

WATER: DROUGHT AND FLOOD

Institution of
**MECHANICAL
ENGINEERS**

This summer has presented the UK with the hottest and driest summer since 1976, a year well remembered for melting tarmac and long, hot summer's days. The UK experienced average temperatures in June of 19.9°C, the same as in 1976. When this is combined with June being one of the top five driest Junes on record, and with the dry, hot weather having continued throughout July and set to carry on, concern about how the UK can manage ever-decreasing water availability is increasing.^[1]

The Institution of Mechanical Engineers recommends:

- 1. All major UK cities to publish research on what their infrastructure needs will be in relation to water.** Water is a limited resource – infrastructure for new-build homes and businesses should be designed and developed with increased extreme weather in mind. This should include sustainable urban drainage and grey water recycling in new-build properties, reducing the burden on water treatment works in the summer months and helping to manage extreme rainfall events.
- 2. UK Government should run a public awareness campaign on the value of water and consequences of our changing climate.** This could include actions that householders and businesses need to take to build resilience into their properties, in order to mitigate the impacts caused by poor drainage when periods of dry weather end this year, and in future years.
- 3. The water industry, with the support of Water UK and the National Infrastructure Committee, creates a forum of water-intensive industries.** The forum should produce a water infrastructure sustainability plan for UK industry that combines drought and flood. It is crucial that supply exceeds demand not just by ever increasing production, but instead by mitigating use in a similar way to the electricity grid which has clients on interruptible contracts.

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INTRODUCTION

Our climate is changing and the extreme weather seen this summer is expected to become more common. The UK Government's recently released National Adaptation Programme^[2] report states: The current set of UK Climate Projections (UKCP09) tell us that the UK will continue to warm in the future and more so in summer than winter. UK winters are also expected to become wetter while summers could be slightly drier. Is this what we are beginning to see? We are now in the territory of adapting to climate change, and this brings into focus the urgency to decarbonise our lives today.

The majority of Government policies, strategies and reports do not consider dry, hot weather periods together with flooding. This short report aims to bring the two together, discussing how water management throughout increasingly dry summers is about much more than keeping the water flowing into people's homes.

Water UK, the trade body representing many of the water and sewage treatment companies, has stated that due to the higher-than-normal spring rain, the UK is unlikely to go into drought, but that water use remains extremely high during this period of heatwave and we should use water wisely.^[3] So what does this mean? Water companies are struggling to supply clean water to customers fast enough to meet demand.

The impacts of climate change on the water industry are clear, with both flooding and droughts becoming more commonplace. The water industry has to manage these changes – ensuring that the growing population in the UK can continue to have access to clean water, to manage sewage as well as protect the water environment and associated ecosystems.^[4]

POLICY

Water is a service provided to us from our ecosystems, part of our natural capital. Water not only provides our needs in society through domestic, commercial and industrial use, but is also critical to maintaining our natural environment, and we have to make sure that water management caters for both.

The UK Government's 25-year Environment Plan^[5] states three main policies in relation to water:

- Reducing the damaging abstraction of water from rivers and groundwater, ensuring that by 2021 the proportion of water bodies with enough water to support environmental standards increases from 82% to 90% for surface water bodies and from 72% to 77% for groundwater bodies.
- Supporting Ofwat's ambitions on leakage, minimising the amount of water lost through leakage year on year, with water companies expected to reduce leakage by at least an average of 15% by 2025.
- Ensuring interruptions to the supply of water are minimised during prolonged dry weather and drought.

In 2017 Ofwat, the regulator for the water industry, released Resilience in the Round^[6], a report designed to provide water companies and others with food for thought on what resilience in the round might look like in practice. The report promotes a systems thinking approach, identifying the linkages between many aspects of urban life – physical, social and economic. It brings into the system the challenges of unexpected events, such as superstorms, heatwaves and blackouts, but also infrastructure, and an ageing and growing population. The report provides ideas for water companies in the UK to address these different system attributes, while ensuring the natural ecosystems that provide our water resources and flood defences are maintained. Examples given include sustainable urban drainage, and working collaboratively with land owners and managers to ensure our natural capital is well maintained.

The Institution of Mechanical Engineers encourages Ofwat to persist with a systems thinking approach to water management in the UK, particularly where there is an opportunity to influence policy.

