UUW89

Long Term Strategies

October 2023

Data Table Commentaries

This document provides a commentary and supporting information for the Long Term Strategy PR24 data tables

United Utilities

Water for the North West

Executive Summary

Long-term delivery strategy

Our long-term delivery strategy (LTDS) outlines stretching long-term ambitions, informed by robust customer and stakeholder research, across water and wastewater. Our ambitions mean we can meet statutory targets and deliver further in the areas customers have told us are a priority for them. Our long-term ambitions are largely aligned with the outcomes described in our statutory planning frameworks, however in some cases we've identified opportunities to deliver performance beyond that previously described.

Regular, in depth conversations with customers and stakeholders have shaped our vision and ambitions for this plan and the longer term. We undertake continuous research throughout the year as well as bespoke research projects to understand customer preferences. We've used an independent consultancy to triangulate insight from a wide range of internal, industry and regulator projects as well as operational data to track priorities over time. In addition we have carried out a number of bespoke research projects to understand ambitions and investment priorities for the longer term. This has directly shaped the ambitions and investment proposed in AMP8 and the long-term.

We have adapted our approach to long-term planning in response to customer feedback and guidance. We have embraced adaptive planning as an approach which allows us to test a range of future scenarios to account for uncertainty and provides a systematic approach to plan for how we might adapt programmes in the future to meet long-term ambitions under different circumstances.

Through scenario testing, we have been able to prioritise low regrets activities in the short-term, preparing ourselves for future needs without investing unnecessarily or prematurely but taking action where it is clearly necessary and good value. This is presented through a 'core pathway' reflecting the most likely investment but which keeps other options open to manage future uncertainty (see LS3 - Wholesale water totex enhancement expenditure by purpose, core pathway and LS4 - Wholesale wastewater totex enhancement expenditure by purpose, core pathway). We have considered the uncertainty associated with particularly complex issues including climate change, population growth, technology, and abstraction reduction needs. The impacts of these drivers for change are presented through 'alternative pathways' (LS3a-i, LS4a-i -enhancement expenditure by purpose, alternative pathways, and summarised for all scenarios in LS5 and LS6). Our approach to developing the LTDS and adaptive plans are described in detail in our *Long-Term Delivery Strategy.*

Performance in AMP8 and over the long-term will be delivered through a combination of base expenditure to operate and maintain existing capacities, going beyond this where possible to deliver further stretch through base, and enhancement expenditure where we identified further investment need beyond base relating to delivering a new level of service or requirement.

Planning for the long-term has supported us in defining our performance targets for AMP8 and identifying the key enhancements required in the next 5 years. For example, prioritising sustainable drainage and monitoring impacts before investing in more traditional assets; or carrying out modelling and investigations to ensure longer term solutions are best value.

The proposed AMP8 performance commitment levels (PCLs) for each performance commitment have been considered in the context of our long-term delivery strategy, including pace and affordability, supporting customers' escalated ambitions and priorities for the water environment, climate change, nature and resilient services. Through this process we have confidence that our AMP8 investment is efficient, well targeted and low regrets.

We have calculated bill impacts associated with both the core and alternative pathways to 2050 (LS7). We recognise that the LTDS presents a step change in the scale and pace of investment from AMP8 onwards. This is primarily driven by the delivery of the requirements of the Governments' Storm Overflow Discharge Reduction Plan. We recognise that such increases in bills raise profound challenges for customers in the North West

across the board. Whilst we have a huge amount of support in place for those who struggle the most, the changes to bills will impact all customers.

There are significant uncertainties in the bill impacts presented, there are likely to be efficiencies in the future resulting from innovation and the increased availability of technology. Whilst we have accounted for some of these through our technology alternative pathways there will be other unknown efficiencies, which it would be premature to make assumptions about today that will lead to further efficiencies in costs. Additionally, looking to the energy sector, it is likely that changes in bills will lead to demand side reactions and improve the cost-benefit of household measures to reduce water use beyond our assumptions in core and alternative pathways, consequently offsetting some of the forecast increases in bills. These factors are highly uncertain and will be considered in future planning ahead of PR29. Meanwhile, in AMP8 we are continuing our sector leading support for customers struggling to afford water bills and this will remain a priority over the long term to ensure the delivery of affordable water services remains a priority in all future scenarios.

Alignment across submissions

In developing the long-term delivery strategy (LTDS) we have brought together outputs from across our statutory plans and other submissions including DWMP, WRMP, LTWQ and WINEP. In bringing these together and undertaking scenario analysis we have found opportunities to further optimise our plans for the long-term, either through delivering more stretching targets or through delivering outcomes more efficiently and changes in spend profiles. The result of further maturing our plans for PR24 and in the LTDS means that in some cases the data presented through previous submissions differs from that in the LTS tables

Note on forecasts

Forecasts are not guarantees of future performance or cost. There are a number of factors, many of which are beyond reasonable management control that could cause performance and costs to differ materially.

The Long Term Strategies commentary contains certain forward-looking statements with respect to the operations, plans and objectives, performance and financial condition of the group. By their nature, these statements involve uncertainty since future events and circumstances can cause results and developments to differ materially from those anticipated.

These forward-looking statements include without limitation any projections or guidance relating to the results of operations and financial conditions of the group as well as plans and objectives for future operations, expected future revenues, financing plans, expected expenditure and any strategic initiatives relating to the group, as well as discussions of our business plan and our assumptions, expectations, objectives and resilience with respect to climate scenarios.

The forward-looking statements reflect knowledge and information available at the date of preparation of the Long Term Strategies commentary and the company undertakes no obligation to update these forward-looking statements. Nothing the Long Term Strategies commentary should be construed as a profit forecast. Certain regulatory performance data contained in the Long Term Strategies commentary is subject to regulatory audit.

Contents

1. LS1 and LS2 – Combined commentary for tables LS1 (forecast outcomes) and LS2 (forecast outcomes from base expenditure)

1.1 Summary

1.1.1 The forecast outcomes presented in LS1 represent the most likely glide path for performance, demonstrating the ambitions we aim to deliver under the core pathway from total expenditure. The forecast outcomes presented in LS2 represent the performance we aim to deliver under the core pathway from base expenditure The outlined performance demonstrates stretching long-term targets against challenging future operating circumstances, particularly as a result of additional pressures from climate change and population growth. In reality each of these long-term forecasts has a range or an envelope of potential performance given that the further into the future we forecast outcomes, the greater the uncertainty. We have chosen stretching ambitions within our LTDS and these are presented through LS1 and LS2.

1.1.2 Whilst most outcomes show a continual trend for service level improvements over time, some outcomes show a change in the rate of service level improvement, these are described on a line by line below.

1.1.3 In line with the final LTDS guidance and subsequent table query responses we have not included forecasts for compliance or comparative performance lines (LS1.2 (compliance risk index) and LS1.14 (discharge permit compliance)).

1.1.4 Lines LS1.21 - 30 and LS2.21 - 30 inclusive are not applicable for *UUW* and have been intentionally left blank.

1.1.5 The profiles presented are not delivery profiles and do not consider supply chain optimisation or location specific option design and implementation which could lead to further optimisation of performance over the long-term.

1.2 Water supply interruptions

Total performance

1.2.1 Our long-term forecast outcome is to achieve our stretching ambition of 00:01:30 (hh:mm:ss) by 2050. Customers consider that a reliable service is a basic expectation of the service we offer. This is reflected in our long-term plan for improvement which reduces interruptions by 70% over the planning horizon (2025 - 2050).

1.2.2 This improvement is principally delivered by consistently driving better performance through base funding. It includes the benefits of schemes delivered through enhancement funding in addition to the performance delivered through base. We are not proposing enhancement targeting supply interruptions specifically but our forecast accounts for secondary benefits from the replacement of water mains selected in the core pathway of our LTDS for primary drivers of either mains renewal or leakage.

1.2.3 Please note we believe there is an error in the formatting of LS1.1, this line is formatted as ‘general’ from 2030 onwards and should be formatted as ‘time’ please see Figure 1 below for the suggested correction.

Figure 1: LS1.1 formatting inconsistency

	2030-31	2031-32	2032-33	2033-34	2034-35	2039-40	2044-45	2049-50
Current	0.0029099	0.0027761	0.0026861	0.0025965	0.0025318	0.0020818	0.0015041	0.0010417
Suggested	00:04:11	00:04:00	00:03:52	00:03:44	00:03:39	00:03:00	00:02:10	00:01:30

Performance from base

1.2.4 This improvement is principally delivered by consistently driving better performance through base funding, which we expect to contribute a significant proportion of our stretching ambition from total expenditure. This entails a combination of proactive and reactive expenditure, moving to increasing proactive expenditure through AMP8 and into the long-term.

1.2.5 Please note we believe there is an error in the formatting of LS2.1, this line is formatted as 'general' and should be formatted as 'time' please see Figure 2 below current line and updated format.

Figure 2: LS2.1 formatting inconsistency

	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2039-40	2044-45	2049-50
Current	0.0034771	0.00347272	0.00345681	0.00343237	0.0034089	0.00339733	0.00338575	0.00337418	0.0033626	0.00335103	0.00273612	0.00239973	0.00206335
Suggested	00:05:00	00:05:00	00:04:59	00:04:57	00:04:55	00:04:54	00:04:53	00:04:52	00:04:51	00:04:50	00:03:56	00:03:27	00:02:58

1.3 Customer contacts about water quality

Total performance

1.3.1 We have achieved a significant reduction in customer contacts since 2017 (which was established as a baseline in DWI notice UUT-2020-00005). We are committed to going further; for AMP8 as reflected in customer contacts about water quality enhancement case and our stretching 2030 target of 0.8 contacts per 1,000 population.

1.3.2 We asked customers about their preferred target for 2050 and the preferred option selected by customers was 0.4 contacts per 1,000 population. This goal – reducing contacts by half again from 2030-2050 is built into our long-term strategy and performance forecast.

1.3.3 Improvement is delivered through:

- Consistently driving better performance through base funding, for example through the continuation of our water quality first programme and catchment interventions to manage the quality of water runoff from catchment land;
- The benefits of the Vyrnwy Aqueduct Modernisation Project (VAMP) which targets a 50% reduction in discolouration contacts from zones which received more than 50% of their water from Lake Vyrnwy; and
- The secondary benefits of mains renewal options selected in our Water Resources plan to reduce leakage.

1.3.4 There are also areas where increasingly adverse external factors would, without intervention, lead to worse performance. We are proposing enhancement investment (LS3.27 & LS3.29) to offset these external factors, such that customers see the benefit of the improvements outlined above.

Performance from base

1.3.5 We forecast consistent improvement from base expenditure which we expect to contribute a significant proportion of our stretching ambition from total expenditure.

1.4 Internal sewer flooding

Total performance

1.4.1 The forecast outcome for internal sewer flooding incidents per 10,000 sewer connections is derived from the DWMP BRAVA modelling (absolute incidents) and number of sewer connections as modelled in OUT 5 line 5.1 and linearly interpolated to 2049/50. All AMP 10 to AMP 12 enhancement values are outputs from the DWMP modelling and are based upon the AMP 8 to 12 baseline position and aligned with AMP7 performance commitments and our current view of AMP8 (demonstrated through the OUT tables).

1.4.2 The profiling of long-term performance for internal sewer flooding is aligned to our DWMP preferred plan. The change in rate of service level improvement, which slows in later AMPs, is driven by the increasing challenge to capacity posed by climate change. Our models do not yet account for the potential multiple benefits delivered by surface water management and sustainable drainage which we anticipate will deliver further improvements in performance over the long-term. Through our rainwater management enhancement case we propose investment during AMP8 to manage surface water. Monitoring and measuring the impact of this investment will inform and allow us to adapt our future delivery profiles for this measure.

Performance from base

1.4.3 Performance from base expenditure for internal sewer flooding includes investment to maintain a stable level of performance. The baseline risk for internal flooding as modelled in the BRAVA process of the DWMP shows increase in risk over the long-term resulting primarily from climate change, growth and urban creep. Within the baseline, flood risk continues to increase from present to 2050. Consequently, it becomes more challenging to maintain a stable level of performance from base expenditure over time.

1.4.4 LS2.4 shows improved performance in comparison to our DWMP forecasts from base expenditure, forecasting stable performance from end of AMP9. We assume that innovation, efficiencies in delivery from base and synergistic benefits resulting from enhancement investment in other areas and will allow us to offset the deterioration in performance resulted from climate change and growth reported in our DWMP.

1.5 External sewer flooding

Total performance

1.5.1 The forecast outcome for external sewer flooding incidents per 10,000 sewer connections is derived from the DWMP BRAVA modelling and number of sewer connections as modelled in OUT 5 line 5.8 and linearly interpolated to 2049/50.

1.5.2 All AMP 10 to AMP 12 enhancement values are outputs from the DWMP modelling and are based upon the AMP 8 to 12 baseline position and aligned with AMP7 performance commitments and our current view of AMP8 (OUT tables).

1.5.3 The profiling of long-term performance for external sewer flooding is aligned to our DWMP preferred plan. The change in rate of service level improvement, stabilises from AMP9 onwards, is driven by the increasing challenge to stabilise performance levels and offset the impact of growth and climate change. Our models do not yet account for the multiple benefits delivered by surface water management and sustainable drainage which we anticipate will deliver further improvements in performance over the long-term. Through our rainwater management enhancement case we propose investment in during AMP8 to manage surface water. Monitoring and measuring the impact of this investment will be inform and allow us to adapt our future delivery profiles for this measure.

1.5.4 In line with customer preferences the DWMP prioritised expenditure to deliver performance improvements for internal sewer flooding and pollution ahead of external sewer flooding.

Performance from base

1.5.5 Performance from base expenditure for external sewer flooding includes investment to maintain a stable level of performance from the end of AMP9 onwards. The baseline risk for internal flooding as modelled in the BRAVA process of the DWMP shows increase in risk over the long-term resulting primarily from climate change, growth and urban creep. Within the baseline, flood risk continues to increase from present to 2050. Consequently, it becomes more challenging to maintain a stable level of performance from base expenditure over time.

1.5.6 LS2.5 shows improved performance in comparison to our DWMP forecasts from base expenditure, forecasting stable performance from end of AMP9. We assume that innovation, efficiencies in delivery from base and synergistic benefits resulting from enhancement investment in other areas and will allow us to offset the deterioration in performance resulted from climate change and growth reported in our DWMP.

1.6 Biodiversity

Total performance

1.6.1 In setting the long-term forecast we considered the biodiversity assessment data available through the development of enhancement programmes and used expert ecologists to predict reasonable but stretching profiles for when these benefits would be realised. We have assumed investment in this performance commitment continues in future AMPs at a steady rate and consequently see an increase in performance as the benefits realised cumulate over time. As part of the process used to demonstrate delivery of these commitments we will complete detailed baseline assessments and post interventions assessments using the Defra metric with assessments completed by suitably trained and experienced assessors, validated by our external biodiversity advisory group.

Performance from base

1.6.2 This is assumed to be entirely delivered through enhancement expenditure. Whilst there are significant biodiversity benefits from the wider activity we deliver through base in managing catchment land, this is not reported in the specific performance commitment methodology.

1.7 Operational greenhouse gas emissions (water)

Total performance

1.7.1 Reductions since 2018/19 are a result of efficiencies to date and forecast to 2024/25.

1.7.2 Increases from water WINEP are offset in the forecast by reductions from standard enhancements and net zero enhancements selected (not in the challenge fund).

1.7.3 The standard enhancements are for leakage, water efficiency enhancement and metering.

1.7.4 The net zero enhancements selected (not in the challenge fund) that impact the water price control in AMP8 are Green Fleet (moving to electric vehicles), Property Enhancements moving to heat pumps and Net Zero Catchment Strategy Phase 1. The net zero enhancements selected (not in the challenge fund) that impact the water price control in AMP9 are peatland restoration, and woodland restoration. Work begins for both of these projects in AMP8, with Pending Issuance Units (PIU) noted in CW21 data tables, however they will only show reportable carbon benefits within AMP9.

1.7.5 All of these result in a general downward trend.

1.7.6 Note that enhancements are calculated in each AMP and the impact from that programme is forecast to continue out to 2049/50 (and beyond). This has a compounding effect where, for example, the enhancement at the start of AMP10 (2040/41) is the compounded impact of AMP7, 8, 9.

Performance from base

1.7.7 Reductions since 2018/19 are a result of efficiencies to date and forecast to 2024/25. The forecast from 2024/25 base consumption remains fairly static, with a small increase as a result of population growth.

