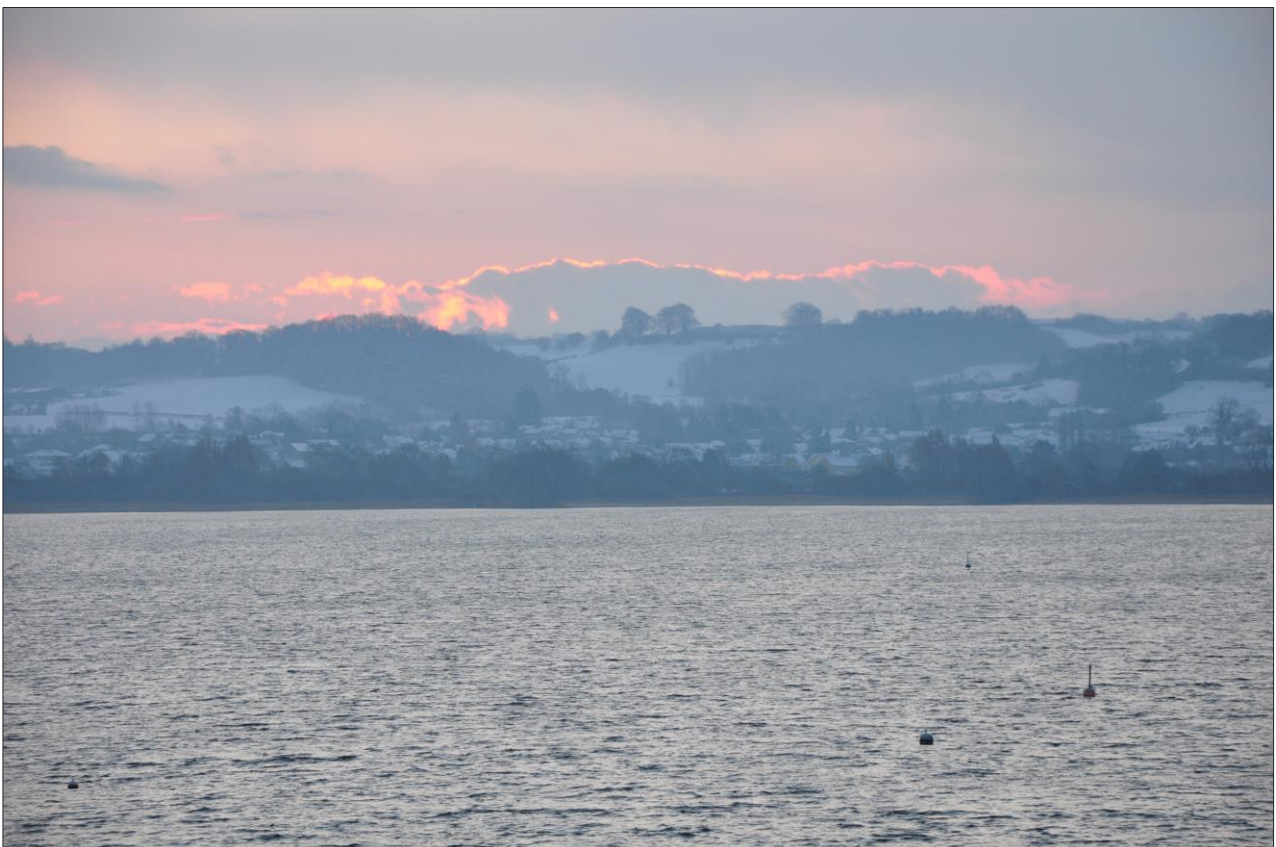


Review of resilience to severe weather incidents

Bristol Water

September 2018



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1. Executive summary

Maintaining the trust of our customers is a top priority for Bristol Water. How well water companies plan and respond to operational incidents, in particular during severe weather, plays a significant part in maintaining customer trust. We set out in this document how we responded to the severe weather experienced across the UK in February and March 2018. We also set out what we learnt from recent operational events such as this, specifically from Ofwat's review into the water supply issues resulting from these weather systems, '[Out in the Cold](#)', Ofwat's company specific [letter](#) to Bristol Water and the Drinking Water Inspectorate (DWI)'s [letter](#) to all water companies.

Ofwat's overall assessment of our performance during the freeze thaw was that we responded well and met our customers' expectations, keeping disruption to a minimum. Although there were no company specific learning points for Bristol Water, we have carefully considered our own experience and those from other water companies. This document sets out the actions already taken and those underway.

We recognise the importance of sharing best practice across the sector as a whole. To facilitate this, we have been proactively sharing our approach and learnings with other water companies (for example by hosting knowledge sharing sessions with individual companies), and have also contributed to national efforts in sharing best practice, coordinated by Water UK.

We are committed to continually improving the resilience of our services for our customers, as demonstrated by our investment in operational resilience schemes over the past ten years and our future plans. In our recent Price Review 2019

business plan (PR19)¹, we set out how we will continue to build resilience across the four strands of our resilience framework - operational, service, corporate and financial resilience. We also set out how we have assessed the key strategic risks to resilience in the future (including climate change leading to more extreme disruptive weather events), together with our plans to address these risks, leading to improved resilience across all four strands.

One of the key outcomes is "Local Community and Environmental Resilience". Our plan includes a range of **Bristol Water For All** initiatives, delivered in partnership with our local stakeholders. These stakeholders, which include local authorities, community groups and other utilities, are key to successful planning and response to severe weather, as well as working with us to address long-term challenges faced by society and the environment.

Through our investment and continuous improvements in our level of preparedness for extreme events, whatever their nature, we will continue to provide a reliable supply of safe drinking water to our customers for generations to come.

A handwritten signature in black ink, appearing to read "Mel Karam".

Mel Karam
Chief Executive
Bristol Water

¹ <https://www.bristolwater.co.uk/about-us/for-all/>

2. Background

Our customers have told us that their top priority is for a safe and reliable supply of water. We recognise how distressing and inconvenient it can be to be without a water supply for any length of time. Consumers need to trust the quality, pressure and availability of their water supply, and their local water supplier.

