Anglian Water

# 4A. PROVIDING APPROPRIATE REGULATORY FUNDING FOR CAPITAL MAINTENANCE ACTIVITY: ENSURING CAPITAL SUSTAINABILITY AND SERVICE RESILIENCE


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# PROVIDING APPROPRIATE REGULATORY FUNDING FOR CAPITAL MAINTENANCE ACTIVITY: ENSURING CAPITAL SUSTAINABILITY AND SERVICE RESILIENCE

DR HARRY BUSH CB AND JOHN EARWAKER

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## EXECUTIVE SUMMARY

Asset health, and the necessary capital maintenance, is key to the sustainability and resilience of the water and wastewater service standards that consumers value. It is also important to inter-generational equity. Assuring appropriate capital maintenance over time has been a perennial issue for UK policymakers, with independent economic regulation of both private and public entities providing the potential for an objective, evidenced, long-term approach in most of the UK's infrastructure industries.

Ofwat's approach in PR19, mirroring in part that of PR14, has been to assess capital maintenance as part of base expenditure (botex), using sector-wide econometric approaches which seek to standardise PR19 funding allowances around the historical spend of the 25th percentile company during the period 2011-18. Such an approach, in isolation, looks to us to create a significant risk of mis-provision for capital maintenance on an individual company basis. This is because underlying capital maintenance requirements can vary markedly between companies, and within companies over time, depending inter alia on differences in underlying asset health and age. We are therefore concerned as to how far Ofwat is really capturing top quartile efficiency in its PR19 botex allowances (as is its stated intention) as compared to instead merely basing all companies' cost allowances on historical lower quartile volumes of maintenance activity irrespective of the profile of past investment, new information on the underlying condition of assets, or any other company- or period-specific factors which may be impacting on asset health and serviceability.

The water sector has been here before. Ofwat was sharply criticised following PR99 for relying too much on historical patterns of spend and of failing adequately to take account of forward-looking risk assessments of maintenance need. The result was the development through joint working across the sector of improved approaches to asset management and information and the development of risk-based approaches to forecasting capital maintenance requirements. It is perhaps understandable that Ofwat does not wish to embrace entirely the methods of the past, given the move that there has been to board ownership of business plans and reduced regulatory intrusion into company decision-making. It is less understandable that risk-based analyses of future capital maintenance requirements should seemingly play no part at all in its PR19 assessment of capital maintenance given the apparent variability and cyclicality of this activity.

The obvious solution to this problem is one that Ofwat, the Competition & Markets Authority (CMA) and other economic regulators have all identified in the past, namely the triangulation of historical cost benchmarking with more grounded asset-based evidence. In our view, a price review in which the funding levels suggested by econometric models are cross-checked, when necessary, against engineering assessments is likely to produce more rounded and accurate overall funding allowances than a review in which lower quartile historical expenditure is simply rolled forward for another five years. This was also the CMA's view in the 2015 Bristol Water case, and we note that other regulators also use such information even where (as in Ofgem's case) there is the potential in a multi-company environment for sector-wide benchmarking.

Against this background, we think it advisable for Ofwat to take account of forward-looking asset and engineering information as it considers companies' revised business plans in the run-up to draft and final determinations. This might mean permitting companies to make special cost factor claims under a capital maintenance heading or through instituting a more generic process to enable the necessary cross-checking of econometric projections with company-specific information. The precise process is to our mind less important than that the work is undertaken to provide assurance to customers and government on service sustainability and resilience.

***Update, July 2019. We have seen no evidence that Ofwat has, in the draft determinations issued in July 2019, supplemented its econometric modelling by consideration of company-specific information in the way we suggest; it may be that time was too tight. However, this omission makes it even more important that the necessary work is put in hand in good time for its final determinations later this year.***

# PROVIDING APPROPRIATE REGULATORY FUNDING FOR CAPITAL MAINTENANCE ACTIVITY: ENSURING CAPITAL SUSTAINABILITY AND SERVICE RESILIENCE

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## Overview

This paper contains an independent perspective on Ofwat's PR19 approach to assessing capital maintenance expenditure. It looks at Ofwat's PR19 methodology in the context of historical experience in the water sector and the approaches that have been used by regulators in other regulated industries. The central recommendation is that Ofwat should consider, as part of its analysis of companies' resubmitted business plans, revisiting its approach to capital maintenance to take account of the more forward-looking, risk-based approaches developed in the sector under Ofwat auspices. The aim should be to ensure that the econometric analysis that Ofwat is utilising in PR19 is appropriately complemented by more risk-based analysis of companies' inevitably differing expenditure requirements and profiles.

## Background

Capital maintenance in the water sector is critical to resilient networks and the services they supply to customers over the longer term. In recent years it has accounted for an increasing proportion of sector capital spend.[1] Ensuring that companies have the resources to enable them efficiently to maintain their networks is therefore a critical part of Ofwat's periodic review, as Defra has noted in its statement of strategic objectives and priorities for Ofwat.[2]

In its PR19 Initial Assessment of Plans (IAP), for the second successive periodic review following PR14, Ofwat has set companies' capital maintenance allowances as part of a wider total expenditure (totex) aggregate. These allowances have been derived from econometric analysis of recent historical spend and by rolling forward assessed lower quartile industry expenditure through to 2024/25.

### Box 1

Ofwat's funding for capital maintenance expenditure for the period 2020/21 to 2024/25 (AMP7) is contained within a set of allowances for total base expenditure (botex) – i.e. operating costs plus capital maintenance costs, excluding capital enhancement costs. Ofwat's PR19 botex allowances have so far been assembled via econometric analysis of companies' expenditures between 2011/12 and 2017/18. This approach to setting allowances approach involves:

- normalising companies' historical botex for a small number of exogenous factors, like the number of connected properties and sewer load in each region;
- identifying the 25th percentile level of normalised annual company expenditure during the 2011/12 to 2017/18 period; and

[1] Anglian Water (2015), Capital maintenance planning: from a historical and future perspective.
[2] Defra (2017), The government's strategic priorities and objectives for Ofwat, passim.

- projecting forward the cost that each company will incur in AMP7 if they maintain expenditure levels in line with historically observed lower quartile industry spend.

(An overview of Ofwat's models is given in a technical appendix that accompanied its 31 January 2019 initial assessment of plans.)[3]

In addition to the modelled expenditure which Ofwat obtains from this process, the regulator has separately provided for certain 'cost adjustment claims', where companies have been able to evidence that they will encounter expenditure requirements in AMP7 that are not captured in Ofwat's econometric modelling. Ofwat has also assumed that productivity growth in the sector will cause the efficient level of expenditure to fall by 1.5% per annum in real terms.

