

# CIWEM Metropolitan Branch Event

Delivering AMP7

23<sup>rd</sup> October 2019



Turner & Townsend






**CIWEM** Chartered Institution of  
Water and Environmental  
Management

Metropolitan Branch

making the **difference**



# Agenda

18:00 – 18:05	<b>Welcome</b>		Tom Dix	Senior Project Manager, Turner & Townsend
18:05 – 18:20	<b>Delivering AMP7</b>		Tania Flasck	Head of Utilities, Turner & Townsend
18:20 – 18:35	<b>The Regulatory Framework</b>		Nigel Sanders	Head of Regulation, Turner & Townsend
18:35 – 18:50	<b>View from Affinity Water</b>		Keith Gardner	Director of Asset Strategy, Data & Innovation, Affinity Water
18:50 – 19:05	<b>Addressing AMP7 Leakages Obligations</b>		Siraj Tahir	Senior Engineer, Arup
19:05 – 19:30	<b>Q&amp;A</b>			
19:30 – 20:30	<b>Drinks Reception</b>			

# Turner & Townsend

- **Independent professional services consultancy** advising the infrastructure, real estate and natural resources sectors.
- **108 offices in 45 countries**
- Experience advising on over \$400bn USD of infrastructure projects globally
- Specialist UK focus on **utilities, water, rail, roads, power, aviation and defence** sectors
- Experts at managing the many moving parts involved in **complex programmes and projects.**





# Delivering AMP7



Turner & Townsend

**CIWEM** Chartered Institution of  
Water and Environmental  
Management

Metropolitan Branch

Tania Flasck

23 October 2019

making the **difference**

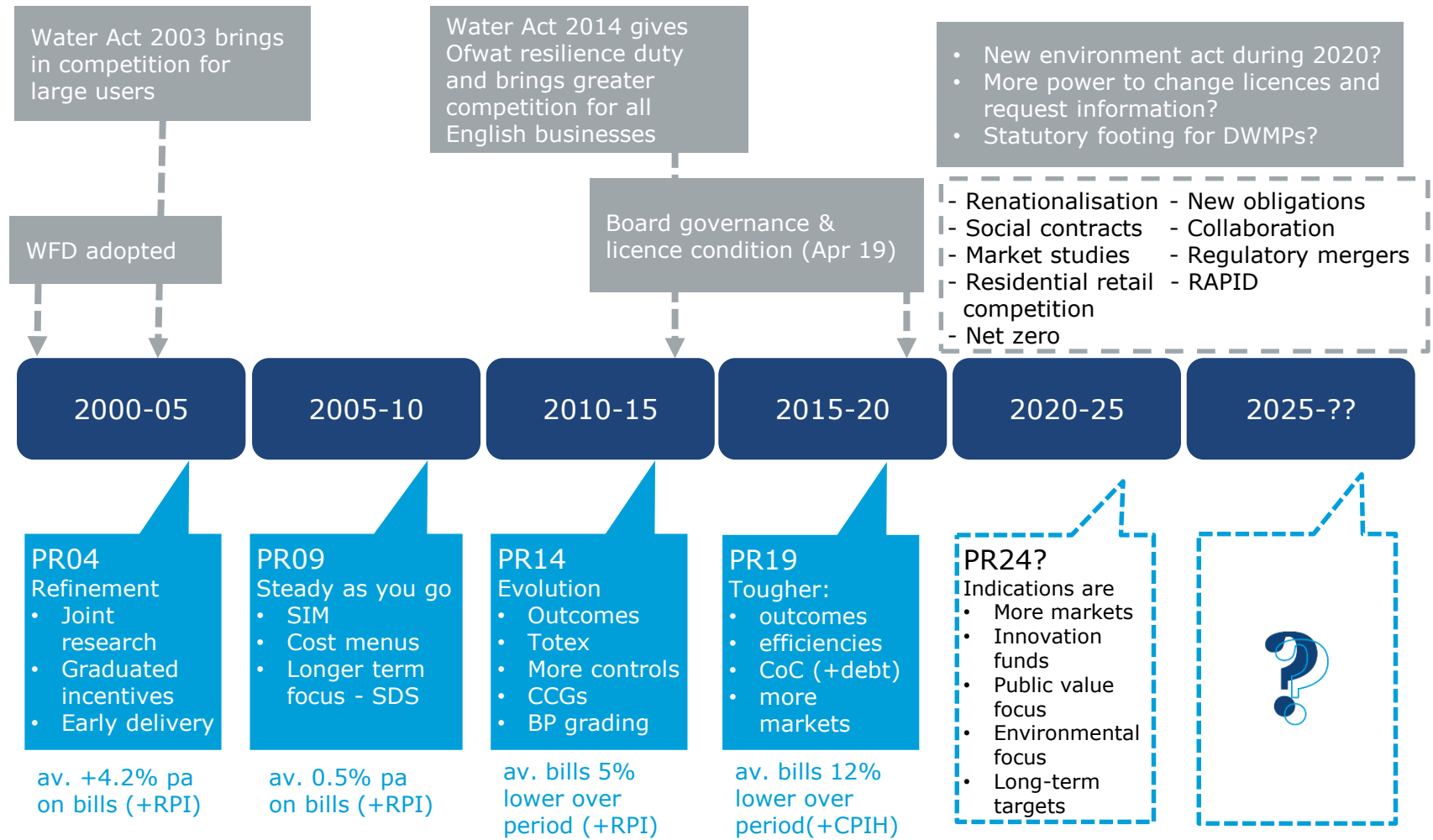


# Agenda

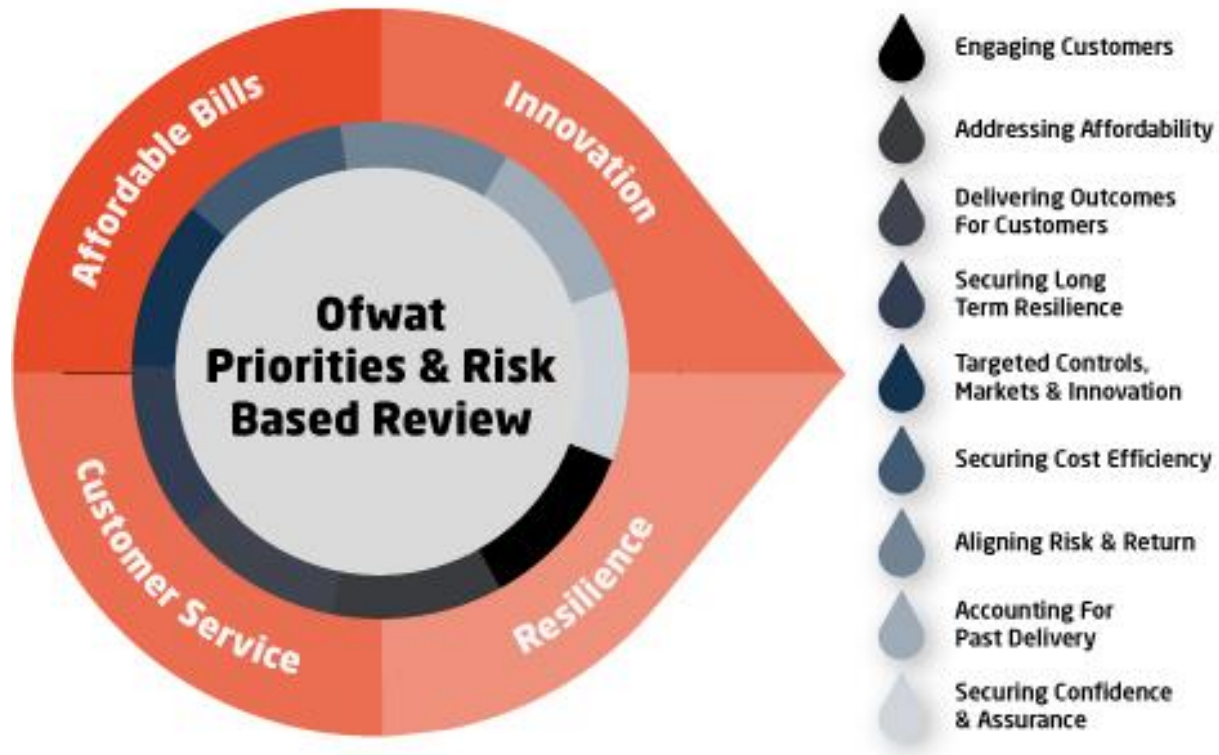
---

- **A Potted History of Developments**
- **PR19 Principles**
- **Addressing Future Challenges**
- **PR19: A Calculated Gamble?**
- **Achieving the Step Change**
- **T&T's Role Throughout AMP7**

# 2000-25: A Potted History of Developments



# PR19 Principles



# Addressing Future Challenges



## Environmental Challenges

- Increasing population
- Climate change
- Water scarcity
- Environmental quality standards



## Resilient Systems

- Anticipate changes in demand
- Efficient recovery from disruptions
- Deliver sustainable services



## Customer Expectations

- Champion reliability & responsiveness
- Achieve ambitious performance targets




## Affordability

- Step change in efficiency to provide better service
- A nominal 12% reduction in bills
- Better customer engagement and support



# Pr19: A calculated gamble?




---

“The Environment Agency expects to see investment to increase resilience to drought and flooding, and a commitment to enhance the environment. We welcome Ofwat’s announcement today which supports these principles.”

**Environmental Secretary Michael Gove, 2017.**

---



---

“Companies may struggle to achieve allowed returns under Ofwat’s renewed focus on cost efficiency in PR19 as average performers could face penalties... if they fail to meet efficiency targets, in turn exacerbating the pressure of lower returns.”

