Hafren Dyfrdwy PR24 Cost Adjustment claims

June 2023

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Content

1. HDD network expenditure to manage interruptions performance

Cost models assume a consistent level of performance is being delivered across the sector. Therefore, the HDD model forecasts are assuming an interruption performance of around 5 minutes.

Interruptions performance is a function of network complexity (rurality and topography) and other characteristics (for example mains material) that determine how quickly water supplies may be restored when they are affected by an asset or system failure. We estimate that this additional challenge contributes approximately 20 minutes to interruptions performance. As these factors make the delivery of common levels of performance harder, more expenditure is required. Econometric models give additional expenditure based on the complexity of the supply area. In the PR24 consultation models this is through the density and network complexity drivers (boosters/length or APH).

Table 8: Claim summary table

Claim component	Value	Description
Is the claim symmetrical?	No	Whilst all companies invest to manage to interruptions, this expenditure is for incremental expenditure in addition to that previously incurred. Therefore, symmetrical adjustments are not required.
Can the cost be isolated from the botex+ dependent variable?	Yes	Claim is based on Network capital expenditure (TWD renewals + MNI)
Is there a suitable explanatory variable available to describe the costs?	No	We do not consider that models can appropriately forecast our future expenditure requirements (i.e. they are not sufficiently sensitive of the relationship between cost, cost driver and performance).
Gross claim (assuming PR24 consultation models)	£68.6m	Implicit allowance + Net Claim
IA (assuming PR24 consultation models)	£52.0m	Triangulation of Difference approaches (removing TWD renewals and MNI (and explanatory variables))
Net Claim (assuming PR24 consultation models)	£16.6m	Bottom-up assessment of costs - historic renewal rate adjustment
Gross claim (assuming SVE symmetrical network complexity CAC)	£68.6m	Implicit allowance + Net Claim
IA (assuming SVE symmetrical network complexity CAC)	£56.2m	Triangulation of Difference approaches (removing TWD renewals and MNI (and explanatory variables))
Net Claim (assuming SVE symmetrical network complexity CAC)	£16.3m	Bottom-up assessment of costs - historic renewal rate adjustment
Relevant Price Controls		Water Network+

Cost models assume a consistent level of performance is being delivered across the sector. Therefore, the HDD model forecasts are assuming an interruption performance of around 5 minutes.

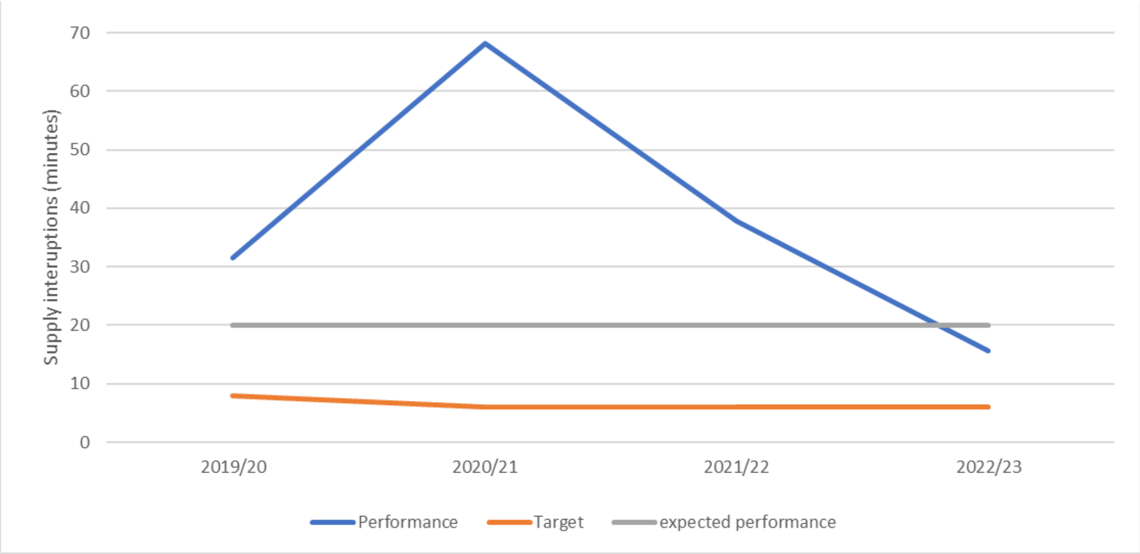
Interruptions performance is a function of network complexity (rurality and topography) and other characteristics (for example mains material) that determine how quickly water supplies may be restored when they are affected by an asset or system failure. We estimate that this additional challenge contributes approximately 20 minutes to interruptions performance. As these factors make the delivery of common levels of performance harder, more expenditure is required. Econometric models give additional expenditure based on the complexity of the supply area. In the PR24 consultation models this is through the density and network complexity drivers (boosters/length or APH).

We have calculated the additional TWD expenditure that the models are giving to HDD as a result of its density, boosters and APH characteristics. This can be considered as a TWD complexity Implicit allowance. This IA is £27m, this is the additional costs that HDD theoretically need to spend to deliver the performance relative to if HDD had an average level of density and network complexity.

The current performance challenge of around 20 minutes is due to rurality and failures of trunk mains in Wrexham which, being made from Asbestos Cement (AC) and Polyvinyl Chloride (PVC) sections, require full 4 metre lengths to be replaced when it bursts. The modelled allowance is insufficient to overcome these inherent difficulties to deliver a five-minute performance. We therefore believe that additional expenditure is required to achieve the level of performance assumed within the econometric modelled allowances.

Performance has improved over the last two years in part because we have targeted investment effectively and in part because of the absence of a significant event. Recent significant events have been failures of sections of trunk main in Wrexham (with an average impact between 2020 and 2023 of 17.5 minutes) and storm Arwen in 2021 that simultaneously affected the energy supply to multiple distribution booster stations (DBS) in Powys (with an impact of 11.5 minutes).

Figure 23: Improvement in Supply interruptions performance against target



Whilst the ODI collar at 22minutes brings some financial protection, we need to step up investment to mitigate these significant individual events and thereby improve customer service to the levels expected.

1.1 Need for adjustment (necessary)

1.1.1 Unique circumstances

Criteria

- a) Is there compelling evidence that the company has unique circumstances that warrant a separate cost adjustment?
- b) Is there compelling evidence that the company faces higher efficient costs in the round compared to its peers (considering, where relevant, circumstances that drive higher costs for other companies that the company does not face)?
- c) Is there compelling evidence of alternative options being considered, where relevant?

We are managing our network sensibly in a way that minimises interruptions. But the inferred level of expenditure assumed within base models is not sufficient to deliver comparative levels of performance.

We have reviewed both our operational capability and capital maintenance activities to ensure that we are making the best use of our customers' money. To do this we have identified and prioritised activities through the supply interruptions lifecycle and factored in lessons learnt from our root cause analysis that we apply to all interruption events.

The table below sets out an overview of each phase of an event, the generic factors that influence likelihood and consequence (extent and duration), the challenges facing Hafren Dyfrdwy reflecting the characteristics of our network and how we have sought to address these challenges.

Table 9: Supply interruptions lifecycle and challenges

Phase	Factors influencing likelihood, extent and duration	Specific challenge facing HDD	Operational Improvements and capital interventions in AMP 7
Initiation of an event	Asset failure • mains (capacity, condition, pressure and ground conditions) • Booster station (capacity, condition, power supply reliability) • Service reservoir (capacity, water quality integrity) • WTW (water quality integrity, condition, power supply reliability) High demand event Reliability and accuracy of customer reporting process	• High predominance of Asbestos cement and PVC mains • High numbers of booster stations in remote upland areas • Unstable geology prone to landslip and river erosion • High number of private water supply customers able to switch to public supply in hot, dry weather	• Pressure management to prevent mains bursts from occurring • Replacement of frequently bursting mains with a high likelihood of causing interruptions (AC/PVC) • Ensuring DBS, Distribution Service Reservoir (DSR) mains capacity keep pace with increasing peak demand • Relocation of assets affected by river erosion and landslip
Speed of awareness to pin-point location, identify cause and initiate remedial action	Density of asset monitoring points and customers (rurality) Availability of real time flow, pressure and asset health data Quality of systems and people to interpret data	• large, dispersed network with low density of monitoring points and customer contact on which to base decisions • mobile phone network coverage intermittent due to terrain	• Enhanced monitoring to enable earlier detection and location of asset failures
Isolate failed asset and provide alternate supply	Ability to rezone customers Valve and hydrant frequency volume to drain down	• Greater distances between isolation valves (greater travel time and volume to drain down) • Lack of rezone options in the Powys valleys	• Providing more resilience and storage to keep customers on supply • Improved temporary supply (tankers and injection points)
Repair and restore supplies to all customers	Repair type and complexity Health and Safety Valve and hydrant frequency volume to re-charge	• Greater distances between isolation valves (greater travel time and volume to drain down) • High predominance of Asbestos cement and PVC mains that require full length repair	• Creation of depot at Newtown to enable a quicker on the ground response • Targeted renewal of AC/PVC mains

Our operational management strategy has been to increase our capability to respond to events and reduce travel time to site by inspectors and gangs by:

- Opening a new distribution depot in Newtown at an estimated annual cost of £60k per year opex;
- Recruiting two additional Network Controllers based in at our Wrexham control room;
- Recruiting an additional Technical Operator within the Powys area;
- Recruiting apprentices for succession planning purposes;
- Improving visibility on the network by migrating the Dee Valley legacy Wrexham telemetry system to Escada;

- Logging every valve location using 'What 3 Words' to make finding fittings in agricultural land and at night quicker;
- Deploying high speed loggers on a trial basis at critical locations on trunk mains;
- Engaging a local supplier available 24/7 to assist in clearing flooded areas using suction tankers;
- Carrying out an extensive data cleanse of our operational assets within our data systems, and;
- reviewing and assigning reoccurring proactive maintenance activities to critical valves, hydrants and air-valves.

In terms of capital investment, we have developed a base maintenance plan that seeks to strike the right balance of achieving stable asset health and meeting key performance commitments. This is informed by our root cause analysis of interruptions alongside an assessment of water quality risk and a review of activities required to reduce leakage and improve customer experience.

The outcome of this process is shown in the table below that shows an AMP7 investment programme that is skewed towards improving our performance on supply interruptions. For example, out mains renewal programme targets high bursting AC and PVC mains that cause interruptions rather than leaky cast iron mains.

Table 10: AMP7 Network Investment Programme

Activity	Purpose	Capex £m
Mains renewal	To replace frequently bursting mains, those that cause interruptions or impacted by river erosion	4.925
Pressure management	To prevent mains bursts from occurring	0.160
Network visibility	More flow and monitoring points across the network to detect and locate events earlier	0.426
Cross connections and tanker injection points	Enhancing our rezone and alternative supply capability to reduce the number of customers impacted during an event	0.214
Booster station replacement / upgrades	Ensuring transfer capacity keeps pace with increasing peak demand	2.108
DSR	Ensuring DSRs can be taken out of supply	0.095
Total		**7.928**

This data driven, balanced approach has been successful in that we have improved interruptions performance, albeit at a level still above the 5-minute target, whilst achieving leakage, water quality and customer service goals.

