

TA 11.WN04 Water Networks Business Case

September 2018
Version 1.0

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1. Executive Summary

Name of technical annex	WN04 Water Networks
Context	<p>We have ~ 13,900km of water mains serving 2.5 million customers.</p> <p>We currently have the lowest leakage in the industry.</p> <p>However, current performance levels will not meet the future expectations of our customers and regulators. This is particularly true in the case of the need to reduce leakage; and the introduction of the Compliance Risk Index (CRI).</p> <p>There are also further pressures from growth in the south-east of England (a 10.5% increase in population by 2030) and climate change.</p> <p>These pressures result in a demand deficit across our region of 294 megalitres per day (Ml/d) by 2030, with a deficit of 188Ml/d in Hampshire alone.</p> <p>Leakage is a key part of our integrated demand management approach with Target 100 to reduce demand by 38 Ml/d¹ across the region by 2025.</p>
Customer and stakeholder views	<p>Customers have consistently told us that reducing leakage from the water network is a high priority with customers willing to pay £3.40 per household per year to reduce leakage by 16 litres per household by the end of AMP7. Other stakeholders also identified leakage as a high priority, including Ofwat who expect water companies to reduce leakage by at least 15%. Both of these equate to a ~16 Ml/d reduction by 2025.</p>
Our aim	<p>We will reduce leakage by 15.1% (16 Ml/d) between 2020 and 2025. In the long term we will reduce leakage by 40% to 2040 and 50% by 2050.</p> <p>We aim to become an Upper Quartile company in all network performance measures with the exception of the Event Risk Index (ERI). In the case of ERI, we aim to improve from Quartile 4 to Quartile 2. These are key secondary benefits of our investment to achieve the 15.1% leakage reduction.</p> <p>We will: improve asset health, reduce the number of mains bursts, reduce the number of customer contacts as a result of taste and odour and reduce the number of water supply interruptions.</p>

¹ PR19 Data Table WS4.

Scope of this business case	All capital maintenance and base opex investment relating to Water Network assets. This business case also includes a component of enhancement which is the £19.8m lead pipe replacement programme.		
	Botex	Enhancement	Total
Totex (£'m)	£241.0	£ 19.9	£ 260.8 ²
Opex (£'m)	£ 168.0	£ 0	£ 168.0
Capex (£'m)	£ 72.9	£ 19.9	£92.8
Residual, post-AMP7 capex (£'m)	0	0	0
20 year Whole life totex (£m)	N/A	N/A	£ 839.6 ³
20 year cost benefit (£m)	N/A	N/A	- £ 225
Materiality (% 5 year Totex)	-	-	21%
Relevant business plan table lines	WS1 – Lines: 5,12, &13	WS2 line 6	
Botex and Enhancement			
Overview of AMP7 proposals	<p>We are investing £261m over AMP7 to improve the resilience and performance of our water network, including reducing leakage. We will utilise two primary levers to deliver leakage reduction: Active leakage control (“find and fix”), which allows us to reduce leakage by 8.1% in AMP7 (this includes the use of smart technologies). 330km of area scale water mains renewal, which allows us to reduce leakage by 7%.</p>		
Why are the proposals the best programme- level option for customers	<p>We have identified 28 different interventions that will reduce leakage. We have estimated the totex of each intervention and the contribution that each will make to reducing leakage. We then ranked interventions from the lowest to the highest cost per Ml/day leakage reduction. We then selected the top 11 most cost effective options to achieve the 16 Ml/d reduction. This forms our preferred option.</p> <p>We ruled-out three further strategic options for reducing leakage on the grounds that these are not cost beneficial: An option to deliver the same 15% leakage reduction using traditional approaches (without smart networks) was discounted as these costs exceed customer willingness to pay.</p> <p>An option to reduce leakage by 25% - because the costs of doing this significantly exceed customer willingness to pay and would</p>		

² Our gross wholesale plan includes £5.436 million of enhancement Opex for AMP6 nitrate schemes, as required by WS2. To account for this we have reduced our Water Networks gross operating costs by £5.436 million. In order to align with our AMP7 delivery planning our technical annexes do not reflect these adjustments. Our Nitrate technical annex investment is therefore £85m - £5m = £80m, and our Water Networks technical annex investment is £255m + £5m = £260m.

³ Due to the integrated way we have built our Network plan, in this whole life cost and cost benefit analysis we have included relevant elements from elsewhere in our plan (Intelligent Networks and Leakage to Upper Quartile). The funding for these elements is captured in technical annex TA.11.WN01 Supply Demand Balance.

require an extra £50m in AMP7 capex which would increase customer bills.

An option to only reduce leakage by 10% - because whilst this would involve lower costs, it would fail to meet customer and regulatory expectations.

The secondary benefits of the selected programme are top quartile performance across all other water network performance commitments.

We plan to implement four key innovations in AMP7: We will adopt a complete District Metered Area (DMA) replacement policy, which will see the replacement of all water mains, communication pipes and customer supply pipes in each DMA. This achieves a 7% reduction in leakage.

We will change our approach to mains cleaning and using DMA contact regeneration rates as part of our predictive analysis (using leading rather than lag indicators to prevent incidents). This will improve our appearance performance from average to upper quartile.

What we would like to highlight

We will implement our industry leading intelligent network strategy which will use increased monitoring, automation and control of our network using established smart technologies to reduce leakage, reduce water quality risks to customers and improve network performance. This includes deploying c15,000 new network monitors and an innovative combination of machine learning paired with 5G technologies.

We will implement our 6 Pillars Strategy for removing lead from the water network by 2045, this will include an innovative trial in Deal, Kent which will provide subsidies to customers to remove lead in their homes whilst we replace all water mains, communication pipes and supply pipes.

Performance Commitments supported by this business case

PC	How relevant is this business case?	Comment
Leakage	High	Reduces leakage by 15.1%
Asset Health: mains bursts	High	Improves performance to Upper Quartile
Per Capita Consumption	High	Compliments supply demand and integrates smart metering as part of our demand management approach.
Appearance	High	Improves performance to Upper Quartile.
Replacing lead pipes	High	28,000 lead pipe replacements under this programme
Water supply interruptions	High	Improves performance to Upper Quartile

Schemes and scheme-level options

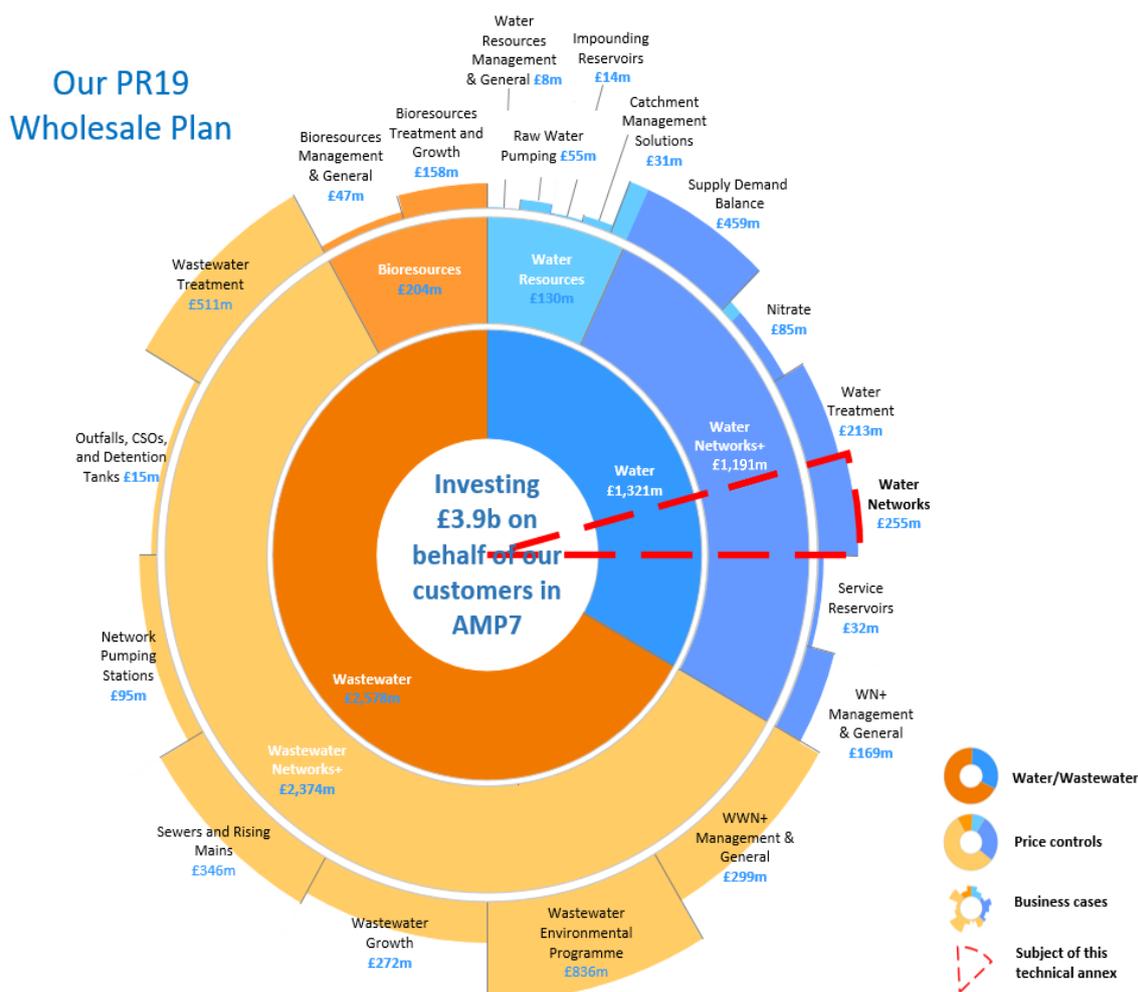
Schemes over £20m/£10m Options

	Description	Cost	Selected option and rationale
None			

2. Scope of Technical Annex

Our wholesale plan has been valued at £3.9 billion. This technical annex covers all capital maintenance and base opex investment relating to our water network assets. The funding is from the Water Networks+ price control and equates to £261m in totex for AMP7.

Our gross wholesale plan (shown below) includes £5.436 million of enhancement Opex for AMP6 nitrate schemes, as required by WS2. To account for this we have reduced our Water Networks gross operating costs by £5.436 million. In order to align with our AMP7 delivery planning our technical annexes do not reflect these adjustments. Our Nitrate technical annex investment is therefore £85m - £5m = £80m, and our Water Networks technical annex investment is £255m + £5m = £260m.



This investment is impacted by Network 2030, new assets will be required to connect Water Supply Zones and enable rationalisation of Water Supply Works and Water Service Reservoirs.

The scope of this annex includes:

- 13,905km of water mains (transmission trunk and distribution mains)
- 1.1 million Communication pipes
- Stop Taps
- Network control assets (e.g valves)

- Pipe Bridges
- Cathodic Protection Systems
- Water Meters
- Network Monitoring and Telemetry Equipment (meters and outstations)

Investment is split into the following AMP7 programmes:

- Water Mains Renewal Programme
- Rownhams and IOW discolouration undertaking
- Mains cleaning (discolouration management)
- DG2 Property Reduction (Maintain Pressure)
- Leakage (Opex and Capex)
- Water Booster Stations
- Communication Pipe and Stop Tap Replacement
- DG2 (Low Pressure)/Critical Valves Programme
- Pipe Bridges Safety Programme
- Distribution Risk Mitigation Programme (minor works)
- Metering Programme

Quality enhancements, such as dealing with increasing raw water nitrate levels or new connections, are not covered in this technical annex. Likewise, other asset classes including Water Service Reservoirs, and Impounding reservoirs are covered in other technical annexes.

3. AMP6 Strategy

3.1 Investment Strategy

Over the last two AMPs we focussed on maintaining stability for the majority of water network asset health serviceability measures⁴. The exception is leakage where we achieved a significant reduction of around 10MI/d between 2010/11 and 2016/17.

Our major water network investment programmes include:

- Around 87% of domestic customers are now metered after the first universal metering programme in the UK
- Investing over £125m on finding and fixing leaks between 2010 and 2020
- Replacing approximately 300km of water mains between 2010 and 2017
- Flushing 2,600km of mains – 20% of our network – to manage total iron and manganese (TIM) compliance and reduce discolouration risks
- Replacing all cast iron mains in the Woolmans Wood area of Chatham as part of our multi-AMP discolouration reduction programme
- Ongoing trial of smart networks in Rownhams, Southampton where we are driving an industry-leading deployment in network water quality monitoring

Table 1 summarises the total AMP6 Capex and Opex spend for Water Networks

Table 1: AMP6 Actuals/Forecast

Doc #	Technical Annex	Year 1	Year 2	Year 3	Year 4	Year 5	AMP6
WN04	Water Networks	59.647	58.952	69.002	67.231	63.026	317.858
	Capex	19.108	16.035	15.849	12.618	18.111	81.721
	Opex	40.540	42.917	53.153	54.613	44.914	236.137

We have committed to a major programme of pipe bridge safety upgrades to meet Health and Safety Executive compliance obligations – this will continue into AMP7. We have also received a DWI notice to reduce discolouration complaints in the Rownhams and Isle of Wight North Water Supply Zones throughout AMP7 and AMP8⁵. Our plan reflects these commitments.

3.2 Customer Benefits and Resilience

We achieved stable serviceability in AMP6 for the following water network specific performance measures:

- Asset Health – Mains Bursts
- Asset Health – TIM Compliance
- Asset Health – Turbidity

⁴ See Figures 1 to 4

⁵ SRN 28 – Rownhams and Isle of Wight – Discolouration

- Asset Health – Discolouration
- Mean Zonal Compliance
- DG2 Pressure

We have delivered measurable and sustained improvements in the following performance measures since 2010:

- Leakage (MI/d)
- Interruptions to Supply (DG3)

Investment in previous AMPs focussed on long-term stable serviceability, rather than achieving performance improvements relative to other companies. A number of significant changes in performance measures and increased comparisons mean current performance will no longer meet customers', stakeholders' and regulators' expectations. These include:

- Introduction of CRI means we will drop from upper quartile water quality compliance performance to 8th in the industry
- Changes in leakage methodology means we will drop from Industry leading but will still be amongst the best in the industry

However, changes to interruption to supply reporting will see our comparative performance improve from 9th to 5th in the industry⁶. The new normalised burst metric, will result in our performance being around the lower 2nd and upper 3rd quartiles.

Figures 1 to 4 compare our performance to industry quartiles for key customer impact measures projected to the end of AMP6⁷.

