

# **FINANCING THE SCOTTISH WATER AND SEWAGE INDUSTRY**

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## Introduction

The remit for this research, is outlined in the research brief, 'Financing the Scottish Water and Sewage Industry', December 2003. Specifically, the STUC is seeking to develop policy on the following three areas:

- Alternatives to the current structure of water charges
- Investment and the Treatment of debt
- Regulatory approaches to efficiency.

In order to assist the discussion on these themes I have provided below a detailed, critical analysis of the approach taken by the economic regulator of Scottish Water, the Water Industry Commissioner for Scotland (the WIC) in his Strategic Review of Charges 2002-6 and supplemented by the Cost and Improvement Report 2002-3 along with the Investment and Asset Management Report 2002-3. I have also taken into consideration a number of reports from the water quality regulator for the industry, the Drinking Water Quality Regulator for Scotland, and other bodies such as the Scottish Environmental Protection Agency and the Water Customer Consultation Panels whose remit is also to monitor quality on behalf of customers served by Scottish Water.

## **The Regulatory Regime**

The conceptual and practical difficulties of regulation, both of public sector industries and other (usually privatised) natural monopolies, are well understood by economists.<sup>1</sup> The main problems which arise under this heading are ‘how to induce firms in non-competitive markets to act in a way that is compatible with social goals’ (Train, 1991). In other words to ensure that firms/industries act in the public interest when their activities are not constrained by competitive pressures in such a way as to increase efficiency and to keep prices at a socially acceptable level.

Productive efficiency in this regard can be understood as producing a greater level of output/quality using the same inputs or, alternatively producing the same level of output/quality using fewer inputs. It does not involve any consideration of costs since these are related to input prices which are not entirely under the control of the producer. Productive efficiency also takes on a dynamic character in the sense that optimal regulation should induce cost-reducing investment by the firm. Allocative efficiency is defined as circumstances where the product price is equal to marginal cost or as near to marginal cost as can be achieved while still allowing the firm to remain viable. In any event no excess profits should be made. The regulator’s problem in these circumstances is to gather cost information from the firm in order to determine rates of price increase which will keep excess profits to a minimum, maintain the viability of the firm/industry and encourage investment designed to reduce costs in the future. For private or privatised industries regulation has always, in the UK context, been intended as a temporary measure. The gradual introduction

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<sup>1</sup> See Train, 1991, Armstrong & Sappington, 2003, Crew & Kleindorfer, 2002

of competition was always intended to provide the ultimate replacement for the regulator.<sup>2</sup> In terms of the regulation in the public sector there is clearly no issue of excess profits, and in some cases there are private sector competitors, but the economic regulator still has a role in promoting dynamic efficiency and monitoring prices for customers.

In most industries the issue of quality is important, but none more so than in the water industry which has among its remits the production and supply of safe, clean drinking water for all citizens and the safe removal and processing of sewage from homes and businesses. The WIC has acknowledged this fundamental role of the water industry in his Strategic Review where he states

*‘cutting costs and making ‘efficiencies’ are not the same thing – even though they are often understood to be synonymous. A true efficiency is achieved only when a service or product of equal utility is delivered or created for less cost. It is not in the customer interest to cut costs in any way that will have an adverse impact upon the service that is provided to the customer. Nor is it acceptable to take short cuts with safety, public health or the environment.’*<sup>3</sup>

In Scotland the quality of the water is overseen by the Drinking Quality Regulator for Scotland (DWQRS), a post which was created by the Water Industry (Scotland) Act 2002 to ‘provide an independent check that Scottish Water is complying with the drinking water quality regulations’<sup>4</sup> In addition the Scottish Environmental Protection Agency (SEPA), which was established by the Environment Act in 1995 is responsible for regulating all activities that may affect the environment including water abstraction, ‘activities that may pollute water’ and the ‘storage, transport and

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<sup>2</sup> OECD, The role of competition policy in regulatory reform, 2002, OECD

<sup>3</sup> WIC, 2001, p39

<sup>4</sup> [www.dwqr.org.uk](http://www.dwqr.org.uk)

disposal of waste'.<sup>5</sup> Finally there are the five Water Customer Consultation Panels, also created by the Water Industry (Scotland) Act 2002 to represent the interest of domestic and non-domestic customers of Scottish Water. Their task is to

1. *represent the views and interests of the customers of Scottish Water, and each Panel must make*
2. *reports and recommendations on any matter they consider relevant to the interests of customers*<sup>6</sup>.

