



Enhancing Water Services Resilience: Perspectives

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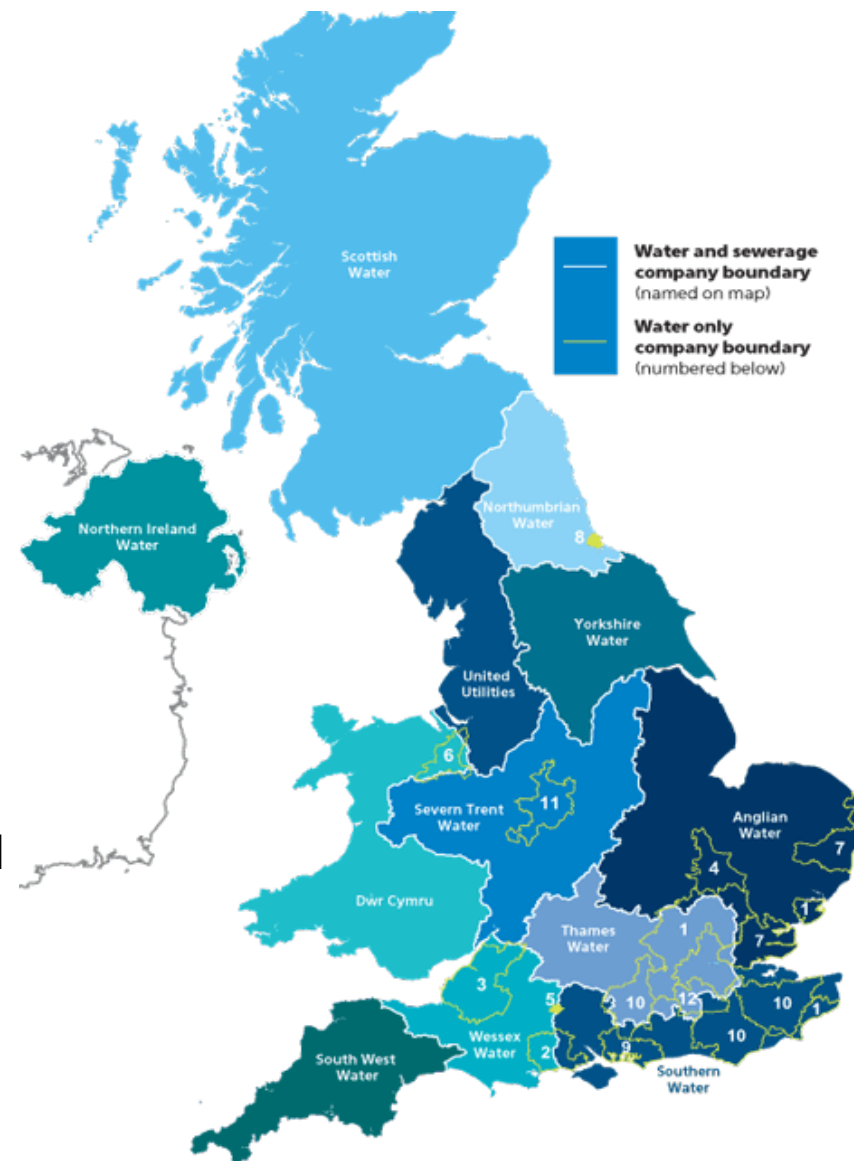


Overview

- UK water sector contexts – *it's complicated*
- Public and *private* supplies
- Resilience in governance
- Resilience in water policy and regulation
- Resilience in water research
- Resilience in practice
- Summary
- Acknowledgements

