SRN19 Botex
Technical Annex

2nd October 2023
Version 1.0

from Southern Water

Contents

1. Executive summary

In this technical annex, we describe our botex and delivery plans for AMP8. Firstly, the annex describes the methodology we have followed to establish our bottom-up botex plan. Secondly, we provide the detail of the associated delivery plans for our base capital expenditure over AMP8.

We have divided this technical annex into Part A and Part B for ease of reading. In Part A, we describe the methodology we have followed to develop the bottom-up Business Plan for AMP8. Part A covers all aspects of wholesale water and wastewater (including bioresources) botex.

We have built our plan bottom-up and have tested the efficiency of our proposed costs using Ofwat's approach. This combination of robust methodology, underlying processes and overall consistency with the estimated regulatory cost envelope means that we are confident that our plan is efficient. In Part A, we cover:

- An explanation of the bottom-up cost methodology used to generate our BP Botex
- Our view of the range for the potential botex allowances following Ofwat's standard methodology and an overview of our key assumptions underlying the regulatory cost assessment methodology. The top-down approach Ofwat takes to assessing botex costs depends on several assumptions including the choice of model, degree of catch-up efficiency etc. Our estimation of these assumptions means that we have generated a range for the regulatory allowance, from which a midpoint has been reported. As such it is important to consider the assessment in the round alongside out bottom-up cost estimates when assessing the efficiency of the BP proposals
- A reconciliation of the BP against the range of estimated regulatory allowances. We show that our bottom-up costs fall within the range of estimated allowances and explain factors that help explain the difference in the numbers

In Part B, we provide the detail on the associated delivery plans for base capital expenditure over AMP8. We have broken down the botex into three sections; water, waste and central costs. For each section, we consider what we have achieved in AMP7, our plan for AMP8 and the associated base capital expenditure (Capex) requirements.

We have carefully reviewed the ongoing capital maintenance needs of both Water and Wastewater assets, considering asset deterioration, the root causes of service failure in AMP7 and requirement to control risk to an ongoing greater level to meet ever tightening performance objectives. Our plans therefore ensure:

- We are maintaining capital maintenance activities at a sustainable rate to deliver environmental, water quality and customer service performance
- Replacement of high-risk water and wastewater service impacting critical assets where planned interventions are more efficient and cost beneficial
- Required levels of statutory maintenance to remain complaint with all key regulatory controls across the asset base

In the remainder of the document, Part A: Botex Estimation Methodologies and Efficiency can be found in pages 7 to 39 and Part B: Botex Delivery Plan for AMP8 can be found in pages 40 to 93.

Part A: Botex Estimation Methodologies and Efficiency

2. Introduction and Context of Part A

2.1. Introduction

Part A of this Botex Technical Annex sets out the:

- Methodology we have followed to estimate our bottom-up Botex requirement;
- Cross-checks that we have applied to test the efficiency of our bottom-up estimate which include:
  - A review of the key processes involved in procuring third party support and determining our labour costs; and
  - An estimate of what we believe Ofwat would allow Southern Water (SW) as an efficient level of expenditure (regulatory allowance); and
- Factors that we believe explain the difference between our bottom-up estimate and the estimated regulatory allowance

We have followed a robust methodology to establish the bottom-up BP for AMP8. This has drawn on several tools and approaches to generate estimates of the costs that will be faced in each of the businesses. All of this is within the broader context of the longer-term programmes for water and wastewater.

To ensure that the proposed BP is efficient we have considered additional information.

1) Processes followed for key input costs around labour and procured services have been assessed to ensure that they meet with industry best practice and can deliver both current and ongoing efficient levels of costs. The processes we follow should deliver efficient costs
2) We have estimated what we believe the regulatory allowance will be for AMP8. This has involved using the econometric models that Ofwat has published prior to BP submission and the most up to date input information capturing the 2023 APR. From these we have been able to generate an estimate of the regulatory allowance

Table 2 1 summarises the overall position for the two wholesale businesses and SW as a whole. At a headline level it would appear that our BP is over £200m below the estimated regulatory allowance (assuming that all our CACs are accepted and that there are no adverse symmetrical CAC adjustments based on claims made by other companies). However, this is primarily because £183m will be delivered via an alternative delivery / DPC route with costs included in data table SUP12 rather than CW1.

Table 2-1 Final forecast regulatory allowances and proposed BP

Regulatory allowance	Water	Wastewater	Total
Forecast regulatory modelled botex allowance	909	2154	3063
CACs	110	343	453
Energy base cost uplift	125	144	269
RPEs	-89	-106	-195
Total forecast regulatory allowance (a)	**1,055**	**2,535**	**3,590**
Business plan			
Proposed botex (b)	**1,145**	**2,243**[1]	**3,387**
Differences			
(a) – (b)	**-90**	**292**	**203**

Note: A positive difference implies that the BP proposed botex is less than our forecast regulatory allowance and a negative difference implies that the BP proposed botex is greater than our forecast regulatory allowance. The table reports Botex on an equivalent definition to the regulatory allowance and assumes that all CACs are 100% allowed. BP Botex numbers are as per CW1 and CWW1 and CWW3. The RPE numbers are consistent with those reported in SRN16 Real Price Effects/ Frontier Shift Technical Annex adjusting for the energy cost model uplift option (option 2).

At an individual wholesale business level Wholesale Water faces a situation where the BP numbers are greater than the estimated regulatory allowance. We believe that the difference can be partly explained through adjustments for non-controllable, or only partly controllable, costs which have increased substantially between AMP7 and AMP8 but which the regulatory allowance does not adequately capture. We are making a specific claim for energy costs, one of those we consider to be non-controllable, which is explained in the SRN16 Real Price Effects/ Frontier Shift Technical Annex. However, other non-controllable costs have increased, and specific claims have not been raised. The increase in rates, for example, is at least £25m across AMP8 for the combined wholesale businesses.

In addition, the higher BP numbers reflect sustainable capital maintenance levels required for the Water asset base to maintain levels of required service.

Given the scale of the difference, and the fact that some of this can be explained through changes in non-controllable costs, we believe that this reinforces the fact that our BP is set at the efficient level of costs for us.

[1] Excludes alternative delivery costs for Whitfield growth scheme and the 2 Kent bioresources schemes reported via SUP12

This combination of robust methodology, underlying processes and overall consistency with the estimated regulatory cost envelope means that we are confident that our plan is efficient.

This annex is an integral part of the background to the BP. It provides information on the methodologies applied as well as the results of the different approaches. As such it draws on information from other parts of the BP, which form assumptions underlying Botex, and provides cost estimates that are incorporated into key parts of the plan.

Specifically, this annex:

- explains and supports the Botex elements of SRN05 Wholesale Water and SRN 06 Wholesale Wastewater (Cost and Outcomes) Chapters of the main BP which feed into the costs submitted in the plan underlying financeability, bill increases etc
- draws on the evidence in SRN04 Cost and Outcomes Approach Chapter and its associated annexes with respect to evidence from AMP7 being incorporated into the bottom-up methodology
- draws on the evidence provided on CACs (SRN20, SRN21, SRN22, SRN23 and SRN24) presented as supporting evidence to SRN04 Costs and Outcomes Approach Chapter to the BP
- supports the technical annex on Bioresources strategy (SRN36 Bioresources Strategy Technical Annex)
- provides the context for the narrative on Botex provided in Part B of this technical annex (SRN19)
- should be read in conjunction with SRN16 Real Price Effects/ Frontier Shift Technical Annex on Real Price Effects (RPEs)

Two independent reports, jointly commissioned by some of the water companies including ourselves, are referenced in this annex:

- Frontier Shift at PR24 – Economic Insights[2]
- RPEs – KPMG[3]

2.2. Consistency in calculations

It is important to ensure that the correct BP and regulatory allowance numbers are compared when assessing the efficiency of our plans.

The BP Botex proposal is taken as the sum of:

- Botex opex and capex from CW1.1, CW1.8, CWW1.1 and CWW1.8
- Totex growth at sewage treatment works (CWW3.155)

Noting that CW1/CWW1 are the post-frontier shift and RPE values.

This estimate of Botex can be compared to a regulatory allowance of:

- Modelled costs after catch-up efficiency and frontier shift

[2] Frontier shift at PR24-05-04-23-STC (economic-insight.com)
[3] *Treatment of energy costs in base models* and *Real Price Effects at PR24*.

- Cost adjustment claims (CACs)
- Expected real price effects across AMP8

We return to this consistency calculation in the final section of this annex. Note that since we employ an energy cost model uplift the RPE numbers are consistent with those reported as option 2 in the Real Price Effect Technical Annex.

2.3. Key assumptions

In this annex we have made assumptions about which models Ofwat will use at PR24, the value of cost drivers that Ofwat will use when estimating the regulatory allowance for AMP8 and the likely efficiency challenges that will be made.

These assumptions reflect our best view of what decisions Ofwat will make based on the available information. We reserve the right to challenge Ofwat's actual regulatory allowance it will publish at draft determination. Our view of the current allowance gap faced by Southern Water (SW) will also be subject to updating as we respond to Ofwat's draft determination.

We also assume that all our CACs are fully accepted and that there is no impact from symmetric CACs proposed by other companies.

All values are reported in 2022/23 prices.

3. Bottom Up

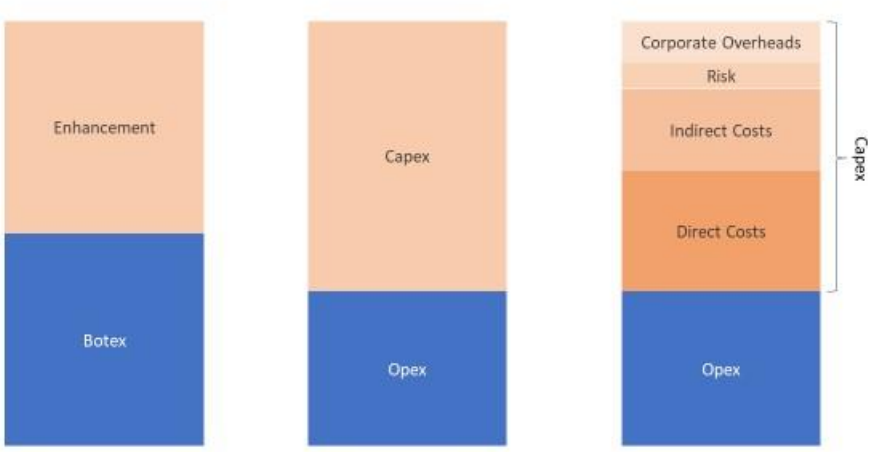
3.1. Overview of approach

This section describes the methodology employed in determining the bottom-up BP.

Overall Cost Stack

When thinking about costs it is possible to consider them in different, complementary, ways. For example, as shown in **Figure 3-1**, it is possible to think of the cost stack either from the perspective of the activity being supported – base costs or business-as-usual costs (Botex) and new activity costs (Enhancement) – or through the way that the cost is classified – operating expenditure (opex) or capital expenditure (capex). It is also possible to break the types of costs down further – **Figure 3-1** also illustrates a way of thinking about cost components within capex.

Figure 3-1 Our cost stack (illustrative)



While we need to build-up all these elements of cost, this annex is focused primarily on Botex. A separate annex provides more detail on enhancement.

The breakdown of costs considered is in line with industry/regulatory practice and also aligns with the way that Government expects project/capex costs to be considered.[4]

Asset Management Modelling

Base costs encompass both Capital Expenditure (Capex) and Operational Expenditures (Opex) that are essential for the fundamental functioning, maintenance, and sustainability of our water and wastewater infrastructure.

Estimating base costs is important in ensuring we allocate resources effectively, maintain service and asset quality, comply with regulatory demands, and safeguard operational resilience. It provides the essential foresight required to maintain the core infrastructure, ensuring the seamless delivery of vital water and wastewater services. By accurately forecasting the necessary Capex and Opex, we can ensure the longevity and efficiency of our assets and proactively address potential risks. This proactive approach to business planning not only sustains reliable service provision but also improves our ability to adapt to changing circumstances and evolving demands. It is imperative that we understand our risks across our portfolio, in order to keep providing a vital service that cannot be allowed to fail.

The core elements of our base costs are outlined below:

Base Capex – This is baseline Capex, i.e., the level of investment required to maintain our existing assets and infrastructure across Waste and Wastewater in a reliable and compliant state. These assets include treatment plants, reservoirs, pumping stations, and pipework.

Central Capex - This refers to investments that support the operation of our business, i.e., expenditure in our general infrastructure, facilities, or support functions, such as IT costs.

Base Opex – This refers to the operational expenditure required to maintain our existing level of services and functionality of our infrastructure, assets, and operations. It represents the ongoing costs associated with our day-to-day operations, maintenance, and routine activities necessary to sustain the baseline level of service. This can encompass labour, materials, energy, and other expenditures directly associated with ensuring the reliability and functionality of our water and wastewater infrastructure and service.

Capex Costing

Understanding our investment needs

Before we can accurately estimate how much our base plan will cost, we first need to understand the core requirements of our AMP8 plan. We need to understand whether there are any changing investment needs due to risks we have identified in the latest AMP period. We have strong tools that allow us to identify and record risks that may require additional investment in the next AMP. These tools allow us to then go through our optioneering process, ultimately determining what the essential investments in our core infrastructure that we need to prioritise are. Our subject matter experts will use their knowledge and experience, aided by

[4] UK Government Infrastructure and Projects Authority Cost Estimating Guidance, Published in 2021. IPA_Cost_Estimating_Guidance.pdf (publishing.service.gov.uk)

the insights from our risk process and tools, to then determine what is the optimal approach to costing specific areas of the plan.

It is thus crucial that we continually monitor, identify, and manage risks. For operational risks that relate to our core activities, we have a "business-as-usual" process to capture and monitor these through our Asset Risk Management (ARM) tool. Given our substantial asset base, we also face the known and inevitable risk of gradual physical deterioration of our assets over time. In some circumstances, we will utilise our deterioration modelling tool to project this degradation. We have outlined the process for utilising these tools in **Table 3-1** below.

Table 3-1 – Tools available

Tool	Explanation
ARM process	We are continually assessing our risks. We have a defined internal process used to identify risks to existing asset needs and resilience. This information is populated in our risk register ARM, with information on cause of failure, likelihood and failure consequence (based on serviceability consequence). As part of our business planning process, our SMEs review the risks in ARM and determine a short list of key priorities for investment in the Price Review.
Deterioration Modelling	Our [redacted] investment planning tool has a deterioration modelling module that we have been using and continuously improving since 2012. This looks at the potential future cost of deteriorating assets and the potential impact on service. This tool has been used in the derivation of some of our key investment areas (e.g., regional capital maintenance projects) and to support programme level cost decision making. This tool is strategically deployed where the predictive assessment of asset degradation is deemed to offer a substantial advantage. It is effective where assets within our portfolio exhibit well-defined degradation patterns, and where historical performance data can be used to project future deterioration rates. Given the resource requirement, it is most useful in cases where the potential consequences of asset degradation are significant, requiring a proactive and precise approach to resource allocation and maintenance planning.
Deep Dives	We perform deep dives where there is unacceptable risk or uncertainty, or data is not sufficiently robust. For example, if we have data that does not fit an expected pattern, e.g., if manhole cover repairs are linear for 4 years and then significantly different in year 5, we would perform a deep dive to get to the bottom of this discrepancy, ensuring the level of uncertainty is brought to a manageable level. We have targeted deep dives for areas where our SMEs have identified a need to improve infrastructure maintenance, management of assets, network performance and compliance with regulatory and legal requirements. They allow us to develop a thorough understanding of the complex challenges and opportunities within these areas. Our SMEs analyse data to identify trends, vulnerabilities, and potential risks within our infrastructure, ultimately developing actionable strategies and solutions, which determine the volume of work required that can then be

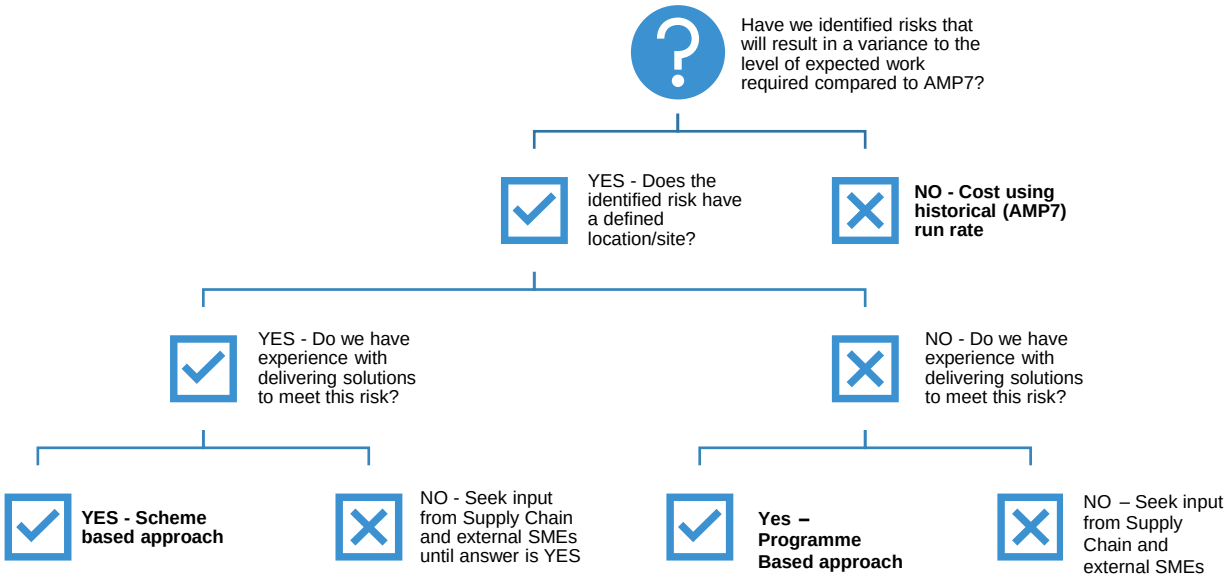
	costed. As with the other tools discussed, a key facet of a deep dive is the systematic evaluation of risks associated with our existing infrastructure. This informs the development of a risk profile, for example the risk of pipes failing or rising mains bursting. Consideration is given to solutions that enhance the resilience of our infrastructure, mitigate risks, and optimise long-term performance.
External SME/Consultancy Support	Some areas of investment have been derived by a subject matter expert or through the use of external consultancy support. These are typically areas of investment for which there is not a large amount of historical data available and/or require expertise and industry knowledge to understand needs, create cost effective solutions and provide industry comparable costs. We procure this external support through a number of routes. Our primary options are our Engineering and Technical Solutions supply chain, Low Complexity Delivery Route partners and our Repair and Maintenance (R&M) framework providers. These give us access to a broad range of both general and very specialist suppliers from which we can draw the necessary expertise.

Our approach to assessing and costing the investment required – Water and Wastewater

A one-size-fits-all approach to cost estimation is inappropriate given the diversity of issues faced across Water and Wastewater. The nature of the underlying tasks necessitates a nuanced and adaptive approach to accurately assess needs and determine appropriate costs. Recognising this, we employ a multifaceted strategy that tailors methodologies based on the specific nature of the work at hand, giving a more precise and effective estimation process.

Figure 3-2 below shows a simple decision tree that allows us to determine which of the three broad costing approaches (run-rate-based, scheme-based and programme-based) is most optimal for an area of work. The three approaches are explained in more detail in **Table 3-2**. Our SMEs consider the nature of the work, and any associated risks from reviewing the output of the relevant tools discussed above. This allows them to assess whether there is an additional need above and beyond the AMP7 requirement that will necessitate solution design and optioneering work from our Engineering Technical Solutions (ETS) team, which will then be costed by our Cost Intelligence Team (CIT). This design and costing will be done at the scheme or programme level depending on the nature of the risk identified.

Figure 3-2 Water and Wastewater Capex costing decision tree



Of the three approaches, run rate would be the first and simplest tool, but if not suitable then we would use the scheme or programme based approaches.

Table 3-2 – Costing approaches

Tool	Explanation
Run rate Based	There are some investment areas where our risks are repetitive and have a spend profile that is proportional to the amount of work required. Our SMEs have used historical spend data to determine the required spend. In many cases, where this historical information is used directly there are no plans to alter the needs and requirements in the future; so, the use of historical investment data is a straight-forward projection of the future investment levels. A good example of this would be manhole cover repairs. Investment in manhole cover repairs has been assessed in terms of need - there is no evidence to suggest a changing requirement. This is an effective approach for work where fundamental requirements have exhibited stability across time and our risk monitoring process has not captured significant risks that necessitate further investment.
Scheme Based	For work where we have identified risks at a known location, we take a scheme-based approach. Our base schemes are schemes that we have already delivered in previous AMPs, thus they require solutions that we have experience of delivering and have past delivery data to support our projections into the future. For example, we may have a pumping station in a particular location that keeps failing, resulting in us having to tanker/over pump and repair. Therefore, we give the scheme to our ETS team to determine the root

	cause of the problem and to follow the optioneering process to fix. This follows the standard cost methodology and optioneering process for enhancements to design and build a replacement pumping station or other permanent repair. We have outlined our robust and efficient cost and optioneering process in SRN15 Cost and Option Methodology Technical Annex. Our subject matter experts use a mix of tools to analyse and model the impact of these risks to determine the volume of work required. Work can then be costed by SMEs using unit rates or by ETS/CIT.
Programme Based	For work where we have identified risks, but we do not know the exact location/sites where the risk will require work, we need to take a programme-based approach. We can estimate the potential impact in terms of volume of work required based on our risk assessments and historical experience, however we cannot design scheme solutions in advance as we do not know the precise locations where the work will be required. Thus, we need a budget that allows us to react to the need as and when it arises. An example of assets that fall under this criterion are rising mains where we have thousands of kilometres of pipework across the network. All this pipework will be degrading for various reasons, and at different rates. We know that we will have to replace some of this pipework each year, so we have targeted mains replacement programmes (proactive capital maintenance - scheme based). We also know that some unexpected segments will also need work (reactive capital maintenance). As such we take a programme-based approach where we undertake condition assessments and respond to bursts. We assign a capital value to this risk and our mitigation is to determine where to intervene through responding to bursts. Our SMEs use a mix of tools to analyse and model the impact of these risks to determine the volume of work required. For example, in the case of Sewers, our SMEs performed a deep dive, analysing various data sources, including historical data to inform asset condition, failure likelihood, impact and risk. We utilised our [redacted] to predict asset health and collapse trend, as well as to forecast the impact of different solutions. We have a risk score table that identified high risk/poor condition critical sewers and developed a strategy for AMP8 that includes focusing on inspecting critical sewers and planning pro-active intervention to avoid high cost and high impact incidents, and ringfencing budgets for structural repair and ground water related schemes. Our plan is to improve our surveying and monitoring of assets, validating data, and rehabilitating high risk and poor condition sewers to improve asset health. We also plan to invest in new surveying technologies to be utilised as appropriate.

