PR24

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NORTHUMBRIAN WATER RESPONSE TO CMA PROVISIONAL FINDINGS

STRUCTURE OF THIS RESPONSE

1 SUMMARY

1. Northumbrian Water Limited (**NWL**) are pleased to be able to respond to the Competition and Market Authority's (**CMA**) Provisional Determination (**PD**) in the water redeterminations from Ofwat's 2025-2030 Price Review (**PR24**). We welcome the additional time that has been allowed for this response and recognise the significant effort undertaken by the CMA, in a challenging sector context, to manage multiple redeterminations within the statutory timescales.

1.1 OVERVIEW

2. We welcome several elements of the CMA's PD, which represents a somewhat improved settlement for NWL, our customers and the environment. In particular, we support various adjustments that the CMA has made to the funding position versus Ofwat's Final Determination (**FD24**), including:

- the additional funding for greater power resilience at some of our highest risk locations which will help to reduce harmful pollution events and ensure we are marginally more resilient to the increasing number of extreme weather events we face as a result of climate change;
- the removal of various retrospective adjustments that Ofwat applied in error in its FD24 for metering and growth at sewage treatment works, the correction of various further errors that the CMA has signalled it will undertake in its Final Determination (**FD**) and the inclusion of network reinforcement costs that will allow funding that better reflects the efficient costs needed to deliver such a stretching settlement;
- the additional allowances for our phosphorus removal (**P-removal**) programme to reflect the scope changes required by the Environment Agency (**EA**) post-FD24 which, alongside a somewhat improved cost assessment framework, will better enable us to complete that programme effectively, maximising the benefits it will provide to the environment; and
- the additional risk protections provided by the addition of Howdon growth schemes and the Suffolk Strategic Network (**SSN**) to Ofwat's large-scheme gated process, both of which Ofwat also supported.

3. We also support the improvements made to the overall risk return balance, including:

- the increased equity return, where the CMA has proposed a figure which is consistent with the range we presented in our Statement of Case (**SoC**);
- the adjustments that the CMA has made to the frontier efficiency assumptions which were too aggressive in FD24 and not consistent with wider evidence on productivity trends in the UK economy; and
- we accept the minor amendments the CMA has made to the incentive package across two performance indicators which marginally reduce the asymmetry for the notional company.

4. However, the above changes are somewhat overshadowed by:

- the use of an experimental cost modelling approach that has not been considered in a regulatory price control setting in any sector before and which unfortunately has been applied too rapidly, without sufficient consultation or consideration of its merits versus alternatives – this has led to substantial errors in the CMA's calculations, unstable modelling results that are not statistically robust and the inclusion of odd coefficients that are not consistent with sound engineering and economic rationale;
- the CMA's decision not to meaningfully engage with the evidence on the historic underfunding of capital maintenance and its undue reliance on Ofwat's uncertain and narrow Roadmap process, rather than funding our targeted investment case as part of this redetermination – this sidesteps the opportunity to take positive action to address one of the greatest areas of concern facing the sector and does not discharge the CMA's procedural or substantive duties with respect to this issue; and
- the material change in the long term CPIH assumption used for deflating nominal cost of capital estimates and the unlikely suggestion that long term CPIH is 40 basis points above CPI, which relies on productivity assumptions that are inconsistent with the PD's position on frontier shift and is challenged by broader market evidence - this reduces the allowed cost of debt and almost entirely offsets the CMA's methodological improvements to the cost of equity, such that the PD only marginally improves the allowed return estimate compared to Ofwat's FD.

5. The net effect of these changes, once the identified mistakes in the CMA's cost modelling are corrected, is a regulatory package which puts us in a very challenging position at the beginning of a period where we are carrying out an unprecedented amount of new investment for the benefit of our customers and the environment. After a very difficult five years for the sector, this redetermination should leave companies in a position where we can be confident that we can deliver our business plan outcomes in full, begin to restore public trust and offer a return to investors that is at least competitive relative to the returns that can currently be earned on similar investments elsewhere. Unfortunately, this is not the outlook that we are currently seeing following receipt of the PD - even as a better performing company in the sector.

6. We would highlight, in particular, that it is impossible to reconcile the CMA's conclusion that the risk return position in FD24 is 'broadly balanced' with our experience on the ground and with the commentaries that have been issued by other independent observers, including rating

agencies,[1] investor surveys,[2] the National Audit Office (**NAO**)[3] and the Independent Water Commission (**IWC**).[4] We expected the CMA would reflect on the negative sentiment that continues to afflict the industry and the observed outturn position for the most recent period[5] which suggests to us a very high risk that the PR24 settlement is, once again, miscalibrated and address more of the problems that we face at source. Instead, the PD asks us to take on an algorithm-driven cut in our base totex allowance which, if extrapolated across the sector, would amount to a more than £2bn reduction in allowances (and potentially much more if certain errors are corrected) following a period when companies have had to actually overspend base by around £4.6bn. Whilst the CMA reasonably makes a distinction between its redetermination and the work of the IWC, its position on cost assessment is in full and direct conflict with the conclusions of the IWC which does not appear credible. In multiple places it also offers only a light-touch review of the specific funding issues that we asked the CMA to look at.

7. There is, fortunately, time within the statutory review period for the CMA to remedy the miscalibrations and gaps in its PD. We recognise that this will move the decision beyond a point where changes can take effect in 2026/27 bills, but we consider that it is more important and consistent with the overriding objective to get this redetermination right, than complete it early.

8. We have consistently recognised the real concerns about the affordability pressures on customers. Our business plan contained a comprehensive package of support to ensure that no

[1] Moodys 11.2024 Predictability, SOC362: "Given the above considerations, we have changed our assessment of the stability and predictability of the regulatory environment for the UK water sector under our rating methodology to A from Aa (note – not reversed by the subsequent FD24): We believe that the predictability and supportiveness of the regime has reduced regardless of whether the final determination for the next regulatory period ultimately results in a more positive outcome for the sector than the draft determination. This assessment reflects a continuing trend of negative public perception resulting in more regulatory powers, an increased focus on enforcement action, demanding targets, greater penalties for operational underperformance and growing regulatory complexity that, in turn, result in higher cash flow volatility and leaner returns. All of these factors are leading to an environment that is less supportive of the water utilities' operations and, therefore, credit negative." S and P Water Rating Action 2025, SOC439: "We have revised our view of the preliminary regulatory advantage for water companies to strong/adequate from strong. We consider that the framework's supportiveness has weakened on regulatory and financial stability as well as regulatory independence and insulation".

[2] Barclays Investor Survey Nov 24 (**NWL-PD-REP-010**): 85% of respondents expect AMP8 underperformance (Fig 15). Ofwat's most recent investor surveys from 2023 concluded 'All scores fell from last year with the biggest falls from last year for questions one, two, three and five (our regulatory framework aligning interests, our regulatory approach being proportionate etc, perceptions of Ofwat's independence from government(s) and listening to investors). Questions one, five and seven (our regulatory framework aligning interests, listening to investors and engaging consistently and sufficiently with all types of investment stakeholder) saw their lowest score since the survey began'.

[3] NAO Regulating for investment and outcomes in the water sector, 2025 para 17: "The regulators do not have a shared understanding of the condition of water and wastewater assets, and the level of funding needed to maintain them.'

[4] This is reflected in the confirmation in the IWC Final Report that changes to the regulatory framework are needed to address concerns that "water companies may have faced successive periods in which allowances for asset maintenance and renewal were too low" (IWC Final Report, Summary para 103, p27). The IWC also concluded that "government and regulator pressure on bills played an important role in what can now been seen as underinvestment [between 2009 and 2024]" (Ibid p.204).

[5] Ofwat, 2025, Water Company Performance Report 2024-25 (**WCPR25**). This report highlights that the sector has overspent base cost allowances by £4.6bn and incurred £700m in service performance penalties suggesting that the settlement was miscalibrated. In more recent Monitoring Financial Resilience report (p.28) we can see that the average RoRE over the period was 1.71% compared to a base return expectation of 4.1% at PR19. We can see that only three companies (SVT/HDD, UU and WSX) were able to earn the base return and this was despite the period seeing 1.87% average financing outperformance driven by high inflation and tax reductions.

household spends more than 5% of their income on water bills by 2030. If the CMA implemented all the requests we make in this response this would increase bills by around 2% or £11. We have undertaken separate work on the affordability challenge which we shared with the CMA[6] and already committed to expand those plans if necessary to address any outstanding gap. Even with these changes our average bills would remain the lowest in the country.

9. The PD presents a curious profile for customer bills which is inconsistent with the preferred approach customers articulated to us when developing our business plan (**BP24**).[7] We suggest that for the FD the bill impacts should be profiled to reflect gradual increases over the remainder of AMP 8. This would be more consistent with the preferences of our customers and reflects the profile previously suggested by CC Water.

1.2 WE ASK THE CMA TO ADDRESS SIX KEY POINTS IN ITS FINAL DECISION

10. In the interests of maximising the time available in this process, we have focused this response to the PDs on six key targeted requests to the CMA panel ahead of its final determination.

FIGURE 1: SUMMARY OF KEY ISSUES WITH THE PD

Base cost models: Section 2

Challenge:

- The CMA's approach to base cost modelling results in the removal of £2 billion of allowances (and potentially more, depending on how the CMA wishes to correct the errors that we have previously flagged in the PD calculations).[8] This further stretch to Ofwat's already very demanding cost challenge is not credible.
- The process to date has allowed insufficient opportunity for review, interrogation, testing and consultation on the CMA's proposed approach to cost modelling. The CMA referenced an intent to explore a data-driven approach to variable selection in its prioritisation document but did not take any opportunity to engage with the Parties (e,g, through working papers or technical discussion) about the application of this methodology or the specific results its algorithm produces. By contrast, the Ofwat models that are being disregarded were developed over more than a decade following the CMA's PR14 decision for Bristol Water with an intensive period of multiple iterations and consultation during the two-year development of the PR24 methodology.
- Whilst the CMA's models may offer a stronger fit to the data than Ofwat's, they do not accord with operational realities, they are not sufficiently stable, and they do not exhibit good statistical precision. These problems invalidate the selected models as a sensible method for estimating efficient costs.

Ask:

- The CMA must utilise the remainder of the statutory window to undertake proper engagement and consultation on its approach to base costs in its FD, taking into account all feedback received on the PDs.
- This work must remedy the technical problems that afflict the PD modelling. But the CMA panel must also show more clearly that it has applied expert judgment in conjunction with the econometrics, particularly in relation to

[6] CMA Affordability Impact on Bills, Frontier Economics, 15 May 2025.
[7] Deliberative research into complex bill drivers for 2025-30, p. 70.
[8] See Section 2.2.6

the size of the industry-wide cost challenge.
- If the issues identified with the CMA's models cannot be properly resolved in that window, the CMA must revert to relying upon, or at the very least placing greater weight on, Ofwat's FD24 models for its FD.

Water mains replacement: Section 3.1

Challenge:

- The CMA's provisional decision that 0.3% of water mains replacement can reasonably be funded from base allowances during AMP 8 is unjustified and inconsistent with the evidence.
- The CMA has adopted the view that the industry can scale up mains replacement activity from recent levels, which show a clear long-term decline, to a long-term industry average rate (2011-2024) without any consideration of what that implies for funding available for other essential activities. Fundamentally, we do not consider that the volume of mains renewal completed in 2011 has any sensible bearing on an assessment of what base buys in AMP 8.
- In this context the period used for the analysis is inconsistent with that used in other places elsewhere in the PD.[9] For example, in its calculation of relevant changes to the outcomes package it looks at the last four years of performance (and recognises explicitly that there is a relationship between outcomes and costs).
- As we demonstrate in this response, this position will have a significant impact on our ability to deliver the required level of mains replacement activities without negatively impacting on other activities that must also be funded from the base allowance.

Ask:

- We ask the CMA to reconsider what base buys in light of the evidence presented in response to the PDs.

Asset Health Investment Case: Section 3.2

Challenge:

- The importance of this asset health activity in AMP8, and our concerns regarding the limited scrutiny of our case during the PR24 process, were key reasons for seeking this redetermination. The CMA's provisional decision to defer this for consideration in Ofwat's roadmap process and/or AMP 9 calls into question how the statutory duties applicable to Ofwat and the CMA are going to be adequately discharged in the context of the AMP 8 settlement. It does not seem to us that the CMA's approach is consistent with best regulatory practice and procedural expectations for a redetermination.
- The CMA appears to accept that our customers will face negative impacts from the delay to the investment but that this is acceptable because there is some uncertainty in the estimation of the timeline of deterioration. We disagree. We consider that the CMA's decision significantly underestimates the risk to customers, based on little or no evidence to give it confidence that this risk would not materialize.
- The reliance on the Ofwat Roadmap is misplaced – it is an insufficient response to a targeted and evidence-based request for funding as part of PR24 to defer that case to a different process which is partial in scope, uncertain in its application and will definitely cause delays to the investment leading to customer detriment.
- The CMA is missing an important opportunity to make a positive contribution to tackling the largest challenge facing water and wastewater supply in this country. Neither Ofwat nor the CMA has sufficient evidence to reasonably inform them, as to whether asset health risk will remain stable, fall or increase with the settlement proposed in the PD. As noted above, the CMA's PD actually makes the asset health challenges we are facing

[9] Economic Insight, Time inconsistency error in what base buys PDs, 7.11.25 (**EI Time Inconsistency Error**) (**NWL-PD-REP-003**).

worse than Ofwat's FD24. In this context, rejecting this engineering-led investment case for a specific group of assets is neither reasonable nor proportionate.

Ask:

- We would like the CMA to consider and fund this investment in the FD.
- In the alternative we ask that the CMA makes some changes to, and prescribes rules for, Ofwat's roadmap process so that our case can be given fair consideration by that process. To place the level of reliance that it has on the Roadmap process, it is essential that the CMA takes further steps in the FD to ensure that this process will be effective in the way the CMA anticipates it should be, so that we and they can have greater confidence in that process. In particular, the CMA should:
  - instruct Ofwat to consider our investment case as part of its roadmap process and issue such guidance as is necessary to ensure that it receives fair consideration;[10]
  - include in the FD some clear, targeted and legally enforceable rules or guidance with respect to the conduct of Ofwat's Roadmap process, to make it more effective to give stakeholders confidence that it will result in sensible schemes being funded during AMP8; and
  - as part of such rules, to require Ofwat to allow companies to make cases for a wider range of assets than those groups currently in its roadmap process and ensure that cases are not rejected because of the lack of industry-wide data and the difficulties associated with calculating 'what base buys' or the practical application of PCDs.

Power resilience PCD Section 4.1

Challenge:

- We welcome the CMA's provisional decision to increase the scope and the funding provided to cover the additional highest risk sites in AMP8.
- As the CMA notes in the PD, the highest risk sites are generally more expensive than the average unit cost rate because there is a higher mix of wastewater treatment works that include UV treatment. In order to deliver at the higher risk sites within the cost constraints imposed by the lower unit rate, we would need to reprioritise slightly. We are likely to retain our larger sites with UV treatment from the highest priority list but then will need to select some alternative smaller sites. We are already developing this new program.

Ask:

- We think the CMA intended the flexibility to use alternative solutions using batteries and renewables if these solutions become feasible. We ask the CMA to set the PCD for this program to specify that this should provide either fixed generation or an equivalent level of risk protection using alternative methods such as batteries or generators. We suggest that this level of risk protection should be set at two hours (consistent with the analysis on mobile generators and spill times that Ofwat and the CMA considered during this process). To enable this, we would support a PCD that requires us to reinvest any efficiency savings from cheaper solutions into delivering greater power resilience at more sites, as we intend to maximise the benefits to the environment and customers from this totex allowance. This approach provides flexibility for us to stretch the funding allowance as far as possible across the sites to reduce the risk.

[10] We note that Ofwat has recently started to provide early information on that roadmap process. We have already written to Ofwat seeking clarity on whether our investment case can be considered as part of the process.

- With respect to the efficiency of our costs, while the CMA raises some concerns it does not reference the evidence we previously provided in this area following Ofwat's DD, which looked at the efficiency of costs for different sized generators - so we highlight this again for the CMA's review and consideration. We do not know what further evidence we could provide here.

Allowed return and risk Section 5

Challenge:

- In setting the overall Weighted Average Cost of Capital (**WACC**) the CMA has used a long-term inflation assumption of 2.4%. We recognise the possibility that the 'H' in CPIH might drive inflation above 2% but struggle to see how that could reasonably equate to 40bps of difference. This position and the underlying evidence and assumptions that underpin the 2.4% estimate are also inconsistent with the CMA's position on productivity growth as set out in its view of frontier shift.

Ask:

- We provide some additional evidence in this area[11] and ask the CMA to consider that evidence and an adjustment to the 40bps. Something closer to 10bps appears more appropriate.

Network reinforcement Section 3.3

Challenge:

- We welcome the adjustment that the CMA has made for network reinforcement allowances, including following Ofwat's helpful recognition that it would have funded these costs in PR24 if provided.
- The CMA has only allowed additional costs for Boreham Booster, not the other AMP 8 network reinforcement schemes. The CMA has referenced the Boreham Booster evidence and indicated that the information provided for other schemes was too high level to support an additional allowance.

Ask:

- We think the CMA intended to suggest that the Boreham Booster scheme is the only scheme that is required *beyond* the allowance expected in previous AMPs (as estimated by 'what base buys'), rather than suggesting this is the only scheme that will be required in AMP8. We ask the CMA to correct this mistake, if this is the case.
- We provide a detailed breakdown of costs and further evidence of the underlying need for our other AMP 8 schemes. We ask the CMA to consider this evidence too, as this had not previously been requested.
- Given the uncertainty of these costs and the fact that they are outside of companies' control, we suggest a different approach to risk protection which we ask the CMA to consider.

11. We also present comments on a small number of additional areas where we think some further change might be required for the CMA's FD, including:

    - **P-removal:** we update with EA's latest view of sites and re-estimate the cost allowances using the CMA's new enhancement model (see Section 4.2); and
    - **Suffolk Strategic Scheme**: we request the retention of a development allowance to fund the work that must take place in AMP8 prior to the next review under the large scheme gated process (see Section 4.3).

[11] First Economics, CPIH Inflation, 23.10.2025 (Earwaker Report 2025) (NWL-PD-REP-009)

2 BASE COST - MODELS

12. We are surprised at the provisional conclusions the CMA has reached in its PD to address the cost-related claims put forwards by two of the Disputing Companies. Our concerns relate to both the approach the CMA has taken to give effect to its preference for a more 'data driven' approach and the reliance it has placed on the results. For instance:

- whilst a LASSO approach to model selection, through use of an algorithm, may be simpler and appropriate in certain contexts, it is not appropriate in the context of a regulatory determination. For example, LASSO might be suitable for an academic exercise to forecast stock prices, where what matters is whether on average the model predicts well, but it is not suited to a regulatory determination where the results for each and every company must be intuitively appropriate and where there are more limited datapoints;
- rather than achieving its aim of being "objective and targeted"[12] the CMA's approach is arbitrary and subjective in the choices it has made to reach a set of models and assess levels of base cost allowances; and
- by not building in the elements of the Ofwat approach that consider the appropriateness of each coefficient and the results from a suite of diagnostic and robustness tests, the CMA's approach does not have the necessary level of checks or balances to ensure that under the models companies will have sufficient funds to carry out their functions. Such an approach does not meet the standards necessary to ensure a robust regulatory framework that customers, companies and investors can have confidence in.

13. In deciding to take this approach to base costs for all Disputing Companies the CMA has not met the overriding objective to dispose of redetermination references "fairly, efficiently and at proportionate cost"; nor has it met its duty to "have regard to the principles of best regulatory practice (including the principles under which regulatory activities should be transparent, accountable, proportionate, consistent and targeted only at cases in which action is needed)" (**Best Regulatory Practice Duty**).[13] For example:

- the changes proposed by the PDs are **disproportionate to the claims** raised by the Disputing Companies: whilst some challenges were raised to aspects of the models, including the inclusion or exclusion of particular variables, by SEW and SRN, none of the Disputing Companies, nor Ofwat, requested the CMA to take a fundamentally different approach to base cost modelling in its determination – i.e. they all envisaged retention of the FD24 models.[14] As such the decision to select and adopt a fundamentally different approach

[12] PD, para. 4.47.
[13] CMA Rules, para. 4.1; s2(5) WIA 1991.
[14] PD para. 4.10 (SEW); para. 4.17 (SRN); para. 4.24 (NWL); and para. 4.31 (Ofwat). The only exception is WSX who sought a bottom-up view of its costs to replace the modelled costs entirely as a company-specific CAC: PD, para. 4.20.

has been driven entirely by the CMA itself;

- the approach is not **targeted** at addressing the points of dispute but instead has broader implications for the Disputing Companies, which raises concerns about **procedural fairness**: the CMA explicitly requested that companies provide targeted and focussed statements of case, which meant that not all companies put forward substantive arguments with respect to the models. The clear steer from the CMA that companies should not be introducing new claims, arguments and evidence at later stages of the process, as well as the limits placed on written submissions (see Section 2.1.7) and the lack of meaningful signals about the emerging thinking within the CMA constrained our ability to engage in this substantively. As such, the Disputing Companies that did not challenge the base cost models from the outset are at a clear procedural disadvantage to those that did on this matter;
- there are clear concerns about the **transparency and consistency** of the LASSO approach: rather than improving the robustness of the cost allowances, the CMA's approach results in a situation where the results of the models are used mechanistically regardless of their statistical performance, whether they make intuitive sense, or whether there are good arguments for different cost drivers to be selected. This means that once the algorithm is selected there is no further debate about the models regardless of the evidence. Decision making via the LASSO 'black box' is not transparent;
- there are concerns about the **quality of output** and the **accountability** afforded by the limited amount of engagement: the speed with the CMA has moved in this complex space has resulted in errors in its implementation which significantly change the impact of the choices that the CMA has made, further complicating the responses the Disputing Companies and Ofwat need to prepare;
- the approach is **inconsistent with regulatory precedent:** all the parties were clear that caution should be exercised with respect to moving away from modelling principles adopted by Ofwat as a means to assess comparative efficiency: Ofwat's models, whilst acknowledged not to be perfect, have been subject to extensive scrutiny and consultation and have been shaped over 10+ years, including by reference to the precedent the CMA set in its PR14 redetermination for Bristol Water. For the reasons we have set out in this response, decision making via the LASSO approach is not consistent with the regulatory precedent that informs the Ofwat models; and
- the approach is also **inconsistent** with the express direction of travel advocated by the findings of the IWC that "Ofwat has relied too heavily on a data driven, econometric approach"[15] – indeed the CMA exacerbates this by placing greater emphasis on a data driven approach with no consideration of the merits of the model once selected.

[15] Independent Water Commission Final Report (IWC Final Report) page 193, para 417

14. To make such a large change with limited consultation in such a short period of time is very unusual in the context of regulatory policy development. In setting out its rationale for the use of LASSO the CMA notes its expectation that the parties and third parties will want to "properly interrogate and comment on our methodology".[16] However, noting the scale of the challenges, we consider that the limited opportunity afforded for engagement on these changes in the form of written responses to the PDs is insufficient to satisfy the CMA's duties with respect to adequate consultation and procedural fairness.

15. Robust and thorough consultation is required before the CMA can safely conclude that such a substantial change in approach is the most objective, targeted, proportionate and reasonable way to address the issues raised by SEW and SRN. It is important, therefore, that the CMA takes time to reassess its position following the PD responses and properly considers its framework in consultation with the main parties and wider stakeholders.

16. To inform our response we asked for an independent assessment of the CMA's approach from Melvyn Weeks, an Associate Professor of Economics at the University of Cambridge.[17] His research interest spans both theoretical and applied microeconometrics including policy evaluation, model testing and evaluation; and computationally intensive methods including machine learning, simulation-based inference and the bootstrap. The LASSO technique falls within the machine learning area where he also teaches at post graduate level. We have referred to that assessment in this response and encourage the CMA to consider Professor Weeks' report.[18]

17. Our concerns with, and challenges to, the CMA's approach to base cost models are further developed in the following sections:

- Section 2.1 discusses our process related concerns about how the CMA has developed its experimental approach to cost assessment and why we do not think it forms an appropriate basis for determining modelled base costs at a redetermination;
- Section 2.2 discusses our concerns about the robustness of the modelling covering the statistical performance, the intuitiveness of the results, and the sensitivity of results showing how uncertain the estimates are; and
- Section 2.3 discusses real price effects which are integrated into the base cost modelling

[16] PD, para. 4.45.
[17] Melvyn Weeks has previously worked as Senior Economic Advisor to Ofgem. This work focused on the provision of advice relating to the benchmarking of costs for electricity companies. He has also provided advice to the regulator for the DPCR5, RIIOED1, RIIO-GD1 and RIIO-T1 price reviews. Melvyn prepared expert evidence for Ofgem in the wake of the CMA inquiry into a number of aspects relating to price setting during RIIO-ED1. He has advised Ofwat, Ofcom and other regulatory bodies on issues relating to incentive design, welfare effects of policies and econometric modelling.
[18] Professor Melvyn Weeks, CMA Provisional Determinations for Base Cost: A Response, 7.11.2025 (**Weeks Report**) (**NWL-PD-REP-001**).

but have also been used elsewhere such as for the sector wide cost adjustments.

18. Based on the evidence we have seen on the performance and robustness of the CMA's models we do not think they can be retained for its FD. Instead, the approach developed by Ofwat offers a more suitable and reliable basis for deciding the issues raised. If, however, the PD does retain the LASSO approach and models, then it is not appropriate to apply an upper quartile efficiency challenge. Instead, it would be more appropriate to rely on a more conservative benchmark, based on an industry-median.

2.1 PROCESS RELATED CONCERNS

19. Prior to the PD the CMA had given only limited indication of the significance of its potential approach to base cost models. In its prioritisation consultation the CMA included a single paragraph where it said it planned to "**explore**" a data driven approach such as LASSO which it considered "**may well be suited** to the assessment of the disputed points". The CMA added "Depending on the **robustness of the results** and the **extent to which they differ from Ofwat's**, we **may use the results** to **inform** our assessment of the claims submitted by the Disputing Companies and our decisions on whether to revise allowances."[19]

20. As we set out in the following sections, we do not think it is procedurally appropriate for the CMA to set modelled base cost allowances for all Disputing Companies using its LASSO approach:

- LASSO is an untried technique for CMA and other economic regulators in this context – as such any conclusion that it is a suitable method for the setting of base cost allowances for all Disputing Companies must be clearly supported by strong evidence of the robustness of the techniques, its application and the results (see Section 2.1.1);
- given the extensive history of stakeholder engagement in the development of the Ofwat models, and the acceptance by all Parties that they remain the most appropriate basis for setting base costs in this redetermination, the threshold for taking a decision to depart from the models and replace them must be high (see Section 2.1.2);
- the CMA's approach, however, relies on a range of subjective decisions which impact on the robustness of the results (see Section 2.1.3);
- the CMA's approach also leads to results that represent a large shift away from the allowances under FD24 at a sector aggregate level which casts doubt on their reliability (see Section 2.1.4);
- in contrast, Ofwat has a more developed approach to model selection that is more reflective of precedent and best regulatory practice (see Section 2.1.5);
- the CMA does have other options for consideration of the cases put forward by the Disputing Companies on base costs that do not rely on the LASSO approach (see Section 2.1.6); and

[19] CMA PR24 Approach and prioritisation 28 May 2025 (**CMA Approach Consultation**) para 43.

- the CMA has not engaged in an acceptable level of consultation to date, it has not adequately reflected on the feedback provided on the use of LASSO already received, and it is unlikely that there is time within this process to enable sufficient consultation to take place to have the requisite level of confidence in its approach (see Section 2.1.7).

21. These procedural concerns are exacerbated by the technical concerns we have identified in Section 2.2 with respect to the robustness of CMA's LASSO approach and its application.

22. As such, we do not think that the CMA has demonstrated that its LASSO approach is sufficiently robust or better suited than Ofwat's FD24 for the setting of base cost allowances. As such it is neither targeted nor proportionate for the CMA to replace the assessment of base cost allowances in the way envisaged in its PD.

2.1.1 LASSO is an untried technique for the CMA and other UK regulators

23. The use of the LASSO in this context by the CMA is experimental and represents "a significant methodological departure from established regulatory practice".[20] We can find no evidence of:

- the CMA having used the technique on any other inquiry or redetermination;[21]
- other UK economic regulators having used the LASSO technique for comparative efficiency assessment; or
- academic papers using the LASSO technique for selecting models for comparative efficiency assessment.

24. The CMA acknowledged early in the process "the complexity of this area and the substantial amount of work conducted in PR24 to develop these models"[22] which undoubtedly informed its articulation that it would just "explore" LASSO as a method to potentially "inform" its assessment of the specific cost adjustment claims presented by two of the Disputing Companies.[23] The CMA did not, at any stage prior to the PDs, give a clear indication to the Parties that it intended to completely replace the FD24 base cost models for all Disputing Companies.

25. The CMA also notes in the PDs that "care would be needed to ensure the methodology results in models that uphold the economic and engineering rationale" yet as the Weeks Report notes the PDs "provide limited evidence of how this principle was applied in practice".[24]

26. At the very least, to justify such a substantial departure from FD24, we would expect the CMA to have definitively demonstrated the robustness of its approach and the justification for using it in this setting. We do not think this has been achieved. Nor do we think the changes it introduces

[20] Weeks Report, Section 2.1, p. 3 NWL-PD-REP-001.
[21] This is based on a search of the CMA's website using a search engine.
[22] CMA Approach Consultation, para. 41.
[23] CMA Approach Consultation, para. 43.
[24] PD, para. 4.39; Weeks Report, p.3 NWL-PD-REP-001.

are targeted and proportionate.

2.1.2 Ofwat reached its PR24 position through many years of stakeholder engagement

27. The PR24 approach to base cost modelling was the product of many years' interaction between Ofwat, companies, the CMA (through the PR14 and PR19 appeals) and other stakeholders. This interaction over the last 10+ years developed a broad consensus in approach. This is undermined by the CMA's PD.

FIGURE 2: TIMELINE OF DEVELOPING MODELLING FRAMEWORK FOR PR24

PR14 Final Determination: PR14 was the first price control set by Ofwat incorporating the totex framework. For this it developed a new approach to cost modelling that combined both opex and capex for both base and enhancement areas whereas previously its benchmarking had focused on opex models. These new models incorporated a complex translog functional form.

PR14 CMA redetermination for Bristol Water: The CMA replaced Ofwat's translog PR14 models with simpler models that focused on base expenditure only. The reasons for this included:

> The models involve relatively complex explanatory variables and it is difficult to interpret the relationships that they imply between costs and explanatory variables in economic or engineering terms.
>
> Ofwat did not provide a convincing explanation of the economic or engineering rationale for the translog specification and its results. [25]

Instead the CMA introduced models with fewer explanatory variables and focussed on models with a clearer economic and engineering rationale.

PR19 Final Determination: Ofwat further developed the approach initiated by the CMA's PR14 redetermination which focused on developing statistically robust models with fewer variables which had strong engineering and economic rationale. There were strong similarities with the CMA's PR14 redetermination approach.

CMA PR19 redetermination: The CMA effectively endorsed Ofwat's PR19 approach as it only made one change to the models (adding a squared density term to one of the sewage collection models). In reaching this conclusion the CMA deployed the same approach to Ofwat on: estimation technique, functional form, which explanatory variables should be used (with 1 small exception), what level of aggregation to model at and how to use triangulation, the role of importance of statistical robustness of the models alongside the engineering and economic rationale of the models.

PR24 Final Determination: Ofwat evolved its approach further in terms of considering new variables (e.g. refinement of the density variables used at PR19), and new data on average pumping head. In terms of approach the framework used to select models there was consistency with its PR19 FD and the approach adopted by the CMA at PR19.

Source: NWL analysis

28. Given the extensive process that led to the modelling framework for PR24, which had the CMA's support just five years ago, we think there should be a high bar to fundamental changes. Significant changes, that have not been subject to extensive consultation and wider stakeholder involvement, could undermine regulatory stability and confidence which could be detrimental to how current and potential investors may view the sector.

29. We do not think this high-bar has been met with respect to the proposed introduction of the LASSO technique in the PD. We consider that the approach adopted in the PD is inferior to the

[25] Bristol Water CMA PR14 Redetermination (SOC381) pp.72-73.

consensus previously reached by Ofwat, the CMA and other stakeholders.

2.1.3 The CMA's approach relies on a range of subjective decisions

30. In setting out its rationale for adopting a LASSO approach the CMA expresses its view that it is simpler, more accurate and more objective than Ofwat's FD24 models, so is a targeted and proportionate way to address the issues raised by the Disputing Companies and set base cost allowances for its redetermination:

> by adopting LASSO we have sought to use a simpler approach to benchmarking, relying on fewer models that each incorporate additional cost drivers and explain a larger share of cost differences between companies (as opposed to many, narrower models).[26]
>
> Finally, the presence of strong correlations between variables represents a challenge for any econometric technique, and LASSO provides an objective way of selecting among a set of correlated variables. It is not clear to us how the PR24 FD approach, which essentially involves applying arbitrary weights on different models estimated with different cost drivers, is a more effective way of dealing with these issues.[27]
>
> We have used LASSO as a targeted and proportionate way of assessing the issues and requests raised by Disputing Companies in the context of this redetermination, rather than an in-depth review of all aspects of Ofwat's modelling approach.[28]
>
> The models that result from this approach are considerably simpler (and therefore more transparent) than the suite of models used by Ofwat in its PR24 FD. … Despite being simpler, these models provide a better statistical fit than the models used in the PR24 FD … In other words, the share of cost differences that is attributed to company inefficiency or unobserved factors is much lower. Consequently, the ranges of efficiency scores produced by this approach are significantly narrower … In other words, this approach results in fewer companies being considered as very efficient or very inefficient. This makes us more confident that a large share of these efficiency scores can be attributed to genuine differences in efficiencies rather than the effect of omitted variables or misspecification.[29]
>
> We have provisionally decided to use LASSO to assess the claims submitted by Disputing Companies with respect to modelled based costs. The models that result from this approach are both simpler and more accurate than Ofwat's and therefore provide a suitable basis for setting allowances in the context of this re-determination.[30]

31. We do not agree with this characterisation of the options. The CMA's approach is in itself arbitrary and subjective in the choices it has made to reach a set of models and levels of base cost allowances. For example:

- the CMA has chosen to use the LASSO technique whereas it could have used multiple other techniques involving traditional economic approaches or other machine learning techniques more similar to LASSO. The CMA does not explain whether it considered these various

[26] PD, para. 4.42
[27] PD, para. 4.39.
[28] PD, para. 4.45.
[29] PD, para. 4.57.
[30] PD, para. 4.73.

techniques or why it selected LASSO;[31]

- the goal of the modelling exercise has been to select the model(s) with the lowest root mean squared error (RMSE).[32] That means that this objective is prioritised exclusively at the expense of more traditional approaches that consider the statistical properties of the models or their intuitiveness from an engineering and economics perspective;
- when estimating its models using LASSO the CMA has decided which approach it wanted to use to select the penalty parameter (lambda) which ultimately decides how many variables to include within the model. It has chosen a cross-validation technique that uses a 1 standard error approach. However, there are multiple other techniques available which do not appear to have been discussed or considered;
- the pool of candidate explanatory variables in the model LASSO can choose from is also subjective. The CMA has decided to use the FD24 variables plus additional ones suggested by two of the Disputing Companies. The CMA could have decided to use other variables that were considered earlier in the PR24 process, at PR19 or at previous reviews. The CMA could have explicitly signalled this approach to the Disputing Companies and asked the others, that had not put forward detailed representation on the base cost models, to make representations about the variables it should use. Similarly, the functional form of the relationship between costs and cost drivers could have been explored further (e.g. whether certain variables should be expressed in logarithms or levels);
- as part of including the candidate variables from the PR24 models, the CMA has also implicitly decided that the data quality of these are sufficiently high for inclusion in a final model without any further express consideration. This is surprising given that one of the issues raised in Southern Water's SoC (and we echoed in our response to the SoCs) concerned the data quality of the average pumping head (**APH**) variable.[33] The CMA has made the subjective decision to allow the LASSO algorithm to adjudicate the issue raised with respect to data quality rather than explicitly considering the evidence in this area;
- the choice of whether to average between top down and bottom-up models, or to focus on whichever gives the lowest RMSE, is another subjective decision; and
- even the order of the explanatory variables within the modelling code used by the CMA and the choice of the software package itself makes a difference to the models selected and the results, suggesting that the CMA has made an arbitrary and subjective decision in presenting the results that it has (see Section 2.2.4 for further details).

32. What the CMA has done, therefore, is to substitute one set of subjective decisions that drew on

[31] We note that whilst the CMA's prioritisation consultation suggested it would consider econometric tools "such as" LASSO, that was the only technique flagged in the consultation and there is no express consideration of other techniques in the PD.
[32] PD, para. 4.49
[33] Southern SoC, Chapter 2 Base Costs, para. 58 onwards; NWL Response to other company SoCs, Appendix 2, p.15.

regulatory judgment "to reconcile divergent results and incorporate company-specific evidence" supported by extensive triangulation across multiple models[34] with a completely new set of subjective decisions that result in an algorithm deciding the final model. Each of the decisions above has a material impact on the allowances that the models provide for individual companies and for the sector as a whole. It is clear that the CMA has not adequately considered the importance and materiality of these decisions as there is limited discussion of them in the PD.

