Insights from debates on Asset replacement in Scotland

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About the author

I was appointed the Water Industry Commissioner for Scotland in 1999. My role was to establish economic regulation of the public sector water and sewerage industry in Scotland. I served in this role until 2005, after which I assumed the role of Chief Executive at the new Water Industry Commission for Scotland. The Commission was chaired by Sir Ian Byatt, the first Director General of Ofwat.

I advised the European Union Task Force for Greece and was asked by the European Union to participate in an IMF Mission to Cyprus. I advised the Romanian economic regulator for several years under an European Union assistance program. I also advised the New Zealand Government on its initial attempt at water reform over a period of three years.

I served on the Bureau of the OECD's Network of Economic Regulators for five years and participated in missions to Mexico and Brazil.

Why I am submitting evidence

I saw my role as the economic regulator of the water industry in Scotland as being to ensure that the industry was properly sustainable and resilient. I benefitted considerably from the advice and mentoring of Sir Ian Byatt. In my early years as Commissioner and at the Commission, we largely followed the example set by Ofwat.

Capital maintenance had always been a challenging issue. The weaknesses in Ofwat's approach (which WICS largely replicated) were well documented. Scottish Water, however, never appeared to put forward a compelling case.

This all changed when the Scottish industry adopted the thinking of Professor Christopher Hodges on Ethical Business Regulation (EBR). Consistent with the ideas of Professor Hodges, WICS invited all the water industry stakeholders in Scotland to participate in shaping its thinking on the methodology for the Strategic Review of Charges 2021 to 2027.

This overview sets out the lessons that were learned during this detailed and intensive collaboration with stakeholders. The participants in this stakeholder group were:

- The Scottish Government (as policy maker, owner and banker)
- Scottish Water
- The Water Industry Commission for Scotland (WICS - the economic regulator)
- The Scottish Environment Protection Agency (SEPA)
- The Drinking Water Quality Regulator (DWQR)
- Consumer Focus Scotland (CFS - the statutory customer representative)
- The Customer Forum (established by agreement between regulator, regulated company and Consumer Focus to negotiate an acceptable business plan with Scottish Water).

The stakeholders met frequently. They challenged each other to ensure that:

- there was as good a collective understanding of the issues as was possible;
- the solutions developed were as analytically robust as possible; and
- the customer interest was central to the entire process.

Scottish Water, its regulators and customers all benefitted from the improved understanding of intentions and requirements that resulted from these in-depth discussions. The discussions successfully cut through the asymmetries of information (favoring the regulated company) and of enforcement power (favoring the regulators) that are inherent in any regulatory framework.

I was made aware by two of the Disputing Companies that reference was being made to the approach taken by WICS to asset health in the context of these issues being raised with the CMA. Having reviewed the statements of case, it seems to me that my experience in Scotland in considering asset replacement may be useful.

Anglian Water and Northumbrian Water have covered the cost of some of the time that I have spent writing this paper.

I am happy to discuss my thinking further, if this would be helpful.

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1.0 Introduction

This paper discusses the key insights from an industry wide review in Scotland that was launched with the goal of future proofing the water industry in Scotland.

There was no preconception of what future proofing the Scottish industry would entail. There was certainly no expectation[1] that our joint work would reveal that the Scottish industry was as significantly underfunded as the joint analysis and discussion proved it to be. The strength of this joint work was its iterative approach, based on analysis, discussion and challenge. This long term commitment to joint working allowed all stakeholders to buy into the way forward that was ultimately identified.

The discussions of the stakeholders[2] were observed by the OECD and stakeholders all received individual feed-back from an EBR Support Group[3] – envisioned as a 'temperature check' to ensure that all stakeholders felt properly engaged and had had a full opportunity to contribute.

At an early stage, it became clear that DWQR and SEPA had concerns about the reliability of some of the assets operated by Scottish Water. The Quality Regulators considered that Scottish Water should look to replace assets rather than adopting a 'make do and mend' type approach. Scottish Water agreed that it adopted the approach described by the Quality Regulators but noted that it did not have the funding to do otherwise.

WICS accepted that its approach to setting funding had been focused on ensuring that the performance of Scottish Water's assets could be maintained. There was therefore an early consensus amongst the stakeholders that the resilience of assets at lowest whole life cost, should be a focus of the future-proofing discussions.

Considerable progress was made. But, given the shortfall in funding identified, it inevitably takes time to transition to the point where the industry is sustainably funded and has the opportunity to steward its assets as optimally as it can. This paper is supported by five short annexes that outline the 'why?', 'how?', 'what?' and 'what next?' questions as they were discussed, and resolved, by Scottish stakeholders. These five supplements cover:

1. The importance of asset replacement;
2. Initiating stakeholders' collaboration;
3. The conclusions of stakeholders' efforts to understand asset replacement;
4. Starting to address Scotland's asset replacement liability; and
5. Other implementation issues.

This overview paper explains the six key insights that came out of the joint stakeholder work in Scotland. These six insights relate to:

1. The route to compliance and performance improvements
2. Capital maintenance
3. Review of the Setting of Capital Maintenance Allowances
4. The Pension analogy

[1] Scottish Water's initial view was that it would likely need a higher allowance for capital maintenance, but its proposed request fell a very long way short of the level of sustainable funding for asset replacement that the group identified. Looking back, it may be that Scottish Water had been conditioned by its experience of previous WICS' price reviews.
[2] The perspectives of the different stakeholders are discussed in Annex 2.
[3] This Group was led by Steve Johnson, the ex-CEO of North West Electricity

5. Reliable Reporting
6. Perspectives not being irreconcilable.

Each is explored in more detail below.

2.0 Background

Economic regulation of the water and sewerage industry in Scotland was introduced in November 1999 – some ten years after the water and sewerage companies had been privatized in England and Wales.

Until 1996, water and sewerage services had been the responsibility of the nine Regional and three Island Councils. In 1996, three new water authorities (similar to those that were established in England and Wales in 1973 and were ultimately privatized in 1989) were created. Scottish Water was created in 2002 in response to analysis by the Commissioner.

The Commissioner noted that there were marked differences in asset management approaches between the authorities. The authorities reported, in turn, that they had inherited a range of approaches from the Regional Councils. The Commissioner's analysis (such as the data allowed by 2002) suggested that although the differences in measured performance appeared to be small, it was equally clear that the profile of capital expenditure in each of the authority areas had been quite different.

The impact of economic regulation and structural reform in Scotland was significant. There is no question that Scotland benefitted significantly from the experience of both Ofwat and the regulated companies in England and Wales. The only material divergence in approach (before 2010) was the introduction of non-household retail competition in 2008.

Scottish Water is no longer a laggard in Great Britain. It has developed into a well-performing company. Economic regulation first focused on improving the relative cost position of the Scottish industry and then on improving levels of performance. By 2010, performance had broadly matched that of the privatized industry.

WICS set its next key objective as being to ensure that the gains that had been made were future proofed. WICS used a series of expert groups to debate issues and help to refine its thinking. These experts were asked to challenge thought papers. During these debates, it became clear that WICS would likely need to revisit some of the benchmarking techniques and incentives that it had copied from Ofwat[4].

3.0 The route to compliance and performance improvements

The Scottish Government leads a 'Quality and Standards' process that allows it to identify priorities for investment. The quality regulators, customer groups and others (such as developers and local Government) provide input. At the end of this process, the Scottish Ministers define the standards that the Scottish water industry must achieve. WICS sets charges such that Scottish Water is appropriately funded to meet these standards.

Beginning in 2005, WICS required Scottish Water to put together a 'Technical Expression' that set out the projects (with their location) that were required to meet the collective expectations

[4] These benchmarking techniques and their implications are considered in detail in Annex 1

defined by this Quality and Standards process[5]. As such, there was a detailed understanding of how much and where investment was being committed.

The Scottish stakeholders met quarterly to discuss progress with the delivery of the capital expenditure programme. There was, however, no discussion or detailing of how these listed projects actually delivered the desired compliance or service level improvement output.

Notwithstanding the developed governance around investment delivery reporting, it was only during the stakeholder discussions on asset replacement that WICS (and others) learnt that these enhancement projects typically involved investment in short to medium life assets. These assets could typically be expected to have asset lives from a few years (technology) to around 40 years (pumping stations). Subsequent review of Scottish Water's expenditure on these asset categories suggested that an average life could be between 18 and 26 years[6].

Stakeholders considered the various asset categories with their expected lives and their optimised replacement costs in detail[7]. There was initial surprise when stakeholders realised that while the short to medium life assets accounted for only around 20% of the total asset value in Scotland[8], their annualized cost to replace was actually greater than the expected annualized cost to replace the longer life assets that accounted for the other 80% of the company's asset value[9]. Such was the impact of the predominance of much shorter asset lives in the capital expenditure programme.

Enhancement expenditure had been around £300 million annually[10] on average since the turn of the century. Further examination of these enhancement projects revealed that **an estimated 60 to 80 percent** of the costs was accounted for by investment into these short to medium life assets.

As such, the level of required expenditure on asset replacement resulting directly from the improvement in compliance and customer service levels since 2000 could reasonably be expected to be around £180 million to £240 million annually by 2020. This represented a new asset replacement requirement that had not existed prior to 2000.

The drive to improve compliance had added around 40% to the calculated annual expected costs of replacing assets in less than 20 years. During the same period, the WICS allowance for capital maintenance had not increased materially in real terms – reflecting just the new short to medium life assets should have added some 60-80% to this allowance[11].

[5] This built on earlier efforts to understand the (apparently) very different investment programmes of the three authorities and the initial combined programme pursued by Scottish Water following its creation in 2002.
[6] This range reflected both a simple and a weighted (by expenditure) average
[7] The details of this analysis are set out in Annex 3.
[8] Not including what we termed the 'assets in perpetuity': sewers, reservoirs and dams.
[9] See the detail set out in Annex 3.
[10] In 2017/18 prices
[11] Calculated as £180 million or £240 million (the annual average short to medium life asset investment) divided by the £300 million annual allowance set for capital maintenance.

The full asset analysis[12] suggested that between £280 million and £430 million annually would be required to replace short to medium life assets. The low end of this range required the maximum expected asset life to be achieved and the lowest reasonable optimised cost to be obtained.

This suggests that the quantity of short to medium life assets in Scotland had approximately doubled since 2000.

It demonstrates just how much change there had been in the underlying asset base operated in Scotland in recent times. This change in the asset base was a direct result of the regulatory pressure on Scottish Water to improve its compliance with water and wastewater standards and to improve the levels of service experienced by customers.

As stakeholders explored the nature of this investment (typically MEICA[13] and pumps), it became clear just how critical the performance and resilience of these assets were to levels of service and compliance with water and wastewater quality. The Quality regulators had concerns that these assets were at risk of failure and should be being maintained and replaced more pro-actively. What might have been adequate levels of maintenance expenditure in the past were no longer so.

4.0 Capital Maintenance

WICS had used the Ofwat capital maintenance models in its initial Strategic Reviews of Charges[14]. The underlying assumption of these models was that capital maintenance was the amount that had to be spent to maintain assets at the same level of condition and performance. This was at the heart of 'broad equivalence'[15] – i.e. the annual spend on capital maintenance should be broadly equal to the annual allowance. The allowances were considered to be sufficient to cover the cost of asset replacement over time.

Stakeholders were surprised to learn how Scottish Water, in practice, used this capital maintenance allowance. The allowance covered capitalised repairs; asset refurbishment and asset replacement.

This usage split in capital maintenance proved to be important. It was not reflected in the Ofwat modelling approaches. The repair of an asset is a response to a serviceability issue – it may help maximize the life of an asset, but it does not impact the ultimate cost of a replacement.

WICS was separately able to confirm that other companies used this allowance in similar ways. The allowance also covered what Scottish Water had classified as 'assets in perpetuity': its sewers, dams and reservoirs.

Understanding the potential liability of asset replacement required the focus of stakeholders to be on the funding provided for replacement and the overall cost of doing so – not an overarching allowance for repair, refurbishment and replacement.

[12] Details in Supplement 3
[13] MEICA: Mechanical, Electrical, Instrumentation, Control and Automation
[14] The Strategic Review of Charges is the WICS' equivalent of an Ofwat Final Determination – it sets out the regulatory contract offered to Scottish Water.
[15] Developed by Ofwat as a check on capital maintenance allowances

Faced with a budget constraint, Scottish Water (and other water companies) had used different techniques to decide how best to allocate the resources available to them. These Common Framework[16] style approaches sought to identify what sort of intervention could be considered optimal. They offer nuanced solutions in different situations for different asset types that can range from 'run to failure' to 'repair pro-actively' and 'replace'. As such, these models necessarily conflate the expenditure on repairs and refurbishments with expenditure committed to asset replacement.

These predictive models are doubtless generally helpful to a cash-constrained asset manager. Whether the suggested approach is efficient will depend on the quality of the model and the input information (asset performance, condition, intervention cost etc.). This is for the regulated company to address.

In any event, it is important to note that while these models can contribute to effective prioritisation of expenditure; they do not give visibility as to how much ultimate asset replacement will cost and when that liability will fully crystallize.

Ultimately the user of these models should be monitoring carefully what is being spent on replacement, what is going to repairs and the impact of interventions on the range of lives of assets. Only by understanding what has been committed to asset replacement (and the impact on the portfolio of asset lives under management) can asset managers maintain a good understanding of the potential future replacement liability that they face.