A review of the publications and statements of the above bodies indicate that they have a number of serious concerns about both the quality of the outputs which Scottish Water produce (both in terms of water quality and regulatory information) and the role of the WIC. Many of these concerns relate to the quality of the existing assets, much of which is in need of refurbishment or replacement. In its submission to the Scottish Parliament Finance Committee, in September 2003, the Water Customer Consultation Panels' Convenor, Ian Smith, reported customer concerns over 'delays and difficulties in obtaining increased service capacity and infrastructure to meet demands' and went on to raise the issue of the importance to customers of 'sufficient flexibility at a local level in its (Scottish Water) investment and operational activities'. In his first Annual Report published in October 2003, Tim Hooton (DWQRS) outlined a number of disturbing indicators in relation to water quality. Although in 2002 the number of samples which failed to comply with the relevant standard<sup>7</sup> had fallen compared to 2001 the absolute number was described by Mr Hooton as 'significant' which indicated 'a need for improvements'. Within these figures there is evidence that the number of microbiological failures actually

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<sup>5</sup> [www.sepa.org.uk](http://www.sepa.org.uk)

<sup>6</sup> [www.watercustomer.org](http://www.watercustomer.org)

<sup>7</sup> The Water Supply (Water Quality) (Scotland) Regulations 1990

increased. The presence of both coliforms and faecal coliforms in drinking water samples increased throughout the year although in both cases this rise went against a long-term downward trend. There were a number of incidents during the year in North Ayrshire and Glasgow which led to bottled water being distributed and/or a boil notice being issued. The DWQRS found it necessary to report Scottish Water to the Procurator Fiscal (PF) in relation to the North Ayrshire incident although the PF subsequently decided to take no action due to the remedial work which Scottish Water undertook in the interim period. A number of the incidents throughout the year were precipitated by extreme weather conditions ie heavy rainfall. The report highlights the need for Scottish Water to 'invest in robust equipment and processes that can cope with the vagaries of the Scottish weather' a point I shall return to later. It is important to understand that insufficient investment over a period of years is likely to lead to deterioration in drinking water quality. However this deterioration will not necessarily show up immediately. It is presumably for this reason that the DWQRS found it necessary to refer to 'increasing pressure....to invest more in its infrastructure..' and to issue a warning to the effect that

*'Improvements in efficiency however, must not compromise drinking water quality and public health'*

Scottish Water was also reported to the Procurator Fiscal at Hamilton by SEPA in 2002 in relation to a charge of causing pollution to the Kittoch Water and its parent river, the White Cart Water by allowing effluent to enter the water from the Philiphill Sewage Treatment Works. Following the case, in which Scottish Water were fined £10,000, SEPA spoke in the press of the 'need to ensure that their treatment works do

not fall below the required standards'. Scottish Water gave assurances that major improvements in the facility would be carried out.

In conclusion, it is clear that there are no disagreements among the agencies, including the WIC, in relation to the quality problems which are a feature of the water industry in Scotland. In addition, there appears to be no major disagreement in relation to a fundamental cause of these problems, that is, years of underinvestment in the capital stock. All of this has to be seen in the context of increasingly stringent water quality and environmental controls which are coming into force in the near future. Without investment these changes will merely result in increasing the quality gap.

