Appendix 7
Efficiency

A Introduction

1.1 We invest money on behalf of our customers and shareholders – therefore an essential attribute of delivering our vision is to ensure we spend money as efficiently as we possibly can.

1.2 Efficiency is core to our management and operational processes and as such we have a deliberate and methodical approach to ensure we spend money wisely.

1.3 Our approach is to test that we are delivering the outcomes our customers want for the best value. Four principles underpin this:

1) **Customers' need** – ensure the expenditure supports an outcome that customers want and are prepared to pay for;

2) **Whole-life cost** – ensure we take a strategic approach to maintaining versus renewing assets, and strike the right balance between reactive, preventative and predictive maintenance;

3) **Systems thinking** – ensure we manage systems costs to frontier efficiency rather than sub-process efficiency (for example, if we focus on reducing upfront call-handling costs, we may inadvertently dispatch engineers and increase operational costs); and

4) **Great service = efficiency** – delivering great customer service means getting it right first time, reducing the cost of failure. This is consistent with a highly efficient outcome.

1.4 We apply these principles consistently across our business, but the application is slightly different between spending money on operations versus investing in replacing or renewing assets. In all cases we consider the overall totex impact of our plan and ensure that investment is optimised across totex overall across the whole life of the related assets.

1.5 We split totex into three categories for the process of analysing efficiency:

a. **Base opex** is the spend on our day-to-day operations to keep our business running;

b. **Capital maintenance** is the spend on our asset base to maintain their capability and ensure we can deliver services for our customers at the lowest whole life cost; and

c. **Enhancement** is spend on assets and operations that improves the level of service or resilience.

1.6 Table 1 summarises our planned expenditure for AMP7 in each of the broad cost categories across price controls.

Table 1 Our total planned expenditure over AMP7 by price control and cost category[1] (£m, 17/18 prices, except for Retail costs)

£m	Water Resources	Water Network Plus	Waste Network Plus	Bio resources	TTT	Retail	Total[2]	Section
Base opex (wholesale and retail) – excl depreciation	321	1,932	1,652	278		777	**4,960**	**BASE OPEX**
Retail depreciation						120	**120**	**BASE OPEX**
Enhancement Opex[3]	33	151	177	2	19		**381**	**ENHANCEMENT**
Base Capital Maintenance[4]	95	1,631	1,472	303			**3,500**	**CAP MAINT**
Base CM - grants, contributions and third party		-39	-121				**-160**	**CAP MAINT**
Enhancement capex	147	1,499	1,200	106	117		**3,069**	**ENHANCEMENT**
Enhancement - grants, contributions and 3rd party		-111	-71				**-182**	**ENHANCEMENT**
TTT Income					-343		**-343**	**TTT**
TOTEX	**595**	**5,063**	**4,309**	**688**	**-206**	**897**	**11,346**	

Source: Thames Water, price control documents[5]

In summary, we expect the following efficiency outcomes for **OPEX** in AMP7:

1) **Base opex to fall by 13.6%** per household (see Figure 3) between AMP6 and AMP7 (after adjusting to remove above inflation increases in power price and business rates outside of our control) [6]. Within this:

   - **Retail costs to fall by 9.7%** (see Figure 4) - trending to upper quartile efficiency by the end of AMP7[7];
   - **Wholesale water costs (combined across price controls) to fall by 13.4%** including a 23.2% reduction in repair and maintenance cost of repairing leaks – upper quartile in Water Resources and Treatment, trending to upper quartile in Treated Water Distribution[8];

1 All Prices in 17/18 CPIH except Retail which is in Outturn – before adjustment for rates and power price
2 **Totals based on exact amounts, table will not therefore cast due to rounding differences. This applies throughout this appendix in respect of total and percentage calculations**
3 Base opex analysis used in this IAP chapter adjusted from £4,959m above to £4,835m – see section B (1.8) for reconciliation of adjustments made
4 Capital maintenance totals £3,341m net of developer income
5 PCD1-PR19-Retail, PCD2-PR19-Wastewater Network Plus, PCD3-PR19-Bioresources, PCD4-PR19-Water Resources, PCD5-PR19-Water Network Plus, PCD6-PR19-Thames Tideway Tunnel (TTT)
6 Thames Water analysis
7 Thames Water analysis
8 Thames Water analysis

- **Wholesale wastewater costs (combined across price controls) to fall by 15.7%** - upper quartile or better in Waste Network plus and Bioresources[9];
- Integrated power efficiency strategy which **reduces energy intensity by 22%** (see section B7) by the end of AMP7;
- **Base IT costs reduce by 5%** (Figure 30) on a like for like comparison[10]; and
- **Wholesale base opex includes £137.6m over AMP7 evidenced through our Cost Adjustment Claims[11]** (see Table 19) as being over and above the position we have estimated as being allowed through Ofwat's econometric modelling.[12] We have not adjusted for the impact of these claims in our opex industry benchmarking in Section B – taking them into account would further improve our position relative to the rest of the industry.

2) **Capital maintenance and enhancement** plans have followed a rigorous process to ensure value and that it is in line with customer need:

- **Investment planning process has removed £1.3bn in costs** (see Figure 32) through challenge on price, scope, solution and timing requirements – across capital maintenance and enhancement[13];
- **Base capital maintenance reduces by 6%** adjusting for areas of additional spend (see Figure 33) on a like-for-like basis between AMP6 and AMP7, driven by a proactive maintenance strategy and rigorous challenge process[14];
- **Additional capital maintenance of £653.2m** planned (in addition to above) (see Table 15) – **targeted to meet customer needs around resilience and reliability** – required above normal base levels to avoid deterioration in steady state[15]; and
- **Enhancement spend of £3,269m** (capex and opex, see Table 16) targeted at improving specific performance levels in line with clear customer feedback[16];
    - This includes spend of £571m (Table 19) supported by wholesale Cost Adjustment Claims for either the material impact of our company's circumstances, material new

9 Thames Water analysis
10 Thames Water analysis
11 Thames Water - CSD006-WNP-01a-PR19-CA PF Urban productivity, CSD006-SNP-01a-PR19-CA PF Urban productivity, CSD006-WNP-02a-PR19-CA PF Network maintenance, CSD006-WNP-03a-PR19-CA PF Water stress, CSD006-BR-01a-PR19-CA PF Sludge enhancement, CSD0006-WNP-04a-PR19-CA PF Resilience of supply, CSD006-RR-02a-PR19-CA PF Population transience, CSD006-RR-01a-PR19-CA PF CRMB depreciation
12 Our calculations take account of the suite of econometric models that Ofwat consulted upon in March 2018 and the responses shared by consultees – notwithstanding that, we raised material concerns with the approach and models in our response to that consultation. For the avoidance of doubt, we still have material concerns about Ofwat's proposed approach, and the models we have adopted for these calculations should not be interpreted as an endorsement of Ofwat's econometric approach or models.
13 Thames Water analysis
14 Refer to Section: C2 Capital Maintenance expenditure
15 Refer to Section: C2 Capital Maintenance expenditure
16 Thames Water, all CSD006 documents

costs or the Bio-resources price control, where Ofwat's methodology confirmed no econometric models would be produced .

1.7 We explain, in this Appendix, how we have ensured that each of these cost components within our plan is as efficient as possible, how we plan to achieve this and the benchmarking we have performed to support the level of stretch and ambition in our plan. Whilst we recognise that Ofwat use econometric models, we believe that our approach - using a cost-driver level analysis of efficiency improvements, supported by a range of benchmarking assessments – provides a rounded and appropriate view of efficiency.

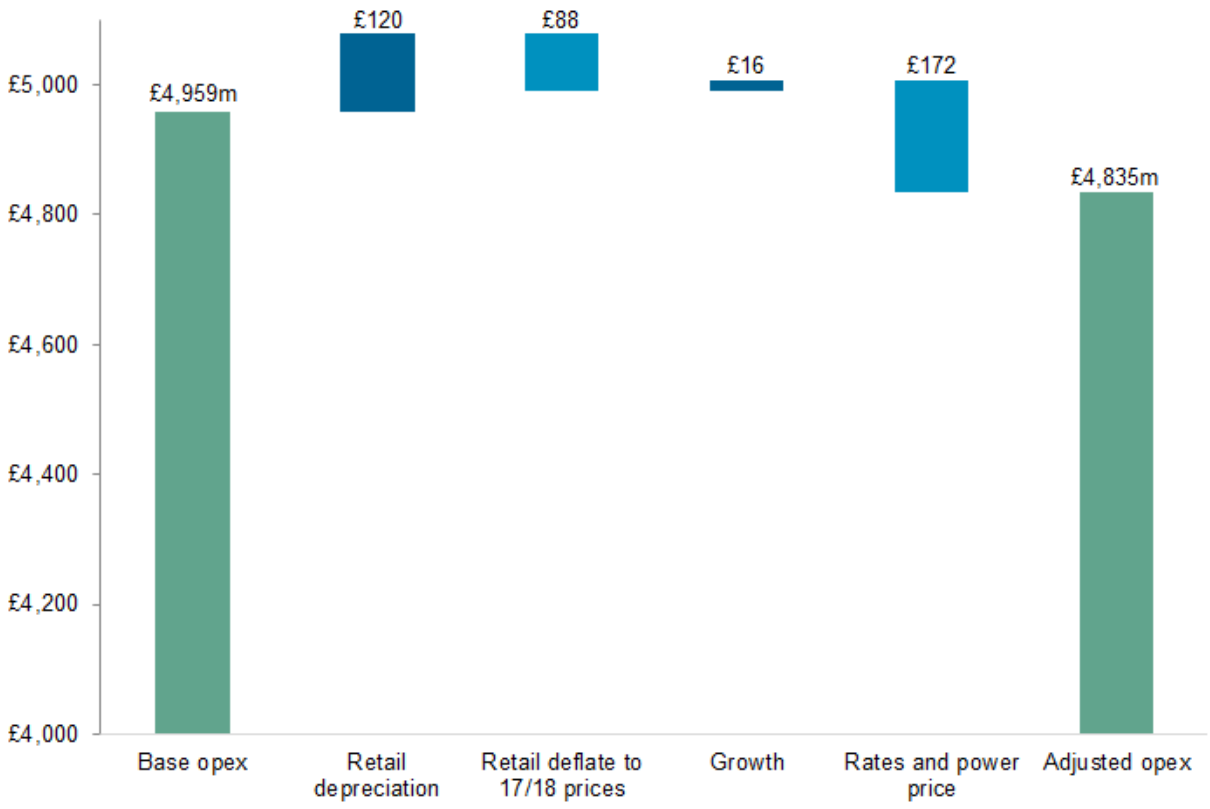
- Section **B** sets out our approach to developing our AMP7 investment plans for our operations (i.e. **base opex**), including how we have established that these costs are efficient;
- Section **C** sets out our approach to developing our AMP7 investment plans for our assets (i.e. **capital maintenance** and **enhancement**), including how we have established that these costs are efficient;
- Section **D** summarises how we have developed our Thames Tideway Tunnel expenditure plans for AMP7, including how we have established that these costs are efficient;
- Section **E** sets out our approach to identifying and justifying our cost adjustment claims (i.e. the factors that make us different to other companies in the English & Welsh water industry) and how we have ensured that the claims we are seeking reflect only differences in efficient costs between companies; and
- Section **F** provides additional supplementary information, as appropriate, to support the detail within sections B to E.

B Base operating expenditure

1.8 Our total Opex for AMP7 totals £5.0bn – we make four adjustments to convert this to a 'Base Opex' metric of £4.8bn, which we use to measure efficiency against:

- Adding in retail depreciation of £120m;
- Subtracting £88m for converting Retail opex to 17/18 prices;
- Adding in £16m of growth to ensure consistency when we look at the unit cost per household; and
- Removing the impact of inflation of £172m in power and rates rates to ensure a like-for-like comparison[17].

Figure 1 Waterfall illustration showing adjustments to Opex (£m, 17/18 Prices)



Source: Thames Water analysis

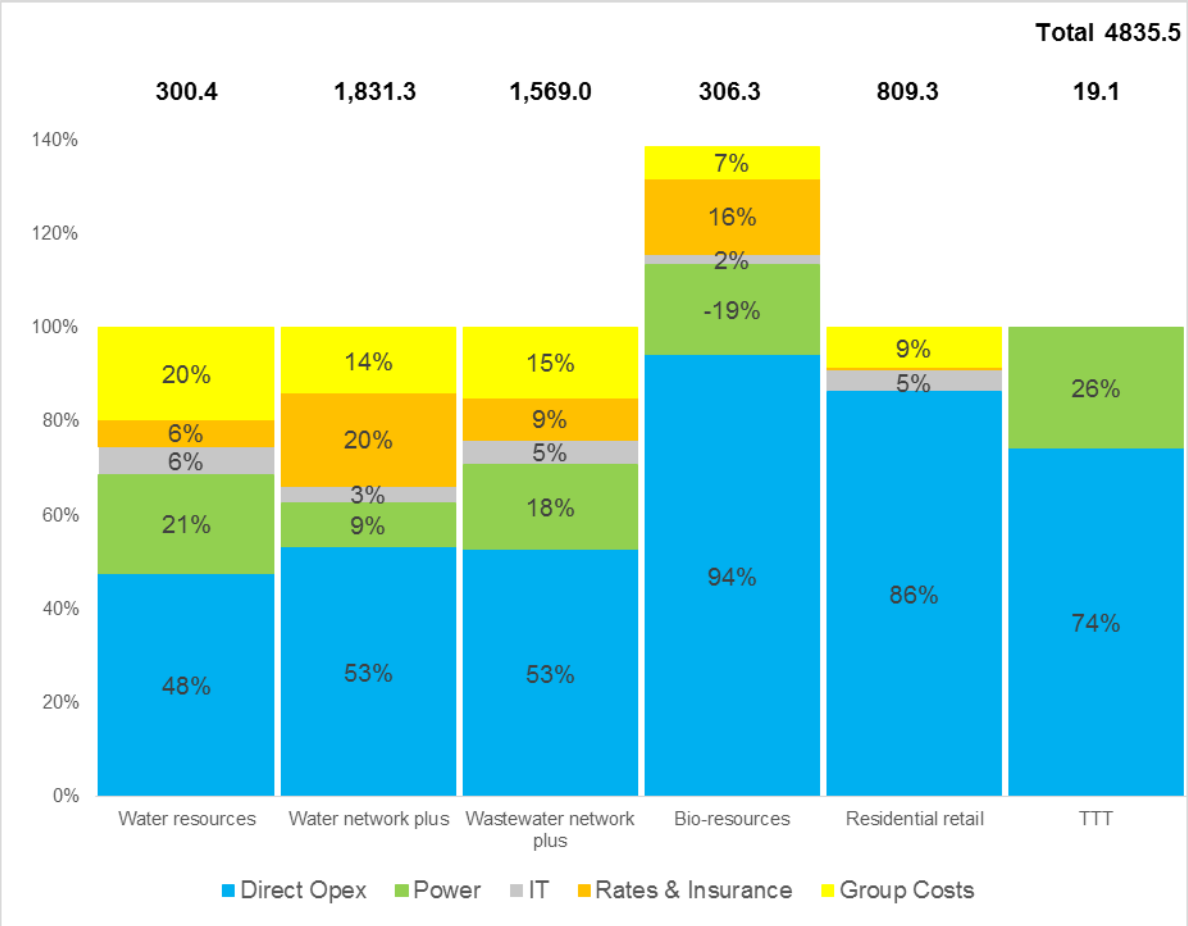
[17] Thames Water analysis

1.9 We take a '**vertical and horizontal**' approach to presenting base opex to test for efficiency. This approach is as follows:

- Split opex into price controls (vertical) – we do this because it is a good representation of how costs accumulate in our business, and there is benchmark data available as it is a standard way water companies report costs;
- For each price control, identify 'direct costs' i.e., costs directly related to the operation of assets and associated service outcomes within that price control, as well as common (horizontal) costs across price controls: IT, power, insurance, rates; and
- Look at overall employee costs, which, while common, tend to have different drivers in each price control.

1.10 Our base opex is summarised below – split into 'vertical' components (i.e. by price control) and 'horizontal' components (i.e. by common cost).

Figure 2 Base Opex costs in AMP7 (£m)



Source: Thames Water analysis (note: allocation of certain group costs for above chart is against adjusted base opex number and may therefore differ to values in relevant price control documents)

1.11 We have reviewed and challenged efficiency both vertically and horizontally: vertically, for each price control; and horizontally, for common costs. For some price controls, where there are

multiple cost drivers, we reviewed the next level down. We reviewed efficiency in a number of ways:

1) Assessing cost per household (as an overall high level driver of cost for all areas of our business);

2) Assessing other key cost drivers that may impact the price control or sub-level of the price control;

3) Identifying that the right initiatives are in place to reduce costs, linked to these cost drivers (note these are often a continuation of AMP6 initiatives). These initiatives will either: reduce volume, reduce price, or reduce volatility;

4) Assessing against our full potential view (see Sections B1 and F4) to identify gaps to frontier efficiency - and ensuring our plan is bridging this gap;

5) Validating against cross-industry benchmarks to verify the level of ambition and challenge in our cost efficiency programme by price control, e.g. our industry benchmarking for 17/18 opex, cross industry benchmarking of our capex by third parties, retail cost drivers, power consumption and price (see Section B7) and IT costs (see Section B8);

6) Reviewing business wide, horizontal costs such as power, rates, IT and employees to ensure that the overall efficiency programme across all price controls is consistent, challenging and with interdependencies being well understood; and

7) Ensuring that we consider opex as part of an overall efficient totex plan – with a focus on whole life cost and business cases to support our investment programmes. For some areas where there is a heavily integrated opex/capex programme of work, we have assessed efficiency using totex – for example network plus sewage treatment and treated water leakage repairs and maintenance.

1.12 This section is structured as follows:

- **B1** gives a summary of our overall base opex efficiency;
- **B2** covers efficiency for our Household Retail price control – including cost per household, driver analysis, initiatives which drive efficiency and benchmark data**;**
- **B3** to **B6** cover efficiency in the same way for each of our wholesale price controls, including Water Resources, Water Network Plus (including Water Treatment and Treated Water Distribution), Wastewater Network Plus (including Sewage Collection and Wastewater Treatment), and Bioresources; and
- **B7** to **B10** cover efficiency for cost categories where a cross company view has been taken to supplement the work done in each price control - including power (consumption and price), IT, rates (local authority and Cumulo rates) and employee costs.

B1 Overall base opex efficiency

Table 2 Summary of AMP7 Capital plan

Item	Total	Section (£m)
Base opex (wholesale and retail) – excl depreciation	**4,959.7**	**BASE OPEX**
Retail depreciation	**120.0**	**BASE OPEX**
Enhancement Opex[18]	**381.5**	**ENHANCEMENT**
Base Capital Maintenance[19]	**3,500.1**	**CAP MAINT**
Base CM - grants, contributions and third party	**-159.5**	**CAP MAINT**
Enhancement capex	**3,068.8**	**ENHANCEMENT**
Enhancement - grants, contributions and 3rd party	**-181.7**	**ENHANCEMENT**
TTT Income	**-343**	**TTT**
TOTEX	**11,345.8**	

Source:Thames Water analysis

£5,079.7m covers base opex for both wholesale and retail, including retail depreciation. We estimate our opex cost per household will fall by 13.6% between AMP6 and AMP7

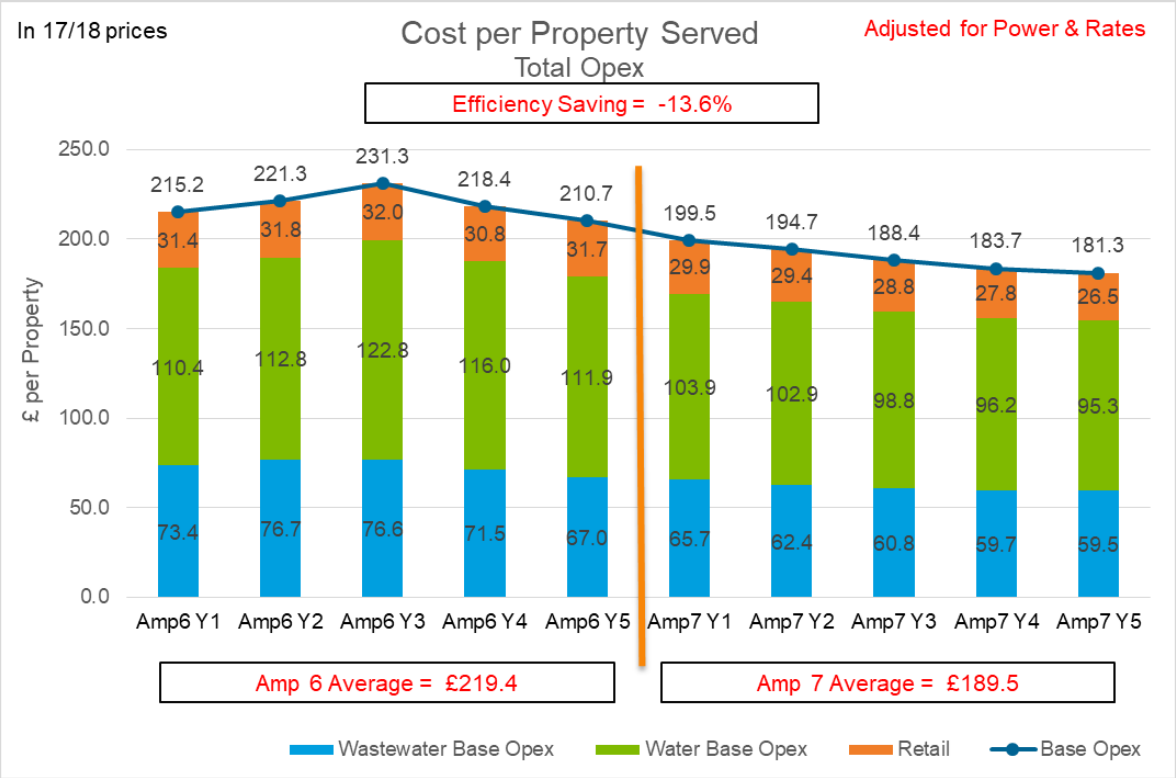
OVERALL UNIT COST PER PROPERTY

1.13 At a company level our adjusted average annual base unit opex, measured by cost per property, is falling by 13.6% between AMP6 and AMP7, reducing from £219.4 to £189.5 per household – with reductions ranging between 9.7% and 24.8% per household across the price control areas depending on our current efficiency position and opportunities to improve[20].