The planning for and response to severe weather is a key part of the resilience of Bristol Water. In late February and early March 2018, the UK experienced a period of severe weather termed 'the Beast from the East' and 'Storm Emma', with the South West of England particularly impacted.

These weather systems resulted in red weather warnings, issued by the Met Office, indicating a high likelihood that the weather would cause a high level of impact.

In terms of low temperatures and significant widespread snow across the UK, this was the most significant spell of severe winter weather since December 2010². Across the country, over 200,000 customers lost their supply for more than four hours and some customers were cut off for days. This prompted Ofwat to undertake a review of how companies in general responded to the event, as well as reaching conclusions on individual company performance. The Drinking Water Inspectorate (DWI) also reviewed water quality impacts and made a number of recommendations to companies.

The water supply to Bristol Water customers was not significantly affected despite the area suffering amongst the worst of the severe weather, with less than 0.1% of customers without their normal water supply for more than 12 hours.

We cannot be complacent however, and as noted in Ofwat's feedback to us, there is always room

for improvement. We have embraced this opportunity to learn and improve and also to share best practice with others.

This document follows the format of Ofwat's review, with five key areas of focus:

- Planning and preparation
- Incident response
- Communication with customers and key stakeholders
- Customers in vulnerable circumstances
- Ongoing support and compensation

Within these areas the recommendations from the DWI will also be addressed.

One of our key priorities is to maintain the trust of our customers. Our experience suggests that customers accept that exceptionally there may be situations where their normally reliable water supply is disrupted. The freeze/thaw incident, together with our other recent operational incidents, have shown that open and honest communication with customers, including a visible presence from Bristol Water staff with direct communication on site to affected customers, plays an important part in maintaining their trust.

In the remainder of this report, we start by recapping our experience of the freeze/thaw incident to provide a context for our performance. Transparency is important to us and we summarised our performance during this incident in our [2018 Annual Report](#). Our annual report also provides summaries of other recent operational incidents that are relevant to our review, notably the major burst at Willsbridge in July 2017 and the precautionary boil water notice at Clevedon in January 2018.

Our experience of this operational incident, and the other significant incidents which we experienced last year, has been an important part in developing our approach to resilience, which we discuss later in this report and has been a key consideration for our 2020-25 business plan.

² [Met Office](#), accessed September 2018

3. Freeze thaw recap

What happened?

In late February, the Met office issued a yellow/red warning across the South West and other parts of the country for wind, snow and ice. When we experience rapid changes in temperature from freezing to mild, the impact on the ground conditions and the material that some of our pipes are made from typically leads to an increase in bursts and then subsequently to higher leakage.

This spring was no exception, and the rapid thaw period between Thursday 1 and Saturday 3 March 2018 following a period of cold weather saw a significant impact on the outbreak of burst mains in a relatively short period. This resulted in over 250 burst mains in March 2018, of which more than 70% occurred in the first week alone. As a comparison, the 5-year average for burst mains in the month of March is 68. As a result, leakage reports were also high and the volume of customer complaints increased including customers calling us about leaks from their own pipes on their property.

Three tower blocks in Dove Street, (Bristol City Centre) were severely affected, as a damaged high voltage cable meant the repair to the main was particularly difficult. The other incident of note affected 88 properties that were interrupted for more than 12 hours (but less than 24) resulting from a burst in

Tweentown, Cheddar. In both cases the interruption event started at just before midnight on 4 March and was repaired by mid-afternoon the following day, with the response time reflecting the health and safety considerations in making the repair.

What did we do?

To minimise the impact of conditions like these, we have a procedure for dealing with operational and business continuity called the Severe Weather Task Force (SWTF) and this has been in place since the cold weather events in 2009/10. In November 2017 the SWTF met to prepare for the 2017/18 winter period and make sure we were operationally ready. On 23 February 2018, following confirmation of the cold weather forecasts, the SWTF was convened to prepare and plan for the cold weather. This forward planning and the mobilisation of additional resources meant we were able to respond quickly and in fact the average time taken to respond to burst mains did not increase during this event. When the worst happened, and our customers were without water, our colleagues rallied round and volunteered to help by hand delivering bottled water to customers affected at Dove Street.



316

total bursts

197

customers experiencing low pressure

5,749

customer contacts including phone, email, social media

1/3

of these calls related to customers' own frozen pipes

5.71°C

average water temperature entering the supply network

250

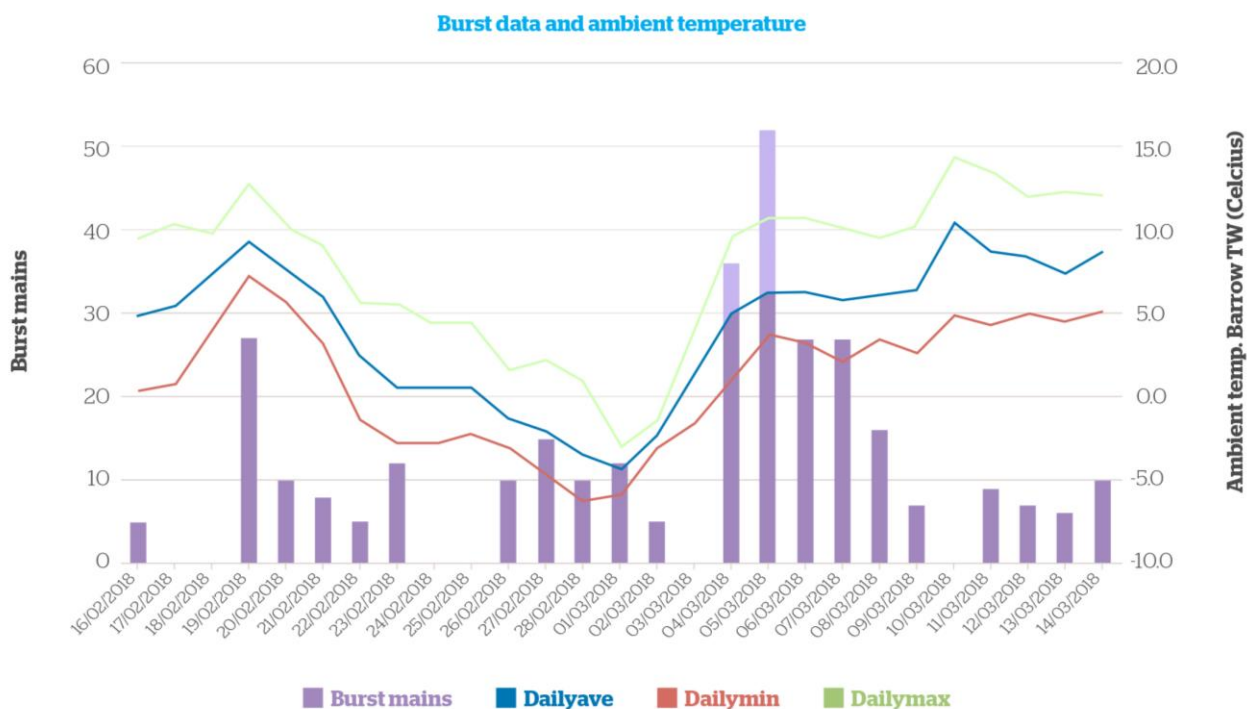
burst mains during the winter thaw in March 2018, with more than 70% occurring during the first week