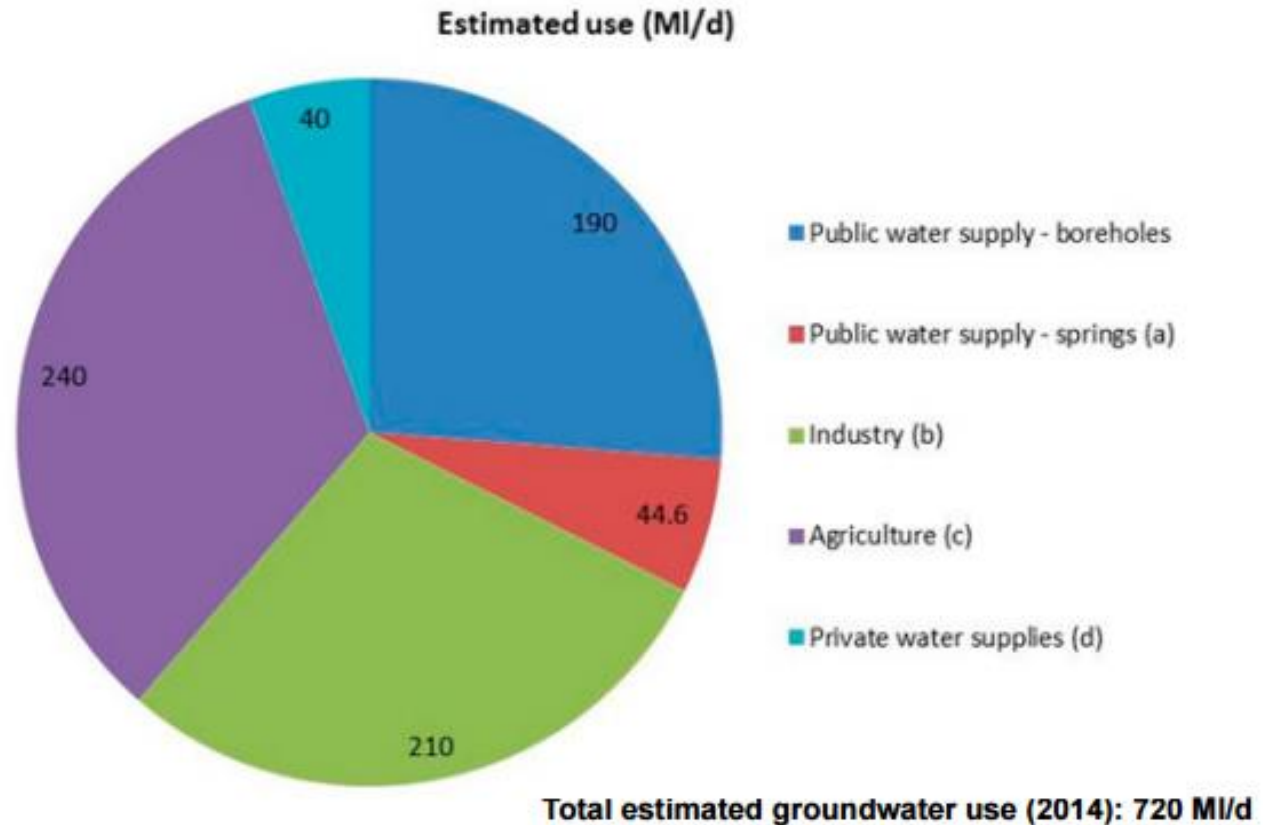
UK Water Sector Context/s – *it's complicated...*

- England: private companies for wholesale and retail to household customers but separate retailers for non-household customers
- Wales: employee owned company (a not-for-profit organisation with no shareholders)
- Scotland: government owned company for wholesale but with water retailers (licenced providers) for non-household customers
- Northern Ireland: government-owned company



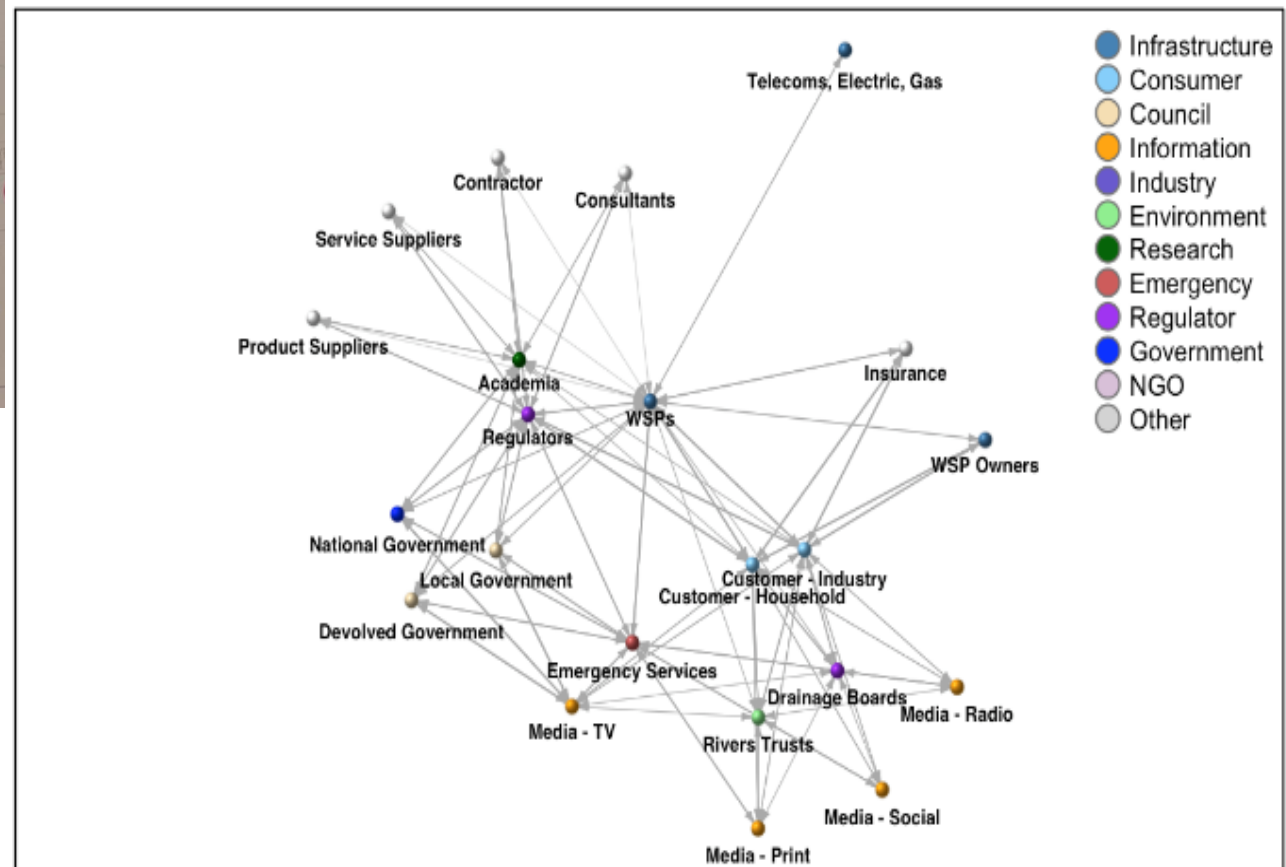
That's *public* supplies, there's also *private* supplies...