1.14 We recognise that we incurred some levels of inefficiency in the first half of AMP6, in particular for Treated Water Distribution activity, as a result of challenges in the operation of our Infrastructure Alliance. We are making significant improvements in this area for Years 4 and 5 of AMP6 to ensure that we exit AMP6 at a good level of efficiency, which we can further improve through our planned AMP7 initiatives. Treated Water Distribution costs per household reduce from £83.90 in 2017/18 to £68.60 on average for AMP7 (18.2% reduction) and to £65.10 by the final year of AMP7 (22.4% reduction) [21].

[18] Base opex analysis used in this IAP chapter adjusted from £4,959m above to £4,835m – see section B (1.8) for reconciliation of adjustments made
[19] Capital maintenance totals £3,341m net of developer income
[20] Thames Water analysis
[21] Thames Water analysis

Figure 3 Actual and forecast cost per property served over time – wholesale and retail combined (17/18 Prices)



Source: Thames Water analysis

Table 3 Opex efficiency calculations for each area of value chain - adjusted

Efficiency calculation method	Water (%)	Wastewater (%)	Retail (%)	Total (%)
Average AMP6 to Average AMP7	-13.4%	-15.7%	-9.7%	-13.6%
CAGR[22] over AMP7	-1.7%	-2.0%	-2.4%	-1.9%
Y5 AMP6 to Y5 AMP7 exit	-14.8%	-11.3%	-16.4%	-13.9%
Y3 AMP6 to average AMP7	-19.0%	-19.6%	-10.9%	-18.1%

Source: Thames Water analysis

[22] Compound annual growth rate

KEY COST DRIVERS

1.15 Our specific cost per volume driver measures in each price control are also reducing due to our efficiency initiatives – between 5.1% and 23.2% from AMP6 to AMP7. See sections below for further details[23].

1.16 Our plan is to drive efficiency through a range of levers:

- REDUCE VOLUME:
  - **Transaction efficiency** – getting things right the first time by having all the enablers in place, e.g. removing unwanted customer visits for water networks activity through better planning and customer journey tracking;
  - **Removing unnecessary activity volumes** – doing more proactive maintenance to reduce reactive work and cost of asset failures;
  - **Automation** – using alternative channels for certain demand, e.g. automating 40% of our processes in customer contact centres;
- REDUCE PRICE:
  - **Procurement** – ensuring we get best price from our supply chain, and they are incentivised correctly the first time;
  - **Managing resources to better meet demand** – structuring our supply chain in a way that gives us the right level of capacity at the right price;
- REDUCE VOLATILITY:
  - **Reducing demand volatility** – using predictive analytics in our Waste network business to target high risk areas and better predict workloads; and
- APPLY SYSTEMS INTELLIGENCE:
  - **Using system level analysis** – to ensure optimising sub-processes drives overall efficiency – for example, reducing call handle time in the call centre may increase costs in the field, resulting in overall unit costs being higher.

BENCHMARKS

1.17 We have assessed efficiency per unit driver against the rest of the industry, using the most recently published Ofwat data for 2017/18 – we expect to maintain or improve for all areas and be around or better than upper quartile by the end of AMP7 for Retail, Water Resources, Water treatment, Sewage Collection, Bioresources and Waste treatment. These areas covered 63% of our total base opex per household in Year 3 of AMP6[24].

1.18 In assessing performance, we recognise that industry upper quartile performance as at 2017/18 will continue to improve each year through to 2024/25. We have challenged our efficiency

[23] Thames Water analysis
[24] Thames Water analysis

programmes to deliver at a level that we believe will be in line with, or ahead of the frontier move during this period – for example in treated water distribution where we are below industry average at 2017/18, our AMP7 average costs per household reduce by 18.2% versus 2017/18 (and by more than this for leakage totex in particular) [25]. We also note that 2017/18 represented our highest across AMP6 for cost per household across all of our operations (see Figure 3).

1.19 To test our overall efficiency programme, as part of our November 2017 strategic review we commissioned a third party to develop a 'full potential' view of our business to identify the gap to frontier efficiency and how we would close it across our Retail, Water and Waste activities.

1.20 This work examined a range of our core activities that drive costs materially – identifying a range of changes which could be made to reduce volumes, lower processing time through productivity improvements and eliminate wastage.

1.21 The work was performed using data from 2015/16 and identified potential cost saving benefits (primarily opex) estimated at c£110m to £145m per annum[26] to get to what was considered a challenging and ambitious level by mid-AMP7, based on our business as at 2015/16. Retail benefits were £20 to 25m, Water benefits were £60m to £75m and Waste were £30m to £45m (Table 22).

1.22 Efficiencies identified included optimisation of network repairs and maintenance processes for both water and wastewater, reducing chemical and power volumes in wastewater treatment and water production, reducing customer call volumes, increasing productivity in call centres and lowering bad debt costs. More details are included in Section F4.

1.23 Our plan delivers efficiencies (using the levers set out in 1.16 above) within the range identified by the middle of AMP7 and at the top end of the range by the final year of AMP7 in each area. Further details are provided in each of the relevant sections. A summary of our initiatives is set out within Section F1.

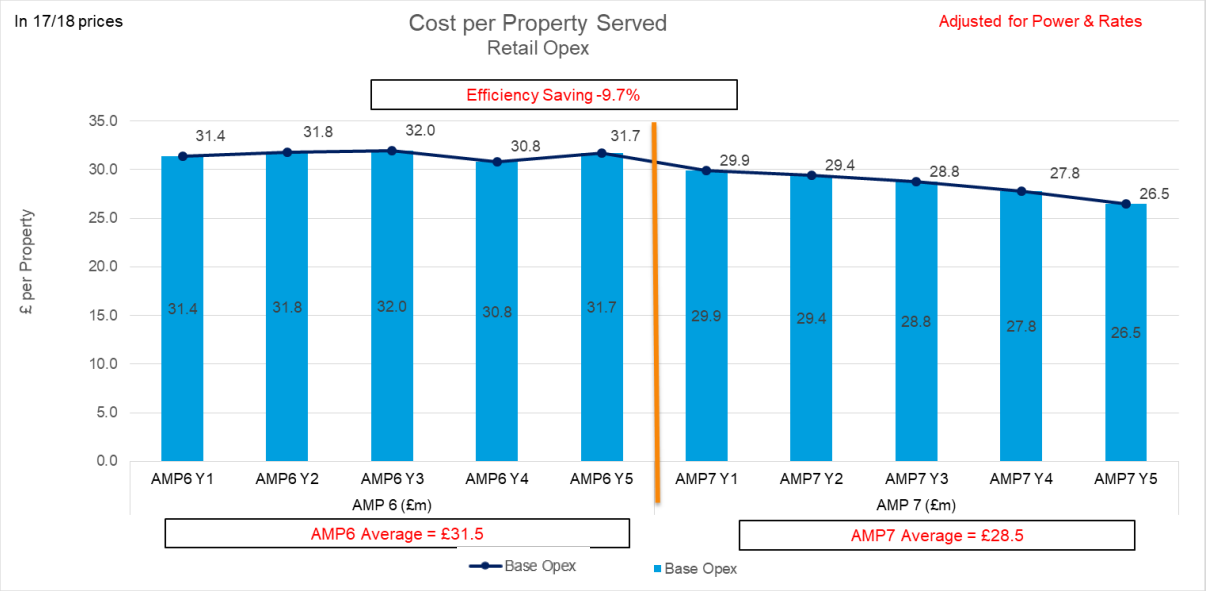
[25] Thames Water analysis
[26] Thames Water analysis

B2 Retail price control

OVERALL UNIT COST PER PROPERTY

1.24 Our average retail cost to serve (opex plus depreciation) per household reduces by 9.7% between AMP6 and AMP7 (Figure 4). Between Year 5 of AMP6 and Year 5 of AMP7 the reduction is 16.4% excluding depreciation, which increases significantly in AMP7 as we realise the benefit of investment in our Customer Relationship Management and Billing platform (CRMB) and digital technology. These comparisons use 17/18 Prices in line with how we have assessed our wholesale price controls.[27]

Figure 4 AMP7 vs AMP6 exit Cost to Serve breakdown and per Household (17/18 Prices)



Source: Thames Water analysis

Total costs used in calculation of cost per property served are taken from line 14, Table R1 – before depreciation recharges. Household data non adjusted – no additional weighting applied for dual customers. The Retail Price Control document does take into account differences in cost to serve for dual customers.

KEY COST DRIVERS AND EFFICIENCY LEVERS

1.25 We consider cost per household to be the most appropriate overall cost driver to use in measuring our efficiency. In building our plan we have considered costs in each of the critical activities which drive cost and how we can make changes in volume, price or volatility to reduce costs in each of these areas. See details overleaf – note this analysis is consistent with the

[27] Thames Water analysis

Retail Price Control document and uses nominal prices as well as a 1.3 economy of scale multiplier as set out in that document:

- **Customer Service** costs are reducing from £10.14 to £7.59 per Household from AMP6 year 5 to AMP 7 year 5, a 25.1% reduction, driven by reductions in incoming customer contact volumes, a shift towards digital channels and improvements in the efficiency of our contact centre operations (see data table R1) [28].
- **Debt Management** declining from £1.70 to £1.25 from AMP 6 year 5 to AMP 7 year 5 per Household, 26.5% reduction (see data table R1). This reduction is driven by enhanced debt management tools, increase in customers on payment plans and streamlined processes as well as the reduction in LAHA commissions[29].
- **Doubtful debt** is increasing despite improvements made because of more sophisticated use of data and tailored pathways for more effective debt recovery, together with our holistic affordability support which includes the introduction of an enhanced tiered social tariff which will help 200,000 customers by the end of the AMP (see data table APP1). This reduction in doubtful debt is offset by an increase of £37m (total over course of AMP7 versus AMP6) driven by our strategy to transition LAHA customers to a direct billing relationship. We believe that it is extremely important to have a direct relationship with these customers, so we are able to provide them the support they require more easily. We have also assessed the cost effectiveness of the contracts and believe that they no longer represent good value for money for our entire customer base. As a result of making this change, doubtful debt costs will rise based on our assessment of collections which is 80% for this segment of customers. However, the overall total costs to all customers will fall as we have assessed that it is more cost beneficial to bill directly than pay LAHA commissions; this is reflected across other cost categories[30].
- **Other operating expenses** are declining from £3.48 to £3.21 on a per household basis (7.8% reduction) driven by a reduction in support costs.[31]

1.26 The total value of savings delivered in AMP7 by the above initatives is £113.2m in 17/18 prices measured against the AMP6 exit rate (Table 20).

1.27 These improvements are enabled by our investment in our CRM / Billing platform and latest digital technology e.g. new generation contact centre platform, intelligent work distribution, robotic process automation, artificial intelligence, enhanced website and data factory. These will provide better data and tools for our people and customers to use.

1.28 Our Retail Price Control document[32] gives a deep dive into our costs and explains the way cost efficiency has been reviewed against each of the Ofwat Retail Expenditure types.

[28] PCD1-PR19-Retail
[29] PCD1-PR19-Retail
[30] PCD1-PR19-Retail
[31] PCD1-PR19-Retail
[32] PCD1-PR19-Retail

BENCHMARKS

1.29 We have developed a plan that appropriately balances efficiency with customer service and experience. We have reviewed appropriate benchmarks (where available), in the context of the unique features of our region, our customers and what our customers want.

1.30 To learn from best practice and test the efficiency of our plan, we have used a range of examples from across industries, and appropriate benchmarks, including the PwC Retail Services Efficiency Benchmarking report and the Contact Babel UK Contact Centre HR and Operational benchmarking report (2017/18).

OPERATIONAL BENCHMARKS

1.31 The key drivers of **customer service costs are contact volumes and unit costs** – we have used our external benchmarking to challenge and test our plan along with a range of other indicators. Table 4 and Table 5 below sets out the key drivers, current performance and benchmark, where available, and the financial savings benefit. We estimate the overall impact of the efficency strategy will deliver £106m of efficiency benefit in AMP7 vs AMP6 exit rate for customer service costs (excluding customer growth and input price pressure)[33].

Table 4 Contact volumes driver efficiency strategy over AMP7

Initiatives	Impact by 2024/25	Benchmark
• Optimise total contact volumes through eliminating unwanted contacts, including reducing repeats; and • Shift traditional contact volumes to digital and self-serve channels.	• Telephone contacts reduce by 30% from 17/18 level; • Other traditional contacts reduce by 20% from 17/18 level; and • Complaints reduce to 25 per 10k properties from 32 in 17/18.	• Complaints – 28.9 per 10k properties (WASCs). (CCWater 16/17 report)

Source: PCD1-PR19-Retail

[33] Thames Water analysis

Table 5 Unit cost driver efficiency strategy over AMP7

Initiatives	Impact by 2024/25	Benchmark
• Optimise unit costs through focus on critical metrics; and • Maximise opportunities to utilise AI and automate processes.	• Unit costs fall to £4.13 (£3.51 at 16/17 prices) from £4.83 in 17/18	• £3.66 in 16/17 • PwC Retail services efficiency report, September 2017 (Section 1.33 below).

Source: PCD1-PR19-Retail

1.32 PwC conclude in the Retail Services Efficiency Report (2017)[34] that water providers could indicatively save between 16 – 32% to achieve cost per contact costs in line with the Public Sector and the Telecoms and Tech industry. Although the cost per contact metric used is not an easily comparable one, the level of ambition and efficiency is comparable. This plan delivers 17.7% efficiency in the Customer Services expenditure category, including inflation. If the impact of inflation is excluded, this is a 26.8% improvement against the AMP7 baseline position[35].

1.33 The key drivers of debt management and bad debt costs are debt prevention and debt recovery. Again, we have used third party benchmarking to challenge and inform our plan and the level of improvement targeted. We estimate that the overall impact of our efficency strategy will deliver a £16.5m efficiency benefit in AMP7 for debt management costs and £4.1m for doubtful debt costs against the AMP6 exit rate (in nominal prices)[36]. See Table 6.

[34] PwC Retail Services Efficiency benchmarking (2017) p.59
[35] Thames Water analysis
[36] Thames Water analysis

Table 6 Debt management and doubtful debts costs efficiency strategy over AMP7

Initiatives	Impact by 2024/25	Benchmark
• Reduce the number of customers that enter the collection process through effective billing and debt prevention, including affordability support; • Enhance collection methods to increase early collections; • Improve segmentation and effectively target those who 'won't pay'; and • Use automation and AI capability to increase the speed and accuracy of billing and collections resolution.	• Reduce doubtful debt as a percentage of revenue from 3.4% to 3.1%.	• Median Water – 3.2% • Median Energy – 1.5% • Median Telco - 0.8% • Median Local Authorities – 0.8%[37] • The performance has been benchmarked across multiple sectors, however, due to the universal service obligations of the water sector and billing cycles the cross sector benchmarks have limited validity.

Source: PCD1-PR19-Retail

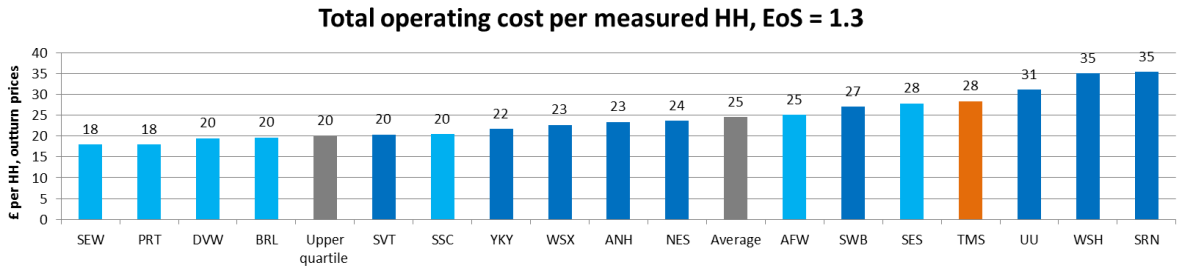
1.34 Further detail can be found in the Retail Price Control Document in (PCD1-PR19-Retail).

FINANCIAL BENCHMARKS

1.35 The chart below shows retail operating costs (including depreciation and amortisation, excluding third party opex) per household against the other WASCs for 2017/18, using an economy of scope factor of 1.3 (in line with the assumptions Ofwat used in PR14). This shows our efficiency performance as being below average for the industry.

[37] PwC Retail Services Efficiency benchmarking (2017)

Figure 5 Review against Ofwat industry datashare, 2017-18 (17/18 Prices)



Source: Thames Water analysis

1.36 However, this benchmarking does not take into account significant specific factors that we consider not to have been included in Ofwat's model, that impact our customers and cost to serve. The two factors are special transience in our region and, for AMP7 in particular, depreciation of our new CRMB system.

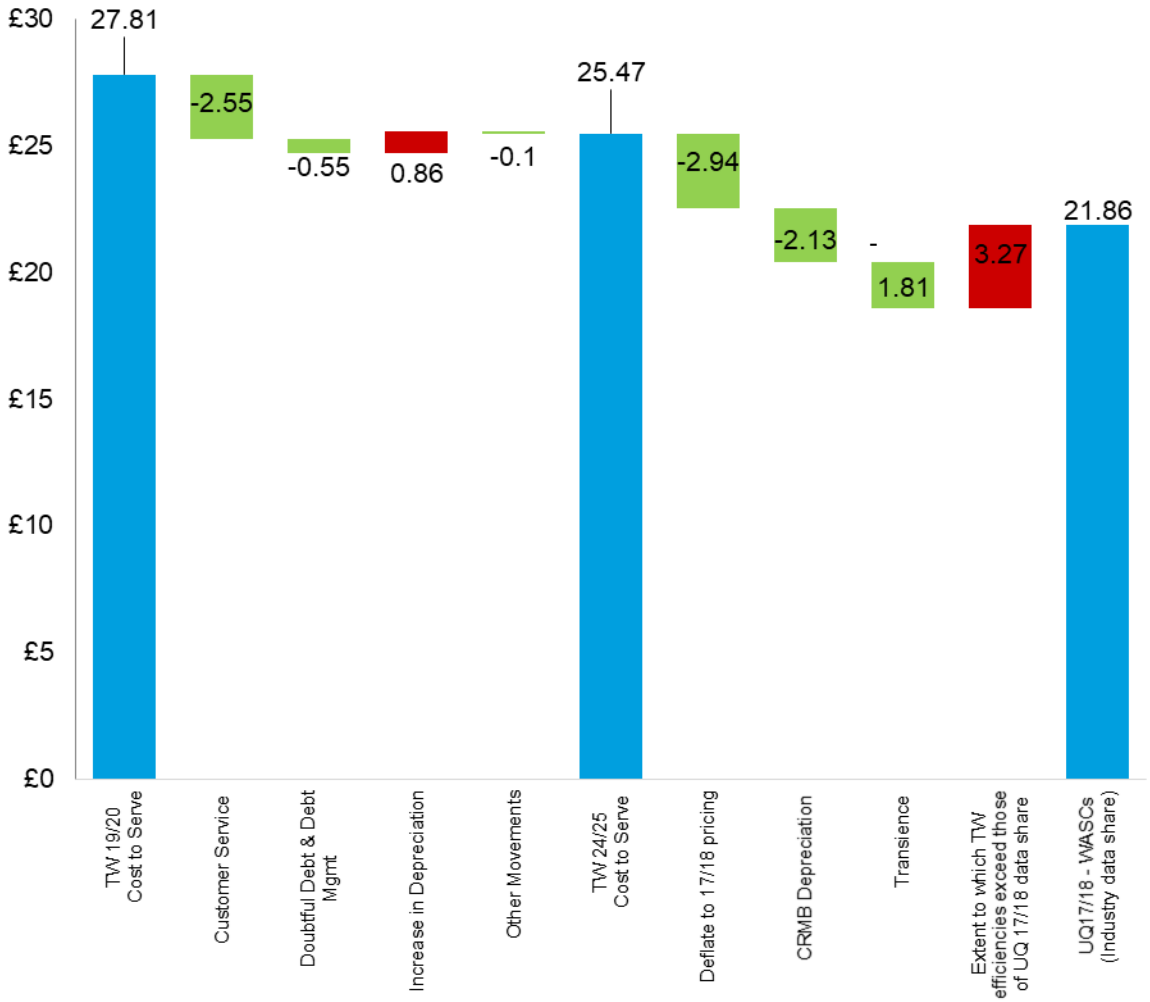
1.37 We are currently testing our new CRMB system and plan to migrate customers to this system in controlled stages over the next few years as we have already made the majority of investment, our costs will be higher to cover the depreciation associated with the system. We have therefore submitted a cost adjustment claim (CSD_RR_01). This is therefore shown as an adjusting factor ('CRMB depreciation') when we consider our expected benchmarking performance in 2024/2025.

1.38 Our region has the highest level of transience in the industry (50% more than the average, as estimated by Edge Analytics)[38]. This increases our costs in two main ways – firstly, our operating costs increase with the greater number of home move transactions, secondly, bad debt costs increase because it is more difficult to identify occupation, chase and collect debt from such households (higher debt management costs) and it results in more frequent levels of debt remaining on accounts when customers have vacated (higher debt write offs). Our cost adjustment claim reference CSD_RR_02 provides further detail.

1.39 When we account for these, we expect our cost to serve performance to align to upper quartile (as per 2017/18 data and using the same economy of scope assumption) by 2024/25. **When we adjust for inflation, then we outperform upper quartile for 17/18** – although we recognise that upper quartile will improve over time for the industry[39]. See Figure 6.