33. Professor Weeks categorises these concerns as the "illusion of automation":

> The promise of regularisation methods in regulatory settings rests on their ability to remove subjective judgment from model selection, replacing human expertise with algorithmic choices. Yet the reality reveals judgment relocated rather than removed. This persistence of judgment would be less problematic if it were transparent and contestable. Traditional econometric approaches, whatever their limitations, allow companies to challenge variable inclusion based on engineering logic, economic theory, or empirical evidence. The new framework transforms these substantive debates into technical discussions about cross-validation procedures and penalty parameters that few stakeholders can meaningfully evaluate.[35]

34. Professor Weeks goes on to add that:

> The CMA's methodological choices must be evaluated not merely on statistical grounds but also in terms of their implications for democratic participation in regulatory processes. The shift toward automated methods, while potentially enhancing transparency in some dimensions, fundamentally alters the nature of regulatory engagement. When variable selection becomes algorithmic rather than economic, companies lose the ability to contest decisions through substantive evidence and engineering logic. This transformation of regulatory discourse fundamentally undermines the democratic engagement that effective regulation requires, replacing economic reasoning with algorithmic artifacts that resist contestation through the kinds of evidence that stakeholders can meaningfully evaluate.[36]

35. The issue Professor Weeks raises of the increased complexity of the CMA's approach is another material issue that the CMA should be concerned about – the more complex the method the less transparent it becomes. This limits the accessibility of stakeholders to understand and meaningfully engage with the approach, the models and the outcomes.

2.1.4 The CMA models are a large shift away from FD24 at the sector aggregate level

36. When different methods and approaches are applied to the assessment of base costs it would be reasonable to expect some changes to modelled costs between companies, particularly given that was the essence of the challenge presented by some of the Disputing Companies. However, the CMA base models result in a 4.9% reduction in modelled base allowances across the sector compared to FD24 (rather than the 3.8% reduction indicated in Table D.5 of the PD).[37] This results in a **£2.052bn** reduction across the sector for water and wastewater combined – a very

[34] Weeks Report, p. 3 NWL-PD-REP-001.
[35] Weeks Report, p. 13 NWL-PD-REP-001.
[36] Weeks Report, p. 14 NWL-PD-REP-001.
[37] PD, Appendix D, Table D.5. See also email to CMA from Anglian Water of 20 October 2025.

large additional efficiency challenge indeed.[38]

37. However, the gap is even larger when a material and unambiguous error in the CMA's R code is corrected.[39] Once corrected, under the CMA's suggested method, this would reduce cost allowances across the sector by a **further £1.3bn,** resulting in an incredible **£3.4bn overall reduction in sector allowances or more than 8% less than Ofwat's FD**.

FIGURE 3: IMPACT OF PD ON BASE ALLOWANCES

	Wholesale water			Wholesale wastewater		
	Ofwat FD	**CMA PFs**	**% change**	**Ofwat FD**	**CMA PFs**	**% change**
Affinity Water	1305	1183	-9.3%			
Anglian	**1837**	1708	**-7.0%**	1970	1887	**-4.2%**
Bristol Water	416	457	9.9%			
Hafren Dyfrdwy	136	143	5.1%	27	24	-11.1%
Northumbrian	**1484**	1374	**-7.4%**	867	785	**-9.5%**
United Utilities	2588	2308	-10.8%	2483	2314	-6.8%
Portsmouth Water	199	163	-18.1%			
SES Water	202	193	-4.5%			
South East	**854**	836	**-2.1%**			
Southern	**878**	875	**-0.3%**	1921	1850	**-3.7%**
South Staffs Water	576	462	-19.8%			
Severn Trent Water	3028	2810	-7.2%	2555	2329	-8.8%
South West Water	878	853	-2.8%	735	686	-6.7%
Thames Water	4922	3983	-19.1%	4014	3580	-10.8%
Dŵr Cymru	1332	1266	-5.0%	1234	1123	-9.0%
Wessex	**535**	592	**10.7%**	973	900	**-7.5%**
Yorkshire Water	1776	1734	-2.4%	1858	1782	-4.1%
Total	22945	20940	-8.7%	18636	17262	-7.4%
Disputing Companies	5588	5385	-3.6%	5731	5422	-5.4%

Source: Anglian Water email to CMA 20 October 2025 and Economic Insight note to CMA 29 October 2025.

38. A change of this scale across the sector is not plausible, particularly in the context of all but one water company significantly overspending their PR19 cost allowances in the 2020-25 period (with an average overspend of 22% on water and 13% on wastewater and a c.£4.6bn overspend on base costs in total).[40] Nor is it plausible when both the IWC and Ofwat recognise the urgent need for increased spending on capital maintenance above the FD24 base allowances, including in AMP8.[41]

39. We consider that the scale of the difference between Ofwat and the CMA's results for the sector-

[38] PD, Appendix D, Table D.5 shows a gap of £1.5bn. There is an error in table D5 where the sum of CMA allowance for wastewater is 17,913, not 15,126 as presented.
[39] Economic Insight, An error in the CMA's implementation of LASSO, 28 October 2025 (**EI LASSO Error**) (**NWL-PD-REP-002**).
[40] Ofwat, Company Performance Report 2024-25, p43
[41] IWC Final Report, Chapter 7. In the context of Ofwat, this is reflected in the adoption of the Asset Health Roadmap which accepts that it may be appropriate to allow additional expenditure on capital maintenance in AMP 8, over and above the FD24 allowance.

wide totex allowance, as shown in Figure 3, raises a significant question mark about the reliability and robustness of the CMA's results.

40. To put this into context, on opex our analysis shows a gap of £30m a year to the base opex allowances provided by the CMA's PD, representing around 8% of controllable opex.[42] This represents a 2% increase in the savings we need to find from FD24 (or £8m per annum). The £30m pa gap is equivalent to 90bps of RORE, pre cost sharing. We will seek to find savings equivalent to this level over the AMP but it is clearly not a trivial sum. Indeed, when we look at the gaps faced by other companies, they are often larger than our own. At a sector level we can see that 10% or £500m pa of savings in operating costs will need to be obtained.

FIGURE 4: OPEX GAP FROM 24/25 ACTUALS TO AMP8 CONTROLLABLE COSTS (22/23 PRICES)

Company	Gap
SWB	-34%
SRN	-33%
SES	-25%
HDD	-15%
WSH	-14%
SEW	-12%
WSX	-12%
TMS	-9%
AFW	-8%
PRT	-8%
NES	**-8%**
UUW	-4%
ANH	-3%
SVE	7%
YKY	12%
SSC	12%
Sector	-10% (£500m pa)

Source: Taken from companies 2024/25 APR tables 4D & 4E, controllable opex excludes abstraction charges and business rates and compared to FD24 (for non-disputing companies) and CMA PD allowances (for disputing companies). NWL PD Response Databook.

41. From a base capex perspective, the further reduction in the PD to our allowances of £19.6m will further exacerbate the challenges we already face with respect to the base water service. This is considered further in Section 3.1.3.

42. Overall, based on our latest forecasts with respect to our capital programme, [redacted]. This is despite being a relatively efficient company that ranks 4th amongst the WaSCs based on Ofwat's FD24 cost assessment, close to the upper quartile of the sector. We further note that, based on Ofwat's most recent performance report, the entire sector has overspent the AMP7 totex allowances by £4,588m (base modelled) and £90m

[42] To make this assessment we have started with our most recent reported year's annual controllable costs of £385m (APR 2024/25, excludes abstraction charges and business rates, 22/23 prices). We compare these current annual operating costs to the opex allowances in the CMA's PD to understand the gap that would need to be met through either efficiency or overspending of allowances.

(enhancement).[43] Within this NWL's own overspend is at the lower end of the sector.

43. We do not think that the CMA has adequately considered the robustness of the results, or the extent to which they differ from Ofwat's results. The CMA should properly assess this difference and be able to adequately explain the intuitive and engineering rationale for such a steep increase in efficiency challenge.

2.1.5 Ofwat has a more developed approach to model selection based on precedent

44. In its response to Disputing Company SoCs, Ofwat explained the importance it placed on its principles for base cost models and how it had addressed this over time:

> Overall, our selected models produce robust results that align with engineering and economic rationale. Internal and external engineering experts played an integral role in model development so that the models have a clear engineering rationale and capture the key cost drivers that explain differences in efficient base expenditure between companies and over time. For example, engineers helped to identify the important cost drivers from an engineering perspective, and how we can proxy these with explanatory variables. They also assisted us to ensure the model estimation results are intuitive and consistent with engineering logic. We developed our models with input from Cambridge Economic Policy Associates (CEPA), a specialist regulatory economics consultancy, and our econometric academic advisor, Professor Andrew Smith. Our models build on those used by Ofwat at PR19, and the CMA at PR19 redeterminations. We have made several improvements, which are set out in our final determination base cost modelling decision appendix.[44]

45. When assessing the relative merits of the Ofwat and CMA models, it is worth noting that the process Ofwat followed at PR24 was in line with best practice with respect to consultation and methodology. As demonstrated in Figure 5 the CMA has been unable to match this in its approach and the PD. Nor do we think it is realistic that these failings can be remedied in the time remaining for this process.

FIGURE 5: COMPARISON OF THE OFWAT PR24 AND CMA PD APPROACHES

Ofwat PR24 approach	CMA PD approach
Consultation and stakeholder involvement prior to draft findings	
The Ofwat approach to its PR24 models built heavily on the approach first put forward by the CMA at PR14 that was developed further at PR19 (see Figure 2). This was carried out through a cost assessment working group[45] which met c. 16 times and a detailed 98 page consultation[46] on potential changes to the PR19 models.	There has been limited consultation and engagement by the CMA with the Parties and other stakeholders prior to the PD (see Section 2.1.6). We do not consider that the engagement contemplated by the consultation on the PDs is sufficient to remedy that. Nor do we expect that there will be sufficient time in the remainder of the statutory timeframe for this redetermination to have an appropriate level of engagement that would meet requirements and expectations for best regulatory practice and procedural fairness.

[43] WCPR25, 17-18 prices. Total overspend is over £9bn in 22/23 prices.
[44] Ofwat, Ofwat_Response_to_Common_issues_on_expenditure_allowances_28_May_2025.pdf, p11
[45] Cost Assessment Working Group - Ofwat
[46] Econometric_base_cost_models_for_PR24_final.pdf

Model estimation method	Following on from the use of random effects by both Ofwat and the CMA at PR19, Ofwat continued to use this technique at PR24.[47] This approach explicitly takes into account the panel data nature of the data (i.e. multiple data from each individual company which will be correlated).	In adopting the LASSO technique, the CMA's PD models are estimated through OLS which does not take account of the panel data structure of the data. As we discuss in Section 2.2 and Appendix 1 this is a less efficient estimator and results in biased standard errors.
Model selection process	Ofwat's approach largely replicates its PR19 approach (as used by the CMA in its PR19 redetermination). Ofwat's "emphasis has been to develop and select simple and transparent cost models that are consistent with engineering, operational and economic rationale. This allows the models to capture the key cost drivers, and that the resulting efficiency analysis reflects actual differences in relative efficiency instead of other factors".[48] This approach is supplemented with a series of model robustness tests to ensure that they are suitable for estimating and predicting efficient costs. We discuss the application of these tests to the CMA's models in Section 2.2 and Appendix 1.	The CMA's LASSO approach starts with the pool of variables and adds in suggestions from the appellants plus energy and wage terms interacted with a single chosen scale variable. There does not appear to be any examination of the resulting coefficients, their statistical significance, nor the robustness of the models selected to estimate and forecast efficient costs.
Consideration of data quality of the variables	Ofwat's model selection process includes explicit consideration of the quality of data of the different variables being considered.[49] As a result of this, and recognizing data quality concerns around APH, Ofwat decided to have different versions of the model with and without APH to address this concern.	Despite the quality of the APH data being an issue raised by Southern in its SoC, we cannot see any consideration of the data quality of APH in the PD by the CMA. It is included in the list of candidate variables as it was raised by South East Water but there is no further consideration of this issue.
Triangulation of results	Ofwat's approach tries to avoid models with too many variables that are not statistically significant or grouping together variables that are strongly correlated in order to pass its robustness tests. This approach results in alternative models being available that have different measures of density for example. Ofwat's approach takes the view that there is no right way of considering costs top down or bottom up and estimates models at both levels of aggregation. Ofwat then triangulates between different models at each level of aggregation and then between the two different levels of aggregation. Ofwat states: "We triangulate across a set of models with different cost drivers and levels of cost aggregation to mitigate the risk of error and bias in any one model."[50]	The CMA's approach does estimate models on a top down and bottom up basis but selects the single resulting LASSO models with the lowest RMSE. This means that there is no triangulation between models or between different levels of aggregation.

Source: NWL analysis

2.1.6 There are other options available to the CMA for consideration of the issues raised by the Disputing Companies

46. The CMA suggests that there is no other reasonable way of assessing the base-cost related claims put forward by the other Disputing Companies but this is not correct:

[47] FD24 Base Cost Appendix SOC620, Section 2.4, para. 1, p.14.
[48] FD24 Base Cost Appendix SOC620 p.15.
[49] FD24 Base Cost Appendix SOC620, Figure 1, p.15.
[50] FD24 Base Cost Appendix SOC620 p.1.

- the CMA did assess specific issues with base models as CACs for individual companies as part of its PR19 redetermination;[51]
- Ofwat routinely addresses such issues as CACs at each price review; and
- there is significant precedent regarding how to apply judgment in the selection of cost drivers based on modelling results and various diagnostic tests alongside considering the engineering rationale of the driver.[52]

47. The CMA is well placed to exercise its regulatory judgment on these matters as it did at PR19. It cannot delegate these crucial decisions to an algorithm that has no accountability. Seen in that context it is clear that the CMA's approach is a disproportionate response to the points of challenge raised by individual Disputing Companies – which they have all sought to have corrected on an individualised basis.

48. Whilst all Disputing Companies accept and understand that the CMA may depart from Ofwat's methodology, if the CMA intends to adopt an approach that has such a significant impact across the sector it must be confident that the implied results are reasonable and sufficiently reliable. To conclude that its models are an appropriate way to set the base cost allowances for the five Disputing Companies (and presumably Thames Water, were it to exercise the option to join the process) the CMA must be satisfied that the allowances are appropriate for all companies within the sector (i.e. that a £3.4bn overall reduction in sector allowances is a proper reflection of efficient costs).[53] It must also ensure that the redetermination it makes for each individual company is sound and that they have had adequate opportunity to make reasoned arguments about all aspects of the decisions that impact them.

49. As such, we think it is crucial that the CMA maintains long-established precedent of ensuring that the models: are intuitive; align with engineering and economic rationale; and are statistically robust – this is not something that the LASSO approach appears able to deliver. It is important that the CMA delivers a robust approach that stakeholders can understand both methodologically and intuitively so that they continue to have confidence in the regulatory regime.

[51] The CMA assessed and rejected 5 CACs raised by Disputing Companies at the PR19 redetermination, see CMA PR19 Final report pp. 335–352.
[52] The PR19 Redetermination devoted 44 pages to considering the appropriate variables to inclusion in the models (Final report pp. 129-173).
[53] We note that in its redetermination for Bristol Water in PR14, where it did adopt a different approach to modelling (supported by a bottom up assessment of Bristol Water's actual costs) the CMA did acknowledge that this was undertaken in the context of reaching a determination for a single company, rather than the whole sector: "Finally, we agreed with Ofwat's view that our assessment of its econometric models should be seen within the context of our determination for Bristol Water, which differs to that for a price control review that needs to determine 18 wholesale water price controls and ten wholesale wastewater price controls. The weight that we gave to the issues we identified, and the approach that we took in the light of these issues, reflected the circumstances of our inquiry." (CMA PR14 Final Determination, para. 4.80).

2.1.7 The CMA's consultation to date has been inadequate and there has been insufficient reflection on the feedback provided

2.1.7.1 Adequacy of consultation

50. The CMA has suggested that it provided the Parties and interested third parties with the "opportunity to comment on the feasibility and suitability of this approach in general terms" when it signalled its "intention to explore data-driven approach using tools such as LASSO in the CMA PR24 Approach document".[54] The CMA has also suggested to the Parties that it "had already indicated the possible scope of changes to base costs modelling in the PR24 Approach Document"[55] and had received "submissions on our intention to use LASSO in both the PR24 Approach Document and the hearings".[56]

51. We do not accept this characterisation of the process to date. We do not consider that the single paragraph included in the Approach Consultation (see para. 19 above)[57] can be taken as an indication of the possible nature, scope or scale of changes that have actually been presented in the PDs (in particular once corrected for errors). It also fails to provide sufficient detail to enable meaningful commentary on the feasibility or suitability of the approach taken by the CMA in practice, not least as this was mentioned only in response to specific cost adjustment claims presented by two Disputing Companies.[58]

52. Nor do we think that was achieved by the relatively limited discussion of this topic in the all-party hearings. In the day of hearing allotted to base costs, 90 minutes was set aside for econometric modelling.[59] Within those 90 minutes the CMA asked questions on: the industry approach to controlling for regional differences in wages in a systemic way; whether energy prices should be incorporated explicitly in the models; whether there are any input prices, other than energy and wages that are relevant and should be reflected in the model; the views of the parties on the data quality of APH data; and the use of 2024/25 data.[60] There were only two questions directed to the potential use of LASSO:

> I am going to move on to our alternative modelling techniques now. In our approach document, we set out that we were interested in alternative models and specifically mentioned the least absolute shrinkage and selection operator as an alternative technique. A general question about that approach, LASSO approach or other alternative modelling techniques.

[54] PD, para. 4.39.
[55] Email from the CMA to the Main Parties, 27.10.2025.
[56] Email from the CMA to the Main Parties, 3.11.2025.
[57] PR24 Approach and prioritisation 28 May 2025 page 13, para 43.
[58] The Disputing Companies that hadn't raised concerns with Ofwat's modelled base costs were also clear that if the CMA proposed changes that impacted their allowances, they reserved the right to make submissions, and provide evidence as required, in order to properly engage with this fundamental part of the redetermination.
[59] CMA PR24 Base Costs Hearing 24 June 2025 Indicative questions for parties, p.1.
[60] Base Cost Hearing Transcript, 24 June 2025: p.19 lines 4-8; p.26 lines 20-21; p.31 lines 4-5; p.33 lines 14-16; and p.42 lines 14-20.

> Are any other modelling techniques out there that you think we should consider or does LASSO end the story there as to what we should be exploring?[61]

53. With only two questions relating to the discussion of these alternative approaches, the discussion was limited.[62] The CMA did not provide any information expanding on the single paragraph in its Approach consultation. However, the Parties were all clear in their responses – there had been extensive engagement on Ofwat's approach, there is broad agreement on the approach and core principles (including the robustness tests) within Ofwat's approach, it might be appropriate to consider LASSO, but it would not be a sufficient solution to the challenges presented in the SoCs by itself, and caution should be shown not to undermine the important principles (intuitive rationale, statistical significance, data quality) that had informed Ofwat's approach:[63]

> we think it should be used to complement our cost assessment principles. Which again a general agreement around the room here, that those approved principles should be applied specifically. Particularly in relation to engineer rationale; quick, quality data; simple and transparent to ensure that the stakeholders can engage effectively and focus on exogenous cost drivers and making sure the models can actually predict and forecast efficient costs.[64]

54. With respect to written submissions, we note that constraints were placed on the Main Parties with respect to the content and length of core submissions, as set out in Figure 6.

FIGURE 6: CONSTRAINTS PLACED ON MAIN PARTY WRITTEN SUBMISSIONS

Response to other Disputing Companies statements of case (1.5.25)
Page limit: 20
Other constraints: Reply to matters contained in other Disputing Companies SoCs.[65]

Reply to Ofwat's response (30.5.25)
Page limit: 10
Other constraints: Reply should be limited to issues concerning 'new' information not available to Ofwat at the time of making its FD24 or to arguments raised in Ofwat's Response which did not form part of its reasoning in the FD24.[66]

Post-hearing written submissions
Page limit: 5 (individual response); 5 (joint response)
Other constraints: Individual submissions should focus on: (a) any information provided to the Group during the Hearings that the main party considers to be inaccurate; and (b) comments on any new evidence or arguments arising from the Hearings that the main party has not previously had the opportunity to address.[67]
Joint submission should be focused on any perceived inaccuracies or new arguments in the Ofwat Hearing slide deck.[68]

Additional submissions with respect to base cost models
Page limit: 5
Other constraints: Limited to commentary on response made by other main parties to the PDs on base cost modelling.[69]

Source: as per the references in the table.

[61] Base Cost Hearing Transcript, 24 June 2025, p.37 lines 15-19; and p.39 lines 19-21.
[62] The discussion accounts for under 5 pages of a 150 page transcript
[63] See, for example, in the Base Cost Hearing Transcript, 24 June 2025: Wessex p.37 lines 20-21; Southern p.38 lines 10-24; p39, lines 22-24; p 40 line 15-p.41 line 20; p.42 lines 9-13.
[64] Base Cost Hearing Transcript, 24 June 2025, p.39 lines 10-15 (Ofwat). See also p.41 line 21-p.42 line 5.
[65] Email from CMA to Parties 19.3.2025.
[66] CMA Process Note 3, para. 11.
[67] CMA Process Note 7, para. 33.
[68] Email from CMA to Parties 18.7.2025.
[69] Email from CMA to Parties 3.11.2025.

55. This demonstrates that the opportunities to make meaningful submissions on modelling issues, particularly for Disputing Companies that did not raise issues with Ofwat's models in their SoCs, have been limited.

56. When restricting the content and length of written submissions the CMA has always been clear that the Parties should not be concerned as there would be adequate opportunity to respond to the PDs.[70] However, in response to the request of NWL and Anglian Water to extend the timeframe for that response by two weeks in order to address the modelling changes fully and effectively, the CMA has only allowed 2 additional working days for this response, plus a further five working days to provide up to an additional 5 page commentary on other Parties' responses to the PDs with respect to base costs. We remain unconvinced that this is sufficient to meet the standards of legally adequate consultation.

57. As such, we consider it is important that the CMA follow through on the suggestion of further information gathering and analysis and further consultation on base cost modelling before reaching its final determination.

2.1.7.2 Response to the feedback provided

58. In the PD the CMA states:

> Responses to the CMA PR24 Approach document, and follow-up discussions at the hearings, did not raise any fundamental issues. However, both Ofwat and Disputing Companies cautioned that the use of data-driven tools such as LASSO is relatively novel in regulation and that, if used, care would be needed to ensure the methodology results in models that uphold the economic and engineering rationale.[71]

59. Noting the constraints placed on written responses from the Parties (see Figure 6) and the CMA's control over hearing topics (see para.52), we consider it is misleading to suggest that no fundamental issues were raised with this approach.

60. All Parties were clear in written submissions and the hearings that they were not requesting the CMA to take a fundamentally different approach to base cost modelling in its determination – i.e. they all envisaged retention of the FD24 modelling approach – and that caution should be exercised with respect to moving away from modelling principles adopted by Ofwat and the use of a data-driven approach, such as LASSO.

FIGURE 7: COMMENTARY ON THE LASSO APPROACH

Ofwat acknowledged the CMA's proposed data-driven approach to variable selection, including using LASSO. It set out some further considerations it had used to test that its own base cost models had accurately predicted and forecasted efficient costs:

- Are the estimated coefficients of the right sign and plausible magnitude?
- Can the models accurately predict the efficient expenditure of companies?

[70] E.g: "We also note that there will be further opportunities for the disputing companies to make submissions (and elaborate on submissions) in this matter in the coming months, including at hearings.": Email from CMA to Parties 2.5.2025.
[71] PD, para. 4.39.

> • How do models perform across a range of statistical diagnostic tests (eg statistical significance of individual parameters; RESET test for omitted non-linearities; and multicollinearity test)?
> • Are the estimated model results stable and robust to changes in the underlying assumptions and data (eg different sample period; removal of most and least efficient company; and alternative model specifications)?
> • Cross-checking efficient base expenditure allowances against business plan forecasts, PR19 base allowances, and outturn spend over the past five years.[72]

Ofwat also provided its views on the need for consultation with all water companies and some concerns with consistency with its base cost assessment principles:

> Poor data quality can bias parameter estimates, leading to incorrect conclusions…. A key example is average pumping head…
>
> The estimated parameter estimates should be consistent with engineering and operational rationale and produce intuitive results. For example, it is likely to be inappropriate to include an explanatory variable which was statistically significant but the estimated beta coefficient has the wrong sign.
>
> LASSO could lead to models that are overly complicated and difficult to interpret… it may therefore be appropriate to use LASSO to choose between explanatory variables that reflect the same cost driver, rather than develop base cost models from first principles.[73]

Ofwat's approach to consultation and its base cost principles over time has been one of the key reasons that the sector has generally accepted this approach. Ofwat notes that "other companies have not raised concerns with these cost drivers and changes in cost drivers will impact the allowances for all disputing companies and potentially all companies if reflected in benchmarks for PR29".[74]

Anglian Water said that

> while data can inform the model development process, it should not dictate the decision-making process, which must remain grounded in sound economic and engineering rationale… should the CMA decide to pursue the LASSO approach, it would be important to allow Anglian and other parties a reasonable opportunity to engage with the outputs.[75]

Northumbrian Water said that the CMA should take appropriate account of factors such as data quality, statistical significance, and consistency between models. We said that there should be

> a high bar for making any changes to the models to ensure that the results are robust, in keeping with engineering understanding and best practice within economic regulation. This would also reflect the significant consultation that was undertaken on those models through PR24.[76]

South East Water said that

> data-driven methods need to be considered alongside other important, more 'real world' modelling criteria, such as the operational, engineering and economic rationale for including or excluding certain cost drivers and the quality of their underlying data. Data driven methods can therefore be used as an additional source of evidence supporting key modelling decisions but cannot be used as the sole basis for making such decisions…No regulator uses [LASSO] for the sole basis for model development. Moreover, data-driven approaches like LASSO are not 'assumption-free' and tweaking the assumptions or data or specifications of the LASSO approach can lead to materially different conclusions – so the selected models should be evaluated in this context of underlying data and modelling uncertainty.[77]

[72] Ofwat, Ofwat Response to Approach and prioritisation.pdf, 1.16, p6
[73] Ofwat, Ofwat Response to Approach and prioritisation.pdf, Table A1, p11
[74] Ofwat, Ofwat Response to Common issues on expenditure allowances 28 May 2025.pdf, p1
[75] Anglian, Anglian Response to Approach and Prioritisation.pdf, para 15 and 16
[76] NWL, Northumbrian response to Approach and prioritisation.pdf, para 12 and 13
[77] South East Water, South East Response to Approach and prioritisation.pdf, para 3.3 and 3.4.

Southern Water said that

> …there are potential risks as well as benefits to the [LASSO] technique" and set out a number of concerns. These included how the CMA would determine economic and engineering rationale, how the CMA could filter variables for data quality, and how the CMA would consider triangulation to mitigate the risk of error and bias. Southern Water warned that using a different method to Ofwat for determining economic and engineering rationale could lead to the final models looking "substantially different to the one at FD, going beyond the specific disputed points that the CMA is reconsidering.[78]

The CMA has not reflected this in its summary in PD, saying that:

> Southern welcomed the proposal to review the set of explanatory variables in the base cost models and supported a data-driven approach to model selection.[79]

Wessex Water asked the CMA to adopt an alternative bottom-up engineering approach to base costs. On econometric benchmarking, it says that its case includes

> considerable evidence on the limitations of [econometric] models. While econometric benchmarking is a well established practice, this would not of itself justify a decision to attach little or no weight to other evidence. Nor would it justify using the results of such benchmarking to determine expenditure allowances without regard to the feasibility (and desirability) of the cost reductions implied by it.[80]

The fact that the LASSO model more closely matches Wessex Water's current costs than Ofwat's FD24 does not, in itself, mean that the points made by Wessex Water have been addressed – this has not considered engineering rationale, and introduces similar gaps for other (non-appellant) companies such as BRL and SWB. Indeed, there is no clear engineering or economic explanation of why this model should more closely predict Wessex Water's costs.

Pennon said that it "found Ofwat's PR24 cost modelling process to be rigorous, transparent, and evolutionary. The base cost models built on those used in PR19 and incorporated lessons from CMA PR19 determinations."[81]

Source: various submissions as referenced.

61. These concerns, voiced out the outset of this process, have come to bear in the PDs, which do not directly or adequately address how these risks have been considered and mitigated.

62. For example, the CMA should explicitly consider how its new models can compare to the robustness of Ofwat's method, given the long period of consultation and its consideration of the base cost modelling principles, particularly its consideration of engineering and operational rationale. This is not adequately addressed in the PD, which address concerns about consultation and engineering rationale simply by saying that these are based on some of the same foundations as Ofwat models, and that the variables chosen all start with an economic, engineering, and operational rationale.

63. There is also no evidence of testing that the estimated parameters are consistent with economic, engineering and operational rationale (as Ofwat suggests). It is clearly not true to say that because these models are based on some of the same foundations as the Ofwat models, or that there has been adequate consultation.

[78] Southern Water, Southern_Response_to_Approach_and_prioritisation_1.pdf, Annex p6-8.
[79] PD, para. 4.17.
[80] Wessex, Wessex_Response_to_Approach_and_prioritisation_updated_110725.pdf, para 1.8.
[81] Pennon, Pennon.pdf, p2.

64. Finally, the IWC's final report was published on 21 July 2025, after the close of the CMA's consultation on its approach. The IWC finds that:

> Ofwat has relied too heavily on a data-driven, econometric approach, and has not taken sufficient account of company-specific conditions and challenges… the Commission judges that over-reliance on this approach, and its over-development, have over the years led to sub-optimal outcomes for the sector, for customers, for investors and for the environment.[82]

65. We acknowledge that this should not lead to an immediate move away from econometric benchmarking, particularly in this redetermination, but it should make the CMA more cognisant of the potential risks associated with a shift towards an even more data-driven approach (such as the use of LASSO). It should also highlight the importance of making sure that the modelled results are intuitively sound and consistent with the underlying engineering understanding. The PDs do not meet this standard.

2.2 MODELLING ROBUSTNESS CONCERNS

66. Our review of the CMA's models, in the limited time available, has revealed a significant number of concerns related to the robustness and accuracy of the results. Once the LASSO approach has selected variables, and they are used to estimate the models using OLS, there is very little to none post-estimation evaluation of these results to see whether they are sensible or have desirables characteristics. We are concerned about the lack of regard paid to this issue in the PDs. We have summarised our concerns in the following sections – the underlying technical analysis is provided in Annex 1.

2.2.1 The CMA's models are not statistically robust

67. Base cost models are a core part of the cost assessment framework – across the sector they are used to set around £40bn of cost allowances for base activities. It is therefore important that they are specified and estimated accurately so that companies have sufficient funds to carry out their activities and so that customers do not overpay unnecessarily. In order the achieve this it is important that the models are developed in line with best practice. When econometric models are estimated they are normally subjected to a series of diagnostic tests to check that the models perform well statistically to produce robust results that can be relied upon.

68. Ofwat has developed a series of tests that were used at PR19 (including by the CMA) and PR24 to help ensure that the models being used are accurately able to identify differences in efficient costs rather than identifying spurious correlations in the data. These include:

- the T-test to assess the statistical significance of the cost drivers;
- the adjusted R-squared to measure how closely the model fits the data;
- the RESET test to detect if an alternative functional form may be superior;

[82] Independent Water Commission final report, Independent Water Commission Final Report, para 417.

- the VIF assessment to detect multicollinearity;
- the Pooling/Chow test to determine the appropriateness of using a panel dataset structure;
- the LM test for pooled OLS versus random effects;
- normality and heteroskedasticity tests to test the distribution and variance of the model residuals; and
- sensitivity checks to assess the robustness of the model to changes in the underlying assumptions.

69. We are surprised that the CMA has not deployed the use of any of these checks on its models developed by its LASSO approach. Further detail on each of these tests is provided in Annex 1 Figure 33. Instead the PD puts very little weight on this issue as the only model quality parameter it considers is the goodness of fit. Professor Weeks expresses similar concern over the CMA's lack of robustness checks:

> The CMA's failure to report basic robustness checks undermines the credibility of their results, and consequently creates a lack of transparency. True transparency requires acknowledging when methods produce unstable results, and making explicit comparisons across different approaches.[83]

70. We have undertaken analysis to apply these standard tests to the CMA's models. Our approach and results are detailed in Annex 1 Section 7.1. In particular we have identified a series of problems with the CMA's models including:

- lack of statistical significance of many of the coefficients;
- issues with misspecification and multicollinearity; and
- results being very sensitive to a small number of data points.

71. Overall, it appears clear that the Ofwat models are superior to the CMA's LASSO models in terms of their statistical significance of the cost drivers, the estimation technique (random effects) better reflects the panel data structure, a lower risk of multicollinearity resulting in imprecise and uncertain estimates of the coefficients, and better performance against the sensitivity checks showing that the estimates are less dependent on a small amount of the data. Overall this suggests that the CMA's models are not robust and this raises serious concerns over their suitability for setting cost allowances in a regulatory context.

2.2.2 The CMA's estimates of efficient costs are less accurate than Ofwat's

72. At a high level, the statistical performance of an econometric model of base costs (or suite of models) boils down to two factors: goodness of fit and the statistical precision / sensitivity with which the model is estimated (i.e. what is the confidence interval around the results). A wider confidence interval implies a poorer model as the results emerging are more statistical accidents

[83] Weeks Report, p. 13 NWL-PD-REP-001.

than precise estimates. This is important in a regulatory setting as the models are being used to determine expenditure allowances for the provision of an essential service.

73. It is well-recognised that adding additional explanatory variables can improve goodness of fit but that this may come at the cost of over-fitting (e.g. with the modelled coefficients capturing spurious correlations in the data rather than underlying cost causality). The CMA's PD presents evidence on how its models compare to Ofwat's in terms of goodness of fit but does not provide much direct comparison of statistical precision or of over-fitting concerns. When the results to be used from an econometric model are the predicted values, rather than estimated coefficients, the most directly relevant aspect of statistical precision concerns that of the predicted values rather than that of the individual coefficients.

74. From a theoretical perspective Professor Weeks identifies that the characteristics of the water sector mean that LASSO is likely to exhibit instability in the models and resulting cost allowances:

> In addition LASSO is likely to exhibit instability under the conditions prevalent in water regulation. Variable selection can change dramatically with: addition of one year's data, removal of a single company, minor revisions to historical costs, or different cross-validation folds. This instability makes business planning impossible and creates legal vulnerability in appeals.[84]

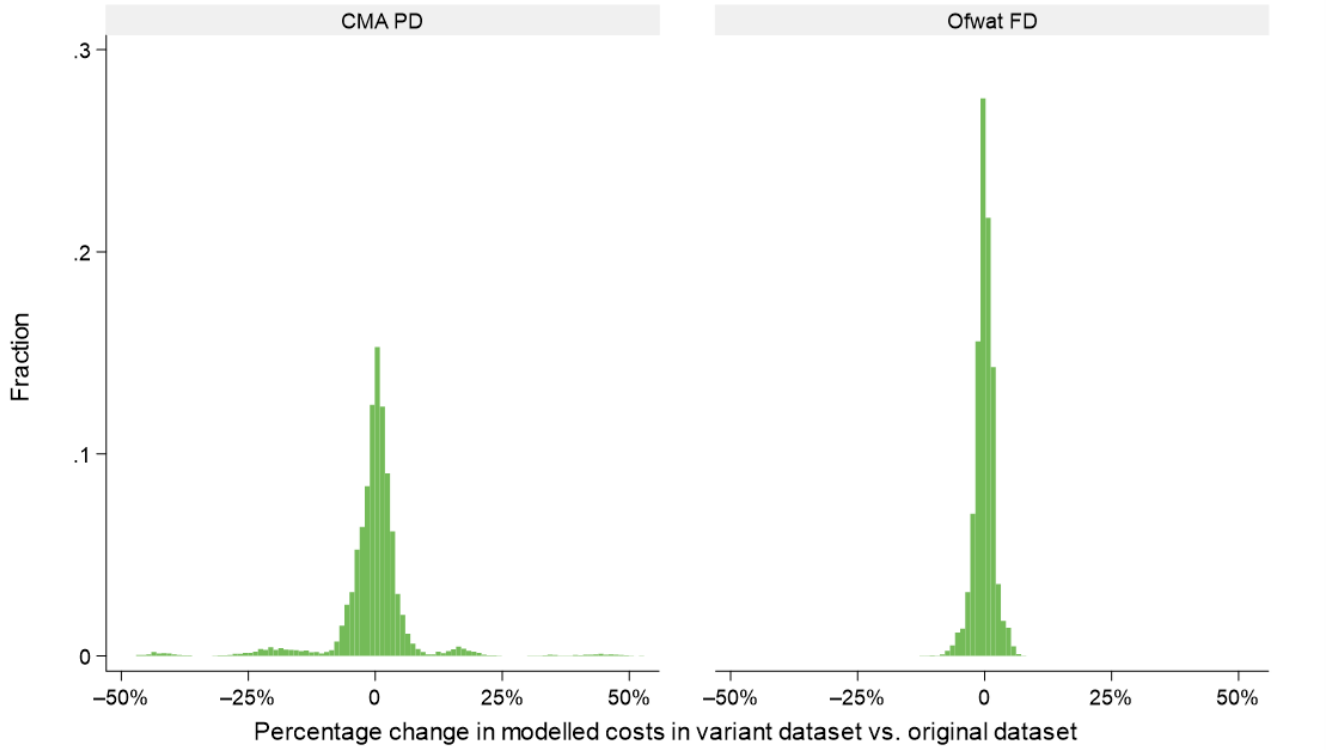
75. We have applied a resampling technique to develop a metric for statistical precision that measures the sensitivity of modelled costs to re-running the econometric model estimation across a large number of variations in the dataset (e.g. impact of dropping one company and/or year). This has an intuitive appeal, building on existing water industry practice (e.g. Ofwat at PR24 looked at the sensitivity of results to dropping specific companies and years as discussed above). This approach has links to Jackknife techniques in econometrics/statistical literature. Our methodology and results are provided in Annex 1 Section 7.1.

