# WSX-C05 – Enhancement costs – water quality improvements

Response to Ofwat's PR24 draft determination

Wessex Water
YTL GROUP

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# Representation reference: WSX-C05

# Representation title: Enhancement costs – water quality improvements

## CONTENTS

# 1. Summary

We are not able to accept the cost allocation proposed by Ofwat for our ✂ nitrate scheme or WINEP schemes for drinking water supply areas, as we do not believe it will allow provision of adequate protection for our customers in the future. We request that costs included in our original business plan submission, and additional costs relating to new PFAS needs are allowed (Table 1).

Wessex Water believe that the provision of nitrate treatment, along with increased catchment activity, are crucial to the cost-effective provision and safeguarding of wholesome drinking water for our customers in the future.

In addition, changes in DWI requirements for PFAS mitigation since the submission was made have created a need for significant investment not included originally. This covers catchment investigations and modelling for a number of sites, optioneering and design of treatment at ✂, as well as provision of treatment at ✂ WTC. We have agreed our measured approach for the coming AMP with the Inspectorate and again request that Ofwat provides the funding proposed in the best interest of our customers.

*Table 1 – Summary of changes requested*

| Details | Data table lines | October 2023 submission | Draft Determination allowance | Our requested allowance |
|---|---|---|---|---|
| ✂ nitrate treatment plant | CW3.99 | £21.3m | £12.8m | £21.3m |
| Enhanced Catchment Management at 10 high nitrate sources | CW3.15 | £10.25m | £5.13m (assumed because 50% cut applied to total) | £10.25m |
| Domestic Oil Storage Customer Campaign at 3 surface water reservoirs | CW3.15 | £0.34m | £0.165m (assumed because 50% cut applied to total) | £0.34m |
| PFAS – additional sampling requirements | CW2.14 (October submission)<br><br>CW3.99 (post DD submission) | £3.55m | £2.27m (assumed based on 36% cut to Supply base expenditure) | £3.55m |
| PFAS – additional catchment investigations and modelling | CW3.31 (October submission)<br><br>CW3.102 (post DD submission) | £1.06m | £0.53m (assumed because 50% cut applied to total) | £2.13m |
| PFAS – new additional requirements to meet DWI undertaking | CW3.99 | £0m | £0m | £13.15m |
| Total | | £36.39m | £20.90m | £50.72m |

We note that we have accepted Ofwat's proposed enhancement cost allowance for lead pipe replacement, as we consider this to be sufficient to carry out the necessary work. We have amended our costs for this programme of work in lines CW3.106-CW3.111 to reflect this this allowance.

# 2. ✂ Nitrate Treatment Plant

In Table CW3 Line 99 we requested £21.285m over the 2025/26 to 2029/30 period to construct the new nitrate treatment plant at ✂ as agreed with the DWI in their letter of support reproduced in WSX15 Annexe – Water Network Plus Strategy and-Investment.

Please also see response to query OFW-OBQ-WSX-117 that covers our approach to selection of the most appropriate and best value treatment option.

In the draft determination a 40% efficiency challenge was applied, 20% each for best option for customers and cost efficiency.

*Table 2. Ofwat's shallow dive assessment of nitrate treatment scheme from PR24-DD-W-Raw-water-quality-deterioration*

| Criteria grouping | Assessment comments | Criteria decision | % adjustment |
|---|---|---|---|
| Need for enhancement investment | Pass: The investment meets the criteria for enhancement investment and additional customer funding.<br><br>The company's proposed investment relates to addressing water quality risks. This is supported by the Drinking Water Inspectorate as it has served a notice on the company under Regulation 28 (4) of the Water Supply (Water Quality) Regulations 2016 (as amended) reference WSX-2023-00002 (✂) that the investment is the most appropriate steps to address water quality risks within the 2025-2030 period.<br><br>The company also provides sufficient and convincing evidence to show there is no overlap with previous enhancement or base funding. | Pass | 0% |
| Best option for customers | Some concerns: We have some concerns whether the investment is the best options for customers.<br><br>The company states that alternative options have been considered. However, it does not provide sufficient and convincing evidence regarding all discounted options to demonstrate how the treatment (and waste disposal) options have been considered and selected.<br><br>The company does not provide sufficient and convincing evidence to explain why the recent and previous nitrate modelling studies provided different forecasts and the reasons for these. And how the preferred option of ion exchange is the best option to reduce nitrate concentrations to allowable levels | Some concerns | 20% |
| Cost efficiency | Some concerns: We have some concerns whether the investment is efficient. The company does not provide sufficient and convincing evidence that the proposed costs are efficient.<br><br>The company state that capital and operating costs are well understood having previously completed an installation of nitrate treatment plant near Blandford. The company does not present sufficient and convincing evidence to demonstrate cost efficiency with the latest nitrate removal techniques/developments and any benchmarking, or third-party assurance of costs. | Some concerns | 20% |

In the following sections we address the points raised

## 2.1. Best option for customers

***The company states that alternative options have been considered. However, it does not provide sufficient and convincing evidence regarding all discounted options to demonstrate how the treatment (and waste***

***disposal) options have been considered and selected….. And how the preferred option of ion exchange is the best option to reduce nitrate concentrations to allowable levels***

Wessex Water employed the Consultant Atkins to undertake the review of the available nitrate removal treatment technologies, both those that have been successfully operated in the UK and more recent developments with future potential and to recommend a preferred option for nitrate treatment at ✂

An options identification and appraisal evaluated the five most feasible treatment processes for ✂ These included Ion Exchange (IEX), Reverse Osmosis (RO), Electrodialysis Reversal (EDR), combination of IEX/BD (Biological Denitrification) & combination of BD/Filtration.

Atkins then devised a scoring matrix to weight each option (based on factors such as CAPEX, OPEX, complexity, reliability etc.). A list of technologies capable of treating the regeneration wastewater from IEX has been reviewed, this includes both chemical and biological denitrification, as well as the use of an evaporation lagoon.

The option evaluation concluded that the IEX is the preferred option, based on the selection of the most efficient IEX supplier technology in terms of regenerant waste stream and associated OPEX.

These are advanced IEX processes offering a very high efficiency of nitrate removal and able to control and maintain the treated nitrate value within a tighter control band allowing for a more consistent blend ratio.

The full ✂ Nitrate Removal Technology Review is provided in Annex 1 of this response.

The proposal for ✂ is to adopt a side stream treatment where a proportion of the flow is treated by the IEX plant and blended back into the bulk flow. The sizing of the IEX plant can then be optimised based on its efficiency of producing a low nitrate feed to blend with the untreated water to bring down the overall nitrate value to be within the target level to go into supply.

Following technology review, Atkins were asked to assess the option for an IEX plant for Nitrate removal treatment, taking into account the whole life cost of the process. The conclusion was whilst a conventional IEX plant may have a lower CAPEX, the advanced IEX processes have a smaller footprint and a significantly reduced volume of brine waste. This was a key consideration for this particular site as there is no existing sewer connection within the locality and the closest Water Recycling Centre that would currently be prepared to accept this volume of brine waste as a trade discharge is located at ✂. The OPEX driver here is to minimise the volume of waste that ultimately needs to be tankered from site.

The nitrate removal plant is installed such that a proportion of combined raw water is diverted to the ion exchange units. This treated stream is then blended back into the main process stream (upstream of the existing chlorine dosing point) thus reducing the total nitrate concentration to below 9 mg/l as N. This target control point has been selected to take into account the inherent errors within the differing measuring techniques used for online control and compliance sampling to ensure the treated water does not risk exceeding the compliance level of 11.3 mg/l as N. (50mg/l as Nitrate) and thus protects public health.

Brine is created as a waste product from the nitrate treatment system and would be stored in waste tanks external to the nitrate treatment building. The brine would then be taken offsite by tanker for disposal at a suitable location.

After the nitrate removal plant, the process continues as normal to be disinfected by the use of a contact tank and chlorine dosing.

The proposed PFD is shown in Figure 1 below.

*Figure 1. Simplified process flow diagram*

✂

**Brine Waste Disposal**

Predictions for the volume of brine waste produced at ✂ WTC from Nitrate Removal Treatment are substantial. There are no larger sewage treatment works nearby which can take brine waste. Current Brine waste disposal routes are very limited. Options considered are given below:

Base option - Brine waste transfer to ✂WRC via tanker

> ✂) is licenced to receive trade effluent. ✂ has dedicated facility to receive trade effluent. ✂ brine waste will be transported by road to✂ . Waste is deposited into a reception tank at WRC where it is discharged into the main inlet flow. Distance for a round trip from ✂) to ✂ is approximately 180miles. Frequency for brine waste transfer would be approximately 1 or 2 tankers a day depending on brine production.

Alternative option – Disposal via long sea outfall (potential disposal route currently under investigation)

> Investigations are being carried out with Wessex Water Permitting team to submit a proposal to the Environment Agency into utilising a long sea outfall for discharge. The proposal is to discharge the inert brine waste at a controlled rate into the WRC effluent then discharge to the coastal environment. This would provide a far more sustainable discharge facility in the long term. The route by road could be reduced substantially to approximately a 75 mile round trip. The sites currently under consideration which have long sea outfalls are ✂.
>
> This proposal has been discussed with EA and Natural England (NE) representatives and an enhanced pre application has been submitted to EA.

Subject to agreement with the regulators, there will be a requirement for new infrastructure at ✂ for the brine waste disposal facility. It is anticipated that this will include brine waste storage facilities, brine waste transfer and metering pumps, blending facility together with a building for instrumentation, power, control and telemetry. There will be a requirement to create separate access for tankers to segregate the WRC from the brine waste disposal facility to allow this to be maintained as part of the supply infrastructure.

Subject to agreement with the Regulators and any constraints imposed on the discharge, this option would be assessed against the base option of discharge to ✂. Until agreement is reached as to any water quality parameters, volumes, dilution rates etc. it is not possible to cost this and there is still no certainty this would be agreed.

WW will continue to pursue this option as we believe this will provide a more sustainable solution and will compare the benefit of a lower carbon / lower OPEX solution against the increased CAPEX required to provide this new facility. For this reason, no costs for this facility are included within this submission.

## <u>Discounted Options</u>

### Substitution

Historically, WW have adopted a policy of substitution to manage a number of sources which have experienced seasonal elevations in nitrate levels. These tended to be on smaller sources where nitrate exceedances were marginal and generally only occurred in low demand / winter periods.

✂ WTC is a base load source that cannot be substituted for any significant period of time. The criticality of the source has increased over the years as flow reductions have been imposed on other groundwater sources both in the south and north of the WW supply area and the need to keep this operational has become more critical.

Looking forward, catchment investigations driven by WFD and HRA statutory requirements on all our groundwater sources highlight significant reductions will be coming into effect over the next 10 – 15 years. Whilst this has also highlighted a risk to the ✂ and ✂ abstraction licences, mitigation for this is being proposed under the Poole

Strategic Resource Option (SRO) that will allow recycled water to be returned to the River Stour at key points to maintain river levels without the need to reduce abstraction licences at ✂

The SRO scheme is fully supported by RAPID and is progressing to Gate 3 and is planned to be implemented by 2035. This will ensure ✂ remains as a critical base load plant operating at the current design flows. This output cannot be compromised as it will be required to support other areas where source reductions cannot be mitigated.

**Nitrate Blending**

Under scheme B0703, a nitrate blending facility was built at ✂ WTC. The blending scheme relies on availability of water from ✂ WTC to lower nitrate concentration at ✂ WTC.

This scheme was included in PR19 submission based on AMP6 nitrate modelling data. At that time it was understood that the historic nitrate trending model done in 2013 implied nitrates had peaked and did not predict a need for enhanced blending outside of the winter period.