**Moody’s Investors Service, 2017.**

---

# Achieving the Step Change

## Driving Innovation

- Creating a culture and environment that allows changes to take hold and work in practice
- Place customers at the forefront of decision making
- Collaboration and joint ventures between companies to harness efficiency gains

## Future Proofing Industry

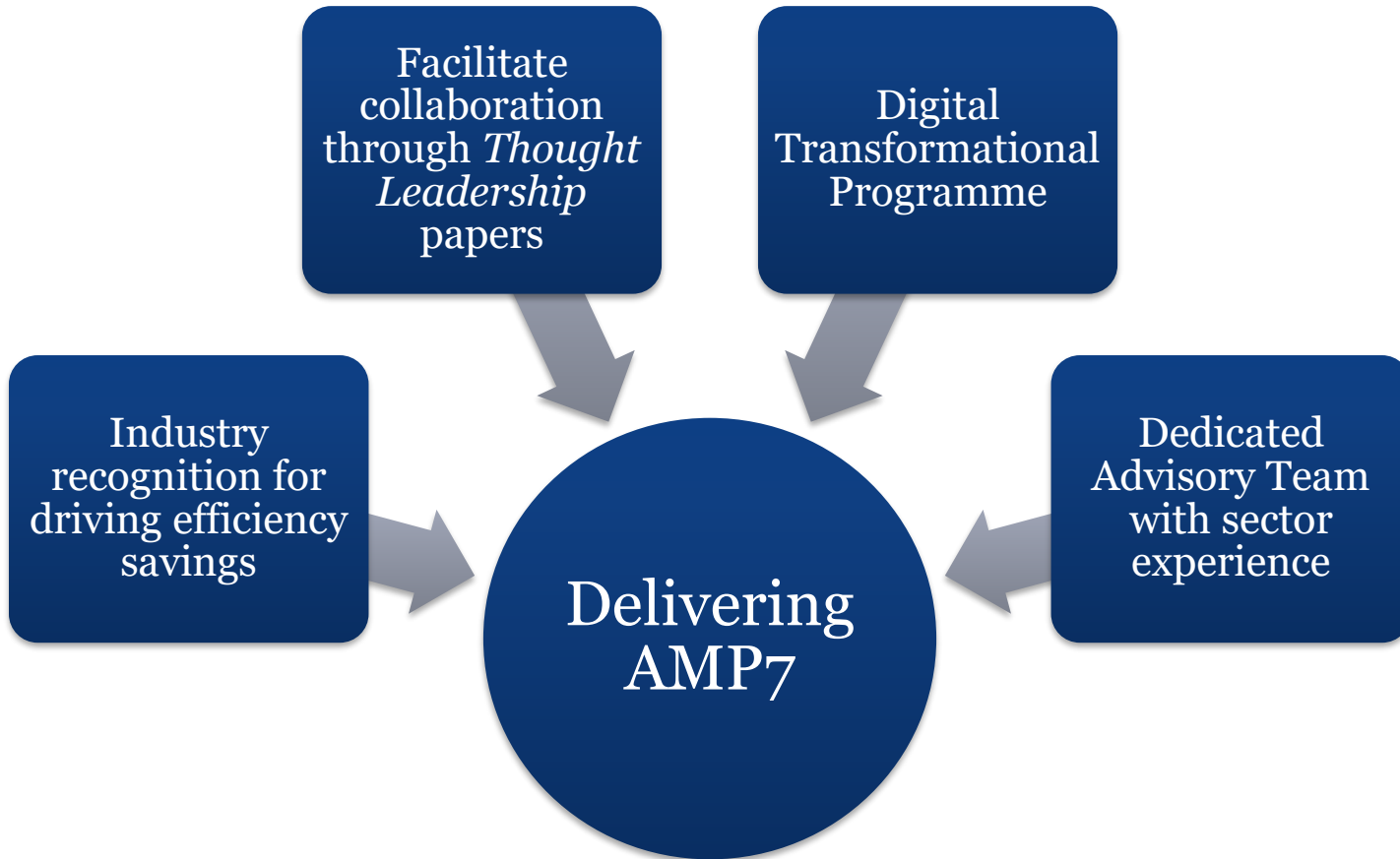
- Internet of Things (IoT) can provide more efficient water management
- Adopt Artificial Intelligence (AI) solutions, to learn and problem-solve the challenge of water scarcity and improve resilience
- Improved data analytics can bring commonality to the industry, and improve reporting metrics

## Enabling Resilient Behaviours

- Challenge the status quo through greater customer engagement
- Evolve society's response to climate change by improving awareness of the challenges, and the role society has to play
- Prioritise long-term stewardship of the environment, assets and relationships and avoid financial repercussions

# T&T's Role in AMP7

---



# Delivering AMP7

Nigel Sanders

23 October 2019



Turner & Townsend

**CIWEM** Chartered Institution of  
Water and Environmental  
Management

Metropolitan Branch

making the **difference**





# Delivering AMP7

---

---

*"These are seriously stretching goals for the sector"*

*"a new era for customers and the environment"*

**Ofwat 2019**

---

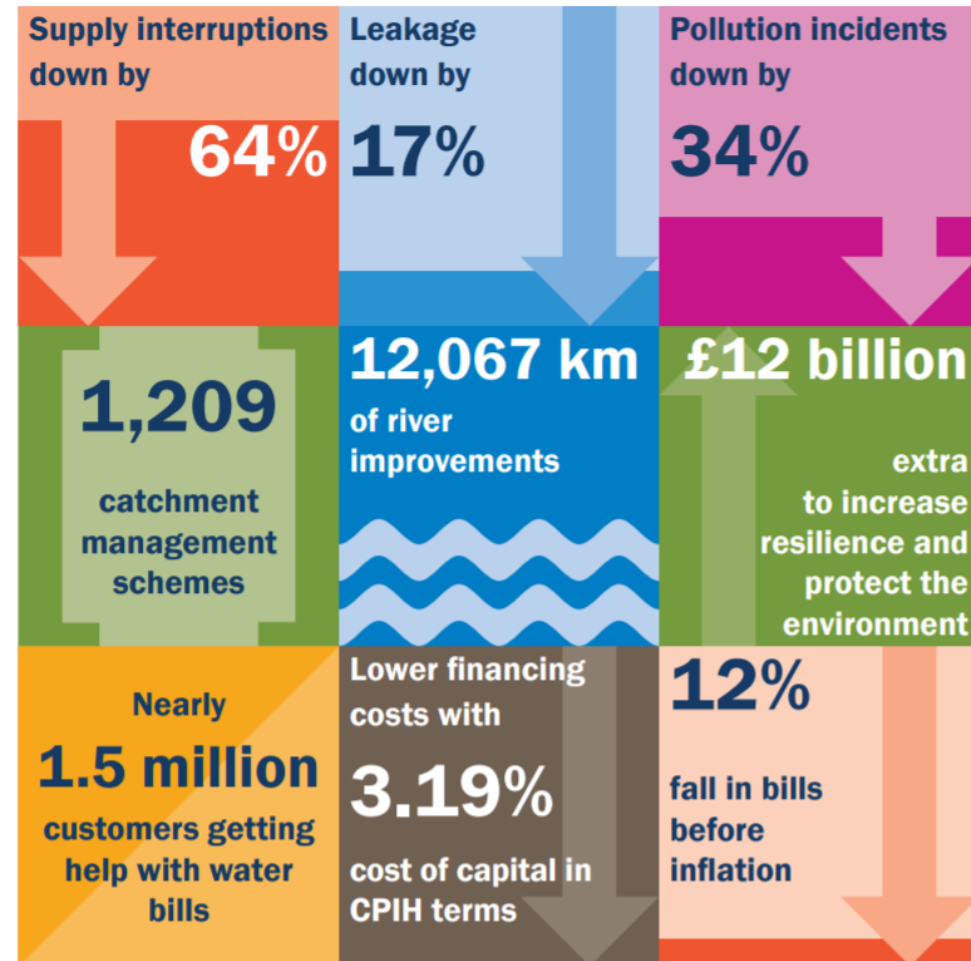
## **AMP7 will be different**

Ambitious new performance targets go beyond the visible horizon while bills are to come down by 12%

The sector must innovate but innovation isn't just about technology

# PR19 – what we know

The Ofwat PR19 draft determinations have been published

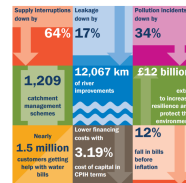


# PR19 – what we know

Ofwat is laying down an unprecedented level of challenge

Is this disrupting the sector or something else?

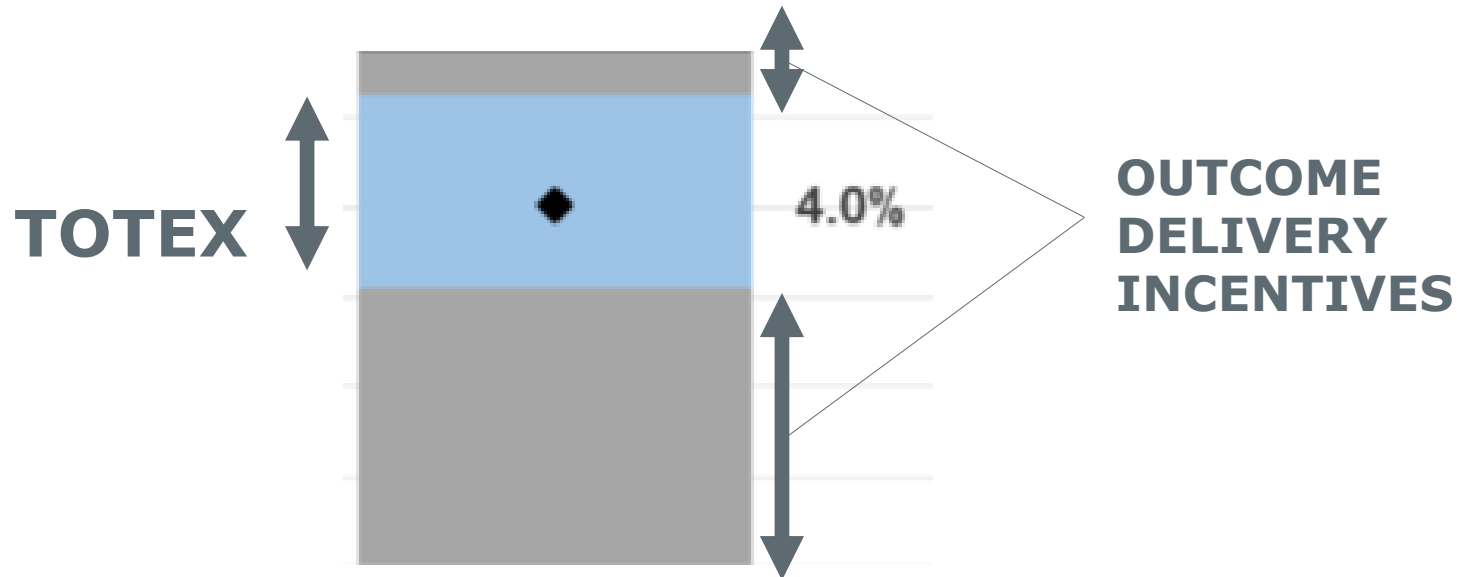
Either way this is a tough problem



# PR19 – what we know

---

In 2020 – 2025 the focus will be on Outcomes because this is where the greatest risk lies