Our approach to assessing and costing the investment required – Central Capex

Central Capex is comprised of general business overheads such as IT, Facility and R&D costs, i.e., investments that support the operation of our business. These are costs which do not directly serve the needs of Water or Wastewater operations or capital schemes. We determine what level of cost estimation is required for a given project based on the nature and complexity of the costs, and our experience and data availability relating to the work required by the project.

For costs modelled by an SME, the typical approach to modelling these is a bottom-up approach, i.e., forecasting the volume that will be required at AMP8 to serve the business and then multiplying this by an estimated unit cost. Given the nature of central costs, i.e., they fit into well-defined categories, it is appropriate for our experienced Asset Managers to utilise their market experience, knowledge and familiarity with industry benchmarks to ensure a robust initial cost estimate. We have designed a cost maturity methodology to ensure that as we progress through design, we implement more detailed costing.

Our IT business enablement investment has been cost assured externally by [redacted]. These costs have been selected for assurance as [redacted] has a lot of experience with implementation of capabilities with have identified in our business enablement portfolio. [redacted]'s review of our business enablement activity indicated our projected costs were c.14% above their expectations (based on their experience and industry benchmarking). To set ourselves an efficient target we have reduced our proposed business enablement costs by 14%. We have also scrutinised our core IT costs in cost efficiency reviews and are proposing a 14% Capex efficiency on these costs to align with the efficiency applied to the business enablement costs.

3.2. Ensuring efficiency of key spend areas

This section considers two key areas of expenditure and the actions that we take to ensure that our costs are efficient both now and into the future.

Procurement

We have developed new framework procurements aligned to the scope of AMP8 that have been informed by extensive market engagement, analysis of the sector, and the wider infrastructure market. Our operating model relies upon effective contracts for Capital Delivery, Project Management, Technical and Asset Management Services (Professional Services), and Operate, Repair and Maintenance services (Network Services).

The rationale and overview for each of our new frameworks is set out in the table below.

Table 3-3 Approach to procurement for key contracts

Area	Rationale
Capital Delivery	To ensure efficient and effective delivery and accommodate the challenges of pipeline uncertainty, framework contracts will be procured for AMP8 Capital Delivery. Works will be called-off in the form of works contracts (with project or programme specific options) as programmes and projects are agreed. Market analysis, and our experience, confirms that that supply chain resilience can best be achieved through having access to a range of delivery routes, each with their own specialist capabilities.

	We are tendering two Capital Programme packages: Strategic Delivery Partners and the Infrastructure Low Complexity Delivery Route.
Professional Services	The requirement for professional advice covers both routine and ad-hoc requirements, spanning project management and controls, asset management, and related technical advisory capabilities. There is an opportunity for us to further build our own in-house capabilities and capacity, using bought-in help for surges and ad-hoc demand, but this needs to be founded on a stable known programme of work emerging from PR24.
Network Services	The Network Services scope includes routine inspection, test, and maintenance, but will also need to handle emergent repairs, and have the option of calling-off additional services if funds are available to invest (e.g., preventative maintenance). It will include leakage detection and control, and developer services.
Other Areas of Spend	In addition to the Non-Infrastructure LCDR framework which has been let in 2023 and extends into AMP 8, we have other equipment and operational site services contracts which complement the new AMP 8 frameworks outlined above and will support the resilience of the supply chain to deliver the AMP 8 programme.

Packaging of our frameworks

We are establishing sufficient depth and breadth of supply chain partners, which will reduce the risk to our delivery schedule that may arise in our supply chain due to capacity constraints. This will also facilitate a healthy level of competition that will drive supplier performance through our frameworks.

Our framework requirements have been packaged to secure the best competition from the suppliers with the capability and capacity to deliver the services to us. The frameworks have flexibility to provide greater resilience, allowing works to be allocated to best meet business requirements.

Agreeing the essential requirements and commercial terms in the frameworks simplifies the call-off process and will improve supplier participation in mini-competitions where they are needed.

Contract Award/ Provision

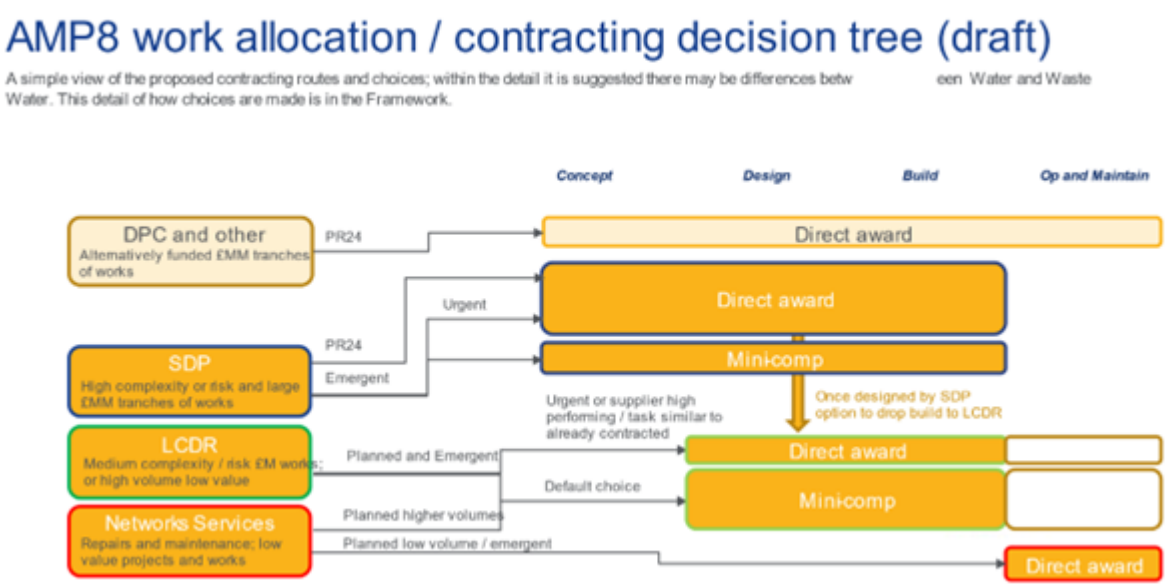
We commenced our procurement process for AMP8 in February 2023, which follows the below stages:

1) Market engagement event to explain our priorities, undertake a market review, and gain feedback from suppliers on our design drafts. The market engagement stimulated a healthy level of competition and aims to reduce the volume of clarification questions during the tendering process
2) Prior Information Notice (PIN) to advertise the opportunity for each framework package
3) Pre-Qualification Questionnaire (PQQ) to pre-qualify the market
4) Invitation to Tender (ITT) to secure offers. Evaluation will therefore not just be focussed on price, but the quality of responses in promoting our priorities (incl. delivery effectiveness and efficiency)
5) Contract Award: The approval process will follow our existing process, ensuring that contract awarding aligns with other procurements throughout the organisation

Mini competition

There will be multiple suppliers for most of the frameworks. In most cases there is the option of a mini competition or direct award based on the criteria set -out in the decision tree shown in **Figure 3-3**. This again gives us the flexibility to keep competitive pressure on suppliers where that is feasible and desirable.

Figure 3-3 Mini-competition decision tree



Labour

We currently work with [redacted] and their [redacted] as our benchmarking and market testing survey data.

[redacted] and their [redacted] are considered market leading in the services that they provide, is simple to use and therefore transparent for our Line Managers and provides information enabling data led, robust decision making around pay and benefits.

[redacted]

[redacted]

[redacted].

Table 3-4 Salary job families

Corporate Affairs & Communications
Customer Service
Engineering
Engineering Project Management
Finance
General
Health & Safety
HR
IT
IT Specialist
Legal
Operations
Procurement
Project Management
Real Estate, Facilities & Fleet
Risk Management
Strategic Planning

Each job family has a match into the [redacted] data. [redacted] survey over 900 UK companies and provide regular updates on all elements of the reward package. SW receive [redacted].

[redacted]

An ongoing review process of benchmark data for base pay, flexible pay elements and additional benefits is in place to ensure we remain competitive to both attract and retain talent for SW.

The [redacted] and is based on negotiation [redacted] and is based on [redacted]. Performance is recognised via the [redacted]

3.3. Non Controllable Costs

A final set of costs that should be considered are those where we have limited, or no, control over the costs. There are several important areas of costs that fall into this category including:

- Energy
- Business Rates
- Traffic Management Act costs; and

- Lane charges

These costs are subject to change outside our control, yet they are estimated by Ofwat based on historical information.

Energy is a good example of this. Our net energy costs are forecast to increase from 2022/23 to 2025/26 by 114% for water and 101% for wastewater. This is substantially beyond our control – as described in our response to Ofwat's supplemental questions set out in its letter of 11th August 2023. Even when hedging is considered our degree of control is limited and the transaction costs associated with hedging and the degree of protection offered has changed materially since the jump in energy costs linked to the invasion of Ukraine. Again, this is descried in our response to the Ofwat data request/supplemental questions.

While the other non-controllable costs are of a lower magnitude than energy, the increases can still be significant. For example, the increase in Business Rates across AMP8 compared to AMP7 is at least £25m.

Where costs are outside our control, we have sought to provide the latest estimate of the cost for the BP and, in many cases, this represents a substantial increase on the AMP7 costs and consequently needs to be taken into account when setting the regulatory allowance.

It should be noted that getting the starting level right for non-controllable costs is different to the issue of managing year-on-year changes in these costs. The latter is best achieved through RPEs while the former can be either through a direct increase in the starting regulatory allowance or a change to the RPE approach employed by Ofwat (cumulative RPEs starting from earlier in AMP7 rather than focused solely on a year-by-year change). This issue is explained in further detail in the Real Price Effects Technical Annex.

With respect to RPEs, the numbers are explained in the Real Price Effects Technical Annex and are those that adjust for the existence of the energy cost model uplift (option 2). The RPEs are summarised in **Table 3-5** below.

Table 3-5 Estimated RPEs over AMP8

RPEs	Water	Wastewater	Total
Energy	-94	-128	-222
Labour	5	23	28
Chemicals	0	-1	-1
Materials and Plant	0	0	0
Total	**-89**	**-106**	**-195**

4. Top-down Benchmarking

When using top-down benchmarking we have sought to follow Ofwat's approach to estimating the allowed costs (or regulatory allowance). Ofwat has followed a standard approach to determining the regulatory cost allowance. For botex this aproach is:

1. use a suite of econometric models to estimate the required cost allowance for different elements of the wholesale business
2. apply catch-up efficiency challenges to the estimated values to provide an efficient allowance
3. bring together the various estimates at different business levels to provide triangulated single values for each of the regulated businesses and for the wholesale business as a whole
4. allow companies to make CACs for areas where the modelled value is deemed insufficient
5. apply ongoing year-on-year efficiency savings (frontier shift) as well as RPEs to establish the final allowance

It should be noted that we only consider modelled botex in this technical annex. Unmodelled botex is considered in the main chapters.

4.1. Modelled values

In its April 2023 consultation, Ofwat identified suites of preferred models which it was seeking views on. The following table summarises the number of models Ofwat was proposing by business area (**Table 4-1**).

Table 4-1 - Modelled Values

Area	Number of models
Water resources plus	6
Treated water distribution	6
Wholesale water	12
Sewage collection	6
Sewage treatment	3
Wholesale wastewater plus	8
Bioresources total cost	6
Bioresources unit cost	4

Source: Ofwat, April 2023 consultation

At the same time, Ofwat released an updated cost database that can be used to estimate the individual company allowances with the models. We have subsequently updated this database to include the APR2023 data.

To forecast AMP8 allowances we have:

1. Generated SW values for the cost drivers across the AMP8 period
2. Used these forecast cost driver values to generate estimates for cost allowances

The cost driver values were generated using the same approach adopted by Ofwat at PR19. This means linear trends have been applied in the majority of cases but a sense check has been applied to ensure that values are robust, i.e. meter penetration does not exceed 100% etc.

4.2. Catch up Challenge

The econometric models generate forecasts of cost allowances at average efficiency. Ofwat has interpreted its obligation to allow efficient costs as requiring a stricter target than average efficiency and consequently sets a higher requirement for efficiency based around at least meeting an upper quartile level of efficiency. This means the allowance is reduced to be set at the more demanding level of efficiency.

In its guidance for PR24 Ofwat has stated that it will use its regulatory judgement to decide if a more stretching target than upper quartile is needed. At 2019 Price Review (PR19), Ofwat used targets tighter than upper quartile – for water this meant the fourth company's value was used and for sewerage the third company's value.[5]

Given the uncertainty about final models, the data not covering a full AMP and the lack of BP data for the forward-looking estimates, it is not possible to forecast what the catch-up efficiency challenge for PR24 will be. As an alternative we have chosen to apply the range of catch-up efficiency from PR19 (**Table 4-2**).

Table 4-2 - Catch-up efficiency range from PR19

Area	Historical	Forward-looking
Water	0.9540281745	0.8909063615
Wastewater (inc bioresources)	0.9796415849	0.9884862988

Source: Table 7: Comparison of the catch-up challenge at different performance level, *PR19 Final Determination: Securing cost efficiency technical appendix*, April 2020, Wholesale water Feeder Model 4 and Wholesale wastewater Feeder Model 4.

These values have been used when setting the efficient regulatory botex allowance.

4.3. CACs

Ofwat's econometric model informs the setting of efficient cost allowances for companies by developing models that are consistent with engineering, operational and economic understanding of cost drivers. The models are designed to be sensibly simple and capture the main global cost drivers to allow comparison between different water companies. Ofwat recognises that any model has its limitations particularly when modelling a complex water network and regularly undertakes industry consultations to consider changes to its cost models where appropriate.

[5] Ofwat, page 35 of *Appendix 9 – Setting expenditure allowances* of the Final Methodology, December 2022

All water companies have different challenges with regional variations in geography and network age. For example, our network comprises the Isle of Wight separate from the mainland which brings its own nuances that increase our Opex spend.

All our CACs are discussed in detail in separate documents attached to the BP.

Water

We are submitting two water botex CACs, for **meter replacement**, and **regional wages.** Table 4-3 summarises our water related CACs and the value on each claim.

Table 4-3 Water Related CACs

Claim	Water
Meter replacement	£88.8m
Regional wages	£21.5m
Total	**£110.2m**

Wastewater

Table 4-4 summarises the CACs that have been submitted alongside this BP. There are four formal CACs that we have submitted to Ofwat. These cover: the **coastal variable effect**; **regional wages**, **wastewater growth** and the **AAD at Ashford and Ham Hill**.

Table 4-4 - CACs

Claim	Wastewater
Coastal variable effect	£65.5m
Regional wages	£66.4m
Wastewater growth	£97.9m
AAD Ashford and Ham Hill	£112.8m
Total	**£342.6m**

Note: values are the net value once any implicit allowance has been removed.

Other company symmetric claims

Ofwat published information on the symmetric CACs proposed by all the companies in the sector and asked for our views on the legitimacy of the claims to be set out in our BP. Appendix 2 provides our view.

No adjustment has been made to our estimate of the regulatory allowance for symmetric CACs made by other companies. We do not make any adjustments as: (i) it is not clear whether Ofwat will allow the CAC or not; and (ii) the precise impact for Southern will depend on the final regulatory models selected by Ofwat and these will not be known until Draft Determination. We reserve the right to respond on specific symmetric CACs once Ofwat has made its position clear at Draft Determination.

4.4. RPE / Frontier shift

A second efficiency challenge is made. This is a dynamic challenge, referred to as frontier shift or ongoing efficiency, which reflects the fact that year-on-year improvements in efficiency across the industry can be expected.

Across the industry support has been provided by [redacted], whose report is included with our BP submission. The remainder of this section summarises the plausible range identified by the consultants. This range is 0.3 – 0.7%.

Ofwat's PR19 frontier shift challenge was set at 1.1%. However, between the years 1995 and 2019, only 12 out of 46 sectors in the UK had Total Factor Productivity (TFP) growth of 1.1% or above. These sectors were high-tech industries, such as telecoms; chemicals; and computing.

Prior to PR14, frontier shift was typically set well below 1.0% by Ofwat. The persistence and consistency of low productivity in the UK over time, and across industries, calls into question the trajectory of regulatory determined frontier shift.

Choice of Comparators: Selection of database and industries:

Before assessing any comparators against the three set of criteria, all the industries (in both the EU KLEMS and ONS databases) were first filtered down to a set that contained:

- Those previously considered by Ofwat and the Competition and Markets Authority (CMA) or by the Utility Regulator Northern Ireland (UREGNI)
- Any further industries that we consider could share similar characteristics to the water industry

This led to NACE II industries, along with the NACE I equivalent. The EU KLEMS dataset provides productivity information that is comparable across a range of countries, including those from the EU, UK, US, and Japan. EU KLEMS draws its source information from national statistics agencies. It analyses how TFP varies over the time period by decomposing the contribution to growth in volume terms of capital, labour and TFP. It considers up to 46 sectors in its NACE II dataset. An advantage of using EU KLEMS is that the dataset is consistent with the national accounts data of the countries it reports on. This is an improvement upon the alternative of using firm-level data, which is not usually consistent with national accounts, and contains estimates that are crude. Furthermore, the EU KLEMS dataset builds upon the national accounts data of individual countries by using a common methodology to estimate the labour quality and capital. This enables productivity comparisons to be drawn.

During PR19 and the subsequent redeterminations Ofwat and the CMA broadly agreed on the industries that represent appropriate comparators to the water industry, for the purpose of assessing frontier shift. The industries considered were:

- Total manufacturing
- Construction
- Chemicals and chemical products
- Other manufacturing; repair and installation of machinery and equipment
- Transport and storage
- Machinery and equipment N.E.C.

- Professional, scientific, technical, administrative and support service activities

Alongside the above comparators, Ofwat also reviewed a wider set of industries that included those assessed by various economics consultancies on behalf of water companies. Furthermore, in its Draft Determination for the 2021-27 price control, UREGNI considered Manufacturing, Electricity, gas, steam and air conditioning supply, Transportation and storage, Financial and insurance activities and Professional, scientific and technical activities, and administrative and support service activities.

Criterion behind choice of comparators:

- **Criterion 1:** *Similarity of activities being undertaken:* The activities undertaken in the comparator sector should be similar to those in water
- **Criterion 2:** *Competitiveness of industry:* The comparator sector should be competitive in order to mitigate the impact of catch-up efficiencies
- **Criterion 3***: Extent of scale effects:* The extent of fixed costs and growth rates over time should be similar between comparators and the water industry in order to mitigate the impact of scale effects

Rationale for selecting comparators:

The 'preferred set' of comparators as those that fulfil the following conditions:

- Defined as "Green" or "Amber" in Criterion 1, such that the activities being undertaken by firms working in the comparator industry are similar (at least in part) to the water industry
- Defined as being "Green" or "Amber" in Criterion 2, such that the industry is at least somewhat competitive
- Defined as "Green" in at least one of Criteria 1, 2 and 3, such that the magnitude and/or timing of scale effects are at least somewhat similar to the water industry

Table A1-5-5 in Appendix 1 highlights the final list of sectors that are selected for the preferred set to assess the frontier shift, along with a comparison with the sectors considered by Ofwat in PR19.

Choice of time period:

Rationale-

1. **Internal consistency**, such that the time period used to assess frontier shift is consistent with the time period used to inform other key components of the price control (for e.g., equity returns, given their correlation with productivity and growth).
2. The **structural break** arising from the financial crisis, which has marked a 15-year period of falling and persistently low productivity.
3. The inclusion of **full business cycles**, as productivity is shown to be pro-cyclical.
4. The **utilization of the data** available, to reduce the impact of outliers.

Selected time periods in datasets-

1. **2010-2019 (EU KLEMS NACE II):** This covers majority of the recent business cycle (2010-2020). [TFP estimates are unavailable for 2020 within the NACE II database].
    a) The lower bound of frontier shift is estimated to be **0.3%.**
    b) It is presumed that it is *unlikely* that productivity will deteriorate further; and so, a persistence of the recent past also provides a likely lower bound.

2. **Weighted average of 1995-2019 (EU KLEMS NACE II) and 1970 to 2007 (EU KLEMS NACE I):**

Estimates from the two databases by calculating a weighted average. **(**Table A1-5-5**)**
This estimate effectively provides a long-term view, which balances the low productivity seen post financial crisis against higher productivity performance in the more distant past.

1970 to 2007 (EU KLEMS NACE I): This covers all period for all available data in NACE I database, including the vast majority of the four business cycles before the financial crisis (considered to be 1970-1974; 1975-1980; 1981-1991; and 1992-2009) [data is unavailable beyond 2007 in the NACE I database].

1995-2019 (EU KLEMS NACE II): This covers the period for all available in NACE II database, including the two most recent business cycles (considered to be 1992-2009; and 2010-2020) [data is unavailable for 2020, or before 1995].

a) This leads to a frontier shift estimate of **0.7%,** which provides the upper end of our *'PR24 focused range'*.
b) As this still amounts to almost doubling of productivity, relative to prevailing levels, it unlikely that performance in the water industry will be above this level over PR24.

Summary on Frontier Shift

As per the work undertaken by [redacted] for ourselves and other companies in the sector, a range of 0.3 to 0.7 is a robust range for the annual Frontier Shift that the water sector should be subjected to. As there is no obvious reason for choosing either of the extreme ends of our range, we propose a Frontier Shift of 0.5% per annum for AMP8.

This Frontier Shift has been applied to the estimated regulatory allowances generated by the econometric models and estimated allowances are reported in this annex after the application of the 0.5% per annum reduction.

5. Comparison of Bottom-up and Top-down

5.1. Reconciling the overall modelled Botex allowance

This final section draws together our forecasts of the various allowances and compares this with our BP proposals. This is summarised in the tables below.

Table 5-1 Summary of modelled costs (£m)

Wholesale water	Min	Max
Water resources	85	89
Water network plus	797	847
Wholesale water	881	936
Midpoint	909	
Wholesale wastewater		
Wastewater network plus	1,800	1,815
Bioresources	346	348
Wholesale wastewater	2,145	2,163
Midpoint	2,154	

Note: Min and Max generated through use of different catch-up efficiency assumptions on the same triangulated models, see Section 4.2.

As discussed in Section 4, there are adjustments that can be made to the forecast regulatory allowance. These and a comparison with the BP numbers are shown in Table 5-2.

Table 5-2 Final forecast regulatory allowances and proposed BP

Regulatory allowance	Water	Wastewater	Total
Forecast regulatory modelled botex allowance	909	2154	3063
CACs	110	343	453
Energy base cost uplift	125	144	269
RPEs	-89	-106	-195
Total forecast regulatory allowance (a)	**1,055**	**2,535**	**3,590**
Business plan			
Proposed botex (b)	**1,145**	**2,243**	**3,387**
Differences			
(a) – (b)	**-90**	**292**	**203**

Note: A positive difference implies that the BP proposed botex is less than our forecast regulatory allowance and a negative difference implies that the BP proposed botex is greater than our forecast regulatory allowance. The table reports Botex on an equivalent definition to the regulatory allowance and assumes that all CACs are 100% allowed. BP Botex numbers are as per CW1 and CWW1 and CWW3. The RPE numbers are consistent with those reported in the RPE Technical Annex adjusting for the energy cost model uplift option (option 2).