Wessex Water Catchment management team revisited the nitrate trend modelling approach under project Nmod-20 in preparation for PR24. This was completed by Rukhydro Ltd (a specialist external consultant), who developed the original approach to long term nitrate trending in 2008/9 that was used for the AMP 5/6 assessments. The methodology has now been enhanced with improved leaching trends, historical records of nitrate application to farmland and updated catchment boundaries and whilst for most of the reviewed Wessex Water sites the trending is still generally as originally predicted, there has been significant divergence on others, including for ✂, as explained below.

Whilst the latest model is not perfect, it does provide a far better representation with the actual measured data recently seen on site. The trend not only indicates a sharp increase in predicted nitrate levels over all periods, but also the trend does not predict values peaking till at least 2025 - 30 and unlikely to show any real drop off in trend before 2040.

The revised prediction highlights a much higher risk of having to blend throughout the year, not just over the winter period.

With our current blending we rely on both demand being low and having a surplus available at the blending sources which constrains the duration over which blending can take place. The key blending source for ✂. The background levels for nitrates at this source are 6 – 8 Mg/l as N resulting in a need for a substantial volume of ✂ water to blend to maintain compliance at ✂

The key impact of this is that utilisation of ✂ is seriously compromised due to lack of blending water as demand increases. This position will continue to get more acute as more licence reductions come into play and the dependency on ✂ output in higher demand periods increases.

In addition, should we experience any issue with the existing works at ✂, this will immediately impact on our ability to supply water from ✂ which in turn would significantly increase the risk of supply to customers as this impacts on the two major base load Water Treatment Centres supplying the Poole catchment. Whilst in low demand periods we can utilise other sources using the water supply Grid, once the Grid is required to support the seasonal supply deficit in the north following the agreed licence reductions that came in force in Amp 6, this option is no longer available.

Therefore, the current blending arrangement at ✂ will not provide longer term resilience of supply.

***The company does not provide sufficient and convincing evidence to explain why the recent and previous nitrate modelling studies provided different forecasts and the reasons for these***

*Prior to considering the nitrate modelling work that was carried out for AMP7 and AMP8, a review of the raw data trends from the individual borehole illustrates some of the complexities and limitations of the modelling approach (*

Figure 2).

Borehole 4 is the base load borehole for the source due to its lower nitrate trend. It has been used as the internal blend to keep ✂ sources compliant for nitrate since 2010-2012. (✂ sources combine and are treated at ✂).

Prior to 2012 Borehole 2 exhibited a similar nitrate trend to Borehole 4. Borehole 3 has always had a higher trend that Boreholes 2 and 4.

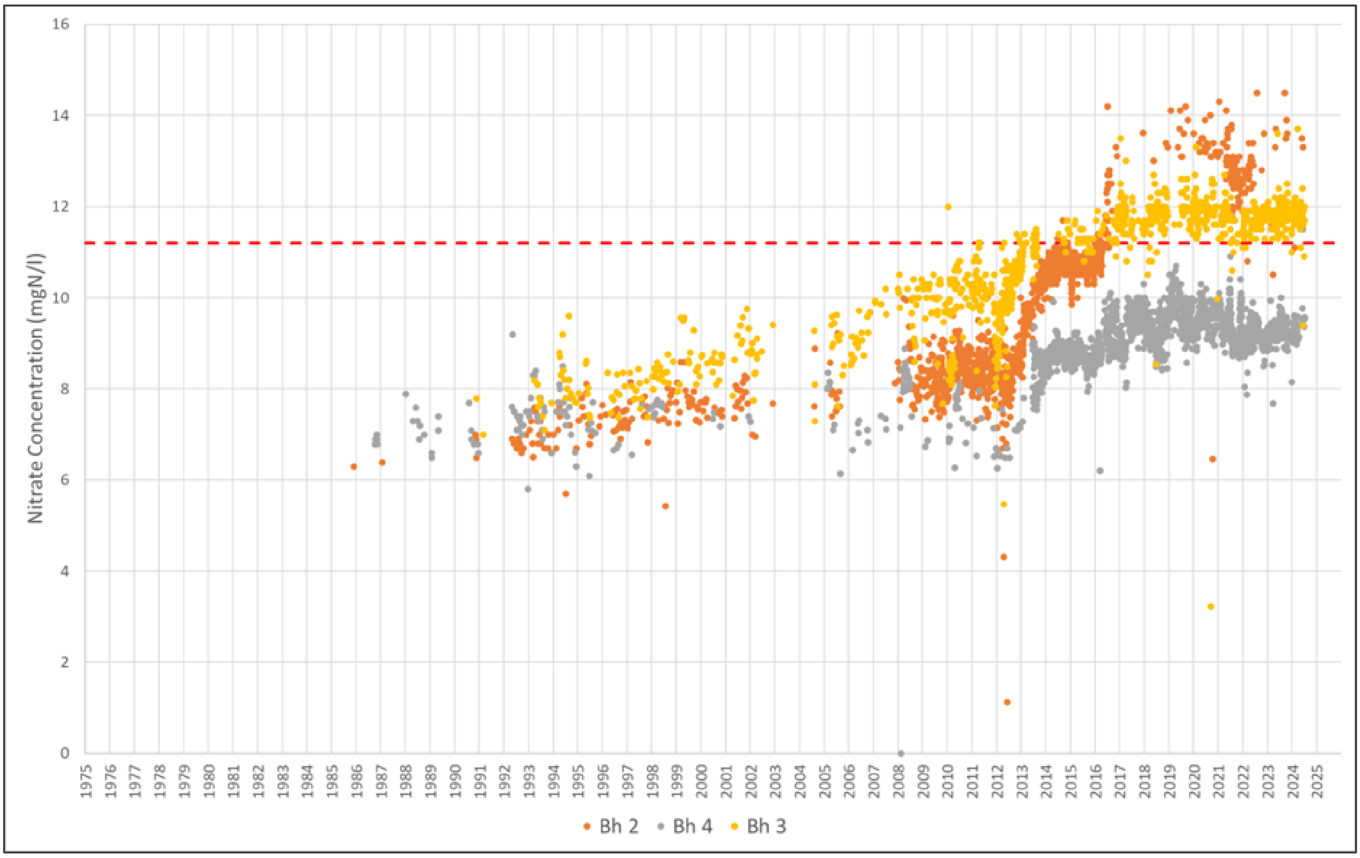
In 2012, Borehole 2 (and to a lesser extent, Borehole 3) nitrate levels increased significantly, in line with many other Chalk groundwater sources, following the unprecedented summer storms in 2012. Borehole 4 did not exhibit the same response but did continue to rise more gently.

This was followed by a further significant rise in nitrate trend in Borehole 2 & 3 in 2016. Since 2020 Borehole 4 nitrate trend seems to be stabilising.

Despite investigation, the mechanisms behind these sudden rises in nitrate trend in Boreholes 2 & 3 but not in Borehole 4 are not fully understood. Of particular concern is that the nitrate trends in Boreholes 2 & 3 remain high and appear to show no sign of reversal.

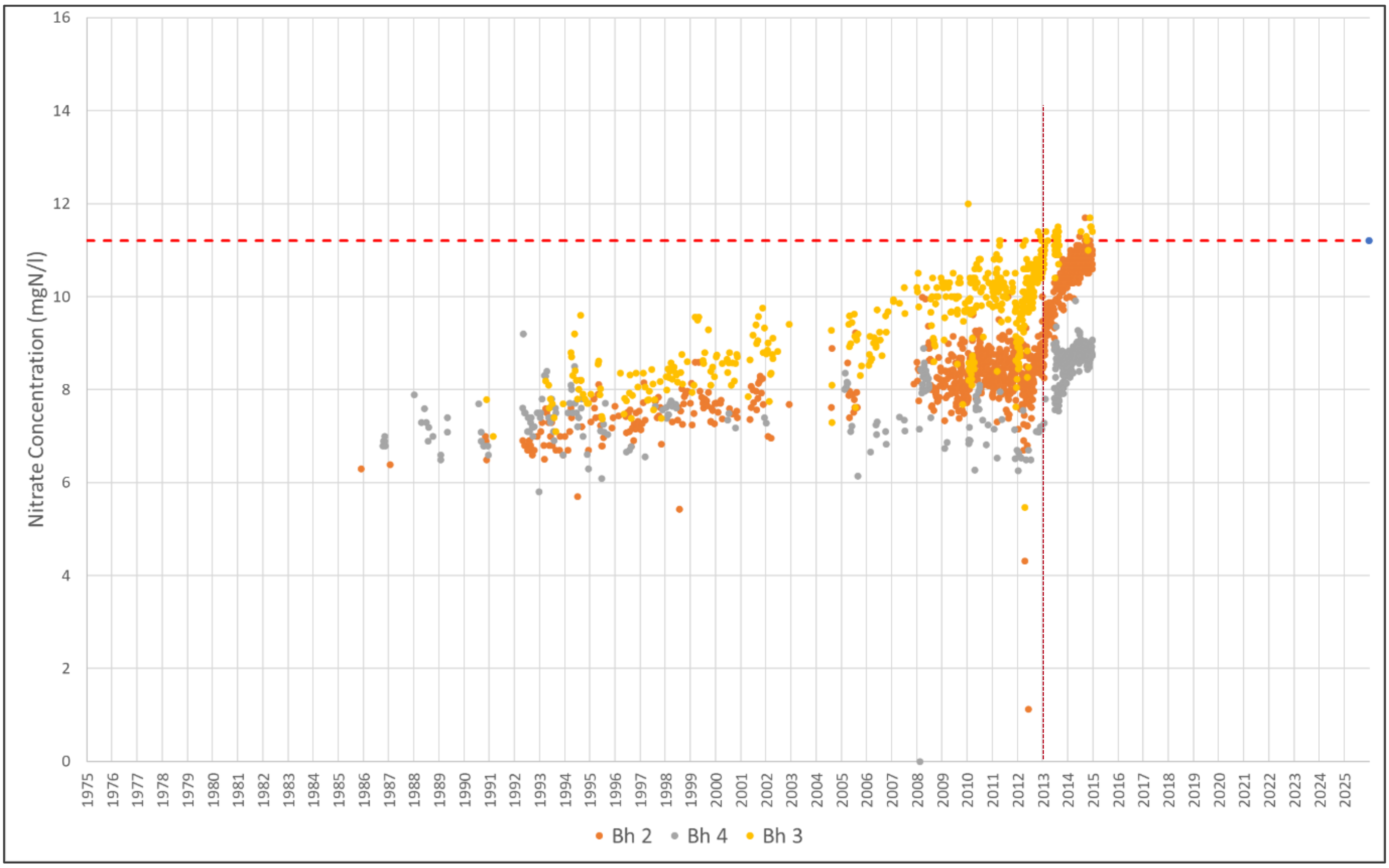
At present therefore, if we were to lose Borehole 4, or if its nitrate trend were to experience a sudden rise we would not be able to keep ✂ in supply.

*Figure 2. ✂ Raw Borehole Nitrate Trends (to present day)*



In order to create the model in time for it to be used for the PR14 submission, only data collected prior to 2013 could be used. At that time, the nitrate trend rises had occurred in all three site boreholes, most markedly in Boreholes 2 & 3, but further increases were seen in immediately subsequent samples (Figure 3).