The botex allowances that Ofwat has obtained via this process are, in aggregate, around £2.8 billion or 8% lower than forecasts made in business plans in September 2018. At an individual company level, 13 out of 16 companies receive lower allowances than they asked for, with six companies (Anglian Water, Southern Water, Thames Water, Yorkshire Water, Bristol Water and SES Water) seeing shortfalls against projected expenditures of more than 10%.

## Purpose and approach of this report

In light of the potential implications of Ofwat's IAP for the funding of future capital maintenance expenditure, we have been commissioned by Anglian Water to consider how Ofwat (and regulators generally) should ensure that they are making sufficient provision in regulatory allowances for capital maintenance activity. This is particularly important as this area of expenditure makes a major contribution to system resilience and the sustainability of the service quality that customers value, safeguards long term asset health, and helps to ensure future customers are not adversely impacted by short-term decisions on expenditure.

We have approached this work from the perspective of regulators seeking to ensure that they reach balanced decisions in an inevitably uncertain world with imperfect and potentially contested information. There is now, in contrast to past decades, a much more developed information set around asset health and performance standards in the water sector, and indeed other regulated sectors. It is not for regulators themselves to become asset health experts but rather to assure themselves that the allowances they set enable companies to maintain their assets (against licence requirements), that future performance targets are achievable within the botex envelope and that companies have the necessary systems and information to make informed decisions. A key theme of this paper will therefore be how far the information from asset management systems should appropriately be reflected in the methodologies for fixing regulatory cost allowances, alongside other evidence, especially the results of econometric analysis of historical industry expenditure.

This report first considers in Section 1 some of the historic and policy context which should inform regulators' approach to this area; Section 2 then reviews the regulatory approach in successive Ofwat reviews, including the parliamentary and CMA reactions; Section 3 briefly considers how capital maintenance is tackled in other regulated sectors; Section 4 considers the lessons from Ofwat's previous reviews and from the experience of other sectors, the implications of these for the PR19 process so far, and how Ofwat might best ensure that the remainder of that process best

[3] Ofwat (2019), Supplementary technical appendix: Econometric approach.

assures that capital maintenance requirements for individual companies have been appropriately reflected in its final determinations.

## 1. Historical and policy context

Critical infrastructure in the UK is largely, if not entirely, provided by the public sector or economically regulated private companies. The historical, pre-1980s position was overwhelmingly one of public provision, with cycles of spending and retrenchment determined by economic and political tides. As economic circumstances deteriorated in the 1970s, and there was increasing focus on controlling public expenditure, financial constraints began increasingly to determine investment. For the nationalised industries, external financing limits established annualised cash controls covering net spend. The easiest way for managements to meet such targets was often through deferral of capital expenditures, and the less visible spend at that – namely, the maintenance of existing assets where the adverse effects might only eventuate some years hence.[4]

Against that background, the privatisation of swathes of UK critical infrastructure alongside the creation of sector-focused, expert regulatory offices offered the prospect of infrastructure development and maintenance outside (from an industry perspective) the arbitrary financial constraints of government. Of course, the privatisation drive had multiple objectives, which varied indeed by sector, but the potential to finance needed large-scale investment was one of them. Some of this was about what is now termed 'enhancement' investment but a good deal, in the water sector at least, was about remedying the deficiencies of the past, not least in relation to serviceability standards and environmental protection, and therefore related to capital maintenance.

Privatisation was not the only tool available to government to deal with investment backlogs. Private finance for individual projects was also used, including in the water sector in Scotland. In addition to the undoubted attractions of off-balance sheet financing, PFIs also had the advantage of encouraging greater honesty and transparency in procurement as the resulting annual charge would incorporate the required maintenance over the life of the asset. Public authorities would therefore more clearly face the full cost of their decisions at the point of making them. (This advantage has been somewhat lost in the general opprobrium that PFIs have attracted for their overall expense, inflexibility and returns to shareholders but it had merit, given the incentives that otherwise existed for future maintenance costs to be ignored by decision makers.)

The purpose of this brief overview is simply to underline that issues in properly providing for capital maintenance are not new, that even now they are significantly affecting parts of public infrastructure, but that independent economic regulation of private (and, for rail and roads, public) companies has provided the potential for a more rational, evidenced approach to ensuring that the right amounts are spent at the right time for the right reasons across a substantial proportion of the UK's key infrastructure

The key issue that then arises here in a regulatory setting is, of course, one of evidence. Capital maintenance defined through asset management approaches seems to us prima facie to entail

[4] Similar effects are apparent in the public sector currently, whether in the NHS estate, local authority roads or, adjacent to the water sector, the issues around previous Environment Agency budgetary constraints. See: The Health Foundation (2018), How much has the backlog in maintenance of NHS estates increased?; House of Commons Library (2019), Briefing Paper, Local roads maintenance in England; NAO (2014), Strategic flood risk management, Part 2; Defra (2018), Central Government Funding for Flood and Coastal Erosion Risk Management in England

greater complexity than other major elements of spend and therefore to generate a greater evidential burden, both for companies making proposals and regulators opining on them. Of its nature, capital maintenance relates to the company's whole asset base which for a water company will have been built up over many decades and potentially centuries. What needs to be replaced or maintained will vary across time according to the scale of the asset base and the vintage of the assets, and also the developing state of knowledge about how those assets are performing against customers' and stakeholders' expectations. Some longer-lived assets may require less maintenance than those more recently installed depending on the materials used and the purposes to which they have been put. The justification for replacing or augmenting long-life assets where there is limited failure history adds to the complexity. And the required rate of maintenance of physical assets of the same vintage may vary depending on the pressures on them, with population or commercial growth adding to those pressures. Also, over time customer and regulatory expectations of service and resilience change with consequences for spend.[5]

This is by no means a comprehensive articulation of all the factors that bear on capital maintenance but it is sufficient to demonstrate that capital maintenance spend is likely both to vary over time for individual companies and between companies facing different built legacies and demographic and other pressures. Depending on circumstances there may be 'bow waves' of maintenance need, or, conversely, periods of lower activity, reflecting investment cycles of the past and a certain lumpiness.[6] That itself implies that capital maintenance spend need not always be on an escalating trend, but rather that patterns in one company or area of the country may not be replicated elsewhere.