1.7.8 Note that base takes the position that any enhancements from AMP7 form the baseline for AMP8 (2025/26). For future years the 2025/26 value is used, with population growth applied year on year from this point on. Therefore base does not include the impact of future enhancement expenditure, from AMP8 onwards.

1.8 Operational greenhouse gas emissions (wastewater)

Total performance

1.8.1 A general increasing trend can be seen for wastewater price control from 2018/29 to 2049/50, built up of the following elements.

1.8.2 An increase in consumption of electricity and chemicals as a result of AMP7 projects yet to come live (as of 2023) result in an in increase base consumption from 2023/24 onwards.

1.8.3 An increase is seen across AMP8 from wastewater WINEP, with full impact by 2032/33.

1.8.4 There is also small increase forecast forwards as a result of population growth.

1.8.5 A reduction is seen from 2027/28 to 2029/30 as a result of the cost adjustment claim for covering anaerobic digestion tanks as part of compliance with Industrial Emissions Directive (IED). Covered tanks will include some form of abatement/treatment of gases, and can therefore be classed as closed in line with CAW v17, resulting in lower emissions.

1.8.6 A reduction is seen from the net zero enhancements selected (not in the challenge fund) that impact the wastewater price control. These are Green Fleet (moving to electric vehicles for the majority of the fleet and Bioresources HGV fleet using biomethane as a fuel), Property Enhancements moving to heat pumps, Net Zero Catchment Strategy Phase 1, and fuel switching to use biogas in boilers where fossil fuel was previously used. These all start in AMP8, with full benefit seen in 2030/31.

1.8.7 Beyond 2029/30, increases and decreases in emissions are seen as a result of future WINEPs which are assumed to meet the same profile of increase in emissions as AMP8 WINEP, but magnitude applied in line with magnitude of spend from AMP8 to future AMPs.

1.8.8 For Bioresources, gas consumption increases resulting in an increase of 19,000 tCO_2e/y in 2037/38 and 2038/39 when biosolids drying process begins, before reducing to pre 2037/38 levels when combustion of these biosolids comes online. Combustion of biosolids generates heat which then acts autothermically to sustain the combustion without further need for gas. The gas demand increases again when a second drying hub comes online, resulting in an increase of ~10,000 tCO_2e/y in 2042/43, 2043/44, before dropping when a second combustion unit comes online. This same pattern repeats a third time where a further increase is seen in 2047/48 and 2048/49 for a third drying hub.

1.8.9 Note that enhancements are calculated in each AMP and the impact from that programme is forecast to continue out to 2049/50 (and beyond). This has a compounding effect where, for example, the enhancement at the start of AMP10 (2040/41) is the compounded impact of AMP7, 8, 9.

Performance from base

1.8.10 An increase in consumption of electricity and chemicals as a result of AMP7 projects yet to come live (as of 2023) result in an in increase base consumption from 2023/24 onwards. A reduction is seen from 2027/28 to 2029/30 as a result of the cost adjustment claim for covering anaerobic digestion tanks as part of compliance with Industrial Emissions Directive (IED). Covered tanks will include some form of abatement/treatment of gases, and can therefore be classed as closed in line with CAW v17, resulting in lower emissions. There is also small increase forecast forwards as a result of population growth.

1.8.11 For Bioresources, gas consumption increases resulting in an increase of 19,000 tCO_2e/y in 2037/38 and 2038/39 when biosolids drying process begins, before reducing to pre 2037/38 levels when combustion

of these biosolids comes online. Combustion of biosolids generates heat which then acts autothermically to sustain the combustion without further need for gas. The gas demand increases again when a second drying hub comes online, resulting in an increase of ~10,000 tCO_2e/y in 2042/43, 2043/44, before dropping when a second combustion unit comes on-line. This same pattern repeats a third time where a further increase is seen in 2047/48 and 2048/49 for a third drying hub.

1.8.12 Note that base takes the position that any enhancements from AMP7 form the baseline for AMP8 2025/26. For future years the 2025/26 value is used, with population growth applied year on year from this point on. Therefore base does not include the impact of future enhancement expenditure, from AMP8 onwards.

1.9 Leakage

Total performance

1.9.1 Our long-term performance for leakage is determined through our Water Resources Management Plan 2024 (WRMP24). The WRMP has assessed the supply-demand requirements to ensure water resources resilience, as well as meeting the long-term and interim leakage targets in the Government's Environmental Improvement Plan 2023.

1.9.2 Mains renewal/replacement is critical in enabling us to reduce leakage in a way that can be sustained over the longer term. In the short-term view, this could be seen as a more expensive option for leakage reduction, but it is one of the only options that will allow us to deliver the ambitious leakage reductions we are planning in our core pathway for WRMP and LTDS.

1.9.3 Please note we believe there is an error in the formatting of LS1.9, this line is formatted as 'general' and should be formatted as 'percentage' please see Figure 3 below current line and suggested format change.

Figure 3: LS1.9 formatting inconsistency

	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2039-40	2044-45	2049-50
Current	14.8 %	17.3%	19.6%	21.7%	23.8%	0.26	0.282	0.299	0.314	0.326	0.404	0.462	0.498
Suggested correction	n/a	n/a	n/a	n/a	n/a	26.0%	28.2%	29.9%	31.4%	32.6%	40.4%	46.2%	49.8%

Performance from base

1.9.4 Our long-term performance from base shows we aim to maintain leakage performance from base alone from 2031-32 onwards, base expenditure will offset the natural rate of rise. Predictive analytics applied to the vast amount of data we have on our water network will support improved leakage detection targeting and a resulting efficiency throughout AMP8, after this point performance will stabilise from base.

1.9.5 Please note we believe there is an error in the formatting of LS2.9, this line is formatted as 'general' and should be formatted as 'percentage' please see Figure 4 below current line and suggested format change.

Figure 4: LS2.9 formatting inconsistency

	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2039-40	2044-45	2049-50
Current	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.02	0.02	0.02
Suggested	1.6%	1.6%	1.6%	1.6%	1.8%	1.9%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%

1.10 Per capita consumption

Total performance

1.10.1 The forecast outcome associated with per capita consumption aligns to our WRMP preferred plan. The preferred plan, and our core pathway in the LTDS, include accelerated performance improvements in the first 4 AMPs in order to deliver against our long-term target of 110 litres per head per day by 2050.

1.10.2 Please note we believe there is an error in the formatting of LS1.10, this line is formatted as 'general' and should be formatted as 'percentage' please see Figure 5 below current line and suggested format change.

Figure 5: LS1.10 formatting inconsistency

	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2039-40	2044-45	2049-50
Current	6.7 %	7.4%	8.1%	8.9%	9.7%	0.104	0.112	0.12	0.128	0.137	0.181	0.228	0.247
Suggested	n/a	n/a	n/a	n/a	n/a	10.4%	11.2%	12.0%	12.8%	13.7%	18.1%	22.8%	24.7%

Performance from base

1.10.3 Stable improvement is forecast through base for PCC. Performance improvements will also be delivered through the actions of developers as water efficiency standards for new build homes become more stringent.

1.10.4 Please note we believe there is an error in the formatting of LS2.10, this line is formatted as 'general' and should be formatted as 'percentage' please see Figure 6below current line and suggested format change.

Figure 6: LS2.0 formatting inconsistency

	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2039-40	2044-45	2049-50
Current	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.088	0.1	0.112
Suggested	6.5%	6.9%	7.1%	7.2%	7.4%	7.5%	7.6%	7.8%	8.1%	8.3%	8.8%	10.0%	11.2%

1.11 Business demand

Total performance

1.11.1 Total business demand Forecast data for AMPs 9 - 12 aligns to our Water Resources Management Plan 2024 (WRMP24) forecast of total business consumption, including the benefits of enhancement expenditure.

1.11.2 Please note we believe there is an error in the formatting of LS1.11, this line is formatted as 'general' and should be formatted as 'percentage' please see Figure 7 below current line and suggested format change.

Figure 7: LS1.11 formatting inconsistency

	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2039-40	2044-45	2049-50
Current	4.0%	4.9%	6.1%	7.2%	8.3%	0.093	0.1	0.104	0.107	0.108	0.117	0.129	0.141
Suggested	n/a	n/a	n/a	n/a	n/a	9.3%	10.0%	10.4%	10.7%	10.8%	11.7%	12.9%	14.1%

Performance from base

1.11.3 Stable improvements are presented through base for business demand.

1.11.4 Please note we believe there is an error in the formatting of LS2.11, this line is formatted as 'general' and should be formatted as 'percentage' please see Figure 8 below current line and suggested format change.

Figure 8: LS2.11 formatting inconsistency

	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2039-40	2044-45	2049-50
Current	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.062	0.074	0.086
Suggested	3.7%	3.9%	4.2%	4.4%	4.6%	4.8%	4.9%	5.0%	5.1%	5.3%	6.2%	7.4%	8.6%

1.12 Total pollution incidents

Total performance

1.12.1 This forecast outcome is derived from the DWMP. Sewer length for this performance commitment is constant across five-year periods consistent with PR24 business plan table guidance. For 2021/22 to 2025/26, this is the sewer length value from 2017-18. For 2026/27 to 2030/31, this is the sewer length value from 2022/23. For 2031 onwards, this is forecast sewer length for sewer length in 2027/28.

1.12.2 All AMP 10 to AMP 12 post enhancement values are derived from DWMP modelling and are based upon the AMP8 to 12 baseline position and aligned with AMP7 performance commitments. The profiling of performance is derived from the decision support tool used to optimise the selection of interventions to resolve flooding, pollution and collapses. Within DWMP performance has been modelled for 2020, 2030 and 2050, a linear profile has been interpolated between these points.

1.12.3 The performance outlined for LS1.12 is aligned to that of LS2.12 as performance to improve pollution is derived entirely from base expenditure.

Performance from base

1.12.4 Performance for this measure is entirely from base.

1.13 Serious pollution incidents

Total performance

1.13.1 Performance has improved significantly for serious pollution incidents in line with the industry, achieving zero for 2019, 2020 and 2022. Pollution incidents have reduced as a result of operational improvements, enhancing our review process, investing in our people, assets and systems, to create a smarter network. Through enhanced monitoring and improved operational responses, smart networks can identify changes to normal operation which can be proactively investigated before an incident occurs. This is helping *UUW* to reduce number of pollution events and deliver on our commitments to customers and regulators.

1.13.2 Our forecast outcome for serious pollution incidents is zero from 2025 through to 2050.

Performance from base

1.13.3 Performance for this measure is entirely from base.

1.14 Bathing water quality

1.14.1 Total performance

1.14.2 The forecast performance for bathing water quality is based on the AMP7 bathing water investigations to achieving good and excellent status by 2050. As the models used in the investigation do not necessarily align with current classifications, rather than using the forecast classifications we have scored the changes in classification that have been predicted. There is 1 drop in classification and are 4 improvements in classification which equates to a 3.4% improvement on the end of AMP8 predicted position of 63% (using bathing season 2022 as a baseline).

1.14.3 Predicted improvements have been smoothed; one increase in classification in 2044/45 and 2 increases in classification 2049/50. The impacts of climate change are unknown, consequently this is a high level prediction which will be subject to ongoing monitoring and change.

1.14.4 The forecast future performance is based on the change of classification by 2050 modelled by the AMP7 Bathing Water Investigations. The change in classification is scored using the Bathing Water Quality Performance Commitment methodology.

1.14.5 Please note we believe there is an error in the formatting of LS1.15, this line is formatted as 'general' and should be formatted as 'percentage' please see Figure 9 below current line and suggested format change.

Figure 9: LS1.15 formatting inconsistency

	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2039-40	2044-45	2049-50
Current	61.8 %	61.8%	61.8%	61.8%	63.0%	0.63	0.63	0.63	0.63	0.63	0.63	0.641	0.664
Suggested	n/a	n/a	n/a	n/a	n/a	63.0%	63.0%	63.0%	63.0%	63.0%	63.0%	64.1%	66.4%

Performance from base

1.14.6 As stated in the latest PR24 Final Methodology submission table guidance Aug 23 for River Water Quality and Bathing Water performance Commitments – "we do not consider it mandatory for

companies to complete table OUT2 because performance improvements for these metrics are principally driven by enhancement expenditure". As LS2.15 is based on OUT2.15 this line has also not been completed.

1.15 River water quality

Total performance

1.15.1 The long-term strategy for this performance commitment aligns with the Environment Act target to reduce phosphorus loadings from treated wastewater by 80% by 2038. Once this target has been achieved we will continue to maintain performance.

1.15.2 The PC methodology differs to the methodology outlined by the Environment Agency for delivering river water quality performance improvements, this leads to a perceived overperformance in the forecast in LS1.16 required in order to meet the targets under the EA methodology. The projections for this measure are also subject to changes in the WINEP.

Performance from base

1.15.3 As stated in the latest PR24 Final Methodology submission table guidance Aug 23 for River Water Quality and Bathing Water performance Commitments – "we do not consider it mandatory for companies to complete table OUT2 because performance improvements for these metrics are principally driven by enhancement expenditure" As LS2.16 is based on OUT2.16 this line has also not been completed.

1.16 Storm overflows

Total performance

1.16.1 The long-term strategy for this performance commitment aligns with the Government's Storm Overflow Discharge Reduction Plan spill targets up to and including 2050. Opportunities have been identified to accelerate performance in AMP8, this results from a combination of changes to WINEP drivers for some overflows, plus both our advanced and accelerated WINEP. This results in a current profile for storm overflows which is different to that in the DWMP published in May 2023, which was based on our January WINEP submission, consequently we present a more stretching improvement compared to the performance profile outlined in the DWMP.

1.16.2 A linear projection has been used to profile annual performance between 2031 - 35, this and all future projections are subject to future WINEP and funding approvals. The 2050 performance target of below 10 is an average figure, this results from a combination of the lower spill targets at bathing water sites and design headroom being included to account for climate change.

Performance from base

1.16.3 We have included no further improvement from base after the end of AMP7 as all future improvement in this measure will be driven from enhancement funding. Maintenance of existing assets will not reduce spill frequency of storm overflows.

1.17 Mains repair

Total performance

1.17.1 Total Mains Repairs Forecast data for AMP 9 - 12 aligns to our Water Resources Management Plan 2024 (WRMP24). This provides a linear profile for performance improvement to meet our 2050 target.

Performance from base

1.17.2 Performance for this measure is entirely from base.

1.18 Unplanned outage

Total performance

1.18.1 This performance commitment assumes an 80% improvement from our 2025 target to 2050. We believe this is ambitious and will be upper quartile performance for 2050. A linear projection has been used to profile the improvement between 2025 and 2050.

1.18.2 This assumes our exclusions on this unplanned outage performance commitment are permitted.

1.18.3 Please note we believe there is an error in the formatting of LS1.19, this line is formatted as 'general' and should be formatted as 'percentage' please see Figure 10 below current line and suggested format change.

Figure 10: LS1.19 formatting inconsistency

	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2039-40	2044-45	2049-50
Current	0.65 %	0.58%	0.52%	0.46%	0.41%	0.004	0.003 9	0.003 8	0.003 7	0.003 6	0.003 1	0.002 6	0.002 1
Suggested	n/a	n/a	n/a	n/a	n/a	0.40%	0.39%	0.38%	0.37%	0.36%	0.31%	0.26%	0.21%

Performance from base

1.18.4 No enhancement is assumed to achieve our 2050 target in LS1.19 and therefore 100% of the target is delivered from base expenditure.

1.18.5 Please note we believe there is an error in the formatting of LS2.19, this line is formatted as 'general' and should be formatted as 'percentage' please see Figure 11 below current line and suggested format change.

Figure 11: LS2.19 formatting inconsistency

	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2039-40	2044-45	2049-50
Current	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0031	0.0026	0.0021
Suggested	0.65 %	0.58%	0.52%	0.46%	0.41%	0.40%	0.39%	0.38%	0.37%	0.36%	0.31%	0.26%	0.21%

1.19 Sewer collapses

Total performance

1.19.1 Our LTS profile for sewer collapses represents a linear trajectory from our end of AMP8 (i.e. 2029/30) PCL position to the DWMP optimiser 2050 position of 11.32 incidents per 1000 km of sewer.

1.19.2 The DWMP optimiser profile showed improvement in sewer collapse performance followed by deterioration. We instead believe that a stable, linear trajectory towards the DWMP 2049/50 position is a more realistic delivery profile and have therefore smoothed the profile.

Performance from base

1.19.3 No enhancement is assumed to achieve our 2050 target in LS1.20 and therefore 100% of the target is delivered from base expenditure.