*Figure 3. ✂ Raw Borehole Nitrate Trends (to end of PR14), Pre 2013 data was used in modelling.*

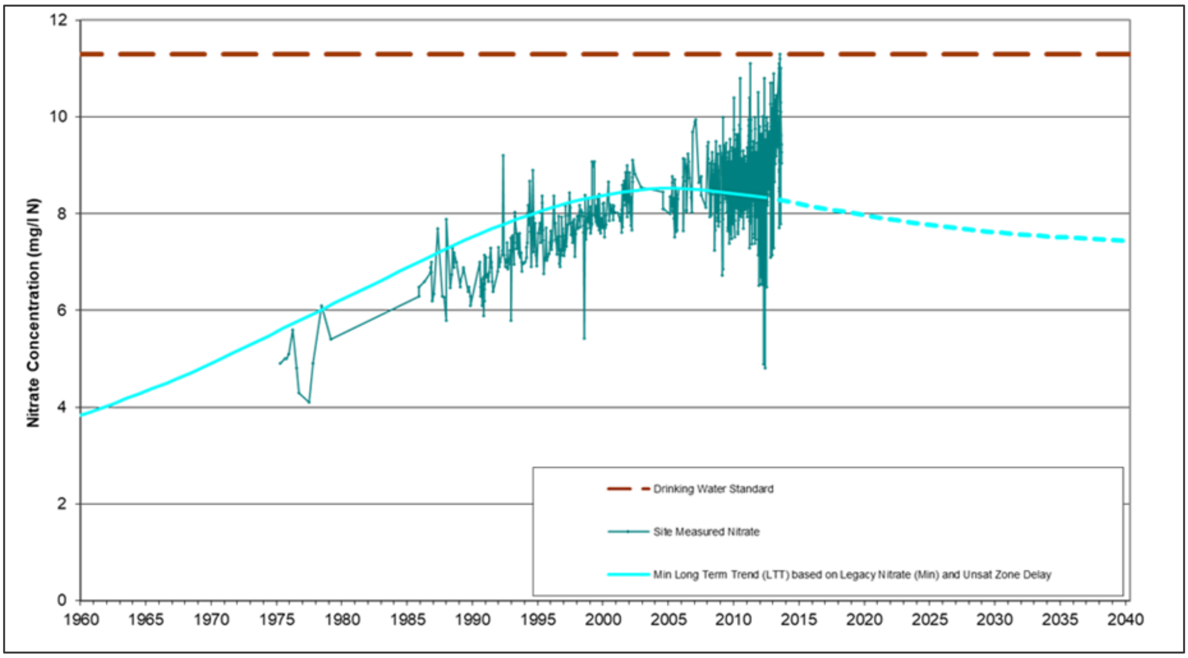



It should be noted that the nitrate modelling work is based on the measured average nitrate trend of all the constituent boreholes; modelling of the individual borehole trends is not carried out as supply demand requires the conjunctive use of source boreholes. As a result, the nitrate modelling suggested that the average nitrate trend had reached its maximum and that it was beginning to decline (Figure 4).

In the absence of a full understanding of the mechanism by which the nitrate trends in Borehole 2 & 3 had risen so sharply towards the end of the modelled period and immediately subsequently, Wessex Water planners were obliged to utilise the modelled output during the submission process. This was the best understanding of the catchment, historic nutrient inputs and groundwater travel times available at the time. It seemed at that stage that the high nitrate seasonal peaks were related to unprecedently high summer recharge in 2012. The reasonable assumption was that these would decline over time to correlate more closely with Borehole 4 as they had done historically. The data at the time suggested that the nitrate trend in Borehole 4 had begun to stabilise in line with modelled output.

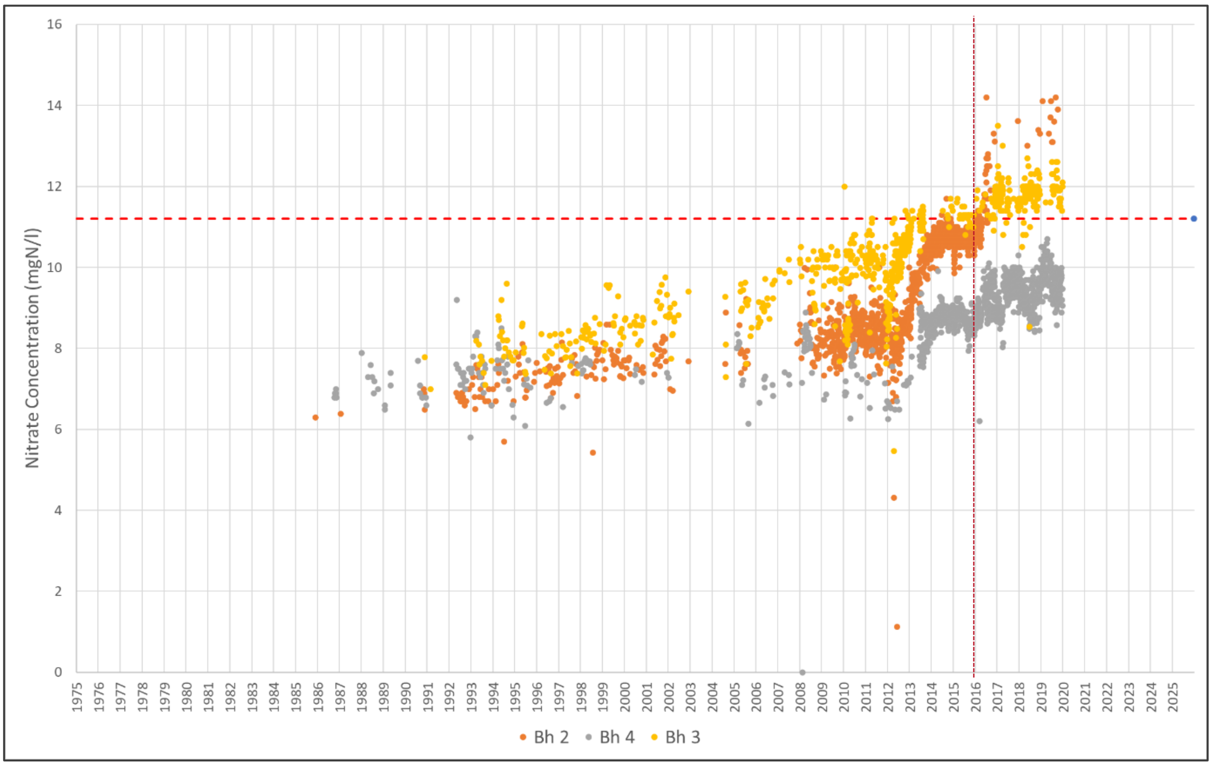
In that light, the modelling, which had proved effective over a range of Chalk groundwater sources, including ✂ previously, appeared to accurately reflect the 'shape' of the average trend and was accepted. It was concluded on balance that an asset solution was not required during AMP6 (2015-20), and that Catchment Management should be pursued to attempt to secure and, if possible, accelerate this position.

*Figure 4. ✂ Nitrate Modelling for AMP6*




Unfortunately, AMP 6 saw a continued elevation in measured nitrate concentration at ✂ (Figure 5). Not only did the nitrate trends remain high in Borehole 2 & 3 but, in 2016, they experienced a further dramatic rise. In addition, the nitrate trend in Borehole 4, which had previously been stable, began to rise.

*Figure 5. ✂ Raw Borehole Nitrate Trends (to end of AMP6). Note the significant rise in 2016*




It was clear that Catchment Management by itself, and in the form that it was being delivered in AMP6, was not impacting the nitrate trend as quickly and/or deeply as had been expected. In hydrogeological terms the mechanisms for the nitrate changes were uncertain and as a result it was still not clear how the model could be modified to match and then predict this behaviour. At this stage the model was considered good for some sites, adequate for most and poor but with limited options for improvement at a few. Rather than overhauling the model completely at this stage (PR19) it was simply updated with the latest nitrate data. However, given the level of model uncertainty and the ongoing nitrate trend, at PR19 the decision was taken to construct an asset solution. A blending scheme was designed for implementation in AMP7 on the basis of the available data. This scheme uses lower nitrate groundwater from ✂ source to blend down the nitrate level at ✂. Catchment management was continued in order to keep the momentum going with catchment farmers.

During AMP7 (2020-25) the nitrate trends at ✂ remained high in Boreholes 2 & 3 (Figure 2). Even though the trend in Borehole 4 appeared to have stabilised, peak nitrate levels continued to threaten compliance, and the source remained dependent on Borehole 4, creating a significant resilience risk. In addition, the nitrate window appears to be lengthening with high nitrate persisting until well into spring. The mechanisms for this are also not well understood, but climate change impacts are almost certainly a factor with more intense winter rainfall persisting through to the spring and beyond. This in turn is affecting the farming calendar resulting in increased nitrate leaching periods.

A complete review of the nitrate modelling was undertaken in preparation for PR24. In general, the previous modelling had worked well for many catchments but for some including ✂, it was poor. The review process (Nmod-20) is summarised in a briefing paper prepared by consultant RukHydro. Common to the long term trend predictions of both ✂ was that they did not go high enough and they suggested that the trend should have peaked in the 2000-2010 period.

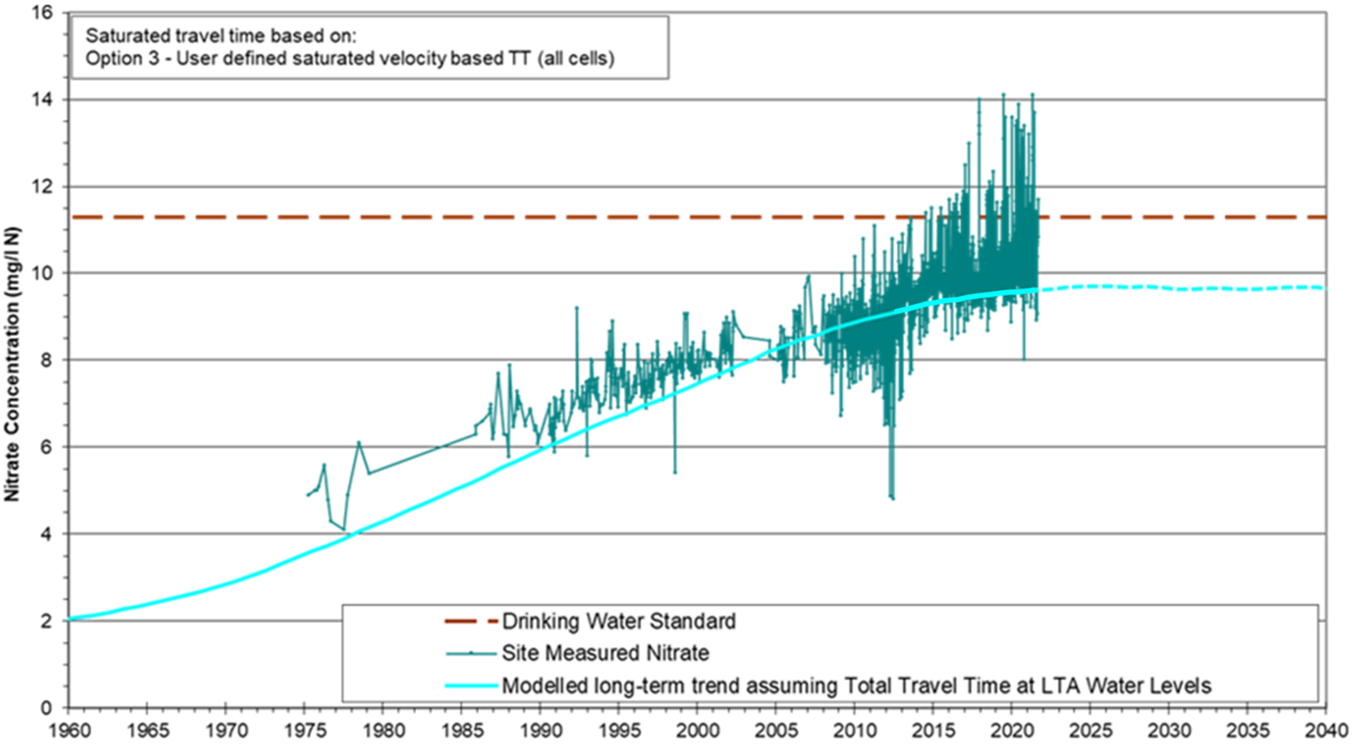
The review attempted to understand why the model had not been so effective for ✂ and how it was modified to attempt to improve it.

