1 – Ongoing Operating Costs of AMP7 WINEP Phosphorus Removal Programme

1.1. Executive Summary

This document provides Yorkshire Water's evidence for a cost adjustment claim related to the ongoing operating costs associated with our AMP7 WINEP Phosphorus (P) Removal Programme in Wastewater Network Plus (WWN+).

Yorkshire Water (YW) is delivering schemes to meet tightened Phosphorus consents at 80[1] sites in the 2020-25 period with all schemes expected to be completed before 31/3/2025.

Enhancement cost models developed by Ofwat and built on by the CMA at PR24 allowed YW a Totex value of £549.8m (17/18 prices) in Wastewater Network Plus to deliver P-removal at 80 sites serving a population equivalent of c. 4,460,000. No allowance was made for the ongoing operation and maintenance of these assets.

The current modelling process assumes that ongoing costs of maintaining compliance become base maintenance in future periods. An additional allowance is only available however if the investment programme impacts on a cost driver that is used in the cost models (e.g. an increase to treatment complexity).

We will have a large increase in treatment costs associated with this P-removal programme which have no impact on the cost variable in the models

Our total claim for P-removal after the reduction of a calculated implicit allowance is **£22.7m** p.a. or **£113.5m** for the 2025-30 period.

The sections below set out:

- A background on our PR19 submission and the WINEP requirement
- Our approach to identifying the best solution within our AMP7 allowances and estimating the ongoing operating costs.
- Economic analysis – top down and bottom up to set out evidence that YW's costs are efficient at an industry level.
- Discussion of implicit allowances and symmetrical adjustments.
- A Customer Protection mechanism

Table 1.1 below points to the locations in the document where we address Ofwat's cost adjustment claim assessment criteria.

[1] Please note this includes Huddersfield which has two separate outfalls; however, we are treating these as one scheme

Cost Adjustment Claim Assessment Criteria	Sections
Need for adjustment	1.2, 1.3, 1.5
Cost efficiency	1.4, 1.6
Need for investment	1.2
Best option for customers	1.4
Customer protection	1.8

Table 1.1 References in Document to Ofwat's Cost Adjustment Claim Criteria.

1.2. Introduction

What is the Water Industry National Environment Programme (WINEP)?

Ahead of PR19, Yorkshire Water (YW) worked with the EA and Natural England to apply and interpret their Water Industry Strategic Environmental Requirements (WISER) to our region. The final WINEP3, agreed with these environmental regulators, listed the extensive statutory obligations to meet these regulatory requirements and ambitions.

The WINEP programme required of YW at PR19 was the most extensive and ambitious ever. The range of solutions varied from conventional engineering approaches, to the largest ever programme of catchment interventions.

Phosphorus Removal

The key driver impacting on the scale of Yorkshire Water's WINEP3 programme was Phosphorus (P) removal. The P Drivers set out in WINEP3 for each company came under one of 3 drivers:

- Urban Wastewater Treatment Directive (UWWTD) Improvement U_IMP2
- Water Framework Directive (WFD) – Improvement WFD_IMP G,M
- Water Framework Directive (WFD) – No deterioration WFD_ND

Each site in the programme had one or more of the above drivers and an associated permit limit for the works to achieve to meet the driver. Typically, the WFD_IMP drivers are more stringent than the UWWTD_IMP driver on the same site. Yorkshire Water had no obligations under the WFD_ND driver.

The key variables impacting on the relative efficient cost of meeting P removal obligations set by environmental legislation included the following:

Number and size of sites. The scale of STWs that are affected by obligations. Companies with more affected sites, or larger sites, will – all else being equal – face greater costs of meeting their obligations. The size of sites is typically measured by load or by a site's Population Equivalent (PE)

Permit level. The lower the absolute level of permit, the more costly it is to achieve. For example, it is more costly to achieve a permit level of 0.5mg/l than it is to achieve

a permit level of 1mg/l. This is because lower limits require additional treatment units and additional chemicals leading to increased capital and operating costs.

Change in permit level. Enhancement costs reflect step changes from current levels of service. The extent to which permit levels change can vary between companies, and therefore this drives differences in costs between companies. Companies that have received enhancement cost allowances in the past to achieve the UWWTD (typically a set 1 or 2 mg/l limit), may have less of a change to meet the WFD standard (set based on the output of river modelling) than a company that currently has no permit and has to achieve both standards.

Type of obligation. The type of designation affects what solutions can be applied to achieve the required permit levels. The UWWTD is clear in that permit levels must be achieved by treating wastewater before it is discharged from the treatment works. Whereas the WFD applies no such restrictions. Therefore, less costly technologies (e.g. catchment-based solutions) can be used to meet WFD obligations compared to UWWTD obligations. The cost differential is likely to be greatest on larger sites, however catchment approaches at all scales show greater benefits due to their additional impact in a six capitals valuation.

An additional consideration linked to the type of obligation was that UWWTD is a statutory driver that stipulates end-of-pipe treatment by law, and as such the solution was not subject to cost benefit analysis by the EA before inclusion in the WINEP, whereas WFD drivers were.

For sites with both drivers, the EA's cost-benefit analysis of the WFD element was based on only the incremental cost between achieving the UWWTD limits and the WFD limits whereas the benefit achieved by both drivers was assumed.

This means that WFD schemes that would not be cost beneficial on their own became beneficial for YW's WINEP3. More expensive WFD schemes at other companies not subject to UWWTD drivers may have been rejected on cost benefit grounds and been excluded from Ofwat's modelled dataset (see Ofwat's Modelling Approach section below).

The final WINEP was confirmed on 31st March 2017 and contained 81 new phosphorous limits, with 11 limits driven from the Urban Waste Water Treatment Directive Sensitive Designations, 32 limits driven from the Water Framework Directive and 39 limits driven by both drivers. One site required no action at PR19 as it already met the standard.

The Scale and Challenge of YW's AMP7 Programme

The WINEP programme for Yorkshire Water was different to those for other companies in that:

- It had the largest total PE of sites with new phosphorus drivers in the industry. This meant that it had the largest scale driver of costs (Figure 1.1).