Despite this interruption focussed network maintenance approach, we do not believe that the allowances are sufficient to deliver the common performance levels expected by regulators or customers. The most significant issue is renewal of AC and PVC sections of trunk mains in Wrexham.

Quantifying the impact of our current network maintenance costs on interruptions

Our root cause analysis enables us to understand where we need to focus investment. The table below shows a breakdown of the root cause of events and how our investment programme maps to it.

Table 11: Average contribution to interruptions performance between 2020/21 and 22/23 by category

Causation category	Number of events	Customer minutes	% of total	Expenditure that contributes to this performance
Small diameter mains bursts	70	1,116,899	26%	Infrastructure renewal expenditure IRE
Trunk mains bursts	7	2,629,753	61%	
Booster pumping station failures	5	272,165	6%	Water network MNI
Power failure at rural booster pumping stations and service reservoirs	1	191,247	4%	Water network MNI
Peak demand stress on Booster pumping stations	1	1,403	<0%	Water networks MNI
Failure of valves and hydrants	9	79,234	2%	Infrastructure renewal expenditure IRE
Total	**93**	4,290,701	100%	

In total these operational and capital maintenance interventions we have undertaken in AMP7 have delivered a reasonable improvement from a high point of 68 minutes in 2020/21 to 16 minutes in 2022/23.

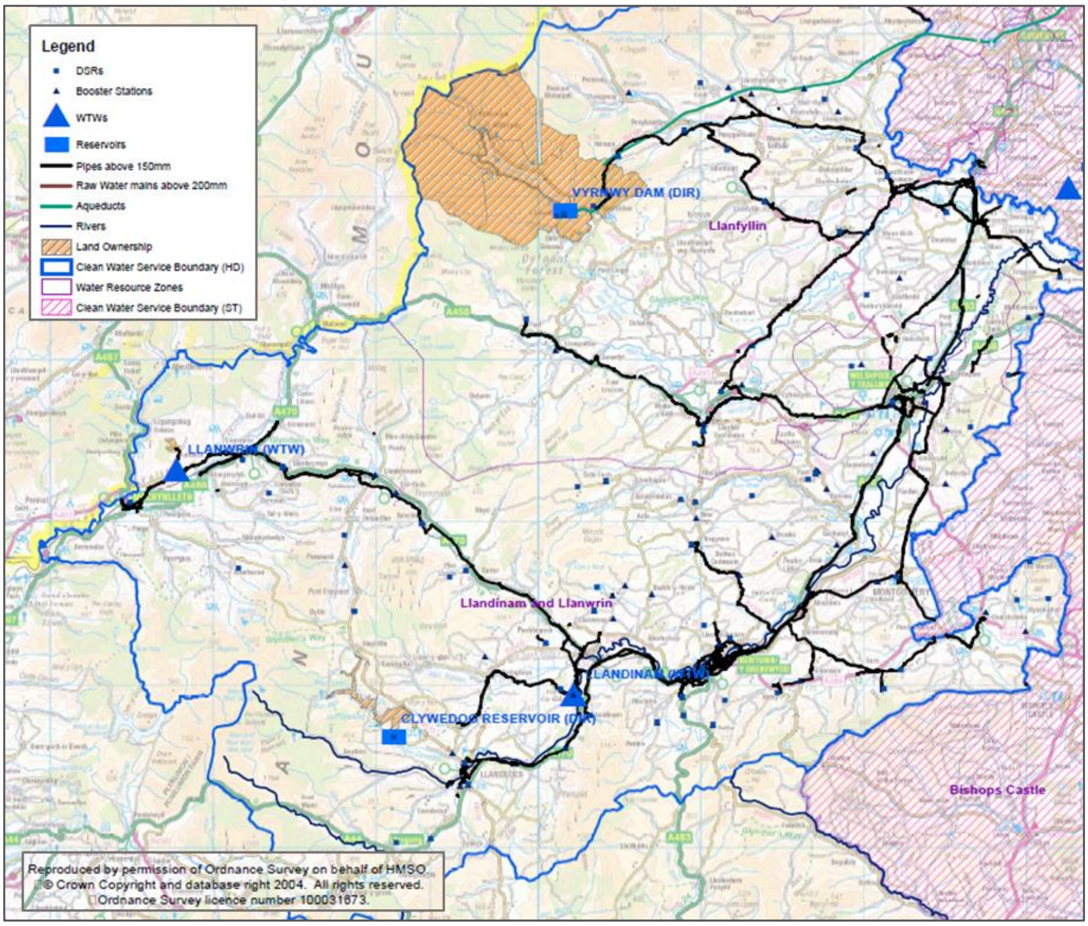
There are specific challenges that we face which makes it hard to deliver interruptions performance in line with other companies (that have very different characteristics)

Our supply area is made up of a small rural population spread over a wide area and a single large town that contains a about a third of our customers. Both these aspects contribute to our supply interruptions challenge.

Small rural population spread over a wide area:

- It is difficult to always react to failures quickly as travel times are longer and we cannot benefit from economies of scale.
- In addition to the longer distances that our operatives must travel, pinpointing the location of the issue is more challenging rural areas with mains in agricultural land taking longer to track down compared to bursts in urban areas as there are fewer customers, street lighting and access to fittings.
- Isolating the damaged main to enable repair also takes longer. Analysis using hydraulic models indicates that there is a greater number and distance between valves meaning that it takes longer to isolate a main.
- Rezone options are limited because the distribution network follows the topography and serves the small communities that stretch along the valleys. Analysis using hydraulic models indicates that in the Powys area approximately 30% of customers cannot be rezoned if their supply main fails. An equivalent analysis for Severn Trent gives 15%. The map below illustrates this point by showing the trunk main network in Powys area following the topography.

Figure 24: Map showing the Powys trunk main network to illustrate lack of re-zone options



- We have more assets relative to supplying in a more urban/suburban setting. This means more assets to fail and, due to a greater length of main to serve each customer, more time is needed to drain down the network to enable a safe repair and then recharge to restore supplies.
- More booster stations are required to deliver water to customers in an undulating area. This leads to fluctuating pressures that are a driver of mains deterioration.

Wrexham urban area dominating:

- Despite having a relatively small population at a national scale, the Wrexham urban area dominates the supply area - Wrexham has a 65,000 population out of a total of 206,000 whereas Leamington-Spa with a roughly equivalent population in Severn Trent has a population of 50,000 out of a total of 8,456,000.
- When the strategic assets needed to supply our customers, for example trunk mains, fail a proportionally larger number of people will likely be impacted.
- Whilst Wrexham assets are not huge on a UK level, they are for HDD. The small total population means that any failure of these asset has a very large impact on the company interruptions performance. All things equal, the assets needed to supply Leamington Spa are roughly equivalent and will have a similar likelihood of failure. However, the impact of individual failures over the total population will have a significantly reduced impact on Severn Trent's reported interruption performance relative to the impact of failures of Wrexham assets on Hafren Dyfrdwy's interruptions performance.

In addition to the spread of our customers across our region, there are other company specific attributes of our asset base that make interruptions harder to manage relative to the industry average.

Mains material impacting repair times:

- As seen from ***Table 12***, over the last three years, 87% of our interruptions have come as the result of a mains burst. Drilling down into this data reveals that 89% are from failures on AC and PVC mains where, typically, a full length needs to be replaced which extends duration that the main is out of commission.

Table 12: Supply interruptions by mains material type

Material type	% of mains in HDD with that material	% interruptions caused by failures on mains of this type
Asbestos Cement	24%	79%
PVC	22%	10%
Polyethylene	32%	4%
Ferrous	22%	6%

- The reason for the long duration to repair AC mains is due to the risk to health of cutting into the main to replace a short section meaning a larger excavation is needed to replace the length of main between joints. PVC mains tend to split along a length again requiring a large excavation to facilitate a full-length repair. These issues are illustrated in ***Figure 25*** below.

Figure 25 examples of full length replacements for failed sections of trunk main in Wrexham

Failure on an AC section of trunk main in Wrexham

Length repair on the same section of trunk main in Wrexham

Split on length of a PVC section of trunk main in Wrexham requiring length repair

- In comparison to other companies, we have a larger proportion of AC and PVC mains. The principal reason for this is that both materials are lighter than similar diameter ferrous mains and are therefore easier to install in rural locations. The UKWIR mains failures database indicates that the industry average percentage of AC mains is approximately 10% (compared to 24% for HDD), and the percentage of PVC mains 15% (compared to 22% for HDD).

Model coverage and the impact of the SVE network complexity claim.

This claim relates to costs that have not been incurred in the past. Consequently they are not included in the modelling data panel and therefore, symmetrical adjustments are not required.

Network complexity in the botex+ models does not account for HDD's specific circumstances. We are aware of Severn Trent's attempts to better specify models such that they take better account of network complexity cost drivers. However, our analysis shows that this symmetrical cost adjustment claim will only partially account for the pressures felt by HDD.

1.1.2 Management control

- **Criteria**
- d) Is the investment driven by factors outside of management control?
- e) Have steps been taken to control costs and have potential cost savings (eg spend to save) been accounted for?

We cannot control the external circumstances of our supply area that underpin interruptions performance.

In the section above, we set out some of the specific circumstance that make the consistent delivery of common interruption performance levels more challenging:

- Rurality;
- Configuration of assets that follow the local topography;
- Pumping stress;
- The dominance of Wrexham on performance statistics, and;
- The predominance of mains materials laid between 1950 and 1975 that require replacement of lengths on failure rather than quicker collar or piece repairs.

Where these are driven by the attributes of the supply area we serve (i.e. the geography, geology and location of the customer base), they will always be outside of management control. Where they relate to the location and configuration of assets, they will be outside of management control in the short and medium term.

Whilst we can control the way in which we invest (given the external attributes that we face), these choices need to be viewed in the context of the underpinning external factors and the size of the expenditure that would be required to get to common levels of performance

The way in which network expenditure is spent in the face of such external circumstances is within management control. Our average mains renewal rate over the last five years is 0.32% and is targeted at reducing supply interruptions.

However, the level of this expenditure needs to fit within the wider view of required efficient base expenditure. This is determined by Ofwat's base econometric models. There is a material gap between the level of efficient expenditure inferred by models and the identified cost needed to get to the common 5-minute target. Delivering such expenditure without any adjustment would lead to the company appearing to be dramatically inefficient.

- Fundamentally, we are efficiently spending our network base allowance following a coherent and proven asset management approach and this is delivering 20 minute interruptions performance.
- If we were to re-allocate this money (e.g. more proactive work and less reactive work), this would likely lead to an increase in interruptions rather than a reduction. The current expenditure is delivering the existing performance level. This is the underlying level of performance which needs to be built upon rather than allowed to deteriorate.

Therefore, we do not think that the expenditure set out in this claim to get interruptions performance to 5 minutes can be coherently considered as being within management control.

1.1.3 Materiality

Criteria

- f) Is there compelling evidence that the factor is a material driver of expenditure with a clear engineering / economic rationale?
- g) Is there compelling quantitative evidence of how the factor impacts the company's expenditure?