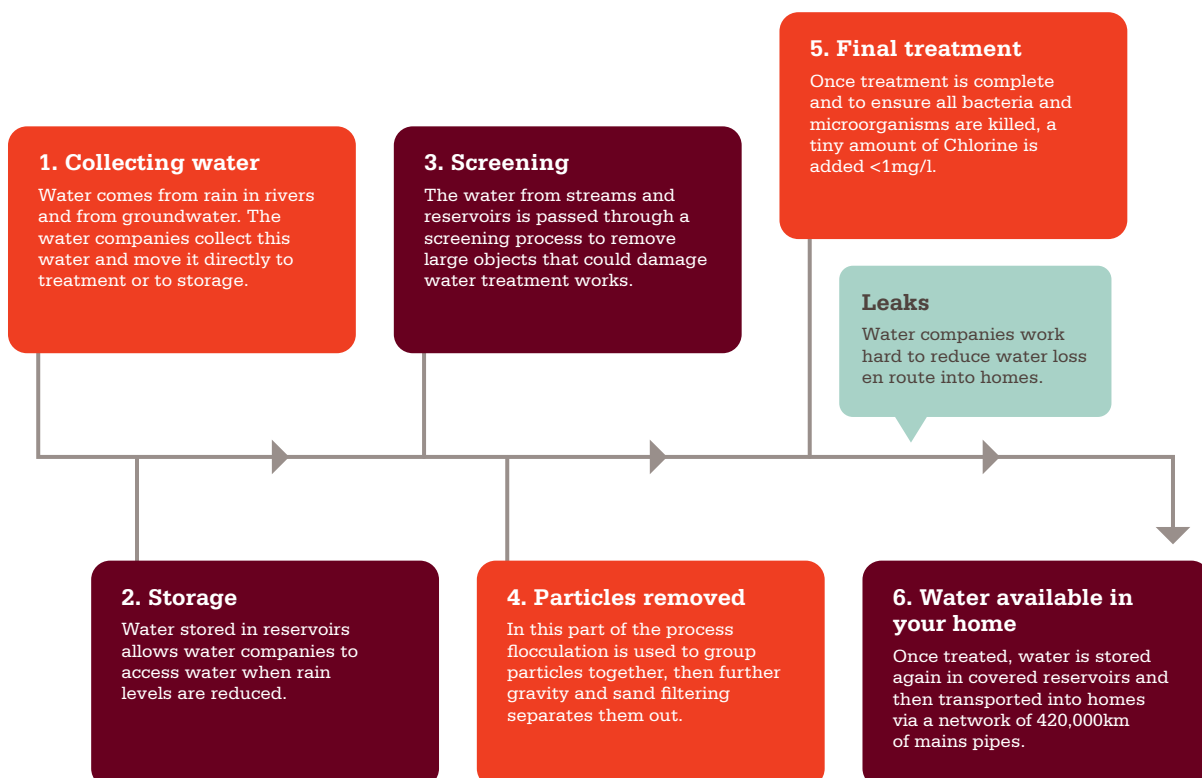
THE WATER INDUSTRY

The average person consumes circa 150 litres of water a day, and this figure helps companies decide what size their water treatment works has to be to meet demand, what type of equipment should be used and what is their relationship to their natural resources in their area. From this average figure, maximum and minimum flow rates can be derived for the water treatment works. As the climate changes and the trend towards longer, hotter summers increases, then water treatment plants will be required to run at their peak flows for longer. Running a water treatment plant constantly at peak flow will increase the energy requirement for running equipment, such as pumps and compressors, increase the chemicals needed to clean more water faster and cause parts to wear out faster, increasing maintenance and running costs. The need to push more water through the water treatment works will also mean that reservoir storage sites will drop faster, continuing to put pressure on water as a resource. These additional pressures mean extra costs for the industry and ultimately for the consumer too.

Leaks in our water pipes are an ongoing issue for UK water companies, and the reduction of leaks in our water industry will build greater resilience into the system, reducing the likelihood of water shortages. The water industry has achieved success in the last couple of decades in respect of leakage levels. However, much of that success has been achieved through improved distribution system control to minimise working pressures, and hence reduce leakage volumes. Essentially this improves the symptoms of the problem, but doesn't address the root cause of failing infrastructure. **It is important to significantly increase the pace of pipework replacement, which will be expensive but is becoming essential.**

The process for managing water in industry can differ depending on the industry and its needs. Some industries abstract water directly from rivers and boreholes, as well as receiving mains water.