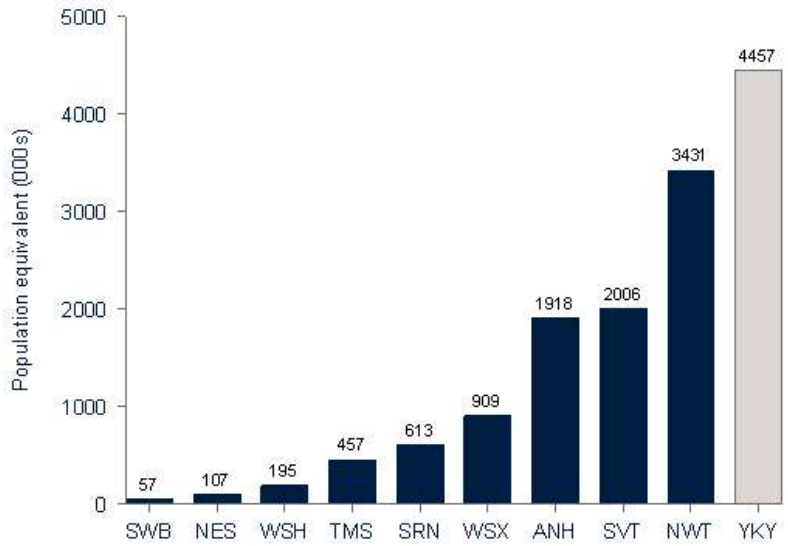


Figure 1.1 Population Equivalent impacted by new P permits for each company (in AMP7)

- YW had not had significant P-removal obligations in previous National Environment Programmes and hence did not have existing treatment in place. This meant that the level of improvement in P permits at YW sites, was larger than companies that already had permits in place (often going from no permit to an extremely tight permit). Companies with existing treatment in place may have been able to achieve improvements by minor modifications or optimisation of existing approaches or through catchment management at a significantly lower cost than if no treatment is currently in place. This is represented in Figure 1.2.

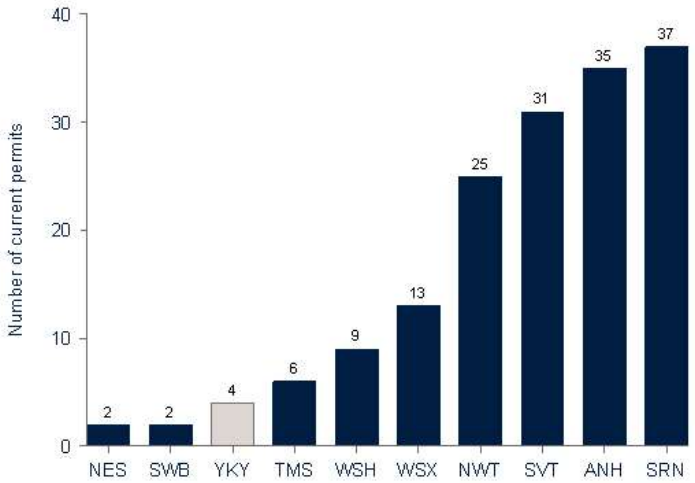


Figure 1.2 Number of Sites with new P Drivers that have Existing P Permits

- Approximately half of YW sites had both a U_IMP Driver and a WFD_IMP Driver. This was unique in the industry and the proportion was particularly large when viewed weighted by load (Figure 4). Many companies received UWWTD drivers in previous periods and were allowed enhancement funding to deliver improvements at the works. Further improvements to meet WFD drivers may have been achieved through catchment management and minor modifications of existing approaches. However, the requirement in the UWWTD that "*urban wastewater entering collecting systems shall before discharge be subject to secondary treatment or an equivalent treatment…*" meant the solutions and efficiency available to Yorkshire Water were limited by the need for end of pipe treatment. Figure 1.3 shows how YW's UWWTD obligations were proportionally much greater than the rest of the industry.

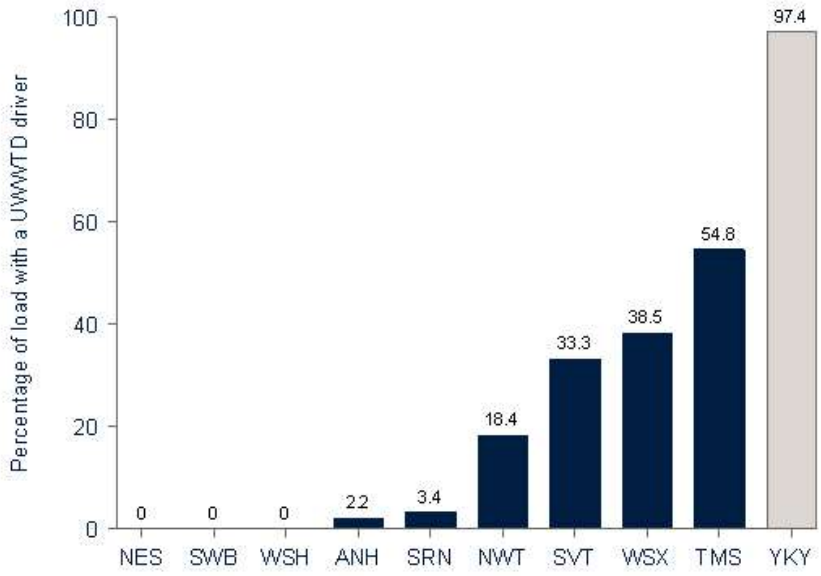


Figure 1.3 Proportion of AMP7 programme subject to new UWWTD obligations (by load)

In summary, YW had the industry's largest set of Phosphorus removal obligations in AMP7. As we had not previously had obligations under the UWWTD we are installing end-of-pipe solutions as mandated by the directive. This means that more efficient costs options (e.g. process optimisation or catchment management) are not available to YW as they are to other companies who have received funding in previous price reviews to achieve UWWTD phosphorus limits.

Phosphorus Modelling at PR19

The PR19 cost models for Phosphorus removal went through several iterations between the IAP stage and the CMA's final determination.