# Delivering AMP7

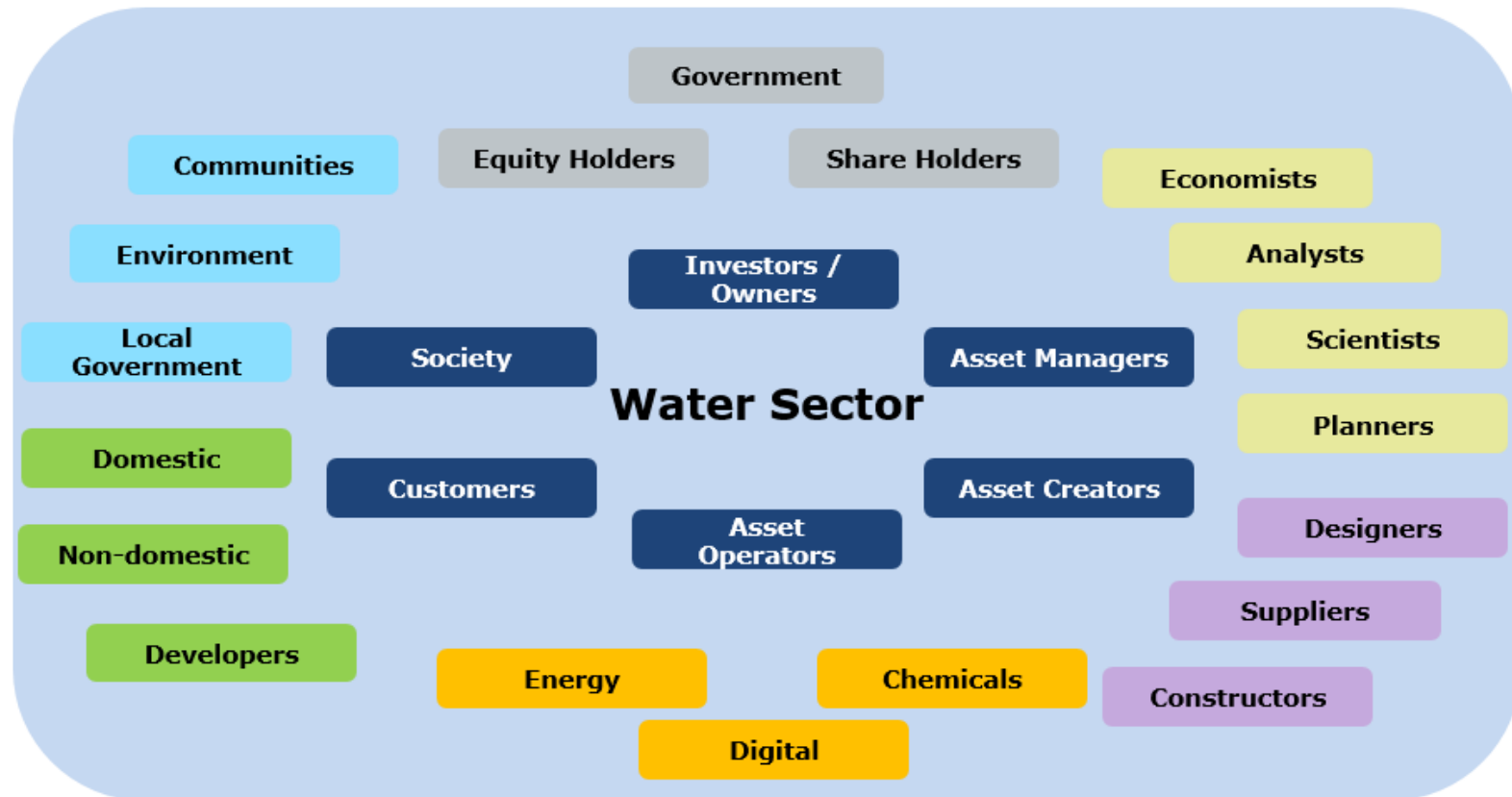
---

The sector needs to evolve quickly but...

*"We cannot solve our problems with the same thinking we used to create them"*

# Delivering AMP7

Looking holistically at the sector



# Delivering AMP7

What is the full engagement framework that we believe will be successful?

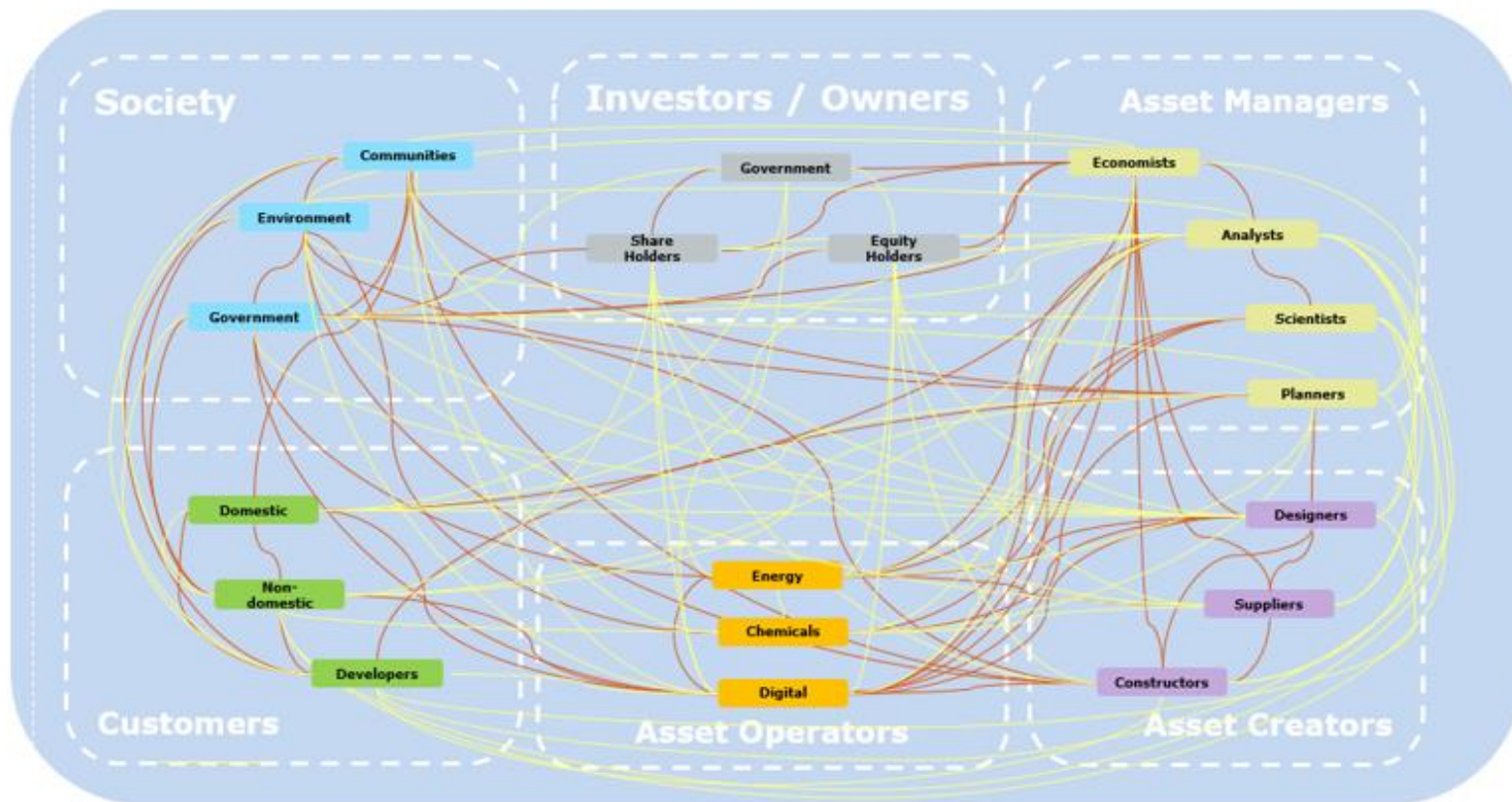
		Investors / Owners			Asset Managers			Asset Creators			Asset Operators			Customers		Society				
		Equity Holders	Share Holders	Government	Economists	Analysts	Scientists	Planners	Designers	Suppliers	Constructors	Energy	Chemicals	Digital	Domestic	Non-domestic	Developers	Government	Environment	Communities
<b>Investors / Owners</b>	Equity Holders		M	M	H	M	L	L	M	M	M	M	L	M	L	L	L	H	L	L
	Share Holders			H	H	M	L	L	M	M	M	M	L	M	L	M	L	H	L	L
	Government				H	L	L	L	L	L	L	L	L	M	M	L	L	M	M	H
<b>Asset Managers</b>	Economists					H	L	M	H	H	M	L	H	H	H	M	L	H	M	M
	Analysts						H	M	M	M	L	H	M	H	M	M	M	M	M	L
	Scientists							L	M	M	M	H	H	H	L	M	L	L	M	L
	Planners								H	L	M	M	M	H	M	M	H	M	H	H
<b>Asset Creators</b>	Designers								H	H	H	H	H	H	M	L	M	M	M	M
	Suppliers									H	H	H	M	L	L	L	L	L	M	L
	Constructors											L	L	H	L	L	M	H	H	H
<b>Asset Operators</b>	Energy												M	H	L	M	L	H	H	M
	Chemicals													M	L	M	L	L	H	M
	Digital														H	L	M	H	M	M
<b>Customers</b>	Domestic														M	M	L	H	H	H
	Non-domestic																H	H	H	M
	Developers																	M	M	H
<b>Society</b>	Government																		H	H
	Environment																			H
	Communities																			

The mapping shows that the need for collaboration between, say, domestic customers and digital is HIGH

