OFWAT

Water and sewerage service unit costs and relative efficiency

2003–2004 report

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January 2005

OFWAT

OFFICE OF WATER SERVICES

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Foreword

This report is published soon after our decisions on price limits for the 2005-10 period. This year's report amplifies and supports our price review decisions on relative efficiency. We set down the detailed results of our analysis that we did not include in the price review documentation but which we feel merit a wider audience. Our 2004-05 report will discuss any issues arising from any referrals of our decisions on price limits to the Competition Commission or from our review of the periodic review.

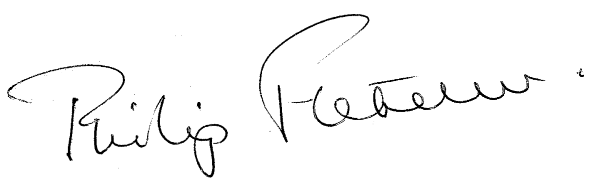
Since 2000 we have improved transparency in all areas of our work. We have published each year the full results of our analysis and we have involved companies in the process of refining and improving our relative efficiency modelling tools.

In the 1999-2000 report we looked at options for improving our approach to relative efficiency – we have used the four years since then to review the system. We think that we all (regulators, consultants and companies) have accomplished a great deal in ensuring that our relative efficiency modelling tools are fit for purpose. We have looked at our process, we have answered challenges and tested alternatives. Our work remains robust and provides information of use to all stakeholders.

The results of the efficiency analysis this year show just how much companies have improved. The spread of company performance has narrowed with all companies now within 25% of the benchmark performance. However, this still leaves a number of companies with considerable scope to catch up with their peers. We have turned our attention to improving incentives to outperform our assumptions for the best companies (an increasingly large group) to push the boundary of efficiency forward.

Some commentators have questioned whether our 1999 assumptions were too demanding. We do not think so. When fully corrected costs are taken into account the industry has outperformed our total operating cost assumptions. We accept that new costs have arisen that were not anticipated when we last set prices. But many of these costs feed into inflation and are therefore taken into account in the RPI-X price setting formula. Other new costs may not feed directly into inflation, but are seen as normal business risks for the companies.

This report also includes a substantial section on the result of the 2004 price review cost base exercise. We hope this will answer questions and stimulate debate on this very useful analytical tool.



Philip Fletcher
Director General of Water Services

Summary

This report analyses water and sewerage industry total and unit costs for 2003-04. It considers our new assessments of companies' relative operating and capital maintenance efficiency. We have used these assessments and the cost base in setting price limits for 2005-10.

Unit costs

There is a wide variation in the unit costs between companies. This is because of differences in operating environments, the scale of expenditure needed to deal with new quality obligations, companies' inherited systems and assets, and differences in efficiency.

The unit cost per cubic metre of water delivered to customers comprises the unit costs of:

- operations;
- capital maintenance; and
- the return on capital.

In recent years for both the water and sewerage services increases in operating costs have been matched by increases in the volumes of water supplied or sewage collected, and therefore unit costs of operations have remained stable. This year the volume of water delivered and sewage collected has risen but the unit costs have remained stable overall due to rising costs, such as energy and pensions.

Companies continue to invest in improving and extending their assets. For some companies, tighter standards on drinking water quality and environmental protection have required substantial capital investment. The capital base of the companies has increased with this net investment. Investors receive a return on this base. The unit cost of the return on capital increased between 1992-93 and 1999-2000 due to the need to raise more capital and the outperformance of our assumptions by some companies.

The return on capital is also affected by prices. Lower prices generally mean lower profits. Return on capital unit costs reduced for most companies in 2000-01 following the 1999 price review. Some of this reduction represented the return of past outperformance to customers. There has been a further reduction in return on capital unit costs in 2003-04 for the water service, but a small rise for the sewerage service.

Total water service unit costs are now below their 1992-93 level in real terms. Total sewerage service unit costs are slightly higher than they were then.

This report includes figures on unit costs of operation per property for 2003-04. The industry average unit cost for water is £65 per property – the same figure, in real terms, as in 2002-03. The industry average unit cost for sewerage, £57 per property, is slightly higher than last year's figure of £56 per property.

Relative efficiency

We use companies' costs and operating conditions to assess their relative efficiency. High costs do not always indicate low efficiency; a high cost company may be operating in a particularly unfavourable environment. Similarly, low costs do not necessarily point to high efficiency. Likewise, rising costs do not necessarily indicate that a company is becoming less efficient. For example, many companies face increasing costs for operating new treatment works to meet higher quality standards.

We use a variety of methods to assess relative efficiency. Robust statistical modelling, combined with assessments of company specific factors, suggests that there may be less than a 25% difference between the benchmark and the least efficient companies. However, some of this difference may result from the limitations of the data.

The relative efficiency league table is dynamic. Under our regulatory system, companies that are less efficient have strong incentives to cut costs while maintaining outputs. A company that improves its efficiency quickly can overtake its peers, and so leapfrog up the relative efficiency rankings. We have built into price limits assumptions about efficiency improvements. If a company outperforms our efficiency assumptions, it will keep the benefit of any incremental outperformance against our operating expenditure efficiency assumptions and any outperformance against our capital expenditure assumptions for five years. In chapter 1 we look at how companies have outperformed the operating expenditure assumptions we made in our 1999 price determinations.

1. Trends in total expenditure and unit costs

This report provides our estimates of 2003-04 unit costs to customers. We derive these from company data. We set out the costs per cubic metre of water delivered and sewage collected, and per property billed. Water delivered is the estimated volume of water supplied to the boundary of each customer's property and includes leakage from customers' supply pipes. Sewage collected is the estimated volume of water returned from customers' properties to the sewerage network, where served. Companies estimate it from water delivered.

Companies' unit costs are not in themselves a measure of efficiency. Costs vary because of differences in operating conditions that are outside companies' control, and different assumptions used to estimate the amount of water delivered and sewage collected.

1.1 Trends in operating expenditure

Figure 1 shows actual trends in operating costs since privatisation in 1989.

Since the 1994 review, companies have significantly outperformed our expectations about how efficient they could become. Our 1994 allowance for operating expenditure included company specific catch-up assumptions of between 0% to 2.5% per annum and a continuing efficiency of 1% per annum. Companies also responded positively to the efficiency incentives of the 1999 review. Our 1999 price limit assumptions for operating expenditure in price limits included company specific catch-up assumptions of between 0% to 3.5% per annum and a continuing efficiency of 1.4% per annum.

The industry has continued to outperform during the current five-year period, although to a lesser extent than previously. The outperformance of our 1999 efficiency assumptions has been eroded by increases in costs since 2002-03 – for the most part these have arisen from cost increases associated with National Insurance contributions, pension contributions and energy costs.

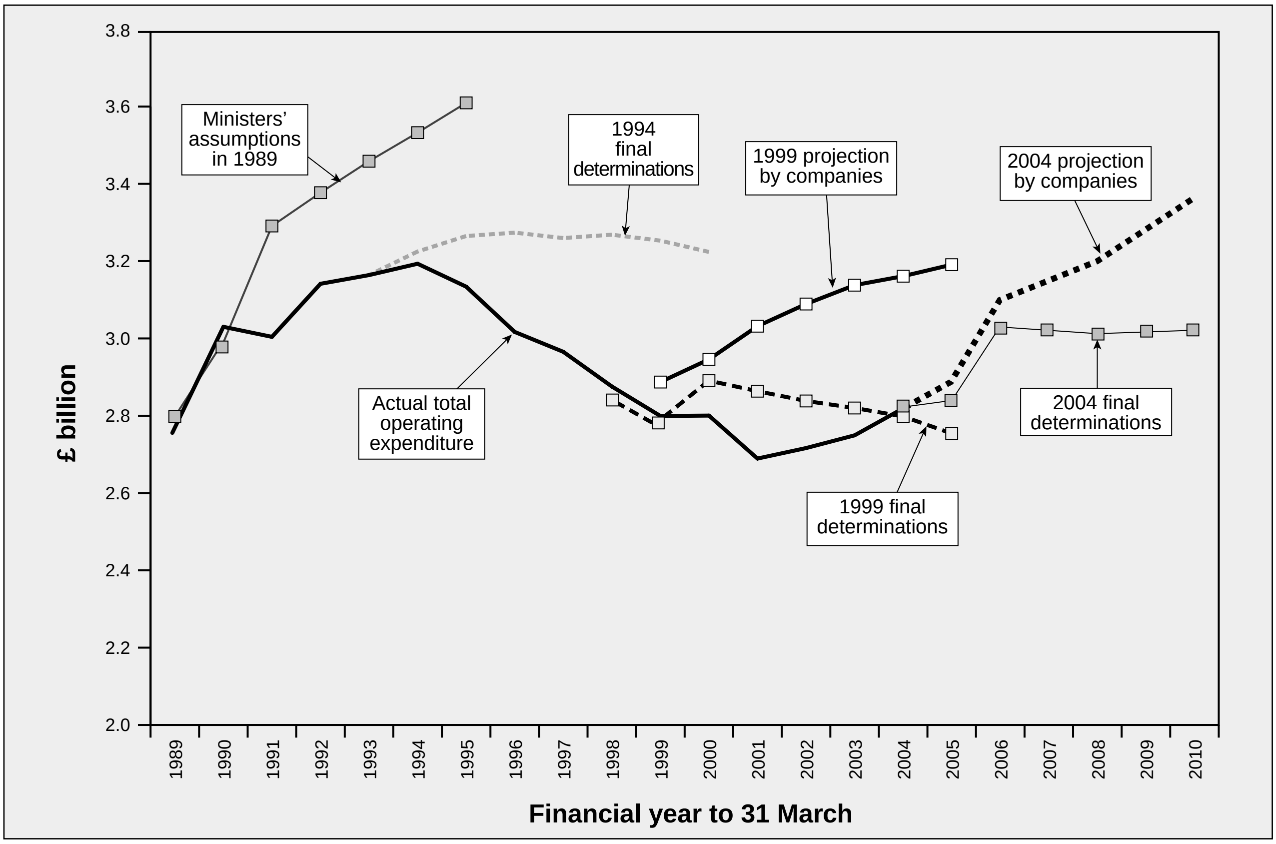
The companies have also consistently outperformed their own estimates. Cumulatively for 2000-01 to 2003-04 companies have reported operating expenditure that is £316 million or 3% below the projections made in their 1999 final business plans.

Companies submitted their final business plans in May 2004. They projected that operating expenditure will need to increase over the next five years to a higher level than that projected in 1999. At an industry level this represents an increase of £511 million or 18% from 2003-04 actual operating expenditure.

We have made a lower allowance for operating expenditure in price limits for 2005-10 than that included by companies in their final business plans. After efficiency improvements we project that total operating costs will increase by 7% by 2009-10 due to rising costs faced by the companies. These rising costs include the expenditure needed to deliver improved quality standards, satisfy demand for more water and improve customer service standards.

Our 2004 review price limit allowance for operating expenditure includes company specific catch-up assumptions of between 0% to 2.9% per annum for the water service with a continuing efficiency of 0.3% per annum. The sewerage service price limit allowance includes company specific catch-up assumptions of between 0% to 1.5% with a 0.5% per annum continuing efficiency.

Figure 1 Comparison of total operating costs (2003-04 prices)



1.2 Unit cost components

We can improve our understanding of cost trends by breaking costs down into the:

- cost of operations;
- capital maintenance charges; and
- costs of servicing capital, ie the return on capital.

Cost of operations

This includes employment costs, energy costs, costs of materials and hired and contracted services. It excludes the costs of third party services and exceptional costs, such as restructuring. See appendix 4 for details.

Capital maintenance charges

Companies are required to maintain the operating capability of their asset systems to ensure continuity of service for current and future customers. For above-ground assets companies apply a current cost depreciation charge based on the expected life of these assets. For below-ground assets, companies apply an infrastructure renewals charge. This reflects the expected costs, averaged over a period of many years, of maintaining the serviceability to customers of these long-lived assets. The charges recorded in the accounts may differ from the costs of maintenance actually incurred in the year in question. When we assess relative capital maintenance efficiency, we use the actual costs recorded in the accounts averaged over a period.

Other factors that may affect the unit costs of capital maintenance are detailed below:

- the quantity of inherited assets;
- the age and performance of inherited assets;
- differing assumptions used to estimate the volume of water delivered;
- differences in accounting practices between companies; and
- previous management decisions on the balance between capital and operating expenditure.

Return on capital

The return on capital represents the remuneration to the providers of capital, both equity shareholders and lenders. It is the difference between income and costs (both operating costs and capital maintenance charges). In this report we have included atypical and exceptional costs, such as restructuring and pension holidays, in the return on capital to avoid distorting unit operating cost comparisons.

Differences in the return on capital reflect differences in the cost of capital and the capital base of each company. The return on capital can also be influenced by gains from increased efficiency and the timing of previous capital expenditure. The return may also reflect the requirement for internal funds to finance future investments.

1.3 Volumetric unit costs

Tables 1 and 2 show the breakdown for 2003-04 of volumetric unit costs for the water and sewerage services, ranked in ascending order of cost to customers.

For the water service:

- Unit costs to customers vary from 48 pence per cubic metre (p/m^3) of water delivered for Portsmouth Water to 135 p/m^3 for Tendring Hundred Water.
- Unit costs of operation range from 24 p/m^3 for Portsmouth Water to 56 p/m^3 for Tendring Hundred Water.
- Unit costs of capital maintenance range from 11 p/m^3 for Portsmouth Water to 51 p/m^3 for Dŵr Cymru.
- Unit costs of the return on capital range from -8 p/m^3 for Dŵr Cymru to 52 p/m^3 for Tendring Hundred Water.

The negative unit cost of the return on capital for Dŵr Cymru is due to a change in the accounting treatment of its infrastructure renewals charge. The company has re-examined the way it apportions this between the water and sewerage services, increasing the water service charge and decreasing the sewerage service charge. This results in a higher cost of capital maintenance and a lower negative return on capital for the water service, and a lower cost of capital maintenance and a higher return on capital for the sewerage service compared to previous years. We took account of this reapportionment of the infrastructure renewals charge when we set prices for the water and sewerage services for 2005-10 for Dŵr Cymru.