[38] Thames Water, CSD006-RR02-PR19-Population Transience
[39] Thames Water, PCD1-PR19-Retail

Figure 6 Retail cost to serve benchmarking (outturn costs)



Source: Thames Water analysis

1.40 We have also considered our efficiency programme against the 'Full Potential' activity analysis which gave an efficiency range of £20-25m per year. Our programme achieves the top end of this range by the end of AMP7[40].

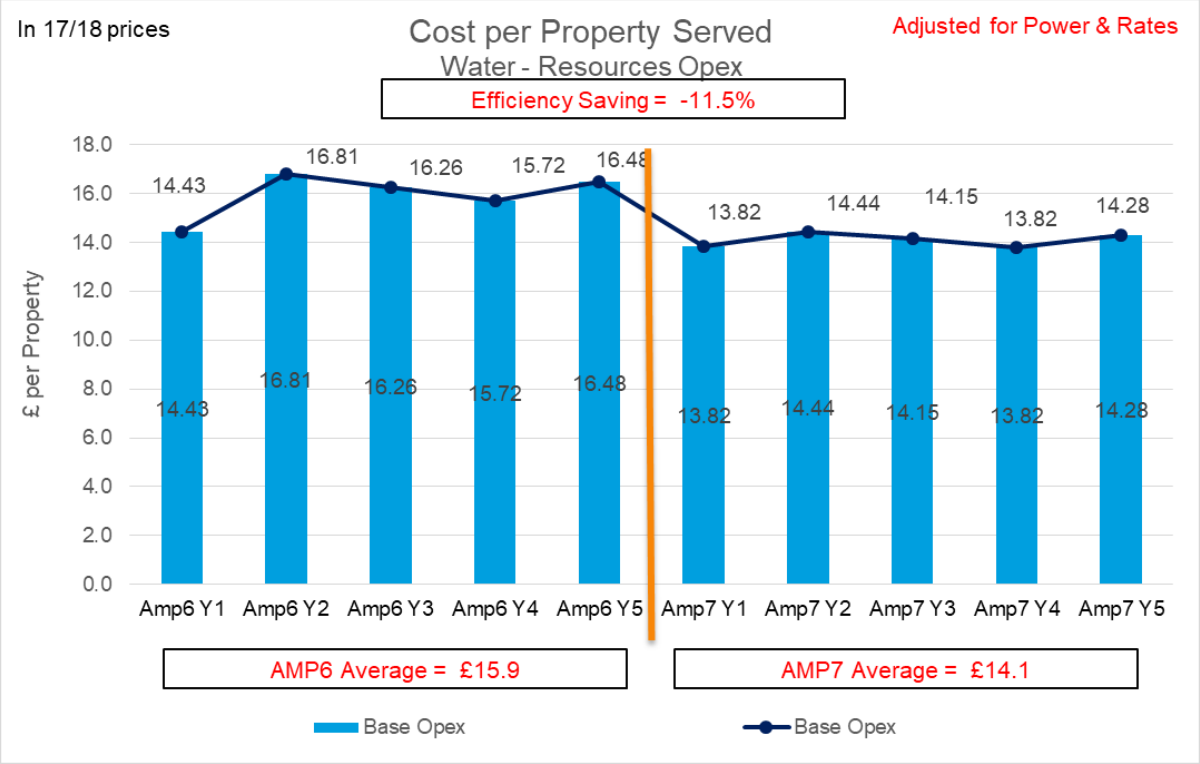
[40] Thames Water analysis

B3 Water Resources price control

OVERALL UNIT COST PER PROPERTY

1.41 Overall our unit costs for Water Resources are forecast to decrease by 11.5% between AMP6 and AMP7, as shown in Figure 7, when power price and rates are held at AMP6 levels. This decrease in unit costs is primarily driven by reduced power consumption, achieved through our investment in more efficient pumps and improved control systems at boreholes, lowering start/stop volumes.

Figure 7 Actual and forecast cost per property served overtime – water resources (17/18 Prices)



Source: Thames Water analysis

Table 7 Opex efficiency calculations – water resources

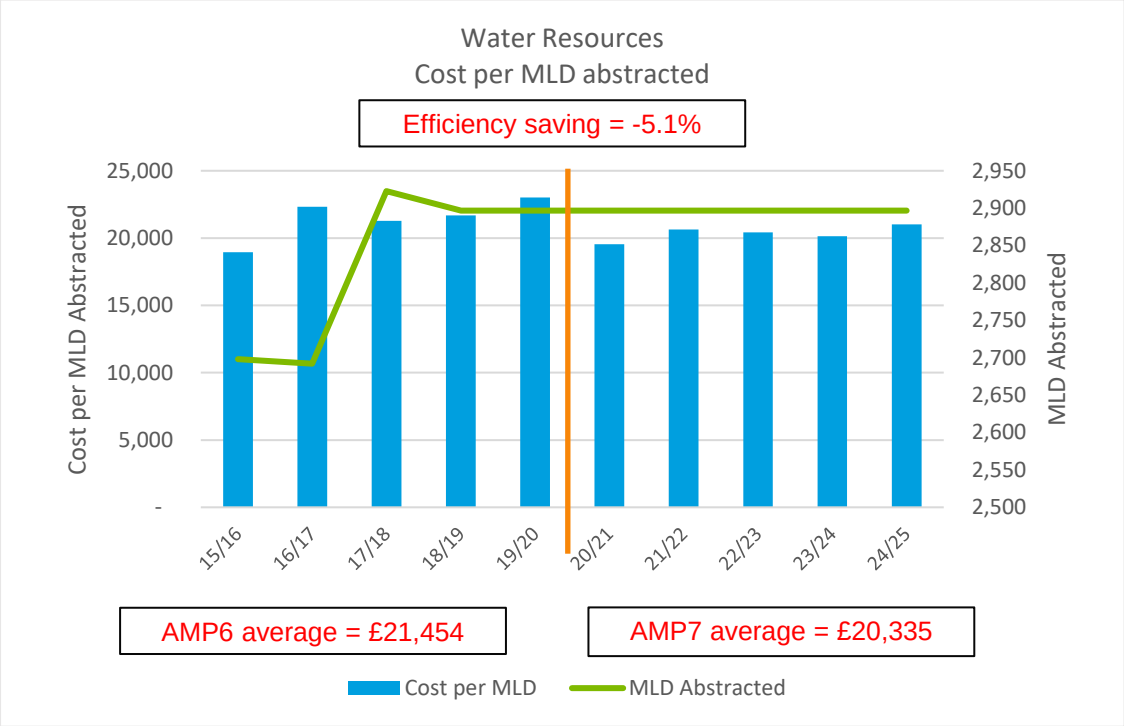
Efficiency calculation method	Unadjusted (%)	Adjusted (%)
Average AMP6 to Average AMP7	-5.8%	-11.5%
CAGR over AMP7	1.0%	0.6%
Y5 AMP6 to Y5 AMP7 exit	-7.3%	-13.4%
Y3 AMP6 to average AMP7	-7.1%	-13.2%

Source: Thames Water analysis

KEY COST DRIVERS AND EFFICIENCY LEVERS

1.42 The most material volume driver for Water Resources is the cost per MLD abstracted, which is driven by power costs in this area. The cost per MLD abstracted is planned to reduce by 5.1% between AMP6 and AMP7 (Figure 8).

Figure 8 Actual and forecast cost per MLD abstracted for water resources (17/18 Prices)



Source: Thames Water analysis

1.43 The key initiatives delivering this improvement relate to power consumption reductions – we are investing in more efficient pumps to improve **transaction efficiency** and improving controls systems at boreholes by lowering start/stop volumes and power intensity through **automation**. These improvements are offsetting other upward cost drivers in this area which vary through the AMP and therefore give a fluctuating cost per MLD abstracted through AMP7.

BENCHMARKS

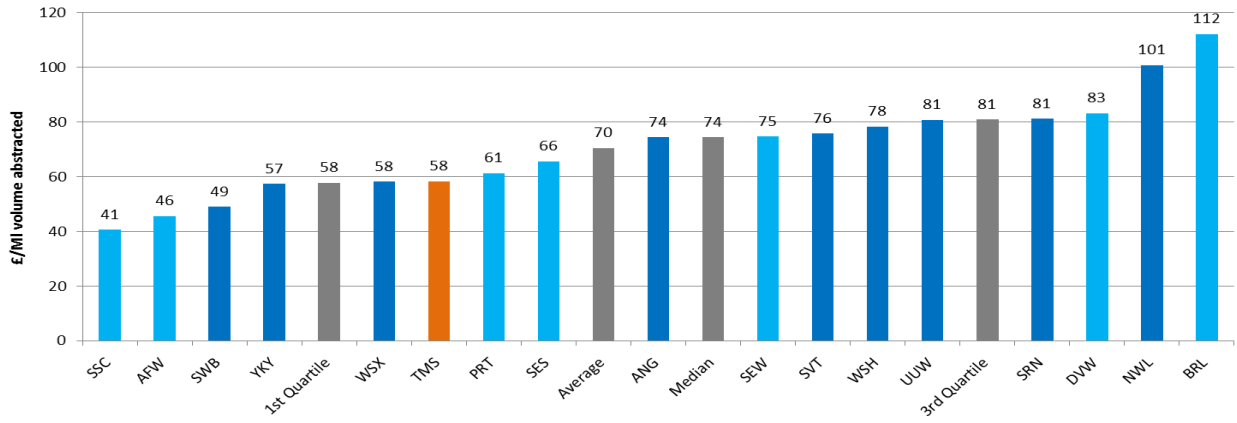
1.44 We have benchmarked our Water Resources performance to the wider industry, which shows that we are at upper quartile efficiency for Water Resources opex as measured against per ML volume abstracted. See Figure 9.

1.45 AMP7 average costs are 13.2% below the level for 2017/18, with which we expect to move beyond upper quartile in AMP7[41].

[41] Thames Water analysis

1.46 We have assessed our efficiency programme against the 'Full Potential' activity analysis across Wholesale Water as a whole (as the analysis was not performed by price control) – see the Treated Water Distribution benchmarking section.

Figure 9 Water resources unit cost benchmarking to wider industry, 2017-18 (17/18 Prices)



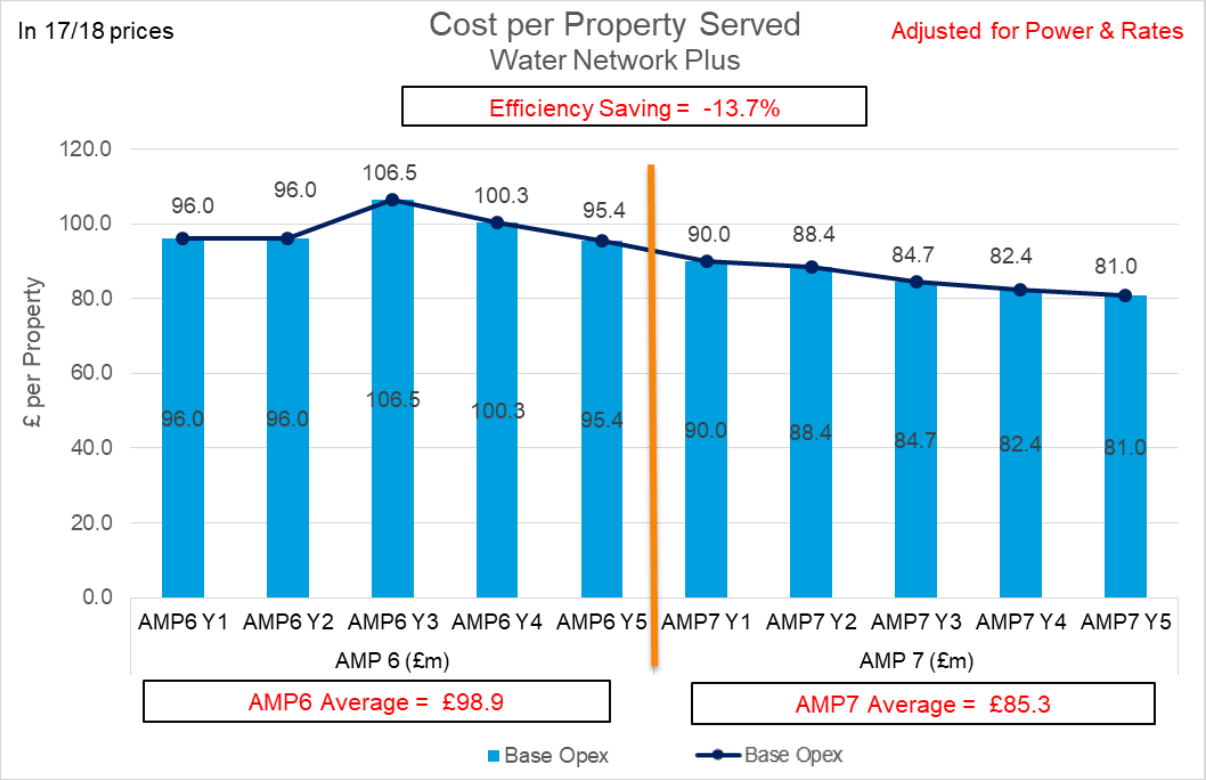
Source: Thames Water analysis

B4 Water Network Plus price control

OVERALL UNIT COST PER PROPERTY

1.47 Water Network Plus annual unit costs are forecast to reduce by 13.7% between AMP6 and AMP7, as shown in Figure 10, when power price and rates are held at AMP6 levels. The drivers for this are reducing unit costs in both water treatment and treated water distribution.

Figure 10 Actual and forecast cost per property served over time – Water Network Plus (17/18 Prices)



Source: Thames Water analysis

Table 8 Opex efficiency calculations – water network plus

Efficiency calculation method	Unadjusted (%)	Adjusted (%)
Average AMP6 to Average AMP7	-8.9%	-13.7%
CAGR over AMP7	-1.3%	-2.1%
Y5 AMP6 to Y5 AMP7 exit	-5.1%	-15.1%
Y3 AMP6 to average AMP7	-15.9%	-19.9%

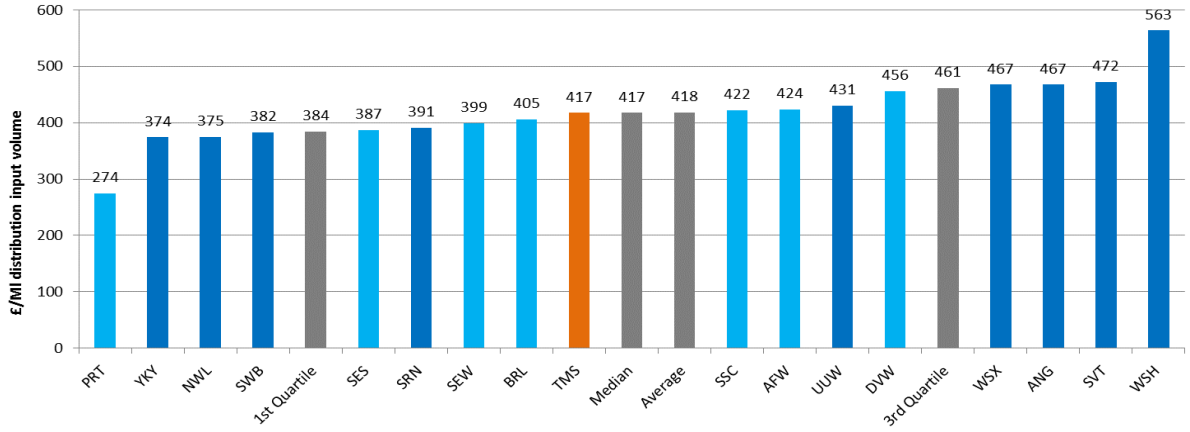
Source: Thames Water analysis

1.48 The Water Network Plus price control relates primarily to Water Treatment and Treated Water Distribution opex (making up 98% of the total opex costs[42]), which have distinctly different cost drivers and are therefore discussed separately.

BENCHMARKS

1.49 We have performed industry wide benchmarking of unit costs based on the 2017/18 annual performance reports. In Water Network Plus, we are around average as shown in Figure 11. However, we consider benchmarks in this area to be more relevant at a sub-price control level.

Figure 11 Water network plus benchmarking to the wider industry, 2017-18 (17/18 Prices)



Source: Thames Water analysis

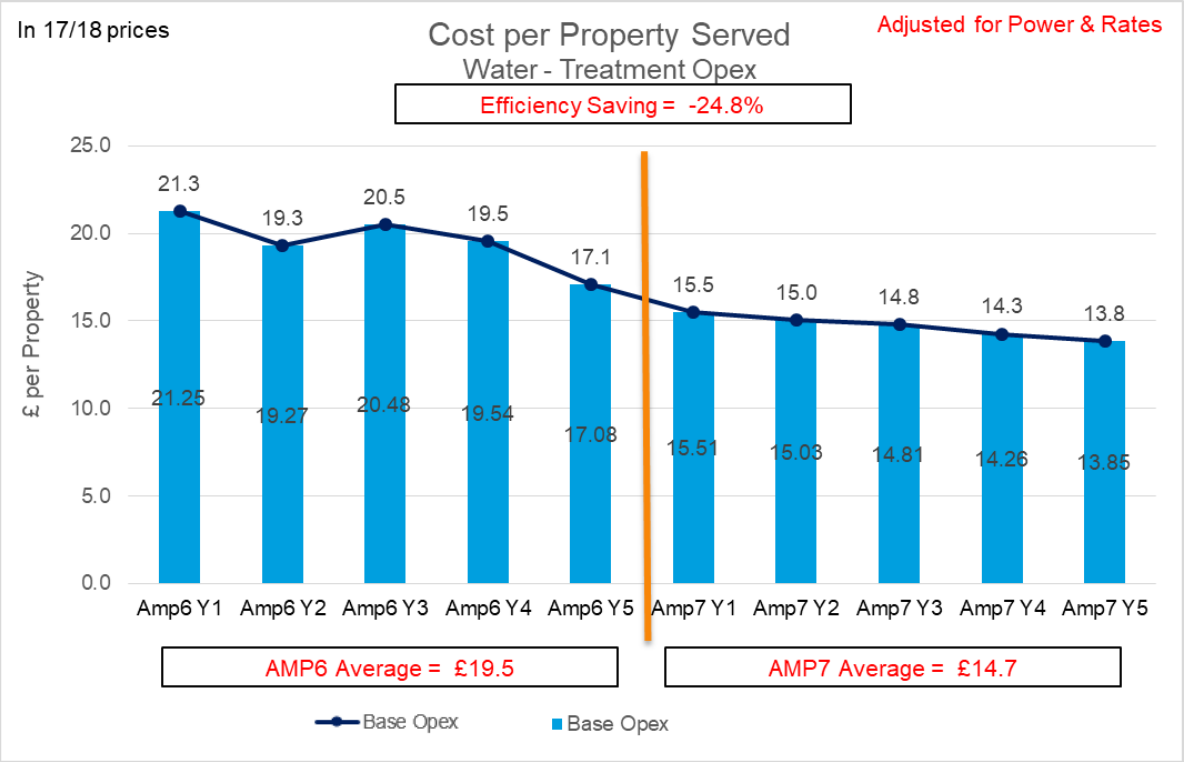
WATER TREATMENT SUB PRICE CONTROL

OVERALL UNIT COST PER PROPERTY

1.50 Our Water Treatment opex costs per property are forecast to fall by 24.8%[43] between AMP6 and AMP7 (Figure 12).

[42] Thames Water analysis
[43] Thames Water analysis

Figure 12 Actual and forecast cost per property served over time – water treatment (17/18 Prices)



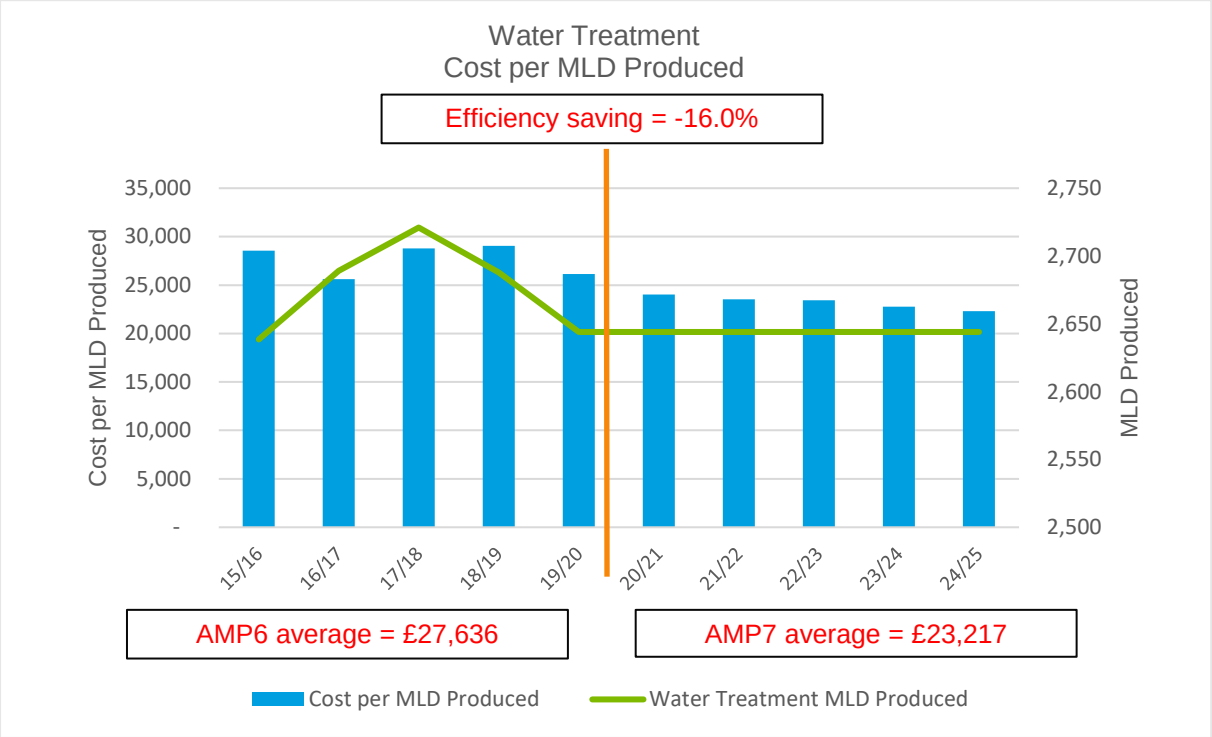
Source: Thames Water analysis

KEY COST DRIVERS AND EFFICIENCY LEVERS

1.51 The key driver of Water Treatment costs is considered to be MLD volumes of clean treated water put into our network. We expect cost per MLD produced to fall by 16.0% between AMP6 and AMP7 (see Figure 13). Volumes will reduce in AMP7 as we drive down leakage levels, with litres per property per day expected to fall by 10.5%[44]. This fall in volumes per household, together with the falling cost per MLD, is driving a lower water production cost per household.