As can be seen from the table water and wastewater appear to face quite different situations:

- In wholesale water we are proposing to spend £90m more than the adjusted regulatory allowance would allow us
- We are proposing to spend about £300m less in wastewater than our estimated regulatory allowance. This is primarily due to some major schemes being delivered via an alternative delivery mechanism accounting for £183m[6], these costs are not included in CWW1
- Overall, we are proposing spending over £200m less than our expected regulatory allowance

The situation is not as simple as this. First, the regulatory allowance numbers are indicative as:

- We do not know what the final econometric models are that Ofwat will apply and what the level of any catch-up challenge or frontier shift applied will be
- They are based on 100% acceptance of our proposed CACs
- They include a base uplift for energy costs (equivalent to a CAC); and
- They ignore the possible impact of symmetric CACs proposed by other companies

Second, there are factors that are not captured, especially costs outside the control of the company that could give rise to additional allowances.

These are discussed in more detail in the following sections that investigate the differences at the wholesale business level.

[6] Refer to SRN17 Direct Procurement for Customers & Alternative Delivery Model

5.2. Wholesale Water reconciliation

The impact of the additional factors is summarised in **Table 5-3** below.

Table 5-3 Explanation of deviation in Wholesale Water Botex

Regulatory allowance	
Forecast regulatory modelled botex allowance	909
CACs	110
Energy base cost uplift	125
RPEs	-89
Total forecast regulatory allowance (a)	**1,055**
Business plan	
Proposed botex (b)	**1,145**
Differences	
(c) = (a) – (b)	**-90**
Non-controllable costs	
Rates/ TMA (d)	8
Overall position	
(e) = (c) + (d)	-82

Note: A positive difference implies that the BP proposed botex is less than our forecast regulatory allowance and a negative difference implies that the BP proposed botex is greater than our forecast regulatory allowance.

While our BP is greater than our estimate of the regulatory allowance, much of the difference can be explained by:

- CACs; and
- Non-controllable cost increases

When these two elements are taken together, we believe that our BP is £82m greater than the estimated allowance.

A further explanation for the higher BP numbers is the need for sustainable capital maintenance levels required for the Water asset base to maintain levels of required service. This is discussed further in Part B of this Technical Annex.

5.3. Wholesale Wastewater reconciliation

The impact of the additional factors is summarised in **Table 5-4** overleaf.

Table 5-4 Explanation of deviation in Wholesale Wastewater Botex

Regulatory allowance	
Forecast regulatory modelled botex allowance	2,154
CACs	343
Energy base cost uplift	144
RPEs	-106
Total forecast regulatory allowance (a)	**2,535**
Business plan	
Proposed botex (b)	**2,243**
Differences	
(c) = (a) – (b)	**292**
Non-controllable costs	
Rates (d)	20
Overall position	
(e) = (c) + (d)	312

Note: A positive difference implies that the BP proposed botex is less than our forecast regulatory allowance and a negative difference implies that the BP proposed botex is greater than our forecast regulatory allowance.

Our BP is less than the estimated regulatory allowance. Once the non-controllable costs are also taken into account this difference is over £300m[7].

[7] Excludes £183m of schemes being delivered through the alternative delivery route

Part A Appendices

Appendix 1: Frontier Shift industry data

When choosing industries to include in the frontier shift analysis it is important to have a clear set of criteria. The consultants developed three criteria for choosing industries as comparators:

- **Criterion 1:** the activities undertaken in the comparator sector should be similar to those in water.
- **Criterion 2:** the comparator sector should be competitive (to mitigate the impact of catch-up efficiencies).
- **Criterion 3:** the extent of fixed costs and growth rates over time should be similar between comparators and the water industry (to mitigate the impact of scale effects)

Applying these criteria to the industries covered in the NACE I and II datasets led to seven industries (or industry groupings) being considered as comparators for the water sector. These industries and the results of the frontier shift analysis are set out in the table below.

Table A1-5-5: Industry-wise Lower and Upper Bound Values

Comparator	2010-2019	1970-2019 (weighted average of 1970-2007; 1995-2019)
Total industries	0.2%	0.2%
Agriculture, forestry and fishing	1.1%	1.1%
Manufacturing	0.4%	0.9%
Chemicals; basic pharmaceutical products	1.2%	1.6%
Manufacture of rubber and plastic products and other non-metallic mineral products	1.0%	0.9%
Manufacture of furniture; jewellery, musical instruments, toys; repair and installation of machinery and equipment	-0.4%	1.0%
Wholesale and retail trade; repair of motor vehicles and motorcycles	-0.1%	-0.1%
Transportation and storage	-0.6%	0.5%
Final results (average)	**0.3%**	**0.7%**

Appendix 2: SW view on relevant CACs submitted by other companies

Company	Claim area	Control	SW view
Anglian Water	Average Pumping Head	Water Network Plus	Ofwat has included average pumping head (APH) as an alternative variable to capture the topography in which networks operate in. South Staffs Water and Anglian Water support Ofwat's decision to use APH and do not support the use of booster pumping station per length of mains used at PR19 as a measure of topography in any of the cost models. **We do not agree with the inclusion of APH in the water network plus models.** We do not believe *'the concerns raised over the quality of APH data during PR19 and the subsequent CMA process have been substantially addressed by the industry.'* Although there has been improvement in reporting, the data quality remains a concern. This is evident in the Turner and Townsend report[8]. There are significant variations adopted by companies in capturing both volume and lift data as many companies rely mainly on estimated rather than measured data. The widespread use of estimated, static (or near static) data, means that the data is necessarily wrong, inconsistent, and likely to be overestimated. Severn Trent and SES Water propose inclusion of average pumping head in Water Resources Plus models. **We do not agree with this proposal either** as there is no evidence from the data and modelling to support this claim. The APH variable is an insignificant driver of costs in the water resources plus cost models. While we accept that there is an engineering logic for using APH, on balance, we do not agree with its use at this stage. The number of booster pumping stations per length of
Severn Trent	Average Pumping Head	Water Network Plus, Water Resources	
SES Water	Pumping costs / topography	Water Resources Plus, Water Network Plus	
South Staffs Water	Topography	Water Network Plus	

[8] Average Pumping Head: data quality improvement. Final report to Ofwat. Turner & Townsend, 24 March 2022.

Company	Claim area	Control	SW view
			mains is a suitable proxy for differences in topography of the network. Its estimated coefficient is robust, statistically significant, and positive across all cost models.
Anglian Water	Boundary box replacements	Water Network Plus	Anglian provides evidence that it installed meters early in comparison to the industry and, as early adopters, has a more pressing need to replace assets. **We support this claim.** Likewise, Southern was an earlier adopter of universal metering in AMP5 (2010-15) ahead of many other companies. Earlier meter adopters Anglian and Southern, are now in a situation where the meter assets need replacing in AMP8 is significantly above the average seen in the sector historically and captured in the base cost modelled allowances. Failing to replace metering assets compromises the ability to accurate measure consumption and ensure we are compliant with statutory obligations to maintain meters to a prescribed level of accuracy.
South East Water	Meter renewals	Water resources, Water Network plus	South East Water find that the rate of meter replacement given by the wholesale models is well below the rate required to keep all of their meters working. **We support this claim.** We find ourselves to be in exactly the same position Early meter adopters South East Water, Anglian (see claim above) and SW have a much higher proportion of meters that need replacing in AMP8 than the industry average. Base cost models fund the historical meter replacement rate which results in a funding shortfall for these companies which face a replacement rate above industry average in aMP8. Underfunding will compromise our ability to continue to accurately measure consumption. Any such significant under-registration of meters would be in breach of our statutory obligation to maintain meters to a prescribed level of accuracy. It would also impact negatively water efficiency and leakage performance; reduce accuracy of customer charging; create unfairness in charging favouring under-registered customers and distort incentives to use water wisely.

Company	Claim area	Control	SW view
Affinity Water	Regional wages	Water Network Plus	We support the rationale behind Affinity Water's CAC. We raised a similar claim. The case for making regional wage adjustments in cost benchmarking is strong when considering that: 1. Labour is the most dominant input for our services 2. Regional wages vary across UK regions – they are particularly high in London and the South-East compared to other regions. 3. The need to employ people within the region and the level of regional wages are largely outside management control. While we agree with the rationale for the claim, we do not agree with Affinity's approach to calculating required cost adjustments. 1. Affinity is using data on weekly wages rather than hourly wages. The case in favour of hourly wages and against weekly wages was made clear at PR19 (e.g., weekly wages capture not only variation in wage levels across regions, but also variation in working hours. This variation is irrelevant and distortive for our purpose). For these reasons both Ofwat and Ofgem have used hourly wage in the past. When regional wages are calculated based on hourly gross wage, SW ranks fourth highest in the sector, rather than eighth with the weekly wage. Affinity, on the other hand, ranks sixth highest with an hourly wage, rather than third with weekly wages (we note that we have not verified Affinity's calculations of regional wages with weekly ASHE data). 2. From our understanding, based on Appendix B, Affinity Water used all employees to calculate reginal wages. A better approach – again, consistent with Ofgem's and Ofwat's past application – is to use information from occupational categories that are used in the provision of water and wastewater services. Using information from all employees can materially distort the regional wage variation in the water sector. 3. Affinity's use of the second approach (pre-modelling adjustment) does not involve any efficiency assessment (when Ofgem does pre-modelling adjustment it then estimates models on the adjusted data to efficiency assess

Company	Claim area	Control	SW view
			companies' costs – Affinity does not do that). 4. The symmetrical adjustments are based only on the second approach (pre-modelling adjustment) This is not appropriate. The first approach (adding the regional wage variable to the econometric models) can provide just the same insight on symmetrical adjustment. 5. It is not clear why Affinity's symmetrical adjustment (58.5m in table 12) is different from the value of its claim (which is either £53.5 as appear in the exec summary, or £48.7m as appear on page 12 after deduction of an implicit allowance). This undermines the credibility of the symmetrical adjustments. We re-iterate that we agree with the rationale for Affinity's claim and would like to see Ofwat taking into account the effect of regional wage variation in its cost assessment approach.
Portsmouth Water	Lumpy maintenance expenditure	Water Network Plus	Botex models provide insufficient allowance for lumpy capital maintenance for small companies if subjected to a cap as happened to SEW at PR19. For consistency a greater allowance has to be available for capped companies. PRT is seeking a higher allowance for PR24. **We neither support nor reject this claim.** It is not symmetric or relevant to Southern although the underlying principles are ones that Southern believes to be necessary and reserves the right to comment on depending on Ofwat's treatment of the CAC at draft determination.
Severn Trent	Growth at STWs	Wastewater Network Plus	Severn Trent claims that the assessment of growth at sewage treatment works (STWs) as part of botex models (as at PR19) or through the standalone model proposed by Arup do not account for atypical investment needed to accommodate both very high population growth forecasts and environmental permits. Severn Trent claims, therefore, that the assessment will need to be supported by deep-dive of bottom-up costs accounting for the unique circumstances at each STWs. **We support this claim.** The atypical nature of investments needed at STWs is driven by a combination of (very high growth in population served) ; (ii) stringent environmental requirements that

Company	Claim area	Control	SW view
			need to be met and (iii) the fact that historical practices of incremental capacity increase and removal of bottlenecks is no longer viable in many STWs. None of t these factors will be well captured by the scale drivers, population growth, and load treated (proposed for the botex models) or population equivalent growth and treatment intensity proposed for the standalone STW growth model, depending on the assessment approach eventually followed by Ofwat.
Wessex Water	Growth at STWs	Wastewater Network Plus	Wessex Water makes a similar claim as Severn Trent that the benchmarking econometric methods proposed by Ofwat fail to fully account for the atypical investment needed to accommodate population growth and environmental permits. **We support this claim** for the same reasons as set out in the previous claim.
South East Water	Economies of scale at Water Treatment Works	Water Network Plus	South East Water submitted a symmetrical CAC on economies of scale in water treatment works. **We support this claim.** We agree with South East Water that the water botex models lack a measure of economies of scale, unlike in the wastewater models. This is a significant omission. The botex water models include a measure of population density but this is not a direct measure for scale at water treatment works in any way. We note that South East Water found a low correlation between size of water treatment works and population density, which indicates that much of the impact of size of works is not captured by the proxy variable used in the botex water models. By not including a direct measure of water treatment works size, the water botex models miss interactions and effects on costs which result in biased allowances. This is supported by CEPA's report for Ofwat as par of the Spring base cost models consultation (link), which states that unit costs are expected to fall with the size of water treatment works.
Yorkshire Water	Internal sewer flooding	Wastewater Network Plus	Yorkshire water claims that Ofwat's wastewater botex models should include the proportion of combined sewers as a cost driver because higher proportion of combined sewers leads to greater risks of sewer flooding and therefore impacts the

Company	Claim area	Control	SW view
			costs that companies incur to implement operational strategies to minimise penalties. **We do not support this claim.** Adding combined sewers as a cost driver would perversely incentivise companies not to separate sewers into surface water and foul, which various companies, including SW have done over the years. We note that in the Spring 2023 base model consultation (link), Ofwat suggests using urban rainfall instead of combined sewers. We do not support the inclusion of urban rainfall as a cost driver due to the difficult of forecasting it, and because population density already captures the urban element of the urban rainfall variable. This is demonstrated by the strong correlation between urban rainfall and the density variables. Please refer to our response to the Spring 23 base cost consultation for detailed correlation information (link).

Part B: Botex delivery plan for AMP8

6. Introduction and Context of Part B

6.1. Introduction

Our operational performance is driven through Botex. In AMP7 we have been going through a period of transformation, which we have set out the third phase of in our published turnaround plans. Our Turnaround Plan will deliver a short sharp ambitious improvement by 2025, particularly in terms of our environmental performance. It includes four clear outcomes that we're promising to deliver, improving our service to customers and the environment:

- Provide reliability and quality reaching 3rd quartile for quality by 2025
- Improving our environmental performance and reach a 3 Star EPA rating
- Provide a great customer experience and reach a 7.5/10 C-Mex score (8% increase)
- Manage a safe and ethical workforce with reduction to 0.2 lost time injury rate

To support this turnaround the £1.6 billion of new investment into our group by funds managed by Macquarie Asset Management has provided much needed financial stability. It has also supported a step change in investment in operations and infrastructure by Southern Water of £1 billion above the 2020-25 regulatory allowance.

Our resulting forecast outturn against the water and wastewater price controls for AMP7 is summarised as:

Table 6-1– Forecast outturn for AMP7

	AMP7 total (£m)
Base Operational Expenditure - Water	688.3
Base Operational Expenditure - Waste	1228.4
Base Capital Expenditure - Water	580.2
Base Capital Expenditure - Waste	1049.1

This technical annex (SRN19 Botex Technical Annex Part B) provides detail on our wholesale Botex delivery plan for AMP8. Botex is broken down into three sections; water, waste and central costs. In each section we consider what we have achieved in AMP7, our plan for AMP8 and the associated base capital expenditure (Capex) requirements. Key step changes between AMP7 and AMP8 include:

- Increasing our leakage reduction programme for water in line with asset health and deterioration
- Increasing the rate of planned sewer renewal accounting for the need to stabilise serviceability and the rate of collapse
- Delivering investment to meet challenging growth predictions and ensure that housing developments are facilitated in line with government drivers
- Investment in IT infrastructure for critical system renewals, IT/OT end of life replacement and ongoing digitisation of the business

We have carefully reviewed the ongoing capital maintenance needs of both Water and Wastewater assets, considering asset deterioration, the root causes of service failure in AMP7 and requirement to control risk to an ongoing greater level to meet ever tightening performance objectives. Our plans therefore ensure:

- We are maintaining directly managed operational Capex levels and targeted capital maintenance activities at a sustainable rate to deliver environmental, water quality and customer service performance
- Replacement of high-risk water and wastewater service impacting critical assets where planned interventions are more efficient and cost beneficial
- Required levels of statutory maintenance to remain complaint with all key regulatory controls across the asset base

Our AMP8 plan flows from the implementation of our turnaround plan performance levels, these are set out in SRN18 Performance Commitment Methodologies Technical Annex.

Our plans for AMP8 continue at a higher rate as we continue our transformation and address long term issues of asset reliability and deterioration. Although asset age alone is not the only factor to determine appropriate replacement rates, the current level of asset replacement across the industry indicate a growing issue. The National Infrastructure Commission (NIC) highlighted their concerns about the use of lagging indicators or historical spend as the method of determining sustainable investment for the future (ref letter from NIC to Ofwat 18th May 2023).

Please note that although growth is considered within "base", there is an enhancement case for WTW growth that is covered separately from this technical annex; the section on WTW growth (see section 8.33) should be read in conjunction with SRN22 Network & WTW Growth Enhancement Business Case. Botex estimation methodologies and efficiency are covered separately in SRN19 Botex Technical Annex Part A.

6.2. Alignment with Data Tables

This technical annex provides supporting evidence for the wholesale water and waste Base Capital Expenditure (see CW1a.8 and CWW1a.8 in the PR24 Business Plan). The values summarised in Table 6-2 are cross referenced in Table 7-3 (water) and Table 8-2 (Waste).

Table 6-2– Base Capital Expenditure Data Table Alignment

Description	PR24 Business Plan Reference	Data Table	AMP8 total (£m)
Base Capital Expenditure - Water	CW1a.8[9]	CW1a	415.063
Base Capital Expenditure - Waste	CWW1a.8[10]	CWW1a	952.591

The benefits associated with base expenditure are covered fully in SRN18 Performance Commitment Methodologies Technical Annex.

[9] AMP8 Base Capital Expenditure comes from CW1a.8 (2022/23 price base)
[10] AMP8 Base Capital Expenditure comes from CWW1a.8 (2022/23 price base)

6.3. Base Operational Expenditure

This Technical Annex focuses on the narrative for Base Capital Expenditure (Capex). However, this capital expenditure is linked to an associated operational expenditure (Opex). Table 6-3 below summarises the Base Operational Expenditure associated with our plan.

Base Opex – This refers to the operational expenditure required to maintain our existing level of services and functionality of our infrastructure, assets, and operations. It represents the ongoing costs associated with our day-to-day operations, maintenance, and routine activities necessary to sustain the baseline level of service. This can encompass labour, materials, energy, and other expenditures directly associated with ensuring the reliability and functionality of our water and wastewater infrastructure and service.

Table 6-3– Base Operational Expenditure Data Table Alignment

Description	PR24 Business Plan Reference	Data Table	AMP8 total (£m)
Base Operational Expenditure – Water	CW1a.1[11]	CW1a	711.929
Base Operational Expenditure – Waste	CWW1a.1[12]	CWW1a	1071.865

The operating costs projections for AMP8 are based on our closing forecast for 2024–25 adjusted to include:

- elements of our capital investment enhancement programme that will be delivered as opex solutions rather than capital investment schemes. These schemes typically include improvements to catchment management, ecological work, investigations and sustainable drainage solutions that do not result in the construction of new assets as well as certain IT software projects delivered through ‘Software as a Service’ cloud based solutions
- anticipated increases in business rates charges across the AMP resulting from Ratings Agency revaluations of our assets
- new operating costs following the completion of capital projects at our water and wastewater treatment works to operate the new equipment and processes installed

Working with wholesale teams we have reviewed bottom up Opex costs and the activities which drive these costs throughout the AMP to derive our overall AMP8 Opex plans. These take into account what we currently know about both unit rates for activities and the products and services we procure. Forecasts have been created for all of the key general ledger (GL) areas and overlayed with any cost efficiencies forecast and change in costs arising from the delivery of new assets e.g., Operational costs for recycling plants when delivered.

[11] AMP8 Base Operating Expenditure comes from CW1a.1 (2022/23 price base)
[12] AMP8 Base Operating Expenditure comes from CWW1a.1 (2022/23 price base)

7. Wholesale Water

7.1. Overview

Overall, our water expenditure for AMP7 on capital maintenance and opex has been higher than the regulatory funding allowance to ensure we continued to improve our aged asset base and provide a level of service that our customers expect. Our AMP 8 plan requires we continue with a similar level of investment in support of asset health to sustain water quality, supply resilience and the service required by customers. In developing our bottom up water Botex plan we see the need for the run rate for AMP8 to remain above what we believe to be the regulatory modelled allowance.

We have also seen during AMP7 weather records broken, with extreme cold periods, dry periods, extreme heat. The drought in 2022 was followed by periods of extreme wet weather. This has had an impact on our assets and in some cases systems and services we rely on from others, for example power supplies and this has formed part of our review of asset and system risks in developing AMP8 plans.
Our improvement plan throughout AMP7 has been about two key phases:

- Focus on stabilising our water quality and compliance position. At the start of AMP7 we committed to an extensive review of water supply asset health and water quality risk. This is called our Hazard Review (HazRev) programme. This programme has completed deep dives across 100% of all of our in-service water supply sites and created over 500 improvement interventions. HazRev has dominated our capital maintenance activities in AMP7, and we have worked closely with the DWI to prioritise and target improvements plans where risks have been greatest.
- Delivering significant improvements in our performance targets and in AMP asset health through turnaround. This second part was first established through our Water 1st programme, with a focus on ensuring that we had the right bedrock of people, process and systems across our Water Operational teams and is now embedded in the recently published turnaround plans through the pillar – A reliable supply of water for our customers. These plans have the following activities that will be delivered by the end of AMP7:

  - **Improving the reliability of our water supply works** by putting in place new assets and improving maintenance.
    - This includes the complete overhaul of our four main sites, benefiting [redacted] our customers.
    - Deliver c200 actions at our four largest water supply works through the investment of £180m
    - Tactical investment at 20 sites to improve reliability and output by 50ML/d
    - Complete our most ambitious reservoir inspection programme

  - **Using digital technology** to build next-level smart networks with new technology, including sensors and smart meters to reduce leakage and enable our teams to respond more quickly
    - Deliver smart water meter improvements
    - Complete the pressure management and programme to support leakage and network resilience
    - Roll out of our new GIS location and asset register system, enabling improved systems across our water networks Improve our process for finding and fixing leaks – we've already improved our fix rate by 30% since summer 2022

  - **Upgrading our logistics capability** so we can move people and materials around faster, 24/7. This includes a new tanker fleet, storage of critical spares and an overhaul of our work management processes
    - Continually improving the use of our six in-house 24/7 water tankers
    - Increase our logistic stores to eight to enable improved response in and out of hours

- Deliver tactical improvements to our end-to-end work management processes

– **Improving the management and control of our sites** and networks through a constant review of our core systems and processes.
  - Roll-out of a new risk assessment approach to enable safe control of work on our assets
  - Investing in key improvements
  - Roll-out of new contracts and ways of working to improve customer management and operational response

The following programmes have formed the core investments across AMP7 for the water services:

- **Outage recovery**

  In AMP 7 we set aside £8m for a targeted outage recovery scheme that focuses on sites with issues around pump sizing, turbidity, process constraints and reduced deployable output. We have completed deep dive analysis into root cause of outage at our most vulnerable sites including those that had previously exceeded our WRMP19 year 5 allowances. We have delivered a range of works to ensure we are resilient to outage including installing amazon filters, chlorination systems and borehole pumps to prevent disruption. The programme is part of our ongoing commitment to securing reliable supply of water for our customers and will support us surpass our Unplanned Outage Outcome Delivery Incentives (ODI) PR19 target of 3.25% by 2025 (see Table 7-2 for forecast).