76. We find the CMA's models are much more sensitive to changes in the data and therefore produce less certainty over the projected levels of base expenditure required by each company (see Figure 8).

77. This wider confidence range could be driving the much larger levels of catch-up efficiency that we observe in the CMA's PD and this may just be due to the instability of the LASSO approach rather than real differences in efficiency that warrant a large catch-up challenge.

[84] Weeks Report, p. 8NWL-PD-REP-001.

FIGURE 8: HISTOGRAMS OF MODELLED COSTS SENSITIVITY FOR OFWAT & CMA WASTEWATER MODELS



Source: NWL analysis using Ofwat's FD dataset. NWL PD Response Databook.

78. The finding that the Ofwat approach provides better prediction stability is consistent with Professor Weeks' finding about model averaging:

> Rather than relying on a single model specification, Ofwat and Ofgem have traditionally employed multiple models that capture different aspects of cost relationships, then combined their predictions through triangulation. This approach explicitly acknowledges model uncertainty: the recognition that no single specification can fully capture the complex relationships between costs and their drivers given severe data limitations. The core insight is that when individual models capture different signal, their combination can outperform any single model, particularly in small-sample, high-correlation environments where any single estimator faces severe statistical challenges.
>
> The case for model averaging in regulatory contexts rests on several principles. First, with only 17 water companies and high multicollinearity, we cannot know which specification is "correct." Different functional forms, variable transformations, and aggregation levels each illuminate different aspects of cost variation. A single model implicitly assumes we have identified the true data-generating process - an implausible claim given the data constraints.
>
> Second, water companies differ fundamentally in their operating contexts. No single functional form can capture all these relationships optimally. Multiple models, each emphasizing different cost drivers, collectively provide a more complete picture than any single specification.
>
> Third, averaging across models with different assumptions reduces the impact of any single misspecification. The combined prediction is less sensitive to arbitrary modelling choices than reliance on

a single framework.[85]

79. We strongly agree with these findings and support the use of the averaging approach between models as implemented by Ofwat for these reasons.

2.2.3 The CMA's models imply implausible relationships between cost drivers and costs

80. The relationships estimated by the models should align with economic and engineering rationale. This is so that all stakeholders can understand and interpret the results allowing them to have confidence that robust relationships are being estimated. It also helps ensure that when the results are extrapolated, e.g. when setting AMP8 allowances, that these are based on meaningful relationships and are therefore achievable.

81. When the CMA included wages and an energy price index in its models it has done these through an interaction term (e.g. for example when including wages the term included is the log(wages)*log(length of main) for the water models). This results in a relationship between these variables and costs which does not make intuitive engineering or economic sense.

82. In particular, the results imply that larger companies will have a larger percentage share of costs that are energy or wages and are therefore more affected by changes in these. We provide analysis to demonstrate this in Annex 1 Section 7.3. There is no good engineering or economic rationale to suspect this and it is contradicted by the data collected at PR24.

83. We also find that the relationship between energy prices and costs is not all related to energy costs. When we exclude energy expenditure from the model, the LASSO approach still selects the energy price variable suggesting that there are spurious relationships being picked up. This suggests that the true relationship between energy prices and energy expenditure is not being captured by the model.

84. As there is no evidence either in theory or in the data for the relationships implied by the CMA's functional form which uses interaction terms, we think it is more likely that the model is finding spurious correlations in the data rather than fundamental underlying economic or engineering relationships and as a result the model design in this area is poorly suited to identifying differences in efficient costs between companies.

85. Such considerations were also relevant in the CMA's redeterminations of the PR14 price control for Bristol Water. Ofwat's models at PR14 used a functional form that it referred to as 'translog', which included the use of squared and cross-product (or interaction) terms involving a subset of the cost drivers (length of mains, number of connected properties divided by the total length of mains – which is a measure of density, and water delivered per connected property). In that case, the CMA found that it "was difficult to interpret the relationships between costs and

[85] Weeks Report, p. 8 NWL-PD-REP-001.

explanatory variables in economic and engineering terms" and the use of the cross-product terms "seems to have compromised the results", which it "found to be counter-intuitive".[86]

86. Professor Weeks' report reaches a similar conclusion:

> The CMA's methodological repositioning toward LASSO-based variable selection creates a time-inconsistency when compared to its own previous determinations. This becomes clear when examining the regulatory evolution from PR14 through PR24, where similar model complexity concerns that justified simplification at PR14 are now apparently acceptable under algorithmic selection.[87]

87. In addition to these counter-intuitive results, the CMA approach also produces results that are impossible to interpret – for example around the inclusion of the density variables when several are selected with varying sign. Professor Weeks captures this as follows:

> The same concerns that motivated simplification at PR14 remain equally valid at PR24. When LASSO selects multiple correlated density measures with varying signs, the resulting model becomes as difficult to interpret as the translog's interaction terms. The coefficient on "properties per sewer length" of 0.599 alongside "lad from MSOA weighted average density" of 0.193 and "MSOA weighted average density" of −0.281 creates interpretative challenges comparable to those that troubled the CMA at PR14.
>
> The CMA criticized the translog for lacking "convincing explanation of the economic or engineering rationale." Yet LASSO's algorithmic selection provides no rationale beyond statistical correlation.[88]

88. Professor Weeks considers that this is evidence of the model capturing spurious rather than genuine relationships:

> [The CMA's] models retain multiple correlated density variables - three to four in some specifications - with some showing contradictory signs. The retention of multiple correlated predictors with mixed signs indicates the model is capturing spurious patterns specific to the sample rather than identifying genuine cost relationships. This is what theory predicts when λ is chosen for prediction rather than selection in small samples with correlated predictors.[89]

89. In the absence of any economic or engineering explanation for the counter-intuitive relationships observed in the CMA's LASSO, good regulatory practice (and precedent) would be to consider carefully whether the models are truly capturing differences in efficiencies rather than spurious correlations in the data.

2.2.4 The LASSO techniques is not able to produce a set of replicable results

90. A fundamental prerequisite of any approach to estimate efficient costs in a price control or redetermination setting is that it produces a single set of reproduceable results. The models should be both replicable with a chosen software package in a way where arbitrary choices of ordering of data do not affect the results, and the same results should be easily replicable in

[86] CMA PR14 Final Determination, para 4.50
[87] Weeks Report, p. 11 NWL-PD-REP-001.
[88] Weeks Report, p. 12 NWL-PD-REP-001.
[89] Weeks Report, p. 7 NWL-PD-REP-001.

other software packages. This ensures that the results are not random and based on the underlying relationships rather than arbitrary choices on ordering or software. This is not the case for the LASSO approach deployed by the CMA.

91. When examining the CMA's code we noticed that the results are sensitive to the order of the variables that are given to the LASSO command in the R statistical software. In particular, different variables are selected depending on the order to the variables given to the software.

92. We found that putting the variables in reverse alphabetical order resulted in one of the density variables being dropped from the WRP model, whereas ordering them shortest to longest variable name resulted in an extra variable being selected by the model. Because the LASSO approach selects different variables depending on the order, it also predicts different costs. In Figure 9 below we present three different iterations of the models that we have been able to generate just by changing the order of the variables given to the LASSO command in R - e have found a deviation in the allowance for NWL of up to £17m.

FIGURE 9: DIFFERENT LASSO RESULTS FROM THE SAME SET OF VARIABLES FOR WATER RESOURCES PLUS

Order of the variables	Changes in variables selected	Industry reallocated predicted cost for WRP
CMA PD order	NA	NA
Reverse alphabetical order	In WRP model, property per length squared was dropped	£284m
Longest to shortest variable name	In WRP model, wage_scale was picked	£181m
Proportion of vowels in variable name (ascending)	In WRP model, wage_scale was picked	£181m
LASSO in Stata	In WRP model, wage_scale was picked and property per length squared was dropped	£314m[90]

Source: NWL analysis. We have run LASSO in different scenarios using Ofwat's FD datasets. NWL PD Response Databook.

93. We have noticed the same issue also arises when the error in the CMA's LASSO code over the selection of the lambda parameter is corrected as outlined in the response to the query received from the CMA on 4 November 2025.[91] This is shown in Figure 10.

FIGURE 10: DIFFERENT RESULTS OF CORRECTED VERSION OF LASSO FROM THE SAME SET OF VARIABLES FOR WATER RESOURCES PLUS

Order of the variables	Changes in variables selected	Industry reallocated predicted cost for WRP
CMA PD order	NA	NA
Reverse alphabetical order	In WRP model, all input variables were picked.	£12m
Longest to shortest variable name	In WRP model, all input variables were picked.	£12m
Proportion of vowels in variable name (ascending)	In WRP model, WAD_MSOA_population was dropped.	£40m

Source: NWL analysis. We have run LASSO in different scenarios using Ofwat's FD datasets. NWL PD Response Databook

[90] We found LASSO very sensitive when run in Stata. The variables picked changed almost every time it ran for the WRP model. This result is what we got at a specific time. We have provided the Stata code and the input dataset but the CMA might get different results.
[91] Response to the CMA's 4 November query sent by Norton Rose on behalf of the disputing companies on 6 November 2025.

94. This finding is consistent with Professor Weeks' assessment:

> The order in which variables are processed can influence which specific optimum point (from the set of near-optimal solutions) the algorithm converges to, especially in cases of high correlation where the path to the minimum is not strictly defined. The sensitivity to variable order in glmnet, a commonly use R package, is primarily observed when you have highly correlated independent variables (predictors).[92]

95. This should not be the case – a robust estimation technique should be able to select the variables the best achieve the objective. For OLS or Random Effects estimation the same variables will produce the same results regardless of order. It is clear to us that LASSO is unable to do this.

96. Given that there is no "correct" order of variables to give the LASSO command the method does not produce a single set of correct results. We do not see how it can be justifiable to use a technique with this property as the results are essentially random.

97. The approach used should also be replicable across platforms, such as in Stata. For other estimation techniques like OLS you would get the same coefficients whether the model were estimates in R, Stata, or even in Excel. However, this also does not appear to be the case for the LASSO approach. We have tried to reproduce the CMA's results in Stata but have been unable to – in the table above we show the result using the inbuilt LASSO command in Stata which gives a different result to the CMA's PD.

98. Overall, the LASSO approach appears to be unstable (it does not give a single answer within R) and non-replicable on other platforms. Instead the variables chosen and resulting cost allowances are dependent on the arbitrary ordering of variables. This suggests that the technique is not able to identify a single answer that stakeholders can agree is the correct result from applying a desired method.

99. We do not see how the technique can be viewed as robust on these grounds alone and its use by the CMA could be damaging for regulatory confidence if the results from the cost modelling are seen to be random depending on non-relevant factors such as the order of the variables, or the software platform used to estimate the models.

2.2.5 The use of an upper quartile efficiency challenge is not justified

100. Traditionally regulators and the CMA have set the strength of the catch-up challenge based on the quality and confidence of the models developed. The better they are able to robustly estimate efficient costs, the more stretching a catch-up challenge can be. For areas with good model quality the upper quartile (**UQ**) has been used typically within the water sector. At PR14 where the CMA developed new models and had less confidence in the models it set allowances at the average level as it did not have the confidence that the new models were able to accurately

[92] Weeks Report, p. 7 NWL-PD-REP-001.

estimate efficient costs.

101. There is long-established precedent, including from the CMA (and its predecessor body, the Competition Commission) that draws a clear link between the appropriate benchmark to set for the catch-up efficiency challenge (i.e. whether at the UQ or another point such as the median) and the quality of econometric benchmarking models, the degree of uncertainty in its results (i.e. predicted costs) and the potential for data error. We summarise key findings from previous CMA decisions in Annex 1 Section 7.4.

102. Based on the concerns we have set out with respect to the LASSO technique we do not think it should be used by the CMA at all: it has resulted in over-fitted models with a higher degree of uncertainty in the estimates of modelled costs than Ofwat's approach and the technique does not give a single unique answer than is easily replicable in other software. However, if the CMA were to stick with the LASSO technique then we do not see how it can justify retaining a UQ efficiency challenge due to:

- the poor statistical significance of many of the cost drivers once the standard errors are estimated without bias;
- the poor performance against the standard post estimation diagnostic tests;
- a much higher degree of uncertainty in the estimates of modelled costs compared to the Ofwat cost as a result of the over-fitting in the model; and
- lack of engineering and economic rationale for some of the relationships observed between variables.

103. These concerns are very similar to the concerns expressed by the CMA in considering the limitations of the models that it used in the Bristol Water PR14 redeterminations. In particular, the CMA found that its own models suffered from:

- risks of "inaccuracy in the estimation of the relationships between expenditure and the cost drivers used for the explanatory variables" due to the "large number of explanatory variables relative to sample size", although these were less of a concern compared to Ofwat's models that it replaced;
- concerns about the quality of input data to the models, which it considered "will be subject to some inaccuracy and measurement error";
- the limitations to the accuracy of the models due to the finding that its own models had "fewer coefficients that were statistically significant at the 95% confidence level" than Ofwat's models that it replaced;
- concerns about the instability of estimated coefficients for explanatory variables across different model specifications and "instances of counterintuitive coefficients", which reflected the "high standard error or variance of some of the estimated coefficients"; and

- the sensitivity of predicted costs to a number of aspects of its model specifications.[93]

104. Given these concerns, the CMA decided that

> an efficiency benchmark based on an upper quartile efficiency concept would be overly demanding if applied to the results of the econometric models that we used.[94]

105. This decision was also taken following the 2009 Price Review period where the sector performed well against the settlement - not in a context £4.6bn of overspending against base cost allowances in the previous AMP, as we have now.

106. Indeed, within the context of PR24, Ofwat chose not to apply a UQ benchmark for many of its enhancement cost models, in part due to concerns about the limitations of its modelling. Instead, it used the median to set the benchmark.

107. The levels of catch up implied by the CMA's models are also significantly higher than previous water price control reviews. The CMA presents a table[95] with the catch up challenges since PR14 but we think this is partially misleading:

- the PR14 catch-up challenge set by Ofwat related to PR14 models that are not directly comparable as they also included enhancement costs. Those models were also heavily criticised by the CMA in its Bristol Water redetermination. They are not a good comparator for the appropriate PR24 challenge. A better comparator is the CMA's PR14 redetermination which did estimate base expenditure models in a more robust way;
- the table excludes the CMA's PR19 redetermination where the CMA did make some tweaks to the Ofwat framework; and
- when the error in the R-code used to estimate the CMA's models is corrected the catch-up challenge is increased further.

108. A more representative comparison is set out in Figure 11.

FIGURE 11: REVISED VIEW OF CATCH-UP EFFICIENCY CHALLENGES FOR BASE COST MODELS SINCE PR14

	PR14 redetermination	PR19 Ofwat	PR19 CMA	PR24 Ofwat	PR24 CMA (with LASSO error)	PR24 CMA (with error corrected)
Water	0.0%	4.6%	1.4%	1.3%	5.6%	6.2%
Wastewater	NA	2.0%	3.3%	0.6%	4.0%	6.7%

Source: Efficiency challenges from each price control's FD. PR24 CMA (with error corrected) figure: EI LASSO Error (NWL-PD-REP-002).

109. This shows that the catch up challenges are much higher than any base cost model since their creation at the PR14 redetermination (prior to PR14 Ofwat estimated opex only models). For the CMA to confident that these unprecedented levels of catch up are appropriate and achievable it

[93] CMA PR14 Final Determination, para 4.177.
[94] CMA PR14 Final Determination, para. 4.224.
[95] CMA PD Table 4.3.

would need to have an extremely high degree of confidence from its models – given the issues we have identified in this section we do not see how this is possible.

110. We also have concerns with some of the other reasoning that the CMA has used to justify the use of a UQ challenge. We set these out in Figure 12.

FIGURE 12: CONCERNS WITH CMA PD REASONING TO SUPPORT AN UPPER QUARTILE CHALLENGE

Issue	Our concern
Energy Prices: The main reason why our models imply stronger efficiency challenges than Ofwat's is that our models control for energy prices, whereas Ofwat's do not. Energy prices more than doubled over AMP7, and this is interpreted very differently under our approach and that adopted by Ofwat at PR24 FD. Under our approach, modelled costs over the financial years 2020/21–2022/23 are adjusted upward to reflect the impact of higher energy prices. In contrast, in Ofwat's models, modelled costs are not adjusted upward in the recent period, and the increase in energy prices is interpreted as a generalised increase in the inefficiency of companies. (PD para. 4.65) Our approach recognises that increases in energy prices over the past five financial years (2019/20-2023/24) is not equivalent to inefficiency. (PD para. 66)	We think the CMA is partially right. Energy prices did increase over AMP7 and they did result in an increase in costs. However we think the CMA's approach significantly overstates this impact. When Ofwat considered the impact of the increase in energy prices, it calculated that it only explained 2% of the overspend.[96] This 2% increase in costs driven by energy prices cannot explain a 4.9% increase in the efficiency challenge in water and a 6.1% increase in wastewater. As we set out in Section 2.3.4 the coefficient on the energy variable is picking up correlations in the data unrelated to power costs (the energy price variable is still picked by LASSO even when energy expenditure is excluded from the model). This means that the model is overestimating the impact of energy costs and therefore is giving a misleading picture.
Protecting customers against inefficiency: First, we consider that the application of the UQ catch-up efficiency challenge is required to protect the interests of customers. In our view, the primary economic rationale for the catch-up efficiency challenge is to protect the interests of customers served by inefficient companies. Put simply, if customers are served by companies that have been identified as being inefficient, they should not be expected to cover the cost of these companies in their entirety. This principle remains applicable to the PR24 FD and our redeterminations. (PD para. 4.69)	This whole paragraph is predicted on the CMA's models being able to accurately distinguish between inefficiency and other factors such as spurious correlations, misspecification and omitted variables. Given the results of the robustness tests we have carried out and greater variance in the predictions of the models we do not think this is the case. Requiring companies to reach an unachievable benchmark is the opposite of protecting the interests of consumers, by not providing sufficient funds to carry out their companies will not be able to deliver in the best interests of customers or the environment.
Robustness of models: Second, our models provide a better basis to estimate differences in efficiency between companies. While it is never possible to be confident that a model precisely captures all relevant determinants of costs, our models explain a larger share of variations in costs than Ofwat's, and therefore we can be more confident that a large share of the companies' efficiency scores is attributable to genuine differences in efficiency rather	The CMA has only examined the robustness of its models in one dimension - their goodness of fit or the RMSE compared to Ofwat's models. There are many other relevant dimensions to model robustness as we have set out in this response. Based on these we do not think the CMA's models are a better basis. They instead appear much worse. The CMA needs to consider the robustness of its models beyond their goodness of fit.

[96] Expenditure allowances addressing asset health.pdf first bullet of para 3.18 on page 17 "Unexpected energy price increases. We estimate the overspend reduces at an industry level from 14% to 12% when this is accounted for."

than omitted variables or misspecification. (PD para. 4.70)	
Other factors impacting level of challenge Third, other aspects of our provisional decision have the effect of reducing the overall challenge faced by Disputing Companies. In particular, we have provisionally decided to reduce the frontier shift from 1% to 0.7% (paragraph 4.153), and to amend the PCLs for water supply interruptions and external sewer flooding (see chapter 6 (Outcomes)). More generally we have provisionally decided to provide additional allowances to the Disputing Companies for example through increases to the sector-wide asset health base cost adjustment (see paragraph 4.291 to 4.479, a higher rate of allowed return (see chapter 7 (Allowed Return)) and additional allowances for enhancement schemes (see chapter 5 (Enhancement costs)). (PD para. 4.71)	The issues are irrelevant to the setting of the level of catch-up achievable which should be based on the robustness and confidence in the models estimated. Under a building block approach to price controls, each component of the settlement needs to be appropriately calibrated to ensure a fair overall package. Just because the CMA has corrected or amended another building block such as the PCL for interruptions or the allowed return this has no bearing on the decision about the appropriate level of catch-up that can be achieved from a base cost model. The CMA needs to make a decision on the level of catchup that is achievable based on the quality of the models and not based on other irrelevant changes it has made elsewhere.

Source: PD and NWL analysis

111. The CMA should consider carefully whether the limitations of its modelling means that a UQ challenge remains appropriate. We believe that in light of the significant number of problems identified, the untested nature of the technique, the limited scrutiny of the models, and implausibility of the implied reduction to base expenditure at a time when government and Ofwat are both concerned about levels of capital maintenance investment, a UQ benchmark is not appropriate. Imposing an unachievable cost challenge of this nature is not in the interests of customers. It will either result in reduced levels of capital maintenance (it is much easier to defer capital maintenance than to cut opex in the short term) or will result in larger overspend, further reducing the financeability and investability of the sector, thereby exacerbating the impacts of PR19 as the most miscalibrated regulatory settlement in the sector's history. This is not in the best long term interests of customers.

112. We do not think it is appropriate for the CMA to use the LASSO technique as deployed in the PD for the reasons we have set out. If, however, it is retained in the PD then given the poor robustness properties of these models a move away from the UQ seems essential to ensure that companies are able to recover their efficient costs. The most analogous situation in the PR14 redetermination where the CMA changed the modelling approach significantly and due the lack of confidence in those untested models it decided to apply a median efficiency challenge. Those PR14 models were much more intuitive that than CMA's models at PR24. Consistent with that precedent, it would be more appropriate to rely on a more conservative benchmark, based on an industry-median instead.

2.2.6 The CMA's PD approach contains a significant error

113. There is an error in the CMA's code that selects the penalty term or lambda. This is described in

more detail in a note submitted to the CMA prepared by Economic Insight.[97] Correcting this error results in new models being selected with difference cost drivers. Overall, the change reduces allowances across the sector by £1.3bn - another significant reduction compared to the PD.

114. Once the error is corrected the resulting models still perform poorly against the robustness tests and there are further counter-intuitive results such as there being a negative relationship between wages and costs in the wholesale water and wastewater network plus models. There are other unexpected results such as the wastewater network plus model no longer selecting any of the density variables at all – this is a fundamental shift from the models at PR19, PR24 and the PD. The results of our analysis to demonstrate this are set out in Annex 1 Section 7.5. Addressing this error therefore does not address in any way the concerns we have set out above around the use of the LASSO approach.

2.3 REAL PRICE EFFECTS

115. The CMA has made significant changes to FD24 in the area of real price effects (**RPEs**) which are designed to capture the cost pressures arising from input costs increasing faster than CPIH inflation. There needs to some modifications to the CMA's PD approach to arrive at a coherent position that delivers a fair outcome for both customers and companies. In particular:

- labour RPEs need to be applied to all modelled costs and not just treated water distribution (see Section 2.3.1);
- RPEs should be applied to network reinforcement and unmodelled costs (see Section 2.3.2);
- the forecast of future real wages should be based on OBR data rather than extrapolating current trends (see Section 2.3.3);
- the approach to energy RPEs may be picking up different correlations in the data unrelated to energy costs (see Section 2.3.4); and
- regional wages should be more reflective of actual costs faced by water companies (see Section 2.3.5).

2.3.1 Labour RPEs need to be applied to all modelled costs and not just treated water distribution

116. For modelled base costs the PD currently only provides an RPE adjustment for treated water distribution. This is because the wages cost driver is selected by the LASSO approach for treated water distribution which means that future RPEs are picked up through the forecast of this variable. For water resources plus and wastewater, the LASSO approach in the PD does not select the wages variable and therefore the AMP8 forecasts of costs do not reflect changes in wages. The CMA justifies this by saying:

[97] EI LASSO Error (NWL-PD-REP-002).

> Wages are retained in the model for treated water distribution, but not in other models. This suggests that, while wages are strongly correlated with other variables, the inclusion of these other variables is insufficient to fully account for the effect of differences in regional wages in at least one model.
>
> As input prices are explicitly included in these models, the cost predictions generated for AMP8 automatically take account of expected changes in labour and energy costs. This implies that there is no needed for additional, post-modelling adjustments for RPEs.[98]

117. This reasoning is flawed:

- wages are only explicitly included in the treated water distribution model so the cost predictions for the remaining areas of modelled costs (wastewater network plus and water resources plus) cannot take account of future changes in wages; and
- the CMA has found in WNP and WWNP that wages are not selected – this could just mean that the difference in regional wages is already largely captured by the density variables. However, this does not mean future changes in wages, which may differ from CPIH, are therefore captured by the forecasted costs for AMP8. Wages over AMP8 are not known with certainty and will be determined independently of changes in our other cost drivers (for which there is no true up in any event). There is therefore no way that our allowances will reflect actual changes in wages unless they evolve precisely in line with CPIH which we know typically underestimates wage changes.

118. We see the situation as being analogous with frontier shift. The CMA knows that the future will be different from the past in that companies will make future productivity improvements. It therefore makes an adjustment to forecasted costs from the model to account for this even though there is no controlling for frontier shift within the parameters of the model itself. The same reasoning applies to labour RPEs where the CMA knows that labour costs tend to rise more quickly than CPIH inflation and without an adjustment for this, companies will not be able to recover the additional costs arising from this issue.

119. The CMA must therefore apply RPE adjustments for future labour costs so that companies are able to recover their efficient costs. If a true up is included then this will ensure that both customers and companies are fairly treated.

120. This inclusion of an RPE adjustment for labour costs would be in line with the precedent at PR14 redetermination, PR19, PR19 redetermination, PR24 and price controls in other sectors (for example all of Ofgem's network price controls since 2009 have included an RPE adjustment for labour costs). At the PR19 redetermination the CMA included a significant consideration of where and how to apply RPEs.[99] We suggest that the CMA follows a similar process here, building on that approach and Ofwat's PR24 developments. A departure from this cross-sector

[98] PD paras. 4.58 and 4.60.
[99] CMA PR19 Redetermination Final Report, 2021 see 'Real price effects, paras 4.653- 4.740

precedent would be significant and the CMA has not established a strong reason to do so. Instead its PD risks companies being unable to recover their efficient costs if wages rise faster than CPIH inflation as have been the case historically and is predicted by economic theory. We urge the CMA to reconsider its decision in this area.

2.3.2 RPEs should be applied to network reinforcement and unmodelled costs

121. The changes in the approach to RPEs has resulted in no RPEs being applied to network reinforcement and to unmodelled costs:

- the sector wide adjustment model for network reinforcement does not include any labour RPE adjustments like the mains renewal and metering adjustments; and
- in the base costs aggregator file, the CMA has set RPEs to zero which results in no RPEs for unmodelled costs.

122. We think that this is an error and will result in companies not being able to recover costs associated with labour costs rising faster than CPIH inflation.

123. For network reinforcement, we understand why the CMA has not applied a regional wage adjustment – this is because the costs are based on individual company costs and there is no volume measure to compare unit costs. Because of this and since the PCD is set based on a level of expenditure there is no need to make a regional wage adjustment. However, this does not mean that future labour cost increases do not need to be considered. Companies costed their plans in 2022/23 prices which means that increases input prices above CPIH will not be accounted for – an adjustment is therefore required to costs to address this issue.

124. For unmodelled costs the issue is less material (as frontier shift and RPEs are only applied to traffic management act and lane rental charges under the PR24 FD). However the same issues apply where the allowances have been reduced for frontier shift but have not had a labour RPE adjustment applied to them.

125. The CMA should correct these errors in its FD so that appropriate RPE adjustments are made for these cost areas. For transparency we think these adjustments would sit most naturally in the base costs aggregator file as per the Ofwat approach.

2.3.3 The forecast of future real wages should be based on OBR data rather than extrapolating current trends

126. In its PD the CMA has estimated future RPE adjustments based on extrapolating the regional wage series that it uses in the base cost models. This results in different forecasts for different companies. These numbers differ from the PR24 FD assumption using OBR data and the most recent OBR. We show this in Figure 13.

FIGURE 13: PD LABOUR RPE ASSUMPTIONS (AVERAGE PERCENTAGE INCREASE IN WAGES ABOVE CPIH)

Company	Water	Wastewater
Northumbrian	0.63%	0.19%
Anglian	0.56%	0.45%
Southern	0.80%	0.80%
Wessex	0.90%	0.90%
South East	0.80%	NA
Ofwat PR24 FD assumption	1.03%	1.03%
Updated PR24 FD assumption based on OBR March 2025 data[100]	1.30%	1.30%

Source: average AMP8 construction wage growth from the CMA's CAC variables dataset. Ofwat FD numbers are averages of RPEs from 2024-25 to 2029-30.

127. It can be seen that the OBR figures are larger than those obtained from extrapolating the wage data using the CMA's method. We think that the OBR forecasts should take precedence over extrapolating the regional data as they are based on a more complete and detailed assessment for the UK economy than a simple extrapolation. In the short run there is likely to be divergences between wage growth in different regions, however in the medium term we would expect more mean reversion between regions that would even out short-term differences. We therefore think that the best available forecasts are those used by the OBR which we used by the CMA at PR19 and have continued to be used by Ofwat at PR24.

2.3.4 The approach to energy RPEs may be picking up different correlations in the data unrelated to energy costs

128. We understand the intuitive appeal behind the CMA including an energy price index in the econometric models as it provides a simpler way to adjust for changes in energy prices. However, we think that the incorporation into the models is having unintended consequences.

129. In exploring the change in approach to energy prices, we experimented with removing energy costs from the models altogether. When we did this, we got an unexpected result, the LASSO approach still selects the energy price series as a variable even when energy costs are excluded from the model. This should not be happening if the variable is correcting for changes in energy prices and their impact on energy costs – it should not be selected by LASSO when energy costs are removed from the dependent variable. Figure 14 shows the impact on the energy price variable with and without energy costs included in the dependent variable. It shows that 34% to 67% of the impact of the energy cost variable is completely unrelated to energy costs.

[100] OBR, CP 1289 Economic and fiscal outlook March 2025, Table A1, p158. RPE calculation used CPI and Wages & salaries data.

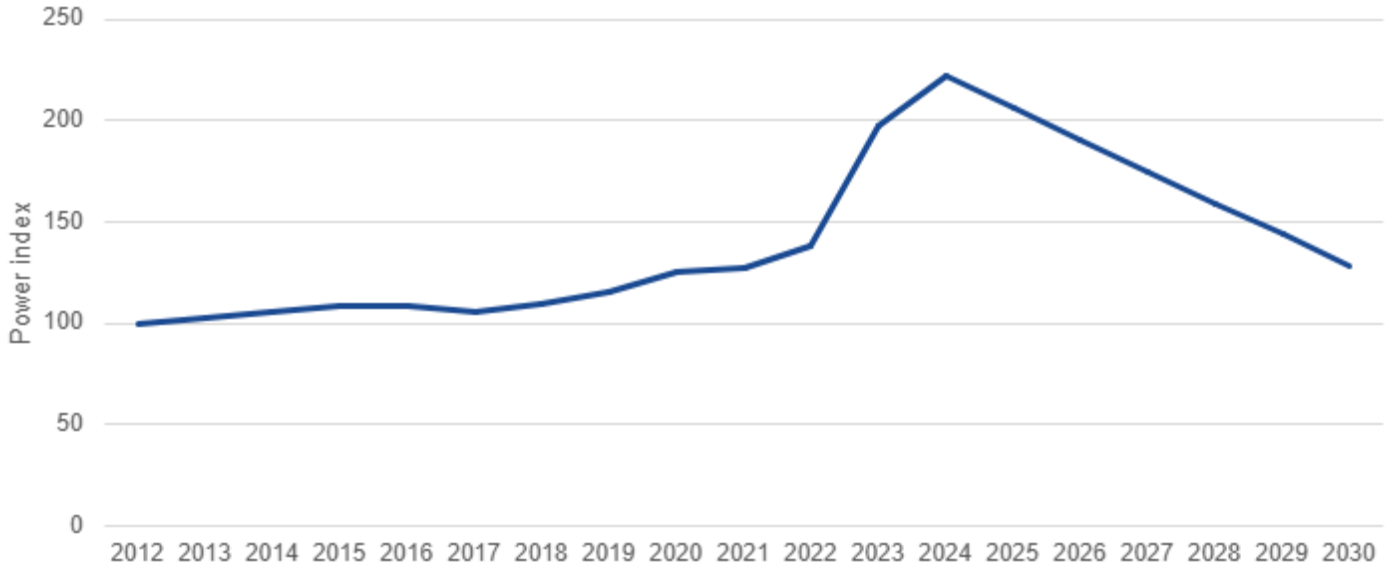
FIGURE 14: COEFFICIENT ON THE ENERGY PRICE VARIABLE WHEN ENERGY COSTS ARE INCLUDED AND EXCLUDED

Model	Coefficient when energy costs are included in the dependent variable	Coefficient when energy costs are excluded in the dependent variable	Implied percentage of the coefficient unrelated to energy costs
Treated water distribution	0.016933	0.011422	67%
Water resources plus	0.012557	0.007391	59%
Wastewater network plus	0.015644	0.005316	34%

Source: NWL analysis of the CMA's base models with and without the energy cost. The codes for energy costs removed from the dependent variables are WS01001WR, BM202TWD, WS1001CAW for water models and BM402SC, BM502ST for wastewater models.

130. This creates a significant problem in predicting AMP8 costs. Figure 15 shows the energy index forecast used for AMP8 which the CMA has retained from Ofwat's FD. It shows that the index used to calculate AMP8 allowances hits a peak in 2023/24 and then falls back to a long term average by 2030. However, because the size of the coefficient on energy costs is not just picking up the impact on energy costs, when the forecasts of this index are used to calculate AMP8 allowances the reduction is also effectively being applied to other costs that are not energy related. This is overstating the reduction in costs that can be achieved from falling energy costs and we believe is a key driver of the CMA's approach deriving allowances for the sector that are not credible.

FIGURE 15: ENERGY PRICE INDEX USED IN THE PD



Source: Power price index over time from the CMA's CAC variables dataset. NWL PD Response Databook.

131. We think this may be due to the fact that the biggest change in the energy index occurs during AMP7 when two things happened:

- energy prices increased significantly following the conflict in Ukraine; and
- companies overspent their base allowances significantly by £4.6bn (or 13.5% on average) of which only a small portion was due to energy costs – Ofwat estimated that only 2% of this

overspend was due to energy price increases.[101] The majority of the increase was therefore due to factors unrelated to energy costs, such as the costs of meeting a very stretching outcomes package where the average company received an ODI penalty across the AMP equivalent to 0.68%[102] RoRE on the common ODIs.

132. Ideally you would want the coefficient on the energy price variable to pick up the impact of the first bullet. However, because the increase in costs due to the pressures on the AMP7 settlement happened at the same time, the model is unable to distinguish between the two factors as they happened at the same time and there are no other variables that capture the tightening of the AMP7 settlement. This means that the coefficient on the energy price variable could be picking up the impact of both of these factors.

133. For most variables this would not be an issue as the level of forecasted cost drivers is similar in the AMP8 period to what we have seen during AMP7. However, for energy this is not the case as the forecast is for a significant decrease – this means that the impact of the coefficient on this reduction is overstanding the reduction in modelled costs that can be achieved.

134. Since the model is unable to distinguish between these factors and accurately estimate the impact of changing energy prices, we do not think that the econometric approach can be relied upon as it results in unachievable levels of future costs. We therefore think that the CMA must switch back to the Ofwat approach in this area to account for energy RPEs. It provides a more realistic estimate of the impact of falling energy prices in AMP8 which is consistent with actual spend levels on energy costs.