Many of these issues will be reflected across the regulated sectors to varying extents. The particular complications for the water sector arise from the often very long-lived nature of its assets, the variation in the design and delivery standards prior to privatisation and the resulting asset health implications and uncertainties, the relative invisibility of many of its assets, making the maintenance case potentially more problematic and difficult to prove, and the weather and climate impacts of different company geographies. There may also be issues around shorter average asset lives and new town renewal.[7] This means that the assessment of asset health risk is both more difficult and necessary in the water sector. It is difficult at first sight to differentiate between the reasons for reduced or enhanced spend – whether the regulator is confronting a maintenance 'holiday' or, conversely, 'gold plating' or whether there is genuinely a need for less or more capital maintenance spend relative to trend. This places an emphasis on individual companies' asset health risk

[5] The National Audit Office (NAO) has described the challenges in relation to the maintenance of sewer networks the following terms: "As with most network industries, sewer networks' current performance, condition and expenditure is not necessarily a good guide to future performance, and the relationships between maintenance expenditure and the performance and condition of sewer networks are inherently complex. The age of a pipe may be a poor guide to its condition and performance. Since sewerage networks are located underground, they are relatively inaccessible. Inspection of the condition of underground assets can only be carried out by specialized programmes (most commonly using CCTV cameras) which can be costly. Sewer assets, such as pipes, can have very long lives and can be serviceable for at least 100 years before they may need renewing or replacing. They deteriorate at different rates for many reasons such as environmental factors, construction standards of pipes when installed and the materials used." NAO (2004), Out of sight, not out of mind: Ofwat and the public sewer network in England and Wales, para 3.1.

[6] House of Commons (2000), Environmental Audit Committee, Seventh Report, para. 182; Competition and Markets Authority (CMA) (2015), Bristol Water plc, Report, para. 5.95.

[7] UKWIR (2012), Understanding the impact of shorter life assets on the longer term maintenance requirements of the UK water industry; House of Commons (2008), Communities and Local Government Committee, New Towns: Follow-up.

assessment systems and how the resulting data and judgements can appropriately be reflected in regulatory decision making.

The above issues all relate to the complexities that regulators and, in other spheres, policymakers face in ensuring that the 'right' amount is allowed for capital maintenance. It is worth also reflecting on the consequences of 'getting it wrong'. Systematic underspending on capital maintenance is most often associated with gently declining service. It can often take many years before the cumulative impact becomes both noticeable and subject to public scrutiny and criticism. It is one of the reasons why such underspending often provides the easy answer to public sector budgetary dilemmas. However, there can also be what might be termed 'cliff edge effects' where failures in asset management, whether from lack of asset management, information or financial resources suddenly become all too apparent. This approach has intergenerational impacts and compromises companies licence duties. At their most severe, such as at Hatfield or Larkhall, these can involve tragic consequences for individuals and, subsequently, serious impacts on the regulatory and other bodies implicated in the problems.

Short of such catastrophes there may nevertheless be inflection points where corporate and regulatory credibility is seriously compromised. The congestion and security queuing at major U.K. airports caused by the imposition of the 'liquids' ban in 2006 laid bare for many commentators and the public the seriously deficient nature of key airport infrastructure. What had been logical (waiting on the delivery of Heathrow's new Terminal 5 to resolve capacity and comfort issues) rapidly became difficult to defend. The reputations of both BAA and the CAA took a serious hit. The former was later restructured, the latter reformed. In a less dramatic fashion, the approach that Ofwat had taken to capital maintenance in its first price reviews was castigated by a parliamentary committee as "intellectual neglect".[8]

Of course, there are lots of issues which can cause the public pillorying of regulated companies and their regulators. The difference with capital maintenance is the potentially slow-burn nature of the resulting issues, and the consequential capacity for unpleasant surprises. Of course, the improvement in asset management systems should mean that managements and regulators are better informed and prepared. Nevertheless, the lessons of history are well worth bearing in mind when companies and Ofwat approach the task of calibrating expenditures and associated funding during Ofwat's periodic reviews.

## 2. Ofwat's approach to capital maintenance since privatisation

In setting price controls, regulators are continually seeking to balance their different statutory duties, which may at times point in different directions, and also to interpret what those individual duties mean in the circumstances that the regulated sector faces. There may, to take a common issue, be a balance to be struck between the interests of consumers now and the interests of a somewhat different (given demographic change) group in the longer term. How far should present day consumers meet costs that might be better met by successor generations or, conversely and perhaps more likely, how far might pressures to keep prices down for current consumers lead to inappropriate burdens on future consumers? Questions of inter-generational equity mingle with those relating to network sustainability and resilience (though it is perhaps worth pointing out in relation to the former that for the water sector particularly current and future consumers are all likely to be benefitting from the long-lived assets paid for in various ways by our predecessors).

[8] House of Commons (2000), op. cit., para. 208.

Regulators over time also face changing circumstances. The political and social climate within which they operate can change; consumers (and their representatives) have become more demanding generally. Problems emerge that were not considered in earlier years (climate change being a notable example). And the information available about the issues that regulators face will itself change as, for example, information technology enables greater availability of data and offers new management techniques and processes.

In the years since privatisation Ofwat has had to deal with all these pressures, as can be seen in the changing approach to capital maintenance at successive regulatory reviews.

1990-00

The first ten years of Ofwat's existence were marked by a substantial increase in capital spending as the sector began to make good, in line with expectations at privatisation, the depredations of the pre-privatisation period. Capital spend generally doubled in the 5 years from 1989 and was then held broadly constant in the period 1995-00.[9]

2000-05

In PR99, there were tensions between companies, other stakeholders and Ofwat about the appropriate level of maintenance expenditure for the 2000-05 control period. Ofwat took the position that, where there had been no deterioration in serviceability indicators in the period 1992-99, it was appropriate to set allowances primarily using econometric models which effectively rolled forward the prevailing, efficient level of expenditure in the 1995-2000 for another five-year period. Companies and others disagreed, arguing that much more account needed to be taken of forward-looking assessments of the condition of the asset stock and that companies should pre-empt and predict asset failures rather than wait for problems to emerge.[10]

This resulted, ultimately, in a somewhat scathing report in late 2000 from the House of Commons Environmental Audit Committee (EAC).[11] Ofwat's approach to capital maintenance spend was characterised by the Committee as relying overmuch on past levels of spend to determine what was appropriate for the forthcoming 2000-05 period: [12]

> A clear advantage to Ofwat's indicator approach is that it emphasises the "output" of the network and the actual service which customers receive. However, the evidence put to the Committee throughout its inquiry has suggested that the disadvantages to this method are overwhelming and that it has a number of inherent flaws. These relate to the particular indicators which are used, the reliance on historical data, lack of economic appraisals and forward-looking assessments of asset condition.
>
> …
>
> Water companies need to manage and renew their sewers and water mains in order to develop appropriate levels of service to their customers on a sustainable basis. The Committee is not satisfied that Ofwat's "no deterioration" approach to the maintenance and renewal of underground assets (sewers and water mains) is a logical or acceptable means of assessing the amount of investment which water companies need to meet these requirements. The

[9] House of Commons (2000), op. cit., para. 187
[10] Ibid., paras. 198-9
[11] Ibid..
[12] Ibid., paras 195 and 208.