- **Leakage**

  We have continued to deliver on our commitment to halving leakage by 2050 by making significant investment in technology and ensuring that we have the right capabilities in place to support us in delivering our targets. We increased the size of our leakage team from 150 to 185 technicians which is allowing us to enhance our find and fix capability and have introduced our £25 million leakage recovery programme following the extreme stresses on the network of the 2022 drought and wet winter periods. This programme is also utilising new technology to identify leaks for example the use of satellite imagery to see leakage. We also continued to invest in advanced pressure management schemes. The schemes are designed to enable us to better control water pressure across our network including our ability to alter and optimise pressure remotely which is improving our leakage performance. Overall, we have invested in leakage significantly above what was allowed for in our final determination, with an overall investment in excess of an additional £100m.

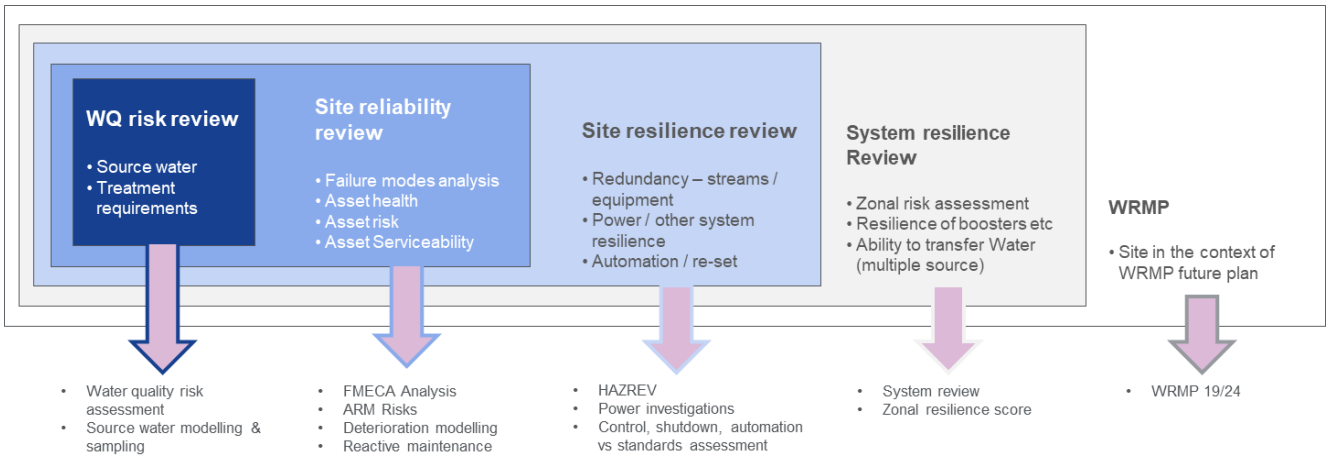
- **Hazard Review**

  Our AMP7 Hazard Review (Hazrev) methodology developed in partnership with the DWI at the time was industry leading, At the start of the AMP we had envisaged that this programme would be circa £80 million, we now have a targeted programme in excess of £200 million that will deal with the key risks identified and maintain high levels of regional water compliance.

  We are continuing to deliver our ongoing HazRev programme to implement holistic improvements in our water quality and support us in achieving our Turnaround commitment of 3rd quartile performance against our Peers by the end of AMP7 2025.

Throughout AMP8 and AMP9, we have developed a strategic roadmap for the modernisation of our 4 largest surface water supply works, the approach we have taken is to apply the HazRev principles across an entire connected system, ensuring we start from the first principles of understanding the raw water quality both now and into the future. These system reviews are based around 5 strategic components: water quality risk, site reliability, site resilience, system resilience and integration into long term water resource management plan (WRMP) (see fig.21). This has been the basis of developing our Supply Resilience Enhancement Programme Special Cost Claim business case which has been produced with support from the DWI, Modernisation of these 4 strategic sites which serve [redacted] our water customers is essential in securing water supply resilience.

Figure 7-1: Key Strategy Components considered in our risk review



- **Water First Programme**

  Our Water First programme also continues to drive water quality improvements across our region. Our action plan covers 6 criteria to support continuous improvement of our Compliance Risk Index (CRI) performance, which is set out in Table 7-1.

Table 7-1 Water First Programme

Project Name	Target Finish	CRI Contribution	Plan Completion
Water First Overall	26/12/2028	2.778	84%
Networks Plan	26/12/2028	1.271	75%
Notice Tracking -Monitoring Plan Capability Improvement	01/09/2025	0	83%
Procedural Management Control Framework-FYLD	31/03/2025	0	75%
Public Health and Culture-Phase 2	31/03/2025	0.278	100%
Sampling & Analysis	31/03/2025	0.611	90%
Treatment	31/03/2025	0.618	81%

- **Asset Health Maintenance strategy**

  We are working hard to deliver a more reliable asset base supported by a robust maintenance strategy to ensure they are resilient to disruptions. Our asset health monitoring and proactive maintenance programme has been key to delivering this. As part of the programme, we are completing comprehensive assessments of our assets. To date the programme has completed reviews of 14 water equipment class maintenance strategies, understanding the asset condition and implementing proactive maintenance programmes to prevent asset failure. We will be continuing to develop new asset maintenance strategies and care plans in AMP8 as part of our ongoing maintenance improvement plans.

Water Performance Commitments AMP7:

Despite continuing to deliver significant improvements through these programmes, we also experienced some challenges in delivering some of our key performance commitments, and much like the rest of our

sector, the covid pandemic generated a number of unforeseen challenges. We recognise our historical performance has not always met our customers' and stakeholders' expectation and have been working hard to ensure we address our most critical areas, focusing on programmes which deliver asset health improvements, and support our targets around securing resilient water supply for our customers, these form the basis of the turnaround plans published in April 2023.

Our plan in AMP8 is to continue to improve from this step up in performance by the end of AMP7 through turnaround. AMP8 botex investment plans have been developed through root cause analysis to support ongoing improvements across these key performance commitment areas. Table 7-2 summarises our key botex performance commitments and AMP 8 and longer-term targets. Note: leakage performance above base is set out within our Water Resources Management Plans (WRMP) and form part of the demand management enhancement case (see SRN27 Water Resources – Demand Enhancement Business Case)

Table 7-2 Water Performance Commitments

Performance Commitment	Baseline	Forecast	Forecast	AMP8 target	2050 target
	2020-21	2023-24	2024-25	2029-30	2040-50
Compliance Risk Index (CRI)	4.61	5.39	3.23	2	1
Water Quality Contacts	1.12	0.99	0.88	0.80	0.40
Leakage 3y-average	96.9	98.9	97.3	68.4	48.4
leakage (in year)	93.8	91.5	76.9	66.7	48.4
Mains Repairs	150	150	150	152.9	98.1
Unplanned Outage	9.44	4.43	3.13	3.13	2.00
Water Supply Interruptions	0:12:43	0:45:40	0:07:23	0:04:31	0:02:00

In developing the AMP8 Botex plan we have used the methodology as set out in the Botex annex A. Ensuring that we spring from the turnaround targets from the end of AMP7. We have also continued to build on the risk picture we have following HazRev reviews and zonal risk reviews.
As a result, our plan for AMP8 Botex is greater than the regulatory allowances once cost adjustment claims are taken into account. These differences are explained through:

1) adjustments for non-controllable, or only partly controllable, costs like energy which have increased substantially between AMP7 and AMP8 but which the regulatory allowance does not adequately capture. This is discussed in SRN19 Botex Technical Annex Part A;

and

2) the sustainable capital maintenance levels outlined below required for the Water asset base to maintain levels of required service, shows a reduction from AMP7 due to the exclusion of the four strategic surface works, which are captured in the Supply Resilience Enhancement Programme Business case:

- Water resources – Protecting the vital Water Quality of catchments and source water
- Raw Water – Ensuring regulatory compliance at our impounding reservoirs
- Water Treatment – Maintaining the momentum on reducing water quality risk and asset reliability and resilience

- Water distribution – Delivering a sustainable rate of leakage activities and network maintenance to ensure we deal with the natural rate of rise and network water quality compliance

Table 7-3 summarises our proposed AMP8 Capex investment (see CW1.8 in Table 6-2).

Table 7-3 Water base capital expenditure by programme

Programme		PR19 FD	AMP7 total[13](£m)	AMP8 total (£m)
Base Operating Expenditure (Opex)	CW1a1[14]		688.3	711.9
Base Operating Expenditure (Capex)				
Water Resources			50.5	19.8
Raw Water			4.2	3.3
Water treatment			297.1	134.3
Water Distribution			228.4	257.7
Sub Total	CW1a8[15]		580.2	415.1
Developer Services[16]			58.5	82.3
Total Botex Expenditure		890.9	1326.9	1209.3

We acknowledge the need to drive for ongoing levels of efficiency and have included an efficiency stretch based on a 1% year on year improvement, we will look to our innovation programme, AMP7 to 8 supply chain strategy and ongoing transformation to support this. Our AMP 8 water plan is focused on delivering a strategy moving us away from a reactive environment to a panned and proactive delivery approach. This will be achieved through our revised commercial arrangements, along with the further development of Zonal plans, allowing for a holist view of addressing risks.
In the following sections we set out the investments we plan to make across the 4 water programmes.

7.2. Water Resources

Our approach to managing our river and groundwater sources in AMP8 will build on the achievements to date of our AMP7 Headworks Improvement programme. Proactive management of our Water Resources catchments is a critical part in ensuring source water and water quality risks are managed effectively.

Table 7-4 Water Resources Summary

	AMP8 (£m)
Water Resources	19.8

(note: sub programme lines do not include M&G costs- see section 9)

[13] AMP7 values are based on APR submissions for the first two years of AMP7 and CW1a from 2022/23 onwards
[14] AMP8 Base Operating Expenditure comes from CW1a.1 (2022/23 price base)
[15] AMP8 Base Capital Expenditure comes from CW1a.8 (2022/23 price base)
[16] Developer Services not part of capital delivery but included in table to align with PR19 FD

The Headworks improvement programme has been successful in AMP7 in:

- Identifying sources of water quality issues through investigation work and mitigating many of these within the same AMP period
- Understanding the hydrogeology of our catchment
- Removing pathways for contaminants, and
- Improving the condition of the headworks and pumps

Our AMP8 plan has been developed by applying a strategy which utilises the prioritised risk base data from the UGS Risk Assessment Tool, which captures data from headworks condition, local flooding, survey reports, UGS reliability and raw water quality challenges and includes the following key interventions:

- A programme to improve resilience in areas where we have known water resource issues, including the Sussex North water resource zone, where Rotherfield water supply works currently has an artesian borehole which impacts our operations. Redrilling this borehole will provide a compliance reliable site and will reduce the supply demand balance deficit in the area. Making Rotherfield WSW more resilient will reduce the level of dependency on Hardham WSW – this scheme will cost £1.8 million

- Our AMP 8 UGS Risk Assessment Tool has identified a £5 million programme of works to carryout detailed surveys and borehole headwork water quality activities at key water supply site such as Broadwater WSW, Angmering WSW and Hazel WSW, to further stabilise our resilience position

- We need to investigate and complete mitigation work in Kent due to a risk that adits with deteriorating condition such as Wingham shaft and Capstone Green Sand are potentially causing significant turbidity issues that have reduced site deployable output in times of extreme wet weather. This impacts our ability to provide water during hot weather as was observed during the 2022 heat wave. We have estimated this programme will cost £2.7 million

The drop in capital maintenance investment from AMP7 to AMP8 is explained by the unexpected need within AMP7 for drawdown and a detailed study of Bewl reservoir. It was identified that the original design would impact the structural integrity of the valve tower and a scheme to utilises siphon pipework and a culvert structure, that allows the draw down to take place without impacting the overflow tower at a value of £24 million is being delivered to remove the risk in line with our reservoir act duties. Some work remains to be completed at Bewl in AMP8 with the majority of other programmes maintaining a normal run rate.

7.3. Raw Water Storage

In AMP 7, our raw water storage programme focused on ensuring our surface water reservoirs were compliant with section 10 of the Water Reservoirs Act 1975. We completed section 10 surveys for several of our surface water reservoirs, and we are continuing to complete section 10 surveys in line with regulatory compliance, of our surface reservoirs to identify required actions. Linked ODI's to Raw water storage include **compliance risk index (CRI)** and **Unplanned Outage.**

Table 7-5 Raw Water Storage Summary

	AMP8 (£m)
Raw Water Storage	3.3

(note sub programme lines do not include M&G costs- see section 9)

Across our region, we have ten statutory reservoirs that fall within the provisions of the Reservoir Act 1975. As such, we have an obligation to deliver regular inspections and risk-based capital maintenance to ensure compliance with the legislation. Each AMP we carry out a programme of statutory inspections and minor capital maintenance as required under Section 12 of the Act. Issues and recommendations arising from the statutory inspections are categorised according to priority based on safety risk with higher priority issues formally notified to the EA.

We will complete inspections and remedial works on the following surface water reservoirs (SWR) in AMP 7:

- Plenty Brook SWR
- Purbrook SWR
- Bewl SWR
- Darwell SWR
- Weir wood SWR
- Testwood Lakes

We also carry out section 10 inspections under the Act which are completed by a Qualified Civil Engineer every ten years. In AMP 7, four of our reservoirs were identified as requiring a Section 10 survey and a further five (listed below) are scheduled for AMP8. The completion of surveys will cost £3.3 million.

- Plenty Brook SWR
- Wishing Tree SWR
- Purbrook SWR
- Bewl SWR
- Powdermill SWR

7.4. Water treatment

Our AMP7 Water Treatment approach was characterised by our HazRev programme which supported us in delivering in improvements in several of our ODIs across AMP 7. Our plan for AMP 8 is to continue to build on this industry leading approach continuing to target assets which present water quality risks.

Our water treatment programme is linked to the following ODI's: **CRI, Water Quality Contacts (WQC), Water Supply Interruptions** and **Unplanned Outage.**

In AMP6 a dedicated team of subject matter experts was formed consisting of civil engineers, MEICA engineers, process engineers and site-specific SMEs to carry out an extensive Hazard Review of all in service water works. A prioritised programme of works was initiated, following the below principles:

- Consistency with Risk Position reported under Regulation 28
- Regulatory Notices
- CRI risk exposure – ODI penalty and service to customers
- High severity hazards (CRI parameter score)
- The size of sites / number of affected customers (CRI Impact score)

Our Water treatment plan has been divided between two sub programmes: Planned Capital maintenance and Compliance and Performance.

Table 7-6 Main AMP8 Sub Programmes within Water Treatment

Sub Programme	AMP8 (£m)
Planned capital maintenance	109.5
Compliance and Performance	31.3

(note sub programme lines do not include M&G costs- see section 9)

The total Capex expenditure under Water treatment is significantly reduced for AMP8, a 55% reduction compared to AMP7. This is because a large part of our Capex investment in AMP7 has been driven through the HazRev programme required to support water quality. At the start of the AMP7 we had envisaged that this programme would be circa £80 million but this has increased to over £240 million to address key risks identified and maintain high levels of regional water compliance.

As a result of our strategic reviews and systemised approach we have agreed a long term, more holistic programme of works to modernise 4 strategic sites which serve [redacted] our water customers. This has been supported by the DWI and is the basis of our Supply Resilience Enhancement Programme Special Cost Claim business case[17], these sites now each have final enforcement orders which encode the agreed scope of works they need over the next two AMP periods. This means the ongoing base HazRev programme returns to more sustainable levels of investment required to support water quality compared to AMP7.

7.4.1. Planned Capital Maintenance:

In AMP 8 through the continuation of our HazRev plan, we intend to invest £65.2 million addressing obsolete and life expired assets, and these programmes break down as follows:

We are investing £80.7 million on regional programmes to improve our water quality compliance and resilience position.

Our regional plans, developed using asset deterioration data and SME input comprise of:

Table 7-7 AMP8 Regional Programmes

Project	Risk	AMP8 investment
HazRev Phase 6	Life expired and obsolete assets	£4.6 million
Programmable Logic Controller's (PLC's)	Life expired and obsolete assets	£22 million
Motor Control Centre's (MCC's)	Life expired and obsolete assets	£6.1 million
Gas Storage/Chlorguard	Health and Safety upgrades	£1.2 million
Chemical bunds & delivery point replacement	Environmental spill	£6.1 million

[17] SRN25 Supply Resilience Enhancement Programme

Air Circuit Breakers and transformers	Life expired and obsolete assets	£1.2 million
Run to Water systems	Out of specification water management	£6 million
Chemical dosing assets	Life expired and obsolete assets	£3 million
Water Quality Shut Down replacement/upgrade	Life expired and obsolete assets	£15 million

In addition to our plan, and following a risk based approach, we are investing £44.3 million on 20 high risk supply works that have the potential to cause outage, water quality or resilience issues due to site specific asset deterioration, the sites targeted comprise of:

Table 7-8 High Risk Water Supply Works

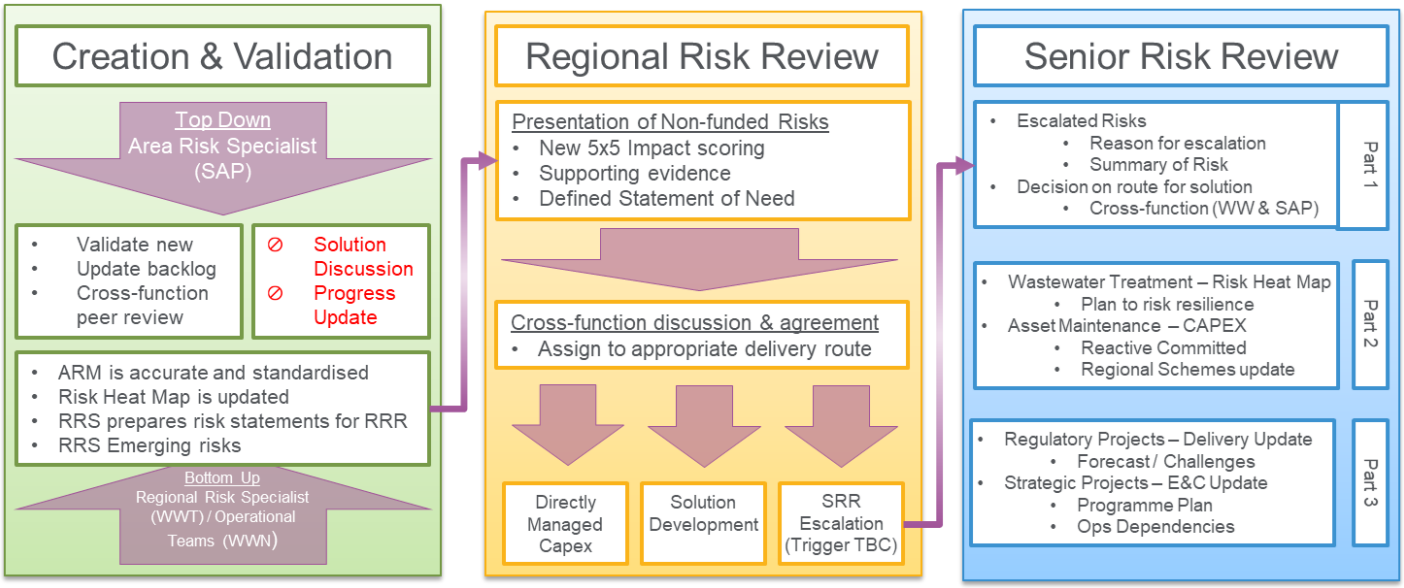
Water Supply Works	Risk	Region
Sandown WSW	Life expired and obsolete assets	Isle of Wight
Lodsworth WSW	Life expired and obsolete assets	Sussex
Timsbury WSW	Life expired and obsolete assets	Hampshire
Martin Mill WSW	Life expired and obsolete assets	Kent
Goldstone WSW	Life expired and obsolete assets	Sussex
Balsdean WSW	Life expired and obsolete assets	Sussex
Arundel WSW	Life expired and obsolete assets	Sussex
Patcham WSW	Life expired and obsolete assets	Sussex
Burpham WSW	Life expired and obsolete assets	Sussex
Shoreham WSW	Life expired and obsolete assets	Sussex
Newmarket C & D	Life expired and obsolete assets	Sussex
Falmer WSW	Life expired and obsolete assets	Sussex
Madehurst WSW	Life expired and obsolete assets	Sussex
Northbrook WSW	Life expired and obsolete assets	Sussex
Northfleet WSW	Life expired and obsolete assets	Kent
Nashenden WSW	Life expired and obsolete assets	Kent
Southover WSW	Life expired and obsolete assets	Sussex
Stanhope Lodge WSW	Life expired and obsolete assets	Sussex
Chillerton WSW	Life expired and obsolete assets	Isle of Wight
Pluck Gutter WSW	Life expired and obsolete assets	Kent

7.4.2. Compliance and Performance:

Our AMP 8 plan investment of £31 million extends on our Power resilience strategy ensuring we continue to address network brown out and black out challenges across the region, with a targeted £2.7 million programme of work.

We intend to invest £28 million in our WSW directly managed Capital Maintenance programme continuing to focus on addressing compliance and resilience risks by following our Risk Review Process.
The needs under each subprogramme are identified and prioritised in the same way, through our Risk Review process. This process uses several gateways to identify, validate, and prioritise risks, using the Pioneer suite of asset management tools. Initially risks are identified and recorded by operational teams and are assessed and validated through a series of cross functional Regional Risk Review meetings (see Figure 7-2).

Figure 7-2: Regional Risk Reviews



A decision is made whether local operational teams manage or mitigate risks either via operational budgets or escalated to the Operational CAPEX Programme Manager for inclusion in the Directly Managed Capex prioritisation process. Any risks which cannot be managed or mitigated locally are presented to the Senior Risk Review, chaired by the Managing Director of Water Service, and attended by cross functional heads of departments and Subject Matter Experts (SMEs). Risks escalated to the Senior Risk Review are typically those which are complex to resolve and/or are likely to result in higher cost solutions with engineering and construction input required.

7.5. Treated water distribution

Our treated water distribution programme impacts our CRI, Leakage, Water supply interruptions and Mains repairs ODI's, and in AMP7 the following programmes were key to supporting delivery of water services to customers and these performance commitments:

In AMP 7 we reprioritised investment to address our leakage challenge, investing over £100m more than planned to manage leakage rate of rise and the impact of weather events during the AMP. As part of this investment, we increased the size of our leakage team from 150 to 185 technicians and employed new tools and techniques to find and fix leaks. During 2020-21, we completed 22,000 leak repairs with 175 field staff supported by 50 analysts and planners.

We have developed our AMP8 plan targeting these known areas of network risk, ongoing pressure management and digitisation to calm networks for resilience and improved leakage efficiency, alongside supporting performance commitment improvements.