2.3.5 Regional wages should be more reflective of actual costs faced by water companies

135. The CMA has used an index of wages from ASHE that reflects only construction costs. These are not representative of the activities that companies carry out in practice. In its SoC, Southern Water suggested a weighted mix of different categories from ASHE that represent its split of costs between the categories (across construction, manufacturing, water and wastewater, and professional services).[103] This is likely to be a better measure than using wages for the construction sector alone, because it more closely captures the types of costs water companies face across their own business and through supply chains. By selecting a wider range of categories, this is also much less volatile between companies and between years. This is a calculation of “occupational weights” that could be used for a typical water and wastewater

[101] Ofwat PR24 - Addressing asset health, April 2025, p. 17 “Unexpected energy price increases. We estimate the overspend reduces at an industry level from 14% to 12% when this is accounted for.”
[102] Ofwat WCPR25: data total for AMP7 years by Company, average of five years total divided by notional regulatory equity. WPCR25 Data (includes Ofwat’s WCPR data for C-MEX, leakage, water supply interruptions, water quality compliance, water and wastewater asset health, internal sewer flooding and pollutions)
[103] Southern Water SoC Chapter 2 Base Costs, paras 202-209.

company.

136. We note that in RIIO-2, Ofgem used an average proportion of FTEs allocated to each occupational category to calculate regional wages indices for energy companies.[104]

137. This could be adjusted further, too, by reflecting that some costs are national in their nature rather than regional. For example, we note that Southern Water, in its cost adjustment claim in its business plan estimates that around 20% of costs are within management control about the location – including business process outsourcing, offshoring IT contracts, and customer contact centres.[105] This is similar to RIIO-2, where Ofgem assumed a "local work proportion" of 85% (having previously argued that it may be the case that there should be no structural difference in wages between energy companies).

138. If differences in wages are to be used in the model for all base costs (rather than just as a real price effect or adjustment for water company wages), this could be extended further. Across all our investments, we seek to make sure that at least 60% of our expenditure is made within our regions – and the challenge we find in seeking to do this demonstrates that large parts of expenditure on materials and services across the water sector are, in practice, reflecting wages and materials costs outside individual regions. We would expect that at least 20% of wages should reflect national average wages, and so a proportion of the regional wage calculation for each company should reflect the national average rather than regional average.

2.4 CONCLUSIONS ON BASE COST MODELS

2.4.1 Changes that the CMA needs to make from its PD approach

139. We think the CMA has made a mistake in adopting its LASSO approach to variable and model selection for the setting of base costs. It has resulted in models with poor robustness that we do not think can be reasonably described as better than Ofwat's approach. Importantly the CMA's models resulting from this technique are no longer intuitive – this an important feature that is necessary to ensure that the models are estimating robust underlying relationships rather than spurious correlations in the data. For example, once the error in the CMA's code is corrected the models imply a negative relationship between wages and cost – this is clearly not a sensible relationship and we do not see how the CMA can stand behind an approach that results in clearly wrong relationships being used to extrapolate future cost levels for an essential service.

140. Given where we are now in the process Professor Weeks suggests an approach aligned with the Ofwat approach of multiple models combined with robustness testing:

[104] RIIO-2 Final Determinations – GD Sector Annex, para. 3.55 and para. 3.61.
[105] Southern Water, October 2023, SRN23 Regional Wages Cost Adjustment Claim, SOC-2-0023.

> Considering the limited timescale of this redetermination, there is merit to remain with a multiple model approach based on explicit criteria, combined with diagnostic testing, as opposed to the use of a single-model framework with greater vulnerability to specification error.[106]

141. The CMA needs to take ownership of the decisions that it must make on a limited number of variables that two appellants have raised. These decisions cannot be delegated to an algorithm which does not and cannot understand the setting of a utility price control and the importance of developing robust intuitive models that are necessary for cost setting and maintaining stakeholder confidence in the approach.

142. **We therefore ask the CMA to return to the Ofwat approach of modelling and make specific decisions on the issues raised by appellants**, e.g. whether to remove APH from the models altogether due to data quality concerns (as advocated by Southern and supported by us) or whether it should include APH in all the relevant water models (as proposed by South East). This framework has the confidence of stakeholders and will result in more statistically robust and intuitive models.

143. If the CMA does decide to retain its LASSO approach then it must:

- **reconsider the use of the UQ efficiency challenge**. We do not think this is supported by the quality of the models and its counter-intuitive coefficients. Instead a **median level of challenge is more appropriate**. This is in line with the PR14 approach where new untested models were introduced and in line with the approach on many enhancement models at PR24.
- **change its approach to energy costs** – as set out in section 2.3.4 the current approach exaggerates the impact of energy prices on base expenditure which results in an unrealistic cost reduction when extrapolated into AMP8 where prices are predicted to fall. **We strongly suggest that the Ofwat approach is used if it cannot be addressed within the modelling.**

144. Whichever approach the CMA adopts it **must ensure there is a comprehensive consideration of RPEs**. As outlined in Section 2.3 the CMA needs to ensure that:

- RPEs are applied to all relevant categories where they exist (Sections 2.3.1 and 2.3.2);
- the forecasts for real wages uses OBR data rather than simple extrapolations of historical data (section 2.3.3); and
- the regional wages adjustment/variables (see Section 2.3.5) should use a better mix of wage categories (as proposed by Southern) rather than solely being based on construction and it should be reflected that some wages (~20%) should be set more on a national basis as companies have freedom where to locate these staff (also as suggested by Southern and

[106] Weeks Report, p. 14 NWL-PD-REP-001.

as used by Ofgem in its price controls).

2.4.2 CMA must take necessary time to consult further on these issues

145. Given the importance of the base cost modes, the scale of change proposed by the CMA, and the issues we have identified with the CMA's approach there needs to be further meaningful engagement on the topic before the CMA can issue its Final Determination. This is necessary in order to ensure a fair process and to make sure that the resulting decision is robust. We consider that at a minimum this should include working paper(s) to document the evolution of the CMA's position and enable scrutiny and challenge. This should be supplemented by technical working group sessions with the CMA staff team and representatives of the Parties to facilitate meaningful discussion. Any changes from the PD position (or indeed a view that the PD approach should be retained) should be subject to further consultation.

146. We think there is also merit in holding more formal discussions/hearings involving the Panel on certain components of the approach. For example, the PD raises important issues of principal which to date have not been subject to any scrutiny:

- whether it is appropriate/feasible for an algorithm to replace regulatory judgement on model selection;
- whether it is important for the modelling results to be in line with engineering and economics intuition; and
- what is the appropriate the role of diagnostic testing on models?

147. The answers to these questions will have a large bearing on the appropriateness of the technique adopted and need to explored by the panel before reaching its final decision. We are keen to work with and support the CMA in reaching its final decision in this area to ensure that it provides the right approach that meets the needs of all stakeholders.

3 BASE COSTS – COST ADJUSTMENTS

3.1 WATER MAINS REPLACEMENT BASE ALLOWANCE

148. The CMA's PD concludes that base buys a water mains renewal rate of 0.3% a year in line with Ofwat's FD24. We believe that the CMA's provisional conclusion is unjustified and not consistent with the evidence. In particular:

- the CMA's assertion that the low mains renewal rates across the industry in AMP7 is driven by temporary factors is not supported by evidence;
- the CMA's reliance on industry-wide mains renewal data over the full modelling period is inconsistent with its approach to the calculation of base cost allowances (through the UQ challenge) and the setting of PCLs for common PCs, and there is no justification for this inconsistency; and
- the CMA takes no account of the risks to customers and the environment from requiring us to increase mains renewal activity to 0.3% from its current levels with no additional funding.

149. In this section, we provide a detailed response to the CMA's stated rationale for its provisional conclusion by reference to:

- the conceptual approach to determining 'what base buys' (see Section 3.1.1);
- the relevant time period to use in the calculation (see Section 3.1.2);
- the consequences of the CMA's provisional decision (see Section 3.1.3); and
- what we are asking of the CMA for its FD (see Section 3.1.4).

3.1.1 The approach to determining 'what base buys'

150. We agree in principle with the CMA's conceptual framework for 'what base buys', which is the "level of activity that base allowances can reasonably be expected to fund for an efficient company over the PR24 period".[107] We welcome the CMA's recognition that companies "have discretion over how they spend their capital maintenance budgets, and […] will take account of forward-looking conditions when deciding how to allocate their AMP8 allowances" and that "what base has funded historically may not be exactly the same as what it may reasonably be expected to fund over AMP8".[108] Furthermore, we agree with the CMA that "what base buys could in principle vary across firms depending on their characteristics and their operating environment".[109]

151. We also acknowledge the practical challenges when estimating 'what base buys' in a way that might capture company-specific factors, which means that in some circumstances, and where

[107] PD, para. 4.317.
[108] PD, para. 4.318.
[109] PD, para. 4.319.

consistent data across the sector are available, it may be reasonable to estimate an industry-wide figure.[110] However, the lack of consistent sector-wide data should not necessarily preclude the use of company-specific information, especially when efficient activity levels could be heavily influenced by company-specific characteristics (e.g. their asset base or operating environment).

152. The PD refers to two methods that NWL and other Disputing Companies have put forward to estimate what base buys: a pre-modelling approach and a post-modelling approach. The CMA has used the post-modelling approach, which involves estimating what base buys using historical levels of activity across all companies. In applying this approach, the CMA considered:

- which time period to use; and
- which statistic to use.

153. We do not express a view on the CMA's proposed statistic. However, we disagree with the CMA's provisional view on which time period to use.

3.1.2 The time period to use

154. The CMA provisionally concludes that: a) it would not be reasonable to rely solely on renewals data for the last five years as NWL and other DCs had requested; b) there is no convincing reason for entirely excluding data from years in the modelling period that fall within AMP5 (2011/12 to 2013/14); and therefore c) it is appropriate to use data from the full historical modelling period to estimate what base buys. We respond to these points below.

3.1.2.1 There is no basis to expect reversion to a long-term average renewal rate

155. The CMA notes that companies will take account of forward-looking conditions when deciding how to allocate their AMP8 allowances, and that it "must therefore approximate what base buys using the observed decisions of companies *in the recent past*".[111] We agree. An efficient company's expenditure decisions are driven by multiple factors including statutory and regulatory requirements, performance commitments and targets, environmental and operating conditions. Unless there are good reasons to believe that these factors might revert to a stable long-term average, decisions made in the most recent period (i.e. AMP7) are likely to be better predictors of decisions to be made in AMP8 than decisions made in the relatively distant past.

156. The CMA notes that there has been a significant decline in average mains renewal rates over the full period covered by Ofwat's base cost models but has not reached "a definitive interpretation of the low renewal rates of AMP7. This could be an efficient response to exceptional circumstances, or it could be the effect of (some) companies taking advantage of

[110] PD, para. 4.318.
[111] PD para 4.318

the outcomes-based framework".[112]

157. We accept that there may not be a single industry-wide explanation for the declining trend in mains renewals. However, what we have seen is that companies across the sector, acting independently over multiple AMPs, have decided to increasingly prioritise other capital maintenance activity over mains renewals. There is simply no evidence that these decisions have been exclusively driven by temporary or cyclical factors. Ofwat's own estimates suggest that just 2% of the industry-wide base expenditure over AMP7 can be attributed to "unexpected energy price increases" arising from exceptional events, and that the industry-level overspend would reduce only marginally from 14% to 12% once this is accounted for.[113]

158. The available evidence suggests that the low average renewal rate in AMP7 is better seen as the continuation of a longer-term trend, as shown by the CMA's figure 4.9, than as a temporary blip that might last for one AMP. The CMA's own analysis shows that industry average renewal rates came down from 0.47% in AMP5, to 0.27% in AMP6 and 0.13% in AMP7.[114]

3.1.2.2 Inconsistency between assumptions used for setting allowances and performance expectations

159. The CMA has rightly recognised that there is an important link between allowances for base costs and the levels of performance that can reasonably be expected from companies. For example, in relation to the PCL for water supply interruptions, the CMA said:

> Allowances for base costs essentially fund companies for providing a level of performance reflective of the industry average in previous years. If a company provides a level of performance above the industry average, it is likely to incur higher costs that are not directly covered by its base allowances, all else equal. If the PCLs are set to remove any scope for ODI rewards for companies that perform better than the industry average, then by design these companies may not recover their costs, and we do not consider that such an approach is likely to be in the long-term interests of customers.[115]

160. In setting PCLs for water supply interruptions, the CMA's PD draws on industry performance over the four-year period from 2020/21 to 2023/24. The CMA said: "we consider the median of the average levels of performance individual companies have actually achieved in recent years to provide a more appropriate reference point"[116] and "setting a 2024/25 baseline level equal to the median of companies' average performance in 2020-24 anchors the setting of water supply interruption PCLs in levels of performance that have been achievable over a number of recent years, and applies an approach that is consistent with that used by Ofwat for other common

[112] PD, para. 4.333. It is not clear what the CMA means by "taking advantage of the outcomes-based framework" in this context. Ofwat's outcomes-based framework since PR14 has focused on driving companies to focus on improving outcomes through PCs and financial incentives. The CMA's PD does not change this for AMP8, so we would expect any impact of the outcomes framework to persist into AMP8.
[113] Ofwat response to SoCs, Expenditure allowances – addressing asset health, Para 3.18
[114] PD, Figure 4.9.
[115] PD, para. 6.227.
[116] PD, para 6.224

PCLs".[117] Notably, the setting of the PCLs takes no account of industry performance in the period before 2020/21.

161. In this context, it is a serious matter of inconsistent decision-making for the CMA to adopt the positions that: (a) common PCLs across a range of performance commitments should be set exclusively using data on industry-wide performance over the last four years; but (b) the level of mains renewals that base would buy in AMP8 should be set using industry-wide renewal rates over the period 2011/12 to 2023/24.

162. In our SoC we emphasised the need for consistency between the time period used for the UQ adjustment and the time period used for estimating what base buys on mains renewal. The CMA's calculation of UQ efficiency adjustments uses data from the last five years, which has the effect of rebasing cost allowances for AMP8 so that these are more in line with expenditure over the last five years than with expenditure over the full historical data period. The PD does not provide an explanation for the inconsistency in the CMA's position.

163. On the question of whether it is reasonable to rely "solely" on mains renewal data from the most recent 5 years or to entirely exclude data from AMP5, it is our view that as long as other, related aspects of the regulatory framework rely solely on data from the most recent period in setting expectations for AMP8 (e.g. in setting PCLs and the UQ challenge for base costs) it is also appropriate to rely on data from the same periods in setting expectations for what base buys in terms of mains renewals.

164. Analysis for the Disputing Companies by Economic Insight suggests that the impact of this inconsistency error could be £70.8m for NWL.[118]

3.1.3 Consequences of the CMA's PD

165. Following FD24 our asset investment teams undertook a line-by-line review of our capital expenditure programme to identify investment priorities given the base cost allowances that we were set for AMP8. Following this review, our investment teams made their recommendations based on a hierarchical ranking that takes account of legal/regulatory compliance requirements, asset and performance risk, incentive performance and broader operational requirements. The final base capital plan was established following a series of several days of working sessions involving all operational Directors across the business with support from regulation and finance.

166. While our preferred approach is to proactively identify investment priorities, the absence of sufficient capital maintenance funds means in practise we often cannot undertake sufficient

[117] PD, para 6.228
[118] EI Time Inconsistency Error, NWL-PD-REP-003, Table 3. This estimate is higher than the adjustment of £62m that we have requested in our SoC. The higher estimate arises from EI's use of the CMA's preferred statistic for "what base buys" rather than a simple average, when applied to industry-wide mains renewals over the last five years of data. The CMA's preferred statistic applied over the last five years implies that base buys a renewal rate of 0.13%.

proactive activity. For some asset classes, the efficient course of action in any event is to allow assets to fail and then reactively fix them. When this happens, we use 'reactive maintenance' expenditure budgets. These budgets therefore can be seen as a 'last resort' option. Our reactive maintenance spend has been consistently increasing over time.[119] In AMP8, our investment teams anticipate a further increase in reactive maintenance expenditure driven by the same underfunding issue.

167. All other capital maintenance expenditure projects, including smaller maintenance sub-programmes and discrete larger named schemes, are categorised into three priority groupings.

- **Priority 1 (legal / regulatory) projects** are those that are primarily driven by compliance with a legal or regulatory obligation. Examples include Water Industry National Environment Programme (**WINEP**) projects, Reservoir Act compliance projects, schemes under Drinking Water Inspectorate (**DWI**) notices and Health and Safety work (**H&S**) such as that identified through Dangerous Substances and Explosive Atmospheres Regulations (**DSEAR**) surveys.
- **Priority 2 (compliance) projects** are those driven by significant risks that could escalate into a legal/regulatory compliance issue and potentially ODI penalties. Examples include those with a drinking water quality (Compliance Risk Index (**CRI**)) or those which relate to an EA permit condition (e.g. discharge compliance driver projects that relate to permits we hold on our treatment works with the EA).
- **Priority 3 (performance) projects** are not primarily driven by legal or regulatory obligations, but instead by performance and/or operational risk. These projects primarily target risk reduction in customer service, water quality, environmental performance, cost escalation, worsening ODI performance and resulting financial penalties. Examples include strategic mains remedial work, management of unplanned outages at WTWs or replacement boreholes at critical sites.

168. Each project was costed through our internal costing processes which uses cost curves that were independently benchmarked against a set of comparator companies to ensure that our cost estimates are efficient.[120]

169. We consider that priority 1 and 2 are 'must do' projects, as they are intended to address risks of non-compliance with legal, regulatory and H&S requirements, with high risk of detrimental impacts on customers, our staff and the environment if not delivered. Our 'must do' plan includes provision for reactive maintenance work and a continuation of smaller 'sub-programmes' that cover low cost/low complexity interventions across our asset base based on a combination of the run rate seen in AMP7 and residual risk across AMP8. In addition to these 'must do'

[119] SoC Section 4.2.1.3 and Figure 17.
[120] BP24 Appendix A3 Costs SOC018 Section 4.7 for details of the external benchmarking exercise carried out by Mott McDonald.

schemes, our planning teams recommended some Priority 3 projects in AMP8. These projects were identified as 'business-critical' and fundamental to operations for AMP8.

170. [redacted]

171. Focusing on the water service, we have categorised our AMP8 water mains renewal activity funded from base as Priority 1 (legal/regulatory compliance) and therefore 'must do'. For the capital programme review, we had assumed that we would deliver a mains renewal rate of 0.15% from base allowances to meet our AMP8 PCD obligations, in line with our view of 'what base buys' for AMP8 as set out in our SoC.[121] A renewal rate of 0.15% is itself higher than our renewal rates in three of the past 5 years, and is also higher than what we might have expected to deliver in AMP8 from base allowances based on a pure risk/performance-based prioritisation. This

[121] We had already started ramping up our mains renewal activity by year 5 of AMP7 in anticipation of more demanding regulatory expectations for mains renewals in AMP8. Our expectation was that any renewals above 0.15% would be funded through an uplift to base allowances (either as an enhancement or a base cost adjustment).

means that we have already had to divert some funds from other parts of the capital maintenance programme to deliver the mains renewal PCD, even if the CMA were to agree with our view that base buys a renewal rate of 0.15%.

172. [redacted]

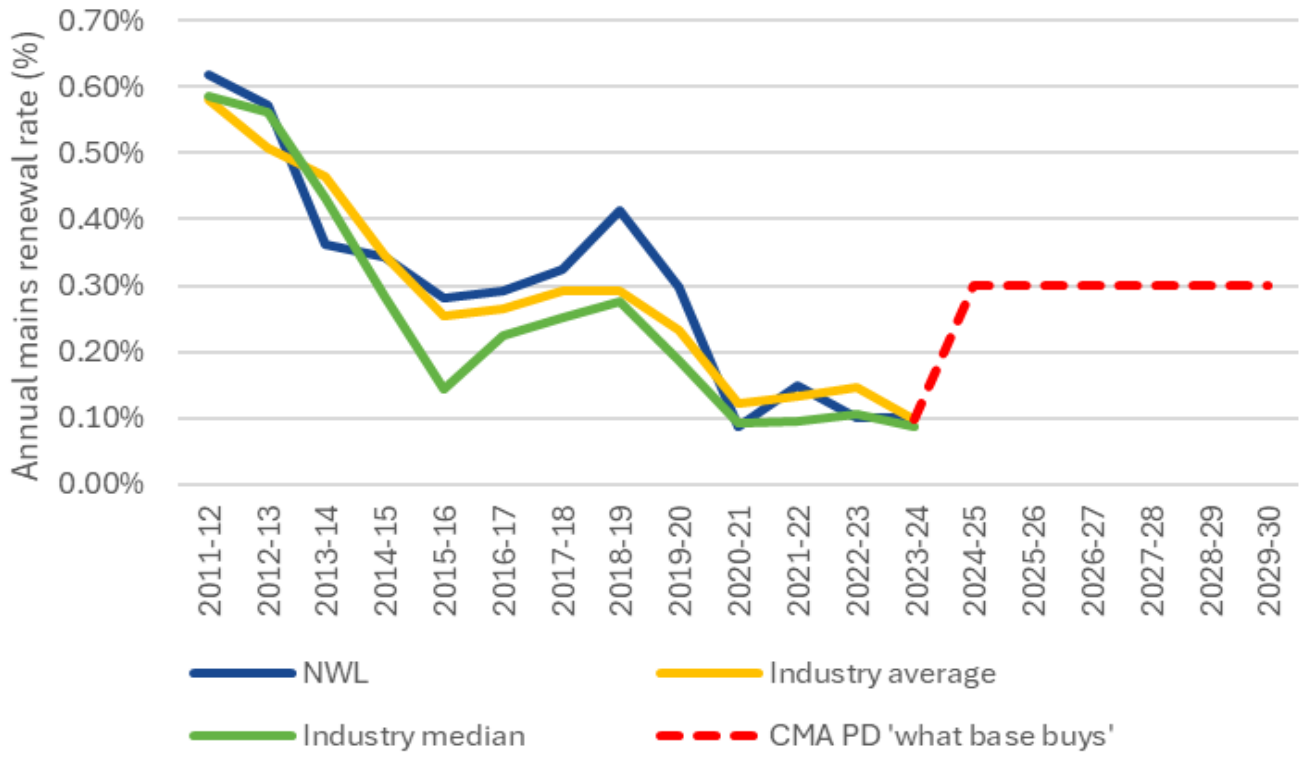
[redacted]

173. We note that over the past 25 years we have overspent our water capital maintenance

allowances by £63m[122] including by £319m in the last AMP.[123] We are conscious that these decisions mean that risks for customers, the environment and our performance levels are higher than otherwise. As a consequence of these decisions, we are already carrying increased risk of performance deterioration and higher ODI penalties across a number of areas of performance commitments, including on leakage, CRI and Discharge Compliance. [redacted]

174. If the CMA maintain its PD position that base buys a mains renewal rate of 0.3% rather than 0.15%, we would face the additional cost of delivering the difference (i.e. 0.30% less 0.15%) as set out in Figure 18 below, which could be £62m based on the unit costs used in Ofwat's FDs.[125]

FIGURE 18 HISTORICAL TRENDS IN MAINS RENEWALS



Source: NWL analysis of Ofwat's FD mains renewal cost adjustment model, SOC315. NWL PD Response Databook

175. We would need to fund this through a combination of: a) spending as necessary including

[122] SoC, Figure 16.
[123] As per water-company-performance-report-2024-25, Base Modelled Data, Water 20-25, £270m in 17-18p, £319m in 22/23p
[124] [redacted].
[125] As set out in Section 3.1.2, analysis by Economic Insight suggests that the impact could be as high as £70.8m if the CMA's preferred statistic for what base buys is used and applied over the last 5 years.

potentially overspending against the allowances; and/or b) further cuts to business-critical schemes and some 'must do' schemes.

176. We do not believe that further increases in the overspends are tenable. Any predicted AMP8 overspend needs to be seen in the context of our total AMP7 overspend of £372m.[126] Persistent overspends of this magnitude over multiple AMPs (even if partly shared with customers) raises serious questions on financeability and our long-term cost of capital, and further casts doubt on Ofwat's claim that its base allowances are adequate to fund long-term capital maintenance expenditure requirements. It also calls into question the CMA's analysis of the balance of risk in its PD, as part of which the CMA said: "We have assessed the companies' concerns and requests with respect to base cost allowances, and having done so, it would not be coherent to assume that the resulting allowances still understate the expected costs of an efficient company".[127]

177. On the other hand, cutting back on capital maintenance to accommodate the unfunded increase in mains renewals will have serious repercussions for regulatory and compliance risk, as well as risks to asset health and service quality for customers. Following publication of the CMA's PD, our investment planning team has considered what options might be available to accommodate the increase in mains renewals without increasing the size of the predicted overspend:

[126] WCPR25 Data, All Wholesale totex plus Retail overspends, £315m in 17/18 prices, £372m in 22/23 prices
[127] PD, para 8.23.
[128]

178. Clearly none of these options are desirable. We would not opt for a course of action that exposes our customers to an unacceptable compliance or public health risk. However, the limited list of options available, and the negative consequences they have attached, demonstrates the impossible challenge facing the company to manage the acute situation that has resulted from multiple-AMPs of underfunding.

179. If our choices on how to spend our base allowance were unconstrained we would not prioritise mains renewals over the activities identified in the options above. Any decision to cut back on these essential activities to fund an increase in mains renewals to 0.3% will inevitably lead to greater risk of regulatory and statutory non-compliance, higher ODI penalties, compromised service quality for customers, and worse environmental outcomes.[129] However, the PCD obligation means that we would lose the additional funding altogether if we do not spend it on mains renewals.[130]

180. It is not clear that the CMA has properly considered the implications of its PD, the impossible situation it places NWL and the other Disputing Companies in and the likely impact on customers and environment.

3.1.4 What we are asking from the CMA

181. We ask that the CMA looks again at the question of what base buys in relation to water mains renewals before its final determinations. We strongly believe that base buys no more than an annual renewal rate 0.15% over AMP8, and respectfully invite the CMA to revise its estimates, taking account of the impacts of assuming a higher figure on our ability to deliver critical capital maintenance activity within existing base allowances, and the consequent risks for asset risk, customer service and the environment.

3.2 GENERAL ASSET HEALTH ISSUES AND OUR TARGETED INVESTMENT CASE

182. As we have previously said, this redetermination could not have tackled the inherent issues with the current regulatory framework that have led to persistent underfunding of asset health maintenance activity over a long period of time. As such, we do not disagree with the CMA's

[129] We acknowledge that we would expect some ODI benefit from the additional 0.15% of mains renewal, in reality this will be very small given the scale of the impact this has on the overall network.
[130] Incidentally, we do not rule this out as a possibility given the pressures elsewhere.

decision not to address the broader issues relating to this "highly important area" here.[131] Since our SoC, the IWC, NAO and Ofwat have all identified the need to address these issues.

183. However, given the scale of risk exposure for customers and the environment that has built up over time as a consequence of this underfunding, we put forward a targeted and risk-based set of low regret interventions that must be undertaken in AMP8.[132] We demonstrated in our SoC why it is important that the CMA considers and funds our investment case as part of its redetermination to help bridge the funding gap created by failures of the broader regulatory framework until those failures can be addressed on a more enduring basis.

184. We are deeply disappointed with the CMA's provisional conclusion on our targeted asset health investment case. We do not see how the CMA's statutory duties are going to be discharged in relation to our asset health investment case. In particular:

- the CMA is wrong that the need for our investment case in AMP 8 has not been established (Section 3.2.2);
- there is compelling evidence to support this critical asset health investment in AMP8 (see Section 3.2.3); and
- the CMA has relied too much on the "asset health roadmap" process established and managed by Ofwat (Section 3.2.4).

185. These shortcomings in the CMA's provisional determinations can, and must, be put right ahead of its FDs. Our suggestions for how this could be addressed are set out in Section 3.2.5.

3.2.1 Approach to the assessment of our asset health investment case in the context of the statutory duties

186. We welcome the CMA's assessment that "asset reliability is of critical importance for customers and the environment" and that "the consequences of asset failure can be substantial (e.g. it can lead to service failures such as interruptions to supply, sewer flooding or pollution incidents").[133]

187. However, the CMA has not taken action to meet this critical need in the PD – instead concluding that "industry-wide policy work, including through the process established by Ofwat, is therefore in our provisional view the most appropriate route to address the broader issues on asset health in the water sector".[134]

188. One of the reasons for this is the CMA's view that it would not be feasible to collect sector-wide robust and comparable asset health data, or to develop such a set of common measures or

[131] PD, paras. 4.193-4.194.
[132] The approach we took to the development of the investment case, and how it was assessed by Ofwat, is set out in Annex 1.
[133] PD para 4.191
[134] PD para 4.193

framework during the redetermination timescale. [135] Both the IWC and Ofwat itself now acknowledge that Ofwat was not proactive enough in considering alternative methods of cost assessment or collecting necessary comparative information across the sector to enable it to properly address the issue in the PR24 process.[136] We accept that this presents a substantial challenge for the CMA.

189. The existence of such challenges does not, however, absolve the CMA of its statutory duties with respect to facilitating the activity necessary to support asset health. Nor should it prevent the funding of properly evidenced investment cases, such as that which we have put forward for redetermination. As we said in our SoC, the evidence base we put forward will not change with new comparative information. That will confirm that the sector is not sufficiently funded for capital maintenance in the round, and the same investments will still be required.

3.2.2 The CMA is wrong that our investment case does not fulfil the need criterion

190. The CMA provisionally concludes that our investment case does not fulfil the need criterion. We strongly disagree and set out our reasons below.

191. The CMA summarises our position that "the proposed investment is necessary due to an increasing need for maintenance spending on these assets … necessitated by the need to replace and refurbish ageing assets" and points to our deterioration modelling evidence that shows the assets were reaching the end of their life cycles and would need increased maintenance going forward.[137] However, the CMA concludes that "this is not compelling evidence that the claims fulfil the need criterion".[138]

192. In setting its base totex allowances, Ofwat may have intended its allowances to enable companies to maintain the long-term capability of assets while managing peaks and troughs in capital maintenance. However, it has not carried out any analysis to test if the level of base totex allowances has, in fact, been sufficient to do so – or if the PR24 totex allowances will be enough to do so in the next five years. By rejecting our investment case by reference to evidence on our specific situation, the CMA has not engaged with the primary evidence presented in support of our case – and indeed the evidence presented by the other Disputing Companies – that Ofwat's base allowances have not been sufficient to enable companies to maintain the long-term capability of assets while managing peaks and troughs in capital maintenance over time. Like Ofwat, the CMA has not carried out any analysis to test if this is really the case.

193. This is reflected in the confirmation in the IWC Final Report that changes to the regulatory framework are needed to address concerns that "water companies may have faced successive

[135] PD, para 4.233.
[136] IWC Final Report para 877; and Ofwat response to company SoCs paras 1.12 and 1.13.
[137] PD, para. 4.277.
[138] PD, Para. 4.278-4.279.

periods in which allowances for asset maintenance and renewal were too low".[139] The IWC also concluded that "government and regulator pressure on bills played an important role in what can now been seen as underinvestment [between 2009 and 2024]".[140] Ofwat's base cost modelling has not considered what it should cost an efficient company to maintain the long-term capability of its assets, and our assessment shows that capital maintenance allowances and expenditure have not kept up with what is needed.[141]

194. As we have been very clear, this investment case is not based on the premise that funding is required to manage a short-term peak, specific to the status of our assets. Nor is it relevant to raise the concern of over-recovery of costs overall by virtue of CACs granted at the high point of investment cycles – that is demonstrably not the case here.

195. We note that the CMA references Ofwat's incorrect claim that we "had historically underspent its total capital expenditure allowance with a cumulative underspend of £1.1 billion"[142] but does not refer to our challenge to that claim.[143] Ofwat has made several errors in its calculations, and when these are corrected, our capex is almost exactly in line with allowances. Moreover, the CMA does not engage with the wider points and analysis we provided on this that showed that considering capital maintenance expenditure (which excludes for example enhancement capex, which had a specific purpose and requirements) we had spent our allowances in full.[144] This is not referenced in the PD – we consider it should be evaluated for balance.

196. We have shown that there is no underspend in the past, but we know that the CMA could also be concerned that these requirements will reduce in the future (that is, an increase in expenditure in AMP8 might allow reduction in expenditure in AMP9 and beyond if there are "troughs" in expenditure requirements). There is no reason or analysis to believe this should be the case. For civil assets at WTWs and STWs our SoC showed that long-term capital maintenance requirements would continue to grow and accelerate to 2050.[145] Our long-term delivery strategy shows that we expect capital maintenance requirements to increase further over time[146]. It is therefore not reasonable to expect future underspend to offset AMP8 overspend on capital maintenance.

3.2.3 There is compelling evidence to support this critical asset health investment in AMP8

197. The CMA acknowledges that 45% of the requested funding in our investment case is not within the scope of the Roadmap. As confirmed in our post-hearing submission the current scope of

[139] IWC Final Report, Summary para 103, p27.
[140] IWC Final Report, p.204.
[141] SoC section 4.2.1.2
[142] PD para. 4.271.
[143] NWL Reply to Ofwat's Response, para. 13.
[144] NWL SOC section 4.2.1.2
[145] SOC, Figure 26
[146] nesltds.pdf pp.91-92

the Roadmap could only accounts for 31% of the assets by volume.[147] However, the CMA concludes that the evidence we presented in support of the impact of delaying the investment until PR29 is sensitive to the underlying assumptions.[148] As such, the CMA does not find that we have presented "compelling evidence that there are immediate critical asset health needs related to these assets during PR24 ahead of PR29".[149] This conclusion is based on evidence from Ofwat which is incorrect - we ask the CMA to consider this again.

3.2.3.1 The evidence on deterioration rates does not support the CMA's conclusion

198. Our evidence cannot be disregarded on the premise that our analysis "is sensitive to underlying assumptions on concrete corrosion rates" and that "using alternative plausible assumptions would shift the estimate of time to economically repair the assets from 10 years to 18-30 years".[150] As we set out below, the evidence provided by Ofwat[151] on this was provided in response to an illustrative example only, and is not deterministic of the overall position.

199. Many of our concrete and steel structures operate in environments far more aggressive than the generic C3 or C4 examples cited by Ofwat. Water and wastewater treatment works routinely experience conditions at the upper end of the classification scale C4/5. Many assets operate in constantly damp or saturated environments, with high humidity, splash zones, and limited ventilation. Final settlement tanks, inlet works, sludge treatment, and chemical dosing area are regularly exposed to a combination of moisture, condensation and chemicals like hydrogen sulphide and ammonia. These exposure conditions match the examples listed under C5 – very high in ISO 12944-2 and justify adopting that classification when assessing deterioration.

200. Our investment case is not solely based on this type of modelling. Instead, it is based on civil engineer-led individual site inspection surveys which identified assets that are in condition grade 4 and concluded that they need to be fixed during AMP8 to manage failure risk associated with those assets. It is wrong to simply overwrite these independent engineering conclusions, based on inspections of the assets in question, with a change in modelling parameters to "alternative plausible assumptions".[152]

3.2.3.2 These risks are not theoretical

201. Once a concrete asset enters the "propagation phase", there is a limited time window available before the asset becomes so degraded that failure becomes inevitable. Without intervention, the risk of failure will increase year-on year, exposing customers and the environment to increased risk of negative consequences.

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[147] NWL Post-Hearing Submission, para. 3.
[148] PD para. 4.288-4.299.
[149] PD, para. 4.276
[150] PD, para. 4.289.
[151] Ofwat Response to Company SoCs – Expenditure Allowances – CACs, Para 5.18.
[152] CMA PD, para 4.289

202. These risks are not merely theoretical. Since we submitted our SoC to the CMA, we have experienced the collapse of a structure above sludge holding tank no.7 at our Bran Sands STW due to corroded steel beams (see Figure 19).[153] This is one of the sites assessed as being in condition grade 4B following detailed site surveys, and identified for intervention as part of our investment case.[154] This has triggered the need for reactive maintenance and emergency work at the site, just as we had previously flagged to the CMA. This failure demonstrates the validity of the assumptions used in our deterioration modelling, which identified a clear risk of asset failure in the near-term unless action is taken in AMP8.

FIGURE 19: COLLAPSE OF GLASS REINFORCED PLASTIC (GRP) STRUCTURE AT BRAN SANDS STW

Source: NWL

203. The CMA's PD expresses no view on whether the risk and consequence of asset failures of this type can and should be tolerated until funding is provided. This lack of consideration of the risks and consequences of regulatory action (or inaction) has been a feature of Ofwat's regulatory framework, and it is disappointing to see it repeated by the CMA.

204. Serious asset failures that occur while we wait for PR29 are likely to lead to adverse impacts on our compliance with statutory and regulatory obligations, on our performance against ODI targets, and lead to additional maintenance costs. Importantly, they pose a risk to customers,

[153] NWL Health & Safety Notice No. 266: Collapse of GRP Structure, September 2025 (**NWL H&S Notice**) (**NWL-PD-REP-004**).
[154] See Aqua PCD Asset Health Civil Structures Scheme List SOC010, 'PCD- Wastewater' tab, row 75.

the environment and the safety of our colleagues.

3.2.3.3 The CMA has not taken account of the consequences for our capital maintenance plan

205. As set out in Section 3.1.3 above, following Ofwat's final determinations for PR24, we undertook a line-by-line review of our capital expenditure programme to identify our investment priorities in light of the FD24 base cost allowances. This resulted in a recommended list of 'must do' projects that would need to be delivered in AMP8, based on a hierarchical ranking that takes account of legal/regulatory compliance requirements, asset and performance risk, incentive performance and broader operational requirements. Reactive maintenance expenditure (of the type that will now be required at our Bran Sands STW) takes priority over all capital maintenance expenditure.