1.20 Supply-side scheme benefit

Total performance

1.20.1 This forecast outcome is calculated from our WRMP. It represents the deployable output benefit of the supply-side options for the 1 in 200 year emergency drought order (EDO) until 2039 and 1 in 500 year EDO post 2039. This aligns to values provided in WRMP24 Table 8e.

Performance from base

1.20.2 All supply-side schemes are delivered through enhancement expenditure therefore the supply-side scheme benefit from base expenditure is zero.

1.21 Wastewater network storage volume delivered or avoided

Total performance

1.21.1 This forecast outcome combines the volume provided by grey storage and volume removed by SuDS solutions in our DWMP preferred plan. In order to calculate the combined volume we collated the sum total grey network storage associated with options selected by the optimiser decision support tool over a 25 planning horizon and the sum total volume removed in a one in 30 year storm associated with all of the options selected in the core plan for SuDS solutions.

Performance from base

1.21.2 All wastewater network storage schemes and avoidance of storage through surface water management and SuDS are delivered through enhancement expenditure therefore the network storage benefit from base expenditure is zero.

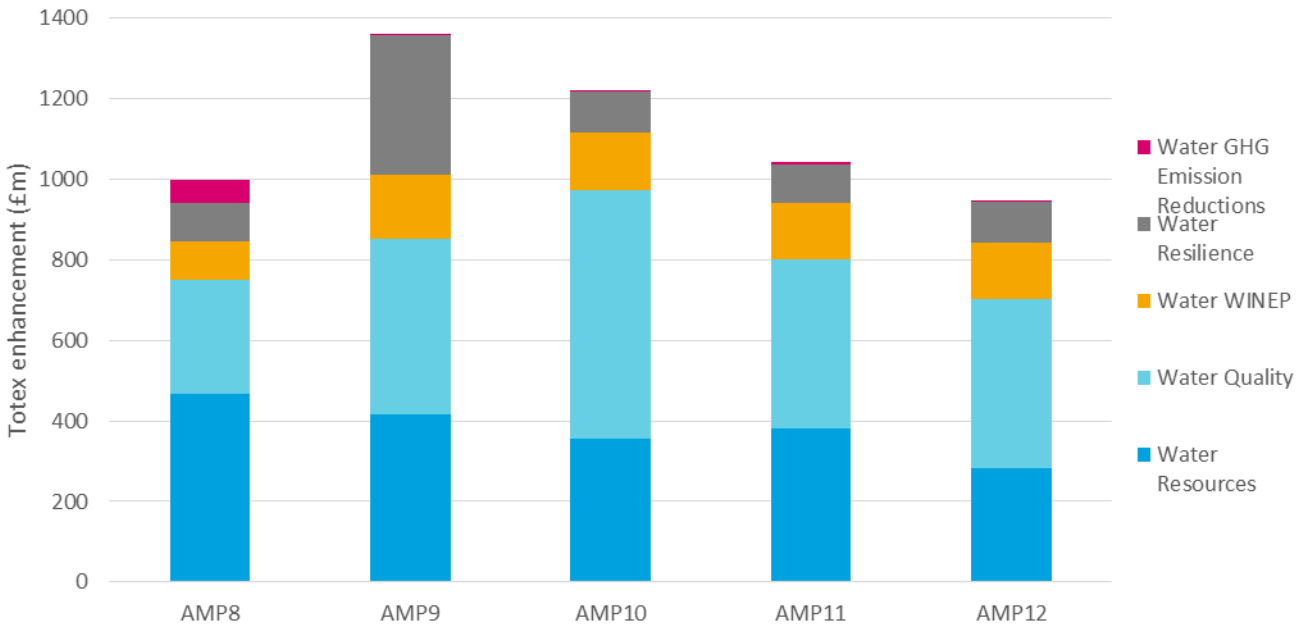
2. LS3 – Wholesale water totex enhancement expenditure by purpose, core pathway

2.1 LS3 Summary

2.1.1 Data table LS3 presents the totex enhancement expenditure associated with our Water Core Pathway. Figure 12 summarises this expenditure for AMP8 through to AMP12. The expenditure in AMP8 aligns with our PR24 Business Plan.

2.1.2 Over the period from 2025 to 2050, we currently forecast invest needs totalling circa £5.6 billion to deliver our water ambition. This covers investment in water resources, water quality, the water environment, resilience and greenhouse gas emission reduction activities. This presents our view of future costs based on current known drivers and regulation, in reality this is likely to represent our lowest possible future investment given any further requirements that are as yet unknown would lead to increases in cost.

Figure 12: Totex enhancement expenditure in our Water Core Pathway by expenditure grouping



Enhancement expenditure that we have proportionally allocated between data table lines

2.1.3 The expenditure associated with LS3.28 and LS3.30 is summed together and reported in line LS3.5.

2.1.4 The expenditure associated with investigations is reported as one line in LS3.12.

2.1.5 This approach avoids double counting of enhancement expenditure.

How we have used additional lines in LS3

2.1.6 Our use of additional lines in LS3 is as follows:

- LS3.40, additional line 1: Environmental destination. This captures enhancement spend in AMP9 that is associated with the 25 Year Environment Plan;
- LS3.41, additional line 2: Strategic Regional Water Resources Options. This captures enhancement spread associated with Strategic Regional Water Resources Options in order to distinguish this from other supply-side enhancements;
- LS3.42, additional line 3: Innovation. This captures enhancement spread associated with AMP7 investment only;

- LS3.43, additional line 4: Concessionary Supplies. This captures enhancement spread associated with AMP7 investment only; and
- LS3.44, additional line 5: this line is intentionally left blank.

Other notes

2.1.7 Our estimates include ongoing operating expenditure. This means that if a new asset is constructed in AMP9, we include operating expenditure for that asset in AMP10, AMP11 and AMP12. We do not include estimates for capital maintenance (replacement and major refurbishment of assets).

2.1.8 Our estimated expenditure is derived from a number of sources, the assumptions applied for each expenditure type are outlined in Section 2.2. For the core pathway, AMP8 data, in all cases, aligns to that presented in CW3.

2.1.9 Assumptions outlined will continue to be monitored and updated at least once per AMP in line with cyclical LTDS updates.

2.2 Price base 2022-23 FYA (CPIH deflated) - Water enhancement expenditure by purpose ~ totex

LS3.1 Water enhancement totex (core pathway); Biodiversity and conservation

2.2.1 AMP8 data from CW3.

2.2.2 Beyond AMP8, there are no confirmed changes to regulatory expectations for WINEP spend in this area and therefore we assume our AMP8 enhancement expenditure will continue in future AMPs at the same rate.

2.2.3 AMP9 expenditure also includes some AMP8 carryover investment.

LS3.2 Water enhancement totex (core pathway); Eels/fish entrainment screens

2.2.4 AMP8 data from CW3.

2.2.5 We have estimated enhancement costs for AMP9 based on the average cost of eel schemes in AMP8 and the number of AMP8 eel investigations. We assume the AMP8 investigations lead to AMP9 schemes at a similar scale and cost to those delivered historically.

2.2.6 We currently forecast zero spend in AMPs 10 - 12. The Environment Agency may request that we address low priority sites however we consider the uncertainty too high to forecast costs at this time.

LS3.3 Water enhancement totex (core pathway); Eels/fish passes

2.2.7 AMP8 data from CW3.

2.2.8 We anticipate there will be a requirement for spend against this line in AMP9 and beyond but there is uncertainty around the number of schemes which will be required. We have assumed the future enhancement expenditure required will be less than in AMP8 with 1x scheme in each of AMPs9 - 12 based on the average cost of the schemes costed for AMP8.

LS3.4 Water enhancement totex (core pathway); Invasive Non Native Species

2.2.9 AMP8 data from CW3.

2.2.10 Beyond AMP8, there are no confirmed changes to regulatory expectations for WINEP spend in this area and therefore we assume our AMP8 enhancement expenditure will continue in future AMPs at the same rate.

LS3.5 Water enhancement totex (core pathway); Drinking Water Protected Areas

2.2.11 AMP8 data from CW3.

2.2.12 Beyond AMP8, the expenditure is derived based on an assessment of the water quality substances at risk in each catchment and an expected timescale for when these would reach a threshold that required investment in the catchment. We also looked at the priority for investing in these catchments, the

length of time it would take to establish relationships and how successful we could be in bringing about a change in water quality.

2.2.13 For example, the River Lune catchment covers a very large area but water from the catchment is not always used (the preference is to use other sources due to relative water quality). We predicted that in future the water may be needed more and therefore a programme of interventions would be needed by 2035.

LS3.6 Water enhancement totex (core pathway); Water Framework Directive

2.2.14 AMP8 data from CW3.

2.2.15 Beyond AMP8, there are no confirmed changes to regulatory expectations for WINEP spend in this area and therefore we assume our AMP8 enhancement expenditure will continue in future AMPs at the same rate.

LS3.7 Water enhancement totex (core pathway); Wetland creation

2.2.16 AMP8 data from CW3.

2.2.17 There is no current guidance indicating the need for enhancement expenditure against this line in AMPs 9-12 for the water price control. Enhancement expenditure related to wetland delivery on peatland is covered in LS3.1.

LS3.8 Water enhancement totex (core pathway); Trade effluent discharge flow monitoring

2.2.18 AMP8 data from CW3.

2.2.19 We currently do not expect further enhancement expenditure against this line in AMP9-12. We have completed a review which confirmed that existing requirements have been met.

LS3.9 Water enhancement totex (core pathway); 25 year environment plan

2.2.20 AMP8 data from CW3.

2.2.21 We anticipate there will be a requirement for some spend against this line in AMP9 and beyond. We have therefore assumed 2x schemes in each of AMP9-12 based on the mean cost of AMP8 water catchment schemes.

LS3.10 Water enhancement totex (core pathway); Investigations (WINEP/NEP) - desk based study only

2.2.22 AMP8 data from CW3.

2.2.23 All our investigations fall under the category of multiple surveys, and/or monitoring locations, and/or complex modelling water.

LS3.11 Water enhancement totex (core pathway); Investigations (WINEP/NEP) - survey, monitoring or simple modelling

2.2.24 AMP8 data from CW3.

2.2.25 All our investigations fall under the category of multiple surveys, and/or monitoring locations, and/or complex modelling water.

LS3.12 Investigations; (WINEP/NEP) - multiple surveys, and/or monitoring locations, and/or complex modelling water totex

2.2.26 AMP8 data from CW3.

2.2.27 Beyond AMP8, there are no confirmed changes to regulatory expectations for WINEP spend in this area and therefore we assume our AMP8 enhancement expenditure will continue in future AMPs at the same rate.

LS3.13 Water enhancement totex (core pathway); Supply-side improvements

2.2.28 AMP8 data is consistent with CW3 for demand and supply, and CW7 for metering lines.

2.2.29 Programmes are aligned to the WRMP24 submission and later years reflect the WRMP costs at an uplifted price base, and with reduced capital overhead as a result of cost efficiency identification in the price review process.

2.2.30 Please refer to commentaries for CW3, CW8 and CW7 for further detail.

LS3.14 Water enhancement totex (core pathway); Demand-side improvements (excluding leakage and metering)

2.2.31 AMP8 data is consistent with CW3 for demand and supply, and CW7 for metering lines.

2.2.32 Programmes are aligned to the WRMP24 submission and later years reflect the WRMP costs at an uplifted price base, and with reduced capital overhead as a result of cost efficiency identification in the price review process.

2.2.33 Please refer to commentaries for CW3, CW8 and CW7 for further detail.

LS3.15 Water enhancement totex (core pathway); Leakage improvements

2.2.34 AMP8 data is consistent with CW3 for demand and supply, and CW7 for metering lines.

2.2.35 Programmes are aligned to the WRMP24 submission and later years reflect the WRMP costs at an uplifted price base, and with reduced capital overhead as a result of cost efficiency identification in the price review process.

2.2.36 Please refer to commentaries for CW3, CW8 and CW7 for further detail.

LS3.16 Water enhancement totex (core pathway); Internal interconnectors

2.2.37 AMP8 data from CW3.

2.2.38 There are no planned internal interconnector schemes.

LS3.17 Water enhancement totex (core pathway); New meters requested by existing customers (optants)

2.2.39 AMP8 data is consistent with CW3 for demand and supply, and CW7 for metering lines.

2.2.40 Programmes are aligned to the WRMP24 submission and later years reflect the WRMP costs at an uplifted price base, and with reduced capital overhead as a result of cost efficiency identification in the price review process.

2.2.41 Please refer to commentaries for CW3, CW8 and CW7 for further detail.

LS3.18 New meters introduced by companies for existing customers; metering totex

2.2.42 AMP8 data is consistent with CW3 for demand and supply, and CW7 for metering lines.

2.2.43 Programmes are aligned to the WRMP24 submission and later years reflect the WRMP costs at an uplifted price base, and with reduced capital overhead as a result of cost efficiency identification in the price review process.

2.2.44 Please refer to commentaries for CW3, CW8 and CW7 for further detail.

LS3.19 Water enhancement totex (core pathway); New meters for existing customers – business

2.2.45 AMP8 data is consistent with CW3 for demand and supply, and CW7 for metering lines.

2.2.46 Programmes are aligned to the WRMP24 submission and later years reflect the WRMP costs at an uplifted price base, and with reduced capital overhead as a result of cost efficiency identification in the price review process.

2.2.47 Please refer to commentaries for CW3, CW8 and CW7 for further detail.

LS3.20 Water enhancement totex (core pathway); Replacement of existing basic meters with AMR meters for residential customers

2.2.48 There are no planned AMR options within the programme.

2.2.49 LS3.21Water enhancement totex (core pathway); Replacement of existing basic meters with AMI meters for residential customers

2.2.50 AMP8 data is consistent with CW3 for demand and supply, and CW7 for metering lines.

2.2.51 Programmes are aligned to the WRMP24 submission and later years reflect the WRMP costs at an uplifted price base, and with reduced capital overhead as a result of cost efficiency identification in the price review process.

2.2.52 Please refer to commentaries for CW3, CW8 and CW7 for further detail.

LS3.22 Water enhancement totex (core pathway); Replacement of existing AMR meters with AMI meters for residential customers

2.2.53 AMP8 data is consistent with CW3 for demand and supply, and CW7 for metering lines.

2.2.54 Programmes are aligned to the WRMP24 submission and later years reflect the WRMP costs at an uplifted price base, and with reduced capital overhead as a result of cost efficiency identification in the price review process.

2.2.55 Please refer to commentaries for CW3, CW8 and CW7 for further detail.

LS3.23 Water enhancement totex (core pathway); Replacement of existing basic meters with AMR meters for business customers

2.2.56 There are no planned AMR options within the programme

LS3.24 Water enhancement totex (core pathway); Replacement of existing basic meters with AMI meters for business customers

2.2.57 AMP8 data is consistent with CW3 for demand and supply, and CW7 for metering lines.

2.2.58 Programmes are aligned to the WRMP24 submission and later years reflect the WRMP costs at an uplifted price base, and with reduced capital overhead as a result of cost efficiency identification in the price review process.

2.2.59 Please refer to commentaries for CW3, CW8 and CW7 for further detail.

LS3.25 Water enhancement totex (core pathway); Replacement of existing AMR meters with AMI meters for business customers

2.2.60 AMP8 data is consistent with CW3 for demand and supply, and CW7 for metering lines.

2.2.61 Programmes are aligned to the WRMP24 submission and later years reflect the WRMP costs at an uplifted price base, and with reduced capital overhead as a result of cost efficiency identification in the price review process.

2.2.62 Please refer to commentaries for CW3, CW8 and CW7 for further detail.

LS3.26 Water enhancement totex (core pathway); Smart meter infrastructure

2.2.63 AMP8 data is consistent with CW3 for demand and supply, and CW7 for metering lines.

2.2.64 Programmes are aligned to the WRMP24 submission and later years reflect the WRMP costs at an uplifted price base, and with reduced capital overhead as a result of cost efficiency identification in the price review process.