> Committee believes that this approach has amounted to intellectual neglect of this important problem. [13]

The Committee was also critical of Ofwat's interpretation of the evidence from customers. While Ofwat concluded that customers were inclined towards price reductions rather than service improvements – a view that arguably shaped Ofwat's entire PR99 approach to investment levels and bills – this was "out of step with other research" by government bodies and companies which had found that customers were less oriented towards price reductions where they might compromise environmental and quality benefits. The Committee saw a need to ensure that the five-year regulatory cycle was consistent with industry long term planning which "must not be compromised by short term political decisions designed to please the customer over a five-year time horizon".[14]

2005-15

In the wake of the Committee's report, Ofwat signalled a willingness to consider forward-looking assessments of capital maintenance requirements at the next price review, PR04, provided that companies worked up proper economic appraisals of future options.[15] Joint working in the sector involving Government departments, regulators and companies led to the development of a new 'Common Framework' (CF) which was based on "a forward-looking, risk-based approach (specifically the probability consequences of asset failure)".[16] It was designed to enable the economic level of capital maintenance to be identified and involved historical as well as forward-looking analysis, effectively adding the latter to the sort of analysis undertaken for PR99. The CF was in line with and drew upon increasingly sophisticated asset management methodologies that were being developed worldwide.

The CF, and the step change in asset management improvements it fostered within companies, was central to consideration of capital maintenance in the next two Ofwat price reviews (PR04 and PR09). PR04 was the first time that the forward-looking, risk-based approach enabled by the CF was incorporated into Ofwat's regulatory methodology. Ofwat assessed that given the CF's relative recency "most companies still had some way to go" in developing their asset management systems,[17] and the quality of a company's capital maintenance plan was taken into account in assessing the appropriate level of investment that it was factoring into price control calculations. Ofwat used a four-stage approach to assessing capital maintenance at sub-service level which took as its starting point in Stage A current serviceability and the trend in past investment; then explicitly considered at Stage B, using the risk-based approach, whether the future would be different; going on at Stage C to traditional regulatory assessment of the scope for efficiency using sector-wide econometric analysis; and, finally, in Stage D whether there might be (double-counting) overlap between improvement and maintenance capex.[18]

The overall approach was consistent with significant regulatory challenge to the numbers that companies submitted. The increase in spend allowed by Ofwat in PR04 was around half (relative to

[13] Similar observations were made in a 2002 NAO report: "Regulators can obtain (and in Ofwat's case have analysed) historic figures on how much maintenance and renewal has cost the companies. But this gives an inadequate guide to how much it will cost to deliver the required outputs in future …". NAO (2002), Pipes and wires, para 3.9.
[14] House of Commons, op.cit.,., paras. 47, 174.
[15] Ofwat (2000), MD161.
[16] Capital maintenance: A Common Framework, published by UKWIR, ref 05/RG/05/14.
[17] Ofwat (2004), Future water and sewerage charges 2005-10, final determinations, p.175.
[18] Ibid., pp. 172-5.

PR99) and one third (relative to actual spend 2000-05) the amounts requested by companies.[19] Yet, the approach managed to triangulate between (a) the more certain, current data on what companies were spending and the resulting serviceability, and (b) less certain, but risk-based future looking assessments of capex and serviceability requirements, while giving companies a clear, continuing incentive to improve their asset management systems. This represented a significant advance on the PR99 approach and one better matched to the criticisms of the EAC and the particularities of capital maintenance set out at the beginning of this section.

The approach used by Ofwat in PR04 was further refined, jointly with the sector, into an Asset Management Assessment (AMA) process for PR09. Companies were required to demonstrate how their asset management processes and behaviour measured against Ofwat's aspirations and to demonstrate in business plans a "robust risk-based derivation" of the economic level of capital maintenance. Once again, Ofwat took account of "the most recent evidence on expenditure trends and growth in the asset base" but made it clear that this was "only a starting point to the analysis from which we assess planned increases or reductions" in capital maintenance spend. Forward-looking projections were also part of the mix along with the quality of companies' risk-based systems. Ofwat separately reviewed exceptional items which were either "unusual" or where they involved discrete additions to serviceability parameters.[20]

Ofwat at the end of PR09 assessed that the Common Framework had served the sector well and that there had been a big improvement in companies' understanding of their assets. However, in its final PR09 determination it clearly signalled that (in the light of a near 50% increase in planned capital maintenance spend compared with 2000-05) there were questions to be asked whether "we are now approaching a sustainable level of capital maintenance for the future" and, in particular, whether differences in costs between companies be driven by differences in efficiency rather than requirements.[21]

Overall, Ofwat's developing approach through PR04 and PR09 had been to triangulate between data on past trends and the forward-looking information provided by companies' improving asset management systems. In also taking account, in the setting of capital maintenance allowances, of the quality of companies' asset management systems, Ofwat had provided an important incentive for companies to improve in this area. This will have been to the benefit of customers in helping to ensure sustainable and resilient services and that the maintenance costs were efficiently incurred and fairly spread across generations

2015-present

Given Ofwat's PR09 view on the overall level of sector capital maintenance spend, it was likely that PR14 would have entailed tougher questioning of capital maintenance spend even if Ofwat had retained its previous approach to setting price controls. In the event, however, the years following PR09 involved a fundamental rethinking of Ofwat's regulatory *modus operandi*. This went wider than price control methodology to the questioning, following the Gray review, of Ofwat's very detailed monitoring of the sector (and the risk that entailed of detracting from company responsibilities). There was also a move towards a more outcome-based approach to price controls, along with greater customer engagement in the preparation of business plans and of greater, more personal company board responsibility for them.

[19] Ibid., p.176.
[20] Ofwat (2014), Future water and sewerage charges 2010-15: Final determinations, pp. 74-5.
[21] Ibid., pp. 76-7.

One key change to price control methodology at PR14 was the introduction of totex regulation, whereby price control allowances would be set on the basis of efficient overall spend, whether capex or opex, so helping to overcome what was felt to be a bias in company decision-making towards capital expenditure. It is open to debate whether a price control process focused on outcomes and the setting of totex allowances would have been consistent with a traditional input-based approach to setting allowances. Possibly, but, in any event, Ofwat chose to emphasise top-down, econometric totex benchmarking as its main tool for assessing the overall financial resources required by companies, not least because an approach based on "relatively high level data" could "avoid the difficult and burdensome assessment of companies' operating practices and capital plans".[22] There was recognition of the difficulties there would be in modelling enhancement spend on the basis of historical data and a recognition that Ofwat would need to consider a range of data and cost estimates. There did not appear to have been a comparable recognition of the potential implications for capital maintenance. However, the use of Special Cost Factors in its determinations was an attempt by Ofwat to account for the particularities of individual company circumstances

While Ofwat's embrace of totex was broadly, if not universally, welcomed there was more company disquiet over the specification of Ofwat's models. Nevertheless, the resubmission of "non-enhanced" companies' business plans and iteration with Ofwat led to all companies bar one accepting Ofwat's Final Determinations. Bristol Water's refusal of its Ofwat Determination led to a reference from Ofwat to the Competition & Markets Authority (CMA). While Bristol Water did not itself fare particularly well from the CMA determination, the CMA criticised Ofwat's modelling and approach for Bristol Water (which mirrored that applying to all companies), and in doing so laid down some clear markers for Ofwat consideration in advance of future price reviews.