## **Econometric Analysis**

The office of Water Industry Commissioner for Scotland was created by Part II of the 1999 Water Industry Act and came into being on 1 November 1999.<sup>8</sup> In taking up his responsibilities as the economic regulator for the water industry in Scotland, Alan Sutherland (WIC), made it clear that

*'Ultimately the best and only way of promoting customer interests in a public sector model is for the customer regulator to improve the economic efficiency of the industry, and thereby the value for money generated'*<sup>9</sup>

In attempting to achieve these improvements in efficiency, the WIC looked to the practices of the economic regulator of the privatised water companies in England and Wales, OFWAT. In his own words he followed the lead of OFWAT in that he 'relied

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<sup>8</sup> [www.watercommissioner.co.uk](http://www.watercommissioner.co.uk)

heavily’ on the incentive effects of ‘comparative competition.’<sup>10</sup> He further described his reliance on comparisons with companies in England and Wales as the ‘cornerstone’ of his Review.<sup>11</sup> While introducing competition is a recognised practice in the UK to regulate utilities<sup>12</sup>, it is usually done in the context of privatised industries. The WIC’s reliance on comparisons with other companies to induce increased efficiency from the management of Scottish Water, which is a public body, has no basis in economic theory and his evidence<sup>13</sup> that competition between the three Scottish water authorities (prior to the merger which created Scottish Water) led to improved standards, no longer holds in a single-authority context. In addition, his assertion that

*‘Management should, after all, want to show all stakeholders how good they are’<sup>14</sup>*

is not a behavioural assumption I have seen appear in any economic study in any context. The absence of any convincing behavioural assumptions leave this part of the WIC’s analysis open to question.

For the purposes of measuring the ‘efficiency’ of the Scottish industry the WIC used a suite of eleven econometric models (equations), which were developed for OFWAT by Professor Mark Stewart of the University of Warwick. These models, together with an analysis of unit costs for certain activities, are designed to explain the main determinants of various elements of operating and capital expenditure for the water

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<sup>9</sup> WIC, Commissioner’s Corporate Plan, July 2002

<sup>10</sup> WIC, 2001, Section 2 Chapter 7 p72

<sup>11</sup> *ibid* p71

<sup>12</sup> OECD, 2002 *op cit*

<sup>13</sup> WIC, 2001 *op cit*, p72

<sup>14</sup> *ibid* p77

industry including distribution costs, resource and treatment, power, business activities, sewerage network and infrastructure.

The data collected by OFWAT from the water and sewerage companies in England and Wales are used to estimate the models and provide a method of comparing the efficiency of the companies in various aspects of their activities. While it is not my purpose here to question the usefulness of the models in the English and Welsh context a number of comments can be made at the outset. First, the models are designed to capture (or explain) the main elements of costs in a statistical sense. They are not based on engineering principles and are therefore very specific to the set of companies and market structure for which they were developed. Second, OFWAT has acknowledged certain flaws in the models. In particular, it allows as a matter of practice certain ‘special factors’<sup>15</sup> to be accounted for in an *ad hoc* way which is a sensible acknowledgement of the limits of any econometric exercise which is used for policy reasons. Second, OFWAT acknowledges that limitations in the data which are collected also explains some of the differences in the efficiency scores between the English and Welsh companies.<sup>16</sup> Third, OFWAT has accepted the need to make changes to the original set of models on the basis of challenges from external bodies. As a result of these challenges, OFWAT recently stated that is has

*..made adjustments to water service operating and capital maintenance expenditure to ensure consistent treatment of leakage control costs between companies. We have done this to address concerns that costs used in our analysis are influenced by company specific accounting policies...we have also reduced the modelling residuals, that is the difference between actual costs and the costs predicted by the models, to take account of errors in the data and in our statistical*

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<sup>15</sup> OFWAT, 2003 p 19

<sup>16</sup> *ibid*, p 4

*process. We have adjusted the water residuals by 10% and the sewerage residuals by 20%.<sup>17</sup>*

This last point highlights another problem with the use of econometric models. OFWAT has treated the *residuals* of the model (as explained above) as being a measure of inefficiency. This is not a valid assumption unless one can be absolutely sure that the data is correct and that the structural form of the model is as good as it can be. Even under those criteria it is still a very strong assumption that there is no other possible reason for the *unexplained* element of costs.