Table 7-9 Main AMP8 Sub Programmes within Treated Water Distribution

Sub Programme	AMP8 (£m)
Planned leakage	144.1
Planned capital maintenance	75.9
Network reinforcement	29.6

(note sub programme lines do not include M&G costs- see section 9)

The plan for how we will deliver on our leakage and water supply interruptions ODIs is as follows:

Planned Leakage

Managing leakage is an important part of our water resources strategy. It also demonstrates to our customers that whilst we are asking them to use water more efficiently through our Target100 initiative, we are also making efforts on our end to reduce losses by as much as we possibly can. We committed to reduce leakage by 50% by 2050 in WRMP19. In AMP 8 we are aiming to spend £ 144 million of base expenditure on maintaining leakage through targeted mains replacement, delivering enhanced find and fix solutions along with targeted network reinforcements.

The following table summarises the base expenditure on leakage:

Table 7-10 : Base expenditure on leakage

Activity	AMP8 Investment
Leakage CM	£5 million
Mains renewal CM	£60 million
Mains repairs DM	£12 million
Comm Pipes and Stop Taps DM	£55 million
Network improvements CM	£12 million

We are also delivering targeted mains replacement across the network to support meeting the leakage target, and we have allocated £60 million to tackle bursts impacting service and known instances of water quality events or where we have identified areas that require additional resilience to the supply from our large trunk mains. This also includes a £15 million allocation to address a multi-AMP networks improvement

schemes, in Hampshire and the Isle of Wight to address taste and odour. The water mains targeted comprise of:

Table 7-11 : Planned Leakage: Mains Renewal

Water Mains	Risk	Region
Rownhams (Targeted DMA's)	Water Quality and Resilience	Hampshire
Moore Hill /Hedge End GRP	Water Quality and Resilience	Hampshire
Darwell to Beauport raw water main	Water Quality and Resilience	Sussex
Hardham 32 inch outlet main	Water Quality and Resilience	Sussex
Wingham to Fleete main	Water Quality and Resilience	Kent
Medway steel mains	Water Quality and Resilience	Kent
Brambles lane 18" Alvington HL to Cowes	Water Quality and Resilience	Isle of Wight
Medham trunk main, feed main to Osborne WSR from Alvington High	Water Quality and Resilience	Isle of Wight
Broadfields to Mopply Under Solent Main connection to BPT	Water Quality and Resilience	Isle of Wight
Water Mains Renewals (Targeted DMA's)	Water Quality and Resilience	Isle of Wight
Regional mains renewals (Targeted DMA's)	Water Quality and Resilience	Regional
Regional GRP/GRE replacement (Targeted DMA's)	Water Quality and Resilience	Regional
Regional FRC replacement (Targeted DMA's)	Water Quality and Resilience	Regional
Regional bitumen lined main replacement (Targeted DMA's)	Water Quality and Resilience	Regional
Pipe bridges	Health and Safety	Regional

Planned leakage: Mains Repairs, Comm pipes & stop taps (Directly Managed)

We acknowledge our water treated distribution performance hasn't been where our customers and stakeholders expect, which has led to a strategic review of our approach. Although we are investing significantly across our asset base on Capital maintenance plans, we recognise that assets will continue to

fail on a regular basis. In AMP 8 we are investing £67 million in Directly managed plans, which will allow for agile and targeted improvements to our network.

Table 7-12 : Planned Leakage: Mains Repairs and Comm Pipes - Directly Managed

Activity	AMP8 Investment
Mains repairs DM	£12 million
Comm Pipes and Stop Taps DM	£55 million

Planned leakage: Network improvements (Capital Maintenance)

In AMP 7 we encountered a catastrophic mains failure in our South East region (Kent), which resulted in a high number of customers without water for prolonged periods. Although In AMP 7 we invested c£5 million in the Isle of Sheppey loss of supply to customers incident in 2022, the event highlighted the increased need for resilience networks. The following table summarises the base expenditure on Network improvements:

Table 7-13 : Planned Leakage: Network Improvements Capital Maintenance

Activity	Risk	Region
Isle of Grain resilience improvements	Customer outage due to poor network resilience	Kent
Isle of Sheppey resilience improvements	Customer outage due to poor network resilience	Kent
DG2 Register Mitigations	Low pressures at customers property	Regional

Planned Capital maintenance

Table 7-14 : AMP 8 Planned Capital Maintenance

Activity	AMP8 Investment
Water service reservoirs DM	£23 million
Water service reservoirs CM	£23 million
Water Booster stations	£12.5 million

Service Reservoirs

We are allocating £23 million in AMP8 to our reservoir cleaning and maintenance programme to manage the condition of our assets and continue delivering water of high quality to our customers.
In our service reservoir plan we have also allocated a further £23 million to address highest risk reservoirs where intervention is required for structural and/or security of supply risk, such as relining reservoirs and construction of full height dividing walls, and these include:

Table 7-15 : Highest Risk Water Supply Reservoirs

Water Supply Reservoirs	Risk	Region
Fairlight Old WSR	Water quality and resilience	Isle of Wight
Management of bitumen coating	Water quality and resilience	Regional
Shoreham 1 WSR	Water quality and resilience	Sussex
Queens Park Rd WSR	Water quality and resilience	Sussex

Water Supply Reservoirs	Risk	Region
Vinings WSR	Water quality and resilience	Sussex
Rake WSR	Resilience	Sussex
Buchan Hill WSR	Water quality and resilience	Sussex
Reservoir isolation upgrades (valving)	Resilience	Regional
Management of concrete coating	Water quality and resilience	Regional
Turners Hill WSR	Water quality and resilience	Sussex
West Hill WSR	Water quality and resilience	Hampshire
Itchingfield WSR	Water quality and resilience	Sussex
Perry Hill WSR	Water quality and resilience	Sussex
Cooks Castle WSR	Water quality and resilience	Isle of Wight

Water Booster Stations

Similarly, we have developed a targeted programme of £12.5 million to renew a number of Water Booster Stations across the region that require investment due to aging and end of life assets. Several sites require new electrical equipment, pumps and structural work to maintain them in operation and enable network resilience.

Table 7-16 : Targeted Water Booster Stations

Water Booster Station	Risk	Region
Singlewell WBS recommission	Life expired and obsolete assets	Kent
Rumfields WBS resilience improvements	Life expired and obsolete assets	Kent
Mount Harry WBS	Life expired and obsolete assets	Kent
Stubb Hill WBS	Life expired and obsolete assets	Sussex
Sompting WBS	Life expired and obsolete assets	Sussex
Cocking WBS	Life expired and obsolete assets	Sussex
Buchan Hill WBS	Life expired and obsolete assets	Sussex
Hampers Lane WBS	Life expired and obsolete assets	Sussex
Olivers Battery WBS	Life expired and obsolete assets	Hampshire
Winchester Romsey Rd WBS	Life expired and obsolete assets	Hampshire
Mopey WBS	Life expired and obsolete assets	Hampshire
Regional WBS kiosks replacements	Life expired and obsolete assets	Regional
Regional booster pumps replacement	Life expired and obsolete assets	Regional

8. Wholesale Wastewater

For AMP7 the focus has been on addressing legacy issues, driving performance improvements in key metrics and transforming the way we work. We are making significant progress, and this is captured in our shorter-term Turnaround Plans, published in summer 2023. Expenditure on capital maintenance and opex has been higher than the regulatory funding allowances, with an additional £1 billion financing across the business through our new shareholders.

Our wastewater proposals for AMP8 capital maintenance are within regulatory allowances, once cost adjustment claims are taken into account (see Part A of SRN19 Botex Technical Annex). We need to address asset age and health issues for key asset groups. Our asset health monitoring and maintenance strategy programmes are designed to drive continuous improvement in the overall reliability of our asset base. Although delivery is at a relatively early stage, the programme is designed to support us in undertaking comprehensive assessments of our assets including age, performance and failure trends. This information is overlayed with other data including criticality and location. This will improve efficiency; ensure we address highest risks first and start to move us to more sustainable levels of infrastructure investment.
Looking further forward, we will need to build resilience into all our assets – meaning like for like replacements may not be adequate for our changing climate.

We acknowledge the need to drive for ongoing levels of efficiency and have included an efficiency stretch based on a 1% year on year improvement, we will look to our innovation programme, AMP7 to 8 supply chain strategy and ongoing transformation to support this. This is further supported by the AMP7 transition plan which enables a more planned, forward looking approach.

There are a number of performance measures that are driven through our botex investment plans, Table 8-1.**Error! Reference source not found.** shows our performance in AMP7, forecast levels for AMP8 and our long-term target for each measure. See SRN18 Performance Commitment Methodologies Technical Annex.

Table 8-1: Waste performance measures driven through botex investment

Performance Commitment	Baseline (2020/21)	Current (2022/23)	End AMP7 (2024/25)	End AMP 8 (2029/30)	2050 target
Category 1-3 pollution incidents	406	358	193	63	0
Internal flooding incidents	393	456	274	240	172
Curtilage flooding incidents	4409	3748	3525	3011	1000
Sewer collapses and rising main bursts	315	247	250	230	230
Wastewater Treatment Works compliance	97.1	98.2	99.1	99.1	100
Bathing Waters at excellent status	57	57	57	58	84

Our turnaround plan was published in May 2023, which recognises a step change in performance is required. It delivers a short, sharp ambitious set of improvements by 2025 and provides the foundation we need to deliver a successful AMP8 plan. It has a strong focus on environmental performance and safety and

for Wastewater with a goal by the end of the AMP to improve our environmental performance and reach a 3 Star EPA rating through the following actions:

- **Building capacity and resilience at our WTWs** to reach 99%+ compliance with treatment and permit standards. This means making sure our pumping stations and networks continue to operate effectively as our climate changes
  - Deliver our 'Go to Green' programme – £25m of tactical interventions at 45 sites to make sure our treatment works reliably meet standards
  - Make sure our works are able to treat required flows, as described in our permits, through strategic investments and tailored initiatives
  - Reduce the number of spills from monitored storm overflows to fewer than 18 by removing excess surface water from our systems
- **Making sure our assets work to capacity.** Updating our maintenance standards and proactive control to stop assets failing and developing an improved emergency response
  - Restructure our control room so we can spot failures before they happen and, when they do, respond faster
  - Increase the durability of our sites and networks by upgrading 52 pumping stations, increasing resilience at over 700 pumping stations to allow them to reset automatically and investing over £40m on new pumps and control systems
  - Prevent wastewater escaping from our network by cleaning over 700km of sewers a year and installing over 80 new devices to reduce bursts through more effective pressure management
- **Digitalising our sewer network to reduce pollutions and flooding**, using industry-leading monitors, artificial intelligence for prediction and maintenance
  - Digitalise our network by installing 24,000 sewer level monitors and 1,300 Event Duration Monitors to allow us to predict spills and network issues before they happen
  - Reduce the number of flooding incidents by having greater visibility of flows through our network. We'll do this by using Artificial Intelligence and case managing flooding hotspots on our network
  - Improve the accuracy and efficiency of our spill reporting by automating processes and using artificial intelligence
- **Improving training, development and productivity by upskilling our front-line colleagues**. Making sure they are multi-skilled and externally accredited to deliver the service our customers expect
  - Apply externally accredited training expertise with practical upskilling programmes for all Operators and Technicians, together with technical training for all managers, scientists and engineers
  - Improve efficiency through better logistics management

Although our performance targets for 2024/25 are ambitious they are based on activities outlined above. Our AMP8 plans continue to build on these actions.

Table 8-2 summarises our proposed AMP8 Capex investment (see CWW1a.8 in Table 6-2) alongside a line-by-line comparison of the corresponding programme spend area in AMP7.

Table 8-2: Wastewater base capital expenditure by programme

Programme		PR19 FD	AMP7 total (£m)	AMP8 total (£m)
Base Operating Expenditure (Opex)	CWW1a1[18]		1228.4	1071.9
Base Capital Expenditure (Capex)				
Sewage collection			347.7	451.1
Sewage treatment			619.3	400.1
Bioresources			82.1	101.4
Sub Total	CWW1a8[19]		1049.1	952.6
Developer Services[20]			87.7	92.3
Total Botex Expenditure		1817.2[21]	2365.2	2116.8

8.1. Sewage Collection

In AMP8, our sewage collection strategy continues to build on our AMP7 approach:

- Wider development of the SMART network with strong data, modelling and analytics to identify and address risks proactively. Use the information to better target routine maintenance
- Moving from a time-based maintenance approach to fully implementing reliability centred maintenance on our 3,499 pumping stations
- Move to a more sustainable level of sewer and rising main refurbishment, increasing the level of planned refurbishment for the highest risk mains
- Work closely with planning authorities and developers to support growth with additional capacity where required

We are increasing our Sewage Collection spend in AMP8 by 30% from AMP7 (see Table 8-2) to address the increase in burst and collapse rates, particularly for critical assets

- We are increasing the length of sewers and rising mains to be replaced from 80 km in AMP7 to 148 km in AMP8 through a planned programme to improve collapse rates and our performance. Increasing the proportion of planned to reactive work will improve efficiency, with a 1% year on year efficiency included

- Continuing to invest in smarter networks using pressure monitoring on critical mains to identify issues proactively and where appropriate utilising variable speed pumps to minimise pressure surges

[18] AMP8 Base Operating Expenditure comes from CWW1a.1 (2022/23 price base)
[19] AMP8 Base Capital Expenditure comes from CWW1a.8 (2022/23 price base)
[20] Developer Services not part of capital delivery but included in table to align with PR19 FD
[21] PR19 FD adjusted to remove WTW growth to align with CWW1a, estimated at £90m for AMP7

- DWMP: Cycle 1 of the DWMP demonstrated the need for more detailed 2 directional modelling to accurately forecast flood risk and the need for all systems, surface water and foul/combined networks to be modelled. We will be increasing our hydraulic model coverage to include all systems and adding detail to models to more accurately reflect overland flow and flood impact

We are making good progress to improve pollution and flooding performance, driven through our Incident Reduction Plans. Compared to a 2020 baseline, we are forecasting for the current year:

- 43% reduction in pollution incidents
- 7% reduction in internal flooding
- 16% reduction in external flooding

Our AMP8 plan builds on this improved performance with further incidents reductions against the primary ODI's for sewerage service. This is show in Table 8-3.

Table 8-3 : Linked ODIs

Performance Commitment	Baseline (2020/21)	Current (2022/23)	End AMP7 (2024/25)	End AMP 8 (2029/30)	2050 target
Category 1-3 pollution incidents	406	358	193	63	0
Internal flooding incidents	393	456	274	240	172
Curtilage flooding incidents	4409	3748	3525	3011	1000
Sewer collapses and rising main bursts	315	247	250	230	230

Key AMP8 sub programmes for sewage collection are show in Table 8-4 . Our proposals will improve both performance and efficiency. However, we now need to move to more sustainable levels of refurbishment to address an aging asset base but also build greater resilience to weather extremes with a more proactive, data led approach delivering more for the money.

Table 8-4 : Main AMP8 Sub Programmes within Sewage Collection

Sub-programme	AMP8 (£m)
Compliance and Performance	47.9
Planned sewers and rising mains	161.4
Planned pumping stations	88.7

(note sub programme lines do not include M&G costs- see section 9)

Our delivery plans for each of these components are described in the following sections:

8.1.1. Compliance and Performance

The operation of our sewerage networks has a direct impact on our overall pollution and flooding performance. In 2022 75% of pollution incidents were caused by network issues and virtually all flooding incidents are caused by the network. For example:

- In AMP7 blockages in our sewer network have caused 75% of external flooding events and 65% of internal flooding events
- The major cause of pollution incidents in 2021 was mechanical and electrical at 49%, down to 32% in 2022 (primarily at pumping stations)
- The second largest cause of pollution incidents in 2022 was sewer blockages at 15%

We are seeing significant improvements in pollution and flooding performance through AMP7, enabled through root cause analysis, enhanced operational processes and targeted investment.

A core part of our strategy for AMP7 and AMP8 is to enhance our monitoring and analytical capabilities. During AMP7 we have invested £29 million installing over 24,000 sewer level monitors to provide greater visibility of real-time sewer flows. The new pro-active control centre uses artificial intelligence to identify when sewer levels are behaving abnormally by understanding how they react to rainfall events. Rather than waiting for an incident to happen before responding, this capability enables us to identify emerging issues before they cause an incident.

For AMP8, we will continue on this journey with investment to update our network models.

Network modelling

Southern Water has 381 wastewater catchments of which 103 have Urban Drainage Models (UDMs) covering 93% of our customer base.

In AMP 8 we will enhance the coverage of hydraulic models so that all wastewater catchments have a model with the level of verification determined by the need for investment. Where required we will incorporate overland flow paths by two directional modelling as this will provide the level of granularity needed to more accurately determine internal property flood risk. In addition, we will create models of our more complex surface water systems so that hydraulic performance and risk is better understood. Our cost estimate for the model updates is £12 million.

Through AMP 8 we will need to update the outstanding UDMs to high confidence models. The cost for this is set out in Table 8-5

Table 8-5: Estimated cost for Urban Drainage Models

Modelling Exercise	Description	Estimated Cost (£m)
Urban Drainage Modelling	Asset and flow Surveys	6.4
Urban Drainage Modelling	Model build, verification	3.1
River Modelling	Water Course Surveys	1.2
River Modelling	Model build and integration	1.3
	TOTAL	**12.0**

Network Permit Compliance

Our Environment+ programme started in 2018 to identify any shortfalls against the full Environment Agency issued permits, especially flow conditions. Initially this work focused on our wastewater treatment works and remediation work will be concluded by the end of AMP7. The scope has been widened to include all network assets, with site audits due to complete in 2024.

Remediation work has started but will continue into AMP8. This ranges from simple changes to operational practises to larger scale engineering design and capital investment. Non-compliant spills are reported as pollution incidents, this work will support provide benefits for pollution performance.

- 152 audits have been completed so far out of a total of 473 to be completed in AMP7 (flow compliance audits of Wastewater Pumping Stations with associated environmental permits)
- 624 non-compliance issues identified so far; remedial actions raised to provide the appropriate fixes: Operations process change, maintenance change, asset replacement, capital works etc
- Permit Compliance Awareness Course launched in 2021 for Operations staff.
- 321 remaining sites to be reviewed by the end of AMP7

Flooding Resilience

We continue investment to provide flooding resilience through flood and flood mitigation programmes.

8.1.2. Planned Sewers and Rising Mains

The number of rising mains bursts and sewer collapses has been trending up in recent years. In addition, they were the root cause of 11% of pollution incidents in 2022 – up from 7% in 2021. The graph was created from our annual performance reports with respect to sewer collapses and rising main bursts, OCF309.

Figure 8-1: Sewer and rising main collapse

Overall refurbishment lengths for AMP7 have been relatively low, reflecting the need to address some high-cost refurbishments in key areas. A number of these rising mains were having significant environmental or customer impact but required significant enabling costs, such as large scale tankering or long distance overpumping. The key investments made in AMP7 are shown in Table 8-6.

Table 8-6: key sewer and rising main investments made in AMP7

Scheme	Value	Benefit
Military Road rising main replacement	£10m	Multiple bursts p.a. and bathing water pollution risk
Wencelling rising main replacement	£4m	Multiple burst and internal flood risk
Margate rising main	£2m	Bathing water pollution risk
Coach Road Westhampnett	£1m	Multiple bursts p.a, pollution risk
Cinque Ports rising main replacement	£5m	Bathing water pollution risk
Florence Farm Groombridge	£1m	Multiple bursts p.a, pollution risk
Hall Road, Aylesford	£1m	Multiple bursts p.a, pollution risk
St Marybourne, Barton Stacey	£1m	Multiple bursts p.a, pollution risk

We propose a marked change in the amount of planned sewer and rising main renewal that takes place. Analysis of our annual performance reported data on rising mains bursts shows that 60% of bursts as on rising mains of cast-iron and PVC material which are also the pipe materials associated with our longest installed assets. We plan a targeted replacement programme of these assets prioritised by risk. Currently much of this work is carried our reactively. Due to the size and age of the asset base significant levels of reactive work will need to continue but will be supplemented by a stronger planned renewal programme which will be managed, more efficient in its delivery and will start to reduce the failure rates that are affecting our ODIs and drive down over time the reactive work need.

This investment proposal will bring about a material change in performance and provide long term benefits to customers and the environment in terms of bursts prevented and associated flooding and pollution consequences. In AMP8 we will stabilise our collapse rates and maintain this stable performance going forward and commence the significant renewal of our asset stock required to deliver the resilience required for the future.

A number of alternative options were reviewed, using our deterioration models and risk assessments to determine costs and benefits. This analysis is shown in appendix A. The preferred option selected prioritises the planned replacement of critical assets and will allow us to move from a more controlled and less disruptive service by reducing the likelihood of high impacting asset failures. Figure A in Appendix A shows the rising main burst trend against intervention.

Our plan for AMP8 is threefold:

- Increase planned rising main refurbishment to address the highest risk mains, with a reduction in reactive costs. Our plans deliver 40 km of rising main replacement. Table 8-7 show the highest priority of these
- Continue to invest in additional monitoring and modelling, calming the pressure changes which can lead to burst mains
- Additional surveys and refurbishment for critical sewers only, with 115km of sewer rehabilitation. We will continue to address non-critical sewers with low failure consequence on a reactive basis

Our rising main replacement programme will include our highest risk rising mains assets in Table 8-7.

Table 8-7: AMP8 Priority rising main replacement

Pumping Station	Material	Diameter (mm)	Rising Main length (m)	bursts
Ashurst Bridge	DI	600	4420	12
Larkfield	BAC	250	2500	13
Maidstone Road Borough Grn	CI	300	1500	5
Rushenden Road	ST	1000	1330	5
School Lane Nutbourne	PVC	300	1180	6
Mainland Drayton	SI	600	4000	11
Ensfield Road Leigh	BAC	350	5800	6
Fishery Lane No.2	SI	400	2730	14
Lower Road Lower Halstow	DI	375	3760	8
Mill Lane Sheet	CI	125	1500	12

We will also continue to deliver our multi-AMP project to address infiltration in the Chichester catchment and address high impacting risks identified through our Asset Risk Management process. In AMP7 we have undertaken surveys to determine the location of sewers with greatest potential for infiltration, in our plan we have allowed £10m in AMP8 for the sealing and repair of these assets. Through the DWMP process concerns were raised about the potential for sewers to impact groundwater capture zones. We will progress this further through survey and remedial work as required on a risk basis.

Our strategy for spend in AMP8 recognises the significant investment already made in our network and provides us with the opportunity to push our performance ODI targets further in AMP8 by maximising the AMP7 work, maintaining the AMP7 levels for sustainable investment and through a new targeted approach to proactive planned maintenance of key network infrastructure as well as carrying out statutory requirements.

Innovation Case Study: Sewer Lining Solution

To understand the root cause of storm overflows spills and thereby ensure the appropriate solutions to spill reduction are implemented we analysed all spill data from our monitored overflows. Our analysis using artificial intelligence and modelling identified that around 25% of storm overflow releases are due to groundwater getting into the system. We also know that 40% of assets in the holistic drainage system are privately owned. We believe excess water from these sewers is also getting into the public sewers, leading to an increase in storm overflow releases in some areas across our region. These require increased tankering services to minimise flooding - tankers are sent to pump diluted sewage out of the network in a bid to protect the local water networks from overflows. We wanted to find an innovative solution to sewer repair, which also minimised cost and disruption associated with traditional pipe replacement works.