The CMA found significant deficiencies in both the specification and coverage of Ofwat's models but also with the weight and focus given to high-level modelling, instancing inter alia the problems with relying on such models to assess capex requirements.[23] It substituted its own modelling, which it restricted to 'base expenditure', namely opex and capital maintenance spend, which it believed to be more amenable to benchmarking than enhancement spend which it subjected to separate bottom-up assessment. In its determination the CMA considered it appropriate to accord greatest weight to industry-wide benchmarking while still taking account of Bristol Water's specific needs. However, the CMA was clear that there will "always be limitations to benchmarking analysis", and it therefore subjected Bristol Water's base costs to separate bottom-up review, explaining that: [24]

> …we decided to carry out a targeted review of the base expenditure forecasts from Bristol Water's business plan, drawing in part on our engineering analysis. Given our statutory duties, in particular our financing and resilience duties, we considered this assessment an important element of our determination as it enabled us to test the feasibility of the results from the econometric benchmarking analysis.

This had particular implications for capital maintenance spend. The CMA stated that:

> Capital maintenance is different from opex in that a greater proportion of capital maintenance is of a non-recurring nature from year-to-year. This means that one year's capital maintenance, or even one regulatory period's capital maintenance, will not necessarily be a good predictor of the future.

[22] Ofwat (2013), Setting price controls for 2015-20 – final methodology and expectations for companies' business plans, p. 85.
[23] CMA (2015), Bristol Water plc, para. 4.46-50.
[24] Ibid., para. 3.34.

> These characteristics of capital maintenance also pose some risks to the use of econometrics. For example, capital maintenance may be more 'lumpy'. In addition, the level of capital maintenance costs for a single company such as Bristol Water may be more closely linked to technical factors that are causally linked to the cost of the network. These may not be identified by econometric analysis[25].

The CMA, within its more detailed analysis of base costs, thus decided to carry out what it described as a "targeted", engineering-led review of Bristol Water's capital maintenance projections, which assessed both the scope of work that Bristol Water was proposing to carry out and the cost efficiency of that activity. In its final report, this bottom-up review was used to validate the results of the econometric analysis: [26]

> We considered it important to have carried out both the econometric benchmarking analysis of base expenditure and the review of Bristol Water's business plan. We recognise that both approaches have limitations. The estimate of £340 million based on the econometric benchmarking analysis is consistent with the outcome of our review of Bristol Water's business plan.

The CMA's approach in the Bristol Water case might therefore be summarised as: recognising the benefits of using top-down benchmarking where it can be applied most effectively, which is on base spend rather than enhancement spend; but also recognising its limitations, in particular (but not exclusively) in relation to capital maintenance spend, given the risk that past spend might not be a good indicator of future requirements; and therefore complementing top down benchmarking with other, more granular analysis focussed on the particularities of the individual company.

## 3. Capital maintenance approaches in other regulated sectors

As indicated in Section 1 of this report, the setting of appropriate levels of capital maintenance has been, and continues to be, a key issue for policymakers and regulators across the infrastructure space. There is therefore the potential effectively to benchmark what is done for the water sector against other infrastructure provision. In doing this, we think it most sensible to look at what other regulators have done. Whilst recognising that only Ofgem regulates a comparable multi-company sector, we include below material on the water sector in Scotland and Network Rail as potentially also containing relevant lessons.

Ofgem, RIIO-1 reviews

Energy networks' current price controls contain allowances for totex that were assembled by Ofgem via a combination of top-down econometric benchmarking and more granular, bottom-up analysis of individual cost items.

- RIIO-GD1 – Ofgem's totex allowances for the eight GB gas distribution networks for the period 2013-21 took the form of a 50:50 weighted average of the cost projections obtained from top-down econometric benchmarking and line-by-line assessment of individual cost items. Under the latter of these headings, Ofgem undertook an engineering-led assessment of replacement expenditure (repex) requirements, comprising analysis of proposed work volumes and inter-company benchmarking of unit costs.[27]

[25] Ibid., paras. 5.94-5.
[26] Ibid., para. 7.9.
[27] Ofgem (2012), RIIO-GD1 final proposals supporting document – cost efficiency.

- RIIO-ED1 – totex allowances for the 14 GB electricity distribution networks for the period 2015-23 were similarly constructed from a weighted average of the results of econometric benchmarking and disaggregated activity-level modelling. In this instance, Ofgem gave two-thirds weight to two pieces of econometric modelling and one-third weight to its bottom-up analysis.

  Ofgem stated that for asset replacement expenditure it used "a bespoke age-based model to assess two-thirds of the asset replacement category costs. This model takes account of the age of a DNO's assets. We completed a detailed qualitative assessment of the DNOs' cost and volumes justification with our expert engineering consultants, DNV GL. This involved crosschecking our model results against historical and forecast information, condition information contained in the secondary deliverables for asset health and criticality, scheme papers and other justification. Where appropriate we make qualitative adjustments to our modelled results to take this into account."[28]

The Office of Rail and Road (ORR)

Unlike Ofwat and Ofgem, which regulate multiple companies in the same sector, ORR regulates a national monopoly, Network Rail. This limits the scope for maintenance and other expenditure allowances to be set on the basis of inter-company benchmarking (although ORR has in the past had some success with international benchmarking of certain cost items). It is nevertheless worth noting that ORR has tended to adopt a noticeably forward-looking, long-term approach when assessing asset replacement expenditure during periodic reviews, and on more than one occasion has intervened to tell the company to increase activity levels beyond the projections in its initial business plan. As an example, in its most recent review, PR18, ORR advised Ministers that:[29]

> There needs to be a significant increase in the volume of renewals undertaken in CP6, to reverse the impact of the deferrals that have taken place in CP5, meet the pressures of growing traffic and address the condition of long-lived assets
>
> ...
>
> We considered the volume of renewals likely to be necessary by: drawing on our analysis of CP5 to date and likely CP5 outturn; reviewing Network Rail's emerging CP6 Plan; focussing on volumes of work assuming no change in efficiency, but assuming we do want asset condition and performance to be sustained over time (noting the above discussion on the importance of performance to end users); and undertaking selective sense checks on alternative high level approaches, and by looking at specific assets …
>
> Assuming steady state, a possible baseline for CP6 is therefore £15.6bn plus £3.4bn to catch up with the condition driven renewals deferred from CP5, a total of around £19bn before efficiencies.
>
> In reality the network is not in steady state. CP5 was intended to begin a recovery from historical underspend on civils assets, which in the event turned out to be unaffordable during CP5. We are also concerned about the much larger volume of signalling renewals that will be required from CP7 onwards, reflecting the age profile of these assets across the network, and

[28] Ofgem (2014), RIIO-ED1 final determinations for the slow-track electricity distribution companies: business plan expenditure assessment.
[29] ORR (2017), Periodic review 2018: ORR's advice to Ministers on the development of the England & Wales High-level Outputs Specification (HLOS) and Statement of Funds Available (SoFA).