[44] Thames Water analysis

Figure 13 Actual and forecast cost per MLD produced over time – water treatment (17/18 Prices)



Source: Thames Water analysis

1.52 The key initiatives which reduce costs per MLD produced relate to power and asset maintenance. Specifically:

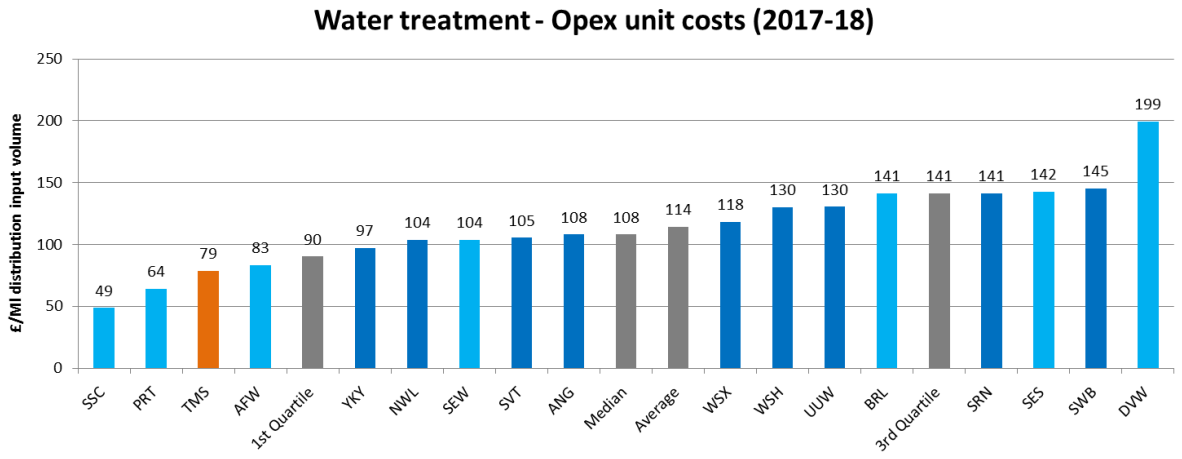
- Power optimisation – we will drive more efficient power consumption across production sites through improved performance management and production planning, using improved consumption reporting and **systems level analysis** – our overall power efficiency programme saves £31.2m in AMP7 across the Wholesale Water value chain[45]; and
- Proactive asset maintenance – increasing the level of proactive planned maintenance jobs – reducing the **unnecessary activity volumes** and cost of reactive maintenance and unplanned failures – saving £25.4m across Wholesale Water in AMP7[46].

BENCHMARKS

1.53 Our benchmarking analysis[47] indicates that Water Treatment unit costs (measured against MLD produced) were better than upper quartile efficiency in 2017/18 and we anticipate our efficiency initiatives to maintain or improve this in AMP7.

[45] Thames Water analysis
[46] Thames Water analysis
[47] Thames Water analysis

Figure 14 Water treatment opex unit cost benchmarking to wider industry, 2017-18 (17/18 Prices)



Source: Thames Water analysis

1.54 We have assessed our efficiency programme against the 'Full Potential' activity analysis across Wholesale Water as a whole – see Treated Water Distribution benchmarking section.

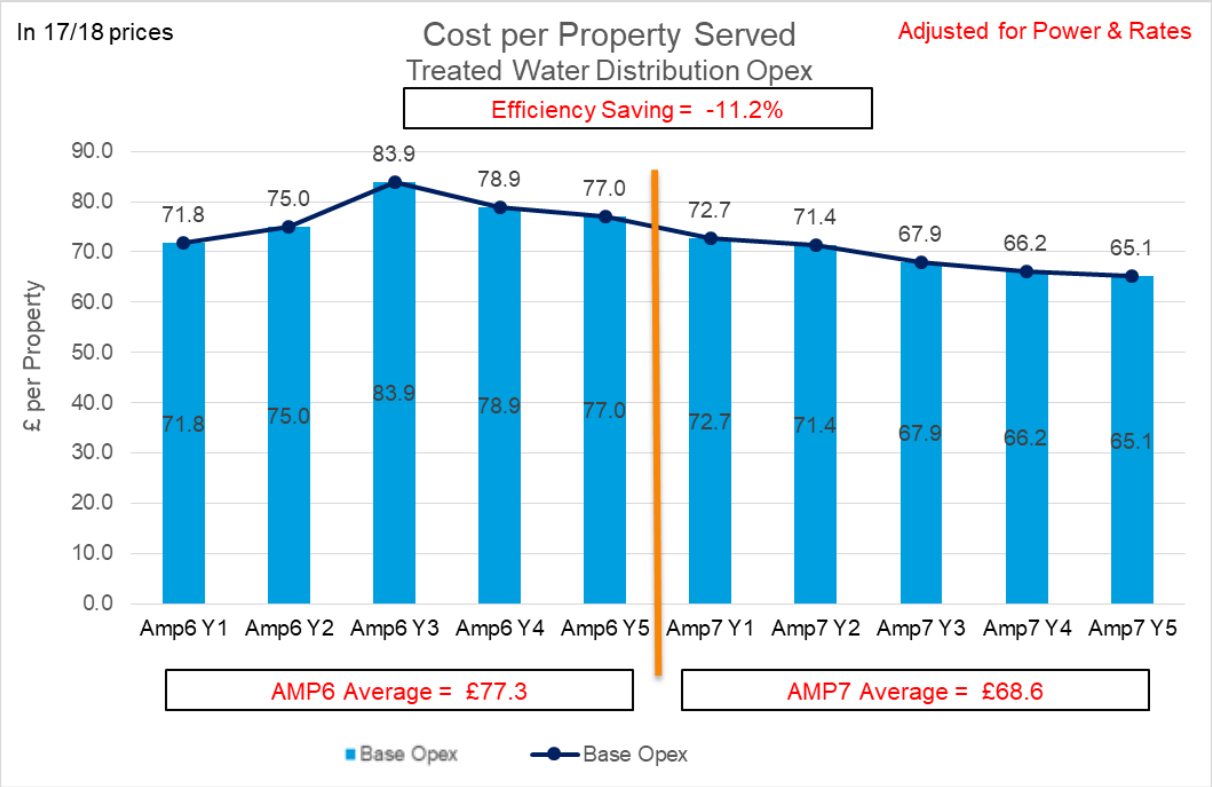
TREATED WATER DISTRIBUTION SUB PRICE CONTROL

OVERALL UNIT COST PER PROPERTY

1.55 Our treated Water Distribution unit costs are forecast to fall by 11.2% between AMP6 and AMP7 (see Figure 15), when power price and rates are held at AMP6 levels[48].

[48] Thames Water analysis

Figure 15 Actual and forecast cost per property served over time – Treated water distribution (17/18 Prices)



Source: Thames Water analysis

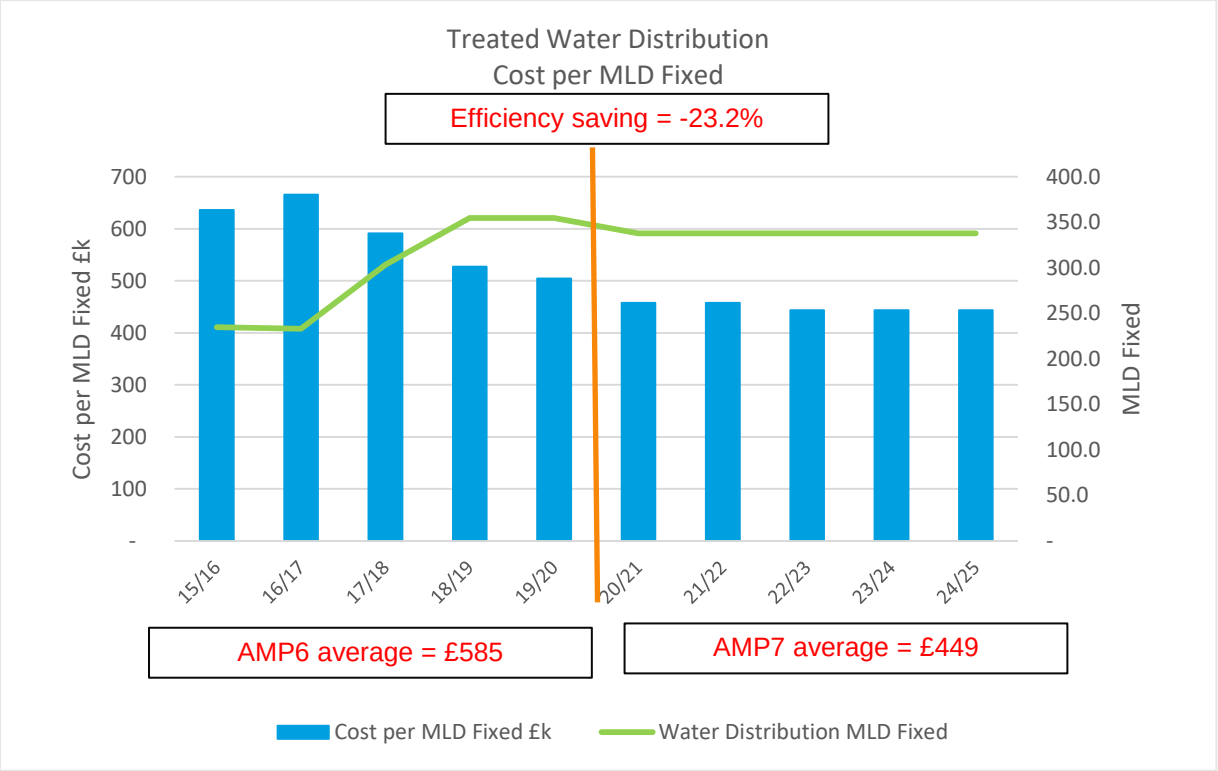
KEY COST DRIVERS AND EFFICIENCY LEVERS

1.56 Repair and maintenance (R&M) work to fix leaks makes up about one third of our total opex costs in this area. We manage this activity on a totex basis (as the overall repair activity is the same, but depending on the size and type of repair, some of the costs are opex and some are capex) – the volume driver being MLD repaired. We consider volumes of leaks repaired to be the most material driver of costs in this price control and we monitor totex cost per MLD as a key measure of our efficiency in this area.

1.57 We expect totex cost per MLD fixed to reduce by 23.2% between AMP6 and AMP7 (see Figure 16) for our base level of activity.[49]

[49] Thames Water analysis

Figure 16 Actual and forecast cost per MLD fixed over time – Treated water distribution (17/18 Prices)



Source: Thames Water analysis

1.58 Our costs in the first half of AMP6 were affected by issues in the implementation of our Infrastructure Alliance which meant that we were inefficient – we have already committed that customers will not bear any of the impact of these inefficient costs through our settlement as part of Ofwat leakage investigation. We have a major efficiency programme underway to resolve these issues and drive efficiency in AMP6 and AMP7. Excluding inefficiencies from AMP6 our cost per MLD still reduces by 13% from AMP6 to AMP7[50].

1.59 Our cost reductions in this area are being achieved through a major water network efficiency programme aimed at targeting the underlying cost drivers – doing the right work, doing it efficiently first time, and with the right enabling technology. The programme started in 2017/18 and includes the following:

- A major overhaul of management and governance structure – with decisions made using improved **systems level analysis**;

[50] Thames Water analysis

- Changed contracts with key suppliers, with improved terms and more alignment of rewards to outcomes, alongside better performance management and training to improve productivity – **helping us manage resources better to meet demand;**
- One visit – right first time – improving our processes and IT systems and training our staff to resolve issues first time – **increasing transactional efficiency and unnecessary activity volumes;** and
- Investment in new technology such as acoustic loggers to reduce the cost of detecting leaks, through **automation**.

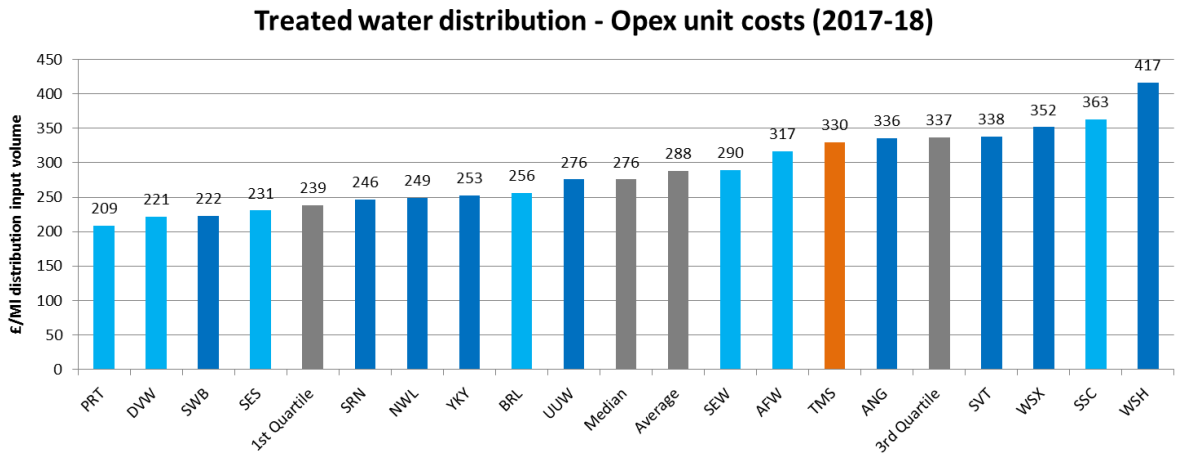
1.60 Taken together, the efficiency initiatives drive incremental annual opex savings of £21.9m in Years 4 and 5 of AMP6, with further annual savings of £4.8m by Year 5 of AMP7[51].

BENCHMARKS

1.61 For 2017/18, our industry benchmarking shows that we were between average and third quartile efficiency for Treated Water Distribution opex – as measured by cost per volume distributed.

1.62 This benchmarking does not reflect the major impact of our efficiency programme, which only started in 2017/18 – we expect this programme to move us to between median and upper quartile by the end of AMP7.

Figure 17 Water treatment opex unit cost benchmarking to wider industry, 2017-18 (17/18 Prices)



Source: Thames Water analysis

1.63 Our efficiency programme across all of our Water value chain delivers more than the potential target range of savings identified by the 'Full Potential' benchmarking review of activities in this area, exceeding £50m per year (including efficiencies for leakage repair and maintenance capex related activity)[52].

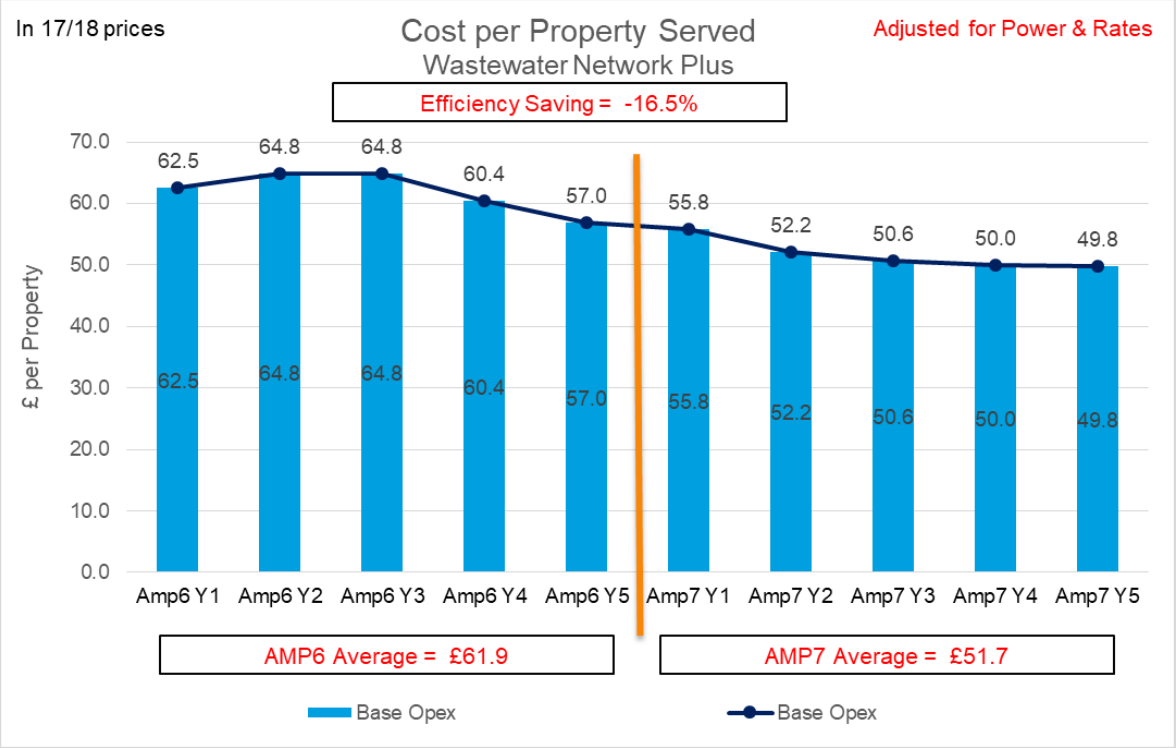
[51] Thames Water analysis
[52] Thames Water analysis

B5 Wastewater Network Plus price control

OVERALL UNIT COST PER PROPERTY

1.64 Overall our unit costs for Wastewater Network Plus are forecast to reduce by 16.5% between AMP6 and AMP7, as shown in Figure 18, when power price and rates are held at AMP6 levels. The Wastewater Network Plus price control relates to Sewage Collection and Waste Treatment, which have distinctly different cost drivers and are discussed separately below.

Figure 18 Actual and forecast cost per property served overtime – wastewater network plus (17/18 Prices)



Source: Thames Water analysis

Table 9 Opex efficiency calculations – wastewater network plus

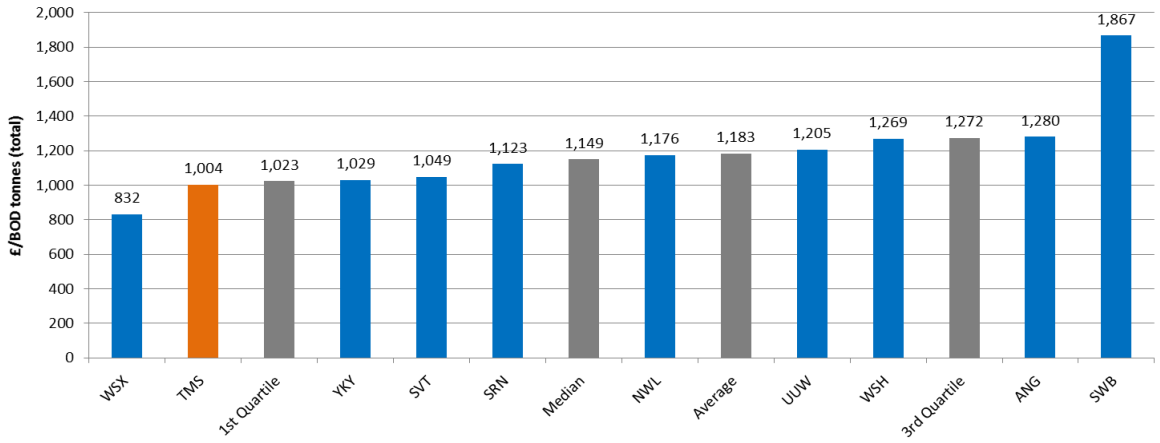
Efficiency calculation method	Unadjusted (%)	Adjusted (%)
Average AMP6 to Average AMP7	-12.0%	-16.5%
CAGR over AMP7	-2.3%	-2.2%
Y5 AMP6 to Y5 AMP7 exit	-9.4%	-12.5%
Y3 AMP6 to average AMP7	-15.3%	-20.2%

Source: Thames Water analysis

BENCHMARKS

1.65 We have benchmarked our Wastewater Network Plus unit costs to the wider industry, which shows that our unit cost performance is in the upper quartile. However, as noted above, we consider it more appropriate to view benchmarks at the sub-price control level.