- What we've done:
  - Bluewave investigated a number of ‘no dig’ solutions looking at novel approaches and solutions

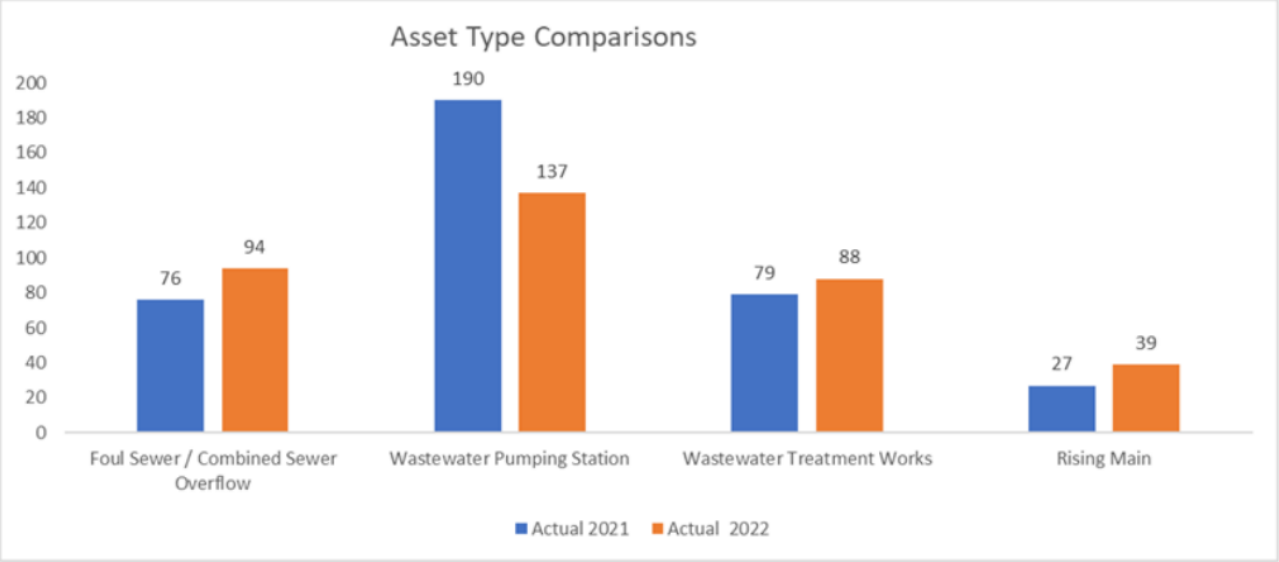
- We trialled a technology ([redacted]) to refurbish the pipe and prevent leaks. This was widely used in Europe, but had not been used in the UK
- Three trials were held, two at Alfriston, and one at Firle. Comparison of pre and post CCTV footage of the trialled sections of pipe demonstrated that defects were successfully sealed by the treatment
- Once the process was understood, it was expected that several of these treatments could be completed in the same day with the same application of chemicals, saving significant time, money and disruption – effectively sealing a network rather than just fixing individual pipes

- What it achieved
  - We've been implementing [redacted] at 100 locations in North Hampshire in a collection of villages known as Pan-Parishes - these areas experience high groundwater levels, especially over the winter months
  - Early indications are positive, with fewer tankers sent to the Pan Parishes site this year. Appendix 2: Sewer sealing benefits compares graphs of pump activity before and after sewer sealing. This shows that groundwater levels need to now be higher before impacting pump activity and requiring tanker support
  - Ongoing monitoring is in place and further surveys and lining installations are planned
  - We were the first UK water company to use [redacted] and we have presented our trials at the United Kingdom Society for Trenchless Technology and several other WASCs are now actively looking to trial it

8.1.3. Planned Wastewater Pumping Stations

Our strategy for wastewater pumping stations is interlinked with how we manage our sewer network assets, and the two facets together will enable us to reduce pollutions, collapses and flooding events.
In AMP7 we have invested £110m on wastewater pumping stations to target compliance, performance and resilience through strategic projects such as refurbishment delivered through our Platinum Health checks and the work associated with our Pollution Reduction Plan. In 2021, pumping stations were by far the main source of pollution incidents, causing over 50% of incidents (see Table 8-8). There was a 28% improvement by 2022 with a significant reduction in mechanical and electrical failures.

Table 8-8: Source of Pollution incidents by Asset type



All 3,499 of our wastewater pumping stations have been ranked by their environmental criticality and pollution history. Full “Platinum” health checks have been carried out, identifying poor condition assets or sub-optimal control systems for the top 280 highest pollution risk pumping stations. Remediation programmes are in progress but will need to continue into AMP8.

Our plans for wastewater pumping stations build on our Pollution Incident Reduction Plan:

- Complete the remediation work driven by the asset health surveys to increase asset reliability and address performance shortfalls
- Fully implement reliability centred maintenance, with a focus on the 825 identified ‘gold’ sites. A 1% year-on-year efficiency has been included recognising the benefits of a more planned maintenance regime
- Using alarm data and artificial intelligence to identify emerging risks within pumping stations
- Flow ‘calming systems’: installing variable speed drives and pressure monitors to help protect vulnerable sewers and rising mains directly impacting our pollution, collapse and flooding performance. To end August 2023 we have installed variable speed drives at 43 sites and replaced 144 air valves
- Full site refurbishment on high risk, end of life pumping stations. This is to fund specific pumping station projects requiring complex design and engineering solutions
- Enhancement investment to provide additional resilience beyond normal capital maintenance investment - see SRN49 Resilience – Power Enhancement Business Case.

Our plan includes the refurbishment of the pumping stations listed in Table 8-9 below. These are the stations with the highest monetised risk based on likelihood of failure and resulting service measure consequence

Table 8-9: Priority Pumping Stations to be refurbished

District	Catchment Zone	Facility
Arun and Western Streams RBD	Ford	Shripney Village South Bersted WPS
Cuckmere and Pevensey Levels RBD	Bexhill and Hastings	Galley Hill, Bexhill WPS
Isle of Wight RBD	Sandown	Albany Road, East Cowes WPS
Stour RBD	Weatherlees B	Margate WPS
Stour RBD	Broomfield Bank	Folkestone Junction WPS
Arun and Western Streams RBD	Ford	West Park, Bognor Regis WPS
Isle of Wight RBD	Sandown	Appley Park, Ryde transfer WPS
East hampshire rbd	Peel Common	Queens Road Lee on Solent WPS
Cuckmere and Pevensey Levels RBD	Bexhill and Hastings	Coombs, Hastings WPS
Various RBD	Kent area	“Satec” pumping station conversions

8.1.4. Flooding Due to Growth

Our DWMP (Drainage and Wastewater Management Plans (DWMPs) (southernwater.co.uk) identifies there is an increased risk of flooding in the future due to the effects of climate change, urban creep and population growth. Our customers will expect us to protect their properties from internal flooding and to not allow flood risk to increase beyond current levels. Our proposed investment to reinforce sewers to allow new developments to connect will address increased foul flows due to population growth but the biggest impact on flood risk is that of climate change and increased impermeability. We propose investment of £4m to allow flood mitigation measures to be installed at vulnerable properties. We anticipate that flood risk may be reduced at some locations from our surface water separation schemes to address storm overflows but there will be properties in sewer systems which do not have overflows which will need to be addressed. At an average mitigation cost of £6k per property we expect to address around 650 properties.

8.1.5. Summary of AMP 8 wastewater networks Investment Strategy

We've started to see real benefits from our key wastewater strategic investments made in AMP7; this is reflected in the confidence we have in our 2023 published Turnaround Plan where we expect to see more benefits driven by SMART Networks, a resilient and compliant pumping station asset base; improved operations and maintenance processes and the delivery of some key growth needs.

We will seek to further increase the benefits for our SMART Network in AMP8 whilst maintaining our focus on ensuring asset availability; resilience and compliance. We also now require specific increased strategic investment through the DWMP to bring our modelling data up to date so that it is fit for purpose to support our wastewater investment needs and allows us to better develop both longer term planning but also support delivery of schemes and programmes such as the CSO spills reduction and surface water removal it targets. Targeted investment and renewal in sewers and rising mains will are needed in both the medium and long term for a continued improvement in performance and the delivery of required network capacity to support the needs of high growth in our region.

Our holistic approach to this investment need will underpin performance gains across our Performance Targets.

8.2. Developer Services: Network Reinforcement, Network Requisitions, Diversions

Network Reinforcement

Growth in a catchment generates additional flows that needs to be conveyed through our network to our wastewater treatment works.

Supporting network growth in our region is an essential part of ensuring that population growth which is high in the Southeast area does not have a detrimental impact on our levels of service to customers and all our ODIs and that we service new customers with the correct level of service. This is done through Network Reinforcement.

Being able to support growth needs is a complex issue and can take many forms from relatively simple schemes of providing a point of connection where we have existing capacity, to the provision of a new sewer to take a new development to a point of capacity, to the need to review a whole catchment holistically to accommodate greater levels of growth with multiple developments.

In AMP7 we have reviewed over 70 catchments and population growth in our area is forecast to continue through AMP8 bringing new needs in addition to us being able to provide capacity for catchments where the design has been completed in AMP7 but where we have not yet delivered the scheme. See SRN23 Network and WTW Growth Cost Adjustment Claim and SRN44 Wastewater Growth Enhancement Business Case.

Our growth requirements and our ability to provide efficient delivery of capacity will also be strongly improved by the DWMP model update output required in AMP8.

In AMP7 the rollout of schemes for growth across the Southern Water region has seen significant progress in supporting population increases across the area where we have seen significant growth. These areas are set out in Table 8-10.

Table 8-10: Areas of significant population growth

Catchment Growth Scheme	Capacity Added (no. of new homes)	AMP7 Cost (£m)
Ashford	5750	15.1
Chichester	4000	8.7
Bishops Waltham	257	1.7
Paddock Wood	1100	3.7
Bexhill On Sea	1508	3.7

We will also be delivering major reinforcement schemes across the region in 17 high risk growth hotspot catchments at cost of £11 million for a total of 21,496 properties. (See**Error! Reference source not found.**)

Table 8-11: high risk growth hotspot catchments

Catchments	No. Properties
Aylesford	840
Bishops Waltham	125
Canterbury	4000
Chickenhall Eastleigh	1293
Faversham	313
Ford - Bognor	112
Goddards Green	3520
Hailsham North	550
Hastings and Bexhill	341
Horsham New	3330
Horsmonden	144
Lidsey	1385
Loxwood	149
Motney Hill	164
Peel Common	4180

Catchments	No. Properties
Sittingbourne	600
Swalecliffe	450
Grand total	**21496**

Additionally, 55 catchment growth assessment are being undertaken to identify preferred reinforcement solutions.

In AMP 8 significant investment is required to support the servicing of continued development across the region.
We need to increase levels of investment based upon previous AMP needs; due to the continuing growth forecast in the South-East; our data supports the need to continue to invest (see SRN23 Network and WTW Growth Cost Adjustment Claim and SRN44 Wastewater Growth Enhancement Business Case.)
Our **Network Reinforcement** funding need is based upon the forecast of new developments and the delivery of preferred options identified through out holistic catchment approach in AMP7.

The latest population growth forecasts for our region is for around 86,000 more properties to be constructed in the period 2025 to 2030 (Office of National Statistics data). This is in addition to some 83,000 new builds in AMP7. Our DWMP results (see our DWMP final report) show that this increasing population will increase the risk of flooding and pollution incidents and that investment is needed to maintain current levels of performance. Development will occur in the 70 catchments currently being reviewed and it is anticipated that our holistic approach to reinforcement i.e. to assess future requirements whilst delivering for now will allow us to deliver reinforcement required in a more sustainable way. Due to the cumulative impact of a number of developments on a sewerage system it is likely that the trunk sewer system will require reinforcement as well as sewers local to developments, it is for this reason that our total reinforcement investment will be higher than previous AMP at £92m which equates to £1,069 per new property connected in AMP8. However, in reality as an allowance is made in the design for future properties to ensure we have a sustainable system, it is expected that the cost per property the schemes are designed to deliver for, will reduce over time in line with the infrastructure charge.

Connections to the sewage network in AMP8 will be funded through the Wastewater Infrastructure Charge will be applied.

Network growth big schemes: Funding is required to service the **Ebbsfleet Development Corporation** strategic development growth need of a total 15784 connections. This scheme is a high cost per property scheme due to amount of network upsizing required to convey flows to treatment which, without additional specific funding would remove funding away from our overall funding forecast required to provide all the necessary reinforcement in AMP8.The forecast reinforcement cost for this strategic development is £15m and at around £1,000 per property is above the average per property cost for reinforcement. As this is a large stand alone site with no further development proposed which would connect to the reinforced assets the per property invested cost will remain at this level. The reason for the high cost is that the sewer to which the development will connect and which will need to be upsized is already large diameter (600mm), laid at depth (>6m) and crosses under both rail and major road infrastructure making construction more difficult due to the mitigation needed and the surface settlement tolerances which will need to be achieved.

Network Requisitions:
Under Section 98 of The Water Industry Act 1991 it is the duty of Southern Water to provide a public sewer for domestic purposes if required to do so by certain person(s) (the requisitioner). The requisitioner will pay for these requisitioned sewers.

- Requisitioning a sewer or lateral drain means that Southern Water is responsible for the design and construction, including the acquisition of appropriate easements or rights over the land in which it will be laid
- After construction Southern Water will be responsible for maintaining the sewers or lateral drains as public apparatus
- We forecast £6m per annum will be required to fund delivery of requisitioned assets

Network Diversions:
Sewer diversions occur when there is a sewer main affecting a planned development, requiring the need to divert the sewer main.

A sewer diversion can be carried out by the Developer or through Southern Water

- If the diversion is constructed and paid for by the Developer, then it could be adopted by Southern Water following a standards inspection
- Where the diversion is delivered by Southern Water the design and construction cost is paid by the Developer
- We forecast £1.5m per annum will be required to fund delivery of Diversions

New Connections:
Connection charge for a Developer to connect their constructed drainage system to a mains public sewer. Costs cover inspection and connections Southern Water will make on the Developer's behalf. Office of National Statistics data forecasts more than 86,000 new properties will be connected to our systems in AMP8.

8.3. Sewage Treatment

Table 8-12 : Main AMP8 Sub Programmes within Sewage TREATMENT

	AMP8 (£m)
WTW Compliance and Performance	20.5
WTW Directly Managed Capex	204.5
WTW Risk Schemes	111.1

(note sub programme lines do not include M&G costs- see section 9)

We've improved our wastewater compliance performance since the beginning of AMP7, reducing the number of failing WTWs under the discharge compliance performance commitment from 10 in 2020 to 6 in 2022, and we're forecasting to achieve 3 in 2023 (going from 96.8% to 99.1% compliance). However, we still have work to do to meet higher standards and build greater resilience for the extremes of weather our assets increasingly have to deal with, whether that's the resilience of our assets themselves or the risks that other organisations systems present to our operation e.g. Power.

Since 2020 we've focussed on upskilling our people, increasing the availability of plant by fixing plan out of action and improved our control of the treatment processes. The introduction of tighter environmental permits such as new phosphorous limits has required a step change in our operational and maintenance processes. For example, final effluent at all our treatment works (with permits) is monitored remotely with daily checks through our process science teams.

During AMP7 we have continued to address legacy flow compliance issues through our Environment+ programme. We have introduced new processes and governance to monitor, report and act on flow compliance risks. Many of the issues are transitory in nature, such as a broken flow meter awaiting repair. There were a total of 39 sites which required more significant enhancement to meet the required flow rates with an additional investment of £25m during AMP7. These legacy issues have been funded through the additional shareholder investment in the company.

For AMP8 we're planning to reduce overall sewage treatment spend by 35% compared to AMP7 – improving performance and compliance while enhancing our services through our WINEP. This is largely due to a reduction in our base maintenance costs being delivered under the Directly Managed Capex sub-programme in AMP8 compared to AMP7. The principal reason for the decrease is a significant spend in early AMP7 to drive an increase in permit compliance performance through our Environment+ programme as described above. As these costs were to address legacy issues and levels of risk, we do not expect to incur them in AMP8. This increased spend was accounted for in the additional investor contributions made this AMP.

Our approach in AMP8 can be summarised as:

- Maintain a focus on flow compliance, although we are not expecting to require significant additional investment in this area
- Increase the level of planned maintenance for both operational and capital maintenance, reducing the need for reactive work. This supports the 1% year on year efficiency we have adopted whilst maintaining good levels of plant availability and has been set at a sustainable level to deliver the right planned / reactive balance
- Continue to develop a stronger data and analytical capability, completing the rollout of new asset maintenance systems. This will be essential to support a significant step change in environmental permit requirements to be delivered via our WINEP programme
- Deliver specific capital maintenance risk schemes targeting assets that are life expired, have unacceptable performance or statutory risk needs (see Table 8-14)

Our discharge permit compliance target is set to maintain over 99% - ambitious considering treatment processes must continue during a period of significant investment from WINEP of and other environmental programmes (40% of sites will see some form of enhanced treatment delivered in AMP8).

Under the Environment+ programme to turnaround WTW Discharge Compliance, several focussed initiatives have been underway since 2022 Q4 as part of our Compliance Improvement Plan. Under these initiatives we have seen a reduction in the number of sites considered to be 'at risk' of effluent discharge compliance failure and continue to build on the performance improvements and reach our target of 99.04% compliance in the current year (2023). Further information on performance can be found in SRN18 Performance Commitment Methodologies Technical Annex.

8.3.1. Compliance and Performance

Examples of initiatives completed and underway as part of the Compliance Improvement Plan include:

- Improved compliance breach review process
- Reducing plant out of action, particularly process critical assets
- Targeted asset resilience programmes (sandfilters; inlet screens; chemical dosing etc.)
- Black Start Programme – ensuring standby generation is fully operational during power supply failures, also tests plant restarts automatically
- Operator training, task books, and learning

Since 2017 we've been delivering our Environment+ programme to understand the root causes of flow compliance problems at our wastewater treatment works and address them. We've introduced new monitoring and processes and invested in improvements to ensure we understand compliance risks at all of our WTWs and have a robust process to fix them. We'll finish this programme in 2024, where it will become an ongoing monitoring and maintenance programme.

Our AMP 8 strategy builds upon the work already carried out in AMP7 but recognises the changing regulatory landscape specifically that of Dry Weather Flow (DWF) compliance.

Many of the incremental improvements being made under Environment+ programme will continue to deliver compliance performance improvements into AMP8 and beyond. As part of this several schemes under the 'WTW Compliance & Performance' programme of work will be delivered through capital investment, ensuring sites are able to continue to comply with their environmental permits, see Table 8-133.

In addition to this base level of performance, our capital 'WTW Growth' and 'WTW Planned Capital Maintenance' programmes will mitigate the most significant risk items that cannot be managed through routine maintenance and operational grip of our sites, where there is insufficient capacity, asset obsolescence, or complex engineering interventions are required.

Our 'WTW Planned Capital Maintenance' programme of work contains schemes to address risks which generally impact the discharge permit compliance performance commitment. These schemes are made up of capital maintenance interventions; either replacement of existing assets with new like for like or improved design, or redesign of existing treatment processes to provide improved resilience. Either way, these capital maintenance schemes will be ensuring the identified assets are able to resiliently achieve their current purpose rather than increasing capacity or treating to a higher standard which are covered by the Growth and WINEP enhancement cases. Projects within this programme will be implemented through several delivery routes depending on complexity, from simple like for like replacements delivered through local operational teams and contractors, to large complex redesigns delivered through our engineering function and delivery partners.

A particular focus in AMP8 will be a change in the regulation of DWF exceedance, which is currently managed through the existing action plan process in liaison with the Environment Agency (EA). From 2026 DWF exceedance will automatically attract performance rating penalties. While details are yet to be confirmed it is the intention of the EA to include DWF exceedance as an EPA metric, therefore we have considered DWF exceedance to be congruent with discharge permit compliance. Our 'WTW Growth' programme of work is designed to minimise the risk of this change in regulation impacting WTW treatment performance, as well as ensuring treatment process capacity risks because of population increase are reduced to an acceptable level to maintain discharge permit compliance. Further information on this programme of work can be found in SRN22 Network & WTW Growth Cost Adjustment Claim and SRN44 Wastewater Growth Enhancement Business Case.

WTW Compliance & Performance Programme

As part of our routine risk review process several risks to permit compliance outside of the discharge permit compliance metric have been identified. These range from maintenance and inspection requirements, to flow configuration at some WTWs which require manual operational intervention to ensure permit conditions can be complied with. The WTW Compliance & Performance programme will ensure resilience against these permit conditions not measured through the discharge compliance performance commitment.

Table 8-13: WTW Compliance & Performance Programme

Project	Description	AMP8 Cost (£m)
Flow Reduction Plans	Sewer remediation and enhancement in 12 catchments to reduce non-foul flows to ensure connected WTW does not spill to storm during dry weather, in liaison with the EA	10.0
Thorns Beach WTW	Redesign WTW outfall to prevent saturation of receiving ground	3.0
WTW Long Sea Outfalls	Inspection and maintenance of long sea outfalls and their diffusers at WTWs	4.5
WTW Cess Import Delivery Points	Reposition cess delivery import points at several WTWs to remove risk of discharging imported cess to storm	3.0

WTW Planned Capital Maintenance

Our WTW Planned Capital Maintenance programme focusses on replacing current assets based on their risk to specified Performance Commitments (primarily Discharge Permit Compliance) due to age, obsolescence, inefficiency, or breakdown. This programme is broken down into two subprogrammes of work; Directly Managed Capex and WTW Risk Schemes.

The needs under each subprogramme are identified and prioritised in the same way, through our Risk Review process. This process uses several gateways to identify, validate, and prioritise risks, using the Pioneer suite of asset management tools. Initially risks are identified and recorded by operational teams and are assessed and validated through a series of cross functional Regional Risk Review meetings. A decision is made whether local operational teams manage or mitigate risks either via operational budgets or escalated to the Operational CAPEX Programme Manager for inclusion in the Directly Managed Capex prioritisation process. Any risks which cannot be managed or mitigated locally are presented to the Senior Risk Review, chaired by the Director of Wastewater Operations, and attended by cross functional heads of departments and Subject Matter Experts (SMEs). Risks escalated to the Senior Risk Review are typically those which are complex to resolve and/or are likely to result in higher cost solutions with engineering and construction input required. We call these solutions ‘WTW Risk Schemes’.

Directly Managed Capex

The Directly Managed Capex (DMC) subprogramme of work typically contains small scale like for like replacement interventions that can be delivered efficiently by local operational teams directly with suppliers without the need for complex engineering or project management activities.

An extended list of needs arising from the Regional Risk Reviews (see Figure 7-2**Error! Reference source not found.**) is held and prioritised by the Operational CAPEX Programme Manager, who manages the use of the assigned DMC budget.

DMC is broadly made up of two types of investment, Reactive and Planned. Our AMP8 plans include a 1% year on year efficiency, based on the transition from a mainly reactive approach to a higher proportion of planned.