WICS had set the allowance at around £300 million a year in 2017/18 prices. Scottish Water was able to evidence that around £130 million[17] on average over a five year period had been committed to asset replacement. The remaining £170 million covered asset repairs, asset refurbishments and the assets 'maintained in perpetuity'. According to the analysis of the costs of replacing assets, this £130 million annually had to grow to a minimum of £470 million, but potentially as high as £770 million.

The bottom end of this range represented an increase of over 345% - and the top end was some 590% greater.

Key Point: A capital maintenance allowance should not, therefore, be equated with investment in replacing assets.

Even if all capital maintenance could be redirected to asset replacement, the previous allowances would have fallen well short of the ultimate need identified.

It is important to note that the demand for tighter compliance standards and improved levels of customer service will require enhancement investment. The replacement of this enhancement investment will ultimately also have to be paid for. Further enhancement investment (at the current average rate of about £300 million a year[18]) in the period to 2040 could add a further £130

[16] UK Water Industry Research (UKWIR) 2002: 'Capital maintenance planning – A common framework, Volume 1: Overview'

[17] Page 80 of WICS Draft Determination notes the reallocation from capital maintenance to operating costs tier one of £170 million

[18] Neither SEPA nor DWQR considered that the level of enhancement investment was likely to fall – they would have preferred to see an increase!.

-£180 million[19]. This suggests a 2040 range of between £600 million and £950 Million in 2017/2018 prices (before any efficiency challenge).[20]

The assessed asset lives should reflect what can be expected on the assumption that the assets in question have been appropriately maintained. Effective, pro-active maintenance policies can reduce the costs of interventions and can extend asset lives. However, experience suggests that this is not always the case. Sometimes repair and refurbishment interventions can weaken the asset structure and actually reduce the remaining life. For example, Scottish Water identified that some relined pipes were lasting less long than they had originally expected.

Perhaps all that can be concluded is that the effectiveness (or otherwise) of expenditure on replacement and refurbishment could impact the timing of replacement expenditure being required – but not whether it will ultimately be required. Repairs and refurbishments were, in essence, the water industry equivalent of annual car servicing.

In addition to understanding how much has been dedicated to actual asset replacement, the asset manager will need to understand how the repair and refurbishment interventions could impact the overall asset stock. For example, it could be attractive to refurbish rather than replace an asset (because it makes a smaller draw on constrained resources at the point of decision). However, if the additional years of asset life divided by the cost of the intervention is higher than the cost of a new asset divided by its expected asset life, this intervention is actually inefficient. Replacement costs may look lower but the costs of repairs and refurbishments are higher – and, on a whole life basis, exceed these savings.

Key Point: Any analysis of relative levels of expenditure should take such different approaches into account – a company committed to the lowest whole life cost solution should be congratulated, not disadvantaged.

The potential asymmetry of information between regulated company and regulator is obvious.

Stakeholders discussed an example where a wastewater site required several different interventions to be made. They learnt that Scottish Water felt unable to focus solely on whole life costs. Scottish Water felt the constraint of its allowed for cash and therefore sought to use the cash available to it as effectively as possible.

Cash limits meant that a couple of the more important interventions were postponed because it was felt that the cash saved could be better committed elsewhere. All parties agreed that it would have been more cost effective (and probably better for both performance and resilience) if all these interventions had been completed at the same time.

This was an important lesson as to the impact of the regulatory hard budget constraint. The hard budget constraint was, for any given level of funding for investment, a cash use driver, rather than a cost reduction lever. Cash use and cost minimization drivers may often bring the same results, but the above example showed how they could be different.

[19] Reflecting the expected split of asset lives that service improvement and compliance projects usually require.
[20] WICS set a range of £700 to £800 million a year, post efficiency, in 2017/18 prices. It was considered essential that this level of funding should be reached by 2040.

A regulatory framework must encourage timely replacement of assets, in a manner the minimizes whole life cost if society is to benefit from sustainable, resilient assets. It is worth bearing in mind that there are two perils of monopoly that a regulator should address: over-charging and unsustainable practices.

5.0 Reviewing the Setting of Capital Maintenance Allowances

Stakeholders were keen to explore WICS' approach to setting capital maintenance allowances. WICS' approach was based on Ofwat's practice in the early 2000s. In essence, Scottish Water's allowance was protected in real terms and reflected growth in the number of connections. There were many sessions committed to identifying what needed to be understood if stakeholders were to make progress in future-proofing the Scottish industry.

Stakeholders identified a number of issues with the comparisons of spend over time and the level of reliance that could be placed on performance and condition grades. These issues can be broken down into six principal areas.

- Geography;
- Improving compliance;
- Responses to the WICS' hard budget constraint;
- Different approaches to asset management over time;
- Demographic shift;
- Condition and Performance.

5.1 *Geography*

Scottish Water was created in 2002 from the merger of the three regional authorities. These three authorities had only been established in 1996 from the mergers of the nine Regional and Three Island Councils. Scottish Water had had to develop a single asset management strategy for the whole company.

Geographic differences were marked. The Central Belt of the country is relatively urban and comparable with more urban areas south of the border (outside the south east of England). In Glasgow or Edinburgh, water supply can generally be maintained even if there is a localised problem in the network. In more rural areas, the supply of water is often single sourced. The management of these respective locations had had to be quite different – because the challenges were quite different.

Stakeholders discussed quite significant differences in how water resources had been managed. Water resources were seen as a more pressing problem in the East of the country. In the West, leakage in the Glasgow system was regarded as almost unimportant as there was, essentially, an unlimited gravity-fed supply.

Stakeholders also recognized that the approach to growth had been different. For example, the East of Scotland Authority had been reluctant to allow new connections to its network (despite being the fastest growing area), whereas the West Authority would connect on request.

Both investment needs and performance varied considerably in the different regions of Scotland.

5.2 *Improving Compliance*

The Quality Regulators explained that compliance with water and wastewater quality legislation had required a rolling programme of investment to meet the phased deadlines (such as the Urban Wastewater Treatment Directive). In rural areas, improving compliance had often meant building an entirely new asset to replace what would originally have been a quite basic solution, whereas in urban areas, assets could be upgraded and control systems improved. This helped to explain what had appeared to have been quite variable progress across the original regional councils and the three authorities.

5.3 *Response to the hard budget constraint*

Scottish Water responded to the capital expenditure efficiency targets set by WICS by using a range of different approaches to delivering its capital expenditure programme. These included a variety of incentive arrangements and penalty frameworks for the contractors. These arrangements appear to have had a material impact on the actual solutions put in place.

Their focus was on meeting the efficiency challenge set by WICS – to deliver the outputs required for the cash made available. The focus was therefore less on whole life cost minimization and rather more on using the funding made available in the regulatory period to deliver the required improvements. Discussions in this area included a useful specific example of a wastewater treatment works, where important, non-urgent interventions were delayed in order that other more urgent requirements could be delivered. All accepted that the approach used had increased the whole life costs of the interventions required at the sewage works – but accepted that Scottish Water had only been trying to manage the challenges that it faced, within the funding allocated to it.

It also became clear that Scottish Water had made less progress in understanding the detailed performance and condition of its assets than WICS had expected.

5.4 *Different approaches to asset management over time*

Scottish Water has two cast iron water mains that run under Princes Street in Edinburgh (colloquially referred to as the 'old' and the 'new' main – although both were installed in the 19th Century). Scottish Water explained that these and other similar water mains were actually in better condition than some of its other cast iron water mains, installed immediately after the Second World War. Their biggest water mains issue, however, related to the asbestos cement mains that had become the standard approach during the 1960s. Many of these mains were in urgent need of replacement. These asbestos cement mains were often in quite rural areas. In these rural areas, a failure of a key water main could result in a prolonged interruption to supply[21].

Stakeholders reviewed evidence of significant peaks and troughs in investment over the last several decades. These peaks and troughs appeared to be generally consistent with historic Government initiatives to boost the economy or pressures to improve compliance. In some cases, these historic peaks were increasing current investment (Asbestos Cement mains being a good example). Stakeholders considered that the observed historic pattern of investment would likely continue to impact on the profile of asset replacement that Scottish Water would face.

[21] Owing to the difficulty of access. The example of the Braddon system in Ayrshire (funded by SRC 2015) illustrates.

5.5 *Demographic Shift*

There have been significant demographic change in Scotland even since 1945. There has been a significant move from the larger cities to the suburbs. In recent decades, there has been a marked movement of the population from West to East. There were several new towns built in Scotland[22]. This had increased the stress on different parts of the country's water and sewerage infrastructure. The gravity fed water system in Glasgow was challenged by the combination of development on high ground south of the city and modern household appliances. The result was new, previously unknown, water pressure problems. On the other hand, de-industrialisation, in particular the closure of heavy industry, has created capacity elsewhere in the Greater Glasgow network.

Local responsibility for water and wastewater services meant that the responses to these trends were different in different parts of the country.

Scottish Water had to address a legacy of assets of varying quality. It also had to manage an installed asset base that, in some areas, was now expected to cope with much higher levels of demand than had initially been planned for. All of these factors complicated any assessment of future expenditure needs.

5.6 *Condition and performance*

Stakeholders in Scotland discussed asset information in Scotland at length. There was a keenness to understand just how much Scottish Water knew and the extent to which our approach to asset replacement could be informed by asset performance and condition information. It was very important that all stakeholders understood clearly what was, and what was not, known. How could this information be used productively? Such a baseline would be essential to any agreed approach to future-proofing the industry's performance. The results of these discussions were impactful.

When WICS was first established, the three authorities had limited information on the condition and performance of their assets. In general, the information was better for the above ground 'non-infrastructure' (the treatment works, pumping stations etc.) than for the below-ground 'infrastructure' (water mains and sewers). The three authorities would produce a five by five matrix that assigned their asset value to a condition and performance grade. A '1' grade meant it was excellent. A '5' meant that it was in a very poor state. There was quite a significant degree of uncertainty around how assets were categorized – but there was a commitment to improving information.

Performance information was easier to capture and to understand. It reflected what was actually happening, the service provided, the repairs needing to be done and so on.

Condition was altogether more challenging. To be done properly, it required asset by asset inspection. The condition of a cast iron pipe would reflect the level of corrosion, the remaining wall thickness and the capacity available.

More recently, condition assessment reporting across the UK had become less a function of actual asset integrity (such as the wall thickness) and more based on proxies. Under this approach, the condition of water mains could, for example, be determined by number of repeat

[22] East Kilbride, Cumbernauld, Livingston, Glenrothes

bursts[23]. This approach was certainly easier to implement – but the Quality Regulators in Scotland considered it to be a much less reliable indicator than actual physical inspection. As an example, bursts can be impacted by the level of water pressure. The level of water pressure in the system can, in turn, be impacted by the fixing of a burst or a leakage reduction exercise elsewhere in the same system.

A standard response to reducing leakage and bursts is often to manage the pressure in the network. It does not, however, improve the underlying condition of a water main. Observed performance could therefore easily obscure an increasing liability (and consequently be increasing whole life costs).

Scottish Water admitted that it had made less progress in improving its understanding of actual asset condition (even for the 'non-infrastructure' assets) than it would have liked. It explained this exercise was resource-intensive and could only be regarded as 'current' for a relatively short period. From what WICS heard, it seemed reasonable to conclude that operational expenditure efficiency targets had impacted the collection of information[24]. WICS' conversations with other water companies in the UK and overseas appeared to confirm that budgets for condition assessment can be sacrificed to ensure that current levels of performance are improved.

5.7 *Implications*

These discussions really helped clarify stakeholders' thinking.

The difficulty of perfecting understanding of condition and performance and the apparent disconnect with the nature and timing of asset failure particularly impacted stakeholders' discussions.

There were four key take-aways from stakeholders discussions in this area.

1. The first was that condition information should focus on engineering and asset integrity and not rely on proxies.
2. The second take-away for stakeholders was that condition assessment could only be as good as the regularity of the inspection.
3. The third take-away was that, no matter how often assets are inspected, there can be little or no certainty as to the timing of asset failure or the actual failure mode (how it would fail). The consequences of a failure did appear to be better understood by Scottish Water, but were, on the company's admission, still incomplete.
4. The fourth take-away was that performance monitoring tells stakeholders very little about when and how assets will fail. Performance monitoring also provides no information about the cost of a sustainable, lowest whole life cost response to the ultimate failure of an asset (and indeed could provide misleading information as the record of committed expenditure will not reflect the replacement of assets, but rather the minimum interventions consistent with maintaining performance).

[23] This also appears to be the approach adopted by Ofwat. It is important to be cautious with any information derived from such proxies. The most immediate reason for the reduced level of bursts is the use of pressure management to maintain and improve leakage levels. In the absence of pressure management, numbers of bursts would be increasing.

[24] This does not mean that WICS agreed that the targets should have had this impact – simply that WICS accepted that the targets had had this unintended and unexpected consequence.

It also became clear that even if reliable, up to date information on condition were to be available, it would likely not contribute materially to an understanding of the ultimate costs of asset replacement.

Stakeholders accepted that 'we are where we are' and recognised that Scottish Water faced new operational pressures on its whole network (caused by the demographic shift). There was a recognition that this was impacting on the need for and timing of investment (both in terms of enhancement/ growth and in terms of asset replacement).

The discussions of stakeholders also covered the rolling implementation of compliance obligations and the very different approaches to managing assets employed in different parts of the country and at different times. It was also clear that specific replacement needs for a future regulatory period could not easily be specified in the way that new capital expenditure, operating costs and financing could.

It was clear that these changes over time made any extrapolation from past practice quite problematic. There appeared to be too many assets with too many failure modes for condition, let alone performance, monitoring to be useful in determining the nature of the asset replacement liability.