Figure 19 Wastewater network plus unit cost benchmarking to the wider industry, 2017-18 (17/18 Prices)



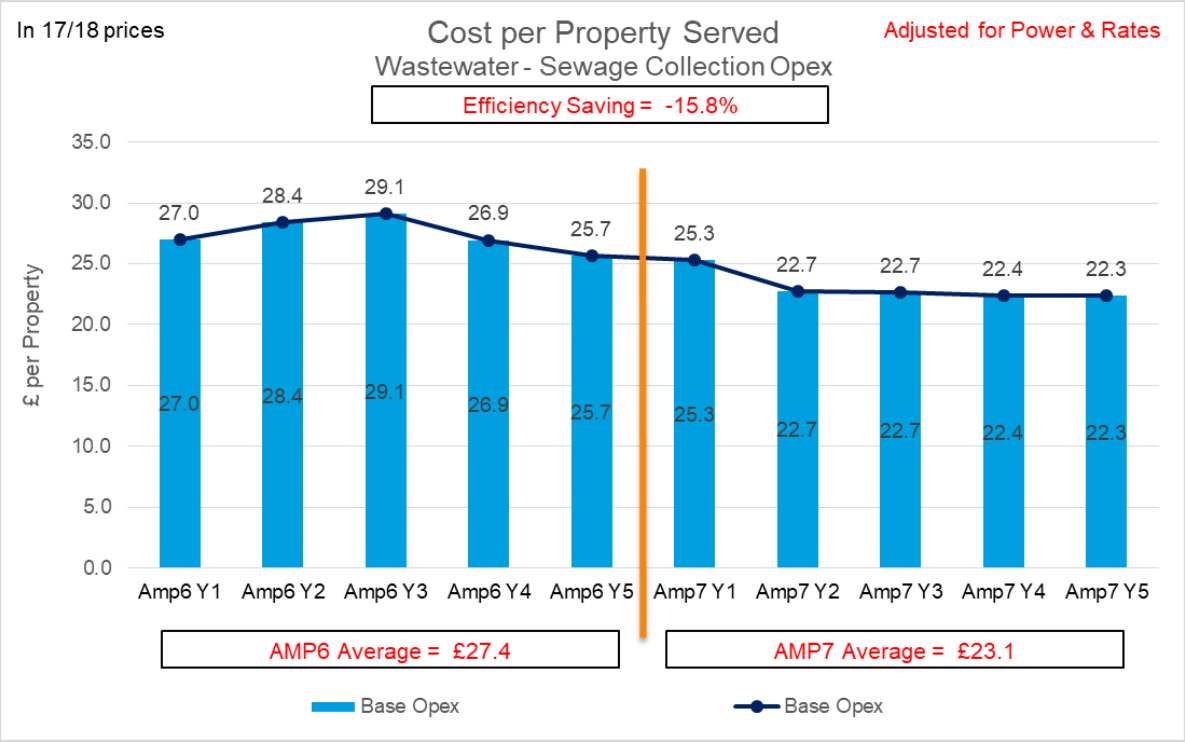
Source: Thames Water analysis

SEWAGE COLLECTION SUB PRICE CONTROL

OVERALL UNIT COST PER PROPERTY

1.66 Our Sewage Collection annual unit costs are forecast to fall by 15.8% between AMP6 and AMP7, when power price and rates are held at AMP6 levels (Figure 20).

Figure 20 Actual and forecast cost per property served overtime – Sewage collection (17/18 Prices)



Source: Thames Water analysis

KEY COST DRIVERS AND EFFICIENCY LEVERS

1.67 We consider the key overall cost driver for sewage collection to be households or volumes as measured by 'Population Equivalent' – this metric is in line with the cost per household measures noted above.

1.68 Our efficiency programme is targeted at the underlying cost drivers set out below which includes the optimal mix of proactive to reactive work, productivity improvements through doing work right first time and using data and technology to target the right work.

1.69 We plan to achieve this through the following initiatives:

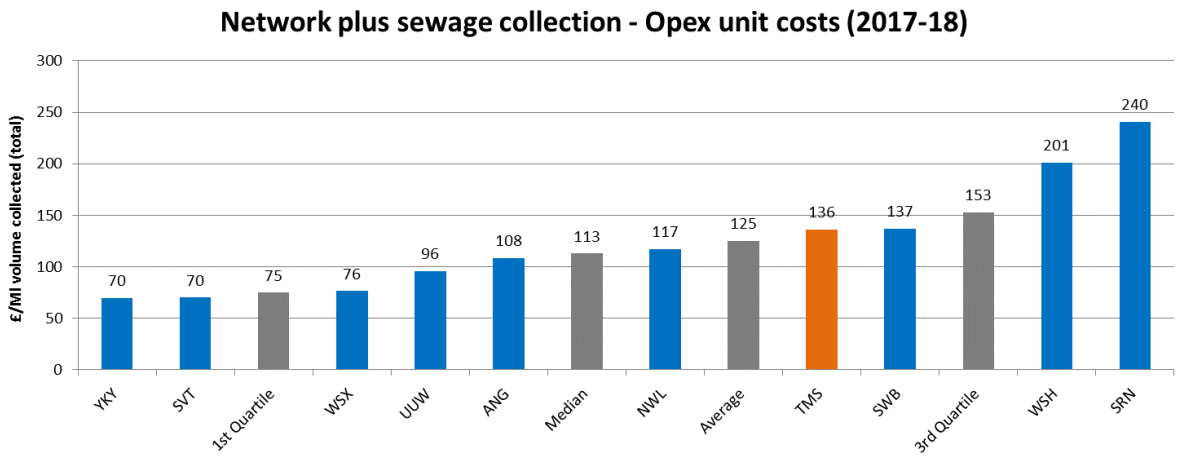
- Shift from a reactive to a proactive operational model to **remove unnecessary activity volumes** of reactive work and asset failures;
- Use **digitisation and automation** to target work, including the use of predictive analytics – enabling the reduction in unnecessary volumes;
- Procure a new Wastewater Network Services contract from 2020, which will align our third party suppliers to this new model in commercial terms, as well as allowing us to bring more work in house – allowing us to **manage resources better to meet demand**; and
- Drive process **automation** through deployment of a new Work Management System. This will ensure work is better planned and enabled with the right information – reducing the amount of repeat visits at customer properties and improving journey times.

1.70 The above initiatives deliver AMP7 savings of £40m across our sewage collection sub-price control.[53]

BENCHMARKS

1.71 For 2017/18 our opex benchmarking shows that we were less efficient than the industry average measured against volume collected (Figure 21). This year was the highest in cost terms across all of AMP6 and our plan will reduce costs by 20.6% in AMP7 (average) versus 2017/18 levels[54]. We expect this to bring us to a materially more favourable position against industry benchmarks.

Figure 21 Sewage collection opex unit cost benchmarking to the wider industry, 2017-18 (17/18 Prices)



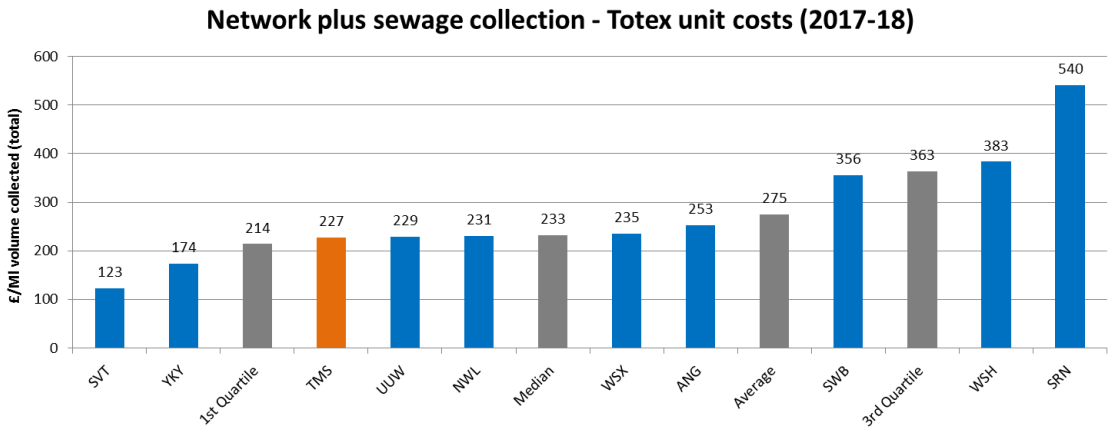
Source: Thames Water analysis

1.72 However, sewage collection activity also involves the optimisation of capital maintenance and opex to drive down overall costs. Therefore we believe for this price control a totex benchmark is more relevant.

1.73 Our totex costs in 2017/18 were close to upper quartile efficiency compared to the industry (see Figure 22).

[53] Thames Water analysis
[54] Thames Water analysis

Figure 22 Sewage collection totex unit cost benchmarking to the wider industry, 2017-18 (17/18 Prices)



Source: Thames Water analysis

1.74 Our efficiency programme across all of our Waste value chain totals £37m per year by mid-AMP7 and £45m per year by the end of AMP7. This compares to the 'Full Potential' range of £30m to £45m identified in our activity based benchmarking[55].

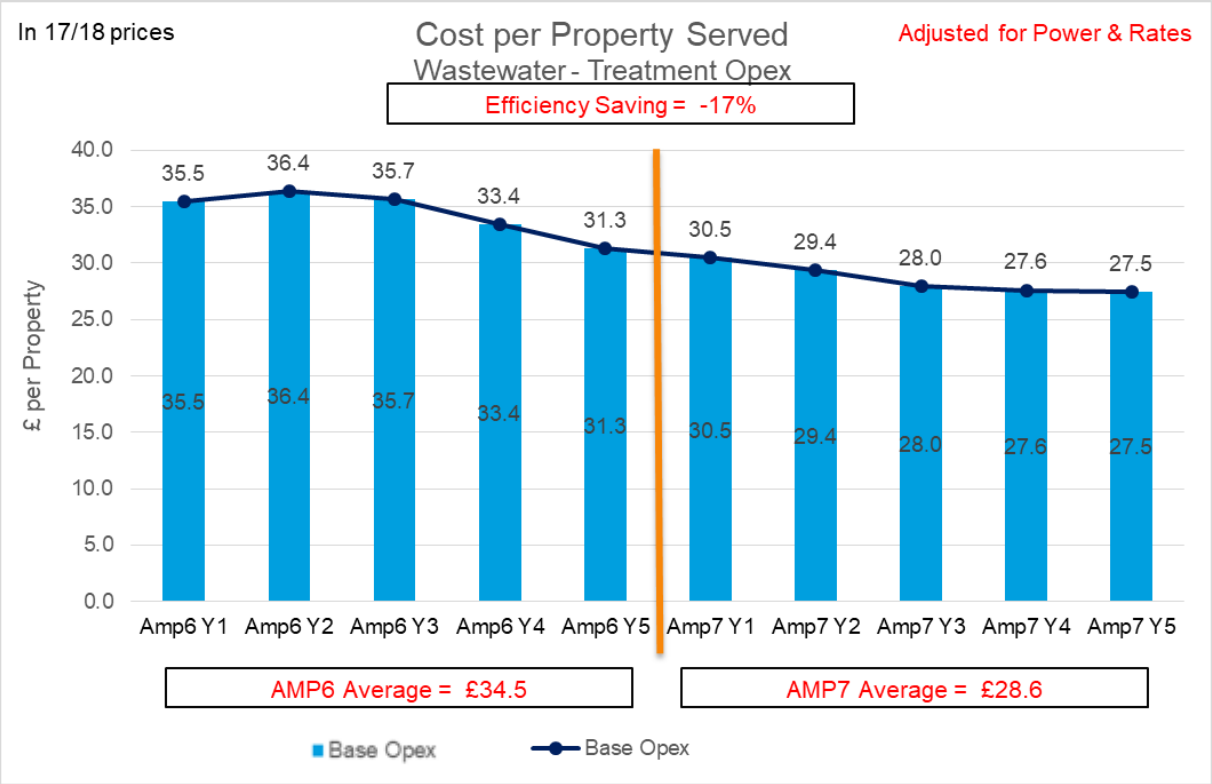
WASTEWATER TREATMENT SUB PRICE CONTROL

OVERALL UNIT COST PER PROPERTY

1.75 Our Waste Treatment annual unit costs are forecast to fall by 17.0% between AMP6 and AMP7 (see Figure 23), when power price and rates are held at AMP6 levels[56].

[55] Thames Water analysis
[56] Thames Water analysis

Figure 23 Actual and forecast cost per property served overtime – Wastewater treatment (17/18 Prices)



Source: Thames Water analysis

KEY COST DRIVERS AND EFFICIENCY LEVERS

1.76 We consider the key overall cost driver for waste treatment to be households or volumes as measured by 'Population Equivalent' – these metrics are in line with the cost per household measures noted above.

1.77 The Wastewater Treatment business has been on a transformation journey since AMP6, with a focus on LEAN manufacturing principles to drive out wastage and ensure sites not only comply with regulatory and environmental requirements, but also operate at optimum cost and performance levels. The cost drivers targeted by this programme are unnecessary volumes throughout the treatment process and process costs which differ to the 'design standard' for our treatment plans.

1.78 Our waste treatment efficiency programme includes the following key initiatives :

- Reducing energy consumption from process automation and better process controls to **reduce unnecessary activity volumes and improve transaction efficiency**;
- Reducing chemical volumes by upskilling site staff to understand and optimise dosage rates and by **automating** where possible;
- Reducing equipment hire costs and tankering by making process improvements that **reduce unnecessary volumes**, purchasing, rather than hiring, where more cost efficient and optimising tanker routes and capacity;

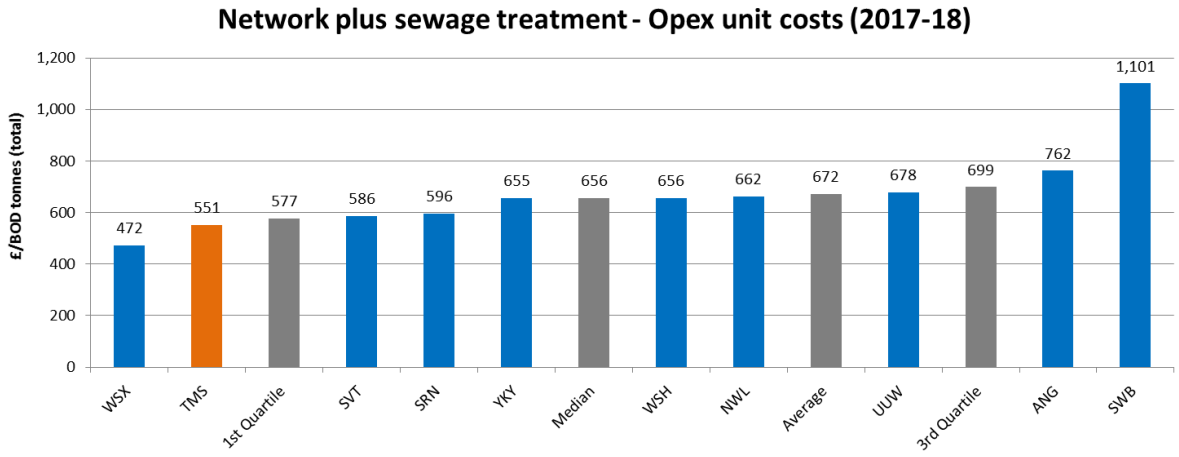
- Recycling more, to reduce skip and landfill costs; and
- Improving workforce productivity – through enhanced workforce management capability, giving us real-time insight of where our engineers are so we can **manage resources better to meet demand** through improved utilisation.

1.79 The above initiatives drive £63m of savings across AMP7 for Waste treatment activity[57].

BENCHMARKS

1.80 Our benchmarking analysis shows that we are upper quartile on Waste Treatment when compared to the wider industry and we expect to further improve our position with our efficiency programme continuing into AMP7 (Figure 24).

Figure 24 Sewage treatment unit cost benchmarking to wider industry, 2017-18 (17/18 Prices)



Source: Thames Water analysis

1.81 Our efficiency programme also exceeds the levels set out in the 'frontier efficiency' process review across Waste overall as set our earlier in this document.

[57] Thames Water analysis

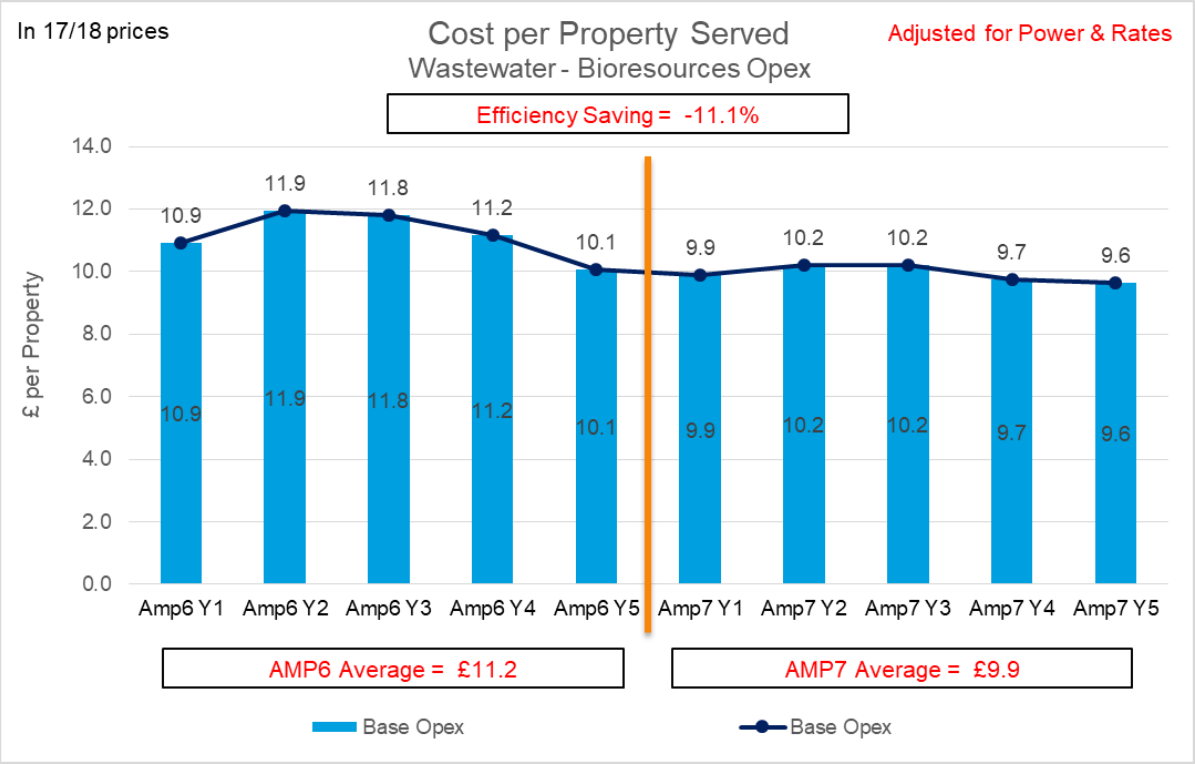
B6 Bioresources

OVERALL UNIT COST PER PROPERTY

1.82 Overall our unit costs for Bioresources are forecast to fall by 11.1% between AMP6 and AMP7, as shown in Figure 25, when power price and rates are held at AMP6 levels.

1.83 This is mainly driven by efficiencies in generation and process improvement – these deliver a £14m benefit over AMP7[58].

Figure 25 Actual and forecast cost per property served overtime – bioresources (17/18 Prices)



Source: Thames Water analysis

[58] Thames Water analysis

Table 10 Opex efficiency calculations – bioresources

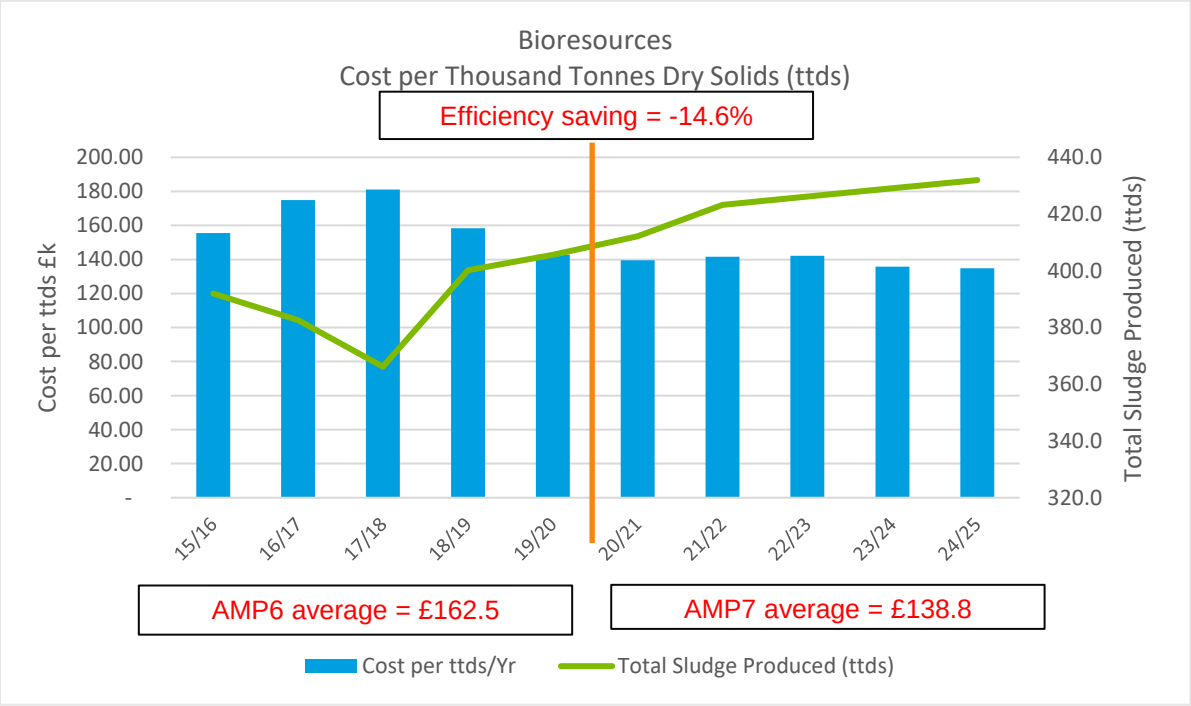
Efficiency calculation method	Unadjusted (%)	Adjusted (%)
Average AMP6 to Average AMP7	-18.4%	-11.1%
CAGR over AMP7	-0.8%	-0.5%
Y5 AMP6 to Y5 AMP7 exit	-11.0%	-4.3%
Y3 AMP6 to average AMP7	-23.6%	-15.8%

Source: Thames Water analysis

KEY COST DRIVERS AND EFFICIENCY LEVERS

1.84 We consider the key overall cost driver for bioresources to be volumes as measured by thousand tonnes of dry solids. The cost per volume on this measure falls by 14.6% on average between AMP6 and AMP7 (Figure 26).

Figure 26. Bioresources cost per ttds, actual and forecast over AMP6 and AMP7 (17/18 Prices)



Source: Thames Water analysis

1.85 The key underlying cost drivers in this area relate to generation optimisation and process time efficiency, and our efficiency programme targets these areas.

1.86 We will improve generation and process efficiency as we bring more Thermal Hydrolysis Process plants online, which use advanced anaerobic digestion, and as we replace our Combined Heat and Power plants.