- Reactive investment is needed to fix critical assets when they become inoperative – for example when a pumping station fails and is unable to pass forward the required flow. These are unplanned, urgent fixes that require immediate intervention
- Planned investments are proactive replacement of ageing, obsolete, or inefficient assets before they impact operations. This investment is needed to prevent the impact of risks materialising and avoids the additional cost of needing to address issues reactively (and the associated mitigation costs). Examples of work carried out through the Planned DMC programme in AMP7 include:
  - Replacement of known problem inlet screening type with more resilient solution
  - Replacement of life expired glass coated steel tanks
  - Purchase of mobile plant to mitigate short term process risks
  - Replacement of obsolete monitoring equipment

WTW Risk schemes

The WTW Risk Scheme programme of work contains specific projects identified through the Risk Review process and require engineered options and more complex project management to resolve.

Following multifunctional review and prioritisation of needs arising from this process, a long list of needs was provided to our engineers who determined notional solutions to address the identified risks, which were then costed. For detail on costing methodology and cost efficiency see Technical Annex – Enhancement Cost Estimation and Optioneering.

A review was then carried out of this long list, prioritised to meet expected Botex allocations and the programme of work set out in Table 8-14 has been included in the plan.

Table 8-14 Prioritised WTW Risk Schemes

Scheme	Description	AMP8 Capex (£m)
Fort Cumberland SST	Replacement of sea defences to prevent risk to public and provide resilience to storm tanks	1.2
East Worthing WTW	Construct improved inlet screen solution to reduce risk to downstream treatment process and upstream catchment flooding	12.9
Eastbourne WTW	Replacement of odour control system to ensure operational continuity, and treatment process resilience improvements	12.0
Weatherlees Hill A WTW	Replacement of inlet screens to reduce risk to downstream treatment processes	4.2
East Worthing WTW	Treatment process resilience improvements	1.9
Chickenhall Eastleigh WTW	Replacement of inlet screens to reduce risk to downstream treatment processes; improvements to sludge process to increase process resilience	11.0

Budds Farm Havant WTW	Increase primary settling capacity to increase process resilience and reduce opex through increase in sludge processing efficiency	39.7
Bexhill & Hastings WTW	Refurbish inlet works civil structure which is damaged due to hydrogen sulphide corrosion	4.0
Staplecross WTW	Install new inlet screen to reduce risk to downstream processes	0.5
Westbere WTW	Install new outfall pipework to prevent spills into SSSI	1.6
Aylesford WTW	Repair work to filter civil structure to prevent treatment bypass and localised spills to land	6.0
Emerging Risk	New capital maintenance risks which emerge as part of the risk review process, to maintain compliance at WTW	16.0

In developing notional solutions and costs any crossover of scope with other drivers (e.g. WINEP, Growth) has been considered.

WTW Enhancement (Growth)

We are forecasting significant population growth across the whole of the region by 2040. (see SRN23 Network and WTW Growth Cost Adjustment Claim and SRN44 Wastewater Growth Enhancement Business Case). All 363 WTWs operated and owned by SW have been assessed for process capacity and DWF and headroom by 2030. Assessment of forecast population growth using the commercial tool Edge v1.3 (19/01/2023) forecasts and cross referencing with council Local Plans have identified 38 Wastewater Treatment Works (WTWs) requiring an increase in capacity by 2033 to prevent deterioration of discharge permit compliance performance.

Further detail on the Growth programme can be found in SRN22 Network & WTW Growth Cost Adjustment Claim and SRN44 Wastewater Growth Enhancement Business Case.

8.4. Bioresources Treatment

Table 8-15: Main AMP8 sub programmes within bioresources

	AMP8 (£)
Compliance and Performance	28.8
Planned capital maintenance	73.8

(note sub programme lines do not include M&G costs- see section 9)

We are increasing our spend in AMP8 compared to AMP7 by around 20%. Our plan for our Bioresources BOTEX spend in AMP8 is to capitalise on the work we have carried out in AMP7 as well as fully align our base programme to our strategic objectives as described in SRN36 Bioresources Strategy Technical Annex.

1. Treat sludge efficiently and cost-effectively to produce materials that benefit downstream supply chains
2. Achieve 100% compliance with Bioresources Assurance Scheme (BAS) whilst eliminating our reliance on secondary treatment
3. Create sustainable outlets for biosolids or any other materials
4. Maximise the recovery of resources from sludge
5. Restore operational resilience and mitigate future threats
6. Contribute significantly to the company's ambition to reduce its operational zero carbon by 2030 and contribute to the UK Net Zero target of 2050

For AMP8, our approach is based on:

- Ramp-up our digester cleaning and maintenance programme to achieve our target of all our digesters (currently 43) inspected on a 10 year cycle. This is to ensure effective operation, restore resilience, improve biosolids compliance as well as comply with best industry practices.
- Replacing assets based on their age and performance, with a focus on dewatering/thickening assets but also storage of liquid sludge and associated biogas assets such as flare stacks and gas bags.
- Construction of two new advanced treatment processes in Kent through the cost adjustment claim (see SRN21 Advanced Digestion Cost Adjustment Claim). Delivery is planned for 2030, meaning we must maintain the 7 existing Kent sludge treatment centres for the whole of AMP8.
- Delivery of the new advanced treatment sites and the additional cake storage being delivered through WINEP will be sized to allow for growth. Costs for this additional capacity are allocated to botex growth.

Compliance and Performance

Our digesters cleaning programme (£11m in AMP8) has been developed to achieve our target of having all our digesters (currently 43 No) inspected on a 10-year cycle (to meet the statutory requirement).

Strengthening of our digestion operation will be carried out alongside the replacement of further Combined Heat & Power (CHP) engines in AMP8, to ensure energy recovery from our sludge is maximised (supporting ongoing net zero target delivery). The location and number of CHP to be replaced will be heavily influenced by the work we are undertaking in the enhancement space as we carry on monitoring the potential benefits from Biomethane upgrade and injection into the grid as a potential alternative.

As the need is continuing to increase for greater levels of data and reporting from these assets, we have within the plan a specific programme of £0.75m dedicated to improving our metering and data capture of key information such as Biogas flow, heat demand/production or liquors treatment. This allows us to meet requirements around operational carbon and other regulatory reporting.

Planned Capital Maintenance

A significant proportion of our BOTEX will be dedicated to replacing assets based on their age (life expired) or performance/risk level. Our analysis shows that AMP8 will need to focus on key assets such as:

- Dewatering/thickening equipment as by 2025 the average age of our centrifuges will be 21.6 years old with 70% of our centrifuges will be over 20 years old
- Biogas treatment and usage as the average age of our Combined Heat and Power (CHP) fleet is 15 years old with 3 engines over 19 years old

- Sludge capacity (e.g. digestion, liquid sludge storage) with limited headroom at present, especially in Kent where maintenance of key digesters in the area is a significant challenge

Growth

Finally, some of our Bioresources BOTEX will be allocation to the growth element of some of our enhancement schemes. These are:

- Consolidation of sites and conversion to Advanced Anaerobic Digestion in Kent – as described in our Cost Adjustment Claim for Ashford and Ham Hill AAD (see SRN21 Advanced Digestion Cost Adjustment Claim)
- Additional storage for treated cake – as described in our WINEP Bioresources Enhancement Case (see SRN43 WINEP - Bioresources Cake Storage Enhancement Business Case)

9. Central Costs

There are a number of common “central” Management and General (M&G) costs that support both the water and wastewater wholesale sides of the business.

We have calculated the percentage of these central costs in proportion to the total cost of the individual wholesale water and waste capex schemes and then spread this percentage across each of the scheme lines to allocate the Central costs. This is summarised in Table 9-1 below.

Table 9-1: Summary of “Central” Management and General Costs

	AMP7 (£m)	AMP8 (£m)
IT	133.5	113.6
Innovation and R&D	9.6	9.1
Commercial	7.6	7.4
Energy	4.2	6.1
Facilities	26.8	28.8
Fleet	42.1	38.9
Property	1.6	1.9
PR29	10.9	10.4
Total		215.9
Water Allocation		66.1
Waste Allocation		149.8

9.1. IT

The AMP8 plan has £113.6 million Capex for IT, which is less than the £133.5 million for AMP7, reflecting increased efficiencies. This is broken down into the following sub programmes:

- Core IT £60.3m
- Digital & Collaboration £1.4m
- Driving Insight with Data £7.2m
- Information Security £15.4m
- Network Comms £10.1m
- Asset Management £4.4m
- Control Centre £4.4m
- Engineering & Construction £10.4m

These are discussed further in the AMP8 focus section overleaf.

9.1.1 AMP 7 Review

During AMP7 we have invested in strategies and technologies to stabilise, de-risk and enable Southern Water. Early in the AMP, we insourced many of the core IT and data related activities within the organisation thereby enhancing knowledge-based value-add capabilities, reducing the reliance on third party proprietary skills and ultimately delivering high quality IT services more cost effectively.

We have transformed our data centre capabilities and are replacing the majority of our networks and IT infrastructure for increased stability, security and resilience of core capabilities.

Focusing on end user services has advanced Southern Water from a predominantly virtualised Citrix desktop working environment to a more strategic mobile device footing employing O365 across the enterprise.

These remediating and transformational activities enabled us to meet the challenge of moving to a remote working environment practically overnight as a result of the Covid pandemic. Further benefits of hybrid working have since been realised allowing us to be more flexible, adaptable and providing a more attractive to place to work. We have seen these benefits flow through into incident management, project lifecycles and in the levels of collaborative working both internally and externally.

Data Analytics

The primary focus in AMP7 for Data and Analytics has revolved around elevating data and analytics proficiency across five principal domains: strategy, business enablement, analytics capability, platforms, and data governance. A pivotal aspect encompassed the centralisation of data management, consolidating it within a 'lakehouse' and an enterprise data catalogue. Concurrently, efforts were directed toward fostering self-service analytics capabilities, a trajectory intended for significant expansion in anticipation of AMP8. An instrumental shift to Microsoft Azure's cloud platforms was embraced, promising augmented agility and access to diverse services and technologies.

To cater to these goals, dedicated teams providing business analytics, data engineering, data science, and data governance were strategically assembled. Notably, a central data governance team was instituted to design overarching frameworks for federated data governance units and to provide indispensable support for the successful delivery of data and analytics products.

Legacy Replacement

A number of core legacy systems have also been replaced during AMP7 including our Human Resources (HR) system, Enterprise Asset Management (EAM) and Geographic Information System (GIS). Replacing our legacy HR systems with a market leading solution ([redacted]) has enabled us to streamline HR processes, from recruitment and onboarding to payroll and performance management.

The transition has led to increased efficiency, reduced administrative burden and improved data accuracy. [redacted]'s intuitive user interface and self-service capabilities have empowered employees, enhancing engagement and satisfaction.

Replacing our legacy EAM and GIS capabilities with integrated [redacted] products will enable us to decommission a large number of obsolete and disparate systems in our software landscape.

By the end of AMP7, the transformation of these core asset management solutions will be in the implementation phases and heading into AMP8 will dramatically improve our mobile workforce capabilities, allow us to move to a true linear asset model, enhance our logistics function and lay the foundations for accelerating our predictive maintenance / data-led decision-making maturity journey. Deploying this fundamental capability during AMP7 to AMP8 transition will enable us to continually improve and successfully build on this position throughout future AMP cycles.

IT/OT Capabilities

IT and Operational Technology (OT) capabilities have continued to converge throughout AMP7. Our OT communications transformation has mobilised to address the decommissioning of Public Switched

Telephone Network lines (PSTN), which has seen us move to a mixture of mobile and fixed line communication solutions.

This switch has also enabled us to provide capabilities for increased volume and frequency of OT data transmissions back to our central control centre. Re-platforming our key top-end OT systems [redacted] (alarm management), [redacted] (OT historian) and deploying a new IIOT platform ([redacted]) has enabled us to embark on our alarm transformation programme, deploy situational awareness solutions to our control centre and to install 24,000 sewer level monitors by 2025, which combined with a proactive analytics capability has driven the identification and treatment of potential waste network issues ahead of the event, thereby reducing network related pollutions.

Further utilisation of our OT data and platforms has also driven the creation of our spills reporting system, [redacted], which is used to automate, simplify and assure our spills reporting process and to drive the Beachbuoy bathing water alerting capability on the Southern Water website. Likewise from a leakage and network calming perspective we have utilised enhanced pressure monitoring to ensure we are optimally operating our assets thereby increasing resilience and reliability of service.

Customer Relationship Management

We have also continued to enhance and improve our Customer Relationship Management (CRM), billing and customer debt management systems throughout the AMP, identifying and implementing various enhancements to drive process efficiencies and deliver an improved customer experience.

Early in AMP7 we implemented our customer portal to increase self-service capabilities for our customers, enabling them to utilise a range of services whenever is convenient for them. Further digital services have been created to enable developers and homeowners to engage with our connections services more effectively via an on-line self-service portal - GetConnected. We also continued to update our retailer portal in-line with the market operators (MOSL) changes to their Central Market Operating System.

By the end of AMP7 we will also have upgraded hosting infrastructure of the Southern Water website and redesigned and deployed the content to enhance the digital experience for our customers.

9.1.2 AMP8 Focus

In AMP8 our focus we be on addressing the gaps in AMP7 and investing in technology to further enable the Southern Water digitisation strategy to be realised. Our technology plan will continue to provide the underlying technology infrastructure, networks and analytics to support and enable our wider transformational plans which span across different business domains, addressing critical needs, boosting compliance, and heightening operational efficiency while keeping customer satisfaction at the forefront.

Core IT

Our plans for AMP8 will enable us to build upon progress made during AMP7, ensuring our core IT remains up to date and secure, whilst enabling productivity for our different business functions and supply chain partners. We intend to maintain our End User Services capabilities, providing a refresh for hardware including laptops and peripheral devices. Mobile devices will continue to be required and form an important part of enable our field teams, often with the need to provide ruggedised devices for operational use.

With Windows 11 being available, we will roll-out and migrate users across to take advantage of the latest functions and security available within the operating system. This will work natively with Microsoft 365 to provide end user productivity tooling used every day by Southern Water staff. As part of this roll-out, we will also address any compatibility issues with legacy business applications which may require changes to continue to operate in a stable manner.

Our printing and plotting estate will increasingly become end of life and will require a refresh, which is scaled according to the forecast usage (significantly reduced with new ways of working). Often these are multi-function printers which provide an important operational service for scanning or copying, which need to be maintained and replaced where appropriate.

There is an increasing demand to keep users up to date through various channels, so we will work towards better digital communication technology being made available to offer a better user experience or being better informed, particularly in result of an outage or incident to our systems.

During AMP7, we made significant progress in providing a more resilience hosting service for our applications and end user services by procuring a new data centre infrastructure. This is forecast to need a refresh during AMP8 and will require investment to ensure it remains a stable, secure service for our hosted applications. It will also provide the backbone for secure back-up services and failover resilience.

As our IT spans across multiple sites within our regions, our network communications are a key aspect in our operational service. This requires investment in our routers, switches, access points and networking circuits in order to ensure connectivity between our core IT hubs and our operational water and wastewater sites. This works in conjunction with our OT network services, which include over the air telecommunication and land-line investments.

Alongside delivering a set of stable and robust IT services, there is also the need to deliver digital services in the most effective manner, enabled through robust testing. These services will span across both hosted and cloud applications, with the increasing need for us to ensure we have the right competencies to make the most of our new technology areas of innovation that quickly become the default in expectations. We will invest in our centre of excellence models, particularly around hybrid and cloud services, to ensure that we are providing the best possible methods to enable our wider business to succeed.

Across our estate, data becomes an increasingly important aspect of how we can operate effectively and efficiently. In AMP 8, the focus for Data and Analytics is on leveraging the foundations set in AMP 7 to optimise data utilisation for Southern Water's stakeholders. This entails valuing data as an exploitable asset, including open data sharing and collaboration with other water companies for innovation and transparency, while also ensuring compliance.

The strategy involves empowering an analytically capable workforce through generative AI and improved metadata management, enabling easy data querying – even allowing field workers to verbally seek evidence-based insights. We will build decision and data products focused in three key areas: facilitating decision-making by providing comprehensive contextual data access, guiding decisions through AI-driven recommendations and human expertise, and automating decisions using AI and IoT for intricate tasks. The plan also includes further investment in the Southern Water cloud Data and Analytics Platform (DAP) to consolidate enterprise data and tap into advanced capabilities like computer vision and natural language processing. Additionally, the data governance team's role will extend to critical data automation and controls, ensuring precise data usage, lineage, metadata, and master data management to ensure accurate and timely decisions are enabled.

To protect everything we do in our IT and OT provisioning, security will play an increasingly important role and provides an essential service given the landscape we operate within. Investments in regulatory compliance, secure access of applications and cyber defence are part of our AMP8 plans to ensure that we avoid being compromised and provide protection and enforcement for our information security needs.

Central to our efforts in AMP8 is the reinforcement of our asset investment planning capabilities. This initiative will see us upgrading our current Asset Investment Planning (AIP) solution, underpinned by a systematic and repeatable framework which will enable us to consistently develop well-informed investment plans and enhance our future business strategies.

The Control Centre stands as a critical hub in our operations, and we will build on foundational work accomplished in AMP7 coupled with the upgrade of our alarm management solution, [redacted], to continue the second phase of our Alarm Transformation initiative. By deploying advanced alarm logic across vital areas, we will streamline operations, enhance response times, and optimise overall control centre efficiency.

Our focus on the wastewater domain centres on safeguarding operational reliability and environmental integrity. To meet regulatory and customer expectations, we're enhancing automated spills and pollution reporting through immediate verification and notification systems, reducing environmental impact and reinforcing compliance. The replacement of obsolete operational technology at our sites ensures operational continuity and smooth functioning across our wastewater Treatment Works. By upgrading our legacy Volume Index Meter (VIM) system, we aim to maintain optimal chemical and cake level management, ensuring operational efficiency and compliance. The initiative to enhance Industrial Emissions (IED) monitoring with additional sensors on gas release valves and sludge-generated liquor further underscores our commitment to environmental preservation and regulatory alignment. Lastly, modernising our Trade Effluent Discharge (TED) system will streamline consent management and billing, enabling more accurate tracking and efficient administration of trade effluent. In AMP8, our wastewater initiatives reinforce our dedication to operational resilience, environmental stewardship, and regulatory adherence.

Similar to wastewater, we're continuing to replace obsolete operational technology capabilities at our Water Treatment Works, ensuring seamless operations and accurate attribute measurement. To comply with new regulations, we're updating the Water Quality Shut Down (WQSD) systems at site, enhancing data frequency and visualisation. Through these initiatives, we continue to ensure safe, reliable, and compliant water delivery for our customers and the environment.

Through a set of focused initiatives, we're reshaping our energy management approach. By transitioning from our current energy management system and ensuring communication continuity beyond PSTN line obsolescence, we're enhancing operational efficiency. These measures will provide us with better insights into energy consumption and costs, improving both office and field-based decision making.

Our Engineering and Construction IT portfolio prioritises innovation and collaboration to drive excellence. We're planning to digitise construction content, advancing BIM capabilities, and replacing our Engineering Tools Suite. Additionally, we are investing in upgrading our existing Hydraulic Modelling Capability, embracing advanced computational fluid dynamics and surge analysis software. This initiative ensures accurate predictions, optimising our infrastructure's performance and resilience. To streamline our Engineering and Construction programmes, we're enhancing the PMO (Project Management Office) Toolset, empowering us to manage and drive projects across cost, schedule, and change management more effectively. These initiatives ensure our engineering efforts remain at the forefront, fostering collaboration with delivery partners, cutting-edge technology, and streamlined project management throughout AMP8. AMP8 underscores our commitment to bolstering back-office services with a pragmatic approach. In the Finance domain, we're replacing our legacy SAP Finance system to ensure modern financial capabilities, compliance, and sustainability. This initiative aligns with regulatory standards and supports data-driven decisions. Concurrently, our Procurement efforts focus on modernising our Source To Pay and Contract Administration platforms for operational efficiency and compliance. This balanced strategy in finance and procurement exemplifies our dedication to improving operational effectiveness and delivering value to stakeholders.

Our commitment to enhancing the customer experience stands at the forefront of AMP8. We are embarking on a transformative journey within our customer portfolio, guided by a range of initiatives aimed at streamlining interactions and providing tailored support. With an investment in a new billing and customer management system, we're transforming customer service by offering personalised, holistic assistance and automating processes to respond effectively to incidents or planned works. This system will also empower us to target communications, promoting water conservation and awareness of our support services. Furthermore, this capability is pivotal for maximising the benefits of our smart metering program, ensuring accurate data and efficient management. We will further digitise our Developer Services offering, as we continue to refine our online portal, GetConnected, simplifying customer applications for developer services. We aim to integrate advanced technology, including AI bots, to guide developers through the application process.

By investing in data quality and replacing non-household customers' AMR meters with smart meters, we're fostering accurate billing and engagement in water-saving initiatives. Our website will evolve, offering improved navigation and new contact options. This comprehensive approach to enhancing customer engagement exemplifies our commitment to delivering efficient, tailored experiences across all interactions.

9.2. Innovation and R&D

The Central Innovation and R&D budget (£9.1 million Capex) is the same as AMP7 and is facilitated by our in-house Innovation Team, Bluewave. Bluewave was established in AMP7 to define and embed innovative practices through problem solving techniques, new partnerships and human-centred design. The team is accountable for enabling innovation across our business, delivering a portfolio of innovative projects, and assisting us in taking a longer-term view on exploiting research. Bluewave focuses on tackling complex problems utilising a diverse set of skills from both within the sector and outside the sector – often conducting discovery and experimentation before handing over solutions to other CAPEX programmes to deliver and realise the benefits. These projects often have significant efficiency benefits across BOTEX.

Bluewave regularly works in collaboration and partnerships. The Central Innovation and R&D Budget is supplemented or matched with funding from partners. For example, we have a strategic partnership with the University of Portsmouth which brings together industrial and academic skill sets to conduct R&D. It encompasses a rolling series of trials based around the test-bed facilities at the Environmental Technology Field Station at our Petersfield wastewater treatment works. This aims to identify and assess novel technologies or solutions that can be applied to our emerging challenges. This unique facility has extensive laboratories where trials can be operated with wastewater from various different stages of the works and intensively monitored onsite. The [redacted] provide contribution in kind, through provision of academic staff and researchers to conduct studies. The Hub has, for example, investigated solutions to challenging phosphorus limits, enforced through the National Environment Programme phase 5 (NEP5). The [redacted] tested novel commercially available media to reduce the total phosphorous to levels consistently below 1 mg/L. They also provided an in-depth analysis into media physical characteristics, process configuration, process parameters and its influence on other water parameters post-treatment. The knowledge generated allowed the selection of Polonite reactive media to be integrated in a new treatment process at East End wastewater treatment works to meet the AMP7 Phosphorus limit. (more details found in the wastewater chapter). Bluewave also facilitates our route into the Ofwat Innovation Fund and UKWIR Big Questions. This includes both bidding for funding, but also tracking and exploiting outputs to maximise impact of wider investment in sector innovation.