Interruptions performance is fundamentally driven by:

- operational processes we follow to manage asset failures as and when they occur (reactive maintenance), and
- capital interventions to reduce the propensity of those assets to fail (proactive maintenance).

The table below sets out our view of which factors are not fully within management control.

Table: Summary of circumstances outside management control and how they impact interruptions

Circumstance outside of our control	Impact on assets	Impact on on-going base costs	Impact on interruptions performance
Supplying a more rural area	More assets per person	More assets to maintain More assets to operate Reduced opportunities for economies of scale	More assets to fail Longer travel times to and from site for people to resolve issues Greater distances between valves and hydrants so longer lengths of main to drain down and recharge
Supplying a more hilly area characterised by isolated valleys	More pumping	Increased pumping increased network deterioration which increases maintenance	More pressure transience (therefore assets deteriorate quicker) Less opportunities to re-zone customers to mitigate the impact
A high proportion of AC and PVC mains	none	negligible	Longer repair times as length repairs required
Supplying an area where most of the population is in one location	None	negligible	Single events in Wrexham have a very large impact on performance commitment

We set out the marginal costs over and above the expected allowance for base expenditure. These consist of the optimal set of interventions that are required in order to operate at the interruptions common performance commitment level.

They are a material increase in expected costs.

Given that we consider that our network costs are already efficiently incurred we suggest that there is a clear economic rationale for the claim.

1.1.4 Adjustment to allowances (including implicit allowance)

Criteria

- h) Is there compelling evidence that the cost claim is not included in our modelled baseline (or, if the models are not known, would be unlikely to be included)? Is there compelling evidence that the factor is not covered by one or more cost drivers included in the cost models?
- i) Is the claim material after deduction of an implicit allowance? Has the company considered a range of estimates for the implicit allowance?
- j) Has the company accounted for cost savings and/or benefits from offsetting circumstances, where relevant?
- k) Is it clear the cost allowances would, in the round, be insufficient to accommodate the factor without a claim?
- l) Has the company taken a long-term view of the allowance and balanced expenditure requirements between multiple regulatory periods? Has the company considered whether our long-term allowance provides sufficient funding?
- m) If an alternative explanatory variable is used to calculate the cost adjustment, why is it superior to the explanatory variables in our cost models?

Methodology for quantifying the claim

We have developed a methodology to quantify additional capital expenditure over and above that assumed PR24 botex+ modelling forecasts. This is the capital expenditure that is needed to perform in line with the common interruptions performance commitment.

- The **gross claim** relates to the total Network Renewals Expenditure (TWD Opex – Renewals expensed in year) and Maintenance Non-Infra (TWD – Maintaining the long term capacity of assets) that we consider is needed for our asset base to have an interruptions risk profile that is in accordance with the common interruptions performance commitment. This Gross claim should incorporate the calculated Implicit Allowance which we consider accounts for the efficient level of expenditure to manage our network assets at the current interruptions risk profile. This adds an efficiency challenge to the existing activity if the modelling shows it to be inefficient.
- The **implicit allowance** relates to the allowance for Network Renewals Expenditure and Maintenance Non-Infra assumed by botex+ models for AMP8. This equates to our current level of interruptions performance.
- The **net claim** relates to the additional Network Renewals Expenditure and Maintenance Non-Infra costs over and above the implicit allowance that we consider are required to get to an interruptions risk profile that is aligned to the required common level of performance. These costs will need to be demonstrably efficient or subjected to an efficiency challenge. Whilst we consider that the bottom-up costs in our claim are efficient, a further challenge when deriving the net claim value to protect customers may be required. This is to reflect Ofwat’s expectation that increased renewal activity would needs to be above a 0.4% baseline rate.

The approach is summarised in ***Figure 26***.

Figure 26: Illustration of how the claim has been quantified

We describe the premise for how we have quantified each of the key components below. Finally, we set out in detail the central scenario of the quantified claim.

Premise for determining the implicit allowance

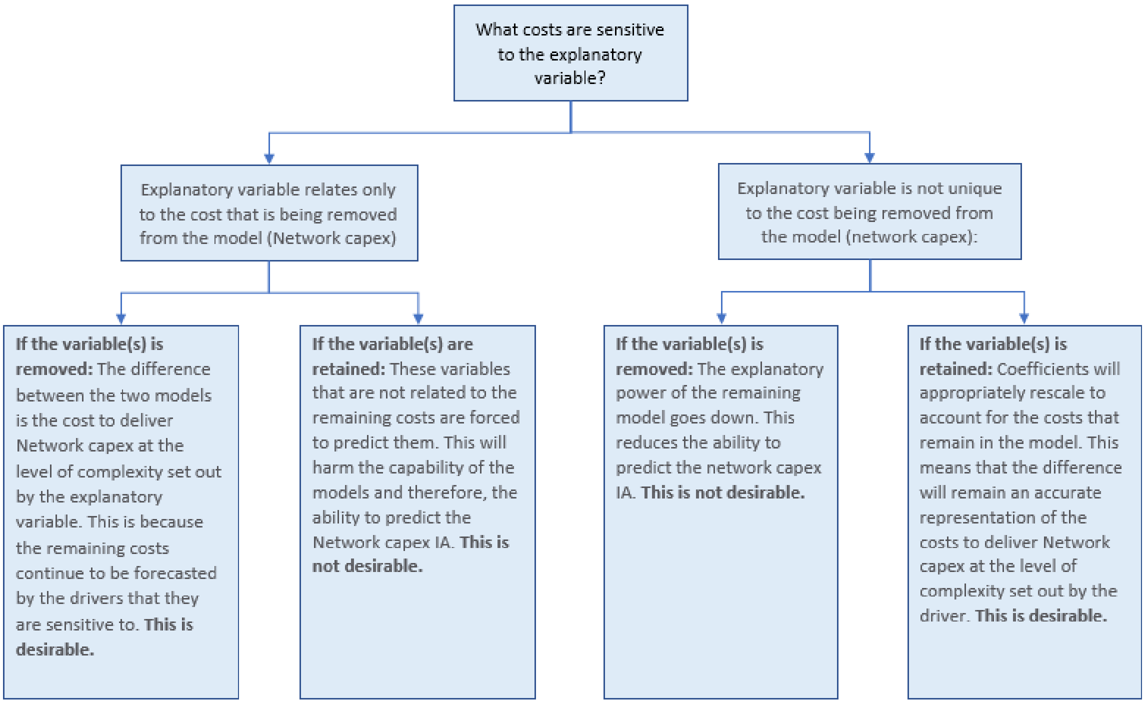
We have calculated the IA of network capital expenditure by using the 'difference' approach (described earlier in the document). This starts with botex+ models and then determines the change in forecast expenditure when costs (i.e. the dependent variable) and/or cost drivers (i.e. the explanatory variables) are removed.

By removing the costs and explanatory variables together, we are essentially removing the impact of network capex for the given level of complexity inferred by the explanatory variables from the model forecast [1]. However, this will also impact on the costs and cost drivers left behind in the model, particularly where explanatory variables describe multiple costs to differing extents. This makes the choice of IA more complicated. Ideally, the identified cost (i.e. network capex) would be removed alongside the related explanatory variables. This would then isolate the cost of this activity at the given level of complexity inferred by the explanatory variable.

However, the appropriateness of the approach relates to whether the network explanatory variables that would be removed are also a driver of the costs that remain in the model. This is set out in the figure below.

[1] A difference approach can also be completed by removing the explanatory variables but not the dependant variable. Whilst this will not help to identify the implicit allowance, it would expose the amount of expenditure that the models are providing relative to the industry average for the given level of complexity as identified by the explanatory variables

Figure 27: The impact of removing explanatory variables in the 'difference' IA approach



In practice, it is not possible to be definitive as variables cannot simply be allocated to one cost type or another. Therefore, it becomes a question of extent. Pragmatically, this would mean that it is sensible to: remove variables that are predominantly related to network capex and have a lesser impact on the other costs; and retain variables that where the explanatory power is relatively equal across the cost categories. The importance of the explanatory variables included in the TWD (and WW) models is set out in the table below.

Table 13: Potential explanatory factors contributing to network capex allowance

Explanatory factors in TWD (and WW) models		Network capex (being removed from dependent variable)	Network Opex (being retained in dependent variable)	Treatment botex (being retained in dependent variable)
Network complexity	Boosters per length	Major cost driver	Some explanatory power	Limited explanatory power
	Network APH	Some explanatory power	Major cost driver	Limited explanatory power
Population density		Some explanatory power	Some explanatory power	Major cost driver

On this basis, density drivers should not be removed, but the position for the network complexity driers is more nuanced.

We have calculated three options:

- Retain all the explanatory variables that are currently included in the TWD models: Boosters/length, APH and population density
- Remove the network complexity drivers (Boosters/length and APH)
- Remove all the explanatory variables (Boosters/length, APH and population density).

We are aware of Severn Trent's proposed symmetrical cost adjustment claim relating to network complexity. It attests that TWD costs would be better specified if models included both Boosters/length and APH drivers rather than switching between them. This is because the explanatory variables are materially different and seek to explain different aspects of the TWD cost base. We support this assertion.

If this symmetrical adjustment were to be applied, this would increase the amount of TWD expenditure being forecasted for Hafren Dyfrdwy. Whilst this would be a welcome step, we do not consider that it would be sufficient to cover the cost pressures set out in this claim. For clarity, we have repeated the implicit allowance approach with the impact of the Severn Trent CAC included (i.e. the IA 'difference' approach is applied to the botex+ models assumed within the SVE network complexity CAC rather than to the PR24 consultation botex+ models).

Network renewal adjustment

We are aware of the need to make sure that additional expenditure on mains renewal should not be to 'catch-up' with activity that had already been funded by customers through cost allowances at previous price reviews. This is set out by Ofwat in section 3.4.2 of Appendix 9 of the PR24 Final Methodology statement. Ofwat consider that the PR19 allowances were calculated on the basis of a 0.4% annual renewal rate. Our outturn mains renewal rate is set out in ***Table 14***.

Table 14: Main Renewal Rates

	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	Average (4 years)*	Average (5 years)*
HDD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.63	0.43	0.15	0.09	0.29	0.33	0.32
SVE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.50	0.59	0.09	0.15	0.31	0.33	0.33
SVT	0.80	0.64	0.58	0.48	0.41	0.35	0.26	N/A	N/A	N/A	N/A	N/A	0.37	0.42
DVW	0.53	0.58	0.48	0.23	0.63	0.23	0.27	N/A	N/A	N/A	N/A	N/A	0.34	0.37
Industry Average **	0.61	0.48	0.43	0.35	0.26	0.26	0.30	0.30	0.26	0.13	0.13	0.22 ***	0.21	0.21
Industry Total Rate**	0.53	0.39	0.32	0.24	0.19	0.20	0.23	0.24	0.22	0.09	0.09	0.17	0.16	0.16

**Average based on last available 4/5 years*

***Industry Average is average of annual company %'s; Industry Total Rate is the sum of all companies renewal activities.*

****Value not yet available, estimate based on trends*

Our renewal rate of 0.32% from 2019/20 compares well with the rest of the industry. However, this does suggest that some the current mains renewal rate is slightly below the PR19 expenditure assumptions. To acknowledge this, an adjustment to the net claim costs would be appropriate.