Tendring Hundred Water's high unit costs can be explained by the company's comparatively large capital base, which is the result of its historically large capital programme to improve water quality. The high unit costs are also due to low demand by its customers and low customer supply pipe leakage. Together, these mean that the company delivers low volumes of water compared to other companies.

For the sewerage service:

- Unit costs to customers range from 57 p/m^3 of sewage collected for Thames Water to 171 p/m^3 for South West Water.
- Unit costs of operation range from 20 p/m^3 for Thames Water to 54 p/m^3 for South West Water.

- Unit costs of capital maintenance vary from 11 p/m^3 for Dŵr Cymru to 41 p/m^3 for Southern Water, South West Water and Anglian Water.
- Unit costs of the return on capital range from 19 p/m^3 for Thames Water to 75 p/m^3 for South West Water.

Tables 3 and 4 show how industry unit costs have changed since 1992-93. Figures 2 and 3 illustrate these trends graphically.

Water unit costs of operation have reduced since 1992-93. This reflects the falling trend in operating costs. In recent years unit costs of operation have remained broadly unchanged as increases in the volumes supplied to customers were matched by similar increases in operating costs arising from new quality obligations.

This year the volume of water delivered and sewage collected has risen, although the unit cost of operations remains the same reflecting increases in energy and pension costs, amongst other things.

Both water and sewerage unit costs of capital maintenance have increased since 1992-93. Costs have been broadly stable in recent years, but there has been an increase this year in the water unit costs of capital maintenance and a reduction in the sewage unit costs of capital maintenance. Like the unit costs of operations, recent increases in the volumes supplied to customers were matched by similar increases in capital maintenance costs.

The unit costs of the return on capital reduced significantly for most companies in 2000-01. This reflected the impact of the first year of price limits for 2000-01 to 2004-05, which led to an industry average initial price reduction of 12.3%. In 2003-04, the unit costs of the return on capital have continued to fall for the water service, but have risen slightly for the sewerage service.

The sum of these components represents the unit costs to customers. Unit costs to customers increased between 1992-93 and 1999-2000, for both services. They decreased significantly in 2000-01 due to the reduction in the unit costs of the return on capital. In 2003-04 there has been a further decrease in the unit costs to customers for the water service, keeping it below the 1992-93 level. There has been a small rise in the unit costs to customers for the sewerage service, but it remains close to the 1992-93 level.

Table 1 Water delivered unit costs 2003-04

	Cost to customers (p/m³)	Breakdown: Cost of operations (p/m³)	Breakdown: Cost of capital maintenance (p/m³)	Breakdown: Return on capital (p/m³)
Portsmouth	48	24	11	13
Bournemouth & W Hampshire	51	25	15	11
South Staffordshire	56	31	15	10
Three Valleys	57	31	16	9
Southern	60	30	24	6
Thames	61	31	20	10
Northumbrian	62	33	17	12
Cambridge	64	36	13	14
Sutton & East Surrey	68	36	19	13
Dee Valley	71	36	18	17
South East	73	34	16	23
Yorkshire	75	28	24	23
Wessex	75	27	25	24
Bristol	75	38	21	16
Severn Trent	76	30	22	24
Mid Kent	77	31	21	25
Anglian	78	32	21	24
South West	80	33	22	25
United Utilities	80	31	28	21
Folkestone & Dover	85	45	18	22
Dŵr Cymru	87	44	51	-8
Tendring Hundred	135	56	27	52
Industry (weighted) average	**70**	**32**	**23**	**16**
Key	Below 60	Below 28	Below 15	Below 10
	60-69	28-32	15-19	10-14
	70-79	33-37	20-24	15-19
	80-89	38-42	25-29	20-24
	Above 89	Above 42	Above 29	Above 24

Note:
Numbers may not add due to rounding.

Table 2 Sewage collected unit costs 2003-04

	Cost to customers (p/m³)	Breakdown		
		Cost of operations (p/m³)	Cost of capital maintenance (p/m³)	Return on capital (p/m³)
Thames	57	20	17	19
Severn Trent	83	32	25	26
Yorkshire	92	30	31	30
Northumbrian	96	38	33	26
Wessex	101	29	29	43
United Utilities	108	37	31	39
Southern	115	39	41	36
Dŵr Cymru	117	48	11	59
Anglian	129	47	41	41
South West	171	54	41	75
Industry (weighted) average	**92**	**33**	**27**	**32**
Key	Below 80	Below 30	Below 25	Below 30
	80-89	30-34	25-29	30-34
	90-109	35-39	30-34	35-39
	110-119	40-44	35-39	40-44
	Above 119	Above 44	Above 39	Above 44

Note:
Numbers may not add due to rounding.

Table 3 Trends in water delivered unit costs 1992-93 to 2003-04

	1992-93 (p/m³)	1993-94 (p/m³)	1994-95 (p/m³)	1995-96 (p/m³)	1996-97 (p/m³)	1997-98 (p/m³)	1998-99 (p/m³)	1999-00 (p/m³)	2000-01 (p/m³)	2001-02 (p/m³)	2002-03 (p/m³)	2003-04 (p/m³)
Cost to customers	75	78	73	70	73	76	79	79	72	72	71	70
Cost of operations	43	40	37	36	36	36	35	34	33	32	32	32
Cost of capital maintenance	16	16	17	17	18	19	20	20	21	21	22	23
Return on capital	16	21	19	17	19	21	23	25	19	19	17	16
Water delivered Ml/d	12,622	12,495	12,707	13,286	13,002	12,661	12,364	12,541	12,541	12,699	12,698	12,936

Note:
All numbers are in 2003-04 prices using the Retail Price Index. Numbers may not add due to rounding.

Table 4 Trends in sewage collected unit costs 1992-93 to 2003-04

	1992-93 (p/m³)	1993-94 (p/m³)	1994-95 (p/m³)	1995-96 (p/m³)	1996-97 (p/m³)	1997-98 (p/m³)	1998-99 (p/m³)	1999-00 (p/m³)	2000-01 (p/m³)	2001-02 (p/m³)	2002-03 (p/m³)	2003-04 (p/m³)
Cost to customers	91	95	99	99	97	102	106	107	92	93	93	92
Cost of operations	35	36	34	31	30	30	31	31	30	31	33	33
Cost of capital maintenance	24	25	22	24	23	26	27	26	28	28	29	27
Return on capital	32	34	42	43	44	46	48	50	34	33	31	32
Sewage collected Ml/d	10,067	9,896	10,049	10,289	10,683	10,307	10,083	10,348	10,331	10,373	10,243	10,553

Note:
All numbers are in 2003-04 prices using the Retail Price Index. Numbers may not add due to rounding.

Figure 2 Trends in water delivered unit costs 1992-93 to 2003-04

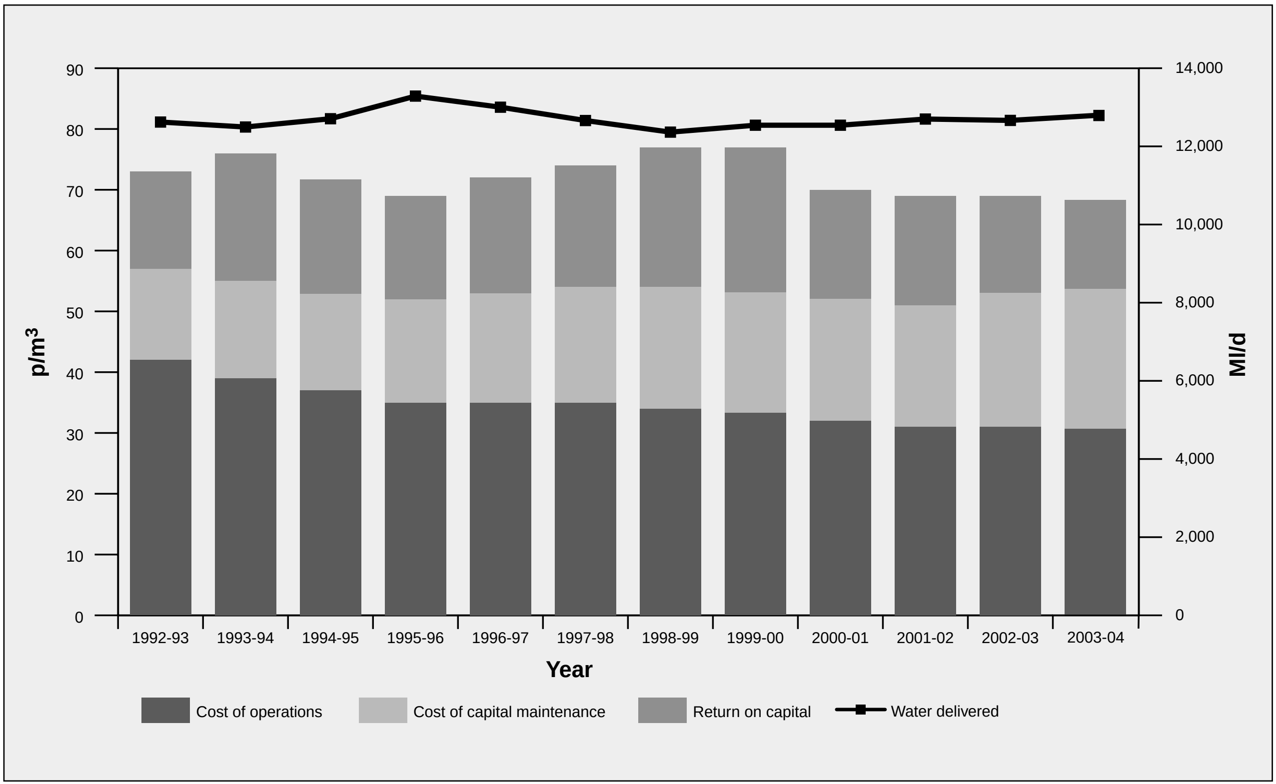
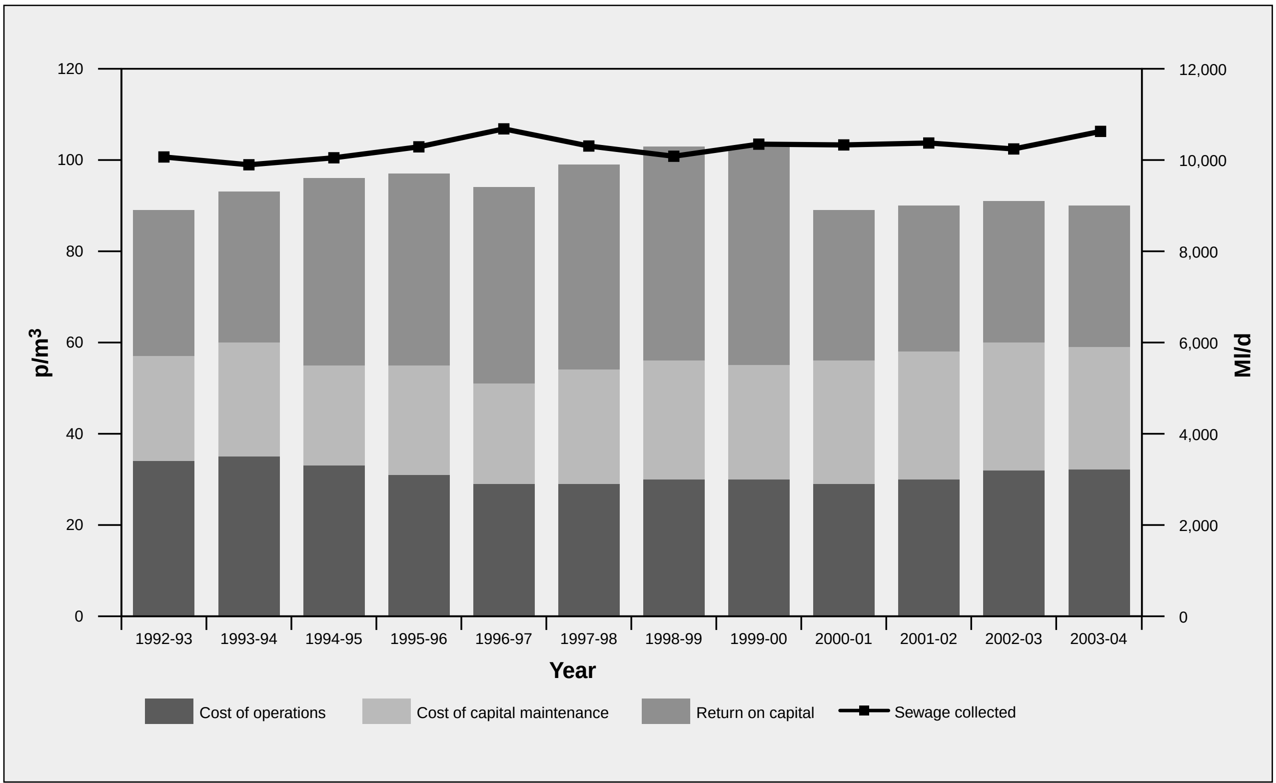


Figure 3 Trends in sewage collected unit costs 1992-93 to 2003-04



1.4 Unit costs per property billed

Tables 5 and 6 show the breakdown of 2003-04 £/property household and non-household billed unit costs.

For the water service:

- Unit costs to customers vary from £101 per property for Portsmouth Water to £194 per property for Folkestone & Dover Water.
- Unit costs of operation range from £51 per property for Portsmouth Water to £104 per property for Folkestone & Dover Water.
- Unit costs of capital maintenance range from £24 per property for Portsmouth Water to £100 per property for Dŵr Cymru.
- Unit costs of the return on capital range from -£15 per property for Dŵr Cymru to £72 per property for Tendring Hundred Water.

The negative unit cost of the return on capital for Dŵr Cymru is due to a change in the accounting treatment of its infrastructure renewals charge. We explain this further in section 1.3.

For the sewerage service:

- Unit costs to customers range from £119 per property for Thames Water to £261 per property for South West Water.
- Unit costs of operation range from £42 per property for Thames Water to £83 per property for South West Water.
- Unit costs of capital maintenance range from £17 per property for Dŵr Cymru to £67 per property for Southern Water.
- The spread for the unit costs of the return on capital is the widest, and for some companies it dominates the cost to customers. It ranges from £41 per property for Thames Water to £115 per property for South West Water. The return on capital figure for South West Water reflects the large and accumulating costs of financing its large past and current quality programme.