Figure 1: The process of treating water for domestic use in the UK.^[7]



Grey water recycling systems

This is the process of re-using collected rainwater, water from sinks and washing machines within homes or processes within businesses, to then be supplied to flush toilets. Currently, water used within homes is all potable. This means there is an opportunity to improve grey water recycling options, making the technology more user-friendly; this is particularly relevant for new-build properties. Like many technologies, retrofitting grey water systems is expensive, however effective grey water recycling systems rolled out in the future could reduce the summer burden on water treatment works, and make homes more resilient to water shortages.

Sustainable Drainage Systems (SuDS)

There is no single solution to managing extreme rainfall events, but sustainable urban drainage can contribute by increasing green infrastructure above ground, such as parks, ditches, ponds and other types of watercourse in urban spaces. These can act as channels for run-off from surface flooding, increase water retention times, moving the water slowly into sewers and other water storage spaces. SuDS also offer other benefits, such as increased urban biodiversity, reduction in pollutants and an increase in amenity areas.^[8] There has been a progressive loss of green space around properties as homeowners build drives and low-maintenance gardens, reducing their homes' resilience to extreme weather events. SuDS provide a simple and effective solution to help manage surface water flooding in extreme events.

There is both a lack of clarity in UK policy on who is responsible for maintenance and adoption of SuDS, as well as a lack of specialist capacity in the building industry to address flood risk and resilience requirements for properties. **These are both areas that the Institution of Mechanical Engineers recommends that Government should address collaboratively with flood specialists, environmentalists and engineers.**

RAIN

The weather will break, and when it does there could be significant rainfall as seen in the last week of July 2018 where there was flooding in Northern Ireland and Scotland. Summer flooding is often caused by short periods of extreme weather, for example in June 2012, Newcastle experienced one month's rainfall over just two hours. This rain fell on hardened dry ground, causing drainage systems to be overwhelmed and for urban areas to experience flash flooding. It is predicted that rainfall in summer will decrease over the coming years by up to 23% over the next 60 years^[9] However, it is also predicted that with this, rainfall may intensify as seen in the Newcastle incident, and subsequently we will continue to see summer flash flooding. With these types of extreme event, it is also likely that urban and rural areas will experience:

- Risks of major surface water flooding, particularly in areas where there is poor drainage and little sustainable urban drainage.
- Risks to crops where the ground is unable to absorb water fast enough and flood occurs.

WHAT THE FUTURE WILL LOOK LIKE?

In 2017, the Adaptation Sub-Committee of the Committee on Climate Change reported to Parliament that the following areas relating to water needed urgent attention:

- Flooding remains one of the most serious current and future risks to the UK from climate change. Investment in flood and coastal defence assets has increased over the National Adaptation Programme (NAP) period. More needs to be done to address the risks from surface water flooding, as there are no plans in place for the investment that is needed to deal with increasingly heavy rainfall.
- Key indicators of environmental quality continue to move in the wrong direction, putting at risk vital ecosystem goods and services such as clean air, clean water and carbon storage. Harmful land management practices persist, including on sensitive peat habitats in the uplands. Some of the most productive agricultural land in England is at risk of becoming unprofitable within a generation, due to soil erosion and the loss of organic carbon. Without further action, farmers may not benefit from the opportunities of longer growing seasons, and the natural environment will be severely harmed by climate change.
- There are plans in place and action is being taken to address the risk of future water scarcity. Significant decisions in terms of new water storage, treatment and supply infrastructure will need to be taken. Reforming the water abstraction licensing regime also remains an urgent priority.^[9]

The latest response from Government in the National Adaptation Programme^[10] provides a number of actions to respond to high temperatures and concerns of water shortages in summer. These include:

- Boost the long-term resilience of our homes, businesses and infrastructure.
- Work to restore natural processes within river systems to enhance water storage capacity.
- Work towards setting challenging and ambitious goals to reduce water leakage.

It is clear from these responses that there is still a big divide between what is considered important from the Committee on Climate Change, and Government policy. The systems thinking approach presented earlier in this report may help to bring these two futures closer together.

RECOMMENDATIONS

The Institution of Mechanical Engineers recommends:

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