Asset Health Cost Change 2026

Asset Health Business Case - Protecting Trickling Filters

UUW26-16

April 2026

United Utilities

Water for the North West

Executive Summary

United Utilities Water (UUW) welcomes Ofwat's consideration of evidence-based proposals for additional asset health investment, focused on priority assets identified in the Roadmap for Enhancing Asset Health Understanding in the Water Sector.

Description
This case, which is a standard – single main submission, sets out our plans for additional investment in our trickling filter wastewater treatment assets, where deterioration is reaching a level that cannot be efficiently managed through AMP8 base expenditure alone.

Our investment proposals set out £41.4m (net of repair savings) of targeted AMP8 investment to maintain and restore asset health across our trickling filter wastewater treatment estate. They include remediation of 65 secondary treatment trickling filters at 19 sites and a further 22 nitrifying trickling filters (NTFs) at 11 sites. This programme is incremental to AMP8 base expenditure and is focused on assets where evidence shows deterioration can no longer be efficiently managed through base allowances alone.

This proposal will deliver a defined programme of civil refurbishment, NTF floor replacement, and proportionate associated Mechanical, Electrical, Instrumentation, Control & Automation (MEICA) renewal, focused on the highest risk assets where base expenditure is no longer sufficient to maintain long-term serviceability, safety, and environmental compliance. The need for this investment has arisen through the identification and escalation of asset health risks via our established asset and operational risk management processes.

Our investment proposals are aligned with our Trickling Filters Asset Class Strategy, which sets out the long-term approach to managing secondary treatment trickling filters and NTFs across the wastewater estate. This investment is proposed in the context of increased regulatory scrutiny of wastewater assets, with the Environment Agency placing greater emphasis on asset condition, failure mechanisms, and the resilience of asset and controls, rather than historic compliance alone.

Asset Class Strategy vision:

Our strategy for trickling filters is to remove obsolete assets from the asset base where appropriate and extend asset life where this is the better whole-life option. This reflects a risk-based approach aligned to the asset health and resilience principles set out in our asset health strategy. The strategy defines the circumstances under which targeted refurbishment, renewal, or process change represents the most efficient and proportionate response to asset deterioration.

Need
UUW operates 858 trickling filters across 322 wastewater treatment works in the North West of England. Of these, 798 (93%) are secondary treatment trickling filters, principally treating biochemical oxygen demand (BOD), with the remaining 60 (7%) being NTFs, designed to target the removal of ammonia. As treatment assets, trickling filters are fundamental to maintaining wastewater effluent quality at the sites they serve. A significant proportion (48%) of the assets were constructed between the 1960s and 1980s and, whilst still delivering process compliance, are now operating at or beyond their original civil design life.

Trickling filters are long life assets. However, recent condition inspections and performance stress analysis indicate accelerating, non-linear deterioration of civil and semi-structural elements. This includes walls, under-drains, and NTF floors. This deterioration materially increases risks to environmental compliance, operational resilience, and safe operation, particularly under increasing environmental standards and climate change driven hydraulic variability. **Deferring proactive intervention increases the likelihood of unplanned outages, higher whole-life cost, and heightened environmental risk.**

What Base Buys
Our AMP8 base programme is actively prioritised and focused on maintaining compliance and managing immediate risks across the wastewater treatment estate. However, evidence shows that for this asset class, while

base expenditure continues to manage immediate compliance and safety risks, allowances are increasingly utilised for reactive, short-term interventions that maintain operability, but do not restore long-term asset health.

Without additional proactive intervention, non-linear deterioration of critical civil elements will continue, increasing both the likelihood and consequence of failure, resulting in higher long-term costs to customers and greater environmental risk. Our proposed approach will enable us to address some of the highest risk structural and semi-structural investment needs for this asset base.

The need for additional investment is driven by:

- Enhanced understanding of asset condition through our most recent condition inspection surveys; and,
- The need to supplement our capital maintenance programme where it is no longer sufficient, with targeted proactive interventions to support sustainable long-term renewal, avoiding more disruptive and costly intervention in future periods.

We plan two distinct programmes of work within the scope of this priority asset class:

- Remedial work for filters with the most significant structural needs, where this is likely to impact site compliance and pollution risk; and,
- Floor remedials on our NTFs where subfloor supports have experienced accelerated degradation, putting compliance at risk.

Benefits

Customer research shows that customers place a high value on protecting rivers, lakes, reservoirs, fish and other aquatic wildlife, and often associate these outcomes with pollution prevention. The proposed investment directly supports these priorities by reducing high consequence environmental, safety and compliance risk arising from deteriorating trickling filter assets. It is focused on maintaining existing levels of service and environmental protection under increasing operational stress, and on reducing the likelihood that asset deterioration results in more disruptive or costly intervention in future periods.

Alongside this core risk reduction benefit, the investment will improve asset maintainability and lower whole-life cost by avoiding more disruptive and higher cost investment in later periods. Alternative approaches, including deferral, reactive base only intervention and full asset replacement, have been assessed and discounted as presenting higher risk or poorer value for customers.

Cost efficiency and best option for customers

Efficiency has been embedded through disciplined scope control, external benchmarking of our estimates against third party comparable costs, targeted intervention selection, and use of established AMP8 delivery models consistent with our PR24 approach and asset strategy. Customer protection is provided through output-based Price Control Deliverables (PCDs), ensuring that customers only fund efficiently delivered outcomes.

This business case represents a proportionate, evidence-led, and low-regret response to material and accelerating asset health risks, consistent with Ofwat's expectations and with customer preferences for proactive maintenance that protects the environment, service reliability, and offers long-term value for money.

Although the primary focus of this submission is civil asset health, the inclusion of proportionate MEICA interventions represents best practice asset stewardship. Where trickling filters are taken out of service for major civil works, addressing end-of-life MEICA assets concurrently minimises environmental risk, reduces total cost, and improves long-term operational resilience.

This case aligns with Ofwat's outcomes-focused approach and UUW's strategic objectives: delivering reliable, resilient wastewater services that protect the environment while supporting customers, communities, and the wider North West over the long term.

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1. Description

This section defines the proposed investment programme for trickling filters, including what the investment will involve, where it will be delivered, and the factors that have been considered in defining and prioritising the programme. It describes how trickling filters are essential for the effective treatment of wastewater. It also explains how the programme interfaces with AMP8 base, growth and enhancement activity, including the principles and governance used to develop the programme and ensure clear scope.

1.1 What the investment will involve

1.1.1 This case, which is a standard – single main submission, responds to identified structural deterioration within our trickling filter asset base and is proposed as incremental to AMP8 base activity.

1.1.2 Secondary treatment trickling filters provide biological treatment for BOD and ammonia, while nitrifying trickling filters (NTFs) provide tertiary treatment to achieve lower ammonia discharge standards.

1.1.3 The scope of this business case covers the following four broad intervention types:

- **Civil remediation of retaining walls and structures, under-drain systems and reconditioning of media.** Partial collapse or blockage of underfloor drainage systems is particularly prevalent in older, masonry built filters and manifests as effluent leaking from filter walls and excessive biomass build up in filter media. We plan to structurally remediate 65 secondary treatment trickling filters.
- **Complete structural rebuild of process units, including under-drain systems and reconditioning of media.** Where above ground walls have failed, we plan to fully rebuild 5 secondary treatment trickling filters.
- **Minor refurbishment of retaining walls and structures.** Where a comprehensive structural remediation is not required, but deterioration has been observed, we plan to remediate the structural elements. We plan to carry out minor refurbishment on 11 secondary treatment trickling filters.
- **Remediation of NTF under floor systems including replacement of collapsed media**. A widespread structural issue has been identified across our fleet of NTFs associated with plenum floor collapse. We plan to structurally remediate 22 NTFs.

1.2 Where we are planning to invest

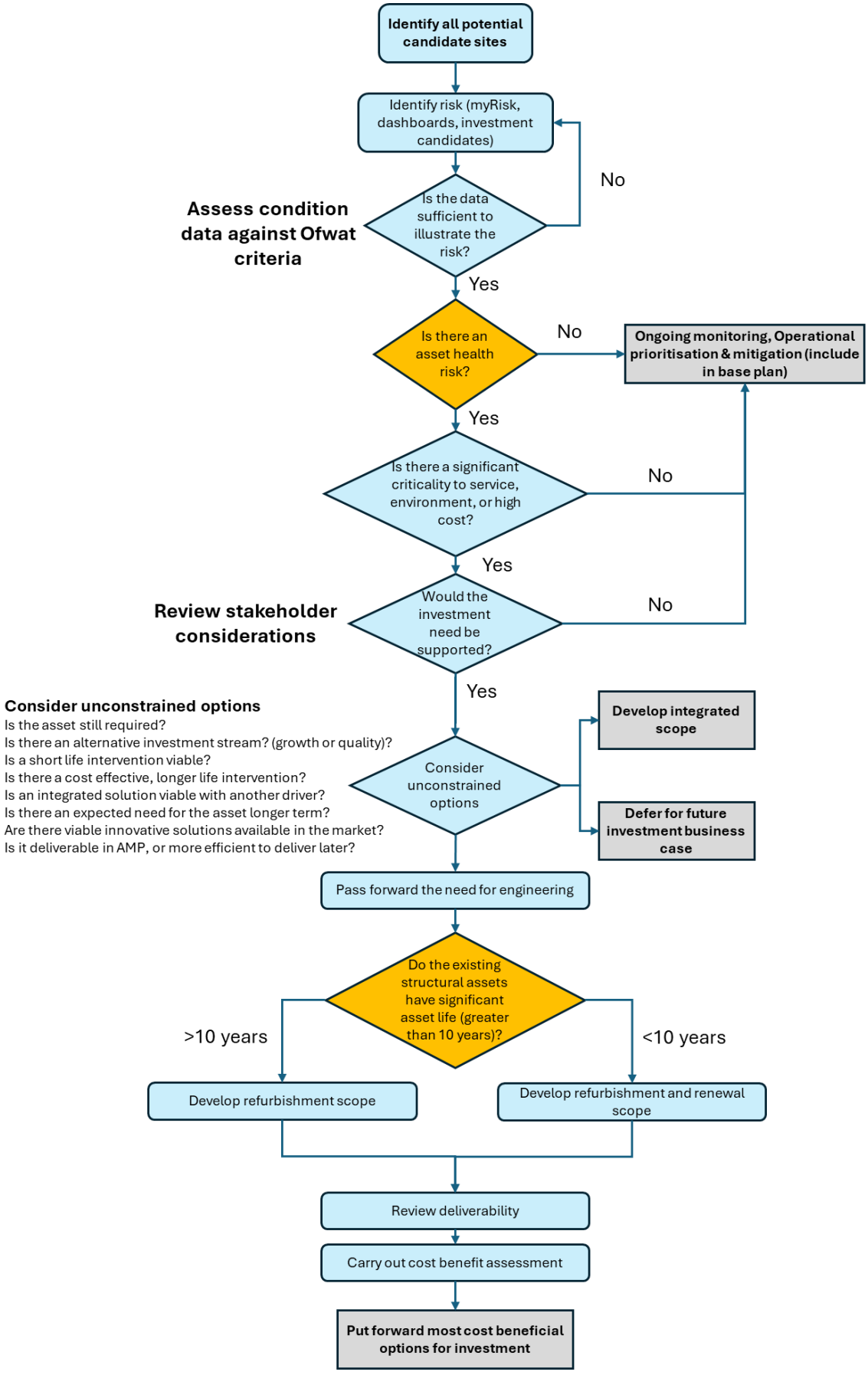
1.2.1 This programme has been developed through a structured, evidence-led prioritisation process to target investment at the highest-risk trickling filter assets where deterioration is material and intervention is deliverable within AMP8.

1.2.2 The process began with the full UUW wastewater treatment works portfolio of 322 sites containing trickling filters. Initial exclusion criteria were applied using corporate asset information and operational knowledge to identify those sites most likely to present material asset health risk. The resulting long list refined to 117 sites for detailed inspection and condition assessment. Sites were then evaluated against asset condition, asset criticality, the suitability of alternative intervention options, and deliverability considerations. This produced a prioritised set of candidate sites where deterioration is evidenced, the associated risks are material, and targeted intervention represents the most proportionate and efficient response.

1.2.3 The final scope has been constrained to sites where delivery within AMP8 is considered achievable. Deliverability is influenced by the complexity of the works, including access, planning, and operational constraints. For the NTF programme in particular, a key limiting factor is the availability of alternative treatment arrangements to maintain service while remedial works are completed.

1.2.4 A summary of the selection process is provided in Figure 1.

Figure 1: Asset health optioneering process



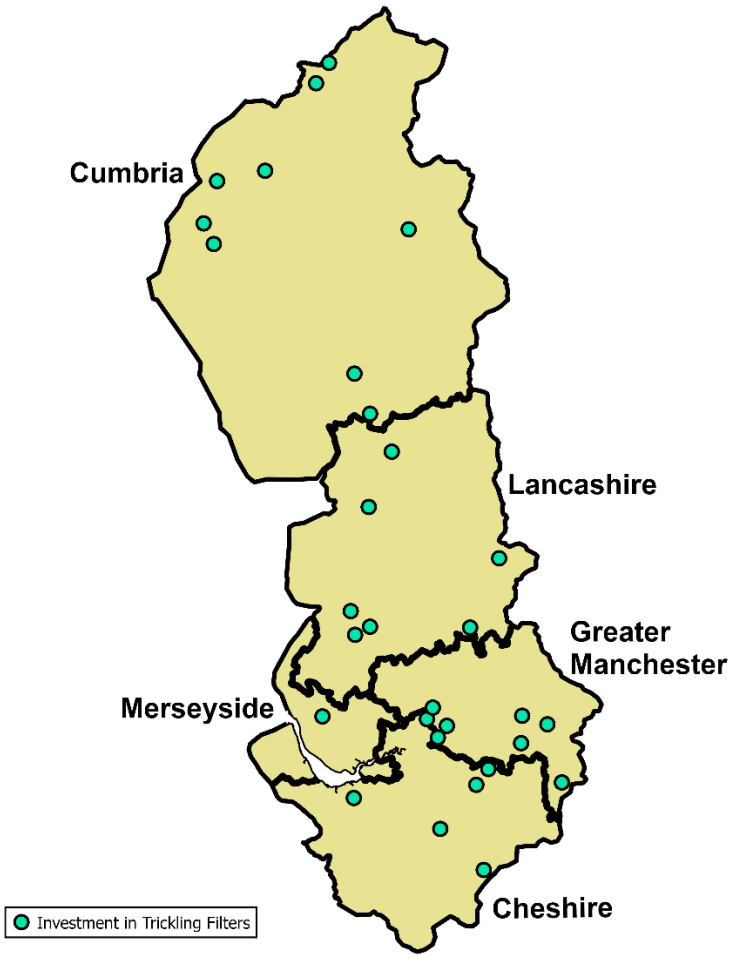
Source: UUW analysis

Candidate sites

1.2.5 We plan to remediate or rebuild 65 secondary treatment trickling filters at 19 sites, and a further 22 NTFs at 11 sites in addition to the AMP8 base maintenance programme of works on filters.

1.2.6 Figure 2 below indicates the geographical location of the sites alongside the work that we have included within the planned programme. Further details of specific sites are provided in Table 31 in Appendix A.

Figure 2: Map of planned trickling filter programme



Source: UUW Analysis

1.3 Regional and site factors

1.3.1 The proposed investment has been developed with regard to regional and site-specific circumstances across the trickling filter estate, including interfaces with AMP8 enhancement activity, growth-related investment, and local delivery constraints.

1.3.2 These factors have informed both site selection and scope definition, ensuring that proposed interventions are deliverable, aligned with planned AMP8 activity, and clearly distinguished from expenditure already provided for through base allowances, growth submissions, or enhancement schemes.

1.3.3 Where multiple investment drivers apply at the same site, scope boundaries have been explicitly defined so that each funding mechanism addresses a separate and evidenced requirement. The interventions included in this submission are limited to restoring structural integrity, maintainability,

and risk resilience of existing assets, and exclude capacity-led or permit-led works funded through other routes.

1.3.4 Further details on the assessment of programme interfaces and phasing considerations for sites is provided in Section 8.

Exclusions from programme due to future investment needs

[✂]

1.3.5 [✂]was identified through the site selection process as a candidate for investment under this business case, based on the condition and risk profile of the trickling filter assets. However, condition assessments have also identified material investment needs relating to other core treatment assets on the site, in particular the settlement tanks, which will form part of a future business case. Given the strong operational and functional interdependency between the trickling filters and settlement tanks, it would be inefficient and potentially disruptive to promote and deliver investment in isolation. For this reason, [✂]is not being progressed within the scope of this business case. Instead, we intend to bring forward a coordinated investment proposal covering both the trickling filters and settlement tanks, to be presented alongside the future settlement tank business case, ensuring a more integrated, efficient and value for money outcome for customers.

Customers will not pay twice for the same intervention.

1.3.6 Our base, growth, enhancement, and asset health expenditure programmes are distinct; we have established clear governance to prevent any overlap. This is ensured through defined scope boundaries at site level, Annual Performance Report (APR) assurance confirming separation of base and cost change expenditure, and proposed output-based Price Control Deliverables (PCDs) that apply only to incremental asset health activity.

1.3.7 The identification and selection of sites have also been informed by deliverability considerations, including alignment with planned AMP8 enhancement schemes, operational sequencing, and the ability to maintain treatment continuity during construction. Where planning, access, or third-party constraints would materially affect deliverability, interventions have either been excluded from this proposal.

2. Guide to evidence

Table 1 below highlights where the key evidential components of our case are located within the document. It is designed to help readers easily navigate to the relevant supporting information. It also outlines the key evidential requirements contained in the document.

2.1 Asset health document signposting

Table 1: Signposting to key sections of document

Assessment area	Key requirements	Section reference
Need for step change in investment	Historical investment and asset management approach	3.6 and 3.7
	'What base buys' assessment	4
	Asset health risk to service environment	3.2 and Appendix B
	Future asset health and risk	3.3
	Aligned long-term strategies	3.6
	Stakeholder engagement	3
Best option for customers	Unconstrained credible options	5.2
	Our proposed solutions	5
	Benefits versus the current position	5.4 and 7.1
	Customer engagement on options	5.5
Robust and efficient costs	Costing methodology for option and solution costs	6.3
	Efficient option and solution costs and good industry practice	6.3
	Cost benchmarking	6.2
	Solution costs	6.1
Customer protection	PR24 base expenditure plan	3.6 and 7.1
	Investment proposed in this cost-change	7.1
Investment delivery plans	Design and delivery risks log	8.2
	Aligned long-term asset strategies	3.5
	Stakeholder and supply chain engagement in delivery plan	8.1 and 8.5
	AMP8 investment delivery is on track	8.4
	Outline delivery schedule	8.3

Source: UUW analysis

3. Need for a step change in investment

This section explains why additional investment is necessary for the trickling filter estate, which comprises 858 filters across 322 wastewater treatment works. Nearly half of the asset base (48%) was constructed between the 1960s and 1980s and is now operating at or beyond original civil design life, with evidence of accelerating, non-linear deterioration in walls, under-drains and floors that cannot be sustainably managed through our existing AMP8 base expenditure.

The section summarises how and why risk is increasing, bringing together condition inspections, asset health forecasting, climate and regulatory pressures. It explains why base expenditure is increasingly focused on reactive, short-term interventions that maintain operation but do not restore long-term asset health.

3.1 Introduction to the investment need

3.1.1 Additional, targeted AMP8 investment is required to address evidenced asset health deterioration across UUW's trickling filter estate. UUW operates 858 trickling filters across 322 wastewater treatment works, including 798 secondary treatment filters and 60 nitrifying trickling filters (NTFs). A substantial proportion of the estate (48%) dates from the 1960s–1980s and is now operating at or beyond its original civil design life. Asset condition evidence shows accelerating deterioration in critical civil and semi-structural components, including walls, underdrains and NTF floors.

3.1.2 Deterioration is placing increasing pressure on the base programme, which is being drawn into reactive, short-term activity that maintains operation but does not provide sustainable asset health. We therefore seek £41.5m of additional AMP8 capital investment to fund a defined remediation programme covering 65 secondary treatment trickling filters across 19 sites and 22 NTFs across 11 sites. The proposed investment is targeted at the highest-risk assets where deterioration can no longer be managed efficiently or sustainably solely through base allowances.

3.2 Risks mitigated by the investment

3.2.1 The proposed investment is required to mitigate increasing risks to compliance, resilience, pollution prevention, and safe operation arising from deterioration across the trickling filter estate. These risks align with the asset health and resilience challenges identified in our PR24 submission and reflect the consequences of continued operation of ageing treatment assets beyond their intended civil design life. These risks are consistent with findings from the Environment Agency's national investigation into wastewater treatment works, which identified potential widespread and serious non-compliance linked to the condition and operation of treatment assets[1].

Risk to environmental compliance and service performance

3.2.2 Secondary treatment trickling filters and NTFs are critical treatment assets for BOD and ammonia removal. Deterioration of civil structures, underdrains, and media support systems reduces process reliability and increases the risk of permit non-compliance, particularly during operational stress.

3.2.3 For NTFs, deterioration of suspended floors and plenum systems creates a heightened risk to ammonia compliance by limiting safe inspection, maintenance, and operation. Failure would result in loss of nitrification capacity and increased ammonia loading to the receiving environment.

Pollution risk arising from loss of containment

3.2.4 Structural deterioration, including wall cracking, joint failure, and underdrain defects, increases the risk of loss of containment and uncontrolled discharges to ground. This risk is greatest where assets are above ground, in sensitive catchments, or where condition defects are not externally visible.

[1] Environment Agency investigation into sewage treatment works - GOV.UK

Health and Safety risk constraining effective asset management

3.2.5 Poor condition also creates safety risks and constrains effective maintenance. Many trickling filters, including all NTFs, are 4–5 metre high above-ground structures. Deteriorated walls, media, and suspended floors can create risks of unsafe access, collapse, or structural failure, limiting our ability to maintain and operate the assets safely.

3.2.6 These risks are currently managed through reactive short-term measures, which sustain operation but do not provide a durable asset health response. This becomes less efficient over time and increases the likelihood of compliance failure, environmental harm, and more disruptive future intervention.

3.2.7 The proposed investment will reduce these risks by restoring structural integrity, improving safe access, and maintaining stable treatment performance at the highest-risk sites.

3.3 How the risks are changing

3.3.1 The risks associated with deteriorating trickling filter assets are not static. They are intensifying over time due to a combination of regulatory change, increasing environmental stress through climate change, changing operational environment, and the advancing age and condition of the asset base. These factors align with the resilience and asset health challenges set out in our PR24 submission and reinforce the need for timely, proactive intervention.

Climate Change Impacts

3.3.2 Climate change is increasing the operational stress placed on wastewater treatment assets; accelerating asset condition issues are impacting performance risk. Amongst other effects, climate change acts to increase:

- Hydraulic loading from more intense rainfall and more frequent storm events that can;
  - Drive higher inflow variability, stressing the biofilm community and leading directly to potential discharge permit non-compliance if final effluent quality drops during or after extreme rainfall.
  - Lead to exceptionally high flows to WwTW. This is especially difficult to manage at treat all flow (TAF) sites that do not have a controlling overflow or permitted flow to full treatment (FTFT) therefore must treat all flows presented at the works. This can lead to hydraulic wash out of treatment units.
- Ambient temperatures affecting biofilm stability which can:
  - Accelerate biofilm growth, causing more frequent and extreme sloughing events beyond the current expected seasonal sloughing;
  - Increase oxygen demand and reduce dissolved oxygen in recirculating flows;
  - Shift microbial populations, reducing nitrification efficiency;
  - Increase odour risk and nuisance complaints; and,
  - Cause sudden biofilm detachment leading to suspended solids spikes.
- Dry-weather periods increasing organic load shocks, and where extended droughts followed by sudden rainfall which can:
  - Lead to septic inflows, with higher ammonia and BOD;
  - Create shock loads that destabilise nitrifying bacteria; and,
  - Increase risk of treatment deterioration and loss of biofilm during first flush events.
- Freeze-Thaw (FT) Cycling - climate change is expected to increase the frequency of FT cycles which can:

- Increase mechanical wear, particularly where ageing assets already exhibit fatigue sensitivity e.g., rotating distributor bearings, weir plates, concrete and brick structures; and,
- Elevate solids mobilisation risk as freeze–thaw can dislodge surface growth, contributing to downstream solids spikes.