Tables 7 and 8 analyse the changes in unit costs of operation per property billed between 1995-96, the first year of the previous five-year price limit period, and 2003-04. The efficiency savings made over the period are clear for the water service, but for the sewerage service they are more than offset by the additional costs of environmental improvements.

For most companies the water service unit costs of operations per property billed have fallen since 1995-96, with some companies achieving reductions of more than 20%. Southern Water and South West Water have achieved reductions of 30% or more.

Since 1995-96 more than half the companies have decreased their sewerage service unit costs of operations per property billed. The industry average for sewerage service unit costs is at the same level as in 1995-96. Thames Water shows the greatest reduction of 17%.

Table 5 Water service unit costs per property billed 2003-04

	Cost to customers (£/property)	Breakdown: Cost of operations (£/property)	Cost of capital maintenance (£/property)	Return on capital (£/property)
Portsmouth	101	51	24	26
South Staffordshire	111	62	29	21
Southern	117	58	48	11
Cambridge	126	72	26	28
Northumbrian	130	68	36	25
Three Valleys	138	76	39	22
Severn Trent	142	56	41	45
Thames	143	73	46	23
Sutton & East Surrey	144	76	40	28
Yorkshire	144	53	46	44
Bristol	145	74	40	31
Dee Valley	145	73	37	35
Anglian	149	62	40	46
Bournemouth & W Hampshire	150	74	44	33
South East	158	74	35	49
United Utilities	159	62	56	41
South West	159	65	43	51
Wessex	167	59	56	52
Dŵr Cymru	171	85	100	-15
Mid Kent	172	70	47	56
Tendring Hundred	188	78	38	72
Folkestone & Dover	194	104	41	49
Industry (weighted) average	**145**	**65**	**47**	**33**
Key	Below 120	Below 55	Below 35	Below 25
	120-134	55-64	35-39	25-34
	135-149	65-74	40-44	35-44
	150-164	75-84	45-49	45-54
	Above 164	Above 84	Above 49	Above 54

Note:
Numbers may not add due to rounding.

Table 6 Sewerage service unit costs per property billed 2003-04

	Cost to customers (£/property)	Breakdown: Cost of operations (£/property)	Breakdown: Cost of capital maintenance (£/property)	Breakdown: Return on capital (£/property)
Thames	119	42	36	41
Severn Trent	135	52	41	42
Yorkshire	152	51	52	50
Northumbrian	156	61	53	42
Wessex	180	52	51	76
Anglian	185	67	59	58
United Utilities	190	66	55	69
Dŵr Cymru	190	77	17	96
Southern	190	64	67	59
South West	261	83	63	115
Industry (weighted) average	**160**	**57**	**47**	**56**
Key	Below 140	Below 45	Below 30	Below 45
	140-159	45-54	30-39	45-54
	160-179	55-64	40-49	55-64
	180-199	65-74	50-59	65-74
	Above 199	Above 74	Above 59	Above 74

Note:
Numbers may not add due to rounding.

Table 7 Water service unit costs of operations per property billed

Water and sewerage companies	2003-04 £/property	Rank 1-22	1995-96 £/property	Rank 1-22	Change %
Anglian	62	7	87	15	-29
Dŵr Cymru	85	21	118	22	-28
Northumbrian	68	10	83	11	-17
Severn Trent	56	3	71	3	-22
South West	65	9	94	21	-31
Southern	58	4	83	12	-31
Thames	73	13	79	10	-8
United Utilities	62	8	70	2	-11
Wessex	59	5	76	6	-23
Yorkshire	53	2	73	4	-27
WaSC (weighted) average	**64**		**80**		**-20**
Water only companies					
Bournemouth & W Hampshire	74	15	87	14	-15
Bristol	74	16	89	18	-17
Cambridge	72	12	79	9	-9
Dee Valley	73	14	89	16	-18
Folkestone & Dover	104	22	91	20	14
Mid Kent	70	11	86	13	-19
Portsmouth	51	1	62	1	-18
South East	74	17	89	17	-17
South Staffordshire	62	6	77	7	-20
Sutton & East Surrey	76	19	90	19	-16
Tendring Hundred	78	20	78	8	0
Three Valleys	76	18	75	5	1
WoC (weighted) average	**72**		**81**		**-12**
Industry (weighted) average	**65**		**80**		**-19**

Table 8 Sewerage service unit costs of operations per property billed

Water and sewerage companies	2003-04 £/property	Rank 1-10	1995-96 £/property	Rank 1-10	Change %
Anglian	67	8	72	9	-7
Dŵr Cymru	77	9	67	7	15
Northumbrian	61	5	51	2	20
Severn Trent	52	4	56	6	-7
South West	83	10	74	10	11
Southern	64	6	69	8	-7
Thames	42	1	51	3	-17
United Utilities	66	7	48	1	36
Wessex	52	3	53	4	-1
Yorkshire	51	2	53	5	-4
Industry (weighted) average	**57**		**57**		**0**

2. General approach to efficiency

We assess and publish our analysis of the relative efficiency of the water and sewerage companies to encourage them to progress against price limits, and for setting future prices. At each price review we use our assessments to derive efficiency factors for inclusion in price limits and to identify companies qualifying for enhanced future incentives. This report includes our 2003-04 assessments of relative efficiency that we have used for price setting at the 2004 periodic review.

We monitor operating and capital relative efficiencies separately. We further divide capital relative efficiency between capital enhancement and capital maintenance expenditure. We do this for the following reasons.

- **For simplicity** – we treat operating expenditure, capital maintenance and capital enhancement expenditure separately in price setting. It is important to recognise the interaction between operating and capital expenditure, and to appreciate that accounting policy can influence the outcome of individual areas. Because of this interaction, we present operating, capital maintenance and capital enhancement relative efficiency together in this report.
- **To avoid circularity** – measures of total efficiency can face problems because, over time, they depend on other regulatory decisions.

We have based the assessments of relative efficiency for operating expenditure on our econometric models and in some areas unit cost comparisons. For the assessments of relative efficiency for capital maintenance expenditure we have also used assessments arising from the cost base. In appendix 1 we have outlined the step-by-step approach we use to derive our econometric models, and the form and coefficients of these models. It is helpful to understand how the econometric models function by describing the effect of the explanatory variables included in the models. We explain this in chapters 3 and 4.

We make adjustments to our econometric assessments for company specific special factors, future expenditure, pension costs and leakage cost allocation. We also apply company specific special factors to our cost base assessment.

We then rank the companies in order of relative efficiency and divide them into five bands, where A is the most efficient. We band companies according to the percentage reductions to their costs they would require in order to achieve the efficiency of our chosen benchmark company. The benchmark company is not always the one at the efficiency frontier. It needs to satisfy a number of criteria, including size, to make it suitable for comparison with the rest of the industry. We apply this principle to both the econometric modelling and the cost base.

Our main benchmark selection criteria for econometrics are summarised below:

- We must have no special concerns about the consistency of the data with our reporting requirements for the potential benchmark company.
- The potential benchmark company must have no special characteristics that are outside the control of the management and which significantly reduce costs relative to the industry norm for the particular area under review.
- The benchmark performance must be achieved by a reasonable proportion of the industry; to date our pragmatic threshold has been greater than 2% of the industry (by service turnover). A series of smaller companies that in aggregate are big enough to exceed the threshold would also be suitable.

For the econometric analysis we have reduced the modelling residuals, that is the difference between actual costs and the costs predicted by the models, to take some account of errors in the data and in our statistical process. We have adjusted the water residuals by 10% and the sewerage residuals by 20%. We put companies into relative efficiency bands after we have made this adjustment.

2.1 Assessment of relative operating expenditure efficiency

We have based our assessment of relative efficiency for operating expenditure on our econometric models and, in some areas, unit cost comparisons. The models we are currently using were used for the 1999 periodic review and we have updated these using 2003-04 costs and operating data.

Companies submit detailed data on their water and sewerage service operating efficiency in their June returns. We collect more detailed data for the sewerage service as there are fewer sewerage companies and therefore fewer independent data sets than there are for the water service operating expenditure econometric modelling.

As with previous assessments, we have modelled companies' reported operating costs after excluding third party costs, local authority rates, Environment Agency charges and unusual one-off costs such as restructuring costs.

We make adjustments for leakage expenditure allocation to some companies' costs; we explain this further in chapter 3. We also make adjustments for future pension costs within our operating expenditure relative efficiency assessment. This is to ensure that the most prudent companies who have managed their funds to avoid a deficit are not disadvantaged when we assess their relative efficiency.

We assess companies within 5% of the benchmark company as band A. Subsequent bands are at 10% intervals from the bottom of band A. On average, a company in band B would need to reduce its modelled costs by up to 10% to achieve the efficiency of a company in band A. We put in band A companies that are more efficient than the benchmark company but which are not suitable to use as the benchmark company.

2.2 Assessment of relative capital expenditure efficiency

We assess capital maintenance relative efficiency by two methods. Outside the periodic review process, for example for the years 1999-2000 to 2001-02, we use econometric models and some unit cost comparisons. This is similar to our approach on operating efficiency. In the run up to the periodic review we collect additional information from the companies in the form of a cost base submission. This is a database of costs for a wide range of standardised projects or units of capital work typical to the water industry (standard costs). We have made our 2003-04 capital maintenance relative efficiency assessment using both these approaches. We explain the cost base assessment in chapter 5. We have included the results of our capital maintenance econometric assessment before combination with the cost base in appendix 2.

Capital maintenance activity changes from year to year. In order to avoid econometric efficiency assessments that fluctuate significantly from one year to the next, we model average expenditure over a period. This year we have modelled the average capital maintenance expenditure for 1998-99 to 2003-04. This is different to the approach we use to assess relative operating expenditure efficiency where we look at a single year. We have assessed relative capital maintenance efficiency using models based on 1997-98 data, including disaggregated sewerage service data, from the capital maintenance econometric return submitted in September 2002 and expenditure data reported in the June returns for the period 1998-99 to 2003-04.

We have adjusted the econometric results for this year to take account of the projected expenditure for the six years, 2004-05 to 2009-10. Combined with the actual expenditure recorded for the six years 1998-99 to 2003-04, this gives a 12-year period of actual and projected costs. We believe that this gives a better estimate of the relative efficiency for the purpose of our efficiency assessments. We have included an explanation of this approach in appendix 2.

For relative capital maintenance efficiency, we combine the results of the econometric models and unit cost comparison and then band companies at 10% intervals from the benchmark company. We also band as A companies that we assess to be more efficient than the benchmark, but that do not fulfil our criteria for a benchmark company. We then combine these bands with the cost base results to calculate the combined capital maintenance relative efficiency bands. We calculate the combined company bands at 10% intervals from A to E. We use these bands in chapters 3 and 4.

We calculate capital enhancement relative efficiency from the cost base. We set out details of our current assessment in appendix 3.

2.3 Assessment of continuing efficiency

When setting prices we include an efficiency factor for each company for each service. This efficiency factor is a combination of our relative efficiency assessment or catch-up efficiency factor and a continuing efficiency factor. Our continuing efficiency assumptions relate to the improvement that we expect all companies to be able to make – these might include new technology, general economic reasons and developments in management practice. For the 2004 price review we based the continuing efficiency factors on the views of those companies we assessed as being the most efficient.

2.4 International comparisons

We publish an annual report comparing the performance of the companies in England and Wales with enterprises in Australia, the Netherlands, Scotland and the USA across a range of activities, including unit costs and relative efficiency. We aim to publish the 2002-03 report in March 2005.

Our analysis of international companies can give us a general indication of the relative unit cost performance of the England and Wales companies. Relative efficiency, however, is very hard to determine for companies that are not subject to the same regime. We design our econometric models with the England and Wales operating environment in mind, and determining allowable company specific special factors is difficult when making international comparisons.

In previous years Sydney Water has made an annual submission to us based on our reporting regime. This agreement came to an end this year and we would like to thank Sydney Water for their involvement in the project. We will continue to seek possible partnerships with other comparable organisations around the world.

This year the Scottish regulator, the Water Industry Commissioner for Scotland (WICS), published Scottish Water's annual submission for 2002-03 and 2003-04. This extra data will allow us to update and develop our analysis using the data from his 2001-02 report.

The regulator collects and analyses data in accordance with our reporting regime and adopts the same processes for identifying and reviewing special factors and other adjustments. This overcomes the difficulties outlined above.

We take our other data from national association publications.

Scotland

Scottish Water has higher unit operating costs per head of population and per property connected than any company in England and Wales. Its operating costs per kilometre of water main are similar to those of the more rural water and sewerage companies in England and Wales, while its costs per kilometre of sewer are higher than in England and Wales.

The results of the Water Commissioner's benchmarking exercise suggest that companies in England and Wales are significantly more efficient than their Scottish counterpart. The difference is even more pronounced when the results are adjusted for expenditure leading to higher levels of service in England and Wales. These results support the conclusions in WICS' strategic review of charges for 2002-06.

In 2003-04, Scottish Water continued to close this efficiency gap. Scottish Water said that it reduced total operating costs by £30 million, or almost 10%, in real terms.

Australia

In 2001-02, Sydney Water's total unit costs for water, adjusted for currency fluctuation, were lower than the England and Wales average on a volumetric basis, but substantially higher on a per property basis. For sewerage, volumetric costs were in line with those in England and Wales, while per property costs were again considerably higher.

In general, Australian consumers use significantly more water per property than consumers in England and Wales do. Most Australian companies therefore appear to show higher costs per property, but lower costs per unit of water delivered or sewage collected. However, the gap with comparator companies varies significantly.

Our econometric analysis suggests that overall Sydney Water is less efficient than the water companies in England and Wales. Its performance would no doubt have been better if we had made allowance for special factors and different cost drivers.

USA

Water usage in the USA is considerably higher than in England and Wales. Volumetric unit costs are below the England and Wales average, but per property unit costs are generally much higher than those in Australia or England and Wales.

Netherlands

Demand per property is lower in the Netherlands than in England and Wales. Dutch companies have similar unit costs to those of their English and Welsh counterparts on a per property basis, but have a higher unit cost of water delivered.