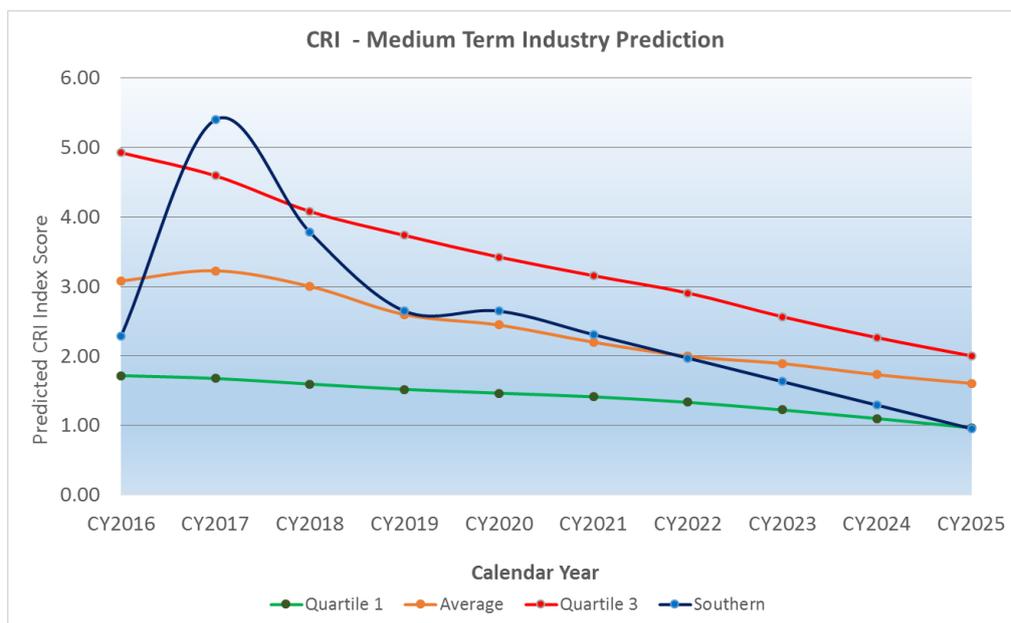


Figure 1 – Compliance Risk Index⁸

⁶ Technical Annex TA.11.01 Water AMP7 Comparative Industry Performance Assessment

⁷ Source for all figures - Source: PR19 Data Table App2 and Technical Annex 'Wholesale Water PR19 Benefit Assessment Methodology & Industry Performance Analysis'

⁸ Source for all graphs: PR19 Data Table App1

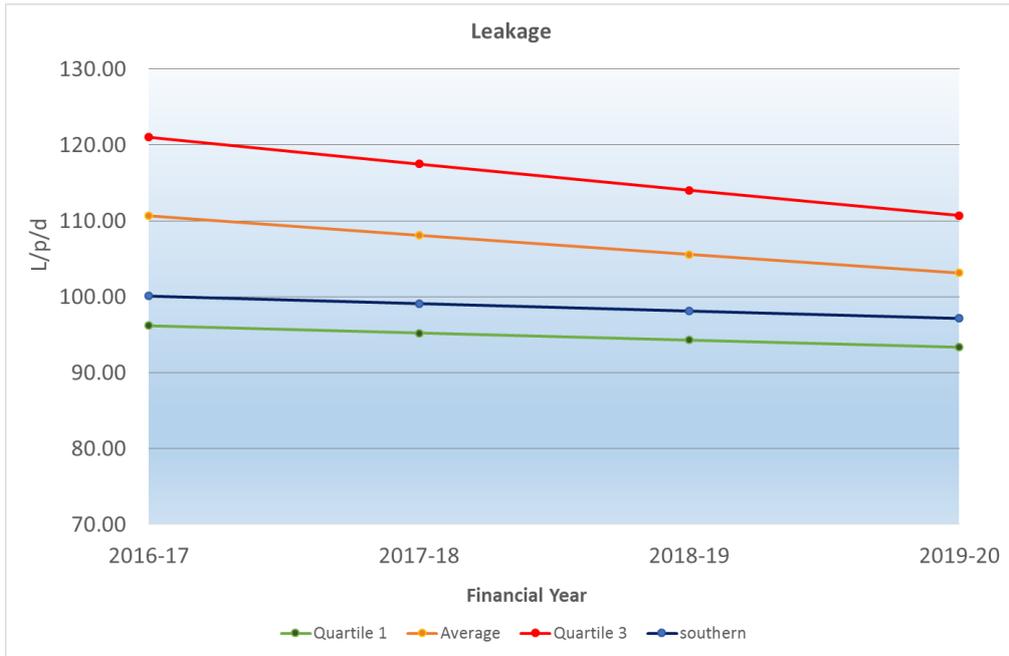


Figure 2 – Leakage (shadow reporting)

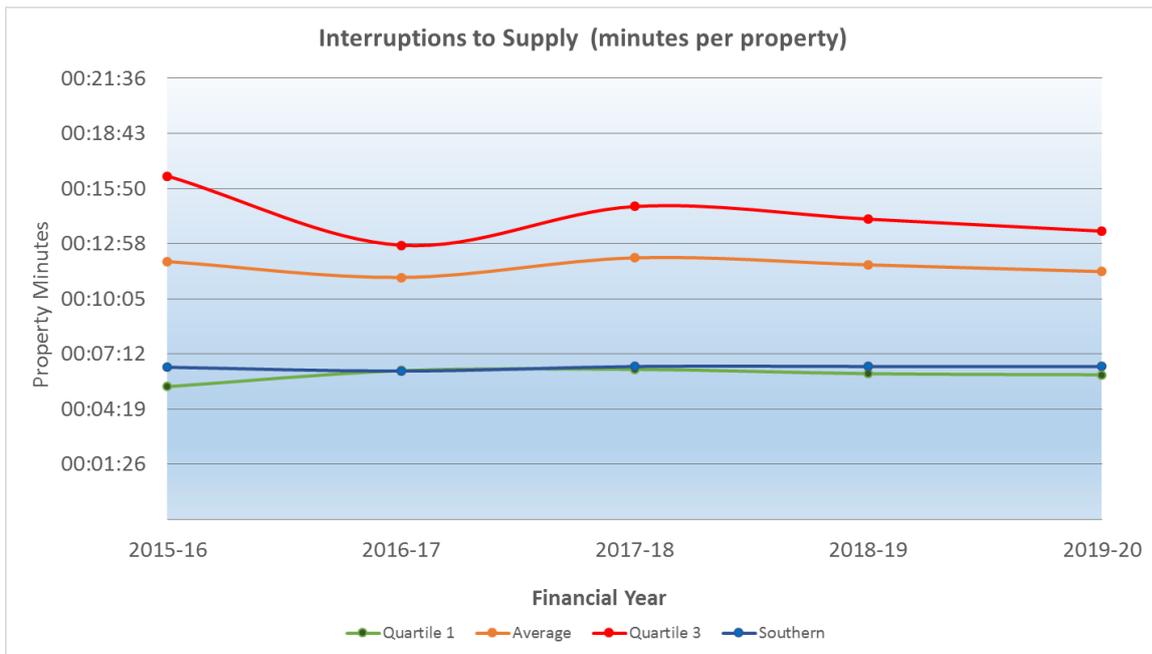


Figure 3 – Interruptions

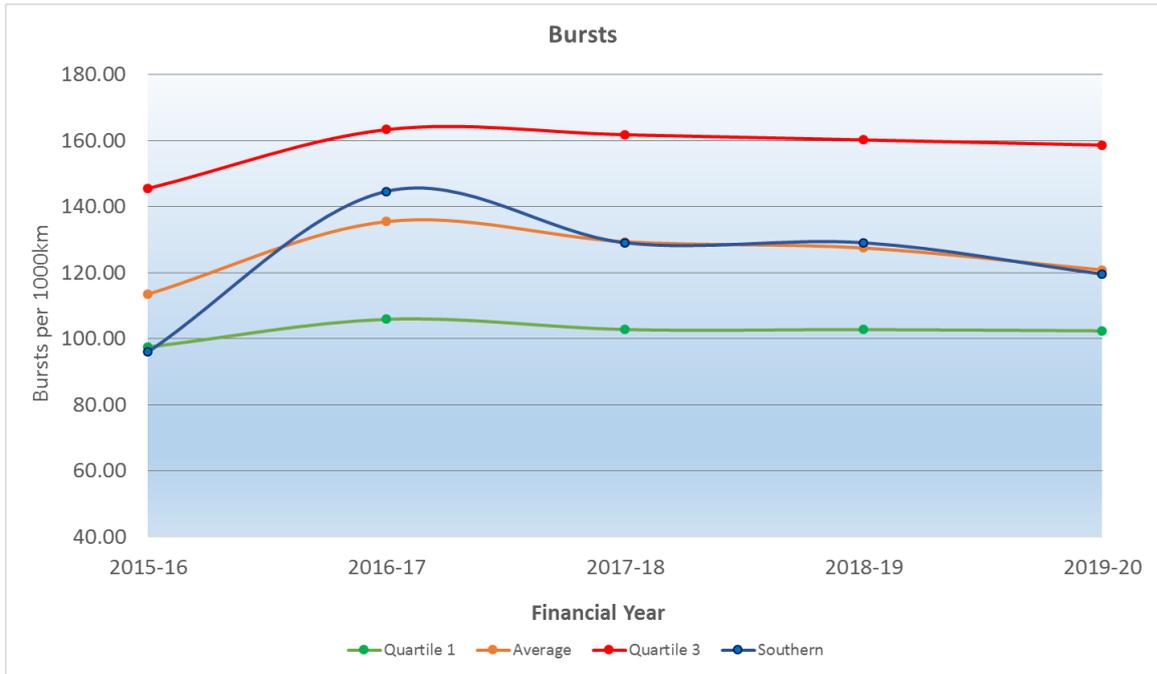


Figure 4 – Bursts

4. Drivers for Change

4.1 Customer and Stakeholder Insight

As outlined in [Chapter 4 – Customer and Stakeholder engagement](#), we used insight from our extensive programme of customer and stakeholder engagement to develop a deep understanding of the views and priorities of our customers. All insight gathered from our customer and stakeholder engagement programme can be found in technical annex [TA.04.04 Research and engagement deliverables](#).

Customers view safe and high quality water as a top priority

Customers say that providing clean, safe, high quality water is an absolute basic of any water company in the UK, and they see that as one of the most important parts of our job.

From a customer perspective, quality comprises of taste, smell and appearance. While household customers have reported widespread issues around chalky/cloudy/discoLOURED water, it was generally accepted as momentary and occasional.

Customers want access to water that is as natural as possible; they don't want too many chemicals to be added to their water supply. In particular, customers are concerned about the impact of lead on human health and would welcome help and support to remove harmful chemicals from pipes within their property. While their general level of satisfaction with current levels is high, customers believe that continuing to ensure harmful metals like lead are not in the water stream is an absolute necessity. Although customers do not want excess chemicals in their supply, they do acknowledge that chemicals are sometimes necessary to ensure water safety.

In general, most customers agree with the above narrative. However, customers of the future's primary focus is protecting and enhancing the environment. They consider water quality a necessity but tend to take it for granted and so believe high quality and safe water is a medium priority.

Stakeholders believe safe and high quality water is a low priority

Stakeholders believe that providing clean, safe, high quality water is a given and so do not view it as a significant area of interest.

Customers believe water resilience is a medium priority

Our customers view water as a precious, natural resource that should be looked after and used wisely. They are concerned about their water supply being at risk due to growing populations, increasing demand and diminishing resources. They expect us to be ensuring that future generations have access to the same level of water services as we do today, and are, themselves, willing to invest now to ensure that there is no deterioration in services in the future. However, they place a higher priority on operational issues that affect them on a daily basis, rather than long term issues. Therefore, they believe this is a medium priority.

Customers believe reducing leakage is a higher priority than reducing their own water consumption

Customers see conserving water as a partnership issue. In the short term the majority of customers expect us to focus on reducing leakage, whilst in the long term some customers want us to help them to use water more wisely.

Throughout our customer research, customers generally highlight reducing leakage as a high priority and view it as a moral issue. While they are pleased that Southern Water is the best performer on this key issue, they feel it's still too much water being lost. Customers express a strong preference for Southern Water to be a leader in reducing leakage.

Non-household customers believed leaks were more important to businesses when they impacted their own supply. Otherwise, they believed reducing leakage was a medium priority. Moreover, customers of the future believed this was a medium priority as their primary focus protecting and enhancing the environment.

Some customers see saving water as a partnership issue and welcome reducing their own water usage. Others are less motivated to change usage behaviour. Specifically, some customers feel it is not equitable for them to be committing to **Target 100** (reducing their PCC to 100 l / h / day) unless we at the same time are fully committed to significantly reducing leakage. Some customers also believe that emerging technologies and innovations will alleviate and facilitate their own personal responsibility to these issues. Customers therefore put consumption reduction as a medium priority.

Customers of the future were highly aware of their role of influence within families in generating change. Moreover, they had a high level of confidence that their usage can make a difference and they were more willing to change as they saw it as a core starting point to make our water sustainable. Nonetheless, their primary focus is to protect and enhance the environment in the short and long term which is why they too put this as a medium priority.

Stakeholders provide strong support for reducing leakage and per capita consumption

Stakeholders expressed significant support for us to further our effort on reducing leakage. They outlined that a reduction in leakage is key to reducing waste, costs and helping to ensure we have a constant water supply in the future.

Stakeholders provided strong support for our **Target 100** target and welcomed our level of ambition. Environmental groups want to see us reach our **Target 100** target sooner than 2040. As a consequence, we have set an AMP7 target to reduce demand by 38 MI/d by 2025. Further details are included in technical annex **TA.11.WN01-Supply Demand Balance**.

Customers believe addressing interruptions to supply are a high priority, whilst addressing unplanned asset outages are a medium priority

When we presented our comparative data for interruptions to supply in England and Wales, broadly speaking customers found our performance to be acceptable in this area. However, customers found unexpected interruptions to supply highly irritating which is why they rated this as a high priority. Moreover, they highlighted the importance of communicating any issues.

Our non-household customers had an increased emphasis placed on maintaining a reliable and uninterrupted supply of water, without unexpected interruptions, or restrictions such as quotas or restricted access hours during summer. This can be explained by the potential implications for their ability to continue to operate and allow employees to work that such restrictions may bring.

Although customers believed interruptions to supply is a high priority, they view an unplanned outage performance commitment as just "simply part of the service a water company provides" and therefore a given, rather than something that needs to be highly prioritised. Therefore, it was ranked as medium priority.

Stakeholders believe interruptions to supply and unplanned outages aren't as important

Stakeholders felt water supply interruptions were a medium priority, and that unplanned outages were a low priority. They noted that these were basic functionalities of a water company that they needed to get right.