The modelling approach estimated the nitrate concentration leaving the soil from 1900 onwards and then delays that water and nitrate's travel by considering the time to reach the water table. Catchments with different land uses and different depths to water table across their areas produce different mixes of water ages and nitrate trends. In some of our supplies the average delay can be 30-50 years. In groundwater recharge, there are two main sections in the transport pathway from the ground surface to the borehole abstraction point; the mainly vertical movement of water through the unsaturated zone (i.e. the rock formations above the water table) under gravity through the pore spaces and fractures, followed by more horizontal flow of water in the saturated aquifer (below the water table) towards the borehole. Given that the travel time down through the unsaturated zone was long (typically several decades), the much shorter travel time in the saturated aquifer towards the borehole, was deemed to be insignificant. This view was, and remains, consistent with the Environment Agency source protection zone methodology which typically suggests travel times in the aquifer of no more than a few years.

To mitigate these problems a revised historical soil leaching trend was developed using an ADAS dataset called NEAP-N. That gridded dataset is used by other water companies, the Environment Agency and Defra and others as a best estimate of how much nitrate left the soil spatially and is available for seven years between 1970 and 2014. The gaps between these years were filled by basic extrapolation and leaching for the years before and since was estimated. A saturated aquifer travel time was added to better reflect actual rates of movement of water and nitrate through the aquifer. The inclusion of longer saturated travel times probably better reflects the large size of the ✂ catchment and allows improved synchronisation of modelled peak nitrate with the observed.

In summary the AMP7 review used updated nutrient input data and revised saturated aquifer travel times (Figure 6). Whilst the mechanisms of the differential nitrate trends in the three source boreholes are still not fully understood, it has become clear that the trends in Boreholes 2 & 3 remain high. This means that the average nitrate trend has not yet peaked and is likely to remain high for some years. In addition, the high seasonal peak is likely to remain through the spring and encroach on the higher demand periods. Even with these refinements, data collected more recently show a divergence from the predicted trend (Figure 2, Figure 6). This suggests that the mechanics of interaction between catchment and aquifer used in production of the model is still not fully understood, most likely for reasons explored above, further reinforcing the belief that there is a significant risk of breaching the health-based standard in the future if no treatment solution is provided, even with the recently completed blending scheme. As a result, the decision has been taken that the only viable option to fully mitigate the nitrate risk and allow us to maximise output from this large baseload source, is the provision of the proposed nitrate treatment in AMP8.

*Figure 6. Revised [redacted] Nitrate modelling for AMP8*




## 2.2. Cost efficiency

***The company state that capital and operating costs are well understood having previously completed an installation of nitrate treatment plant near Blandford. The company does not present sufficient and convincing evidence to demonstrate cost efficiency with the latest nitrate removal techniques /developments and any benchmarking, or third-party assurance of costs***

The non construction costs (excluding optimism bias/risk) have been estimated using historical delivery actual costs and applied as a %. Wessex Water did not get external assuredness for non construction costs as these can vary significantly between water companies dependent on the contract delivery model, the delivery method, size and make up of the programme and ownership of design. It is very improbable that any analysis across the water industry will be able to compare like for like because of these differences as the majority of programmes are delivered by shifting the risk and accountability for programme delivery and design to the contracting entity and supply chain whereas Wessex Water keep the majority of this risk in house. Due to this higher level of uncertainty around the non construction costs it was deemed reasonable to use historical actual costs and hence why we only have external assuredness for the construction element.

For clarity, our non construction costs included the following main work types:-

- Outline design activities
- Detailed design activities
- Construction support activities
- Senior Leadership Team management
- Programme management
- Project management
- Commercial management

- Commissioning activities
- Automation activities
- 3rd party surveys, investigations and ground investigation
- Power upgrades
- Land purchase
- Biodiversity Net Gain
- Optimism Bias/Risk

For optimism bias/risk, the methodology used incorporates the recommendations and templates produced from the water industry wide Cost Consistency Methodology report February 2022, produced by Mott MacDonald as part of the SRO strategy. The recommendations predominantly follow the Governments Green Book which recommends that optimism bias is accounted for in investment appraisal:

> *“Optimism bias is the demonstrated systematic tendency for appraisers to be over optimistic about key project parameters, including capital costs, operating costs, project duration and benefits delivery. Over optimistic estimates can lock in undeliverable targets. To reduce this tendency appraisals should make explicit adjustment for optimism bias. The Green book recommends applying overall percentage adjustments at the outset of an appraisal. The initial optimism bias estimate should not be locked in but can be reduced as an appraisal develops and the cost of specific risks are identified.”*

As we do not have our own evidence for historical levels of optimism bias, we have used the generic levels provided in the green book. For PR24 we have used the templates recommended in the Cost Consistency Methodology and, dependent on the complexity of any given project, we have, in conjunction with the independent cost consultant ChandlerKBS, produced an average and complex set of scores based around the Green Book and Cost Consistency Methodology descriptions. We have then looked at each individual project and identified the mix of standard and non-standard assets then applied this mix to the scores to generate the optimism bias % which is then added to the central estimate.

Due to the historical complexities of working on live water treatment sites and the associated operational and commissioning risks, optimism bias/risk has been calculated at 16.5% of the project total. To apply suitable context to this, most independent cost consultants, reference the “Suitability of estimates and their expected ranges” table compiled by the Association of Cost Engineers (AACE, Table 3). Cost consultants vary between a Price Review estimate being a Class 3 or a Class 4 anticipated accuracy range which equates to -**20%** and **+30%** for a Class 3 and an anticipated accuracy range for a Class 4 of between **-30%** and **+50%.**

Annex 2 of this representation is an external assurance report on the construction works provided by cost consultant ChandlerKBS.

Combining this external assuredness of the construction works, with the certainty provided by using historical actual costs for non construction costs; and the methodology used for calculating optimism bias/risk these, when compared with the AACE expectations, compares very favourably and confirms that our estimating approach is within expected assuredness boundaries.

*Table 3. AACE cost estimation expectations*

| Class | Level of Definition | End Usage | Accuracy Range Low | Accuracy Range High |
|---|---|---|---|---|
| Class 5 | 0% to 2% | Concept screening | -20% to -50% | +30% to +100% |
| Class 4 | 1% to 15% | Study or feasibility | -15% to -30% | +20% to +50% |
| Class 3 | 10% to 40^% | Budget authorisation | -10% to -20% | +10% to +30% |
| Class 2 | 30% to 70% | Bid or tender | -5% to -15% | +5% to +20% |
| Class 1 | 50% to 100% | Check estimate or bid/tender | -3% to -10% | +3% to +15% |

## 2.3. Conclusion

We note that Ofwat accepts the need for this scheme, and we hope the evidence provided demonstrates that the cost requested is appropriate for the scope and nature of works required and is in the best interest of customers.

Wessex Water has carried out an in-depth study of alternative treatment solutions and believe what is proposed provides the only viable option to treat the water to ensure water quality is not compromised. A very detailed assessment has been carried out into ground water modelling highlighting the difficulties in predicting nitrate trends with any degree of certainty especially factoring in the prevalence of extreme weather conditions now occurring due to Climate change. Actual measured data indicates a continued upward trend, with significant peaks above the health-based standard, which means treatment is the only viable solution to maintain the source for public water supply for the foreseeable future. This has been reviewed externally, both for the technology selection and in development of the model. We continue to explore to find a more sustainable and efficient method for waste disposal and we are still hopeful we can improve on this and will look to offset any additional costs associated with this by improving operational efficiencies.

The base costs for the nitrate plant have been benchmarked by external auditors covering both the technology selection and construction of the works. The non construction costs have been estimated using industry standard agreed percentages. We believe our estimate fairly reflects the true cost of the scheme.

We hope Ofwat will consider the additional information presented here and revise the cost allocated to this scheme to reflect those proposed in our original business plan, as the proposal represents the best outcome for our customers.

# 3. Drinking Water Protected Area – WINEP Schemes

## 3.1. Introduction

Wessex Water is proposing two new approaches to raw water quality issues at many of its most important drinking water sources (groundwater and surface water). The first is a new approach to tackling high nitrate levels in our drinking water catchments where previous efforts have failed to stabilise the rising nitrate trends in critical groundwater sources. This approach required significantly greater levels of engagement, regulatory involvement, and critically, funding to implement 'wider and deeper' land use change and management within the catchments to avoid the very real possibility of having to build a number of new nitrate treatment plants in AMP9. A review of Wessex Water's nitrate modelling work (NMod20) concluded that the 10 sources included in the enhanced catchment management portfolio will continue to threaten drinking water quality compliance under present levels of catchment intervention. This provides further justification for a new approach.

The second is a novel customer campaign on Domestic Oil Storage in the catchments of three of our surface water reservoirs. Hydrocarbon contamination is a real risk for both our customers in terms of damage to property and environment, and to our drinking water sources in terms of compliance and short to medium term viability of the source. Targeted customer engagement including provision of free inspections, replacement tanks and oil level monitoring equipment will increase resilience in this area. The inclusion of the customer campaign for domestic oil storage in this submission is a recognition that hydrocarbon contamination is a serious and potentially long-lasting pollution risk. The costs submitted are very small in comparison to the clean-up costs for the householder who experiences a leak, and for Wessex Water in the short to long term loss of a public drinking water source.

In responding to OFWATs draft determination. it is important to note that in the Enhancement Expenditure cost modelling appendix, Ofwat have stated the following: *Although not suitable for setting allowances for draft determination, we see value in the benchmarking for this enhancement area and will **revisit the benchmarks for final determinations** based on any new evidence and data submitted.* We trust that OFWAT will reconsider its allowance in the light of the evidence presented below in response to OFWATs stated concerns.

In response to this assessment, we have considered OFWATs comments in the summary of the model, "*For the six companies with high materiality costs (or appearing inefficient against the indicative benchmark) we have assessed the evidence provided by the company on need (including overlap with base allowances and previously funded activity), options appraisal and robustness and efficiency of costs. We use the outcomes of the deep dive to determine the overall allowance for a company."* We offer the following high-level feedback on this approach as it relates to Wessex Water's submission.

- Ofwat have assessed costs based on the median cost per action of the 15 companies submitting catchment management proposals (against no WINEP actions) in Drinking Water Protection Areas.

- Wessex Water's costs relate to enhanced catchment management over and above the approach taken to date in previous AMPs. This means interventions are by their nature more costly and involved than those proposed by other companies. This is not a like-for-like comparison.

- However, it should be noted that Wessex Water's cost per action is nominally above the median of the 15 companies' costs, unlike the other four companies subjected to a deep dive who exceed the median by 100%. We contest that this demonstrates very efficient costing for more enhanced measures by WW.

- Three of WW's actions relate to a domestic oil campaign rather than Enhanced Catchment Management [although this will bring our average costs down as against 13 actions rather than 10].

In the draft determination a 50% efficiency challenge was applied, 20% each for best option for 'need for enhancement investment' and 'cost efficiency', and 10% for 'best option for customers.

In the draft determination a 50% efficiency challenge was applied, 20% each for best option for 'need for enhancement investment' and 'cost efficiency', and 10% for 'best option for customers.