How did we compare?

Less than 500 customers experienced supply interruptions that exceeded 12 hours. Bristol Water had sufficient resource throughout this incident and the forward planning worked very well. The national news coverage at the time highlighted the severity of conditions with several regional areas affected.

In London and the Thames Valley, over 20,000 had their supplies interrupted due to the thaw.

The chart below shows a temperature swing of 16 degrees Celsius in less than 48 hours and was significantly greater than experienced in other cold periods.



Temperature variations and impact on burst mains during freeze/thaw conditions

4. Learning from other large operational events

Over the last 18 months, we have experienced a number of large operational incidents, including a large burst at Willsbridge in July 2017, a burst affecting Sea Mills in May 2017 and a water quality incident affecting Clevedon in January 2018. After each incident we have reflected on lessons learnt and put continuous improvements in place. Below we provide an excerpt from our 2017/18 Annual Report, which summarised the learning points from the mains burst affecting Willsbridge. It is particularly relevant to this review as it was an operational incident that was affected by the weather.

The Willsbridge burst was a complex repair, hampered by challenging weather conditions and complicating site factors. Despite the overall operational success and customer satisfaction, Bristol Water was able to draw four learnings from the experience:

- 1** More focus could be given to the impact of operational decisions on customers when restoring supplies and cascaded more effectively to further increase satisfaction.
- 2** Stakeholders were informed of the incident, but the process for doing this could be improved further.
- 3** Review processes to improve timing and accuracy of all customer communication channels, so that accurate information can be kept flowing, even when there is no significant update. In this type of scenario, customers are keen to know about how we mobilise in response and who is involved, not just information about their water supplies.
- 4** The incident will inform our review of how alternative water supplies are provided.



The Incident

- Bristol Water crews arrived in Willsbridge, on the outskirts of Bristol, to discover large amounts of surface water with complicating site factors.
- The South Bristol Ring Main, which transports water between North and South Bristol, had to be isolated to allow the cause to be safely investigated.
- The cause of the incident - a burst main in Willsbridge - was confirmed within an hour of the initial reports. It was unique to the site and appears to have been the result of ground movement and the complex pipework at the pumping station.
- Proximity of gas mains, power cables, hazardous weather conditions (lightning strikes) and surface water added complexity to the incident, requiring close collaboration with other utility providers.

Customer Satisfaction

- A recent customer survey included some who were affected by the burst.
- Of those affected surveyed, 62% were very or fairly satisfied, with how the burst was handled.
- Together with social and other media views, generally customers were satisfied with our response and most accepted that such events may occasionally happen. But, we recognise there is always room to improve communication and response.

Customer Communications

- The Communications Team was quick to respond.
- Three members of the Comms team on 'incident alert' for 24 hours to allow social media channels to be effectively monitored and customer interactions proactively managed.

5. Planning and preparation

Bristol Water has tried and tested plans in place to mitigate the impact of disruptive incidents and to ensure high quality drinking water is available for customers. When a piped supply is not available, we have plans in place to provide alternative drinking water to customers which more than meet our minimum obligations under the Water Industry Act as we do not limit how much water people can take.

Ofwat found that “Bristol Water’s planning in advance of, and response to, the incidents in the region appears to have worked well”, and that learning from previous incidents of this type was used to improve our operational response. This allowed us to enact our plans for dealing with a severe weather incident at an early stage, before widespread disruption had occurred.

Our planning for severe weather builds on past experience; in particular our approach took into account the experience from previous incidents within the UK, such as the freeze/thaw that particularly affected Northern Ireland in 2010. We have re-reviewed our approach based on this past experience, as well as our recent operational incidents and the freeze/thaw incident.

Our Severe Weather Task Force convened in November 2017 to prepare for winter, and following confirmation of the cold weather forecasts on 23 February 2018 the group was re-convened to prepare and plan for the likely impacts. The group met five times between 23 February and 2 March 2018. Outputs of this group included communication and raising awareness with customers, ensuring access to production sites and availability of treatment chemicals (for example by timing deliveries either side of the expected poor weather).

Planning for incidents as a result of severe weather is in part dependent on receiving timely

and accurate weather forecasts. To this end, key departments within Bristol Water are subscribed to the National Severe Weather Warning Service, a tool used by the Met Office to cascade information which we, as a Category 2 responder under the Civil Contingencies Act, are entitled to receive and act upon. We also receive information from the joint Met Office and Environment Agency’s Flood Forecasting Centre. Following the freeze/thaw the contact details held by these agencies were checked and we confirmed that they were being sent to the right contacts within Bristol Water.