This could be quantified as follows:

- By bottom-up assessment of the cost to deliver the difference between the outturn renewal rate (0.32%) and the historic allowance assumption (0.4%).
- By review of the apparent efficiency of our outturn expenditure and assuming that this relates a reduction in scope rather than a true efficiency.

The table below sets out the historical efficiency assessment approach. This considers the period form 2017-18 through to 2021/22 – the only years were outturn costs are available for HDD. Once the inferred efficiency is identified, a 50% cost sharing rate is applied in line with the costs that would have been returned to customers through the PR19 cost sharing incentive.

Table 15: Historical efficient assessment approach

	PR24 consultation model		Models accounting for SVE symmetrical network complexity CAC	
Time period	2017-18 to 2021/22 (4 years)	Inflated to 5 years	2017-18 to 2021/22 (4 years)	Inflated to 5 years
Outturn Network Capex	£30.1m	£42.7m	£34.1m	£42.7m
Model outturn	£39.2m	£49.0m	£40.3m	£50.4m
Efficiency (£m)		£6.3m		£7.7m
Efficiency (%)		87%		84.7%
Efficiency after cost sharing (£m)		£3.2m		£3.9m
Efficiency after cost sharing (%)		£93.1%		91.7%

Note: Modelled forecasts are for the 2017-18 to 2921/22 period and assume the 'difference approach' triangulated between no explanatory variables removed and network complexity explanatory variables (Boosters/length and APH) removed.

We consider that this efficiency challenge should be applied to the net costs on a £ for £ basis. This means that a 6.9% challenge would be applied to the net costs if using the PR24 consultation models.

When compared to an estimated unit cost of £200m/m for 0.08% of our network, this equates to c£2m for 5 years (0.08% x 2600km x £200/m x 5 years). This gives confidence that the apparent efficiency approach set about above is suitably cautious and will therefore make sure that any customer detriment is avoided.

Scope of interventions in the claim

Interruptions are most visibly the result of network failures (bursts or issues at network pumping assets). However, interruptions can also originate from water resources or treatment assets, and opex protocols. This can be due to failures are water treatment assets, peak demand stresses (treated water cannot be processed quickly enough to meet end demand).

We have focused the implicit allowance of this CAC on network capex requirements. This is because these contribute the biggest proportion of our interruptions minutes that contribute to our current performance.

However, interruptions performance is fundamentally driven by the inherent risk profile of all assets from source to tap. Therefore, our detailed optioneering of solutions to move our interruptions performance back in line with the common performance commitment level has considered both treatment and network interventions. This is the right thing to do from a long-term risk management perspective rather than considering interruptions in a network expenditure silo.

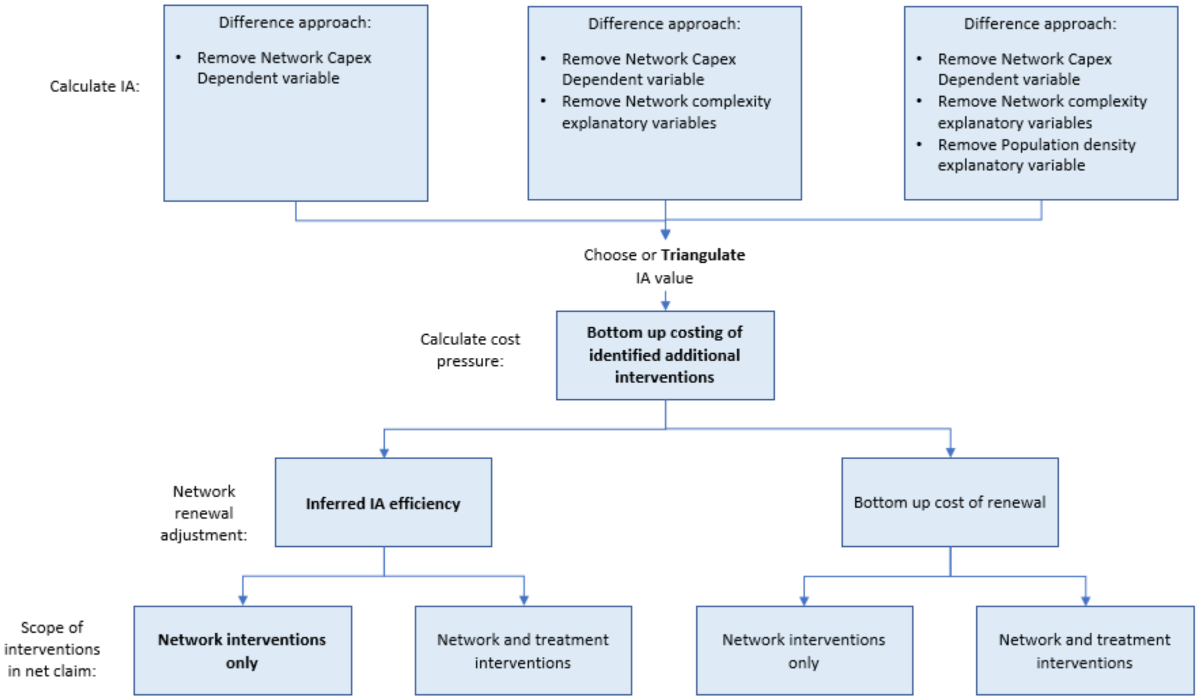
When reviewing the interruptions risk management performance of the identified interventions, it becomes clear that treatment interventions perform very competitively relative to network interventions (£/interruptions minute risk removed). However, they are typically mitigating much greater impact / lower likelihood events. This is unsurprising given that individual treatment assets will serve far more customers than individual network assets and have much greater opportunities for redundancy and resistance interventions (and are rightly the subject of risk averse water quality regulation by the DWI).

There are several factors to consider when determining what type of interventions to include are part of the net claim costs:

- **The type of interventions that should be prioritised in AMP8 (or further into the future)** – In addition to managing long term risk, we are wanting to deliver visible improvements in interruptions performance to customers in AMP8. Whilst treatment interventions will efficiently reduce risk in AMP8, the low likelihood/high impact characteristics of these risks mean that the observed interruptions performance may not materially change during AMP8. Whereas there is much more certainty that the network interventions (with lower impact but higher likelihood risk profiles) will deliver visible changes to interruptions performance in AMP8.
- **The complexity and interpretability of this claim** – Including treatment interventions in the claim would require the implicit allowance to be expanded to include treatment expenditure. This would start to make the IA 'difference' approach more challenging given the scope of the costs being removed. Therefore, it would probably be necessary to develop a separate implicit allowance. A combined claim would also be more challenging to interpret given the need to link historic costs, activities and performance across the two contrasting asset bases which are inherently being traded off against each other.

Quantifying the claim

Figure 28: Option tree showing how the various options for quantifying the claim interact. Central case selections highlighted in bold



We consider our selection of choices for the central case to be appropriate. Our reasoning is summarised below.

- **IA calculation**: We are using the difference approach. We do not consider it is appropriate to remove the density explanatory variable. However, given the varying importance of the network complexity drivers for costs that are being retained in the dependent variable, we have triangulated IA calculations that retain and exclude the network complexity explanatory variables.

- **Calculation of network capex pressure:** We are using values derived from bottom-up costing of interventions identified through detailed optioneering. This is because we do not consider that models can appropriate forecast our future expenditure requirements (i.e. they are not sufficiently sensitive of the relationship between cost, cost driver and performance).
- **Network renewal adjustment:** We are using the IA inferred efficiency approach. Whist we do not consider that historic efficiencies relate solely to the variance in historic renewal rates we consider that this is a more cautious approach to protect the interests of customers. The bottom-up assessments of renewal expenditure for these prior years may be more precise, but it is vulnerable to the selection of which mains to replace, cost will vary materially based on location and size and so too this the impact of the renewal on the interruptions risk profile.
- **Scope of interventions in net claim:** We have included only the identified network interventions from our interruptions risks profile optioneering processes in this cost adjustment claim. This is to ensure interpretability of the claim and pragmatically to acknowledge that network interventions are of elevated priority in AMP8 given the more visible impact that they will likely have on AMP8 interruptions performance felt by customers.

Table 16: Table setting out details of how claim has been quantified (not accounting for SVE symmetrical network complexity claim)

Component	£m Central case	Basis for central case
Gross claim (TWD Base capex)	£68.6m	Implicit allowance + Net Claim
Implicit allowance	£52.0m	Triangulation of x and y
Bottom-up cost of interventions	£17.8m	Network capex interventions only [x interventions]
Renewal rate adjustment	93.1%	Interred efficiency % from selected IA approach (modelled form 2018/19 to 2021/22) applied to bottom-up cost estimates
Net claim	£16.6 [£17.8m*93.1%]	Bottom-up cost of interventions + Renewal rate adjustment

Table 17: Table setting out details of how claim has been quantified (accounting for SVE symmetrical network complexity claim)

Component	£m Central case	Basis for central case
Gross claim (TWD Base capex)	£72.6m	Implicit allowance + Net Claim
Implicit allowance	£56.2m	Triangulation of x and y
Bottom-up cost of interventions	£17.8m	Network capex interventions only [x interventions]
Renewal rate adjustment	91.7%	Interred efficiency % from selected IA approach (modelled form 2018/19 to 2021/22) applied to bottom-up cost estimates
Net claim	£16.3m [£17.8m*91.7%]	Bottom-up cost of interventions + Renewal rate adjustment

1.2 Cost efficiency (necessary)

Criteria

- a) Is there compelling evidence that the cost estimates are efficient (for example similar scheme outturn data, industry and/or external cost benchmarking, testing a range of cost models)?
- b) Does the company clearly explain how it arrived at the cost estimate? Can the analysis be replicated? Is there supporting evidence for any key statements or assumptions?
- c) Does the company provide third party assurance for the robustness of the cost estimates?

Bottom-up estimation of the interventions included in the claim

The process to identify the additional expenditure included in this cost adjustment claim was derived from a combination of top down and bottom-up estimates. We generated a long list of options to improve interruptions performance by:

- undertaking an assessment of how a wide range of plausible hazards might affect our assets (source to tap) and our ability to sustainably supply good quality water.
- combining this top down all hazard approach with a bottom-up view of current issues from our interruptions root cause analysis and operational risk management system.

This all-hazard approach, shown in ***Table 18*** below, was used to inform our Water Resource Management Plan (WRMP), National Environment Programme (NEP) and PR24 enhancement cases. It also revealed areas within base plan expenditure where a step up in investment might be needed to address risks and keep pace with the effects of climate change on short duration events.