Even if predictive approaches could be made to work, they would likely result in quite different levels of identified need in each regulatory control period. Such an approach would likely lead to potentially large variations in bills over time (or for the possibility that enhancement and growth programs would have to be constrained by the need for expenditure on replacing assets). Stakeholders were clear that, having studied the evidence carefully, comparisons of year on year expenditure were likely to be misleading.

It was, for example, clear that, had the three authorities remained separate entities the extent and mix of their capital maintenance needs for a regulatory period would likely have been very different. The risk of not spending would also have been different in the three areas.

Stakeholders considered a 'use or return' approach. Such an option seemed initially to be an attractive and relatively easy to implement option. However, given that there was a material uncertainty in the timing of when these allowances would likely be committed, stakeholders finally concluded that it was neither practical nor effective. Such an approach could encourage inefficient use (earlier, or even nugatory, interventions). And the alternative - returning unspent allowances to customers would only increase the size of future allowances and increase the inter-generational trade-off in favor of the current generation of customers. It did not address the information and time asymmetry issues that stakeholders had identified.

6.0 The pension analogy

Stakeholders were trying to understand the highly complex issue of what should be done about asset replacement. They needed to find a practical approach to understanding what the asset replacement liability was. The analogy of a pension appeared to offer the group a roadmap.

The trustees of a pension fund do not know when specifically there will be calls on the pension fund – but they can have an estimate of what the total draws on the fund will likely eventually be. Trustees therefore have to consider a range of factors, such as:

- The members of the pension scheme;
- Average age of contributing members;
- Average age of members in receipt of benefits;
- Life expectancy; and
- Amount of benefits payable.

The value of the fund required to meet these obligations is a function of:

- The current value of the fund;
- Annual returns; and
- New money to be contributed each year.

Using this pension fund analogy, it became clear to stakeholders in Scotland that issues such as asset condition and asset performance were best compared to life expectancy and the extent of benefits payable. They helped determine when calls on the fund would likely be made, but they did not influence the extent of the fund required.

Using the pension analogy, stakeholders were trying to define the value of the required 'pension fund'. Understanding this total future liability of asset replacement required a quantification of how much would likely ultimately need to be spent to replace all the assets in use. It also required an understanding of what investment may have to be committed to enhancing or growing the asset base in future.

During the discussions, it became clear that, at replacement, several factors would be different:

- Land would not need to be purchased a second time[25]
- The work would likely be more difficult second time as the replacement would be taking place in an area already developed while much of the original asset base would have benefitted from being built on green field sites.
- New materials and technologies would likely make like for like replacement cheaper.

From this discussion, it seemed reasonable to use an estimate of the optimized replacement cost of the assets as a baseline for the total liability.

Stakeholders discussed asset valuation in historic and in current cost accounting. There was a clear consensus that understanding the asset replacement liability required the current replacement cost to be considered. Actual value, rather than book value, would be the driver of future costs. Stakeholders were keen that any such replacement cost should be optimized to take account of new material and new approaches to providing water and wastewater services.

All assets will ultimately need to be replaced[26]. It bears repeating that Scottish Water had been committing around £130 million a year to asset replacement in the years before stakeholders began their discussions. This £130 million compares with the estimated £35 Billion of Scottish Water's asset base considered in the analysis – an implied asset life of over 269 years, notwithstanding the share of short to medium life assets in these totals.

[25] A simplifying assumption was made that if an asset was replaced in a different location and a land purchase was necessary, the cost of the new land would be covered by the proceeds from realizing the old site.

[26] There were, as outlined in the supplements, discussions (and ultimately simplifying assumption) about assets in perpetuity. Stakeholders were keen to begin to make progress and recognized that fully addressing asset replacement would take time.

Under accounting rules, expenditure on assets should be depreciated over their expected lives. Stakeholders therefore decided to focus on understanding the optimized replacement cost of the assets in Scotland and their expected lives. At a high level, it appeared reasonable that the ultimate liability be tagged at the optimized replacement cost and that the annual (current cost) accounting depreciation should represent, on the average, a fair assessment of what would likely be spent.

The pension analogy was very helpful in focusing stakeholders on the key question – the extent of the asset replacement liability. It avoided potentially inevitable distractions on issues such as the priority areas that should be addressed; the difficulty of current trade-offs and when any transition to full funding should start or how quickly it should progress. All these other issues were, of course, more or less important and would, ultimately, need to be asked – but until the potential liability had been defined they were likely only to be an unwelcome distraction and impact the consensual nature of the discussions.

7.0 Reliable Reporting

Stakeholders in Scotland recognized that reliable reporting of how funding for asset replacement was being used would be required. It would have to complement what was done for other investment – but also recognize just how different it was (particularly with regard to the importance of evidencing value for money to customers and communities).

The impact of investment to improve or grow the asset base of a water company is usually quite straightforward to evidence[27]. There will be a new output or some measurable contribution to an improved outcome (for example, river water quality). Money is allocated; benefit will be delivered. The effectiveness of the ex-ante allocation of resources can, as a general rule, be demonstrated[28].

Investment in the maintenance and replacement of existing assets is more challenging. There needs to be a long term plan for the assets – but this plan needs to be sufficiently flexible that the asset manager can respond to new information.

Customers and communities will need to be reassured that the funding allowed for in charge limits is being used appropriately.

Effective reporting will therefore be critical.

There are four areas where reliable reporting were considered essential:

1. *The money question:* what money was received, how was it used, why was it not used and when will it be used;
2. *The portfolio impact:* how has the average age of each category of assets changed;
3. *The individual asset impact:* how near are individual assets to the end of their expected life; and

[27] There are, in practice, complications such as the allocation of expenditure to replacement and to enhancement when both types of expenditure are required. The key point is that a growth project can be seen to have been delivered. All investment in incremental enhancement and growth will increase the required average annual allowance for asset replacement. It is important that there is not double counting and that only the incremental element of the enhancement is funded beyond the asset replacement allowance.

[28] Regulators have generally developed quite sophisticated measures to monitor performance in these areas. For example, Ofwat has its performance commitments.

4. *Cost effectiveness.*

7.1 *The Money Question*

The regulated company could reasonably be expected to maintain a clear picture of the funds that it has received for asset replacement and the funds that it has deployed. It should be able to explain why it may have had to commit more or less resources than was funded in any one year or during a regulatory control period. Where there is a variance, it should be able to explain why it has occurred and when it expects funding and use of resources to have returned to a broad balance. Obviously, the regulated company should highlight as quickly as possible if it had reason to believe that the allowance should be altered.

7.2 *The Portfolio Question*

The reporting of how money allocated to maintaining service levels and resilience is being used will likely be critical. A regulated company should be able to explain how its drawdowns on the annual allocations to asset replacement are being used. This should include how the age and performance of the asset base have been impacted by these drawdowns. It would be reasonable to set out, for example, how the average age of an asset category has been changed as a result of expenditure on asset replacement. This could be done both on a weighted basis (where the optimized replacement cost of an asset is taken into account) and on an unweighted basis.

Average age of the asset could then be compared with the expected range for asset lives.

7.3 *Individual Asset Impact*

Each category of assets used in the macro level analysis is comprised of many individual components. It would be reassuring if there could, for example, be an annual report as to how many of these individual components are:

- older than their expected life;
- within 10% of expected life end;
- within 30%;
- greater than 30% of their asset life remaining.

To report accurately will require the impact of expenditure on enhancement and growth to be clearly separated from expenditure on asset replacement. The regulators and the regulated company would need to work closely together to ensure that this reporting is consistent with good asset management practices and will provide the necessary reassurance that the allocated expenditure is being used appropriately. Such reporting should be useful to all parties: to the reporting company, to the regulators and to the customers and communities served.

7.4 *Cost effectiveness*

One of the approaches considered in Scotland was to re-introduce the Ofwat Cost Base tool or to use some other form of costing assurance. The Cost Base has not been used at recent price reviews either by Ofwat or in Scotland. It had been an effective way to understand the procurement efficiency of proposed projects.

The cost base approach triangulated input information; it worked as follows:

- The regulator asked the regulated companies to cost a wide range of standardized projects.
- The regulator compared the cost estimates of the different companies to assess the lowest achievable costs. These cost estimates were reviewed by the Company Reporter[29] to ensure that they were based on the best information available to the regulated company and were generally reasonable. Companies were often seen to be better at some types of investment than others.
- The Reporter reviewed the costing of the proposed capital program for its consistency with the costing of the standardized projects. The relative efficiency performance of the company for each of the standardized benchmarks was then applied to the proposed program (appropriately weighted to its make-up) to assess an efficiency challenge.

This cost base approach (or an alternative form of assurance) could be used to build confidence both in the analysis of the need for asset replacement expenditure over time but also in the use of the replacement allowance and the costing of incremental investments in enhancement and growth. Stakeholders in Scotland had recognized the importance of consistency in costings when they reviewed the workings of common framework models.

The replacement cost range should be seen to be consistent with how the regulated company costs other projects. Any variances should be reviewed carefully to understand why they exist; any appropriate amendments to the replacement cost ranges for the asset replacement categories should be made such as to ensure consistency is seen to be maintained.

Expenditure on replacement or on enhancement and growth should also be compared to the costing analysis in order that delivery effectiveness can be assessed objectively.

The costing benchmarks would also help to ensure that the allocations of project costs to asset replacement were reasonable as the allocation made should be comparable to the data base of benchmarks.

Such a process of verified cost assurance would allow all stakeholders to improve confidence that the industry is acting sustainably.

8.0 Perspectives not being irreconcilable

As noted earlier, stakeholders in Scotland had adopted the principles of Ethical Business Regulation. There is an unavoidable asymmetry of information between a company and its regulators. There is a similar asymmetry of information between Scottish Water and the Scottish Government (as the owner and the policy maker).

There is also a material asymmetry in timing: the 'here and now' is relatively well defined, but even the end of a regulatory control period[30] could turn out quite differently to what might originally have been expected.

[29] The technical auditor of the information provided by the regulated company to the regulator. The Reporter had a duty of care to both the regulated company and to the regulator.

[30] Up to 6 years plus the months from determination to period start – a maximum of seven years.

Looking ahead to the sustainable level of funding for asset replacement and the timing of a transition introduces further concerns. Will the allowance be sufficient? Will we be able to meet the optimisation expectation? Is it fast enough? Is it too fast?

This required barriers and rivalries to be broken down. Trust had to be built – both to progress the discussion of how best to future proof the industry in Scotland and to evidence that each stakeholder would abide by their commitments. The regularity and in-depth nature of the stakeholders discussions, under the EBR umbrella, helped substantially.

Early on Scottish Water likened the stakeholders' discussions to a dance. It saw the recognition of long term funding as the essential first step in that dance. Once that dance commenced, it appeared to be possible to maintain a consensus between all of the different stakeholders.

Scottish Water could be assured that it would ultimately be funded at a level consistent with it being able to replace its assets at the appropriate time.

WICS would be seen to be acting in the interests both of current and future customers as its statutory remit required. It could focus on whole life cost. Regulatory incentives could be cast in a manner that emphasised a consistent long term focus on performance. The detailed reporting would ensure that value for money was being delivered - an intervention could be made (with a clear objective rationale) if there were ever to be an issue.

The Quality Regulators would be similarly assured that past gains would be maintained. They also welcomed the focus on funding incremental enhancement. They too would rely on the reporting from Scottish Water.

Customers have to fund the industry. Increased funding means increased charges. Increased charges are never going to be welcome, but customers also expect (rather assume) that assets are being appropriately stewarded and Scottish Water and its regulators have a responsibility to ensure that this is the case. The phasing of increased funding could be positively welcomed by customers' representatives. It ensured that progress towards a properly sustainable asset base could be made – and that such progress could be as efficient and effective as possible, whilst managing the impact on the end customers

The Scottish Government could rely on the stakeholders working, and being seen to work, collaboratively. Such an approach makes the achievement of longer term Government policy (such as Net Zero) more likely to be delivered. It is the basis of a sustainable water industry for Scotland.

Reflecting now on the Scottish Water 'dance', it seems right that the price setting had to recognise the liability (anything else is, almost by definition, inefficient) – but a dance requires coordinated partnership. It is now for Scottish Water to evidence how it is using the resources provided and to what effect.

9.0 Conclusions

Stakeholders in Scotland worked very collaboratively to understand what impacted asset replacement and how the potential liability could reasonably be quantified. At each stage, there was open debate and challenge. Solutions generally were found. It was clear that assets would ultimately need to be replaced – and it was equally clear that this would have to be paid for by customers. It is customers and communities now and into the future who suffer if assets are not

properly stewarded. Scotland offers the start of a roadmap – but not yet (at least) a final destination. Confidence will have to be built in the reporting of progress. Value for money will have to be assured.

Annex One: The importance of reviewing asset replacement

A1.1.0 Introduction

The water and sewerage industry in Scotland is very asset intensive – likely the most asset intensive industry in the country. Understanding how these assets are best managed is critical for four reasons:

- The size, extent and import of the asset base;
- Service failures have the potential to be very disruptive;
- Some of these assets have relatively short asset lives (vehicles, IT etc.), but others have very long expected lives (water mains and sewers). This range of asset lives implies clear inter-generational implications both in the incidence of cost and service levels in how these assets are maintained; and
- Reactive interventions to asset failure appear to take longer, to be more expensive and to increase carbon emissions. As such, effective stewardship requires cost effective approaches, consistent with reducing and maintaining as low a carbon footprint as possible.

The original approach to economic regulation in Scotland followed the road map set down by Ofwat. The first significant departure in terms of analytical approach was in 2006-8, when non-household retail competition was introduced in Scotland.