Practical steps taken in the planning and preparation phase included increased staffing and ensuring that service reservoir and production levels could accommodate an increase in demand due to main bursts and customer leaks, through the rescheduling of maintenance and working closely with Wessex Water to manage bulk supplies in a way that customers of both companies were protected. In our experience, by planning and working jointly with other companies, the resilience for all customers is improved.

In advance of the freeze/thaw and as part of our normal resilience planning we had identified the need for additional resource within the business for emergency planning and enhancing preparations for incident response. This is a reflection of the commitment we have to ensuring our planning and preparation for incidents is robust. This post was successfully recruited to in August 2018.

Part of this new role is to carry out comprehensive and regular reviews of all of the company’s incident plans and procedures to ensure they are comprehensive, for example testing scenarios such as an even more severe weather event (e.g. heavier snow causing further disruption to transport, or a more rapid thaw causing many

more bursts in our network). This review of preparedness was a particular recommendation from the DWI.

Another key area for this role is to plan and deliver additional exercises to test our arrangements, including for incidents that have a more severe impact. In doing so, we will involve and work closely with partners within our Local Resilience Forum areas as part of our obligations under the Civil Contingencies Act.

Mutual aid within the water industry is well established, allowing for the sharing of resources (potable water, personnel, equipment and supplies) during an emergency. Bristol Water has on multiple occasions given and received assistance when dealing with incidents. These arrangements are a huge benefit to the industry and more importantly to customers, but it must be acknowledged that in incidents such as this which affect multiple regions in the UK that this capacity will be limited. We plan on the basis that in such circumstances, each company will be dealing with local issues which will stretch their own resources and make reliance solely on mutual aid impractical. Water UK, the industry's membership body, is leading a review of mutual aid within the water sector, which we support and fully participate in.

6. Incident response

The rapid thaw that followed the very low temperatures caused a large number of burst pipes. Whilst severe, the freeze/thaw incident was not exceptional, and was well within our incident planning. This planning includes consideration of the impact of multiple different threats to resilience that could occur at the same time, as well as more severe individual incidents. This reflects operational reality, such as considering the potential for a flu pandemic or communication disruption, combined with a weather impact.

For the freeze/thaw incident, our main challenge was to ensure sufficient water production whilst responding to individual bursts across the network. This was the main issue affecting water companies across the UK, and was no different for Bristol Water. At their peak, mains bursts levels were five times higher than the average level of mains bursts experienced over the period of 14 February to 14 March. A total of 9,802 properties experienced some interruptions to supply during the incident with 471 customers experiencing interruptions that lasted between 12 and 24 hours. The majority of these, however, were located in three tower blocks and our ability to respond more rapidly to restore supplies was hampered by the location of a damaged high voltage cable. This meant that we had to wait for the power company to move the cable before we were able to repair the burst main.

On Monday 5 and Tuesday 6 March, our response moved into formal incident management, whereby a specific command and control structure is enacted to ensure the incident can be responded to quickly and efficiently.

The significant amount of work across the company in advance of the worst of the weather hitting meant that we were in a strong position to identify and repair any bursts on our pipes and did not experience widespread failures across our network or in any of our treatment works or reservoirs. The operational response and mobilisation of resources meant the average time taken to response to mains bursts did not increase over the period.

Our use of technology means we have a detailed and accurate real time view of our network which is vital for an effective response, and the value of this capability was noted in Ofwat's report. As a local water company, we have good network technology as well as local knowledge, which

together provide a resilient response. Our PR19 business plan sets out how we plan to go further to use this technology to boost resilience, reduce leakage and supply interruptions and reduce the risk of long supply interruptions still further.



To support future incident responses, Bristol Water has introduced a designated incident support vehicle. This resource will enhance on-site management of incidents and, where appropriate, provide affected customers with accurate and current information at the scene of the incident. It will allow for significantly improved communications links from staff on the ground to decision makers in the incident room (image below).



7. Communication with customers and key stakeholders

Keeping customers informed when something goes wrong is a priority for us. We recognise that different issues require different approaches – for example an event impacting on water quality may require us to issue large volumes of boil notices to customers, while this wouldn't necessarily be appropriate in the event of a mains burst, which may be able to be resolved quickly by supplying the affected area via a different route.

The communication methods used during the freeze/thaw incident centred on digital communication through our website and social media, which we matched with communications to retailers. In addition, we utilised a local radio broadcast on 5 March 2018 to reach customers through a non-digital channel, and sent direct SMS messages to the customers on Dove Street when alternative water was available on site. Our operational response procedure for our customer contact centre was enacted as part of this incident, and the contact centre stayed open until midnight to answer customer calls. We provided a recorded message (RAD) with further information at peak call times, and an alternative number for customers who still needed to speak to us. This approach appeared to work well, but we recognise in our PR19 business plan that we want to improve our pro-active communication to reduce reliance on RAD as a communication approach during incidents, particularly for customers in vulnerable circumstances. We provide more details on this plan below.

Ofwat noted that “Bristol Water’s overall approach appears to have worked well for the scale of incident it was managing, with a particular reliance on the company website and social media in the overall communications strategy during the incident”. Digital communication tools

were useful considering the dynamic nature of this incident, but we recognise that more work needs to be done to ensure we can effectively communicate in a timely manner for the large number of our customers who may not see messages through these digital formats. To this end, we are developing a revised communication strategy and also investing in technology which will help us to emulate best practice for communicating with customers during an incident. To support our approach, we plan to seek permission from customers to use existing contact details for proactive communications and to consolidate those details which we have into a central repository. In future, our proactive communications programme will utilise a wider range of channels to help customers to prepare for the winter and our IT investments will ensure that we can target messages through a range of channels.