H = high interdependency  
M = medium interdependency  
L = low interdependency

# Delivering AMP7

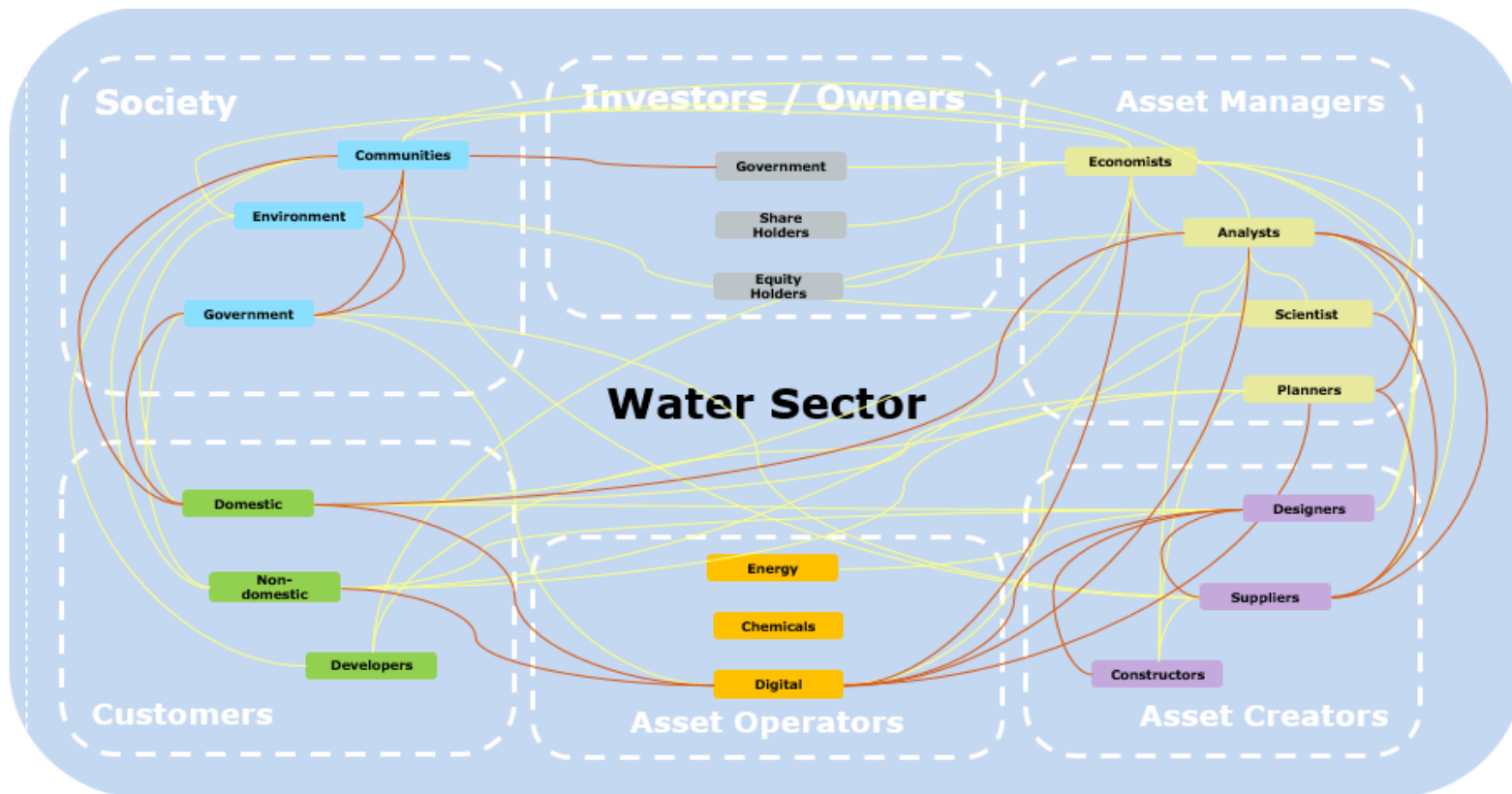
Mapping the links and stakeholders illustrates that the water sector as a system is extremely complex





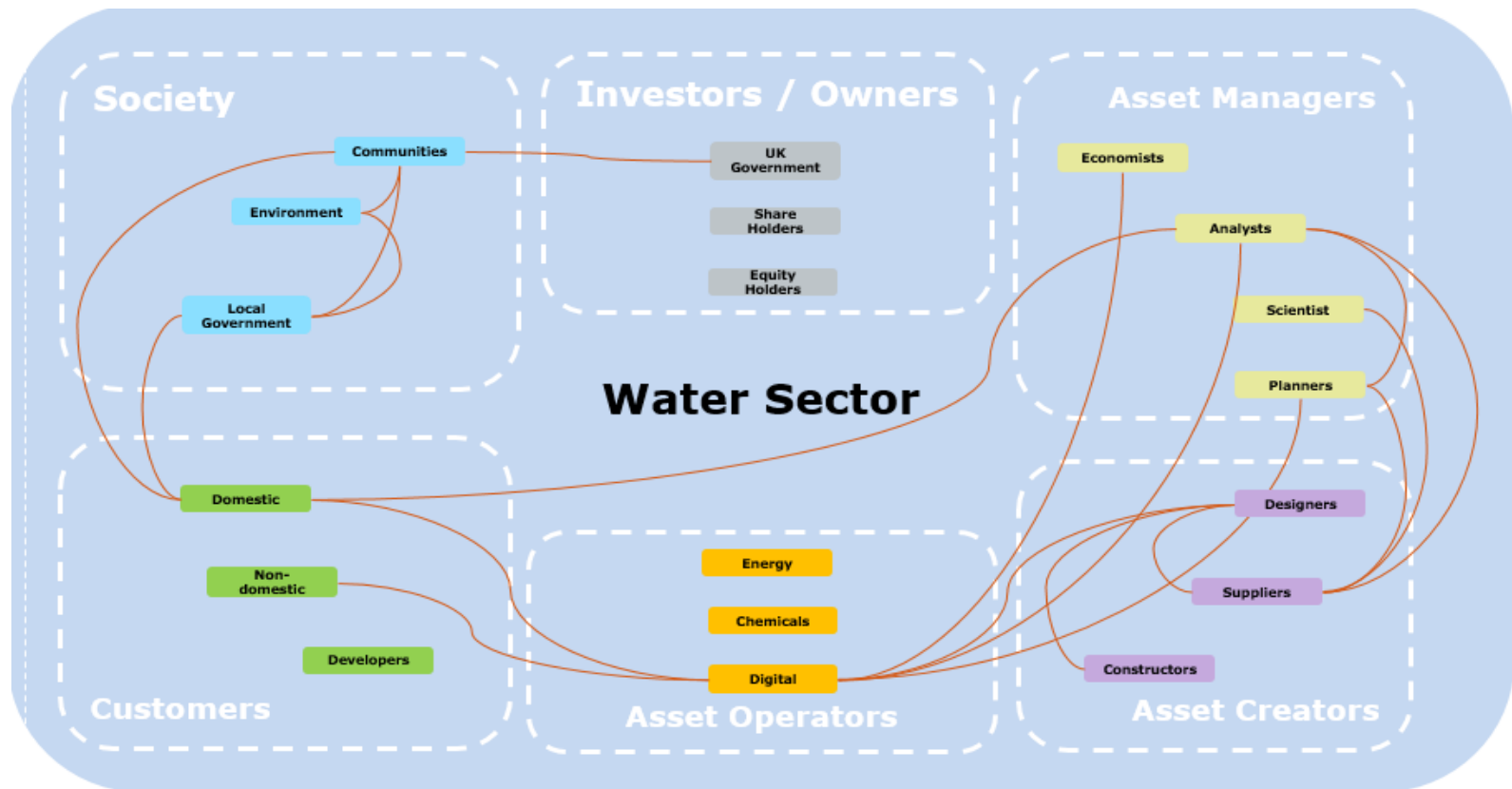
# Delivering AMP7

We can simplify by looking at one measure at a time (Per Capita Consumption)



# Delivering AMP7

We can further simplify by removing secondary links for PCC



# PR19 – what we know

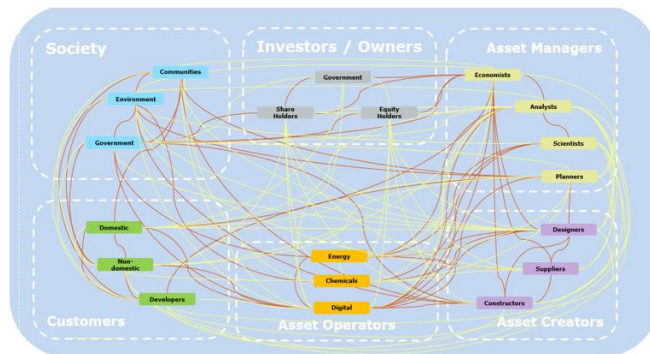
As engineers and scientists we need to look at the challenge holistically

All stakeholders have a part to play and must engage

Interface mapping - per capita consumption

	Investors / Owners	Asset Managers	Asset Creators	Asset Operators	Customers	Society
	Equity Holders Share Holders Government	Economists Analysts Scientists Planners	Designers Suppliers Constructors	Energy Chemicals Digital	Domestic Non-domestic Developers	Government Environment Communities
<b>Investors / Owners</b>	Equity Holders Share Holders Government	L L L	L L L	L L L	L L L	L L L
<b>Asset Managers</b>	Economists Analysts Scientists Planners	M M M M	M M M M	M M M M	M M M M	M M M M
<b>Asset Creators</b>	Designers Suppliers Constructors	L L L	L L L	L L L	L L L	L L L
<b>Asset Operators</b>	Energy Chemicals Digital	L L L	L L L	L L L	L L L	L L L
<b>Customers</b>	Domestic Non-domestic Developers	L L L	L L L	L L L	L L L	L L L
<b>Society</b>	Government Environment Communities	L L L	L L L	L L L	L L L	L L L

■ = high interdependency  
■ = medium interdependency  
■ = low interdependency



# Delivering AMP7 - Conclusion

---

We need to look at the challenge holistically

We need to address one metric at a time

Communication and collaboration between stakeholders is key

- Digital provides a new means of linking stakeholders
- We need to figure out how to use those links to drive engagement
- Engagement must lead to solutions

# Delivering AMP7 - Conclusion

---

We need to look at the challenge holistically

We need to address one metric at a time

Communication and collaboration between stakeholders is key

- Digital provides a new means of linking stakeholders
- We need to figure out how to use those links to drive engagement
- Engagement must lead to solutions

And finally a reminder...