- 4K boreholes & some large springs = large private, industrial or agricultural supplies
- ~20K boreholes, small springs and wells provide private water supplies for at least 80K people



- (a) The volume of water from springs may be much higher, as springs that feed into reservoirs are often classified as surface water
- (b) Industrial use includes distilling and mineral water
- (c) Seasonal use
- (d) There is considerable uncertainty surrounding the amount of groundwater used in private water supplies: this estimate is conservative

What does resilience in governance look like in this diverse context? *(even more complicated!)*



From: Ward *et al.* (to be submitted) Animating inter-organisational resilience: social network analysis of water governance in the UK. *Ecology & Society*

Resilience in water policy & regulation



Water Act 2014

CHAPTER 3 Regulation of the water industry

General duties of the Water Services Regulation Authority

CHAPTER 21

22. Primary duty to secure resilience

27. Water resources management plans for England: resilience

- promote long-term planning and investment, and the use of a range of measures to manage water resources in sustainable ways
- increase efficiency in water use and reduce demand for water to minimise pressure on water resources

Environment Agency

“we treat resilience as the capacity to maintain essential services under a range of circumstances from normal to extreme”

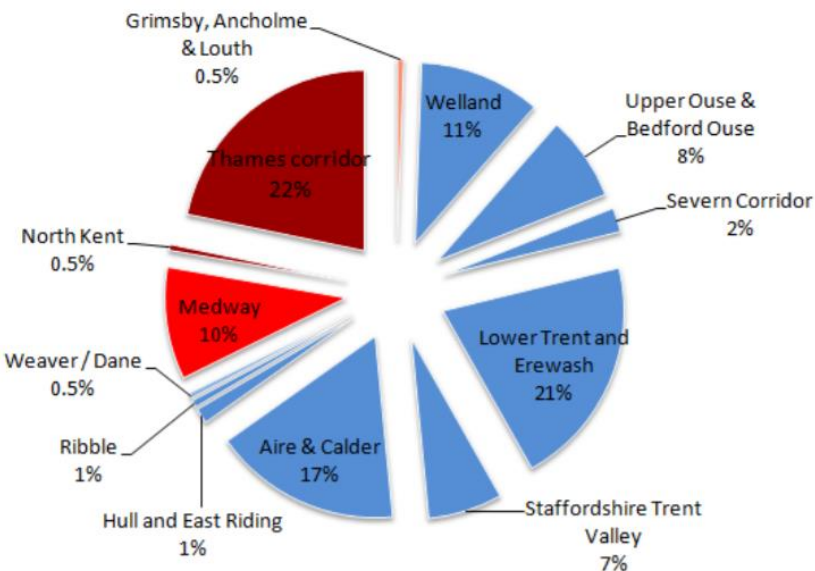


Water supply and resilience and infrastructure

Environment Agency advice to Defra
October 2015

Availability of water for the environment & abstraction –
% range

| | |
|--------------------|------------------------------------|
| Water available | 0-100 % sufficient water |
| No water available | 100% to 124% Insufficient water |
| No water available | 125% to 149% Insufficient water |
| No water available | 150% to 199% Insufficient water |
| No water available | >200% Insufficient water |



Securing resilience 6.

- Roadmap sets out plans to enhance policy framework, building on discussions with water industry, regulators, consumer groups and other water users to understand priorities for reform
- Part 1 sets out how we will enable water companies to enhance the resilience of the public water supply. Some industries take water directly from rivers or groundwater
- Part 2 explains how we will support these businesses to manage their resilience risks, including through closer collaboration with water companies
- Part 3 sets out how we will enable water companies to enhance the resilience of the sewerage network
- Part 4 sets out how we will work with Ofwat to enhance the sector's resilience