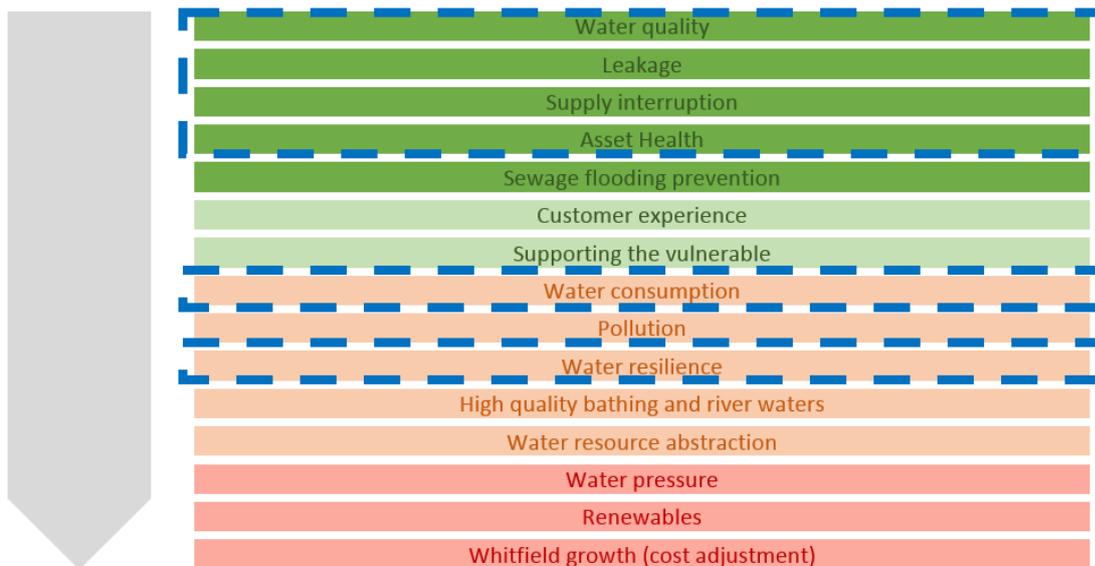


Figure 5: Relative priority of services according to our customers

We have used this understanding of our customers’ priorities to define a set of performance commitments and investment proposals and validated and refined these over the course of our programme of customer engagement. Our success at delivering on these priorities for our customers will be measured by the performance commitments outlined in this business case.

Government, wider stakeholders and regulators expect to see substantial leakage reductions too. Ofwat⁹ and Government¹⁰ expect leakage reductions of 15% by 2025 and the National Infrastructure Commission¹¹ urges a 50% reduction by 2050.

While we will maintain or improve all service measures, as a result of the above insight, delivering significant leakage reductions is the primary driver behind our AMP7 strategy.

4.2 Future Trends and Pressures

There are a number of future trends and pressures relating to the water networks assets base, broadly grouped into industry-wide, region-specific and company-specific.

Industry wide:

- A step-change in regulatory compliance expectations – including the introduction of Compliance Risk Index (CRI) and the Event Risk Index (ERI) by the DWI
- Pressure from government to ensure long-term asset health of infrastructure. A report commissioned by Defra¹² outlines the need to double water infrastructure renewal spending by 2030 and then again by 2050 to maintain current levels of serviceability and affordability¹³
- There is increased focus on, and need to demonstrate, resilience as enshrined in the Water Act 2014 and highlighted in government policies. Ofwat and the DWI require companies to quantify current and future resilience, however there is no common

⁹ Delivering Water 2020: Our Final Methodology for the 2019 Price Review – Ofwat, 2017

¹⁰ A Green Future: Our 25 Year Plan to Improve the Environment – Defra, 2018

¹¹ Preparing for a drier future: England’s water infrastructure needs – NIC, 2018

¹² UKWIR - ‘Long Term Investment in Infrastructure (2017)’

¹³ Also shown in our deterioration model trends found in TA.11.WN04 Water Networks

resilience metric within the sector. This is one of the primary considerations behind our transformational programme **Networks 2030**

- Increasing access to smart meters and Internet of Things enabled devices mean customers are expecting greater access to data to monitor and control their consumption¹⁴. This is a key component necessary to achieve **Target 100**.

Region specific:

- We forecast a 10.5% increase in population across our region by 2030¹⁵, requiring investment in new assets. Detail can be found in our draft WRMP and technical annex **TA.11.WN01 Supply and Demand Balance**.
- Climate change and sustainability reductions will impact the amount of water available for public supplies, particularly in our Western Region

Company specific:

- Raw water deterioration, particularly nitrate contamination, is a challenge.
- Overall regional resilience is challenged due to our unique network configuration of five geographically separate areas with limited interconnectivity. This is further stretched due to the region and industry-wide pressures outlined above

These challenges have shaped our approach for AMP7 and beyond. We have refined our AMP6 approaches, to develop three key transformational programmes:

- By working with customers, we will achieve **Target 100** – our ambitious per capita consumption target of 100 litres per person per day by 2040 by first reducing average consumption to 120 litres by 2025 (see **TA.11 WN01 Supply and Demand**).
- Through **Network 2030** we will rationalise, integrate and modernise our water supply infrastructure to enhance the resilience of our water supply zones. This includes consolidating service reservoirs, building new treatment works and increasing interconnectivity.¹⁶
- Building on our Integrated Water Cycle Management approach, **Catchment First** will deliver holistic catchment management solutions and measure the additional benefits they secure.

¹⁴ Southern Water PR19 Willingness to Pay Main Stage Report – January 2018

¹⁵ PR19 Ofwat data table WS3

¹⁶ TA.11.02 Water Horizons Southern Waters Long Term Asset Management Strategy

5. AMP7 Strategy

5.1 Investment Strategy

Leakage is the primary driver for our AMP7 Water Networks investment strategy. There are three primary levers for delivering leakage reduction:

- Active Leakage Control (traditional find and fix)
- Water Mains Renewal
- Smart Networks Technology (not currently used at enterprise level)

Table 2: Leakage Options Selected by Cost Benefit¹⁷ (for full list see Appendix 3)

Initiative	Selected (in Plan)	Totex (£m)	MI/d Reduction Most Likely	£m Totex per MI/d	Cumulative (MI/d)	Cumulative %
Baseline Active Leakage Control	✓	£56.9	0.00	£0.0	0.0	0.0%
Baseline Leakage Capital Maintenance	✓	£6.5	0.00	£0.0	0.0	0.0%
Semi-permanent acoustic logging	✓	£5.6	5.60	£1.0	5.6	5.3%
Remote Sensing (Satellite Imaging and Drones)	✓	£1.5	1.20	£1.3	6.8	6.4%
Additional Network Monitoring (Flow/Pressure and Transient Sensors)	✓	£2.0	0.67	£3.0	7.5	7.1%
Regional Mains Renewal Block 1 (50km)	✓	£10.1	2.50	£4.0	10.0	9.5%
Regional Mains Renewal Block 2 (100km)	✓	£7.3	1.60	£4.6	11.6	11.0%
Change in Comms and Supply Pipe Policy	✓	£4.6	0.99	£4.6	12.6	11.9%
Network Management System - Phase 1 (Network Data Collection / Visualisation and Reporting).	✓	£4.2	0.64	£6.6	13.2	12.5%
Regional Mains Renewal Block 3 (210km) - Deal Lead Reduction Scheme	✓	£22.0	1.82	£12.1	15.0	14.2%
Rownhams and IOW North Mains Renewal Block 4 (330km)	✓	£30.0	0.86	£34.8	15.9	15.1%
Regional Mains Renewal Block 5 (380km)	X	£11.1	1.68	£6.6	17.6	16.7%

Table 2 shows how we propose using all three leakage leavers and maximise benefits from smart networks to deliver a 15.1% leakage reduction by 2025.

Maintaining expenditure on traditional ‘find-and-fix’ Active Leakage Control (ALC) methods would keep leakage levels stable. We considered additional investment in traditional ALC but this is limited due to resource constraints in the South East, which we anticipate being exacerbated by demand from other companies with similar ambitions¹⁸.

As a result, we have developed a diverse strategy of adopting emerging technologies and renewing 330km of water mains to reduce leakage, minimise supply interruptions and improve CRI and ERI compliance.

¹⁷ TA.11.01 Water AMP7 Comparative Industry Performance Assessment

¹⁸ Technical Annex TA.11.01 Water AMP7 Comparative Industry Performance Assessment.

Smart technologies

We considered a range of emerging smart technologies complemented by enhanced 'Big Data' analytics capability to significantly increase ALC efficiency. Many of these options have high setup costs but deliver cost-efficient leakage reductions thereafter.

As some of the technologies are relatively immature and have not been implemented on this scale before, there are limits to the amount of benefits they can deliver over AMP7¹⁹. We estimate our use of smart technology will reduce leakage by around 8% over AMP7. As part of our long-term strategy, we will invest in emerging technology in AMP7 to enable successful implementation during AMP8 – particularly Artificial Intelligence to support smart networks.

Mains renewal

We propose renewing 330km of mains in AMP7 to reduce leakage. This is significantly less cost-efficient (as measured in £ per ML/d) than ALC or smart technologies, but given their limitations, is a key part of our diversified leakage strategy and Single Integrated Network Strategy (SINES).

To maximise the benefits of this approach, we will replace all pipes – water mains, communication pipes and customers' supply pipes – in each chosen District Metered Area (DMA). This will ensure minimal future maintenance needs in these areas. By investing in long-term resilience now we can fairly secure improved services for future customers, rather than delaying asset replacement until necessary to prevent failure.

The following sections detail the breakdown of this investment (including non-leakage driven programmes), summarised in table 3.

Table 3: Breakdown of Water Networks AMP7 Expenditure in comparison to AMP6 actuals by Programme

	AMP6 Total	AMP7 Total
TOTEX	317.858	260.808
CAPEX	81.721	92.794
Water Mains renewal Programme	30.957	0
Mains renewal - Discolouration Undertaking	9.035	30.203
Water Mains renewal - Lead	0	19.848
Water booster stations	3.753	4.497
Pipe Bridges Public Safety	0.656	2.671
Pipeline Protection (previously Cathodic Protection)	0	1.738
Diversions	4.833	6.218
Meter Replacements	24.239	21.111
Leakage: meter & logger & PRVs	8.248	6.508
OPEX	236.137	168.013
Communication pipe replacements & Stop Taps	34.388	25.027
Leakage Opex	65.656	56.874
Highways Authority Costs	10.473	7.551

¹⁹ See Appendix 2 for more details

Maintain DG2 (pressure) provision	0.195	1.371
Mains cleaning	0.000	2.020
Distribution zonal studies & risk mitigation	5.129	3.964
Distribution Operating Costs	120.296	71.206

Water Mains Renewal Programme (Capex)

To maintain current serviceability performance for Bursts and DG3 Supply Interruptions to 2025, our deterioration modelling estimates 310km of mains should be replaced in AMP7 at a cost of £76m, compared to an AMP6 Pioneer derived cost of £63m.

Based on the new performance measures this would deliver Quartile 3 performance for asset health and Quartile 2 performance for leakage and would therefore not be acceptable to either regulators or customers.

We therefore considered ways to better target investment to improve performance across a range of metrics:

- Leakage (based on DMA minimum night flows) to target levels of leakage reduction expected by customers
- Burst reduction
- Interruption minutes reduction to target levels of interruption expected by customers
- Appearance (Discolouration) complaints reduction
- Total Iron & Manganese (TIM) compliance
- Lead communication pipes replaced.
- Opex reduction

The above created a revised £39.1m programme of 220km of renewals (excluding DWI notice renewals) split into two distinct programmes:

- Renewal of water mains to achieve demand reduction to address deficit – £19.3m²⁰
- Implementation of our 6 Pillars of Lead Strategy (see Appendix 3) including a pilot in Deal aiming to eliminate lead risk (at a cost £19.8m). This will involve:
 - Opportunistic replacement of lead communication pipes.
 - Replace all water mains in the DMA's within the Deal Water Supply Zone.
 - Provide a lead pipe focussed advice service and local media campaign in the Deal WSZ during the pilot with the aims of increasing customer awareness and uptake of lead supply pipe replacement / removing lead pipework from the home.
 - Setup a community fund to subsidise the removal of lead pipework in the home. The fund would be governed by a panel consisting of members of the LWG and Southern Water and would grant funds based on applications from customers. It is proposed that each grant will be to the value of £250 per successful applicant funded from our reward only Performance Commitment.
 - If successful this approach will be rolled out across the region in later AMPs.

Through this investment we will:

²⁰ Costs for demand reduction to address deficit are captured within technical annex TA.11.WN01 Supply Demand Balance

- Meet customers' expectations for leakage and interruptions to supply (upper quartile performance)²¹
- Achieve Quartile 2 performance for bursts.
- Mitigate all water network DWSP D and E risks
- Remove ~28,000 lead communication pipes (with our Lead Strategy)
- Improve appearance of water and TIM, CRI and ERI compliance

Discolouration Undertaking (Rownhams and IOW) Capex

This programme will reduce discolouration complaints in the Rownhams and Alvington Water Supply Zones. We will achieve this through a ten-year, £67m programme to renew 360km of distribution mains.

In AMP7, we will invest £30m to renew 110km of distribution mains. In addition to contributing approximately 260 of the 650 annual contact reductions expected in AMP7 this programme will help improve our appearance and discolouration performance into the Upper Quartile.

During AMP8, we forecast investing £38m to renew 150km of mains which will deliver a similar level of performance improvement.

Mains Cleaning Programme (discolouration management)

Since 2010 we have cleaned 2600km of mains to offset appearance risk (discolouration) caused by background deterioration in mains condition.

Our AMP5 and AMP6 programmes were based on prioritised lists of DMA, based on risk analysis of customer contacts, mains materials and condition. This resulted in significant improvements, reducing customer contacts to below the serviceability reference level.

Our £2m AMP7 strategy uses a refined risk approach based on contact regeneration rates in DMA to determine 1, 3 and 5 year flushing frequencies. The approach recognises some DMA do not respond to flushing – these have been included in the mains renewal programme. Additionally, the programme includes enhanced trunk mains cleaning using the Prediction of Discolouration in Distribution Systems approach.

Our forecast spend is approximately the same as in AMP6, with higher performance being delivered through better targeting of activities to achieve customer outcomes.

DG2 Property Reduction (Maintain Pressure) Opex

This programme will maintain adequate pressure at customers' taps. Our AMP7 budget of £1.3m assumes AMP6 performance is maintained, based on customer insight.

Leakage Opex (Active Leakage Control) and Leakage Meter/PRV maintenance (Capex)

We have performed well against our leakage target of 87.1 ML/d²², and this will see us end AMP6 as a frontier company for leakage. Our Leakage Opex programme, ALC, maintains the level of leakage through traditional find and fix activities and is a vital component in ensuring our performance. Without this, leakage would rise by 9 ML/d per year.