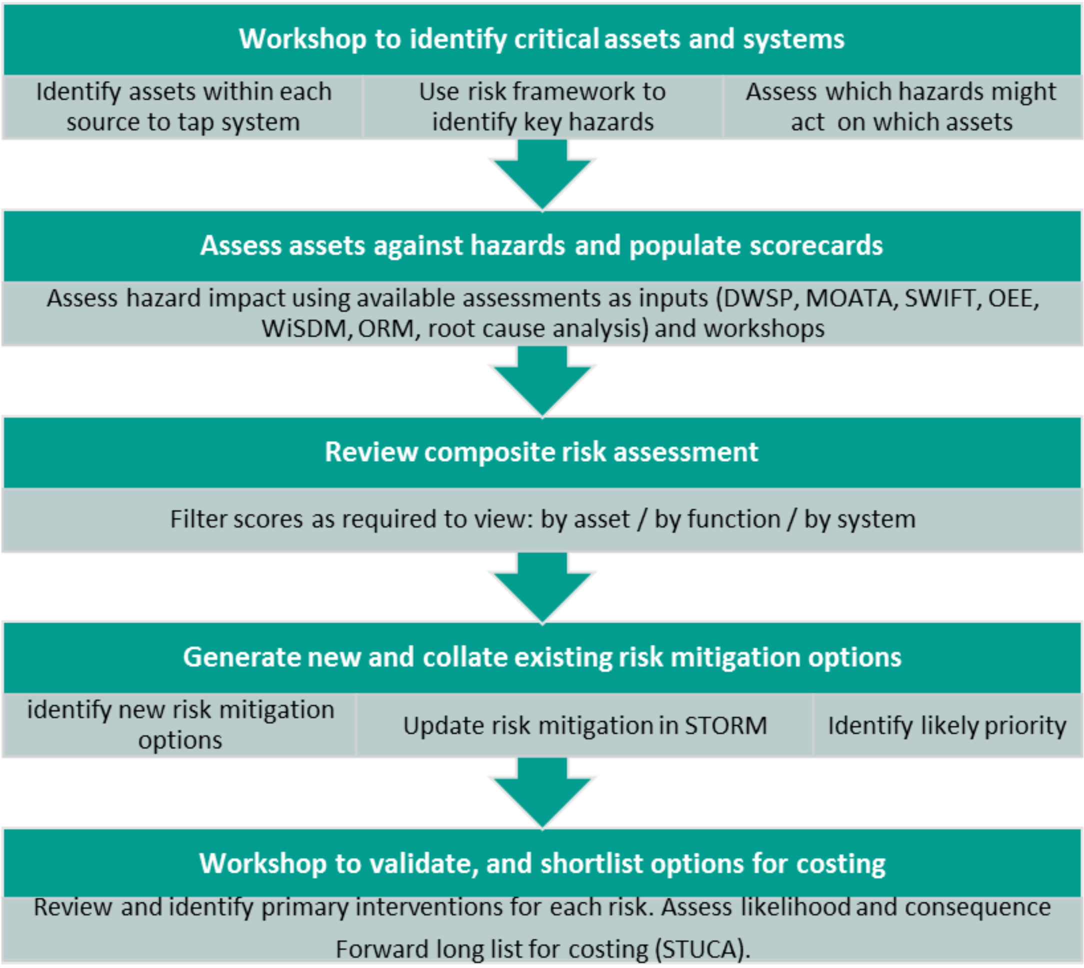
Table 18: All hazard source to tap framework

Drivers / Hazards		Strategic goal	Adapt and Transform (PR24)
Asset and system failures (operational risks/root cause analysis	Asset deterioration, process failure, system failure causing potential harm to the environment and customers	Ensure we improve our ability to **anticipate, resist, absorb and recover** from known hazards	• Increase efficiency and effectiveness through analytics and innovation • **Step up renewal investment to counteract factors affecting supply interruptions**
Government Policy / legislation	New legislation or guidance	**Water always there:** Supplies that are resilient to long duration events and environmental needs	• NEP reservoir Safety (Balmforth review) • NEP (Biodiversity and Net Zero) • Water Resource Management Plan
	Environmental legislation		
	Wellbeing of Future generations		
Demographics / economics	Population and housing growth Levels of economic activity		
Climate change	increased risk of drought		
	increased frequency of dry hot periods or freeze – thaw events	**Water always there:** Supplies that are resilient to short duration events	• **Supply Resilience** ○ low likelihood / high consequence ○ high likelihood / medium consequence
	increased intensity and frequency of rainfall events increasing floods, landslips and river erosion		
	increased severity of storm winds causing power outages		
	Increased run-off and temperature affecting treatability of raw water	Supplies that continue to be **Good to drink**	• NEP catchment management to mitigate raw water deterioration • Lead Free Wales PR24 enhancement case
WQ legislation	New water quality standards		
Human activity	Unintended consequences: land use change, catchment deterioration and pollution events		
	cyber-attacks and security breaches		• Cyber Security to keep pace with threats

The shaded areas indicate the areas where we identified interventions necessary to manage and improve the risk of interruptions.

We then combined these high-level findings with various bottom-up risk assessments and analysis (***Figure 29***) to identify the long list of potential interventions. For each intervention we identified the pre and post risk (likelihood and consequence) of an interruption event.

Figure 29: Approach to generate long list of options



Key to acronyms
DWSP- Drinking Water Safety plans, SWIFT – Structured What If assessment of WTWs, OEE – Operational Equipment Effectiveness, WiSDM – water mains deterioration model, STORM – Operational Risk Management system, MOATA – system constraint analysis, STUCA – cost estimating system

Interventions of this **long list** were then scoped and costed. In total the efficient cost of the 25 options is £39.2m. We estimate that this would reduce the interruptions risk by 19 minutes 22 seconds to bring us broadly in line with performance target.

Table 19: The long list of identified interventions needed to move interruptions risk back in line with the common performance commitment.

Code	Activity	Intervention type	Pre intervention property minutes risk	Post intervention property minutes risk	Supply interruption minutes saved (pre - post intervention)	Cost (£m)	£/interruption risk mitigated	Network (TWD) / Treatment (WRP) intervention
22/19	Enhanced monitoring of Wrexham trunk mains	Network visibility	180,000	9,000	01 mins 37 secs	0.3	1.9	TWD
21	Enhanced monitoring of Powys trunk mains	Network visibility	90,000	9,000	00 mins 46 secs	0.3	3.4	TWD
4c	Wrexham Trunk main (9" PVC Gresford section)	mains renewal	288,000	47,520	02 mins 16 secs	4.7	19.5	TWD
23	Caersws River erosion risk to Talerddig trunk main	mains renewal	287,081	243,000	00 mins 25 secs	0.4	8.1	TWD
29	Cinders to Overton Trunk mains	mains renewal	90,000	29,700	00 mins 34 secs	2.5	42.2	TWD
4a	Wrexham trunk main 15" AC clockwise leg	mains renewal	337,560	142,560	01 mins 51 secs	3.5	17.7	TWD
4b	Wrexham trunk main remainder of AC/PVC sections	mains renewal	247,560	142,560	00 mins 59 secs	3.2	15.3	TWD
31	Abermule river erosion	mains renewal	226,800	162,000	00 mins 37 secs	0.4	6.9	TWD
100	Increased storage at Higher Berse DSR	DSR upgrade	432,000	213,840	02 mins 04 secs	1.9	8.9	TWD
106/107	Llwyn Onn High lift PS resilience	DBS upgrade	82,800	41,400	00 mins 24 secs	0.3	6.2	TWD
39	Yr Allt / Bryn Mawr DBS upgrade	DBS upgrade	96,000	31,680	00 mins 37secs	0.3	5.0	TWD
26	Llay DBS relocation	DBS upgrade	108,000	27,000	00 mins 46 secs	0.4	4.9	TWD
20	Keepers' cottage DBS upgrade	DBS upgrade	120,000	48,000	00 mins 41 secs	0.4	5.2	TWD
24	Winllan DBS upgrade	DBS upgrade	144,000	28,800	01 mins 05 secs	0.4	3.3	TWD
41	Llanwrin DBS upgrade	DBS upgrade	108,000	54,000	00 mins 31 secs	0.4	6.9	TWD
40	Penymynydd strategy	Network rationalisation	144,000	9,000	00 mins 41 secs	3.3	46.1	TWD
27a	Hollybush to Vrynwy mains renewal	mains renewal	18,360	9,000	00 mins 10 secs	3.6	200.2	TWD
110	Llwyn Onn run to waste	WQ	68,307	20,700	00 mins 27 secs	3.5	74.0	WRP
101	Llwyn Onn 2nd backwash tank	Single point of failure	94,756	20,700	00 mins 42 secs	2.1	28.3	WRP
103	Llwyn Onn incoming splitter	Single point of failure	41,400	20,700	00 mins 11 secs	0.3	12.8	WRP

109	Llwyn Onn De-Alk plant bypass	Single point of failure	34,500	13,800	00 mins 12 secs	0.1	6.4	WRP
102a	Llwyn Onn 3rd contact tank	Single point of failure	124,200	62,100	00 mins 35 secs	1.1	18.2	WRP
105	Llwyn Onn bypass for inlet valve	Single point of failure	84,176	20,700	00 mins 36 secs	0.3	4.3	WRP
108	Site ICA control resilience	Systems upgrade	82,800	41,400	00 mins 24 secs	5.3	127.7	WRP
104	Cross connection at Marchwiel Res	Single point of failure	68,307	20,700	00 mins 12 secs	0.2	10.2	RWD
Total					**19 mins 22 secs**	**39.2**		

To identify the interventions to be included into this cost adjustment claim for delivery in AMP8 we focussed on Network interventions rather than on those designed to address the low probability high consequence issues at Llwyn Onn WTW. We also considered deliverability of an extensive trunk main renewal programme and so deferred two lower priority schemes and spread part of the Wrexham trunk main work into AMP9.

This **final shortlist** includes 15 interventions that total to £17.8m. This would reduce the interruptions risk by 15 minutes 12 seconds. The programme has been identified based on:

- prioritising network interventions in AMP8 due to their likely ability to improve both the interruptions risk profile and the interruptions performance seen by customers in AMP8
- considering the affordability and deliverability of the package of interventions across AMP8 by deferring schemes 40 and 27a and spreading half the cost of scheme 4b into AMP9.

Table 20 below shows the estimates of costs and the corresponding impact on interruptions risk of both the short list that forms the scope of this cost adjustment claim.