Creating a great place for
living

Enabling resilience in the water
sector

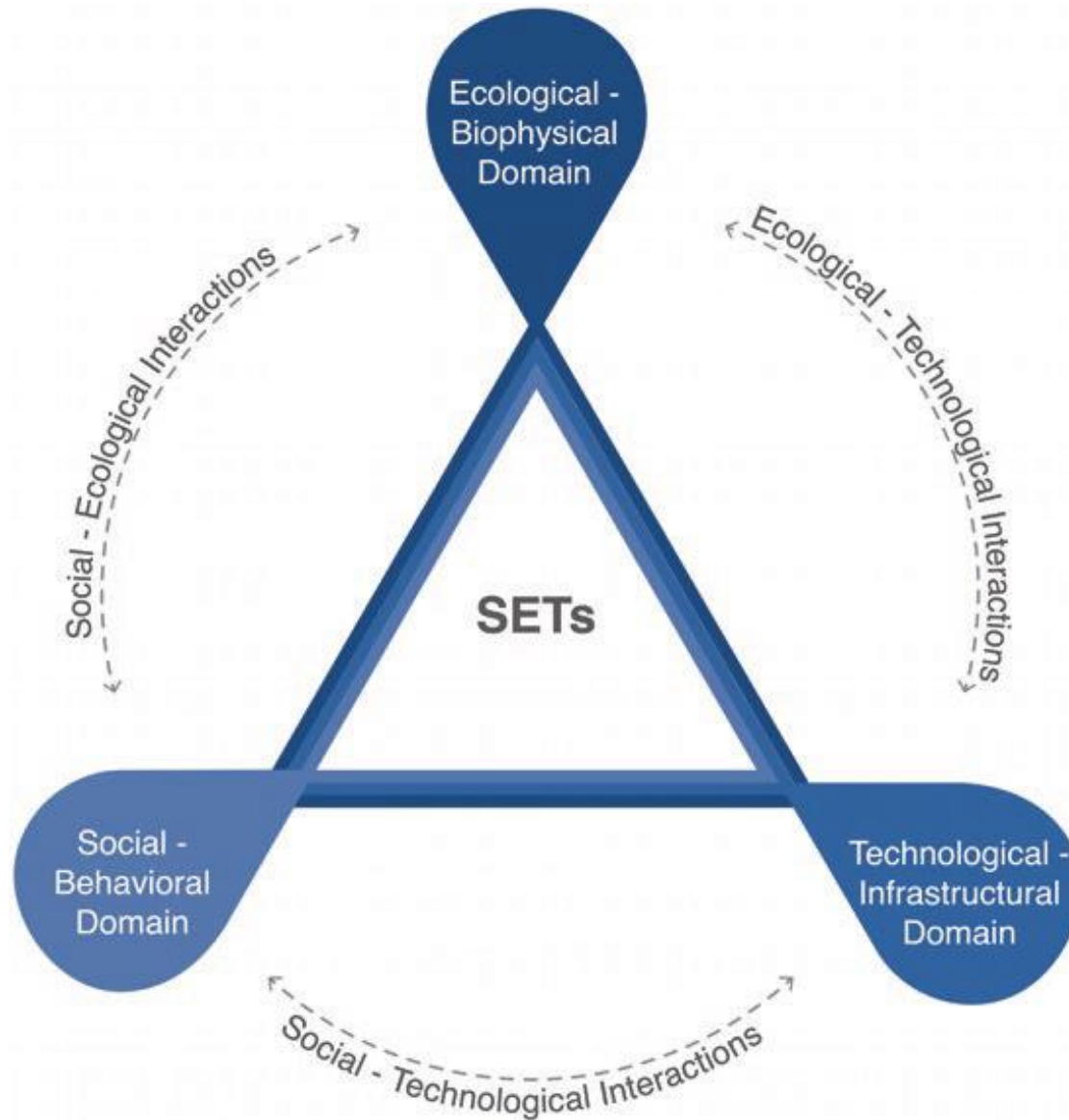
March 2016

The concept of “resilience in the round” is at the core of how companies should approach this issue

- **Corporate resilience:** ability of organisation’s governance, accountability & assurance processes to help avoid, cope with & recover from disruption of all types, anticipate trends & variability in business operations
- **Financial resilience:** organisation’s ability to avoid, cope with & recover from disruption to its finances
- **Operational resilience:** ability of organisation’s infrastructure & skills to run that infrastructure, to avoid, cope with & recover from disruption in performance