The final decision from the CMA was to adjust Ofwat's FD slightly and to use 8 models to estimate Yorkshire Water's efficient Totex costs within AMP7. These were triangulated to create the final allowance.

Model	Drivers	Model	Drivers
1	Population Equivalent with new P permits & No. of Sites with P-removal drivers	**5**	As 1 but excluding 4 UU large catchment interventions
2	Population Equivalent with new P permits & % sites with <=0.5 P permit	**6**	As 2 but excluding 4 UU large catchment interventions
3	Population Equivalent with new P permits & % sites with <=1 P permit	**7**	As 3 but excluding 4 UU large catchment interventions
4	Population Equivalent with new P permits & % sites with no current permit	**8**	As 4 but excluding 4 UU large catchment interventions

Table 1.2 Model specifications for AMP7 Totex Allowances

Outputs of the modelling & Final Determination

The CMA's final determination modelling outcome, following a WINEP in-the-round efficiency challenge for Yorkshire Water resulted in an AMP7 totex allowance of £549.8m (17/18 prices) in Wastewater Network Plus to deliver P-removal at 80 sites serving a population equivalent of c. 4,460,000.

1.3. The Need for a PR24 Adjustment

The challenge facing companies, and particularly Yorkshire Water in AMP8 is that there was no allowance made for the ongoing cost of operating the P removal process once the schemes are delivered.

Ofwat's approach is that the ongoing operating costs of enhancement schemes become part of base cost allowances in the next period. However, unless the interventions delivered by the enhancement programme impact the explanatory variables in the econometric Botex models then no allowance will be made to fund the ongoing compliance with the new obligations.

P-consent levels are neither directly included as cost drivers in the modelling suite, nor are they sufficiently captured by existing cost drivers. This is shown in Table 1.3 Correlation of load treated at P-consent levels ≤ 0.5mg/l with relevant cost drivers below, which shows the correlation of load treated at P-consent levels below or equal to 0.5m/l with the cost drivers included in the relevant sewage treatment (SWT) and wastewater network plus (WWN+) models. We note that correlation analysis alone cannot offer comprehensive evidence on whether a cost driver is appropriately captured by a set of models but can provide a starting point in the investigation.

Cost driver	Correlation coefficient
Load (log)	0.0753
Pumping capacity per sewer length (log)	0.0765
Load treated with ammonia consent ≤ 3mg/l	0.2198**
Load treated in size bands 1 to 3 (%)	-0.1411
Load treated in STWs ≥ 100,000 people (%)	0.1474
Weighted average treatment size (log)	0.0327
Urban rainfall per sewer length (log)	0.0626

Table 1.3 Correlation of load treated at P-consent levels ≤ 0.5mg/l with relevant cost drivers

Note: ** indicates statistical significance at the 5% level.
Source: Oxera analysis of PR24 Cost Assessment Master Dataset, Wholesale Wastewater Base Costs v4,

Only the correlation with cost driver load treated with ammonia consent ≤ 3mg/l is statistically significant, but it has a relatively low magnitude (0.22). All other correlation coefficients are statistically insignificant and close to 0[2]. Overall, the table shows that the correlation of P-removal activities with the cost drivers included by Ofwat is low.

Ofwat has recognised this in its recent Base Cost Modelling consultation[3] stating:

> *"We recognise that the additional ongoing cost associated with more stringent phosphorus removal programmes across the sector may not be fully captured in our proposed base cost models. We are exploring alternative options to ensure that our cost assessment approach funds efficient ongoing P-removal costs, which we welcome company views on:*
>
> - *We will continue to consider models with a P-driver (e.g. percentage of load with a P permit <= 0.5mg/l) fixed at the 2024-25 level. This will have the impact of funding the additional base expenditure associated with phosphorus removal enhancement schemes funded at PR19 and completed by the end of AMP7.*

[2] Note that, after Ofwat's ammonia-related complexity variable, the next strongest correlation is between P-removal activity and the economies of scale drivers ('load treated in size bands 1 to 3' and 'load treated in STWs ≥ 100,000 people'). Although statistically insignificant, the correlation suggests that large STWs may undertake more P-removal activity on average in the historical data.
[3] https://www.ofwat.gov.uk/wp-content/uploads/2023/04/Econometric_base_cost_models_for_PR24_final.pdf p41

- *We are considering whether we can calculate an accurate post-modelling adjustment that funds efficient ongoing opex associated with P-removal using data provided by companies in annual performance reports (APRs).*
- *The cost adjustment claim process."*

We are pleased that Ofwat has identified this gap and accept that the efficient ongoing costs allowance could be allowed for in multiple ways. Given this guidance, we include a cost adjustment claim as part of the Early Submission but would equally support an appropriate modelling, or post-modelling adjustment to ensure that efficient costs are recognised.

While the models' inability to reflect the costs associated with P-removal is a general modelling issue that could (in principle) affect all companies, YW in particular is materially affected by the omission of P-removal cost drivers. Figure 1.4 below shows how YW's P-removal activity is expected to change in AMP8 relative to the rest of the industry.

