquids such as beer and milk down the drain. These organic liquids are much harder for waste water treatment plants to deal with than rainwater or urine, for example, and this caused considerable technical problems at the outset of the pandemic.

“Water companies regularly prepare for potential threats and make new drought and water resource management plans. But there will always be things that come along, like COVID, that are an acute unpredicted threat. So although the water companies had done risk management planning for a flu pandemic, as all large companies would, no-one had anticipated that this volume of people would be away from work,” says Dr Cotterill.

As a follow on to the survey, one of the research team delved deeper into the adequacy of existing risk management plans through a series of semi-structured interviews with senior water company executives directly involved in the COVID response.

Good Advance Planning ... or Simply Good Luck?

“One of the main learnings from all of this work is that there always are going to be acute threats that we cannot predict and for which an appropriate risk management plan cannot be prepared,” says Dr Cotterill. “For example, while there wasn’t an official drought in the UK last year May was an

exceptionally dry month. Fortunately, this was offset by a very wet February, so reservoir levels were sufficient. But how much of that was down to good advance planning and how much simply to good luck? So we're trying to identify what we can learn from acute threats that happen in short periods in order to be better prepared for chronic threats, such as climate change, as well as the possibility of multiple threats occurring simultaneously."

The approach adopted involves a blending of quantitative statistical analysis of data with a more holistic qualitative appraisal of the frameworks within which water supply companies operate. The researchers, for example, have created a "ripple effect map" which teases out the various impacts and consequences from a given threat, starting with direct impacts on water services but then extending out to identify potential consequences from social, environmental and economic perspectives.



Wastewater Treatment Plant

Significant Potential Impacts

One of the most obvious effects of climate change is an increase in the frequency of extreme weather events, including those of protracted periods of dry weather as well as spells of intense rain resulting in flooding and damage to water systems and infrastructures. The uncertain world of fresh water supply, in other words, is becoming even more unpredictable. At the same time the COVID pandemic and consequent lockdowns have provided stark testimony to the threats posed by the "unknown unknown" risks to service provision and the scale of potential disruption that could result when multiple threats coincide.

Dr Cotterill has used the research to delve into the lessons that can be learned from these threats and to help identify how the water industry can become more resilient to them in the future. Improvements in strategic capital investment in infrastructure is one area of opportunity. "Investment is a big thing to come out of this. Everyone is financially constrained and the question is where the best places are to make investment in order to foster resilience," she says.

Another of the outcomes is more fundamental to the way in which water service providers in both the UK and Ireland undertake risk management. "Water supply companies and authorities have roles in managing supply and distribution within their specific geographic locations. But faced with a sudden sharp shock, or a more chronic systemic challenge such as climate change, collaboration and increased levels of joined-up thinking at a regional level become an imperative," Dr Cotterill believes.

"Our research also highlighted that there is a real value in moving away from the traditional 'top down' risk management approach towards a more 'circular' one," she adds. "While this still includes some 'top down' measures, it puts far greater emphasis on a resilience framework process of mitigation, adaptation, coping and learning - with learning at the heart of everything."

As part of that new approach to risk management, what we really need is a more joined up approach - collaboration within and between sectors at a regional scale.

The findings of the research have been widely distributed to the water industry, with coverage of it on the CIWEMs web page. The UK's Water Services Regulation Authority, Ofwat, has also made use of it, with the findings feeding into a broader piece of policy work on the economic impacts of COVID on the water sector in the longer-term.

Also at a national policy level within the UK, the survey findings and resulting papers have relevance to considerations of water trading between water companies. This approach, which effectively sees a limited pooling of available resources between water companies, has potential value in helping to mitigate threats to supply at local levels.



Research References

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