3.3.3 Taken together, the factors described above increase the sensitivity of trickling filter performance to asset condition and operating stress, meaning that deterioration is more likely to translate into elevated compliance and environmental risk over time. In this context, targeted investment in trickling filters supports the continued delivery of compliant and resilient performance under a more extreme and less predictable climate.

Ageing assets and declining maintainability

3.3.4 As trickling filters move beyond their original design life, deterioration increasingly affects asset condition and maintainability. Degradation of walls, underdrains, and suspended floors not only undermines performance, but also restricts safe inspection and maintenance, reducing our ability to manage risk through routine intervention.

3.3.5 This is particularly acute for NTFs, where deterioration of floors and plenums can prevent safe access to distributor arms and associated equipment. As a result, reliance on short-term or reactive controls increases, opportunities for early intervention reduce, and the risk of sudden failure rises.

Expectations of Environmental Outcomes

3.3.6 Deterioration of legacy treatment assets such as trickling filters increases the potential consequence associated with environmental risk, even where assets continue to operate within permit limits. This change is reflected in evolving regulatory frameworks, including the Environment Agency's updated Water Industry Regulatory Intelligence (WIRI) approach, which places greater emphasis on asset condition, underlying failure modes, and the resilience of controls, rather than solely on historic compliance outcomes[2]. Through its ongoing wastewater treatment works investigation[3], the Environment Agency has reinforced that compliance is increasingly being assessed through evidence of asset condition, controllability and resilience, rather than historic compliance alone.

3.3.7 This increased focus is mirrored in our Risk and Asset Planning (RAP) process. We place greater weight on asset condition and loss of structural integrity when assessing risk exposure and prioritisation. This reflects the fact that deterioration can materially increase both the likelihood and consequence of future environmental harm, even where historic performance has been acceptable.

3.3.8 Against this backdrop, continued deterioration of legacy trickling filter assets creates a growing risk that environmental, customer, and regulatory expectations will not be met over time. Maintaining structural integrity, hydraulic containment, and process controllability is therefore essential to sustaining compliance and managing environmental risk proactively.

Treatment Chemical Usage

3.3.9 The increased use of ferric-based dosing to achieve tighter phosphorus standards has created more challenging operating conditions for trickling filter assets and associated MEICA systems. In particular, higher ferric dosing can increase corrosion risk, solids deposition, fouling and mechanical wear.

3.3.10 These effects are generally manageable on assets in good condition, but they are more significant where civil structures and underdrain systems are already deteriorated, as they can accelerate existing degradation and increase the frequency and complexity of operational intervention.

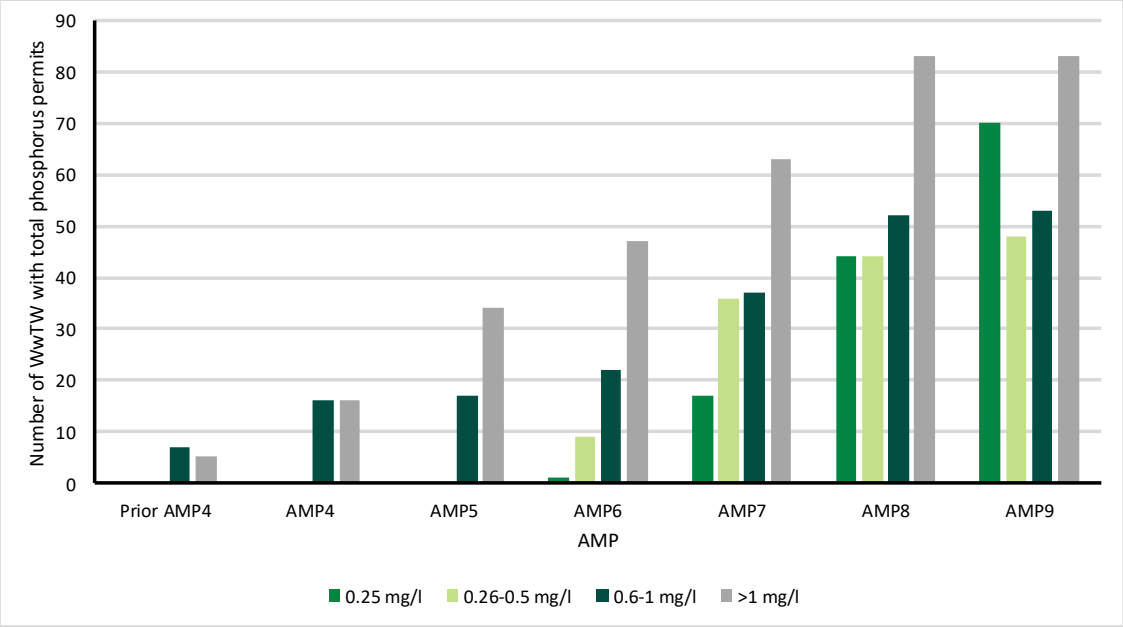
3.3.11 As shown in Figure 3 below, the operational reliance on ferric dosing is expected to continue. In this context, proactive asset health intervention becomes increasingly important to ensure that trickling

[2] Inspections target smashed with 10,000 health checks on water network - GOV.UK

[3] Update on Environment Agency investigation – Creating a better place

filters remain structurally robust, maintainable, and capable of operating reliably under more demanding chemical and regulatory conditions. This is consistent with the asset health and resilience principles set out in our PR24 submission[4].

Figure 3: Number of WwTW with total phosphorus permits by AMP



Source: Historic NEP and future WINEP

Implications for investment timing

3.3.12 Delaying intervention would not simply defer expenditure, it will increase the likelihood that risks materialise as environmental harm, safety incidents, or regulatory failure.

3.3.13 Investment in AMP8 is therefore the least-regrets and most efficient intervention point. Deferral to PR29 would expose UUW to greater deterioration, tighter regulatory pressure, and more challenging operating conditions.

3.4 Why this is the right time to invest

3.4.1 The case for investment in the trickling filter estate is driven not only by current asset condition, but by the increasing cost and risk of delay. Deferring proactive asset health intervention would increase both the likelihood and consequence of failure, leading to greater environmental, operational, and regulatory risk, as well as higher long-term costs to customers.

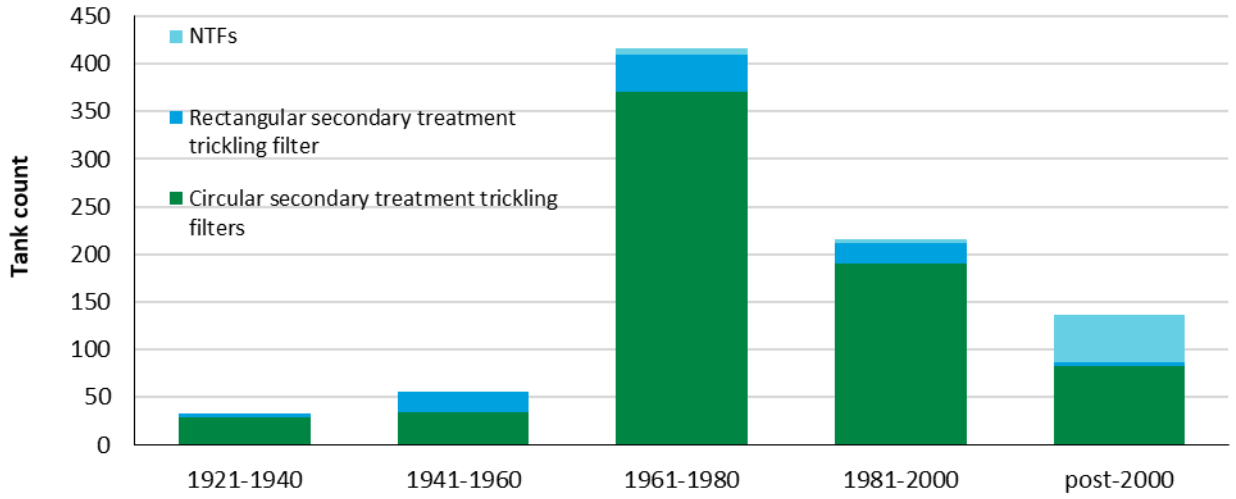
3.4.2 The Environment Agency's expanded inspection regime is intended to identify and address asset condition risks before pollution occurs. In that context, deferring intervention until failure is not credible or efficient.

Age profile and design life considerations

3.4.3 As illustrated in Figure 4 below, our trickling filter inventory's age profile shows that the highest proportion of these assets were constructed between 1961 and 1980, meaning that they are between 45 and 64 years old. This profile is consistent with the wider water sector.

[4] UUW07 Chapter 7 Resilience and asset health

Figure 4: Age profile of trickling filters by tank count (from Inventory data)



Source: UUW analysis

Non-linear deterioration and loss of maintainability

3.4.4 Trickling filter civil structures are long-life assets, typically designed for 40–60 years, while associated MEICA components have shorter expected lives, typically 5–20 years depending on condition, operating duty, and manufacturer guidance.

3.4.5 Many secondary treatment trickling filters constructed between 1961 and 1980 are now operating beyond their original design life. Over time, both civil and MEICA components have been exposed to cumulative deterioration, including degradation of walls, underdrains, support structures, media, and access arrangements.

3.4.6 As these assets age, the relationship between condition and operational risk becomes increasingly non-linear. Early deterioration can often be managed through routine maintenance, but once key structural elements such as walls, underdrains, or suspended floors deteriorate beyond a threshold, the rate of decline accelerates and safe access for inspection and maintenance becomes constrained.

3.4.7 At that point, assets become harder to manage proactively, increasing reliance on temporary or reactive controls and raising the likelihood of compliance failure, safety incidents, or pollution risk. Continued deferral therefore does not preserve optionality; it reduces future intervention choices and increases cost and disruption.

Interaction with MEICA asset life

3.4.8 The condition challenge is not limited to civil structures. Associated MEICA assets, including rotating distributors, drives, controls, and instrumentation, are also ageing and in many cases approaching end of life.

3.4.9 Many of these assets are based on older designs with limited corrosion protection, minimal automation, outdated electrical equipment, and restricted process monitoring. This reduces reliability, resilience, and controllability, and makes efficient operation and maintenance more difficult. Where equipment is in contact with effluent, ferric dosing can further accelerate wear and deterioration.

3.4.10 As a result, trickling filters built between 1961 and 1980 often require integrated refurbishment, combining structural rehabilitation, media replacement, MEICA renewal, and electrical and control modernisation. This improves process reliability, flow and load management, and consistent performance across the process.

Implications for investment timing

3.4.11 Taken together, asset age, accelerating deterioration, declining maintainability, and ageing MEICA mean that deferring intervention to PR29 would increase both risk and cost. By contrast, targeted investment in AMP8 allows high-risk assets to be addressed before deterioration becomes acute, reducing the likelihood of emergency failure, environmental harm, and more disruptive future intervention.

3.4.12 [✂] provides a clear example. The site contains trickling filters constructed between 1961 and 1980, which are now beyond their original design life. The introduction of ferric dosing in AMP7 is also likely to accelerate deterioration. Targeted renewal and refurbishment of 5 of the 16 trickling filters in AMP8 will reduce the risk of failure, associated environmental harm, and the need for costly temporary treatment.

3.4.13 Investing now therefore represents a lower-regret and more cost-effective response than continued reliance on reactive, base-funded intervention.

3.4.14 This is also consistent with the Long-Term Delivery Strategy[5] insight work, which shows that customers expect proactive long-term investment in core infrastructure, particularly where this helps prevent future environmental harm and service failure. Further detail on customer views is provided in section 5.5.

3.5 Evidence of deterioration

3.5.1 This section sets out the evidence base underpinning the assessment of deterioration across our trickling filter estate. The evidence is drawn from established business as usual sources, including asset condition inspections, asset health dashboards, performance stress indicators, and historic workload and expenditure data.

3.5.2 Taken together, these sources demonstrate that deterioration affecting a defined subset of trickling filters is material and accelerating (as can be seen in Figure 5 below), and provide evidence on the risks as described in Sections 2.1–2.3. The evidence shows that, for these assets, continued reliance on reactive, base funded intervention is increasingly ineffective at stabilising risk, supporting the need for a targeted step-change in proactive investment. The deterioration and associated risks described in this section have been identified and escalated through UUW's established asset and operational risk management framework. The need for additional investment therefore does not arise from a failure of risk management or planning, but from the successful identification and escalation of asset health risks that can no longer be efficiently mitigated through operational controls or base funded intervention alone.

Asset Health Profile

3.5.3 We have set out in this section the forecast demographic profile of UUW's trickling filters across the next 30 years. We have forecast how we expect this part of the asset base to change under 3 alternative investment scenarios: no investment, current funded levels of investment and finally including the impact of the AMP8 cost change programme for asset health. How the dashboard is constructed and the data and modelling assumptions utilised are described in Appendix B.

3.5.4 The top row of Figure 5 shows the baseline position and forecasts the change of asset health as the asset base deteriorates through each AMP without any investment. The current position of the asset base is that around 29% is at or approaching their 'End of Life'. During the subsequent AMPs the proportion of the asset base approaching or at end of life continues to increase due to deterioration, resulting in an end of AMP 13 end of life forecast of 91% of the asset base.

3.5.5 The middle row of Figure 5 shows how the current investment programme will impact the "no investment" profile across the same timeframe. In line with our asset class strategy, many of these assets will be replaced with alternative secondary treatment technologies over this time frame. Even

[5] SHED Research Consulting on behalf of UUW, LTDS: Customer Insight Synthesis, February 2023

with the baseline investment there is a significant proportion of assets approaching end-of-life over the 30-year forecast. Without additional investment this demographic position would severely reduce our ability to respond effectively to adverse weather events especially in the later AMPs when impacts of climate change are projected to increase in severity and occurrence. Additionally, we will face increased exposure to final effluent compliance risks as our assets deteriorate with the associated drop in performance.

3.5.6 The bottom row of Figure 5 shows the forecast change in asset health across each AMP with the proposed step change in investment in AMP8 - as detailed in this business case - alongside our usual investment every AMP. The forecast impact of the interventions is to stabilise the demographic position for the next two AMPs through the removal of assets approaching End of Life. This can be seen in the left hand side chart in Figure 5. This shows the proportion of asset close to end of life (85% through design asset life and above).

3.5.7 Despite the proposed investment until the end of AMP 13, the asset base is forecast to be largely life expired by the end of AMP 13, with the end of life forecast extending to 79% of the asset base. The impact of the proposed investment results in an increased level of operational readiness for the next 2 to 3 AMPs that can more effectively mitigate the impacts of increasing adverse weather impacts due to climate change. This will increase the resilience of our wastewater treatment process and reliability of the trickling filters by improving the condition across the asset base, in addition to maximising the value from older trickling filters.

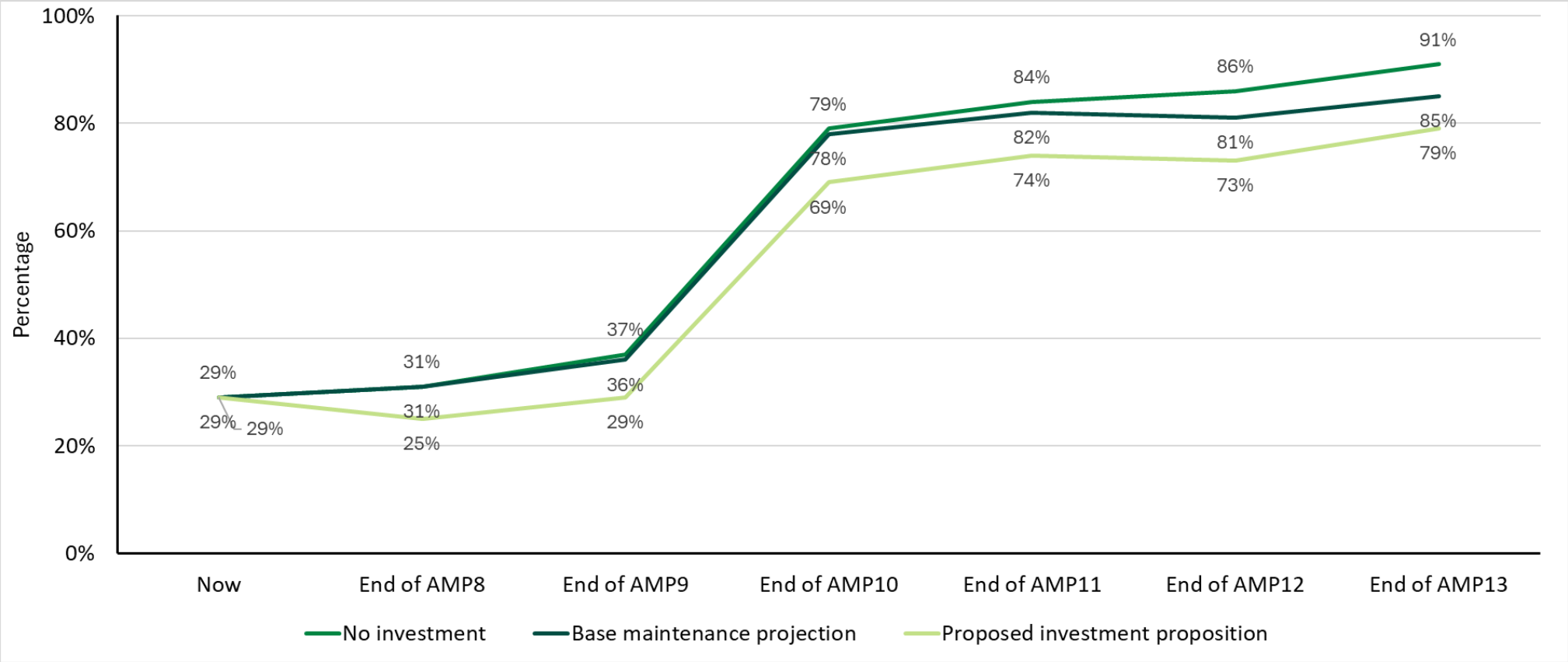
Figure 5: Asset health demographic profiles for trickling filters under 3 investment scenarios; no investment, existing base maintenance and with the impact of the AMP8 cost change programme

Source: UUW analysis (Base Asset Health profile dashboards)

3.5.8 Figure 6 and Figure 7 show the impact of the 3 alternative investment scenarios on the end of life forecast positions and the overall asset health risk positions. Further information on the construction of these charts is provided in Appendix B. Table 2 provides a summary of the end of life forecast positions.

3.5.9 It can be seen clearly that the underlying demographic risk position is predicted to become acute during AMP10 across all three scenarios, as many of the assets are anticipated to become life expired. This position is improved through the proposed investment, with proactive intervention across the asset base reducing asset health risk.

Figure 6: Base Asset Health forecasts for trickling filters – forecast percentage at end of life under 3 investment scenarios; no investment, existing base maintenance and with the impact of the AMP8 cost change programme



Source: UUW analysis (Base Asset Health profile dashboards)

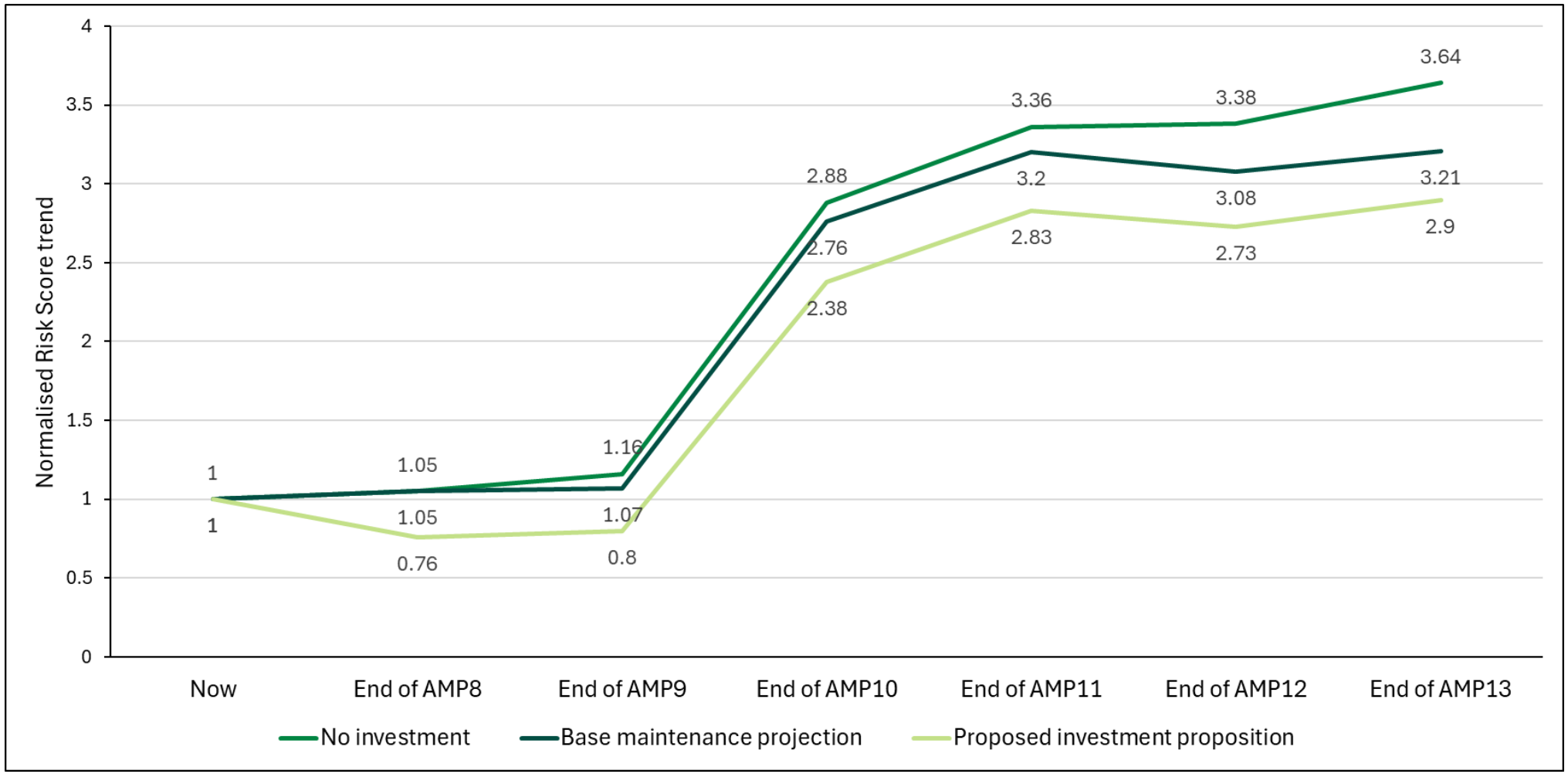
Table 2: Summary end of life percentages

	Now	End of AMP8	End of AMP9	End of AMP10	End of AMP11	End of AMP12	End of AMP13
Scenario 1: Do Nothing	45%	48%	54%	80%	81%	85%	86%
Scenario 2: Base Maintenance Projection	45%	47%	52%	76%	76%	78%	78%
Scenario 3: Proposed Investment Proposition	45%	39%	44%	65%	66%	69%	70%

Source: UUW analysis

3.5.10 Table 2 above summarises the forecast proportion of the trickling filter estate expected to be at (or approaching) end of life under three investment scenarios across AMP8–AMP13. It shows that, without intervention, the end-of-life position deteriorates rapidly and becomes acute by AMP10, whereas the proposed AMP8 investment materially reduces and delays this risk profile. Base maintenance provides some mitigation when compared to the do nothing scenario it does not prevent a substantial increase in end-of-life assets over the longer term, reinforcing the need for targeted proactive investment.