Fourth, it cannot be stated with any degree of conviction that the prime motivation for the undoubted increases in efficiency which have taken place in England and Wales (albeit with some considerable teething troubles and some remaining problems) was the regulatory policies derived from these statistical models. It is at least possible, if not likely, that it was, and continues to be, the influence of actual competition which has led to the much reduced costs of the English and Welsh water companies. In addition the debt write off and lengthy period of substantial investment has also led to the differences that now exist between Scotland and England – I will return to this point later. This fourth point is not intended to be an argument in favour of privatisation of water supplies. The arguments against such a move are many and valid but they are beyond the scope of this report.

### **Application of the models to Scotland**

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<sup>17</sup> *ibid* p20

However it is under this heading that the philosophy and practice of the WIC is most vulnerable to criticism. While the suite of models may well have served a purpose in the environment for which they were created, the wholesale transfer of them to an entirely different set of circumstances in Scotland appears, at the very least, questionable.

The models in question are what are known as cross-section models. That is they rely on data from a number of different sources (ie companies) for a single point in time. It would not be possible to construct such a model from scratch for Scotland because there are not a variety of companies producing these services. Indeed, OFWAT is forced into departing from the standard models in the case of sewerage services in England and Wales because there are only 10 regulated sewerage companies. To overcome this problem the model is not based on data from separate companies but on data from individual large sewage treatment works (regardless of ownership). OFWAT again admit that this is ‘not ideal’.<sup>18</sup> In the case of Scotland, even the pre-merger situation would not have provided sufficient valid data to construct these models.

Estimation of the models, using real data, produces estimated *parameters* for each equation. These parameters are constants and serve as measures in some sense of the effect of each *explanatory variable* on the *dependent variable*, in this case cost, which is being estimated. The parameters represent the structure of the model and can be used for predictive purposes as long as one can be sure that the underlying forces which ultimately determine cost is unchanged. In fact, what the WIC has done is to

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<sup>18</sup> OFWAT, 2003 *op cit*

take the parameter values estimated from English and Welsh data and then use the data from Scottish Water for the explanatory variables<sup>19</sup>. The assumption that this is a valid process is a heroic one. Indeed, it has been pointed out before that the Scottish industry is operating in such different circumstances that to make this assumption seems almost foolhardy. The WIC indicates in various publications that he is aware of the relevant differences and has taken them into account. However, my examination of the WIC's own publications does not bear this out.

The differences that have been referred to previously include geography, topography and population density. I cannot find evidence that these have been adequately accounted for in the models used by the WIC. Adjustments are made for 'special factors' identified by Scottish Water. These are applied at the end of the process and in an aggregate sense ie adjustments are not made at the level of the individual equations.

In relation to geography, topography and, in particular, the variety of sources used, Scottish Water<sup>20</sup> have argued persuasively that the form of the data demanded by the WIC in the Annual Returns fails to account for the variety of sources which SW has to extract water from. In particular the classification of burns does not enter into the Water Resources and Treatment Model (which only uses the English and Welsh classifications). This model is likely then to underestimate the true costs to Scottish Water and to overestimate the efficiency gaps between Scottish Water and any English or Welsh comparator.

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<sup>19</sup> This procedure was departed from in the case of small sewage treatment works. In the case of these

In the Water Distribution model, the explanatory variable (length of mains greater than 300mm diameter divided by total mains length) is used as a proxy for urbanisation. However, this is not an adequate proxy in the Scottish setting where the distribution of the population is uneven. In fact, the Competition Commission in reviewing a complaint from Mid Kent Water in 2000 mentions this factor and suggests that more unevenly distributed population is likely to incur ‘significantly higher costs’.<sup>21</sup> If this is held to be true in the far more homogeneous English setting then it is likely to be more so in the context of Scotland.

The other significant difference between Scotland and England and Wales lies in the very different market structure. The water industry was privatised in 1985 and was at that time given a substantial subsidy from general taxation in the form of a write-off of all debt, a point emphasised in their evidence to the Scottish Parliament Finance Committee, by the Water Customer Consultation Panels.<sup>22</sup> This together with other government grants totalled £6.6 billion. Since that time the number of companies involved in the supply of water and/or sewerage services has risen markedly resulting in a huge increase in competitive pressures. A crucial point to note here is that the time period over which any improvements in efficiency and quality came about in England and Wales far exceeds the time period over which the WIC expects the same improvements to arise in Scotland. It is clear from examination of the figures produced by OFWAT that costs initially rose for some years after privatisation before

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works, of which there is a large number in Scotland, unit cost estimates were derived.