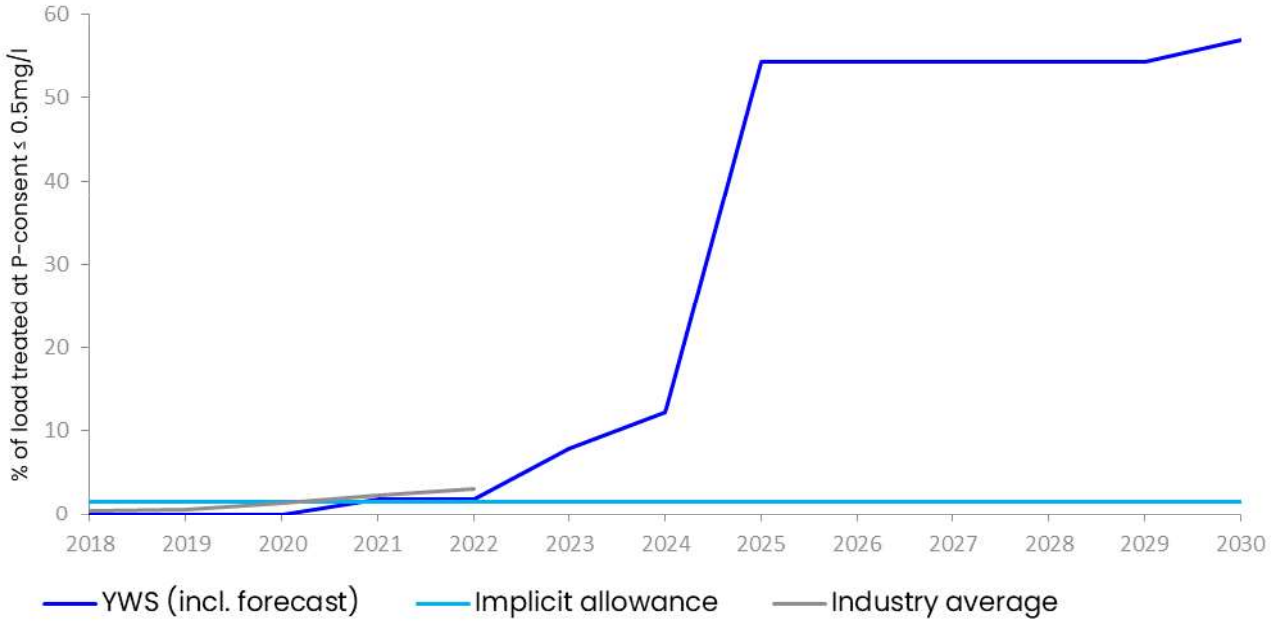


Figure 1.4 Historical and forecast P-removal activity

Note: The implicitly funded P-removal activity ('implicit allowance') is based on the five-year industry average for the years 2018 to 2022 as Ofwat tends to use the last five years of modelled data to determine the appropriate benchmark.
Source: Oxera analysis of PR24 Cost Assessment Master Dataset, Wholesale Wastewater Base Costs v4, and YWS forecast data.

The figure shows that historical P-removal activity across the industry is low. This means that estimating the cost of P-removal activities using econometric analysis on historical data is difficult, because P-removal activities only account for a small share of the relevant cost areas. Moreover, omitting P-removal activity in the models would mean that the implicitly funded level of P-removal activity in the models will likewise be low. In contrast, YW expects to rapidly increase the percentage of load treated at strict P-consent levels

from 2022 to 2025, substantially above implicitly funded levels, requiring additional and more complex P-removal activities.

We discuss the calculation of implicit allowance later in this document.

1.4. Yorkshire Water's Efficient Cost Requirements

This cost adjustment claim is aimed at providing YW with adequate operating cost funding to operate the new P-removal sites. Construction of the new assets is underway, and we are working towards a compliance date of December 2024.

YW's processes, through using the totex hierarchy and having a rigorous design and feasibility process supported by a procurement process that is designed to find the most efficient costs possible through the market place, are implemented to ensure customers are protected as far as possible from unnecessary cost exposure. YW is confident that its costs are robust and efficient and with the customer protection mechanism in place described below, protect customers as much as possible

Each scheme is allocated a scheme sponsor whose role it is to manage and steer the scheme through the concept, optioneering, design and delivery processes to the point that the need, technical solution and the funding requirement is authorised in our corporate governance process. We have a framework of delivery partners who are incentivised to find further efficiencies where possible.

The final determination at PR19 for P-removal was significantly less than we had initially identified would be needed. Factors that we argued were important were recognised by both the CMA and Ofwat and included in final models, however, they were then triangulated with models that did not include them.

Our AMP7 programme has been re-evaluated to achieve compliance within our PR19 Totex allowances. Given the cost challenges outlined above, there are cases where the best value solution is not available given the additional AMP7 Totex cost. We have had to make trade-offs, often moving away from more expensive capital solutions (biological nutrient removal or nature-based solutions), to other less capital-intensive options that offer less value in the long-term as the annual operating costs are higher.

We recognise and welcome that Ofwat has recognised and sought to address the 'best-value' issue at PR24 but the issue with AMP7 allowances remains. We set out our approach to designing and optimising our PR19 programme below and understanding the operating cost impact that forms our CAC.

The table below summarises our planned approach to delivering the P programme by solution type:

Treatment Technology	No of permits
P-removal – Chem Precipitation	71
Biological Nutrient Removal	1
Nature Based Solution	4
Catchment Solution	2
Sewer Out	2
TOTAL	**80**

Table 1.4 Final YW Decisions on AMP7 Phosphorous Treatment Solutions

In order to identify the ongoing operating cost requirements, YW deploys a rigorous set of cost models across several categories. We hold and utilise models for the following key opex components:

- Chemical Use
- Power Use
- Business Rates
- Sludge Transport and Disposal
- Additional Manpower Requirements
- Proactive Maintenance Requirements

The table below summarises the calculated annual opex we require in in each key category to maintain P compliance at the required permit level:

Opex category	Annual requirement (£m)
Chemical Use	13.183
Power Use	4.792
Business Rates	2.187
Additional Manpower Requirements	0.186
Proactive Maintenance Requirements	2.701
Total annual WWN+ Operating Cost Requirement	**23.050**
Sludge Transport and Disposal	6.770
Total annual operating cost requirement	**29.819**

Table 1.5 Total Operating Costs of P Solutions split by Category

Costs in EDA inflated to 22/23 FYA

Design, costing and decision-making process

We undertake a robust assessment of costs, optioneering and efficiency through our end-to-end delivery process. Our Decision Making Framework (DMF) is embedded within this process and involves taking the need from the final WINEP and assessing all available options to achieve the best value outcome within cost constraints provided. Challenging the robustness of the cost based on the design and ensuring cost efficiency is built into the planning process. Figure 1.5 below shows our overall process from need through to authorisation to deliver the scheme.