Figure 7: Asset Risk forecasts for trickling filters under 3 investment scenarios; no investment, existing base maintenance and with the impact of the AMP8 cost change programme



Source: UUW analysis (Base Asset Health profile dashboards)

3.5.11 The preceding charts show the forecast age and risk profile of the trickling filter asset base over the long term. The risk profile is based on the methodology set out in Section 3.1 and described in full in Appendix B.

3.5.12 While the proposed AMP8 investment provides a material stabilisation of risk in the near term, the charts also identify a defined cohort of assets expected to approach end of life towards the end of AMP10. As these assets move beyond critical deterioration thresholds, the model indicates a corresponding step change in asset health risk, driven by non-linear deterioration of civil structures and declining maintainability.

3.5.13 This demonstrates that the current proposal is a targeted and proportionate intervention to arrest immediate risk escalation, rather than a one-off solution for the full asset class. Without continued, planned investment beyond AMP8, a growing proportion of the asset base is expected to move into higher-risk states in later periods, increasing exposure to compliance, safety, and environmental risk.

3.5.14 The analysis therefore provides early visibility of likely future investment needs, enabling informed long-term planning and reducing reliance on reactive or disruptive intervention once deterioration becomes acute.

3.5.15 The clustering of assets approaching end of life towards the end of AMP10 also supports a forward-looking, risk-based approach to investment planning. Our current expectation is that this will be addressed through a future cost adjustment claim at PR34, informed by the latest condition evidence and by any wider changes in requirements or technology. This will allow future interventions to be timed and scoped on the best available evidence, rather than committing too early to solutions that may no longer represent best whole-life value.

Condition and structural evidence

3.5.16 Recent condition inspections and asset surveys across the trickling filter estate identify widespread deterioration of civil and semi-structural elements, including wall cracking, joint failure, under-drain degradation, and, for NTFs, collapse or loss of integrity of suspended floors and plenum systems. These defects directly affect containment, safe access, and the ability to operate and maintain assets effectively.

3.5.17 While trickling filters are long-life assets, the scale and severity of deterioration observed across the 1960s–1980s cohort is consistent with assets operating beyond their original design assumptions. In many cases, deterioration is no longer confined to superficial defects but affects load-bearing and safety-critical components, significantly increasing operational risk. Through this analysis we have identified that 23 of the 30 treatment works identified through this proposal are operating close to their performance limits and therefore have an increased compliance risk position.

Increasing reactive intervention and maintenance burden

3.5.18 Historic workload and expenditure data provide further evidence that deterioration across the trickling filter estate is increasing. Over successive AMPs, spend has increasingly moved away from planned refurbishment and renewal towards reactive repair, demonstrating that base allowances are being absorbed by short-term measures to sustain operation rather than by interventions that restore long-term asset health.

3.5.19 This is characteristic of assets moving into a phase of accelerating deterioration, where the frequency of intervention increases but the effectiveness of that intervention declines. The consequence is a higher cumulative cost of maintenance, increasing operational burden, and greater risk to compliance and resilience.

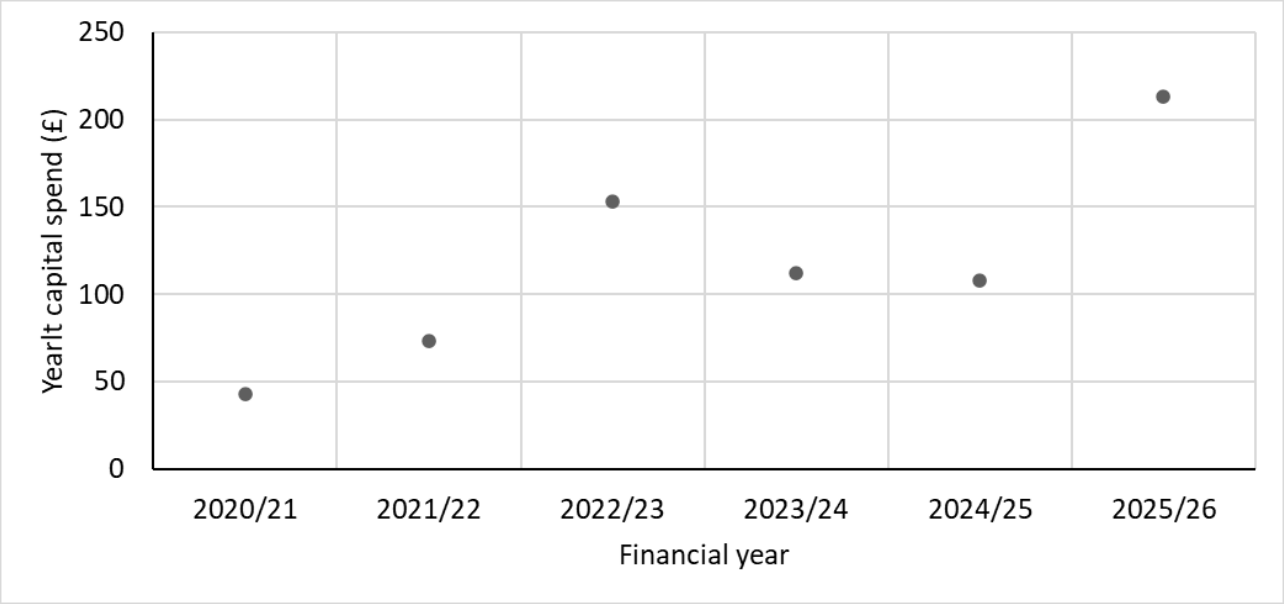
3.5.20 [✂]illustrates this pattern. The site has 10 trickling filters with a volume of 87,292m³ and experienced marked deterioration during AMP7, resulting in higher capital expenditure, as shown in Figure 8. Spend was focused on filter arms and drive systems, with limited media refurbishment,

investigation, and optimisation activity. Even with these measures, supplementary moving bed biofilm reactor treatment was required to maintain compliance.

3.5.21 However, [✂] also demonstrates the importance of considering whole-site strategy. With tighter AMP8 permit requirements, limited site footprint, growth pressures, and the condition of the existing assets, full refurbishment of the trickling filters was not considered the most efficient long-term option. Instead, the preferred solution is replacement with activated sludge plant based technology as part of the planned enhancement scheme.

3.5.22 This example shows both the limitations of prolonged reactive intervention and the importance of aligning asset health decisions with the most efficient long-term site solution. Without enhancement allowances, base expenditure alone would not be sufficient to fully remediate assets of this scale while maintaining compliance.

Figure 8: Annual capital investment example: [✂]

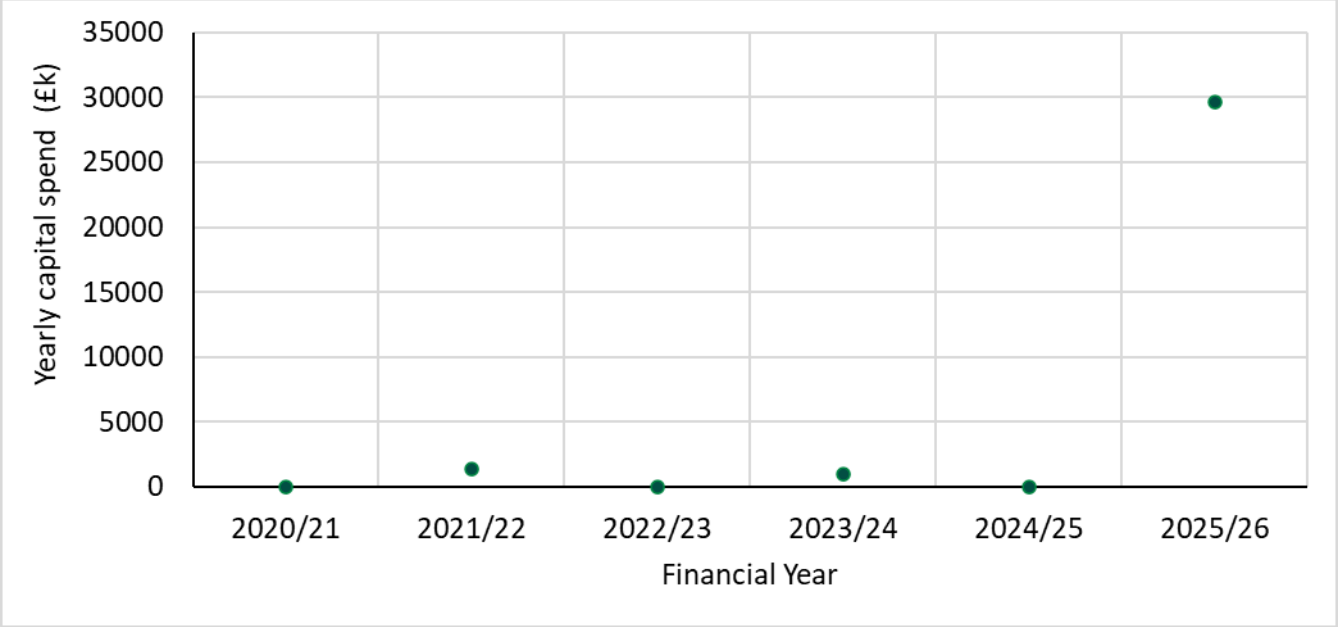


Source: UUW analysis

3.5.23 [✂]illustrates the same risk at the smaller end of the asset base. The site has a single trickling filter of 56m³, placing it within the smallest 31st percentile of trickling filter works.

3.5.24 Reactive capital expenditure during AMP7 was relatively limited and focused mainly on recirculation pumps. However, a larger intervention was required in 2025-26 of AMP8 to address deterioration in the distribution arms and maintain compliance, as shown in Figure 9. To restore asset life more fully, media replacement and other remedial works are also likely to be required. Because this is a single-stream site with no secondary biological treatment redundancy, the filter cannot be taken out of service without temporary treatment provision, increasing both the complexity and cost of intervention.

Figure 9: Annual Capital Investment Example – Bolton Low Houses WwTW



Source: UUW analysis

Alignment to Long Term Asset Class Strategies

3.5.25 This business case is aligned to our asset class strategy for trickling. The asset class strategy covers both secondary treatment trickling filters and nitrifying trickling filters, including their asset base, condition, risks, and long-term investment needs. The strategy outlines what the assets do, their current health and failure modes, operational risks, historic investment, and the future strategic approach required to maintain resilience across the wastewater treatment portfolio. The strategy can be summarised into four key areas of our strategic vision/ long term strategy, why we need to invest now/ AMP8 and the performance benefits of interventions.

Our strategic vision

- UUW will maintain, improve, and expand our drainage and wastewater systems, to ensure resilient and robust infrastructure for the North West, now and for years to come.
- UUW will maximise the asset life of trickling filters through targeted refurbishment and where asset design lives have been exceeded, deliver asset renewals.
- UUW will deliver a step-change in the asset health of trickling filters on the Wastewater Treatment Works (WwTW), building on increased levels of investment.
- UUW will use an asset data driven approach to risk management to focus on long-term resilient solutions to ensure long-term structural integrity of assets.

Why we need to invest now

3.5.26 Most of UUW's trickling filters were built between 1961 and 1980 and are now reaching an age where a step change in investment is required to maintain asset health. Our asset class strategy supports a risk-based approach to investment, reflecting both current asset condition and the growing impact of risks such as climate change. This investment is needed to improve asset integrity and resilience, which are the primary drivers of need. It also aligns with our long-term approach to treatment asset investment, informed by company-wide assessments of climate-related and system-wide risks.

Performance benefit of interventions

3.5.27 The asset class strategy outlines the potential performance benefits of investments outlined in this business case. Investing in our trickling filters asset base will mitigating expensive reactive interventions by focussing on long-term resilient solutions to ensure long-term structural integrity of assets.

Investment will also accommodate growth without impacting on resilience to existing customers through additional capacity, compartments and resilience of operations.

Summary of evidence

3.5.28 Condition surveys, asset health dashboards, performance stress indicators and reactive expenditure trends provide a consistent evidence base showing that deterioration across a defined subset of our trickling filters is material, accelerating and no longer manageable through operational controls or base-funded intervention alone.

3.5.29 This shows that risks identified through business-as-usual asset management have now exceeded the effective limits of base expenditure, supporting the need for targeted, proactive investment in AMP8. Intervening now reduces the risk that deterioration leads to environmental non-compliance, safety incidents, or more disruptive and costly intervention in future periods.

3.6 Our existing strategy and base programme

3.6.1 Our long-term strategy for trickling filters is to remove obsolete assets from the asset base where appropriate and extend asset life where this is the better whole-life option. This reflects a risk-based approach aligned to the asset health and resilience principles set out in our PR24 submission and wider asset health strategy.

3.6.2 We deliver this through operational management, targeted capital maintenance and enhancement investment. Current interventions include refurbishing degraded NTF floors, deploying sparge arm cleaning tools to improve filter bed health, installing distributor drive systems where cost-effective power is available, introducing recirculation at low-flow sites, and replacing trickling filters with ASP or Fujiclean systems where these provide the lowest whole-life cost solution to meet growth or enhancement needs.

AMP8 base programme and prioritisation

3.6.3 In AMP8, wastewater treatment works maintenance investment will be prioritised through established corporate risk management processes, using consequence and likelihood scoring. Base maintenance allowances are allocated across output-led blocks, with funding levels informed by historical run rates and emerging risk forecasts.

3.6.4 The base programme is designed to:

- Maintain regulatory compliance;
- Manage emerging risks; and,
- Support delivery of enhancement schemes.

3.6.5 We therefore prioritise immediate and compliance-led needs, particularly where assets are already failing or enhancement outputs must be delivered within AMP8 timescales.

3.6.6 In AMP8 there is a programme of works to manage risk specifically on wastewater treatment assets to ensure we continue to treat sewage in compliance with our permits. This programme is separate to spend on other risks on WwTW such as flow compliance, spills and pollutions reduction as well as maintaining specific asset classes such as UV and odour control units.

3.6.7 Proactive intervention funding is allocated using risk scores and managed to secure best value for money against our highest risks and strategic priorities. Further detail on our risk and asset planning process is set out later in this section.

3.6.8 A further component of our approach is the use of temporary treatment and the development of a mobile treatment fleet to manage short-term compliance risk and support capital delivery. This approach was used successfully at several sites towards the end of AMP7 and proved a cost-effective way of maintaining compliance ahead of major refurbishment or replacement.

3.6.9 At [✂], for example, an AMP8 enhancement scheme is underway to replace the existing trickling filters with an activated sludge process. However, the filters had reached the end of asset life by the end of AMP7 and required supplementary treatment, alongside optimisation, to maintain permit compliance until the permanent solution is delivered.

3.6.10 Historically, this temporary capacity was rented. We are now procuring our own mobile treatment units, which can be deployed and redeployed across the estate as required. This will improve flexibility and control, allowing us to manage risk across ageing assets while maintaining final effluent quality.

3.6.11 At [✂]optioneering is underway to rationalise multiple treatment stages into a single activated sludge process. If selected, this may require supplementary base allowances. [✂] is currently included in this investment proposal but may be removed depending on the preferred solution to avoid customers paying twice. Sites where we have high confidence that AMP8 enhancement schemes will replace trickling filters due to tight drivers and footprint constraints have been excluded from this case, even where condition is poor, because risk is being managed through the current base programme (for example [✂]).

3.6.12 The other allocation of funding is towards our reactive programme. This is to manage immediate risks that are either realised during the AMP or risks that increase at a rate greater than expected over the AMP and an in-AMP intervention can be planned in the shorter term. Having a reactive pot alongside our planned pot enables us to balance funding our across aging assets to those that are in greatest need.

3.6.13 Only [✂]had trickling filters abandoned and replaced by alternative technologies in AMP7. As our underlying risk profile has not materially changed, we expect this run rate to continue into AMP8. Although several larger sites are expected to convert from trickling filters to activated sludge as part of enhancement schemes, most of these are not due to complete until 2030 and many remain in optioneering. The existing assets will therefore require maintenance until delivery.

3.6.14 As shown above there are many competing priorities for funding in wastewater to ensure we continue to achieve our targets and provide best service to customers and, as illustrated in Sections 3.2 and 3.4, the asset health of trickling filters is deteriorating. The AMP8 base allowance does not keep up with this level of deterioration therefore the rate of renewal and comprehensive refurbishment needs to be increased to prevent overall reduction in asset health. This is not possible with the current allowances available. Further details of our analysis of what bas buys is contained within Section 4.

Risk Management

Risk identification, assessment and escalation

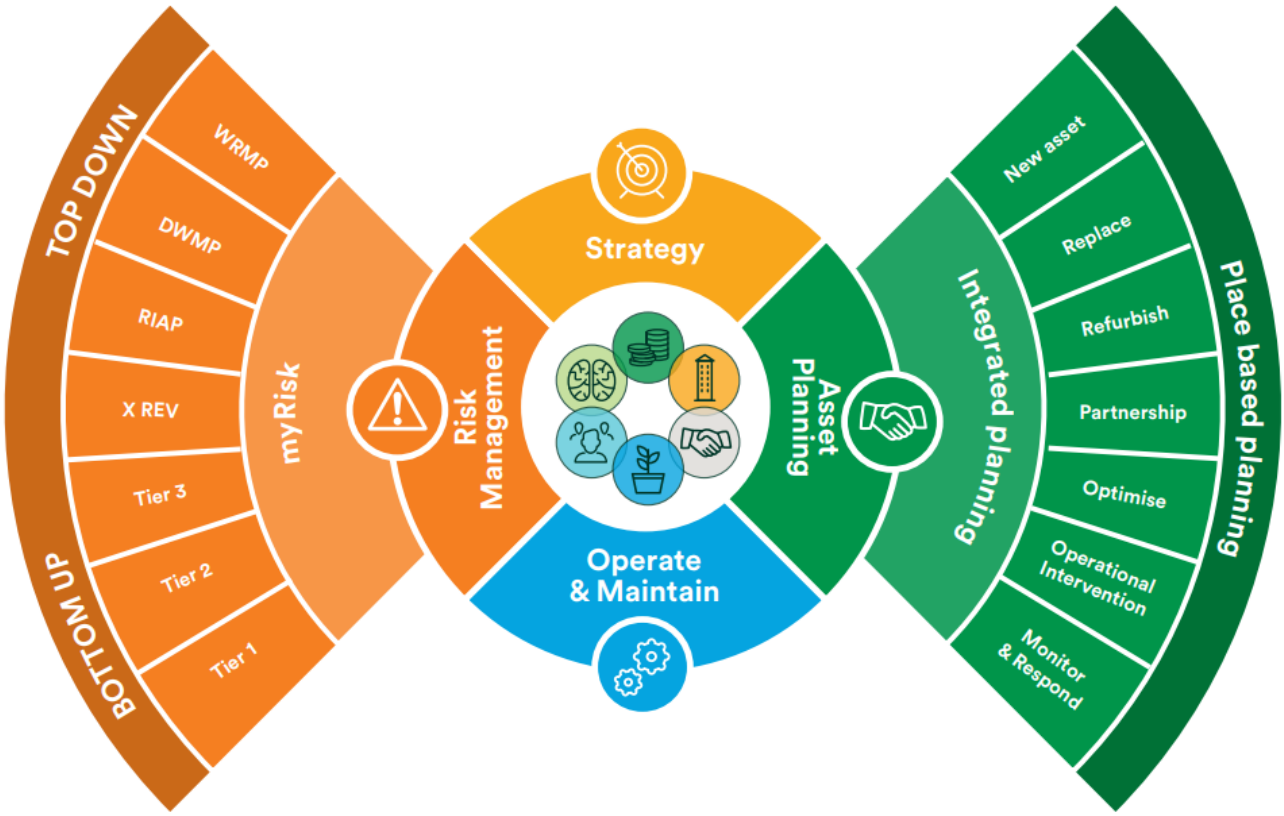
3.6.15 We manage operational and asset health risks through an enterprise-wide risk management framework that provides a clear golden thread from asset-level risk identification to Board-level oversight. This is delivered through our Risk and Asset Planning (RAP) process, as set out in our Strategic Asset Management Plan (SAMP), and was assessed by Ofwat through the PR24 Final Determination and AMMA processes.

3.6.16 Operational risks are identified at asset and site level through routine condition assessments, performance monitoring and operational experience. These risks are recorded in myRisk, UUW's corporate risk management system, which assesses likelihood and consequence across safety, environmental, service and financial dimensions. Risks are scored against defined criteria and supported by documented controls and mitigation actions. Where risks exceed tolerance thresholds, they are escalated through formal governance routes for prioritisation and intervention.

3.6.17 An illustration of this approach is in

3.6.18 Figure 10 below.

Figure 10: Risk and Asset Planning bowtie diagram



Source: UUW analysis

Integration with corporate risk governance

3.6.19 The myRisk system operates as the bottom-up risk capture mechanism and is fully integrated with our wider corporate risk framework. Operational risks recorded in myRisk are aggregated and reviewed through regular six-monthly risk review cycles, informing the strategic risks managed through our corporate risk system. This ensures alignment between operational reality and corporate risk appetite, enabling informed decision-making on investment prioritisation and risk trade-offs at both executive and Board level.

3.6.20 This integrated approach ensures that asset health risks are not considered in isolation, but alongside other material business risks, including regulatory compliance, environmental performance, health and safety, and resilience to climate change. The framework enables the company to identify where reliance on reactive or temporary controls is increasing, signalling the point at which proactive capital intervention represents the most efficient and lowest-regret response.

Alignment with asset management standards and PR24 commitments

3.6.21 Our risk management approach is embedded within our ISO 55001:2024 certified Asset Management System and is set out in our SAMP. The SAMP defines how risks are identified, evaluated, escalated and mitigated across the asset lifecycle, linking long-term strategic objectives to short-term operational decision-making. This framework underpins the company's AMP8 asset health and resilience strategy and provides assurance that investment decisions are evidence-led, proportionate and targeted at the highest-risk assets.

3.6.22 As described in Chapter 7 of our PR24 submission[6], we use asset risk modelling, operational risk management processes and structured assurance to manage current and emerging asset health risks. However, where deterioration becomes non-linear and constrains safe operation or maintainability, the effectiveness of operational controls reduces and reliance on reactive intervention increases. In these circumstances, proactive capital investment is required to restore risk to tolerable levels and maintain alignment with the company's stated risk appetite.

Proactive risk management

3.6.23 We work to avoid disruption that negatively impacts customers or the environment now and in the future. We do this by proactively managing risk associated with our assets, systems and processes, with control and mitigation focusing on preventing or limiting problems, while maintaining the capacity to respond effectively.

3.6.24 Many of our proactive risk management capabilities cut across multiple operational risks. More detail of our approach to risk management can be found in chapter 7 of our main PR24 submission, including details on asset risk modelling, managing operational risks, and our approach to asset health.

Limitations of base allowances for ageing trickling filter assets

3.6.25 Evidence presented in Sections 2.1–2.4 demonstrates that a significant proportion of the trickling filter estate has now entered a phase of accelerated, non-linear deterioration. In this context, base funding is increasingly consumed by reactive and short-term interventions required to maintain operability and compliance, rather than by proactive rehabilitation that would restore long-term asset health.

3.6.26 This dynamic is pronounced for legacy civil structures such as filter walls, under-drains, and nitrifying filter floors, where deterioration constrains safe access and limits the effectiveness of routine maintenance. As a result, base funding alone is no longer sufficient to arrest deterioration across this asset class without displacing higher-priority risks elsewhere in the wastewater treatment portfolio.

Role of this asset health proposal

3.6.27 This proposed asset health investment does not replace, duplicate or correct the AMP8 base programme. Instead, it complements it, enabling a targeted, time limited step change in proactive intervention for a clearly defined set of high-risk trickling filter assets.

3.6.28 This approach aligns directly with Ofwat's framework, which recognises that base allowances may not fully capture emerging or accelerating asset health issues and provides a mechanism to address these through cost adjustments ahead of PR29. By using this proposal to address the most severe structural risks now, we can stabilise asset condition, reduce reliance on reactive intervention, and protect customers from higher future costs.

Summary

3.6.29 We have taken reasonable and proportionate steps to manage trickling filter assets through our base programme and long-term strategy. However, the condition now evident across parts of the estate exceeds what can be managed efficiently within base allowances alone. The proposed additional investment is therefore an evidence-led extension of the existing strategy, required to protect customers, the environment and service resilience.