“We cannot solve our problems with the same thinking we used to create them”

Albert Einstein

# Delivering AMP7

---

Thank you



# Delivering AMP7

Keith Gardner

23 October 2019



**CIWEM** Chartered Institution of  
Water and Environmental  
Management  
Metropolitan Branch

making the **difference**





# Delivering AMP7

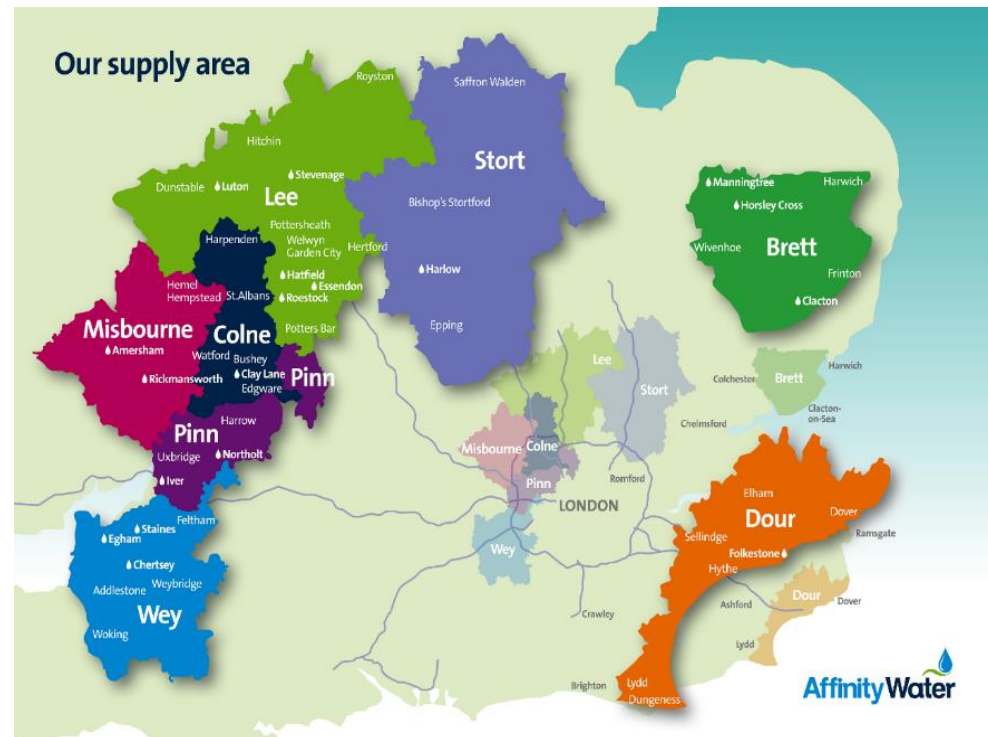
Keith Gardner, Director of Asset Strategy



# Affinity Water

We are the largest water-only supplier in the UK and we are committed to delivering a high quality drinking water service to all our customers.

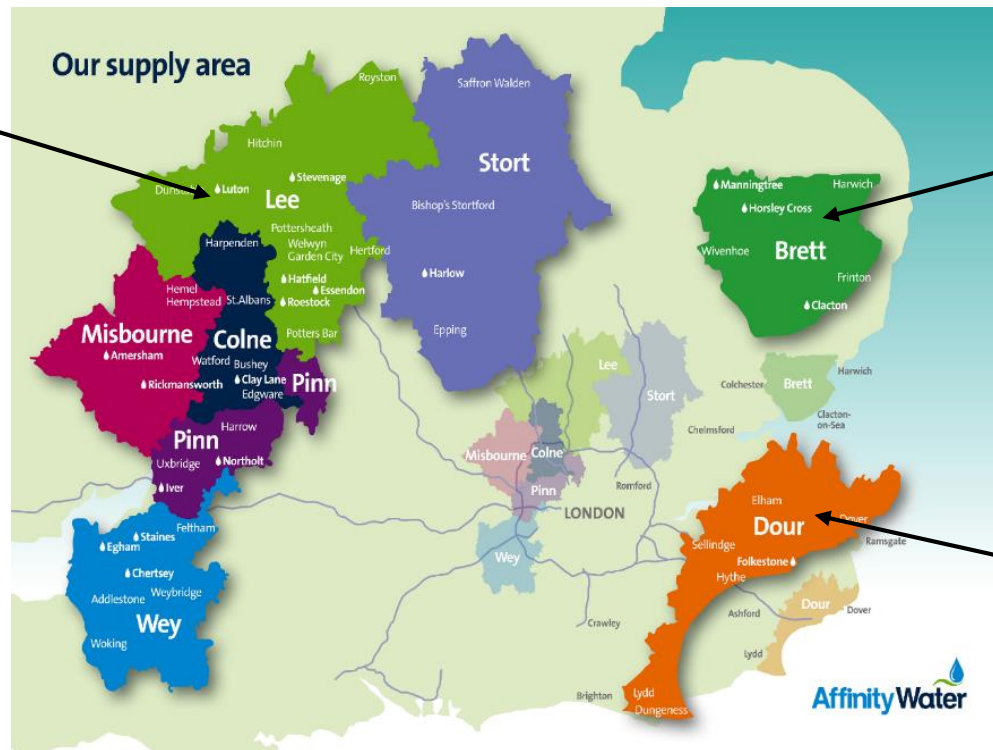
- 900 million litres of water per day
- 1.4 million properties
- 3.6 million people
- 74,000 non-household (commercial) customers



# Our three supply regions

Affinity Water serves 3.6 million customers in Southeast England, in areas that the Government has designated as being under serious water stress.

**Central:**  
 60% groundwater  
 40% surface water  
 Average DI 900 MI/d  
 36MI/d transferred to South East Water



**East:**  
 80% groundwater  
 20% surface water  
 Average DI 29 MI/d  
 7.2MI/d transferred to Anglian Water

**Southeast:**  
 100% groundwater  
 0% surface water  
 Average DI 42 MI/d  
 Small imports from South East & Southern

# Challenges in AMP7

---

- PCs & ODIs
  - OFWAT challenging the sector to achieve more for less
- It's not just about the regulator
  - Drought
  - Strategic resources
  - Abstraction reductions & environmental sustainability
  - DEFRA 25 year environment strategy
  - Cyber security
  - Resilience
  - Vulnerability
  - Macro-economic uncertainty

# Leakage Performance Commitment

18.5% reduction in leakage across AMP7

Performance Commitment :		Leakage				
Measure:		Leakage in ML/d, three-year-average				
Target	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25
	162.2	156.2	150.2	144.2	138.2	132.2

- 2018/19 YE Performance was 201 MI/d
- Currently on target to achieve 19/20 performance
- Moved to a targeted strategy for 2019
- AMP7 will require a step change to achieve



# Supply Interruptions

2018/19 Performance was 12 mins/property

<b>Performance Commitment :</b>		<b>Supply interruptions Greater than 3 hours</b>				
<b>Measure:</b>		<b>Average supply interruption greater than three hours (minutes per property)</b>				
<b>Target</b>	<b>2019-20</b>	<b>2020-21</b>	<b>2021-22</b>	<b>2022-23</b>	<b>2023-24</b>	<b>2024-25</b>
	<b>06:00</b>	<b>04:17</b>	<b>03:58</b>	<b>03:40</b>	<b>03:22</b>	<b>03:00</b>

- AMP7 metric includes planned work
- Control room Situational Awareness will improve response times to network events

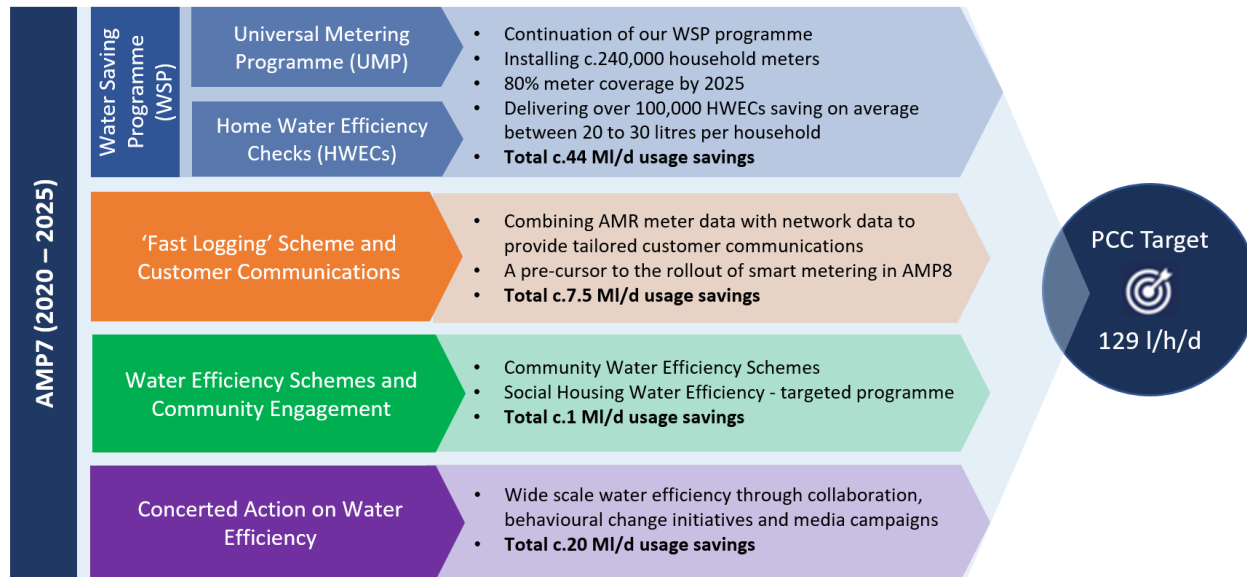
# Per Capita Consumption

Most ambitious PCC reduction in the sector for AMP7

Performance Commitment :		Per Capita Consumption				
Measure:		Litres per head per day (l/h/d), three-year advance				
Target	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25
	151.6	149.00	144.10	140.50	136.50	132.60

- Ambitious PCC target is strategically important for many reasons
- AMP7 Strategy is data driven
- Smart metering trials funded in AMP7

# AMP7 Achieving PCC



# Summary of AMP7 Investment

---

April 2019

The AMP7 **investment portfolio** (capex + opex) is **£852m**.

Across the four sub-portfolios:

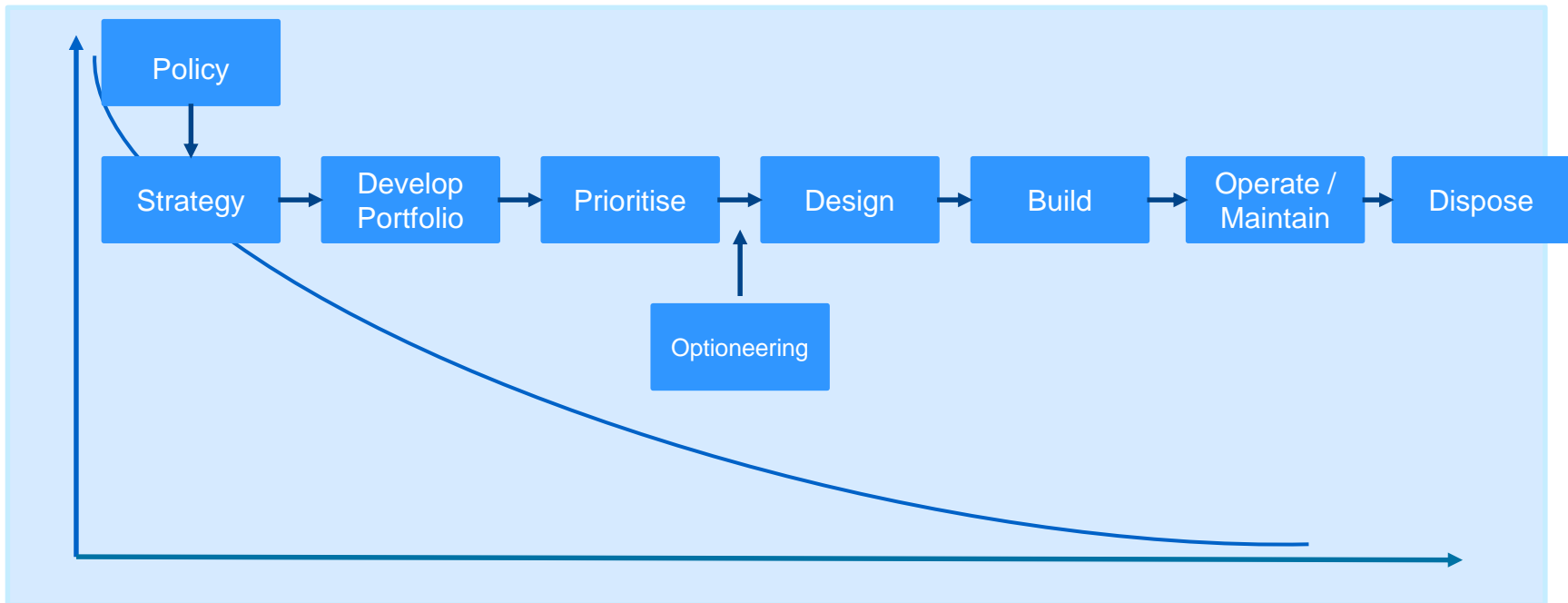
- Environment: £92.0m
- Non-infrastructure: £432.0m
- Infrastructure: £292.3m
- Business Improvement: £35.7m

AMP7 Yr1 Capex £160m vs £96m 19/20



# High Level Process

Significant Opportunities for efficiency early in the Asset Lifecycle



# AFW Investment Programme delivery strategy

---

- Risk based portfolio prioritisation & optimisation
- Early engagement with delivery partners
  - More collaborative working
- Visibility of programmes and certainty of forward delivery
- Bundling of discreet packages of solutions
- Standardisation
- Off site construction
- Alignment with Carbon Reduction strategy
- “Fast follower” innovation strategy





# Strategic Regional Solutions

Adaptive planning approach for AMP7

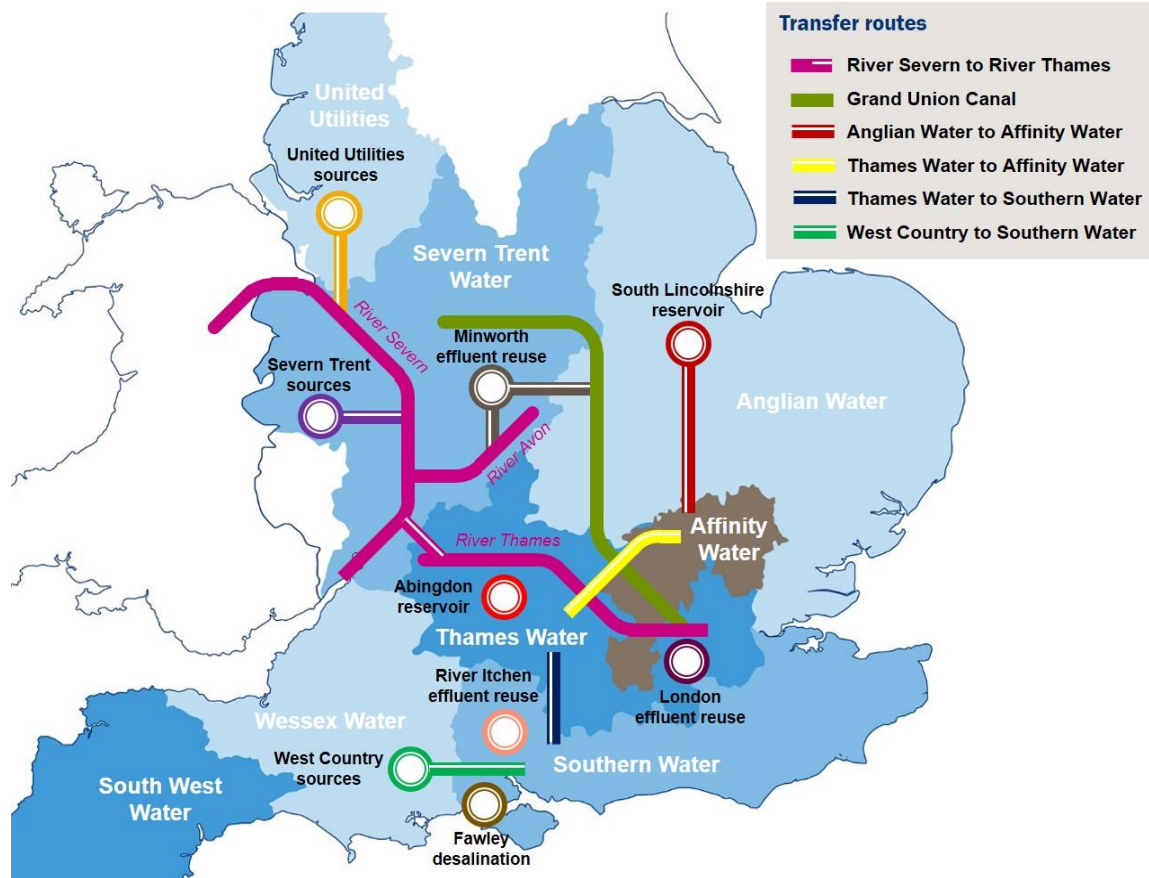
---

## Development of regional/ national solutions



- **In August 2018, Defra, Ofwat, EA and DWI jointly wrote to water companies** setting an expectation for increased ambition in water resources planning to transcend boundaries, enhance resilience and increase efficiency.
- **Companies responded positively:** Six companies - Affinity Water, Anglian Water, Severn Trent Water, Southern Water, Thames Water, United Utilities - put forward joint solutions in their business plans.
- **Ofwat allowed £450 million for development work in 2019 draft determination.**
  - This covers 15 potential regional solutions across 8 companies.
  - Ofwat's assessment identified a further two potential exporter companies - Wessex Water and South West Water.
  - The additional water provided by these regional solutions is in excess of 1000 MI/d.

Diagram of strategic schemes





# Technology & Innovation

---

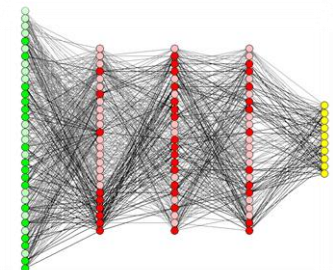
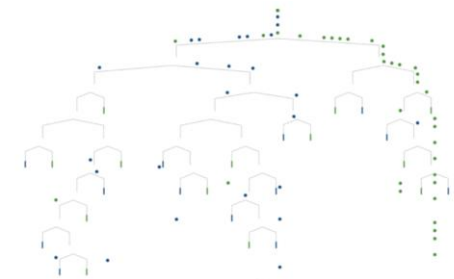
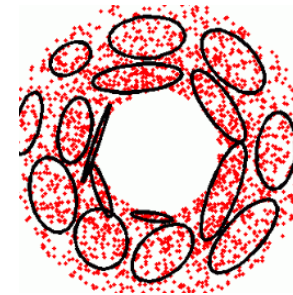
# Machine learning - introduction

## Machine Learning and AI

- Machine Learning is the science of getting computers to learn and act like humans do, and improve their learning over time in autonomous fashion, by feeding them data and information in the form of observations and real-world interactions

Table 1: The three components of learning algorithms.

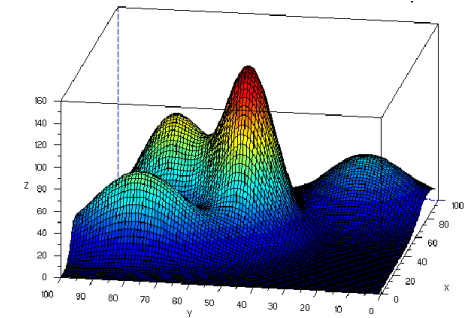
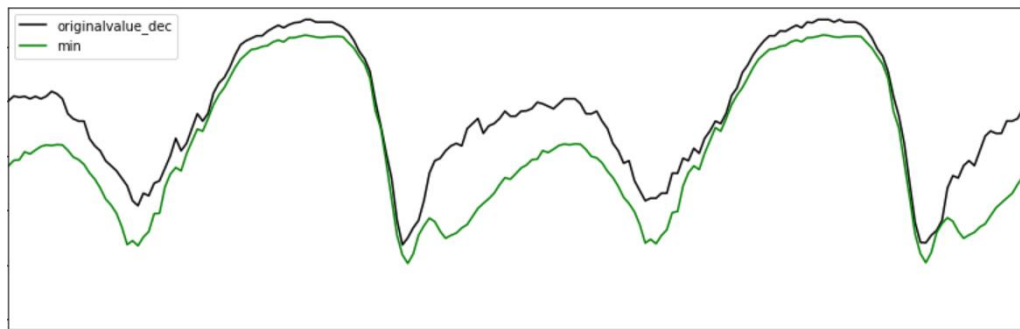
Representation	Evaluation	Optimization
Instances	Accuracy/Error rate	Combinatorial optimization
<i>K</i> -nearest neighbor	Precision and recall	Greedy search
Support vector machines	Squared error	Beam search
Hyperplanes	Likelihood	Branch-and-bound
Naive Bayes	Posterior probability	Continuous optimization
Logistic regression	Information gain	Unconstrained
Decision trees	K-L divergence	Gradient descent
Sets of rules	Cost/Utility	Conjugate gradient
Propositional rules	Margin	Quasi-Newton methods
Logic programs		Constrained
Neural networks		Linear programming
Graphical models		Quadratic programming
Bayesian networks		
Conditional random fields		



# Clustering

## Machine Learning and AI

- 100s of models considered to extract sets of behaviour of the sensors based on similarity in order to define ways to interpret each shown behaviour. This is also known as 'clustering'. Currently opted to use Gaussian Mixture to cluster sensor readings.
- The clustering takes the average smoothed median minimum values (green line) for each reading time of the day. The black line is the normal sensor readings:



- Similar approach is taken for each day of the week so that weekday trends are taken into account. This then results in 31 features, 24 - each reading time of the day and 7 - each weekday



# Luton Mosque & “High water use” communities

## Environmental Pilot Projects

- Pilot project working with Mosque(s) and community leaders/advocates to support and engage with “high water use” communities targeted in Luton that use additional water in relation to faith and culture
- Initial assessment of WSP props in the trial area deemed to have high PHC
- Local “community champions” to support HWECs and help tailor engagement
- Opportunity to go wider and build “social capital” and partnerships – e.g. social tariff schemes, priority services register, REFILL, disposing “FOG”