<sup>20</sup> Overview Document, Annual Return 2002-03, Scottish Water p24

<sup>21</sup> Competition Commission, 2000

<sup>22</sup> [www.watercustomer.org](http://www.watercustomer.org)

they began to fall. Total operating costs rose in the initial years, reaching a peak around 1993 and falling fairly steadily since then.<sup>23</sup>

Almost twenty years of privatisation and competition with considerable borrowing to fund increased investment has created a market and infrastructural landscape which differs in a great many ways from Scotland. I can see no evidence that the WIC has taken any of these factors into account in the adaptation of the expenditure models.

The issue of the actual comparators that are used also raises some questions. It appears that in some cases the comparator is not an actual company but a hypothetical company arrived at by combining the costs for distinct areas of activity from different companies. Scottish Water is therefore being asked to meet standards not actually met by any single company in England or Wales, albeit that the comparator in each case is the one which generates the lowest gap.

Finally, despite the acknowledgement by the WIC in numerous statements to the effect that efficiency measures have to be adjusted for quality<sup>24</sup>, I cannot find any evidence in the methodology used that this has been explicitly adjusted for or taken into account. There appears to be a general reliance on the evidence that quality across all activities is, on average, better in England and Wales. As far as I can determine from the published output of both the WIC and OFWAT there is a huge variation in both practice and quality among the private water and sewerage companies and any genuine quality adjustment would require a detailed comparison of quality measures between Scottish Water and any comparator company.

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<sup>23</sup> OFWAT, 2003 *op cit*

## **Investment and Treatment of Debt**

Leaving aside the benefits of debt write-off enjoyed by the privatised industry in England and Wales, there are issues arising from the projections by the WIC in relation to debt funding of investment for the future in Scotland.

In the Strategic Review, the WIC referred to the fact that ‘The Scottish industry has not invested sufficiently to meet environmental standards and to maintain its assets properly’<sup>25</sup>. The WIC also makes reference to the acknowledgement by the Scottish Executive of ‘historic underinvestment’<sup>26</sup> and concludes that ‘..levels of investment in Scotland should be on balance higher than in England and Wales’.<sup>27</sup> Yet in his Investment and Asset Management Report 2002-03, published in 2004, the WIC adjusts the investment figures for ‘relative efficiency’ and concludes that, in fact, investment (actual and planned) over the period 1996-2006 is marginally higher than England and Wales and that there is no

*‘ ..evidence to support the contention that there is a significant backlog of investment in Scotland relative to that in England and Wales..’<sup>28</sup>*

The WIC acknowledges that the data on which this conclusion is based is not directly from the three authorities, but nevertheless concludes that the key issue is the efficiency with which Scottish Water plans and delivers capital expenditure.

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<sup>24</sup> WIC, 2003, p1

<sup>25</sup> WIC, 2001, *op cit* p6

<sup>26</sup> *ibid*, p7

<sup>27</sup> *ibid* p7

<sup>28</sup> Investment and Asset Management Report 2002-03, WIC, 2004

Another issue of contention between the view taken by the WIC and others relates to the state of the assets which are currently in use in Scotland. In his Investment and Asset Management Report 2002-03, the WIC concludes that

*'..with the possible exception of water mains, the condition of assets in Scotland remains very similar to those in England and Wales.'*

Scottish Water in their Overview Document for the Annual Return 2002-03 argue that the way in which the data is collected 'does not adequately reflect the true condition and performance of the asset stock'.<sup>29</sup> Reference is made to the level of leakage as an indication of the poor state of the assets. Without a detailed independent analysis of both the condition of the stock and whether or not it is 'fit for purpose' it is impossible to conclude which view is correct. However, it seems clear that the levels of investment required to deliver improved quality and environmental standards may differ substantially from those agreed in the Central Option of the Quality and Standards II investment programme. Tim Hooton, the DWQRS, in his evidence to the Finance Committee Enquiry, indicated that in his opinion