Resilience in water research



Resilience Shift

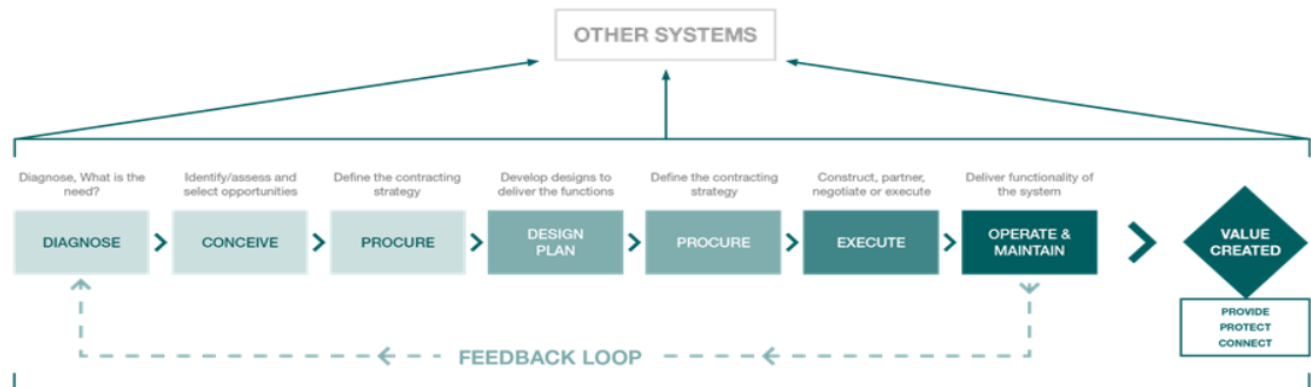


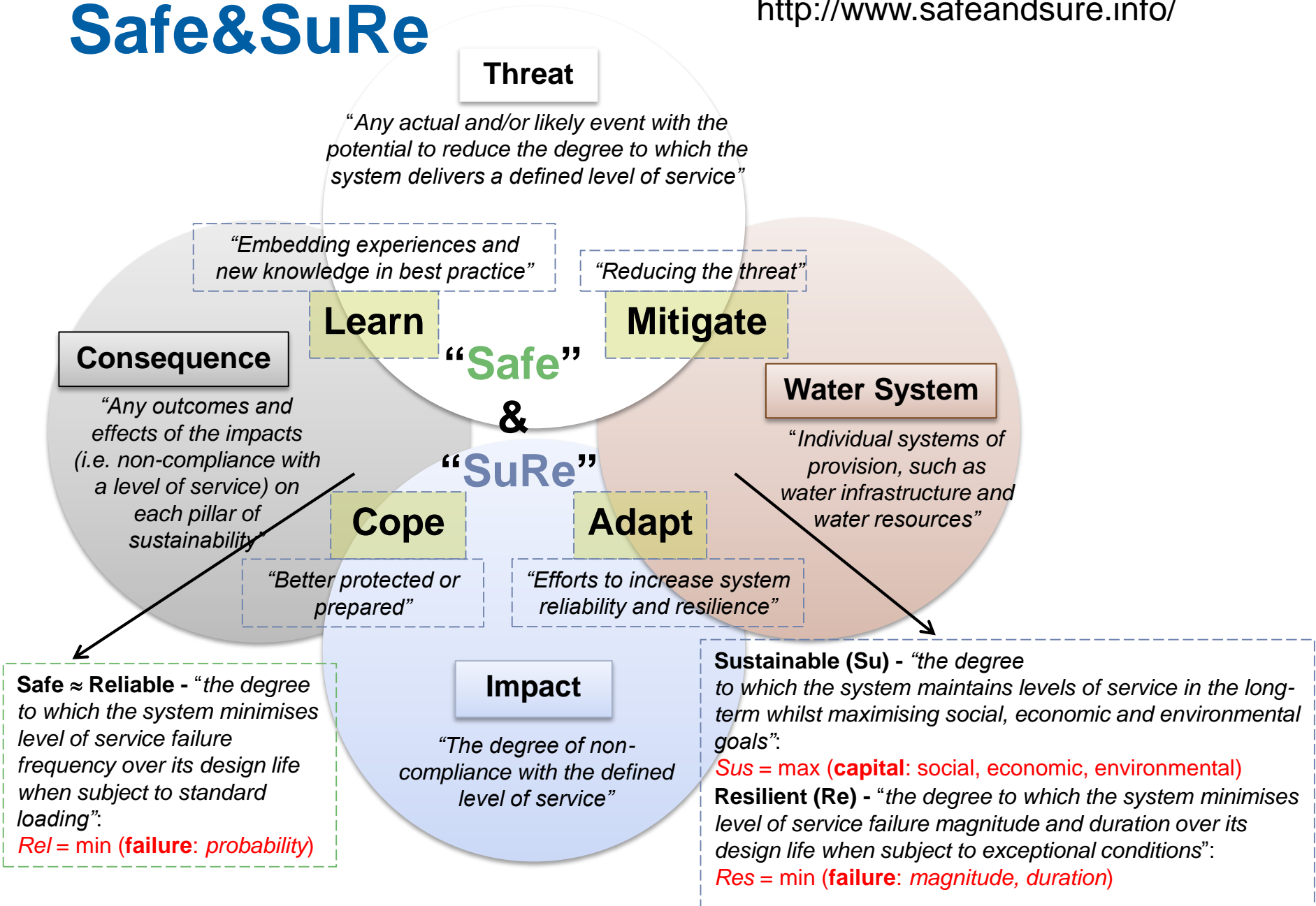
- The adoption of dynamic performance based design approaches in broad practice
- The adoption or use of tools and processes to value resilience and make sure that value is realised throughout the project life cycle by project owners, developers, financiers and insurers
- The use of integrated systems approaches as context for major infrastructure projects
- The integration of systems thinking and resilience into existing engineering education and new courses focused on resilience engineering
- The adoption of transformative technologies that facilitate (rather than compromise) critical system functionality