2.2.65 Please refer to commentaries for CW3, CW8 and CW7 for further detail.

LS3.27 Water enhancement totex (core pathway); Improvements to taste, odour and colour (grey solutions)

2.2.66 AMP8 data from CW3.

2.2.67 We don’t currently anticipate any capital enhancement expenditure beyond AMP8.

LS3.28 Water enhancement totex (core pathway); Improvements to taste, odour and colour (green solutions)

2.2.68 AMP8 data from CW3.

2.2.69 Enhancement expenditure associated with this line is reported in LS3.5.

LS3.29 Water enhancement totex (core pathway); Addressing raw water quality deterioration (grey solutions)

2.2.70 AMP8 data from CW3.

2.2.71 This line covers enhancement expenditure for additional treatment necessary to address raw water deterioration. This includes raw water colour increase and the presence of PFAS compounds in raw water. An example is the installation of a clarification treatment stage at a direct filtration water treatment works, where raw water colour has exceeded the design of the existing direct filtration process. We have previously invested heavily in catchment management and continue to do so to minimise the need for grey solutions, the sites proposed for grey solutions are those at which we have already invested in the catchment but continue to see deteriorating raw water quality.

LS3.30 Water enhancement totex (core pathway); Addressing raw water quality deterioration (green solutions)

2.2.72 AMP8 data from CW3.

2.2.73 Enhancement expenditure associated with this line is reported in LS3.5.

LS3.31 Water enhancement totex (core pathway); Conditioning water to reduce plumbosolvency

2.2.74 AMP8 data from CW3.

2.2.75 We currently have no forecast enhancement funding for this line

LS3.32 Water enhancement totex (core pathway); Lead communication pipes replaced or relined for water quality

2.2.76 AMP8 data from CW3.

2.2.77 Our long term enhancement expenditure is a function of cost and replacement profile.

2.2.78 Costs are a mid-point estimate consistent with our AMP8 enhancement proposal.

2.2.79 Our Core Pathway for lead pipe replacement between 2030 and 2050 follows an ‘S’- profile to achieve our long term ambition of removing all lead pipes by 2070. Replacements will accelerate through the first half of the planning horizon as the industry and supply chain responds to the step change in demand. We expect the rate of replacements to peak in AMP11 and reduce thereafter. This is because our plans allow more time for more complex replacements as the overall population of remaining lead pipes reduces.

LS3.33 Water enhancement totex (core pathway); External lead supply pipes replaced or relined

2.2.80 AMP8 data from CW3.

2.2.81 Full lead replacement (replacing the supply pipe at the same time as the communication pipe) has clear water quality and efficiency benefits. Therefore our long term replacement profile for supply pipes mirrors that outlined for communication pipes above.

2.2.82 Our grant scheme has proven very successful in AMP7 and we propose continuing in AMP8 and beyond (with refinements to expand the reach of the scheme to a larger and more diverse range of customers). For the purposes of completing this line and LS3.34 we allocate the value evenly between external and internal pipes, reflecting that external pipes are longer but internal work is more complicated.

LS3.34 Water enhancement totex (core pathway); Internal lead supply pipes replaced or relined

2.2.83 AMP8 data from CW3.

2.2.84 The values in this line are the same as external lead supply pipes replaced or relined because the profile is the same. For the purposes of completing this line and LS3.33 we allocate the value evenly between external and internal pipes, reflecting that external pipes are longer but internal work is more complicated.

LS3.35 Water enhancement totex (core pathway); Other lead reduction related activity

2.2.85 AMP8 data from CW3.

2.2.86 We have not included planned enhancement in this category for this submission. Activities to expedite lead risk reduction (innovation, engagement etc.) are treated as business-as-usual expenditure.

LS3.36 Water enhancement totex (core pathway); Resilience

2.2.87 AMP8 data from CW3.

2.2.88 Beyond AMP8, we currently expect to invest in improving the resilience of our assets from surface, river and coastal flooding. In addition, we expect to need to further protect assets from the risks of coastal and river erosion processes following on from investigation work to be completed in AMP8.

2.2.89 We will continue to manage the delivery of our Haweswater Aqueduct DPC programme. Building on our experience and learning from our ongoing HARP DPC and VAMP aqueduct projects we have identified that in AMP9 investment in the Vyrnwy Raw Water Aqueduct will be required to maintain service resilience across the Strategic Zone. In this submission we have included this as enhancement investment but will consider, in AMP8, the best delivery route. If DPC is selected then the costs other than the management of the project will be excluded from this line.

2.2.90 We have identified assets at risk of flooding using Environment Agency data sets and applied a calculation to estimate the costs of delivery of flood resilience solutions. We have used Environment Agency unit cost estimates and design guides for the construction of flood embankments. These estimates allow for economies of scale such that delivering a high volume embankment may be cheaper at a unit rate, than a low volume embankment. The perimeter/scale of the flood embankments has been determined as the smallest total volume possible to protect the assets/sites identified as at risk. The delivery profile has been determined based on risk cohorts, i.e. sites with the same service criticality and level of flood risk, we recognise that this could lead to peaky investment profile as there tends to be more assets in certain risk cohorts.

2.2.91 We have chosen to delay initial investment to at least AMP9 for the highest risk sites on the basis of the pending release of new information from the Environment Agency. The National Flood Risk Assessment (NaFRA) is due to be released in 2024 and we will re-review the risk and delivery profile using the latest and best information.

LS3.37 Water enhancement totex (core pathway); Security – SEMD

2.2.92 AMP8 data from CW3.

2.2.93 We have estimated expenditure for AMP9-12 based on planned work to meet the security and emergency measures directive (SEMD) requirements, specifically in relation to critical national infrastructure installs and refurbishments. We have based this estimate on our previous projects.

LS3.38 Water enhancement totex (core pathway); Security – Cyber

2.2.94 AMP8 data from CW3.

2.2.95 The DWI has intimated that they will continually challenge the industry to constantly improve maturity of cyber security. The forecasted costs for AMP9 – AMP12 have been built to allow for ongoing investment for potential changes in scope, technology refresh and any regulatory changes.

LS3.39 Water enhancement totex (core pathway); Greenhouse gas reduction (net zero)

2.2.96 Our AMP8 cost relates to the net zero enhancement programme (CW21 and CWW22).

2.2.97 In AMP9-12, we have estimated the expenditure required to abate operational greenhouse gas emissions using benchmarks from existing programmes of work.

2.2.98 All other LS3 expenditure has been summed, and then factors applied to capex and opex to estimate tCO_2e per £k of spend. Further factor then applied for expenditure required to remove 1 tCO_2e.

2.2.99 For AMP9-12 the line represents the cost to mitigate the operational emissions associated with the enhancement expenditure outlined within this table, i.e. an estimated cost to maintain stable operational emissions in the face of growth pressures from enhancements. From AMP9 onwards we've used the central government estimate for the price to mitigate each tonne of GHG emissions - this is a national generic cost, and for example, much lower than the comparative CCC cost estimate for offsetting process emissions. Consequently the cost of GHG emission reduction is highly uncertain and likely to increase in future AMPs with more certainty and clarification on specific costs. This line does not reflect the much larger cost likely to achieve net zero by 2050 in scopes 1, 2 and 3.

LS3.40 Water enhancement totex (core pathway); Environmental destination (WINEP)

2.2.100 AMP8 data from CW3.

2.2.101 We have included this additional line to reflect expenditure associated with implementing actions arising from AMP8 investigations related to the Environmental Destination driver.

2.2.102 We estimate the cost of these schemes to be £1m annually in AMP9 (then uplifted to 22-23 prices). We expect an uplift in this expenditure in AMP10 and therefore forecast £2m annually in AMP10, AMP11 and AMP12. Costs put forward are driven by nature based solutions. We expect changes to our abstractions to be funded under the Water Framework Directive driver.

2.2.103 Uncertainty in the projected costs exists due to the appraisal of other options that may be required to accommodate longer term licence reductions e.g. network reconfiguration. At this time we are unable to account for projected costs associated with this.

LS3.41 Water enhancement totex (core pathway); Strategic Water Resources

2.2.104 This expenditure type is included to report AMP7 investment only.

LS3.42 Water enhancement totex (core pathway); Innovation

2.2.105 This expenditure type is included to report AMP7 investment only.

LS3.43 Water enhancement totex (core pathway); Concessionary Supplies

2.2.106 This expenditure type is included to report AMP7 investment only.

LS3.44 Water enhancement totex (core pathway); Additional line 5

2.2.107 Not used.

LS3.45 Total water enhancement totex - core pathway

2.2.108 Auto-populated line. Sum of all other lines in LS3

3. LS3a-i – Wholesale water totex enhancement expenditure by purpose, alternative pathways

3.1 Whole table

3.1.1 Please note this table series presents change in expenditure as compared to the core pathway. Our commentary describes how total expenditure changes.

3.2 General approach

Our alternative pathways for water enhancement totex

3.2.1 Our alternative pathways associated with water enhancement are as follows:

- LS3a: adverse climate change CRS;
- LS3b: benign climate change CRS;
- LS3c: adverse demand CRS;
- LS3d: adverse (slow) technology CRS;
- LS3e: benign (fast) technology CRS;
- LS3f: alternative transfer 1 (one of our wider scenarios);
- LS3g: alternative transfer 2 (one of our wider scenarios);
- LS3h: adverse expectations (one of our wider scenarios); and
- LS3i: intentionally left blank.

3.2.2 Our testing indicates that we currently do not expect the need for alternative pathways under the benign demand CRS, or the benign or adverse abstraction reduction CRSs.

Alternative pathways with expenditure in the 2025-30 period

3.2.3 Of the scenarios tested, only the Adverse Demand common reference scenario (CRS) has the potential to require expenditure in AMP8 for water. This is because we expect any delay in the implementation of water labelling (as the adverse demand CRS includes) would necessitate significant additional expenditure which has lead times that necessitate commencement in AMP8. Our testing shows that delaying expenditure beyond AMP8 in this scenario would jeopardise the achievement of our long term demand ambitions.

Trigger point, decision point and likelihood

3.2.4 Tables LS3a-i require that we populate a decision year, most likely trigger year and likelihood (as percentage).

3.2.5 For each of the tables LS3a-i, we have populated the decision and likely trigger year based on the first time that we year that we see a potential change in enhancement expenditure from the core pathway across Lines LS3.1 to LS3.44. These lines cover multiple parts of our business, for example investment to reduce greenhouse gas emissions, investments for water resources and investments to improve drinking water quality. It may therefore be the case that additional decision and trigger points may be required in later years. Only the earliest decision and trigger points are populated.

3.2.6 Our approach to long-term planning aims to ensure we can deliver our ambition under a rage of plausible futures. We do not believe that applying a percentage likelihood to futures is particularly useful as it is inherently inaccurate and uncertain and could be misleading. Moreover we find that different expenditure groupings have different triggers, happening at different times, for example different aspects of ‘climate change’ cause triggers for both water resources and water quality. We have

therefore taken the following approach to meeting the requirement to state a percentage likelihood for each alternative scenario:

- 10% = very low likelihood;
- 25% = low likelihood;
- 50% = medium likelihood;
- 75% = high likelihood; and
- 90% = very high likelihood.

3.2.7 The following tables presents our assumptions in estimating expenditure across LS3a - i where there is a change from the Core Pathway (LS3) only.

3.3 LS3a: Adverse Climate Change

LS3a.7 Water enhancement totex; Invasive Non Native Species

3.3.1 From AMP10 onwards, we assume a 20% increase on AMP8 investment to manage additional pressures on INNS related to more severe climate change.

LS3a.8 Water enhancement totex; Drinking Water Protected Areas

3.3.2 From AMP9 onwards, we assume a 20% increase on AMP8 investment to manage additional pressures related to more severe climate change such as soil erosion associated with more severe rainfall events.

LS3a.18 Water enhancement totex; Leakage improvements

3.3.3 Some slight changes to the preferred plan, including the acceleration of mains renewal by 1 year (2037 to 2036) and in 2049, pressure management is no longer selected.

LS3a.30 Water enhancement totex; Improvements to taste, odour and colour (grey solutions)

3.3.4 This pathway accelerates investment in additional treatment to address taste and odour issues due to the presence of geosmin and 2 - Methylisoborneol (2-MIB) in raw water. Research has shown correlation between temperature peaks and the production of geosmin / 2 - MIB compounds. Therefore taste and odour issues are expected to be exacerbated under the adverse climate change pathway.

LS3a.32 Water enhancement totex; Addressing raw water quality deterioration (grey solutions)

3.3.5 This pathway accelerates investment in additional treatment to address increasing raw water colour. Correlation between temperature and rainfall and raw water colour has been shown. Therefore raw water colour is expected to increase at a faster rate under the adverse climate change pathway.

LS3a.39 Water enhancement totex; Resilience

3.3.6 This pathways includes additional investment to provide flood resilience to our sites to address increasing flood risk associated with more severe climate change, and for increased levels of coastal and river erosion also resulting from further climate change.

3.3.7 Climate change uplifts have been determined per river management area from the Defra Hydrology Data Explorer, and are adjusted for multiple scenarios as per guidance from UK Climate Risk.

LS3a.42 Water enhancement totex; Greenhouse gas reduction (net zero)

3.3.8 The way we calculate investment to address greenhouse gas emissions matches the approach followed in the Core Pathway but for the investment expected under this scenario.

LS3a.43 Water enhancement totex; Environmental Destination

3.3.9 From AMP9 onwards, we assume an increase in investment to manage additional pressures on factors associated with Environmental Destination.

3.4 LS3b: Benign Climate Change

LS3b.32 Water enhancement totex; Addressing raw water quality deterioration (grey solutions)

3.4.1 This pathway delays investment in additional treatment to address increasing raw water colour. Correlation between temperature, rainfall and raw water colour has been shown. Therefore raw water colour is expected to increase at a slower rate under the benign climate change pathway.

LS3b.42 Water enhancement totex; Greenhouse gas reduction (net zero)

3.4.2 The way we calculate investment to address greenhouse gas emissions matches the approach followed in the Core Pathway but for the investment expected under this scenario.

3.5 LS3c: Adverse Demand

LSc3.17 Water enhancement totex; Demand-side improvements (excluding leakage and metering)

3.5.1 Additional investment in water efficiency is required in earlier years, specifically rainwater harvesting in 2028 and water efficiency devices (Carlisle) moves from 2040 to 2038, and flow regulators (Carlisle) in 2034. These are required to reduce demand and meet demand targets in a scenario where water labelling is no longer introduced.

LS3c.18 Water enhancement totex; Leakage improvements

3.5.2 In this scenario, Permanent Network Sensors are moved to 2040 from 2035, the second phase of mains renewal is brought forward from 2037 to 2036 (Strategic), and for Carlisle, mains renewal is moved from 2038 to 2040. Pressure management is no longer selected in 2049 as the metering supports leakage reduction targets.

LS3c.21 New meters introduced by companies for existing customers; metering totex

3.5.3 Metering of common supply-pipes is selected in 2031 to meet demand targets where water labelling is not introduced.

LS3c.42 Water enhancement totex; Greenhouse gas reduction (net zero)

3.5.4 The way we calculate investment to address greenhouse gas emissions matches the approach followed in the Core Pathway but for the investment expected under this scenario.

3.6 LS3d: Adverse (slower) technology

LS3d.17 Water enhancement totex; Demand-side improvements (excluding leakage and metering)

3.6.1 The slower pace of metering means additional water efficiency needs to be selected to meet demand targets.

LS3d.18 Water enhancement totex; Leakage improvements

3.6.2 The slower pace of metering means additional leakage reduction options need to be selected to meet demand targets, such as pressure management (Strategic) and mains renewal (Carlisle) from 2026.

LS3d.21 New meters introduced by companies for existing customers; metering totex

3.6.3 In this scenario, metering occurs at a slower pace but to a greater extent (full metering includes households on common supplies).

LS3e.24 Water enhancement totex; Replacement of existing basic meters with AMI meters for residential customers

3.6.4 In this scenario, metering occurs at a slower pace but to a greater extent (full metering includes households on common supplies).

LS3d.25 Water enhancement totex; Replacement of existing AMR meters with AMI meters for residential customers

3.6.5 In this scenario, metering occurs at a slower pace but to a greater extent (full metering includes households on common supplies).

LS3d.42 Water enhancement totex; Greenhouse gas reduction (net zero)

3.6.6 The way we calculate investment to address greenhouse gas emissions matches the approach followed in the Core Pathway but for the investment expected under this scenario.

3.7 LS3e: Benign (faster) technology

LS3e.17 Water enhancement totex; Demand-side improvements (excluding leakage and metering)

3.7.1 The fuller extent of metering means that water efficiency devices is no longer required in Carlisle in 2048.

LS3e.18 Water enhancement totex; Leakage improvements

3.7.2 Alternative investment for leakage forms part of this scenario, thus Dynamic Network Management is selected and Permanent Network Sensors. As a result, the second phase of mains renewal (Strategic) is no longer required in 2037, and pressure management is no longer required in 2049.