As in England and Wales, the early years of economic regulation were very successful in bringing down operating costs and improving levels of customer service and compliance with European Union Directives. In these early years, allowances for capital maintenance were essentially looked at through the prism of the regulatory 'hard budget constraint'. The focus was on ensuring that the allowance was set at a level consistent with maintaining that constraint. This Annex is in two parts: the first focuses on the assets and asset management; the second covers how economic regulation has impacted asset management and the resilience of the water and waste water system.

A1.2.0 Assets and Asset Management

A1.2.1 The size, extent and impact of the asset base

The water industry in Scotland serves some 2.7 million connected household and non-household customers (around 97% of all households). It relies on:

- 280 separate water sources: equivalent to one water source for roughly every 10,000 connected properties
- 240 separate treatment works
- 6,000 kilometers of trunk mains: equivalent to 2.25 meters for every connected property
- 1,300 service reservoirs (the means of storing treated water)
- Some 43,000 kilometers of water distribution pipes: equivalent to around 16 meters for each connected property.

The Scottish wastewater industry is, if anything, even more asset intensive. It serves some 2.5 million connected household and non-household customers (around 92% of households). It collects and treats over 300,000 tonnes of wastewater from households every day. And this huge

task does not include the waste water from non-household customers or the collection of rainwater from our roads, properties and other public spaces.

It relies on:

- 52,000 kilometers of sewerage collections pipes: equivalent to over 20 meters for every connected property
- 2,200 pumping stations: one for every 1,000 connected properties
- 1,800 sewage treatment works
- 3,700 kilometers of sewer outfalls (pipes that allow treated waste water to be returned to the environment)
- 19 sludge treatment works.

These are large numbers. To put the length of water and sewerage pipe into some perspective, the length of water main and sewer is roughly double the length of the road network in Scotland.

The sheer size alone of this industry makes ensuring resilience and sustainability essential.

A1.2.2 Disruption to service

As customers, we take water and sewerage services for granted.

- We expect water when we turn on the tap.
- We expect waste to disappear when we flush the toilet.
- We expect public places, roads and our homes to drain after a rain storm – and we expect it to be safe to use our beaches and waterways.

These are genuinely great expectations – all the more so if we pause to reflect on the huge asset base that is required to make this service available. The requirement that the assets have to function 24/7, every day of the year only increases the import of this expectation.

As customers, or in our communities, we only tend to think about these important services when something goes wrong. And even then, we do not tend to give any thought as to how the service has been delivered, as to what was involved and how much it really costs.

Customers and communities tend not to realize the extent to which they are dependent on their water and sewerage service. Each member of a household will use around 140 liters of water (weighing 140 kilograms) and look to dispose of around 130 liters of wastewater every day. In other words, a family of four will receive and dispose of half a metric tonne of water and wastewater every day.

The huge asset base is the water industry's solution to this most complex logistical challenge. There is no practical alternative.

Experience tells us that an interruption to service of even a few hours has the potential to be very disruptive and, potentially, unpleasant. This is reflected in how the media, particularly local media in the area impacted, covers such an event.

Scottish Water, like other water companies, is generally effective in efforts to support customers that fall victim to asset failures – from water supply interruptions to flooding. But given the daily use of water and sewerage services of a typical household, such support can never be much more

than palliative – a case or two of bottled water does not come close to normal daily usage. Washing, cleaning and flushing toilets all become unobtainable luxuries during such an event.

As customers and communities, we accept that occasional small issues with services will happen. Provided the response of the water company is quick and effective, complaints will be limited. However, failures that continue for more than a short period are quite different. There is little tolerance from those that are affected.

In taking the service for granted, communities are de facto taking the resilience of the company's assets for granted. Communities rely on these assets being fit for purpose.

Customers and communities trust the water company and its regulators to have ensured that these assets are fit for purpose – which almost certainly explains why the reaction to an extended interruption to supply is so negative.

The Scottish water industry had, in some senses, not helped itself. It has always had a public service ethos, tending to pride itself on being the 'silent service' - always there when needed, but not something that needed to be worried about. This public service approach appears to be typical of the industry – both public and private - across the world.

The Scottish industry had not sought credit for the job that it does. Perhaps understandably, exposed to the financial limits of Government and Regulation, it had focused less on the longer term challenge of delivering sustainably.

In effect communities have, without fully realizing, accepted a real asymmetry of information – only the asset operator can know whether everything that should be being done to maintain reliable and sustainable levels of service, is actually being done. This places a huge responsibility on the shoulders of regulators and the regulated company to ensure that they can live up to these great expectations of customers and communities. There needs to be effective management of this huge asset base both for the here and now and for the long term. Resilience and sustainability are critical.

A1.2.3 Asset Lives and Asset Management

The assets operated by Scottish Water have a wide range of asset lives – from the relatively short (IT and vehicles) to the very long (water mains and sewers). In terms of replacement cost, the very long life asset predominate. Their extended lives complicates the allocation of available maintenance and replacement funding. So too does the fact that some 80+% of the asset base is buried. There are multiple failure modes and end of life patterns are not well understood.

Given these extended asset lives, the asset manager faces obvious trade-offs. The asset manager has to define a level of risk that the organization is prepared to accept. Failures incur costs, both financial and reputational. Risk tolerance will be a function of costs (both financial and reputational) and the investment time horizon that the organization has adopted.

A further trade-off could be the costs incurred in the short term and those that will likely be incurred in future. Anyone on a fixed budget will likely be attracted by the idea of delaying expenditure – particularly if there is no obvious likelihood that the incidence of asset failure will immediately increase (significantly). The asset operator can manage a budget by choosing to operate on the basis of longer expected asset lives.

Customers and communities take the resilience of water and wastewater service for granted. They will likely be more reliant on this resilience in the future as the impact of Climate Change increases. The sheer size of the industry and the significance of failures means there is a need to future-proof water and sewerage services. This will require appropriate investment in maintaining a sustainable, resilient asset base over the very long term.

A1.3.0 The impact of Economic Regulation

A1.3.1 Why Regulate?

Not only do we take the resilience and sustainability of the water and wastewater system for granted, we also take the capital that has been employed to build this system for granted. In many cases, it was bought and paid for by our grand-parents and great grand-parents…

The size of the asset base is such that it could not be economically replicated. As such, the water and wastewater system is a natural monopoly.

To avoid the potential abuses of a natural monopoly, effective regulation should ensure:

- effective and efficient service provision; and
- resilient sustainable services, appropriately future-proofed.

Most economic regulators have statutory duties to consider current and future requirements, covering these two requirements.

Regulators, with their statutory duty to have regard to the interests of future customers, should be well-placed to take decisions that consider the economic and engineering case on its methods. The time horizon over which performance is judged inevitably influences whether there is sufficient focus on refurbishing or replacing assets.

A senior management team should also ideally focus on a sustainable industry. However, under a regulatory regime with price resets every six years, this is easier to say than to achieve. There is an obvious temptation for a senior management team to act cautiously.

Is it worth a senior management team speaking out on charges if they have confidence that assets are unlikely to fail on their watch? Why take the potential 'reputational hit' of speaking out? Why get on the wrong side of the regulator?

When consulted, customers tend to recognize the benefits of increased investment in resilience. However when asked about their bills, they can become sceptical about being asked to pay more to avoid something they have never experienced.

The performance framework that existed in Scotland tended to encourage management to choose to maximize the (short to medium run) financial performance of the business.

A1.3.2 Approach to economic regulation

The UK approach to economic regulation was developed by Professor Stephen Littlechild, whose focus was on creating an incentive to improve efficiency. His approach became known as 'price

cap' regulation[31]. Under this approach, the regulated company becomes a 'price taker', it is required to deliver the requirements of its license and any other regulator imposed obligations for the fixed price.

Price cap regulation is based on the establishment of a hard budget constraint. It is this hard budget constraint that turns the monopoly utility into the price taker of a competitive market. It creates the pressure to improve efficiency.

In its original form, price cap regulation was a top-down price setting process that included an estimate of the improvement in productivity that should be expected. Quite quickly it became a more bottom-up process where allowances were made for core building blocks of expenditure. These were:

- Operating costs;
- Capital Expenditure;
- Financing costs;
- Taxes; and
- Changes in working capital.

Capital expenditure was split between a depreciation allowance (for maintenance of the asset base) and a financing allowance to cover investment in growth and in the enhancement of the company's assets. The enhancement expenditure reflected the requirement to improve water quality and environmental performance and the levels of service provided to customers and communities.

The rationale for price cap regulation was that the regulated company would 'reveal' what its true level of cost could be. This is because it got to keep the difference between what it actually spent and the regulator's allowance - until the next price setting[32].

There is clear evidence that the incentive properties of this approach to regulation were effective. Operating costs in Scottish Water were reduced by some 40% in real terms. There was demonstrated improvement in the unit cost efficiency of capital expenditure. The clear definition of the outputs required from the expenditure on enhancement and growth also supported the improvement in efficiency. The results achieved in Scotland were almost identical to those delivered in England and Wales. Scotland had followed in Ofwat's successful footsteps.

Considering the building block approach in a little more detail, it can be seen that both operating costs and capital expenditure unit costs had a common factor: the expenditure was specific to the regulatory control period for which prices were being set. A regulatory determination sets out clear obligations about what improvements in performance were required. There was close monitoring of whether these improvements were delivered. Similarly, operating expenditure recurs each year and, in such a capital intensive industry, is generally relatively stable and predictable. Given that Scottish Water knew that price levels would be reset to reflect observed improvement in performance, there was little (or no) benefit in claiming an efficiency if it was not

[31] Sometimes referred to as 'incentive based regulation' or 'RPI-X Regulation' (where prices increase in line with inflation less a productivity improvement challenge).

[32] Ofwat later changed the savings retention period to five years. This was designed to encourage the regulated company to make efficiencies through the regulatory control period. There was much less incentive to make a savings if the benefits could be retained for only the short period that might remain until the next price setting.

real and sustainable. The pressure of comparison with (so-called comparative competition between) other companies also helps in ensuring that the incentives for improvement work.[33]

This process did not work as well when it came to capital maintenance and depreciation, where the consequences of actions are not necessarily visible during a regulatory control period or in its immediate aftermath.

A1.3.3 Setting allowances for capital maintenance

WICS followed developments in Ofwat's thinking on capital maintenance and relied on the same basic approach[34].

Ofwat initially set an allowance that reflected previous levels of expenditure. Under this option, the regulator used a combination of comparisons over time and econometrics to establish allowances for capital maintenance. There was an ex-post check at a subsequent price setting to establish whether a company had committed expenditure in a manner that was broadly consistent with the allowance that had been made at the previous price review. This became known as the 'Broad Equivalence' approach. It was effective in maintaining the hard budget constraint. Hindsight suggests that it may not have been as good at encouraging a discussion of what would ultimately need to be committed to asset replacement.

WICS (and Ofwat) monitored the performance of the regulated assets. The expectation was that the performance of their assets had, at worst, stayed the same. This general approach has remained in effect in England and Wales. It was in place in Scotland until the changes introduced for the Strategic Review of Charges 2021-2027.

A1.3.3.1 Attempts at Reform

Ofwat recognized that its approach was not optimal. In its MD161 letter, Ofwat asked companies to provide better evidence about why they needed to spend more on maintenance – in essence an analysis of the costs and benefits of future maintenance expenditure. This apparently straightforward request was actually a huge challenge.

An analysis of costs for a future regulatory control period was just about feasible. The quantifying of benefits was much more challenging. Quantifying costs and benefits for the very long term was essentially impractical. There was an amount that would need to be spent to ensure a resilience sustainable water and wastewater service. Less (or more) could be spent, but how could the impact of this variance be described or its impact on customers and communities even be properly documented, let alone valued? It is obvious that we want to spend the 'right' amount – but when and how that expenditure needs to be made over the long term cannot sensibly be evidenced ex ante in a traditional cost/ benefit analysis.

The industry responded with the 'Common Framework' approach to assessing capital maintenance needs. This approach appears to have been less effective than was initially hoped

[33] In the Scottish context, comparisons of the public sector industry in Scotland with the privatized industry in England and Wales were effective. It was possible to pose two telling questions. Why could the public sector not achieve the levels of efficiency already achieved in England and Wales? And, why should Scotland have to tolerate a less efficient water industry than the rest of Great Britain?

[34] Approaches diverged when Ofwat adopted its TOTEX approach.

because the information available to companies on the condition and performance of their assets was less complete than it could (or perhaps should) have been.[35]

A1.3.4 The economics of capital maintenance

Lower expenditure on capital maintenance is not necessarily a sign of efficiency. There are at least three reasons why such lower expenditure may not be a sign of efficiency. It could:

- signal potentially higher levels of risk being tolerated (both to the service level received by customers and to environmental compliance);
- result from elevated expenditure in previous years; and
- asset life cycles may not require expenditure to have been committed.

Similarly, higher expenditure on capital maintenance could be a sign of inefficiency. Or, it could simply be a reflection of necessary interventions to maintain performance or limit risk levels during a regulatory control period.

Observed expenditure during a regulatory control, or how it has changed, does not necessarily say anything conclusive about the asset management efficiency of the company. There is a clear challenge here for both the regulator and the regulated company.

Economic regulation should consider how best to address both properties of the natural monopoly – the risk of inefficiency and the risk that future performance will be sacrificed to keep current bills and expenditure as low as possible. Timely replacement of assets is in the interests of both the current and future generations of customers.