206. [redacted] These estimates do not include the planned investments in our targeted investment case for civil structures at treatment works and service reservoirs. [redacted][155]

207. The total cost in AMP8 of our planned asset health interventions on civil structures is £179.5m, comprising £104m in the water service and £75.6m in the wastewater service.[156] If the CMA does not fund our investment case, we will need to make some difficult choices about how we manage the risks arising from these structures until (and if) these are funded, either as part of Ofwat's Roadmap or at PR29 (or later). We are mindful that any asset failures that occur in the meantime would require us to incur additional emergency and reactive maintenance costs.

208. Based on our risk modelling, we might face up to an additional £167.5m of reactive maintenance costs in AMP8 if we did not address these issues proactively.[157] This figure might be lower in practice if we were to receive some funding through Ofwat's Roadmap (which currently only covers 55% of the value of our investment case), although this will mean a delay of at least two years. We might also be able to avoid some of the reactive costs if we undertake further unfunded proactive maintenance on these assets. We continue to believe that proactive maintenance of these assets in line with our asset health investment case remains the most efficient long-term solution and the best approach for customers.

209. [redacted]

[155] This does not take account of the impact of the CMA's PD position on what base buys for mains renewals (see Section 3.1). [redacted] (based on Ofwat's unit costs) unless the CMA changes its PD position or we make further cuts to our planned interventions.
[156] SoC Appendix 2, Figure 1
[157] This is the mid-point of our estimated range for reactive maintenance and emergency costs of between £94m and £241m in AMP8

[redacted] We are also hindered in our planning by the considerable uncertainty around which sites will eventually receive funding either through the Roadmap or at PR29, and how much funding we would receive through those routes.

210. However, reactive maintenance expenditure in the event of asset failure is unavoidable. If the CMA were to maintain its provisional position on our asset health investment case, we will need make provision for a substantial increase in the reactive maintenance budget (which could be as much as £167.5m over AMP8). This will require a further review of our capital maintenance programme to consider which of the planned 'must do' or business-critical schemes could potentially be cancelled or deferred to make additional funding available.

211. Cutting back on our current capital maintenance plan to accommodate the unfunded delivery of a mix of proactive and reactive work on civil structures will likely lead to a higher risk of regulatory and statutory non-compliance, higher ODI penalties, compromised service quality for customers, and worse environmental outcomes across our asset base. This is demonstrably not in the interests of customers or the environment.

3.2.4 The CMA has relied on Ofwat's Roadmap process

212. As we set out above, there is no reason why these decisions should be deferred to Ofwat's "asset health roadmap" process. A sector-wide assessment is not required to identify that asset health investment beyond the level of capital maintenance in base totex allowances is needed. Ofwat, the NAO, the IWC and others have already identified that this is the case - it simply remains to determine how much is already funded. The Roadmap process does not prevent the CMA from allowing for *some* asset health investments to be started in 2026/27 (rather than delaying to 2027/28 under the Roadmap). Making some allowance would be a fair and proportionate response given that there is clearly a gap between historical allowances and future investment needs.

213. However, the CMA has relied on the Roadmap to facilitate additional allowances where it does not have sufficient evidence yet to conclude that the CAC criteria are met (that is, where sector-wide comparative data and frameworks are not available). In doing this, the CMA states it has considered two further questions: a) whether the assets identified in the claims are covered by Ofwat's Roadmap process; and if not, b) whether there are "immediate critical investment needs that might need funding before PR29".[158]

214. Taking the first element of that test, we consider that the CMA has placed too much reliance on Ofwat's Roadmap process.[159] Although Ofwat is making progress with the Roadmap, there is too much uncertainty attached to this process for it to be considered a reliable alternative to

[158] PD, para.4.249.
[159] We note that the CMA has also relied, in part, on the existence of Ofwat's Roadmap process to support its provisional decisions to de-prioritise the general concerns around asset health raised by Disputing Companies.

proper consideration of the investment case in this redetermination. The CMA has not properly considered whether the Roadmap process is capable of addressing the problems identified in our SoC or not. The CMA should consider if there are any immediate remedies that should be made to mitigate these risks in its determination, either through examining the issues directly here or by securing commitments from Ofwat to mitigate these risks. We describe these risks in the following sections.

3.2.4.1 The scope of the Roadmap process is too narrow

215. The limited scope of the Roadmap means that only 50 asset classes (out of a potential 250) will be covered. For us, that means that only 31% of the asset types we have identified as requiring interventions in AMP8 in our investment case will be eligible for consideration.[160]

216. The CMA's PD supports its reliance on the Roadmap by noting: "Ofwat has initiated a process to collect more information on asset health and further modify its approach to setting allowances"; and "Since the publication of our Approach document, Ofwat has made further progress on collecting asset data through its asset roadmap process".[161]

217. These observations do not reflect Ofwat's narrow focus on the collection of industry-wide data on asset condition and historical volumes of replacement activity. The reality is that a substantial portion of our investment case will not be eligible for consideration under the Roadmap process, and so it cannot be reasonable to defer these elements of the case. These include, for example, raw water balancing reservoirs, water treatment – clarifiers and sludge blankets. These elements would not be addressed by the Roadmap process because there would still be no sector-wide comparative data with which to calculate implicit allowances from base expenditure.

218. The CMA could mitigate this risk either by:

- assessing these elements by reference to the evidence presented in our investment case, acknowledging that the absence of sector-wide comparative data (which will not be available in the timeframe of the Roadmap) is not a barrier to doing so; or
- requiring Ofwat to broaden its focus for the Roadmap, such that these assets can be considered, regardless of whether or not sector-wide data is available.

219. In both scenarios it must be accepted that a lack of comparative data is not a sufficient or legitimate reason to conclude that the case cannot be considered, or that funding is not required – the absence of comparative data does not change the underlying risks.

3.2.4.2 The assessment criteria under the Roadmap are still uncertain

220. In addition to consulting on its "cost change process" Ofwat has now shared some details as

[160] NWL Post-Hearing submission para. 3; RFI06-NWL Section 1 and RFI06-NWL-001 Databook.
[161] PD, para. 4.232.

part of a sector workshop about its assessment process for submissions under the Roadmap in 2026 and 2027. Ofwat expects to publish its framework in December, alongside some estimates of "what base buys" for each asset type.

221. Until this framework is published and the licence modifications for the "cost change process" are made, there is insufficient predictability and clarity about what the Roadmap will deliver in practice in-period. We expect that Ofwat will publish these details during the course of the CMA assessing this response. This will allow the CMA to reconsider if the design and scope of the process will enable Ofwat to carry out the assessment that the CMA envisages.

222. We note that under the proposed "cost change process", companies would be able to appeal the outcome to the CMA.[162] The CMA could consider how it might either:

- secure from Ofwat that there is a reasonable likelihood that it will make the type of assessment the CMA has envisaged when deferring consideration of our investment case to the Roadmap and that there is a reasonable chance that companies might succeed with their requests for fund. We note that Ofwat did not fund any companies for asset health (or other cost adjustment claims) at PR24 and was not previously able to make these decisions due to a lack of data. As such, this might require the CMA to issue directions with respect to how need could and should be assessed in this context, in particular confirming that the need for investment should not be exclusively dependent on establishing a sector-wide issue; and
- instruct Ofwat to collect the data that the CMA would need to assess any appeals in 2027 and beyond. We understand that the CMA does not have the sector-wide data it considers it needs to assess claims now. However, if Ofwat rejects cases under the Roadmap process on the same grounds and these are appealed to the CMA, we should not be in a position where we are forced to repeat this conversation. It is already an unacceptably poor outcome for asset health assessments to have been delayed for so long due to a lack of effort to collect comparative data over the last decade (as set out in the IWC); it would be even worse if this situation did not improve before 2030.

223. It is difficult to see how the CMA can rely on deferring decisions to the Roadmap process without being confident that this process will deliver the assessment that is needed. We are confident that Ofwat would welcome views from the CMA about how this assessment should be achieved.

3.2.5 What are we asking from the CMA?

224. We ask the CMA to reconsider its provisional decision to reject our asset health investment cases. As we describe in Sections 3.2.2 and 3.2.3, the rationale for the PD is flawed:

[162] Ofwat, Consultation on the PR24 cost change process and proposed licence modifications, July 2025, Section 2.3.3.

- Ofwat's base cost modelling has not assessed whether there is (and has been) sufficient funding for addressing long-term asset health or not and Ofwat's claim that we have not spent our historical expenditure allowances is factually incorrect. An assessment of the long-term need for capital maintenance expenditure, and correcting Ofwat's errors, does show that at least some investment is needed now; and
- Ofwat's claim that different modelling assumptions show that there is not an immediate need for investment is wrong – it is inconsistent with the engineering inspections of the assets. Evidence on the actual state of the assets should be afforded more weight than modelled assumptions.

225. We understand the CMA may still feel that some sector-wide data is required and that a delay of one year by deferring to Ofwat's Roadmap process is unlikely to cause significant harm. In that scenario, we ask the CMA to acknowledge the concerns we have raised regarding Ofwat's Roadmap process and issue directions to Ofwat about the scope and conduct of that Roadmap process, particularly focusing on:

- broadening the scope of assets that can be considered under the Roadmap, recognising that it should allow for proper consideration of individual companies' high priority asset health investments, even where these may be of lower priority more broadly across the industry;
- instruct Ofwat to commence the collection of the data that the CMA might need to assess any appeals in 2027 and beyond;
- establishing that the absence of sector-wide comparative data will not be a bar to putting an investment case forward, or having it funded; and
- issue directions with respect to how need could and should be assessed in this context, in particular confirming that the need for investment should not be exclusively dependent on establishing a sector-wide issue, recognising that there are legitimate reasons why asset health investment priorities may differ between companies.

226. We think Ofwat would welcome input from the CMA in this regard. We also consider it is important, procedurally, for the CMA to have full confidence that the alternative regulatory process on which it is placing significant reliance will be fit for purpose and will deliver the outcomes the CMA expects – i.e. that there is a reasonable chance that at least some companies will have an in-period adjustment for asset health that addresses these risks. In any case, it is within the scope of a price redetermination to set out clarity for all parties about how an uncertainty mechanism, such as this Roadmap process, might work, particularly as Ofwat's subsequent decisions under this uncertainty mechanism can themselves be appealed to the CMA.

227. To the extent there are assets that will not be within the Roadmap scope, for which there are no plans to collect sector-wide data, and the earliest these can be reconsidered will be PR29, the

CMA must acknowledge its obligation to consider the investment cases put to it as part of this redetermination, by reference to the evidence we have presented.

228. Finally, we ask the CMA to consider if any investment should be allowed in 2026/27 (that is, before the Ofwat Roadmap could first provide funding from April 2027). Although we understand that the CMA feels that it cannot determine precisely "what base buys" without sector-wide data, it should now be clear that there is at least some need for investment in asset health in AMP8 – it would be prudent to start addressing some of these risks now, if there is a reasonable expectation that Ofwat will determine that some funding is required under its Roadmap process. Ofwat could then adjust for this "early start" funding, if necessary.

3.3 NETWORK REINFORCEMENT

229. We welcome the adjustment that the CMA has made for network reinforcement allowances, including following Ofwat's helpful recognition that it would have funded these costs in PR24, if provided. However, the CMA has only allowed additional costs for Boreham Booster but not the other network reinforcement schemes required in AMP 8. The CMA has referenced the evidence provided for this particular scheme and indicated that the information provided by NWL for other schemes was too high level to support an additional allowance.

230. In this section we provide some additional information with respect to our AMP 8 requirements and highlight a few issues for consideration in the context of the CMA's FD:

- we think the CMA intended to suggest that the Boreham Booster scheme is the only scheme that is required beyond the allowance expected in previous AMPs (as estimated by WBB), rather than suggesting this is the only scheme that will be required in AMP8. We ask the CMA to correct this mistake, if this is the case (see Section 3.3.1);
- we provide a detailed breakdown of costs and further evidence of the underlying need for other network reinforcement schemes, to provide the same level of evidence as for Boreham Booster (see Section 3.3.2). We ask the CMA to consider this evidence too, as this had not previously been requested; and
- given the uncertainty of these costs and the fact that they are outside of companies control, we suggest a different approach to risk protection which we ask the CMA to consider (see Section 3.3.3).

3.3.1 Scope of AMP 8 network reinforcement activity

231. Regarding our request for the funding of network reinforcement activity[163] the CMA sets out its provisional view that "it is appropriate to only allow additional costs related to the Boreham Booster scheme. For this scheme, Northumbrian has provided: a detailed breakdown of costs;

[163] SoC Section 5.4.4.

a link to an underlying need identified in documents produced by the local planning authority; and linked it to measurable deliverables and changes in service levels. The information Northumbrian provided in relation to the need for other expenditure set out in its claim is much more high level".[164]

232. The CMA then applies its "what base buys" (**WBB**) value to this to calculate a £16.95m allowance under the sector-wide adjustment.[165] This suggests that the CMA forecasts that only Boreham Booster (and no other network reinforcement) will be required in AMP8. We think this might be a mistake, and that the CMA intended to suggest that Boreham Booster would be the only *additional* scheme required *beyond* the allowance expected in previous AMPs (as estimated by WBB). The wording of "appropriate to only allow additional costs" in para. 3.475 implies this is the intended approach.

233. If this is the case, then the allowance for NWL for the sector wide adjustment should be **£28.1m** (that is, the cost of Boreham Booster, £31.236m, above WBB, with an efficiency challenge of 10% applied). We ask that this be corrected in the FD.

3.3.2 Need and cost details for other network reinforcement schemes

234. With respect to the CMA's rationale for allowing the additional funding for the Boreham Booster scheme, we note that it was a focal point for our SoC as it is our largest and most developed scheme. However, this does not mean that it is the only scheme for which we have this evidence available.

235. In our SoC, we included our forecast of nine more schemes in Essex & Suffolk and 19 more schemes in the North East. For some of these schemes we have similar breakdowns of costs from our iMOD system[166] as we provided for the Boreham Booster scheme. However, these smaller schemes have higher levels of uncertainty which can lead to higher overheads (for estimating uncertainty and risk) in the iMOD calculation.

236. As such, for these schemes, rather than use the higher iMOD estimates, we have applied a method for cost estimates that is more similar to the approach we use for small works such as mains replacement. This uses four steps with increasing cost accuracy:

- an initial cost estimate made by our integrated delivery team using unit rates (for items such as new mains);
- an updated cost estimate following pre-project work to scope and assess the specific project (such as assessing issues on the likely route and understanding likely project risks);

[164] PD para. 4.475.
[165] PD para. 4.479.
[166] This is our database of historical costs for projects, which we use to estimate costs for future projects. The output from our iMOD system for the Boreham Booster scheme was used by the CMA in its PD.

- a contractor estimate from initial engagement for delivery; and
- live project updates from the project manager (stored in our project tracking system used for delivery). These are updated to include actuals and contracted costs as the project progresses.

237. In Figure 20 and Figure 21 below we explain how we have calculated the costs for each of the network reinforcement schemes in AMP8 (in some cases, these projects have already begun). As this shows we have used the original costs we forecast for these schemes as noted in our SoC, except where detailed costings have reduced the overall cost estimate. We do flag where we have alternative updated forecasts we have not used, such as the higher iMOD estimates.

238. We also indicate where the schemes listed in our SoC are no longer required so can be removed, as well as detailing new schemes that have become requirements post-SoC. Ofwat's FD24 PCD, if extended to other schemes as in the CMA PD, would mean that any unused network reinforcement costs allowed in price determinations would be returned to customers. There is no equivalent risk protection for new network reinforcement schemes, and these would be funded through cost sharing only. This is particularly relevant for network reinforcement because schemes are dependent on new developments that may not happen; or may not yet be known about. There is limited management control over these schemes. For example at 'Sleekburn' we had scheduled work in Blyth in Northumberland to provide water to a proposed Britishvolt gigafactory – this was rescheduled to meet a proposed replacement datacentre and the latest information means that we do not expect this to be required in AMP8 at all (see Figure 21). Similarly, we are now seeing large developments proposed in the Chelmsford area under the Government growth agenda (Warren Farm and Moulsham Hall Lane) that were not anticipated in our forecast in early 2025 – initial estimated costs of £4.5m increase to more than £12m under detailed costings from our iMOD system based on historical unit costs (see Figure 20).

3.3.2.1 Details of Essex & Suffolk schemes

FIGURE 20: UPDATED VIEW ON AMP 8 NETWORK REINFORCEMENT SCHEMES – ESSEX & SUFFOLK

Scheme name	Cost	Evidence to support costs and need
Framlington and Burnham Booster (schemes underway)	£1.764m	2025/26 costs: Framlington £1.397m (to lay 8.4km of 250mm main); Burnham Booster £0.512m (to upgrade pumps). Costs unchanged from SoC forecast of £1.764m (22/23 prices). 25/26 costs based on live updates from project managers on: actual expenditure incurred; contract prices (where agreed); and forecasts.
St Margaret's Court	£0.140m	Original scheme cost based on unit rate for 400m of 125mm main (£0.140m). Detailed iMod cost schedule[167] shows that the detailed cost estimate would be much higher (£0.494m).
Brentwood Middle School (now Herongate Booster)	£0.408m	Estimate for this scheme was previously £0.805m.[168] Scheme scope has been adjusted – need will be addressed by operational adjustments and an upgrade of

[167] St Margarets Court iMOD cost schedule (**NWL-PD-REP-005 - CONFIDENTIAL**).
[168] SoC Figure 39.

		the pumps at Herongate Booster. Detailed iMOD estimate shows the revised £0.408m cost breakdown. The revised scheme will support other developments in the area as well, so has a high degree of certainty in going ahead.
Mountnessing pumps	£0.322m	Initial scheme cost of £0.322m based on upgrading the booster pumps. Further analysis has indicated that the inlet mains to Mountnessing must also be upgraded. Detailed iMod schedule indicates a higher scheme estimate of £3.384m.[169]
Broadland Sands, Cucumber Lane, and The Street Barnby Beccles	£0.593m	Schemes based on a unit rate cost for similar booster schemes (The Street Barnby Beccles: a £350/m unit rate). This came to an estimate of £0.593m. iMOD estimates are not yet prepared as we expect these schemes to require investment in 2028/29 and 2029/30, so there is still a very high degree of uncertainty.
Bridgwick Road Southminster	0	Scheme removed – developer has not accepted quote.
NAV Barking	0	Scheme removed – mains not required.
PPE in Althorne	0	Scheme removed – development not proceeding.
Land of Fen Lane North Ockendon	0	Deferred to AMP 9.
Warren Farm	£2.402m	Likely to need to provide 4.25km of new 400mm mains. Initial estimate based on unit costs for this is £2.402m. Initial iMOD estimate shows higher costs (at £9.4m), which we think will reduce as we develop a more detailed scope of this project.[170]
Moulsham Hall Lane	£1.755m	Likely to need to provide 2.785km of new 250mm mains. Initial cost estimate is £1.755m. Initial iMOD estimate shows higher costs (at £3.5m), which we think will reduce as we develop a more detailed scope of this project.[171]
Corton	£0.231m	Likely to need to upgrade the booster. Initial estimate based on unit costs is £0.231m.
Total	**£7.615m**	

Source: costs as set out in SOC Figure 39

239. The four schemes that have been removed or deferred accounted for £4.088m of our original forecast (costs based on unit rates). Across the Essex & Suffolk region, this means that our current estimate of network reinforcement costs is **£7.615m** (in 2022/23 prices). This is broadly the same as our SOC forecast of £7.705m.

3.3.2.2 Details of our North East schemes

FIGURE 21: UPDATED VIEW ON AMP 8 NETWORK REINFORCEMENT SCHEMES – NORTH EAST

Scheme name	Cost	Evidence
East View, Hemlington, High Leven, South East Ashington, and Fenrother Booster	£1.596m	These schemes are already underway. The combined cost is unchanged from the forecast in our SoC and are based on live updates from the project manager. Some of these costs have already been incurred.
Eglingham to North Charlton phase 2	£2.205m	The estimated cost in our SoC was £2.205m. Based on an estimate provided by our contractor of £3.951m our SoC is likely to have underestimated the actual costs.
Belford to Warren Mill	£1.592m	The estimated cost in our SoC of £1.592m was based on unit rates. Further investigations have indicated that this is likely to be significantly higher: the pipe route will be significantly longer; this will require a larger main; and we will need to

[169] Mountnessing iMOD cost schedule (**NWL-PD-REP-006 - CONFIDENTIAL**).
[170] Warren Farm iMOD cost schedule (**NWL-PD-REP-007 - CONFIDENTIAL**).
[171] Moulsham Hall Lane iMOD cost schedule (**NWL-PD-REP-008 - CONFIDENTIAL**).

		cross the East Coast mainline railway. We have asked our contractor for an updated estimate.
Boosebeck and Justice WPS, West Street Normanby, Highcliffe WPS, Newham Hall, Frys Booster, Liverton Booster, and High Leven Phase 2.	£3.502m	The estimates for these schemes were all based on unit rates, including costs for similar booster schemes. Most of the schemes are estimates for work that will only be required from 2027 so we do not have confirmed details of all of these developments yet.
Bebside	£0	Removed as no longer likely to be required.
Morpeth	£0	Removed as no longer likely to be required.
Sleekburn	£0	Removed as no longer likely to be required.
Longframlington	£0	Removed as no longer likely to be required.
St Michaels Lane Alnwick	£0.305m	A new scheme for growth requires 650m of 225mm and 460m of 180mm mains, costed using a unit rate approach.
Total	**£9.200m**	

Source: SoC Figure 39, NWL updates.

240. The four schemes that have been removed accounted for a forecast cost of £4.687m. There are some other smaller additional schemes that have arisen since our original forecast, but these have not been included in these costs.

241. Across our North East region, this means that our current estimate of costs is £9.200m, which is lower than our SoC forecast of £13.581m. Taken together with Boreham Booster and the Essex & Suffolk region, the updated forecasts would result in a base uplift allowance of **£30.876m:**

FIGURE 22: CALCULATION OF NETWORK REINFORCEMENT ALLOWANCE

Calculation item	Cost (2022/23 prices)
Essex & Suffolk costs (updated as above)	£7.615m
North East costs (updated as above)	£9.200m
Boreham Booster Costs (as original)	£31.236m
10% efficiency challenge applied (sum of above * 0.9)	**£43.246m**
Remove “what base buys”	-£12.37m
Total	**£30.876m**

Source: Figure 20 and Figure 21; CMA PD.

3.3.3 Options for ensuring a suitable level of risk protection

242. It is clear that forecasts in this area are uncertain and costs are mostly not under management control. We support the use of a PCD to remove costs if these are not required or spent, as customers should not pay for schemes that are not needed. However, the CMA’s approach to allow only expenditure that has been linked to measurable deliverables[172] means that some schemes are ruled out from the outset because there is insufficient certainty that these will be built to a known scope; and that any new schemes required (that are not already anticipated) will never have any totex allowance. This means that the costs of all of those schemes, including

[172] PD para. 4.477

schemes that are already underway, would have to be shared between customers and shareholders under cost sharing. This does not provide adequate funding for these schemes, which we would be legally obliged to deliver. The PCD fully protects customers where schemes are not required, but there is no symmetric protection or allocation of risk where additional schemes are needed.

243. This could be resolved in three possible ways:

- the CMA could allow our full forecast of costs (as Ofwat said they would have at FD24)[173] with the full protection of the PCD for customers if these costs are not spent. This places the risk entirely with NWL to make a correct forecast, with any additional schemes required funded through cost sharing;
- the CMA could allow only the costs of schemes where there is reasonable certainty (such as Boreham Booster as well as schemes that are already started) but apply a different cost sharing rate (such as 25:75) that acknowledges the risk that there will be more schemes than this in practice; or
- the CMA could allow only the costs of schemes where there is reasonable certainty but also set an expectation that Ofwat should fund the efficient costs of new schemes in-period through its cost change process. We note Ofwat has already written to companies to support the facilitation of new growth expenditure it considers is likely to be needed in-period.[174] This could be achieved by including this funding within the cost change process for changes to revenue controls in-period, or simply by adjusting totex allowances at PR29.

244. In practice, Ofwat has applied a combination of the first and third arrangements for other water companies – allowing their full forecasts of costs at FD24 (with an efficiency challenge, but no scope challenge) and also writing to them to support the facilitation of growth in-period. We ask the CMA to do the same. Not allowing forecast costs introduces a further downside totex risk, as well as creating a funding barrier to enabling growth across our regions. We have shown that our costs are likely to be an under-estimate, and customers are protected through a PCD.

245. This would mean allowing **£30.876m as a base uplift** in the FD, rather than the PD's £16.95m.

[173] Ofwat, Response to SoCs – Expenditure Allowances – other issues, para. 2.306.
[174] Ofwat Letter to Reg Directors, Supporting Economic Growth, 22 August 2025.

4 ENHANCEMENT COSTS

4.1 POWER RESILIENCE

246. We welcome the CMA's provisional decision to increase the scope and the funding provided to cover the additional highest risk sites in AMP8.[175] We have always recognised that there is uncertainty about climate change data and energy network resilience. As we noted in the enhancement hearing, without a common standard or approach to cascading infrastructure risks, the right pace to address this risk (and the risk we can all tolerate in the meantime) can only ever be a judgement made by examining the evidence and views from customers.[176] Although we are now able to provide power resilience at 23 sites, this will leave over 1,400 locations exposed to this risk – and so this programme is just a start to address the highest risk locations.

247. We will continue to encourage regulators to develop a consistent approach, including resilience standards, to help fill the gap in how we understand and use climate evidence and assess cascading infrastructure risks in the future. We will also continue to explore and drive efficient solutions, including working with Northern Powergrid and looking at innovative (including lower carbon) solutions. This will help to test and evidence the need for future investment.

248. As the CMA notes in the PD the highest risk sites are generally more expensive than the unit cost rate, because there is a higher mix of wastewater treatment works that include UV treatment.[177] The CMA has, however, retained the lower unit rate from Ofwat's FD24.[178] The PD allows "a total allowance for fixed generators of £15.8m (up from £4.6m at PR24 FD)", and "flexibility on the specific sites where it installs fixed generation so it can proactively manage its power resilience risk going forward".[179] The CMA also applies a 10% efficiency challenge because our average unit costs are above Ofwat's sector average value.

249. We disagree with the implication that our costs are not efficient. We note that the CMA does not reference the cost efficiency benchmarking report made available to both Ofwat at DDR and the CMA.[180] This report illustrates a point we made during the hearings, that the average cost depends on the relative size of generators included in the calculation.[181] The benchmarking report compares generators of the same size with others across the sector and concludes that these costs are efficient.[182] This is a better comparison because it takes the size of the generator (the main cost driver) into account.

[175] PD para. 5.255.
[176] NWL Enhancement Hearing Transcript, 25 June 2025, p.11 lines 14-17.
[177] PD para.5.254.
[178] PD para. 5.255.
[179] PD, para. 5.255.
[180] NWL DDR Benchmark Report - Power Resilience Waste SOC205.
[181] NWL Enhancement Hearing Transcript, 25 June 2025, p.16 lines 17-24
[182] NWL DDR Benchmark Report - Power Resilience Waste SOC205.

250. This report showed that our costs for our wider power resilience schemes (all the sites we assessed) were 24% lower than the average benchmarked cost and in the upper quartile of most efficient companies.[183] We considered providing additional evidence in response to the PD to demonstrate our cost efficiency in this area. However, it is not clear what more we could provide beyond the evidence already submitted to the CMA with our SoC (but not referenced in the PD).

251. To address this challenge, the CMA could increase this unit rate allowance to meet the higher efficient costs for "priority band 1" sites. However, as we explain below, the flexibility to switch to alternative sites would likely allow a more efficient proactive approach to managing power resilience risk.

252. Our original business case highlighted that there could be alternative solutions using batteries and renewables – but none were yet feasible solutions, and so we said we would continue to assess these in the delivery phase.[184] We said that if these types of solutions did become feasible, we would like to be able to use these rather than fixed diesel generators.

253. Over the last few months, and in response to the challenge of addressing power resilience without sufficient totex allowance, we have carried out battery trials at some sites to understand how these might be useful as part of a wider programme. At some very small sites, generators are not feasible because there is not enough space (or insufficient security), so these were not included in our original case. For example, at our Station House Bardon Mill SPS, we have seen repeated pollution incidents due to power failures and a very small wet well capacity – but there isn't space on this site for either a fixed or mobile generator, so this was not included in our original list of sites. The battery trials have shown that it could be possible to provide power resilience at this very small site, at significantly better value for customers than installing a fixed generator elsewhere.

254. This example shows how flexibility in choice of sites and solutions can be beneficial. We would still expect that fixed generation is the only feasible option at many sites, including all the "priority band 1" sites.

255. We think the CMA intends this flexibility. To provide it, we would like the PCD to be set on a technology-neutral basis for this programme to specify that this should provide either fixed generation *or* an equivalent level of risk protection using other methods. We suggest that this level of risk protection should be set at two hours (consistent with the analysis on mobile generators and spill times that Ofwat and the CMA considered during this process).

256. With this flexibility, we are likely to retain our larger sites with UV treatment from the highest priority list but then we are likely to select some alternative smaller sites. We are already

[183] NWL DDR Benchmark Report - Power Resilience Waste SOC205, p8.
[184] BP24 Appendix A3-18 Power Resilience NES32 SOC024, Table 21 – primary screening of options.

developing this new programme. These alternatives might allow better protection for customers and the environment either compared to the alternative solutions or because we could deploy those solutions across a wider range of sites providing greater risk protection and they also offer wider benefits (e.g. carbon savings).

257. We intend to spend the full totex allowance on power resilience and if we do find more efficient solutions, we will reinvest any efficiency savings into delivering greater resilience across more sites. Customers could be protected from the risk of paying more than they need to for power resilience by including this requirement in the specification of the PCD. Including this requirement would mean that allowing flexibility in solutions and sites will drive better value and greater power resilience over more sites, rather than risking incentivising us to select cheaper solutions.

4.2 PHOSPHORUS REMOVAL

4.2.1 Commentary on the P-removal models

258. We have mixed views about the revised P-removal models developed by the CMA.

259. On one hand, the Ofwat models had very low explanatory power and were clearly mis-specified in a way that results in inappropriate allowances for companies that did not have average mix of schemes between the different sizes. The explanatory variables used by Ofwat were unable to distinguish between the factors driving significantly increased costs at certain sites (e.g. where there were land availability issues). The CMA's approach of considering there to be different groups of schemes is therefore a pragmatic approach to ensuring that sensible allowances are provided across the sector.

260. However, similar to the concerns we have raised in relation to base cost models, we are uncomfortable with the engineering and economic rationale of the implied results. In particular, the negative coefficient on wages which implied higher wages result in lower costs is clearly counter-intuitive as the CMA identifies. However, we do not think it is sufficient to say that is acceptable because "it is likely to be the result of multicollinearity, rather than model misspecification".[185] A key desirable feature of cost assessment models is that they are intuitive in their relationships and therefore can be used to set cost allowances for significant areas of expenditure. Without an intuitive relationship it is unknown whether there is just an issue with multicollinearity that does not affect the robustness of predicted costs or whether the coefficient is just picking up a spurious relationship in the data.

261. We would encourage the CMA to try and find a form of model that still uses its approach to different groups but results in a more intuitive relationship between the variables that stakeholders can have more confidence in.

[185] PD, para. E19.

262. The new models seem to capture the points made by wastewater companies about differences between sites and demonstrate with evidence that these differences can be observed and modelled. The evidence seems clear to justify the CMA's conclusion that the original P-removal models had very low explanatory power and were misspecified.

263. The CMA recognises the limitations of its new models, particularly through not having access to a richer set of cost drivers.[186] There are other limitations that could be addressed with more time, such as: a clearer engineering or spatial rationale for the selection of groups within the model; and the interpretation of signs and magnitudes of coefficients (particularly from the inclusion of multiple variants of density and wages, where the CMA concludes that there is some multicollinearity).

264. However, it is clear that the Ofwat models cannot be relied upon to estimate efficient totex because these do not control for different factors at different sites and do not fully understand the difference between historical and forecast totex. Efficiency scores from the CMA seem more plausible (we note that our efficiency score is higher – increased from 0.72 to 0.85 – under the CMA model, but we remain one of the most efficient companies in the sector for P-removal).

265. So, we think that despite the limitations, the new P-removal model is an improvement on the Ofwat enhancement models, as it captures more of the factors that mean variability between sites – and reflects more closely the feedback from wastewater companies during Ofwat's consultation process. The CMA model closely matches our estimated costs for delivering the new phosphorus schemes we are required to deliver to replace our CNB schemes.

4.2.2 Update on the EA's requirements for our P-removal schemes

266. In our SoC, we explained that the new schemes we listed as replacements for our CNB schemes were "subject to change based on the EA's formal requirements, which it will not discuss with us until they have formally confirmed its support".[187] We have now agreed a final list of new schemes with the EA, which we list in Figure 23 below. This replaces Figure 32 in Appendix 1 of our SoC and the parameters can be used to re-estimate the cost allowances (as we have done in the final column of Figure 23 using the PD model). We have marked changes in yellow below. The list agreed with the EA removes 13 schemes, or **£60.4m** of totex allowance (one of which is funded in AMP7 WINEP carryover already) and tightens the consent further for two sites.

267. We note that we have calculated revised estimates for Chester-Le-Street and Tudhoe Mill from the CMA's P-removal model only, without changing any groups or rerunning the models with other schemes removed.

[186] PD paras 5.62 and 5.63.
[187] SOC Appendix 1, para 257.

FIGURE 23: LIST OF PHOSPHORUS SITES REPLACING CNB

Site name	Population equivalent (PE, 000s)	Existing P consent (mg/l)	Initial view of new P consent (as per SOC)	Confirmed view of new P consent (mg/l)	Estimated totex allowance (£m)
Great Ayton	5.038	1	0.25	0.25	5.693
Hutton Rudby	2.027	5	0.25	0.25	6.500
Stokesley	7.538	1	0.25	0.25	6.035
Haggerston Castle	0.737	5	0.4	No consent change	0
Embleton	0.711	5	0.5	0.5	4.502
Barton	0.95	5	0.5	0.5	4.626
Melsonby	0.756	5	0.5	0.5	4.526
Aldbrough	0.413	5	2	2	2.023*
Windlestone	10.399	2	0.25	0.25	7.020
Sadberge	0.643	5	0.25	No consent change	0
Barkers Haugh	34.018	2	0.25	0.25	8.342
University	2.717	5	0.25	No consent change	0
Cassop	0.528	5	2	1.5	2.996*
Lowick	0.395	5	0.7	No consent change	0
Eppleby	0.371	5	2	2	1.512*
Trimdon	5.071	5	0.25	Funded in AMP7 WINEP carryover	0
Bishop Middleham	1.262	1	0.25	No consent change	0
Bradbury	0.053	5	2	No consent change	0*
Hamsterley	0.320	5	1	No consent change	0
Fir Tree	0.243	5	0.6	No consent change	0
Brancepeth	0.274	5	1.5	No consent change	0
Edmondsley	0.497	5	0.25	No consent change	0
Sherburn	5.385	0.5	0.25	0.25	5.339
Hustledown	15.711	0.9	0.25	No consent change	0
Chester-Le-Street	34.241	2	1.3	1.1	3.704
Belmont	10.640	2	1	1	3.383
Tudhoe Mill	23.291	2	1.5	0.25	7.894
Kelloe	2.472	0.3	0.25	No consent change	0
TOTAL	-	-	-	-	72.583

* For four sites (Aldbrough, Cassop, Eppleby and Bradbury) the CMA used our estimated costs rather than modelled costs, due to the higher consent levels. This is unchanged for Cassop as we do not yet have any new costs.

Source: CMA PD phosphorus model and NWL SOC, updated to reflect EA agreed changes (in yellow)

268. Finally, since our SoC, the EA has also asked to replace a phosphorus investigation at Alnwick wastewater treatment works with an "improvement" – that is, a phosphorus removal investment scheme rather than a much lower cost investigation. For a further phosphorus investigation at Swainby wastewater treatment works, the EA has asked us to move the existing investigation to another driver (25YEP) and *also* include a new improvement driver here. We note that at Swainby, there will be permit changes but there is likely to be a "no build" solution.

269. We spoke to Ofwat and the EA about this in October, as this is possible but would require funding through the price controls. Ofwat has indicated that it would consider raising this matter with the

CMA as part of its representation process.[188] Addressing this in the CMA's FD would be a simple method for implementing this change in WINEP and we support Ofwat in its representation to do this here. This should be a simple change:

- the P-removal model will calculate an efficient allowance for the new Alnwick P-removal, based on the parameters (set out in the table below). We note that we do not yet have a separate costing for this scheme, which has only just been agreed. The Swainby P-removal scheme would not be calculated by the model in any case, but we expect a "no build" solution so have included no totex allowance for this; and
- the CMA should then remove the FD24 totex allowance for the investigation, as this is no longer required. The FD24 allowance for the Alnwick elements of this investigation is £0.145, as explained in our query response to Ofwat.[189] There are no changes required for the changes to the Swainby investigation, which will still go ahead under a new WINEP driver.