The change in leakage reporting methodology will see us move from industry-leading to 7th with a revised leakage performance of 111ML/d²³. This will not be acceptable to our customers, stakeholders, or ourselves.

²¹ Technical Annex TA.11.01 Water AMP7 Comparative Industry Performance Assessment.

²² PR19 Data Tables App2 Lines 16/17 (old method)

²³ PR19 Data Tables App2 16/17 (new method)

Our AMP7 strategy will ensure we remain in the Upper Quartile (4th in the industry) through the additional investment in mains renewal and smart technologies – supported by our continuing, robust ALC programme.

Our ALC programme will cost £63.5m (£57m Opex and £6.5m Capex). This is a slight reduction over AMP6, achieved by increasing efficiency by using smart technology.

Communication Pipe and Stop Tap Replacement (Opex)

We forecast investing £25m to reactively and opportunistically replace 6190 stop taps and communication pipes per year through AMP7.

This programme replaces and repairs communication pipes and stop taps not identified through proactive leakage detection. Repairing these assets contributes to our leakage and PCC reduction targets.

Our AMP7 budget is based on a ten-year rolling average of repairs and is approximately £9m less than AMP6. This is due to our DMA level mains renewal programme, which will proactively repair and replace a significant number of communication pipes and stop taps – requiring less reactive effort²⁴.

Distribution Zonal Studies and Risk Mitigation

Our £4m Distribution Zonal Studies programme supports the following key activities:

- Maintaining and updating our water infrastructure based hydraulic models
- Undertaking growth studies
- Maintaining and updating our contingency plans

All of the above contribute to managing our interruptions to supply and CRI performance, and also our statutory duties regarding contingency planning. This is a direct continuation of our AMP6 approach.

Pipe Bridges Safety Programme (Opex)

We are committed to a major programme of pipe bridge safety upgrades to meet Health and Safety Executive compliance obligations which will continue into AMP7. Approximately £2.6m of this programme is allocated to wholesale water.

Pipeline Protection Maintenance Programme

This programme will extend asset life for critical pipelines and reduce the risk of failure from deterioration, which poses a risk to large scale interruptions and impacts on CRI.

The £1.7m AMP7 programme covers the maintenance of our Cathodic Protection (CP) systems on key water infrastructure assets, including remedial works to maintain effective corrosion control.

Highways Authority Costs (Opex)

This £7.5m cost relates to all highway fees for our critical reactive activities. This has been broken out of the AMP6 Distribution Opex cost to highlight a £3m saving (from £10.4m) in AMP7 due to better coordination of activities.

Diversions Programme (Capex)

This £6.2m programme funds the diversion of our assets at the request of developers and third parties under our obligations of S185 of the Water Act.

²⁴ TA.11.01 Water AMP7 Comparative Industry Performance Assessment.

Due to an anticipated increase in new developments, the number of diversions will increase by approximately 20%²⁵ requiring an increase of £1.4m in the programme budget (from £4.8m to £6.2m).

Distribution Network Operating Costs (Opex)

This comprises all other Opex expenditure directly related to the operation of the water distribution network including:

- Employee costs
- Reactive Contractor Costs (for burst mains repairs)
- Power
- Materials and Equipment,

Due to the impact of the AMP7 mains renewal / intelligent network programmes, operational efficiencies and reallocations, AMP7 Distribution Opex will reduce by £49m from £120m to £71m. The continued roll-out of the intelligent network strategy will see further reductions into AMP8 and AMP9.

Water Booster Stations (WBS)

This £4.5m programme will maintain Water Booster Stations – excluding high-lift pumping stations, which are included as part of the Water Supply Works asset class – to maintain current levels of DG2 and interruptions to supply performance.

Our budget assumes current performance is maintained through AMP7, based on deterioration modelling. It is a £400k increase on AMP6.

Domestic Metering (Base)

We are proposing a capital investment of £20m in AMP7 for the reactive replacement of all failing Automatic Meter Reading (AMR) and Visual Meter Reading (VMR) meters with a smart alternative – the Intermediate Smart Meter, a key component of our Single Integrated Network Strategy²⁶. This will ensure we can achieve Target 100 and avoid obsolescence of the AMR meters installed in AMP5.

We also propose an additional £1m investment for three proof of concept trials in AMP7 to better understand various smart metering technologies and inform our selection of AMP8 metering stock.

We will trial:

- Narrow-Band/5G
- Sigfox
- LoRA.

The trials will need to commence early in AMP7 and complete, including the recommendation, by the end of Year 3. We will provide smart meters to all customers who want one in AMP7 by using the clip on device described in [TA.11.WN01 Supply and Demand Balance](#).

We forecast the need to invest £126.8m in AMP8 to replace a large proportion of metering stock with next-generation smart meters. This approach is the lowest whole-life cost of the options considered for base maintenance.

²⁵ TA11.WN01 Supply and Demand (Growth Forecast)

²⁶ TA11.01 Water Horizons Southern Water Long Term Asset Management Strategy

By offering smart meters during AMP7 we will continue to improve our customer engagement and demand management – as well as preparing for a dramatic shift in customers’, stakeholders’ and regulators’ expectations in AMP8.

The total AMP7 investment of £21m is roughly equivalent to our AMP6 expenditure. All metering enhancement spend is include within the **TA.11.WR01 Supply Demand Balance** Technical Annex.

Intelligent Networks (AMP7)²⁷

In addition to network reconfiguration as detailed in our transformational programme **Network 2030**, we have considered improving the operation and control of distribution in response to emerging challenges – particularly our discolouration and distribution water quality performance.

A number of improvements, including our AMP6 smart networks trial, act as a springboard for improved performance in AMP7. To coordinate these efforts, we developed the Single Integrated Network Strategy (SINES) to provide strategic direction for water network investment from 2020 to 2045.

SINES uses a diverse range of options including asset replacement, smart technology and operational solutions to deliver enhance resilience and improved network performance²⁸

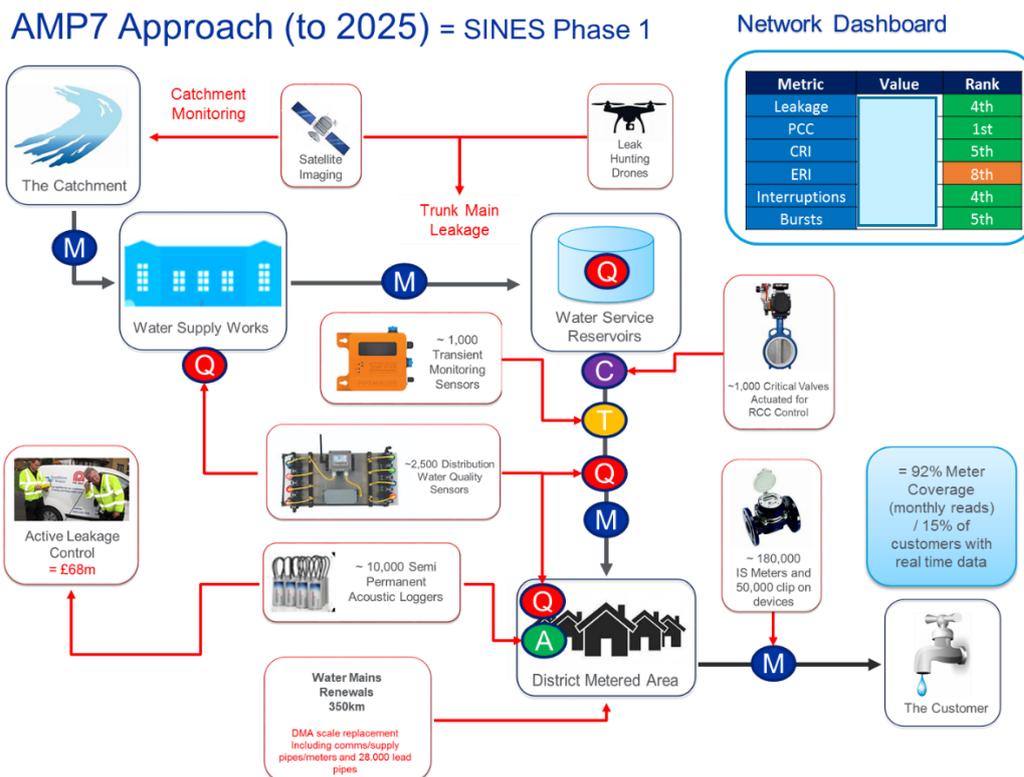


Figure 6: Basic Schematic of the improved water network in 2025²⁹

SINES will support **Target 100**, contribute to a 15.1% reduction in leakage and improve our water quality performance – moving us to Upper Quartile for CRI and Quartile 2 for ERI³⁰.

²⁷ Costs for Intelligent Networks are captured within technical annex TA.11.WN01 Supply Demand Balance

²⁸ TA.11.02 Water Horizons – Southern Waters Long Term Asset Management Strategy

²⁹ Illustrative Example of SINES Schematic and Dashboard

³⁰ Technical Annex TA.11.01 Water AMP7 Comparative Industry Performance Assessment

We will implement SINES through increased monitoring, automation and control of our network – using smart technology to improve network performance and reduce both leakage and water quality risks. In AMP7 this consists of Phase 1 of our Intelligent Networks Programme, which includes:

- Implementing the Network Management Platform (NMP) including the capability to visualise and interpret all data captured by the new systems. This will deliver a significant step forward in capability for both asset management and incident management
- Deployment of quality sensors and automation of critical control valves to improve resilience (response and recovery) and improve CRI, ERI and appearance performance
- Deployment of pressure transient monitors across the trunk main network for improved transient identification and mitigation
- Deployment of semi-permanent acoustic loggers for improved ALC targeting
- Deployment of remote sensing platforms (such as satellite and drone imaging) using high resolution false colour infra-red to efficiently target strategic trunk main leakage and catchment monitoring (in support of Catchment First)
- Installation of smart meter devices to reduce both per capita consumption and customer side leakage
- Replace 330km of water mains as part of a DMA scale asset replacement based on leakage (including communication and customer supply pipes to maximise benefit). This programme will also remove over 28,000 lead communication pipes in support of our lead strategy and improve our discolouration performance to upper quartile

Total AMP7 investment for Intelligent Networks Phase 1 will be £13.9m³¹, with a planned further investment of ~£11m in AMP8 for Phase 2 as part of our long term Single Integrated Network Strategy (SINES).

5.2 Plan Options

Given the importance of leakage reduction to customers and stakeholders, this was the key differentiator between the range of options we considered, shown in Table 4 and Figure 7 below.

All options were assessed using our Whole Life Cost Benefit Tool:

³¹ Costs for Intelligent Networks are captured within technical annex TA.11.WN01 Supply Demand Balance

Table 4: Plan Options^{32 33}

Cost item	Brief Description	AMP7 Totex	Whole Life Cost	Cost Benefit Analysis	Willingness to Pay support	Owat priority	Regulator (DWI/EA) priority	Customer / CCG priority	Business strategic alignment
Option 1: Base plan	Leakage Reduction of 15% (Ranked 4th) – also Upper Q for Interruptions /CRI/Bursts.	£341m	£957m	£244m	●	●	●	●	●
Option 2: Transform to frontier	Leakage Reduction of 25% (industry leading) – also Upper Q for Interruptions /CRI/Bursts/ERI.	£346m	£841m	-£255m	●	●	●	●	●
Option 3: Transform to reduce cost	Leakage Reduction of 15% (Ranked 4th) – also Upper Q for Interruptions /CRI/Bursts/ERI	£294m	£840m	-£225m	●	●	●	●	●
Option 4 – reduce scope to average leakage	Leakage Reduction to 5% (Ranked 10th) – most measures third Q.	£290m	£1076m	£426m	●	●	●	●	●

³² Source: TA.11.01 Water AMP7 Comparative Industry Performance Assessment

³³ Due to the integrated way we have built our Network plan, in these whole life cost and cost benefit calculations we have included relevant elements from elsewhere in our plan (Intelligent Networks and Leakage to Upper Quartile). The funding for these elements is captured in technical annex TA.11.WN01 Supply Demand Balance.

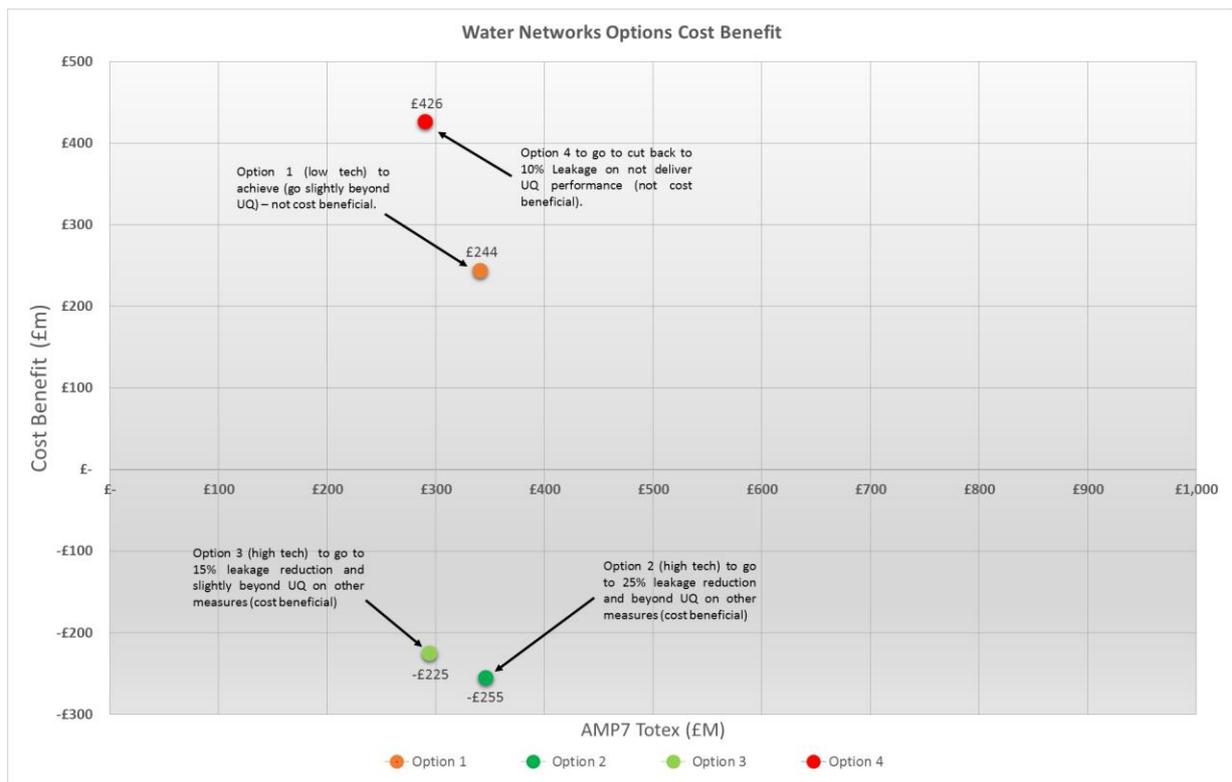


Figure 7. Plan Options (Totex vs CBA)

Options 1 and 4 were discounted due to not being cost beneficial³⁴. Option 2 was also discounted as the additional leakage reduction is not supported by WTP, and would result in increased customers' bills in AMP7.