A1.3.5 The Common Framework and later

Even if the full promise of the 'Common Framework' could have been realized, it would, at best, have enabled a 'pay as you go' approach. It may have set out a need, at the level of an individual company, to spend more in a coming regulatory period – but it would not have been able to say much, if anything, about the level of expenditure required in future regulatory control periods. Subsequent forward looks would have reflected the observed performance of the assets at that time.

The regulator would then have had to accept that the needs of individual companies for the forthcoming period may be different and not immediately comparable (either over time or between companies for the same time period).

If the hard budget constraint were to be maintained, it followed that bills would have had to fluctuate up and down over different regulatory control periods. Such variability would likely have brought much increased scrutiny of the regulator and the industry.

Ofwat changed its approach to benchmarking to analyze total required expenditure on a comparative basis and later maintenance and operating expenditure jointly. The essential

[35] This paper compares what might be termed 'predictive' and 'strategic accounting' approaches to assessing the asset replacement liability. The discussions in Scotland suggested that the latter was more effective. This does not mean to suggest that the use of predictive modelling may not be a very val;uable tool for the asset manager. It merely suggests that it is not the best tool if the aim is to gain an understanding of how much will ultimately have to be spent to replace assets and how this might be most appropriately funded.

benchmarking approach did not however change – allowances still reflected observed historic expenditure and performance levels.

Approaches in Scotland and in England and Wales now diverged markedly. From a Scottish perspective, this change did not appear to address the time dimension of capital maintenance.

A1.3.6 The implications of the previous approaches to capital maintenance

In considering the best approach, it seemed to WICS that using benchmarks over time and between Scottish Water and its peers south of the border to determine allowances for capital maintenance discouraged the revealing of potentially valuable information. In essence, it appeared to do the opposite of what price cap regulation had intended, it encouraged Scottish Water to avoid revealing the true state of its assets and the level of expenditure that would be required to maintain and replace them efficiently and sustainably.

As we thought further about the incentive properties of our previous approach, we started to realize the limitations of performance monitoring. With such a large asset base and regular investment in growth and improving compliance, observed performance is unlikely to change much from year to year. However, this does not mean that the assets under management are not closer to the point at which they need to be replaced.

Asset condition was an alternative approach. But condition information is difficult and expensive to collect. A true condition analysis would reflect levels of corrosion, pipe wall thickness remaining etc. This has led to proxies for condition being used (number of bursts of water mains for example). Even if good quality condition information could be collected and kept up to date, it would be unlikely to be determinative as to when and how assets might fail.

An example illustrates: there will be little (if any) obvious difference in the grip and performance of a car tyre after a year of use. But the tyre will be a year nearer to the point at which it needs to be replaced. A tyre will likely last about three years and its performance will likely be just fine for the first two and a half years of that life. It will be clear when the tyre needs to be replaced – its condition and age rather than its immediate performance will be the decisive factors. A clever driver will compensate for an aging tyre by slowing done a bit more on the bends – but clever approaches are not really an efficiency!

This example may appear to be overly stark – but many water company assets will receive no attention until they fail or are discovered to be at risk of immediate failure. The timescales may be much longer than the tyre – but the pattern is similar.

The difficulty in setting ex ante allowances based on performance (or condition) need is even clearer when one considers the impact of the extended life of water and sewerage assets. Their long life will mean that deterioration is much slower and much less easy to observe. 80+% of the assets being buried further complicates.

There is no certainty as to what end of life looks like or how much warning there may be of an impending asset failure (discussions with Scottish Water have revealed multiple failure modes). When one reflects on these realities, the reputational consequences are obvious.

Under WICS' initial approach, Scottish Water had little practical option but to trust that when resources were needed to address asset replacement, WICS would make them available, either ex ante or quickly ex post. Scottish Water also had to hope that WICS would accept that the need

was a direct result of the approach adopted to the funding of capital maintenance and was not a failure on the part of the regulated company to deliver on its obligations in previous regulatory control periods. Scottish Water would also have had to trust that its reactive approach would be considered efficient by its regulator.

WICS further identified that there could not really be a hard budget constraint if the allowances for maintenance were not properly understood – both at the time they are set and when they are spent. And in setting the allowances, WICS wanted to understand what the medium and long term consequences would be for the regulated company.

WICS opted to work with stakeholders on an ab initio approach to how allowances for maintenance should be considered. It was clear a revised approach would have to address this timing asymmetry issue.

A1.3.7 Unfunded obligations

The identified risk was that the industry should be focusing more on resilience and its long term sustainability. Underfunding asset replacement would create huge problems for Scottish Water, regulators and customers in the future. Assets will ultimately have to be replaced. If Scottish Water had to delay replacing its assets, it is, in effect, creating a liability that will ultimately have to be met and funded. In that sense, it is not dissimilar to its financial borrowing. There is, however, one clear difference – the unfunded liability of the asset replacement is not recognized in the company balance sheet.

Moreover, there can be no straightforward assessment of just how big that liability could be and the extent to which it changes over time. It is not clear how such an unquantified level of risk is consistent with an effective and efficient regulated industry.

A1.4.0 Conclusion

WICS decided against following Ofwat's move towards considering maintenance as part of a TOTEX and BOTEX regime. This required WICS to take a different approach to asset replacement. WICS' review of what it had done previously and what it thought it should do going forward suggested:

- The focus on the hard budget constraint should be complemented by an approach that would ensure long term resilience and sustainability.
- Different stakeholders tended to have very different time horizons and be more or less conscious of where their interests lay.
- Evidencing in detail what asset replacement needed doing over a control period or longer was not realistic[36].
- Any approach adopted to funding capital maintenance should identify its impact on service levels and resilience. These factors would have to be explicitly considered, discussed and the associated risks and implications accepted by all stakeholders.

This thinking triggered a process of discussion and debate with stakeholders about what resilience and sustainability should look like.

[36] In practice the evidencing would need to be for a 7+ year period, given that business plans for a future regulatory control period are required by the regulator some two years before the relevant control period starts.

Annex Two: Initiating stakeholders' collaboration

A2.1.0 Introduction

The 2005 price review in Scotland was very adversarial. WICS cut Scottish Water's business plan investment allowance by some 40% while requiring the same outputs to be delivered. With the advent of a new Board at the regulatory office, there was an explicit recognition that a water company that was seen to be effective would have to be regulated by a regulator that was similarly seen to be effective. And, similarly, a regulator would only be seen as being effective, if the industry it regulated was seen as being effective[37]. This recognition made it easier to work jointly on issues. The first major example was the introduction of the non-household retail market arrangements between 2006 and their 'go-live' in April 2008.

By 2010, there was a common sentiment amongst the industry stakeholders that the successes of Scottish Water in its early years should be future proofed.

The Scottish water industry adopted the principles of Ethical Business Regulation (EBR), advanced by Professor Christopher Hodges. These principles encouraged collaboration and open discussion. They suggested that sanctions should be a last resort and only used when there is deliberate 'bad behavior'. The EBR principles strengthened stakeholders' moves towards collaboration and joint working.

A2.2.0 A joint approach to defining capital maintenance needs

The initial discussions about the need for future proofing suggested that capital maintenance should become a principal focus of the next price review.

The starting premise of this work became an acceptance that 'we are where we are'. This acceptance meant that the discussions and future work should focus on the future rather than what had happened previously and why what had happened had happened. This was important – but not easy. It had implications for all stakeholders.

A2.2.1 For the regulator

As regulator, we had to ensure that Scottish Water would feel able to participate fully in developing an appropriate approach to capital maintenance. For example, we had to recognize that Scottish Water would have to have confidence that the regulator would not seek to capitalize on new information – either with a view to future price setting or in reassessing its view of past performance. We sought to emphasize this commitment frequently as the various discussions progressed.

We also had to be open to learning about the pressures that the regulated company felt that it had to manage. We knew that there would be surprises about what was, and was not, known. As such, we would have to be patient as any new approach would likely need considerable time and effort to implement successfully.

A2.2.2 For the regulated company

The regulated company had to play the most important role. It would potentially face quite a dilemma if it became clear that it was spending much less on asset maintenance than it should have been. Its prior experience of WICS' benchmarking approach could reasonably cause it to be

[37] This ethos was one of the many important contributions that Sir Ian Byatt (the first DG of Ofwat) brought to Scotland as the first Chair of WICS.

wary of being criticized for not having invested in maintaining its assets. It would have to explain why it had not asked for more funding. It may be criticized for not having prioritized maintenance to a greater degree.

Scottish Water would have to set out clearly the challenges that it faced - and, importantly, the extent to which it understood those challenges. How much did it know about its assets – their lives, condition, performance and deterioration profiles? Revealing what it knew, and did not know, would likely feel very risky. How would the economic regulator (and other stakeholders) react? Scottish Water would have known that its partners would likely be surprised about much that they learnt.

Could the regulated company trust the regulator if there were material surprises? It had to adopt an 'open book' approach as to how it had managed its assets and as to what it did and did not know. Not easy!

A.2.2.3 For the Quality Regulators

The quality regulators had to accept that the industry did not, perhaps, have as good an understanding of its assets and their performance as they might have expected or liked. They also had to be prepared to accept that they too should not use new information to the detriment of Scottish Water in the event that an unknown performance issue was discovered. They would have to be prepared to allow sufficient time to elapse such that Scottish Water would have a fair opportunity to address any performance issue that came to light.

A2.2.4 For customers

Customer groups would likely be understandably wary. On the one hand, they would probably recognize how important it was that the industry was properly resilient. On the other, they would immediately understand that this initiative could place an upward pressure on customers' bills. As such, while they agreed that examining the capital maintenance issue had the potential to place the industry on a much stronger footing for the longer term, they remained cautious as customers might be asked to pay more and would likely not see any immediate benefits from resilience.

A2.2.5 Early sentiments

During the early discussions, it became clear to all the other stakeholders just how much reputational risk Scottish Water felt it was taking. If this initiative did not bear a positive result or there was a major asset failure while the work was continuing, there was obvious potential for customers' confidence in the industry to be rattled. Scottish Water understandably sought explicit reassurance from its partners that they would support it in reassuring customer groups about the importance of the work.

Both the regulators and the regulated company had to look forward. In particular, the regulated company had to have confidence that its performance would not be reassessed as a consequence of what its stakeholders learned during these discussions.

A2.3.0 Approach to understanding capital maintenance

Stakeholders agreed that an 'ab initio' approach should be used. There was a consensus that all available information and approaches should be considered. There was also an explicit

recognition that not all the information that stakeholders might want to see may be readily available. Such information could take time to collect, analyze and understand.

Stakeholders identified issues that they wanted to discuss. Discussions would continue until all were satisfied that the collective understanding was as complete as was possible at that time (more information collection or analysis may be required). There was a collective pressure to explain. There was a focus on the 'How' and the 'Why'.

Two further general principles were agreed.

The first was challenging but particularly important: the spending need over time should be kept separate from how, when and to what it would be committed. This premise was particularly important as it kept the initial focus of stakeholders on the overall need - rather than the immediate priorities of individual stakeholders.

The second agreement was that the stakeholders would look to establish ranges for each agreed input. It was felt that this approach would help build confidence in the conclusions of the joint work – and avoid the temptation of pursuing spurious accuracy. The ranges would also allow stakeholders to test the sensitivity of the conclusions to different valuations and asset lives.

Stakeholders also agreed that they should not rely on any existing predictive modelling techniques that were in use in the industry[38]. The over-arching aim of the work was to understand the level of funding that would be required to ensure that the industry would be appropriately resilience and sustainable. A secondary question would relate to how this funding level would be achieved and maintained – given that Scottish Water would continue to be subject to economic regulation.

To determine need, the stakeholders had to discuss in great detail issues such as:

- The asset inventory;
- Asset condition and performance; and
- Asset age

To determine what might be required going forward, the stakeholders had to consider in depth:

- How Scottish Water made investment decisions;
- What Scottish Water was spending on capital maintenance and the make-up of that expenditure; and
- How a funding allowance could be made consistent with economic regulation and the hard budget constraint.

A2.4.0 Conclusion

In other asset intensive industries, asset management standards are set by detailed regulatory requirements (safety, length of use, component or system manufacturer's advice etc.). There is no similar rule book for the water and sewerage industry. Rather there is an expectation on the regulated company will act sustainably and that its regulators will ensure that it is appropriately funded to this end. Its performance should be considered based on what the industry has achieved, what it is achieving and what it will continue to achieve.

[38] For the purpose of assessing the asset replacement liability and how it would be most effectively funded.

Future proofing required all the stakeholders in Scotland to come together to ensure that there was a collective understanding of the different perspectives being brought to the table. This process would allow a way forward to be identified that was in the interests of the industry and the customers and communities it serves both for the current time and into the future.

Annex Three: The conclusions of stakeholders' efforts to understand asset replacement.

A3.1.0 Introduction

This third annex outlines the conclusions of stakeholders' efforts to understand asset replacement.

A3.2.0 Quantification of the need

Stakeholders decided to start their exploration of asset replacement by considering the factors that were inputs to the predictive models. What lessons could be learned?

These models appeared to take account of the assets in use, their criticality; their condition and performance. The models also appeared to include assumptions on the rate of deterioration of different types of asset in various circumstances. This logic seemed to the stakeholders to be sound when it came to predicting the future timing of an intervention.

This assessment did not, however, seem to help the group understand the extent of the future liability. This was for three reasons:

1. Condition and performance could tell stakeholders something about when an individual asset (or group of assets) was likely to fail. But they did not say anything about the extent of the overall liability to replace assets (or the overall timeframe during which the liability might crystallize).
2. These models conflated expenditure on repair and refurbishment with expenditure on the ultimate replacement of the asset. They did this to define an 'optimal intervention'. Stakeholders were clear that all assets will ultimately need to be replaced with an optimized equivalent.
3. Scottish Water had been clear that its condition and performance information would be very variable in its quality. It had explained that it had probably not invested sufficiently in understanding the condition of its assets.