LS3e.21 New meters introduced by companies for existing customers; metering totex

3.7.3 In this scenario, metering occurs at a faster pace and at a greater extent (full metering includes households on common supplies).

LS3e.24 Water enhancement totex; Replacement of existing basic meters with AMI meters for residential customers

3.7.4 In this scenario, metering occurs at a faster pace and at a greater extent (full metering includes households on common supplies).

LS3e.25 Water enhancement totex; Replacement of existing AMR meters with AMI meters for residential customers

3.7.5 In this scenario, metering occurs at a faster pace and at a greater extent (full metering includes households on common supplies).

LS3e.42 Water enhancement totex; Greenhouse gas reduction (net zero)

3.7.6 The way we calculate investment to address greenhouse gas emissions matches the approach followed in the Core Pathway but for the investment expected under this scenario.

3.8 LS3f: Alternative Transfer 1

LS3f.16 Water enhancement totex; Supply-side improvements

3.8.1 The additional investment in this pathway begins in AMP9 for additional sub-options to support larger water transfers from 2040.

LS3f.42 Water enhancement totex; Greenhouse gas reduction (net zero)

3.8.2 The way we calculate investment to address greenhouse gas emissions matches the approach followed in the Core Pathway but for the investment expected under this scenario.

3.9 LS3g: Alternative Transfer 2

LS3g.16 Water enhancement totex; Supply-side improvements

3.9.1 The additional investment in this pathway begins in AMP9 for additional sub-options to support larger water transfers from 2042.

LS3g.42 Water enhancement totex; Greenhouse gas reduction (net zero)

3.9.2 The way we calculate investment to address greenhouse gas emissions matches the approach followed in the Core Pathway but for the investment expected under this scenario.

3.10 LS3h: Adverse expectations

LS3h.32 Water enhancement totex (adverse expectations pathway); Addressing raw water quality deterioration (grey solutions)

3.10.1 Under the adverse expectations pathway, expenditure is accelerated from AMP10 to AMP9 in the case that investment in raw water quality is required more quickly.This coud be driven by a range of factors, including the potential for stricter regulation surrounding the concentration of perfluoroalkyl and polyfluoroalkyl substances (PFAS) in drinking water.

LS3h.35 Water enhancement totex (adverse expectations pathway); Lead communication pipes replaced or relined for water quality

3.10.2 This pathway accelerates lead pipe removal to achieve an earlier 2050 target date. As a consequence activity ramps up quickly in AMP9 and consistent high activity level throughout the planning horizon.

LS3h.36 Water enhancement totex (adverse expectations pathway); External lead supply pipes replaced or relined

3.10.3 This pathway accelerates lead pipe removal to achieve an earlier 2050 target date. External lead supply pipe replacements accelerate in line with communication pipe replacements.

LS3h.37 Water enhancement totex (adverse expectations pathway); Internal lead supply pipes replaced or relined

3.10.4 This pathway accelerates lead pipe removal to achieve an earlier 2050 target date. Internal lead supply pipe replacements accelerate in line with communication pipe replacements.

LS3h.42 Water enhancement totex; Greenhouse gas reduction (net zero)

3.10.5 The way we calculate investment to address greenhouse gas emissions matches the approach followed in the Core Pathway but for the investment expected under this scenario.

3.11 Alignment of LS3a - i to pathways presented in the WRMP

Table 1 below indicates how our alternative pathways for water align to the scenarios assessed in the WRMP.

Table 1: Alternative pathway alignment to WRMP scenarios

PR24 alternative pathway reference	PR24 alternative pathway name	Planning Scenario in WRMP Table 7	Description
3a	Adverse climate change	rd_ofwat_high_climate	This aligns to the high climate pathway in the WRMP, where the RCP8.5 climate scenario was used. In this scenario, the level of service improvement is not selected in 2031. The second phase of mains renewal is brought forward from 2037 to 2036. In 2049, pressure management is no longer selected. Post 2050, a number of supply-side options are selected. There is no change to this scenario in AMP8.
3b	Benign climate change	rd_ofwat_low_climate	This aligns to the low climate pathway in the WRMP, where the RCP2.6 climate scenario was used. There is no change in the investment between this scenario and the preferred plan.

PR24 alternative pathway reference	PR24 alternative pathway name	Planning Scenario in WRMP Table 7	Description
3c	Adverse demand	rd_ofwat_high_demand	This aligns to the high demand pathway in the WRMP, where it is assumed that water labelling is not introduced in 2026. In this scenario, Permanent Network Sensors are moved to 2040 from 2035, the second phase of mains renewal is brought forward from 2037 to 2036, and for Carlisle, mains renewal is moved from 2038 to 2040, and water efficiency devices are moved from 2040 to 2038. Additional investment in metering and water efficiency is required in earlier years, specifically rainwater harvesting in 2028 and enhanced metering of households on common supplies in 2031. Pressure management is no longer selected in 2049 as the metering supports leakage reduction targets. In this scenario, we do not achieve our PCC target of 110 l/p/d by 2050. This, alongside the additional investment in AMP8 needed to maintain the supply-demand balance, highlights that government intervention through water labelling is vital to our core pathway.
N/A	Benign demand	rd_ofwat_low_demand	This aligns to the low demand pathway in the WRMP, where Office for National Statistics (ONS) forecasts are used and water labelling with minimum standards is introduced in 2026. The extra benefit from this option means that water efficiency devices are no longer required in Carlisle in 2048. **Note:** There is no change in expenditure under this scenario under any line in LS3 and we therefore do not include it as an alternative pathway.
3d	Adverse (slow) technology	rd_ofwat_slow_tech	This aligns to the slow technology scenario in the WRMP, where it is assumed that full metering occurs by 2045, and specific leakage interventions are carried out in certain timescales. In this scenario there are a number of changes to the metering and leakage plans as per the PR24 guidance on long-term delivery strategies. The scenario branches in AMP9 for long-term delivery strategies.
3e	Benign (fast) technology	rd_ofwat_fast_tech	This aligns to the fast technology scenario in the WRMP, where it is assumed that full metering occurs by 2035, and specific leakage interventions are carried out in certain timescales. In this scenario there are a number of changes to the metering and leakage plans as per the PR24 guidance on long-term delivery strategies. The scenario branches in AMP9 for long-term delivery strategies.
N/A	Adverse abstraction	rd_ofwat_high_ED	This aligns to the high abstraction reductions/environmental destination scenario in the WRMP, where the Enhanced scenario is used. There is no difference between the investment in this scenario and the preferred plan, as the impacts are later in the planning horizon and are lower in magnitude than other scenarios. **Note:** There is no change in expenditure under this scenario under any line in LS3 and we therefore do not include it as an alternative pathway.

PR24 alternative pathway reference	PR24 alternative pathway name	Planning Scenario in WRMP Table 7	Description
N/A	Benign abstraction	rd_ofwat_low_ED	This aligns to the low abstraction reductions/environmental destination scenario in the WRMP, where highly uncertain abstraction reductions are removed from the BAU+ scenario. There is no difference between the investment in this scenario and the preferred plan, as the impacts are later in the planning horizon and are lower in magnitude than other scenarios. **Note:** There is no change in expenditure under this scenario under any line in LS3 and we therefore do not include it as an alternative pathway.
3f	Alternative transfer 1	rd_noSESRO	This aligns to the Water Resources South East (WRSE) no SESRO (south east strategic reservoir option) scenario, where water transfer needs from WRSE increase due to rejected planning permission for SESRO. The change in investment only relates to water transfer sub-options in this scenario.
3g	Alternative transfer 2	rd_WRSEno110	This aligns to the WRSE higher demand scenario, where needs from WRSE increase due to higher demand than expected. The change in investment only relates to water transfer sub-options in this scenario.
3h	Adverse expectations	N/A, use rd_preferred	This scenario does not apply to water resources and is the same as the preferred plan.
N/A	Benign expectations	N/A, use rd_preferred	This scenario does not apply to water resources and is the same as the preferred plan. **Note:** There is no change in expenditure under this scenario under any line in LS3 and we therefore do not include it as an alternative pathway.

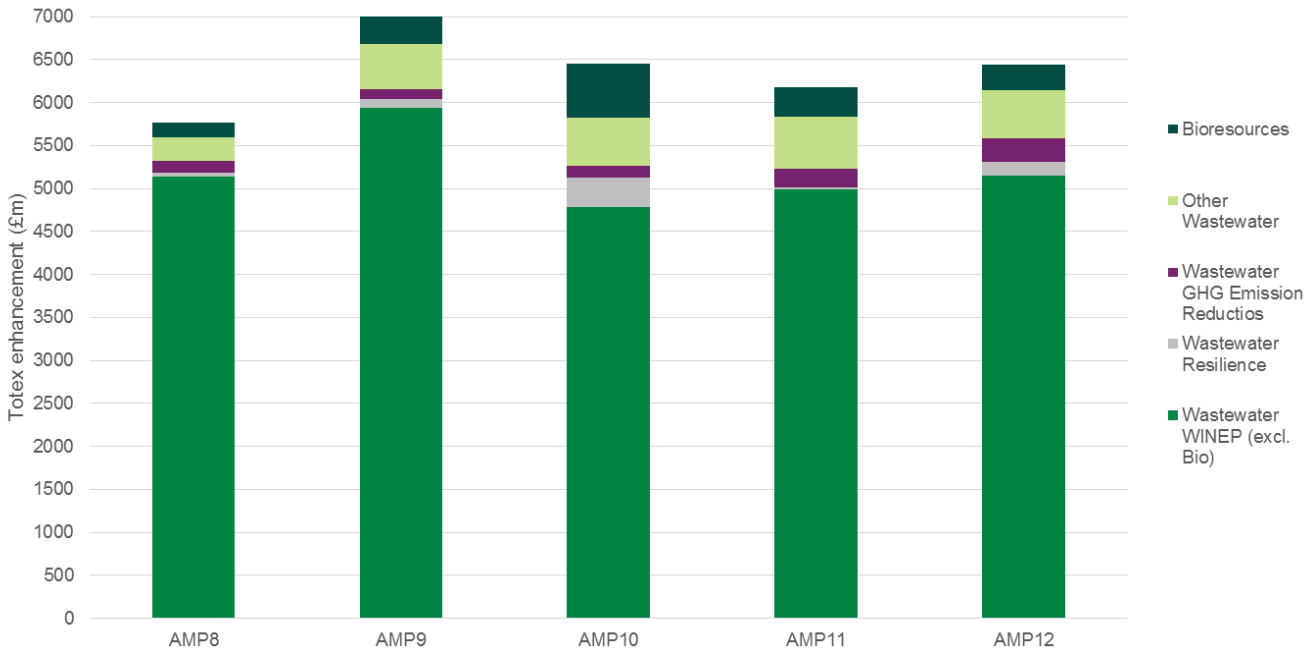
4. LS4 – Wholesale wastewater totex enhancement expenditure by purpose, core pathway

4.1 Summary of LS4

4.1.1 Data table LS4 presents the totex enhancement expenditure associated with our Wastewater Core Pathway (including Bioresources). Figure 13 below summarises this expenditure for AMP8 through to AMP12. The expenditure in AMP8 aligns with our PR24 Business Plan.

4.1.2 Over the period from 2025 to 2050, we currently forecast investment needs of circa. £32bn to deliver our wastewater and bioresources ambition. This covers investment in networks and catchment initiatives to reduce storm overflows, wastewater treatment upgrades, bioresources, wastewater resilience and wastewater greenhouse gas emission reductions. This presents our view of future costs based on current known drivers and regulation, in reality this is likely to represent our lowest possible future investment given any further requirements that are as yet unknown would lead to increases in cost.

Figure 13: Totex enhancment expenditure in our wastewater core pathway (including bioresources)



Enhancement expenditure that we have proportionally allocated between data table lines

4.1.3 The expenditure associated with storm overflows has been assigned to only lines LS4.8 and LS4.9. Expenditure associated with other storm overflow lines in LS4 is included within these two lines.

How we have used additional lines in LS4

4.1.4 Our use of additional lines in LS4 is as follows:

- LS4.59, additional line 1: Innovation. This captures enhancement spread associated with AMP7 investment only;
- LS4.60, additional line 2: UV disinfection (or similar). This captures enhancement spread associated with AMP7 investment only;
- LS4.61, additional line 3: Conservation drivers. This captures enhancement spread associated with AMP7 investment only;

- LS4.62, additional line 4: WINEP requirement for bathing water shellfish driver delivered through long sea outfall or increased flow to full treatment (FTFT). This captures enhancement spread associated with AMP7 investment only; and
- LS4.63, additional line 5: WINEP phase 5 water framework directive (WFD) schemes – treatment increased storage or investigations. This captures enhancement spread associated with AMP7 investment only.

Other notes

4.1.5 Our estimates include ongoing operating expenditure. This means that if a new asset is constructed in AMP9, we include operating expenditure for that asset in AMP10, AMP11 and AMP12. We do not include estimates for capital maintenance (replacement and major refurbishment of assets).

4.1.6 Our estimated expenditure is derived from a number of sources, the assumptions applied for each expenditure type are outlined in Figure 13. For the core pathway, AMP8 data, in all cases, aligns to that presented in CW3.

4.1.7 Assumptions outlined will continue to be monitored and updated at least once per AMP in line with cyclical LTDS updates.

4.2 Price base 2022-23 FYA (CPH deflated) - Wastewater enhancement expenditure by purpose ~ totex

LS4.1 Wastewater enhancement totex (core pathway); Event duration monitoring at intermittent discharges

4.2.1 AMP8 data from CWW3.

4.2.2 The EDM programme is due to complete in AMP8. . We currently do not anticipate spend in AMP9 onwards.

LS4.2 Wastewater enhancement totex (core pathway); Flow monitoring at sewage treatment works

4.2.3 AMP8 data from CWW3.

4.2.4 We have identified where growth forecasts trigger WwTW exceeding greater than 250 PE. At these sites (there is only one, in AMP10) we have estimated enhancement expenditure requirements at £620k).

LS4.3 Wastewater enhancement totex (core pathway); Continuous river water quality monitoring

4.2.5 AMP8 data from CWW3.

4.2.6 We have phased our continuous river water quality monitoring WINEP programme across AMP8 and 9 with approximately 25% in AMP8 and 75% in AMP9 in line with Environment Agency requirements. We currently do not anticipate spend in AMP10-12.

LS4.4 Wastewater enhancement totex (core pathway); MCERTs monitoring at emergency sewage pumping station overflows

4.2.7 AMP8 data from CWW3.

4.2.8 We have phased our MCERTs WINEP programme across AMP8 and 9 in line with Environment Agency guidance. We currently do not anticipate spend in AMP10-12.

LS4.5 Wastewater enhancement totex (core pathway); Increase flow to full treatment

4.2.9 AMP8 data from CWW3.

4.2.10 In AMP8, relevant driver codes were deemed not applicable to sites which are Environment Agency exceptions to the 3DWF rule. We have assumed zero enhancement expenditure spend in AMP9+.

LS4.6 Wastewater enhancement totex (core pathway); Increase storm tank capacity at STWs - grey solution

4.2.11 AMP8 data from CWW3.

4.2.12 Our estimated expenditure for AMP9 to AMP12 is sourced from our DWMP preferred plan. In developing our LTDS and AMP8 plan we have identified opportunities to accelerate some of the overflows programme, consequently the profile in spend over time differs from that presented in the DWMP.

LS4.7 Wastewater enhancement totex (core pathway); Increase storm system attenuation / treatment on a STW - green solution

4.2.13 AMP8 data from CWW3.

4.2.14 We have phased some expenditure from AMP8 to AMP9.

4.2.15 We have no expenditure from AMP9 onwards (except for the phased expenditure). We anticipate there will be future spend in this area, however green solutions for storm system attenuation / treatment on a STW require significant amounts of land and specific operating conditions. As such schemes need to be reviewed in detailed design on a case by case basis. As schemes are design and implemented we will seek to promote green solutions where they provide best value.

LS4.8 Wastewater enhancement totex (core pathway); Storage schemes to reduce spill frequency at CSOs etc - grey solution

4.2.16 AMP8 data from CWW3.

4.2.17 Our estimated expenditure for AMP9 to AMP12 is sourced from our DWMP preferred plan. In developing our LTDS and AMP8 plan we have identified opportunities to accelerate some of the overflows programme, consequently the profile in spend over time differs from that presented in the DWMP.

LS4.9 Wastewater enhancement totex (core pathway); Storage to reduce spill frequency at CSOs etc - green solution

4.2.18 AMP8 data from CWW3.

4.2.19 Our estimated expenditure for AMP9 to AMP12 is sourced from our DWMP preferred plan. In developing our LTDS and AMP8 plan we have identified opportunities to accelerate some of the overflows programme, consequently the profile in spend over time differs from that presented in the DWMP.