Option 3 is our preferred solution as it is supported by WTP, reduces bills and meets customers', regulators' and stakeholders' expectations.

5.3 Innovation

We will implement a number of key innovations from AMP6 as part of our AMP7 Networks strategy:

- Shifting to DMA scale mains replacement, targeting and changing the way we prioritise network interventions to maximise benefits across all performance commitments.
- Better targeting mains cleaning and flushing by using DMA contact regeneration to identify areas with potential issues
- Implementing Phase 1 of our Intelligent Network Strategy in AMP7

We have developed a method of measuring resilience across our asset base which we use to identify threats and the most effective mitigation measures. This assessment allows us to identify households at potential risk of interruptions to supply. All our AMP7 water plans and long-term strategies have been informed by this analysis.

All of the above supports our transformational programme **Network 2030** and our ambition to create a more consolidated, resilient, and integrated network.

³⁴ Negative values show a cost beneficial programme / positive values show a non-cost beneficial programme.

5.4 Customer Benefits and Resilience

Performance commitment	Measure	End AMP 6 Performance	End AMP 7 Performance
Leakage	MI/day	105.4	89.6
Asset Health: mains bursts	per / 1000km	130	86
Taste & Odour	contacts per 1,000 customers	0.24	0.21
Per Capita Consumption	l/head/day	131	120
Appearance	contacts per 10,000 customer	0.92	0.46
Replacing lead pipes	Households	N/A	28797
Water supply interruptions	mins	06:11	05:30
Asset Health (unplanned outage) ml/d pdo	percentage	7%	3%

Figure 8: Summary of projected network performance for AMP7

Source: PR19 Data Table App1

Our investments will build on our AMP6 performance and ensure we end AMP7 as an upper quartile company. This is primarily achieved by maintaining spending levels with enhanced intervention targeted to meet customers' expectations.

The additional investment is largely focussed on improving leakage performance – a priority for customers, stakeholders and regulators. Our customer insight found customers were willing to support a 16ML/d reduction – equivalent to a 15.1% reduction over the AMP. Our proposals will deliver this for £20m less than current AMP6 expenditure, saving households £4 per year by 2025.

Figures 9 to 14 below show our water networks investment will drive our performance into upper quartile by the end of AMP7.³⁵

³⁵ Source: PR19 Data Table App1

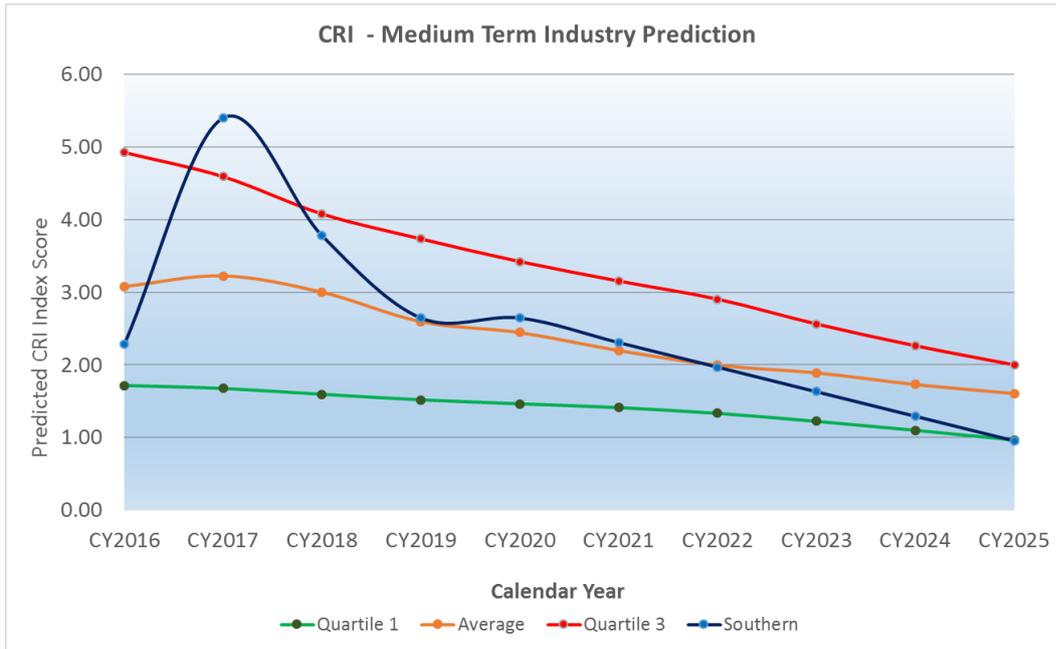


Figure 9: CRI performance

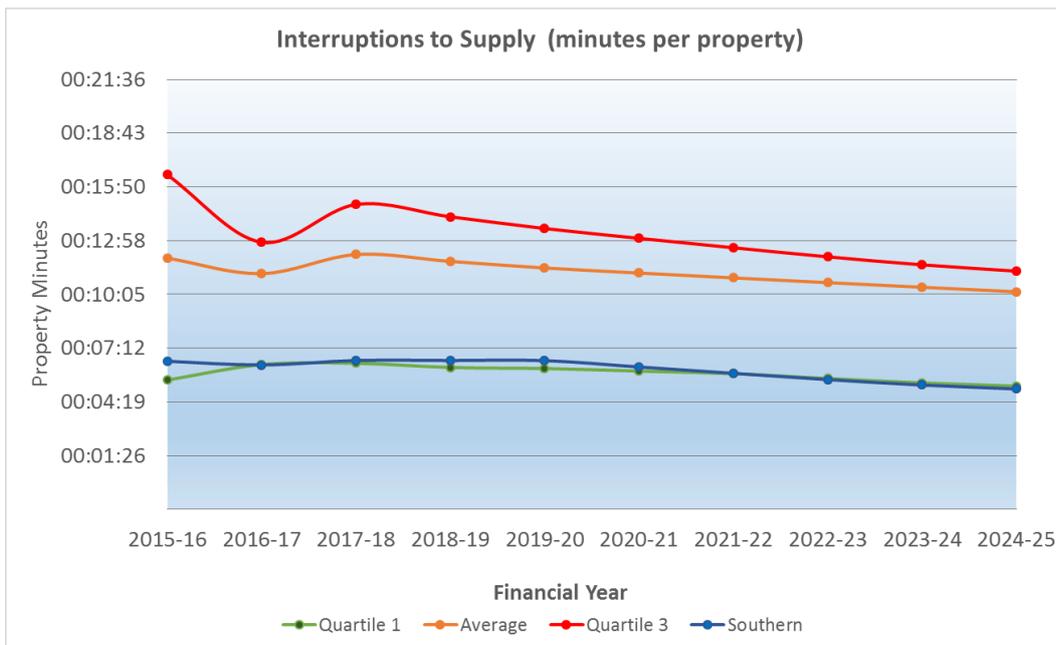


Figure 10: Interruptions Performance

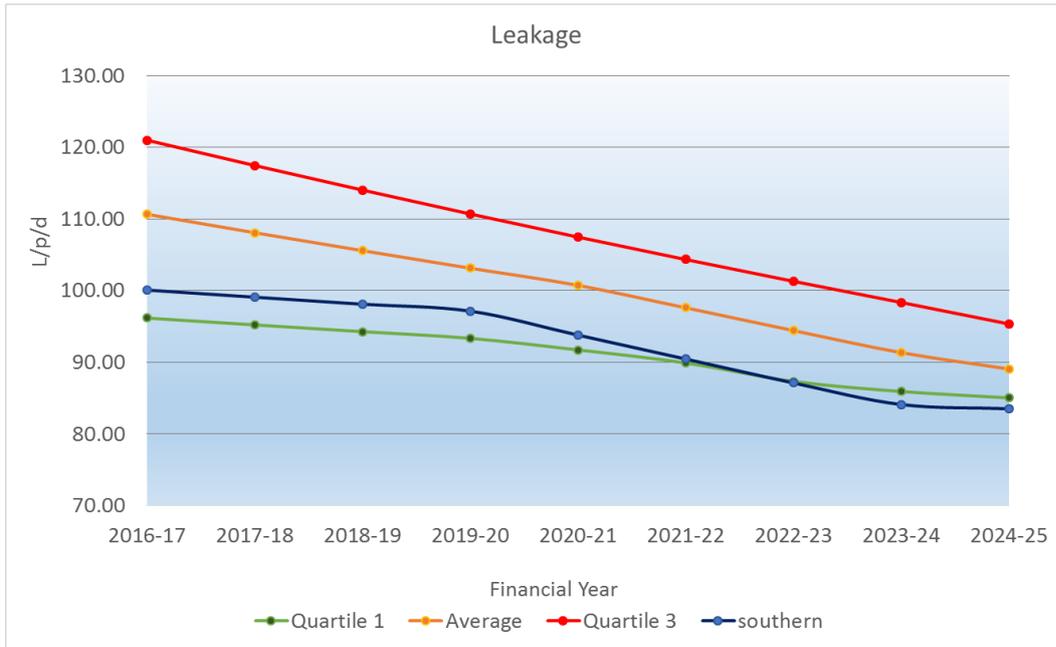


Figure 11: Leakage Performance

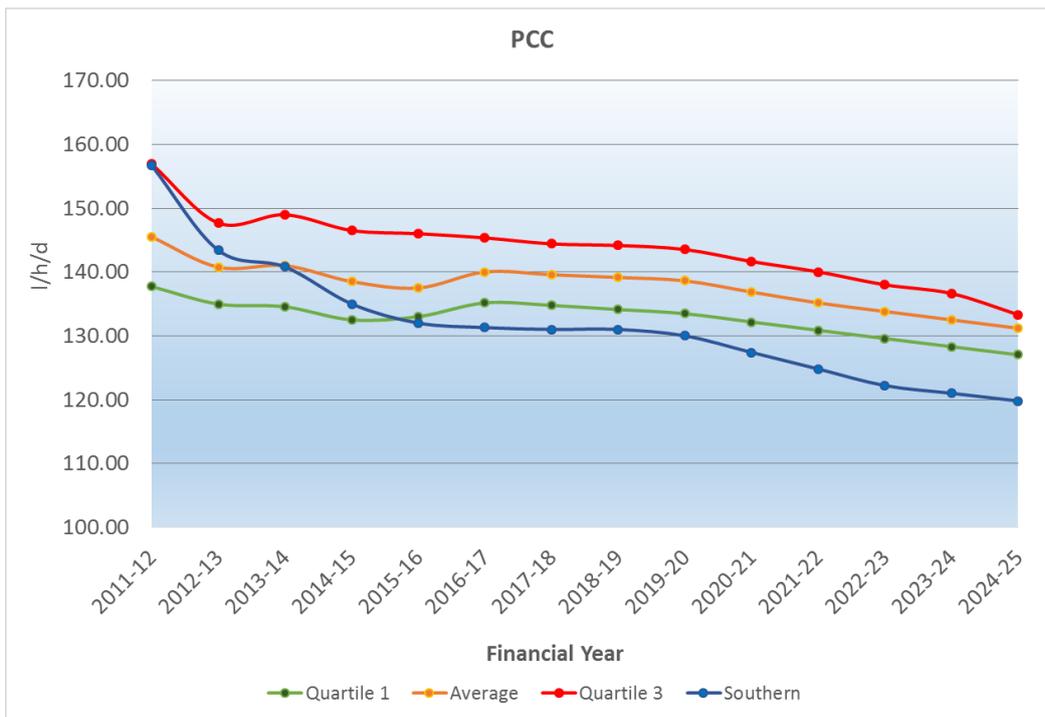


Figure 12: PCC Performance³⁶

³⁶ AMP5 to show context and impact of Universal Metering (2010-2015)