3. Water service efficiency assessment

3.1 Operating efficiency

We make adjustments to modelled water service operating and capital maintenance expenditure to ensure consistent treatment of leakage control costs between companies. We believe that such costs should be accounted for and modelled as leakage operating expenditure. Some companies account for them as infrastructure renewals expenditure and as enhancement capital expenditure.

For modelling purposes we have made an adjustment to the costs of eight companies, for seven of these companies we have increased their operating expenditure and reduced their average capital maintenance expenditure. We do not make a capital maintenance leakage adjustment for Wessex Water; the company was reporting the costs that were more properly allocated to operating expenditure as enhancement capital expenditure, not maintenance. For one company, Folkestone & Dover Water, we have decreased its operating expenditure and increased its average capital maintenance expenditure. This is also to ensure consistent accounting treatment of leakage control costs. We first made these adjustments to our assessments of relative efficiency in 2002-03. We make these adjustments to the data we use in the water distribution operating expenditure econometric model. We detail the operating expenditure adjustments in table 9.

Table 9 Operating expenditure adjustments for leakage control costs

Company	Leakage expenditure (2003-04) £m
Anglian	3.8
South West	5.8
Southern	1.5
Thames	37.5
Wessex	1.2
Yorkshire	6.8
Folkestone & Dover	-0.2
Mid Kent	0.5

We assess operating expenditure relative efficiency using four econometric models, which are described below.

Water distribution

This is a log model expressed in unit cost form with resident population as the scale variable. The proportion of large mains to small mains is the most important cost driver in this model. We use this as a proxy for urbanisation. Repairs, maintenance and inspection of large mains incur much greater costs than the same work on small mains.

Water resources and treatment

This is a linear model expressed in unit cost form with resident population as the scale variable. We take into account the explanatory variables of population, number of sources, distribution input and the proportion of supplies from rivers. These ensure that we take into account economies of scale at source level (costs will be lower if fewer sources are used) and the difficulty of treatment (river supplies will generally be more expensive to treat).

Water power

This is a log linear model. For most companies, power expenditure is almost entirely for pumping, although there are some water treatment processes that are energy intensive. The model considers the effects of terrain (companies in hilly areas will require more power to move water around) and the significant economies of scale associated with high power consumption.

Water business activities

This is a log linear model. Business activities include customer services and scientific services, and the charge for doubtful debts. The model takes into account the economies of scale associated with high volume billing and customer service activities.

We combine the results of the water service models together with any adjustment for special factors and pension costs and compare these to give an overall water service operating efficiency assessment. We have re-estimated the operating efficiency models using 2003-04 data.

3.2 Capital maintenance efficiency

We base our assessment of capital maintenance efficiency on a combination of econometric efficiency and the cost base assessment. We explain the cost base further in chapter 5.

We divide the econometric efficiency assessment of the water service into the following four expenditure areas:

- water distribution infrastructure (water mains network);
- water distribution non-infrastructure (pumping stations and water storage);
- water resources and treatment; and
- water management and general.

The capital maintenance assessment consists of three econometric models and one unit cost comparison. The econometric models are described later in this chapter.

We estimated the capital maintenance models using a six-year average of expenditure (1998-99 to 2003-04). This ensures we take account of annual variations in capital maintenance expenditure and avoid efficiency assessments that fluctuate excessively from year to year. The longer the period of expenditure modelled the smaller the impact of peaks and troughs on the average. This year we have introduced an adjustment to extend the assessed period beyond 2003-04. We make the future expenditure adjustment after the econometric assessments have been calculated. We include an explanation and example of this adjustment in appendix 2.

To be consistent with the leakage control cost adjustments we have made for operating expenditure we have removed this expenditure from our assessment of six companies. We believe that these are operating costs and should not be included in the capital maintenance assessment of relative efficiency. We base our adjustment on average leakage expenditure re-allocation for 1998-99 to 2003-04. These adjustments are shown in table 10. We have not included the adjustment for Folkestone & Dover Water in this table, as this does not affect its efficiency assessment.

Our final adjustment to the capital maintenance econometric efficiency assessment takes account of company specific special factors. More information on these adjustments is included in appendix 1.

Table 10 Capital maintenance expenditure adjustments for leakage control costs

Company	Average leakage expenditure (1998-99 to 2003-04) £m
Anglian	4.2
South West	3.4
Southern	2.4
Thames	33.5
Yorkshire	5.3
Mid Kent	0.3

The three capital maintenance econometric models are as follows.

Water distribution infrastructure

This is a log unit cost model expressed in unit cost form with length of main as the scale variable. The key cost driver in this model is the log of connected properties per length of main.

Water distribution non-infrastructure

This is a log unit cost model expressed in unit cost form with total booster pumping station capacity as the scale variable. We take into account water tower and service reservoir capacities in this model. The ratio of storage capacity to pumping station capacity helps to explain the higher costs of companies with relatively greater storage capacity.

Water management and general

This is a log model expressed in unit cost form with the total number of billed properties as the scale variable. The key cost driver in this model is the proportion of billed properties that are non-household. The model explains the higher unit costs incurred by companies with more business customers due to metering and billing requirements.

We combine the results from the econometric models and the unit cost comparison and make adjustments for further expenditure, leakage allocation and special factors. This is our water service econometric assessment of capital maintenance efficiency. We average this with the results from the cost base to give an overview of each company's capital maintenance efficiency for the water service.

3.3 Overall water service assessment

Table 11a sets out our 2003-04 assessments of relative operating and capital maintenance efficiency. It shows water and sewerage companies followed by water only companies in alphabetical order, together with their efficiency bandings from A to E. Table 11b sets out the relative efficiency rankings of the individual companies.

Within these operating and capital maintenance efficiency bands, there are variations in the levels of service provided by each company. One way to assess performance is to compare the efficiency results with the indicators published in our 'Levels of service for the water industry in England and Wales 2003-04 report'. There is evidence that good standards of customer service do not necessarily require higher costs. For example, South Staffordshire Water had the third highest overall score in the water supply and customer service overall performance assessment for water and sewerage companies in 2003-04 and is banded A for both water operating and capital maintenance relative efficiency.

Figure 4 presents the same information as table 11a, but in the form of a matrix that compares operating and capital maintenance efficiency bands. The frontier company for relative operating efficiency is Portsmouth Water. However, Portsmouth Water is too small to satisfy our criteria as a benchmark company. The most efficient company suitable for comparison with the rest of the industry for operating expenditure is Wessex Water.

For capital maintenance, the most efficient company based on the econometric models is also Portsmouth Water. The most efficient company suitable for comparison with the rest of the industry is Northumbrian Water.

There is no single benchmark company for the overall cost base analysis. We derive benchmarks for each standard cost or group of standard costs. We often choose a single benchmark company for a group of standard costs covering the same activity (eg mains rehabilitation using a surface applied internal coating technique). The most efficient company for combined capital maintenance econometrics and cost base is Yorkshire Water.

Four companies – Bournemouth & West Hampshire Water, Portsmouth Water, South Staffordshire Water and Yorkshire Water – are all band A for both operating and capital maintenance expenditure. No company is band C or lower for both operating and capital maintenance efficiency.

Table 11a Relative operating and capital maintenance efficiency bands – water service 2003-04

Water and sewerage companies	Operating efficiency Band A to E	Capital maintenance efficiency (combined) Band A to E
Anglian	B	B
Dŵr Cymru	B	B
Northumbrian	B	A
Severn Trent	A	B
South West	C	A
Southern	A	C
Thames	C	A
United Utilities	B	B
Wessex	A	B
Yorkshire	A	A
Water only companies		
Bournemouth & W Hampshire	A	A
Bristol	C	B
Cambridge	A	B
Dee Valley	B	C
Folkestone & Dover	C	A
Mid Kent	B	B
Portsmouth	A	A
South East	B	A
South Staffordshire	A	A
Sutton & East Surrey	B	B
Tendring Hundred	B	B
Three Valleys	B	A

Table 11b Relative operating and capital maintenance efficiency ranks – water service 2003-04

	Operating efficiency Rank 1-22	Capital maintenance efficiency (combined) Rank 1-22
Water and sewerage companies		
Anglian	9	14
Dŵr Cymru	16	12
Northumbrian	13	8
Severn Trent	6	11
South West	19	9
Southern	4	21
Thames	21	2
United Utilities	12	16
Wessex	3	15
Yorkshire	5	1
Water only companies		
Bournemouth & W Hampshire	8	10
Bristol	20	19
Cambridge	7	17
Dee Valley	10	22
Folkestone & Dover	22	5
Mid Kent	17	18
Portsmouth	1	4
South East	15	3
South Staffordshire	2	7
Sutton & East Surrey	14	20
Tendring Hundred	11	13
Three Valleys	18	6

Figure 4 Relative operating and capital maintenance efficiency – water service 2003-04

Operating efficiency banding	**A** **Within 5% of benchmark**			Southern	Severn Trent, Wessex, Cambridge	Yorkshire, Bournemouth & W Hampshire, Portsmouth, South Staffordshire
	B Between 5% and 15% of benchmark			Dee Valley	Anglian, Dŵr Cymru, United Utilities, Mid Kent, Sutton & East Surrey, Tendring Hundred	Northumbrian, South East, Three Valleys
	C Between 15% and 25% of benchmark				Bristol	South West, Thames, Folkestone & Dover
	D Between 25% and 35% of benchmark					
	E Greater than 35% of benchmark					
		E Greater than 40% of benchmark	D Between 30% and 40% of benchmark	C Between 20% and 30% of benchmark	B Between 10% and 20% of benchmark	**A** **Within 10% of benchmark**
		Capital maintenance efficiency banding (combined)				

4. Sewerage service efficiency assessment

We have less scope for developing econometric models for the sewerage service than for the water service because there are only ten regulated sewerage companies. The development of robust econometric models of efficiency for each year requires more than ten sets of data. To overcome this problem, we collect detailed sewerage information in the June returns. For the assessment of operating efficiency, this information focuses on individual large sewage treatment works (those serving a population equivalent of 25,000 or more) and on a number of sewerage districts within each company's region, depending on the company's size. For the assessment of capital maintenance efficiency, we used 1997-98 sub-regional sewerage service data from the capital maintenance econometric return and expenditure data from June returns for the period 1998-99 to 2003-04.

Information obtained on this basis is not ideal, as it would be better to have information from a sufficient number of independent companies, but it does allow us to develop econometric models for key aspects of the sewerage service.

4.1 Operating efficiency

We divide the econometric efficiency assessment for the sewerage service into five expenditure areas:

- sewerage (the network);
- large sewage treatment works;
- small sewage treatment works (and sea outfalls);
- sludge treatment and disposal; and
- business activities (including customer services, doubtful debt charge and scientific services).

Three of the sewerage service models are unit cost models: small sewage treatment works, sludge treatment and disposal, and business activities. This means we assess a company that has relatively high unit costs as inefficient for that activity.

The other models for sewerage are set out below.

Network including power

This is a log model expressed in unit cost form with the total length of sewer as the scale variable. The explanatory variables used in the network model are sewer length, area of sewer district, resident population and holiday population. In simple terms, the model takes account of the density of the sewerage network and the population it serves, and of the higher costs associated with the sewer capacity required to serve additional summer populations.

Large sewage treatment works

This is a log linear model. It uses a number of explanatory variables that take account of the total load, the type of treatment used, and the nature of effluent consents. These explanatory variables affect costs (it is more expensive to meet tight effluent consents, for example).

We combine the results of the sewerage service models together with any adjustment for special factors to give an overall sewerage service operating efficiency band.

This year, as last year, we excluded the data from Dŵr Cymru from the large works model. We are concerned that there have been some significant changes in this data when we compare 2002-03 and 2003-04 with 2001-02. Dŵr Cymru has not properly explained these changes. We have tested the impact of both including and excluding this data from the large works model. The overall sewerage service operating efficiency bands and ranks are the same for all companies in either case.

4.2 Capital maintenance efficiency

Our assessment of capital maintenance efficiency is based on a combination of econometric efficiency and the cost base. We give further information on the cost base in chapter 5.

We divide the econometric efficiency assessment for the sewerage service into five expenditure areas:

- sewage treatment (sewage treatment works);
- sewerage infrastructure (sewer network);

- sewerage non-infrastructure (pumping stations);
- sludge treatment and disposal; and
- sewerage management and general.

To ensure that we develop robust econometric models, we collect asset and expenditure data for each sub-region within each company's area relating to all these models except management and general. We collect this detailed data every five years in the capital maintenance econometric return.

We assess the sewerage service using two econometric models and three unit cost models: sewerage non-infrastructure, sludge treatment and disposal, and management and general. Our two econometric models are detailed below.

Sewage treatment

This is a log unit cost model with the total load treated by works as the scale variable. The explanatory factor in this model is the load treated per sewage treatment work. Economies of scale at the works level are taken into account, because fewer larger works will be less costly to maintain, as are the higher costs associated with post-primary levels of treatment.

Sewerage infrastructure

This is a log unit cost model with the total length of sewers as the scale variable. The number of combined sewer overflows is the key cost driver in this model. It is an indicator of the extent of combined sewers in the network. Combined sewers are generally larger and more costly to replace than foul sewers. This cost driver therefore helps to explain the higher maintenance costs incurred by companies with a greater number of combined sewer overflows. We added the proportion of critical sewers to this model in 2002-03. This takes account of the additional costs associated with a high proportion of critical sewers.

We combine the results from the econometric models and the unit cost comparison and make our adjustments for future expenditure, leakage allocation and special factors. This gives us our econometric assessment of capital maintenance efficiency. We average this with the results from the cost base to give an overall assessment of each company's capital maintenance efficiency for the water service.

4.3 Overall sewerage service assessment

The results of our 2003-04 sewerage service assessment of relative efficiency are set out in table 12a. Table 12b sets out the relative efficiency rankings of the individual companies.

Figure 5 presents the same information as table 12a, but in the form of a matrix that compares operating expenditure and capital maintenance efficiency bands. The frontier company for relative operating efficiency is Thames Water. We have not used Thames Water as the benchmark company for relative operating efficiency as it has a large adjustment for company special factors relating to its specific operating circumstances. We have therefore decided to band companies relative to the next most efficient company, Yorkshire Water.