Table 20: The short list of identified interventions needed to move interruptions risk back in line with the common performance commitment. This forms the scope of the net claim (before renewal rate challenge)

ID	Activity	Intervention type	Pre intervention property minutes	Post intervention property minutes	Supply interruption minutes saved (pre - post intervention)	Cost £m	£ / interruptions risk removed
22/19	Enhanced monitoring of Wrexham trunk mains	Network visibility	180,000	9,000	01 mins 37 secs	0.3	1.9
21	Enhanced monitoring of Powys trunk mains	Network visibility	90,000	9,000	00 mins 46 secs	0.3	3.4
4c	Wrexham Trunk main (9" PVC Gresford section)	mains renewal	288,000	47,520	02 mins 16 secs	4.7	19.5
23	Caersws River erosion risk to Talerddig trunk main	mains renewal	287,081	243,000	00 mins 25 secs	0.4	8.1
29	Cinders to Overton Trunk mains	mains renewal	90,000	29,700	00 mins 34 secs	2.5	42.2
4a	Wrexham trunk main 15" AC clockwise leg	mains renewal	337,560	142,560	01 mins 51 secs	3.5	17.7
4b	Wrexham trunk main remainder of AC/PVC sections	mains renewal	247,560	142,560	00 mins 59 secs	1.6	15.3
31	Abermule river erosion	mains renewal	226,800	162,000	00 mins 37 secs	0.4	6.9
100	Increased storage at Higher Berse DSR	DSR upgrade	432,000	213,840	02 mins 04 secs	1.9	8.9
106/107	Llwyn Onn High lift PS resilience	DBS upgrade	82,800	41,400	00 mins 24 secs	0.3	6.2
39	Yr Allt / Bryn Mawr DBS upgrade	DBS upgrade	96,000	31,680	00 mins 37secs	0.3	5.0
26	Llay DBS relocation	DBS upgrade	108,000	27,000	00 mins 46 secs	0.4	4.9
20	Keepers' cottage DBS upgrade	DBS upgrade	120,000	48,000	00 mins 41 secs	0.4	5.2
24	Winllan DBS upgrade	DBS upgrade	144,000	28,800	01 mins 05 secs	0.4	3.3
41	Llanwrin DBS upgrade	DBS upgrade	108,000	54,000	00 mins 31 secs	0.4	6.9
Total					**15 mins 12 secs**	**17.8**	

Below, we set out in more detail the methodology that we have followed to derive these costs.

Identifying efficient costs of increasing capacity

For the risks that were identified we followed the following process:

Step 1: Agreeing the scope

The first step taken was to review the risk and then work up options that would either reduce the likelihood (for example installing pressure management to eliminate surge or renewing a section of main) or dealing with the consequence (for example providing more capacity at a booster station or service reservoir).

The optioneering process involved asset management, operations and engineering teams.

Step 2: Constructing bottom-up cost estimates

When the process option being taken forward has been decided on, we estimate the efficient costs of implementing these changes.

Cost estimates are built up of the following elements:

- Standard cost components (e.g. mains and pumps)
- Non-standard components
- Project on-costs (e.g. design and project management)
- Optimism bias

Standard cost components

Standard cost components for these projects are estimated using Severn Trent Unit Cost Application (STUCA) cost curves. These curves are calculated by independent consultants, and include Severn Trent specific cost curves, as well as being benchmarked relative to an industry-wide curve. They are calculated using cost information from historical projects broken down into the different types of assets. Costs attributed to a certain asset are aggregated together to produce an estimate of the total cost of that asset for each historical observation. These costs are plotted against a yardstick measure for each cost item that best reflects how the cost varies depending on the scale of the asset or process. This enables the estimation of a curve showing how the cost varies depending on the scale of the asset of process being implemented. This curve is then used to predict the cost of building similar assets.

The costs for each project are calculated by applying the cost curves for each area of expenditure to the yardstick value that is estimated to be required for the project. These components are summed together yielding the bulk of the estimate.

Non-standard costs

There are also separate estimates produced for 'non-standard' items that do not fit within the cost curve categories but are required to complete the project. These cost items, by their nature as non-standard, are not able to be benchmarked, but they tend to only reflect a small proportion of the total costs of a project.

On-costs and optimism bias

We have added optimism bias in line with our assessment of Green Book principles.

Step 3: external assurance of costs

We are yet to complete full assurance of the scope and cost estimates. This will be completed by the time of final plan submission.

1.3 Need for investment (where appropriate)

Criteria

- a) Is there compelling evidence that investment is required?
- b) Is the scale and timing of the investment fully justified?
- c) Does the need and/or proposed investment overlap with activities already funded at previous price reviews?
- d) Is there compelling evidence that customers support the need for investment (both scale and timing)?

If we are to deliver 5 minute interruptions performance to customers, the identified investment will be required.

- I.e. we cannot realistically expect to consistently deliver the 5 minute interruptions target over the long term without a step change in the current levels of investment.
- Need to set out the approach to phasing the investment over multiple amps. Link to wider customer engagement about service and bill increases

1.4 Best option for customers (where appropriate)

Criteria

- a) Did the company consider an appropriate range of options to meet the need?
- b) Has a cost–benefit analysis been undertaken to select proposed option? There should be compelling evidence that the proposed solution represents best value for customers, communities and the environment in the long term? Is third-party technical assurance of the analysis provided?
- c) Has the impact of the investment on performance commitments been quantified?
- d) Have the uncertainties relating to costs and benefit delivery been explored and mitigated? Have flexible, lower risk and modular solutions been assessed – including where utilisation will be low?
- e) Has the company secured appropriate third-party funding (proportionate to the third party benefits) to deliver the project?
- f) Has the company appropriately presented the scheme to be delivered as Direct Procurement for Customers (DPC) where applicable?
- g) Where appropriate, have customer views informed the selection of the proposed solution, and have customers been provided sufficient information (including alternatives and its contribution to addressing the need) to have informed views?

Our comprehensive all hazard source to tap assessment combined with the bottom-up view of risks that we worked through system by system in a series of workshops with asset management, operational and engineering teams (see section 3.2) gives us confidence that we have identified a wide range of appropriate options that are necessary to achieve the interruptions target.

We have tested the range of investment options at two stakeholder workshops in January 2023 and with customers.

Our initial discussions with customers in late 2022 focussed on the issue of improving the resilience of their water supplies (interruptions). When explained to respondents they considered the resilience of supplies to be an important issue.

Once potential costs and bill impacts were described, about half of household customers opted for the greatest level of investment (c.£17m). All non-household endorsed this option as they viewed the impact of their businesses being without water greater than the household respondents. The reasons given for support were;

- Preventative investment perceived positively;
- Costs to customers seemed reasonable, when compared to increases in other utilities, and;
- Future proofing the system was seen as a sensible long-term plan.

A Further quarter of customers supported some investment to improve resilience.

Further, quantitative, customer research is currently being carried out.

1.5 Customer protection (where appropriate)

Criteria

- a) Are customers protected (via a price control deliverable or performance commitment) if the investment is cancelled, delayed or reduced in scope?
- b) Does the protection cover all the benefits proposed to be delivered and funded (e.g. primary and wider benefits)?
- c) Does the company provide an explanation for how third-party funding or delivery arrangements will work for relevant investments, including the mechanism for securing sufficient third-party funding?

The common Interruptions performance commitment offers customer protection. Where interruptions performance remains high, we will continue to perform poorly against the performance commitment and attract ODI penalties.

However, if Ofwat were to want further reassurance, that additional expenditure (supplementary to that assumed by the botex+ econometric models) will be delivered, a specific intervention based performance commitment might be helpful. This would most likely work by returning expenditure if the stated interventions have not been demonstrably delivered. Whilst such an approach is counter to the preferred policy of outcome-based regulation, it would give certainty that the additional interventions that are assumed within the cost adjustment claim are delivered.

2. HDD reservoir maintenance

Table 21: Claim Summary Table

Claim component	Value	Description
Is the claim symmetrical?	Possibly?	However, not likely to be material for other companies
Can the cost be isolated from the botex+ dependent variable?	Yes	Claim is based on Water Resources capital maintenance expenditure (Infra Renewals and Infra Maintenance)
Is there a suitable explanatory variable available to describe the costs?	No	We do not consider that models can appropriately forecast our future expenditure requirements (i.e. they are not sufficiently sensitive of the relationship between cost, cost driver and performance).
Gross claim (assuming PR24 consultation models)	£8.5m	Bottom-up costs
IA (assuming PR24 consultation models)	£1.5m	Difference approach (removing water resources infra renewals and infra maintenance expenditure)
Net Claim (assuming PR24 consultation models)	£7.0m	Gross claim – net claim
Relevant Price Controls		Water Resources

This claim described the maintenance component of our reservoir safety expenditure. We have a large reservoir asset base relative to our size. The Reservoir Act sets out statutory obligations for us to inspect and maintain the reservoir in accordance to the reports submitted by reservoir inspection engineers.

Reservoir maintenance has historically been incurred as base expenditure. As such allowance have been previously made through base econometric models. Expenditure is fundamentally driven by the reservoir inspection reports that we will receive in advance of and during AMP8. Whilst we do not yet have visibility of these reports, we can anticipate a material expenditure requirement. This is in part due to the large number of reservoir assets that we have, but also due to the change in risk appetite of reservoir inspection engineers following on form the Balmforth review the followed the Toddbrook Reservoir incident in 2019.

We have sought to understand this AMP8 expenditure requirement by commissioning a report from Mott Macdonald that the been written by a current reservoir inspecting engineer. We have now received this and it forms the basis of the quantification of this Net claim.

We have had constructive discussions with Natural Resources Wales who oversee the compliance of our Reservoir Act obligations. It is minded to allow some investment in be placed into the environmental programme (enhancement expenditure) where it relates to responding to Balmforth recommendations.

Consequently, this claim seeks to remove this Balmforth sensitive enhancement expenditure from this cost adjustment claim and then compare the remaining base expenditure against an implicit allowance from the botex+ models to arrive at a net claim for base reservoir maintenance expenditure.

2.1 Need for adjustment (necessary)

2.1.1 Unique circumstances

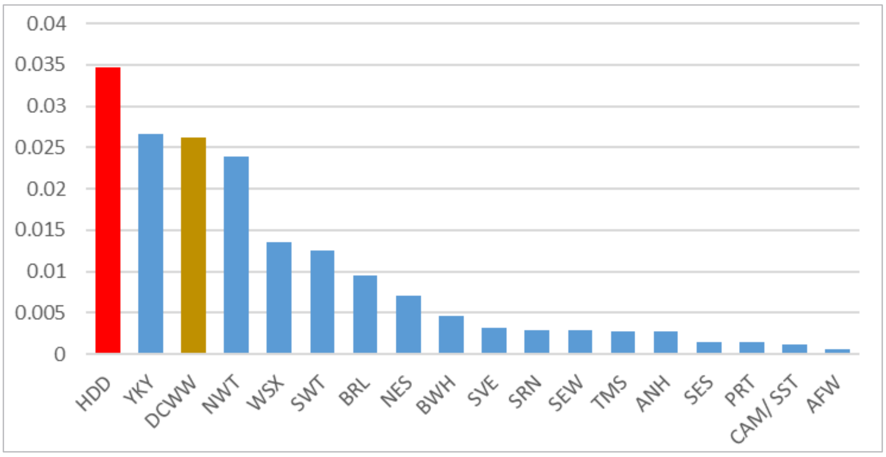
Criteria

- a) Is there compelling evidence that the company has unique circumstances that warrant a separate cost adjustment?
- b) Is there compelling evidence that the company faces higher efficient costs in the round compared to its peers (considering, where relevant, circumstances that drive higher costs for other companies that the company does not face)?
- c) Is there compelling evidence of alternative options being considered, where relevant?

We have an aging asset base, with an evolving and increasing scope of works required to manage them in line with emerging best practice and/or legislative change.

Maintenance of reservoirs and compliance with relevant statute is not a new requirement and nor is it unique to us. However, we manage the highest number of dams/ impounding reservoirs per capita served than any other company in Wales or England, as highlighted by ***Figure 30***.