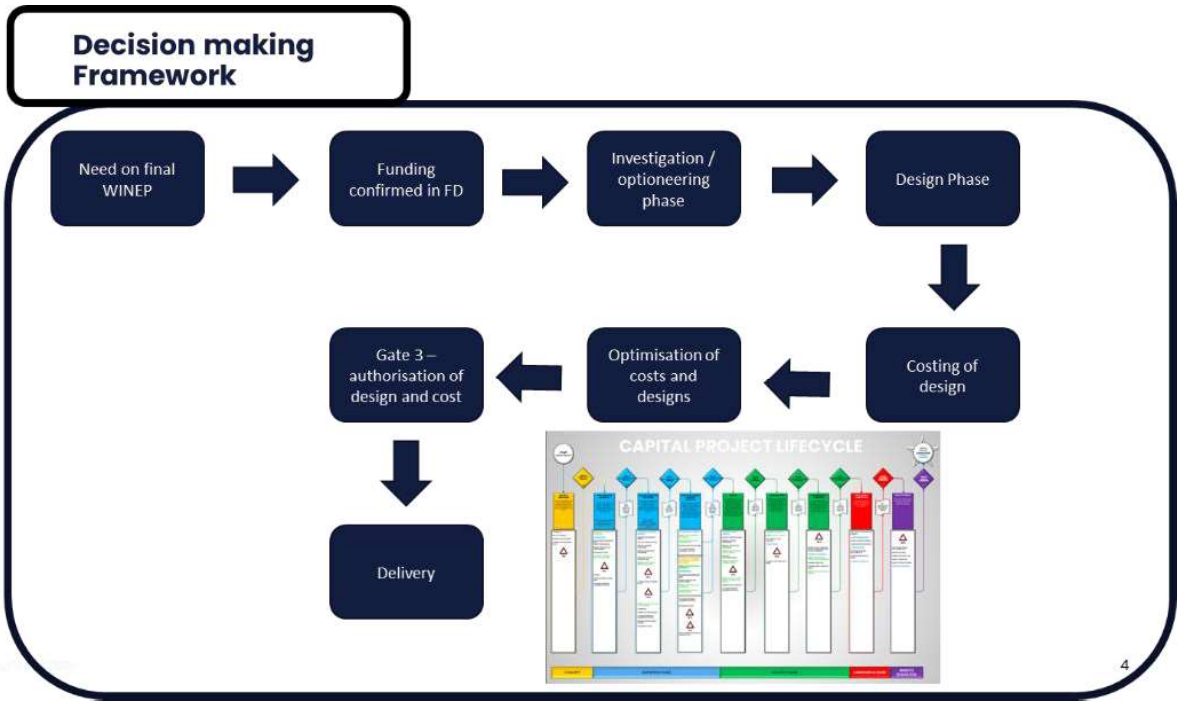


Figure 1.5 Decision Making Framework Process

Investigation and optioneering phase

All 80 limits requiring action were entered into the investigation and optioneering phase of our delivery process. We worked closely with our Strategic Planning Partner, Stantec, and the Environment Agency to assess the range of possible options to deliver our obligations for best value within our Totex constraints.

The decisions made at this stage on the solution type impact our ongoing operating costs and hence the value of the claim.

We deploy the totex hierarchy in all our decision making. Our philosophy, guided by ensuring a low carbon approach where possible and also providing best value for money to customers, is to find ways to minimise the construction of new assets to provide better value. The totex hierarchy we deploy is shown here in Figure 1.6.

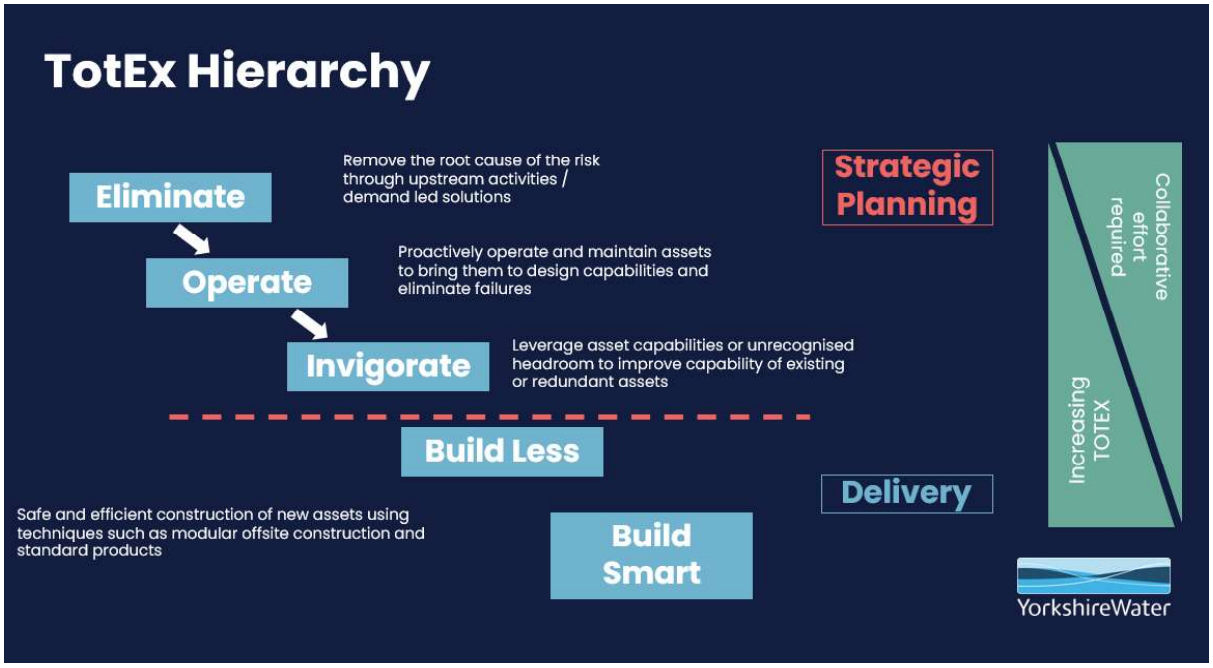


Figure 1.6 Totex Hierarchy

Using this hierarchical approach to totex the following intervention types have been assessed for AMP7 delivery:

Catchment Permit Trading – this is a minimise build approach which involves working with the Environment Agency to manage the overall river water quality objectives set out in the WFD by reviewing and amending permit limits (e.g., including dry weather flow sacrifice and permit trade), ultimately resulting in at least an equal benefit to the watercourse. This approach minimises construction of new assets and therefore additional operating costs in the future providing more sustainable, long-term solutions. We have been able to deploy this approach at a number of sites by optimising the requirement against flow leading to a less stringent limit required, therefore reducing opex requirement. This option is only available for WFD drivers.