For capital maintenance the benchmark company based on the econometric models is Wessex Water. There is no single benchmark company for the overall cost base analysis. We derive benchmarks for each standard cost or group of standard costs. We often choose a single benchmark company for a group of standard costs covering the same activity; for example we have used a single benchmark company for all sewer-laying costs. The most efficient company for the combined capital maintenance econometrics and cost base is also Wessex Water.

Three companies – Thames Water, Wessex Water and Yorkshire Water – achieve band A status for both operating and capital maintenance expenditure.

Table 12a Relative operating and capital maintenance efficiency bands – sewerage service 2003-04

Water and sewerage companies	Operating efficiency Band A to E	Capital maintenance efficiency (combined) Band A to E
Anglian	B	A
Dŵr Cymru	B	A
Northumbrian	B	A
Severn Trent	A	B
South West	B	B
Southern	B	C
Thames	A	A
United Utilities	B	C
Wessex	A	A
Yorkshire	A	A

Table 12b Relative operating and capital maintenance efficiency ranks – sewerage service 2003-04

Water and sewerage companies	Operating efficiency Rank 1-10	Capital maintenance efficiency (combined) Rank 1-10
Anglian	8	4
Dŵr Cymru	9	2
Northumbrian	6	5
Severn Trent	4	7
South West	7	8
Southern	5	10
Thames	1	6
United Utilities	10	9
Wessex	3	1
Yorkshire	2	3

Figure 5 Relative operating and capital maintenance efficiency – sewerage service 2003-04

Operating efficiency banding						
	A Within 5% of benchmark				Severn Trent	Thames, Wessex, Yorkshire
	B Between 5% and 15% of benchmark			Southern, United Utilities	South West	Anglian, Dŵr Cymru, Northumbrian
	C Between 15% and 25% of benchmark					
	D Between 25% and 35% of benchmark					
	E Greater than 35% of benchmark					
		E Greater than 40% of benchmark	D Between 30% and 40% of benchmark	C Between 20% and 30% of benchmark	B Between 10% and 20% of benchmark	**A Within 10% of benchmark**
		Capital maintenance efficiency banding (combined)				

5. Relative efficiency informed by the cost base

The cost base is a method of assessing relative capital efficiency by comparing companies' estimates of capital works unit costs for a range of standardised capital projects (known as standard costs). It is a database consisting of around 120 standard costs. By comparing these costs between companies, we can make judgements on the relative unit costs of each company. This in turn enables us to gauge the relative capital efficiency of each company.

The cost base is not a pricing database for estimating companies' capital investment projections. The standard costs are stylised, but they are developed in consultation with the companies to be similar to actual works likely to be carried out in companies' capital investment programmes. The standard cost estimates must be based on the same sources of information that each company has used in forecasting its capital investment programme.

If a company's standard costs are high compared to its peers, then this indicates that there is scope for this company to deliver its overall capital works programme for less than it had originally forecast.

We choose benchmark companies for each of the standard costs or groups of standard costs. We call the difference between a company's cost and the benchmark the scope for catch-up efficiency. We expect the companies with relatively high standard costs to catch up at least part of the difference with the benchmark costs. Our results challenge the companies' conservative approaches to estimating their future capital investment programmes for the next five-year period.

5.1 Cost base development

We first developed the cost base for the 1994 periodic review as a tool for challenging companies' investment projections. We refined and improved the approach for the 1999 periodic review and introduced checklists to improve comparability between standard costs. For the 2004 periodic review, after consultation with the industry, we made improvements to the standard cost specifications and developed several new standard costs.

The cost base approach has stood the test of time. It has been subjected to independent scrutiny at both the 1994 and 1999 reviews. In 2000, the Competition Commission concluded that the approach had worked well since 1995. The Commission felt that although there may still be some weaknesses in the approach they were not of sufficient magnitude to invalidate it. The Commission also said it may have underestimated the level of efficiency that could be obtained. A study of the cost base by Ove Arup and E C Harris for Water UK in 1998 and updated again in 2004 identified a number of concerns about its use. The study made some recommendations that we can investigate for the 2009 periodic review. It also acknowledged the improvements that we had made for the 2004 review in the cost base process, the technical specifications, the guidance notes and in the role of the reporters.

5.2 2004 periodic review approach

The cost base approach for the 2004 periodic review has involved the work of companies, reporters and ourselves spanning two years. Table 13 summarises the key stages of the approach since April 2002.

Table 13 Cost base approach for the 2004 periodic review

Date	Key stages
April 2002	Efficiency workshop with companies and reporters
October 2002	Issued draft cost base information requirements for consultation
November 2002	Feedback from companies on proposed cost base information requirements
January 2003	Issued final cost base information requirements and feedback on consultation
March 2003	Companies submitted their initial standard costs (reporters submitted their reports around a week later)
May 2003	Published feedback report containing initial cost base efficiency improvement factors
June 2003	Provided each company with company specific feedback
August 2003	Companies submitted their draft business plans (cost base optional)
December 2003	Published updated cost base efficiency improvement factors
December 2003	Provided each company with company specific feedback
January 2004	Issued revised cost base information requirements
April 2004	Companies submitted their final business plans including cost base (reporters submitted their reports around a week later)
August 2004	Published ‘Future water and sewerage charges 2005-10: Draft determinations’ including cost base efficiency improvements and sent company specific supplementary reports
August 2004	Provided each company with company specific feedback on the draft determinations cost base analysis
December 2004	Published ‘Future water and sewerage charges 2005-10: Final determinations’ with final cost base efficiency improvement factors included in price limits and sent company specific supplementary reports
January 2005	Publish feedback report including company’s standard costs and chosen benchmarks

5.3 2004 periodic review results

We derive catch-up efficiency factors for each of the four sub-service asset groups:

- water underground assets (water infrastructure);
- water above-ground assets (water non-infrastructure);
- sewerage underground assets (sewerage infrastructure); and
- sewerage above-ground assets (sewerage non-infrastructure).

Table 14 sets out the catch-up factors arising from our analysis of companies' final business plans' cost base. We used these catch-up factors to support the future capital efficiency assumptions we included in our final determinations. The industry average figures shown are not weighted by company expenditure.

For capital maintenance expenditure, we have used both the cost base and econometric models (see appendix 2) to inform our judgements on the catch-up efficiency for each company sub-service. We derived the cost base catch-up factors for capital maintenance on the basis that the company will close 50% of the gap between its costs and the benchmark costs.

For capital enhancement expenditure, we derive the catch-up factors from the cost base analysis only and we apply these separately to each asset group. The factors assume that the company will close 75% of the gap between its costs and the benchmark costs.

Table 14 Catch-up efficiency arising from the cost base

	Underground assets (infrastructure)		Above-ground assets (non-infrastructure)	
Water service	Capital maintenance %	Capital enhancement %	Capital maintenance %	Capital enhancement %
Anglian	6.1	9.1	10.0	15.0
Dŵr Cymru	4.3	6.4	2.9	4.3
Northumbrian	9.7	14.5	8.4	12.6
Severn Trent	4.7	7.1	3.6	5.5
South West	1.6	2.4	4.0	6.0
Southern	7.9	11.9	9.6	14.4
Thames	6.1	9.1	5.2	7.7
United Utilities	2.3	3.4	9.6	14.4
Wessex	1.2	1.7	1.5	2.3
Yorkshire	1.9	2.9	1.8	2.7
Bournemouth & W Hampshire	9.6	14.4	8.9	13.4
Bristol	15.8	23.7	9.0	13.5
Cambridge	17.4	26.2	13.9	20.8
Dee Valley	11.5	17.2	6.8	10.2
Folkestone & Dover	12.1	18.2	3.0	4.5
Mid Kent	6.6	9.9	3.9	5.8
Portsmouth	5.9	8.9	7.5	11.2
South East	6.2	9.4	4.6	7.0
South Staffordshire	6.6	9.9	7.6	11.5
Sutton & East Surrey	8.8	13.2	10.5	15.7
Tendring Hundred	5.7	8.6	6.7	10.1
Three Valleys	10.1	15.1	6.4	9.5
Industry average	**7.4**	**11.1**	**6.6**	**9.9**

	Underground assets (infrastructure)		Above-ground assets (non-infrastructure)	
Sewerage service	Capital maintenance %	Capital enhancement %	Capital maintenance %	Capital enhancement %
Anglian	10.6	15.9	6.7	10.1
Dŵr Cymru	4.3	6.4	4.1	6.2
Northumbrian	9.0	13.5	6.2	9.4
Severn Trent	2.5	3.7	1.2	1.8
South West	9.2	13.9	9.4	14.1
Southern	1.7	2.6	6.0	9.0
Thames	8.4	12.6	8.0	11.9
United Utilities	7.1	10.6	6.3	9.4
Wessex	1.6	2.4	2.8	4.2
Yorkshire	4.8	7.2	6.1	9.2
Industry average	**5.9**	**8.9**	**5.7**	**8.5**

5.4 Cost base special factors

We acknowledge that there may be differences in the cost of construction between different regions of England and Wales. This may cause material differences in the cost of capital procurement between water companies that are not within their management control. Regional factors are generally acknowledged within the construction industry and a number of organisations publish the differences between regions in the form of comparative indices.

For the cost base regional price adjustment we have primarily used the regional and county factors published by the Building Cost Information Service (BCIS) adjusted to reflect water company boundaries and procurement practices. We have also used information published by the Department of Trade and Industry (DTI) to adjust the standard costs of companies in relatively high construction cost areas to the average costs in England and Wales. We provide a more detailed explanation of the process for the cost base in appendix 3 and for capital maintenance econometrics in appendix 2.

5.5 Cost base at the 2009 periodic review

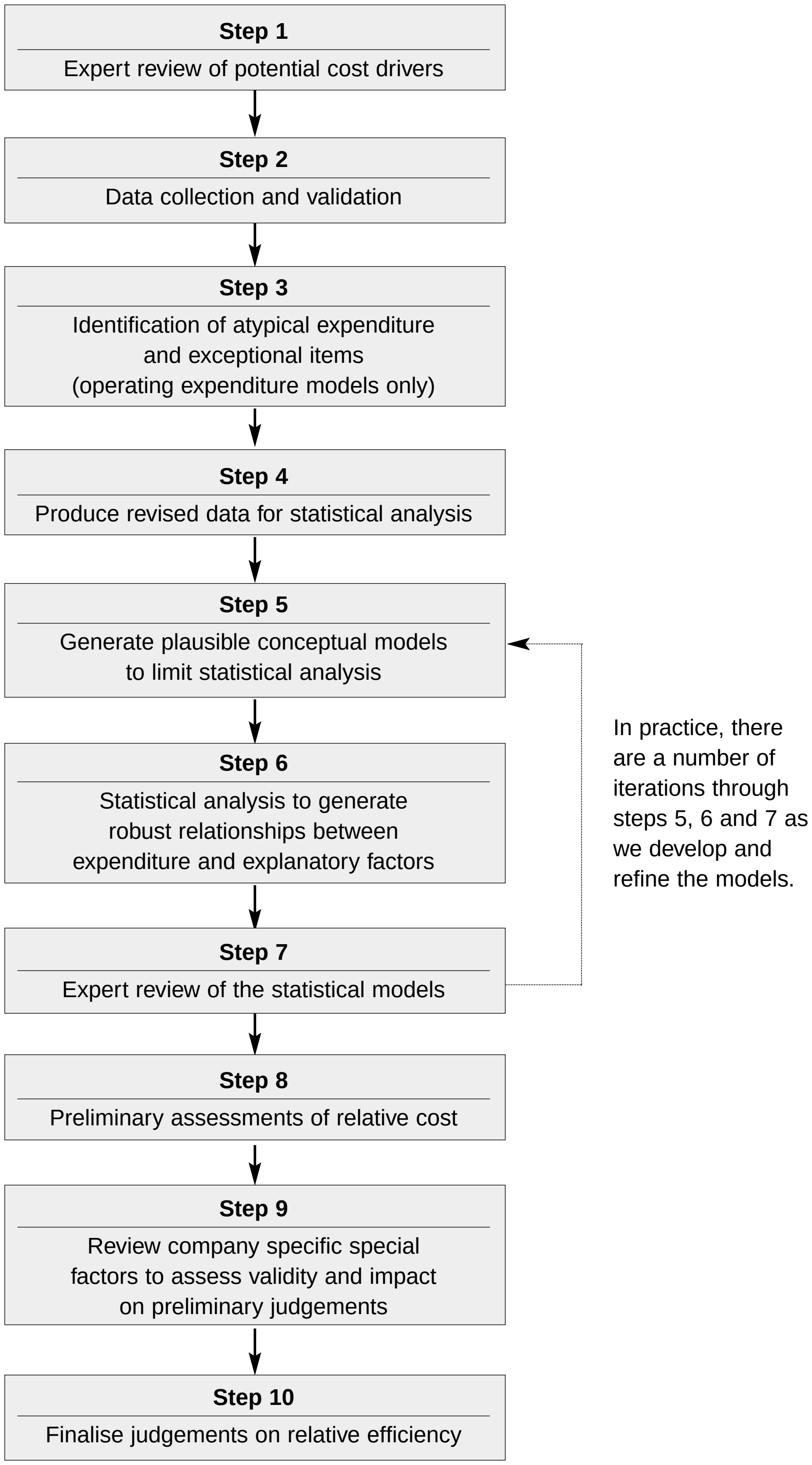
The cost base plays an important role in our ability to challenge the capital investment programmes planned by companies, and paid for by customers through price limits, and to make challenging but achievable efficiency assumptions.

We will continue to develop the approach in consultation with the companies and reporters for the next periodic review in 2009. We will look to incorporate new ideas from the industry and to develop new standard costs so that we continue to improve the current methodology and process.

Appendix 3 contains a more detailed summary of the cost base process in the 2004 periodic review, including histograms of the standard costs and the selected benchmark costs.

Appendix 1: Econometric models (including coefficients and summary statistics)

Figure 6 Step-by-step approach used to derive the statistical models



Definition of the terms and abbreviations in the econometric model descriptions

This appendix details the form of the models. We have used the following terms and abbreviations in tables 15-18.