> we expect Network Rail to begin making inroads into this in CP6 to ensure future deliverability.
>
> Including an allowance for these and for the projected growth would give a renewals spend of around £21bn before efficiencies.

Network Rail and the DfT accepted ORR's advice in a five-year funding settlement that was agreed at the end of 2018. The 2019-14 control period will therefore see a ramp up in Network Rail's renewal programme to meet the engineering and output requirements that ORR has flagged for the next five years.

Water Industry Commission for Scotland

During the Water Industry Commission's early work on the 2021 Strategic Review of Charges (SR21), the Commission has put considerable emphasis on Scottish Water "futureproofing" levels of service via either increased maintenance expenditure or financial provision now for higher maintenance expenditure in the medium term. A recent Commission board paper described the challenge for the regulator in the following terms:[30]

> Assessing the correct level of expenditure on maintenance of assets is very difficult. This is because of the uncertainty that exists in the timing of required maintenance expenditure – with many long-life assets - and because of the regulatory focus on establishing a 'hard budget constraint'. It can also be difficult to demonstrate a material impact on the levels of service experienced by customers of additional spending on maintenance.

In a decision paper, published last year the Commission expressed the view that:[31]

> … the current regulatory framework has not focused sufficiently on a strategy for the long-term replacement of its assets. The Commission recognised that it was highly likely that there would need to be increased expenditure on asset replacement: not necessarily immediately, but in the medium to long-term. However, the long-run need for such investment makes it prudent to take the first steps towards ensuring that Scottish Water is well placed to meet its need for investment in this area.

The Commission is currently exploring three possible approaches to capital maintenance funding in SR21: a standard fixed allowance for identified needs; a financial provision for the underlying long-run annual economic cost; and a 'project financing approach'. Before it settles on one of these approaches, the Commission is asking Scottish Water to develop a long-term asset management plan and to engage with its Customer Forum on the appropriate level of expenditure in the next regulatory period, consistent with the confidence that there is in the company's ability to target higher levels of spend in the right areas.

## 4. Lessons from past experience and implications for PR19

The overviews that we provide in sections 2 and 3 appear to us to generate three key lessons, as follows.

- First, the drivers of capital maintenance spend mean that requirements are likely to vary between companies in particular periods and over time. Even if Ofwat were to assess (as it came close to in PR09) that from a sector perspective capital maintenance spend was at a sustainable level, that could not be assumed to apply to companies individually. Companies

[30] WIC board paper quoted in Indepen (2017), Capital maintenance: summary of the issues from the interviews.
[31] WIC (2018), Decision paper 5: capital maintenance.

will have been the subject of varying investment cycles, and those investments will have been subject to varying demographic and climatic pressures; both the CMA and EAC referred to the potential for previous investment cycles to drive capital maintenance requirements.

- The second lesson is that, in light of the points made above, projections for future capital maintenance expenditure cannot reliably be built up solely from analysis derived from past spending patterns. Any method which uses inter-company aggregate cost benchmarking and/or which rolls forward historical levels of expenditure risks locking in a fixed level of maintenance activity, irrespective of current or prospective engineering requirements. Such analysis ought therefore to be complemented and bolstered by some form of follow-up work which allows for the possibility that required volumes or work at company level may need to be higher or lower than in the past and which takes account of changing requirements over time and associated risk management issues.

- A third lesson is that Ofwat's regulation is likely to continue to benefit from a continued interest in the quality of companies' asset management systems since they will be an important source of bottom-up information against which any top down analysis can be tested. High quality asset management also, crucially, provides for customers some guarantee that the critical infrastructure on which they rely is both sustainable and resilient

Against this background, we have quite serious concerns about Ofwat's approach to capital maintenance so far in PR19, both in relation to cost assessment and the setting of associated performance commitments.

Cost assessment

Box 2 highlights how, consistent with the above hypotheses, there has been, and will likely continue to be, considerable year-to-year and AMP-to-AMP variations in levels of industry water and wastewater capital maintenance activity.

Box 2

The charts below show companies' out-turn expenditure on capital maintenance from 2005/06 to 2017/18, along with companies' business plan projections for capital maintenance expenditure through to 2024/25.

We have split companies into three groups:

- companies that appear to have provided in AMP7 business plans for an increase in capital maintenance activity;
- companies that look to have allowed for broadly flat volumes of work; and
- companies that appear to be planning to reduce the amount of activity that they will be carrying out.

We note upfront that there are certain variables that we have not been able to control for in our categorisation, notably changes in company unit cost efficiency and the possibility that some companies might be substituting capital maintenance expenditure for opex or enhancement capex (or vice versa) in response to Ofwat's new framework of totex regulation. However, even allowing for these limitations, there is fairly clear evidence of different companies experiencing idiosyncratic upswings and downswings in capital maintenance requirements at different points in time.

Figure 1: Five-year trailing average water capital maintenance expenditure (2018 = 100), constant prices