*Table 4. Deep dive cost assessment of catchment schemes from PR24-DD-W-Drinking-Water-Protected-Areas*

| Criteria grouping | Assessment comments | Criteria decision | % adjustment |
|---|---|---|---|
| Need for enhancement investment | Partial pass: The investment meets the criteria for enhancement investment and additional customer funding. The company's proposed investment is consistent with its water industry national environment programme (WINEP).<br><br>The company has not provided sufficient and convincing evidence to show there is no overlap with base spend or previous enhancement funding. This is particularly important as the company describes the schemes in its enhancement case as 'enhanced catchment management' and a continuation of work. We note the company was provided some funding at the last price review, and the company has not provided sufficient and convincing evidence to show the proposed investment does not overlap with the work already funded. | Partial Pass | 20% |
| Best option for customers | Minor concerns: We have minor concerns whether the investment is the best option for customers. The company considers a range of alternative options such as blending and treatment but does not provide sufficient and convincing evidence to demonstrate that the chosen options are the most cost beneficial in comparison to benchmarks.<br><br>The company states that a high-level list of options have been considered which were developed with the Environment Agency. For this category of WINEP action the options available to companies are limited. However, a more detailed evaluation of blending or treatment options would have been useful as a comparison.<br><br>The company has previously discussed and agreed options with the Environment Agency and has selected the options that typically would be expected to be the most cost beneficial. However, the company has not provided the detailed Options Development Report (or previous investigation output) alongside the enhancement case supporting narrative which would provide more background to the optioneering process and demonstrate that the chosen options are the most cost beneficial in comparison to benchmarks. | Minor concerns | 10% |
| Cost efficiency | Some concerns: We have some concerns whether the investment is efficient. The company does not provide sufficient and convincing evidence that the proposed costs are efficient.<br><br>The company briefly describes its cost approaching in its enhancement case. The company states that a bottom-up costing method with consultant benchmarking being utilised. The company does not provide an activity cost breakdown or evidence of benchmarking.<br><br>Detailed build-up of option costs and evidence of benchmarking would provide more confidence in the costing approach. | Some concerns | 20% |

We believe our requested allowance should be funded in full. In the following sections we set out in detail the efficiency challenge presented in the Draft Determination and present new supporting evidence to address the shortfalls identified by Ofwat in our October 2023 submission.

## 3.2. Need for enhancement investment

Our understanding from OFWATs comments on this allowance is that OFWAT require more evidence on the relationship between the funded catchment work that has been carried out prior AMP8 (2025-30) and what is proposed in AMP8, and a demonstration that there is no overlap with existing funding obligations.

This evidence will be provided below. In addition, we would like to provide some feedback on OFWATs approach in the assessment of this element of the investment.

**Wessex Water high level comments on OFWAT challenge on Need for Investment**

Looking across the deep dive assessments for five companies in this category, we note that all have received similar criticism but only Wessex Water has attracted a 20% adjustment. United Utilities and Severn Trent Water received similar criticism but received no cost adjustment, while South East Water and Thames Water received a 10% cost adjustment.

We also note that OFWAT's comments to South East Water included the following extract:

*"The company's proposed investment is consistent with its water industry national environment programme (WINEP).*

*The company provides evidence that all planned works are derived from investigations in the 2020-2025 period with monitoring and catchment management activities being new work over and above business as usual. However, as day to day management of raw water quality requires an element of catchment management there is likely some overlap with base activities which are not accounted for in the business case."*

This criticism is very similar to that applied to Wessex Water, and yet it only attracted a 10% cost reduction to SEW.

In the light of this, Wessex Water would respectfully suggest that there has been an inconsistency in OFWATs approach here which has led to a higher cost adjustment than any other company in this section.

**Wessex Water specific response to OFWAT partial pass comments**

Clarification on base expenditure for ongoing catchment management, current AMP7 obligations and funding and differentiating Enhanced Catchment Management in AMP8 to demonstrate no duplication.

Table 5 below sets out the groundwater nitrate schemes covered by this assessment and gives the AMP8 business plan numbers with the AMP7 budgets for comparison. The nitrate trends in the NON-WINEP AMP8 schemes (continuation from AMP7) have stabilised and many of them are in decline. AMP8 funding will help to secure these improvements.

*Table 5. AMP7/8 cost comparison for groundwater nitrate schemes*

| WINEP Scheme (WINEP Identifier) | AMP8 BP | AMP7 Base opex | Comments |
|---|---|---|---|
| ✂SGZ Enhanced CM (08WW100052a) | 1.564 | 0.197 | Nitrate trends continue to rise at end of AMP7<br>AMP7 funding insufficient to reverse trends<br>Complete redesign of CM approach required |
| ✂SGZ Enhanced CM (08WW100074a) | 0.563 | 0.148 | |
| ✂SGZ Enhanced CM (08WW100075a) | 1.979 | 0.119 | |
| ✂SGZ Enhanced CM (08WW100076a) | 0.620 | 0.169 | |
| ✂SGZ Enhanced CM (08WW100077a) | 0.871 | 0.119 | |
| ✂SGZ Enhanced CM (08WW100078a) | 0.600 | 0.197 | |
| ✂SGZ Enhanced CM (08WW100079a) | 1.005 | 0.197 | |
| ✂SGZ Enhanced CM (08WW100080a) | 1.228 | 0.507 | |
| ✂ SGZ Enhanced CM (08WW100081a) | 0.590 | 0.145 | |
| ✂SGZ Enhanced CM (08WW100082a) | 1.228 | 0.507 | |
| Domestic Oil Customer Campaign –✂Reservoirs (08WW100057a) | 0.113 | 0.000 | Innovative schemes for AMP8 |

| | | | |
|---|---|---|---|
| Domestic Oil Customer Campaign – ✂Reservoir (08WW100057b) | 0.113 | 0.000 | |
| Domestic Oil Customer Campaign –✂(08WW100057c) | 0.113 | 0.000 | |
| **TOTAL WINEP** | **10.586** | **2.305** | |
| | | | |
| **NON-WINEP Schemes** | | | |
| Continuation Groundwater SGZ nitrate CM (✂ | 0.010 | 0.087 | AMP7 funding levels have resulted in significant improvement in nitrate trend Budgets reduced to reflecting ongoing importance but lower risk |
| Continuation Groundwater SGZ nitrate CM ✂ | 0.330 | 0.199 | |
| Continuation Groundwater SGZ nitrate CM ✂ | 0.005 | 0.051 | |
| Continuation Groundwater SGZ nitrate CM ✂ | 0.065 | 0.081 | |
| Continuation Groundwater SGZ nitrate CM ✂ | 0.115 | 0.081 | |
| Continuation Groundwater SGZ nitrate CM ✂ | 0.025 | 0.118 | |
| Continuation Groundwater SGZ nitrate CM ✂ | 0.015 | 0.050 | |
| Continuation Groundwater SGZ nitrate CM ✂ | 0.020 | 0.144 | |
| Continuation Groundwater SGZ nitrate CM ✂ | 0.100 | 0.120 | |
| ✂SGZ | 0.00 | 0.110 | Discontinued – source removed from supply. |
| **Total NON-WINEP** | **0.685** | **1.041** | |

The ‘enhanced’ catchment schemes (included in the WINEP) continue to show high and rising trends. This demonstrates that the approach taken in AMP7, and the associated budgets, were insufficient to secure nitrate trend reversal.

Enhanced catchment management is a complete rethink in approach (summarised below and in Annex 3) which will require significantly increased budgets to avoid additional treatment at at least some of these sites in AMP9.

Enhanced Catchment Management (ECM) is based on previous experience of catchment management, so we are not progressing from a standing start. It has involved significant discussion with EA to agree their regulatory approach in these particular catchments. It builds on a trial carried out in the ✂ catchment where the farmers/landowners recognise it as significantly different to any previous approaches, and it has led to much greater, and more detailed engagement. The approach is significantly different from any previous, ‘traditional’ catchment management, in the following ways.

- Increased involvement of the Environment Agency (EA) in proactive regulation in the form of prioritised farm inspections and engagement. This will require more liaison (meetings, reports etc) than ever before.

- It relies on Safeguard Zone farmers calculating N loss (leaching) on a whole farm annual average basis (using the Nitrate Leaching Tool developed by the EA or similar), in order to understand current leaching levels, reductions required and most effective reduction methods. Wessex Water will need to assist farmers with this either directly or through consultants.

- Increased WW budgets will allow more funding to be available for farmers to supplement existing funding streams for nitrogen mitigation measures and infrastructure. Significant cost uplifts are expected due to world commodity prices affecting agriculture and competition for nutrient and biodiversity offsets driving up compensation costs.

- Greater discretion for WW advisers in terms of funding opportunities, and more innovative options for farmers to consider.

- Greater emphasis on elimination of significant point source (farm infrastructure) sources of nitrate. This will involve greater cost than in-field measures but are significant in terms of effective nutrient management

- Rigorous prioritisation to the catchment areas contributing the greatest proportion of nitrate to the abstraction points (broadly SPZ1 & 2).

- Effective communication of the approach to all stakeholders will be important to ensure that the relationships between EA, WW and the farming community are clear and consistent, and that farmers/landowners feel appropriately engaged with this project.

- Regular WW reporting (annual) of activity and where possible N savings achieved.

Domestic Oil Customer Campaign has not been carried out before at Wessex Water and so this is a completely new scheme. Hydrocarbon contamination of our service reservoirs is a significant and long-term risk to water quality. A significant oil spill that reaches the reservoir would cause the treatment works to be shut down, at best as a precautionary measure, at worst because the oil has contaminated the works. Many of the catchments of our treatment works are rural and the domestic use of oil is common. For the householder whose domestic oil systems leak, there is a three-fold risk, the loss of expensive oil, contamination of their house and garden and environmental contamination. We are aware of many examples of domestic oil leaks where the customer has had to make significant (6 figure) claims on their house insurance to cover the damage claim to property and environment, have had to vacate their house while the clean-up and reinstatement proceeds and have faced potential legal action due to damage to neighbouring properties and for environmental clean. We have experience of householders suffering significant metal health breakdown as a result of an oil contamination event. We are proposing a customer campaign that will involve the identification of domestic oil users in our surface reservoir catchments, the offer of free inspection by a registering OFTEC engineer, and grants for oil tank replacement and oil-level monitoring equipment, on a first-come, first-served basis. The costs have been developed from analysis of commercial costings for the tanks and monitoring equipment. The benefits of this customer engagement in our sensitive catchments will result in significant potential cost savings for the customer and Wessex Water set against remediation of an oil spill. Not only does it represent good value for money for the customer, but it also demonstrates excellent customer service. The EA are very supportive of this approach and hence the inclusion of this domestic oil customer campaign in the WINEP for AMP8.

An assessment has been made in Table 6 below, of the implications to these schemes where the DD allowance was confirmed. The costs in the table are presented as a guide to how Wessex Water would manage a 50% cut in budget across these critical schemes. In essence it would make funding more similar to AMP7 levels, which in the case of the nitrate catchment management schemes, were demonstrably insufficient to bring about the required nitrate trend reversals.

*Table 6. Summary of DD cost allocation implications*

| | AMP7 | AMP8 BP | AMP8 DD | Implications of change |
|---|---|---|---|---|
| **BASE COSTS (Non WINEP in AMP8)** | | | | |
| Base costs for Groundwater (GW) and Surface Water (SW) | £3.346m | £2.16m | £1m | Catchment management approach will reduce to catchment risk surveillance and annual meetings with key land managers in each catchment. Little scope for bespoke whole farm management plans for nutrient loss reduction to be developed and reviewed, or for water company funding of actions required. |
| No of catchments | 19 GW + 4 SW | 9 GW + 4 SW | | |
| **ENHANCED CATCHMENT MANAGEMENT (WINEP in AMP8)** | | | | |
| Enhanced Catchment Management (ECM) costs | | £10.586m | £5.293m | |
| Inform (i.e. evidencing baseline nutrient and pesticide losses, critical source areas and | Est £0.670 | £1.900m | £0.950m | Less monitoring of N concentrations in soil, groundwater and surface water to inform an evidence-based approach at both a strategic and individual farm level. Key research projects to develop evidence base for both |

| | | | | |
|---|---|---|---|---|
| quantifying mitigation effectiveness) | | | | water company and EA delivery strategies will not be affordable. |
| Advise (providing tailored and farm specific advice on reducing nutrient losses from farmland) | Est £1.0m | £2.910m | £1,455m | Less advice, but still prioritising this over grants. Use of specialist farm advisors for specific farm issues may be restricted and so opportunities to develop targeted solutions may be missed. |
| Incentivise (providing financial support to farmers with implementing land management changes which reduce nutrient loss to water). | Est £1.676 | £5.776m | £2.888m | £200k/yr across 10 catchments is very little so in effect financing of changes in land management will be almost entirely reliant on government funding (e.g. SFI, CS, SIG) and private sector nature finance (e.g. BNG and NN). Wessex Water funding will therefore be directed towards providing the support and advice for land managers to access these alternative funding sources. |
| Oil Campaign | £0m | £0.330m | £0.165m | Communications to communities only, little targeted advice or grants for individual oil tank owners. |
| ECM Total | £3.346m | 10.586m | ~£5,293m | |
| No of ECM Catchments | 1GW | 10 GW | | |
| Total No of Catchments | 19 GW + 4 SW | | | |

## 3.3. Best option for customers

Our understanding from OFWATs comments on this allowance is that OFWAT require more evidence on why blending or further treatment options have been discounted.