Nature-Based Solutions – Where suitable land allows, and treatment load is relatively small, there is the option to install a nature-based solution such as a treatment wetland. Wetlands involve a slow rate natural process of removing P over a long period of time. A good example of this is our Clifton site near Doncaster – shown in Figure 1.7 below. The option has multi long-term sustainable benefits offering a low carbon solution, low operating costs, increased biodiversity and provides an amenity for the local community.

Figure 1.7 Clifton Wetlands – Low Carbon and Opex Solution

Sewering Out – where two wastewater treatment works are located in close proximity to each other there is the option to close the upstream site down and send (pump or gravitate) the influent to the next treatment site downstream. This can save large amounts of capex and opex by combining two requirements into one site, providing good value to customers and cost efficiency. The receiving wastewater treatment site will then be subject to the same options assessment as other sites. This option is available for both drivers.

P-Removal through Biological Processes – this is an alternative P-removal process which includes zoning off various parts of the process into aerated and non-aerated compartments (shown in Figure 1.7 below) and using chemicals but to a lesser extent than full chemical removal. The process can provide a better long-term value solution than standard chemical removal but is only cost effective where there is an existing Activated Sludge Process. The process is high capex however and whilst it often presents better long-term value may not be affordable within short-term Totex constraints. YW completed extensive cost assessment of this at PR19[4]. This option is available for both WFD and UWWTD drivers.

[4] https://www.yorkshirewater.com/media/txfoxuxx/appendix-8g-winep-technical-appendix.pdf

Figure 1.8 Biological Treatment Process Example

P-removal through chemical precipitation – this is the standard P-removal process which involves using a suitable chemical e.g. Ferric Sulphate to bind to the P and precipitate it out of the effluent. A tertiary solids capture unit may also be installed where required to capture the extra solids. Additional chemical may also be used to correct for water alkalinity. The process is relatively low in capex but high in opex and provides limited environmental benefit outside of removing the P from the final effluent. The option is available for all drivers.

Soneco –As an alternative to chemical dosing, an electro coagulation process made from specific metals can be used to treat the water. The process can be used for all drivers and reduces the overall need for chemical and therefore opex.

We use our DMF to assess the suitability of all options available at each site. The DMF considers costs and benefits in the short and long-term and incorporates our six capitals approach.

Table 1.6 below summarises all the optioneering we did for AMP7 delivery in this phase. It includes a comparison between the planned solutions at PR19 and what is now being delivered.

	Full Chemical Removal	Biological nutrient removal	Sewering Out	Wetland Option	Catchment Permit Trading	Soneco	Opex Savings from

							PR19 FBP
No of sites in PR19 (FD)	71	7	3	0	0	0	
No. sites assessed*	81	20	10	10	15	10	
AMP7 Solution	66	1	2	4	2	5	£4.1m

Table 1.6 Phosphorus Solutions Considered and Savings Identified

*Number of sites for which each solution type was considered (in design & feasibility stage)

Despite some non-best value decisions being required to deliver our programme within our AMP7 allowances this totex hierarchy led optioneering process has led us to find savings of £4.1m Opex p.a.

Design Phase

After the concept phase, the chosen outline solution was designed by our Strategic Planning Partner Stantec. Stantec base an outline design on a high-level indicative site layout to enable the delivery partner to confirm costs. Stantec undertake a buildability review looking at site layout, tanker access, following design guidance and standard designs from the Engineering Team e.g. dosing kiosks. Where necessary additional expertise was sourced to outline design more bespoke solutions such as EBPR, Soneco and Wetland interventions.

Costing

As designs become more detailed this allows us to get more detailed and accurate costs. This included both capital costs using our established UCD process and also our operating cost approach which aims to identify the operating cost impact of the designed solution.

Our Opex costs are completed for each scheme at the level shown in Table 1.5 with each key cost category being assessed using a range of methodologies at the best level of detail available at the time.

We have used our bottom-up costing tool within our decision-making framework system (EDA) where possible to estimate the costs. Where bottom-up outputs were not available we used expertise from our strategic planning partner Stantec to estimate the costs. The below sections describe more detail on each of the cost categories.

Chemicals

Chemical usage rates have been calculated using internal design guidance, specifically 'Chemical Dosing for P-removal design guidance'. These calculations consider; existing site

technology type, site population equivalent (PE) and permitted dry weather flow (DWF). All estimates are based on theoretical per capita loading and molar dose ratios as defined in the guidance.

All solutions have been designed and costed to achieve compliance for a forecast 2035 population equivalent.

Our chemical unit prices were sourced from our chemical framework procurement process. The framework provides contractual guarantees on price to ensure costs are efficient and as part of the contract we use Ernst and Young annually to verify our rates are efficient.

Energy/Maintenance/Business Rates

For all sites, energy, maintenance and business rates requirements for the chemical dosing and tertiary solid capture were calculated by Stantec based on a mixture of bottom-up detail and top-down assessments where relevant to the cost type. All solutions have been designed and costed to achieve compliance for a forecast 2035 population equivalent.

The assets that are costed included dosing systems or 'package', mixing systems, safety showers and water booster package where available. Rateable assets include civils assets such as storage tanks. Maintenance is applied to M&E assets.