1.87 We will also improve our cakes storage facilities preventing weather deterioration in the quality of our product, and we are replacing dewatering plants to drive efficiency in this part of the process.

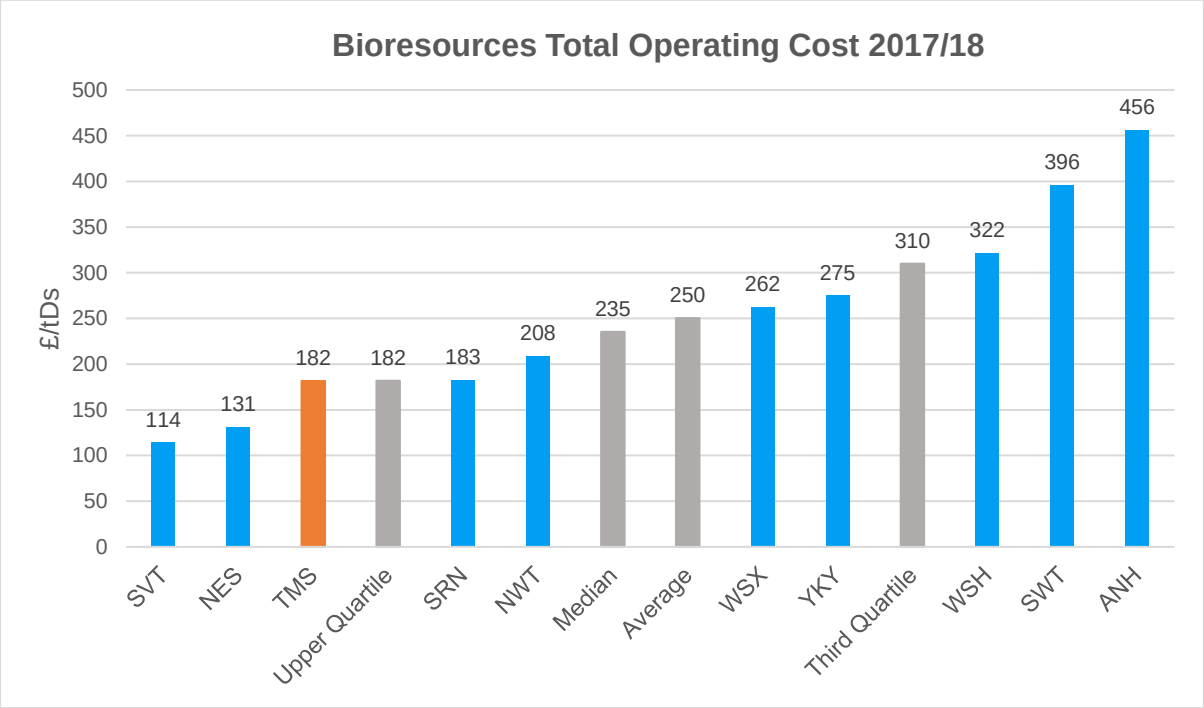
BENCHMARKS

1.88 For 2017/18 our benchmarking shows that we were better than upper quartile efficiency for bioresources. Our average over this period is £182 per tonne of dry solid (tDs) compared to an industry average of £250 per tDS[59]. Our assets are predominately digestion based and so we have been able to offset some of our costs through more electricity generation. See Figure 27.

1.89 We note that in this benchmarking analysis we have taken a more holistic approach to the costs that a company would incur in treating and disposing of their sludge by normalising on a £ per dry tonne basis, including the cost of sludge liquor treatment, which normally sits in the Waste Network Plus Price Control.

1.90 We have also assessed our efficiency programme against the 'Full Potential' activity analysis across Wholesale Waste as a whole – see Network Plus Sewage Collection benchmarking section.

Figure 27 Bioresources unit cost benchmarking with wider industry, 2017-18 (17/18 Prices)



Source: Thames Water analysis

[59] Thames Water analysis

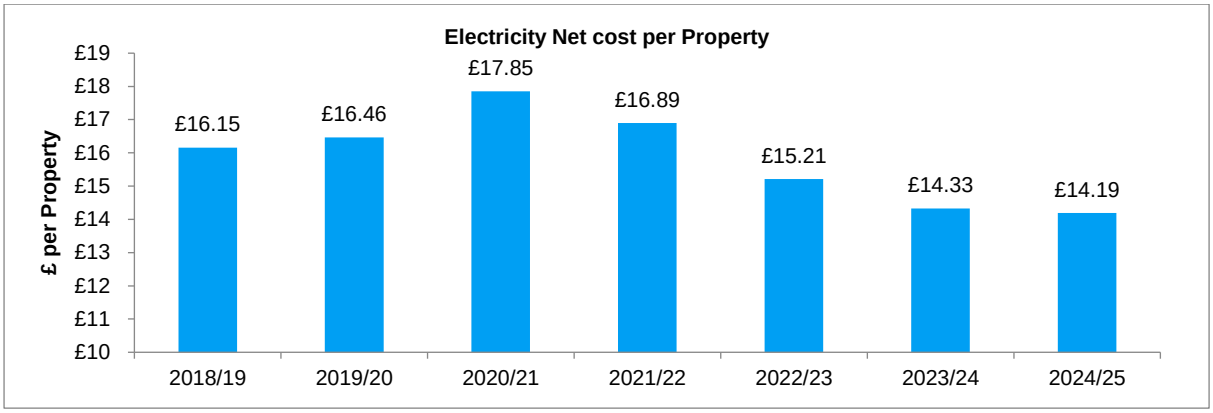
B7 Power Opex (across all price controls)

OVERALL UNIT COST PER PROPERTY

1.91 Power is fundamental to a wide range of our activities across both the water and wastewater value chains. £541m of our total AMP7 opex relates to electricity purchases. Power income from renewable incentives is forecast to be over £42m[60].

1.92 Our power cost is dervied from **volumes** consumed multiplied by **power purchase cost** less **self generation.**

Figure 28 Electricity net cost per property (17/18 Prices)



Source: Thames Water analysis

KEY COST DRIVERS AND EFFICIENCY LEVERS

1.93 We have an integrated power plan for AMP7 across all parts of our business which drives energy efficiency savings across all three core drivers of cost:

- We will **use less** to reduce volumes – reducing the energy intensity of what we do by 22% by the end of AMP7[61];
- We will **pay less** in our power purchase pricing (to partly offset overall market price increases) **–** through using energy at the most cost effective time; and
- We will **self generate more,** allowing us to buy less expensive energy from the grid.

1.94 Examples of how we will deliver the above strategy, and the financial benefit, are given below.

[60] Thames Water analysis
[61] Thames Water analysis

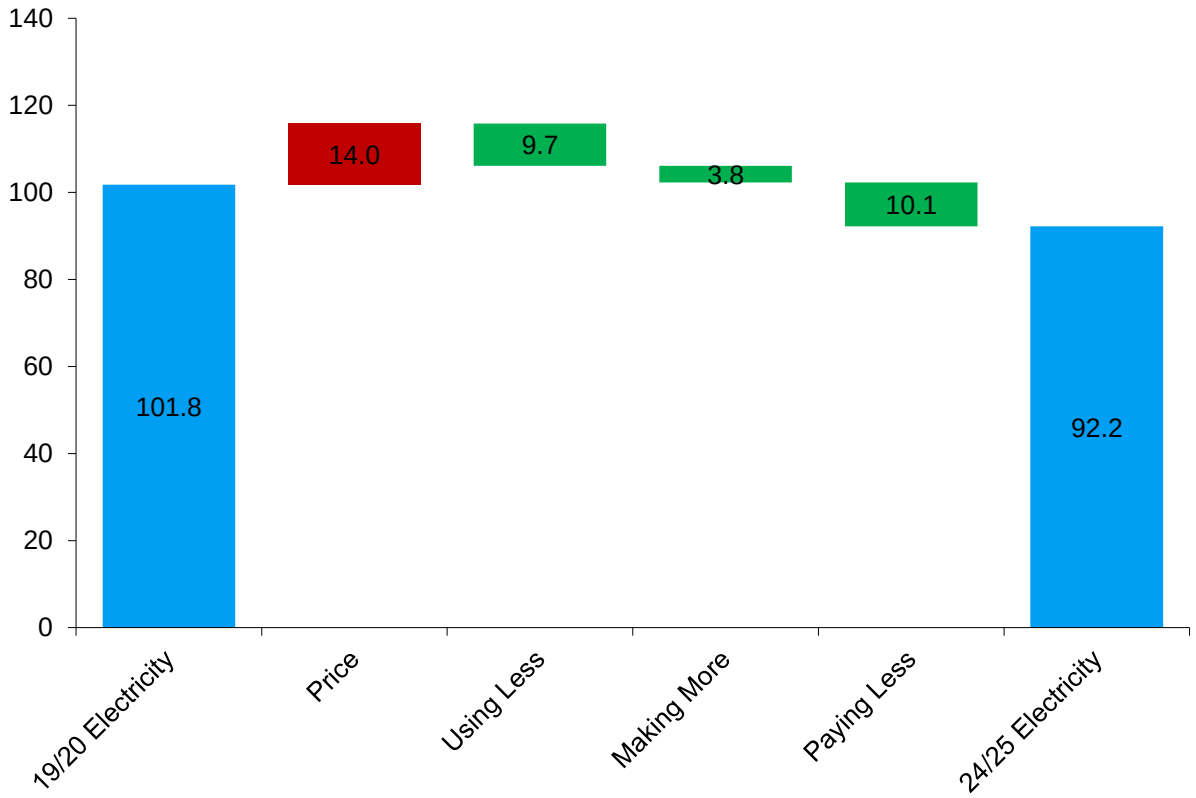
Table 11 Summary of power efficiency initiatives over AMP7

	Intiatives to be implemented over AMP7	Potential savings over AMP7
Using Less	• Installing new pumps and optimising pumping systems; • Having a optimal water production mix; and • Using data to improve processes e.g. at Mogden STW we now use sub-metering data to optimise our use of blowers reducing energy consumption by 12%.	£9.7m per year in reduced consumption (Year 5 AMP6 versus Year 5 AMP7).
Paying Less	• Relocating battery storage closer to self-generation sites; and • Optimising time-of-use to reduce price.	£10.1m per year in lower prices paid by end of AMP7.
Making More	• Improved generation through more Thermal Hydrolysis plants; and • Improving the efficiency of each stage in our sludge process.	Increased generation of £3.8m per year by end of AMP7.

Source: Thames Water analysis

1.95 Overall, by 2024/25, our efficiency programme more than offsets the upward price pressures we will face during AMP7. The position is summarised in Figure 29.

Figure 29 Our forecast electricity costs movements from FY19 to FY24 (£m, 17/18 Prices)[62]



Source: Thames Water analysis

1.96 The above initiatives mean that our plan for AMP7 improves our overall energy intensity (energy consumed against work done, e.g. power used per megalitre treated) by 22% by the end of AMP7. At the same time as improving energy efficiency, we will continue to be an industry leader in energy recovery from sludge (Water UK Energy and Carbon Data Share 2016/17), with plans to increase this by a further 18% by the end of AMP7[63].

BENCHMARKS – PRICE

1.97 Our energy hedging strategy seeks to strike a balance between exposure to market volatility and achieving the lowest price. We have targeted a low/medium risk exposure by hedging. We have identified that the optimal strategy for us is to hedge some of our power needs in advance through power purchase agreements and to source some of our power on a more short term basis through Direct Physical Purchase/Hedging and/or Financial Hedging. This enables us to maintain a prudent risk position.

[62] Thames Water analysis
[63] Thames Water analysis

1.98 As part of striking this balance, we have negotiated a market leading renewable power supply contract, This includes reducing costs of all negotiable elements of energy supply, with highly competitive supplier arrangements and specific non-standard contractual terms and conditions enabling us to manage our portfolio more efficiently.

1.99 All of our assumptions on price have been challenged and verified by independent experts. For example, we have obtained expert advice on forward price projections and have modelled our whole portfolio until 2025. For price projections we have taken input from Bloomberg, Cornwall Energy, National Grid and BEIS models. Our strategy has also been verified by external energy consultants, who have identified that our approach would result in us to having a similar risk profile as other water companies[64].

[64] Thames Water analysis

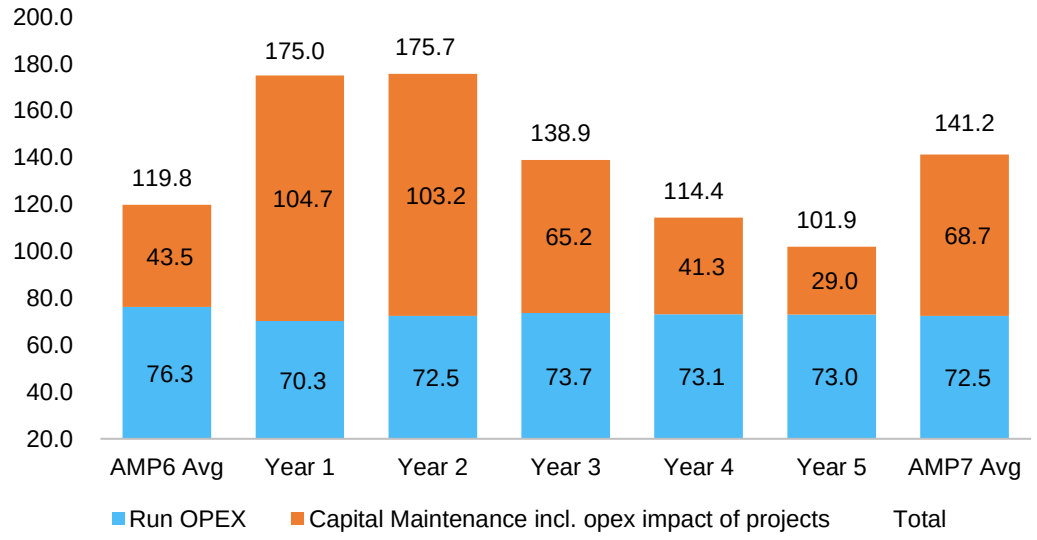
B8 IT costs

KEY COST DRIVERS AND EFFICIENCY LEVERS

1.100 A critical underpinning of our plan is the digitalisation of our business. As there has been a lack of foundational investment in our core IT platforms over the last 10 years, we are making a substantial investment in our IT to ensure we have a stable, secure and resilient platform to support our plan.

1.101 Our overall spend per annum across all opex and capital maintenance therefore increases from an average of £120m in AMP6 to £141m in AMP7 (Figure 30). We are making signficant targeted investment weighted towards the first half of AMP7, replacing some of our core operational and financial IT systems, accelerating investment in operational technology and improving our IT resilience[65].

Figure 30 AMP7 Digital Costs – Run Opex and Capital Maintenance (17/18 prices)



Source: Thames Water analysis

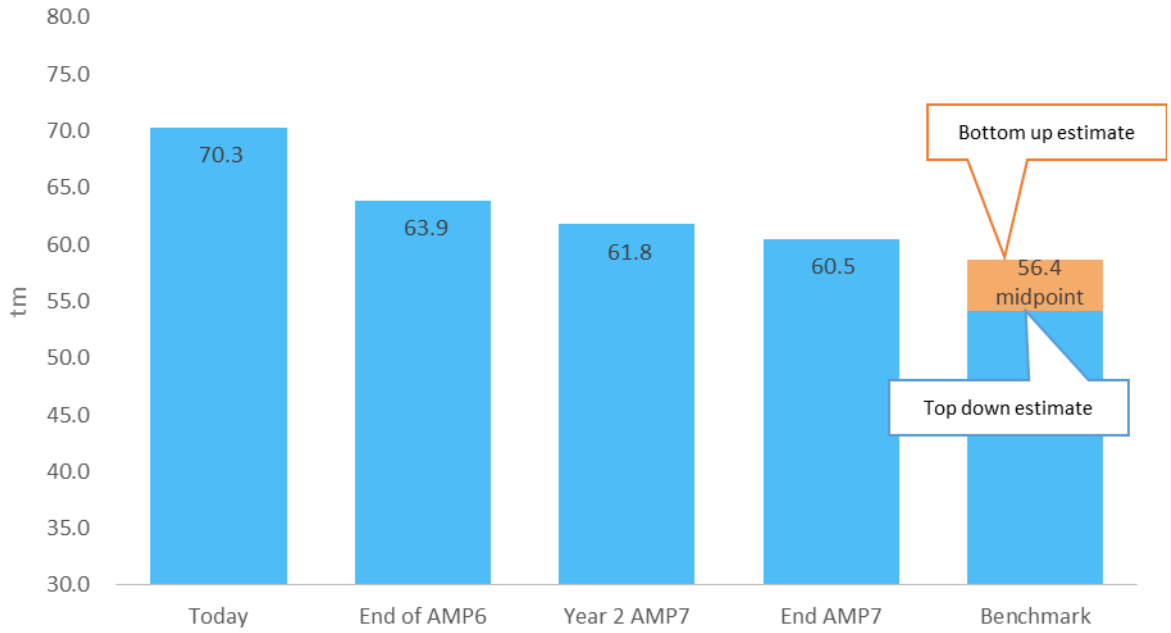
1.102 Our IT plan combines ambitious and significant efficiency savings in the cost of running our IT estate, with investment to improve our digital capability, This will enable improvements in the cost of our core activity, improving service and reliability.

1.103 The largest component of our IT costs is the service delivery base running costs, which makes up c84% of our total IT gross opex (before recharges to capex). This is a key benchmark, as it reflects the cost of our core underlying IT support services – excluding the impact of any change in mix from capex to opex – as we move towards more cloud based solutions, as well as the opex relating to our major IT change projects which deliver a step change in IT capability[66].

[65] Thames Water analysis
[66] Thames Water analysis

1.104 Our core like-for-like IT costs reduce by 5% by the end of AMP7 versus the AMP6 exit rate (see Figure 31).

Figure 31 Service Delivery Base Run Cost Opex (£m 17/18 prices)



Source: Thames Water analysis

1.105 This forecast reduction in IT operating costs will be driven by efficiency initiatives, such as introducing a new alliance contract based on a Price(P) x Quantity(Q) consumption model, which allows us to have greater flexibility and control over our costs. By significantly rationalising our hardware and software estate, we will be able to reduce the "Q", which will flow directly through to opex savings. This mechanism also allows us to offset some of the cost of moving to cloud solutions, by decommissioning on-premise hardware as we migrate systems.

1.106 In addition, we are challenging other key suppliers to provide consumption-based services as our procurement preference to capital investment, to introduce the same level of control and flexibility into our third party contracts as well.

1.107 AMP7 will continue to see us focusing on challenging and rationalising our third party costs, delivering a recurring annual benefit.

1.108 Our total savings across AMP7 from these efficency initiatives total £33.5m[67].

BENCHMARKS

1.109 We have benchmarked our service delivery base running costs on a top down and bottom up basis, with a midpoint annual spend of £56.4m from this work. In AMP7 our efficiency initiatives

[67] Thames Water analysis

drive us to within 7% of this benchmark by Year 5 of AMP7, as we recover from previous under investment in our IT estate which has driven current levels of inefficiency[68]. See Figure 31.

1.110 We recognise IT as a key strategic enabler for our wider operational efficiencies and therefore have ensured that our base IT spend efficiencies do not put this at risk.

[68] Thames Water analysis

B9 Local authority and Cumulo Rates

KEY COST DRIVERS AND EFFICIENCY LEVERS

1.111 Our plan includes rates costs of £638m for AMP7 – an increase of £118m (22.7%) over AMP6. The three key drivers, which account for £114m of the £118m increase, are:

1) Material changes in revaluation in 2017 driven by the Valuation Office (National impact) – £52m;

2) Estimates of above inflation average increases in AMP7 (from 2020/21 and 2024/25 Water revaluations) – £38m; and

3) One-off rebate claim forecast for 2019/20 of £24m, as part of an appeal against the Central Valuation officer concerning the 2005 central list rateable value of Thames Water. We expect our appeal to succeed based on appeals by other water companies[69].

[69] Thames Water analysis

B10 Employee costs

KEY COST DRIVERS AND EFFICIENCY LEVERS

1.112 Employee costs represent £1.62bn of our AMP7 opex plan[70]. In 2018 we introduced a new operating model, 'One Thames', which restructures the business to mirror our customers' view of our operations. As part of this new operating model we are performing a review of all of our overhead functions, with a focus on driving efficiency and adding value to the core business functions.

1.113 As part of this, we will be rationalising resources within these areas. We will drive efficiencies through centralisation of overhead functions, cross-skilling, insourcing and strengthening core skills to reduce reliance on external parties.

1.114 Our rationalisation is expected to drive a total benefit of £50m in our AMP7 plan, which benefits all of our price controls through the recharge of these costs[71].

[70] Thames Water analysis
[71] Thames Water analysis

C Investing in our assets

1.115 Our AMP7 plan includes investment of £6.2bn in our assets, covering both capital maintenance and enhancement. It also includes £382m of enhancement opex which has been identified as part our 5 stage process when building our plan[72].

Table 12 Summary of AMP7 Investment plan

Item	Title	Title (£m)
Base opex (wholesale and retail) – excl depreciation	4,959.7	BASE OPEX
Retail depreciation	120.0	BASE OPEX
Enhancement Opex	381.5	ENHANCEMENT
Base Capital Maintenance (gross)	3,500.1	CAP MAINT
Base CM - grants, contributions and third party	-159.5	CAP MAINT
Enhancement capex	3,068.8	ENHANCEMENT
Enhancement - grants, contributions and 3rd party	-181.7	ENHANCEMENT
TTT Income	-343	TTT
TOTEX	**11,345.8**	

Our £6,609m capex and enhancement opex programme. We have identified £1,276m of efficiency through our 5 stage process.

Source: Thames Water analysis

1.116 We have built our investment plan using a five stage process to ensure we have an efficient plan, delivered in the best way for customers. The process is applied on an integrated basis for both our capital maintenance and enhancement activities, and aligned closely with our operational plans – this ensures our plan delivers whole-life cost efficiency.