Our planned £16m investment in information technology will support all aspects of resilience. Investment includes further integration and consolidation to provide a 'single view of the customer', investment in communications, expanding contact channels, in field operational support, big data analytics, maintenance regimes and knowledge management. There are four main elements to this:

1. Proactive customer communication – this will establish the necessary tools to pre-emptively target and intelligently message customers given a particular scenario. An example of this would be where we identify a leak in a particular street, or postcode area, we would be able to message a customer in advance, informing them of the incident and provide further on-going communication as the work to resolve the issue progresses and status changes. This messaging could be via SMS, email, social media, telephony, online portal or our website.
2. Omni-channel customer contact management – centralising all forms of customer communication with Bristol Water, allowing our customer service agents and field service agents to understand a customer's relationship with Bristol Water in-the-round, meaning they can resolve issues first time without the need for a hand-off. The intention is to provide field service agents access to all the functionality available to our contact centre employees – offering 'door-step customer service' to all our customers.
3. Reporting and analytics – providing clearer management information on how our customer experiences are performing, helping us to address points of dissatisfaction and allowing us to target future investment on those experiences that add the most value for our customers.
4. Digital self-service capability – improving how our customers can interact with us digitally. From viewing their account online, to amending their details, through to booking appointments and tracing a job from inception through to completion.

As well as communicating with domestic customers, we have a responsibility to engage with retailers and their non-household and business customers. Bristol Water has a close working relationship with the 18 retailers working within our area of supply, through the work of our Wholesale Services team. The team have a clear process in place for cascading information to retailers in the event of a disruptive incident affecting their customers. This is based on the Retailer Wholesaler Groups (RWG) Good Practice Guide which was developed by the trading parties. The team also now disseminate posters with advice for retailers to brand and share with their customers, covering issues such as cold weather, hot weather, leakage, water regulations and water efficiency. These have been very well received. Wholesale Services have

also recently introduced Dig Dat's RNS system to improve targeted event push notifications and communications for our retailers.

As well as communicating with customers, Bristol Water works closely with partners through each of the Local Resilience Forums in our areas of operation. During this incident, we liaised directly with Bristol City Council and worked alongside Western Power Distribution to ensure the restoration of water supplies to residents of Dove Street as quickly and safely as possible, with positive feedback from the local authority on the timeliness of our communication with them.

8. Customers in vulnerable circumstances

When consulting with stakeholders who work with people with specific needs, we found that where we have a close working relationship, stakeholders were happy with the service and support we provided to people. However, there is an opportunity for us to collaborate more closely with non-financially focused stakeholder groups (such as local authorities, community groups, charities and groups who work with people with sensory deprivation or mental health issues).

We also talked to our customers about how well we support them in difficult circumstances – for example during supply interruptions. Customers told us that they need more notice for such events – whether to plan for help, to budget for bottled water, or for health planning reasons. For the same reasons, it is important for these customers to have a clear sense, as soon as possible, about how long the interruption may last. Customers value regular, honest and transparent communication. Using multiple communication channels is important to make sure as many people as possible are being reached. Customers also requested delivery of water directly to the most vulnerable within a few hours.

Our PR19 business plan recognises that we need to do more to promote the services which we offer through our priority services register. We aim to treble the number of customers registered for these services through developing and enhancing third party relationships to support identification of vulnerable customers and data sharing with other utilities and interested parties – subject to data protection legislation. We recognise the transient nature of vulnerability and, as such, we are working to embed an awareness of the full range of vulnerability risk factors across our business.

We are developing new ways to proactively support customers in vulnerable circumstances and to close the gap between need and support. As an example, we are planning to work in partnership with charities to communicate our support more easily to those who need it. In addition, we are driving community awareness of the support available for customers in vulnerable circumstances, particularly with regard to transient vulnerability.

We will improve data cleansing procedures to ensure details are kept as accurate as possible, streamline the process for customers to self register for support (online, by phone or by post), and provide a dedicated phone number for customers on the Priority Service Register (PSR) to get direct advice and support.

We will monitor the effectiveness of our inclusive service provision, through our performance commitment to achieve 85% customer satisfaction among those who are receiving vulnerability assistance.

Our strategy for providing Alternative Water Supplies (AWS) works well for us as a small, local company. Our strategy is to provide water from designated hub locations to the majority of people affected by a disruption to their supply, with

bottled water provided for vulnerable customers. We know this process is effective, based on two incidents which recently affected our customers (a burst to a strategic main and a water quality issue). We are actively sharing this learning and the benefits of our AWS strategy with other water companies,

The Business Resilience Manager for Bristol Water is chairing the Water UK task and finish group looking at bottled water and other alternative water supplies in emergency situations.

As a learning point from the freeze/thaw and other operational incidents, we now deploy AWS and individual vulnerable customer provision earlier in the process, on a precautionary basis, for day to day bursts and interruption events. This means that provision is made and communicated to customers before an incident escalates. This approach recognises that even short supply interruptions can be particularly inconvenient for some communities and in some circumstances. An additional benefit is that if an incident does escalate, many customers are already aware of the AWS provision and this builds confidence. There have been circumstances where we have deployed AWS and bottled water for vulnerable customers before any interruption has occurred, which again builds confidence and trust in Bristol Water.

9. Ongoing support and compensation

Those customers whose water supply was disrupted for longer than 12 hours due to the freeze/thaw received payments in line with the guaranteed standards scheme (GSS). A total of £7,500 was paid to 370 household properties and 2 non-household properties (via their retailers) in Dove Street, while £2,100 was paid to 76 household properties and 12 non-household

properties (again, via their retailers) in Tweentown, Cheddar.

We did not apply any severe weather exclusions to GSS payments during the freeze/thaw incident, recognising that this would impact customer trust. We took the decision not to pay enhanced compensation for this incident, taking into account that our response was good and to be consistent with other incidents with a similar level of impact. We will review what compensation is appropriate for any incident in a way that maintains customer trust, and consider whether this should go beyond the standard GSS arrangements.

We are actively supporting the industry review of compensation arrangements, specifically GSS.