The rate of deterioration and the modelled optimal approach to managing groups of assets similarly did not appear to help in developing an understanding of the ultimate need for replacement. It helped only with the likely timing of that need crystallizing.

There was one important learning from this review of these predictive models – the value of cross-checking costs. The cost estimates included in any modelling should be consistent with the ex post capital costs of the regulated company.

Furthermore, when stakeholders discussed the valuation of assets that should be used, it quickly became clear that the extent to which assets were depreciated was not relevant to an assessment of the overall liability. It was the financial equivalent of asset condition and performance – it would likely provide some indications as to when replacement was likely to be required (an older asset was, almost by definition, nearer to the end of its life than a similar newer asset) but it would not impact how much would ultimately have to be committed to ensure that the services provided were sustainable and resilient.

In discussing what asset replacement would mean in practice and, as a result, what would need to be costed, it quickly became clear that, at replacement, several things would be different:

- Land would not need to be purchased a second time[39]
- The work would likely be more difficult second time as the replacement would be taking place in an area already developed while much of the original asset base would have benefitted from being built on green field sites.
- New materials and technologies would likely make like for like replacement cheaper.

From this discussion, it seemed reasonable to use an estimate of the optimized replacement cost of the assets as a baseline for the total liability.

A3.3.0 How the liability might be met

Stakeholders recognized that the cost of replacement was a funding issue, not a question of financing. Ultimately customers would have to pay. There was also a recognition of the potential inter-generational impact of any approach that would be agreed.

Stakeholders considered that there would need to be an estimate of an annual contribution towards asset replacement. This seemed to be consistent with each generation of customers making a fair contribution to the costs of the service that they have received. Going forward, Scottish Water's revenue should be adjusted to include the necessary average annual contribution towards its asset replacement liability[40].

The appropriate annual contribution would have to be sufficient for it to meet the total liability as and when it crystallized. Discussions also made it clear that this annual allowance might not reflect the actual expenditure on replacement that is required in any one year.

Once there was a clear baseline for the current asset replacement liability associated with the existing asset base, there would need to be later adjustments to the annual allowance to reflect subsequent new investment in growth or other asset enhancement.

A3.4.0 Calculating the total liability

It followed that there were two key questions that had to be addressed:

- What was the extent of the liability?; and
- How much annually had to be contributed such that Scottish Water would be able to meet this liability when it crystallized.

[39] An assumption was made that if an asset was replaced in a different location and a land purchase was necessary, the cost of the new land would be covered by the proceeds from realizing the old site.

[40] The original approach to economic regulation saw the capital maintenance allowance as being the de facto depreciation of the asset stock. It turned out that it was not just 'depreciation' in the accounting sense but also the costs of repairing/ maintaining the asset during its expected life.

Scottish Water first prepared a break-down of its different types of assets to test the reasonableness of the developed hypothesis. Scottish Water divided its assets into three categories, as set out in Table 1.

Table 1: Scottish Water's allocation of assets to categories

Category 1: Assets that Scottish Water considered would be repaired and refurbished in perpetuity	**Category 2:** Assets that would ultimately need to be replaced	**Category 3:** Business Services Assets
Sewers	Raw Water Mains	Digital
Raw Water Aqueducts	Water Treatment Works	Property
Dams and Impounding Reservoirs	Treated Water Storage	Logistics
	Water Pumping Stations	Other Business Assets
	Water Mains	
	Sludge Pumping Mains	
	Other Water Operational Assets	
	Wastewater Treatment Works	
	Wastewater Pumping Stations	
	Sewage Pumping Mains	
	Long and Short Sea Outfalls	
	Combined Sewage and Emergency Overflows	
	Sludge Treatment Facilities	
	Other Wastewater Operational Assets	

Scottish Water also had legacy PFI/PPP contracts that were due to end between the early 2020s and 2040. These assets would also have to be included in the calculation of the potential liability for future asset replacement.

Scottish Water's review suggested that they had a very good understanding of the annual cost of replacing business services assets. This was not surprising – it was something that they had had to do on multiple occasions and they had good documented evidence of replacement cycles and costs incurred. As such, dealing with the future liability associated with maintaining and replacing these business services assets could be handled separately.

Perhaps more important was Scottish Water's conclusion that there were three types of asset that might best be considered as 'existing in perpetuity'. These 'in perpetuity' assets would be repaired and refurbished on an on-going basis. For the purposes of this analysis, they would not be replaced. There was considerable debate among the stakeholders regarding the allocation of sewers to this 'in perpetuity' category – but time and resource constraints meant that allocating them to the 'in perpetuity' group was a pragmatic approach.

Scottish Water also divided its assets into short, medium and long life categories. These are set out in Table 2.

Table 2: Scottish Water Assets by Life Category

	Water	Wastewater
Short-Life Assets	Water Meters	MEICA
	MEICA Assets[41]	
Medium-Life Assets	Raw Water Pumping Stations	Sewage Pumping Stations
	Treated Water Pumping Stations	
Long-Life Assets	Raw Water Mains	Sewage and Sludge Pumping Mains
	Civil Engineering Structures	Combine Sewage and Emergency Outflows
	Treated Water Storage	Other Sewage Structures
	Water Mains > 300mm	Cess and Septic Tanks
	Water Mains < 300mm	Civil Engineering Structures
		Sludge Treatment Facilities
		Long and Short Sea Outfalls

Stakeholders were focused on understanding the potential replacement cost of the assets. The best way to do this appeared to be to look at these defined categories and consider the range of valuations that could apply given the assets that would be included in each category. There was some debate as to the extent of disaggregation of the asset base that was appropriate.

The group's conclusion was that the (quite wide) ranges for both asset life and the optimized replacement costs of assets meant that the level of disaggregation proposed by Scottish Water would be sufficient.

As such, the next step was to consider the lowest and highest conceivable replacement cost for each of these categories of assets.

At the same time, the lowest and highest expected average lives were discussed and agreed amongst Scottish Water's asset managers. As was discussed above, these asset lives were fundamental to what would have to be allocated to replacement each year. Scottish Water's conclusions were discussed with the wider group.

[41] MEICA is/ are Mechanical, Electrical, Instrumentation, Control and Automation Assets

This analysis is set out in Table 3:

Table 3: Conceivable Ranges for Asset Lives and Replacement Costs[42]

	Replacement cost (£m) 2017/18 Prices		Lifetime (Years)	
	Low	**High**	**Low**	**High**
WATER SERVICE				
Raw Water				
Raw Water Pumping Stations	£90	£160	25	50
Raw Water Mains	£540	£900	90	140
Water Treatment Works				
Civils	£1,190	£1,790	60	100
MEICA	£1,460	£2,190	15	25
Distribution				
Treated Water Storage	£1,480	£2,920	60	100
Treated Water Pumping Stations	£150	£250	25	50
Water Mains > 300mm	£3,480	£5,800	90	140
Water Mains < 300mm	£8,360	£12,540	80	130
Water Meters	£70	£120	5	15
WASTEWATER SERVICE				
Collection				
Sewage and Sludge Pumping Mains	£390	£650	50	100
Combined Sewage and Emergency Outflows	£300	£450	80	120
Sewage Pumping Stations	£900	£1,340	25	50
Other Sewage Structures	£200	£400	60	100
Cess and Septic Tanks	£240	£470	50	80
Wastewater Treatment Works				
Civils	£1,480	£2,230	60	100
MEICA	£1,810	£2,720	15	25
Discharge				
Sludge Treatment Facilities	£150	£250	60	100
Long and Short Sea Outfalls	£350	£550	80	130
WASTEWATER SERVICE PFI SITES				
Civils	£630	£940	60	100
MEICA	£770	£1,150	15	25
TOTAL	**£24,040**	**£37,820**		

These were obviously very wide ranges. To take the example of smaller diameter water mains, the analysis suggests that £64.3 million per year (£8,360/130) may be sufficient if the highest life considered feasible and the lowest reasonable optimized replacement cost were found to be correct. At the other extreme, it could require an allowance of £156.75 million annually (£12,540/80) to replace water mains when they fail.

The stakeholder group was keen that Scottish Water consider how it could apply its experience and asset management expertise to narrow down this potential range – whilst recognizing that narrowing the range was only beneficial if there was compelling evidence to support it. There was a recognition that several iterations of this analytical process would likely be required in the future.

[42] All costs in this paper are in 2017/18 prices.

Scottish Water developed a matrix that allowed them to consider tighter ranges for both the potential replacement cost and the expected asset lives where they could access better information or leverage their own experience. Scottish Water sought to allocate each asset type to one of six confidence zones. These were:

Zone 1: Cases where Scottish Water judged that it had a good level of understanding of both replacement cost and asset life.

Zone 2: Cases where Scottish Water judged that it had a good level of understanding of replacement cost but only a fair grasp of asset life.

Zone 3: Cases where Scottish Water judged that it had a good level of understanding of asset life but only a fair grasp of replacement cost.

Zone 4: Cases where Scottish Water judged that it had a fair grasp of both replacement cost and asset life.

Zone 5: Cases where Scottish Water judged that it had a weak understanding of both replacement cost and asset life.

Zone 6: Cases where Scottish Water judged that it could not use its experience to estimate replacement cost and asset life.

Scottish Water's matrix used 14 equal steps between the highest and lowest conceivable asset life and highest and lowest conceivable replacement cost. For those areas where it had a good understanding it used lives and costs that were in the middle of the defined ranges. Wider ranges were used where the confidence level was lower. The full conceivable range was used where there was no experience available that would allow that range to be narrowed.

This allowed for improved estimates of the likely range in asset lives and in asset replacement costs. The revised estimates are set out in Table 4.

Table 4: Revised estimated ranges for asset life and replacement cost

	Zone Selection	Revised Estimate for Replacement Cost (£m)		Revised Estimate for Asset Life (Years)		Revised Estimate for Cost Per Year of Life (£m)	
		Low	High	Low	High	Low	High
WATER SERVICE							
Raw Water							
Raw Water Pumping Stations	Zone 4	£106	£144	31	44	£2	£5
Raw Water Mains	Zone 5	£595	£845	98	132	£5	£9
Water Treatment Works							
Civils	Zone 4	£1,328	£1,652	69	91	£15	£24
MEICA	Zone 3	£1,628	£2,022	19	21	£77	£107
Distribution							
Treated Water Storage	Zone 4	£1,812	£2,588	69	91	£20	£37
Treated Water Pumping Stations	Zone 4	£173	£227	31	44	£4	£7
Water Mains > 300mm	Zone 4	£4,015	£5,265	102	128	£31	£52
Water Mains < 300mm	Zone 4	£9,325	£11,575	92	118	£79	£126
Water Meters	Zone 2	£89	£101	7	13	£7	£14
WASTEWATER SERVICE							
Collection							
Sewage and Sludge Pumping Mains	Zone 4	£450	£590	62	88	£5	£10
Combined Sewage/ Emergency Outflows	Zone 4	£335	£415	89	111	£3	£5
Sewage Pumping Stations	Zone 4	£1,002	£1,238	31	44	£23	£44
Other Sewage Structures	Zone 6	£200	£400	60	100	£2	£7
Cess and Septic Tanks	Zone 6	£240	£470	50	80	£3	£9
Wastewater Treatment Works							
Civils	Zone 4	£1,653	£2,057	69	91	£18	£30
MEICA	Zone 3	£2,020	£2,510	19	21	£95	£133
Discharge							
Sludge Treatment Facilities	Zone 5	£165	£235	66	94	£2	£4
Long and Short Sea Outfalls	Zone 6	£350	£550	80	130	£3	£7
WASTEWATER SERVICE PFI SITES							
Civils	Zone 6	£630	£940	60	100	£6	£16
MEICA	Zone 6	£770	£1,150	15	25	£31	£77
BUSINESS SERVICES						£35	£50
TOTAL		**£26,980**	**£34,970**			**£470**	**£770**

A3.5.0 Testing these ranges

In parallel with the Stakeholder Group's discussions, WICS sought to understand the views of other engineering and asset management experts on asset lives. This was a part of the regulator's normal due diligence when it comes to setting charges.

WICS' analysis suggested consistently that the asset lives adopted by Scottish Water were longer than many others thought appropriate. This included the JASPERS[43] technical review group that

[43] JASPERS is the Joint Assistance to Support Projects in European Regions

the European Union and European Investment Bank (EIB) uses to assess investment proposals from its member states.

Other work commissioned in by a State Government in Australia from the Atkins Consultancy suggested that the asset lives used by Scottish Water may be as much as 15% longer than those suggested as prudent by that work.[44]

WICS was substantially reassured when it calculated that a 10% reduction in the asset lives used would increase the investment range to c.£517 million to £847 million. It was a material impact, but the original assessed range still substantially overlapped with any such higher requirement.

To test an opposite scenario, WICS considered how longer asset lives could impact on the levels of expenditure that might be required. If the asset lives were 10% longer than the low end of the Scottish Water range, this would reduce the £470 million minimum requirement to approximately £423 million. The nature of the analysis meant that even an increase to a 20% error in the asset replacement cost or asset life still meant that the best case requirement was £376 million. Again, even these much more optimistic scenarios substantially overlapped with the original analytical assessment.

It also seemed unlikely that any underestimate of asset lives or optimized replacement cost would be consistent across all asset categories.