Key values for the assessment used are:

- **Energy / Power –** Assumed a 26p/kw hour for power consumption (KW requirements assume a 75% loading rate, a 60% average use factor, and 90% overall pump efficiency for M&E Assets)
- **Maintenance –** 2.44% of total M&E capex (where applicable) is applied as the annual rate for maintenance
- **Business Rates –** 0.04% of the total civils capex (where applicable) is applied as the annual rate for business rates

Labour

The labour estimated included an assumption on time based on an Optimiser role as well as a time-based assumption on a Senior Operator role, with cost rates based on YW bands and SAP rates. The time required per site per week includes travel time and is based on information from AMP6 delivered activity. The time and rates assumed were:

Role	Rate (£/hr cost to YW)	Time assumed in hours per site per week
Optimiser	70.38	0.5
Senior Operator	37.69	0.375

Table 1.7 Labour cost assumptions

Sludge

We have used a series of models to understand our sludge costs however these do not form part of this claim.

Assurance and corporate governance

The decision on the final designs and subsequent cost calculations were presented and authorised through our corporate governance process on Nov 22nd 2022 (Board Investment committee). This followed a process of internal YW quality assurance and external review from a Stantec subject matter expert.

Figure 1.9 below summarises our assurance process for costs

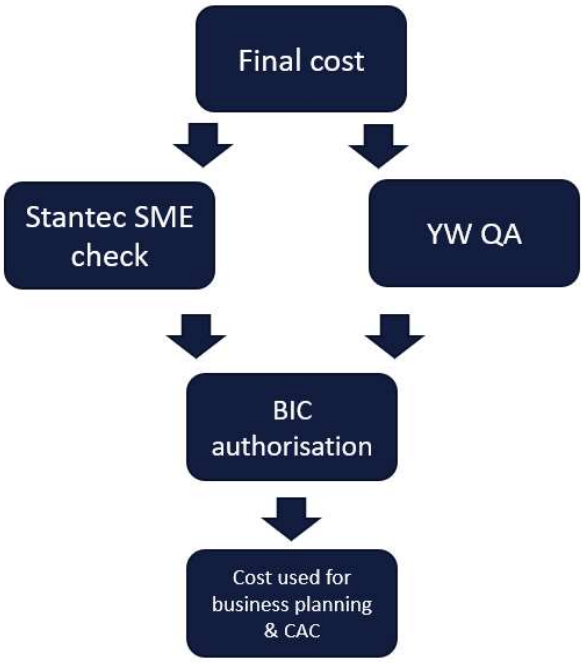


Figure 1.9 Cost and Solution QA and Assurance Process

These costs are now being reported in Table 7F of our APR submission, used for our programme planning and informing the size of this claim.

1.5. Calculating the Claim Value

As shown earlier in Figure 1.4 historical P-removal activity is very low across the industry at the tightest consent levels. Table 1.8 below shows the shares of load treated at P-consent levels below 0.5mg/l during the past five years and as forecast for AMP8.

	in %
YW's current P-removal activity	0.7
Implicitly funded level of P-removal activity based on outturn average	1.5
YW's forecast P-removal activity	54.2
Share of claim relating to meeting implicit allowance	1.5
Share of claim going beyond implicit allowance	98.5

Table 1.8 Calculation of share of claim beyond implicit allowance

Note: YW's current and the implicitly funded level of P-removal activity refer to 2018-2022 averages. Forecast share refers to YW's forecast value for 2026. P-removal activity is defined as the share of load treated at P-consent levels ≤ 0.5mg/l
Source: Oxera analysis of PR24 Cost Assessment Master Dataset, Wholesale Wastewater Base Costs v4.

The table shows that YW currently treats 0.7% of load at the strictest P-consent level of below 0.5mg/l, while the industry average of 1.5% is implicitly funded. However, YW will treat 54.2% of load at the most stringent P-consent levels in 2026. Consequently 1.5% of YW gross claim relates to meeting the implicit allowance and 98.5% goes beyond it.[5]

We have calculated the gross claim p.a. by our bottom-up estimate of OPEX costs relating to P-removal activities based. This reflects the estimated additional expenditure required by YW to meet the more stringent P-consent requirements. Table 1.9 below presents how a net claim value over 5 years can be calculated from this.

	in £ million
Gross claim p.a.	23.050
Net claim p.a.	**22.704**
Net claim over 5 years	**113.520**

Table 1.9 Calculation of Claim value

The gross claim p.a. reflects our bottom up build of costs as set out in Table 1.5 (however, some of this gross claim value (c. 1.5%, see Table 1.8) reflects costs associated with YW 'catching up' to the level of P-removal currently implicitly funded through the models. The net claim p.a. is calculated by multiplying the gross claim value (£23.1m) with the share of the claim going beyond the implicit allowance (98.5%). On the basis of this analysis, the net claim amounts to c. £22.7m p.a., or £113.5m over a five-year period.[6]

[5] The exact calculation is as follows: $\frac{average\ share - current\ share}{forecast\ share - current\ share} = \frac{1.5 - 0.7\%}{54.8\% - 0.7\%} = 1.5\%$

[6] Our populated data tables show the gross value, the implicit allowance, and the net value of the claim by year. They also show the historical expenditure per year.

We will continue to revise the costs to reflect any changes in chemical and energy prices and any final changes to solution type and update for the final CAC submission in October.

1.6. Economic Benchmarking – Empirical Analysis

Section 1.4 sets out in detail the approach we have taken to designing our solutions and understanding the ongoing operating costs. However, in order to support this, we have worked with our economic consultancy partner Oxera to develop econometric evidence on the efficiency of our costs.

Oxera has taken two approaches to assess what could be considered an industry level efficient cost.

- Firstly, it has used the data submitted by companies in APR table 7F to assess an efficient unit rate for the ongoing operating costs associated with additional treatment of phosphorus in the AMP7 WINEP.[7]

- Secondly, it has explored the impact of including a composite complexity variable involving P-removal in the base cost modelling. It has completed further analysis to confirm its assumptions in the weighting of P-removal in the complexity variable.

These are described in detail in Appendix 1 and the calculations will be made available in the accompanying datasheets can be provided upon request.

	Net claim value (£m p.a.)
Analysis based on APR tables 7F	20.4-26.4
Ofwat proposed models with add composite treatment complexity variable	42.2
YW' bottom-up estimate	23.0

Table 1.10 Summary Table of Oxera Model Findings

Source: Oxera analysis.