10. Our plans for continually improving resilience

Our resilience framework (described in Section C4 of our business plan submission) considers operational and service resilience risks and mitigations, as well as corporate and financial resilience. With respect to operational resilience, our long-term ambition is to reduce the number of customers at risk from severe interruptions to supply (interruptions lasting more than 24 hours), with no more than 3,000 customers affected for more than 24 hours from an individual event.

During this asset management plan (AMP) period we have completed our Southern Resilience Scheme. This was a major water infrastructure project that provides improved security of supply to over 280,000 customers across our supply area, including Weston-Super-Mare, Cheddar, Burnham, Wells and the southern part of Bristol, as well as providing support for growth. The project involved laying 30km of new pipeline, installed in three sections from Barrow to Cheddar, as well as an upgraded pumping station at Cheddar Treatment Works. The work allows us

to move water from our northern sources to our southern supply area in the event of a loss of supply, or water back up to Bristol if we lose our northern supply. Through this scheme, and other improvements, we have protected almost all customers in population centres of over 25,000 people from the risk of a severe interruption.

In our PR19 business plan, we propose £12.9m of further investment to protect an additional 540,000 customers in population centres over 10,000 people from a severe interruption due to the failure of a critical asset such as a treatment works, pumping station, service reservoir or critical main. Through the second part of our 10 year programme, the remaining 290,000 customers in population centres of this size will be protected by 2030. To support the development of our investment plans, we analysed our operational resilience risks. As part of this review, we sought to understand the risks to our mains network through asset criticality profiling led by Minerva IAM³. This contributes to how we meet the DWI's recommendation for water companies to review the resilience of their water supply networks to withstand significant weather related challenges.

This investment will improve our ability to respond to a range of operational events such as another freeze/thaw event, the failure of a critical asset, or contamination at one of our works. We have included a bespoke performance commitment to measure the improvement to resilience and this investment will also contribute to our ambitious supply interruptions target of 1.8 minutes per property (our forecast of industry upper quartile performance).

As part of our resilience scheme, we are employing sector leading technology by investing

³ Further information can be found in our Resilience Investment Case BRL.C5B.TA17

in Dynamic Boundary Valves to enable us to react to severe disruption events automatically, mitigating risks in our systems to address the weak points in our critical mains infrastructure. Data from the monitors are transmitted back to centralised software which marshals and analyses the received data to determine whether there are risks to minimum levels of service being achieved. This approach, known as Resilient and Dynamically Adaptive Water Distribution Networks, has been developed by us in collaboration with Cla-Val and Imperial College London. The technology has been deployed at test sites within our supply area, and has been shortlisted for Water Industry Awards 2018 in the "Water Resilience Initiative of the Year" category.

Our remaining 20 AMP7 investment cases all also contribute to overall resilience and the majority to operational resilience specifically. For example, we are investing £2.5m to enhance the configuration and monitoring of our network, to enable us to identify issues early and respond accordingly. This includes:

- a significant increase in pressure loggers to cover 100% of our district meter areas;
- additional transient monitors in our highest risk district meter areas (i.e. in approximately 40% of these areas); and
- a flow monitor on each of our waste water management districts.

This proactive approach will improve our overall response time and reaction to customers as well as highlight any other issues such as low pressure. In addition, installing permanently deployed transient loggers will provide advance warning of harmful transient flow before it causes a burst.

The delivery of our business plan is underpinned by our transformation programme. The network and production aspects of the overall transformation portfolio in particular, make a

significant contribution to our future operational resilience. In our network operations we are fundamentally redesigning how we manage our network and serve our customers. For example, by making performance data more visible to field staff, we can enable real time interventions to avert network issues or minimise the impact when they do occur. For production, we plan to build further resilience into our supplies and improve water quality.

11. Our resilience framework

To guide our current and future strategies, we have developed a resilience framework that:

- Links our customer priorities and outcomes to our four elements of resilience; operational, service, corporate and financial
- Uses Ofwat's resilience planning principles
- Helps to identify and categorise resilience risks, and to ensure we consider a broad range of options to deliver best value solutions
- Highlights the importance of innovation, transformation and continual improvement to all components of resilience.

Our resilience framework helps us to deliver the expectations that our customers, the government and our regulators have of us. A summary of our plans against our framework is given in Figure 1 overleaf and further information can be found in Section C4 of our business plan submission.

12. Our resilience maturity assessment

The combined impact of our people, procedures, systems and infrastructure mean that we are already resilient to many of the challenges we face. We know we can do more however, and we know we need to continually improve as our challenges evolve.

To understand how well the characteristics and attributes of our organisation support resilient outcomes, we have developed a self-assessment tool to grade our current performance. Against more than 100 questions, each linked to one of our four pillars of resilience, we have scored our performance on a scale from 1 (Aware) to 5 (Excellent). The figure below shows where we consider our resilience approach to be most developed across operational, service, corporate and financial resilience. The figure also shows where we expect to be at the end of 2025 based on our future plans.

The results of the self-assessment indicate that we need to improve in some areas, such as how we use the performance of existing and past projects to optimise what we do in future. We recognise this issue and believe it reflects historical challenges in capturing data and information to align experience to our resilience goals. We have completely refreshed our vision and strategy and have developed our organisation to focus on these challenges. This focus includes making sure we learn from our experience of implementing change. Our transformation programme will improve all aspects of resilience alongside other improvements to our corporate resilience. A summary of the results of our assessment is provided in Figure 2. As our assessment shows, we are implementing a range of improvements which develop all of our four pillars of resilience.

As part of this assessment, we reviewed our preparedness for responding to severe incidents. Based on the recovery plans which we have in place and the level of testing undertaken, we objectively scored our current performance as 4 ("optimising"). The learnings from the freeze/thaw incident will contribute to our continuous improvement of our approach.