LS4.10 Wastewater enhancement totex (core pathway); Storm overflow - discharge relocation

4.2.20 AMP8 data from CWW3.

4.2.21 Our DWMP did not assign expenditure to this line and, as we have ensured alignment to the DWMP, this LS line shows zero expenditure for AMP9 onwards (except for the phased expenditure). As schemes are designed and implemented we will seek to consider the full range of potential solutions and implement the scheme(s) that provide best value.

LS4.11 Wastewater enhancement totex (core pathway); Storm overflow - increase in combined sewer / trunk sewer capacity

4.2.22 AMP8 data from CWW3.

4.2.23 Our DWMP did not assign expenditure to this line and, as we have ensured alignment to the DWMP, this LS line shows zero expenditure for AMP9 onwards (except for the phased expenditure). As schemes are designed and implemented we will seek to consider the full range of potential solutions and implement the scheme(s) that provide best value.

LS4.12 Wastewater enhancement totex (core pathway); Storm overflow - sustainable drainage / attenuation in the network

4.2.24 AMP8 data from CWW3.

4.2.25 We have phased some expenditure from AMP8 to AMP9.

4.2.26 For AMP9 onwards, with the exception of phased spend, all expenditure for SuDS, attenuation and other green schemes for storm overflows is accounted for in LS4.9 to avoid double counting between these lines.

LS4.13 Wastewater enhancement totex (core pathway); Storm overflow - source surface water separation

4.2.27 AMP8 data from CWW3.

4.2.28 Our DWMP did not assign expenditure to this line and, as we have ensured alignment to the DWMP, this LS line shows zero expenditure for AMP9 onwards (except for the phased expenditure). As schemes are designed and implemented we will seek to consider the full range of potential solutions and implement the scheme(s) that provide best value.

LS4.14 Wastewater enhancement totex (core pathway); Storm overflow - infiltration management

4.2.29 AMP8 data from CWW3.

4.2.30 Our DWMP did not assign expenditure to this line and, as we have ensured alignment to the DWMP, this LS line shows zero expenditure for AMP9 onwards (except for the phased expenditure). As schemes are designed and implemented we will seek to consider the full range of potential solutions and implement the scheme(s) that provide best value.

LS4.15 Wastewater enhancement totex (core pathway); Storm overflow - sewer flow management and control

4.2.31 AMP8 data from CWW3.

4.2.32 Our DWMP did not assign expenditure to this line and, as we have ensured alignment to the DWMP, this LS line shows zero expenditure for AMP9 onwards (except for the phased expenditure). As schemes are designed and implemented we will seek to consider the full range of potential solutions and implement the scheme(s) that provide best value.

LS4.16 Wastewater enhancement totex (core pathway); Storm overflow - new / upgraded screens

4.2.33 AMP8 data from CWW3.

4.2.34 Our estimated expenditure for AMP9 to AMP12 is sourced from our DWMP preferred plan.

LS4.17 Wastewater enhancement totex (core pathway); Treatment for chemical removal

4.2.35 AMP8 data from CWW3.

4.2.36 We have phased some expenditure from AMP8 to AMP9.

4.2.37 We expect the need for additional investment in future AMPs as compared to AMP8 and have therefore assumed an increase of 25% on AMP8 costs in AMP9, AMP10, AMP11 and AMP12.

LS4.18 Wastewater enhancement totex (core pathway); Chemicals and emerging contaminants monitoring, investigations, options appraisals

4.2.38 AMP8 data from CWW3.

4.2.39 Beyond AMP8, we currently foresee no significant increase or decrease in regulator expectation for WINEP spend in this area and therefore assume our AMP8 enhancement expenditure will continue in future AMPs.

LS4.19 Wastewater enhancement totex (core pathway); Treatment for total nitrogen removal (chemical)

4.2.40 AMP8 data from CWW3.

4.2.41 We expect a scheme to be constructed in AMP9 and have estimated costs based on an existing scheme (Horwich). We have assumed no enhancement expenditure in AMP10 onwards.

4.2.42 See also comment against LS4.50.

LS4.20 Wastewater enhancement totex (core pathway); Treatment for total nitrogen removal (biological)

4.2.43 AMP8 data from CWW3.

4.2.44 Based on current information, we expect future N removal schemes to be based on chemical processes and therefore anticipate zero enhancement expenditure in AMP9 onwards.

LS4.21 Wastewater enhancement totex (core pathway); Nitrogen technically achievable limit monitoring, investigation or options appraisal

4.2.45 AMP8 data from CWW3.

4.2.46 Based on current information, we do not foresee the need for additional monitoring / investigation. We therefore anticipate zero enhancement expenditure in AMP9 onwards.

LS4.22 Wastewater enhancement totex (core pathway); Treatment for phosphorus removal (chemical)

4.2.47 AMP8 data from CWW3.

4.2.48 We have identified sites we expect to require investment in order to meet the Environment Act target of an 80% reduction in phosphorus by 2038. We have assumed no enhancement expenditure beyond AMP10.

4.2.49 See also comment against LS4.50.

LS4.23 Wastewater enhancement totex (core pathway); Treatment for phosphorus removal (biological)

4.2.50 AMP8 data from CWW3.

4.2.51 Until detailed design we are unable to confirm the number of WwTWs which will be appropriate for biological phosphorus removal, consequently from AMP9 onwards spend for phosphorus removal.

LS4.24 Wastewater enhancement totex (core pathway); Treatment for nutrients (N or P) and / or sanitary determinands, nature based solution

4.2.52 AMP8 data from CWW3.

4.2.53 We forecast zero enhancement expenditure in AMP9 onwards for this line. Enhancement to address sanitary parameters is included against LS4.25.

LS4.25 Wastewater enhancement totex (core pathway); Treatment for tightening of sanitary parameters

4.2.54 AMP8 data from CWW3.

4.2.55 In addition to expected AMP9 schemes we expect ongoing ‘no deterioration’ expenditure against this line and have allowed £10 Million a year for this purpose in AMP9 onwards.

LS4.26 Wastewater enhancement totex (core pathway); Catchment management - chemicals source control

4.2.56 AMP8 data from CWW3.

4.2.57 We forecast zero enhancement expenditure in AMP9 onwards for this line but include catchment management initiatives against line LS4.27. The specific nature of these schemes will be defined as specific projects are identified and designed.

LS4.27 Wastewater enhancement totex (core pathway); Catchment management - nutrient balancing

4.2.58 AMP8 data from CWW3.

4.2.59 Beyond AMP8, we currently foresee no significant increase or decrease in regulator expectation for WINEP spend in this area and therefore assume our AMP8 enhancement expenditure will continue in future AMPs.

4.2.60 Total enhancement expenditure in AMP8 therefore matches total enhancement expenditure in AMP9 and all subsequent AMPs to 2050.

LS4.28 Wastewater enhancement totex (core pathway); Catchment management - catchment permitting

4.2.61 AMP8 data from CWW3.

4.2.62 We forecast zero enhancement expenditure in AMP9 onwards for this line but include catchment management initiatives against line LS4.27. The specific nature of these schemes will be defined as specific projects are identified and designed.

LS4.29 Wastewater enhancement totex (core pathway); Catchment management - habitat restoration

4.2.63 AMP8 data from CWW3.

4.2.64 We forecast zero enhancement expenditure in AMP9 onwards for this line but include catchment management initiatives against line LS4.27. The specific nature of these schemes will be defined as specific projects are identified and designed.

4.2.65 LS4.30 Wastewater enhancement totex (core pathway); Microbiological treatment - bathing waters, coastal and inland

AMP8 data from CWW3.

4.2.66 Beyond AMP8, other than a scheme in Liverpool, we currently foresee no significant increase or decrease in regulator expectation for WINEP spend in this area and therefore assume our AMP8 enhancement expenditure will continue at a similar rate in future AMPs.

4.2.67 Total enhancement expenditure in AMP8 therefore matches total enhancement expenditure in AMP10, AMP11 and AMP12. Enhancement expenditure in AMP9 equals AMP8 plus an additional scheme in Liverpool.

LS4.31 Wastewater enhancement totex (core pathway); Septic tank replacements - treatment solution

4.2.68 AMP8 data from CWW3.

4.2.69 We have phased some expenditure from AMP8 to AMP9. We forecast zero enhancement expenditure in AMP10 onwards for this line, other than ongoing opex expenditure.

LS4.32 Wastewater enhancement totex (core pathway); Septic tank replacements - flow diversion

4.2.70 AMP8 data from CWW3.

4.2.71 We have phased some expenditure from AMP8 to AMP9. We forecast zero enhancement expenditure in AMP10 onwards for this line, other than ongoing opex expenditure.

LS4.33 Wastewater enhancement totex (core pathway); Fish outfall screens

4.2.72 AMP8 data from CWW3.

4.2.73 We forecast zero enhancement expenditure in AMP9+ for this line for wastewater. Fish pass schemes are included in LS3.

LS4.34 Wastewater enhancement totex (core pathway); 25 year environment plan

4.2.74 AMP8 data from CWW3.

4.2.75 We forecast zero enhancement expenditure in AMP9 onwards for this line, though we expect this line to act as a secondary driver for other investment.

LS4.35 Wastewater enhancement totex (core pathway); Investigations, other (WINEP/NEP) - desk-based studies only

4.2.76 AMP8 data from CWW3.

4.2.77 Beyond AMP8, we currently foresee no significant increase or decrease in regulator expectation for WINEP spend in this area and therefore assume our AMP8 enhancement expenditure will continue in future AMPs.

4.2.78 Total enhancement expenditure in AMP8 therefore matches total enhancement expenditure in AMP9 and all subsequent AMPs to 2050.

LS4.36 Wastewater enhancement totex (core pathway); Investigations, other (WINEP/NEP) - survey, monitoring or simple modelling

4.2.79 AMP8 data from CWW3.

4.2.80 Beyond AMP8, we currently foresee no significant increase or decrease in regulator expectation for WINEP spend in this area and therefore assume our AMP8 enhancement expenditure will continue in future AMPs.

4.2.81 Total enhancement expenditure in AMP8 therefore matches total enhancement expenditure in AMP9 and all subsequent AMPs to 2050.

LS4.37 Wastewater enhancement totex (core pathway); Investigations, other (WINEP/NEP) - multiple surveys, and/or monitoring locations, and/or complex modelling

4.2.82 AMP8 data from CWW3.

4.2.83 Beyond AMP8, we currently foresee no significant increase or decrease in regulator expectation for WINEP spend in this area and therefore assume our AMP8 enhancement expenditure will continue in future AMPs.

4.2.84 Total enhancement expenditure in AMP8 therefore matches total enhancement expenditure in AMP9 and all subsequent AMPs to 2050.

LS4.38 Wastewater enhancement totex (core pathway); Contribution to third party schemes under WINEP/NEP only (not covered elsewhere)

4.2.85 AMP8 data from CWW3.

4.2.86 There is too much uncertainty in future contributions to third party schemes under WINEP (not covered elsewhere), consequently we have currently forecast zero enhancement expenditure in AMP9 onwards for this line.

LS4.39 Wastewater enhancement totex (core pathway); River connectivity (e.g. for fish passage)

4.2.87 AMP8 data from CWW3.

4.2.88 We currently have no known future drivers so have forecast zero additional enhancement expenditure in AMP9 onwards for this line. We do expect a small amount of carry over spend from AMP8 and ongoing opex.

LS4.40 Wastewater enhancement totex (core pathway); Restoration management (marine conservation zones etc)

4.2.89 AMP8 data from CWW3.

4.2.90 We forecast zero enhancement expenditure in AMP9+ for this line. We have investigations in AMP8 but these are too uncertain to accurately forecast future spend at this time.

LS4.41 Wastewater enhancement totex (core pathway); Access and amenity for WINEP/NEP only (not covered elsewhere)

4.2.91 AMP8 data from CWW3.

4.2.92 We forecast zero enhancement expenditure in AMP9 onwards for this line. We have investigations in AMP8 but these are too uncertain to accurately forecast future spend at this time.

LS4.42 Wastewater enhancement totex (core pathway); Advanced WINEP (not covered elsewhere)

4.2.93 AMP8 data from CWW3. Noting this line only covers spend not covered elsewhere.

4.2.94 Our advanced WINEP programme runs for AMP8 but will have benefits that can be adopted across many other aspects of the WINEP programme in future AMPs.

LS4.43 Wastewater enhancement totex (core pathway); Sludge storage -Tanks (pre-thickening, pre-dewatering or untreated)

4.2.95 AMP8 data from CWW3.

4.2.96 We have forecast zero enhancement expenditure in AMP9 onwards for this line, as we have not forecast any strategic storage for raw liquid sludge. Any cost to deliver operational raw sludge storage as part of a scheme to deliver treatment will be included in the respective lines (LS4.46, LS4.48 and LS4.53).

LS4.44 Wastewater enhancement totex (core pathway); Sludge storage - Tanks (thickened/dewatered or treated)

4.2.97 AMP8 data from CWW3.

4.2.98 We have forecast zero enhancement expenditure in AMP9 onwards for this line as we have not forecast any strategic storage for thickened or treated sludge. Any cost to deliver operational sludge storage as part of a scheme to deliver treatment will be included in the respective lines (LS4.46, LS4.48 and LS4.53).

LS4.45 Wastewater enhancement totex (core pathway); Sludge storage - Cake pads / bays /other

4.2.99 AMP8 data from CWW3.

4.2.100 We have forecast cost for the provision of an additional final product (biosolids) storage delivered in AMP9 to improve supply chain resilience for biosolids disposal.

LS4.46 Wastewater enhancement totex (core pathway); Sludge treatment - Anaerobic digestion and/or advanced anaerobic digestion

4.2.101 AMP8 data from CWW3.

4.2.102 We have forecast cost in AMP9 for the provision of anaerobic digestion pre-treatment technology to allow us to increase the amount of sludge treated through advanced anaerobic digestion and to increase the amount of enhanced biosolids produced.

LS4.47 Wastewater enhancement totex (core pathway); Sludge treatment - Thickening and/or dewatering

4.2.103 AMP8 data from CWW3.

4.2.104 We have forecast zero enhancement expenditure in AMP9 onwards for additional stand-alone thickening or dewatering. Any additional thickening or dewatering required as part of a scheme to deliver sludge treatment will be included in the respective lines ((LS4.46, LS4.48 and LS4.53).

LS4.48 Wastewater enhancement totex (core pathway); Sludge treatment –Other

4.2.105 AMP8 data from CWW3.

4.2.106 Beyond AMP8 we have forecast enhancement expenditure in multiple AMPs to deliver a gradual transition away from biosolids recycling to agriculture.

4.2.107 We have also included enhancement expenditure for the recovery for nutrient recovery at centralised AAD hubs.

LS4.49 Wastewater enhancement totex (core pathway); Sludge investigations and monitoring

4.2.108 AMP8 data from CWW3.

4.2.109 We have forecast zero enhancement cost in AMP9 onwards for sludge investigations and monitoring. We are undertaking enhanced biosolids quality surveillance in AMP8 reported in LS4.48 and on-going reporting.

LS4.50 Wastewater enhancement totex (core pathway); Growth at sewage treatment works (excluding sludge treatment)

4.2.110 AMP8 data from CWW3.

4.2.111 Enhancement estimates for AMP9 onwards are derived from the DWMP WwTW programme. This programme addresses investment need at sites where the primary driver for investment is growth.

LS4.51 Wastewater enhancement totex (core pathway); Reduce flooding risk for properties

4.2.112 AMP8 data from CWW3.

4.2.113 The spend associated with reducing flood risk for properties is derived from our DWMP, within the DWMP options were selected to provide multiple benefits (e.g. across flooding and pollution). This represents the expenditure allocated to the flooding planning objective within the DWMP.

LS4.52 Wastewater enhancement totex (core pathway); First time sewerage

4.2.114 AMP8 data from CWW3.

4.2.115 Future forecasting takes into account the AMP8 expenditure forecast, a review of historic delivery, historic industry wide comparison and future scenarios. Taking the above into account the core profile is projected to remain consistent across future years.

LS4.53 Wastewater enhancement totex (core pathway); Sludge enhancement (growth)

4.2.116 AMP8 data from CWW3.

4.2.117 We have included an allocation corresponding to sludge growth of the total cost to deliver centralised advanced anaerobic digestion (AAD) hubs in AMP9 and AMP10.