**Wessex Water high level comments on OFWAT challenge on Best Option for Customers**

This is a common criticism levelled at all five companies where a deep dive has been undertaken. Only Wessex Water (WSX) and Thames Water (TMS) have attracted a 10% reduction, whereas the other 3 companies have no reduction. We would again respectfully suggest that this illustrates an inconsistent approach in application of this allowance.

Ofwat have stated that WSX did not provide an Options Development Report to support these lines, however, this was not required as part of the Environment Agency's (EA) WINEP guidance[1]. This specifies that if an AMP8 implementation scheme is driven by an AMP7 investigation then the AMP7 investigation output will be treated as the ODR. The conclusion from the AMP7 catchment work and the review of nitrate modelling will be that catchment management in that form is not sufficient to reverse rising nitrate trends and so a new approach is required.

As per the WINEP Guidance Options Appraisal Reports are available on the Defra WINEP sharepoint site and detailed modelling reports have been provided to the DWI advocating this approach (references in previous section).

AMP7 investigations are reported and reviewed annually by EA and NE, including discussion on options. Regulatory direction has strongly supported this Enhanced Catchment Management approach during AMP8.

[1] Environment Agency Water Industry National Environment Programme (WINEP) Options development guidance, Version 3, July 2022

Detailed Action Specification Forms (ASFs) have been prepared for all the schemes in this allowance. At present these are under review by EA/NE specialists under an agreed ASF review process.

**Wessex Water specific response to OFWAT minor concerns**

**Evidence of options appraisal and CBA**

Wessex Water prefers not to install treatment but wherever possible to pursue catchment approaches that engage catchment stakeholder and develop wider catchment benefits. Examples of costs for treatment and blending are given below to illustrate the cost differential between asset and catchment solutions.

- ✂ Nitrate Treatment (Proposed AMP8): Capex - £21m; Opex - £1.2m / year (50% of which is tankering brine waste to ✂)
- ✂ Blending: Capex - £2m; Opex £65k (est)
- ✂ Nitrate Treatment: Capex - £8m (2016) estimated £11-12m at today's prices; Opex - £424k / year (actual 23/24)
- ✂ Blending: Capex - £5.5m; Opex £75k/year
- ✂ Nitrate treatment: Opex £315k / year (actual 23/24)
- ✂ nitrate treatment: Opex - £160k / year (actual 23/24)

Other points to note:

Blending options tie up alternative sources, reducing water resource availability. Set alongside deployable output losses due to a number of environmental drivers (Habitats Regulations, Environmental Destination and LURA), the loss of licensed DO will drive the need to develop much more costly (surface water) Strategic Resource Options.

Nitrate modelling is indicating that at ✂ treatment is required in the short term to maintain compliance. Several other sites are of concern and will be closely monitored during AMP8 with a view to install treatment in AMP9 unless enhanced catchment management can succeed in reversing the trend. However, the modelling (and visual assessment of nitrate trends) is suggesting that the nitrate trends generally have peaked or will do in the next few years and will start to decline. Additional nitrate treatment is not necessary at most sites.

The domestic oil customer storage campaign is deemed very good value for money for the customer and Wessex Water, given for example that a single environmental clean-up operation in Dorset resulting from a fractured oil delivery pipe from a customer's tank to their boiler, cost their insurers over £100k in environmental investigation and remediation (including rebuilding part of their house), resulting in significant mental health issues in terms of stress to the householder, and nearly resulted in the loss of one of Wessex Water's groundwater sources. Replacement costs for this groundwater source were estimated at between £8-10m.

An Options Development Report (ODR) was not required for WINEP submission for these schemes as they have resulted from previous catchment investigations. However, Options Appraisal Reports were produced for each of the 13 WINEP lines. These OARs were checked and approved by Environment Agency and Natural England as our environmental regulators. Wessex Water has been in discussion with area EA staff to develop the enhanced catchment approach.

Whilst it is sometimes difficult to measure short term improvements in groundwater nitrate trends derived from catchment management activity, it is very clear from the field monitoring that is carried out in association with the measure implemented that nitrate losses through leaching from the soil have been significantly reduced. This will lead to reductions in nitrate concentration in groundwater over time. The result of this will either be the removal of the need for treatment altogether, or where treatment is required to manage high nitrates in drinking water in the short-medium term, a reduction in the level and duration of that treatment requirement.

## 3.4. Cost Efficiency

Our understanding from Ofwat's comments on this allowance is that Ofwat require WSX to provide costs and benchmarking required to support efficiency argument and a detailed build-up of options costs and evidence of benchmarking. Some of this information has been supplied in the sections above but further supporting information is included below.

**Wessex Water high level comments on OFWAT challenge on cost efficiency**

OfWat has determined the cost per action for WSX as £0.814m against a median of £0.63m. The range was £0.225 - £1.791m. Of the five companies enduring a deep dive, WSX is the closest to the median cost per action. The other four companies present a cost at least double the median.

**Wessex Water specific response to OFWAT some concerns**

**Cost benchmarking**

The costs and efficacy of all the measures, activities and attitudes that Wessex Water promotes and supports, are subject to continuous and rigorous external and peer review. External reviewers include EA, NE (Catchment Sensitive Farming), Creedy Associates (agricultural consultancy) and from a technical perspective via Lancaster University and ADAS. In addition, we track the full range of government agricultural incentive schemes. We ensure that everything we do is cost beneficial, otherwise the measures will not be taken up.

During AMP7, Wessex Water's involvement with leading and innovative schemes such as reverse and 'fund-spreader' auctions, and the Defra ELMS natural capital auction trial within Poole Harbour catchment, provided market tested benchmarking of our farmer payments. In addition, the Defra ELMS trial provide valuable learning around how we might interact with government funding schemes in order to avoid issues such as 'double funding' and to ensure that water company funding is effectively targeted. Wherever possible we link payments for nitrate reduction with biodiversity improvement payments to maximise environmental gain and get best value for our money for customers (NB biodiversity payments are dealt with under separate BP and WINEP lines).

In terms of the 'variable' costs of catchment management i.e. what we pay for in terms of measures (which will vary annually, by catchment and by farm, depending on farm type, crop rotation, global commodity prices and farmer willingness to engage), and monitoring (which again will vary from year to year), we know we are very competitive. We are very clear and transparent with our costings to facilitate open engagement with farmers.

Our costs have to be in line with Defra's Sustainable Farming Incentives (SFI) payments and other previous and current agri-environment schemes.

Work carried out for CAC for catchment and nature-based solutions with our Consultants Reckon, provided an estimate that in NPT terms, catchment management solutions costs, are on average across our catchments, only 12% of the costs of treatment upgrades that deliver equivalent benefits.

We are very clear that once Catchment Management is selected as the preferred management approach for nitrate that our approach is cost effective and cost beneficial. In addition, the wider benefits in terms of environmental improvements and potential, many of which are unquantifiable means that it represents best value for customers.

An example of similar costs, measures and specification, albeit for phosphorus offsetting rather than nitrate leaching reduction, is available on our website via our Somerset phosphorus reduction scheme. This provides a template for the enhanced measures which would be employed during PR24 to deliver a greater level of nitrate reduction than previously funded interventions.

## 3.5. Required adjustment to cost allowance

We request that Ofwat adjusts our cost allowance for the Drinking Water Protected Area schemes to the level that we proposed in our business plan.

# 4. PFAS Mitigation

## 4.1. Requirement for additional expenditure

Per and polyfluoroalkyl substances (PFAS) are a group of synthetic ‘forever’ chemicals used to produce coatings and products that resist heat, oil, stains, grease, and water. Due to their chemical composition (strong fluorine-carbon bonds), some PFAS are known to be persistent in the environment, bioaccumulate and be toxic at low levels of exposure. Due to their persistence in the environment, PFAS are an emerging risk to drinking water supplies globally.

The PFAS strategy submitted in our business plan in October involved improving our knowledge of PFAS risk within our supply network through enhancing our monitoring programme and further developing our catchment risk assessment process. It didn’t involve planning or implementation of any PFAS treatment as all our supply sites currently fall into tiers 1 and 2 and as such do not require treatment under current DWI guidance. Research and evidence on the efficacy of PFAS treatment is also relatively immature, especially within the UK, and as such we didn’t want to rush into treatment schemes that risk being costly and not delivering desired outcomes.

The DWI issued a letter of support for this strategy (see Annex 4), accompanied by an undertaking that was standard for all water companies. The undertaking included additional activities that weren’t reflected in our PFAS strategy in particular:

- Undertake catchment characterisation and identification of PFAS sources.
- For all sources that fall into tier 2, design a proactive and systematic risk reduction strategy which shall include a prioritised mitigation methodology to progressively reduce PFAS concentrations in drinking water.
- For all sources that fall into tier 1, design a basic mitigation plan, which can be implemented should concentrations increase, or toxicological or other information change that requires mitigation be delivered.
- Participate in relevant research and development activities.

To ensure we comply with the undertaking we have further developed our PFAS strategy to include these additional activities. Our updated strategy (see Annex 4) was submitted to the DWI alongside five Appendix B documents requesting approval for additional specific activities:

- Catchment management
- Optioneering and design of treatment at ✂ WTC with view to implementing in AMP9.
- Optioneering and design of treatment at ✂ WTC with view to implementing in AMP9.
- Optioneering, design and implementation of treatment at ✂ WTC (this site will also provide facility to trial different GAC media and potentially alternative treatment types).
- Mitigation planning and research

The DWI provided letters supporting the need for these schemes (see Annex 4). The catchment management and schemes at ✂ will be subject to regulation 28(4) notices which are being agreed with the DWI.

The three sites referenced above are in tier 2 and recognised as having the highest PFAS risk of all our 64 water treatment centres (WTCs). This risk has been determined using a model assessing all our WTCs on the following parameters - catchment risk, individual PFAS concentrations, total PFAS concentrations, number of repeated tier 2 results and presence of high risk PFAS (e.g., PFOA, PFOS).

As a company we are committed to improving our understanding of PFAS risk in our supply network and associated mitigations. We have developed our knowledge in this area since our original business plan submission through meetings with other water companies, treatment suppliers and involvement in industry groups. Although the DWI undertaking has been the catalyst for us changing our strategy, we believe it is the right thing to do to accelerate our activity in this area, ensuring we develop robust plans to continue to provide our customers with wholesome drinking water over the long term.

## 4.2. Required adjustment to cost allowance

We request that Ofwat adjusts our cost allowance for PFAS mitigation to reflect revised costs as per Table 7 below.

*Table 7. Summary of proposed additional PFAS costs compared to original business plan.*

| Details | Data table lines | October 2023 submission | New requested allowance | Difference in allowance |
|---|---|---|---|---|
| Additional sampling requirements | CW2.14 (October submission)<br>CW3.99 (post DD submission) | £3.55m | £3.55m | £0m |
| Additional catchment investigations and modelling | CW3.31 (October submission)<br>CW3.102 (post DD submission) | £1.06m | £2.13m | £1.07m |
| Optioneering and design of treatment at 3 sites and implementation of treatment at one site | CW3.99 | £0m | £12.4m | £12.4m |
| Mitigation planning and research | CW3.99 | £0m | £0.74m | £0.74m |
| **Total** | | **£4.6m** | **£18.8m** | **£14.2m** |

## 4.3. Rationale

### 4.3.1. Best option for customers

PFAS risk and mitigation measures are an emerging area of research across the water industry with limited literature and evidence currently available. Our PFAS strategy is based around developing our understanding of PFAS risk across our supply network as well as the efficacy of different mitigation options to a sufficiently mature level to allow us to make informed and robust investment decisions to reduce risks and deliver best value for customers. Our PFAS strategy document is included in Annex 4, with the below section highlighting why key elements of our strategy related to requested expenditure represent the best option for our customers.