Given that the total annual investment of Scottish Water was only about £600 million, stakeholders recognized that further thought would have to be given to how the identified asset replacement needs were going to be met. There was no way that existing levels of investment was going to be sufficient to address the asset replacement liability and meet the expectations of the Government and the quality regulators for expenditure on enhancement and growth.

A3.6.0 Implications of the Analysis

The review of asset replacement cost and their expected lives suggested that an annual charge of between £470 million and £770 million would be required if Scottish Water were to be funded to replace assets at the end of their useful lives[45].

This analysis had made it clear that, if the industry was not funded to this level as a minimum, Scottish Water would have to manage an asset base whose average age (before enhancements or growth interventions) would be constantly increasing. Ultimately, Scottish Water would be responsible for assets that were, on the average, being expected to last for longer than had ever been thought prudent. It was difficult to reconcile such an approach with the evidence from third party experts that Scottish Water's estimates of asset lives were, if anything, too long.

Extending asset lives would also likely have implications for compliance, resilience and service levels. It would likely not take long for this aging asset base to prove less resilient and for the customer experience to be impacted. In the future such a shortfall in funding would need to be made up. In effect, an additional future liability is created for future generations of customers.

[44] Subsequent analysis by the consultancies Reckon and Economic Insight have similarly concluded that the expected asset lives commonly used in the United Kingdom tend to exceed those used in other countries.
[45] Before any account was taken of future investment in improving compliance, levels of service or in growth.

Following on from this initial phase of work, there were still a number of questions that stakeholders wanted to address:

- What were customers currently paying towards the long run costs of asset replacement?
- Were there different levels of risk for different categories of asset or for different asset lives?
- How should we get started?

These three issues are considered in turn.

A3.7.0 What was the level of capital maintenance being paid for by customers

Scottish Water had operated with an allocation of about £300 million in 2017/18 prices for capital maintenance – less than the bottom end of the range identified above.

Discussions had revealed that Scottish Water and other UK water companies used the capital maintenance allowance for three things:

- The expenditure on capitalized (as opposed to expensed) repairs.
- Asset refurbishment (such as pump reconditioning and pipe lining); and
- Asset replacement.

As part of its analysis of its past expenditures, Scottish Water separated out what it had committed to the continuing stewardship of those assets that it had classified as being managed in perpetuity (sewers, reservoirs and dams).

Scottish Water's review of its expenditure suggested that it spent around £170 million annually on the first two areas plus the assets being managed in perpetuity. This left around £130 million that was committed annually to asset replacement. This £130 million could then be compared with the potential liability of £470 million to £770 million.

A3.8.0 Differences in Risk

The replacement cost of the long-life assets is much greater than that of the short to medium life assets. However, a higher annual allowance has to be made for short to medium life assets. The long life assets have a replacement cost of between c.£20 Billion and c.£27.5 Billion with an annual replacement cost of approximately £200 million to £340 million[46]. The short to medium life assets in contrast have a replacement cost of just £6.9 to £7.4 Billion, but require an annual contribution towards replacement of between £274 million and £433 million. It is noteworthy that although these short and medium life assets only account for around 20% of the total asset stock by value, they actually require more than half the average annual allocation to asset replacement.

The nature of these short to medium life assets, principally pumps and MEICA, make their timely replacement particularly critical. There are likely to be increased issues with the resilience and sustainability of service levels if they are not replaced in a timeous fashion. There would also likely be an increased carbon footprint.

[46] Obviously, this excludes sewers in line with the analysis completed.

Stakeholders agreed that these categories of assets should be prioritized within the funding available. This difference in age risk profile would have to be taken into account in transitioning to an appropriate level of funding for asset replacement.

A3.9.0 Conclusion

Stakeholders' discussions were detailed, actively debated and very comprehensive. There was a general consensus that future proofing the Scottish water industry would require much more to be invested. There was a heightened awareness of the consequences of not acting. Scottish Water was acutely aware that it would have to explain and justify its use of these higher investment levels if they were to continue to enjoy the support of their regulators and the customers and communities that they served.

Annex Four: Starting to address Scotland's asset replacement liability

A4.1.0 Introduction

There was clearly a very large difference between the £130 million which Scottish Water was able to commit to asset replacement at the time of these stakeholder discussions and the minimum £470 million that the analysis suggested as the minimum required for asset quality to be broadly maintained. The key questions included:

- Could Scottish Water scale up its asset management and investment delivery capability and capacity to use such an increase in its resources effectively and efficiently?
- Could the enhancement and growth investment program be reduced to assist in the transition?
- What was the customer appetite for a quick transition and a sharper increase in charges?
- If a more gradual transition in allowed for funds was appropriate, how should this be done?
- How would asset failures that happen before funding and liability are aligned be explained and justified?

A4.2.0 Transitioning to the Ultimate Funding Requirement

Scottish Water recognized that it would take time to gear up its asset management and investment delivery functions to deal with the potentially very significant increase in its annual investment. All stakeholders agreed that a transition path was the most desirable way forward. It would not just give Scottish Water some breathing space to gear up, but it would also allow new, more detailed, reporting of expenditure and performance to be implemented. It would also ease the impact on customers' bills.

The downside of a transition was that stakeholders were knowingly accepting that the industry was likely to be being under-funded to address all its asset replacement obligations in an optimal way. This approach was, consequently, a risk to performance, compliance and levels of service to customers.

The Scottish Government had conflicting priorities[47]: it wanted Scottish Water to achieve Net Zero by 2040 – both in terms of its operational and its embodied carbon emissions; but it also had concerns (the economic impact of Brexit and COVID on household budgets were both front of mind) about the affordability of water charges. The Net Zero target, however, seemed to place a backstop on when the transition had to be completed by.

The target investment level in 2040 would therefore have to reflect:

- A sustainable level of annual funding for asset replacement of the existing asset stock;
- A sustainable level of annual funding for asset replacement of enhancement and growth investment made by Scottish Water between 2021 and 2040;
- A reasonable efficiency/ optimization rate on the asset management replacement liability; and
- An on-going allowance for enhancement and growth investment.

[47] WICS has an obligation to fund Scottish Water at a level consistent both with the statutory duties of Scottish Water but also Directions issued by the Scottish Government as to the achievement of policy expectations.

WICS[48] accepted the £190 million to £340 million range for long life assets. It accepted that the industry should be funded for the full potential annual cost of replacing short to medium life assets - £430 million. It set an efficiency/ optimization target of £50-£150 million a year by 2040. It also accepted that there would likely be a continuing need for expenditure on asset enhancement and growth of around £300 million each year.

By 2040, WICS assessed the additional annual asset replacement allowance that accrues from enhancement and growth investment in the period 2021 to 2040 as being between £130 million and £180 million. This allowance reflected advice from Scottish Water as to the likely split between long life and short/ medium life assets that would result from enhancement and growth investment over that period.

By 2040, Scottish Water would therefore likely need between £1,000 million and £1,100 Million[49] each year in investment. This requirement is set out in Table 5.

Table 5: 2040 Annual Investment requirement

Category	Low End Estimate	High End Estimate
New Growth and Enhancement investment	£300m	£300m
Short Life Assets (a)	£430m	£430m
Long Life Assets (b)	£190m	£340m
Post 2021 New Enhancement and Growth Assets (c)	£130m	£180m
Optimization and Efficiency Challenge (d)	-£50m	£150m
Total Annual Expected Requirement by 2040	**£1,000m**	**£1,100m**
Current Annual Asset Replacement Expenditure (e)	£130m	£130m
Uplift Required for asset replacement (f) = (a+b+c+d)	£530m	£630m
% Uplift In Investment Spending (f/e)	**407%**	**485%**

The £1,100 million included the top end of the range for all asset replacement (£770 million) plus the £300 million for enhancement and growth and the £180 million for the replacement of enhancement and growth investment post 2021. The efficiency challenge here was higher at £150 million annually. The bottom end of that range used the mid-point of the range for long life assets and the top end of the range for short to medium life assets. It used the low end of the range for new asset replacement needs. As this was a higher risk option, the optimization challenge was restricted to £50 million.

[48] All the numbers in this section are in 2017/ 2018 prices.
[49] In 2017/18 prices

A4.3.0 The Strategic Review of Charges 2021- 2027

The initial transition was set out in the 2021/2027 Strategic Review of Charges.

WICS concluded that Scottish Water should be funded to meet the annual replacement liability of all the existing potential short and medium life assets as quickly as could reasonably be achieved. This reflected the discussions with Scottish Water and the quality regulators[50] and the clear advice that future compliance could be put at risk if these assets were not replaced in a timely fashion. The quality regulators considered that running to failure without appropriate back-up posed an unacceptable compliance and reputational risk.

This meant that Scottish Water would have to be allowed commit £430 million each year to asset replacement for these asset categories.

Scottish Water considered that the average age of its current short and medium life asset stock was about thirteen years. The regulator used ten years as a baseline, having reviewed the detailed lists of projects completed since regulation started.

WICS further calculated that the simple average expected life of these assets was 18 to 22 years. The weighted average expected life was a little longer at 20 to 26 years. This gave a plausible timeframe for a full cycle of replacement of between 18 and 26 years. Accepting the ten year average age of Scottish Water's assets in these categories suggested that Scottish Water had between 8 (18-10) and 16 years (26-10) to be fully funded for this asset category. WICS concluded that the end of the 2021-2027 regulatory control period represented an appropriate transition way point.

WICS also considered that some small allowance for long life asset replacement should be added to the level of annual replacement investment that should be allowed for by the end of the regulatory control period. It added £50 million to this end. WICS therefore concluded that the allowance for annual asset replacement should be £480 million by 2027 (Being the £430 million for short and medium life assets and a small allowance for long life assets of £50 million). Adding the accepted allowance for improving levels of service, compliance and growth of £300 million resulted in an end of period annual allowance for investment of £780 million.

A4.3.1 *The Price Review in the Longer Term Context*

WICS' analysis suggested that increasing charges at 2% real each year between 2021 and 2040 should allow both the transition way point of £780 million annually by 2027 and the £1,000 to £1,100 million range for annual investment by 2040 to be funded. It seemed that this profile of increase in charges could maintain the hard-won consensus amongst stakeholders.

A4.4.0 Other Issues Addressed

There were four other principal issues that were addressed. These included:

- How would year to year variation in the required expenditure on replacement be managed?
- What were the implications of the 'assets in perpetuity' category?
- How could the regulatory 'hard budget constraint' be safeguarded?

[50] SEPA (the Scottish Environment Protection Agency) and DWQR (the Drinking Water Quality Regulator)

- What might be the tax implications?

Each is addressed in turn.

A4.4.1 *Managing annual variations*

During the transition to the assessed average annual expenditure allowance for asset replacement, Scottish Water would not be funded sufficiently to address all the asset replacement needs that longer term sustainability and resilience would require. There was a recognition that Scottish Water would have to prioritize its resources and use its best efforts to limit the decline in the performance and condition of its assets.

While sensitivity analysis confirmed that the aggregate total liability was quite robust – it did not consider the annual profile of needs[51]. A review of spending history and the age profile of assets suggested that it would still be highly unlikely that expenditure in any particular year (or even regulatory control period) would be exactly in line with the price review allowance. Stakeholders expected that the size and variety of the asset base (both in terms of its components and its asset lives) should result in a portfolio effect.

Given the relative preponderance of annual replacement expenditure allocations (over 50%) to short and medium life assets (and their expected age range of 18-26 years on average), stakeholders considered it reasonable to assume that the short to medium term assets would likely require their allocation of expenditure in full during each six year regulatory control period[52]. Any significant annual variation over the regulatory control period would therefore likely result from peaks and troughs in required long life asset interventions.

Allowing for a potential 50% variance during a control period in long life variations suggests that the maximum under- or over-spend of an allowance should likely be no more than about £1,000 million.

If Scottish Water were to underspend its allowance (for replacement or any other element of a price control) and, in consequence, build up a cash balance, these variations could, stakeholders concluded, be managed reasonably straightforwardly. Subject to working out the public expenditure implications, it would likely be desirable to allow Scottish Water to operate with a cash balance of up to £1,000 million. If this were not possible, potentially Scottish Water could accelerate investment in the growth and enhancement projects expected of it[53].

On the other hand, if the required level of spending was higher than the annual allowance (say the requirement for replacing long life assets ran at about 50% higher than the long run average, Scottish Water could be around £1 Billion short in the cash allowed. If there was no pre-existing cash balance to act as a shock absorber, Scottish Water would face a challenge.

This is because Scottish Water is limited in the level of borrowing that it can take on each year. As such, it is unable to use new borrowing to smooth over what are likely to be inevitable differences

[51] Using the pension analogy: the equivalent could be a period where many members of a pension scheme opted to take early retirement, this changes the annual draw on the pension fund but not the total aggregate liability.
[52] A regulatory period was between a third and a quarter of the expected average life of these assets.
[53] The Quality Regulators felt that more could reasonably be committed to improving compliance. Any such acceleration would have to be understood to be simply an acceleration and not additional spending.

between the ex-ante allowance and the actual requirement to invest[54]. Essentially under this scenario, it would have two options available to it:

1. It could seek to delay replacement of assets that may not be in imminent danger of failing or where the consequences of a run to failure approach are not too serious (services could be restored with only a minimal impact on customers, communities or the environment). It would give up on some of the potential for efficiency and optimization.
2. It could seek to scale back or slow expenditure on enhancement and growth projects (typically the latter have proved to vary over time).

In practice, a combination of options 1 and 2, would likely be sufficient either to get to the end of the regulatory control period or to allow some form of interim determination to be carried out. WICS' Final Determination discussed the implications of such a shortfall and how it could be handled. In this regard, Scottish Water's public sector status disadvantaged it.