1.117 This section is structured as follows to demonstrate our efficiency in how we invest in our assets:

- C1 explains our five stage process in more detail;
- C2 sets out our approach to developing our capital maintenance expenditure plans, including how we have established that these costs are efficient; and
- C3 sets out our approach to developing our enhancement expenditure plans, including how we have established that these costs are efficient.

[72] Thames Water analysis

C1 Five stage process to investing in our assets

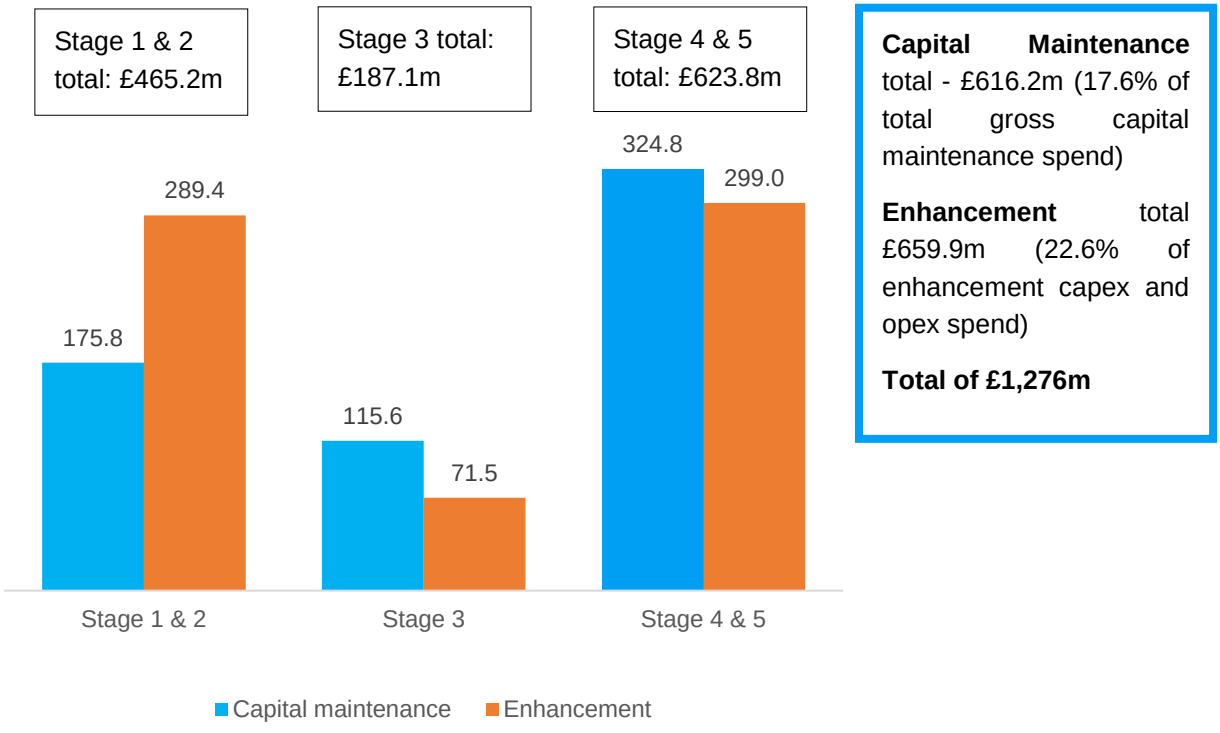
1.118 Our price control plans identify the investment programmes that we need to undertake to safeguard the services that customers want and value. To ensure that we have selected the right solutions within the plan and deliver whole-life cost efficiency, we follow a five stage process:

1. **Understand the need** – does the expenditure support a customer outcome or have our customers told us we need it;
2. **Design best solution** – ensure it delivers the outcomes the best way with the lowest whole-life cost, ensure there is no over-/under-engineering in the solution and that we apply a system thinking approach to solution design;
3. **Buy at the right price** – buy the solution at the right price and ensure it is validated with benchmarks and should-cost models;
4. **Deliver effectively** – ensure oversight and insight of delivery processes to ensure efficient implementation – delivered on time and to budget; and
5. **Ensure successful operation of delivered assets** – are we operating our investments to deliver the expected benefits originally set out.

1.119 We discuss each of these stages further below.

1.120 Overall, across our 5 stage process **we identified efficiencies (either in the form of scope, solution, timing or price challenge) which totalled £1.3bn** as follows:

Figure 32 Our efficiency savings in capital expenditure by stage (£m, 17/18 Prices)



Source: Thames Water analysis

1.121 As Figure 32 shows:

- Stages 1 and 2 of our five stage process allowed us to challenge and prioritise and remove £465.2m of spend from our plan, as part of the work to ensure our solutions represented the best value for customer priorities;
- Stage 3 challenges our delivery price, including use of third party benchmarking which enabled us to achieve efficiency savings of £187.1m in total; and
- Stages 4 and 5 allowed us to perform a range of integration challenge processes and feedback loops on our plan, including a deliverability review, benefits challenge and systems independency review. This process resulted in further cost reductions in AMP7 of £623.8m.

Stage 1 – Understand the need

1.122 We identify the need for a change using our risk management process and data from our asset planning systems, as well as feedback from our front line Customer Services and Operations teams.

1.123 To understand the need we undertake analysis using data from a range of sources including assets surveys, deterioration and hydraulic models, treatment work capability assessments, and failure models.

1.124 We use systems modelling that combines different process models to provide an integrated view of risk from source to tap and drain to river.

1.125 Once identified, each 'need' is scored on the basis of the risk, impacts and the mitigation required to resolve it. The results of the analysis are then compared with what customers tell us through our extensive customer engagement to ensure that our plan is fully aligned to what our customers want and value.

Stage 2 – Design best solution

1.126 We identify and select the right solutions to minimise whole life cost. This means that the solutions and their timing are assessed together with the opex required for the solution or savings in opex that the solution is designed to achieve. Schemes with the greatest savings are brought forward in the programme.

1.127 For example, with regard to the energy efficiency schemes, we have brought forward renewable energy generation and energy efficient mechanical equipment in order to maximise the opex savings that they deliver.

1.128 We use a programme approach to assessing our solutions. For example, for enhancement, because the solutions we define need to be aligned and integrated to our wider programme of enhancement work, we optimise our planned enhancement programme by taking into account the cost of different solutions, their capabilities and outcomes (e.g. the capacity of a treatment works), dependencies (e.g. if dependent on environmental conditions) and different scenarios (e.g. if demand changes).

1.129 As this optimisation process is complicated, we develop our programme of work through our Asset Planning System (APS). It uses an iterative process where needs and solutions are developed and priced, taking into account customer feedback and support. This process

creates a balanced programme delivering defined benefits and risks, subject to a range of constraints. The results are presented to the management team and board for decision making.

1.130 We continually update our plans to take into account the latest available information. A review is triggered towards the end of each annual planning cycle to challenge the investment programme. This challenge process allows us to improve our project definition, risk assessment, and value engineering to better align with our customers' priorities, minimise whole-life cost and deliver best value-for-money to our customers.

Stage 3 – Buy at the right price

1.131 To ensure we achieve the best value for our stakeholders, we use analytical tools and costing methods to assess options. We also consider the way we work with our supply chain, including our framework agreements and competitive tendering of large projects.

1.132 Our capital programme planning tools draw on a range of information on expected costs of solutions and we use four different methods that enable us to balance accuracy, risk and confidence in outcome delivery within the available budget. These methods depend on type of solution involved and include:

- **Engineering estimating system (EES)** – c. 24% of programme: Solutions are scoped by the technical teams and then the costs are derived using one of the 800+ models from our EES cost library (populated using actual outturn costs from AMP5 and AMP6 work)[73].
- **Bottom Up cost methods** – c. 30% of programme: The scope of works is broken down into the lowest level EES cost breakdown structure complete with the yardstick/quantity information required to generate bottom up costs. The base cost (labour, plant, materials and subcontracts resources) is costed using a resource cost library, Alliance data or supplier and service costs. The risk, on-costs and overhead costs are added as a percentage uplift on the total base cost in order to obtain total capex[74].
- **Historical cost** – c. 23% of cost programme: We use average historical expenditure for asset repairs, maintenance etc. over a relevant time period to provide an average run-rate[75].
- **Expert costing judgement** – c. 23% of cost programme: estimators use their expertise and similar historical reference projects to cost needs, solutions or inform appropriate unit rates[76].

1.133 To provide comfort over the cost efficiency of the bottom up estimates used, we hired an independent third party to assess a sample of costs across our programmes and identify any further challenge required to bring costs in line with comparative industry benchmarks. The challenge applied was between 5% and 10% of costs, as a result of this process, totalling c£74m across Wastewater projects and Water projects[77].

[73] Thames water analysis
[74] Thames water analysis
[75] Thames water analysis
[76] Thames water analysis
[77] Thames water analysis

1.134 In addition to the above benchmarking, we have applied further efficiency challenges that recognise the saving opportunities from a systems thinking approach across our investment programmes. We have also challenged our programme around delivery route to ensure that our spend is aligned to the most efficient deliverer.

1.135 These efficiency levers resulted in a further efficiency savings built into our plan of £187.1m (Figure 32).

Securing best value through framework agreements

1.136 We use framework agreements to enable us to access the best value for money through the supply chain. We continue to develop our approach to working with the supply chain over AMP7 taking into account potential changes in circumstances (e.g. the possible implications of Brexit or the need for greater assurance of supply chain resilience and financial stability going forward) and learnings as they become available.

Securing best value through competitive tendering of large projects

1.137 We firmly believe alliancing has a strong role to play in our AMP7 delivery, with our eight2O (Capital programme focus) and Infrastructure Alliance (Water Networks focus) most likely focussing on the substantial parts of our plan which play to their strengths. We will, however, supplement our alliance strategy with other delivery routes, which provide us with fit-for-purpose solutions and flexibility of choice. We are actively exploring these alternative delivery routes.

1.138 Reflecting the learnings from AMP6, we believe that low value, high volume totex solutions may benefit from alternative contracting routes and, in some cases, in-sourcing. Conversely, very large and complex projects may benefit from market competition.

1.139 Accordingly, for major projects it is likely we will competitively tender schemes, with the advent of our Bid Assessment Framework and Direct Procurement for Customers (DPC) also designed to test and provide customers with 'improved' market efficiency. Projects within the DPC portfolio will also be ring-fenced from our alliances and delivered as very large stand-alone schemes.

1.140 There are currently two projects which we consider most likely to meet our criteria for DPC. These are the South-East strategic reservoir option (Abingdon) and the Deephams water reuse plant. Further detail is provided in BPD-A8-Making Use of Markets.

Stage 4 – Deliver effectively

Delivering best value for money by adopting the right organisational structure

1.141 Our overall AMP7 delivery strategy is informed heavily by changes in our organisational structure. Our Executive team includes specific roles with clear accountability for capital delivery and asset management which we did not have before.

1.142 We are working through the detail of the implications of our strategy and have already started implementing a number of key changes to ensure we are ready for AMP7 delivery.

1.143 Our main aim is to develop an overall delivery model that has the flexibility and options within it to allow us to add real value to our customers. We see this as a journey which both our organisation and our supply chain started at the beginning of AMP6.

1.144 A key positive consequence of our strategy is a need to build greater in-house capability in a number of key areas, which means recruiting and developing Thames Water teams to be able

to lead the planning, delivery, and assurance of our AMP7 programme. We are well advanced with our plans in this key area and believe there are some really exciting and challenging opportunities for people to join our business and help make AMP7 a great success.

Securing best value working with our Alliance partners

1.145 Over the course of AMP6 we have worked closely with a number of alliance partners. Whilst we have benefited in AMP6 from working with our alliances, there has also been a huge amount of learning. Creating and delivering value from collaborative vehicles such as alliances takes a lot of work and where we have seen benefit in making amendments to how they operate, these changes have been made. A notable example in AMP6 was the changes made to the operating, commercial and contracting approach with our Infrastructure Alliance which delivers our Water Infrastructure Repair and Maintenance programme.

1.146 We are already actively reviewing a number of areas where we feel we can make further step-change improvements within our alliances ahead of AMP7. The aims for our AMP7 delivery strategy include:

- Exceptional delivery of programmes and projects facilitated by flexible and appropriate delivery routes;
- Value-for-money from a strategy blending both close collaboration and competitive tension within our supply chain; and
- Clear accountabilities for all our people and teams – both inside Thames Water and across our supply chain.

Stage 5 – Ensure successful operation of delivered assets

1.147 The successful operation of delivered assets is integral to ensuring whole life cost efficiency – ensuring that assets deliver on the benefits case which supported their inclusion in our plan. Our plan has been built with close integration between asset planning, delivery and operational teams to ensure that the related benefits cases are robust and deliverable and that we have incorprated lessons from AMP6 projects.

C2 Capital Maintenance expenditure

1.148 Our capital maintenance increased in AMP7 by £484m (gross - before impact of grants, contributions and third party income), compared to the AMP6 level (Figure 33).

Table 13 Summary of AMP7 investment plan

Item	£m	Section
Base opex (wholesale and retail) – excl depreciation	**4,959.7**	**BASE OPEX**
Retail depreciation	**120**	**BASE OPEX**
Enhancement Opex	**381.5**	**ENHANCEMENT**
Base Capital Maintenance (gross)	**3,500.1**	**CAP MAINT**
Base CM - grants, contributions and third party	**-159.5**	**CAP MAINT**
Enhancement capex	**3,068.8**	**ENHANCEMENT**
Enhancement - grants, contributions and 3rd party	**-181.7**	**ENHANCEMENT**
TTT Income	**-343**	**TTT**
TOTEX	**11,345.8**	

£3,341m capital maintenance covered by this section (net of developer income). Incorporates efficiencies of £616.2m from 5 stage Capex programme process above

Source: Thames water analysis

1.149 Our spend on capital maintenance is set out below. Further detail can be found in the individual Price Control Documents.

Table 14 Capital maintenance spend by price controls (£m, 17/18 Prices, net of income)

	Bioresources	Waste Network Plus	Water Network Plus	Water Resources	Total
Capital maintenance spend	302.7	1,350.9	1,592.5	94.5	3,340.5

Source: Thames Water analysis

1.150 In developing our plan we have assessed that historic levels of capital maintenance have not been sufficient to deliver a steady state level of resilience and reliability in our asset base, prior to making enhancement type investments that deliver improved performance.

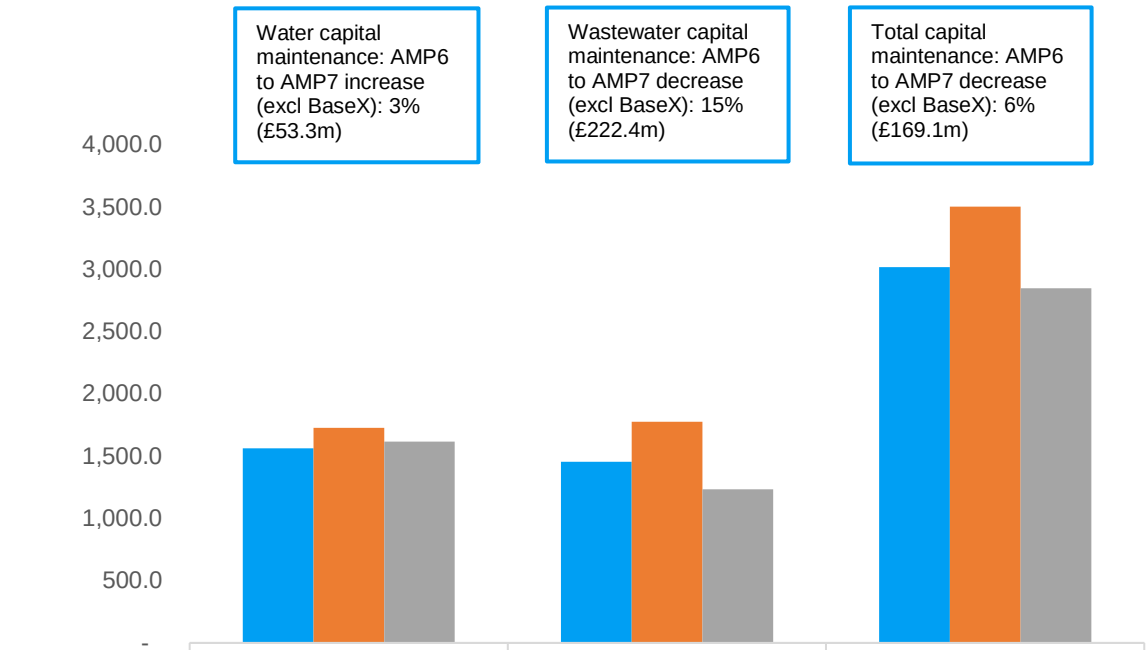
1.151 This is bad for customers as it reduces our ability to drive base operational efficiency savings over the longer term, increases reliability risk for customers and means that our enhancement programme cannot deliver full potential, as investments are not delivered against a steady state level of core asset performance.

1.152 We have made fundamental changes to our approach to asset investment to ensure that our plan has the right level of capital maintenance to address these issues with a focus on optimising the whole-life cost of assets. This delivers the best value for customers overall as we optimise investment decisions to reduce the long term base running cost of our business – both in opex and capex terms.

1.153 To resolve the areas of historic underspend, we have identified a range of investment requirments in AMP7 to bring us back to steady state. These total £653.2m and we have considered these separately when assessing our efficiency - they are referred to as BaseX or BX spend[78]. We do not believe that these types of costs form part of our historic cost assessment data set.

1.154 Excluding our BaseX spend, our underlying like-for-like capital maintenance is reducing overall, driven by reductions in Wastewater, of £169m (See Figure 33 below which shows gross capital maintenance, excluding developer services contributions).

Figure 33 Capital maintenance expenditure for AMP6 and AMP7 for Water and Wastewater (£m, 17/18 Prices, gross of income)



	Water	Wastewater	Total
AMP 6	1,562.0	1,454.0	3,016.0
AMP 7	1,725.8	1,774.3	3,500.1
AMP 7 w/o BX	1,615.3	1,231.6	2,846.9

Source: Thames Water analysis

1.155 Wastewater capital maintenance reduces by 15% from AMP6 to AMP7 excluding BaseX (£222.4m) (Figure 33) –a key driver has been the progress in moving toward a more proactive maintenance regime and reduction in high reactive maintenance costs. We are starting to introduce real-time capability models of our sewage treatment works to help target maintenance activity. Similarly, the majority of our sewage pumping stations are now fitted with smart local

[78] Thames Water analysis

control and monitoring devices (known as multitrodes), which can help to extend the operational life of assets, reducing failures and reactive capital maintenance.

1.156 Water capital maintenance increases by 3% from AMP6 to AMP7 excluding BaseX (Figure 33) – efficiencies are being offset by more spend on some targeted areas. These include increased investment in operational IT equipment, including replacement of systems used to control and monitor water treatment works and pumping stations which drives opex efficiency. It also includes additional investment in fleet renewal which provides a net totex benefit over the whole life of the assets when factoring in opex related maintenance and fuel costs.

1.157 For our BaseX spend, we have tested the requirements at each stage of our process to ensure that they meet our customers' needs and deliver the lowest whole life cost, having applied systems thinking to test against other options.

1.158 The key areas of additional investment are set out in Table 15.

Table 15 Key areas of additional investment and reason for spend (£m, 17/18 Prices)

Investment Area/ Strategic Priority	AMP7 spend (£m)	Description of key investments	Reason for spend in AMP7	Resilience benefit
Sewage Pumping Stations / **(Environment)** **(Resilience)**	114.7	**Replacement of unreliable and obsolete mechanical & electrical equipment** - at our most critical sites £86m. **Upgrade and automation of manual start diesel pumps** at Lots Rd pumping station to improve storm weather response £22m.	Asset age Consequence of failure unacceptable	Improved reliability Reduced risk of flooding & pollution
	14.0	**Replacement of sections of pumped sewer** at Gascoigne Rd pumping station £13m	Consequence of failure unacceptable	Reduced risk of pollution
Sewage Treatment Works **(Environment)** **(Resilience)**	181.5	**Restore headroom at 42 sewage treatment** works to improve our asset capability for the future to manage risk of non-compliance £181m	Headroom position now critical	Improved reliability of existing assets
	79.9	**Tideway Sewage Works Critical Assets** Replacing the 'air main' £17m and diesel storm pumps at Mogden £10.3m; upgrading Beckton control room £15m; investment at Crossness and Riverside to restore headroom £24m.	Long-life Critical assets need replacing	Improved reliability and system headroom
Technology & Transformation **(Resilience)**	103.0	Additional IT spend beyond base case to replace obsolete kit	Underpins Strategic Priorities	System reliability
Other - Asset Health **(Resilience)**	50.4	Targeted spend on additional CM across our	Underpins Strategic Priorities	Improved reliability of existing assets
Raw Water Tunnels **(Resilience)**	42.0	**Maintaining the capability of our Raw Water Tunnels -** Structural Rehabilitation of wedgeblock tunnels £24m; Statutory Inspection & Refurb	Response to Statutory Inspections	Reduced risk of failure

		Programme £11m; Pipe Bridge inspection programme £6m.		
Asset Health **(Customer)**	38.0	Investment in **pumping stations and water treatment sites** to reduce risk of sewer flooding & to support delivery of Acceptability of Water Performance Commitment.	Underpins Strategic Priorities	Reduced risk flooding in severe weather
Sewage Pumping Stations **(Environment)**	30.5	**Electrical Assets –** replacement of 67 Low voltage Motor Control Centres £24.5m; Complying with Fixed Electrical Testing (FET) and Dangerous Substances Explosive Atmosphere Regulations (DSEAR) £6.0m	Statutory requirement	Reliability of electrical assets
Total	**653.2**	**Additional 'BaseX' CM spend driving our Strategic Priorities**		

Source: Thames Water analysis

C3 Enhancement Spend

Table 16 Summary of AMP7 Enhancement Capital plan[79]

Item	£m	Section
Base opex (wholesale and retail) – excl depreciation	4,959.7	BASE OPEX
Retail depreciation	120.0	BASE OPEX
Enhancement Opex	381.5	ENHANCEMENT
Base Capital Maintenance (gross)	3,500.1	CAP MAINT
Base CM - grants, contributions and third party	-159.5	CAP MAINT
Enhancement capex	3,068.8	ENHANCEMENT
Enhancement - grants, contributions and 3rd party	-181.7	ENHANCEMENT
TTT Income	-343	TTT
TOTEX	**11,345.8**	

£3,269m enhancement spend covered by this section. Incorporates efficiencies of £660m from 5 stage Capex programme process above

Source: Thames Water analysis

1.160 Enhancement refers to new investment in assets and operations required by our business in order to improve the level or quality of the services we provide or improve the resilience profile of our company. For example, building new sections of our network to connect new developments or building new treatment works. We are forecasting enhancement expenditure of £2.9bn for our plan in capex and £0.4bn in opex[80].