3.6.30 While AMP8 base expenditure is prioritised to manage immediate compliance and safety risks, it is not sufficient to address the deterioration affecting ageing trickling filter civil assets. These assets have long lives, require periodic major refurbishment, and are not effectively managed through piecemeal or reactive intervention.

3.6.31 Where deterioration has progressed beyond defined thresholds, particularly in filter walls, underdrains and nitrifying filter floors, reactive base-funded activity becomes increasingly inefficient and does not

[6] *UUW PR24 Submission, Chapter 7, Section 7.6: UUW07 Chapter 7 Resilience and asset health*

reduce long-term risk. Targeted proactive intervention is therefore the more efficient and lower-regret response.

3.7 Our historical investment

3.7.1 UUW's historical investment in wastewater treatment assets has been delivered in line with a long-term strategy to protect environmental outcomes, maintain regulatory compliance, and manage risk in a proportionate and cost-effective manner. Over recent AMPs, this investment has been shaped predominantly by tightening environmental standards, rather than discretionary choices around asset class renewal. Despite this, we have always made decisions based on the best whole life value for customers which would consider the health of any existing assets including trickling filters and costing this into the solution.

Enhancement-driven investment and process change

3.7.2 Throughout AMP6 and AMP7, a significant proportion of wastewater treatment capital investment was driven by statutory requirements, including Water Framework Directive obligations, growth-related drivers, tightening ammonia and phosphorus consents. At many sites, existing trickling filter processes were no longer capable of reliably meeting enhanced permit limits.

3.7.3 In these circumstances, the most efficient and sustainable solution was often process conversion, replacing trickling filters with alternative technologies such as activated sludge processes or Nereda. Major enhancement schemes delivered during AMP6 and AMP7, include [✂], exemplify this approach. More information on site-specific examples can be found in Section 3.7.17 to 3.7.21 below.

3.7.4 These schemes delivered substantial environmental benefit and long-term resilience but were capital-intensive, typically requiring:

- Construction of new biological treatment assets,
- Significant civil works and enabling infrastructure,
- Power upgrades, controls and instrumentation, and,
- Integration with existing upstream and downstream processes.

3.7.5 As a result, enhancement-driven investment accounted for a large proportion of available wastewater treatment capital during these periods. Asset health was a fundamental consideration of the design and ensuring the best whole life cost solution was selected. That is why for many projects with older assets a complete site renewal was selected over supplementing the existing site with additional treatment processes to achieve the new permit. Although the outstanding capital cost for the supplementary treatment would be significantly smaller it would not have removed the asset health risk on that site and would still have required future maintenance funding to maintain the asset.

Implications for trickling filter capital maintenance

3.7.6 While process conversion removed risk from sites with enhancement drivers, it also had a structural implication for the remaining trickling filter estate. Capital investment was necessarily prioritised toward meeting statutory environmental requirements, meaning that like-for-like capital maintenance and refurbishment of the residual trickling filter asset base was increasingly constrained within base allowances.

3.7.7 For assets without an immediate enhancement driver, risks were managed through a combination of:

- Operational controls,
- Targeted reactive capital maintenance, and,
- Prioritised refurbishment, where funding allowed.

3.7.8 This was a proportionate response to competing regulatory priorities and supported continued compliance and service delivery. However, it also meant that many of the remaining trickling filters, largely assets built between the 1960s and 1980s, continued to operate without major structural renewal.

Evidence of changing investment balance

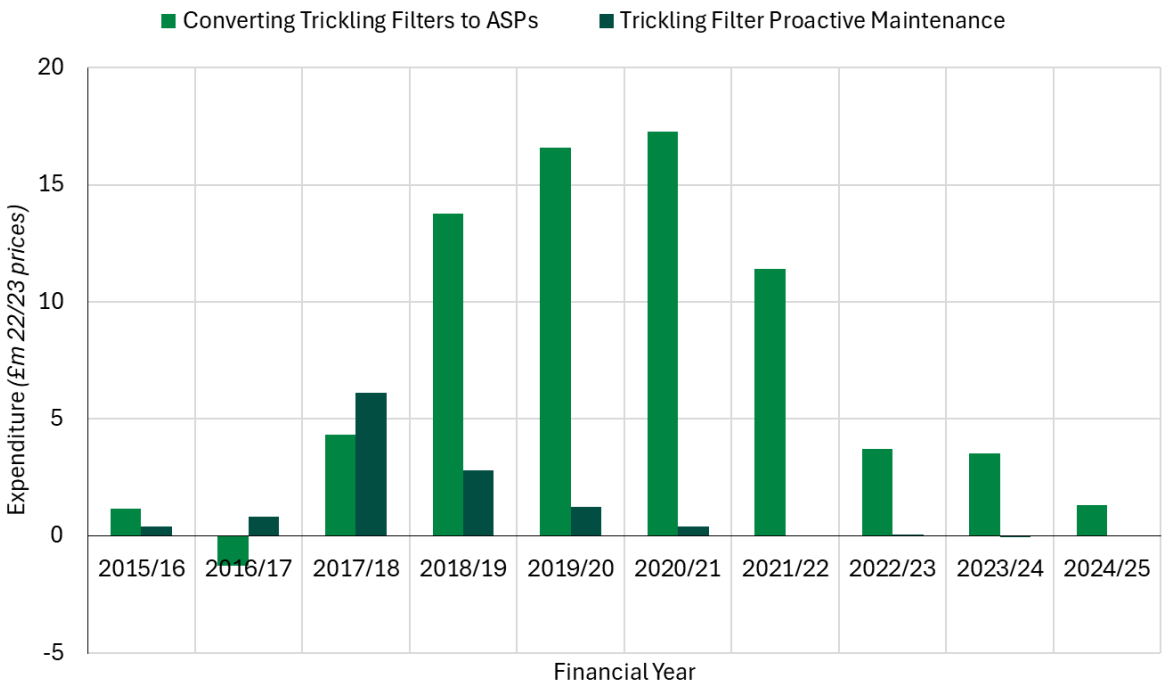
3.7.9 UUW has spent £44 million across base expenditure on trickling filter maintenance between 2015/16 and 2024/25. This has been a blend of proactive and reactive maintenance, with 27% of this funding allocated towards refurbishment and replacement capital maintenance. This split is consistent with an ageing asset base being maintained through short-term interventions to preserve operability and compliance, rather than through proactive structural renewal. While effective in the short term, this approach does not restore long-term asset health and becomes increasingly inefficient as deterioration accelerates.

3.7.10 There was a peak of proactive investment in 2017/18, associated with two large projects[✂] NTF maintenance and [✂] enhancement project which involved refurbishing and supplementing the existing trickling filters. Work and expenditure on both peaked in FY18 ahead of FY20 delivery and accounted for £5m.

3.7.11 Following this, there was a downward trend in refurbishment and replacement investment between AMP6 and AMP7, and total maintenance spend between the AMPs decreased by £4m. The decrease in refurbishment and replacement expenditure does not solely reflect a shift toward reactive maintenance. Instead, it is indicative of a prioritisation of more efficient and sustainable processes in the context of AMP6 and 7, such as activated sludge processes, IFAS or Nereda.

3.7.12 Figure 11 below shows the base maintenance spend on projects in AMP6 and 7 which were converted from trickling filters to ASP technologies. There were eight major projects over this period that make up this spend: [✂].

Figure 11: Maintenance spend on trickling filters compared to maintenance spend on trickling filters converted to ASPs



Source: UUW analysis of Ofwat (2026) Sector workload and expenditure dataset v2 – for circulation.

3.7.13 Our historical costs have been produced using the Workload and Expenditure data, which is built from four main data sources. These are our current above ground inventory and work management system, our Legacy above ground inventory and work management system, our current reporting system for capital projects and our Annual Performance Review data submissions.

3.7.14 Within Ofwat's *Sector workload and expenditure dataset* are four intervention types: repair, refurbishment, replacement and other. The count of repair interventions is provided by our above ground inventory and work management system - current (2016/17-2024/25) and legacy (2015/16-2017/18) work order data. Whereas refurbishment, renewal and other were obtained through our current reporting system for capital project data and our Asset registration data (2016/17 - 2024/25).

3.7.15 In line with Ofwat guidance "*Enhancing asset health understanding roadmap – Workload and Expenditure request*", expenditure has been reported in the year in which it was incurred, and outputs have been reported in the year in which they were delivered. There is limited alignment between expenditure and output profiles. Most data is reported by regulatory period, while project output data has been extracted by calendar year, creating minor inconsistencies in year-on-year comparisons.

3.7.16 Table 3 below outlines the categorisation of treatments into intervention types, in line with Ofwat guidance. It should be noted that we did not categorise renewal of assets from trickling filters to other assets (i.e. ASPs) against trickling filter expenditure.

Table 3: Intervention categorisation

Treatment for data return	Category
Replacement	Full tank reconstruction (e.g. concrete or steel) Complete media and underdrain replacement
Refurbishment	Large-area structural concrete repairs or relining Media replacement or regrading (partial or full) Underdrain cleaning or refurbishment Spray arm overhaul or motor replacement Structural relining or waterproofing of tank walls
Repair	Localised concrete repairs (e.g. patch repairs) Spray arm bearing or nozzle repairs Media redistribution or minor top-up Minor access structure repairs (e.g. handrails, walkways) Pump, valve or penstock repairs Underdrain cleaning
Other	Sensor recalibration or replacement (e.g. flow or level sensors) SCADA or control system upgrades Improved access, walkways, platforms, handrailing etc for maintenance

Source: UUW analysis

Case Studies

3.7.17 Examples of historic investment in AMP6 and AMP7 where we have replaced trickling filters with alterative processes include:

[✂] AMP6 Project

3.7.18 In AMP6 we spent £23m on replacing the secondary treatment trickling filters at [✂]with a Nereda through enhancement investment. Final effluent from [✂]discharges into the [✂]and ultimately [✂]. Forecast population growth created an AMP6 No Deterioration driver at [✂], tightening the ammonia consent from 8 mg/l to 5 mg/l (95 percentile). The existing secondary treatment trickling filters could not meet the tighter permit and were therefore replaced.

3.7.19 The project scope included:

- New Nereda treatment process comprising 3No. reactors.
- New Nereda feed pumping station.
- New sludge buffer tank.
- Conversion of existing clarifier tank No.4 to Nereda feed buffer tank.
- New sludge thickening process.
- Associated MCC's and SCADA works.
- Refurbishment and hydraulic improvements to the inlet screens and grit removal process.

Figure 12: Nereda Plant

Source: UUW photograph of Nereda Plant

3.7.20 By replacing the secondary treatment trickling filters with a new Nereda plant, see above (Figure 12), we were able to replace the trickling filters and treat ammonia more effectively and meet the new consent. Completion of this project UUW meant that 20.21 km was contributed towards performance on the AMP6 Rivers Improved performance commitment.

[✂]AMP7 Project

3.7.21 In AMP7 we spent £20m on replacing the plastic media secondary treatment trickling filters at [✂] with an Integrated Fixed-Film Activated Sludge (IFAS) ASP (Figure 13). Expenditure split £1m on base and £19m on enhancement. The final effluent from [✂]discharges in to the [✂] and had an AMP7 enhancement driver under the Water Framework Directive (WFD) to achieve 'good status'. The new permit under WFD included an ammonia of 1mg/l, a BOD of 6mg/l, a phosphorus of 0.25mg/l and an Iron of 3mg/l (on a 95%ile basis). To meet the new permit the secondary treatment trickling had to be replaced with and IFAS ASP under the enhancement driver.

3.7.22 The full project scope included:

- New Flow to Full Treatment pumps.
- New distribution chamber incorporating a flocculation/mixing chamber for primary dosing point.
- New additional Primary Settlement Tank (PST), to supplement the existing 2 no. existing PSTs.
- 2 no. new compartmentalised bioreactor streams, with Integrated Fixed-Film Activated Sludge (IFAS).
- New distribution chamber incorporating a flocculation/mixing chamber for secondary dosing point.
- Secondary point Ferric dosing upstream of the FST and tertiary processes.

- 2 no. new Final Settlement Tanks (FST).
- 2 no. Tertiary Pile Cloth Filters.

Figure 13: BioP Integrated Fixed-Film Activated Sludge (IFAS) Reactors

Source: UUW photograph of BioP reactors

Long term resilience case study – [✂](AMP7 enhancement scheme)

3.7.23 At PR19 we set out details of the enhancement investment at [✂][7]. At that time this site served [✂] people and is the first major wastewater discharge in the [✂], a recovering salmon river. This means the resilience of our service here is key to the [✂] achieving its long-term objectives of sustainable salmon populations. The key challenges that we needed to address in AMP7 for this site were:

- Provision of phosphorus removal to 0.4mg/l to meet moderate status under WFD by 2024;
- Reduction in the ammonia permit to 2mg/l to protect from deterioration by 2024;
- Population growth of 14,207; and,
- maintenance requirements.

3.7.24 A holistic assessment of risk and whole-life cost showed that the lowest-cost long-term option was to replace the large trickling filter works with a biological phosphorus removal plant. This addressed the full range of site challenges while minimising long-term bill impacts.

3.7.25 This conversion, from trickling filters to an intensified ASP mobile organic biofilm (MOB) plant, also creates future optionality to recover phosphorus as a resource if and when market conditions make this economic.

Position at the start of AMP8

3.7.26 By the start of AMP8, the cumulative effect of enhancement-led capital prioritisation and prolonged reliance on reactive maintenance had left a defined subset of the trickling filter estate:

- operating at or beyond its original design life;
- showing accelerated deterioration in civil and semi-structural elements; and,
- increasingly constrained in terms of safe access, maintainability and resilience.

3.7.27 The asset health risks now evident do not reflect a failure of planning or risk management. They are the consequence of successful delivery of enhancement programmes over successive AMPs, combined with the fact that the remaining trickling filter assets did not receive equivalent levels of proactive capital maintenance.

[7] Enhancement expenditure: Wastewater Network Plus - STW Growth

3.7.28 This context underpins the need for the targeted asset health investment proposed in this submission. The intervention is a proportionate response to historic investment patterns and is needed to stabilise asset condition and risk where base allowances alone are no longer sufficient.

4. Determining What base buys (WBB)

This section explains how much investment is already implicitly funded through base allowances, and how the additional investment proposed ensures that customers are not paying twice.

4.1 Purpose of WBB

4.1.1 WBB represents the level of investment in asset maintenance and renewal that Ofwat assumes to be implicitly funded through PR24 base expenditure allowances. We calculate WBB in order to ensure that our investment proposals are not duplicative of those allowances and, therefore, represent genuine additional investment that has not been previously funded.

4.1.2 In developing asset health investment proposals, any additional asset health investment proposed through the cost change process should reflect the true incremental investment above and beyond WBB. This is informed by an assessment of the capital maintenance activity planned for each relevant asset class in AMP8, and an evaluation of the extent to which this activity can reasonably be delivered within existing base allowances.

4.1.3 The value of the cost change claim therefore comprises of the incremental investment proposed net of our implicit allowance ("*what base buys*"). This supports transparency and ensures that customers are not paying twice for the same investment.

4.2 Limitations of WBB

4.2.1 It is important to note that at PR24 Ofwat set allowances across the entire asset base. Under the current totex-based regime, companies are given discretion to allocate base allowances across their asset base in line with efficient operational priorities, rather than to deliver predefined levels of investment in each specific asset classes.

4.2.2 As a consequence, there is no established approach to estimating WBB for specific asset classes. It is therefore important to recognise the limits of any mechanistic approach used to assess WBB for individual asset classes. Importantly, Ofwat has acknowledged that "there is no perfect way to determine what base buys"[8].

4.2.3 Assessing WBB *ex-post* after the Final Determination for specific asset classes requires making several key methodological assumptions and apply some judgement. It is difficult to robustly estimate WBB because:

- Base expenditure allowances are set in aggregate across the asset base;
- There is a lack of consistent cost definitions across the industry;
- There is a lack of comparative data that can be used to perform robust benchmarking;
- The funding needs for a specific asset class vary over time reflecting companies' specific asset cycles; and,
- The funding needs will depend on the asset strategy adopted by companies for each asset class.

4.2.4 In light of this, in assessing different approaches, we have set out the key risks and limitations associated with the data available for calculation of WBB in the supplementary document *UUW26-18 Asset Health – What base buys methodology.*

4.2.5 In applying any methodology, Ofwat should give significant consideration to the risk of an overstatement of WBB and the potential impacts this could have on restricting companies' base

[8] Ofwat (2025). Asset Health Investment Assessment Guidance. Available at: https://www.ofwat.gov.uk/wp-content/uploads/2025/12/Asset-Health-Assessment-Guidance.pdf, pg. 21.

expenditure decisions in a way that would be inconsistent with the PR24 approach to base expenditure allowances.

4.2.6 Our view is that the methodology presented in this document very much represents the upper end of the range that should be considered for WBB and that, in view of the risks associated with over-estimation, Ofwat should consider whether lower limits should be binding on companies. This may be particularly appropriate in the event that Ofwat applies the same methodology broadly across all companies.

4.2.7 Examples of potential mitigations that Ofwat could consider are set out in the supplementary document *UUW26-18 Asset Health – What base buys methodology.*

4.3 Calculating WBB

4.3.1 Despite these limitations, we have calculated our WBB in line with the principles set out by Ofwat and ensured that industry benchmarking is used alongside externally verifiable data. This is set out Table 4 below and explained in further detail in our full methodology which is set out in the supplementary document *UUW26-18 Asset Health – What base buys methodology.*

4.3.2 We present three potential approaches to calculating WBB in Table 5. Our assessment of each approach is also set out in the supplementary document *UUW26-18 Asset Health – What base buys methodology.* Following this assessment, we concluded that the bottom-up approach is most aligned to these principles. Therefore, all WBB numbers presented are calculated following this methodology.

4.3.3 Based on our approach to calculating the requirements set out by Ofwat on WBB, the implicit allowance for trickling filters is £6.5m over AMP8. As discussed in Section 4.2, this represents the upper end of a plausible range.

Table 4: Alignment with WBB principles[9]

Principles of WBB	Approach's alignment with principle
Avoid the risk of customers paying twice for investment, once through existing base allowances and once through any additional adjustments	✓
Have a clear rationale, and where possible, is consistent with the way allowances are set during the price review	✓
Acknowledges that companies receive long-term base allowances, and that spend on an asset class across periods is likely to vary over time	✓
Is informed by good quality information, and where there are limits to this, is aware of data limitations	✓
Uses externally verifiable data	✓
Relies on an industry benchmark rather than a company specific view	✓

Source: UUW's analysis against Ofwat's Asset Health Investment Assessment Guidance

[9] Ofwat (2025). Asset Health Investment Assessment Guidance. Available at: https://www.ofwat.gov.uk/wp-content/uploads/2025/12/Asset-Health-Assessment-Guidance.pdf.

Table 5: Summary of different approaches assessed[10]

Approach	Description
Bottom-up approach	Adjusting sector average/median outturn AMP6 and AMP7 capital maintenance expenditure related to the priority asset class to the increase in base expenditure allowances provided at PR24.
Econometric based approach	Remove historic capital maintenance expenditure related to priority assets from PR24 base expenditure econometric benchmarking models to estimate implicit level of funding in modelled allowances associated with priority asset classes.
Historic company-specific expenditure approach	Scale company-specific historic capital maintenance expenditure on priority asset classes to PR24 base expenditure allowances and use each company's historic expenditure shares rather than industry-wide averages to estimate the implicit level of base funding associated with those assets.

Source: Ofwat (2025) Asset Health Investment Assessment Guidance.

4.3.4 The bottom up approach estimates the trickling filter specific WBB by identifying the industry average share of modelled base historical expenditure allocated to trickling filter refurbishment and replacement (Table 5). This share is applied to UUW's AMP8 wastewater network plus base allowance to derive an implicit trickling filter allowance. The mean and median estimates are triangulated to reduce sensitivity to outliers and provide a robust implicit allowance.

4.3.5 The approach involves the following steps:

- **Step One:** Sum historical asset expenditure
  - Sum all refurbishment and replacement expenditure for trickling filters across the full dataset period (2015/16–2024/25).
  - Source: *Workload and Expenditure Dataset (06/02/2026).*
- **Step Two:** Sum modelled historical base expenditure
  - Sum a company's modelled base expenditure over the same period for *Wastewater Network Plus.*
  - Source: *Ofwat PR24 Base Costs Wastewater Model 3 – 'Costs' sheet*[11]
- **Step Three:** Calculate historical spend shares
  - Divide the summed trickling filter historical expenditure (Step 1) by the summed modelled historical expenditure (Step 2).
  - This allows us to obtain a percentage share of modelled base historical expenditure on trickling filters for each company.
- **Step Four:** Calculate the industry mean of this percentage share
- **Step Five:** Apply the mean share to AMP8 allowances
  - Multiply each company's AMP8 base allowance by the mean percentage derived in Step 4.

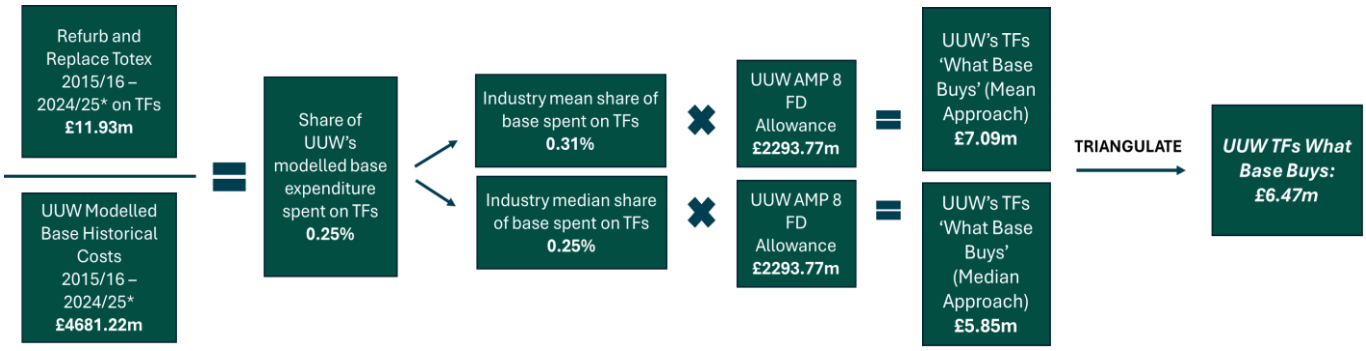
[10] Ofwat (2025). Asset Health Investment Assessment Guidance. Available at: https://www.ofwat.gov.uk/wp-content/uploads/2025/12/Asset-Health-Assessment-Guidance.pdf.

[11] Ofwat (2024). Cost assessment models: Base costs – wastewater model 3 (Network Plus), 'Costs'. Available at: https://www.ofwat.gov.uk/wp-content/uploads/2024/12/PR24-FD-CA08-Base-costs-wastewater-model-3-Network-Plus.xlsx.

  - AMP8 allowances are taken from *Base Costs Wastewater Model 3 – 'final allowance'*[12], adjusted using the cumulative net price change for each year (from the *Base Costs Aggregator Model*[13]) to reflect post-frontier-shift and RPE-adjusted allowances.
- **Step Six:** Repeat step 4 for the industry median
- **Step Seven:** Apply the median share to AMP8 allowances
  - Multiply each company's AMP8 base allowance by the median percentage.
  - This follows the same process as Step 5.
- **Step Eight:** Triangulate results
  - Average the mean-based and median-based estimates to form the final AMP8 implicit allowance for WwTW trickling filters.

4.3.6 Figure 14 below provides the calculation process for the WwTW trickling filters implicit allowance.

Figure 14: Calculation of the trickling filter AMP8 implicit allowance



Source: UUW analysis

4.4 Summary of our proposal

4.4.1 A full list of interventions by site can be found in Appendix A, including a cross reference against both growth submissions and AMP8 enhancement projects. To demonstrate that our cost-change claim is incremental, we propose an expenditure-based Price Control Deliverable in Section 7 that would protect customers from non-delivery and claw back unspent allowances for WBB across the asset classes.