To ensure we fully understand the PFAS risk at our supply sites, we have proposed a significant uplift in activity related to PFAS sampling for AMP8. Over the last 3 years we have developed our understanding of PFAS risk across our supply sites through sampling. We are now in a position to better target our sampling efforts based on site risk and extend monitoring to include catchment sampling upstream of sources as per DWI requirements. More targeted and greater volumes of sample data will robustly inform and underpin investment decisions ensuring these decisions are risk based and in the best interest of customers.

To prioritise investment for PFAS and ensure the greatest benefit for customers, we have prioritised our PFAS work using a risk based analysis. This analysis considers catchment risk, individual PFAS concentrations, total PFAS concentrations, presence of PFAS known to have a health risk e.g., PFOS, and repeated detections. This analysis has highlighted three sites that require planning and investment to mitigate potential PFAS risk – ✂. We will continue to use this risk-based approach to appraise the requirement for further investigatory or mitigation work at all of our sites on a regular basis as more information becomes available.

A number of options were considered for delivery in AMP8, from implementing full-scale treatment at all three sites to taking no additional mitigation action. The proposed option of implementing GAC treatment at ✂ and designing treatment for ✂ was considered the best value option for customers in terms of mitigating PFAS risk and undertaking low regret investment.

An internal options appraisal evaluated the most feasible treatment processes for PFAS. These included Ion Exchange (IEX), Sonolysis, Surface Activated Foam Fractionation (SAFF) and Granular Activated Carbon (GAC). The option evaluation concluded that currently GAC is the preferred option, based on the treatment readiness, the ability to treat full site flows and the established nature of GAC for PFAS treatment (published data and UK water company experience). Other options of blending and site and source abandonment were considered but these are not feasible options for the long-term to ensure water resource resilience and in terms of blending to suitably reduce PFAS concentrations.

As part of the internal options appraisal of treatment solutions, GAC removal of PFAS for the three sites were investigated using US EPA published removal rates (Table 88Table 8). This provides us with theoretical confidence that GAC is a suitable treatment option and provides effective PFAS removal with likely treated concentrations below the Tier 1 guidance value of 10ng/l. However, these are theoretical removal rates, and we plan to conduct column testing and large scale trials at ✂ WTC once the GACs have been refurbished and recommissioned to provide verification of removal rates and the ability to further investigate methods of optimising removal efficiency.

*Table 8. PFAS GAC removal rates for compounds present at WW sites*

| PFAS | GAC Removal (%) | Expected post-GAC concentration (ng/l) | | |
|---|---|---|---|---|
| | | | | |
| PFOS | 98 | 0.08 | 1.02 | 0.01 |
| PFOA | 99 | 0.06 | 0.02 | 0.00 |
| PFHxS | 99 | 0.01 | 0.33 | Not present |
| PFHxA | 99 | 0.24 | 0.08 | 0.28 |
| PFHpS | 99 | Not present | 0.01 | Not present |
| PFHpA | 99 | 0.05 | 0.03 | 0.07 |
| PFecHS | 98 | Not present | 0.14 | Not present |
| PFBS | 99 | 0.05 | 0.03 | Not present |
| PFBA | 99 | 0.09 | 0.02 | 0.11 |
| FHxSA | 59 | Not present | 0.03 | Not present |
| FBSA | 56 | 0.73 | 0.51 | Not present |
| PFPeA | 90 | 1.77 | 1.02 | 1.50 |
| PFPeS | 99 | Not present | 0.04 | Not present |
| PFODA | 90* | Not present | Not present | 0.01 |
| 6:2 FTSA | 88 | 0.92 | Not present | Not present |
| 8:2 FTSA | 88 | 0.01 | Not present | Not present |
| PFDA | 99 | 0.00 | Not present | Not present |
| PFNA | 99 | 0.00 | Not present | Not present |
| 5:3 FTCA | 56* | 0.01 | Not present | Not present |
| 6:2 FTAB | 90* | 3.84 | Not present | Not present |

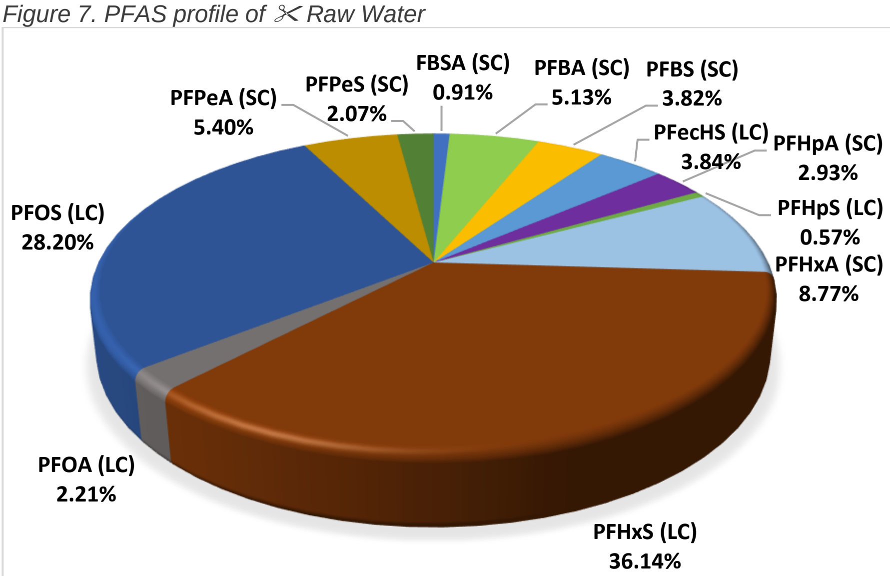
*Conservative removal estimate based on n-octanol-water partition coefficient ($K_{ow}$) and similar PFAS. All other removal rates published on US EPA treatability database.

## ✂ WTC

✂ WTC is supplied by 2 on-site boreholes both of which have had consistent PFAS detections in Tier 2, therefore there is no opportunity for blending source water to reduce PFAS concentrations in treated water. ✂ WTC cannot be removed from supply long term as the site provides up to 13 Ml/d to the Malmesbury supply area and beyond which cannot be substituted with supply from other sources. Therefore, PFAS treatment has been identified as the best option for customers to mitigate the risk identified at this site.

Our current knowledge around the efficacy of GAC treatment for PFAS removal, suggests this will be effective at ✂ given the relatively high proportion of longer chain PFAS detected, see Figure 7. Whilst we will ensure robust treatment optioneering is carried out prior to the design being finalised, we hope design work can be progressed sufficiently within the first half of AMP8 such that implementation may be brought forward from AMP9 if required and transition funding is available to do so.

*Figure 7. PFAS profile of ✂ Raw Water*

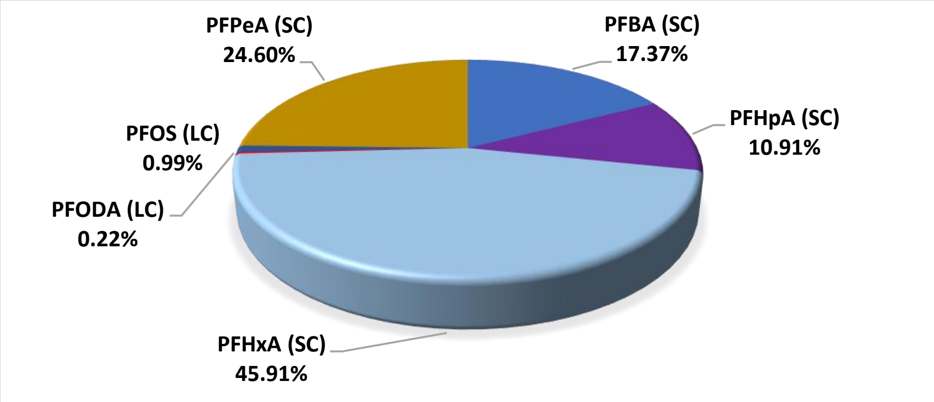



✂ <u>WTC</u>

✂ WTC is supplied by both boreholes and spring sets with the PFAS risk present in the spring water. Although some unverified blending occurs between the higher PFAS spring water and the tier 1 borehole water, blending will not be sufficient to reliably reduce PFAS concentration in treated water to tier 1 levels long term due to the seasonal variation in yield from both BHs and springs and the site being a key baseload site supplying our water supply grid, requiring reliable output to support any deficits at other sites.

Although work to date assumes GAC for PFAS treatment based on our current knowledge of removal rates as per Table 8, analysis of PFAS compounds present in the raw water (see Figure 8) at ✂ indicate a relatively high proportion of PFAS with short carbon chain lengths which some available treatment efficacy research shows may not be efficiently removed using conventional GAC treatment. For this reason, we have chosen not to commit to any treatment implementation in AMP8 at this site, allowing time for further research and treatment efficacy trials to ensure we make a low regret decision that is effective over the long term.

*Figure 8. PFAS profile of ✂ raw water*

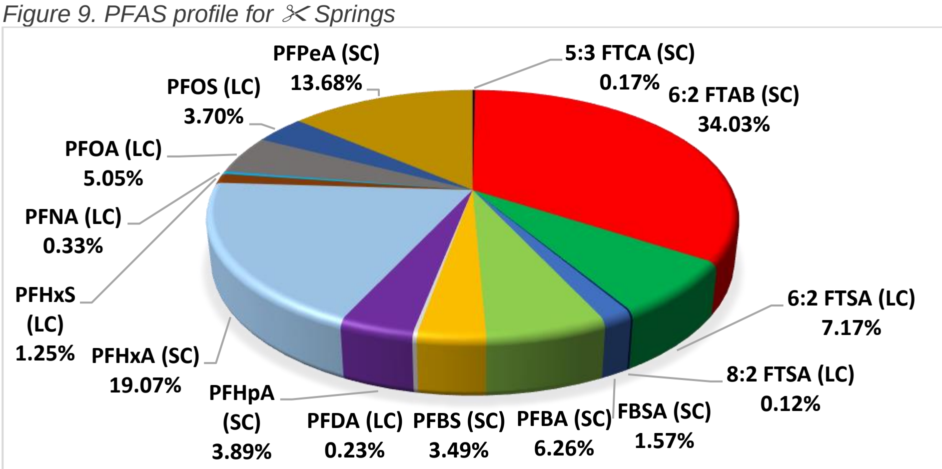



✂

✂ WTC is supplied by 3 local spring sets and 2 remote spring sets. One of the local spring sets, ✂Spring has had PFAS detections in tier 3, as a result of which it has been removed from supply since Jan 2023. Treated water PFAS detections have not exceeded Tier 1 since the removal of this source from supply, however supply from this spring set is important for long term resilience at the site as it is the second highest yielding spring. We have been fortunate that the recent wet weather has resulted in yields from the other springs remaining sufficient to meet the minimum flow requirements for the site, but this would not be the case in a dry year. We have also reviewed blending as a mitigation option at this site but due to the variability in spring yields and some occasional Tier 2 PFAS detections in other springs supplying the site this is not a viable option to reliably maintain treated water PFAS concentrations within Tier 1 over the long term.