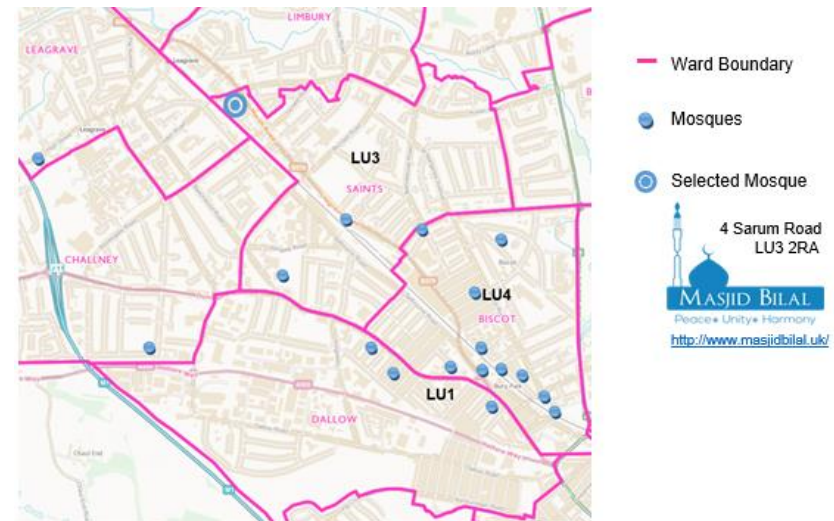


Acorn Category	Property Count	Acorn Group Desc	Avg Daily Vol (mVol)	Avg Daily Vol / 2011 Occs	Property Count	2011 Census Occupancy	Avg Acorn Occs	Metered %
Affluent Achievers	412539	Student Life	0.319	0.131	35235	2.37	2.20	57.35%
Comfortable Communities	382335	Modest Means	0.309	0.123	59253	2.70	2.66	61.97%
<b>Financially Stretched</b>	<b>283634</b>	Striving Families	0.296	0.113	144723	2.65	2.63	52.81%
Rising Prosperity	192387	Poorer Pensioners	0.197	0.121	44423	1.55	1.57	46.26%
Urban Adversity	187231	<b>Total</b>	<b>0.288</b>	<b>0.119</b>	<b>283634</b>	<b>2.45</b>	<b>2.42</b>	<b>54.26%</b>

# Luton Mosque – Grey Water Recycling

## Environmental Pilot Projects

- Mosques use significant amount of water and can be an influential body to propagate key water saving message linking to their faith and core values.
- Our proposed mosque we plan to work with are going through full renovation (incl. new plumbing) and one of the imams is a company employee.
- Opportunity to install grey water recycling plant in the mosque (phase 2 of project) recycling water used for “wudu” (ritual washing before prayers) for toilet flushing.
- Log and measure meters to mosque before and after interventions to evidence the benefits
- Potential to replicate benefits to other communities and other faiths e.g. Hindu temples in Wembley, NW London.



**Community project area map** will focus engagement and interventions in 3 local wards initially

# Delivering AMP7



Turner & Townsend

**CIWEM** Chartered Institution of  
Water and Environmental  
Management

Metropolitan Branch

Siraj Tahir

23 October 2019

making the **difference**

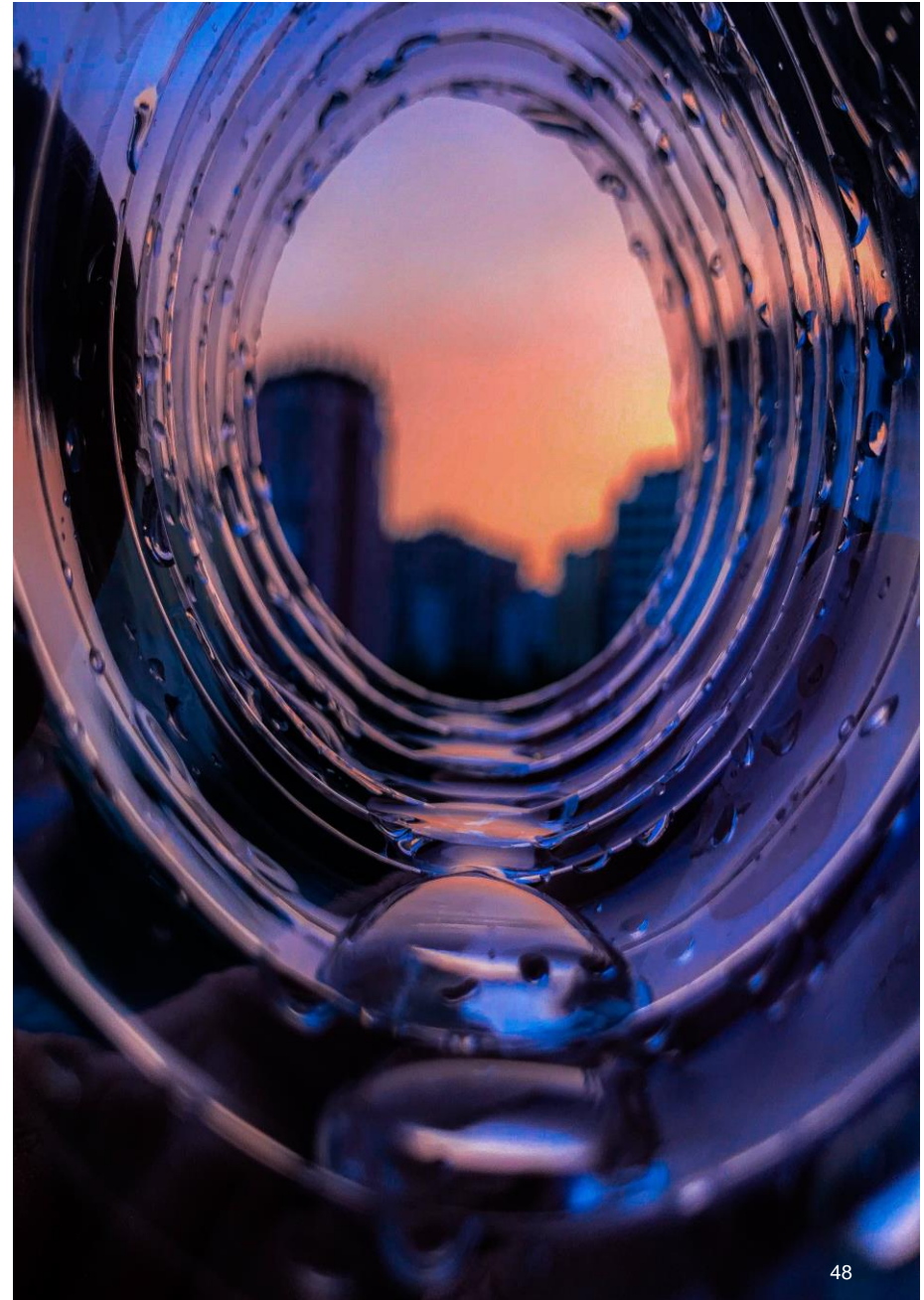




# Delivering AMP 7

*Leakage priorities*

Siraj Tahir  
*Water & Environment*



# How are we doing?



Significant improvement between 1994 and 2000.

Fairly constant since then at around 23%

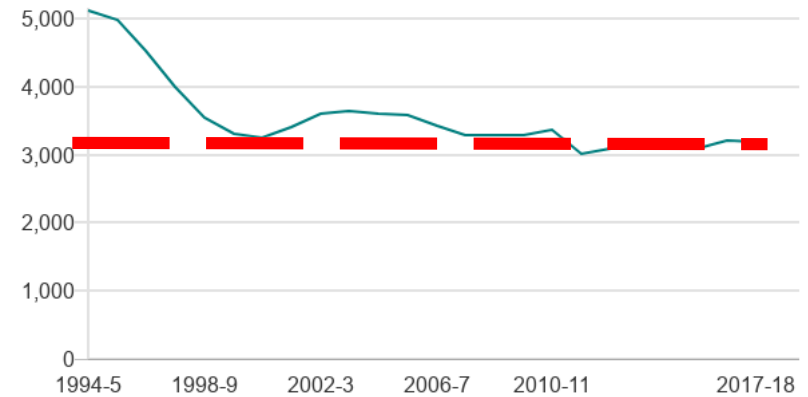
Leakage KPIs not effective?