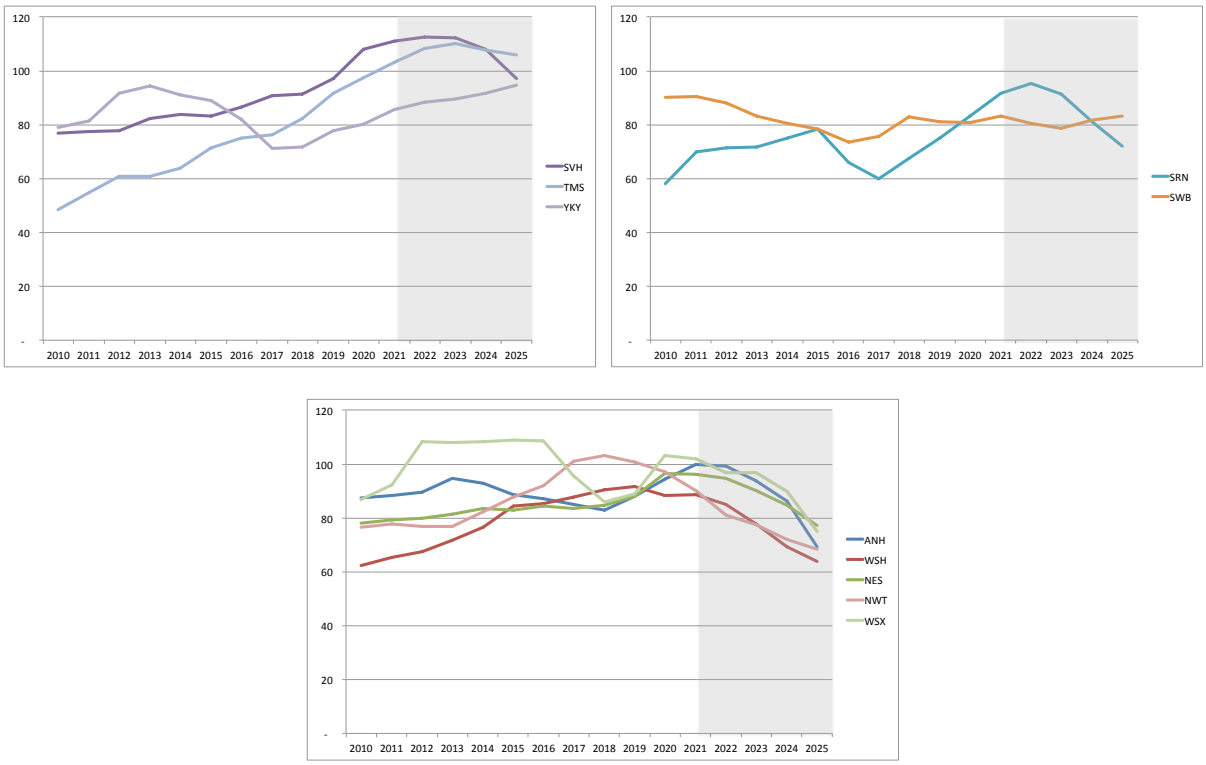
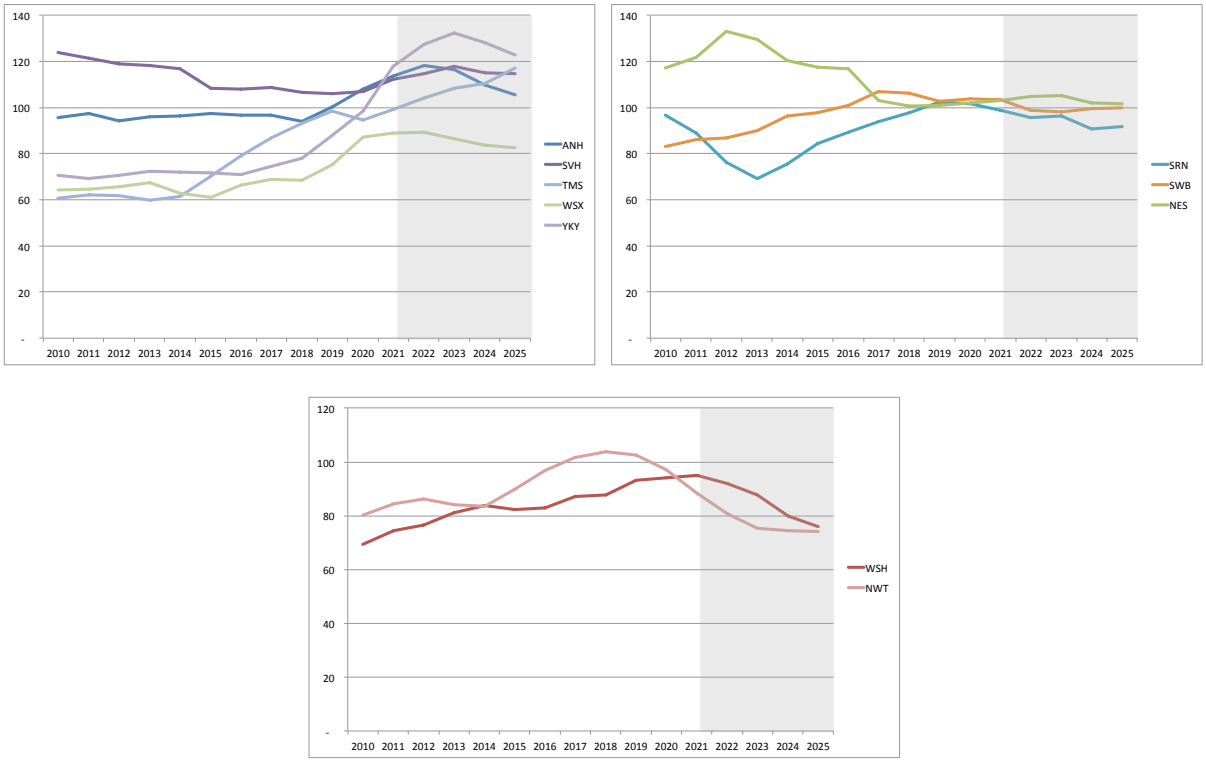



Figure 2: Five-year trailing average wastewater capital maintenance expenditure (2018 = 100), constant prices



At the time of writing, Ofwat's projections of efficient botex in the 2020-25 regulatory period for each and every company in the sector have been based solely on a roll forward of lower quartile industry expenditure in the historical period 2011 to 2018. There may be companies for which such a trajectory is appropriate. However, it is also not difficult to envisage, in light of the data in box 2, that there might be individual companies whose maintenance requirements in the next regulatory period are naturally going to be higher or lower than the 25th percentile company due to the profile of past investment, new information on the underlying condition of assets, or some other company- or period-specific factor.

The variability in capital maintenance spend raises the question of whether in standardising industry capital maintenance spend around the out-turn expenditures of a handful of benchmark companies Ofwat is really locking in top quartile efficiency (as is its stated intention) or, instead, is locking in lower quartile volumes of maintenance activity. To the extent the result is the latter, this would be a more draconian approach[32] than that which was criticised by the EAC in 2000, when Ofwat's then policy permitted at least some consideration of company-specific serviceability indicators.

Our concern is therefore the weighting given to econometric benchmarking in Ofwat's PR19 cost assessment process, to the exclusion of other methods of assessing companies' efficient capital maintenance costs for the next five-year period.

Ofwat has clearly taken steps to remedy some of the shortcomings identified in its PR14 modelling. However, that has not extended to triangulating between historical cost benchmarking and alternative ways of analysing capital maintenance requirements, using more company- and asset-specific data. The CMA report on Bristol Water's PR14 price control was very clear on the importance of cross-checking econometric data with this sort of bottom up analysis, given the inherent "limitations to benchmarking" and given that "one year's capital maintenance, or even one regulatory period's capital maintenance, will not necessarily be a good predictor of the future". Such triangulation with more company-specific bottom-up data has also formed part of recent regulatory methodology in Ofgem's RIIO reviews for the energy network sector, which has a comparable multi-company regulatory structure to Ofwat's. Similarly, single company regulation in the rail and Scottish water sectors does not seek only to look at past spend, but specifically also to consider future requirements, including critically that derived from engineering assessments. There are a variety of ways in which triangulation with more bottom-up data can be achieved, including through the use of customer consultation, but our view is that the clear lesson of the water sector's own history and from other sectors is that without such consideration there is a risk to customers' longer term interests and to regulatory and Government policy objectives, not least given the increased emphasis on infrastructure resilience as the impacts of climate change and population growth are felt.