Figure 30: Number of reservoirs per 1,000 population served



We remain an outlier in the industry due to the disproportionate number of these assets we own compared to the size of our customer base. We have approximately 30% more of these assets per capita served than our closest peer.

The costs associated with maintaining the compliance of these assets, within an evolving statutory framework, are disproportionate compared with our revenue base. This is especially the case when large-scale works or new estate wide programmes are required - we cannot absorb these large costs within the base plan.

This was recognised by Ofwat in AMP7, and remains the fact for AMP8.

Interaction with the PR19 reservoir safety claim

At PR19, Ofwat awarded us a cost adjustment for reservoir safety and resilience based on three factors:

- Legislative changes – the phased enactment, from 2019 onwards, of the **reduction in threshold for the Reservoir Act**, from 25,000m^3 to 10,000m^3 – increasing the number of our assets that need to comply with the Act.
  - We consider that investment to comply with this change has now been completed.
- Modelling gap – Ofwat agreed that its econometric cost **models did not reflect our disproportionately large asset stock per capita**, nor the inherently **high risk from some of the oldest earth dams in the sector**.
  - This remains the case and is relevant for this claim. We remain an outlier in the number of reservoirs we maintain for our size. Inspections a cyclical and therefore we should expect investment requirements to continue.
- Industry catch-up – we had Inherited a stock of assets that needed to catch up with investment carried out the wider industry – requiring a step change in inspection and investment to ensure parity with industry peers.
  - The funds secured at PR19 are allowing us to address the latter of these points and achieve parity with the wider industry. Our resulting AMP7 programme of works is seeing us remove pressurised outlet/scour pipes that run through four of our earth dams, as well as replacing the spillway at one of these sites.

2.1.2 Management control

Criteria

- d) Is the investment driven by factors outside of management control?
- e) Have steps been taken to control costs and have potential cost savings (eg spend to save) been accounted for?

The primary legislation covering these assets is the Reservoirs Act 1975 (as amended). In the interest of public safety, the Act makes provision against the escape of water from large, raised reservoirs. These are structures capable of holding more than 25,000 m^3 of water above natural ground level.

The Flood and Water Management Act 2010 amended the existing Act, changing the threshold from 25,000 m^3 to 10,000 m^3. The Act was enabled in 2010, and enacted in Wales with a phased approach from 2019.

To comply with the Act, we are required to have:

- a reservoir Supervising Engineer appointed “at all times” (Section 12 of the Act);
- an inspection at least every 10 years by an independent Inspecting Engineer (Section 10 of the Act); and
- essential safety works - measures in the interests of safety (MIOS) implemented within a prescribed timescale.

The 10-yearly inspection is a thorough and complete safety review of the dam and its infrastructure, collectively termed the “reservoir”, to current guidance and standards. The Inspecting Engineer is required to review the performance of the reservoir and the management regime (leakage monitoring, etc.) and can prescribe remedial actions, works or investigations as part of their inspection. These requirements are termed “measures in the interests of safety” (MIOS) and are legally binding on the owner. The periodic nature of these inspections can influence the phasing of investment – for example, the discovery of an unforeseen issue can result in a 'peak' of investment in reservoir safety every decade.

The Inspecting Engineer will provide a mandatory deadline for MIOS to be completed, which is typically between 6 months to 3 years (for the more complex works).

A shortage of qualified Inspecting Engineers exists across the industry. We have seen delays of up to a year between initial inspection and the issue of a final Section 10 report.

NRW is the enforcement authority for reservoirs in Wales. It has extensive powers to ensure compliance with the 1975 Act.

The Act is supported by various guidance, which includes:

- the ICE Guide to the Reservoirs Act – setting out the minimum requirements for inspection reports;
- the EA's Risk Assessment Guidance – recommending that inspecting engineers formally identify and evaluate the potential failure modes at the reservoir;
- the EA's Guide to Drawdown Capacity; and
- the ICE Floods and Reservoir Safety Guidance - which relates to assessing the required capacity of spillways.

As a responsible operator, employing the services of professional independent Inspecting Engineers, we are highly unlikely to take a course of action that deviates from this expert guidance.

2.1.3 Materiality

Criteria

- f) Is there compelling evidence that the factor is a material driver of expenditure with a clear engineering / economic rationale?
- g) Is there compelling quantitative evidence of how the factor impacts the company's expenditure?

The legislative basis and the impact of the Balmforth review

Our current programme of reservoir safety works ensures we meet our statutory duties under the Reservoir Act 1975 (as amended by the Flood and Water Management Act 2010).

Whilst the requirements of the Act are absolute – to reduce to a minimum the likelihood of an uncontrolled release of water occurring, the understanding, guidance and best practice does not remain static. The failure of Toddbrook reservoir at Whaley Bridge in 2019 resulted in Defra commissioning Professor David Balmforth to undertake an independent review of reservoir safety.

Part A of this review focused on the causes of the failure, and lessons to be learnt. Part B of the review considers the implementation and suitability of current reservoir safety arrangements in the sector. Part B included a further 15 recommendations, many of which are interlinked, and are directed at owners, engineers, the regulator and Government. These convey an ambition to a step change above and beyond traditional compliance.

Key themes from the recommendations are:

- A move to a quantitative risk assessment approach for the highest risk assets, to reduce risks to 'as low as reasonably practicable' (ALARP);

- Incorporating climate change predictions when calculating flooding/ overtopping risks;
- More widespread and frequent monitoring (with additional remote instrumentation, reporting more frequently;
- Improved access to safely allow more frequent and detailed inspection; and
- Improved provision for emergency measures, such as access and control of critical valves.

The Government announced that DEFRA/ the EA will consult on modernisation of the Reservoir Act in 2023/24[2]. A programme of proposed changes has not yet been announced. NRW advise that we can expect best practice guidance from the EA ahead of legislative changes, and that NRW will seek to adopt this guidance (providing this is the right decision for Wales).

NRW have stated that they wish to secure more reservoir safety outcomes than provided for in law currently. They believe that going above and beyond traditional compliance is required to help meet their duties under the Wellbeing of Future Generations (Wales) Act 2015 and the Environment (Wales) Act 2016.[3]

As guidance is released and codified, we will find that our independent Inspecting Engineers are duty bound to apply these standards to our assets, and as a responsible operator we shall comply. We must begin our proactive response to these now. Many of our proposals will require detailed surveys and investigations, modelling and permitting – and may take most of AMP8 to deliver. If we do not proactively start this programme now, we will have to react to guidance changes/ mandatory measures as they emerge, which will result in less efficient delivery for our customers.

NRW recognise that this represents a step change above our normal base activity. They have therefore included a new non-statutory driver for the National Environment Plan (NEP) at PR24. This is intended to cover a programme of investigations and actions to 'enable future compliance' with the Reservoir Act. NRW have disclosed that this driver will not be available in PR29 – indicating that **AMP8 is the timeframe to make the proposed step change.**

NRW is encouraging asset operators to do more than is required by law and demonstrate a clear commitment to reservoir safety using clear outcomes that should act as better measures of safety than just compliance.

Understanding the likely impact of the Balmforth review on AMP8 reservoir maintenance requirements

The Government has accepted all the recommendations of the Balfmorth review, but a period of consultation will span into AMP8, as new best practice guidance is developed. NRW advise that they will likely adopt any relevant guidance developed by the EA, providing it is the right for Wales.

In the meantime, we expect that Section 10 inspections during AMP8 will be increasingly rigorous, as our independent Inspecting Engineers respond to the Balmforth recommendations and pre-empt the publication of guidance.

We are already seeing this, with larger allowance for climate change impacts on peak flood flows being suggested. We are highly likely to see Inspecting Engineers make new recommendations at our sites

[2] DEFRA Ministerial Statement 20th July 2022, Reservoir Safety – reforming the safety regime and modernising legislation for England

[3] NRW Reservoir Safety in Wales, Biennial Report to the Minister for Climate Change 19-21

so that we can comply with this emerging best practice, any updated guidance, and an improved understanding of risk.

The likely step changes to best practice that we expect to influence the view of risks and necessary mitigations include:

- more detailed assessment of spillway hazards, including providing necessary access to allow more detailed inspection (Balmforth Review Part A – Recommendations 1-3)
- a quantitative risk/hazard approach to reservoir safety, with a resulting tiered inspection regime, focussed on reducing risks to 'as low as reasonably practicable' (ALARP) (Balmforth Review Part B – Recommendations 5 and 10)
- updating our emergency plans, in view of aiming to manage risks to ALARP – ensuring access to any safety critical valves, monitoring equipment or emergency drain down provision can be always achieved safely and efficiently, and automating critical valves where this provides optimal risk reduction (likely to be considered best practice advocated by Balmforth Review Part B – Recommendations 10 and 11)
- implementing the February 2021 revision to the Flood Studies Report (FSR) / Flood Estimation Handbook (FEH) which updates the rainfall-runoff method for estimating floods. We expect that applying this may alter the maximum flood levels and thereby increase the scope of planned works or even generate entirely new MIOS, dependant on subsequent guidance on the magnitude of climate change allowance (Balmforth Review Part B – Recommendation 13)
- preparing Reservoir Safety Management Plans, to detail all the necessary surveillance, monitoring and operation/maintenance, which should include a comprehensive and modern monitoring programme for our dams. Additional remote monitoring equipment taking more frequent measurements can characterise long-term behaviour, provide early warning, capture response to events, predict future performance and demonstrate safe-management (Balmforth Review Part B – Recommendations 3 and 11)

Our own review of these recommendations identifies some sites where should act proactively to bring them in line before an Inspecting Engineer needs to mandate these.

We have engaged and consulted with NRW (conference calls with Reservoir Safety team and NEP team 16th Nov 2022, and including DCWW 14th Feb 2023) as part of the NEP development, to align our views on the likely investment themes required.

We have differentiated the likely investment between that now considered highly likely to be required due to a post-Balmforth tightening of best practice and Inspecting Engineer standards, and that which would still be likely to be required for us to maintain the asset base safely.

In order to ensure confidence in the need for the works, and the scope/ cost estimate, we have commissioned support from a team of external experts, including experiences Inspecting Engineers. In March 2023 we commissioned Mott MacDonald to undertake a Gap Analysis. This process included:

- Reviewing the current AMP8 scope of work already identified by our internal Reservoir Safety Team.
- Liaising with our external Reservoir Panel Engineers to identify likely works in AMP8, incorporating outcomes from our Portfolio Risk Assessment.
- An independent high-level cost estimate of the proposed works.

- Clarifying which of the proposed works which would likely have been required under the current legislative regime, and which would likely be mandated under a more proactive quantitative risk-based regime - aligned with recommendations of the Balmforth Review.
- Cost benchmarking for similar activities by other companies and experienced dam and reservoir contractors.