A4.4.2 *Assets in perpetuity*

There remained a residual feeling that the approach adopted to the assets in perpetuity category could end up being optimistic[55]. The 2021-2027 determination allowed just £170million in 2017/18 prices for all repairs (on the asset base included in the analysis) and for all the required interventions on the sewerage system, reservoirs and dams. To put this allowance in perspective, the optimized replacement cost of the sewers was estimated at around £35 Billion.

If £70 million of the £170 million was solely for the replacement of parts of the sewerage network (ie not sewerage repairs, other repairs, refurbishments or for the maintenance of the other two asset types that had been deemed to be managed in perpetuity), the implied life of the sewer system was 500 years. Even if all that £170 million was committed to sewer replacement, the average implied life of a sewer would be some 205 years. These implied lives appeared to be very optimistic. It is difficult to think of constructed assets that are fully functioning and of comparable age. It was clear that further work would be required in this area. Discussions continued after the price review concluded.

A4.4.3 *Maintaining the hard budget constraint*

Maintaining the hard budget constraint has been fundamental to the establishing of pressure on a management to innovate and to improve efficiency.

If the much higher allowance for asset replacement is to be included in customers' bills, there will have to be steps taken to ensure that the positive incentive properties of the hard budget constraint can be maintained. WICS recognized that it would have to ensure that all stakeholders could have confidence that the ex-ante allowance for asset replacement expenditure was either being spent on asset replacement during the regulatory control period or, if not, was being held in reserve so as to be available when it was needed. This issue was not fully addressed by the conclusion of the Strategic Review of Charges 2021-2027.

[54] It would not be possible for WICS to set prices in a manner that allowed debt allowances to be held in reserve – like all public expenditure, debt allowances operate on a 'use it or lose it' basis. Government had already conceded that borrowing could be used over the control period – but they would likely not have appreciated any potential underspend.

[55] Stakeholders were struck by the longer asset lives typically assumed in the United Kingdom – relative to those in common use in other jurisdictions.

A4.4.4 *Tax*

Increasing the allowance for asset replacement would likely increase taxable profits in the medium run. Under the current corporate tax rules, it appears likely that there would be insufficient tax allowances in the early part of the transition to offset these increases in profit. Future decisions on charge caps would have to take account of whatever tax was expected to be payable.

Tax is, of course, a highly specialized, and ever changing, subject and a full review of the tax implications would be valuable. There was agreement that, in extremis, the price limits may have to be reconsidered in the event that compelling new information on tax liabilities became available.

A4.5.0 Conclusion

When preparations began for the Strategic Review of Charges 2021-2027, there was a consensus amongst stakeholders in Scotland that the improvement delivered by Scottish Water since it had been formed in 2002 should be future-proofed. This resulted in a focus on how assets were being maintained and replaced.

Stakeholders learned how Scottish Water had had to use its allowance for capital maintenance. It turned out it was split into four: asset repair; asset refurbishment; asset replacement and the maintenance of assets in perpetuity.[56] Only about £130 million of the £300 million allowance typically went to asset replacement.

The analysis by stakeholders concluded that Scottish Water would need between £700 million and £800 million annually to be able to meet its expected annual need for asset replacement by 2040. This represented a an increase of more than 300%.

Stakeholders agreed that a transition to the level of investment required to replace assets in a timely manner was the best course of action. This approach balanced affordability, risks to compliance and levels of service and Scottish Water's ability to manage assets and deliver investment effectively and efficiently.

[56] The sewers, reservoirs and dams

Annex Five: Other Implementation Issues

A5.1.0 Introduction

Addressing asset replacement is not just about increasing the level of funding to a level that is properly sustainable and allows the regulated company's assets to be properly stewarded. An effective regulatory framework will ultimately have to be able to deal transparently and effectively with the asset replacement liability. The sustainability and the reputation of the industry depend on its resilience and the extent to which the industry can respond to the growing expectations of the customers and communities that it serves.

An effective regulatory framework also requires that the funding for asset replacement is seen to be delivering what is promised. This will require a new framework for reporting. It will likely require further, on-going analysis. These issues should emphasize the importance of beginning to make progress towards a sustainable level of investment. Inaction is not an option; there is too much at stake for companies and the customers that they serve and for continuing compliance with environmental and water quality standards.

This supplement sets out some of the discussions that took place following the completion of the Strategic Review of Charges 2021-2027. These include:

- Sewers
- Addressing future enhancement and growth investment
- Updating the original analysis
- Implications for borrowing
- Calculating charges
- Private/ Public Sector Issues

A5.2.0 Sewers

Sewers are different to other industry assets – they perform a dual function: the collection of wastewater and the management of drainage. They may well have a much longer asset life and the approach to managing the asset may well properly be more heavily reliant on repair and refurbishment than on replacement.

However, their dual purpose may help mask resilience issues. Sewers typically operate well below their capacity – they are designed to cope both with the normal collection of wastewater and to deal with rain storms. This excess capacity appears to support the more reactive approach of repair and replacement.

Current annual replacement rates in Scotland (270 to 500 years on the most favorable of assumptions) are quite obviously unrealistic. Considerably more thinking is required on sewers maintenance and replacement. Society's and customers' expectations of drainage systems are high. We are not used to excess surface water, let along localized flooding.

Climate change is also impacting rainfall patterns. There are more but shorter and more intense periods of rainfall. As such, the full capacity of the sewer system appears to be required more often (albeit for short periods). This trend is exacerbated as there are more paved surfaces

(gardens, car parks, business and industrial sites) and rainwater typically finds its way from these surfaces to the sewerage system. Such changes could reasonably be expected to impact how sewers can be managed and maintained. These pressures are relatively new and need to be considered carefully.

Climate change and economic growth may result in sewerage system failures. There would likely be a reaction from customers and communities[57]. As such, it will become increasingly important that a water company is able to demonstrate that it is stewarding its sewerage assets appropriately. Such stewardship will be essential if customers are to respond positively to a request for further investment in drainage assets.

A further consideration should be the huge estimated replacement cost of sewers. Sewers account for around half the total replacement cost of the assets that Scottish Water owns and manages. A sustainable level of funding would take into account both the expected repair and refurbishment interventions but also the eventual need to replace these assets.

As an initial hypothesis, it would seem reasonable to adopt the same broad approach for sewers as for the other assets – notwithstanding that it is likely to be much more difficult to assign an appropriate expected life to a sewer that is properly maintained. There may, therefore, have to be a wider range of both expected optimized replacement cost and asset life than for other assets. An initially wide range should not be seen as an obstacle, it is important to get started and to make the effort to understand what the potential liability may be.

There are two immediate reasons why this should be a focus for future consideration. It could be all too easy to confuse genuine enhancement or growth investment with asset replacement that simply restores original design capacity. Such confusions could be expected to increase costs to customers over time. The asset in perpetuity approach risks this confusion.

The second reason is that when responses to climate change are being considered, it will be important to understand the full annualized costs of sewers (asset replacement cost divided by expected life plus expected annual repair and refurbishment costs) to compare their cost to alternative interventions to maintain effective drainage systems across the country. It can be all too easy to opt for the lower up-front cost than adopt a higher up-front but lower whole life cost alternative intervention. There is a common interest in getting the funding and asset management of sewer maintenance and replacement as right as possible. The more the industry faces into the challenge of Climate Change, the more this will become an issue.

A5.3.0 Future Enhancement and Growth Investment

The analysis of the required annual allowance for replacement covers all potential expenditure on optimized asset replacement. There should be no need for any further allowance to be made for asset replacement. Project costs will have to separate clearly the costs of the asset replacement and expenditure on enhancement and growth. The element of each project, which relates to replacement should be funded from the replacement allowance. It should not be included in the cost estimate for the incremental enhancement or growth project.

For stakeholder confidence to be maintained, the allocation of cost between enhancement, growth and asset replacement will have to be as well evidenced as possible. This will be an

[57] Public consciousness has already grown very significantly in England and Wales

important challenge going forward. The regulators (economic and quality) will need to develop the capacity and capability to engage in such discussions with the regulated company. There is a real benefit to customers and communities (and likely to asset owners) in ensuring this joint technical assurance.

In the event that a company develops a new site, the allocation to the asset replacement allowance is, straightforwardly, the optimized replacement cost valuation of the assets that will no longer be in service. Where investment required to meet a new objective is at an existing site, there needs to be an assessment as to what it would cost to return that site to its designed capacity and level of performance, the remaining project cost can then be ascribed to enhancement and/ or to growth.

There may be other ways that the allocation to asset replacement could end up being made. The key point is that the approach would have to be used consistently and that all stakeholders feel that they have understood how the approach works and how it will be used. Such consistency and understanding will be essential to maintaining customer and stakeholder confidence in what is being done.

If there is not a robust separation of the replacement and enhancement/ growth elements of future projects, there will likely be double-counting of costs and requested allocations. Such an outturn would be detrimental to the industry and to its regulatory framework. Even more important, however, it would undermine the confidence of customers in the value for money that they receive.

It is important to understand, however, that, given the nature of asset enhancement (where the new output can be clearly defined and its delivery monitored), it is more straightforward for the regulator to scrutinize the enhancement portion of the investment rather than debate the rationale for maintenance or replacement as was historically often the case.

A5.4.0 Updating the analysis

The original Scottish analysis set out above had 21 categories. These categories appeared reasonable for the first attempt at understanding the asset replacement liability. It is likely better to stay focused on ranges for asset lives and optimized replacement costs. There was some discussion whether it may, however, be appropriate to disaggregate further in future. For example, it may be worthwhile to separate out different pipe materials where there appears to be quite different experience on expected asset lives.

It may also be worth considering whether there should be a geographical breakdown of this analysis. In a Scottish context where we observe quite different investment needs across the country, such disaggregation could offer substantial insights.

It would seem reasonable that the scope and the definition of this analysis is revisited (at least) every ten years.

Whilst regular updates are important, experience suggests that introducing too much complexity may end up being counter-productive. It could suggest that there is some ‘perfect’ answer, which is just not possible.

Given that the regulated company is to be funded for effective stewardship of its assets, it is reasonable to expect it to improve its understanding of its asset base. Estimates of the

appropriate range for replacement cost and asset lives should be updated as better information about the class of asset becomes available.

A company should report on any changes to asset lives and replacement costs and their implications each year at the same time as it reports on the extent to which it has drawn down on the resourcing provided and the impact on its asset base of the expenditure that it has committed. Given the results of the sensitivity analysis, it seems quite unlikely that any changes will have a hugely material impact on the extent of the allowance required.

A5.5.0 Borrowing implications

Scottish Water has limited access to debt. At the current time, the Scottish Government is allowing Scottish Water to access around £170 million each year. When compared to the £300 million of reported (allowed for) investment in enhancement and growth, such a level of borrowing appears reasonable. However, going forward, there should be an expectation that the increase in debt is not more than the actual incremental investment in enhancement and growth (ie after the site specific investment in asset replacement) – plus any required overspend relative to the level of asset replacement allowed for in annual charges. To do otherwise would not be prudent and would represent a wealth transfer from future generations to the current time.

Proper debt management will always be critical to an effective hard budget constraint.

A5.6.0 Price calculation

Addressing the asset replacement challenge should actually help make the price setting process more straightforward and understandable. The building blocks approach would still be intact. Operating costs should be extended to cover capitalized costs of repair and refurbishment that fall short of asset replacement.

In place of capital maintenance, there would be the annual allowance for asset replacement (which would increase to reflect incremental investment in enhancement and growth). The incremental investment should be added to the regulatory asset base.

In a Scottish context, where prices are set by balancing cash inflows and outflows, new incremental investment in enhancement and growth should be added, less an appropriate level of new borrowing.

Separating these building blocks into their more discrete economic elements should make it easier to monitor delivery and benchmark performance.

A5.7.0 Private sector versus public sector

There is no obvious reason why the approach taken in Scotland could not be applied to the privatized water industry. It should be. Customers care about the resilience of the service that they receive and it is they who will have to fund an appropriate allowance for asset replacement. Indeed, in many ways, much of what is discussed is easier to manage in a private sector context.

For example, the limitation on Scottish Water's borrowing currently makes it more difficult for Scottish Water to respond in the event that actual required expenditure on asset replacement is much lower, or higher, for a period of time.

Privatized companies can likely respond much more easily. They could look to repay borrowing in the event that allocations of replacement expenditure were not needed for a few years, or they could borrow more if higher expenditure were to be required. Provided that variances between expenditure and allowed for funding are properly reported and an appropriate adjustment is made to the financing of the company, the hard budget constraint can be maintained. Such a process can reassure all stakeholders that the industry is being sustainably financed, funded and managed. A private company could be required to show that it has borrowing authorizations in place that would allow it to respond quickly and effectively to any asset replacement need that remains high relative to the funding allowed for over a regulatory control period.

The reporting of variances between what has been funded and what has been committed are also likely easier in the private sector. The private sector does not face the same degree of scrutiny about money being raised in advance of need that can hamper medium and longer term thinking in the public sector.

A5.8.0 Conclusions and Next Steps

There is a lot of thinking still to be done if the water industry is successfully to transition to an appropriate level of funding such that assets can be replaced when the time comes.

These key priorities include:

- Thinking about sewerage – a five hundred year implied life for a sewer cannot be realistic; and
- Ensuring that the costing of new projects is appropriately allocated to replacement and enhancement/growth in order to demonstrate that there has not been any double-counting.

As work in this area progresses, doubtless many new questions will arise. The industry will need to work collaboratively to ensure that those issues are properly addressed. Scotland offers the start of a roadmap – but not yet (at least) a final destination…