1.161 The enhancement spend in our plan is targeted at delivering what our customers want at an efficient level of cost that will provide high levels of value – this is fundamental to how we prioritise the plan.

1.162 We have done this by following our five stage process outlined in Section C1. This has removed costs of £659.9m[81] (see Figure 32) through a combination of:

2) prioritising to ensure we are fully aligned to customer needs;
3) choosing the most efficient and innovative solutions;
4) price benchmarking and challenge;
5) reviewing systems interdependency; and
6) whole-life cost benefits reviews.

[79] Thames Water analysis
[80] Thames Water analysis
[81] Thames Water analysis

1.163 A summary of our enhancement spend by price control is set out in Table 17 – further details can be found within the individual price control documents.

Table 17 Enhancement spend by price control (£m, 17/18 Prices)

£m	Water Resources	Water Network Plus	Waste Network Plus	Bio resources	TTT	Retail	Total	Section
Enhancement Opex	33	151	177	2	19		**381**	**ENHANCEMENT**
Enhancement capex	147	1499	1200	106	117		**3069**	**ENHANCEMENT**
Enhancement - grants, contributions and 3rd party		-111	-71				**-182**	**ENHANCEMENT**

Source: Thames Water analysis

D Thames Tideway Tunnel expenditure

1.164 As shown in Table 18 below, our totex spend over AMP7 in the TTT price control will be £144.3m. We plan to generate £344.6m of income in land sales and rental income over this period. The net impact of expenditure and income from TTT price control is downward pressure on customer bills of £206m.

Table 18 Cost profiling of AMP7 totex spend (£m, 17/18 Prices)

	Total AMP7	2020/21	2021/22	2022/23	2023/24	2024/25
Totex Total	144.3	35.4	39.9	22.6	32.1	14.3
Income Total	-344.6	-3.1	-3.3	-4.9	-164.2	-169.1

Source: PCD6-PR19-Thames Tideway Tunnel (TTT). Differences to Table 1 explained within price control document

1.165 To ensure we deliver the best value for money for our customers, we are determined to perform our commitments in the price control at the lowest possible cost. We explain below how we have ensured that our costs are efficient.

1.166 **Property costs:** We have tested our forecasts of property costs for AMP7 to ensure that these costs are efficient, i.e. we are only compensating those who need compensation and we are paying fair amounts (not overcompensating). The compensation we expect to pay has been assessed by external property advisors and industry experts.

1.167 **Rental income:** To inform our rental income forecasts for AMP7 we have conducted a series of tests, including market valuations by our independent property expert Savills, as well as benchmarking against the impact that other large infrastructure projects such as Crossrail and HS2 have had on rental incomes. We also have taken into account our experience over AMP6. All of these factors have suggested that rental income is likely to be significantly lower over AMP7 than we expected at PR14 and accordingly we have revised our PR19 forecasts to reflect these reduced expectations.

1.168 **Land disposal:** We plan to dispose of 12 properties at significant development sites near the TTT construction works over the course of AMP7. The income we expect to earn through these disposals has been derived from a market valuation study prepared by independent property experts Savills, taking into account the details of any pre-emption rights applicable to those properties (which in some cases allow the properties to be sold at their original purchases price). We also plan to dispose of some properties bought from homeowners under the EHP and NSOMCP schemes. The income we expect to earn from these sales is based on independent expert valuations.

1.169 **Beckton inlet works:** To ensure that the cost of the works at the Beckton inlet represent the best value for money for our customers, we have market tested the costs with the assistance of independent expert advisers. Their report found that our costs were 10% to 15% above comparative benchmarks, but this is primarily due to differences in benchmark estimates for mechanical costs for screens and screening handling units. In addition there are engineering explanations for Beckton screening costs not being comparable to past experience elsewhere e.g. Beckton STW has the largest inlet works in Europe and its size and scale results in complex construction works.

1.170 **System operator functions:** In order to test whether our expected system operator expenditure is efficient, we commissioned the consultants Mott MacDonald to carry out a benchmarking study to compare our SO model for TTT to similar schemes around the world. The Mott MacDonald study demonstrated that the size of our proposed TTT team is broadly in line with experiences elsewhere, when differences in scale are accounted for. Average staff costs used within TTT are the same rates used within the wholesale Water and Wastewater AMP7 plans, the efficiency of which is discussed earlier in this document.

1.171 **Power costs:** The costs of power changes as a result of TTT operation have been forecast using bottom up assessments of the impact at new sites and existing sites. The overall output was signed off by the lead operational strategic pumping station manager as part of our assurance process. Full details of how we calculated the power change due to the tunnel are in the opex methodology statement for TTT. The price of electricity assumed in our TTT power costs forecasts is the same as in our wholesale water and wastewater plans.

1.172 **Tideway Integration Group (TIG):** The costs we expect to incur for TIG in AMP7 have been guided by actual costs in early AMP6 for staff and accommodation, with expert judgement used as to how these will ramp down when construction stops. We consider our current costs to be efficient on the basis that our costs are in the lower half of the range identified by an independent report we commissioned at PR14, which concluded that the supervisory costs on other major projects are comparable with the TIG 'Client role' for the TTT project.

E Cost adjustment claims

1.173 This section sets out the approach we have used to select our cost adjustment claims, building on our submission of 3 May 2018 and provides a summary of each claim. Full details of each claim, including the revised pro-forma for cost adjustment claims[82] and supporting evidence and analysis, can be found in the Core Supporting Documents[83].

1.174 In our 3 May 2018 submission we provided summary details for seven claims and highlighted that we would expect to propose a further claim related to resilience later in the year. We have retained our seven proposed cost adjustment claims and added an eighth resilience claim as summarised in the table below.

1.175 We note that the first two claims in respect of urban density (water and waste networks) relate to opex spend in our Water and Waste network plus price controls . Our third claim, in respect of the impact of age and ground conditions on network maintenance, relates to both opex and capital maintenance.

1.176 We have not made any adjustments for these cost adjustment claims in performing our industry benchmaking analysis within the relevant sections above. Adjusting for the impact of these claims would further improve our benchmarking position relative to the industry.

1.177 To ensure that our Cost Adjustment Claims are efficient and only used where necessary, we have:

- Tested the evidence for each of our claims with internal and external experts.
- Passed two stages of detailed external assurance performed by experts on the quality of our claims against the tests proposed in the Ofwat methodology.[84]
- Subjected our claims to a “deep dive” review by four members of our Board.
- Engaged with our Customer Challenge Group to test our approach and the narrative of our claims.
- Used conservative estimates from sensitivity testing where material uncertainty exists. For example, assuming a lower quartile impact of regional wages, from an extensive sensitivity testing process.
- Applied our claims only to the elements of cost we can evidence as being efficient. For example, in our claim for the incremental cost of water stress on balancing supply / demand we have performed an extensive exercise to benchmark the costs of our metering programme to support this practice.

[82] Provided by Ofwat in Information Note 18/11 Enhancement expenditure: setting expectation for well evidenced proposals and clarifying interaction with cost adjustment claims. June 2018.

[83] CSD006-WNP-01b-PR19-CA FE Urban productivity, CSD006-SNP-01b-PR19-CA FE Urban productivity, CSD006-WNP-02b-PR19-CA FE Network maintenance, CSD006-WNP-03b-PR19-CA FE Water stress, CSD006, BR-01b-PR19-CA FE Sludge enhancement, CSD0006-WNP-04b-PR19-CA FE Resilience of supply, CSD006-RR-02b-PR19-CA FE Population transience, CSD006-RR-01b-PR19-CA FE CRMB depreciation

[84] Delivering Water 2020: Our final methodology for the 2019 price review. Appendix 11: Securing cost efficiency, Box 2. Ofwat, December 2017.

- Been careful to avoid double-counting between claims by establishing clear boundaries. For example, we have adjusted the cost of leakage detection used in our impact of age and ground conditions on efficient network maintenance costs claim to avoid double-counting the impact of the regional wages within our productivity impacts from operating in exceptionally dense urban environments claim.

Table 19 Brief descriptions of proposed cost adjustment claims

Title	Brief description	Purpose	Opex value (£m, 17/18 prices)	Capex value (£m, 17/18 prices)	Total Claim value (£m, 17/18 prices)
Productivity impacts of working in exceptionally dense environments (Water network plus)	This covers the impact of working in the most densely populated part of the country and covers additional costs associated with traffic permits, travel disruption and regional wages.	Base (Wholesale)	60.9	23.9	84.9
Productivity impacts of working in exceptionally dense environments (Wastewater network plus)	This covers the impact of working in the most densely populated part of the country and covers additional costs associated with traffic permits, travel disruption and regional wages.	Base (Wholesale)	40.5	4.9	45.5

Impact of age and ground conditions on efficient network maintenance costs	This covers the higher costs of network maintenance in London due to the age and poor condition of the network.	Base (Wholesale)	36.1	19.4	55.5
Incremental cost of water stress on supply / demand balance	This covers the elevated unit cost of the options available to balance supply and demand as a result of regional water stress.	Enhancement (Wholesale)	-13.0	296.1	283.1
Growth and quality investment for bio-resources	This covers the costs of enhancing capacity at three of our sludge treatment centres as a result of population growth and expenditure, to achieve compliance with Environmental Permitting Regulations.	Enhancement (Wholesale)	1.6	106.0	107.6
Cost of exceptional population transience	This covers the additional cost we incur as a result of the high level of population transience in London.	Base (Retail)	63.0	-	63.0
Customer Relationship Management and Billing system	This covers the carry-forward of the additional depreciation allowed in AMP6 for our new CRMB system.	Base (Retail)	-	43.8	43.8
Delivering long term system resilience for the London water supply	This covers the cost of the first five years of a ten year programme to protect resilience of water supply in North East London from climate change impacts to raw water quality and distributional pressures of growth.	Enhancement (Wholesale)	0.6	179.7	180.3
TOTAL			**189.8**	**673.8**	**863.6**

Source: Thames Water[85]

1.178 As indicated in our 3 May 2018 submission, we have updated our draft WRMP following our consultation. This has changed some of the data in our cost adjustment claim, and further details are set out in the detailed submission - Water Network Plus price control document[86].

1.179 To complete the data tables and Cost Adjustment Claim pro-formas in line with the data table guidance, we needed to make assumptions as to modelling Ofwat will undertake in order to derive an "implicit allowance". Our calculations, therefore, take account of the suite of econometric models that Ofwat consulted upon in March 2018 and the responses shared by

[85] CSD006-WNP-01a-PR19-CA PF Urban productivity, CSD006-SNP-01a-PR19-CA PF Urban productivity, CSD006-WNP-02a-PR19-CA PF Network maintenance, CSD006-WNP-03a-PR19-CA PF Water stress, CSD006-BR-01a-PR19-CA PF Sludge enhancement, CSD0006-WNP-04a-PR19-CA PF Resilience of supply, CSD006-RR-02a-PR19-CA PF Population transience, CSD006-RR-01a-PR19-CA PF CRMB depreciation

[86] CSD006-WRMP

consultees – notwithstanding that we raised material concerns with the approach and models in our response to that consultation. For the avoidance of doubt, we still have material concerns about Ofwat's proposed approach, and the models we have adopted for these calculations should not be interpreted as an endorsement of Ofwat's econometric approach or models.

1.180 In addition to assessing the "implicit allowance", the prescribed calculation requires an assessment of how atypical our costs are, relative to those of other companies. Whilst we have a good knowledge of our circumstances, data is less readily available on the circumstances of other companies. Notwithstanding these challenges, we have put forward a number of Cost Adjustment Claims in line with Ofwat's process. As explained below, we have endeavoured to ensure that all our Cost Adjustment Claims are conservative, and therefore, represent the minimum additional cost that should be taken into account.

Our Approach

1.181 In considering which Cost Adjustment Claims are appropriate, we have been mindful of the need to apply a responsible approach, and only to raise Cost Adjustment Claims where there is good evidence that an adjustment is required. We have taken a balanced view, reflecting areas where our specific factors provide us with an advantage as well as those areas where we incur additional costs.

1.182 We also recognise that Ofwat intends to apply a high evidential bar, and that companies should only propose Cost Adjustment Claims that are prudent and appropriate. We have not, therefore, included details for factors where we expect the econometric models to reflect any higher or lower costs that we will incur relative to other companies. These include:

- the impact of the combination of deprivation and high housing costs applying simultaneously on bad debt costs (where there is clear evidence that housing costs form a greater proportion of customers disposable income in our area);
- the impact of having tighter ammonia consents than the rest of the industry for our large sewage treatment works, which results in higher base operational costs (because it requires more power, chemicals and contact times to achieve the lower levels of ammonia in the final effluent);
- the impact of the higher costs on our Wastewater Network Plus business of network maintenance in London due to the higher costs of surface reinstatement and the density of utility infrastructure in London;
- the additional costs of longer lengths of sewerage network in London that means that sewage spends longer in the network resulting in more hydrogen sulphide being released from the sewage and consequential corrosion of structures and lower energy potential; and
- the additional costs for the water network arising from the disproportionately longer distances from treatment works to customer, which means we require additional chlorination at source and operate higher levels of network based booster chlorination dosing.

1.183 We understand that there is considerable interaction between the final specification of the econometric models that Ofwat will use to benchmark companies and the level of any cost adjustment claim. In each of our detailed documents describing our Cost Adjustment Claims we have made an assessment of a potential level of implicit allowance infered from models

proposed by Ofwat in their econometric modelling consultation. Each claim will have to be reviewed following finalisation of Ofwat's models. In addition, we will need to consider whether any of the items we considered would be covered appropriately in econometric models, including those listed above, need to be presented as Cost Adjustment Claims.

1.184 For each of these claims we have provided a supporting document providing full details of the need for the investment, the need for the cost adjustment claim; the level of management control; the best option for customers; the robustness and efficiency of the costs; customer protection; affordability; and board assurance.

F Supplementary Information

F1- Efficiency initiatives

1.185 The table below summarises our key initiatives that drive opex efficiency during AMP7, as described in further detail through this appendix.

Table 20 Summary of Efficiency Initiatives

Area	Description	£m Total over AMP7
Water		
Power efficiency initiatives	Reduce our power consumption across sites and pumps, optimising production mix, improving time of day usage – system plan across Water value chain	31.2
Leakage efficiency programme – AMP6	Productivity improvements, commercial terms changes, use of technology on leak detection, improved performance management - changes delivered in year 4 and 5 of AMP6 as part of recovery programme, which flow through to AMP7 run rate	109.5
One visit right first time – (Water network)	Further AMP7 process improvements to improve work first time resolution, reducing aborted or repeat visits	4.3
New delivery model for customer activity (Water Network)	Reduce number of supply chain partners currently used in treated water distribution	5.2
Workforce productivity	Increasing the productivity and utilisation of our Water workforce with digital tools, reducing spend required with third party providers and allowing increased proactive work. The majority of this initiative starts in AMP6 year 5	25.4
Waste		
Commercial contract changes (Waste Network)	Opportunity to procure a new waste water network services contract in 2020 and align commercials to new proactive strategy	10.4
Customer & work management optimisation	Savings from review and improvements in our work management processes	29.2
Power efficiency initiatives	Reduce our power consumption across sites and pumps, optimising production mix, improving time of day usage – system plan across Waste value chain	60.9

LEAN efficiency programme in Waste treatment	Efficiency initiatives to remove wastage from process across chemicals, hire costs, skip use, temp costs etc.	17.6
Generation - Biorecycling	Improved generation levels – e.g. improved biogas capture	7.5
Workforce productivity	Increasing the productivity and utilisation of our Waste workforce with digital tools, reducing spend required with third party providers and allowing increased proactive work. This initiative starts in AMP6 year 5	25.0
Household Retail (17/18 Prices)		
Customer service costs	Reductions in incoming customer contact volumes, a shift towards digital channels and improvements in the efficiency of our contact centre operations	94.8
Debt management costs	Enhanced debt management tools, increase in customers on payment plans and streamlined processes as well as the reduction in LAHA commissions	14.9
Doubtful debt costs	More sophisticated use of data and tailored pathways for more effective debt recovery, as well as shift from LAHA to direct billing	3.5
IT costs		
Base efficiency programme	3rd party savings and Apps rationalisation	31.1
Commercial changes	Consumption based commercial model	2.4
Total		472.9

Sources: Thames Water analysis

F2 - Adjustments made in respect of rates and power prices to allow like-for-like comparison between AMP6 and AMP7

1.186 Our plan includes rates costs of £638m for AMP7 – an increase of £118m – this is driven mainly by the impact of the 2017 valuation (£52m), estimates of above inflation increases during AMP7 (£32m) and a one-off rates rebate assumed in AMP6 of £23m (relating to 2005-2010). In our efficiency analysis by price control we have normalised rates costs at 2017/18 levels to ensure that these cost increases outside of our control do not distort the underlying efficiency position[87].

1.187 Our plan includes power costs of £570m for AMP7 – an increase of £21m – this is driven by power price increases offset by improved consumption efficiency and self generation. In our efficiency analysis by price control we have normalised power unit prices at 2017/18 levels to remove the impact of price increases outside of our control which distort the underlying efficiency position[88].

[87] Thames Water analysis
[88] Thames Water analysis

F3 - Wholesale opex unit cost benchmarking to the wider industry

1.188 Included in our cost efficiency analysis is unit cost benchmarking using 2017/18 annual performance data. This analysis calculates unit costs for each area of the wholesale water and wholesale wastewater value chain, for all companies in the industry. To do this, we divided our opex costs in each area of the value chain by a volume driver. We then calculate the upper quartile, average, median and lower quartile points to understand our position relative to the industry.We then ranked each company in order from lowest to highest. We carried this analysis out for opex only.

1.189 The analysis does not take account of differences in operating arrangements or geographical differences between companies and we did not attempt to adjust for these. The table below shows the volume driver used for each area of the value chain benchmarked.

Table 21 Summary of volume drivers used in benchmarking analysis

Value chain area	Volume driver
Water resources	Ml volume abstracted
Water network plus	Ml distribution input volume
Water treatment	Ml distribution input volume
Treated Water distribution	Ml distribution input volume
Wastewater network plus	BOD tonnes
Sewage collection	Ml volume collected
Sewage Treatment	BOD tonnes
Bioresources	Ttds sludge produced

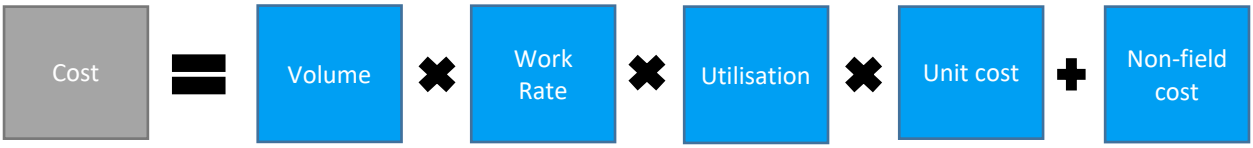
F4 - Independent third party bottom up benchmarking of costs – 'Full Potential' review

1.190 We commissioned an independent third party to develop a view of the 'Full Potential' level of cost efficiency that we could achieve through an in-depth analysis of internal performance and cross-industry benchmarking. The assessment identified the key drivers for efficiency gains and quantifies the scale of opportunity to become more efficient that is realisable by the middle of AMP7 i.e. 2023.

1.191 The independent third party analysed Wholesale Water, Wholesale Wastewater and Retail separately. In each area it looked at the key drivers of cost, and where there are quick wins to reduce cost in each major process. It did this by conducting interviews with employees who work in each individual area, getting their feedback on issues with existing processes and teams. The independent third party developed process maps for the key areas of cost and broke these down to identify potential process improvements and savings. For example, in wholesale water, the key areas of focus were (i) distribution repair & maintenance; (ii) power; and (iii) treatment repair & maintenance.

1.192 Where possible, costs were broken down into their component parts and the drivers of costs were analysed to identify opportunities for efficiency improvements. For example, in distribution repair & maintenance, costs were broken down into:

Figure 34. Illustration of independent third party analysis prepared for Thames Water



Source: Independent third party analysis prepared for Thames Water

1.193 Each individual component of cost was analysed and broken down and inefficiency removed. For example, in the distribution repair & maintenance activity, the volume of aborted and repeated jobs assumed to occur each year was reduced by 50% from 22% to 11%. Repeated jobs were reduced from 15% to 5% in the assessment of the 'Full Potential' of distribution repair & maintenance costs. Utilisation was increased by 15% by reducing the idle waiting time at a job from 32% to 10% of working time by each employee.[89]

1.194 To achieve these changes in key cost driver assumptions, the independent third party proposed a number of actions and initiatives that we could take. These included revising the operating model and process in the cost area, improving systems and data, reviewing role definitions and performance management and optimising logistics.

[89] Thames Water analysis

Table 22 Summary of independent third party potential efficiency savings by the middle of AMP7 compared to 2015/16 costs

Business Area	Potential efficiency savings identified £m per annum
Wholesale Water	60-75
Wholesale Wastewater	30-45
Retail	20-25
Total	110-145

Source: Independent third party analysis prepared for Thames Water

1.195 We consider the efficiency improvements implied by the independent third party to be challenging and ambitious. We have assessed our performance by comparing the areas of potential efficiency identified in the benchmarking versus the related initiatives within our plan. We have not assessed against this benchmark work in totex terms as we are not able to compare like for like in terms of volumes, definition of base spend for capital maintenance and adjusting for changes in internal structure and overhead costs.