FIGURE 24: LIST OF FURTHER NEW PHOSPHORUS SITES

Site name	Population equivalent (PE, 000s)	Existing P consent (mg/l)	Confirmed view of new P consent (mg/l)	Estimated totex allowance (£m)
Alnwick	7.695	None	0.25	7.838
Swainby	0.816	None	3.5	0
TOTAL	-	-	-	7.838

Source: NWL and EA discussions

270. In total, taking into account all changes from the EA discussions, this changes the allowance for phosphorus to **£80.276m** (compared to £132.994m at PD), keeping the model the same as CMA PD. This is calculated as the totals from Figure 23 (£72.583m) and Figure 24 (£7.838m), minus the £0.145 allowance in FD24 for the Alnwick investigation.

4.3 SUFFOLK STRATEGIC NETWORK

271. The CMA has provisionally added the Suffolk Strategic Network to the large scheme gated process.[190] It did this by increasing the FD24 allowance from £126.2m to £148m at PD, and then removing the full £148m from the enhancement allowance.[191] This is different to the approach taken by Ofwat in its FD24 for large schemes, where they retained some funding for a development allowance associated with the scheme (for design and development costs to the point of a later decision to proceed).

272. We support the decision to move the scheme to the gated process, but we think the CMA inadvertently removed the development funding that was already allowed for Suffolk Strategic Network in 2023/24 and 2024/25 and did not allow for the design and development costs through

[188] See OFW-CMAR-NES-001.
[189] See OFW-CMAR-NES-001 – NES Response.
[190] PD para. 5.307.
[191] PD, footnote 157.

to 2027/28 (after which the gated process would allow funding). So, we would like the CMA to consider restoring the development allowance associated with this scheme that had already been allowed by Ofwat through "accelerated expenditure"; and including a further development allowance to support this scheme through "submission 1" and "submission 2" of Ofwat's gated process. This is consistent with the approach taken by Ofwat in its FD elsewhere.

273. As Ofwat has noted its Accelerated Infrastructure Delivery (**AID**) project in 2023[192] allowed us to use transition expenditure to fund work on the detailed design for this project – up to £12.490m (in 2021/22 prices).[193] The AID project did not determine any transition expenditure in practice, because it did not use any of Ofwat's formal determination powers, and so this was just a commitment to allow for some funding at FD24. At FD24, Ofwat allowed £8.09m of "accelerated programme" expenditure, placing this in 2023/24 and 2024/25.[194] This was consistent with the values that Ofwat set out in AID, where Ofwat assumed that the remaining £3.4m would be funded in totex allowances during 2025-30 at FD24.

274. This £8.09m of accelerated programme expenditure was allowed for by Ofwat by adjusting RCV through its "PR24-FD-PD24-RCV-Adjustments" model, as an increase to RCV.[195] At first glance, it would appear that the CMA has not considered this adjustment – but in practice, this amount has been stripped out through the following steps:

- Ofwat allowed for £8.09m in accelerated expenditure (through an RCV adjustment) and allowed the remaining £118.1m in enhancement totex in AMP8;
- the CMA increased the efficient totex from £126.2m to £148m in AMP8 (adding £21.8m) and then stripped out £148m to defer to the large scheme gated process; and
- in effect, then, the CMA has removed the £8.09m allowance for accelerated expenditure too (it is, in effect, added to RCV on 1 April 2025 and then removed gradually through the period).

275. The detailed design and planning work for Suffolk Strategic Network will still need to go ahead, even with the scheme moving to the Large Scheme Gated Process. Although this is on a delayed timescale, this work has been ongoing since 2023.

276. For other schemes in the large scheme gated process, Ofwat included a "development allowance" of between 6% and 12% of the total costs.[196] This covered costs during the detailed design and planning work, before Ofwat makes decisions under the large scheme gated process to allow the remaining contingent allowance (if required). For our Lowestoft scheme, which had the same treatment as Suffolk Strategic Network under Ofwat's AID project, Ofwat allowed

[192] Ofwat, Accelerated infrastructure delivery project, Appendix 1, June 2023, p15.
[193] PD, para 5.299.
[194] FD24 Supply Interconnectors Model CA92 SOC319, "Outputs to aggregator" sheet, cells E10 and G10 (pre frontier shift and RPEs).
[195] PR24 RCV Adjustments Feeder Model NWL.
[196] Ofwat PR24 final determinations: Expenditure allowances, February 2025 Table 42.

10.88% of the costs as a development allowance – reflecting the commitments it made under that process.[197]

277. We ask the CMA to retain a similar "development allowance" in AMP8. There are two possible ways to calculate this allowance: either using the forecast values calculated by Ofwat under the AID project in 2022 **(£13.586m** in 2022/23 prices); or using the current project estimates to 31 March 2028 **(£20.4m**). We think the CMA should use the current project estimates (£20.4m):

- this is a much more up-to-date forecast than the estimate from 2022 and reflects the updated scope and approach to planning permission and engagement. We will have already spent £7.7m of this cost by 31 March 2026 and will spend a further £7.8m in 2026/27 and £4.9m in 2027/28;
- the original estimated allowance of £13.586m was set using a lower forecast of total project costs (at DD24, Ofwat allowed £100.114m for this scheme under its models); and
- the development allowance must now cover costs up to 31 March 2028, as the first available Ofwat cost change process would provide revised revenue and totex allowances from 1 April 2028.

278. Ofwat assumed £12.490m (in 2021/22 prices) in the AID project – or £13.586m in 2022/23 prices. This is equivalent to **13.6%** of the Ofwat DD24 allowance for the project, or **10.8%** of the FD24 allowance, and so is broadly in the upper range of around 12% set by Ofwat. A £20.4m development allowance would be **13.8%** of the CMA PD totex allowance.

279. This could be achieved using a simple change for the CMAs FD: the funding removed from the FD enhancement totex should be reduced from £148.0m to **£127.6m** (to reflect the "contingent allowance" for Ofwat's large scheme gated process). This increases the overall totex allowance in PD for 2025-30 by £20.4m. This, then, retains the development allowance made by Ofwat in the RCV adjustments model (£8.09m) as well as a £12.11m totex allowance in AMP8 to cover additional development costs until the large scheme gated process allows further revenue for construction (from 2028/29). In total, this is equivalent to **£20.4m**.

280. For customers, this is neutral because Ofwat's large scheme gated process will take account of the development costs already allowed in setting the revenue allowance for the construction phase. However, this reflects the costs that have already been incurred (and will be incurred over the next two years), as well as preserving the commitment that Ofwat made in the accelerated delivery project.

[197] Ofwat PR24 final determinations: Expenditure allowances, February 2025, Table 42.

5 ALLOWED RETURN

5.1 THE ALLOWED RETURN IS AT THE LOWER END OF REASONABLE ESTIMATES

281. We welcome the CMA's increase in the allowed return, in particular the important methodological changes to the CoE. The new equity return proposed by the CMA in its PD makes a great deal more sense than the figures Ofwat used in its own FD and does sit at the bottom end of the range we suggested in our SoC. However, as the CMA acknowledges:

- over half of the increase is due to market movements, which does not increase the investability, relative to other contemporaneous investments because the opportunity cost of alternative investments will have moved by a comparable amount; and
- the methodological improvements to the CoE are almost entirely offset by a material methodological change to the use of the OBR's 2.4% CPIH forecast, from October 2024, which is a material change from regulatory precedent for which insufficient check and challenge has been undertaken by the CMA.

282. In practice, there is therefore little improvement in our ability to attract and retain capital, as the allowance for debt has been reduced and returns to equity investors can only be paid after debt costs have been serviced.

283. As discussed above (see Sections 2.1.4 and 3.1.3), [redacted].

5.2 A LONG-TERM CPIH INFLATION FORECAST OF 2.4% IS NOT SUPPORTED BY THE EVIDENCE

284. The allowed return element of revenues in each year of the price control is calculated by applying the proposed WACC to the relevant RCV. The CMA has retained the approach of fully indexing the RCV to CPIH. Consistent with Ofwat and disputing companies, the CMA therefore expresses its estimates of the components of the cost of capital in real CPIH terms.[199] In order to estimate the components of the cost of capital in real CPIH terms, important assumptions must be made for the rates at which to deflate nominal input data and adjust RPI-based input data.

[198] NWL PD Databook (Confidential)
[199] PD, para. 7.25.

285. Two key assumptions are required when determining an appropriate measure of CPIH inflation to use to deflate nominal input data, or when determining appropriate adjustments to apply to RPI-based input data. These are, firstly, the relevant time horizon over which the estimates should apply, and secondly, the estimates that should be used over that horizon.

286. With respect to the relevant time horizon, the CMA considers that Ofwat and the Disputing Companies' approach of using a long-term inflation assumption should ensure that the companies are remunerated for efficiently incurred nominal debt costs over time, provided that it is not systematically biased upwards or downwards relative to the market's inflation expectations embedded in bond yields at typical tenors at issue, which in the water sector are around 15 – 20 years.[200] The CMA found this approach to be reasonable and continues to apply this long-term approach in its PD.[201]

287. With respect to estimating long-term CPIH inflation, Ofwat maintains a 2.0% CPIH inflation assumption in FD24. This is based on the assessment that CPI inflation has on average been close to the Bank of England's 2.0% CPI target set in December 2003, and that CPI and CPIH have tracked each other closely over time.[202] All Disputing Companies also used a 2.0% long-term CPIH inflation assumption in their cost of capital submissions.

288. In contrast, the CMA deviates from both Ofwat's FD24 and Disputing Companies SoCs by provisionally using the OBR's October '24 long-term forecast of CPIH of 2.4% as its long-term inflation assumption.[203] The OBR's long-term CPIH inflation assumption is based upon a long-term CPI inflation forecast of 2.0%, and a long-term forecast of the difference between CPIH and CPI (the 'CPIH-CPI wedge') of 0.4%.[204]

289. We find that there is no credible evidence to support an assumption that CPIH will systematically exceed CPI by 0.4% over the long-term. To assess the strength of the evidence supporting a long-term CPIH-CPI wedge of 0.4%, we consider in the following sections:

- the OBR's forecasts of CPI and CPIH over its regular forecasting horizon of 5 years;
- the performance of the OBR's approach to estimating its long-term CPIH forecast, and whether its forecasts are likely to suffer from systematic over- or -underestimation that are likely to bias its long-term CPIH forecast;
- long-term and 20-year forecasts of the CPIH-CPI wedge based on econometric modelling and statistical testing of historical data of the difference between CPIH and CPI series from 1989 to the present day; and

[200] PD, para. 7.29.
[201] PD, paras. 7.28 and 7.29.
[202] PD, para. 7.37.
[203] PD, para. 7.52.
[204] SOC523 OBR Economic and Fiscal Outlook October 2024, Box 2.3.

- market-based estimates of the CPIH-CPI wedge provided by current inflation swap quotes.

5.2.1 The OBR's 5-year forecast

290. The Disputing Companies jointly commissioned John Earwaker of First Economics to consider the appropriate forward looking CPIH-CPI wedge and in turn the appropriate long-term CPIH assumption.[205] Mr Earwaker highlights that the OBR's regular forecasting horizon is 5 years and sets out the forecasts for CPI and CPIH over that period as demonstrated in Figure 25.

FIGURE 25: OBR 5-YEAR FORECASTS FOR CPI AND CPIH

	CPI inflation	CPIH inflation
2026/27	1.9%	2.3%
2027/28	2.0%	2.1%
2028/29	2.0%	2.0%
2029/30	2.0%	2.1%

Source: Earwaker Report 2025, Table 1 which cites the OBR, NWL-PD-REP-009.

291. Mr Earwaker explains that at the limits of the OBR's regular forecasting horizon the OBR assesses that the wedge is around 0.1%, which he observes to be 'a fair distance short' of the 0.4% in the longer term forecasts adopted by the CMA. He observes that the increase in the wedge for the longer-term forecast is a function of the OBR's future productivity growth assumption.

5.2.2 Systematic bias in the OBR's long-term CPIH methodology

292. The OBR's 'Economic and Fiscal Outlook', published in October 2024, contained its first long-term estimate of CPIH, which was 2.4%.[206] We consider whether the OBR's methodology, or its estimates of components of the long-term CPIH-CPI wedge, are likely to induce systematic over or underperformance, leading to some degree of bias in its long-term CPIH-CPI estimate.

293. The OBR notes that CPIH is identical to CPI, except that it also includes owner occupier housing costs (**OOH**) and council tax.[207] To generate its long-term estimate of CPIH, the OBR combines its CPI forecast, with forecasts for council tax and OOH, using weights that reflect those used in the construction of the CPIH index, which are 81% (CPI), 3% (council tax), and 16% (OOH).[208]

294. The OBR's long-term forecast for CPI is assumed to be 2%. Its policy-neutral assumption for the growth in council tax is 4.8%, which is informed by known referendum principles, announcements by councils and examining trends in recent behaviour. To forecast growth in OOH, the OBR investigates proxy or component measures. It finds that OOH and private rentals for housing move closely together over time, which it expects given that the ONS measures OOH using the rental equivalence methodology. Therefore, the OBR finds that OOH is well-proxied

[205] Earwaker Report 2025, NWL-PD-REP-009.
[206] SOC523 OBR Economic and Fiscal Outlook October 2024, Box 2.3.
[207] SOC523 OBR Economic and Fiscal Outlook October 2024, Box 2.3
[208] SOC523 OBR Economic and Fiscal Outlook October 2024, Box 2.3

by private rentals for housing.[209]

295. The OBR also finds that the long-run response of changes in private rents to average earnings is close to one-for-one, which drives an assumption that in the long run, private rents will grow in line with average nominal earnings growth. However, we note that the OBR cautions that private rental inflation and earnings growth can deviate significantly in the short run, despite a close relationship over the long-term.[210] Finally, under its assumptions for long-term economic determinants, the OBR assumes that the share of labour in national income is constant in the long run. As a consequence, its long-term assumption for average earnings growth of 3.8% is equal to the sum of labour productivity growth (assumed to be 1.5%) and whole economy inflation (assumed to be 2.3%).[211] The OBR's long-term GDP deflator inflation projection of 2.3 per cent a year is built bottom-up by weighting assumptions for each of the expenditure components of GDP[212] (including a 2% CPI inflation assumption, and 2.9% RPI inflation assumption, which we note may no longer be consistent with its CPIH-CPI wedge, given the transition of RPI to reflect CPIH in 2031). We focus below on the OBR's long-term forecasts for labour productivity because these are likely to attract the highest degree of uncertainty.

296. We examine the forecast performance of the OBR's shorter-term estimates of productivity growth by extending the analysis of Atkins and Lansley in their 2023 working paper 'The OBR's forecast performance' for the OBR. Figure 26 below shows the performance of the OBR's productivity growth forecasts against actual productivity growth from 2009.

297. Figure 26 shows a material and persistent overestimation of the growth in productivity since 2009. The OBR's long-term forecast for the growth in productivity of 1.5% in the October '24 forecast used by the CMA is also likely to embed a similar degree of optimism, which is evident from Figure 25 above and which generates an upwardly-biased estimate of the long-term CPIH-CPI wedge. This optimism bias, particularly in recent years, has been recognised recently by the Labour Government:

> Our independent forecaster is likely to downgrade the forecast for productivity in the UK, based not on anything this government has done but on our past productivity numbers, which, to be honest, since the financial crisis and Brexit, have been very poor.[213]

298. The OBR has recently reduced its productivity estimates in its pre-measures forecast, in recognition of the historical optimism bias,[214] which is still baked into the October '24 forecasts used by the CMA.

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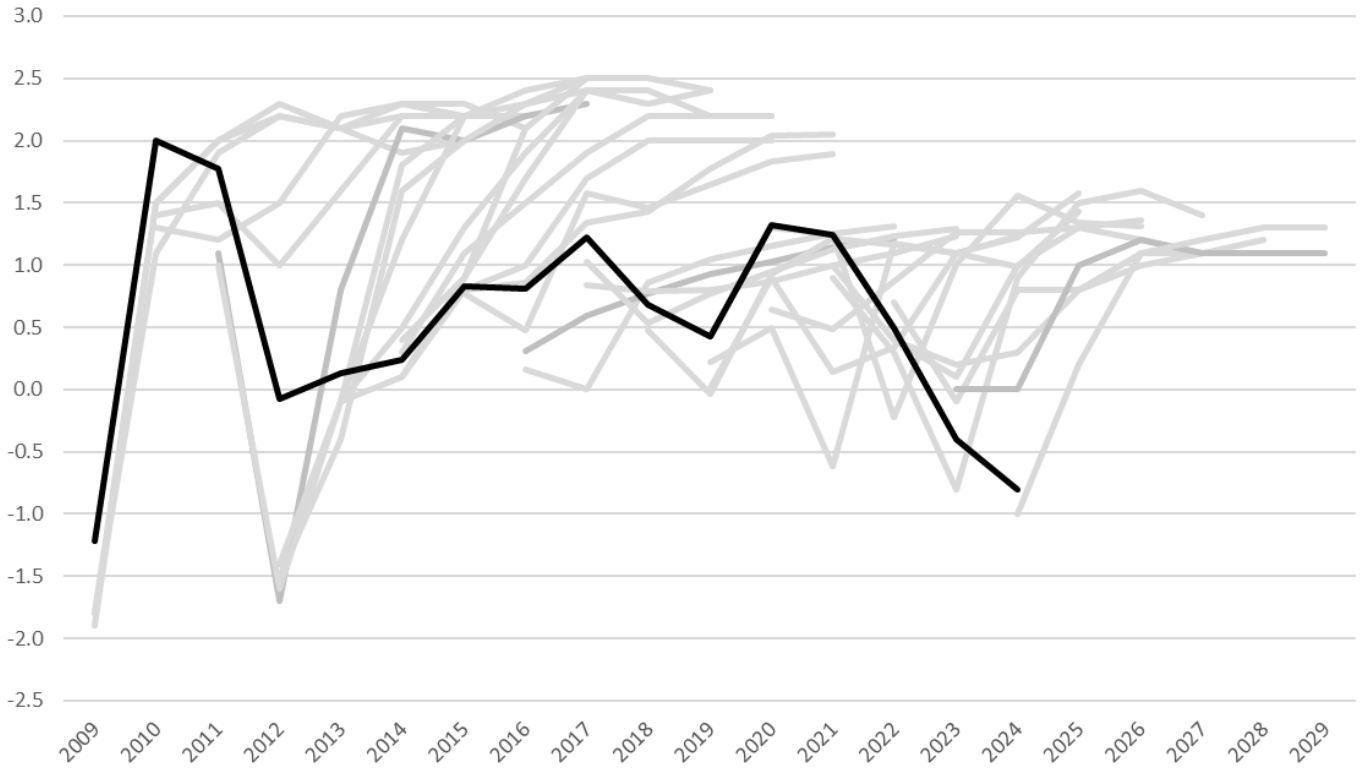
[209] SOC523 OBR Economic and Fiscal Outlook October 2024, Box 2.3.
[210] SOC523 OBR Economic and Fiscal Outlook October 2024, Box 2.3
[211] OBR Economic and Fiscal Outlook (March 2020), page 213.
[212] OBR Economic and Fiscal Outlook (March 2020), page 213.
[213] Financial Times, Reeves faces £20bn hit to UK public finances from productivity downgrade, 27 October 2025.
[214] Financial Times, Reeves faces £20bn hit to UK public finances from productivity downgrade, 27 October 2025.

299. The CMA's use of the 0.4% CPIH-CPI wedge is therefore heavily reliant on an optimistic productivity assumption that is not supported by the historical evidence or recent changes by the OBR, which are expected to remain for the official update in November. Forecasts embedding an optimism bias are not suitable for setting a long-term assumption in a regulatory charge control.

FIGURE 26: PERFORMANCE OF THE OBR'S PRODUCTIVITY GROWTH FORECASTS AGAINST ACTUAL PRODUCTIVITY GROWTH FROM 2009



Source: NWL analysis of historical OBR data. NWL PD Response Databook.

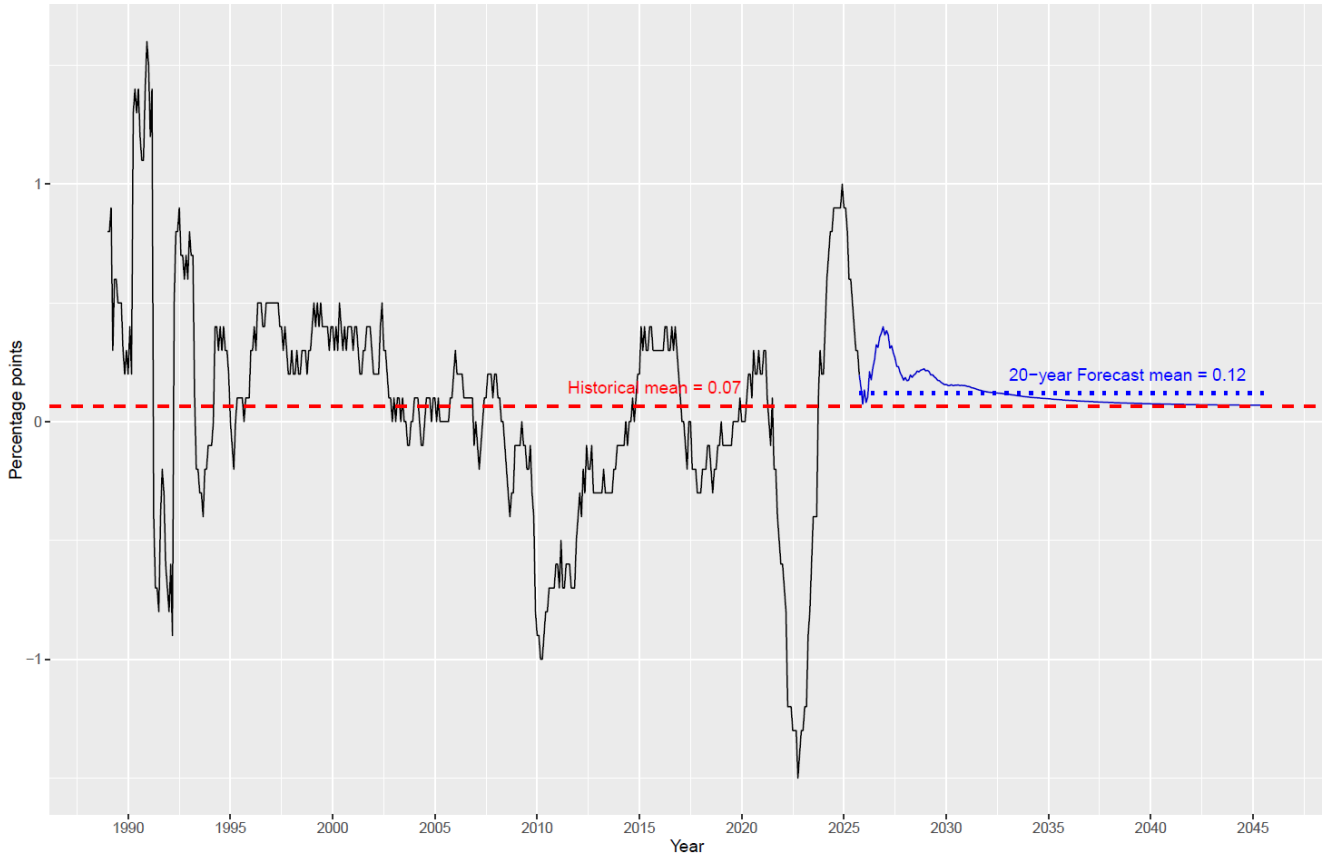
5.2.3 Econometric estimates based on historical ONS CPIH-CPI data

300. We consider whether a long-term CPIH-CPI wedge of 0.4% is supported by historical data of the CPIH-CPI wedge over the period from January 1989 to August 2025 (which is the full period of historical data that is provided by the ONS), by:

- testing statistically whether the hypothesis of a zero CPIH-CPI wedge, which has been used in previous regulatory decisions (including by the CMA at PR19), should be rejected if the future looks like the past; and
- generating an average forecast of the CPIH-CPI wedge over a 20-year horizon (which is consistent with the CMA's conclusion for the relevant time horizon that is discussed above) that is calculated from annual forecasts of the wedge over the period using commonly-used econometric forecasting methods, to understand whether it is comparable with a long-term CPIH-CPI forecast wedge of 0.4%.

301. For the purposes of generating econometric estimates and forecasts, the CPIH-CPI wedge is modelled as a Seasonal Autoregressive Integrated Moving Average (**SARIMA**) process, which is able to capture seasonal dynamics under the traditional ARIMA framework.[215] Figure 27 below shows the results of our estimation.

FIGURE 27: ACTUAL AND FORECAST YEAR ON YEAR CPIH-CPI WEDGE FROM 1989 TO 2046



Source: NWL analysis of ONS data. NWL PD Response Databook.

302. The historical sample mean (shown in red) of the historical observations of the CPIH-CPIH wedge (shown in black) is 0.07%. The mean of the forecasts over the 20-year period from 2026 – 2046 (shown in blue) is 0.12%.

303. Using the sample mean of the CPIH-CPI wedge over the full period as an estimate of the long-term CPIH-CPI wedge, we find a 95% confidence interval of (-0.07%, 0.20%) with a point estimate of 0.07%.[216] This demonstrates that: (i) a hypothesis of a zero long-term CPIH-CPI wedge cannot be rejected, implying that there is no statistical basis to support a break with regulatory precedent (if the future looks like the past); and (ii) a forecast long-term wedge of

[215] The non-seasonal component of the CPIH-CPI process is modelled as an ARMA(1,2) process, with the seasonal component modelled as an ARMA(1,1) process having a 12-month frequency, due to the underlying data having monthly observations of Year-On-Year changes. The modelled process has been chosen to minimise an information criterion over a range of potential processes.
[216] We report 95% confidence intervals using Newey-West corrected standard errors .

0.4% sits outside of the confidence interval (-0.07%, 0.20%), which contains the true long-term wedge with a 95% likelihood, implying that **0.4% is a statistically implausible estimate.**

304. In addition, the mean of the forecasts over the 20-year forward-looking period is 0.12%. This demonstrates that, even if there were a strong basis on which to break with regulatory precedent and select a non-zero long-term CPIH-CPI wedge, an appropriate forecast built on empirical foundations is not comparable with 0.4%.

305. Therefore, on the basis of the evidence provided by historical data shown above, we consider that an estimate of the long-term CPIH-CPI wedge 0.4% is unjustified.

5.2.4 Market-based estimates of the long-term CPIH-CPIH wedge

306. We consider whether the evidence provided by RPI and CPI inflation swap quotes support a long-term CPIH-CPI wedge of 0.4%. Whilst Kairos has documented the shortcomings of relying on swap-based estimates of certain parameters due to distortions,[217] inflation swap quotes may nevertheless provide a cross check on the size of the CPI-CPIH wedge.

307. Market-based inflation swap quotes are available across a range of maturities for RPI and CPI price indices. Whilst CPIH-based swap quotes are not readily published by financial data providers, we can infer market expectations of RPI beyond 2031 using RPI inflation swaps of sufficiently long tenor, which is the point at which changes in RPI will be set to be equivalent to changes in CPIH. By comparing changes in market expectations of RPI beyond 2031 (and thus market expectations of CPIH inflation) with CPI, we can infer the market-based expectations of the CPIH-CPI wedge over the longer-term.

308. Using 6-year and 20-year RPI and CPI inflation swaps, which expire in 2031 and 2045 respectively, we calculate an implied market-based CPIH-CPI wedge of 0.15%. This is significantly below the OBR's long-term forecast of the CPIH-CPI wedge of 0.4%.

5.2.5 Conclusions on inflation

309. The CMA's move to a 2.4% CPIH inflation assumption is positioned as a market movement but we respectively suggest that this is in fact a material methodological change requiring further consideration. When examined closely, it is clear that the OBR's assumed 0.4% wedge is:

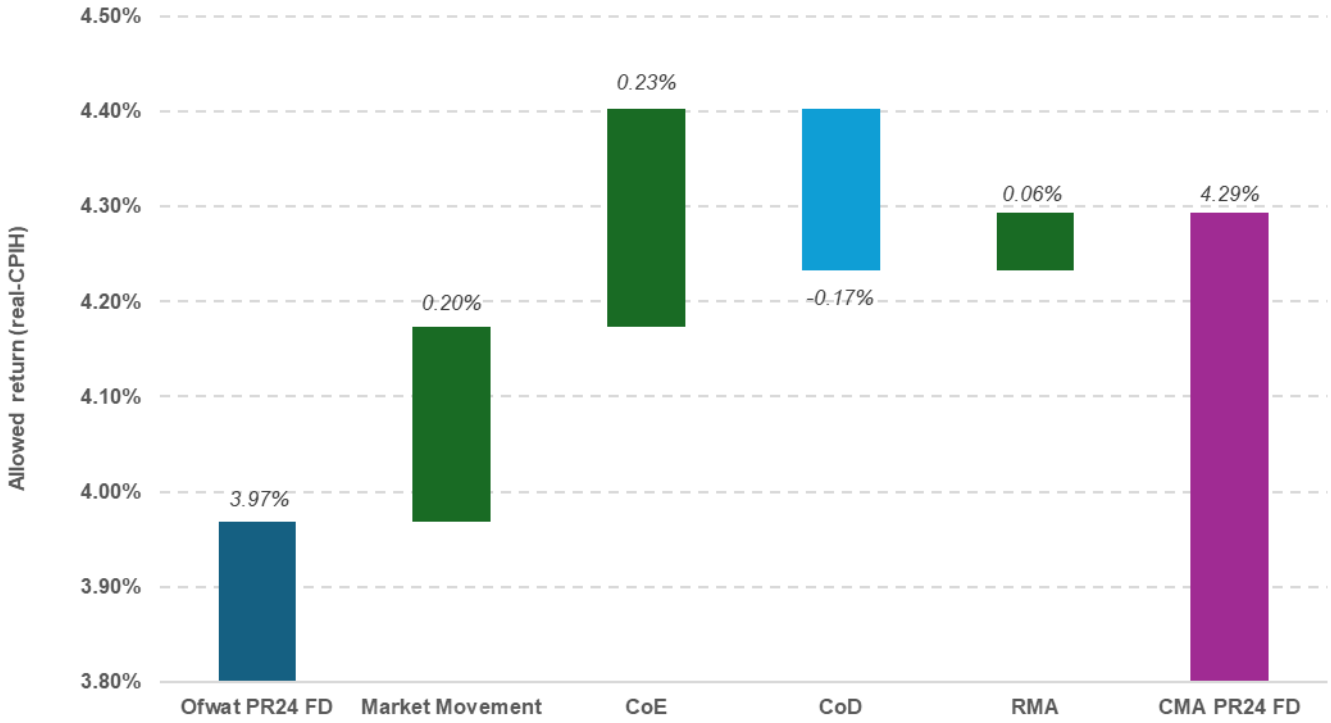
- a function of systematic optimism bias in the OBR's productivity forecasts, which may be appropriate for an OBR forecast but it is not suitable for setting a long-term assumption in a regulatory charge control;
- some way above the OBR's estimate of 0.1% at the jumping off point of its regular forecasting horizon of 5-years (see Mr Earwaker's report);
- statistically implausible, if the future looks like the past;

[217] Kairos PR24 Allowed Return 2025, SOC001.

- substantially above the long-run average of 0.07% and the 20-year forecast mean of 0.12%, neither of which are statistically different from zero;
- substantially above evidence from swap markets, which whilst subject to distortions and therefore directional only, suggests a wedge of 0.15%.

310. The effect of the CMA's 2.4% CPIH assumption is most material for the allowed CoD, where the CMA's change in methodology reduces the real allowance by c.40bp, all else equal. The effect of such a material shift in methodology is that the CMA's important recalibration of the CoE is substantially offset by a change in the CPIH inflation assumption, meaning that the PD has not substantially improved our ability to attract and retain capital. This is shown in Figure 28.

FIGURE 28: WATERFALL FROM OFWAT FD TO CMA PD



Source: NWL analysis of the CMA's PD. NWL PD Response Databook.

311. We request that the CMA reconsider it's 0.4% CPIH-CPI wedge for the reasons given above. Should the CMA wish to deviate from the 0% assumption used for the water sector in the past, the evidence is supportive of a substantially smaller wedge of c.0.1%.

5.3 COST OF EQUITY PARAMETERS

5.3.1 TMR

312. Consistent with both Ofwat and the Disputing Companies, the CMA has recognised that a long-run 'stable-TMR' approach may under or over-estimate the TMR over the regulatory investment horizon, depending on where the current RFR lies, compared to the long-run average. Given that interest rates have increased even further since Ofwat's FD and the cut-off date for our SoC,

we agree with the CMA's upper end reflecting an approach that combines a long run ERP with a current RFR.

313. However, the CMA's estimate of 4.8% is likely to underestimate the implied ERP from the Dimson Marsh and Staunton (**DMS**) dataset. This is because the CMA's analysis subtracts the *realised* return on a long run bond series from annual TMR returns to derive its ERP. However, the realised return on the portfolio of government bonds that is compiled by DMS (which is designed to have a maturity of 20 years)[218] is not risk free because it will include both inflation and interest rate risk at an annual horizon. This will tend to overstate the underlying RFR and in turn understate the ERP.

314. An alternative approach is to use a long run historical series of promised yields[219] on long term government bonds, which will not be distorted by risk premia to the same extent. This alternative estimate of the ERP is presented in Figure 29 alongside the CMA's estimate from the PFs.

FIGURE 29: TMR UNDER ALTERNATIVE APPROACHES TO DERIVING THE ERP FROM DMS

Approach	ERP	CMA RFR	Implied TMR
CMA PD, realized bond return	4.8%	2.5%	7.3%
Promised bond yields	5.2%	2.5%	7.7%

Source: NWL analysis of DMS and CMA PD. NWL PD Response Databook.

315. Turning to the CMA's other estimates, we agree that a 1-year arithmetic average of the DMS outturn TMR is an appropriate estimator of the TMR in this context.

316. Similarly, we agree with using Fama French and DMS decomposition ex ante approaches as further data points for the TMR. However, we disagree with the CMA using 6.7%, as opposed to 6.9% as its Fama French estimate, which forms the lower end. This is because the Fama French 2002 model requires a trailing dividend yield, *not* a contemporaneous yield.[220] Indeed, all of the formulas in the 2002 paper use dividends at time t divided by capital value at time t minus 1 year.

5.3.2 RFR

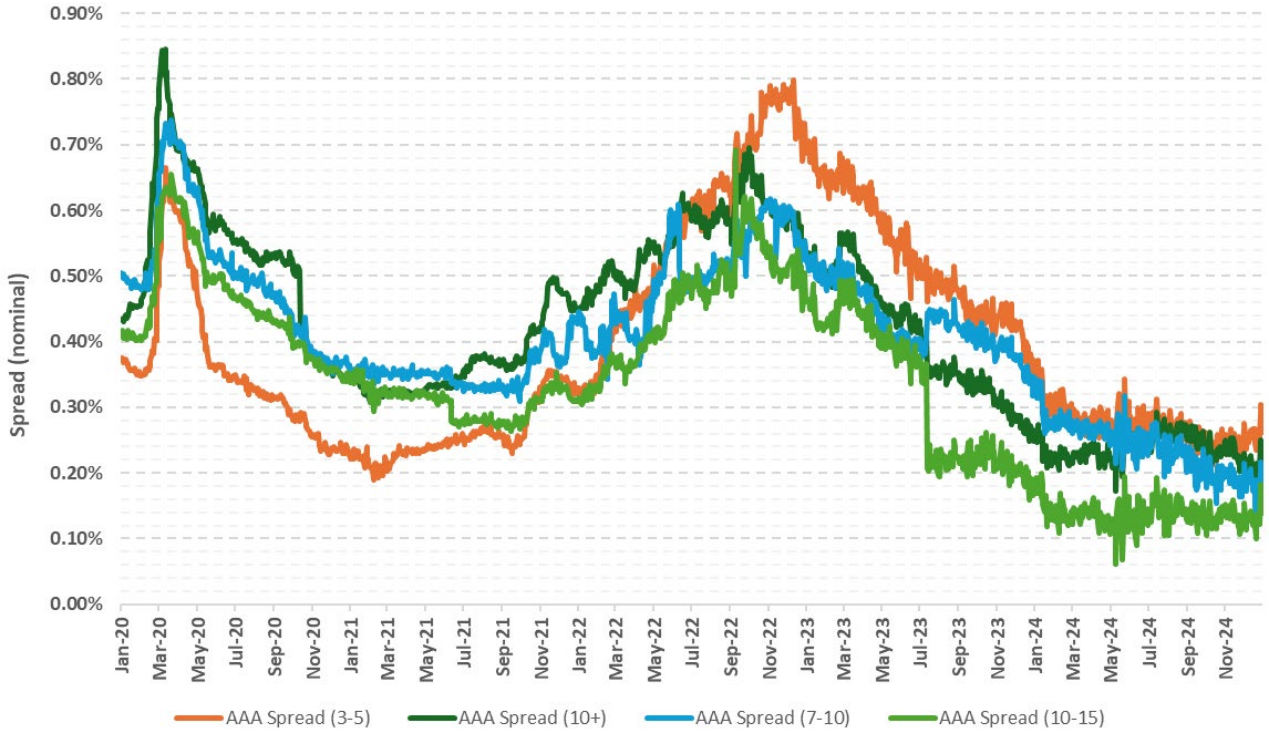
317. The CMA's PFs place sole weight on index-linked gilts, rejecting our SoC position that the RFR should be set between the risk-free lending and borrowing rates, consistent with the CMA's PR19 approach of using the Brennan improvement to the basic CAPM. This represents a surprising change from the precedent set by the CMA at PR19. The CMA's rationale for this change in approach appears to hinge upon the following arguments:

[218] Dimson-Marsh-Staunton Global Returns Data (DMS Global) Documentation (March 2025), page 3.
[219] We construct a long run historical series of promised yields on long term government bonds by splicing a series of nominal consol yields from 1899-1934 and 10-year nominal yields from 1935-1999 (both taken from the BoE's 'A millennium of macroeconomic data for the UK' (Version 3.1)), and 20-year nominal yields from 2000 onwards, when the series has been reliably available from the BoE's published yield curve data. Nominal yields are deflated using the 'constructed CPIH series' that is used by the CMA for its TMR assessment from the PFs.
[220] Fama and French, The Equity Premium, 2002 formulas (1), (2) and (3)

- the difference between lending and borrowing rates are smaller than they were at PR19,[221] such that the benefits of increased accuracy are not outweighed by the additional complexity that the Brennan model brings; and
- relatedly, there are measurement difficulties when estimating the risk-free lending rate from AAAs, in particular due to other premia within the AAA yields such as liquidity and default risk and inflation risk premia.[222]

318. The CMA considered that the measurement uncertainties coupled with the reduced gap between lending and borrowing rates meant that the simplicity benefits of using a single proxy outweighed the accuracy benefits that the Brennan model may bring. We recognise that the size of the gap between lending and borrowing rates has reduced since PR19, but as the CMA acknowledges, there is still a non-trivial difference between the two rates. This is illustrated by Figure 30.