A VALUE CHAIN APPROACH FOR CRITICAL INFRASTRUCTURE

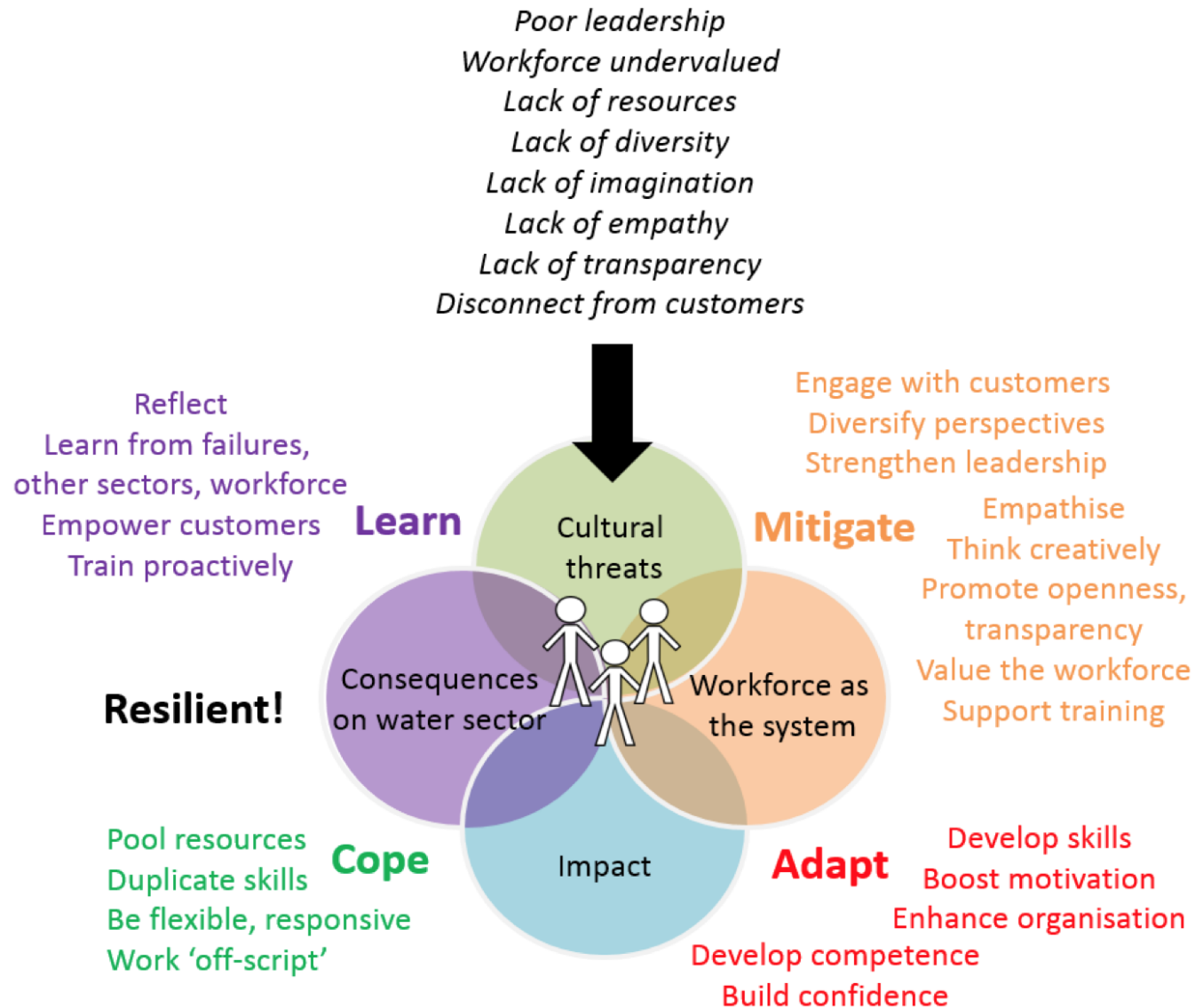
Using value as a lever

There are currently many approaches and tools to enhance resilience at a different level of maturity, some of them directly related to critical infrastructure and others not yet connected. All tools and approaches have been developed to serve a specific purpose.

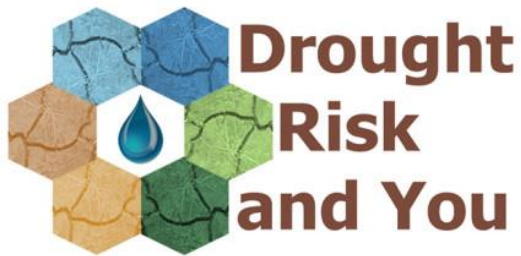




Safe&SuRe – sector culture change



Drought & flood stories & memories



<http://dryproject.co.uk/>

FLOOD MEMORIES

Does remembering previous floods make communities more resilient to future floods?