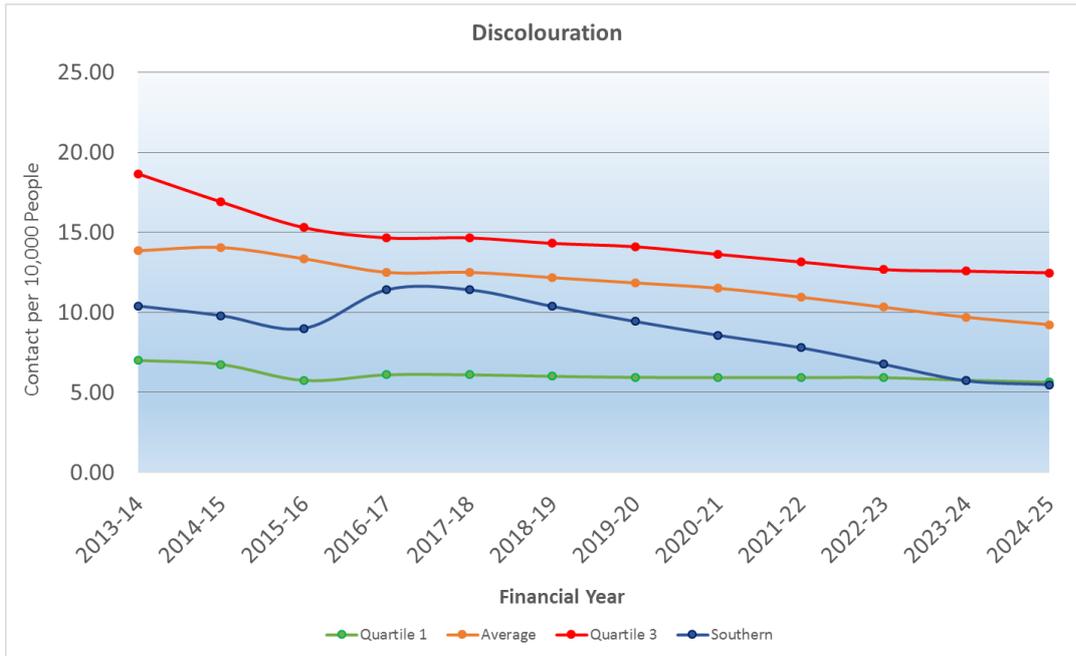


Figure 13: Appearance Performance

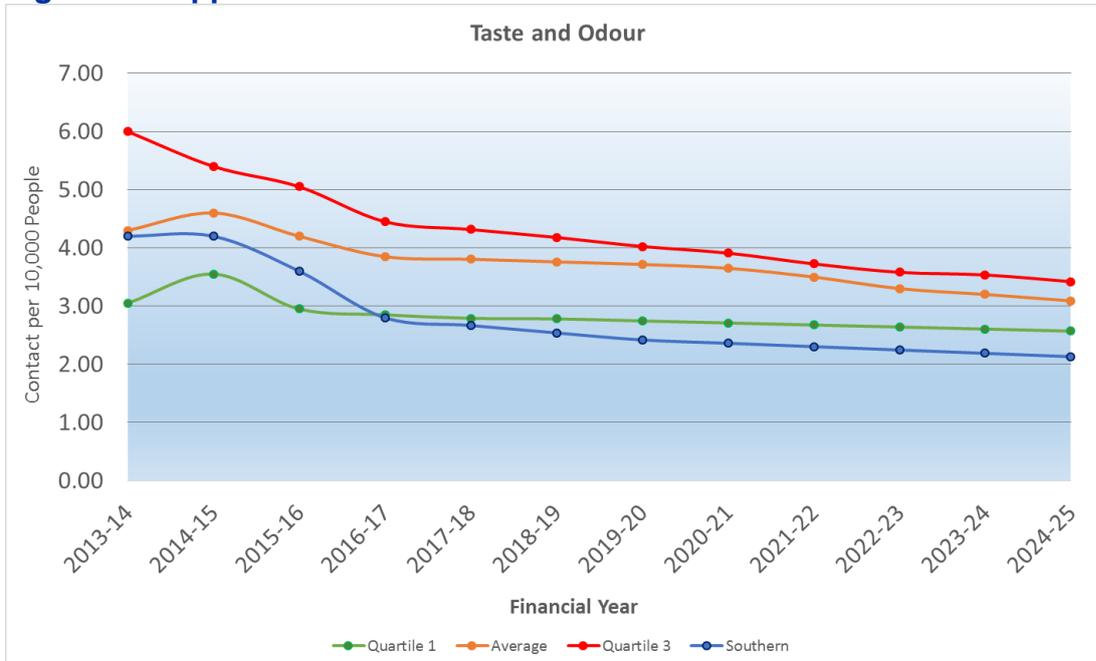


Figure 14: Taste and Odour Performance

5.5 Value for Customers

Customers are highly averse to accepting reductions in service in exchange for lower bills, and in general are willing to pay for improvements in service levels for our proposed water measures:

- Across all groups, our customers report willingness to pay £2.00 per property per year for a service level improvement to reduce non-ideal taste and smell of water from 3.6 cases per 10,000 people per year to 3.2 cases.
- Customers report willingness to pay £3.40 per household per year to reduce leakage from 76 litres / household / day to 60 litres / household / day.

Whilst not as significant, our customers report willingness to pay of £0.90 per property per year to help customers reduce their water usage per day from 132 litres to 122 litres, as well as £1.00 per property to reduce unexpected interruptions to supply. Our findings are highlighted in the table below.

Our additional ODI research into willingness to pay for service level improvements indicated that our customers demand and are willing to invest in significant improvements to leakage and main bursts, as well as improvements to water quality, interruption to supply, and minor improvements for unplanned outage. Full detail on our customer engagement findings can be found in [Chapter 4 – Customer and Stakeholder engagement](#).

Table 5 – Total Unit WTP Values for Water Services³⁷

Service Attribute	Unit	Level of Service				WTP [£/Property/Year]		
		-1	SQ	+1	+2	SQ to -1	SQ to +1	+1 to +2
		Reduction in service level of -1	Standard service level (Status Quo)	Improvement in service level of +1	Improvement in service level of +2	Amount customers are WTP for -1 reduction	Amount customers are WTP for +1 improvement	Amount customers are WTP for +2 improvement
Leakage	Litres / hh / day	91	76	68	60	-92.5	3.4	0.1
Non-ideal taste and smell of tap water for a few days	Per 10,000 people	4.3	3.6	3.2	2.9	-47.9	2.0	0.1
Unexpected interruptions to supply	(average minutes lost per home per year)	14	12	11	10	-26.3	1.0	0.0
Water use per person per day	Litres	140	132	122	110	-12.8	0.9	0.1

5.6 Medium and Long Term Proposals

Figure 15 shows our strategic direction to 2070. This is derived from Pioneer deterioration modelling and triangulated using UKWIR industry standards³⁸.

³⁷ Source: Southern Water PR19 Willingness to Pay Main Stage Report – January 2018

³⁸ UKWIR report Long Term Investment in Infrastructure (2017).

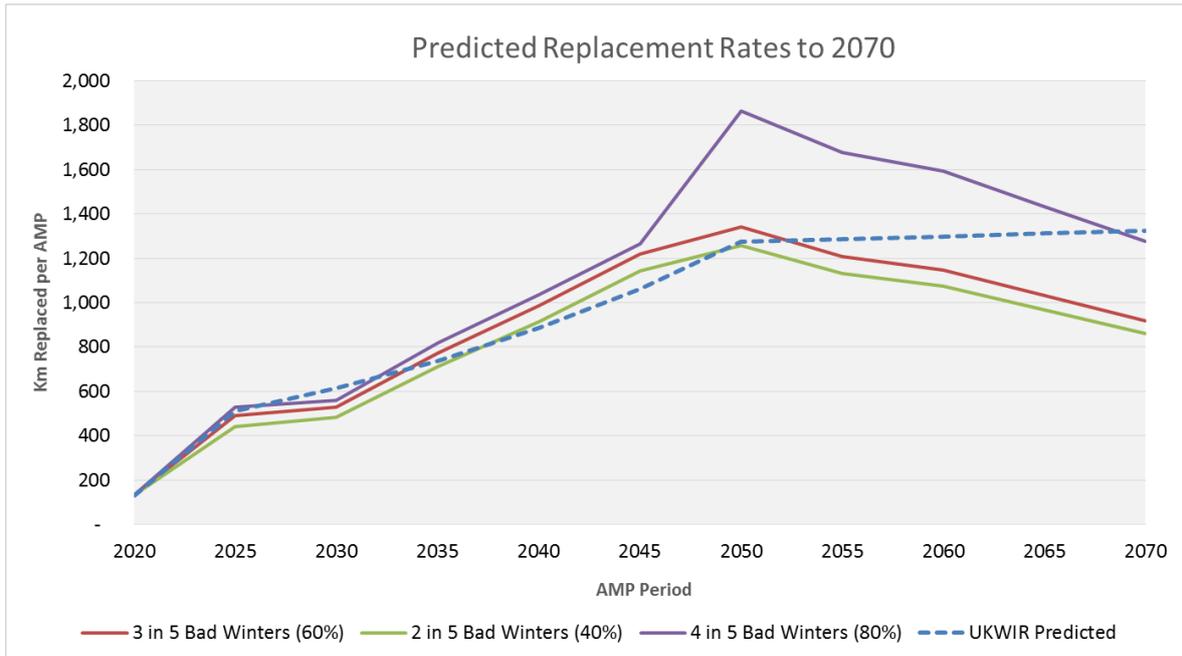


Figure 15 – Weather scenarios and mains replacement programmes (2020-2070)³⁹

This has been correlated against different weather scenarios, and data from UKWIR, to maintain serviceability levels. In any of the above cases both our modelling and UKWIR predictions lead to a complete replacement of all non-polyethylene assets by the end of 2100.

Our AMP7 programme sits within the defined ranges and we anticipate a similar programme in AMP8. Beyond AMP8 we will use smart networks to extend the life of our assets, reducing the replacement rate. Using the most likely 60% weather scenario, we have compared the impact of implementing smart networks in the long-term. This is shown in Figures 16 and 17⁴⁰.

³⁹ Pioneer Sensitivity Modelling March 2018 / UKWIR report Long Term Investment in Infrastructure (2017) / Intelligent Networks Report (2018)

⁴⁰ Pioneer Sensitivity Modelling March 2018 / UKWIR report Long Term Investment in Infrastructure (2017) / Intelligent Networks Report (2018)

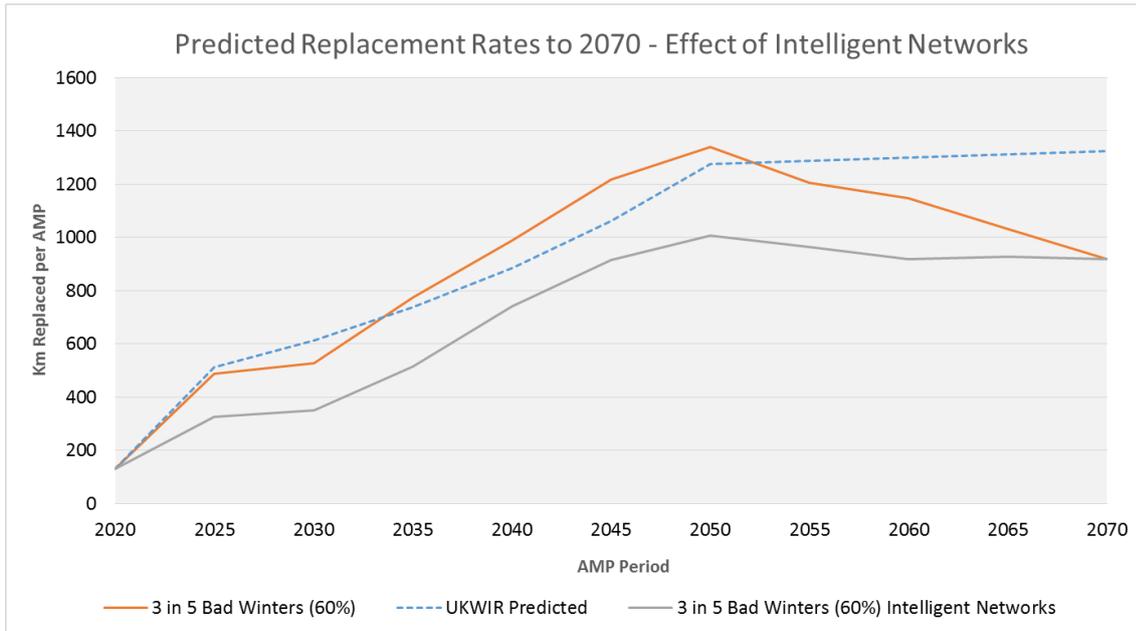


Figure 16: Effects of our Intelligent Networks programme

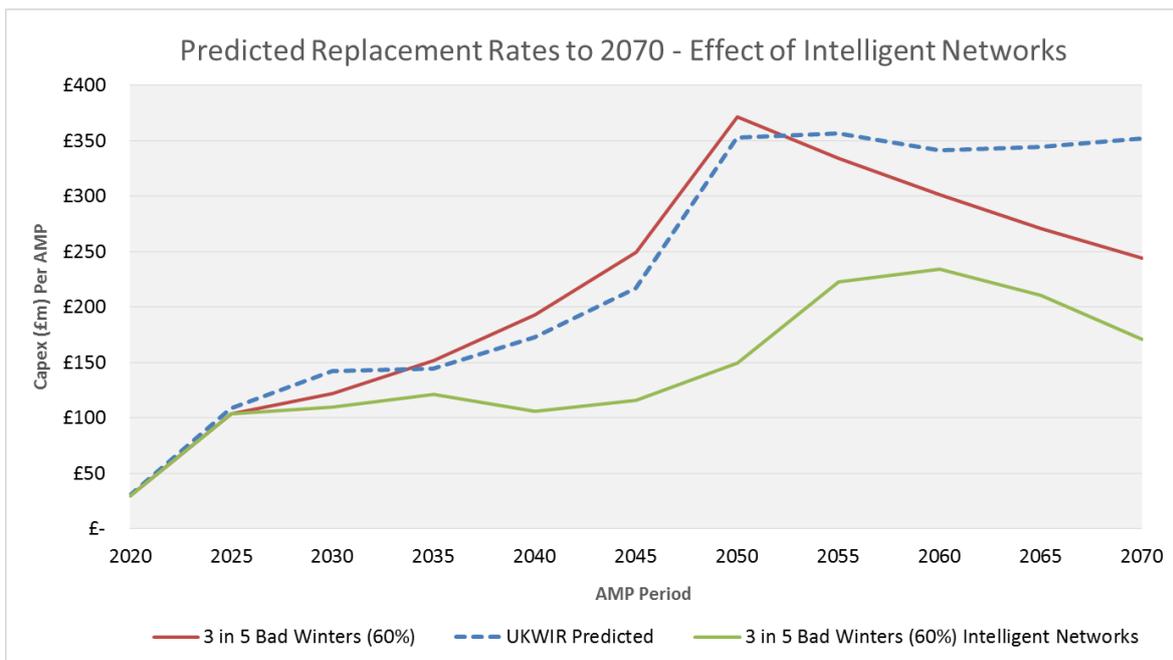


Figure 17: Effects of Intelligent Networks (totex comparison)

Although infrastructure must increase to maintain services, we can reduce the impact on customers and deliver improved performance more efficiently by adopting new technology. This aligns with both [Network 2030](#) and our long-term asset management strategy, [TA.11.02 Water Horizons](#).

6. Costing Strategy

Please see Cost Efficiency / Optioneering annex.

7. Key Risks and Opportunities

7.1 Key Risks:

- There is a risk that DMA scale mains replacement may deliver lower than expected leakage reduction. This will lead to a need for additional costs and/or initiatives in priority areas in order to achieve our supply/demand targets. Our AMP7 investment plan currently assumes 60% leakage reduction per DMA based on average minimum night flows.
- There is a risk that we will be unable to generate the procurement savings targeted leading to higher than expected water main replacement costs. This is due to the large increase in work occurring in AMP7.
- There is a risk that weather patterns in AMP7 may be harsher than modelled. All deterioration modelling assumes a 60% weather scenario (Two harsh winters out of five).

7.2 Key Opportunities:

- There is an opportunity that DMA scale mains replacement may deliver 10-12% higher than expected leakage reduction. This will help us to achieve our challenging supply/demand targets.
- There is an opportunity for greater levels of procurement savings than those assumed if we use large zonal/regional procurement packaging to achieve greater economies of scale.