Model significance (F test): We use this to determine whether there is an association between the modelled cost and the other variables used in a model. The number in our tables is the probability that there is no association between the variables. Therefore a small number (we usually say less than 0.05) means that there is a statistically significant association between the variables.

R^2: This shows you how closely the variables in the model are related to each other. It lies between -1 and 1; an R^2 of 1 or -1 means there is a perfect linear relationship and an R^2 of 0 means there is no linear relationship. However, the R^2 term can be misleading depending on the way the model is expressed. For example, the R^2 values for the distribution and the resources and treatment models are low because these models are expressed in unit cost terms, as opposed to total cost terms.

Model standard error: This is a measure of the overall variation in a model. It measures how spread out the data is around the regression line. The further away the data points are from the regression line the greater the value of the standard error. It is based on the standard deviation of the data points, therefore the smaller the number relative to the mean of the data the better the fit of the regression line.

In: The logarithm to base e, also called the natural logarithm.

BOD_5: Five-day biochemical oxygen demand (BOD_5) is a standard way of measuring the polluting effect of wastewater. It is a measure of how much oxygen is consumed in five days at a temperature of 20^oC by any micro-organisms or organic matter present in the water.

COD: Chemical oxygen demand (COD) is another way of measuring the polluting effect of wastewater. It is a measure of how much oxygen is required to oxidise all compounds in the water, both organic and inorganic.

Table 15a Operating expenditure – water distribution model

Water service:	Distribution expenditure	
Data:	June returns 2004	
Modelled cost:	ln (distribution functional expenditure excluding power expenditure [£m] divided by resident winter population [000s])	
Explanatory variables:	Coefficient	Standard error
Constant	-5.213	0.158
Length of main greater than 300 mm diameter [km] divided by total length of main [km]	6.106	1.941
Form of model:	Modelled cost = -5.213 + 6.106 x $\frac{\text{length of main > 300 mm diameter}}{\text{total length of main}}$	
Statistical indicators:	Number of observations: 22	R^2: 0.331
	Model standard error: 0.212	Model significant (F test): 0.005

Table 15b Operating expenditure – water resources and treatment model

Water service:	Resources and treatment expenditure	
Data:	June returns 2004	
Modelled cost:	Resources and treatment functional expenditure [£m] less power expenditure [£m] less Environment Agency charges [£m] divided by resident winter population [millions]	
Explanatory variables:	Coefficient	Standard error
Constant	0.468	1.990
Number of sources divided by distribution input [Ml/day]	22.415	6.557
Proportion of supplies derived from river sources	5.933	2.487
Form of model:	Modelled cost = 0.468 + 22.415 x $\frac{\text{number of sources}}{\text{distribution input}}$ + 5.933 x (proportion of supply from rivers)	
Statistical indicators:	Number of observations: 22	R^2: 0.381
	Model standard error: 1.989	Model significant (F test): 0.010

Table 15c Operating expenditure – water power model

Water service:	**Power expenditure**	
Data:	June returns 2004	
Modelled cost:	ln power expenditure [£m]	
Explanatory variables:	Coefficient	Standard error
Constant	-8.930	0.265
ln (distribution input [DI] [Ml/day] multiplied by average pumping head)	0.929	0.024
Form of model:	Modelled cost = -8.930 + 0.929 x ln (DI x average pumping head)	
Statistical indicators:	Number of observations: 22	R^2: 0.986
	Model standard error: 0.152	Model significant (F test): 0.000

Table 15d Operating expenditure – water business activities model

Water service:	**Business activities expenditure**	
Data:	June returns 2004	
Modelled cost:	ln (business activities expenditure [£m] including doubtful debts [£m])	
Explanatory variables:	Coefficient	Standard error
Constant	-3.646	0.270
ln of number of billed properties [000s]	0.917	0.042
Form of model:	Modelled cost = -3.646 + 0.917 x ln (number of billed properties)	
Statistical indicators:	Number of observations: 22	R^2: 0.960
	Model standard error: 0.236	Model significant (F test): 0.000

Table 16a Operating expenditure – sewerage network, including power, model

Sewerage service:	**Sewerage network expenditure**	
Data:	June returns 2004	
Modelled cost:	ln (sewerage network functional expenditure [£m] less Environment Agency charges [£m], per kilometre of sewer, for each area)	
Explanatory variables:	Coefficient	Standard error
Constant	-5.858	0.355
ln (area sewer district [km^2] per kilometre of sewer)	0.157	0.032
ln (resident population [000s] per kilometre of sewer)	0.776	0.187
Holiday population divided by resident population [000s]	1.550	0.487
Form of model:	Modelled cost = -5.858 + 0.157 x ln (area of sewer district per km of sewer) + 0.776 x ln (resident population per km of sewer) + 1.550 x $\frac{\text{holiday population}}{\text{resident population}}$	
Statistical indicators:	Number of observations: 64	R^2: 0.519
	Model standard error: 0.247	Model significant (F test): 0.000

Table 16b Operating expenditure – large sewage treatment works model

Sewerage service:	**Cost of sewage treatment at large works**	
Data:	June returns 2004	
Modelled cost:	ln (functional expenditure on sewage treatment at large works [£000s] less Environment Agency charges [£000s] less terminal pumping costs [£000s])	
Explanatory variables:	Coefficient	Standard error
Constant	-1.813	0.245
ln of total load[1] [kg COD/day]	0.800	0.027
Activated sludge[2]	0.393	0.052
Tight effluent consent for both suspended solids and BOD_5[3]	0.057	0.048
Form of model:	Modelled cost = -1.813 + 0.800 x ln (total load) + 0.393 x activated sludge + 0.057 x tight effluent consent for both suspended solids and BOD_5	
Statistical indicators:	Number of observations: 367	R^2: 0.753
	Model standard error: 0.454	Model significant (F test): 0.000

Notes:

[1] Total load in this model is estimated as population equivalent x 120.

[2] Activated sludge includes secondary and tertiary treatment (variable value is 0 if not used, 1 if used).

[3] Tight effluent consent is defined as 30 mg/litre or less for suspended solids and 20 mg/litre or less for BOD_5 (variable value is 0 if tight consent does not apply, and 1 if the tight consent does apply).

Table 16c Operating expenditure – small sewage treatment works unit cost model

Sewerage service:	**Cost of sewage treatment at small works**
Data:	June returns 2004
Unit cost model:	We used a unit cost approach for modelling sewage treatment at small works, using ten treatment categories and five size bands. For each treatment type we compared each company's average annual expenditure (direct costs [£000s] less Environment Agency charges [£000s] less sludge costs [£000s] plus general and support costs [£000s]) with each company's estimated expenditure (weighted average industry unit cost multiplied by each company's load [kg BOD_5/day]).

Weighted average industry unit cost
£000s/(kg BOD_5/day)

Treatment type	Primary	Secondary activated sludge	Secondary biological	Tertiary A1	Tertiary A2	Tertiary B1	Tertiary B2	Sea outfall preliminary	Sea outfall screened	Sea outfall unscreened
Size band 1	0.58	0.76	0.94	0.87	0.33	0.76	0.76	1.01	0.08	0.29
Size band 2	0.37	0.71	0.48	0.70	0.34	0.51	0.66	0.00	0.25	0.05
Size band 3	0.21	0.44	0.30	0.36	0.41	0.30	0.40	0.09	0.02	0.01
Size band 4	0.22	0.22	0.17	0.18	0.29	0.17	0.16	0.03	0.12	0.01
Size band 5	0.00	0.14	0.11	0.14	0.17	0.11	0.12	0.03	0.00	0.00
Number of observations:	500									

Table 16d Operating expenditure – sludge treatment and disposal unit cost model

Sewerage service:	**Cost of sludge treatment and disposal**
Data:	June returns 2004
Unit cost model:	We used a unit cost approach for modelling the treatment and disposal of sludge. For each disposal route, we compared each company's average annual expenditure (sludge functional expenditure [£000s] less Environment Agency charges [£000s]) with each company's estimated costs (weighted average industry unit cost multiplied by each company's load [ttds]).

Weighted average industry unit cost
£000s/(thousand tonnes of dry solids)

Disposal route	Farmland – untreated	Farmland – conventional	Farmland – advanced	Incineration	Landfill	Composted	Land reclamation	Other
£000s/ttds	222.8	173.5	231.5	171.1	169.5	157.8	171.0	168.4
Number of observations:	80							

Table 16e Operating expenditure – sewerage business activities unit cost model

Sewerage service:	Sewerage business activities expenditure
Data:	June returns 2004
Unit cost model:	We used a unit cost approach for modelling business activities, based on the number of billed properties. We compared each company's average annual business activities expenditure (total business activities [£m] plus doubtful debts [£m] divided by the number of billed properties) with the weighted average industry cost.
£/billed property	Weighted average industry unit cost 12.43
Number of observations:	10

Table 17a Capital maintenance expenditure – water distribution infrastructure model

Water service:	Water distribution infrastructure expenditure	
Data:	Capital maintenance econometric return, June returns 1998-2004	
Modelled cost:	ln (annual average water distribution infrastructure functional expenditure [£m] divided by length of main [km])	
Explanatory variables:	Coefficient	Standard error
Constant	-5.104	0.608
ln (total number of connected properties [000s] divided by total length of main [km])	0.762	0.225
Form of model:	Modelled cost = -5.104 + 0.762 x ln $\left(\frac{\text{no. of connected properties}}{\text{total length of main}}\right)$	
Statistical indicators:	Number of observations: 22	R^2: 0.364
	Model standard error: 0.239	Model significance (F test): 0.003

Table 17b Capital maintenance expenditure – water distribution non-infrastructure model

Water service:	Water distribution non-infrastructure expenditure	
Data:	Capital maintenance econometric return, June returns 1998-2004	
Modelled cost:	ln (annual average water distribution non-infrastructure functional expenditure [£m] divided by pumping station capacity [kW])	
Explanatory variables:	Coefficient	Standard error
Constant	-6.203	0.514
ln (water service reservoir and water tower storage capacity [Ml/d] divided by pumping station capacity [kW])	0.740	0.200
Form of model:	ln modelled cost = -6.203 + 0.740 x ln $\left(\frac{\text{storage capacity}}{\text{pumping station capacity}}\right)$	
Statistical indicators:	Number of observations: 22	R^2: 0.407
	Model standard error: 0.548	Model significance (F test): 0.001

Table 17c Capital maintenance expenditure – water management and general model

Water service:	**Water management and general expenditure**	
Data:	Capital maintenance econometric return, June returns 1998-2004	
Modelled cost:	ln (annual average management and general expenditure [£m] divided by billed properties [000s])	
Explanatory variables:	Coefficient	Standard error
Constant	-5.842	0.420
Proportion of billed non-household properties	12.766	5.513
Form of model:	Modelled cost = -5.842 + 12.766 x proportion of non-household properties	
Statistical indicators:	Number of observations: 22	R^2: 0.211
	Model standard error: 0.352	Model significance (F test): 0.031

Table 17d Capital maintenance expenditure – water resources and treatment model

Water service:	**Water resources and treatment expenditure**
Data:	Capital maintenance econometric return, June returns 1998-2004
Unit cost model:	We used a unit cost approach for the water resource and treatment model. We divided each company's average annual expenditure by the total connected properties and compared this with the weighted average industry cost.
£/connected properties	Weighted average industry cost 8.854
Number of observations:	22

Table 18a Capital maintenance expenditure – sewerage infrastructure model

Sewerage service:	**Sewerage infrastructure expenditure**	
Data:	Capital maintenance econometric return, June returns 1998-2004	
Modelled cost:	ln (average annual sewerage infrastructure expenditure [£m] divided by the total length of sewer [km])	
Explanatory variables:	Coefficient	Standard error
Constant	-5.606	0.356
ln (the number of combined sewer overflows [CSOs] divided by the total length of sewer [km])	0.379	0.059
Ln (proportion of critical sewers)	0.441	0.210
Form of model:	Modelled cost = $-5.606 + 0.379 \times \ln\left(\frac{\text{number of CSOs}}{\text{total length of sewer}}\right) + 0.441 \times \ln(\text{proportion of critical sewers})$	
Statistical indicators:	Number of observations: 63	R^2: 0.427
	Model standard error: 0.457	Model significance (F test): 0.000

Table 18b Capital maintenance expenditure – sewage treatment model

Sewerage service:	**Sewage treatment expenditure**	
Data:	Capital maintenance econometric return, June returns 1998-2004	
Modelled cost:	ln (average annual sewage treatment functional expenditure [£m] divided by the total load received at sewage treatment works [kg BOD_5/day])	
Explanatory variables:	Coefficient	Standard error
Constant	-8.270	0.282
ln (the total number of works divided by total load received at sewage treatment works [kg BOD_5/day])	0.165	0.041
Form of model:	Modelled cost = $-8.270 + 0.165 \times \ln\left(\frac{\text{total number of works}}{\text{total load received at works}}\right)$	
Statistical indicators:	Number of observations: 60	R^2: 0.214
	Model standard error: 0.502	Model significance (F test): 0.000

Table 18c Capital maintenance expenditure – sewerage non-infrastructure model

Sewerage service:	Sewerage non-infrastructure expenditure
Data:	Capital maintenance econometric return, June returns 1998-2004
Unit cost model:	A unit cost approach resulted from modelling sewerage non-infrastructure data. We compared each company's average annual expenditure [£m] divided by the total number of pumping stations [000s] with the weighted average industry cost.
£m/number of pumping stations [000s]	Weighted average industry cost 2.956
Number of observations:	10

Table 18d Capital maintenance expenditure – sludge treatment and disposal model

Sewerage service:	Sludge treatment and disposal expenditure
Data:	Capital maintenance econometric return, June returns 1998-2004
Unit cost model:	We used a unit cost approach for the sludge treatment and disposal model. We compared each company's average annual sludge expenditure [£000s] divided by the total weight of dry solids [ttds] disposed of with the weighted average industry cost.
£000s/thousand tonnes of dry solids	Weighted average industry cost 67.894
Number of observations:	10

Table 18e Capital maintenance expenditure – sewerage management and general model

Sewerage service:	Sewerage management and general expenditure
Data:	Capital maintenance econometric return, June returns 1998-2004
Unit cost model:	We adopted a unit cost approach for sewerage management and general expenditure, comparing each company's average annual expenditure [£m] per billed property [millions] with the weighted average industry cost.
£/billed property	Weighted average industry cost 7.619
Number of observations:	10

Company specific special factors

The econometric models take into account factors that describe the size or operating environment of different companies. These factors are common to all companies. There are other factors that are specific to each company or a group of companies that we cannot incorporate into our econometric models. Such company specific special factors typically lead to higher operating or capital maintenance costs, which in the short to medium term are outside management control. We need to take account of these when we interpret the results of our econometric models. Examples of special factors are legal requirements or circumstances peculiar to an individual company's area of operation.