<https://esrcfloodmemories.wordpress.com/>

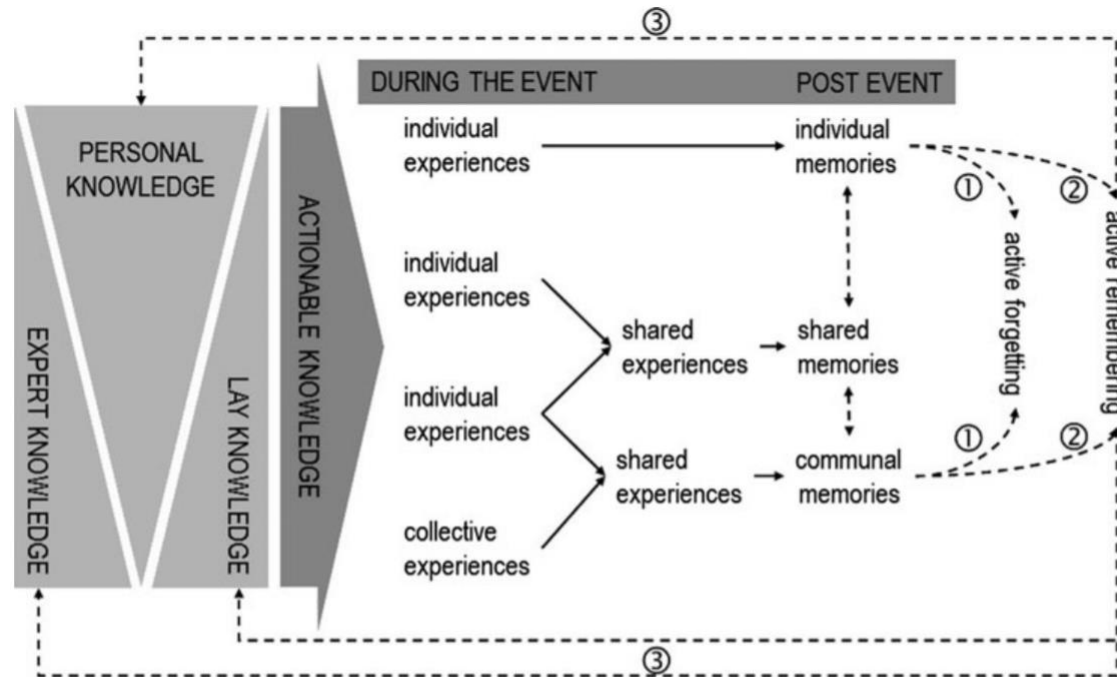


Figure 2 Towards 'sustainable flood memory': pathways of active remembering and forgetting in relation to knowledges

McEwen *et al.* (2017) Sustainable flood memories, lay knowledges and the development of community resilience to future flood risk. *Transactions of the Institute of British Geographers*, 42 (1). pp. 14-28. ISSN 0020- 2754. <http://eprints.uwe.ac.uk/29509>

Resilience in water practice



<https://utilityweek.co.uk/six-ways-water-companies-are-addressing-resilience/>

Water UK



Improving resilience



Water companies spend billions each year to protect and enhance the environment and to make sure they can provide water and wastewater services now and in the future.

The water sector, and the UK overall, is facing a wide range of enormous and complex challenges and is working to secure the long-term resilience of water and sewerage supplies and services.

South West Water

| | | | |
|--|--|--|--|
| <p>CASE STUDIES</p> <p>DELIVERING ON OUR COMMITMENTS</p> | <p>1.</p> <p>FLOOD PROTECTION AT PYNES</p> <p>p.07</p> | <p>2.</p> <p>WIMBORNE DUPLICATE MAIN</p> <p>p.08</p> |  |
| <p>3.</p> <p>CATCHMENT MANAGEMENT/UPSTREAM THINKING</p> <p>p.09</p> | <p>4.</p> <p>DOWNSTREAM THINKING</p> <p>p.12</p> | <p>5.</p> <p>RIVER COUNT</p> <p>p.13</p> | <p>The new main will enable Wimborne to have a dual resilient feed from both of our Stanbridge and Alderney sources.</p>  |
| <p>7.</p> <p>FINANCIAL RESILIENCE</p> <p>p.15</p> | <p>8.</p> <p>WORKFORCE/SKILLS/APPRENTICES</p> <p>p.16</p> | <p>9.</p> <p>FLOOD DEFENCE INNOVATION</p> <p>p.17</p> | |
| <p>11.</p> <p>ENERGY STORAGE</p> <p>p.19</p> | <p>12.</p> <p>CYBER SECURITY</p> <p>p.20</p> | <p>13.</p> <p>SEWER LOVE Y</p> <p>p.21</p> | |

Bristol Water

<https://www.100resilientcities.org/cities/bristol/>

<https://www.bristolwater.co.uk/help-support/work-in-your-area/southern-resilience-scheme/>