4.4.2 Given the limitations highlighted in Section 4.2 and the supplementary document *UUW26-18 Asset Health – What base buys methodology,* we consider that our assessment of WBB represents the upper end of a plausible range. In light of the risks associated with over-estimation, it is therefore important that Ofwat considers the potential implications for constraining companies' base expenditure decisions. We also plan to report in our Annual Performance Report the amount of expenditure for each relevant asset class as per Ofwat's latest proposals on companies' reporting requirements[14].

4.4.3 In Section 7 we propose that the base expenditure PCD covers all the asset classes of the investment proposal so that if the expenditure in one asset class is less than its implicit funding allowance, but it is offset by a higher expenditure in one of the other asset classes, there would be no net PCD clawback. This would provide sufficient flexibility to ensure that companies remain incentivised to target their maintenance interventions efficiently whilst providing appropriate customer protection.

[12] Ofwat (2024). Cost assessment models: Base costs – wastewater model 3 (Network Plus), 'Final Allowances'. Available at: https://www.ofwat.gov.uk/wp-content/uploads/2024/12/PR24-FD-CA08-Base-costs-wastewater-model-3-Network-Plus.xlsx.

[13] Ofwat (2024). Base Costs aggregator model. Available at: https://www.ofwat.gov.uk/wp-content/uploads/2024/12/PR24-FD-CA02-Base-costs-aggregator-model.xlsx

[14] Ofwat, Consultation on regulatory reporting for the 2025-26 reporting year, December 2026 can be found here.

4.4.4 Further examples of potential mitigations that Ofwat could consider, reflecting the risk of over-estimation and the upper-bound nature of these WBB estimates, are set out in the supplementary document *UUW26-18 Asset Health – What base buys methodology.* We would be happy to discuss the merits of any such approaches with Ofwat.

4.4.5 The cost-change claim (Table 6) is for activities above this already-funded level of expenditure, and for this we propose an output-based PCD as set out in Section 7. Overall, this approach provides transparency and accountability and ensures that customers are appropriately protected.

Table 6: WBB and Cost Change Claim: WwTW trickling filters (£m, 2022-23 CPIH prices)

£m	WBB	Cost Change Claim*	Total Allocated Spend in AMP8
Trickling filters	6.5	41.4	[ ]

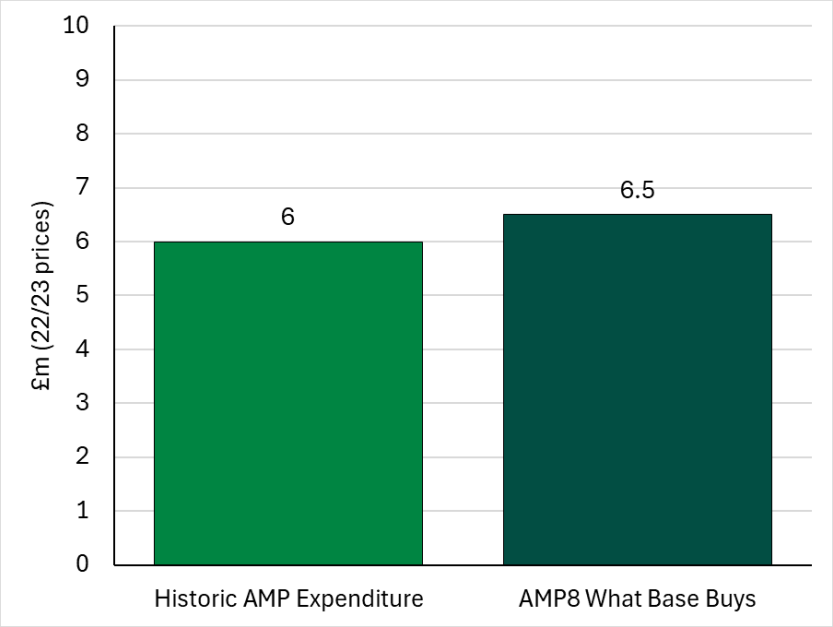
Source: UUW analysis

**net of repair savings*

4.5 Comparison with historical expenditure

4.5.1 UUW has historically spent a similar proportion of its base expenditure on trickling filters compared to the industry benchmark. As shown in Figure 15, our historical base expenditure is broadly in line with our calculated AMP8 WBB allowance which represents the high end of a plausible range. This illustrates a strong track record of investing our base allowances, providing confidence that customers are not paying twice. Further evidence of our actual AMP8 planned expenditure can be found in Section 3.6. Additional detail can be found in [✂]

Figure 15: Comparison of average historical expenditure per AMP with AMP8 WBB, trickling filters[15][16]



Source: UUW analysis of Ofwat (2026) Sector workload and expenditure dataset v2 – for circulation.

[15] Ofwat (2026) Sector workload and expenditure dataset v2 – for circulation.

[16] Historical AMP expenditure represents the average five-year expenditure on trickling filter refurbishment and replacement across 2015/16-2024/25.

5. The best option for customers

This section demonstrates how we have developed the preferred programme via a robust optioneering process, tested our programme for value, assessed its benefits and how it is been informed by customer research and stakeholder engagement.

5.1 Our proposals are based on robust optioneering

5.1.1 UUW has undertaken structured optioneering to identify the most appropriate way to deliver a reduction in risk associated with trickling filters. The purpose of this process was to ensure that the proposed AMP8 cost change programme for asset health represents a proportionate, deliverable and efficient response to the need.

5.1.2 The proposed programme has been shaped by three primary considerations:

- **Current levels of asset health risk:** interventions have been prioritised where there is confirmed poor asset condition from both operational experience and recent visual inspections.
- **Deliverability within AMP8:** only interventions that can be designed and constructed within the AMP8 period have been included.
- **Alignment with asset strategy:** consideration of the long-term need for the assets and that growth and quality drivers for the site have been considered.

5.1.3 The optioneering process was undertaken in two stages. Unconstrained optioneering was used to confirm the site-specific need and alignment to the requirements for inclusion within the asset health cost change process. Constrained optioneering was then applied to develop options that represent a credible, proportionate and deliverable solution within AMP8.

5.1.4 A list of 117 sites with potential relevant asset health risks was developed, and visual site surveys were carried out. Data was then triaged and those sites with assets that confirmed to the cost change requirements were then progressed for design and estimating. The outcome from the unconstrained optioneering stage included assets on 30 sites. All of these assets that passed the first stage filter were then assessed against credible alternatives, including refurbishment and full asset replacement. The options were then subject to a value assessment to demonstrate the best balance of risk reduction, whole-life cost while aligning with customer preferences. This process ensured that the proposed programme was developed from a structured and evidence-based optioneering process.

5.2 Unconstrained optioneering – sites considered

5.2.1 Unconstrained optioneering was undertaken to collate the known asset health risks associated with trickling filters and to exclude interventions that would not meet the requirements of the cost assessment process. The purpose of this stage was to ensure that assets across the full class were considered prior to detailed quantitative assessments and the application of delivery and strategic alignment constraints.

5.2.2 Each option was assessed against two core criteria:

- Current condition; and,
- Criticality to the business.

5.2.3 The assessment ensures that only those assets where a potential risk to service would be prioritised for further consideration for AMP8 delivery. Table 7 below summarises the outcome of this unconstrained assessment.

Table 7: Unconstrained options sites and assets assessed

Option	Visual Surveys	Passed forward for best value assessment	Summary
Sites	117	30	We progressed only assets where condition grades of civil aspects of each asset were considered to be grade 4 or 5 and where there was a clear ongoing operational need.
Assets	1857	97	

Source: UUW analysis

5.2.4 The unconstrained assessment excluded assets from sites where investment was already included in the base programme, where the risk could be managed operationally or the structural condition did not evidence imminent need. The resultant list of assets from 30 sites was then passed through to the constrained options assessment.

5.3 Constrained optioneering – interventions considered

5.3.1 Investment needs were then assessed against their ability to reduce identified asset health risks, deliver value for customers through lower whole-life cost and remain deliverable within AMP8 constraints. Each shortlisted investment need was then progressed against the following options

- **Proactive refurbishment (structural remediation with or without media removal):** This option comprises targeted civil refurbishment, nitrifying trickling filter floor replacement, and proportionate associated MEICA renewal at high-risk sites.
- **Renewal or process conversion:** This option would involve wholesale replacement of trickling filters or conversion to alternative treatment processes across the affected sites.

5.3.2 The proposed programme comprises a combination of refurbishment and renewal interventions aimed at addressing asset health and maintaining operational resilience. Refurbishment activities include the structural remediation of filter walls, media and NFT floors, while renewal interventions comprise the replacement of existing tanks and their associated MEICA equipment.

5.3.3 Proactive refurbishment typically provides the best balance of risk reduction, whole-life cost and deliverability. It targets the specific failure modes affecting the highest-risk assets, delivering substantial risk reduction at materially lower cost than full replacement while avoiding the inefficiency and disruption of continued reactive intervention. It is deliverable within AMP8 through established routes and assured through intervention-specific PCDs.

5.3.4 Renewal was taken forward for most sites for assessment despite generally involving significantly higher cost and delivery complexity. It has only been selected as preferred where asset condition is sufficiently degraded that targeted refurbishment is no longer viable.

5.3.5 Appendix A provides details of the 30 sites taken forward for value assessment, including details of the assets on each site identified for intervention.

5.4 Best value assessment

5.4.1 For this submission, we have used a valuation tool that evaluates the most cost-beneficial approach out of the constrained options identified through the optioneering process. This analysis draws on our work to develop a broader “six capitals” based valuation approach to reflect changes in regulatory and government approaches to valuations of service, the environment and amenity values.

5.4.2 This assessment has been used to compare the constrained options identified through the optioneering process and to help to define a proportionate and deliverable preferred AMP8 trickling filter cost assessment programme. The outcome of the best value assessment supports a mixed programme dominated with refurbishment options. This helps to maximise the value from existing assets and to protect customers from unnecessary cost and risk.

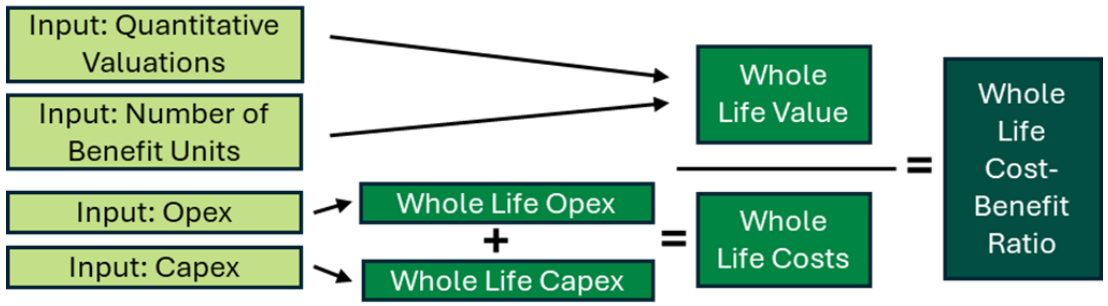
Our approach

5.4.3 Our approach comprises three key steps as summarised below.

- Calculating the whole life value;
- Calculating the whole life cost; and,
- Comparing the whole life cost-benefit ratio across different solutions.

5.4.4 These steps are described in further detail in Figure 16 below.

Figure 16: Whole life cost benefit ratio calculation



Source: UUW analysis

Whole life value

5.4.5 We calculate whole life value of an investment solution as the present value of the total benefits accrued over a 30-year assessment period. This is derived by:

- Multiplying the number of projected benefit units from the investment solution by the annual quantitative valuation; and,
- Calculating the compounded value over the investment horizon and discounting it using the Social Time Preference Rate, in line with the HM Treasury Green Book.

Whole life cost

5.4.6 We calculate the whole life cost of an investment solution by adding the whole life capital expenditure and the whole life ongoing operating costs. Capital expenditure includes capital overheads but excludes the effect of taxation. Whole life cost has been calculated on a consistent basis to the approach taken for PR24 investment appraisal. The present value of capital expenditure has been converted to a stream of annual costs over a 30-year appraisal period. To calculate the present value of these costs, and associated operating costs, the Social Time Preference Rate was used for discounting, consistent with the HM Treasury Green Book. Costs are in 2022/23 price base, using the CPIH financial year average.

Cost benefit ratios

5.4.7 The cost benefit ratio is calculated by dividing whole life value by whole life cost.

Quantification of benefits

5.4.8 The primary benefit is the reduction of high consequence environmental, safety, and compliance risk arising from deteriorating trickling filter assets, maintaining existing levels of service and environmental protection under increasing regulatory, operational, and climate related stress.

5.4.9 Secondary benefits include improved maintainability and safer access for operational staff, reduced reliance on reactive interventions, and lower whole-life cost by avoiding more disruptive and higher cost intervention in future periods.

5.4.10 The two core values modelled for trickling filters are reducing future pollution risk and reducing compliance failure risk. More detail on these values is provided below. This is described further in this

section. These benefits directly align with the Environment Agency's stated regulatory focus on preventing pollution through proactive identification and remediation of asset condition risks[17].

Pollution risk

5.4.11 The proposed investment will reduce the risk of future pollution by addressing deterioration in trickling filter civil containment before failure occurs. Across the sites, there is evidence of declining asset condition, including localised weeping through filter walls in periods of high hydraulic loading. While this does not indicate current uncontrolled pollution, it does represent an increasing risk of loss of containment as asset condition degrades.

5.4.12 This risk is greatest during periods of elevated hydraulic loading, when works operate at or near hydraulic capacity and deteriorated structures are exposed to peak stress. Analysis of historic daily flow data across the 30 sites in scope shows that these conditions occur with sufficient frequency to create a material and growing pollution risk over time.

5.4.13 By intervening before deterioration progresses, the proposed investment reduces the likelihood of containment failure and potential groundwater impact, providing a targeted and proactive reduction in pollution risk.

Compliance risk

5.4.14 The proposed investment will reduce underlying compliance risk by improving the condition of trickling filter assets that are critical to final effluent performance. Secondary treatment trickling filters are often the main process for achieving compliance with BOD permits, while nitrifying trickling filters are key to achieving ammonia compliance.

5.4.15 Across the 30 sites in scope, compliance risk has been assessed against these two core parameters using statistical analysis of five years of historic final effluent performance data. This shows underlying compliance risk trends associated with asset health deterioration. By addressing that deterioration, the investment will reduce average annual compliance risk for BOD and ammonia, which is a core source of value.

5.4.16 In the absence of intervention, continued deterioration would increase the likelihood of BOD and ammonia permit failures, particularly during periods of peak flow or process stress. By intervening proactively, this performance decline is avoided, and customers and the environment are protected from the consequences of asset failure, consistent with Ofwat's outcomes-focused approach.

Health and Safety risk

5.4.17 For NTFs, replacement of degraded floors and plenum systems restores safe access and operational control, reducing the risk of sudden loss of nitrification capacity at sites with limited redundancy. Across the wider trickling filter estate, civil remediation and refurbishment reduce the risk of containment failure, hydraulic leakage and restricted maintenance access.

5.4.18 This investment will improve operational resilience by enabling assets to perform more reliably under increasingly variable hydraulic and process loading conditions associated with climate change and population growth.

5.4.19 The following table summarises quantified cost benefit assessments for preferred and non-preferred options, see Table 8 below.

[17] Inspections target smashed with 10,000 health checks on water network - GOV.UK

Table 8: Quantified cost benefit assessment for options

Site name	Refurb Capex (£k) (Preferred programme)	Renewal Capex (£k)	Cost Benefit (Preferred programme)	Cost Benefit Renewal
[✂]	185	679	423	129
[✂]	175	345	448	283
[✂]	256	568	301	175
[✂]	1,506	3,930	2	1
[✂]	206	401	327	197
[✂]	724	3,601	117	30
[✂]	176	709	478	148
[✂]	11,871	10,193	1.8	2.13
[✂]	2,978	4,435	35	26
[✂]	171	1,658	68	9
[✂]	792	2,582	104	43
[✂]	316	1,110	10	3
[✂]	166	401	412	197
[✂]	47		936	
[✂]	84	1,105	1325	92
[✂]	636	1,804	120	56
[✂]	225	668	318	134
[✂]	3,771	13,505	18	7
[✂]	11	887	737	12
[✂]	1,220	1,761	92	64
[✂]	1,592	2,622	27	16
[✂]	2,691	4,194	39	25
[✂]	1,605	2,700	21	12
[✂]	611	1,052	168	98
[✂]	1,517	2,412	4	2
[✂]	3,552	5,892	30	18
[✂]	1,258	1,948	87	56
[✂]	742	1,229	7	4
[✂]	1,336	2,091	34	22
[✂]	1,131	1,765	23	15

Source: UUW analysis of cost benefit

5.4.20 There is no valuation for Longton renewal as the issue is resolved through low-cost refurbishment of the filter distribution chamber and therefore an alternative was not costed.

Non-monetised benefit

5.4.21 In addition to the quantified benefit above, there are several non-monetised benefits that we anticipate from this investment, including:

- Safer maintainability;
- Fewer unplanned outages; and,

- Reduced risk of incidents.

5.4.22 These benefits are real and material but are not included in the quantified appraisal due to uncertainty, attribution challenges, and the risk of over-precision.

Delivery approach for sites with high cost–benefit ratios

5.4.23 Many of the selected sites have been assessed to have highly cost beneficial options, this is typically due to the relatively small costs and the potential for significant highly valued future risk avoidance. The cost–benefit assessment identifies three sites: [✂]with particularly high cost–benefit ratios. In each case, this reflects a combination of material risk reduction and relatively low intervention cost, rather than any difference in the underlying need or assessment approach.

5.4.24 At [✂], the proposed intervention is limited in scope compared to other sites in the programme and can be delivered independently without adverse impacts on cost efficiency or deliverability. While the need for intervention has been verified through the same risk based and evidence led process applied across the programme, the nature of the works allows delivery to be brought forward without material cost escalation. We therefore intend to deliver the [✂] intervention at the earliest opportunity, outside this submission process, ensuring timely risk reduction while ensuring value for customers.

5.4.25 In contrast, the interventions proposed at [✂], while relatively low cost, are similar in nature to those required at other sites within the wider programme. Delivering these works as part of the coordinated programme enables the use of shared delivery models, specialist contractors, and efficient sequencing, which is critical to maintaining the anticipated cost levels. Accelerating these sites in isolation would increase unit costs and reduce overall programme efficiency.

5.4.26 Accordingly, interventions at [✂]will be delivered alongside the wider programme to ensure that customers benefit from economies of scale, consistent delivery, and efficient use of supply chain capacity. This approach ensures that high value interventions are delivered in a manner that maximises whole-life value and minimises unnecessary cost, consistent with our efficiency and customer protection commitments.

Ensuring no overlap with growth submission and AMP8 enhancement projects

5.4.27 The following 3 sites are included in this asset health cost change submission as well as the growth submission: F[✂] The full table is provided in Appendix A which also indicates WwTW sites with enhancement schemes in AMP8. We have ensured that there is no overlap in any solutions put forward for the growth submission and that neither the asset health nor the growth case is dependent on the other for successful delivery. For the three sites that appear in both asset health and growth cost change cases the growth scheme involves work on other assets but not the trickling filters which have sufficient capacity for the future predicted population. Once we have received the outcome of both cases, we will review the solutions holistically to ensure that the best value option is selected.

5.4.28 Many AMP8 enhancement schemes are still in optioneering phase still with no confirmed solution however the vast majority have no potential for scope for overlap with the asset health cost change i.e. the enhancement driver is for flow monitoring only. On any sites where we believe there could be scope overlap we have removed these from the submission.

Measurability and customer protection

5.4.29 The benefits of the proposed investment will be delivered through clearly defined outputs and assured through output-based PCD, ensuring that customers only pay for interventions that are efficiently delivered. This provides strong protection for customers while enabling the flexibility required to manage site level risk across a diverse asset base. More details can be found in Section 7.

5.5 Customer and stakeholder views

5.5.1 It is vital we engage with customers and stakeholders across the entire region about their water and wastewater services. We have undertaken an iterative research approach to understanding customers' views on Asset Health. For this submission, we therefore reviewed recent and relevant research from our established body of customer research, including key projects which informed the PR24 business plan. Building on this existing knowledge base, we then undertook targeted bespoke research using both qualitative and quantitative methods. We have taken steps to ensure our customer research approach is proportionate and comprehensive, with the quantitative survey elements using a robust sample allowing for sub group analysis, and qualitative research using members of our existing research community.

5.5.2 Further information on the methodology, Independent Challenge Group engagement and the application of our insights can be found in the appendix *UUW26-26 Customer Research Approach – Regional Growth and Asset Health.*

5.5.3 The research programme shows strong customer support for intergenerational equity and a clear expectation that UUW invests proactively to address major long-term challenges. Customers consistently prioritise safety, service reliability and regulatory compliance as core outcomes. In particular, the findings indicate that:

- Customers expect investment decisions to be fair, future-focused and environmentally responsible.
- There is strong support for approaches that avoid transferring costs and risks to future generations. Customers want UUW to take early, responsible action on long-term risks, ensuring that expenditure is targeted at what matters most and delivers value for money. The Asset Health proposals have been developed in direct response to these expectations.
- Customers support increased investment to protect drinking water quality. They want UUW to stay ahead of high-impact, long-term risks, while retaining the flexibility to respond quickly to emerging issues and emergencies. The proposed investment reflects this balance and acknowledges customer sensitivity to bill impacts.

5.5.4 We have proactively sought the views of key statutory and customer stakeholders, in line with our programme wide engagement plan. This has ensured that our proposals are grounded in customer expectations and aligned with regulatory priorities. Engagement to date includes:

5.5.5 **Your Voice** – the Independent Challenge Group for the North West. We presented our findings from the recent customer research and welcomed input. The panel was broadly supportive of our plans.

5.5.6 **The Environment Agency** – we held a meeting with the Environment Agency on 17 March to explain our intentions to submit asset health investment cases across a range of water and wastewater assets. We followed this up with a letter setting out our proposals and high-level indications around cost. We received a response on 25 March explaining that the Environment Agency will be working jointly with Ofwat to assess the proposals where those proposals are relevant to the Environment Agency. Due to the collaborative model of business case assessment, the Environment Agency will not provide additional supporting comments ahead of the submission deadline.

6. Robust and efficient cost

This section explains how we have developed our costs and the build-up of our estimates. It also provides evidence that our proposals are efficient, and summarises the results of the benchmarking against third party comparable costs.

6.1 How we developed our costs

6.1.1 This section explains how we developed our cost estimates for borehole interventions. We give a general overview of our methodology then we show a breakdown of costs at a project and programmatic level.

An overview of our methodology

6.1.2 This section sets out our methodology for calculating direct and indirect costs.

6.1.3 Direct costs are those that can be clearly and directly attributed to a specific asset, activity, or scheme. They arise solely because of the works being undertaken and would not be incurred otherwise. Direct costs are typically site-specific and measurable, and include construction labour, plant and equipment, materials, and disposal costs directly associated with delivering the works on site.

6.1.4 We assess direct costs using a bottom-up approach. This involves developing an engineering scope for each element of the work. We then develop a granular view of cost of each element of scope. To do this, we considered what we would need to do to deliver each element of scope. For example, if the engineering scope indicated we need to demolish existing infrastructure, we would need to use a bulldozer, remove the demolished material etc. In some cases, we had to make assumptions on what would be involved in each element of scope.

6.1.5 Each of these elements was then priced using a database containing costs from a range of different companies. This ensures that our estimates are in line with industry standards. Finally, we added an element of optimism bias to reflect best estimating practice, which varied depending upon whether we had a robust understanding of the asset. This produced our estimate of direct costs.

6.1.6 Indirect costs are those that enable, support, and govern the delivery of direct activities, but which cannot be practically or proportionately allocated to a single asset or activity. These costs are required to ensure that works are properly planned, managed, assured, and delivered safely and compliantly, and are typically incurred across multiple activities, projects, or sites rather than at an individual asset level.

6.1.7 Indirect costs include, for example:

- project and programme management;
- design management and technical assurance;
- health, safety and environmental management;
- planning, supervision and coordination activities;
- temporary works design and oversight; and,
- the corporate and operational support functions required to enable delivery.