FIGURE 30: WEIGHTED AVERAGE SPREADS BETWEEN YIELDS ON BONDS IN THE IBOXX GBP NON-GILT AAA INDICES AGAINST TENOR-MATCHED NOMINAL GILT BENCHMARK EQUIVALENT BONDS OVER TIME



Source: Kairos PR24 Allowed Return 2025, SOC001, Figure 3

319. Indeed, updating the approach adopted by the CMA at PR19[223] using a more robust CPIH estimate of 2.1%, given the evidence we present in Section 5.2 above, would generate a borrowing rate of 2.88% compared to a lending rate (based on the 20-year ILG yield) estimated by the CMA of 2.49%, resulting in a wedge of c.39bp.

[221] PD, para 7.198
[222] PD, paras 7.201 and 7.202.
[223] As detailed in PD, para. 7.198.

320. Given that stakeholders are familiar with the Brennan model from PR19, we fail to see why the CMA is comfortable trading accuracy for increased simplicity in this case. At the very least, if the CMA continues to set the RFR based purely on the ILG yields then the known downward bias and in turn asymmetry in its CAPM range should be reflected when selecting a point estimate.

321. Finally, the CMA rejected our suggestion of a forward uplift because it found forward rates to be a poor predictor of future rates.[224] This represents a misunderstanding of our case, which was that with a fixed RFR investors need to be compensated for the risk that the RFR changes over the course of PR24. The forward uplift is the market price of this risk, not a forecast of future rates.[225] Rejecting the forward-uplift because markets mis-forecast interest rates is analogous to restating nominal debt costs because markets mis-forecast inflation. The rationale for the forward uplift was explicit in both our expert report and SoC, for example:

> It is important to note that **the purpose of the forward uplift is not to forecast the path of the RFR over time**, but to reflect the RFR at a future date that can be 'locked in' by an investor today. Uplifts based on other approaches (or no uplift) will generate a windfall gain or loss for an investor obligated to invest in a riskless asset at a future date.[226]

322. We do not therefore consider that the CMA has appropriately considered this aspect of our RFR case and request that it revisits the forward uplift ahead of the FD.

5.3.3 Beta

323. Overall, we are broadly comfortable with the CMA's provisional unlevered beta estimate of 0.31. An unlevered beta of 0.31 makes a great deal more sense relative to Ofwat's FD24 0.28 estimate and the CMA's PR19 estimate of 0.29, given the change in the risk environment for UK water.

324. However, we remain of the view that 0.33 is a more accurate estimate, based on the market data. The main cause of the CMA's c.0.02 underestimate is its choice to use the unadjusted 10-year betas of SVT and UU at the lower end of its range. As set out by Kairos (and referred to in our SoC) the 10-year betas for SVT and UU are distorted below the forward-looking beta due to:

- the distortion effects of Covid-19 on water betas, which has an effect of approximately -0.02-0.03 on the SVT and UU betas;[227]
- forward-looking betas being above the long-run average due to the increase in risk facing the water sector, in particular due to the larger capex programme;[228] and
- SVT and UU representing top performing companies - a wider comparator set including PNN is likely to be more representative of the systematic risk faced by a notional water

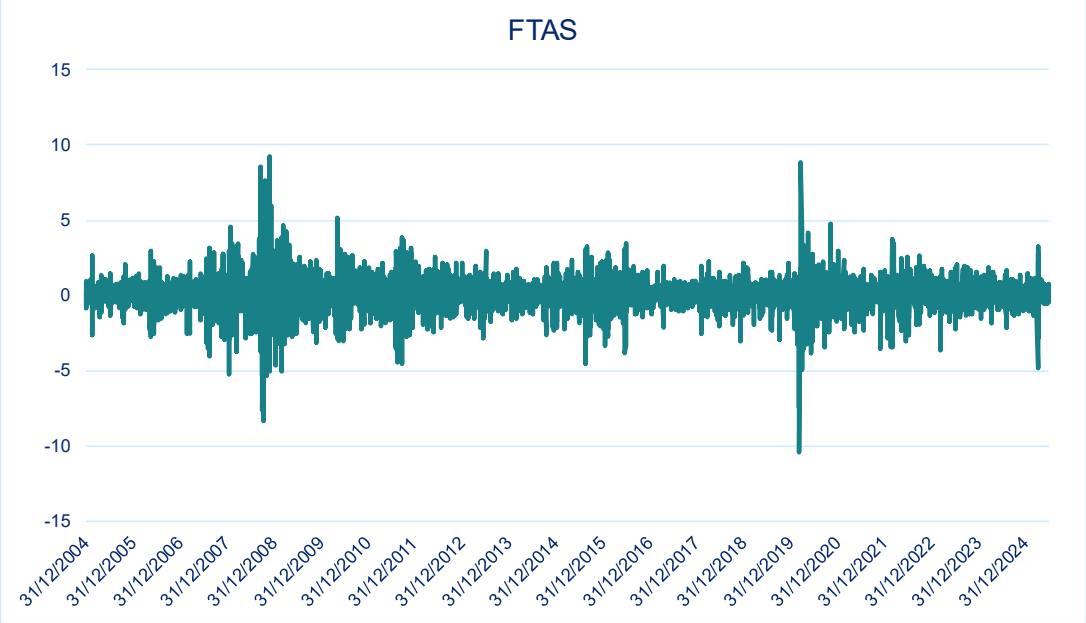
[224] PD, para 7.123.
[225] SoC Figure 51; Kairos PR24 Allowed Return 2025, SOC001 para. 85.
[226] Kairos PR24 Allowed Return 2025, SOC001, para 85.
[227] Kairos PR24 Allowed Return 2025, SOC001, Table 7.
[228] Kairos PR24 Allowed Return 2025, SOC001, paras 162 to 181.

company.[229]

325. The CMA's reasoning for rejecting an adjustment for Covid-19 is based upon theoretical errors and unsound reasoning and is inconsistent with the CMA's own H7 precedent. More specifically:

- the CMA considers that the bar for adjusting econometric beta estimates (through applying dummy variables or re-weighting data) should be high.[230] We agree. But Kairos provided evidence of statistical significance at the P95 level, using published government lockdown dates and numerous sensitivities on the dates selected.[231] It is unclear what the evidential bar should be based upon, if statistical significance has not met the evidentiary bar; and
- the CMA repeatedly conflates changes in volatility with changes in beta. As explained in in our joint response to Ofwat's response, changes in volatility may not mean any change in beta, as beta measures the impact that market wide volatility has on a given stock.[232] The CMA's Figure 7.10, which shows the scale of market wide volatility arising from Covid-19 compared to the last 20 years, is therefore irrelevant to the question of whether there was a structural break in water betas from Covid-19.

FIGURE 31: CMA ANALYSIS OF FTSE ALL SHARES TOTAL RETURNS



Source: PD, Figure 7.10

326. The CMA's conclusion that the Covid-19 market movements were not unusual is therefore an example of wrong reasoning as the relevant question is whether the water betas were unusually low, not whether market volatility was unusually high. However, whilst PD Figure 7.10 is not

[229] Kairos PR24 Allowed Return 2025, SOC001, paras 155 to 161.
[230] PD, para 7.356.
[231] Kairos PR24 Allowed Return 2025, SOC001 Table 9 and Disputing Companies Joint Reply to Ofwat's Responses, paras 65 to 68.
[232] Disputing Companies Joint Reply to Ofwat's Responses, paras 64.

directly relevant to the question of whether Covid-19 lockdowns caused a step change in water betas, we do not interpret the chart in the same way as the CMA. Indeed, it is quite clear from the chart that the biggest spike in volatility occurs during Covid, with the only comparable level of volatility taking place around the financial crisis. Our interpretation of PD Figure 7.10 is also consistent with a common sense view on whether Covid-19 was an unusual period for financial markets – being that it was highly unusual.

327. The CMA rejects Professor Gregory's argument that Covid-19 had a mechanical effect on water betas (as the average beta has to remain at 1 and some betas went significantly higher in response to Covid, with others, like water, reducing) by simply stating that this is what beta is supposed to measure.[233] This is a misunderstanding of Professor Gregory's argument and that put forward by Kairos.[234] Professor Gregory was simply explaining why the Covid-19 lockdowns had the effect of reducing water betas. The next step is then to consider if this effect is likely to repeat at the same frequency over the forward-looking investment horizon. Consistent with the CMA's own reasoning in H7, we do not consider that the assumption that the same effect will repeat with comparable frequency is sound. Indeed, we consider that the CMA's position in the PD is irreconcilable with its conclusion in H7 that *"We also agree with the CAA's assessment that **HAL's estimates implicitly assume that a COVID-19-like event will occur once every five, seven or ten years, which we think is not a credible assumption**. Not only does this assume that pandemic-like events are relatively frequent, it also assumes that governments' responses to such events would be similar to their handling of the COVID-19 pandemic."*[235]

328. Finally, the CMA rejects making direct adjustments for the effects of Covid-19 lockdowns on water stocks because the exercise is subjective, due to the subjective nature of the dates provided.[236] This statement fails to take into account Kairos' use of published government dates, with multiple sensitivities showing the effect is still statistically significant. Moreover, the CMA's statements around the subjectivity of the dates appears to disregard (without giving reasons) evidence we submitted in the form of date-agnostic structural break analysis, which showed that a break occurred precisely in line with the government's lockdown date.[237] We request that the CMA engages with this evidence and explains why it still considers the dates to be subjective, despite the use of published government lockdown dates, extensive sensitivity analysis and date-agnostic econometric analysis all confirming the dates used were correct.

329. With regards to the use of Pennon (PNN), the CMA appears to accept that PNN should be included post the Viridor sale.[238] It is therefore not clear why it is comfortable with it being

[233] PD, para. 7.360
[234] Kairos PR24 Allowed Return 2025, SOC001, paras 143, 147 and 148.
[235] CMA H7 Heathrow Airport Licence Modification Appeals, Final Determination, 17 October 2023, para. 6.75.
[236] PD para 7.361
[237] Disputing Companies Joint Reply to Ofwat's Response, para. 67.
[238] PD, para 7.332.

excluded from the lower end of its range and simultaneously concluding that it's range is not asymmetric.[239] As suggested by Kairos and explained in the Technical Meeting, if a longer window of data is used but there are concerns about the representativeness of PNN prior to the Viridor sale, a portfolio approach can be adopted, whereby an investor holds pure-play water stocks over 10-years, with PNN being introduced once it is considered 'clean' of Viridor effects.[240]

330. We request that the CMA either adopts the portfolio approach for including PNN at its lower end and adjusts the historical data for the effects of Covid-19 lockdowns or at the very least recognizes the asymmetry in its beta range when selecting a point estimate.

5.4 SELECTING A POINT ESTIMATE FOR THE COST OF EQUITY

331. Overall, we are pleased that the CMA has recognised the principle of aiming-up for consumer welfare impacts and the evidentiary value in a simple top-down analysis of the debt versus equity premium, consistent with how our investors consider alternative opportunities to deploy their capital.

332. However, we are disappointed with the CMA's reluctance to engage with new techniques such as the multi-factor models (**MFMs**) and probability distribution modelling. There is an inconsistency here with the approach for example taken to base cost models, where new techniques are adopted without any concerns for their novelty.

333. We have reviewed the CMA's MARs analysis and find that it is downwardly biased because:

- the CMA has retained the broad brush 0-2% expected outperformance assumption from Ofwat's FD24 MARs model. However, this broad brush estimate has now been superseded by detailed announcements from the listed companies on how they expect to perform over PR24. Market participants are likely to place more weight on the expected performance by the companies themselves than Ofwat's 0-2%. The CMA's model therefore does not reflect the most up to date and accurate information; and
- the CMA continues to use the same approach to RCV growth as Ofwat, by using a model that requires an assumption of RCV growth into perpetuity.

334. Kairos provided a more robust alternative, in the form of a truncated approach, that splits the RCV growth assumption between a 20-year forward look and a perpetuity assumption in 20-years time.[241] This allows more accurate RCV growth estimates to be used for the first 20-year period, which reduces the uncertainty in the outturn CoE's that is driven by the terminal value assumption. The CMA rejects this approach and continues to use a 0-2% RCV growth

[239] PD, para 7.567.
[240] Kairos PR24 Allowed Return 2025, SOC001, Table 10.
[241] Kairos PR24 Allowed Return 2025, SOC001, paras 230 and 231 and Table 17.

assumption into perpetuity:

> Although we recognise that it may be useful to assume differing RCV growth assumptions for the short and longer term, we note there is uncertainty in the estimation of the terminal value in Kairos' analysis and therefore we conclude that Kairos' methodology is not obviously more robust…[242]

335. This is an example of wrong reasoning. Whilst the Kairos analysis does still require an assumption for the perpetuity RCV growth this is only required in 20 years' time, which means it has much less of an impact on the implied CoE estimates. As such there is much less uncertainty introduced by the RCV growth assumption in the Kairos model versus the one adopted by the CMA. Moreover, given the long-term investment programmes planned for the sector, a lower end of 0% RCV growth is simply indefensible and not 'conservative'[243] as the CMA provisionally concludes.

336. Using updated market data alongside the truncated approach adopted by Kairos, and including a 1% RoRE expected outperformance assumption, which is the midpoint of the outperformance range assumed by the CMA and which broadly reflects the projected performance expectations of SVT, UU and PNN, results in a revised MARs range of 5.4% to 6.5%, as set out in Figure 32.

FIGURE 32: UPDATED MARS ANALYSIS USING RECENT MARKET DATA UNDER KAIROS' TRUNCATED APPROACH

Comparator	MAR	Implied CoE (%)
UU	1.15	5.6%
SVT	1.18	5.4%
PNN	1.04	6.5%

Source: CMA PD, Refinitiv, NWL analysis. Notes: MARs are calculated using: (i) an average of the market capitalisation values between 9 October 2025 and 22 October 2025 to capture market values following the CMA's publication of its PFs on 9 October, and (ii) the value of debt and unregulated activities used by the CMA in its PD. Implied CoE calculations assume 1% expected RoRE outperformance, short-term RCV growth of 2.3% and long-term RCV growth of 1%. NWL PD Response Databook.

[242] PD, para. 7.452.
[243] PD, para 7.456.

6 OTHER ISSUES

337. In this section we cover a range of smaller issues not captured elsewhere in our response: outcomes (see Section 6.1) and bill profiling (see Section 6.2).

6.1 OUTCOMES

6.1.1 Outturn Adjustment Mechanism (OAM)

338. We are concerned that the PD outcomes package may still have a negative skew. This is because ex ante modelling is not precise, and we will only know at the end of the AMP whether the package was calibrated as expected. This problem can be seen in the PR19 outcomes package where, despite the best efforts made by Ofwat and the CMA, the historical performance data now shows that the package had a significant downward skew where the average company received an ODI penalty across the AMP equivalent to 0.68% RoRE on the common ODIs.[244] We therefore do not think that the CMA can be confident that it has "addressed the Disputing Companies' concerns around the outcomes package 'at source'".[245] We continue to believe that the only way to ensure that the ODI package is a "fair bet" is if the deadband is removed and it is not possible to confirm ex ante if this is the case.

339. We disagree with the CMA that removing the deadband would be a disadvantage to customers:

> Removing the deadband would be a material change in the risk and reward balance – in favour of the Disputing Companies and to the disadvantage of customers, which does not seem necessary or appropriate.[246]

340. The deadband is applied symmetrically to outperformance and underperformance to the median companies. It is therefore just as beneficial for customers as it is for companies. Removing the deadband would also avoid a situation in the future where we realise that the ODI targets have been set too generously for companies – and instead makes sure that any additional rewards made by companies in this scenario would be returned to customers.

341. Similarly, we note that the CMA is "concerned that the removal of the deadband could result in potentially rewarding poor performance across the industry".[247] First we disagree with the motivation behind this statement – if targets have been set at impossible levels that companies are not able to meet then bringing the package back into balance is not rewarding performance, it is avoiding penalisation of reasonable performance. Second, due to the symmetry of the OAM, the removal of the deadband avoids the rewarding of companies when targets were not

[244] Ofwat WCPR25: data total for AMP7 years by Company, average of five years total divided by notional regulatory equity. WPCR25 Data (includes Ofwat's WCPR data for C-MEX, leakage, water supply interruptions, water quality compliance, water and wastewater asset health, internal sewer flooding and pollutions).
[245] PD, para 8.187
[246] PD, para 8.187
[247] PD, para 8.186

stretching enough. This should also be relevant in the CMA's consideration of the removal of the OAM deadband.

342. Removal of the OAM deadband is the only way to ensure a fair outcome between companies and customers and we therefore ask the CMA to reconsider this issue.

6.1.2 Total pollutions ODI incentive rate

343. We want to make sure that the CMA and Ofwat are joined up in their changes they are making in respect of the total pollutions ODI. The CMA has proposed to change the ODI incentive rate in its PD. Ofwat is also currently consulting on changes to the total pollutions ODI as a result of changes to the Environmental Performance Assessment (**EPA**) methodology.[248] The Ofwat changes only apply to years 2 to 5 of AMP8 (i.e. 2026/27 to 2029/30) after the EPA changes come into effect.

344. To ensure that the CMA and Ofwat's changes work together, the FD should make clear that:

- any changes to the total pollutions incentive rate would only apply to year 1 of AMP8 if Ofwat makes changes to the incentive following its consultation; and
- the changes outlined in Ofwat's consultation would apply for all disputing companies for years 2 to 5 of AMP8.

6.2 BILL PROFILING

345. The CMA invites comments on the bill profiling from the revenue changes. The current approach as set out would require a substantial revenue increase on FD in 2026/27 and then a declining and negative adjustment by 2029/30. In attempting to flatten the natural annual bill increases in the FD as the enhancement programme accumulates, it gives an unnecessarily high increase in 2026/27, then reverses some of it in later years.

346. When we spoke with them in developing our business plan our customers[249] supported a transitional approach to bill increases spread gradually over the period. This would apply **equal stepped increments to the FD in each of the 4 years.**[250] This is the approach taken by the CMA in the PR19 redeterminations. This is also the profile proposed by CCW in its response to the CMA approach consultation.[251] We suggest the CMA makes this change in its FD.

[248] Consultation-on-changes-to-three-PR24-environmental-performance-commitments.pdf
[249] Deliberative research into complex bill drivers for 2025-30, p.70.
[250] Giving the same total revenue value in NPV terms, using the financial model reprofiling function
[251] Consumer_Council_for_Water_Response_to_Approach.pdf, 3.3.

7 ANNEX 1 – DETAILED INFORMATION ON OUR MODELLING ROBUSTNESS CONCERNS

7.1 STATISTICAL ROBUSTNESS

7.1.1 Overview of the robustness tests used by Ofwat

347. As noted in Section 2.2.1 Ofwat has developed a number of important tests for understanding the robustness of models used to assess costs.

FIGURE 33: MODEL ROBUSTNESS TESTS USED BY OFWAT AT PR24[252]

What it does	Why it is important
Statistical significance of the cost drivers (t-test) This tests whether the data can statistically reject the hypothesis that the coefficient is zero (i.e. it has no impact on costs). This is presented as stars (*) after the coefficients in the presented output. The more stars the more statistically significant (i.e. different from zero) the cost driver is.	The presence of statistically significant guards against the inclusion of spurious relationships and cost drivers which cannot be estimated with any precision (i.e. they have a wide standard error or variance which means that statistically they cannot be differentiated from zero).
Adjusted R-squared "The adjusted R-squared measures how closely the model fits the data. It measures the proportion of variation in the dependent variables (in our case, variation in costs) that is explained by the model. The statistic is within the range from 0 to 1. The higher the value the closer the model fits the data."	The cost models need to be able to explain a significant portion of the differences between companies costs in order for them to be helpful in setting cost allowances. However, Ofwat identify concerns with purely seeking a high goodness of fit: "But equally, a strategy of searching for a model with a high R-squared has the risk of finding a model that fits the data well but is in fact incorrect. Because rather than reflecting the true underlying relationship, the model could be capturing accidental features of the data at hand". This is a concern that we have with the CMA's approach as it seems to put much more weight on finding a better goodness of fit at the expense of other robustness tests discussed in this table.
RESET test "This is a test to detect if an alternative functional form may be superior, through missing non-linear terms (e.g. quadratic). The higher the p-value, the more confident we are that the functional form is adequate."	Failure of this test usually means that you explore alternative functional forms to see if they are preferable.
VIF This assessment is used to detect multicollinearity – for example two measures of density or scale measured using different data would be expected to be highly correlated.	"High collinearity means that we cannot estimate the coefficients with confidence – their variance is high and statistical significance low. As a consequence, the individual coefficient estimates are not precise and unstable. As a rule of thumb, a VIF >4 indicates medium risk and VIF >10 indicates harmful collinearity. An exception to this rule is when the model includes a variable and its quadratic term. In such cases the VIF becomes high due to the correlation between these two related terms." In these cases we (and Ofwat) present the next highest VIF score to avoid this issue. We are concerned that the CMA's inclusion and the LASSO's approach choosing multiple density measures

[252] All quotes in this table are from FD24 Base Cost Appendix SOC620 Table 9, pp. 61-63.

	creates a high level of collinearity and therefore inaccurate estimates of the coefficients to these variables.
Pooling/Chow test	
"This is a test to determine the appropriateness of using a panel dataset structure. When using a panel data estimation method, we assume that the estimated coefficients in the model are stable over time – ie the null hypothesis of this test is that the slope of the estimated relationship is stable over time. If the null hypothesis is rejected, it would imply that each individual cross-section has its own slope, and the panel data analysis may not be appropriate. The higher the p-value, the more confident we are that panel data analysis is appropriate."	If this test is failed then it is an indicator that there may be a structural break in the data and that the model should not be estimated over the full timespan of the data as the relationship between the drivers and costs is not stable.
LM test	
This is a standard "Breusch-Pagan LM test" for pooled OLS versus random effects. This test is failed for lower p-values. "Failure of this test would indicate that the random effects estimation method is preferred over the pooled OLS estimation."	This essentially tests whether a random effects estimator (as used by Ofwat) is likely to be better than an OLS estimator (as used by CMA).
Normality, Heteroskedasticity	
"Obtaining the best estimates using OLS requires the model residuals to be normally distributed with an average of zero and a constant variance. If this assumption is violated, the model estimation results are still unbiased and consistent. Hence, a low level of importance is attached to these test results. Normality and heteroskedasticity tests are failed for lower p-values. If the normality test fails, it would suggest that the model residuals are not normally distributed. If the heteroskedasticity test fails, it means that the variance of the model residuals is not constant across observations. If the test fails, different measures could be introduced to address the issue (eg use cluster standard errors)."	These tests are less important (also as graded by Ofwat) but are an indication that raw OLS estimation is not appropriate. Given that we know that the data is from a panel data structure (where observations for a company are related to one another) we would expect there to be heteroskedasticity which would point towards the use of a panel data estimator (like Ofwat) or the use of corrected standard errors to account for this. We are surprised that the CMA has reported the raw standard errors from a OLS regression as we would expect these to be biased given our knowledge of the data.
Sensitivity checks	
"This is a test to assess robustness of the model to changes in the underlying assumptions. Results of the test are reported using the following RAG rating (the lower the rating, the less confident we are in model stability): • Red (R): the estimated coefficients present changes in sign, and the p-value changes by more than 0.1 for at least one explanatory variable; • Amber (A): the estimated coefficients have the same sign for all explanatory variables, but the p-value changes by more than 0.1 for at least one explanatory variable; and • Green (G): the estimated coefficients have the same sign for all explanatory variables, and the p-value does not change by more than 0.1 for any explanatory variable"	If the modelled estimates are sensitive to the removal of a small part of the dataset this is indicative of a non-robust estimate of efficient costs as it implies that the results are driven by a small number of observations. This means that the results are less likely to be robust when forecasting out of the sample, i.e. when predicting efficient cost for AMP8.

Source: NWL analysis

348. The models presented by the CMA in its PD are estimated by standard OLS. Due to the panel data nature of the data (multiple observations from different companies) the data does not satisfy the assumptions of the classical linear regression model for OLS to be the most efficient

estimator. This means that the standard errors are biased and underestimated which implies a higher level of certainty in their estimation than is the case. To address this, when presenting the results of the tests detailed above for the CMA's model (labelled "OLS no robust se" in each case) we also present a version in the next column with robust standard errors to give a more accurate reflection of the statistical significance of each variable. We also present in the final column the estimates from a Random Effects estimation of the CMA's final model to show the difference when reflecting the panel data nature of the dataset.

7.1.2 Application of the robustness tests to the PD Water Resources Plus Model (WRP)

FIGURE 34: RESULTS AND ROBUSTNESS TEST FOR THE PD WATER RESOURCES PLUS MODEL

Cost driver	Explanatory variable	WRP (OLS no robust se)	WRP (OLS robust se)	WRP (RE robust se)
Scale	Connected properties (log)	0.897***	0.897***	0.920***
Economies of scale	Volume treated per WTW (log)	0.083	0.083	0.198**
Complexity	Water treated at complexity levels 3 to 6 (%)	0.009***	0.009**	0.002
Density	LAD from MSOA - Weighted average density (log)	-0.500***	-0.500**	-0.551***
	MSOA - weighted average density (log) – squared	0.088***	0.088***	0.068***
	Properties per length (log)	3.309	3.309	0.447
	Properties per length (log) – squared	-0.563**	-0.563	-0.152
	Energy interacted with length of mains (log*log)	0.013	0.013	0.017
Constant	Constant	-15.537***	-15.537	-9.457
Robustness tests	Adjusted R-squared	0.936	0.936	0.929
	RESET test	0.007	0.007	0.929
	VIF	21.14	21.14	21.14
	Pooling/Chow test	0.995	0.995	0.995
	LM test	N/A	N/A	0
	Normality	0.007	0.007	0.007
	Heteroskedasticity	0	0	0
Sensitivity checks	Remove most efficient company	GREEN	AMBER	AMBER
	Remove least efficient company	RED	RED	RED
	Remove 1st year	GREEN	GREEN	GREEN
	Remove last year	GREEN	AMBER	GREEN

The stars indicating the significance of the coefficients used by Ofwat are slightly different to the CMA's. For Ofwat: * 0.10 ** 0.05 *** 0.010. For the CMA: . 0.10 * 0.05 ** 0.010 *** 0.001. We have used Ofwat's way for the tables.

Source: results from running the CMA's WRP model in Stata. NWL PD Response Databook.

349. We observe the following from these results for the WRP model:

- the CMA's estimation without robust standard errors or Random Effects overstates the

statistical significance of the cost drivers. Using unbiased estimates we see the properties per length (log) squared variable is no longer statistically significant; and the Water treated at complexity levels 3 to 6 variable is no longer significant when estimated by Random Effects which takes account of the panel data structure of the model;

- once the standard errors are calculated more accurately, the Ofwat models cost drivers have better statistical significance – only the weighted average treatment complexity variable is not significant in 2 of the 6 Ofwat models, whereas in the CMA model with robust standard errors there are variables that are not statistically significant. The Ofwat models are superior in this area;
- the Reset test for the CMA model used has a very low P-value indicating a high risk of misspecification of the functional form. The Ofwat models all have significantly higher p-values in the 0.478 to 0.937 range indicating a much lower risk;
- the VIF test results over 10 indicate a high risk of multicollinearity which could result in imprecise and unstable coefficient estimates. These VIF scores result from the inclusion of multiple density variables which LASSO selects whereas the Ofwat models do not suffer from this (they all have VIF scores less than 1.3 indicating a low risk in this area);
- the Breusch-Pagan LM test for the RE estimation clearly shows that the data strongly supports the use of RE over pooled OLS due to the low p-value (i.e. the pooled model is strongly rejected) – this indicates that the RE estimation approach is preferred over an OLS estimation. The Ofwat models already use this RE estimation approach and the test similarly supports the use of this technique; and
- the sensitivity checks are also much worse for the CMA's model. Once the standard errors are corrected using robust estimation there are 2 ambers indicating some large changes (>0.1) in the p-values, and there is a red. This means that when the least efficient company is removed from the sample the coefficient on the log of property per length variable changes sign from positive to negative. This shows that the CMA's model is very dependent on a small number of data points in determining the estimated coefficients. This is not surprising given the higher risk of over-fitting in a LASSO model where many of the coefficients are already not statistically significant as they are estimated with a high variance. The Ofwat models for WRP have on average 1.5 ambers each across the 6 models and no reds whereas the CMA's model has 2 ambers and a red for just one model. This shows that the CMA's models are much more sensitive and therefore less robust to small changes in the input data.

7.1.3 Application of the robustness tests to the PD Treated Water Distribution Model (TWD)

350. We see a similar picture for the TWD model estimated by the CMA compared to the Ofwat suite of models (6 for TWD).

FIGURE 35: RESULTS AND ROBUSTNESS TEST FOR THE PD TREATED WATER DISTRIBUTION MODEL

Cost driver	Explanatory variable	TWD (OLS no robust se)	TWD (OLS robust se)	TWD (RE robust se)
Scale	Length of mains (log)	0.865***	0.865***	0.934***
Topography	Booster pumping stations per length of mains (log)	0.306***	0.306	0.309*
	Average pumping head TWD (log)	0.338***	0.338***	0.280***
Density	LAD from MSOA - Weighted average density (log)	-2.280***	-2.280***	-2.294***
	LAD from MSOA - weighted average density (log) – squared	0.158***	0.158***	0.159***
	MSOA - weighted average density (log) – squared	0.031***	0.031	0.034*
	Properties per length (log) – squared	0.04**	0.04	0.04
Input price	Wages interacted with length of mains(log*log)	0.037	0.037	0.006
	Energy interacted with length of mains (log*log)	0.017***	0.017*	0.020***
Constant	Constant	-0.291	-0.291	-0.094
Robustness tests	Adjusted R-squared	0.969	0.969	0.97
	RESET test	0.008	0.008	0.261
	VIF	25.98	25.98	25.98
	Pooling/Chow test	0.996	0.996	0.996
	LM test	NA	NA	0
	Normality	0.194	0.194	0.194
	Heteroskedasticity	0.333	0.333	0.333
Sensitivity checks	Remove most efficient company	RED	RED	AMBER
	Remove least efficient company	GREEN	AMBER	RED
	Remove 1st year	GREEN	AMBER	RED
	Remove last year	GREEN	GREEN	GREEN

The stars indicating the significance of the coefficients used by Ofwat are slightly different to the CMA's. For Ofwat: * 0.10 ** 0.05 *** 0.010. For the CMA: . 0.10 * 0.05 ** 0.010 *** 0.001. We have used Ofwat's way for the tables.

Source: results from running the CMA's TWD model in Stata. NWL PD Response Databook.

351. We see the following when examining the CMA's TWD model:

- 3 fewer variables are statistically significant once the standard errors are estimated more accurately using a robust estimator to account for the panel data structure;
- overall, this means that 4 variables are not statistically significant with robust standard errors (or 2 if estimated by random effects). By contrast all of the variables in the Ofwat TWD models are statistically significant indicating a more robust estimation;
- the low p-values on the RESET test indicate a high risk of misspecification of the functional form, particularly for the OLS version used by the CMA. By contrast the Ofwat models have better p-values;

- the VIF tests for the CMA models are much worse (all >10) compared to the Ofwat models (all <2) indicating that the CMA's models have more collinear variables (driven by overlapping density measures) which could result in much more uncertain and less accurate estimation of the underlying relationships;
- the Breusch Pagan LM test again supports the use of a random effects estimator over pooled OLS due to the panel data structure of the data which supports the Ofwat approach; and
- the CMA's TWD model also does worse against the sensitivity checks. Once robust SEs are used there are 2 ambers for changes in p-values and when the most efficient company is removed the sign of log of property per length squared variable changes from positive to negative.

7.1.4 Application of the robustness tests to the PD Wastewater Network Plus Model (WWNP)

FIGURE 36: RESULTS AND ROBUSTNESS TEST FOR THE PD WASTEWATER NETWORK PLUS MODEL

Cost driver	Explanatory variable	WWNP (OLS no robust se)	WWNP (OLS robust se	WWNP (RE robust se)
Scale	Load (log)	0.675***	0.675***	0.675***
Economies of scale	Load treated in size bands 1 to 3 (%)	0.011	0.011	0.011
Complexity	Weighted average treatment size (log)	-0.122***	-0.122*	-0.122**
	Load treated with ammonia consent ≤ 3mg/l (%)	0.004***	0.004***	0.004***
Topography	Pumping capacity per sewer length (log)	0.115	0.115	0.115
Urbain rainfall	Urban rainfall per sewer length (log)	0.088***	0.088*	0.088*
Density	LAD from MSOA - Weighted average density (log)	0.193**	0.193	0.193
	MSOA - weighted average density (log)	-0.281*	-0.281	-0.281
	Properties per sewer length (log)	0.599**	0.599	0.599
Input price	Energy interacted with pumping capacity (log*log)	0.016***	0.016*	0.016**
Constant	Constant	-3.894***	-3.894**	-3.894**
Robustness tests	Adjusted R-squared	0.955	0.955	0.959
	RESET test	0.188	0.188	0.000
	VIF	34.883	34.883	34.883
	Pooling/Chow test			
	LM test	NA	NA	NA[253]
	Normality	0.067	0.067	0.067
	Heteroskedasticity	0.183	0.183	0.183
Sensitivity	Remove most efficient company	AMBER	AMBER	AMBER

[253] Stata could not perform the standard Breusch-Pagan LM test for random effects (p_value = 1) because random effects estimation requires at least as many groups as model parameters. With 10 companies and 11 coefficients (including intercept), the test and random effects model are not estimable.

checks	Remove least efficient company	AMBER	AMBER	AMBER
	Remove 1st year	GREEN	GREEN	GREEN
	Remove last year	AMBER	AMBER	AMBER

The stars indicating the significance of the coefficients used by Ofwat are slightly different to the CMA's. For Ofwat: * 0.10 ** 0.05 *** 0.010. For the CMA: . 0.10 * 0.05 ** 0.010 *** 0.001. We have used Ofwat's way for the tables.

Source: results from running the CMA's WWNP model in Stata. NWL PD Response Databook.

352. Our assessment of the PD WWNP models shows a similar picture that:

- correcting for robust standard errors reduces the number of statistically significant cost drivers by 3 variables;
- in total this means that 5 of the variables chosen by the LASSO approach are not statistically significant. By comparison all the variables used in Ofwat's WWNP models are statistically significant;
- the VIF test shows a high degree of correlation between the drivers given the 3 different density measures used in the model. This means that the estimates are much more likely to produce imprecise and unstable coefficients. This can be seen by the MSOA weighted average density variable having a negative sign when all the other density variables have a positive sign in the model as they do in Ofwat's sewage collection models; and
- the results of the sensitivity checks are similar to the Ofwat models.

7.2 ACCURACY OF RESULTS

7.2.1 Our approach to testing the accuracy of the results

353. The metric will reflect combined impact of imprecision / sensitivity for individual coefficients (e.g. a less "significant" coefficient on an explanatory variable will tend to go hand-in-hand with increased sensitivity of modeled costs). We have used this metric to compare the CMA's set of models against Ofwat's *triangulated suite* of models (taken as a whole).