[7] It is not clear whether APR Table 7F contains elements of Bioresources costs for each company. The output of this analysis provides a range based on different assumptions regarding whether bioresources expenditure is included in the cost data.

Oxera's analysis considers the reasonable range for a cost adjustment claim based on P-removal to be in range of **£20.4m to £42.2m p.a**. YW's bottom-up estimate of **£23.0m p.a** lies within this range**.**

We anticipate updating this analysis to reflect the latest APR data prior to our final submission and recommend that Ofwat ensures that the definition of table 7F is clear on whether it includes the bioresource operating cost impact of the investments.

1.7. Symmetrical Adjustments

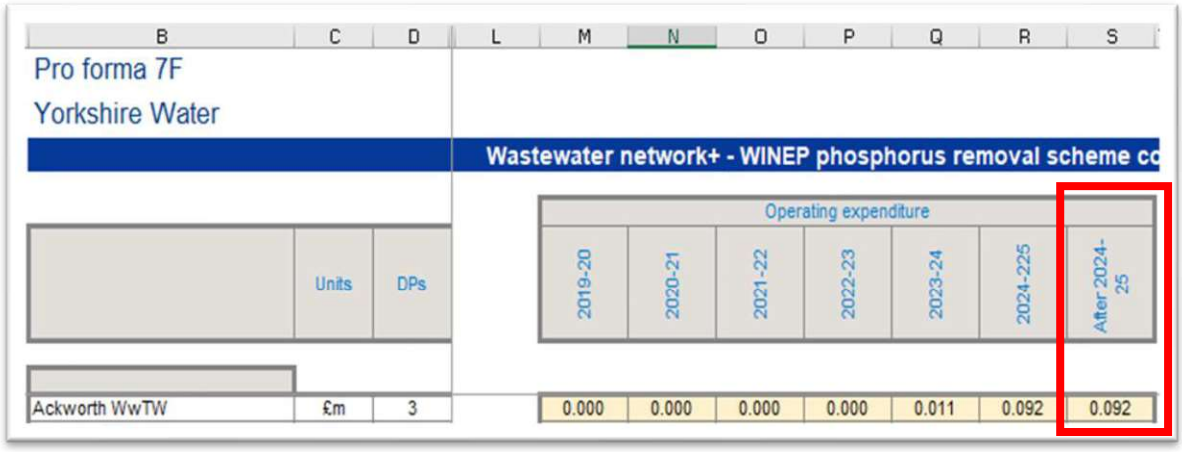
In theory, the cost adjustment claim can be symmetrical as companies could undertake future P-removal activities below the implicitly funded historical average. However, forecast data indicates that all companies expect to significantly increase their P-removal activities in the coming years, due to tightening P-consent levels. In practice, we do not expect many companies to be affected by negative cost adjustments due to this claim.

1.8. Customer Protection

Whilst we are investing to complete our construction at all 80 sites by December 2024, we propose a protection mechanism for this cost adjustment claim to protect customers in the event that any schemes are delivered late.

We propose to use the reported values in Table 7F of the APR which contains a value for operating expenditure 'after 2024-25' but excluding any sludge costs.[8] See figure 1.10 below.

[8] We note that our previous submission of Table 7F contained sludge operating costs relate to the scheme. It was not clear in the RAG guidance whether this was the correct assumption or whether other companies reported these costs. This protection mechanism will be based on costs in table 7F *excluding* bioresources costs. We have sought clarification on this and if Ofwat confirms bioresources costs should be excluded then then Table 7F can be used as the basis of the protection mechanism.



Pro forma 7F

Yorkshire Water

Wastewater network+ - WINEP phosphorus removal scheme co

	Units	DPs	Operating expenditure 2019-20	2020-21	2021-22	2022-23	2023-24	2024-225	After 2024-25
Ackworth WwTW	£m	3	0.000	0.000	0.000	0.000	0.011	0.092	0.092

Figure 1.10 APR Table 7F

We propose a mechanism where we would return a proportion of the annual operating costs associated with each late delivered scheme based on the number of months late delivery (rounded up to the nearest month). Where 'late' is defined as not achieving the compliance date (December 2024 or March 2025).

For example if Ackworth were delivered 6.5 months late we would return **7**/12 x £0.092m = £0.0536m. If it were delivered 15 months late we would return **15**/12 x £0.092m = £0.115m

We will expand on this further in our final plan and would welcome engagement with Ofwat on the suitabiltiy of this mechanism before final determination. We would propose that the most up to date APR table 7F available is used to set the rates (there will be two further iterations of this table before final determination).

1.9. Data Table Commentary

	Title	Commentary
CWW18.1	**Description of cost adjustment claim**	The base cost impact of YW's AMP7 Phosphorus Removal Programme unfunded through base modelling
CWW18.2	**Type of cost adjustment claim**	We have assigned this to 'new legal requirements' as the claim is for the costs to maintain compliance with new legal requirements not in the historic dataset.
CWW18.3	**Symmetrical or non-symmetrical**	This is a forward-looking claim and therefore non-symmetrical.
CWW18.4	**Reference to business plan supporting evidence**	Refers to this document as this is the Early submission.
CWW18.5	**Total Gross Value of Claim**	We populate the gross value of the claim to align our costed ongoing operating costs excluding Sludge. We do not populate claim values for the period 2022-25 as we assume that any operating costs in this period are allowed for through the PR19 Totex allowance.
CWW18.6	**Implicit Allowance**	This has been calculated as set out in Section 1.5 above
CWW18.7	**Total Net Value of Claim**	Calculated from above two lines
CWW18.8	**Historic Base Expenditure**	The investment to address these new obligations has only begun in AMP7 with the first operating expenditure seen in 2021/22 so we have not included historic base expenditure for years prior to this. A small value (as reported in APR table 7F Column O has been reported in 2021/22) as the first small schemes with early compliance dates have been delivered.
CWW18.9	**Totex for the control**	We are not required to populate Totex value but include a WWN+ value
CWW18.10	**Materiality**	N/A We note that the size of the claim is significantly higher than 1% of WWN+ Totex historically.

Table 1.11 Data Table CWW18 - Cost Adjustment Claim