6.1.8 Indirect costs are therefore not discretionary overheads, but a necessary and integral part of delivering capital works in a regulated, safety-critical environment. Excluding these costs would understate the efficient cost of delivery and would not reflect how capital programmes are practically delivered in the water sector.

6.1.9 Our calculation of indirect costs is aligned with best estimating practice. We include a risk allocation, which is informed by the extent to which historic schemes have been impacted by cost changes. We also

include for our cost to serve, which reflects the costs UUW incurs managing and integrating the project. Finally, we include our corporate overhead, which enables us to recover our functional support costs.

6.1.10 We then subjected our cost estimates to third party benchmarking, which is set out in Section 6.2.

Programme-level cost build

6.1.11 This section provides more detail on the breakdown of direct and indirect costs. We have allocated optimism bias to direct costs. This is because we would expect optimism bias to reduce and direct costs to increase as schemes mature and move into delivery. Where applicable, we allocate contractor indirect costs to indirect costs.

6.1.12 Table 9 shows the split between direct and indirect costs by project. This shows that our indirect cost allocation is low compared to what could typically be expected that the ratio of direct to indirect costs to be roughly equal. This shows that our indirect cost allocation is low compared to what could typically be expected - that the ratio of direct to indirect costs to be roughly equal.This is because we have challenged ourselves with a lean indirect cost allocation for this programme of work. This reflects the fact we will aim to absorb a high proportion of the programme into our existing cost base.

Table 9: Split of direct and indirect capital expenditure by project (£, 2022-23 CPIH)

Project	Direct	Indirect	Total
Bolton Low Houses	114,201	70,687	**184,888**
Broughton Cross	159,888	96,580	**256,469**
Urmston	4,278	6,617	**10,895**
Fazakerley - only refurb	5,596,420	3,400,016	**8,996,436**
Fazakerley - Renew	1,645,506	1,228,672	**2,874,177**
Kirkandrews Moat	102,665	63,740	**166,405**
Long Town Esk	45,201	39,021	**84,222**
Great Warford	98,419	72,088	**170,507**
Brigsteer	105,331	69,876	**175,207**
Dolphinholme	106,194	69,455	**175,649**
Newbiggin	390,693	245,143	**635,837**
Rossendale	2,393,147	1,377,483	**3,770,631**
Glossop	744,749	440,661	**1,185,410**
Glossop	1,021,607	770,763	**1,792,370**
Croston	435,174	288,462	**723,636**
Colne	948,400	557,264	**1,505,664**
Longton	23,757	23,322	**47,078**
Pardshaw	143,264	81,336	**224,600**
Hayfield	473,296	318,632	**791,928**
Combes	122,073	84,106	**206,179**
Hornby	188,041	127,940	**315,981**
NTF - Dukinfield	733,480	486,199	**1,219,679**
NTF - Glazebury	957,113	634,438	**1,591,552**
NTF - Hazel Grove	1,618,369	1,072,763	**2,691,131**
NTF - Helsby	965,255	639,835	**1,605,090**
NTF - Holme	367,377	243,522	**610,899**
NTF - Kidsgrove	912,091	604,595	**1,516,686**
NTF - Middlewich	756,525	501,475	**1,258,000**

Project	Direct	Indirect	Total
NTF - Partington	446,429	295,923	**742,351**
NTF - Tyldesley	803,204	532,417	**1,335,621**
NTF - Wilmslow	679,946	450,713	**1,130,659**
NTF - Leyland	2,135,861	1,415,791	**3,551,652**
Total	**25,237,955**	**16,309,534**	**41,547,489**

Source: UUW analysis

6.1.13 Table 10 shows the programme-level breakdown of costs across the different indirect cost categories as described in paragraph 6.1.9.

Table 10: Programme-level cost build (£, 2022-23 CPIH)

[✂]	[✂]
[✂]	[✂]
[ ]	[✂]
[✂]	[✂]
[✂]	[✂]
[✂]	**[✂]**

Source: UUW analysis

6.2 Our costs are efficient

6.2.1 This section presents evidence of cost efficiency and demonstrates that our costs are in line with those expected by independent third parties.

Our costs are considered efficient by Turner & Townsend and Mott MacDonald

6.2.2 We engaged Turner and Townsend and Mott MacDonald to provide third party benchmarking. This involved comparing our cost estimates against the costs similar organisations incur when carrying out the activity. We provide an excerpt from Turner and Townsend's report below, which sets out the methodology used as part of the benchmarking analysis.

"Our team have utilised our extensive industry data and Water Sector Benchmarking Club to undertake a comprehensive benchmarking exercise for UU across several programmes of work covering Boreholes, RGFs, Service Reservoir, Filters, Settlement Tanks, Aeration Tanks and Growth projects for New Homes. Our Water Sector Benchmarking Club compiles external cost data through our platform, the Hive. This leverages anonymised data from six water sector organisations, creating the largest dataset of its kind within the sector. The Water Sector Benchmarking Club has been utilised in this benchmarking exercise, alongside our internal industry data.

We carried out a comprehensive review of the cost build-up of the projects provided by UU.

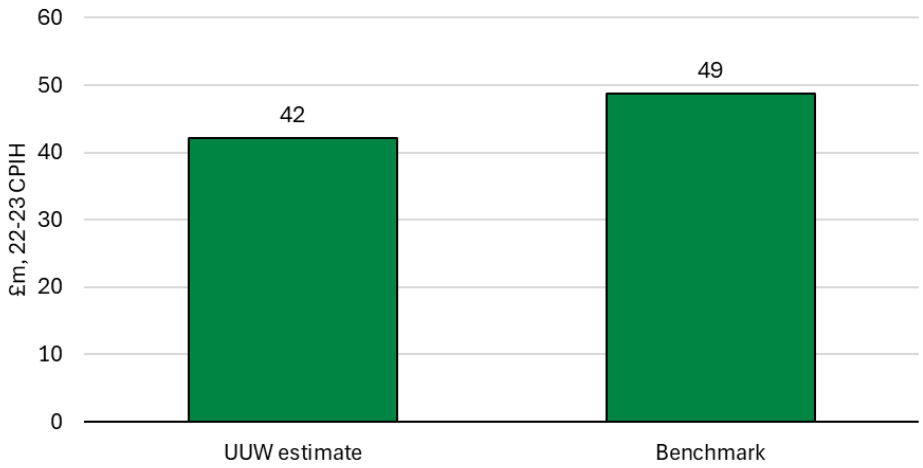
We benchmarked the direct costs at component level, in accordance with UU's work breakdown structure, where possible. We have also benchmarked the uplifts for the following on-costs (Indirect costs, Project overheads, Risk and Estimating uncertainty) ***finding these were in line with industry expectations****.*

Our conclusion is that the methodology for developing the Capex estimate prepared by United Utilities is robust, and that the performance and cost profiles of UUs proposed interventions are consistent with the expected range observed across comparable projects delivered by industry peers*.*[18]*"*

[18] Turner and Townsend. *Asset health and growth benchmarking report.*

6.2.3 Figure 17 below illustrates the results of benchmarking for our trickling filters programme showing that our costs are 14% below the industry benchmark. This demonstrates that our cost estimates are efficient and well aligned with those expected by third parties.

Figure 17: Turner & Townsend and Mott MacDonald found our costs to be efficient compared to external benchmarking



Source: UUW analysis, Turner & Townsend and Mott MacDonald

6.2.4 We provide a full overview of our benchmarking approach and associated reports in *UUW26-28 Benchmarking reports*.

6.3 We do not consider Ofwat's workload and expenditure data to be a robust source for cost benchmarking

6.3.1 We understand that Ofwat may wish to use its workload and expenditure data to compare companies' intervention costs to identify an efficient benchmark. However, we would caution against any reliance on this dataset as a source of company comparisons.

6.3.2 This section sets out evidence that demonstrates the data is not sufficiently granular to provide a meaningful indication of relative efficiency. In summary, this is because it reflects an average cost of multiple different intervention types carried out across the sector. A company that carries out a greater proportion of cheaper intervention types will appear artificially efficient – whereas – in reality - the lower observed unit cost is merely reflecting a simpler programme of work, often with shorter life interventions. If applied inappropriately, this dataset could distort incentives and discourage companies from selecting lowest whole-life-cost solutions aligned with good asset management practice.

6.3.3 We have set out the key issues in relation to the dataset and its unsuitability for robust cost efficiency assessments under the following headings:

- Lack of granularity;
- Inconsistent categorisation; and,
- Distortion of incentives.

Lack of granularity

6.3.4 The data is split into four categories, 'repair', 'refurbishment', 'replacement' and 'other' types of intervention. There is significant variation captured within each expenditure category, as refurbishment or replacement activities can differ materially in scope and complexity. As a result, higher unit costs may simply indicate that a company is undertaking more intrusive or costly interventions that can result in a longer asset life rather than implying a lower level of efficiency.

6.3.5 If unit costs are used at the refurbishment and replacement level, as captured by Ofwat, genuine differences in company intervention mix will be embedded as differences in efficiency.

6.3.6 This approach to unit costs would reward companies that engage in a high proportion of relatively lower cost refurbishment and replacement interventions. In contrast, companies will be disincentivised to invest in a high proportion of more expensive refurbishment interventions as the assessed efficient unit cost will be unachievable for these solutions. Furthermore, this incentive structure would contradict a key aim of the Asset Health Roadmap, that companies should use allowances to "maintain the long-term capability of assets" [19]. This would require proactive and long-lasting interventions.

6.3.7 For example, as seen in Table 11, [✂]likely has relatively more small-scale refurbishments, which would reduce its unit costs for reasons not solely linked to differences in efficiency.

Table 11: Total refurbishment expenditure (trickling filters) and number of interventions (2015/16-2024/25)[20]

Company	Expenditure (£m) (2015/16-2024/25)	Number of Interventions (2015/16-2024/25)	Average Unit Cost (Expenditure / Interventions)	Number of Trickling Filters	Intervention Rate per Trickling Filter
SRN	16.23	2165	0.01	607	3.57
SVE	35.61	1515	0.02	1173	1.29
TMS	21.46	146	0.15	755	0.19
WSX	6.19	118	0.05	742	0.16
NES	4.52	72	0.06	438	0.16
UUW	11.88	63	0.19	858	0.07
ANH	1.19	38	0.03	1786	0.02
SWB	1.86	27	0.07	497	0.05
WSH	0.72	7	0.10	953	0.01
HDD	0.05	6	0.01	35	0.17

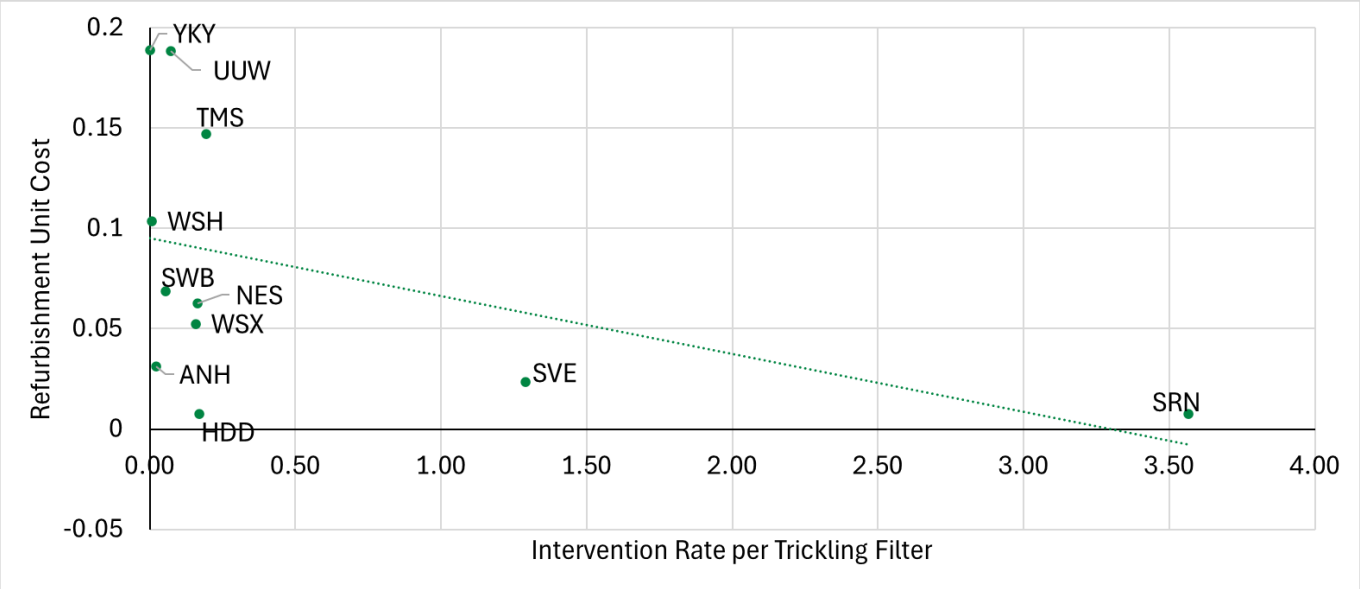
Source: UUW analysis of Ofwat (2026) Sector workload and expenditure dataset v2 – for circulation.

6.3.8 This is further supported by the negative correlation between refurbishment unit cost and the intervention rate per trickling filter, this indicates that there is a contrast between companies that engage in a large number of small-scale interventions and those that prioritise fewer, more costly, interventions. This is illustrated in Figure 18.

[19] Ofwat (2024). Roadmap for enhancing asset health understanding in the water sector. Available at: PR24-final-determinations-Roadmap-for-enhancing-asset-health-understanding-in-the-water-sector.pdf.

[20] Ofwat (2026). Sector workload and expenditure dataset v2 – for circulation.

Figure 18: Diagram showing the negative correlation between refurbishment unit cost and intervention rates for trickling filters[21]



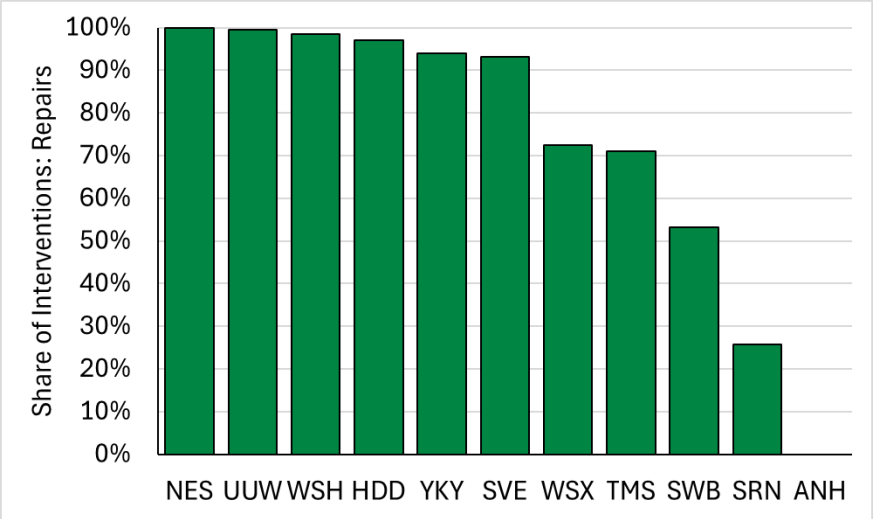
Source: UUW analysis of Ofwat (2026) Sector workload and expenditure dataset v2 – for circulation.

Inconsistent Categorisation

6.3.9 There is not necessarily a clear distinction between repairs and refurbishments, which may lead to some companies having the same cheaper intervention categorised as a 'repair' where others categorise it as a 'refurbishment'. This will distort any unit cost comparisons.

6.3.10 Figure 19 and Figure 20 show that companies with a higher proportion of repairs typically have a low proportion of refurbishments. Without a more granular breakdown of the data, it is not possible to ascertain whether this stems from a preference for proactive over reactive maintenance or simply demonstrates an inconsistency in classification of repairs and refurbishments.

Figure 19: Proportion of water asset class interventions categorised as 'repair'[22]

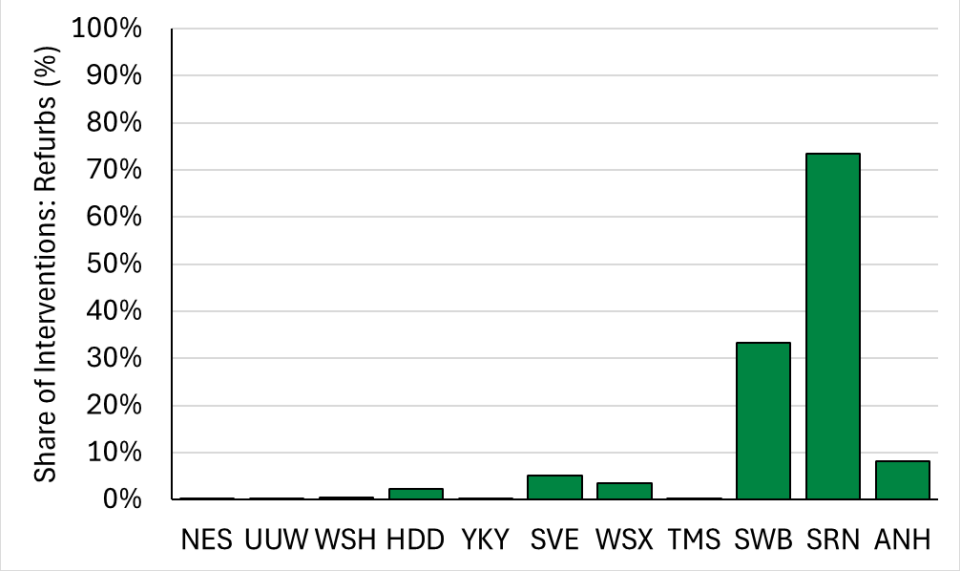


Source: UUW analysis of Ofwat (2026) Sector workload and expenditure dataset v2 – for circulation.

[21] Ofwat (2026). Sector workload and expenditure dataset v2 – for circulation.

[22] Ofwat (2026). Sector workload and expenditure dataset v2 – circulation.

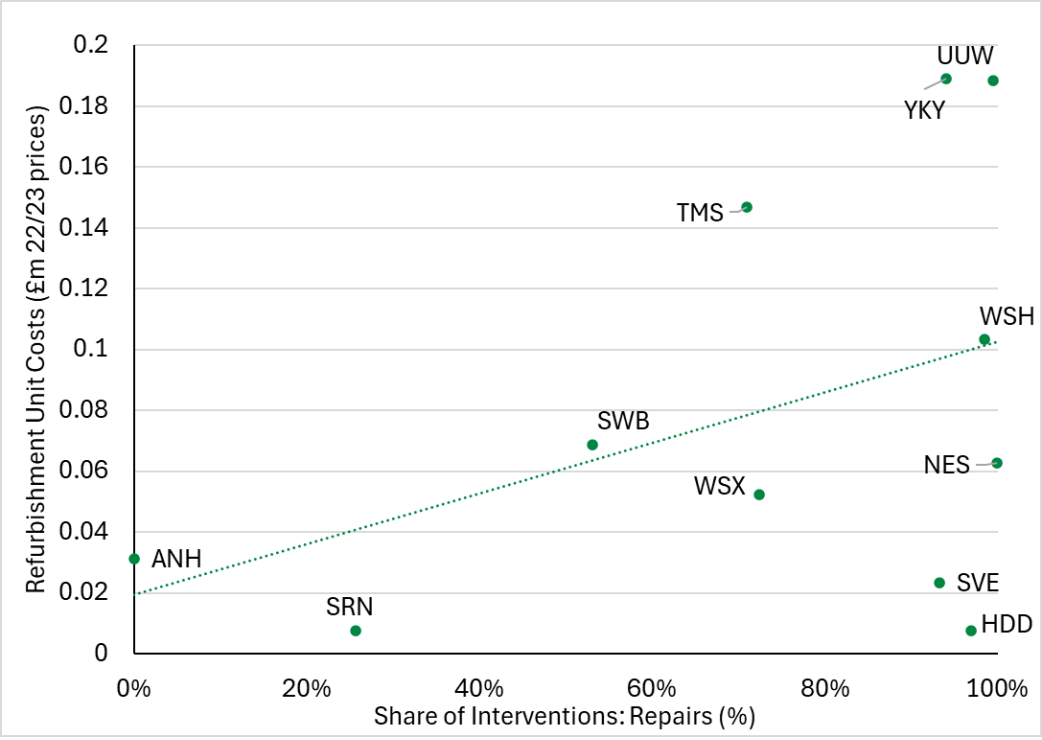
Figure 20: Proportion of water asset class interventions categorised as 'refurbishment'[23]



Source: UUW analysis of Ofwat (2026) Sector workload and expenditure dataset v2 – for circulation.

6.3.11 Potential misclassification is also evidenced by the fact that companies with a low proportion of repairs are more likely to have a low refurbishment unit cost, which suggests that certain repairs could be miscategorised as refurbishments. This is illustrated by some companies, such as [✂], that have a low trickling filter refurbishment unit cost, a low proportion of repairs and a large number of refurbishment interventions per asset. Figure 21 illustrates the positive correlation between refurbishment unit cost and share of repair interventions across the industry.

Figure 21: Diagram showing the positive correlation between proportion of repair interventions and refurbishment unit cost[24]



Source: UUW analysis of Ofwat (2026) Sector workload and expenditure dataset v2 – for circulation.

[23] Ofwat (2026) Sector workload and expenditure dataset v2 – for circulation.

[24] Ofwat (2026) Sector workload and expenditure dataset v2 – for circulation.

6.3.12 The relationship between the proportion of repair interventions and refurbishment unit costs presented in Figure 21 above may help to explain the negative correlation observed in Figure 18, between the refurbishment unit cost and the volume of refurbishment interventions. Specifically, where a relatively high proportion of lower-cost repair activities are delivered alongside, or instead of, more expensive refurbishments, this can influence the reported average refurbishment unit cost across the industry. A simple unit cost approach would create distortive incentives

A simple unit cost approach would distort incentives

6.3.13 A simple unit-cost approach to assessing cost efficiency could materially distortive incentives for a company asset strategy. If companies are judged against a single refurbishment, or replacement-level unit cost, the regulatory framework would implicitly reward those who choose the lowest short-term capital expenditure option—regardless of whether it delivers the best whole-life outcome. Under such an approach, companies are likely to prioritise low-cost interventions to remain "efficient" in comparative assessments, even where a more substantial, longer-lasting intervention would provide better value for customers over the asset's life and deliver greater improvements in environmental and operational resilience.

6.3.14 This incentive structure is directly counter to the aims of the Asset Health Roadmap. The Roadmap is explicitly designed to encourage proactive, higher-quality and long-lasting interventions, rather than short-term fixes that defer cost into the future.[25] Using simple unit costs to assess efficiency risks undermining this objective by effectively penalising companies that adopt more intrusive and sustainable interventions. Instead of promoting good asset management practice, a simple unit-cost benchmark would encourage behaviour towards short-term solutions that appear cheaper when assessed during a single period but lead to higher long-term costs for customers.

6.4 How we developed our cost estimates

6.4.1 This section sets out the methodology we followed to scope and estimate our project costs. We set out our assumptions, then we give a high-level overview of the methodology and show how this methodology has been implemented for a specific scheme.

Estimating assumptions

6.4.2 We have made the following assumptions when estimating costs.

- All estimates are based on engineering scopes produced from survey reports.
- Project costs are a bottom-up assessment of activity and cost including labour, plant and duration.
- For media replacement, we have assumed that existing media can be removed, washed and replaced, which mitigates overall cost estimates. However, we have assumed a small amount of media is lost or cannot be reused. Based on project norms and expert judgement, we have conservatively assumed between 5-10% depending on media volume – large volumes will be associated with a smaller percentage.
- Rates for media replacement are based on a quote from media replacement specialists to give us confidence that costs are aligned with competitive market rates. We have supplemented these costs with additional costs reflecting indirect contractor costs such as site welfare.
- We have based our direct cost estimates for nitrifying trickling filters on a historic project carried out at [✂] in AMP5, pro-rated for changes in volume.
- Mechanical, Electrical, Instrumentation, Control & Automation costs are priced based on labour and plant installation norms and material prices from past quotations.