354. The method involves the creation of a large number of variant datasets (see box on the variant datasets). For each variant dataset we calculate modelled costs, in £m for each company and year by first calculating modelled costs for each model and then aggregating/triangulating across the set of models used by Ofwat or CMA. We do this separately for water and wastewater.

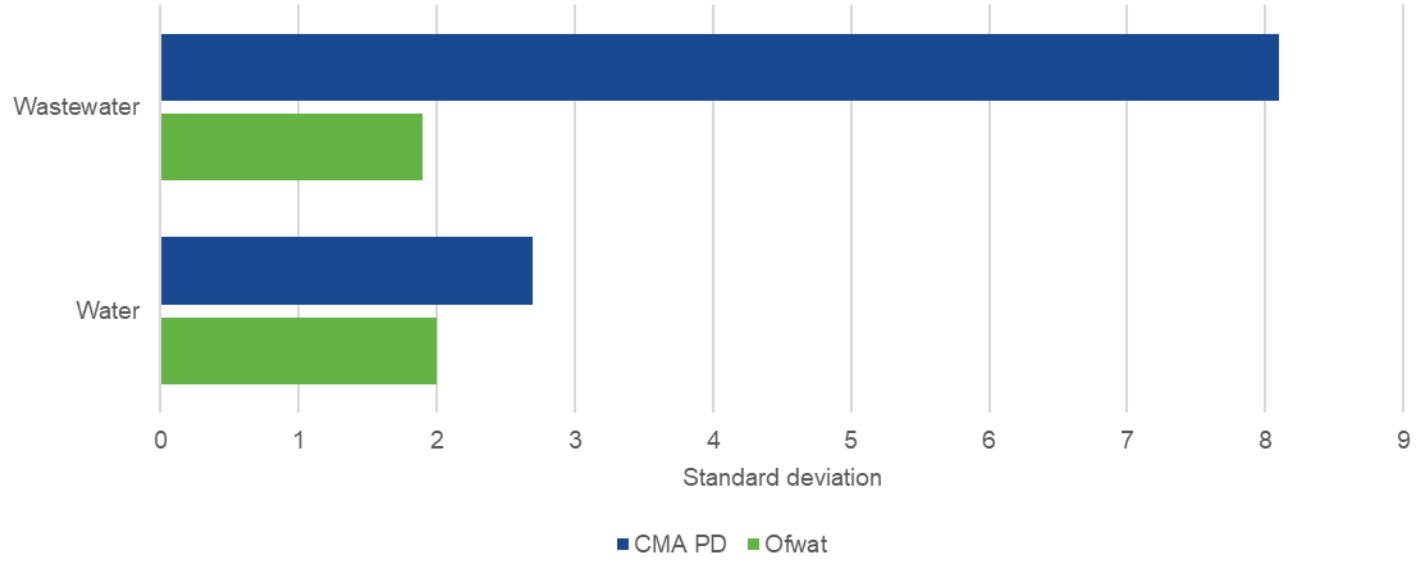
355. For each company and year, we calculate the % difference in modelled costs derived from the regressions estimated on the variant dataset with those derived from regressions on the original dataset. Repeating across all variant datasets produces a large number of observations relating to the sensitivity of modelled costs under: (i) the Ofwat FD model suite (triangulated) and (ii) the CMA's model (or combination of two models in the case of water).

356. We can then take the standard deviation across these observations as a metric to compare the CMA and Ofwat approach in terms of sensitivity of modelled costs to dataset variations.

7.2.2 Results of our assessment of the accuracy of the results

357. Figure 37 below compares the standard deviation of the Ofwat and CMA's PD estimates of modelled costs to the dataset variations described above.

FIGURE 37: STANDARD DEVIATION OF SENSITIVITY OF MODELLED COSTS TO DATASET VARIATIONS



Source: NWL analysis using Ofwat's FD dataset. NWL PD Response Databook.

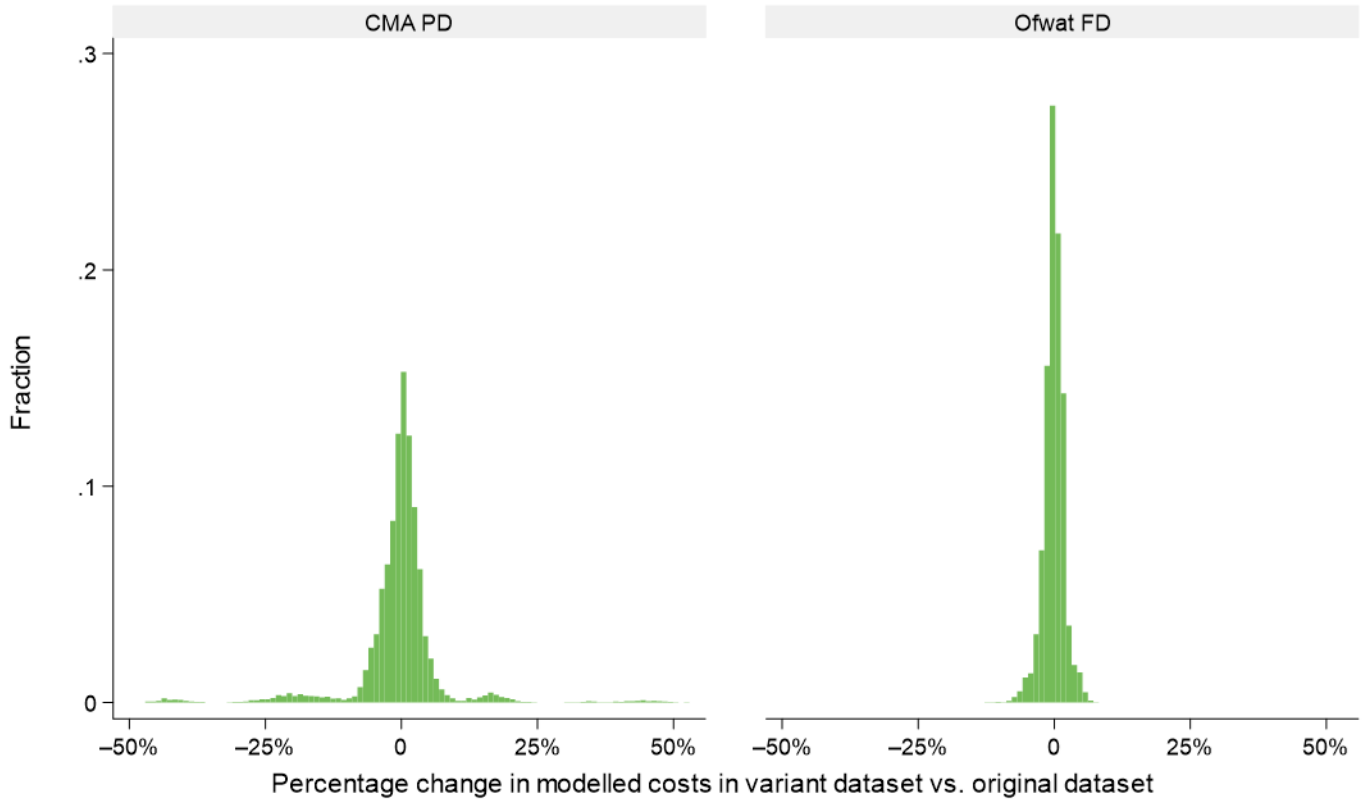
358. The higher the standard deviation, the more sensitive modelled costs are to the variations in the dataset created by dropping companies and years. These results indicate that the CMA models produce predicted cost estimates that are considerably more sensitive to variants in the data than Ofwat's triangulation across its suite of models. Any benefits of the CMA models in terms of goodness of fit have come at the cost of worse statistical precision in estimation results.

359. These results are consistent with the coefficients in the CMA models having worse statistical significance versus Ofwat's models and cases of the CMA models' coefficients not making intuitive sense.

360. Figure 38 below further demonstrates the greater degree in uncertainty in the CMA's estimates of modelled costs compared to the Ofwat FD models. We consider that this convincingly demonstrates that the CMA's models have been over-fitted. They have a better R-squared (or lower RMSE) but this comes at the expense of less certainty and robustness in the estimation of modelled costs and therefore in efficiency differences between companies. This is consistent with the findings that many of the CMA's cost drivers are statistically insignificant (as they are estimated with a high variance or degree of uncertainty, and the coefficient on the MSOA weighted average density variable has the opposite sign of what would be expected (likely caused by the multicollinearity with other density variables). Ofwat's approach also relies on greater triangulation which is likely to result in more robust estimates as results are not

dependent on a single model.

FIGURE 38: HISTOGRAMS OF MODELLED COSTS SENSITIVITY FOR OFWAT & CMA WASTEWATER MODELS



Source: NWL analysis using Ofwat's FD dataset. NWL PD Response Databook.

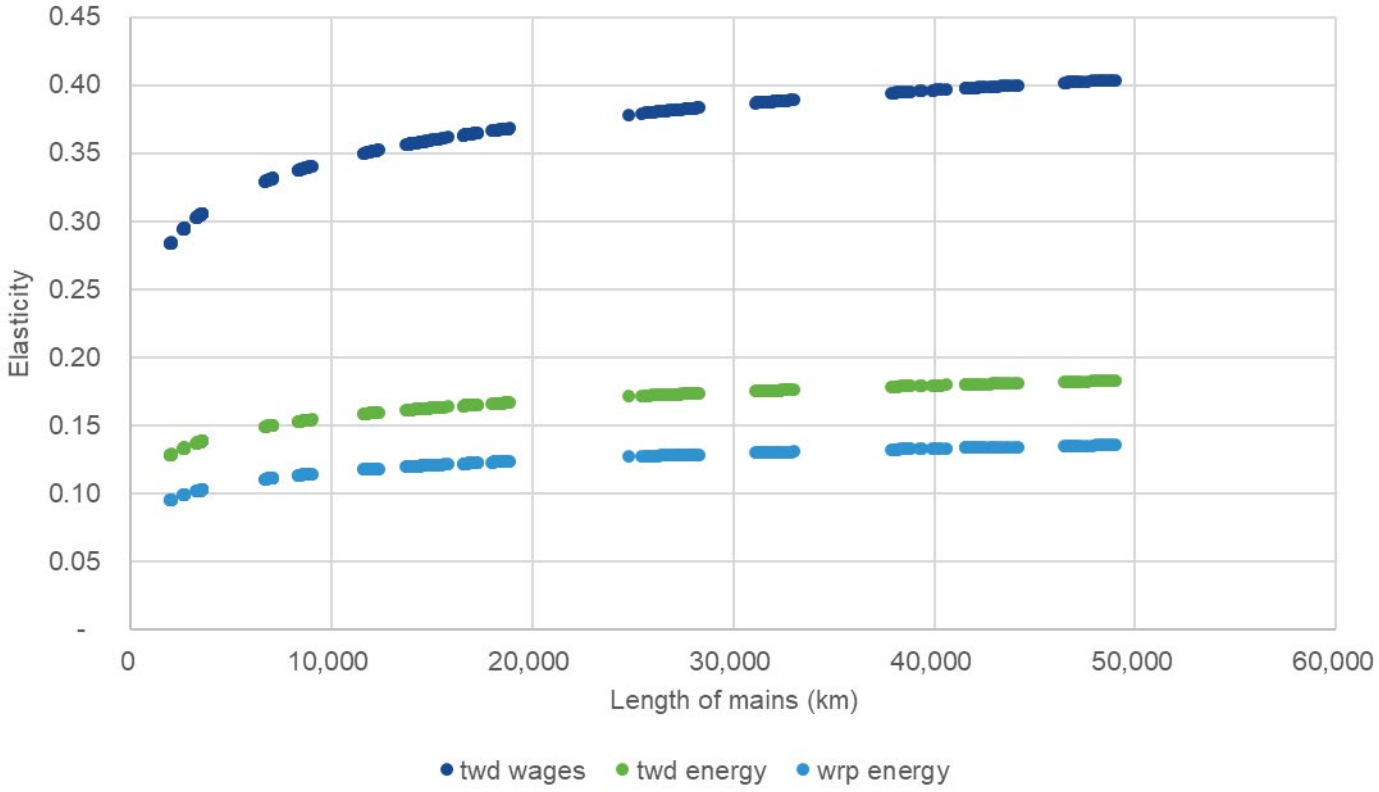
7.3 PLAUSIBILITY OF ESTIMATED RELATIONSHIPS

361. Given the interaction terms used the elasticity between wages or energy and costs is non-linear in these models. The elasticity measures the percentage increase in costs from a 1% increase in wages or the energy index. We have plotted the elasticities for these variables in the water models in Figure 39. It shows the elasticity is larger for companies with longer lengths of mains. We cannot think of a good engineering or economic rationale for why that would be the case.

362. In the case of wages, it implies that a 1% increase in wages will increase costs by 0.3% for the smallest companies but by 0.4% for the largest company. This effectively means that larger companies would have a larger share of labour costs than smaller companies which doesn't seem to have any basis in theory or the evidence collected as part of PR24.

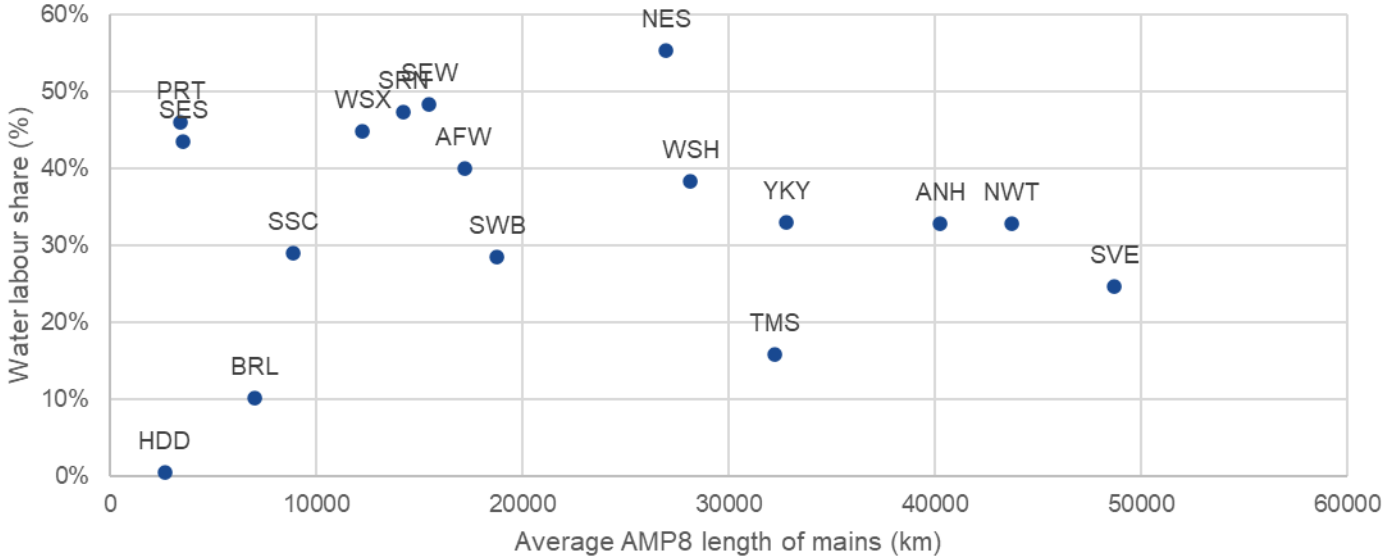
363. Figure 40 plots the labour share of water base costs against each company's length of main. The evidence from companies' business plans is not consistent with that relationship as there is no clear upward trend and the companies with the largest lengths of networks do not have the highest labour share of costs.

FIGURE 39: ELASTICITIES OF WATER WAGE AND ENERGY VARIABLES



Source: NWL analysis. Elasticities of wage and energy are calculated by multiplying their coefficients (from CMA models) with log of length of mains for all companies and all years. Length of mains is from tab "Cost driver" of Ofwat's FD feeder model 3. NWL PD Response Databook.

FIGURE 40: WATER LABOUR COST SHARE VS LENGTH OF MAINS

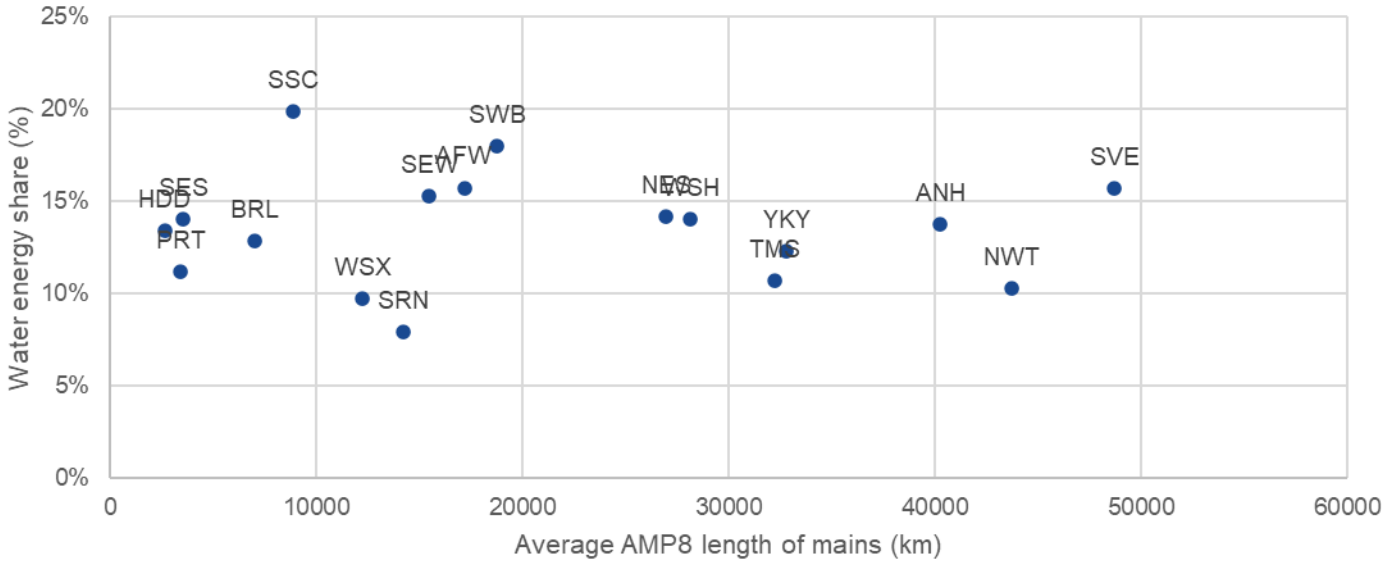


Source: NWL analysis. Water labour share is from table SUP11 of companies' business plan data tables. Length of mains is from tab "Cost driver" of Ofwat's FD feeder model 3. NWL PD Response Databook.

364. We get a similar finding when we look at the relationship between the energy price index and water base costs. As can be seen from Figure 39 there is also an upward sloping elasticity for energy prices implying that a 1% increase in energy prices has a larger percentage impact for companies with longer length of mains. This again does not appear to have any engineering or economic rationale. As with wages, that relationship is also not supported by the information submitted by companies in their APR data that Ofwat used to set the energy cost adjustment as shown in Figure 41.

365. This chart again does not show any clear relationship between length of main and the share of energy costs. The functional form selected by the CMA therefore appears inconsistent with both theory and the data.

FIGURE 41: WATER ENERGY COST SHARE VS LENGTH OF MAINS

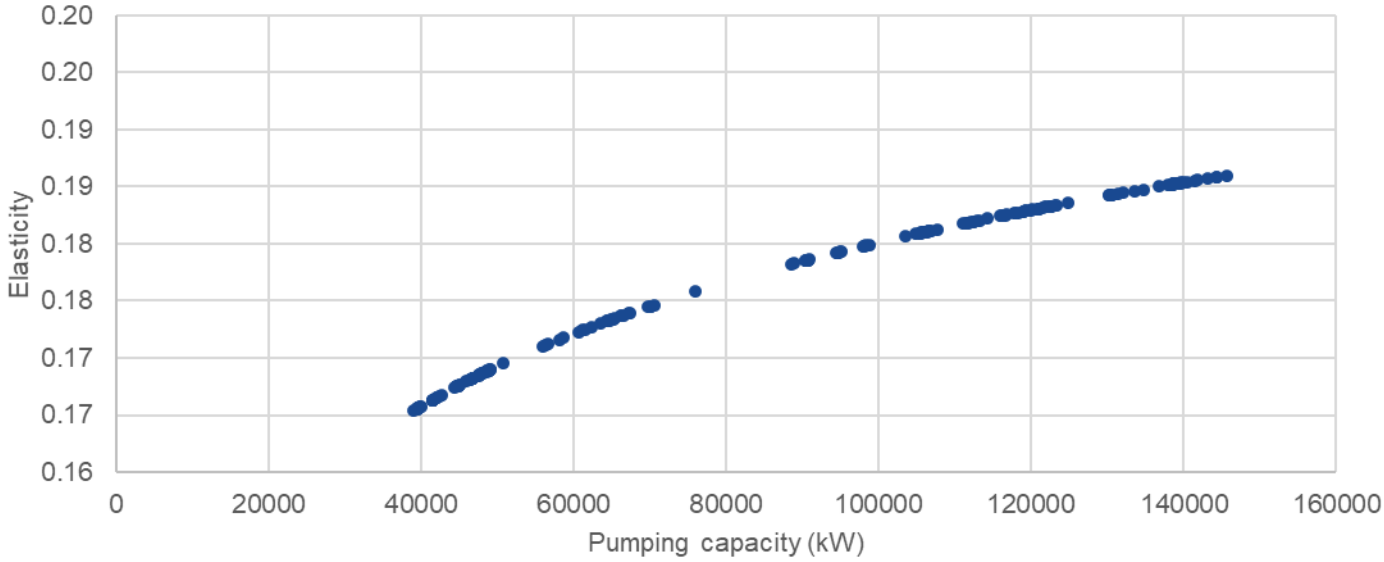


Source: NWL analysis. Water energy share is from Ofwat's FD energy adjustment model. Length of mains is from tab "Cost driver" of Ofwat's FD feeder model 3. NWL PD Response Databook.

366. The same issue arises in the wastewater model where the energy index is interacted with pumping capacity showing another upward sloping elasticity chart (see Figure 42).

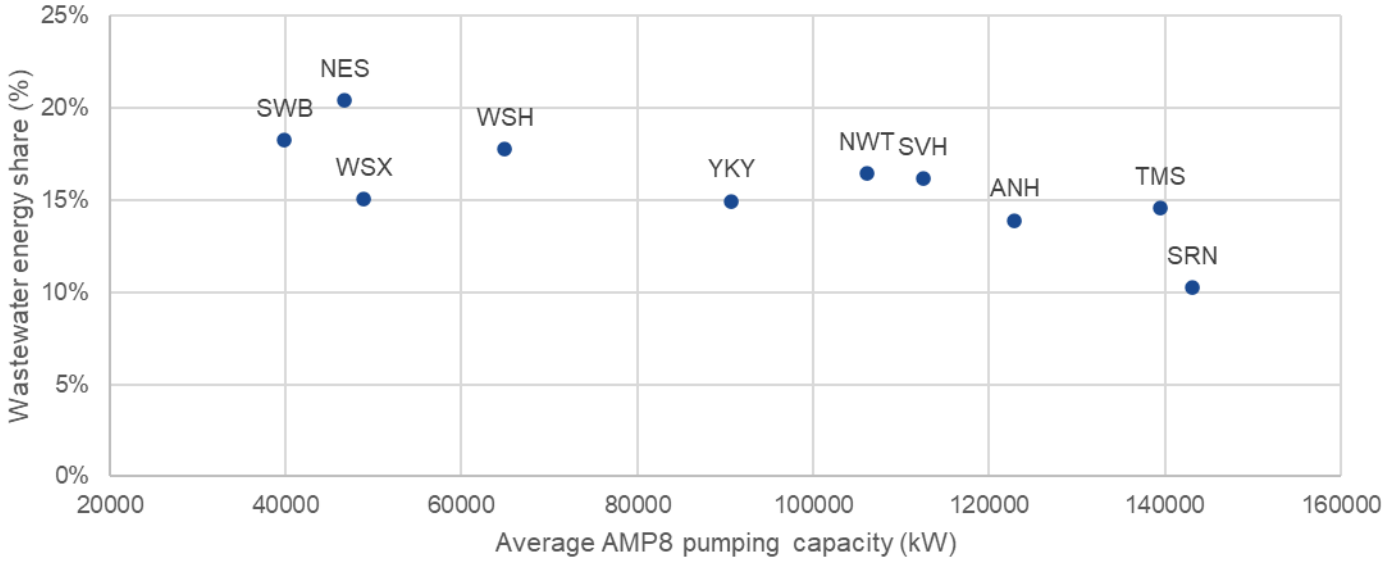
367. Again we have no engineering or economic basis to assume that this would be the case and there is no evidence in the data to support a relationship that implies larger companies have a larger share of energy costs as shown in Figure 43.

FIGURE 42: ELASTICITY OF THE WASTEWATER ENERGY VARIABLE



Source: NWL analysis. Elasticity of wastewater energy is calculated by multiplying it's coefficient (from CMA model) with log of pumping capacity for all companies and all years. Pumping capacity data is from tab "Cost driver" of Ofwat's FD feeder model 3. NWL PD Response Databook.

FIGURE 43: WASTEWATER ENERGY COST SHARE VS PUMPING CAPACITY



Source: NWL analysis. Wastewater energy share is from Ofwat's FD energy adjustment model. Pumping capacity is from tab "Cost driver" of Ofwat's FD feeder model 3 (a calculation of sewer length*pumping capacity per length). NWL PD Response Databook.

7.4 CHOICE OF THE UPPER QUARTILE FOR THE EFFICIENCY CHALLENGE

368. Indeed, in its final determinations on the RIIO-2 appeals (2021), the CMA noted the importance of considering model limitations and using regulatory judgement when setting the efficiency benchmark:

> As a starting point, we observe that the choice of efficiency benchmark is an area where the regulator has to use judgement, based on an overall assessment of what level of efficiency improvements should be achievable by those firms which appear to be less efficient within the efficiency benchmarking and taking into account its various duties. There is no direct way to measure the choice of benchmark.
>
> When setting an efficiency benchmark there is a range of options available to regulators. The closer the regulator sets the efficiency benchmark to the modelled efficiency level of the frontier firm the greater the challenge. However, given the limitations of the models, the true level of the frontier is unknown and so the regulator needs to exercise its judgement when selecting the level of efficiency benchmark included in the price control. [254]

369. In its redetermination of the Bristol Water PR14 price controls, the CMA recognised that in setting the benchmark for the catch-up efficiency challenge (i.e. whether at the UQ or at some other point), it is important to take account of the quality of econometric benchmarking models, the degree of uncertainty in its results (i.e. predicted costs) and the potential for data error. Specifically, the CMA said:

> The regulatory precedent from Ofgem and the CC has also recognised that a less demanding benchmark than the upper quartile may be appropriate in cases where there was less confidence in the modelling results. The effect of modelling error and limitations will tend to mean that an upper quartile benchmark will require levels of efficiency that are, in practice, greater than the upper quartile.
>
> […]
>
> We were concerned that an efficiency benchmark based on an upper quartile efficiency concept would be overly demanding if applied to the results of the econometric models that we used. This was a judgment in the light of the issues we had identified both from our review of Ofwat's econometric models and from our development of alternative models. [255]

370. The CMA decided to use an "average-efficiency benchmark" rather than an upper quartile benchmark in the Bristol Water PR14 redeterminations to reflect its judgement "in the light of general concerns about the risks of inaccuracy in benchmarking analysis that compares measures of totex or base expenditure between companies and specific concerns about inaccuracy in our econometric models and those used by Ofwat".[256]

371. In reaching this view on the Bristol Water PR14 redeterminations, the CMA referred to an earlier determination by the Competition Commission on the Northern Ireland Electricity (NIE) price controls, which considered the relationship between model limitations and the choice of efficiency benchmark in greater detail. Here, the CMA found:

> Weaknesses or limitations in the econometric models and any errors or inconsistencies in the data set we used will contribute to the variance in costs across the 15 companies in the sample. We would expect this to have an effect on the statistical properties of the cost benchmarks. We would expect this variance to

[254] CMA RIIO-2 Final Determination, paras 12.130-12.131.
[255] CMA Bristol Water, PR14 redeterminations, para 4.222 and 4.224.
[256] CMA Bristol Water, PR14 redeterminations, para. 4.235.

> introduce a bias that overstates the relative performance of companies ranked better than the median performance and understates the relative performance of companies ranked worse than the median. Where we see a company that has performed relatively well in the benchmarking analysis we would expect that, on the balance of probability, its performance or rank has been improved (to some degree) by modelling limitations and data issues.
>
> In the presence of modelling limitations and data error, we expect that our choice of the fifth company for the benchmark means that, on the balance of probability, NIE would need to be more efficient than the fifth company if its costs are to match our estimated cost benchmark. An effect of modelling limitations and data issues is that the cost benchmark is more demanding than it might appear.
>
> We noted that Ofgem has set less demanding benchmarks than the upper quartile, such as benchmarks based on the upper third or median company, where it has had more concerns about the accuracy of its benchmarking analysis (eg because of data inconsistencies). [257]

7.5 ERROR IN THE CMA'S PD APPROACH

372. As pointed out by Economic Insight there is an error in the R code for choosing the penalty parameter lambda. The CMA states that it has followed a standard approach which is using lambda.1se. However, the R code provided seems to "conflate whether the standard error is applied in MSE space or in lambda space".[258] Correcting for this error results in significant changes to the set of variables selected by LASSO, efficiency challenge, and the allowances for all companies.

373. For wastewater, the top-down model (wastewater network plus) is still chosen due to lower RSME. However, LASSO has dropped all the density variables which were previously included. This goes against the established view that density is an important driver of wastewater cost. For water, the bottom-up approach (water resources plus and treated water distribution models) no longer has the lowest RMSE and therefore the top-down model (wholesale water) is chosen. This model keeps most of the input variables (including the density variables). LASSO seems to behave one way in water models and another in wastewater models even though there are several similarities between them. In addition, the regional wage variable, which was only included in the treated water distribution model, is now picked in all water and wastewater models. If the CMA believes the original models are sensible and appropriate, how can it justify using the new models given how different they are.

374. Using these models, efficiency challenge has become more stretching. For water it has gone from 5.6% to 6.2% and for wastewater from 4% to 6.7%. This also means a staggering reduction in allowances of £677m for the sector for water and £651m reduction for wastewater.

375. We present the detailed performance tables of the top-down water and wastewater models in Figure 44 (water) and Figure 45 (wastewater). In general, we found the new models suffer similar

[257] CMA NIE Final Determination, paras 8.135-8.137.
[258] EI LASSO Error, NWL-PD-REP-002.

robustness issues and are no better than the original ones. The estimation without robust standard errors overstates the statistical significance of some cost drivers. The wastewater model fails the RESET test (low p value) indicating misspecification of functional form. The VIF test shows highly correlated variables in both water and wastewater models. We notice that the coefficient of regional wage has negative sign which could be due to its strong correlation with the scale variables (properties and load). This makes no sense as it suggests that companies operating in higher wage regions should have lower costs. Another unexpected finding is the sign of volume treated per WTW variable. In the original CMA's water resources plus model, it has a positive coefficient whereas in the updated water model, the coefficient is negative in OLS models and positive in random effects model. These changes in sign make it difficult to understand the impact of these drivers on costs and to determine whether to include it in the models. The new models also fail the sensitivity tests where dropping the most/least efficient company from the dataset has caused one cost driver to change sign. This has happened to all models.

FIGURE 44 - DETAILED PERFORMANCE TABLE - WATER

Cost driver	Explanatory variable	Water wholesale (OLS no robust se)	Water wholesale (OLS robust se)	Water wholesale (RE robust se)
Scale	Connected properties (log)	0.945***	0.945***	0.955***
Economies of scale	Volume treated per WTW (log)	-0.026	-0.026	0.085
Complexity	Water treated at complexity levels 3 to 6 (%)	0.005***	0.005	-0.002
	Weighted average treatment complexity	0.011	0.011	0.093
Topography	Booster pumping stations per length of mains (log)	0.148**	0.148	0.18
	Average pumping head TWD (log)	0.185***	0.185**	0.235***
Density	MSOA - weighted average density (log) - squared	0.048***	0.048***	0.041***
	LAD from MSOA - weighted average density (log)	-1.768***	-1.768***	-1.624***
	LAD from MSOA - weighted average density (log) - squared	0.112***	0.112***	0.100***
	Properties per length (log)	-0.878***	-0.878***	-0.675**
Input price	Energy interacted with length of mains (log*log)	0.018***	0.018***	0.017***
	Wages interacted with length of mains(log*log)	-0.006	-0.006	-0.006
Constant	Constant	-1.697*	-1.697	-2.791*
Robustness tests	Adjusted R-squared	0.976	0.976	0.974
	RESET test	0.585	0.585	0.862
	VIF	34.96	34.96	34.96

	Pooling/Chow test	0.977	0.977	0.977
	LM	NA	NA	0
	Normality	0.639	0.639	0.639
	Heteroskedasticity	0	0	0
Sensitivity checks	Remove most efficient company	AMBER	AMBER	AMBER
	Remove least efficient company	RED	RED	RED
	Remove 1st year	AMBER	GREEN	GREEN
	Remove last year	GREEN	GREEN	GREEN

The stars indicating the significance of the coefficients used by Ofwat are slightly different to the CMA's. For Ofwat: * 0.10 ** 0.05 *** 0.010. For the CMA: . 0.10 * 0.05 ** 0.010 *** 0.001. We have used Ofwat's way for this table.

Source: results from running the corrected wholesale water model in Stata. NWL PD Response Databook.

FIGURE 45 - DETAILED PERFORMANCE TABLE - WASTEWATER

Cost driver	Explanatory variable	WWNP (OLS no robust se)	WWNP (OLS robust se)	WWNP (RE robust se)
Scale	Load (log)	0.667***	0.667***	0.641***
Economies of scale	Weighted average treatment size (log)	-0.078***	-0.078**	-0.099*
Complexity	Load treated with ammonia consent ≤ 3mg/l (%)	0.006***	0.006***	0.004***
Topography	Pumping capacity per sewer length (log)	0.272***	0.272**	0.119
Urbain rainfall	Urban rainfall per sewer length (log)	0.086**	0.086*	0.120***
Input price	Energy interacted with pumping capacity (log*log)	0.016***	0.016**	0.015**
	Wages interacted with load (log*log)	-0.003	-0.003	0.017
Constant	Constant	-2.787***	-2.787***	-2.699***
Robustness tests	Adjusted R-squared	0.952	0.952	0.951
	RESET test	0.038	0.038	0
	VIF	21.653	21.653	21.653
	Pooling/Chow test	1	1	NA
	LM	NA	NA	0
	Normality	0.036	0.036	0.036
	Heteroskedasticity	0.498	0.498	0.498
Sensitivity checks	Remove most efficient company	RED	RED	AMBER
	Remove least efficient company	AMBER	AMBER	RED
	Remove 1st year	GREEN	GREEN	AMBER
	Remove last year	GREEN	AMBER	AMBER

The stars indicating the significance of the coefficients used by Ofwat are slightly different to the CMA's. For Ofwat: * 0.10 ** 0.05 *** 0.010. For the CMA: . 0.10 * 0.05 ** 0.010 *** 0.001. We have used Ofwat's way for this table.

Source: results from running the corrected wastewater network plus model in Stata. NWL PD Response Databook.

376. We observe the following from the wholesale water model:

- the CMA's estimation without robust standard errors or random effects overstates the statistical significance of the cost drivers. 2 fewer variables are statistically significant once

robust standard errors are used. This means a total of 5 variables chosen by LASSO are not statistically significant;

- the VIF test shows that model suffers from multicollinearity. This is mainly driven by overlapping density measures and the strong correlation between wage scale and properties;
- the Breusch Pagan LM test supports the use of a random effects estimator over pooled OLS due to the panel data structure of the data which supports the Ofwat approach; and
- the model does worse against the sensitivity checks. When the least efficient company is removed from the sample, the coefficient of weighted average treatment complexity (wac) variable changes sign from positive to negative. When using random effect model, both wac and percentage of water treated at complexity levels 3 to 6 change sign.

377. For the wastewater network plus model, we observe the following:

- the coefficient of the wage scale variable has negative sign in the OLS models but positive sign in the random effects model. It is also not statistically significant in any of the models. This is likely due to the strong correlation with the scale variable (load);
- the low p-values on the RESET test indicate high risk of misspecification of the functional form. The LM test again supports the use of random effects over pooled OLS; and
- the model also does worse against the sensitivity checks. Once robust SEs are used there is an extra amber for changes in p-values and when the most efficient company is removed the sign of the wage variable changes from negative to positive.

378. In terms of statistical performance, these updated models are not better than the original models. They fail most of the robustness tests and are sensitive to changes to the sample.