The profile of PFAS compounds detected in ✂ spring includes a significant proportion of short chain PFAS, some of which cross over with those found at ✂. However, the highest concentration PFAS detected, 6:2 FTAB, although classed as short chain, based on its n-octanol-water partition coefficient ($K_{ow}$) and similarity to 6:2 FTSA, should effectively be removed by GAC (90% removal, see TableTable 8). As previously stated, the efficacy of GAC treatment for short chain PFAS is less robust than for longer chain compounds so we plan to undertake column testing of different carbons before using ✂ WTC for larger scale trials once the GACs have been refurbished and recommissioned. This work will inform our PFAS treatment strategy for the higher risk sites within our supply network going forward, but also help enrich industry wide understanding in this emerging field.

*Figure 9. PFAS profile for ✂ Springs*




### 4.3.2. Robustness and efficiency of costs

Currently, Wessex Water do not have the capability to analyse for PFAS in-house and subcontract PFAS analysis. There are limited laboratories who offer commercial analysis of the 48 required PFAS compounds. The current cost from our analytical provider is £270 per sample. We are exploring options to bring PFAS analysis in-house although due to the nature of analytical methods required and the number of compounds measured in each sample, we don't foresee any significant reduction in unit cost in the near-term.

We have reviewed our sampling programme for AMP8 to prioritise PFAS data from higher risk sites, whilst expanding our monitoring to include investigatory sampling in catchments and at different process stages through treatment works as well as sampling sources and final treated water as per DWI guidance. We will also require more intensive sampling at ✂ WTC to test the efficacy of GAC PFAS removal trials and during in commissioning of the final treatment solution.

Sampling costs developed reflect a significant uplift compared to AMP7 to ensure we are able to meet DWI requirements around catchment modelling and mitigation as set out in the undertaking and are able to make data driven investment decisions that are in the best interest of our customers.

PFAS treatment – Optioneering, design and implementation costs

The non construction costs, such as optioneering and design have been estimated using historical delivery actual costs and applied as a %. Wessex Water did not get external assuredness for non-construction costs as these can vary significantly between water companies dependent on the contract delivery model, the delivery method, size and makeup of the programme and ownership of design. It is very improbable that any analysis across the water industry will be able to compare like for like because of these differences as the majority of programmes are delivered by shifting the risk and accountability for programme delivery and design to the contracting entity and supply chain whereas Wessex Water keep the majority of this risk in house. Due to this higher level of uncertainty around the non-construction costs it was deemed reasonable to use historical actual costs and hence why we only have external assuredness for the construction element.

Estimated costs were adjusted to include optimism bias - RAPID best practice templates were adopted and a weighting matrix applied as agreed with ChandlerKBS in order to mitigate the Green Book upper boundaries. A second tier of analysis was then applied which was dependent on the scope of works for each project and the asset types required for the particular scheme. This then gave a % of non-standard and standard assets which was applied to the Green Book categories in order to obtain the final adjustment.

✂WTC

The existing site at ✂ is located in a flood plain and has insufficient space to accommodate a new PFAS treatment facility. Our current high level solution assessment proposes to build a new facility 200m to the south of the existing site to accommodate PFAS treatment. ✂ WTC is currently a relatively simple site with only marginal chlorination treatment for disinfection, therefore introducing a major treatment process such as granular activated carbon adsorbers (GAC) will require a significant redesign of the whole site. All current borehole pumps will need replacing to accommodate the change in pressure requirements and a new balance tank and re-lifts pumps would be required to distribute final treated water post GAC. We also intend to purchase the land required for this scheme in AMP8 to ensure we are as prepared as possible to proceed with implementation thereafter. A summary of costs associated with the optioneering, design and land purchase to prepare for implementation of PFAS treatment at this site are detailed in the table below.

*Table 9. ✂ WTC PFAS treatment design and land purchase costs*

| Activity | Cost estimate (£000) |
|---|---|
| Treatment optioneering | £184 |
| Outline design | £1,413 |

| | |
|---|---|
| Detailed design | £2,826 |
| Land purchase | £371 |
| **Total** | £4,793 |

✂ WTC

Our current high level solution assessment for PFAS mitigation at ✂ WTC comprises the building of a new spring collection chamber, a new building housing relift pumps, compressors and backwash pumps, and a new GAC plant comprising of four GAC vessels, clean and dirty backwash water tanks. The existing treatment plant on site includes iron removal filters, UV treatment and chlorination as well as a contact and balancing tank. Due to this and the different treatment streams for borehole and spring water, integration of new processes for PFAS treatment will require careful design and planning.

*Table 10. ✂ WTC PFAS treatment design costs*

| Activity | Cost estimate (£000) |
|---|---|
| Treatment optioneering | £186 |
| Outline design | £882 |
| Detailed design | £1,765 |
| **Total** | £2,833 |

✂

✂ WTC has an existing treatment plant on site that was designed for the temporary treatment of water from the river Avon during a drought. This treatment plant has been fully decommissioned since 2021 but still remains on site and includes four GAC vessels and associated backwash system. Our current high level solution assessment for PFAS mitigation at the site involves refurbishment of this existing GAC plant, as such design and implementation costs are minimised whilst also resulting in significant carbon savings compared to installing a new GAC plant.

*Table 11. ✂ WTC PFAS treatment design and implementation costs*

| Activity | Cost estimate (£000) |
|---|---|
| Treatment optioneering | £187 |
| Outline design | £296 |
| Detailed design | £593 |
| Construction phase design | £296 |
| Environmental mitigation | £142 |
| Treatment implementation (mechanical and electrical works) | £2,472 |

| | |
|---|---|
| Treatment implementation (civils works) | £520 |
| Additional OPEX | £102 |
| **Total** | £4,608 |

Catchment investigation and modelling costs

The cost model for additional activities related to catchment investigations, modelling and source identification has been developed using the current PFAS tiers to assign each site a proposed list of activities to develop our understanding of PFAS in the catchment based on risk. Costs are based on known costs of current activities carried out, e.g., observational borehole drilling, additional data and monitoring equipment required, as well as estimates of costs based on best available data and expert judgement, e.g., land access and modelling. Risk and optimism bias have been added to base costs to reflect the level of uncertainty, given the nature of catchment work involving a reliance on third parties.

The requirement for the additional catchment assessments stems from the DWI guidance (23 Nov 2023) with the accompanying draft undertaking, which effectively committed Wessex Water (as with all UK water companies) to catchment characterisation of all our drinking water sources, along with the identification of potential sources of PFAS within each catchment. Where potential sources of PFAS are identified within a catchment, additional monitoring work will be required to understand the actual risk including any potential contaminant pathways.

Most of Wessex Water's sources are groundwater sources in which the source–pathway–receptor model of contaminant movement is complex. At many of these groundwater sources we have very little groundwater information beyond that from our own boreholes. In addition, Wessex Water owns very little land within its catchments and so will rely on effective and, given the sensitivity of PFAS in terms of public perception, delicate stakeholder engagement to access land, obtain samples and communicate findings to the regulator.

Effective catchment characterisation will require the setting up of new groundwater monitoring networks to provide the necessary data to inform effective assessment. This will include the construction of appropriately designed observation boreholes and to ensure sufficient information on catchment hydrogeology (including groundwater movement direction) at least 3 boreholes will be required in each catchment. In addition, where a historic source of PFAS is suspected further observation boreholes will be required to confirm the impact of those sources on groundwater quality.

As Wessex Water owns very little land within its catchments, 3rd party land agreements will need to be negotiated for suitable locations. The sampling of these new observation boreholes for PFAS is a specialised activity, requiring bespoke sampling equipment, much of which can only be used once due to potential contamination. Specific training and PPE will also be required to ensure non contaminated samples can be retrieved. Wherever possible, surface water sampling will also be required in order to ascertain the distribution and movement of PFAS through the catchments. This will require innovative sampling techniques to obtain representative catchment samples. As a result, this work will require significant additional monitoring costs. These costs are well understood through market research and competitive tendering.

Additional staff and transport are likely to be required to facilitate this additional work. These resources will be procured through our own recruitment process (salaries are benchmarked to ensure they are competitive). Transport will be provided through our internal transport frameworks.

The additional data retrieved from the monitoring will be used to inform the conceptual modelling, and any numerical groundwater and contaminant transport modelling, in an iterative way to provide confidence in the modelling and ensure that any management decisions are thoroughly evidence based. It is likely that some of this modelling will involve contribution from specialist consultants. This work will be through service contracts procured through our internal procurement process as and when required.

Additional data will be procured to provide information on among other things licensed waste management facilities and other commercial business's that might be producing or using PFAS. This is to avoid the need to go door-to-door, which may not be a productive activity anyway. It is possible that the analysis of this data will also require consultant support in understanding the implications of this data. This is in addition to free issue data from the EA on historic land fill sites, land use etc. These costs are well constrained through our own internal procurement and supplier set up process and by direct correspondence with sole suppliers of data.

*Table 9. Additional PFAS catchment investigation and assessment cost estimate*

| Catchment assessment activity | Cost estimate (£000's) |
|---|---|
| Modelling (conceptual and numerical) | £127 |
| Data Procurement | £73 |
| Stakeholder engagement | £18 |
| Monitoring (inc. observational boreholes) | £807 |
| Reporting | £41 |
| **Total** | **£1,066** |

<u>Mitigation planning and research costs</u>

Costs associated with designing a basic mitigation plan for tier 1 sites (58) and a more in-depth mitigation plan for remaining tier 2 sites (3) have been developed by our Engineering team and based on previous work used to support the basic mitigation plans for ✂ to inform Appendix B documents supported by the DWI for these sites.

Costs associated with research and development have been developed by our Science, Strategy and Compliance teams who have experience in conducting site trials, laboratory scale experimental research and putting together Ofwat Water Breakthrough Challenge bids. These costs have been benchmarked against standard industry treatment trials such as GAC column testing and Ofwat Water Breakthrough Challenge PFAS bids e.g., PFAS – A whole system approach to an impossible problem (Ofwat project). Breakdown of costs with industry examples used to develop costings for the research budget is detailed in the Table 10 below.

*Table 10. Research and development costs*

<table>
<tr><th>Research and Development Activity</th><th>Cost Benchmark</th><th>Cost Rationale</th><th>Cost Estimate (£000s)</th></tr>
<tr><td>GAC column testing</td><td rowspan="2">External costings for similar development bench-scale testing work for strategic resource options (SRO) investigations.</td><td rowspan="2">Laboratory or bench scale trials of 2-3 treatment technologies – GAC, surface activated foam fractionation and ion exchange.<br><br>This would include hire and/or purchase or relevant equipment, a range of trials (source water, carbon type, resin) to better understand treatment</td><td rowspan="2">£265</td></tr>
<tr><td>Trialling of bench-scale alternative treatments</td></tr>
</table>

| | | | |
|---|---|---|---|
| | | performance and when resin/carbon would require replacement. | |
| Trialling of GAC on pilot water treatment works | Carbon provider costings | Trials of PFAS specific virgin GAC for $20m^3$ vessel with regular PFAS analysis. | £200 |
| Participation in Ofwat Water Breakthrough Challenge PFAS bids | Breakthrough 4 Catalyst project led by Severn Trent Water – PFAS - A whole system approach to an impossible problem. | Total project cost of £1,781,200 with 10% contribution form industry partners. Approximately £35k. | £35 |

# Annex 1 – Nitrate Removal Technology Review

This annex has been fully redacted for public release.

# Annex 2 –✂ Cost Benchmarking and Assurance Report

This annex has been fully redacted for public release.

# Annex 3 – Comparison of ‘routine’ catchment management and proposed ‘enhanced’ catchment management (ECM)

This annex has been fully redacted for public release.

# Annex 4 – PFAS Supplemental Evidence

This annex has been fully redacted for public release.

# A4-1. PR24 PFAS Strategy

This annex has been fully redacted for public release.

# A4-2. PFAS Section 19 (1)(b) undertaking

This annex has been fully redacted for public release.

# A4-3. PR24 Proposal Appendix B Documents: Proposals to carry out improvements for drinking water quality reasons

This annex has been fully redacted for public release.

# A4-4. PR24 Proposal Appendix B Documents: Letters of support from DWI

This annex has been fully redacted for public release.