Figure 1: Summary of our plans against our resilience framework

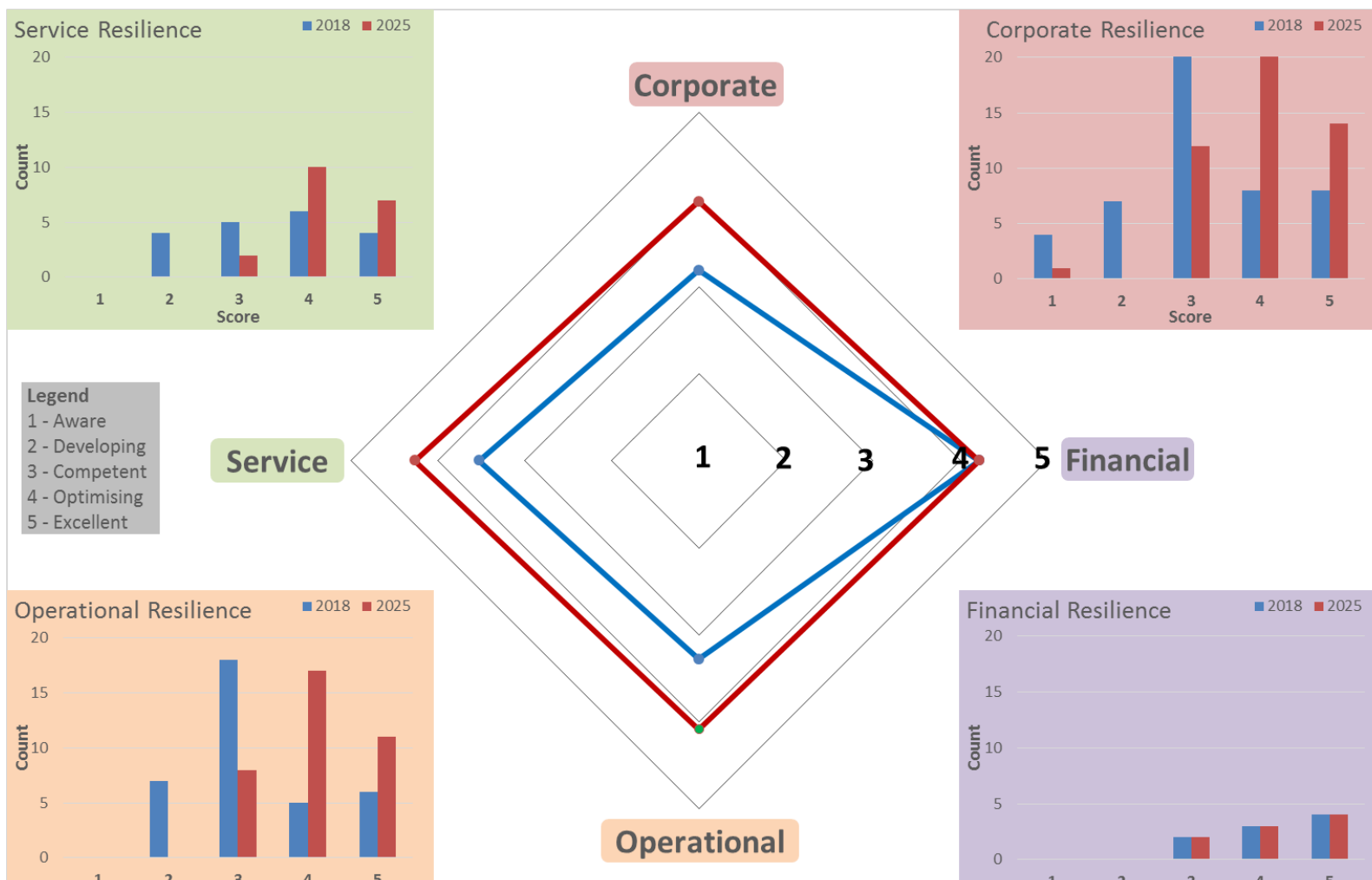


Figure 2: Summary of our resilience maturity assessment (the blue line is the position at the time of the assessment and the red line is the forecast position in 2025)

13. External assurance

Our independent Security and Emergency Measures Direction (SEMD) Certifier has reviewed this report and confirmed that both our preparations for emergency planning and incident response, and our actions identified in reply to the recommendations from Ofwat relating to these activities appear appropriate.

We are working with the Certifier to ensure a comprehensive review of the completed actions, and an update on the status of those in progress will be included as part of the 2018/19 SEMD certification report provided to the Department for Environment, Food & Rural Affairs (DEFRA) in April 2019.

Appendix 1: Our actions in response to recommendations from our regulators

In this appendix we have drawn out the specific actions and recommendations from Ofwat and the Drinking Water Inspectorate relating to the freeze/thaw incident, and assigned ownership to relevant people and teams within Bristol Water:

Recommendation	Bristol Water action	Owner	Deadline
(Ofwat) <i>[With reference to the reliance on the website and social media]</i> the company should also use a range of different tools to maximise reach and ensure that the tool is appropriate for different stakeholders.	<p>Develop a Communications Strategy to ensure customers are able to receive information from the company in a timely manner, to include investment in multiple channels of communication.</p> <p>Our PR19 business plan sets out a wide range of communication channels, and our investment plans to fully and effectively utilise them.</p>	<p>Implementation: Head of Communications</p> <p>Senior owner: Chief Customer Officer</p>	01/04/2019
(Ofwat) Engagement with business customers and retailers also needs to be improved. This is an area that all companies should be reviewing to ensure that their approach is appropriate and targeted.	<p>Based on our review of procedures for contacting retailers (and their positive feedback during and following incidents) we have concluded this area is appropriate and sufficient.</p> <p>Work closely with retailers to ensure site specific plans and contact information are up to date and in place for their sensitive customers as appropriate.</p>	<p>Implementation: Emergency Planning & Security Advisor / Head of Wholesale Services</p> <p>Senior owner: Head of Legal & Compliance / Chief Customer Officer</p>	<p>Complete</p> <p>31/10/2018</p>
(Ofwat) Individual companies' Priority Service Registers do not adequately capture all customers who may need additional support.	<p>Creation of a Customer Care Team with dedicated phone number for customers on the Priority Service Register (PSR).</p> <p>Improve data cleansing procedures to ensure details are kept as accurate as possible.</p> <p>Streamline the process for customers to self register for support (online, by phone or by</p>	<p>Implementation: Head of Customer Services</p> <p>Senior owner: Chief Customer Officer</p>	<p>Recruitment of additional resource in progress.</p> <p>01/04/2020</p> <p>31/10/2018</p>