[25] Ofwat (2024). Roadmap for enhancing asset health understanding in the water sector. Available at: PR24-final-determinations-Roadmap-for-enhancing-asset-health-understanding-in-the-water-sector.pdf.

- For small sites, contractor indirect costs have been built up from first principles based on the duration of the repairs works. There is an element of fixed cost for contractor indirect costs regardless of project size, applying fixed percentage uplifts tends to understate this fixed cost. However, for larger sites, our standard uplift was applied.

Our scope and estimating methodology

6.4.3 Our methodology followed these key steps.

1. **Asset surveys identified key risks that require immediate mitigation.** As set out previously in this case, we assessed the asset condition at each of our sites. These assessments highlighted key asset risks, with the costs of addressing these incremental to the expenditure programme delivered by our PR24 base allowances.
2. **We identified a scope of works to mitigate asset risk.** We then scoped an appropriate solution to mitigate each of these risks. Our scope was scrutinised internally through peer and managerial review.
3. **We developed bottom-up estimates based on this scope of works.** We then estimated the costs associated with each scope item. Activities were multiplied by unit rates to derive a direct cost estimate. The unit rates were based on commercial supplier rates and historic schemes. Our estimates were scrutinised internally through peer and managerial review.
4. **We apply indirect cost uplifts to reflect the full scope of activity.** We apply uplifts to reflect indirect activity, in line with best estimating practice.

6.4.4 The next section shows how this methodology was enacted for one specific scheme; [✂] treatment works is in the rural north of Cumbria.

Asset surveys identified key risks that require immediate mitigation

6.4.5 Our site visit revealed deficiencies in the mortar of the brickwork supporting the settlement tank. Although the main filter column has been refurbished in recent years, the survey shows the asset condition requires mitigation. We will focus on how the scope and costs to address the brickwork have been developed through the rest of this section.

We identified a scope of works to mitigate asset risk

6.4.6 We designed a scope of works to address the brickwork deficiencies. This scope assessed:

- **Settlement tank diameter.** The total diameter of the settlement tank. This helps to inform the area to be addressed and is an input into subsequent calculations.
- **Settlement tank circumference.** Calculated by multiplying the diameter by the number pi. This helps to inform the area to be addressed and is an input into subsequent calculations.
- **Wall height.** The total height of the wall. For the external wall, this is the height from the top of the wall to the ground. For the internal wall, this is the height from the top of the wall to the top of the media.
- **Total surface area.** Circumference multiplied by wall height. This captures total surface area on the internal brickwork from i) top of the wall to top of the media (internal) and ii) top of the wall to the ground (external).
- **Surface area to be addressed.** The surveyor assessed how much of the total surface area requires remediation. In this case, we consider that 40 percent of the brickwork would need improvement. This percentage is multiplied by the total surface area to calculate the surface area to include in the scope.

6.4.7 This is set out in Table 12.

Table 12: Our scope for addressing brickwork deficiencies at [✂]

	Settlement tank diameter (m)	Settlement tank circumference (m)	Wall height (m)	Total surface area (m^2)	Surface area to be addressed (%)	Surface area to be addressed (m^2)
Internal brickwork	9	28.26	0.3	8.5	40%	**3.4**
External brickwork	9	28.26	1	28.3	40%	**11.3**

Source: UUW analysis

We developed bottom-up estimates based on this scope of works

6.4.8 We estimated a rate per m^2 for a) internal brickwork repairs and b) external brickwork repairs. These calculations are set out in Table 13 and Table 14.

6.4.9 The estimates set out for internal brick repair reflect a slower pace of work due to the additional complications that come with working within a live asset. As such, the calculated unit rate is higher for internal brickwork.

6.4.10 These calculations look complex. However, in reality, these are systemised with our estimating software. We have replicated the calculations here for clarity.

Table 13: How we calculated the unit rate for internal brick repair (2024 Q1 CPIH prices)

[ ]	[✂]	[✂]	[✂]
-]	[✂]	[✂]	[✂]
-]	[✂]	[✂]	[✂]
-]	[✂]	[✂]	[ ]
-]	[✂]	[✂]	[✂]
-]	[✂]	[✂]	[✂]
-]	[✂]	[✂]	[ ]
-]	[✂]	[✂]	[✂]
-]	**[✂]**	**[✂]**	**[✂]**
-]	**[✂]**	**[ ]**	**[✂]**

Source: UUW analysis

Table 14: How we calculated the unit rate for external brick repair (2024 Q1 CPIH prices)

[ ]	[ ]	[ ]	[ ]
-]	[ ]	[ ]	[ ]
-]	[ ]	[ ]	[ ]
-]	[ ]	[ ]	[ ]
-]	[ ]	[ ]	[ ]
-]	[ ]	[ ]	[ ]
-]	[ ]	[ ]	[ ]
-]	[ ]	[ ]	[ ]
-]	[ ]	[ ]	[ ]
-]	**[ ]**	**[ ]**	**[ ]**
-]	**[ ]**	**[ ]**	**[ ]**

Source: UUW analysis

6.4.11 These unit rates were then multiplied by the number of units identified in the engineering scope to calculate a total direct cost for each element. This calculation is shown in Table 15: How we calculated direct costs for brickwork at Bolton Low Houses (2026 Q1 CPIH prices)Table 15.

6.4.12 Table 15The source calculations for the unit and unit rates are set out in Table 12, Table 13 and Table 14.

Table 15: How we calculated direct costs for brickwork at Bolton Low Houses (2026 Q1 CPIH prices)

[ ]	[ ]	[ ]	[ ]	[ ] -]	[ ] -]
-]	[ ]	[ ]	[ ]	[ ]	[ ]
-]	[ ]	[ ]	[ ]	[ ]	[ ]

Source: UUW analysis

6.4.13 These costs are combined with other elements of the Bolton Low Houses engineering scope to calculate a total project cost. This is shown in Table 16. Each of these individual elements have been calculated in a similar bottom-up way to the process set out above. The total direct cost reconciles back to Table 9.

Table 16: Direct cost build for Bolton Low Houses

[✂]	[✂] -]
[✂]	[ ]
[✂]	[✂]
[✂]	[✂]
[✂]	[✂]
[✂]	[✂]
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[✂]	**[✂]**
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[✂]	**[✂]**

Source: UUW analysis

6.4.14 We then add on appropriate indirect costs to this to calculate a total project cost. This is shown in Table 17. The total cost reconciles back to Table 9.

Table 17: Bolton Low Houses cost build (£m, 2022-23 CPIH)

[✂]	[✂]
[✂]	[✂]
[ ]	[✂]
[✂]	[✂]
[✂]	[✂]
[✂]	**[✂]**

Source: UUW analysis

6.5 How we have accounted for repair costs associated with the proposal

6.5.1 Typically, civils assets have relatively infrequent, but more substantial investment than mechanical, electrical and instrumentation assets. Trickling filters assets are more often refurbished or replaced than they are repaired. This is reflected in the historic cost splits for repairs, with civils often accounting for less than 10% of repair expenditure.

6.5.2 We therefore expect to realise only modest savings in repair costs across the Trickling Filter asset class during AMP8 because of the asset health cost change expenditure. This is because:

- Our investment proposal covers only a small proportion of the installed asset base within the Trickling Filter asset class i.e. around 10% of our stock (87 of 858 filters);
- The delivery investment profile is in the last few years of the AMP; and,
- It impacts predominantly civil assets which account for a relatively small proportion of repair costs. Repair work on trickling filters has historically been approximately 90% on mechanical, electrical, instrumentation and control and automation (MEICA) assets, with around 10% associated with civil and structural elements.

6.5.3 Whilst the proposed investment on Trickling Filters will help to extend the life of these assets and reduce the risk of incidents and failures, it will have a negligible impact upon in-AMP repair costs across the asset class.

Historical repair expenditure and implicit allowance

6.5.4 It is important to note that Ofwat has not set asset class specific allowances but rather an overall base expenditure allowance across the entirety of the asset base. Therefore, assessing ex-post WBB for a subset of asset classes requires applying key methodological assumptions and subjective judgement. While we have complied with Ofwat's guidance for the Cost Change process, we believe that adopting a mechanistic approach to estimating WBB has its limitations and that such an approach should not set a precedent for wider application at PR29.

6.5.5 We have used a similar WBB approach to assess an implied level of funding for repairs for four of the five asset classes in our cost change submission (excluding gravity sewers), see Table 18. This assessment indicates that we have historically invested in a higher level of repair than is implicitly funded.

Table 18: Historical repair expenditure compared with implied WBB allowance for trickling filters (£m, 2022-23 CPIH prices)

	Trickling Filters (£m/AMP) 2022/23
WBB assessment - repair	5.7
UUW's average AMP repair expenditure over AMP6-7	15.3

Source: UUW analysis

6.5.6 We have quantified an estimated range of implied savings associated with the proposed investment as **£15k** to a maximum of **£149k** for AMP8 (Table 19). These potential savings would only be relevant to AMP8 as they would be associated with avoiding repair work on the assets in scope as they would instead be receiving capital investment during the AMP.

6.5.7 Our approach involved the following steps:

- **Step 1a** - Calculate a WBB allowance for repair by extending our existing WBB calculation to include repair expenditure alongside replacement and refurbishment costs (for detail please see *UUW26 – 18 Asset Health – What base buys methodology*);
- **Step 1b** - Subtract from the total WBB that include repair costs (as calculated in step 1) the WBB covering only refurbishment and replacement costs;
- **Step 2 -** Scale the repair only WBB allowance calculated in step 1b based on the subset of assets in scope for the cost change investment;
- **Step 3** - Adjust the potential savings based on the delivery profile of our investment (this assumes that each year's delivery programme on average delivers mid-year, so the year 3 programme has potential for savings across the last 2.5 years of the AMP);
- **Step 4** - Assess the low end of the range by adjusting the potential savings by the proportion of civils only.

Table 19: Calculation of indicative repair cost savings associated with the AMP8 trickling filter investment

Step	Description	Interim Calculation
1	**Calculate WBB repair**	
	WBB implied repair allowance per AMP	£5,720k
2	**Scale WBB for assets in scope**	
	Proportion of asset base included in cost change	10%
	WBB repair for assets in scope	£572k
3	**Calculate potential WBB savings based on investment profile (20%,40%,40%)**	
	20% x 2.5 years + 40% x 1.5 years + 40% x 0.5 years	26%
	Whole AMP implied saving (£572k x 26%)	£149k
4	**Calculate the proportion of potential civils repair savings**	
	Historic civils proportion of repair	10%
	Whole AMP implied civil saving (£149k x 10%)	£15k

Source: UUW analysis

6.5.8 We have therefore included £149k as potential operating expenditure savings associated with avoided repairs in AMP8. This represents the high end of the plausible range.

7. Customer Protection

This section sets out strong safeguards to ensure customers only fund efficiently delivered work. We propose output-based PCDs for our incremental investment and an expenditure-based PCD for our existing AMP8 programme. Our proposals ensure that customers are protected from double-funding through transparent separation of base and incremental investment.

7.1 Price Control Deliverables (PCDs)

Trickling filters cost change PCD

7.1.1 We are proposing PCDs based upon efficient delivery of intervention types for this investment proposal programme. For the cost change claim on the trickling filter priority class this would involve an output-based PCD with four sets of rates, one for each deliverable. Any non-delivery would be subject to the PCD clawback mechanism as set out below in Table 20.

7.1.2 Table 20 below presents the proposed PCD clawback for trickling filters, disaggregated by intervention type. These models provide a robust way of calculating clawback in the event of non-delivery. The approach has been designed to ensure that the proposed allowance is fully protected and that clawback is directly proportionate to any shortfall in delivery.

7.1.3 For each of the four intervention types, we have developed a bespoke linear regression model based on the underlying cost dataset that supports the cost allowance proposal. We have used this approach for trickling filters due to the significant variation in individual filter size from works to works, with small rural works having filters over 100 times smaller than larger works. This approach ensures a strong and transparent link between the proposed expenditure and the clawback mechanism. By calibrating each model using the same data that underpins the cost forecast, the clawback rates accurately reflect the cost drivers of delivery and avoid any risk of under- or over-recovery in the event of non-delivery.

7.1.4 Each model comprises two components:

- a fixed cost element per scheme, representing non-volume-dependent activities; and
- a volumetric rate applied per cubic metre of tank capacity.

7.1.5 This structure reflects the observed cost behaviour across the dataset and provides an appropriate balance between fixed and variable cost recovery. Importantly, it allows clawback to be calculated on a scheme-by-scheme basis using objectively measurable parameters, namely, intervention type and tank volume.

Table 20: PCD deliverable and non-delivery rates (£m, 2022-23 CPIH prices)

Intervention type	Number in AH proposal	Cost driver	Unit rate model for PCD		Volume	Total cost	Worked example provided
			Fixed rate £ (a)	Volumetric rate £ per m3 (b)			
Minor refurbishment (walls only, media not removed)	11	Tank volume (m3)	14,504	49	17,889	1.036	Example A
NTF floor	22	Tank volume (m3)	347,748	510	18,819	17.253	
Rebuild	5	Tank volume (m3)	616,826	178	8,890	4.667	

Intervention type	Number in AH proposal	Cost driver	Unit rate model for PCD		Volume	Total cost	Worked example provided
			Fixed rate £ (a)	Volumetric rate £ per m3 (b)			
Refurbishment (including media removal)	49	Tank volume (m3)	169,040	180	57,202	18.591	
Total						**41.547**	

Source: UUW analysis

PCD reporting, assurance and other conditions

7.1.6 This section provides further details underpinning our approach to this proposed PCD. This includes parameters such as the measurement, reporting and assurance of the PCD, any timing incentives proposed and any additional conditions of the PCD mechanism on the proposed allowance.

7.1.7 This is an output-based PCD mechanism that applies to this expenditure, this would be above and beyond our base programme expenditure.

7.1.8 The base programme would be assured as part of the APR process to confirm base capex each year against each priority class.

7.1.9 The APR assurance for Asset Health would confirm there has been no overlap between the base programme and the additional Asset Health expenditure.

7.1.10 Any changes to the list of sites / interventions arising from new information as set out in the agreed Asset Health cost change would be presented alongside the APR PCD data. Commentary would provide a clear explanation for the change(s) and demonstrate how it would not increase risk to customers.

7.1.11 The overall programme value would not exceed the cost adjustment allowance although the mix of interventions could be varied.

7.1.12 PCD outputs, progress and expenditure would be reported each year as part of our standard Delivery Plan reporting arrangements applied to all existing PCDs. Overall delivery against this PCD will be assessed at the end of year five AMP8 (i.e. 2029/30). If we have spent at least 60% of the allowed expenditure for this PCD due in AMP8, then there would be no claw back provided that the remaining delivery takes place by the end of AMP9 (i.e. 2034/35). This is in line with Ofwat's current PCD guidance (February 2026).

7.1.13 The delivery of the interventions is not anticipated to have any impact on existing PR24 FD PCDs. We therefore do not propose any adjustment to the existing FD PCDs.

7.1.14 Timing incentives: Ofwat's PR24 Final Determination sets out where timing incentives apply. These are restricted to water supply, supply and resilience interconnectors, metering, phosphorus removal, storm overflows and mains renewals. These incentives are designed to promote timely delivery of benefits. With the exception of mains renewals, these areas use scheme level PCDs that allow greater flexibility in deliverables, therefore reducing the financial risk created by the application of timing incentives. In contrast, the PCDs proposed in this submission case have tightly defined, granular outputs, limiting the ability to substitute deliverables. For this reason, we do not propose applying timing incentives, except in the scenario of post-AMP8 delivery.

Examples

7.1.15 The worked examples in Table 21 below explain how we propose clawback would be calculated in the event of non-delivery for one of the output types shown in Table 20. Each output has a fixed and volumetric component. The example provided can be applied to all outputs but with intervention type specific rates for "a" and "b".

7.1.16 In the example below, interventions are required for "Minor refurbishment" on three filter tanks.

Table 21: Example A - Minor refurbishment (walls only, media not removed)

Parameter	Value / Calculation
Number of tanks	= 3
Volume of tanks	= Tank 1 - 100m3 , tank 2 – 90m3 ,tank 3 – 95m3
Fixed rate per tank "a"	= £14,504
Rate per m3 "b"	= £49
PCD assessment	= (1 x (14,504 + 49 x 100)) + (1 x (14,504 + 49 x 90)) + (1 x (14,504 + 49 x 95) = 19,404 + 18,914 + 19,159
PCD Potential clawback	= £57,477

Source: UUW Analysis

Base expenditure PCD

7.1.17 In addition to the output based PCD for this cost change submission, we also propose an expenditure-based PCD to protect customers from non-delivery and claw back unspent allowances for WBB across the four relevant asset classes (see Table 22) and alternative forms of secondary treatment assets. Where maintenance investment expenditure is carried out on alternative forms of secondary treatment assets (for example, ASPs) rather than trickling filters, then this will also be included in the assessment of base expenditure. If the expenditure in one asset class is less that its implicit funding allowance, but it is offset by a higher expenditure in one of the other asset classes or alternative forms of secondary treatment, there would be no PCD clawback. This would provide sufficient flexibility to ensure that companies remain incentivised to target their maintenance interventions efficiently whilst providing appropriate customer protection.

7.1.18 This type of expenditure-based PCD is similar to the PCDs included in the PR24 FD. These include Network Reinforcement and Climate Change Uplift PCDs, both of which have separate expenditure-based outputs for the Water and Wastewater services respectively. This additional granularity, of reporting at Water and Wastewater price control levels provides additional customer protection.

Limitations of WBB

7.1.19 In our calculation of WBB, we have highlighted the limitations of any mechanistic approach used to assess WBB for individual asset classes and the data issues associated with the assessment. In applying any methodology, we believe that Ofwat should give significant consideration to the risk of an overstatement and the potential impacts this could have on restricting companies' base expenditure decisions in a way that would be inconsistent with the PR24 approach to base expenditure allowances.

7.1.20 We therefore believe that our WBB estimates very much represents the upper end of the range that should be considered for WBB and that, in view of the risks associated with over-estimation, Ofwat should consider whether lower limits should be binding on companies. We have therefore proposed potential mitigations that Ofwat could consider in the *UUW26-18 Asset Health – What Base Buys* document.

Detail of PCD breakdown

7.1.21 In our AMP8 programme across the priority asset classes, we have allocated base funding to cover drain down, cleaning and inspection and remediation at a specified number of small, medium and large sites. The planned expenditure on proactive interventions will be ringfenced through a base expenditure PCD in line with the aggregate WBB figure of £77m across the asset classes.

7.1.22 Table 22 below summarises the breakdown of 'what base buys' across the relevant asset classes in our submission (excluding Gravity Sewers, because it is not an expenditure based PCD). We propose that our base expenditure PCD should be ringfenced at the aggregate level. This approach ensures delivery of the

full £77m of base investment, whilst allowing us to optimise prioritisation of intervention across assets in response to emerging risks.

Table 22: Breakdown of WBB PCD (£m, 2022-23 CPIH prices)

Asset class	WBB
Boreholes	6.4
Rapid Gravity Filters	8.5
Water Network storage assets	55.7
Trickling filters	6.5
Total	**77.1**

Source: UUW analysis

7.2 Impact on Performance Commitments

7.2.1 The delivery of the interventions is not anticipated to provide measurable in-period performance improvement, as the programme is targeting risk reduction, not short-term performance uplift. The investment will mitigate a set of material and increasing risks to environmental compliance, service resilience and safe operation, arising directly from deteriorating asset health.

7.2.2 These benefits primarily manifest as avoided failures rather than improvements visible in AMP8 performance commitments. As such, we are not expecting to see any secondary benefit associated with this investment against the AMP8 performance commitments.

8. Investment Delivery Plan

We are actively managing all key delivery risks, including outage availability, access constraints and interfaces with live assets, through early operational engagement, and flexible outage planning. Delivery planning shows investment is fully deliverable within AMP8, with supply-chain capacity confirmed across the delivery runways. It covers programme management, risk management, supply chain readiness, and phasing across AMP8.

8.1 Supply Chain Readiness

8.1.1 Our strategy is to deliver the projects within this case via the most appropriate delivery "runway" in our established AMP8 runway-based delivery model, which is described in more detail in Section 7 of *UUW26-02 Growth Unlocked: Water for the New Economy*.

8.1.2 Assessment of supply chain capacity and deliverability risk should not be considered in isolation. Instead, we have considered the impact of all cases with our Growth and Asset Health submissions in aggregate on the baseline AMP8 programme. We have completed a comprehensive assessment of AMP8 supply-chain capacity and confirmed that our design consultants, construction partners, and internal programme management teams have sufficient resources and headroom to deliver the proposed additional investment.

8.1.3 Please refer to Section 7 of *UUW26-02 Growth Unlocked: Water for the New Economy* for the programmatic assessment which considers all projects proposed for investment across all cases within our Growth and Asset Health submissions, with the supporting evidence that all such investments are deliverable.

8.2 Delivery risks: design & delivery risks tracked with mitigations

8.2.1 Risk and opportunities have been captured throughout the optioneering and design phase along with site specific constructability and deliverability risks. Risks have either been mitigated during the optioneering phase or have a mitigation plan in place to monitor and manage any residual risk.

8.2.2 We understand the overlap with the existing AMP8 programme and have undertaken project by project assessment to establish any change to the current risk profile or impact to in AMP delivery.

8.2.3 A constructability and deliverability matrix and scoring system has been established. This is driven by key attributes including the scale of the upgrade required, complexity of the interface with existing asset, any land purchase requirements, likely planning or ecological constraints or other 3rd party constraints such as power or communications upgrades. A more detailed overview can be found in the programme level risk register.

8.2.4 Risk and opportunities have been scored based on analysis of likelihood and impact. Table 23 below illustrates the categorisation for both Risk and Opportunities.

Table 23: Probability Impact Diagram

Risks						Opportunities				
VL(1)	L(2)	M(3)	H(4)	VH(5)	Likelihood	VH(5)	H(4)	M(3)	L(2)	VL(1)
5	10	15	20	25	>80%	25	20	15	10	5
4	8	12	16	20	50-79%	12	16	12	8	4
3	6	9	12	15	26-49%	15	12	9	6	3
2	4	6	8	10	11-25%	10	8	6	4	2
1	2	3	4	5	<10%	5	4	3	2	1
<£25k	£25k - £100k	£100k-£200k	£250k-£500k	>£500k	Cost Impact	>£500k	£250k-£500k	£100k-£200k	£25k - £100k	<£25k
Insignificant		Moderate		Severe	Schedule Impact	Severe	Moderate		Insignificant	

Source: UUW analysis

Risks with mitigation plans

8.2.5 Alongside scheme level risks, wider programme level risks have also been assessed. A detailed review of AMP8 supply chain performance and forecast capacity has been completed. Risks identified during optioneering and design have either been mitigated or now have active mitigation plans. Programme level factors, including supply chain capacity and long lead dependencies, are embedded in the integrated schedule. A programme risk register for Asset Health is available in the *UUW26-27 Deliverability* Risk Register. Key risks for trickling filter delivery are listed below and Table 24 provides more detail on the highest risk scores by type.

a) **Supply chain constraints**

A robust assessment of AMP8 supply chain capability has been undertaken, confirming capacity to accommodate the additional growth-related scope. This assessment included partner capacity modelling, specialist resource availability, and logistics capability.

b) **Materials, Long Lead Items & Advanced Procurement**

- Advanced procurement strategies for critical components (pumps, MCC panels, packaged treatment units, controls and telemetry) are in place.
- Long lead profiling includes.
- Imported equipment.
- Electrical connections or temporary power.
- Specialist fabrication and assembly slots.

Our procurement forecasts and supplier commitments will be incorporated into an integrated delivery schedule.

c) **Third Party Approvals and Enabling Requirements**

Growth driven infrastructure requires extensive external engagement. Early engagement with third parties has begun; however, further approvals are required (planning, highways, landowners, utilities). Programme timescales include mandatory lead in periods and iterative design development.

d) **Design and Ground Investigation (GI) Risks**

Detailed route assessments require early commencement of ground investigation to remove uncertainty around geotechnical conditions. Early GI mobilisation is planned to reduce design risk and compress downstream approval and construction phases.