Early in 2004 we asked companies to submit claims for special factors for inclusion in our 2003-04 relative efficiency assessments. We asked companies to provide us with information about each claim based on the four criteria listed below:

- What is different about the circumstances that cause materially higher costs?
- Why do these circumstances lead to materially higher costs?
- What is the net impact of these costs on prices? What has been done to manage the additional costs arising from the different circumstances and to limit their impact?
- Companies should also explain the impact of any other different circumstances that reduce the company's costs relative to the industry norms.

Twenty-one companies submitted claims for operating expenditure special factors and seventeen companies submitted claims for capital maintenance special factors. Although there were fewer claims for capital maintenance special factors they tended to be for higher costs than those for operating expenditure. In total we were asked to consider claims for over 150 company specific special factors.

We have reviewed all the claims. Where claims were justified and verified and supported by the company's reporter, we have taken the additional costs into account in our assessments of relative efficiency. As part of the process for the 2003-04 assessment we have reassessed claims we previously allowed at the 1999 periodic review. We have done this to take account of current circumstances.

We provided feedback to companies on their special factor claims as part of their final determination of price limits for 2005-06 to 2009-10.

Table 19 summarises the most significant types of special factors we have allowed in the assessments of relative efficiency for 2003-04.

Table 19 Special factors

	Number of companies
Operating expenditure	
Water resources (including bulk supplies)	9
Water quality	2
Water treatment	6
Leakage	4
High level of meter penetration	5
Sewage treatment and sludge	3
Location	
Regional salaries and construction costs	8
Regional power costs	4
Debt	5
Coastal sewage treatment works	2
Traffic congestion	2
Burst rate	2
Location (other)	2
Welsh language obligations	1
Size and number of assets (including rurality)	3
Company size (small companies)	2
Accounting for depreciation	1
Impact of large industrial customers on the econometric models	2
Total operating expenditure	**63**
Capital maintenance expenditure	
Shared water resources	1
Water treatment	1
Tight ammonia discharge consent	1
Number of meter replacements	1
High seasonal tourist population	1
Regional price adjustment	9
Impact of reservoir safety	1
Impact of coal mining	1
Company size (small companies)	2
M6 toll road	1
Total capital maintenance expenditure	**19**

Figures 7a and 7b show the impact that our adjustment for special factors has had on companies' relative efficiency bands for 2003-04. The graphs show the number of companies who have moved from their banding before special factor adjustments. For water service operating expenditure, we have improved our banding assessment of one company's relative efficiency by two efficiency bands. All the other changes are movements of one band only.

Figure 7a Impact of special factors on operating expenditure relative efficiency bands

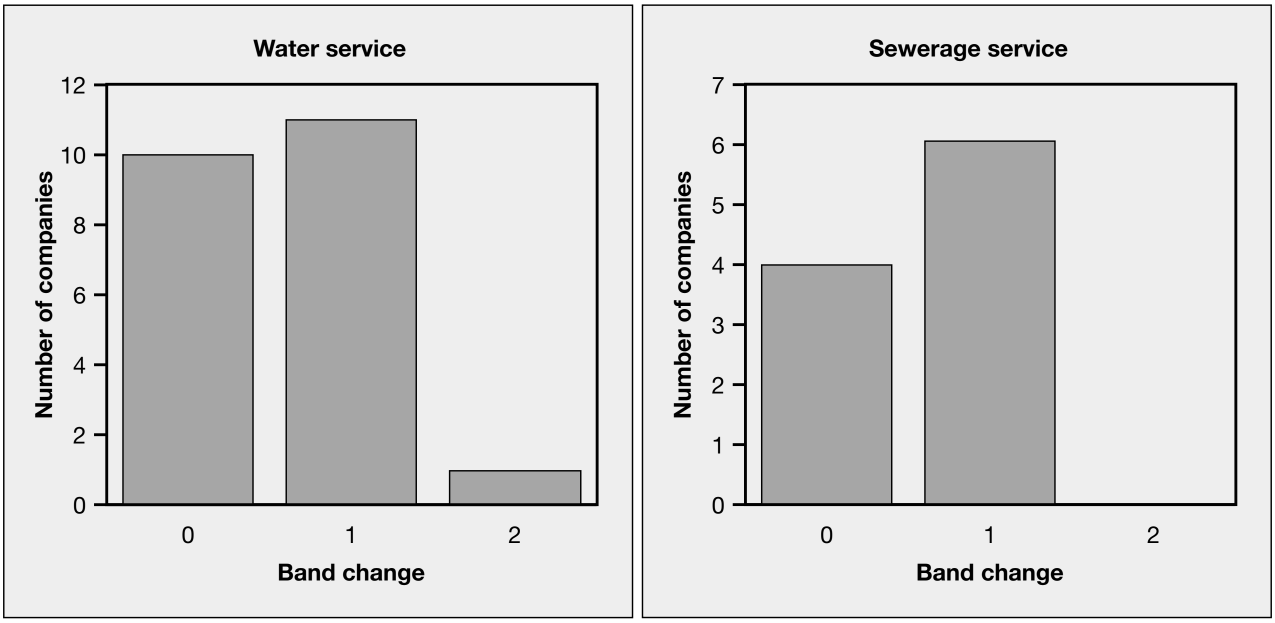
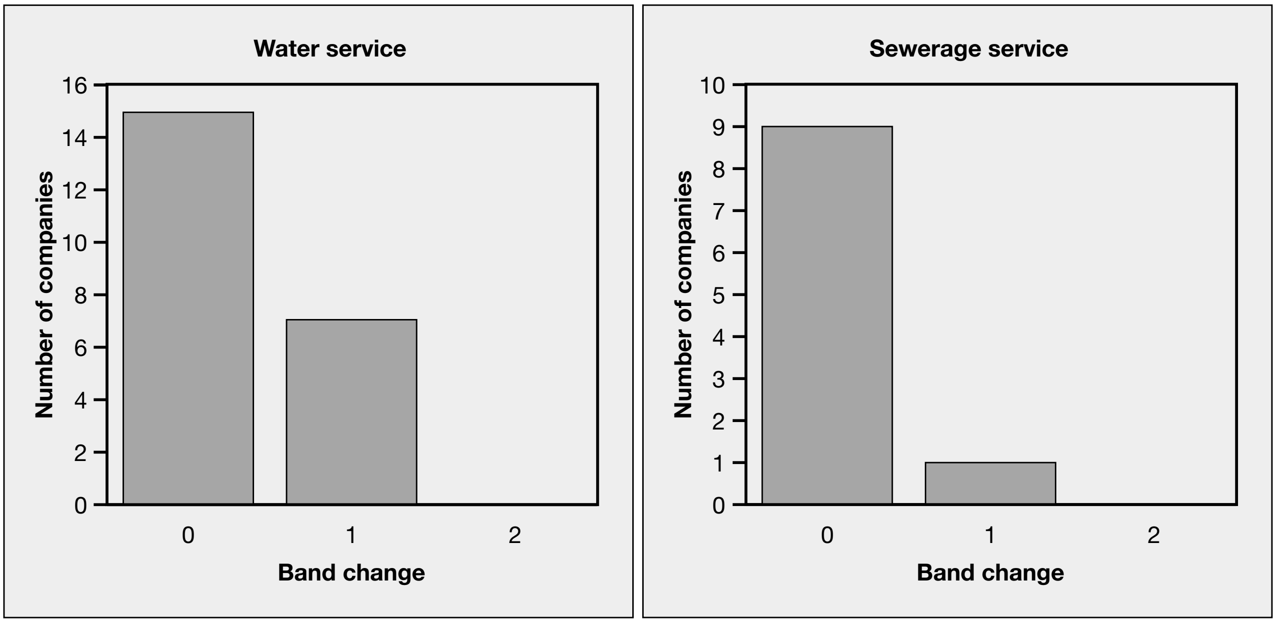


Figure 7b Impact of special factors on capital maintenance relative efficiency bands



Capital maintenance regional price adjustment

Ten companies claimed that their capital maintenance costs were higher because of their location. Their claims included the effects of regional salaries, labour, engineering and construction costs. We have reviewed these claims and we have carried out an assessment of the factors that might influence regional differences in capital maintenance costs. We have concluded that regional differences in construction prices affect a significant proportion of capital maintenance costs.

Capital maintenance includes a significant element of construction-related activities. Independent national statistics for building and construction prices by region are available and these have enabled us to prepare an assessment of the claims that is independent of individual company cost data. We have made adjustments for companies operating in regions that the national statistics show have significantly above average costs.

Our assessment is based on a study of building and construction cost indices (including the effects of labour) published by the BCIS and DTI. The results of our analysis support nine of the ten claims. The adjustments we made to our efficiency analysis are based on the results of this assessment. In some cases we have made a larger adjustment than requested by the company, in others we have made a smaller adjustment.

There is no specific information published on the regional costs of the water industry for capital maintenance. We have used the most appropriate indexes available to us to inform the calculation of this adjustment. The BCIS data on location factors is our primary source of information for regional prices. This provides an index with a large number of regions and locations that we can allocate to company areas. The index published by the DTI is based on only eight districts that do not correspond to company areas. We have used this information as a check on the BCIS information. Some companies also used the BCIS and DTI data to support their claims for variations in regional costs.

The BCIS index covers a total of 13 regions of the United Kingdom. These regions are further split into a total of 68 areas. We have removed Scotland, Northern Ireland and the Channel Islands from the BCIS index to give an index for England and Wales, leaving a total of 55 areas. There is some mismatch between company supply boundaries and the areas used in the BCIS index. We have used data from the 2001 Census to calculate a proportion of each BCIS area covered by each company supply area. There is a large spread in the index for each England and Wales region; for example the South East (including Greater London) ranges from an index of 1.02 (Oxfordshire) to 1.21 (London postal districts). We do not, for example, assume that the cost of all the work carried out by Thames Water within the Oxfordshire area is 21% above the national average as this would be over-estimating the adjustment. Neither do we assume that the cost of this work is only 2% greater than average. This would significantly underestimate the adjustment as only a small proportion of Thames Water's supply area is within Oxfordshire.

We have used the adjusted BCIS index for England and Wales to derive two sets of indices with an index for each company. The first based on the 22 water supply company areas and the second on the ten sewerage service areas. Using these company specific indices, we have calculated a regional price factor for each company. We have done this by comparing each company's index with the weighted average of the indices of the remaining companies. We use the regional price factor for each company to calculate the cost allowances we have made for each company.

For the small water only companies we have made an additional adjustment to their allowance. This is to take account of the size of the company in relation to their location within the area for the BCIS index. For small companies where their operations are concentrated in areas that are likely to have a regional index at the higher end of the range presented by BCIS, we have made an additional allowance. We have increased the regional price factor by the percentage difference between the area average and the upper limit of the BCIS range. We have applied this additional allowance to three small companies.

The assessment process is summarised in figure 8.

Our work shows that for one of the ten companies claiming additional costs due to location their case was not justified. Our results indicated that for the remaining nine companies there was overall scope for regional price variation factors of between 4% and 18% compared with the England and Wales average. Not all of this adjustment is relevant to capital maintenance activity. We make adjustments for regional costs to both our capital maintenance econometric assessment and the cost base assessment in different ways. We explain the application of this below.

Cost base assessment – regional price adjustment

We have reduced the standard costs submitted by the companies to allow for the effect of regional variations in costs for nine companies. We make this adjustment to their standard costs prior to selecting benchmarks. We apply the adjustment to the typical construction and supervision elements of each standard cost. Table 20 shows the proportion of cost base standard costs to which we apply the regional price adjustment. We do not consider that the remaining proportion of standard costs varies because of regional price effects.

Table 20 Percentage of cost base standard costs that attract a regional price adjustment

	Cost base element	%
Water infrastructure	Water mains	72
	Communication pipes	80
Water non-infrastructure	Water treatment works – surface	57
	Water treatment works – ground	67
	Pumping stations	19
	Service reservoirs	100
	Meters	50
Sewerage infrastructure	Sewers	88
	Combined sewer overflows	80
	Self-contained units	70
Sewerage non-infrastructure	Pumping stations	21
	Treatment works	62

Econometric assessment – regional price adjustment

We use the same principles in applying the regional price adjustment to the econometric assessment as for the cost base standard costs. Table 21 identifies the proportion of costs that are subject to a regional price adjustment. We apply these proportions according to each company's profile of expenditure projections.

We apply special factors to our capital maintenance econometric assessment after adjustment for leakage allocation and the future expenditure adjustment.