Based on our initial consultations with NRW, we have classified the investment into the following categories:

- Theme 2 - Quantitative risk assessments (Tier 2 RARS or similar) including the likely cost and scope of any Site Investigation to inform these.
- Theme 4 - Remote monitoring of movement/deflection/cracks, drainage and seepage etc. including the necessary telemetry and power upgrades to collect this data.
- Theme 5 - Improved access for operational staff to allow safe inspection and control during normal operation and S10 inspections (e.g. improved access to facilitate spillway condition assessments).
- Theme 6 - Improved access/ facilities for emergency response such as access, space and power for emergency pumping, or automation of critical valves.
- Theme 7 - Suitability of dam and bypass/overflow based on updated climate change and flood estimation guidance (both the initial assessments, and the resultant follow-on works).

2.1.4 Adjustment to allowances (including implicit allowance)

Criteria

- h) Is there compelling evidence that the cost claim is not included in our modelled baseline (or, if the models are not known, would be unlikely to be included)? Is there compelling evidence that the factor is not covered by one or more cost drivers included in the cost models?
- i) Is the claim material after deduction of an implicit allowance? Has the company considered a range of estimates for the implicit allowance?
- j) Has the company accounted for cost savings and/or benefits from offsetting circumstances, where relevant?
- k) Is it clear the cost allowances would, in the round, be insufficient to accommodate the factor without a claim?
- l) Has the company taken a long-term view of the allowance and balanced expenditure requirements between multiple regulatory periods? Has the company considered whether our long-term allowance provides sufficient funding?
- m) If an alternative explanatory variable is used to calculate the cost adjustment, why is it superior to the explanatory variables in our cost models?

Estimation of the implicit allowance

We have developed a methodology to quantify the amount of expenditure currently allowed for in the models to account our allowance for reservoir maintenance. This means that fundamentally:

- The **gross claim** relates to a bottom-up assessment of expenditure requirements required to ensure statutory reservoir maintenance requirements are met.

- The **implicit allowance** relates to the costs implicit in Ofwat's consultation suite of models.
- The **net claim** relates to the additional costs that we have identified to ensure reservoir compliance (i.e. the difference between the gross claim and the implicit allowance.

Premise for determining the implicit allowance

Reservoir maintenance forms the Water Resources Infra Renewals and Infra Maintenance lines, depending on how it is accounted for by companies. Reservoir assets are the only water resources infrastructure components. Therefore, we can remove this from the data panel and generate the difference between the implicit allowance with and without these costs. To ensure efficiency, we do not apply an efficiency challenge to the implicit allowance. This will remove more costs from our gross claim. This is set out in more detail in the attached calculation spreadsheet.

Quantifying the claim

The claim is composed of the gross claim, which is formed from a bottom-up cost assessment. From our total assessment of bottom-up costs required to ensure compliance, some is enhancement, while some will come from base expenditure.

For the purposes of this claim, we remove the enhancement expenditure from our full view of bottom-up costs. We then subtract from this the implicit allowance to generate the base claim. ***Figure 31*** shows the construction of the claim from the full view of bottom-up costs. This is set out in more detail in the attached claim calculation spreadsheet.

Table 21: Table showing the construction of our claim

Claim Component	Description	Value
Bottom-up expenditure requirements	Our full view of expenditure required to meet statutory reservoir safety compliance.	£14.5m
Enhancement	The expenditure requirements that will be covered by enhancement expenditure supported through the NEP.	£6.0m
Base (Gross Claim)	The expenditure requirements that will be considered as part of base expenditure.	£8.5m
Implicit Allowance	The implicit allowance generated by the difference in allowance forecast by the current suite of PR24 models, and the current suite of PR24 models with Water Resources Infra renewals and infra maintenance removed.	£1.5m
Net Claim	Gross Claim – Implicit Allowance	£7.0m

2.2 Cost efficiency (necessary)

Criteria

- a) Is there compelling evidence that the cost estimates are efficient (for example similar scheme outturn data, industry and/or external cost benchmarking, testing a range of cost models)?
- b) Does the company clearly explain how it arrived at the cost estimate? Can the analysis be replicated? Is there supporting evidence for any key statements or assumptions?
- c) Does the company provide third party assurance for the robustness of the cost estimates?

We have completed a desk based Gap Analysis undertaken by Mott MacDonald. This has resulted in a bottom-up cost estimate for each theme of investment, at each site.

Cost data used within this report has been sourced from a combination of tender/outturn unit costs collated from over 8 water companies within the United Kingdom with additional data via direct quotes from the supply chain.

The costs are provided in two forms; direct (construct only) without and optimism bias, and direct (construct only) with a 30% optimism bias.

We have assumed the latter is an appropriate estimate of total outturn costs for this programme, as this 30% would typically allow for client design and project management costs, capital overheads and a smaller optimism bias of <= 10%.

We are going to continue to improve the robustness of these costs as we more to our PR24 business plan submission.

2.3 Need for investment (where appropriate)

Criteria

- a) Is there compelling evidence that investment is required?
- b) Is the scale and timing of the investment fully justified?
- c) Does the need and/or proposed investment overlap with activities already funded at previous price reviews?
- d) Is there compelling evidence that customers support the need for investment (both scale and timing)?

Our proposed enhancement in AMP8 compliments our base activity on reservoir safety, by allowing proactive programmes of work to be undertaken, to comply with emerging best practice ahead of guidance publication/ legislative change and any mandatory MIOS being imposed.

Our strategy seeks to respond to NRW's objectives, and the recommendations of the Balmforth review, by moving beyond legal compliance – to proactively adopt emerging best practice.

Whilst we will not know the exact phasing and scope of the MIOS works which will be mandated by the Inspecting Engineers, it is highly likely that most of the works identified in the Gap Analysis would be mandated at the next Section 10 Inspection for each site.

The latest possible inspection date for our reservoirs is as follows:

Table 22: Section 10 Inspection due dates

Site	Date of most recent Section 10 Inspection	Report received for current inspection?	MIOS completed for current inspection?	Latest possible date of next Section 10 Inspection
Cae Llwyd	March 2019	Yes	Yes	March 2029
Llwyn Onn Tanks	N/A – built 2017	N/A	N/A	February 2033
Llyn Cyfynwy	January 2022	No	N/A	January 2032 TBC
Marchwiel	June 2018	Yes	Yes	June 2028
Nant-y-Geifr	October 2022	No	N/A	October 2032 TBC
Nant-y-Ffrith	January 2022	No	N/A	January 2032 TBC
Pant Glas	October 2022	No	N/A	October 2032 TBC
Pendinas	March 2019	Yes	Yes	Match 2029
Penycae Lower	January 2022	No	N/A	January 2032 TBC
Penycae Upper	January 2022	No	N/A	January 2032 TBC
Pen-y-Gwely	March 2021	Yes	Ongoing	March 2031
Ty Mawr	March 2019	Yes	Yes	March 2029

Whilst the latest possible dates for eight of the sites are in AMP9, there are a number of reasons why we are proposing investment happens in AMP8.

- For the six sites marked as TBC, we have not yet received the final Section 10 report. If the Inspecting Engineer considers that the risk at the site is poor, or likely to be out of alignment with emerging best practice, this date can move forwards.
- Likewise, dates can move forwards if our internal Supervising Engineers identify this is needed as part of their annual monitoring.
- For those sites inspected in 2022, it is likely that any significant or complex MIOS identified (when the reports are finally issued) will have a completion date in 2026.
- Work does not have to wait for a MIOS before it is acknowledged as required – we should plan to proactively undertake work such as studies, inspections and monitoring upgrades so that we have data available to inform the next Section 10 Inspections, and so that we align with the emerging best practice post-Balmforth
- For the work we have identified as a new post-Balmforth requirement, NRW have indicated that AMP8 is the only AMP likely to include a NEP driver for this. NRW are actively encouraging proactive works ahead of them becoming mandatory – and investing based on robust risk assessment, rather than reliance on a statutory backstop, is one of the recommendations of the Balmforth review.
- The Balmforth review recognises that shortages of experienced Inspecting Engineers (and Construction Engineers – who oversee the MIOS works) is an increasing risk to Reservoir Safety in England and Wales. By proactively delivering through AMP8, we can spread the Inspection (and supervision) work more evenly, and mitigate the risks of a shortage of experienced Inspecting Engineers and supply chain.

2.4 Best option for customers (where appropriate)

Criteria

- a) Did the company consider an appropriate range of options to meet the need?
- b) Has a cost–benefit analysis been undertaken to select proposed option? There should be compelling evidence that the proposed solution represents best value for customers, communities and the environment in the long term? Is third-party technical assurance of the analysis provided?
- c) Has the impact of the investment on performance commitments been quantified?
- d) Have the uncertainties relating to costs and benefit delivery been explored and mitigated? Have flexible, lower risk and modular solutions been assessed – including where utilisation will be low?
- e) Has the company secured appropriate third-party funding (proportionate to the third party benefits) to deliver the project?
- f) Has the company appropriately presented the scheme to be delivered as Direct Procurement for Customers (DPC) where applicable?
- g) Where appropriate, have customer views informed the selection of the proposed solution, and have customers been provided sufficient information (including alternatives and its contribution to addressing the need) to have informed views?

Fundamentally reservoir safety is a statutory requirement. We must adhere with the recommendations of the reservoir inspection reports that we receive. Equally, the options for how to address report recommendations are typically limited given that the recommendations are typically very descriptive. One option we may have is whether to maintain or decommission reservoirs that we do not currently use:

- For two of our smaller sites, we currently do not use the retained water as a resource and have no plans to do so in our WRMP. These are legacy assets which face increasing maintenance costs as they age, especially as the expected best practice and post-Balmforth guidance is likely to mandate increasing interventions.
- Discontinuance of these sites may be the optimal solution – however this will require a full investigation and cost benefit analysis to confirm. Discontinuance of a dam can require significant volumes of earthworks – and the requirement to fully consider the environment and other downstream stakeholders means that these projects can be relatively slow and expensive to deliver. If the safety risks are significant, we may need to undertake them anyway, even if we have confirmed a longer term aspiration to discontinue. Due to this uncertainty, we continue to include the cost estimates for the full works at these sites in this claim.

2.5 Customer protection (where appropriate)

Criteria

- a) Are customers protected (via a price control deliverable or performance commitment) if the investment is cancelled, delayed or reduced in scope?
- b) Does the protection cover all the benefits proposed to be delivered and funded (e.g. primary and wider benefits)?
- c) Does the company provide an explanation for how third-party funding or delivery arrangements will work for relevant investments, including the mechanism for securing sufficient third-party funding?

Reservoir maintenance is mandatory with a clear enforcement framework to make sure that interventions are delivered. However, we are aware that there remains material uncertainty about the scope of AMP8 investment. This relates to both:

- the total scale of reservoir safety work (i.e. due to uncertainty about what future reservoir inspection reports will mandate us to do)
- the fraction of the programme that will be considered as enhancement expenditure and included in the NEP.

Whilst we are very confident that the implicit allowance assumed by botex+ models is not likely to be sufficient for our AMP8 investment requirements, material uncertainty surrounds the size of the net cost adjustment claim. Consequently, it might be desirable to consider the use of an uncertainty mechanism to protect the interests of customers. This could be a true-up process to return any funds that are not required at the consultation of AMP8, or an ODI type process that releases expenditure as and when the requirements become definitive.