The potential deficiencies from over-reliance on econometric modelling of historical capital maintenance spend seem to us capable of remedy in the remaining months of the PR19 process. This could happen in a number of ways, noting that in its PR19 documentation Ofwat had suggested that it would "supplement" its econometric modelling with "further analysis" as well as the cost adjustment claims process. In line with this, Ofwat could accept capital maintenance projections out of line with econometric modelling as eligible for consideration under its cost adjustment process where companies may be able to point to features of their capital maintenance position that

[32] This would particularly be the case if one or more of the frontier-defining companies' expenditures in the 2011-18 were at cyclical low points.

differentiate them from the generality of companies.[33] [34] Alternatively, Ofwat could identify a separate process which recognises the need generically to take account of the specific issues around capital maintenance for individual companies. In principle, this latter approach seems more suited to issues that are cross-company in nature.

Whatever the precise mechanism, we think there is a need and opportunity for a cross-checking or triangulation of the results of Ofwat's econometric work with some form of separate bottom-up, analysis (with costing and engineering input) of companies' capital maintenance projections for PR19, particularly where these differ materially from the output of Ofwat's models. This would be in line with Ofwat's commitment in PR19 documents to undertake further analysis complementary to its econometric modelling.

The additional work that we are recommending need not involve a full line-by-line scrutiny of company requirements. The CMA took a more targeted approach for Bristol Water. In the remainder of PR19, it would be feasible for Ofwat to examine, for example, the validity or otherwise of company business plan projections of higher spend than projected by Ofwat's modelling, including its cause, deep diving where material into a selected sample of projects, examining cost and engineering aspects and output from customer consultation as well as questioning the 'margin' of more routine spend to assess whether there are offsetting reductions that have yet to be reflected in company plans.

The aim would not be for Ofwat to bless individual projects but rather to assess, as the CMA did in the Bristol Water report, whether and how far the company's capital maintenance projections within its botex allowance should be permitted to deviate from the starting point established by the prior sector-wide econometric modelling, deviations that, for capital maintenance, may be expected for the reasons already set out in this paper. Where Ofwat considers that a company has made a strong case, this would be reflected in an appropriate adjustment to its cost allowances in the relevant companies' draft determinations.

It does not seem to us that in undertaking this work Ofwat would be at all compromising its overall approach to totex and the incentives that creates to more flexible spending within period. Rather, the process adjustments we propose are about creating more viable botex allowances that better reflect the underlying capital maintenance requirements of individual companies and therefore set a better baseline from which the incentive properties of the totex regime can operate.

***Update, July 2019. The recommendations above were submitted to Ofwat by Anglian in May 2019. We had hoped to see evidence of Ofwat taking account of a broader set of evidence in time for its draft determinations in July 2019. However, this is not apparent from our review of the published documents. We recognise, of course, that time was short. However, the strength of the arguments we have made remains and with them the risk that Ofwat's current approach to capital

[33] We note that the Cost Adjustment Factors that Ofwat provided for in its IAP and its fast-track draft determinations were based on claims that companies submitted in May 2018 prior to having sight of other companies' AMP7 business plans. It would be possible for Ofwat to expand the list of Cost Adjustment Factors in its slow-track draft determinations and/or its final determinations to take account of factors – like the differing profiles and cycles of capital maintenance spend in different regions of the country – that were not capable of being identified one year ago.

[34] Were the cost adjustment process to be used, it would be important to recognise that the symmetry adjustment to other companies' cost allowances that Ofwat set out in its PR14 methodology is unlikely to be appropriate or necessary as Ofwat's modelling is already likely to have captured any advantage to customers from low spending on capital maintenance.

maintenance risks mis-specifying the requirements of individual companies through failing to cross-check econometric data with other evidence. We would advise Ofwat to undertake such work in advance of its final determinations later this year.***

Consistency with performance commitments

There is another aspect of the PR19 process which has potential implications and risks for sector capital maintenance. Ofwat's approach to setting performance commitments has been to 'stretch' companies, in particular by effectively standardising the three comparative common commitments on upper quartile performance. Our concern in this paper is not with the intrinsic merits of this approach but rather with its potential implications for capital maintenance spend.

Ofwat's approach means that the setting of performance commitments and of efficient cost allowances has effectively been decoupled. Adopting a universal frontier performance without the requisite expenditure at company level may risk sub-standard performance over time.[35] This has particular implications for capital maintenance spend because of its link into the three common commitments where the comparative approach has been employed and to leakage. Companies will have considered their approaches to relevant performance commitments, taking account of customers' feedback against the capital maintenance (and other) resourcing in their plans. Where, because of the inherent variability in that spend over time (explored above) companies are asking for more resourcing in PR19 to enable them to deliver their proposed performance commitments, the botex 'efficiencies' demanded by Ofwat's cost assessment methodology should at least have led to questioning of the attainability of the related performance commitment. Instead, Ofwat's standardisation of botex (including for capital maintenance) on lower quartile historic spend and key performance commitments on upper quartile company propositions risks driving resourcing and performance commitments even further apart.

None of this is to question a the regulatory imperative to ensure that companies are not set soft targets in relation to the resources allowed, but rather to underline the need to bring both sides of the equation together in a framework that comprehensively considers the drivers of spend. It seems to us that that could be another element in the cross-checking we have proposed, though to the extent that the triangulation of econometric and company-specific data provide a more resilient resourcing envelope the potential for a gap between performance and associated cost allowances is likely to diminish.

## 5. Conclusions

The lessons of Ofwat's own experience, the critiques to which it has previously been subject, the broader development of asset management systems and experience, and the record of other sectors suggests that Ofwat's approach so far in PR19 risks failing to take account of all the factors that need, company by company, to be considered in projecting capital maintenance spend. It is also arguably inconsistent with the emphasis on investment in the guidance given Ofwat by Defra in the context of the former's resilience duty.

The variability of capital maintenance spend over time and between companies means that the weight that Ofwat has placed on econometric benchmarking and the roll forward of lower quartile levels of expenditure is unlikely to prove sufficient to the task of setting cost allowances that are robust to the infrastructure challenges that individual companies face and the resilience that customers and Government demand. Such benchmarking can be a starting point for regulatory

[35] Economic Insight (2019), Maximising customer benefits from the outcomes framework, Section 2.3.

analysis but it needs to be significantly complemented by more detailed, company-specific analysis which embraces engineering as well as financial factors. The alternative is the likely generation of inconsistencies with performance commitments with attendant risks to long-term network sustainability.

Some painful lessons in this regard have had to be learned over the years by infrastructure providers and their regulators, not least in the water sector. Even where the results do not entail major failure, the potential for performance degradation and maintenance backlogs can be storing up problems for future consumers who will not welcome meeting the costs that should have been borne by their predecessors.