Table 24: Scored risks by risk type

Risk Description	Risk Type	Mitigation Details and Progress	Risk Impact Score Maximum 25
Overlap of growth and Asset Health schemes with existing AMP8 solutions - risk that the additional growth has a detrimental impact on cost and programme by introducing late requirements changes and scope (Extended prelims, resource standing time, abortive design or construction costs)	Threat	Overlaps are known and understood - existing AMP8 design and delivery teams will be engaged to develop a project by project plan in terms of incorporating the additional scope into the AMP8 project in the most cost and programme efficient manner - sessions to be held during determination phase	16
Overlap of growth and Asset Health schemes with existing AMP8 solutions - opportunity that the additional growth has a beneficial impact as the growth or AHR scope can be delivered more efficiently by a single projects reducing site mobilisation costs	Opportunity	Overlaps are known and understood - existing AMP8 design and delivery teams will be engaged to develop a project-by-project plan in terms of incorporating the additional scope into the AMP8 project in the most cost and programme efficient manner - sessions to be held during determination phase	15
Interface with existing assets - There is a risk that a number of the projects will require significant modifications to existing live assets - this could result in additional cost and programme impacts relating to temporary treatment or over pumping to enable any modifications or upgrades	Threat	Sites where the interface with existing assets has been identified as a high risk have additional allowances in place to cover temporary treatment and over pumping to mitigate. Initial discussions have commenced with operational teams to ascertain likely requirements and timescales	9
Power requirements for rural sites - There is a risk that power upgrades are disproportionally expensive and delayed - there is a large population of rural sites where power availability will be a significant risk	Threat	Non powered sites or sites with limited existing DNO capacity have been identified during optioneering - Sites with significant upgrades or power intensive assets such as SAFs, ASPs etc have also been included. Quotes for upgrades will be sought from the DNO to firm up risk to each site if an upgrade is required.	9
Availability of supply chain to deliver the additional scope in AMP8 - risk that there is insufficient capacity to deliver the additional scope causing delays to delivery and/or increased costs for accelerated delivery	Threat	Early visibility of the Growth & Asset Health programmes will be provided to our delivery partners - this work will help to bridge the ramp up to AMP9 Transitional Investment and AMP9 and avoid critical resources being redeployed to other water programmes or other growth industries. Where there is overlap between Growth and Asset Health with the AMP8 programme the works will be amalgamated to reduce rework	6

Source: UUW26-27 Deliverability risk register

8.3 Outline delivery schedule

8.3.1 Overlap between the growth submission and this asset health submission and AMP8 WINEP schemes has been assessed. To accurately estimate overall supply chain capacity it has been assumed that the

currently assigned runway and partner allocation will be maintained – unless the scope of the works has increased or changed to the extent that the existing partner may no longer be best for task.

Project categorisation

8.3.2 Projects have been categorised to provide greater granularity in terms of likely supply chain, interface with existing assets and likely programme durations. A list of the categorisations is set out in in Table 25.

Table 25: Project delivery categorisation

Category	Category Description	Description
Category 1	Offline Build	Small number of new assets
Category 2	Offline Build	Significant number of new assets
Category 3	Significant interface with existing assets	High risk of temporary treatment
Category 4	Moderate to Minor number of new assets	Manageable interface with existing assets
Category 5	Refurbishment only	High risk of temporary treatment
Category 6	Refurbishment only	Low risk of temporary treatment

Source: UUW analysis

8.3.3 Each category is then split into 4 further categories (Table 26) to identify whether additional land is required and whether there is an existing live AMP8 project that needs to be considered. The number of projects per categorisation is set out in Table 27.

Table 26: Sub-categorisation

Category	Category Description	Description
A	No existing AMP8 schemes	No temporary treatment required
B	Existing AMP8 scheme	No temporary treatment required
C	No existing AMP8 schemes	Treatment required
D	Existing AMP8 scheme	Treatment required

Source: UUW analysis

8.3.4 These standard programmes are based on current AMP8 delivery performance and have been adjusted based on individual project complexity or constraints identified during the optioneering and constructability assessments (Table 27).

Table 27: Number of projects split by categorisation

Category	Number of Projects
	Wastewater Structures NTF/TF
Category 1	0
Category 2	0
Category 3	3
Category 4	3
Category 5	9
Category 6	15

Source: UUW analysis

8.3.5 Projects have also been scored against a constructability and deliverability matrix that assesses each project based on a number of criteria that have a material impact on project delivery. Details of the categorisation can be found in Table 28 below.

Table 28: Constructability and Deliverability risk scoring

Category	Assessment	Scoring
Access	Constructability	Range 1-5
Topography	Constructability	Range 1-5
Services	Constructability	Range 1-5
Land Purchase	Constructability	No 0 / Yes 5
Land Rental	Constructability	No 0 / Yes 5
Environmental	Constructability	Range 1-5
Flood Zone	Constructability	Range 1-5
Existing live AMP8 scheme	Deliverability	No 0 / Yes 5
Impact on regulatory commitment	Deliverability	Range 1-5
Complexity of solution	Deliverability	Range 1-5
Likely runway & capacity	Deliverability	Range 1-5
Operational interface	Deliverability	Range 1-5
Programme risk based on above	Deliverability	Range 1-5
Total		**Out of 65**

Source: UUW analysis

8.3.6 These key criteria drive differing project durations to allow sufficient time for project delivery i.e. extended programmes for temporary treatment install and/or seeding time. Time risk allowance (TRA) has been built into riskier activities, such as modifications or tie into existing structures to ensure that programmes have sufficient contingency included in the baseline and are deliverable.

8.3.7 High level project programmes have been developed to provide a full programme view, allowing an overall deliverability assessment to be completed. As part of this, resource levelling has been applied to the programme to reduce the impact and workload on our design supply chain. This staggering of work ensures that the supply chain is productive in 2028/29 and 2029/30 ready for AMP9. Letters of support from key organisations within our supply chain can be found in *UUW26-25 letters of support.*

8.3.8 Through this we have confirmed that the preferred option is deliverable within AMP8 using established delivery models, proven intervention types, and an experienced supply chain. The scope has been deliberately constrained to sites where access, planning, and operational constraints are manageable, and where sufficient treatment resilience exists to enable outages to be safely accommodated.

8.3.9 Delivery will be governed through established AMP8 assurance and reporting arrangements, with output-based PCDs providing additional customer protection and delivery discipline.

8.3.10 The existing AMP8 supply chain will be utilised to deliver this investment, depending on the size and complexity of the works the “Detailed Design & Build” runway or the “Build only” runway will be utilised. There are several contractors who specialise in GRP floor and plastic media replacement and filter bed refurbishment respectively. These contractors have been engaged to validate our methodology, programme and pricing. Programmes from previous capital projects have also been utilised to ensure the logic and timescales for the larger NTF sites is sound and robust, see Table 29 below for an example programme.

Table 29: Example NTF floor replacement programme for standard size (Tyldesley – 11.5m diameter)

Activity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
Procurement of new media and GRP floor																																						
Enabling works for Temporary Treatment																																						
Temporary treatment set up & seeding																																						
Removal of filter arms and drives																																						
Media removal (Grabber)																																						
Media crush and disposal																																						
Install new GRP floor																																						
Install new media																																						
Re install drive and filter arms																																						
Seeding time for filter																																						
Remove temporary treatment																																						

Source: UUW analysis

8.3.11 Alternative methodologies for refurbishment are limited due to the nature of the work. Durations will vary based on the overall volume of media to be removed, disposed of and replaced and the time of year when the filters are re-commissioned and seeded. TRA has been built into the programme to allow for any slippage that results in seeding and commissioning being undertaken in the winter or early spring.

Maintaining current site compliance

8.3.12 All solutions have been designed and costed to ensure that the sites can remain operational throughout the works, for example including provision of standby treatment and standby power generation to support standby treatment if the site is unpowered.

8.3.13 An allowance has been made for standby treatment for all NTF sites due to their process criticality. Standby treatment has also been provided for all filter cases where a site normally operates with either one or two filters as it will not be possible to maintain compliance without additional capacity.

Figure 22: Moving Bed Biofilm Reactor (MBBR) Siltbuster (left), SAF (right)

Source: UUW photographic evidence of MBBR

8.3.14 For larger sites with larger flow requirements (e.g. [✂]) a modular MBBR plant has been included to ensure compliance is maintained. For the smaller rural sites (e.g. [✂]) a modular SAF unit has been allowed for with temporary power generation allowed for where there is insufficient power headroom available (see examples in Figure 22 above).

8.3.15 The trickling filters works have been batched and staggered across the remainder of the AMP8 programme to ensure the supply chain is provided with a steady volume of work, The programme has been developed to allow gangs and temporary treatment to move from site to site in sequence.

8.4 AMP8 delivery evidence

8.4.1 UUW remains on track to deliver against its PR24 Final Determination (FD) Performance Commitment Deliverables (PCDs). As explained in the *UUW26-02 Growth Unlocked: Water for the New Economy*, we are delivering against the requirements of the FD PCDs whilst spending in line with UUW's AMP8 enhancement allowances in the FD.

8.4.2 The mains renewals base PCD in the PR24 FD is most relevant to this submission case as it helps monitor improvements in the asset health during AMP8 by imposing a PCD on set outputs. Our performance illustrates we are successfully delivering against our current FD PCD commitments. In the FD, Ofwat expects the sector to move towards a sustainable mains replacement rate to maintain and improve asset health during the period. It therefore set a PCD on all companies to deliver the specified output of the PCD (a company specific length of mains). In the May 2026 Delivery Plan progress update we are reporting delivery against this PCD as Green, showing we are on track in delivering the requirements of this base investment to Ofwat's FD requirements.

8.4.3 Figure 23 and Table 30 illustrate the investment for asset health in the context of the Asset Health submission and the existing AMP8 programme. We are confident that the full programme is deliverable.

Table 30: WwTW Trickling Filters Capital Expenditure Profile (£m, 2022-23 CPIH prices)

Cost Change Category	2025/26	2026/27	2027/28	2028/29	2029/30	Total
Asset Health	0	0.07	60.44	140.51	92.42	293.44
Trickling Filters	0	1.21	15.43	17.83	7.08	41.55

Source: UUW analysis

Figure 23: Investment profile for Trickling Filters against AMP8 (22/23 Price Base)

Source: UUW analysis

Phasing and coordination with planned future asset health investment programme

8.4.4 A small number of sites identified through the asset health prioritisation process are not included in this submission because investment needs to be coordinated across interdependent asset groups. At [✂], trickling filter assets were identified for intervention through this business case, but condition assessments also identified material investment requirements in the settlement tanks. Given the strong operational and functional interdependency between these assets, delivering isolated interventions would be inefficient and would increase the risk of rework, additional outages and avoidable cost.

8.4.5 [✂]has therefore been intentionally phased and excluded from the scope of this submission. UUW intends to bring forward a coordinated proposal covering both trickling filters and settlement tanks alongside the future settlement tank business case. This will support integrated delivery, reduce inefficiency and disruption, and provide a more effective whole-life solution.

8.5 WwTW Stakeholder engagement and permissions

8.5.1 Each year, UUW delivers a wide-ranging programme of infrastructure investment, spending around £800 million annually across its asset base, based on average capital expenditure over the past three financial years. Most of this work, including the trickling filters activities set out in this proposal, takes place within our site boundaries and has minimal impact on customers or local stakeholders. Where communities may be affected, for example by increased traffic movements associated with deliveries, we proactively manage impacts by streamlining traffic routes, using screening to reduce visual and noise disruption, and offering community drop-in sessions for nearby residents. These measures ensure stakeholders are well informed, supported, and able to raise concerns at an early stage.

8.6 Summary of Deliverability

8.6.1 Overall, we are confident the programme is deliverable over AMP8, supported by:

- A structured delivery model and assured governance;
- Sequenced work packages aligned with supply chain capacity;
- Early mitigation of key risks through optioneering, GI mobilisation, and early procurement;
- Clear visibility of long lead constraints and a mitigation strategy; and,
- Integrated assessment of programme level risks, third-party approvals, and resource availability.

9. Assurance

The submission meets Ofwat's requirements for third-party assurance, with independent review of technical scope, cost robustness and customer protection mechanisms. This provides strong confidence that the programme is justified, efficient, deliverable, and aligned with PR24 asset health expectations.

9.1.1 This section summarises UUW's approach to assuring this submission and the outcomes of the third-party assurance. It is supported by *UUW26-19 Asset Health assurance report.*

9.1.2 Ofwat requires cost changes submissions to include a third-party assurance report in line with the requirements set out in "*PR24 final determinations: Expenditure allowances - assurance requirements for delivery of enhancement schemes appendix*"[26]. This includes technical and commercial assurance across the content of the submission.

9.1.3 The Technical Assurance confirms that the proposed investment meets the requirements set out in Ofwat's guidance for the following areas:

- Need for a step change in investment;
- Best option for customers; and,
- Investment delivery plan.

9.1.4 The Commercial Assurance provides a view on the robustness of the costs proposed by the company and whether they are efficient and represent industry best practice, this includes an assessment of cost estimation approach.

9.1.5 The Commercial assurance also confirms that the proposed investment meets the requirements set out in this document for the following areas:

- Robust and efficient costs; and,
- Customer protection.

[26] PR24-final-determinations-Expenditure-allowances-Assurance-requirements-for-delivery-of-enhancement-schemes-appendix.pdf

10. Site Specific Case Studies – Section Removed

Appendix A Sites for investment – Trickling filters

Table 31: Sites for investment

Site	Type	Overlap with the growth submission	Overlap with AMP8 enhancement scheme	Assets included in proposal	Assets on site	Intervention type	Comment on any potential overlap with other cases
[✂]	Secondary	No	No	1	1	Refurbish	n/a
[✂]	Secondary	No	No	1	1	Refurbish	n/a
[✂]	Secondary	No	No	2	2	Refurbish	n/a
[✂]	Secondary	No	No	4	6	Refurbish	n/a
[✂]	Secondary	No	No	1	1	Refurbish	n/a
[✂]	Secondary	No	Yes	4	7	Minor refurbishment	Solution for AMP8 WINEP drivers is in early feasibility.
[✂]	Secondary	No	No	1	1	Refurbish	n/a
[✂]	NTF	No	Yes	1	5	NTF floor	Solution for AMP8 WINEP drivers is not yet confirmed
[✂]	Secondary	Yes	Yes	14	22	Refurbish + Renew	Solution for AMP8 WINEP low P (0.25mg/l) is chemical dosing and TSR, no intervention on filters. Growth submission does not include any intervention on the existing tricking filters.
[✂]	NTF	No	No	3	3	NTF floor	n/a
[✂]	Secondary	No	No	5	16	Refurbish + Renew	n/a
[✂]	Secondary	No	No	3	4	Minor refurbishment	n/a
[✂]	Secondary	No	No	3	3	Refurbish	n/a
[✂]	NTF	No	Yes	2	2	NTF floor	NTFs are not included within the scope of the AMP8 WINEP scheme
[✂]	NTF	No	No	2	2	NTF floor	n/a
[✂]	NTF	No	No	2	2	NTF floor	n/a
[✂]	Secondary	No	No	3	3	Refurbish	n/a

Site	Type	Overlap with the growth submission	Overlap with AMP8 enhancement scheme	Assets included in proposal	Assets on site	Intervention type	Comment on any potential overlap with other cases
[✂]	NTF	No	No	2	2	NTF floor	n/a
[✂]	Secondary	No	No	1	1	Refurbish	n/a
[✂]	NTF	No	No	2	2	NTF floor	n/a
[✂]	Secondary	No	Yes	1	6	Minor refurbishment	Current solution for AMP8 WINEP drivers indicates no intervention on trickling filters
[✂]	Secondary	No	No	2	4	Minor refurbishment	n/a
[✂]	NTF	No	No	2	2	NTF floor	n/a
[✂]	Secondary	Yes	No	2	2	Refurbish	Growth submission does not include any intervention on the existing trickling filters
[✂]	Secondary	No	No	2	2	Refurbish	n/a
[✂]	NTF	No	Yes	2	2	NTF floor	Current solution for AMP8 drivers indicates no intervention on NTFs
[✂]	Secondary	No	Yes	14	28	Refurbish	Solution for AMP8 WINEP drivers does not include for intervention on the trickling filters
[✂]	NTF	No	No	2	2	NTF floor	n/a
[✂]	Secondary	Yes	No	1	6	Minor refurbishment	Growth submission does not include any intervention on the existing trickling filters
[✂]	NTF	No	No	2	2	NTF floor	n/a

Source: UUW analysis

Appendix B Base Asset Health Dashboard Risk Forecasting

B.1 Base Asset Health Dashboard

B.1.1 The Base Asset Health dashboard is a tool developed by UUW to support asset investment decision making. It provides a picture of the current and future asset health, and risk position of our asset base resulting from a defined investment programme.

B.1.2 The dashboard presents a view across our whole above ground asset inventory. Each asset has:

- a modelled replacement cost, based upon historic UUW's project costs.
- a nominal expected asset life based upon historic UUW norms for asset replacement ages.
- an effective age based on physical age but influenced by the most recent condition assessment.
- a criticality band, based upon the potential service impact associated with asset failure.

B.1.3 The model includes forecasts of asset health and risk for various investment scenarios for each five-year investment period for the next thirty years to 2055.

B.1.4 The dashboard displays three scenarios with the profile of asset value by life for the selected assets in that investment period. Assets move upwards as they age. Assets which have exceeded 85% of their life are identified as 'end of life'.

B.1.5 The three scenarios are:

- No investment. In this scenario the assets age and are not replaced or renewed.
- Existing base maintenance. In this scenario the current planned level of capital maintenance for AMP8 is continued each AMP for the next 30 years, ring fenced to the relevant part of the asset base, such as "all wastewater treatment works".
- Planned investment with cost change as per the investment proposed in this case. In this scenario the current planned level of capital maintenance for AMP8 is supplemented, just for AMP8 with the refurbishment of the targeted assets included within the AMP8 cost change business cases. Subsequently investment returns to PR24 levels for the next 30 years, ring fenced as before.

B.1.6 For all three scenarios for each forecast period, the effective age of the asset base is increased by five years, i.e. accounting for the initial condition state. Assets that are predicted to be fully life expired are then selected for renewal based upon a risk measure; the most critical life expired assets are selected first, until the available capital maintenance programme budget is exhausted. Upon renewal assets are assumed to have an effective age of zero as they enter the next five year period.

B.1.7 In the third scenario "Planned investment with cost change" additional specific assets included within the investment cases are refurbished i.e. a tank, including media, instruments, scrapers, distributors, valving and pipework, plus any local control.

Risk forecasts

B.1.8 Assets typically carry significantly more risk of failure as they enter the last 15% of their lives. The forecast change in risk position is driven by the number, value, and criticality of assets that are predicted to be life expired. This assessment enables us to track whether a well targeted investment programme is sufficient to stabilise or improve the overall risk position of the asset base, or if is predicted to lead to an overall degradation in asset health related risk.

B.1.9 The following worked example indicates the risk forecast assessment methodology on four assets over two investment periods, showing scenarios with and without investment.

Table 32: Risk forecast assessment methodology on four assets over two investment periods (without investment)

Without investment

End of AMP	Asset	Effective age	Asset Life	Criticality	Replacement cost	BAH	Last 15% End of life	Criticality weight	End of life risk score
7	1	10	12	A	£1,000	83%	0	5	0
	2	60	60	B	£10,000	100%	1	4	40000
	3	30	35	C	£20,000	86%	1	3	60000
	4	25	23	D	£5,000	100%	1	2	10000
								End of AMP7 risk score	110000
								End of AMP7 normalised risk score	**1.00**
End of AMP	**Asset**	**Effective age**	**Asset Life**	**Criticality**	**Replacement cost**	**BAH**	**Last 15% End of life**	**Criticality weight**	**End of life risk score**
8	1	15	12	A	£1,000	100%	1	5	5000
	2	65	60	B	£10,000	100%	1	4	40000
	3	35	35	C	£20,000	100%	1	3	60000
	4	30	23	D	£5,000	100%	1	2	10000
								End of AMP8 risk score	115000
								End of AMP8 normalised risk score	**1.05**
End of AMP	**Asset**	**Effective age**	**Asset Life**	**Criticality**	**Replacement cost**	**BAH**	**Last 15% End of life**	**Criticality weight**	**End of life risk score**
9	1	20	12	A	£1,000	100%	1	5	5000
	2	70	60	B	£10,000	100%	1	4	40000
	3	40	35	C	£20,000	100%	1	3	60000
	4	35	23	D	£5,000	100%	1	2	10000
								End of AMP9 risk score	115000
								End of AMP9 normalised risk score	**1.05**

Source: UUW analysis

Table 33: Risk forecast assessment methodology on four assets over two investment periods (with investment)

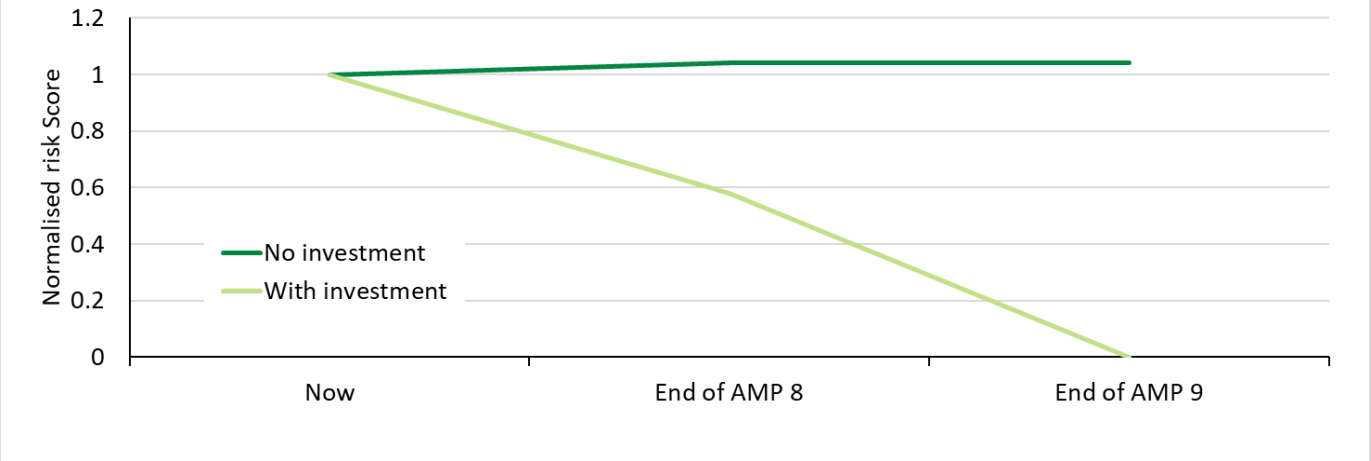
With investment (grey highlighting indicates investment)

End of AMP	Asset	Effective age	Asset Life	Criticality	Replacement cost	BAH	Last 15% End of life	Criticality weight	End of life risk score
8	1	15	12	A	£1,000	100%	1	5	5000
	2	0	60	B	£10,000	0%	0	4	0
	3	35	35	C	£20,000	100%	1	3	60000
	4	0	23	D	£5,000	0%	0	2	0
								End of AMP8 risk score	65000
								End of AMP8 normalised risk score	**0.59**
End of AMP	**Asset**	**Effective age**	**Asset Life**	**Criticality**	**Replacement cost**	**BAH**	**Last 15% End of life**	**Criticality weight**	**End of life risk score**
9	1	0	12	A	£1,000	0%	0	5	0
	2	5	60	B	£10,000	8%	0	4	0
	3	0	35	C	£20,000	0%	0	3	0
	4	5	23	D	£5,000	22%	0	2	0
								End of AMP9 risk score	0
								End of AMP9 normalised risk score	**0.00**

Source: UUW analysis

The above example (no investment) as described in Table 32, and the related example (with investment) as described in Table 33 would result in the following changes over time in underlying asset health risk across the portfolio of assets, as shown in Figure 24.

Figure 24: Risk change over time



Source: UUW analysis

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