Appendix 1: Projects & Schemes in AMP7

Scheme Name	PRN	Schemebuilder Reference	QBEG	Business Case	Business Case Investment Line	AMP7 Capex Total
Water Mains Renewals - Rownhams Opt1	730075	4045	Base	8	Discolouration Undertaking	12.778
Water Mains Renewals - IoW Opt1	730077	4050	Base	8	Discolouration Undertaking	17.425
Mains flushing opt2 - 1500km	730072		Base	8	Mains cleaning	2.020
Cathodic protection - Opt3	730070	3625	Base	8	Pipeline Protection (previously Cathodic Protection)	1.500
Domestic meter replacement	722039		Base	8	Domestic meter replacement	21.111
					Business Case Subtotal	54.834

Appendix 2: List of Leakage Reduction Options

Initiative	Selected (in Plan)	Certainty	Totex (£m)	M/d Reduction Most Likely	Em Totex per M/d	Cumulative (M/d)	Cumulative %
Baseline Active Leakage Control	✓	99%	£56.9	0.00	£0.0	0.0	0.0%
Baseline Leakage Capital Maintenance	✓	99%	£6.5	0.00	£0.0	0.0	0.0%
Semi-permanent acoustic logging	✓	80%	£5.6	5.60	£1.0	5.6	5.3%
Remote Sensing (Satellite Imaging and Drones)	✓	80%	£1.5	1.20	£1.3	6.8	6.4%
Additional Network Monitoring (Flow/Pressure and Transient Sensors)	✓	80%	£2.0	0.67	£3.0	7.5	7.1%
Regional Mains Renewal Block 1 (50km)	✓	60%	£10.1	2.50	£4.0	10.0	9.5%
Regional Mains Renewal Block 2 (100km)	✓	60%	£7.3	1.60	£4.6	11.6	11.0%
Change in Comms and Supply Pipe Policy	✓	99%	£4.6	0.99	£4.6	12.6	11.9%
Network Management System - Phase 1 (Network Data Collection / Visualisation and Reporting)	✓	80%	£4.2	0.64	£6.6	13.2	12.5%
Regional Mains Renewal Block 3 (210km) - Deal Lead Reduction Scheme	✓	60%	£22.0	1.82	£12.1	15.0	14.2%
Rownhams and IOW North Mains Renewal Block 4 (330km)	✓	60%	£30.0	0.86	£34.8	15.9	15.1%
Regional Mains Renewal Block 5 (380km)	X	60%	£11.1	1.68	£6.6	17.6	16.7%
Regional Mains Renewal Block 7 (490km)	X	60%	£10.4	1.36	£7.7	18.9	17.9%
Regional Mains Renewal Block 8 (540km)	X	60%	£9.9	1.29	£7.7	20.2	19.2%
Regional Mains Renewal Block 6 (440km)	X	60%	£10.9	1.41	£7.7	21.6	20.5%
Network Management System - Phase 2 - Automated Optimisation and Control	X	30%	£3.5	0.45	£7.8	22.1	20.9%
Regional Mains Renewal Block 9 (600km)	X	60%	£9.2	1.17	£7.86	23.2	22.0%
Real-Time pump and pressure optimisation	X	30%	£3.0	0.36	£8.3	23.6	22.4%
Regional Mains Renewal Block 10 (650km)	X	60%	£9.7	1.08	£9.0	24.7	23.4%
Permanent Acoustic Logging	X	30%	£22.5	2.40	£9.4	27.1	25.7%
Regional Mains Renewal Block 11 (710km)	X	60%	£12.1	1.26	£9.6	28.3	26.9%
Regional Mains Renewal Block 12 (760km)	X	60%	£12.8	1.23	£10.4	29.6	28.0%
Regional Mains Renewal Block 13 (820km)	X	60%	£10.7	1.03	£10.47	30.6	29.0%
Regional Mains Renewal Block 14 (880km)	X	60%	£11.3	1.02	£11.1	31.6	30.0%
Regional Mains Renewal Block 14 (930km)	X	60%	£10.6	0.80	£13.2	32.4	30.7%
Regional Mains Renewal Block 15 (990km)	X	60%	£12.8	0.92	£13.9	33.3	31.6%
Regional Mains Renewal Block 16 (1050km)	X	60%	£10.7	0.76	£14.1	34.1	32.3%
Regional Mains Renewal Block 15 (1100km)	X	60%	£11.7	0.82	£14.2	34.9	33.1%

Note most likely M/d reduction derived from maximum possible leakage reduction multiplied by the assessed certainty⁴¹.

⁴¹ Technical Annex TA.11.01 Water AMP7 Comparative Industry Performance Assessment

Appendix 3: Southern Water Leak Risk Reduction Strategy

DWI Report Southern Water Lead Risk Reduction Strategy

Long Term Objectives and AMP7 Pilot Programme

January 2018

Issue and revision record

Revision	Date	Author	Checker (s)	Approver	Comments
1.0	15/01/2018	M.Tully	C.Lumb	G.Franklin	

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Introduction

The purpose of this report is to present Southern Water Services' (SWS) PR19 proposals for mitigation of drinking water quality risks in the long term.

The submission has been prepared in line with DWI's Guidance Note: Long term planning for the quality of drinking water supplies issued in September 2017.

Southern Water is seeking support from the Drinking Water Inspectorate (DWI) on proposals to mitigate this risk in the long term.

This report introduces our long term approach to reducing lead risk, details of each of the 6 key components of risk reduction and a pilot of combined approach in a defined control area (Deal WSZ).

The success of the pilot is defined as having no exceedances of 5 ug/l of lead within the Deal WSZ by 2025.

Our approach

Current Risk and Mitigation

Southern Water has had 9 lead failures (at 10 ug/l) in the last 4 years (see Figure 1).

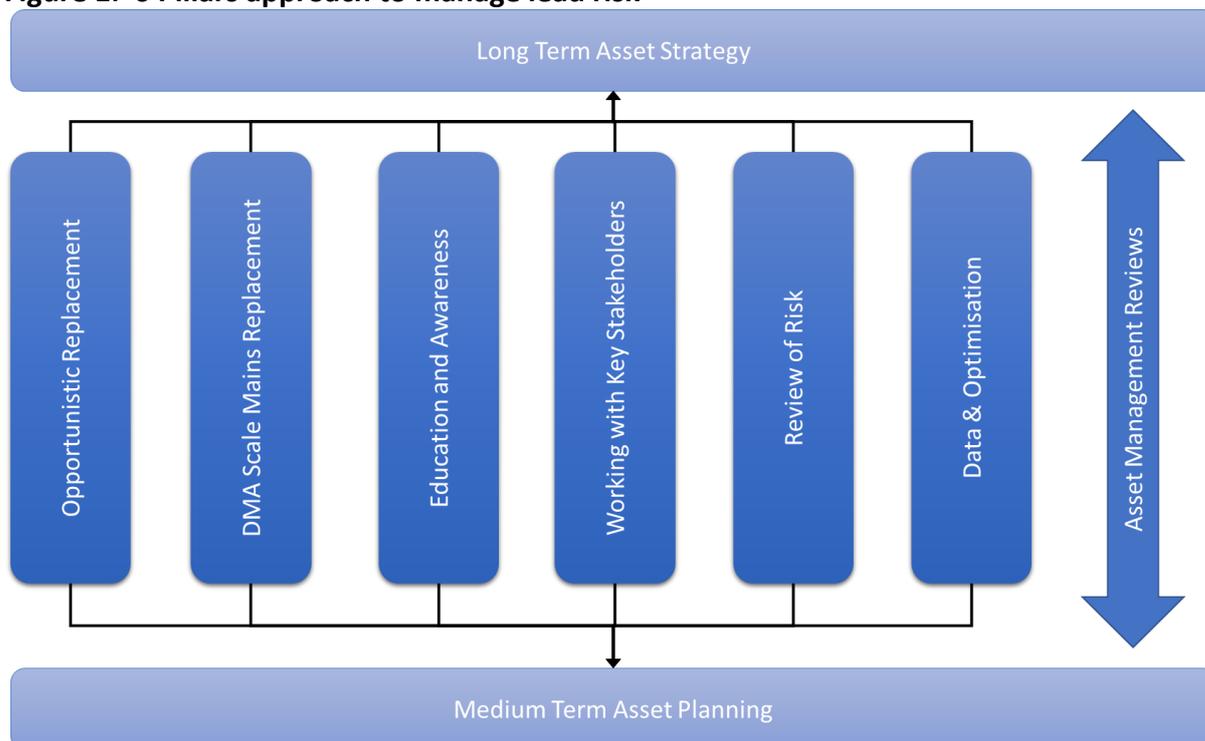
Table 1: Lead Failures (2013-2017)

Sample Point Name	Sample ID	Sample Collection Datetime	Year	Determinand name	Test Result	Unit of Measure Code
K510 SHEPPEY WATER SUPPLY ZONE (18289)	2482766	08/07/2013 01-01-1900 10:12:00	2013	LEAD (UNFLUSHED)	15	UG/L
K512 SINGLEWELL WATER SUPPLY ZONE (18291)	2483279	09/07/2013 01-01-1900 11:07:00	2013	LEAD (UNFLUSHED)	15	UG/L
S502 BRIGHTON HIGH SERVICE WATER SUPPLY ZONE (18255)	2488418	06/08/2013 01-01-1900 11:40:00	2013	LEAD (UNFLUSHED)	21	UG/L
K512 SINGLEWELL WATER SUPPLY ZONE (18291)	4132001	17/11/2015 01-01-1900 10:41:00	2015	LEAD (UNFLUSHED)	11.1	ug/l
S503 BRIGHTON HIGHER SERVICE WATER SUPPLY ZONE (18256)	4131463	16/11/2015 01-01-1900 11:05:00	2015	LEAD (UNFLUSHED)	11	ug/l
H513 ROWNHAMS_02 WATER SUPPLY ZONE (18233)	4215666	25/02/2016 01-01-1900 10:12:00	2016	LEAD (UNFLUSHED)	16.9	UG/L
K512 SINGLEWELL WATER SUPPLY ZONE (18291)	4306341	15/06/2016 01-01-1900 08:40:00	2016	LEAD (UNFLUSHED)	11.9	UG/L
I502 ASHEY WATER SUPPLY ZONE (18244)	4639646	06/06/2017 01-01-1900 12:41:00	2017	LEAD (UNFLUSHED)	14.8	UG/L
S523 UPPER BEEDING WATER SUPPLY ZONE (18276)	4717036	31/08/2017 01-01-1900 12:26:00	2017	LEAD (UNFLUSHED)	22.7	UG/L

The above demonstrates that the current control measures (primarily orthophosphoric dosing) are adequately controlling lead risk. However Southern Water recognises that there are a large number of lead communication and supply pipes in the network which need to be removed from service as part of a long term asset renewal strategy. Southern Water also recognises that a significant improvement in customer awareness of lead pipework in the home is required, along with working closer with local authorities and community groups to work toward eliminating lead in public buildings. This has now been formalised as a single overarching long term strategy, *the 6 Pillars Approach*.

Overview of the 6 Pillars Approach

Figure 1: 6 Pillars approach to manage lead risk



The 6 pillar approach will become central to all our asset management decisions regarding lead risk at strategic, tactical and operational levels. The 6 pillar approach will be implemented in AMP6 and further enhanced in AMP7. The following sections detail the purpose of each of the 6 pillars and how we have targeted a local pilot of our integrated approach to dealing with lead risk in the long term.

1st Pillar – Opportunistic Replacement

Southern Water will continue to replace lead communication pipes and customer supply pipes which are found through reactive works and customer discoveries. This includes the following scenarios:

- Where compliance sample taken at the Customer tap exceeds the Prescribed Concentration or Value (PCV).
- Where a customer states that they intend to replace a lead supply pipe, Southern Water will replace the first 10 metres free of charge, for all customers. Where necessary, renewal of additional lead supply pipe over 10 metres in length shall be offered at cost (although this will be fewer than 5% of customers).
- Where mains are being replaced as part of the capital works programmes or as reactive works.
- When found, all leaking or damaged lead communication pipes (found through active leakage control or customer discoveries) shall be replaced.

Southern Water proposes to continue the above approach into AMP7 and to better integrate this approach with the other Pillars (this is described further in the following sections). We anticipate this will lead to approximately 7,500 opportunistic replacements in AMP7.

2nd Pillar – Long Term DMA Scale Mains Replacement

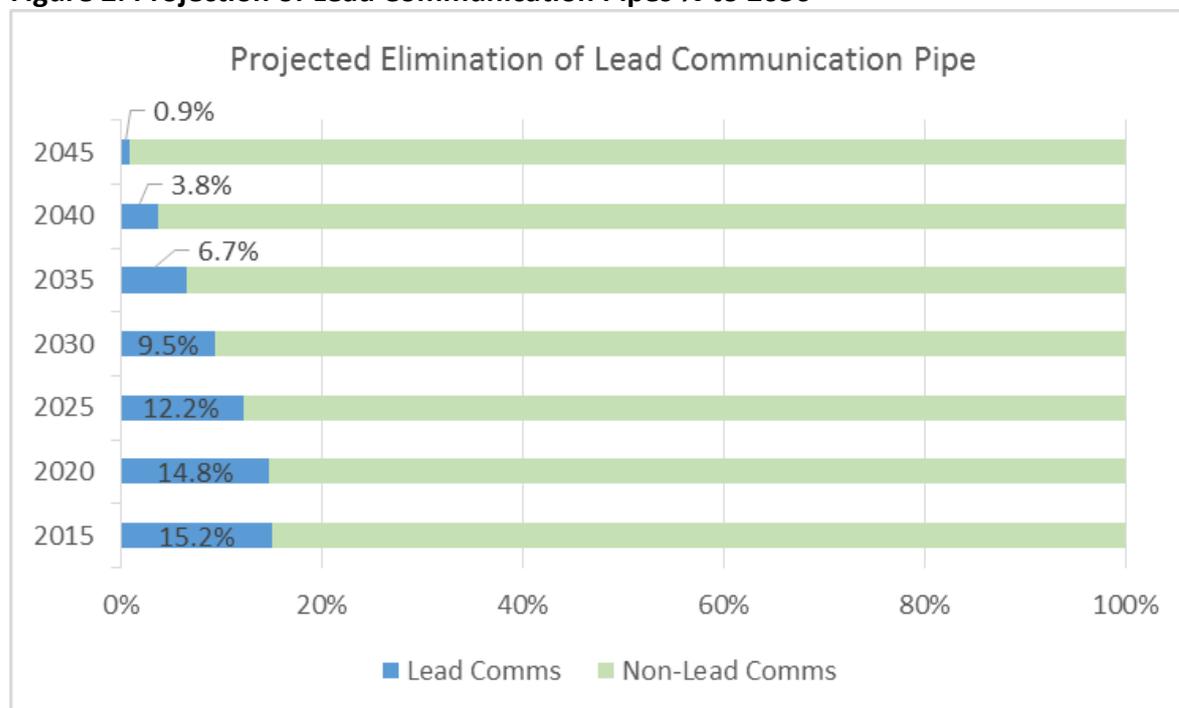
Southern Water has recently undertaken an assessment and consolidation of communication pipe data obtained from its Universal Metering Programme (UMP). The consolidated data set holds data on the material type of approximately 1/3 of its communication pipe asset stock. Based on extrapolation by Water Supply Zone (WSZ) and District Metered Area (DMA), Southern Water estimates that it has approximately 160,000 lead communication pipes within the asset base (approximately 14% of its communication pipe asset stock). More details of this assessment are shown in Section 2.9.