LS4.54 Wastewater enhancement totex (core pathway); Odour and other nuisance

4.2.118 We have established a downward trend in odour / nuisance related contacts driven by base expenditure. We currently have no anticipated future enhancement spend in this area.

LS4.55 Wastewater enhancement totex (core pathway); Resilience

4.2.119 AMP8 data from CW3.

4.2.120 Beyond AMP8, we currently expect to invest in improving the resilience of our assets from surface, river and coastal flooding. In additional we expect to need to further protect assets from the risks of coastal and river erosion processes following on from investigation work to be completed in AMP8.

4.2.121 We have identified assets at risk of flooding using Environment Agency data sets and applied a calculation to estimate the costs of delivery of flood resilience solutions. We have used Environment Agency unit cost estimates and design guides for the construction of flood embankments. These estimates allow for economies of scale such that delivering a high volume embankment may be cheaper at a unit rate, than a low volume embankment. The perimeter/scale of the flood embankments has been determined as the smallest total volume possible to protect the assets/sites identified as at risk.

4.2.122 The delivery profile has been determined based on risk cohorts, i.e. sites with the same service criticality and level of flood risk, we recognise that this could lead to peaky investment profile as there tends to be more assets in certain risk cohorts. This is particularly true of our wastewater assets which are more

numerous than our water sites and also tend to be at higher risk of flooding due to the gravity processes used in waste water treatment and the requirement to be close to water bodies for recycling purposes.

4.2.123 We have chosen to delay initial investment to at least AMP9 for the highest risk sites on the basis of the pending release of new information from the Environment Agency. The National Flood Risk Assessment (NaFRA) is due to be released in 2024 and we will re-review the risk and delivery profile using the latest and best information.

LS4.56 Wastewater enhancement totex (core pathway); Security – SEMD

4.2.124 AMP8 data from CW3.

4.2.125 We have forecasted zero expenditure as SEMD does not apply to wastewater assets.

LS4.57 Wastewater enhancement totex (core pathway); Security – cyber

4.2.126 AMP8 data from CW3.

4.2.127 We have forecasted zero expenditure as NIS-D does not apply to wastewater assets.

LS4.58 Wastewater enhancement totex (core pathway); Greenhouse gas reduction (net zero)

4.2.128 Our AMP8 cost relates to the net zero enhancement programme (CW21 and CWW22).

4.2.129 In AMP9-12, we have estimated the expenditure required to abate operational greenhouse gas emissions using benchmarks from existing programmes of work.

4.2.130 All other LS4 expenditure has been summed, and then factors applied to capex and opex to estimate tCO_2e per £k of spend. Further factor then applied for expenditure required to remove 1 tCO_2e.

4.2.131 For AMP9-12 the line represents the cost to mitigate the operational emissions associated with the enhancement expenditure outlined within this table, i.e. an estimated cost to maintain stable operational emissions in the face of growth pressures from enhancements. From AMP9 onwards we've used the central government estimate for the price to mitigate each tonne of GHG emissions - this is a national generic cost, and for example, much lower than the comparative CCC cost estimate for offsetting process emissions. Consequently the cost of GHG emission reduction is highly uncertain and likely to increase in future AMPs with more certainty and clarification on specific costs. This line does not reflect the much larger cost likely to achieve net zero by 2050 in scopes 1, 2 and 3.

LS4.59 Wastewater enhancement totex (core pathway); Innovation

AMP8 spend only. We have not currently assessed spend in AMP9 onwarsd for this enhancement type.

4.2.132 LS4.60 Wastewater enhancement totex (core pathway); UV disinfection (or similar)

4.2.133 AMP8 spend only. We have not currently assessed spend in AMP9 onwarsd for this enhancement type.

LS4.61 Wastewater enhancement totex (core pathway); Conservation drivers

4.2.134 AMP8 spend only. We have not currently assessed spend in AMP9 onwarsd for this enhancement type.

LS4.62 Wastewater enhancement totex (core pathway); NEP requirement for bathing water shellfish driver delivered through long sea outfall or increased FTFT

4.2.135 AMP8 spend only. We have not currently assessed spend in AMP9 onwarsd for this enhancement type.

LS4.63 Wastewater enhancement totex (core pathway); NEP phase 5 WFD schemes - treatment increased storage or investigations

4.2.136 AMP8 spend only. We have not currently assessed spend in AMP9 onwarsd for this enhancement type.

LS4.64 Total wastewater enhancement expenditure - core pathway

4.2.137 Auto-populated. Total of all other lines

5. LS4a-i – Wholesale wastewater totex enhancement expenditure by purpose, alternative pathways

5.1 Whole table

5.1.1 Please note this table series presents change in expenditure as compared to the core pathway. Our commentary describes how total expenditure changes.

5.2 Our alternative pathways for wastewater enhancement totex

5.2.1 Our alternative pathways associated with wastewater enhancement are as follows:

- LS4a: adverse climate change CRS;
- LS4b: benign climate change CRS;
- LS4c: adverse demand CRS;
- LS4d: benign demand CRS;
- LS4e: adverse (slow) technology CRS;
- LS4f: benign (fast) technology CRS;
- LS4g: adverse expectations (one of our wider scenarios);
- LS4h: adverse expectations (one of our wider scenarios); and
- LS4i: intentionally left blank.

5.2.2 For wastewater, we do not need alternative pathways under the benign or adverse abstraction reduction CRS, or our bespoke alternative transfer 1 or alternative transfer 2 wider scenarios which relate to changing water resource transfer needs nationally.

5.3 Alternative pathways with expenditure in the 2025-30 period

5.3.1 Of the scenarios tested, only the Adverse Expectations wider scenario has the potential to require expenditure in AMP8. This is because regulatory decisions related to bioresources application to land have the potential to drive significant expenditure in the short term. Our testing shows that delaying expenditure beyond AMP8 in this scenario would jeopardise the achievement of our bioresources ambitions.

5.4 Trigger point, decision point and likelihood

5.4.1 Tables LS4a-i require that we populate a decision year, most likely trigger year and likelihood (as percentage).

5.4.2 For each of the tables LS4a-i, we have populated the decision and likely trigger year based on the first time that we year that we see a potential change in enhancement expenditure from the core pathway across Lines LS4.1 to LS4.65. These lines cover multiple parts of our business, for example investment to reduce greenhouse gas emissions, investments for water resources and investments to improve drinking water quality. It may therefore be the case that additional decision and trigger points may be required in later years. Only the earliest decision and trigger points are populated.

5.4.3 Our approach to long-term planning aims to ensure we can deliver our ambition under a rage of plausible futures. We do not believe that applying a percentage likelihood to futures is particularly useful as it is inherently inaccurate and uncertain and could be misleading. Moreover we find that different expenditure groupings have different triggers, happening at different times, for example different aspects of ‘climate change’ cause triggers for both water resources and water quality. We have

therefore taken the following approach to meeting the requirement to state a percentage likelihood for each alternative scenario:

- 10% = very low likelihood;
- 25% = low likelihood;
- 50% = medium likelihood;
- 75% = high likelihood; and
- 90% = very high likelihood.

5.4.4 The following tables presents our assumptions in estimating expenditure across LS4a-i where there is a change from the core pathway (LS4) only.

5.5 LS4a: Adverse Climate Change

LS4a.58 Wastewater enhancement totex; Resilience

5.5.1 This pathways includes additional investment to provide flood resilience to our sites to address increasing flood risk associated with more severe climate change, and for increased levels of coastal and river erosion also resulting from further climate change.

5.5.2 Climate change uplifts have been determined per river management area from the Defra Hydrology Data Explorer, and are adjusted for multiple scenarios as per guidance from UK Climate Risk.

LS4a.61 Wastewater enhancement totex; Greenhouse gas reduction (net zero)

5.5.3 The way we calculate investment to address greenhouse gas emissions matches the approach followed in the Core Pathway but for the investment expected under this scenario.

5.6 LS4b: Benign Climate Change

5.6.1 We used a decision support tool to model a low climate change scenario from 2025 to 2050 against our DWMP planning objectives. The option hierarchy selection philosophy used for this scenario matches the core pathway and is established from customer research (as detailed in DP1, the *UUW* DWMP Main Document). This best value approach has been used irrespective of climate and population growth risk.

5.6.2 To emulate a benign climate change scenario *UUW* assumed no increase in risk associated with the hydraulic components for flooding, pollution and collapse risk after 2030 (i.e. stable climate change to 2050). Baseline performance is aligned with forecasted performance predictions at the end of AMP8. The difference in scale and nature of the baseline risk between 2030 and 2050 impacts the blend and number of options selected to meet the DWMP planning objectives.

5.6.3 The interventions associated with this scenario are seen to be the ‘no regrets’ options of the LTDS due to the very unlikely scenario that the rate of climate change will be benign or low between present day and 2050. We therefore have reported zero expected change under the benign climate change scenario.

5.7 LS4c: Adverse Demand

LS4c.53 Wastewater enhancement totex; Growth at sewage treatment works (excluding sludge treatment)

5.7.1 Impact in AMP11 and 12 - assume garden village expansion equivalent to Carlisle at £136M

LS4c.55 Wastewater enhancement totex; First time sewerage

5.7.2 Impact in AMP9+ /- expenditure estimate includes minor allowance for additional first time sewerage allowance.

LS4c.56 Wastewater enhancement totex; Sludge enhancement (growth)

5.7.3 Sludge growth materialises at a faster rate. Higher overall allocation of AAD hub centralisation costs being allocated to sludge growth enhancement.

LS4c.61 Wastewater enhancement totex; Greenhouse gas reduction (net zero)

5.7.4 The way we calculate investment to address greenhouse gas emissions matches the approach followed in the Core Pathway but for the investment expected under this scenario.

5.8 LS4d: Benign Demand

LS4d.56 Wastewater enhancement totex; Sludge enhancement (growth)

5.8.1 Sludge growth materialises at a slower rate, investment in AMP10 AAD hub in the core pathway is delayed until AMP11. Lower overall allocation of AAD hub centralisation costs being allocated to sludge growth enhancement.

LS4d.61 Wastewater enhancement totex; Greenhouse gas reduction (net zero)

5.8.2 The way we calculate investment to address greenhouse gas emissions matches the approach followed in the Core Pathway but for the investment expected under this scenario.

5.9 LS4e: Adverse (Slow) Technology

LS4e.51 Wastewater enhancement totex; Sludge treatment – Other

5.9.1 A slower rate of technology change means we are reliant on existing technology (incineration) for alternative disposal of treated sludge for longer.

5.9.2 Assumption that advanced thermal conversion (ATC) technologies become deployable at scale by 2045. Deployment driven by landbank restrictions rather than economic advantage of ATC over AAD and sludge to land business model.

LS4e.61 Wastewater enhancement totex; Greenhouse gas reduction (net zero)

5.9.3 The way we calculate investment to address greenhouse gas emissions matches the approach followed in the Core Pathway but for the investment expected under this scenario.

Other

5.9.4 Advancement of new technologies is a staple of *UUW*'s wastewater network delivery strategy and long term plans for the future. Dynamic Network Management (DNM) for example; uses real-time data, artificial intelligence and machine learning to process data to help identify issues such as blockages and the rise of water in the sewer networks, so proactive action can be taken before issues impact customers or the environment. During the investment period 2020 – 2025 we have transformed wastewater network monitoring through the DNM programme in 64 priority areas approximate to 85% population equivalent of customers.

5.9.5 As a result of the high proportion of technological investment already undertaken, and inclusion of technological improvements placing highly on the option hierarchy option selection philosophy modelling a slower rate of technological rollout shows little distinction from *UUW*'s core pathway related to wastewater networks.

5.10 LS4f: Benign (Fast) Technology

LS4f.51 Wastewater enhancement totex; Sludge treatment – Other

5.10.1 A faster rate of technology change means we are able to deploy ATC technology sooner as an alternative disposal solution. Assumption that ATC technologies become deployable at scale by 2035.

LS4f.61 Wastewater enhancement totex; Greenhouse gas reduction (net zero)

5.10.2 The way we calculate investment to address greenhouse gas emissions matches the approach followed in the Core Pathway but for the investment expected under this scenario.

5.11 LS4g: Adverse Expectations

LS4g.51 Wastewater enhancement totex; Sludge treatment – Other

5.11.1 Assumption is a faster change in landbank availability and the loss of land reclamation sites. Therefore increased urgency to incinerate biosolids and interim landfill of biosolids.

5.11.2 Large increase in expenditure in AMP8 due to the landfill of biosolids, followed by large increase in expenditure in AMP9 and AMP10 to rapidly deploy incineration technology.

LS4g.61 Wastewater enhancement totex; Greenhouse gas reduction (net zero)

5.11.3 The way we calculate investment to address greenhouse gas emissions matches the approach followed in the Core Pathway but for the investment expected under this scenario.

5.12 LS4h: Benign Expectations

LS4g.51 Wastewater enhancement totex; Sludge treatment – Other

5.12.1 Slower change in landbank availability, no loss of land reclamation sites. Therefore no move to combustion and is drying sufficient.

5.12.2 Reduction in expenditure compared to core pathway.

6. LS5 - Wholesale water totex enhancement expenditure under common reference scenarios

6.1 Summary

6.1.1 We have identified the following alternative pathways associated with water enhancement:

- Adverse climate change CRS;
- Benign climate change CRS;
- Adverse demand CRS;
- Adverse (slow) technology CRS;
- Benign (fast) technology CRS;
- Alternative transfer 1 (one of our wider scenarios);
- Alternative transfer 2 (one of our wider scenarios); and
- Adverse expectations (one of our wider scenarios).

6.1.2 For each of these scenarios, the data in LS5 represents the total expenditure for the pathway.

6.1.3 Our testing indicates that we currently do not expect the need for alternative pathways under the benign demand CRS, or the benign or adverse abstraction reduction CRSs. For each of these scenarios, the data in LS5 represents the same total expenditure as the Water Core Pathway.

6.2 Price base 2022-23 FYA (CPIH deflated) - Water enhancement expenditure by common reference scenario ~ totex

LS5.1 Water enhancement totex - Abstraction reductions common reference scenario – low

6.2.1 The total expenditure represented in this line matches the Core Pathway.

LS5.2 Water enhancement totex - Abstraction reductions common reference scenario – high

6.2.2 The total expenditure represented in this line matches the Core Pathway.

LS5.3 Water enhancement totex - Climate change common reference scenario – low

6.2.3 The total expenditure represented in this line differs to the Core Pathway. The trigger point for this pathway occurs at the start of AMP9.

LS5.4 Water enhancement totex - Climate change common reference scenario – high

6.2.4 The total expenditure represented in this line differs to the Core Pathway. The trigger point for this pathway occurs at the start of AMP9.

LS5.5 Water enhancement totex - Demand common reference scenario – low

6.2.5 The total expenditure represented in this line matches the Core Pathway.

LS5.6 Water enhancement totex - Demand common reference scenario – high

6.2.6 The total expenditure represented in this line differs to the Core Pathway. The trigger point for this pathway occurs at the start of AMP8.

LS5.7 Water enhancement totex - Technology common reference scenario – low

6.2.7 The total expenditure represented in this line differs to the Core Pathway. The trigger point for this pathway occurs at the start of AMP9.

LS5.8 Water enhancement totex - Technology common reference scenario – high

6.2.8 The total expenditure represented in this line differs to the Core Pathway. The trigger point for this pathway occurs at the start of AMP9.

LS5.9 Water enhancement totex – Expectations – Benign

6.2.9 The total expenditure represented in this line matches the Core Pathway.

LS5.10 Water enhancement totex – Expectations – Adverse

6.2.10 The total expenditure represented in this line differs to the Core Pathway. The trigger point for this pathway occurs at the start of AMP9.

LS5.11 Water enhancement totex – Alternative Transfer 1

6.2.11 The total expenditure represented in this line differs to the Core Pathway. The trigger point for this pathway occurs at the start of AMP10.

LS5.12 Water enhancement totex – Alternative Transfer 2

6.2.12 This line has been added to LS5 (as advised by Ofwat).

6.2.13 The total expenditure represented in this line differs to the Core Pathway. The trigger point for this pathway occurs at the start of AMP12.