*'..there is still a significant backlog of under-investment that needs to be addressed. The condition of Scottish Water's assets still varies hugely between sites. The poor performance of some assets arising from age or design continues to represent a high risk of failure to meet regulatory standards compared with the best performing assets. Many projects aimed at levelling out such inequality were not included in the Quality and Standards II middle option.'*

A further feature which appears not to have been incorporated into the Central or middle option of the investment programme is the question of the degree of automation which would be required to replace the amount of manpower at the rate which has been proposed by Scottish Water in response to the WIC's demands for savings. Almost all of the cost savings made so far and commended by the WIC in his Costs and Performance Reports relate to the reduction in staffing levels, much of which arose as part of the merger of the three authorities. Further reductions in the labour force, without adequate investment to introduce automation bring, without question, a risk of compromising the quality of service already provided. The nature of the skills and experience already lost to the industry, which involve a great deal of tacit (ie non-codified) knowledge in operating particular equipment in particular terrains, cannot be easily replaced. Concerns regarding quality must therefore be raised by the lack of consideration of this issue in the investment plan.

A further problem in relation to investment is the level of debt that the WIC assumes is necessary to carry out this programme. Again this is something that the Water Customer Consultation Panels, representing both domestic and non-domestic customers, has raised in its evidence to the Scottish Parliament Finance Committee. For investments which are likely to bring efficiency and quality improvements over lengthy periods it does not seem unreasonable for the cost of that investment to be spread over current and future customers in the form of long term debt. Indeed the amount of debt-funding of investment in England and Wales currently stands at around 35%. The WIC's plans, outlined in his review, to fund investment entirely out of charges by 2005/6 appear to have no economic justification and also raises

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<sup>29</sup> Scottish Water, 2003, *op cit* Section 1.7, p6

questions about the desirability of raising some investment funding from general taxation given the economic and social externalities involved in having a safe, clean water provision and sewerage system. However, subsequent statements from the WIC to the Finance Committee appear to suggest that current debt levels will be maintained in real terms over this period. Notwithstanding this reversal however, the method which the WIC used to calculate the amount of debt which Scottish Water could sustain has been questioned in a paper again presented to the Finance Committee in its recent enquiry.<sup>30</sup> The technical merits of the paper are beyond my expertise but it should be noted that whilst the Finance Committee ultimately rejected the argument, a minority report by three of the MSPs on the committee found their arguments to be valid.

## **Charging**

In addition to the debate about what proportion of investment funding should come from charging there has been a lengthy debate about the merits of charging in its own right.

In England and Wales there are a set of principles which are supposed to underpin any tariff and these are:

- Fairness and Equity
- Sensible Incentives

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<sup>30</sup> Cuthbert & Cuthbert, 2003

- Simplicity and Comprehensibility

The principles involved in a sensible and fair charging system, not to mention the issue of affordability, merit research projects in their own right but it is possible to make some comments here regarding some of the key issues.

It appears fair to state at the outset that all fixed costs – which relate to assets with a long life – should not be borne by existing customers only. It would also be socially divisive and politically unacceptable to charge domestic customers in different parts of the country at different rates in relation to costs. This would make some rural communities unviable and give incentives for migration patterns which are not warranted for other economic and social reasons.

In terms of non-domestic customers, it does seem sensible to set in place a system of charging which signals to heavy users of water and sewerage services to locate in areas of low cost or to incorporate higher costs into their own charging system. A harmonisation of charges for non-domestic customers would offer a perverse signalling mechanism which would lead to economic in other sectors of the economy.

## **Conclusion**

In summary, my review of the methods and policies of the Water Industry Commissioner for Scotland suggest that he is open to the charge of placing undue emphasis on the history and practice of the water industry in England and Wales; that the behavioural assumptions underlying his approach are questionable; that his methodology in assessing efficiency is flawed; that the timescale over which the

industry is being asked to introduce fundamental change is too short and that the investment programme and job losses that are proposed are likely to lead to severe problems in the provision of a quality water and sewerage service in Scotland.

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