In parallel to this assessment, Southern Water has developed a DMA scale mains replacement programme targeting reducing leakage, bursts, interruptions to supply and discolouration. We have now included the extrapolated number of lead communications pipes in this assessment and our mains renewal targeting.

The revised programme consists of 480 km (including all DMA's in the Deal WSZ, see section 3) which will deliver significant customer benefits, making Southern Water a top quartile company for leakage, bursts, interruptions and discolouration performance (and forms a significant part of our targeted CRI/ERI performance). The programme will also remove approximately 20,500 lead communication pipes from the asset base.

In total (including opportunistic replacements) we therefore anticipate removing approximately 28,000 lead communication pipes in AMP7. We have also projected this replacement rate forward (see figure 2).

Figure 2: Projection of Lead Communication Pipes % to 2050



Based on the application of the combined targeting of mains replacement and lead communication pipe replacement Southern Water envisages replacement of 99% of all lead communication and supply pipes by 2045.

It should be noted that this rate of replacement is based on the AMP7 rate of replacement and 5% enhancements in opportunistic replacements in AMP8/AMP9 due to the successful implementation of the 5 other Pillars.

3rd Pillar – Education and Awareness

Southern Water will expand its advice service to customers with regards to lead services and lead pipe risk within the home. This will include:

1. Updating our website with a more comprehensive guide to identifying lead in the home including an on-line questionnaire to enhance our data capture to better verify the presence of lead at customer properties. A separate lead helpline will also be setup (see point 3).
2. Providing updated advice leaflets to customers in areas which have been identified as having properties with a high likelihood of containing lead pipework.
3. Updating training at our call centres to maximise data capture of lead risk from customers and answering customer queries through a separate lead helpline.
4. The above will also be integrated with our customer on-boarding/ home move process to further increase customer awareness and identify lead risk.

The above will be undertaken in close conjunction with the 4th Pillar.

4th Pillar – Stakeholder Engagement

Continue the work of Lead Working Group (LWG) set up in AMP6. The objectives of each LWG are:

1. Work with local authorities to identify vulnerable consumers, and to identify appropriate solutions, including the replacement of lead pipes in public buildings (e.g. when refurbishment is carried out in local authority housing).

The curate of the LWG should include representation from:

- Local Health Authority
 - County and District Council representatives (Public and Environmental Health)
 - Southern Water
 - Other Water Undertakers in the Local Authority Areas.
2. For vulnerable customers Southern Water will work with local authorities to subsidise the management of lead pipe risk in the home (this will be initially trialled in the pilot).
 3. Allow Southern Water (and other undertakers) to provide technical advice on lead risk within public buildings and other local authority assets.

Initial Lead Working Groups kick-off meetings are being undertaken in AMP6 and will continue into AMP7. Pending the outcome of the proposed AMP7 pilot, the LWG may also have accountability for a Community Fund (jointly funded by Southern Water and the Local Authority) to help subsidise the replacement of private and public supply pipes.

5th Pillar – Review of Risk

Southern Water will continue to review Lead risk on a cyclic basis through its risk assessment and management processes and update the Southern Water Drinking Water Safety Plan (DWSP) accordingly. This review process will be enhanced further by additional data, assessment of that data and further optimisation of the risk controls (the 6th Pillar).

6th Pillar – Assessment and Optimisation

In order for Southern Water to continue to improve its assessment of lead risk a number of initiatives are being undertaken that will help to optimise treatment and identify future requirements for new assets.

Over the course of AMP7 and AMP8 Southern Water intends to implement Phase 1 of the Intelligent Networks Strategy which will see the asset base deployment of additional Chlorine/Turbidity/pH monitors into the water network and which will be feeding data into our network management systems (including new analytics software). This will give Southern Water a significant improvement in analytic and diagnostic capabilities to help identify network risks. In-situ network pH monitoring will act as a useful tool in determining plumbosolvency dosing optimisation but will need to be used in conjunction with other data.

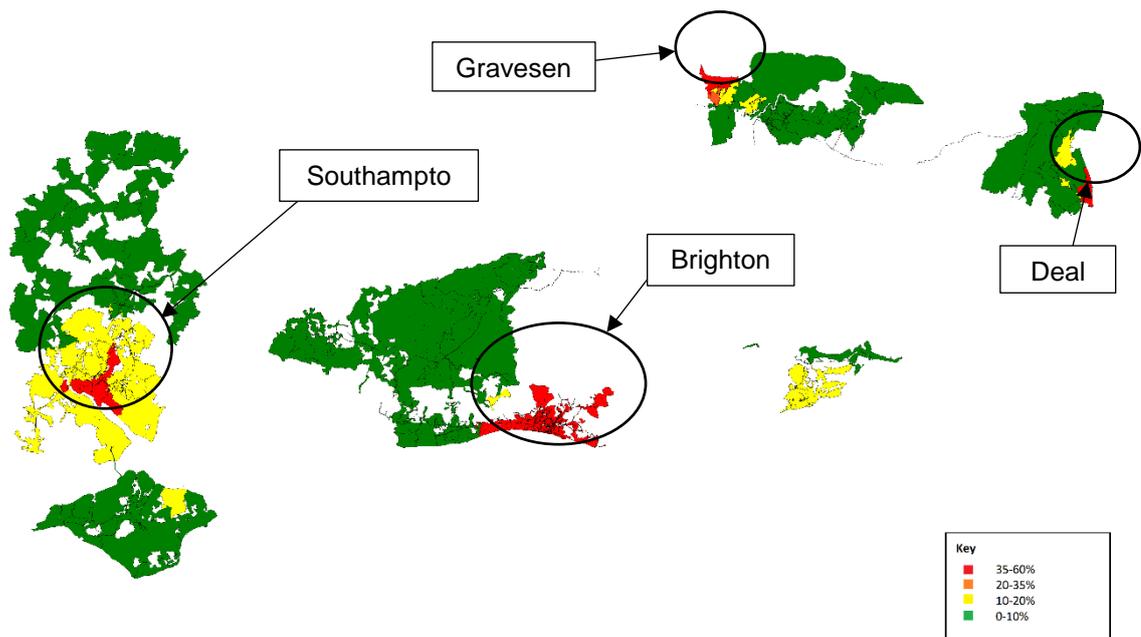
In addition to Phase 1 of the Intelligent Network Strategy, Southern Water will also be purchasing a number of additional lead sampling rigs (as part of its AMP7 temporary plant programme) to permit better assessment of dosing effectiveness (reviews of plumbosolvency effectiveness will be undertaken yearly for each zone).

To further enhance optimisation, Southern Water proposes to trial Phase 2 of the Intelligent Networks in AMP8 within a discrete control area (see Section 3). This will comprise of multi-determinand monitors (including Conductivity and Chloride) which would allow for greater understanding of water quality within the distribution network but in particular the effectiveness/suitability of dosing.

AMP7 Lead Pilot – Deal Water Supply Zone Selecting the Pilot Area

To test and optimise the application of the full 6 pillar strategy, an AMP7 Pilot is proposed in a discrete area. Geospatial mapping of the Universal Metering Programme (UMP) communication pipe data was used to identify lead communication pipe hotspots, this assessment is shown in Figure 3.

Figure 3: Heat Map of Lead Communication Pipe % of asset base based on UMP Data



The assessment above clearly shows 4 hotspot areas with significant numbers of lead communication pipes. Pilots in Brighton, Southampto and Gravesend were discounted based on a Cost Benefit Assessment (see Appendix A) and Deal was selected as the pilot area. Note that if the Deal pilot is successful, this approach would be applied to the other hotspot areas in AMP8. It should also be noted that a significant number of Southampto and Brighton DMA's are included within the proposed AMP7 mains renewal programme. Details of the pilot proposal and the application of the 6 pillar approach are detailed in Sections 3.2 and 3.3.

Proposed Pilot Programme (Deal WSZ)

Details of the key components of the pilot programme are provided below:

1. Continue with the AMP6 opportunistic replacement policy (1st Pillar)
2. Replace all water mains in the DMA's within the Deal WSZ (2nd Pillar), all of which are now included in the proposed AMP7 Mains Renewal Programme. As part of this programme the replacement of the DMA's in the Deal WSZ contribute significantly to achieving Quartile 1 performance for leakage, bursts, interruptions, discolouration and CRI. This work will include replacing approximately 6,500 lead communication and customer supply pipes. The total cost of this investment (embedded as part of the mains renewal programme) is approximately £25m. Details of the DMA's targeted for replacement are shown in Table 2.

Table 2: Deal Water Supply Zone DMA

DMA Reference	DMA Description
DH15	Stockdale Gardens
DH16	Sydney Road
DH14	Sandwich Road
DL10	Deal Low South
DH12	Middle Deal PMA
DH13	Walmer
DL11	Deal Low North

DH11	Lower Walmer PMA
DH10	St. Richards Road

3. Provide a lead pipe focussed advice service and local media campaign (3rd Pillar) in the Deal WSZ during the pilot with the aims of increasing customer awareness and increasing uptake of lead supply pipe replacement / removing lead pipework from the home (also see point 4). The estimated cost of this component is £100k.
4. In co-ordination with the local LWG, setup a Community Fund to help subsidise the removal of lead pipework in the home (4th Pillar). The fund would be governed by a panel consisting of members of the LWG and chaired by Southern Water and would grant funds based on applications from customers. Uptake and applications would be encouraged via the media campaign (point 3). This would encourage customers to have free inspections by Southern Water Regulations Inspectors to help identify lead pipework and referral to a Southern Water approved plumbing organisation for a quotation to replace this pipework. It is proposed that each grant will be to the value of £250 subsidy per successful applicant and assuming a 50% uptake (including administration) for ~ 6,000 households this equates to a Community Fund of £800k. Southern Water and the LWG could consider increasing this fund further depending on uptake.
5. Southern Water will continue to review Lead risk for the Deal WSZ on a cyclic basis through its risk assessment and management processes and update the Southern Water Drinking Water Safety Plan (DWSP) accordingly (5th Pillar).
6. Southern Water's Intelligent Network Phase 1 will be deployed across the asset base in AMP7 (6th Pillar). It is proposed that the monitoring technology currently envisaged for Phase 2 is trialled. This will comprise of multi-determinand monitors (including Conductivity and Chloride) which will allow greater understanding of the effectiveness/optimisation of plumbosolvency dosing in the network. It is proposed that the phase 2 monitoring is installed prior to mains replacement being undertaken (so pre/post intervention performance can be understood). This in combination with enhanced monitoring at customer taps will allow assessment of the success of the pilot scheme and potentially a reduction in plumbosolvency dosing at Southern Water Treatment works. The estimated cost for this component is £200k (scaled from the AMP6 Rownhams Phase 1 trial).

The above elements represent a total investment of £26.1m in the Deal WSZ, this includes £25m from the base capital maintenance programme and £1.1m of additional enhancement funding for the additional lead pilot activities Deal WSZ to improve water quality compliance. This investment would be embedded into our Network 2030 Plan for Thanet.

Success Criteria and Milestones

Below sets out the main success criteria for the pilot:

- Removal of 99% of all lead communication and supply pipes in the Deal WSZ.
- A significant reduction in the amount of lead in customer properties subsidised by the Community Fund programme.
- Improved customer engagement and understanding.

- Proof of concept for the Water Quality component of Intelligent Networks Phase 2.
- Optimisation and reduction of plumbosolvency dosing requirements.
- Decreasing lead concentrations in the distribution system.
- Significant serviceability improvements for Leakage/Bursts/Interruptions to Supply/Discolouration and CRI.
- Long term partnership with local health authority to monitor the effects and benefits of the programme.

The above criteria will be measured through sampling pre and post pilot both in the distribution network (using the sampling rigs described in 3.2) and at customer taps to ensure no exceedances of 5 ug/l of lead.

It is proposed to complete the pilot by March 2024 with a full assessment of the success criteria being completed by December 2024. Intermediary milestones will be set up on yearly basis. Based on meeting the above criteria, application of this approach will be considered in AMP8 for the other hotspot areas.

Appendix A – Cost Benefit Assessment

Table 3: Selection of Trial Area based on pilot method (Net Present Value)

	Option 1	Option 2	Option 3	Option 4
WLC 60 yrs	Deal WMR (Lead)	Brighton WMR (Lead)	Southampton (Lead)	Gravesend (Lead)
Preferred Option (Financial Only)	Preferred Option			
Preferred Option (Full)	Preferred Option			
Whole Life Cost (Financial Only) NPV (£k)	£33,737	£347,530	£189,263	£59,805
Full Whole Life Cost NPV (£k)	£18,482	£235,134	£87,989	£18,661
Source data spreadsheet file name	ID406.11 Whole Life Cost Model Lead Options.xlsm			

Notes:

1. Application of the pilot approach in Deal represents lowest NPV.
2. The Full Whole Life costs include benefits of reductions in bursts, interruptions to supply, discolouration and reduction in communication pipe replacement costs to show a balanced whole life cost view of the 4 areas.
3. This currently doesn't include leakage, this will be worked into future reiterations of these calculations. However this is not expected to have a notable effect (leakage rates per property are similar in the 4 target areas).

Table 4: Selection of Pilot Type in Trial Area.

	Option 1	Option 2	Option 3	Option 4
WLC 60 yrs	Deal WMR Lead Pilot	Line lead Pipes	Replace just comms pipe	-
Preferred Option (Financial Only)			Preferred Option	
Preferred Option (Full)	Preferred Option			
Whole Life Cost (Financial Only) NPV (£k)	£33,737	£23,966	£20,099	£0
Full Whole Life Cost NPV (£k)	£18,482	£22,798	£20,070	
Source data spreadsheet file name	ID406.11 Whole Life Cost Model Lead Options.xlsm			

Notes:

4. Application of the pilot approach in Deal represents lowest NPV compared to the other pilot type options (due cumulative serviceability benefits).
5. Option 2: Lead lining was considered as is assumed to cost £350 per property based on current contract costs and information from other trials in the industry. It is also assumed that the majority of lead communication pipes require replacement in the NPV horizon due to deteriorating asset condition.
6. Option 3: Represents lowest financial only whole life cost, however does not deliver the additional serviceability benefits compared to Option 1 (when leakage is factored into this the differential between these options is likely to grow).