7. LS6 - Wholesale wastewater totex enhancement expenditure under common reference scenarios

7.1 Price base 2022-23 FYA (CPIH deflated) - Wastewater enhancement expenditure by common reference scenario ~ totex

LS6.1 Water enhancement totex - Abstraction reductions common reference scenario – low

7.1.1 The total expenditure represented in this line matches the Core Pathway.

LS6.2 Water enhancement totex - Abstraction reductions common reference scenario – high

7.1.2 The total expenditure represented in this line matches the Core Pathway.

LS6.3 Water enhancement totex - Climate change common reference scenario – low

7.1.3 The interventions associated with this scenario are seen to be the 'no regrets' options of the LTDS due to the very unlikely scenario that the rate of climate change will be benign or low between present day and 2050. We therefore have reported zero expected change under the benign climate change scenario.

7.1.4 The total expenditure represented in this line matches the Core Pathway.

LS6.4 Water enhancement totex - Climate change common reference scenario – high

7.1.5 The total expenditure represented in this line differs to the Core Pathway. The trigger point for this pathway occurs at the start of AMP9.

LS6.5 Water enhancement totex - Demand common reference scenario – low

7.1.6 The total expenditure represented in this line differs to the Core Pathway. The trigger point for this pathway occurs at the start of AMP9.

LS6.6 Water enhancement totex - Demand common reference scenario – high

7.1.7 The total expenditure represented in this line differs to the Core Pathway. The trigger point for this pathway occurs at the start of AMP9.

LS6.7 Water enhancement totex - Technology common reference scenario – low

7.1.8 The total expenditure represented in this line differs to the Core Pathway. The trigger point for this pathway occurs at the start of AMP9.

LS6.8 Water enhancement totex - Technology common reference scenario – high

7.1.9 The total expenditure represented in this line differs to the Core Pathway. The trigger point for this pathway occurs at the start of AMP9.

LS6.9 Water enhancement totex – Expectations – Benign

7.1.10 The total expenditure represented in this line differs to the Core Pathway. The trigger point for this pathway occurs at the start of AMP9.

LS6.10 Water enhancement totex – Expectations – Adverse

7.1.11 The total expenditure represented in this line differs to the Core Pathway. The trigger point for this pathway occurs in AMP8.

LS6.11 Water enhancement totex – Alternative Transfer 1

7.1.12 The total expenditure represented in this line matches the Core Pathway.

LS6.12 Water enhancement totex – Alternative Transfer 2

7.1.13 This line has been added to LS6 (as advised by Ofwat).

7.1.14 The total expenditure represented in this line matches the Core Pathway.

8. LS7 - Average total water, wastewater and combined bills under core and alternative pathways

8.1 Whole table

Methodology

8.1.1 To calculate the bill impacts for each pathway, we apply the calculation guidance set out by Ofwat to calculating incremental bill impacts contained within 'PR24 and beyond: Final guidance on long-term delivery strategies', (April 2022, p. 65). As a result, we do not use the AMP8 bill impacts generated by the PR24 financial model. This means that the projected bills from LS7 will not align to the bills projections within RR14 due to other factors within the financial model e.g. reconciliation adjustments. The simplified approach to calculating current tax allowances within LS7 is also a material cause of variation in future bills to RR14, as capital allowances are effectively ignored.

8.1.2 Bill impacts have been calculated on post-frontier shift efficiency and real price effects costs.

Calculations and approach

8.1.3 In AMP7, the average bills stated reflect the actual bills incurred to date and the forecasted bills for years 4 and 5 that we expect based on our current latest best estimate of future charges.

8.1.4 In calculating future (AMP8 onwards) revenues and bill impacts, each enhancement line within LS3 and LS4 (and the alternate pathway versions) is allocated to one or more of 9 expenditure categories based on the type of enhancement undertaken; opex, IRE, infrastructure enhancement, land and five capital expenditure categories based on the accounting asset life. Revenues are derived using the standard building block approach where:

- Opex and IRE are recovered through revenues in year via PAYG;
- Deprecation (RCV run off) is calculated on the capital expenditure additions on a straight-line basis for each category of capital expenditure. It is assumed to commence in the year in which the expenditure is incurred, rather than 50% as in the financial model. This is a simplifying assumption but over time a 25 year period that we anticipate would be largely immaterial;
- Expenditure that is not recovered through RCV run off in year is added to an enhancement RCV, which incurs the allowed return. In calculating the allowed return we have reflected the changes made as a result of the consultation on allowed return and discounted the closing RCV using the WACC for that AMP when calculating the average RCV for each year; and
- Tax is calculated using the formula contained within 'PR24 and beyond: Final guidance on long-term delivery strategies', (April 2022, p. 65).

8.1.5 Wholesale revenues are then multiplied by 1.01 to account for the retail margin in line with the guidance and the amount recovered from household customers derived. The forecast for the number of household customers is sourced from our WRMP submission and the proportion of wholesale revenues that are recovered from household customers is taken from those calculated in the financial model for PR24 (used in deriving average bills within RR14) for AMP8 and then held constant for future years at the 2029/30 level.

Assumptions

8.1.6 Bill impacts are calculated only on the incremental enhancement expenditure but for modelling, we assume that capex additions are not fully depreciated at the end of their accounting life. We do this because maintenance / replacement expenditure is excluded from the totals within the LS3 and LS4 tables. By continuing the depreciation of each enhancement in perpetuity it mirrors the impact of the replacement costs and prevents bills from being understated as the future maintenance / replacement would be accounted for within the price control revenues as part of allowed botex.

8.1.7 We do not attempt to forecast any future changes to tax and allowed returns beyond what is stated within tables RR1 and RR5. Therefore, we assume that corporation tax remains at 25% for all years and that the Wholesale CPIH-stripped WACC is 3.23% for AMP8 and 3.84% for AMP9 and beyond. We maintain the 1% Retail margin for all years.

8.1.8 We have presented the 'Average change in average bills per year over period' for AMPs 10, 11 and 12 as being the difference between the average of the total bill increase in each year in the respective AMP minus the bill in the final year of the previous AMP. Therefore, if bills are increasing it will slightly understate the total bill increase by the final year, and if bills are decreasing then it will overstate the total bill increase by the final year. For the avoidance of doubt, this calculated average change in bills does not need to be multiplied by five.

8.1.9 For simplicity we allocate all water enhancements to the 'water bill', wastewater enhancements to the 'wastewater bill' and the combined bill is then the summation of both for commonly defined pathways, reflecting that *UUW* has roughly the same amount of water and wastewater customers in its region. We only calculate combined bills where there are pathways that are comparable and change in expenditure is forecast across both water and wastewater. Therefore, any adaptive pathway that is specific to either water or wastewater is only presented by the specific average total bill and not a combined bill. This applies to the following adaptive pathways:

- LS3f Water scenario: Alternative transfer 1 (adverse);
- LS3g Water scenario: Alternative transfer 2 (benign);
- LS4d Wastewater scenario: Benign demand; and
- LS4h Wastewater scenario: Benign expectations.

Outputs

8.1.10 For clarity on how the table should be interpreted, we have provided graphs below that show the cumulative bill impact relative to 2024/25's average bill for both the core and alternate pathways for Water (Figure 14) and Wastewater (Figure 15) separately. This also provides the end of AMP rather than the AMP average increase for AMPs 10, 11 and 12.

8.1.11 There is variance in the water bill impact under different scenarios, aligned to the adaptive pathways. This reflects the assumptions outlined in section 3 and consequent forecast enhancement expenditure in LS3(a-h) data tables.

8.1.12 Comparably, for wastewater there is little change in the forecast bill impact. This is a result of scenario testing outputs in LS4(a-h). As described in our LTDS there are a combination of factors leading to the small change in LS4 and consequently wastewater bill impacts:

Adverse climate change

- The industry wide modelling capabilities for wastewater are limited (at the time of modelling) to testing the RCP8.5 climate change scenario using UKCP09 data only. We have carried out sensitivity testing using UKCP18 data for a small number of drainage areas and found no material impact on flooding, however we anticipate that once UKCP18 data is fully available testing may show greater variations in the impacts from climate change. Sensitivity tests could not be carried out for UKCP18 on storm overflow forecasts as these require time series data. Consequently, the bill impact for adverse climate change shows the minimum level of change.

Adverse technology

- Due to *UUW*'s investment in innovative 'dynamic network management' we are already have significant coverage of real-time monitoring across the wastewater network. In the adverse scenario we considered the impact of this slowing, but due to the existing coverage the impact is negligible.

Adverse demand

- The demand scenarios outline the need to test the higher and lower of the growth forecasts from local plans or from ONS population and household projections. The difference between plan based

and ONS forecasts for growth equates to ~5% difference (15.2% plan based, 10.5% ONS). We tested this through our WwTW models along with a +/-30% sensitivity testing assessment. Both of these exercises concluded that whilst investment is clearly required for growth, the uncertainty in growth forecasts can be accounted for through solution design and as such have an immaterial impact on WwTW investment need. Where there would be a greater impact of growth is in isolated areas with significant growth resulting from developments such as of garden villages which may require new WwTWs to provide sufficient capacity. We have tested the impact of two further developments of such a scale over the planning horizon which we believe reflects an extreme but plausible change in future needs.

Adverse expectations

- This scenario accounts for changes to bioresources leading to loss of landbank outlets for biosolids recycling. Whilst this is a significant change for the bioresources price control the impact on bills is largely driven by statutory storm overflow requirements which remain the same in this scenario.

Figure 14: Average total water bills under core and alternative pathways

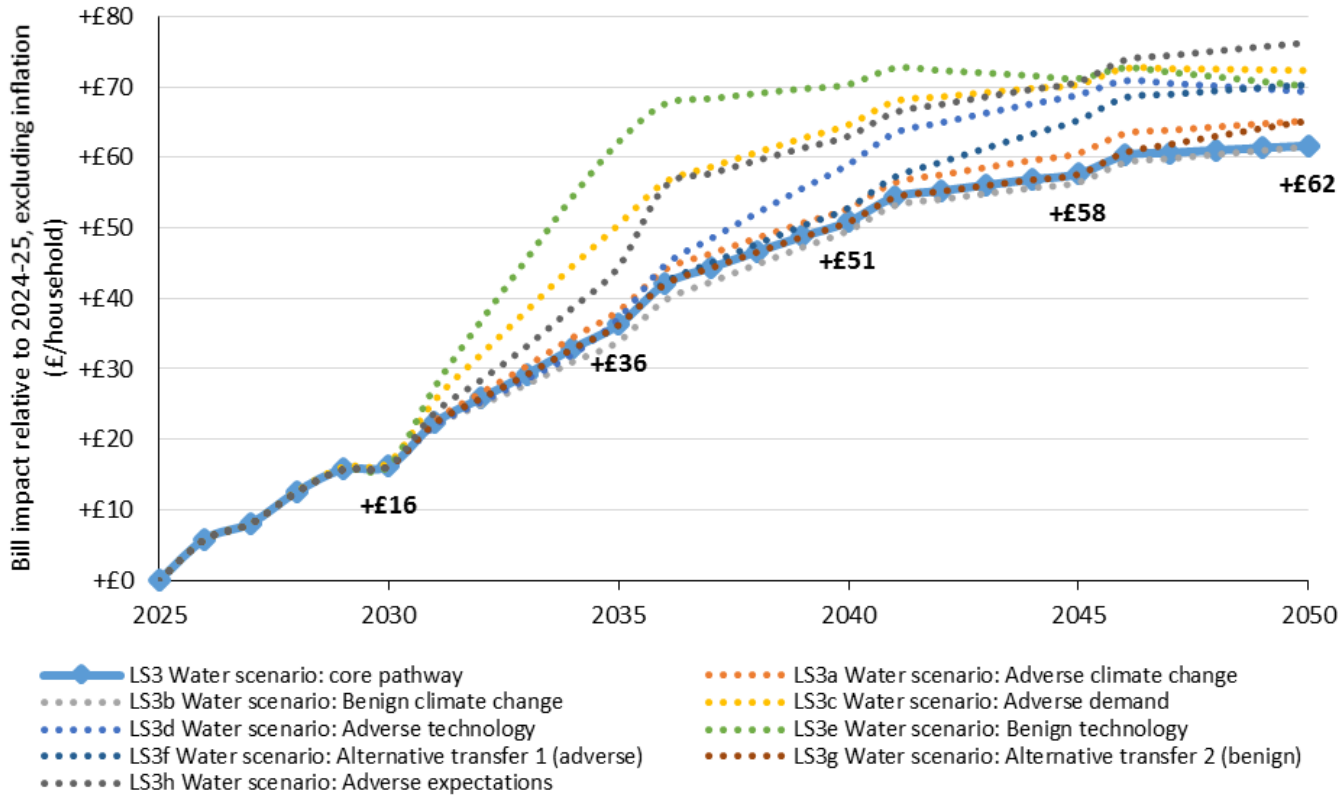
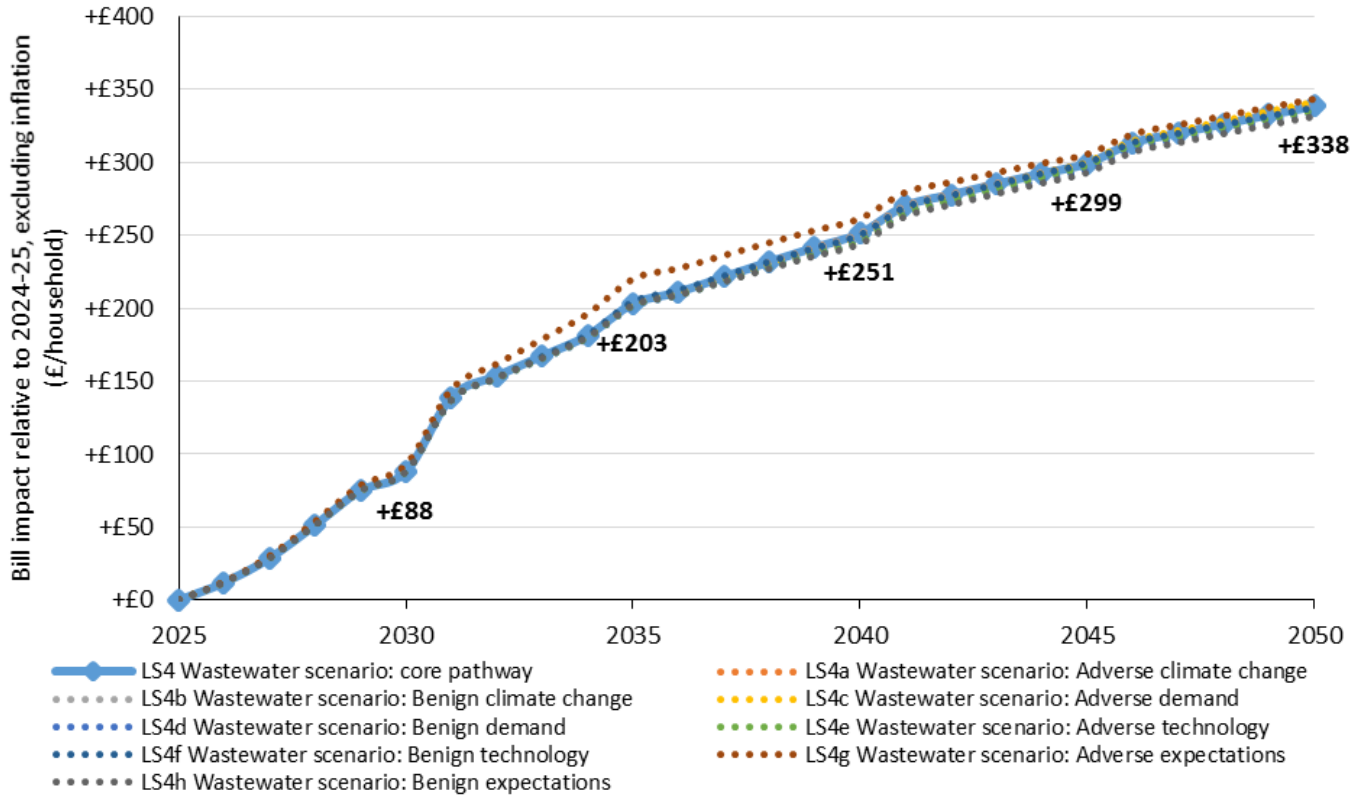


Figure 15: Average total wastewater bills under core and alternative pathways



Appendix A Compliance with reporting requirements

A.1 General

A.1.1 *UUW* have endeavoured to fully comply with all of the reporting requirements. In a small number of instances where this is not the case, we have fully explained this within the table commentaries with appropriate justification.

A.2 Ofwat query response ID-533

A.2.1 *UUW*, in response to query ID-533, has not trimmed its data to match Ofwat's defined number of decimal place requirements. For display purposes data will, however, always conform to the formatting rules as set within the Ofwat PR24 tables. We believe this to be fully aligned to the table requirements.

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