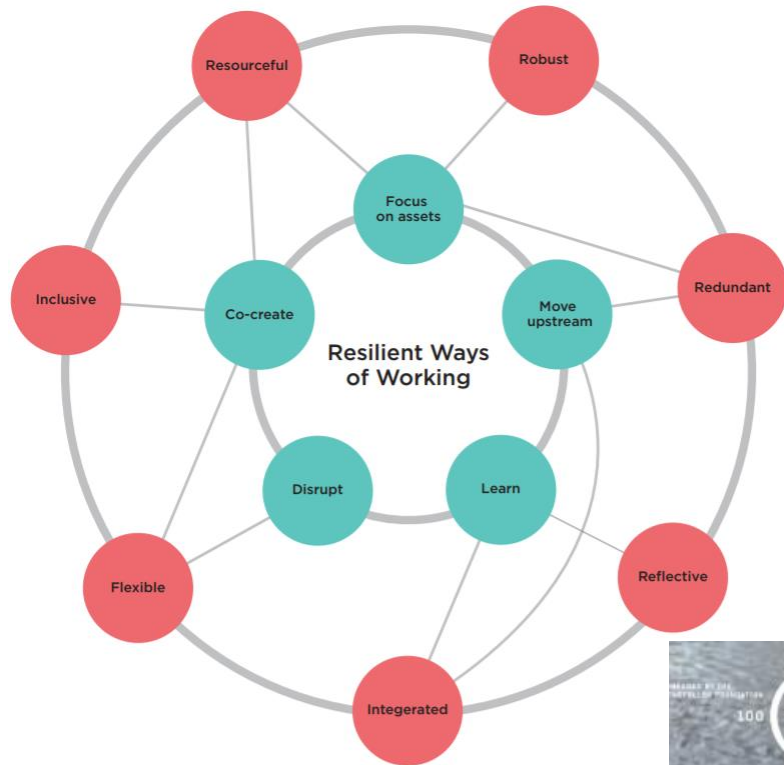
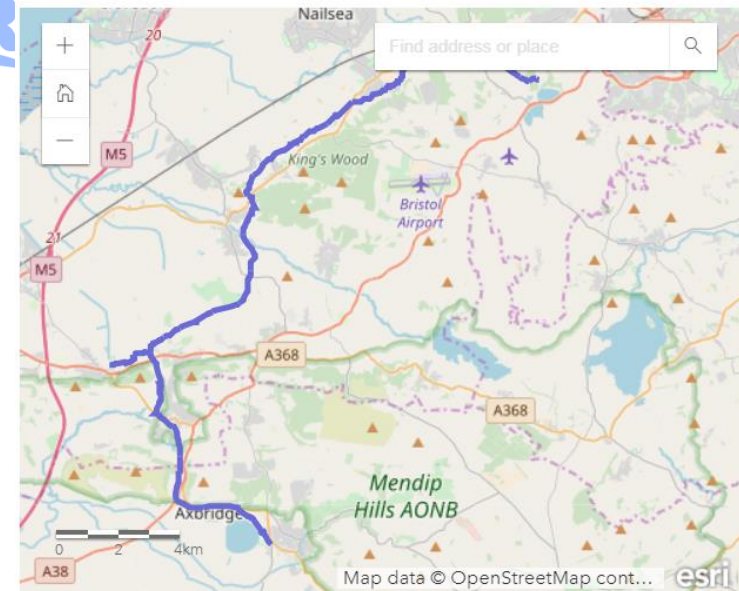


Bristol's Resilience Challenge

Not satisfied with being the most efficient major city in the UK, this city is pushing best practices forward in urban sustainability.



Southern Resilience Scheme



How do you prepare an essential service for unknowable shocks and stresses?

<https://www.arup.com/projects/welsh-water-resilience>

Welsh Water

“A new way of thinking about resilience”

- We identified around 60 shocks and stresses that Welsh Water might be vulnerable to
- We then developed a best practice resilience framework, drawing on our global experience of resilience planning for cities and infrastructure
- We applied this framework to identify areas of best practice and areas for improvement within Welsh Water
- We arrived at a series of initiatives that can embed resilience into all aspects of the business including people, infrastructure, use of natural resources, finances, leadership and strategy



Anglian Water

Anglian Water's structure for a resilient enterprise



Locally, we're facing a unique set of challenges

demand for water
will rise, but available water won't

28% of the region is below sea level

as a low-lying region
there is a high use of energy to pump water around the region

population
is expected to rise – around one million homes to be built in the next 25 years

Climate change
impacts and uncertainty

it is the **driest** region in the UK



United Utilities

$$\text{Risk} = C (\text{consequence}) \times V (\text{vulnerability}) \times T (\text{threat likelihood})$$

$$\text{Resilience} = R (\text{risk}) \times 4R_s (\text{control factor})$$

Measuring resilience in the water industry

June 2017

| Classify what to measure | Assess risk score | Assess control factor | Calculate resilience score |
|---|--------------------|-----------------------|--|
| Hazard characterisation A hazard is something that is potentially dangerous or harmful, often the root cause of an undesirable outcome, for example flooding, malicious damage, or an untriggered asset failure | Scale of impact | Redundancy | Resilience score: 1 Normalised company resilience score 2 A customer focused score by zone |
| System characterisation Systems, or system elements, are critical components of collecting, treating and conveying water to and from customers, for example water treatment works, pumping stations or trunk mains. | Duration of impact | Response & Recovery | |
| | Likelihood | Resistance | |
| | Vulnerability | Reliability | |

Figure B: High level methodology for assessing resilience

| System | Flood | Critical asset failure | Infiltration | Raw water loss | Malicious damage | Telemetry failure | TOTAL | Confidence |
|--------|-------|------------------------|--------------|----------------|------------------|-------------------|-------|------------|
| WTW 1 | ● | ● | ● | ● | ● | N/A | ● | 92% |
| WTW 2 | ● | ● | N/A | N/A | ● | ● | ● | 73% |

Summary – we have looked at enhancing water services resilience perspectives...

- In a diverse water sector context (the UK)
- Across public and private water supplies
- In the water governance domain
- Across water policy and regulation
- In water research
- Embedded in water sector practice
- It is both complex & multi-faceted with no 'quick win'
- Resilience, like sustainability is a journey, not an end point

Thank you

Questions?

www.watersecuritynetwork.org

www.twitter.com/water_network

Acknowledgement

The International Water Security Network is funded by Lloyd's Register Foundation, a charitable foundation helping to protect life and property by supporting engineering-related education, public engagement and the application of research. For more information, see:

www.lrfoundation.org.uk