Recommendation	Bristol Water action	Owner	Deadline
	post). Increase the number of customers on our Priority Services Register through various means including the national data sharing initiative (commitment in business plan to treble the total number on the PSR by 2025).		End of AMP7
(DWI) All water companies review their arrangements for reporting of sufficiency of supply events, particularly in relation to providing the actual area and population affected and including location maps of investigatory samples collected following the restoration of supplies. Also, establishing the root cause for the loss of supplies and demonstrating the steps taken to mitigate against a reoccurrence should be part of the investigation and included in final reports.	We have reviewed our processes relating to notification of events to DWI and the subsequent submission of reports. We have confirmed they are fit for purpose and fully compliant.	Implementation: Emergency Planning & Security Advisor / Head of Water Quality Senior owner: Head of Legal & Compliance / Director of Strategy & Regulation	Complete
(DWI) All water companies review their levels of preparedness to cope with severe, but not unforeseeable, weather events.	We have reviewed our Emergency Management Manual and business continuity plan relating specifically to severe weather and ensured these are scalable to more severe weather events. Review of severe weather task force procedures (for hot and cold weather).	Implementation: Emergency Planning & Security Advisor / Regional Heads of Networks Senior owner: Head of Legal & Compliance / Director of Network Operations	Complete Complete
(DWI) Review the adequacy of current arrangements for meeting their statutory requirements for provision of alternative supplies, including procurement of bottled water stocks, during widespread insufficiency events such as this.	We have reviewed our strategy for the provision of alternative water supplies, including our stock of bottled water, to ensure it is sufficient and appropriate. Based on successful deployments during previous incidents we have concluded our arrangements are robust and we are sharing our practices with other water companies. We have also taken into account the revised	Implementation: Business Resilience Manager / Emergency Planning & Security Advisor Senior owner: Head of Legal & Compliance	Complete

Recommendation	Bristol Water action	Owner	Deadline
	<p>sampling regulations for alternative water supplies.</p> <p>Involvement (Chair) in the Water UK task and finish group looking at bottled water and other alternative water supplies in emergency situations.</p>		Complete (as part of the submission coordinated by Water UK)
(DWI) All water companies review their own capacity, and that available within mutual aid requirements, for dealing with events of this type.	Participate in, and support, Water UK's review of mutual aid within the water sector.	<p>Implementation: Business Resilience Manager / Emergency Planning & Security Advisor</p> <p>Senior owner: Head of Legal & Compliance</p>	Complete (as part of the submission coordinated by Water UK)
(DWI) All companies review their preparedness and ability to respond to forecasts of severe weather that may present a risk to sufficiency of water supplies, to limit the scope and duration of potential consequences for consumers.	<p>As part of review of business continuity plan relating specifically to severe weather and the review of severe weather task force procedures.</p> <p>Audit of those within the company who receive weather alerts from the Met Office and Environment Agency etc. conducted and confirmed as correct.</p>	<p>Implementation: Emergency Planning & Security Advisor / Regional Heads of Networks</p> <p>Senior owner: Head of Legal & Compliance / Director of Network Operations</p>	<p>Complete</p> <p>Complete</p>
(DWI) All water companies review their capacity to meet the recommendations of the report 'Utility Regulator's report of the investigation into the Freeze/Thaw incident 2010/11' published following a similar event in Northern Ireland.	We have reviewed the report and ensured all relevant recommendations from 2011 are incorporated in planning arrangements, including severe weather task force procedures.	<p>Implementation: Emergency Planning & Security Advisor</p> <p>Senior owner: Head of Legal & Compliance</p>	Complete
(DWI) The Inspectorate noted that some companies had assets out of supply due to winter maintenance or because they are summer holiday demand sources, which meant they were not available during the event. The Inspectorate	During this incident, small works not normally required at this time of year were brought back into supply and pump and valve maintenance rescheduled as necessary. We have reviewed our processes to ensure any available additional	Implementation: Emergency Planning & Security Advisor / Head of Production	Complete

Recommendation	Bristol Water action	Owner	Deadline
recommends that those companies review whether these sites might be made available for contingency purposes.	resources will be brought into service in the event of severe weather or other similarly disruptive incident.	Senior owner: Head of Legal & Compliance / Asset Management & Production Director	
(DWI) All water companies review both their contingency planning arrangements and bulk supply contract arrangements to ensure that sources they may need to rely on to maintain supplies to consumers will be available when needed.	During this incident we worked closely with Wessex Water to ensure our bulk water supply contracts did not negatively impact on supplies to customers. We have reviewed our processes relating to these supplies and concluded they are fit for purpose and proportionate.	Implementation: Head of Water Resource & Environment Senior owner: Asset Management & Production Director	Complete
(DWI) All companies review their contingency plans to ensure their treatment assets and sites are resilient and that critical failure points are identified and feed into their risk assessments for extreme cold weather events.	Drinking Water Safety Plans include assessment of critical failure points. Furthermore, we have identified those treatment works where specific emergency plans would be appropriate. The 10,000 population centres resilience investment is a 10 year programme over 2020-30 to reduce the risk of long interruptions still further.	Implementation: Emergency Planning & Security Advisor / Head of Production Senior owner: Head of Legal & Compliance / Asset Management & Production Director	Complete 2030
(DWI) All companies review the resilience of their water supply networks to withstand significant weather related challenges.	As part of our ongoing assessment of operational risks to our network, we have identified critical network assets and through our resilience investment we have implemented a long-term programme to protect major population centres from critical asset failure. Our next programme of investment over AMP7 and AMP8, will address these potential failure points to protect population centres over 10,000 people. This will reduce the risk of long interruptions still further.	Regional Heads of Network Senior owner: Director of Network Operations	2030