**377,000**  
tonnes CO<sub>2</sub>/year

UK leakage carbon footprint

### Water lost to leakage in England and Wales

Total leakage/millions of litres per day



Source: Ofwat

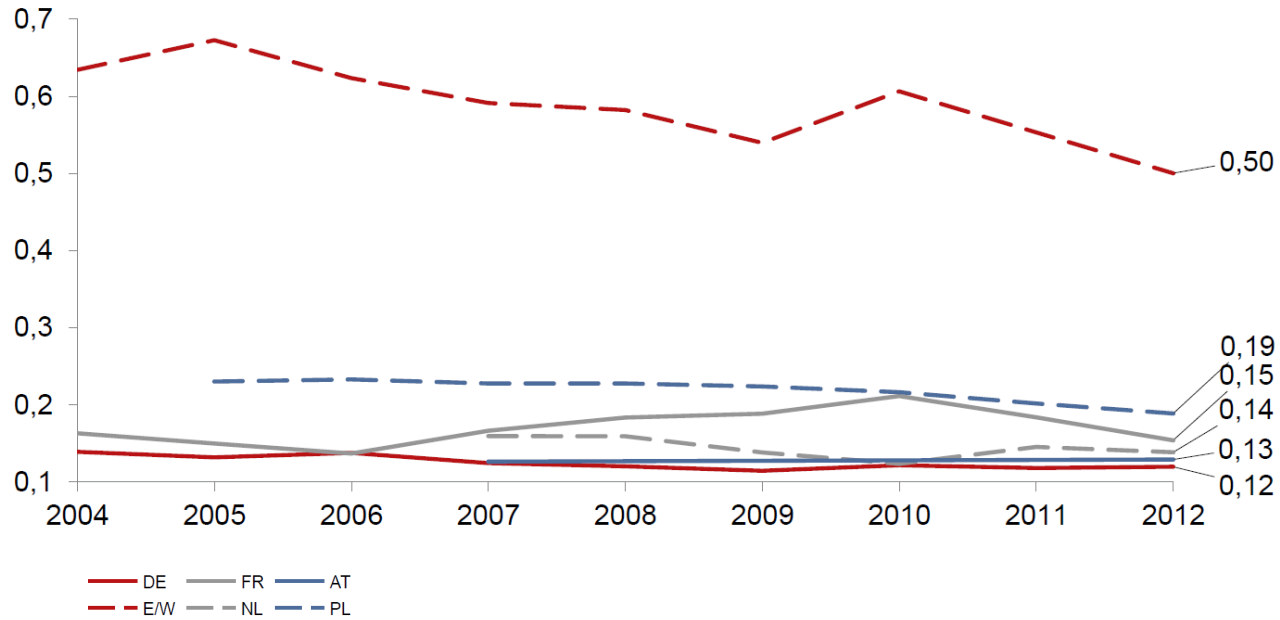


# How do we compare?



## Specific water losses

in m<sup>3</sup> per pipe kilometre and hour

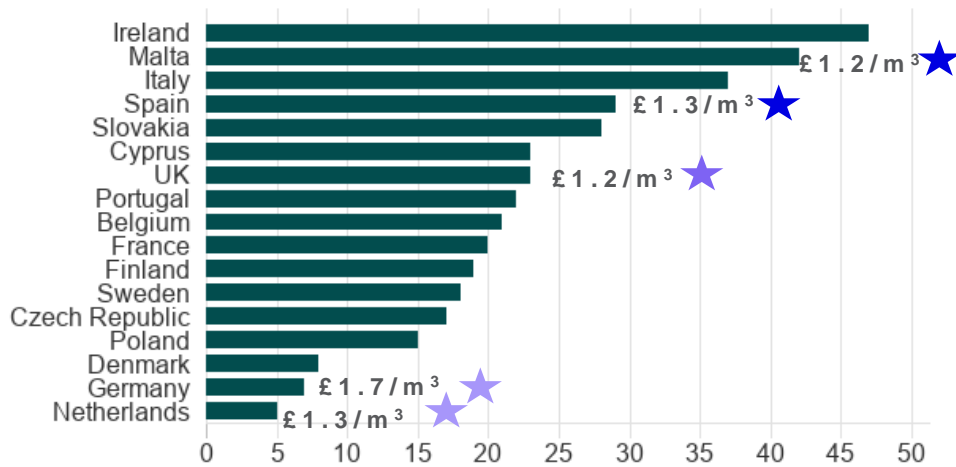


Source: Civity

# How do we compare?

## Water lost to leaks across European countries

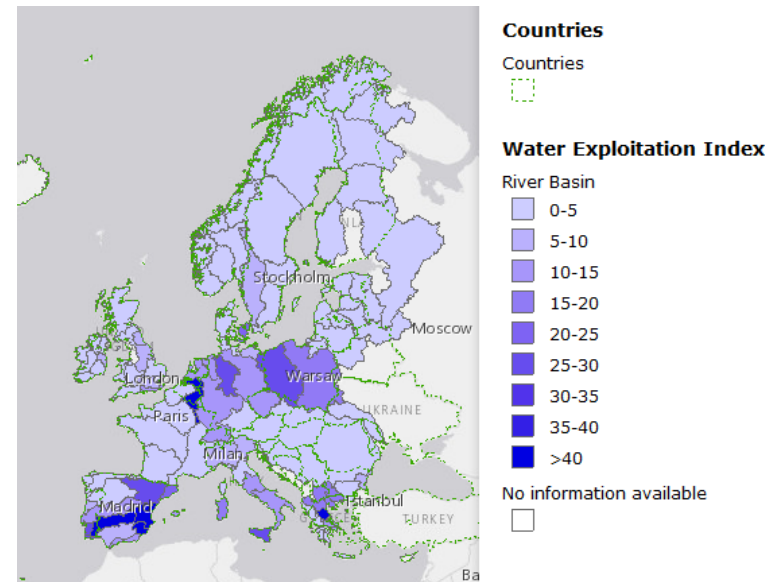
Percentage of water supplied that is lost to leakage



Source: Selected countries from EurEau - Europe's water in figures 2017

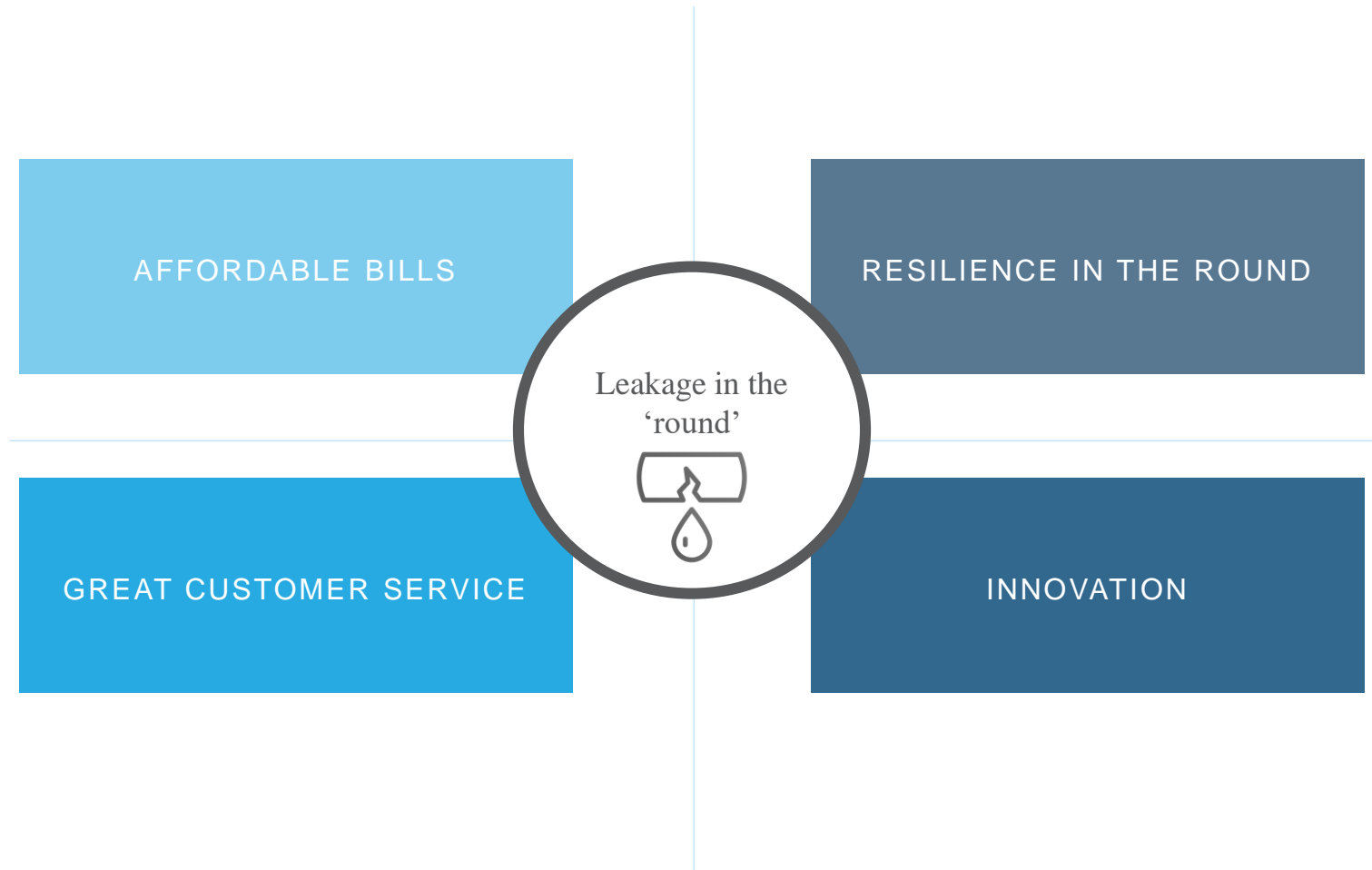


## Water Exploitation Index





# Ofwat Priorities & Leakage



# Where do we go next?



## PROCESSES

MULTIPLE CAPITAL  
ACCOUNTING

OPERATIONAL

PROCUREMENT



## PEOPLE

STAFF NUMBERS

SKILLS

TRAINING



## TECHNOLOGY

PREDICTIVE

ADAPTIVE

QUICKER + FASTER +  
CHEAPER

Innovate and Collaborate Across the Sector

# What are we doing?



## Supporting Utilities



## Supporting Innovation

**WET NETWORKS**  
London + Online  
7th November 2019

Wet Networks | London + Online | Closing the Loop  
By Wet Networks by Arup and WRc

Free

[Register](#)

**Closing the Loop for Circular Water Economy [also being live-streamed]**

**About this Event**  
Arup and WRc are joint conveners of Wet Networks series of events that provide a medium for networking and the exchange of ideas between senior players in the water technology sector. The event will **also be live-streamed** for those who can't attend in person. You can make appropriate ticket selection during registration.

**Agenda**

**Date And Time**  
Thu, 7 November 2019  
16:30 - 20:00 GMT  
[Add to Calendar](#)

**Location**  
Arup  
8th Floor, Strand  
London  
W1T 4BS  
[View Map](#)

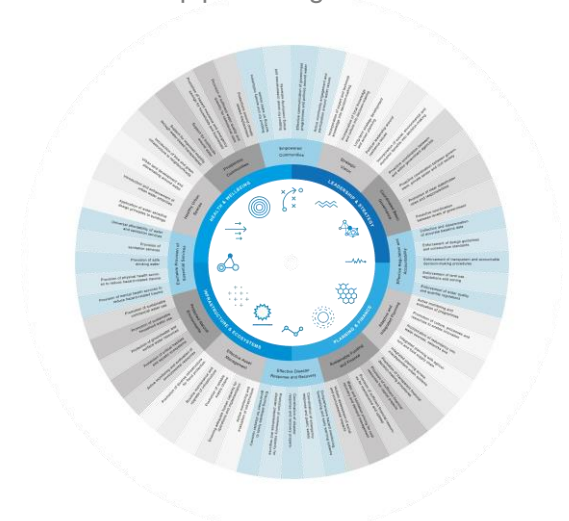
**Welcome to our Venturi Water Innovations Community**  
Showcasing water technologies, sector needs and thought leadership

**Welcome to the Venturi Portal**

If you are interested in technology and innovation, networking with like-minded people in the water sector or simply reading up on latest news on climate change or other sector issues then the Portal welcomes you as a free subscriber.

In partnership with  
**ARUP** **wrc**

## Supporting Cities



City Water Resilience Approach (CWRA)

Siraj Tahir | *Water & Environment*

*siraj.tahir@arup.com*

# Delivering AMP7



Turner & Townsend

**CIWEM** Chartered Institution of  
Water and Environmental  
Management

Metropolitan Branch

Q&A

23 October 2019

making the **difference**