Examples of AMP7 activities under our Innovation and R&D budget that have that are having a positive impact on operation efficiency are illustrated in the case studies in section 3.

In AMP7, the Central Innovation and R&D budget has also contributed to investigations, experimentation, and solution implementation associated with several our other key strategic challenges and long-term priorities:

- **Reducing household and non-household consumption**. Innovation has been a core part of the T100 programme. The Bluewave team have been leading on lean testing new and innovative concepts, and using behavioural science, to reduce consumption – for details see Innovation Annex and WRMP
- **Reducing plastic in our business**. We have been using innovation to challenge the use of plastic within the business operations. 'Plastic reduction' sits within a risk theme within our Environmental Strategy – for details see Innovation Annex and Environmental Strategy Technical Annex
- **Understanding and reducing Process Emissions**. In line with our Net Zero plan, we are implementing the UK-first on site wastewater treatment works assessment through installation of nitrous oxide sensors, with testing of operational interventions to understand their impacts on fugitive emissions – for details see Innovation Annex and Net Zero Annex
- **Improving support to our vulnerable customers**. We led on the OFWAT Innovation Fund Water4All project. This project used a range of data sources, such as age, household composition and income, to attempt to determine whether a customer is eligible for additional financial support. We believe that proactively supporting our vulnerable customers has a bearing on our cost to serve

Looking ahead to AMP8, we are preparing a portfolio of innovation continuing to tackle priorities within the business and seeking novel solutions to a range of specific challenges. The Central - R&D budget will be utilised for experimentation across Southern Water through the delivery of technology trials, campaigns and competitions focused on Southern Water's key strategic challenges. These will manage risk through small rapid trials and deliver results through a combination of technical blueprints and/or businesses cases. This will drive the scaling of successful solutions and approaches to benefit our customers and the environment. The steady CAPEX budget for innovation from AMP7 levels will be supplemented through the increasing volume of sector-wide innovation delivered through the Ofwat Innovation Fund, joint initiatives with Southern Water framework partners and our increasing participation in un-funded activities with our growing academic partners. The proposed portfolio will develop and mature over the remainder of AMP7 as we continue to deliver activities and research that will inform the starting point for AMP8 innovation. Please see the SRN54 Innovation Technical Annex for details on how this proposed portfolio has been formed, and more detail on proposed activities and project plans.

AMP8 Innovation Theme	• Proposed AMP8 Project Activities
 Improving sustainability and maximising value using the circular economy	• Novel technologies, energy-efficient practices, and stringent emission control measures (process and fugitive greenhouse gas emissions) • Alternative pathways for converting wastewater bioresources into renewable energy and valuable by-products, including nutrient recovery
 Tackling emerging contaminants holistically	• Ensure emerging contaminants are dealt with effectively, proactively and collaboratively; including consideration of (but not limited to) Cypermethrin, PFAS, PFOS, Microplastics, Antimicrobial resistance
 Delivering resilient supply & affordable service for all	• Behavioural science and ethnography to drive engagement with our customers on key topics and areas for collaborative impact • Promote water efficient behaviours and new technology solutions that reduce household and non-household consumption • New charging structures and seasonal tariffs • Identifying, supporting and protecting our most vulnerable customers • Advanced leak detection technologies, such as satellite detection, aerial surveys and artificial intelligence based acoustic sensors • No-dig technologies, such as in-situ pipe replacement and lining technologies
 Enhancing our regional water environment	• Technological advancements and novel treatment technologies to better understand persistence, degradation pathways, and potential impacts of nutrients and pollutants (existing and emerging) • Identify more efficient, cheaper and greener solutions for nutrient permits. Wetlands are one area of those solutions that could help to reduce our reliance on 'end-of-pipe' solutions

To continue our approach to driving efficiency and innovation in collaboration with our delivery partners and supply chain, our new AMP8 frameworks will provide greater emphasis on continuous improvement, innovation and transformation. They seek to share the Southern Water definition of innovation with-in our supply chain and encourages principles that enable innovative behaviours (see innovation annex). There are key elements that we are using to enable transformation and innovation with our AMP8 supply chain;

1. The supplier Balanced Scorecard tracks our priorities and drives the supply chain to assist towards their achievement, with payments linked to performance. Suppliers are held to account to enable us to achieve our ambitions in delivering value for the customer. And specifically ensuring commitment to efficiency, long term social value and water quality
2. A Continuous Improvement Plan is to be submitted to Southern Water. Bluewave will support the development of the plan with the business and suppliers at an initial strategy event with-in 6 months

of contract award. The continuous development of these will be progressed through routine governance and at monthly innovation forums. The plan encourages each supplier to commit to making improvements and innovations in everything it is doing. This will, for example, ensure suppliers are identifying innovations and or the emergence of relevant new technologies/processes and how these might be incorporated into the works and services they deliver for us

3. Gainshare incentivisation will enable a supplier to invest in new ideas and technologies (spend to save) and get payback of any financial efficiency benefit for us (providing that the gainshare proposal would not have the effect of lowering the quality of the works)

4. Co-development and collaborative activities. Bluewave will support the development and delivery of innovation through the sharing of processes, ways of working and techniques with framework partners and the supply chain. Supply chain partners will be engaged in future campaigns, competitions and/or sprints originating from Southern Water. As part of our approach to partnerships, we will explore and encourage opportunities to develop bids for the OFWAT Innovation Fund

We know that it is essential that we meaningfully embed a multi-capitals approach into our investment decision-making. We will also continue to test novel approaches in our investment decision and investment evaluation processes (such as the 'Risk and Value' and benefits process) to ensure that we are incorporating natural and social capital benefits across our CAPEX expenditure. At this stage, it is important to stress that we may still make the same decisions when it comes to more traditional financial or manufactured capital, but we will be able to demonstrate a broader awareness of our business impact. A proof of concept has been tested and within our 'Risk & Value' project management process, using natural and social capital metrics aligned with regulatory guidance. The method includes a qualitative and a more detailed quantitative tool at the stage where a project team needs to decide between options for delivery. This working proof of concept has given us a useable proven methodology for further embedding natural and social capital into decision points throughout the business.

9.3. Commercial

The AMP8 plan has £7.4 million Capex for Commercial, which is comparable to the £6.76 million in AMP7. This is broken down into three areas:

1. £5.3 million for the AMP8/9 Supply Chain Strategic Review. To review our supply chain model for AMP9, defining benefits and lessons learnt from AMP 7/8, completing a full market analysis and testing of the supply chain market benchmarking Southern Water's supply chain model against our peers and the wider asset infrastructure / utilities sector and mapping out a strategic plan to transition the critical supply chain frameworks and contracts from AMP8 to AMP9, identifying all risk, issues, assumptions and dependencies to deliver an improvement in supply chain performance.

2. £1.4 million for [redacted], which is out of support. Source to pay technology platform to digitalise the end-to-end procurement process from sourcing and contracting with new / existing vendors (competitive tendering / e-sourcing) to onboarding vendors, raising purchase requests against agreed spend catalogues and managing / maintaining contracts. Automating existing manual processes, improving end user experience (vendors and purchasers / buyers of good and services) and data accuracy, enabling enterprise-wide efficiencies.

3. £0.7 million for the Commercial exit from the AMP7 supply chain model and mobilisation of the AMP8 supply chain model, to create a safe, diverse, resilient, outcome-based supply chain that's aligned to our strategic themes and contributes to business performance and enables the business

to achieve its ambitions of delivering value for the customer and community, protecting and improving the environment.

9.4 Energy

The AMP8 plan has £6.1 million Capex for energy, which is comparable to the £4.2 million in AMP7. This includes £5.3 million to provide solutions to and leverage market opportunities from the increasing volatility of electricity production. The rest is replacement of the electricity billing meters in-line with the industry required life-expiry cycle every 10 years.

9.5 Facilities

The AMP8 plan has £28.8 million Capex for facilities, which is comparable to the £26.8 million in AMP7, This includes the budget to maintain “Buildings, Roads & Fences” at our office locations, Water and wastewater sites. There is also £2.1 million for replacement of the life-expired legacy access control system to maintain security (including hardware) on sites.

9.6 Fleet

The AMP8 plan has £38.9 million Capex for fleet, which is comparable to the £42.1 million in AMP7. This is for the replacement of around one thousand vehicles in our fleet, which have an asset life of around five 5 years. This excludes the additional capex required for electrification of the fleet, as this will be justified on a 'spend to save basis'.

9.7 Property

The AMP8 plan has £1.9 million Capex for property, which is comparable to the £1.6 million in AMP7. These are the costs associated with the owning and acquiring actual land, including legal costs.

9.8 PR29

The AMP8 plan has £10.4 million Capex for the PR29 submission, which is comparable to AMP7. This is for the production of the business plan and submission associated with developing the 2029 price review. This projected cost aligns with our EP22+300 plan.

Part B Appendices

Appendix 1: Sewer and Rising Main Strategy

Sewer Strategy

Please note this analysis completed in November 2022
Southern Water's sewer asset base is 38,258 km (in 2021) which includes an assessed length for ex-private (S105a) sewers.
Of this 21% of sewers are considered category A (Highest Criticality) or B (High Criticality). Category C sewers are considered non-critical.

Table A-9-2 - Sewer Strategy (2021 data)

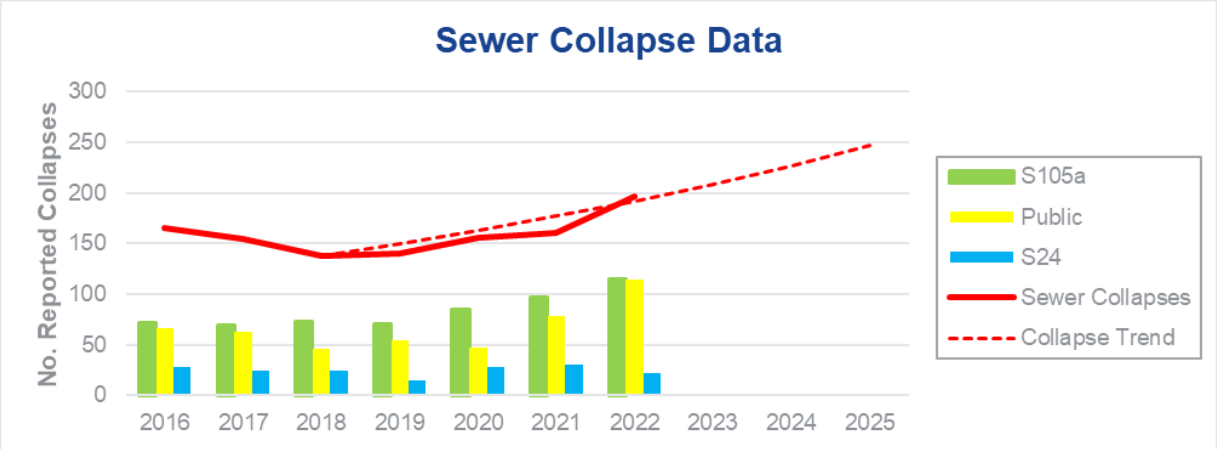
Sewer Type	Length (km)	Criticality Category A	Criticality Category B	Criticality Category C
Legacy Public Sewers	20721	2935	5228	12558
Formerly Private (s105a) Sewers	17537	-	-	17537

The Current Situation

Planned Sewer Rehabilitation has been inconsistent across previous AMPs.

- Planned funding has frequently been utilised for emerging risks and ground water reduction projects
  - Little funding used for structural schemes
- Only a small percentage of the network has been surveyed and data is often old with limited value for meaningful analysis

Figure A 9-1 - Sewer Collapse Data



- Collapse figures have increase by 5% per year since 2018. See Figure A 9-1.
- S105a sewers represent 48% of reported collapses.

Proposal

In AMP7 investment (as previously stated) has been used to protect existing assets, provide performance and resilience. Southern Water requires an increase in investment to fund structural rehabilitation and Ground Water related schemes over multiple AMPs targeting:

- Critical A and B high risk/poor condition sewers
- Non-Critical highest risk/poor condition sewers
- Continued sewer inspections using traditional and new technology where appropriate
- Alignment with the DWMP to survey sewers in water source capture zones

Through existing survey records we have already identified **109 km of Critical A & B sewers in a poor condition *** alongside **149 km of Non-Critical sewers in a poor condition.** Three options have been considered for rehabilitation:

Table A-9-3 - options for rehabilitation:

Option 1	Option 2	Option 3
All Critical A Risk Band 5,6,7 AMP8.	Critical A Risk Band 7 only in AMP8. Bands 5, 6 in AMP9	Critical A Risk Band 5,6,7 split across AMP8 and AMP9
Critical B Risk Band 7 & Non-Critical Risk Band 7 AMP8.	Critical B Risk Band 7 & Non-Critical Risk Band 7 AMP8.	Critical B Risk Band 5,6,7 split across AMP8 and AMP9
Critical B Risk Band 6 in AMP9.	Critical B Risk Band 5, 6 in AMP 9.	Non-Critical Risk Band 5,6, 7 split across AMPs 8, 9 and 10.
Non-Critical Risk Band 5,6 split between AMP9 and AMP10.	Non-Critical Risk Band 5,6 in AMP9.	

* Sewer conditions are graded from 1 – 7 with sewers in condition grade 5+ being considered in a poor condition with 7 the worst condition.

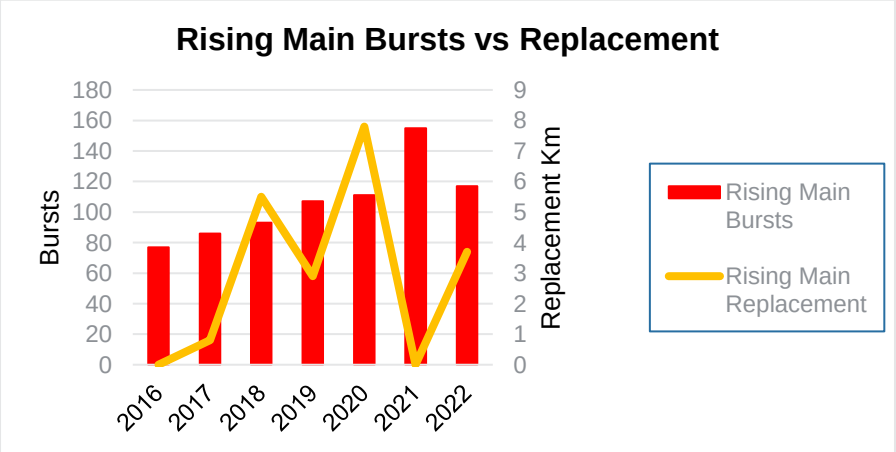
Option 3 is the preferred option as it balances risk across the next three AMPs whilst providing a deliverable medium to long term plan.

Rising Main Strategy

- Rising main replacement has been sporadic across AMP6 and AMP7; in 2016 no rising main replacement took place, in 2020 we replaced almost 8km of rising main, in 2022 the figure was around 4km
- Bursts have continued to rise almost 80 in 2016 to nearly 160 in 2021

*See Figure A 9-2

Figure A 9-2 Rising Main Burst vs Replacement.



AMP 8:

- An average deterioration rate of 2% has been calculated across AMP6 and AMP7 using bursts/km of rising main
- Without intervention bursts are forecast to reach 140 per year in AMP8. See Figure A
- Pump calming techniques and rising main replacement interventions in AMP7 will effect the burst rate but a change in renewal rate is required to meet a target of 80 bursts per year or less
- The AMP8 strategy will drive down burst numbers to achieve the target figure

Interventions through AMP 8 for rising main resilience works will benefit the asset stock by improving performance and adding longevity.

Figure A 9-3 Rising Main Burst Trend vs Intervention.

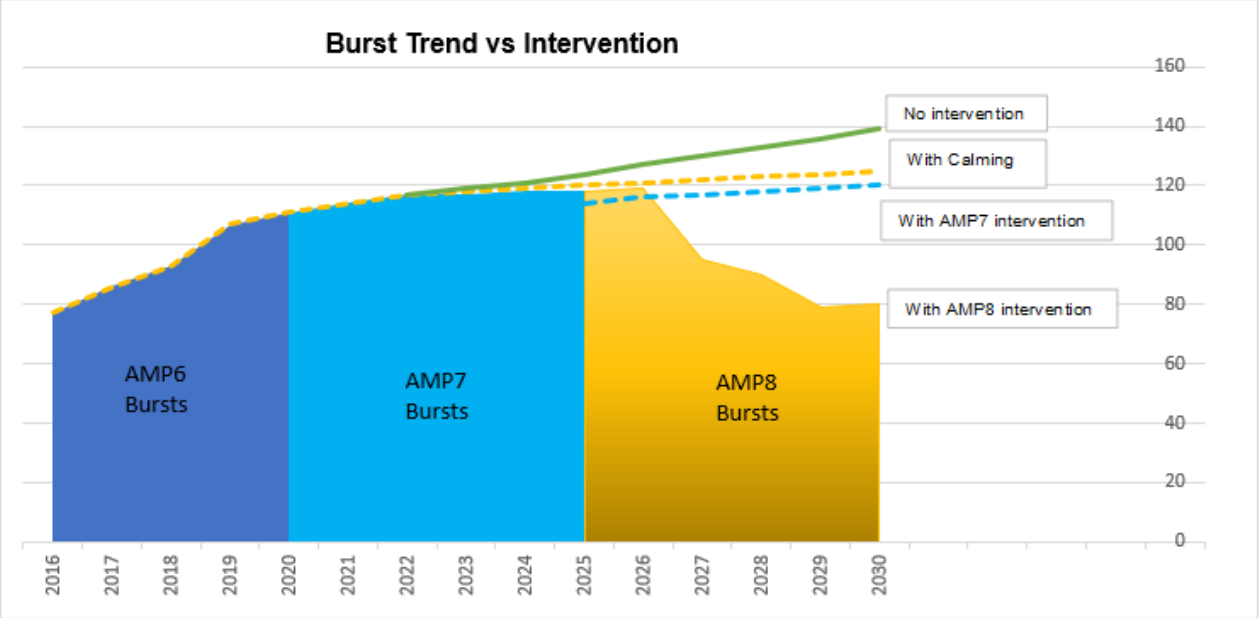
The strategy focuses on small diameter mains with high burst frequencies and high-risk large diameter mains. Renewal of these mains will enable Southern Water to meet improved performance targets.

TableA-9-4 shows 48 identified rising mains which offer a burst reduction of 40 per year to meet the strategy and target numbers with partial replacement the preferred option for efficient delivery.

TableA-9-4 - Rising Main Renewal Strategy

Rising Main Dia.	Rising Main No.	Total Length km	Total Burst No.	Average Frequency per yr.	Average Frequency last 5 yrs.	Potential Burst Reduction	Partial Replacement Length km
0-175mm	36	38.7	305	0.9	0.9	32	25.00
250-1000mm	12	30.8	93	0.7	0.86	8	16.60
Total	**48**					**40**	

This analysis was completed in 2022 and we have since added an additional three rising mains to the scope for the AMP8 submission which have been costed.

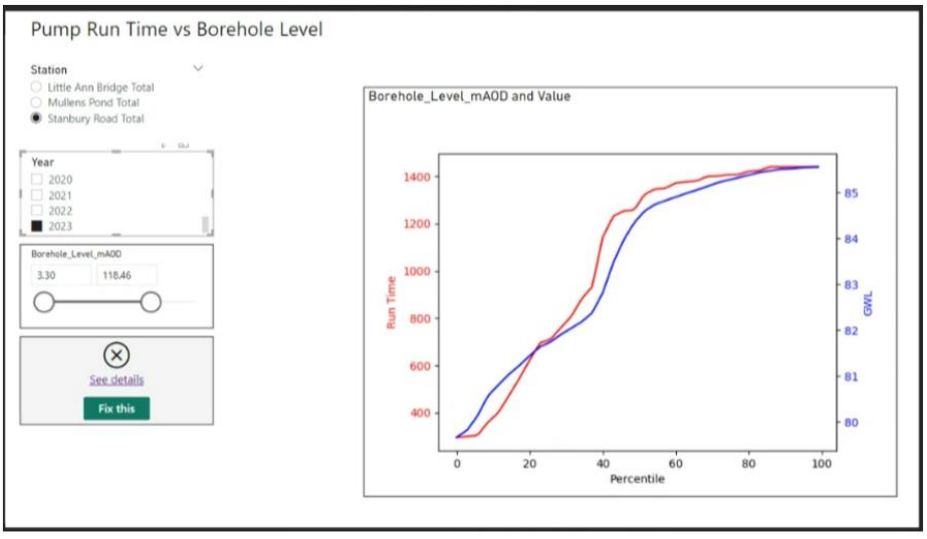


Appendix 2: Sewer sealing benefits

Analysis of benefits of sewer sealing in Pan Parishes, Andover

from Southern Water

Pump activity and groundwater level pre-sealing

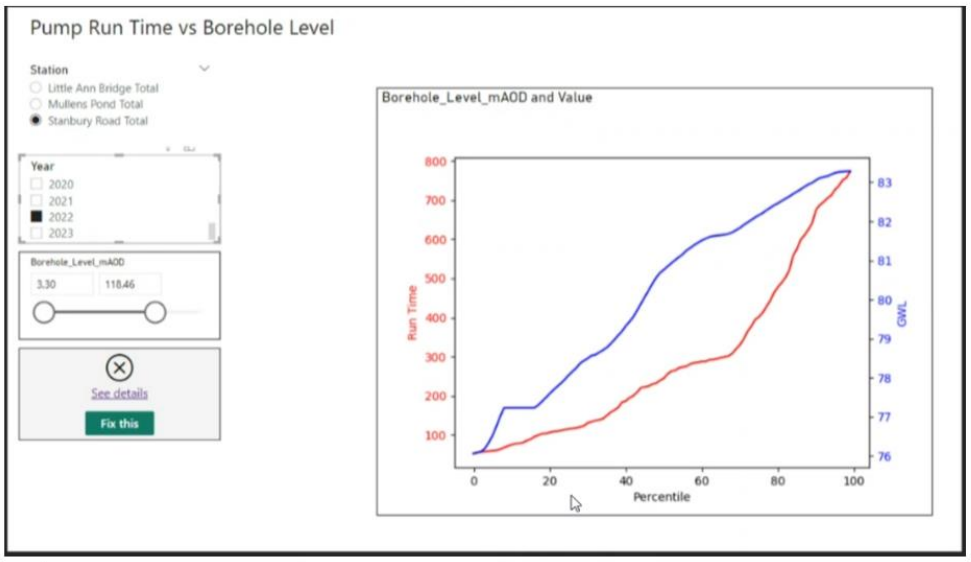


2

from Southern Water

from Southern Water

Pump activity and groundwater level post sealing



3

Conclusion on sealing work

Comparison of the two graphs shows that post sealing the pump run time at Stanbury Road WPS reduced significantly after sealing work was completed.

There is a particularly marked difference when groundwater levels are less than 83 mAOD which demonstrates the effectiveness of sealing sewers closest to the water table.

This also demonstrates that as the water table rises infiltration increases as more sewers become submerged and therefore supports that infiltration reduction must be completed at scale to be fully successful.

4