Table 21 Percentage of expenditure that attracts a regional price adjustment for econometric assessment

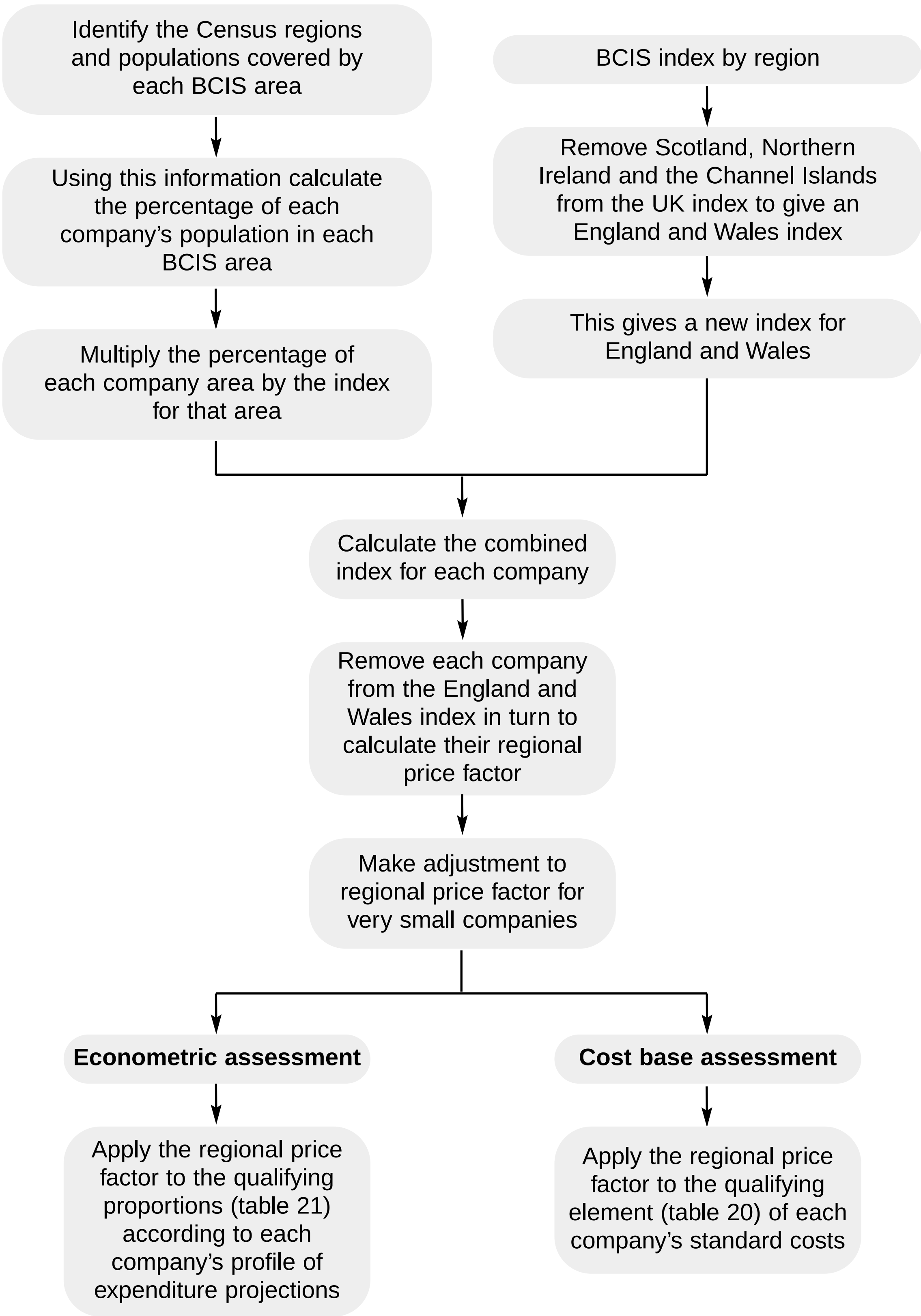
Water service

Expenditure area	%
Water resources	100
Water treatment works – surface	57
Water treatment works – ground	67
Storage	100
Pumping stations	19
Potable mains	72
Communication pipes	80
Meters	50
Management and general	80

Sewerage service

Expenditure area	%
Sewers	88
Sewer structures	80
Sewage pumping stations	21
Sewage treatment – preliminary	100
Sewage treatment – primary	100
Sewage treatment – secondary	62
Sewage treatment – tertiary	62
Sea outfalls	100
Sludge treatment and disposal	60
Management and general	80

Figure 8 Flow chart for the assessment of the affect of regional prices for construction



Appendix 2: Capital maintenance efficiency – econometric assessment

The capital maintenance relative efficiency assessments included in chapters 3 and 4 are based on a combination of our econometric and cost base analysis. We explain this approach in chapter 2. In this appendix we give the capital maintenance relative efficiency assessments based solely on the econometric models and unit cost comparisons. These are set out in tables 23 and 24. We have included these so comparison of this approach can be made back to 1997-98. Our assessments include adjustments for leakage expenditure, which we explain in chapter 3, special factors, which we explain in appendix 1, and a future expenditure adjustment, which we explain in this appendix.

We currently use a six-year average of expenditure over the period 1998-99 to 2003-04 in our econometric modelling. This takes account of annual variations in capital maintenance expenditure and ensures that the explanatory variables are independent of modelled expenditure. The longer the period of expenditure we consider for the modelled average, the smaller the impact of peaks or troughs on the average. Some companies feel that the current six-year average is not long enough to remove this impact.

A company that has proportionally spent large sums of money on the maintenance of its assets in the past and is projecting reduced expenditure in the future may believe that our efficiency target based solely on historical information is too tough. This is because it would have a high efficiency target going forward applied to a low future spending profile. The reverse is also true. A company that has spent little on its assets in the last six years may look efficient based on the econometric models. Due to the time lag between insufficient maintenance and a detectable deterioration in serviceability, this lack of activity may not be apparent, especially in long-life infrastructure assets. If this company's spending for 2004-05 to 2009-10 increases it would have a low efficiency target applied to its higher spending profile. Some companies, which are a significant way towards fully implementing the common framework, did not accept the existing method of calculating the econometric element of capital maintenance efficiency targets.

To address these issues we have introduced an adjustment for future expenditure within the 2003-04 capital maintenance econometric relative efficiency assessment. This allows us to extend the average expenditure period before relative efficiency targets are calculated, therefore smoothing out the effect of lumpy expenditure.

We base the adjustment on companies' 2004-05 projections of capital maintenance expenditure taken from their final business plans and our assessment of capital maintenance needs for 2004-05 to 2009-10 as published in our final determinations. We combine this with the last six years' modelled expenditure (after leakage adjustments) to calculate a 12-year average, from 1998-99 to 2009-10, therefore reflecting both actual and projected spend equally. This provides an even balance between what companies have actually spent and their needs for the next price limit period.

The difference between the 12-year average and the 6-year average modelled expenditure (1998-99 to 2003-04) equals the value of the adjustment. We make this adjustment prior to applying special factors and calculating relative efficiency bands. Figure 9 shows an illustration of this calculation for a company that has lower future expenditure than the historic average. In this example the adjustment reduces the average expenditure by £5 million.

Figure 9 Illustration of future expenditure adjustment

£m	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	Total
Modelled expenditure (June return less leakage expenditure)	110	125	105	115	100	105	–	–	–	–	–	–	660
Company projected 2004-05 and Ofwat assumptions for 2005-06 to 2009-10	–	–	–	–	–	–	100	90	95	95	110	110	600
Actual and projected expenditure	**110**	**125**	**105**	**115**	**100**	**105**	**100**	**90**	**95**	**95**	**110**	**110**	**1,260**

1998-99 to 2003-04 average modelled expenditure after leakage reallocation adjustments	**£110m**
2004-05 to 2009-10 average projected expenditure	**£100m**
12-year average expenditure 1998-99 to 2009-10 ([100+110]/2)	**£105m**
Value of adjustment (difference between 12-year average and 6-year actual average) [105-110]	**£-5m**

This adjustment will have different effects for each company depending on its spending profile over the 12-year period. A company with projected lower spending in 2004-05 to 2009-10 than in 1998-99 to 2003-04 receives a negative adjustment. It will then move closer to the benchmark. This may also result in an improved efficiency band. The reverse is also true. A company with lower spending for the last six years compared with 2005-06 to 2009-10 receives a positive adjustment. It will then move away from the benchmark and may move down the efficiency bands.

We publish efficiency relative efficiency bands based on 10% intervals from the benchmark. For price setting we split each of these bands in two and use these assessments of relative efficiency to derive our catch-up efficiency factors. Table 22 shows the movement in companies' 5% bands resulting from the future expenditure adjustment. Over half of the companies do not change band as a result of this adjustment.

Table 22 Effect of future expenditure adjustment on capital maintenance econometric efficiency

Number of 5% band changes	Number of companies (water)	Number of companies (sewerage)
+3	1	0
+2	0	0
+1	2	1
0	**13**	**7**
–1	4	2
–2	2	0
–3	0	0

Table 23 Relative capital maintenance efficiency bands and ranks based on econometric analysis – water service 2003-04

Water and sewerage companies	Capital maintenance efficiency – econometrics only Band A to E	Capital maintenance efficiency – econometrics only Rank 1-22
Anglian	B	15
Dŵr Cymru	B	17
Northumbrian	A	7
Severn Trent	B	14
South West	B	12
Southern	C	20
Thames	A	4
United Utilities	B	18
Wessex	C	22
Yorkshire	A	8
Water only companies		
Bournemouth & W Hampshire	A	5
Bristol	B	11
Cambridge	A	2
Dee Valley	C	21
Folkestone & Dover	A	3
Mid Kent	C	19
Portsmouth	A	1
South East	A	10
South Staffordshire	A	9
Sutton & East Surrey	B	16
Tendring Hundred	B	13
Three Valleys	A	6

Table 24 Relative capital maintenance efficiency bands and ranks based on econometric analysis – sewerage service 2003-04

Water and sewerage companies	Capital maintenance efficiency – econometrics only Band A to E	Capital maintenance efficiency – econometrics only Rank 1-10
Anglian	A	2
Dŵr Cymru	A	6
Northumbrian	A	4
Severn Trent	B	7
South West	B	8
Southern	D	10
Thames	A	5
United Utilities	C	9
Wessex	A	3
Yorkshire	A	1

Appendix 3: Capital works unit costs in the water industry

2004 periodic review process

Development of the cost base approach for the 2004 periodic review began in April 2002. Companies provided their initial cost base reports to us in March 2003 and most followed this with an optional submission in their draft business plans in August 2003. All companies provided their final cost base reports in their final business plans in April 2004. This provided the base data for the assessment of the cost base.

Throughout this period, the process of compiling, auditing and reviewing cost base information has remained consistent. The process we undertook is summarised as follows.

Companies submit their cost base reports containing as many standard costs as they are able to and a breakdown of their projected capital investment programme for the period 2005-10.

- Reporters review and audit the companies' reports.
- Our independent consultants review both company and reporter submissions for consistency and comparability, raising queries where appropriate.
- Our consultants select benchmark companies for standard costs or groups of standard costs.
- We enter each company's data into our cost base model to generate the overall catch-up efficiency factors by weighting:
  - the gap between the company's cost and the benchmark cost; and
  - the proportion of expenditure forecast for that standard cost.
- We publish the results of our analysis and provide each company with detailed company specific feedback on their cost base results.

At each stage of the cost base analysis, we kept companies informed of developments in the approach and in particular, the judgements and decisions we have taken that have affected our assessment of their relative efficiency. Companies have told us they welcome the greater level of openness and transparency during our analysis of cost base for the 2004 periodic review. We plan to continue this for the next periodic review.

Standard costs and specifications

As for previous cost base submissions, the underground standard costs refer primarily to the costs of laying new mains and sewers. We assume that these also reflect the costs of replacing mains and sewers. We require companies to submit costs that are typical of situations where adverse conditions and complications are not material.

For above-ground assets, our specifications aim to remove as many of the factors as possible that would result in site-specific differences, so that we can make fair comparisons between companies' costs. For example, our definitions refer to greenfield sites with no complications. In reality of course, projects have many site-specific factors which would increase the actual unit costs above the standard cost provided for the purposes of the cost base. We ask companies to provide their estimates of these stylised projects based on known actual costs but with the impact of such site-specific factors excluded.

Population of standard costs

The final business plan cost base reporting requirements contained 124 individual standard costs of which 71 relate to the water service and 53 relate to the sewerage service. At a total industry level, companies were able to compile unit cost estimates for 72% of these costs. This is a slight increase on the proportion of standard costs provided for the 1999 periodic review.

Engineering judgement grades

We use engineering judgement grades (EJGs) to assign both a reliability and accuracy grade to each individual cost. A grade of A1 indicates that the cost is based on accurate company specific data relating to an activity that the company has considerable experience of, whereas a grade of D4 is based on international or notional estimates with no company experience of that activity.

In the information requirements we state that we expect engineering judgement grades of B3 or better. This grade indicates that standard cost estimates are mainly based on company specific data and the estimates are to within +/- 30% of the likely costs of carrying out such a standardised project.

Generally, companies were able to meet this requirement. Table 25 confirms that only 5% of the costs submitted were assigned an EJG worse than B3.

Table 25 Distribution of engineering judgement grades

A1	A2	A3	B1	B2	B3	Below B3
14%	28%	4%	2%	34%	13%	5%

Most companies submitted costs based on reliable data derived from actual company experience in capital works and were accurate to within +/- 20%.

Reporters' independent scrutiny of the standard costs

Reporters subject companies' cost base reports to effective and focused scrutiny. The reporters are independent consultants who review the companies' reports and confirm or otherwise the compliance with the guidance and specifications.

We asked reporters to concentrate their reporting on:

- the extent to which companies have followed the specifications and guidance;
- the degree to which the data sources and methodology used by the companies to compile standard costs, was the same as that being used to compile investment projections for the final business plans;
- company claims for company specific factors;
- the accuracy of the standard cost estimates as reflected in assigned EJGs; and
- the independence of the company estimates.

Independent review of companies' submissions to provide specialist advice on the cost base

We appointed a specialist team of independent consultants from the Babtie Group after a competitive process. They carried out a detailed assessment of both the companies' submissions and reporters' reports. Having provided expert technical and costing advice on the cost base at previous price reviews, the Babtie Group have built up extensive knowledge and experience of the cost base approach and methodology.

The role of the Babtie Group was to carry out a detailed, fully auditable and independent assessment of the companies' submissions. Using information contained in the submissions and the associated reporters' reports, we asked the Babtie team to verify that:

- companies' standard costs were comparable, by checking that they complied with our specifications and guidance included in the information requirements;
- standard cost data sources were consistent with companies' capital investment proposals; and
- the selected benchmark companies were robust for each standard cost.

Babtie Group confirmed that the selected benchmarks were consistent with the cost base information requirements. This role is important to ensure that we can apply the cost base results to the companies' capital investment proposals in a fair and consistent manner.

Query process

Overall, the quality of the submissions provided by most companies and the commentaries provided by reporters on the cost base submissions was acceptable. The majority of companies submitted costs in accordance with the specifications and guidance issued. However, there have been mistakes in the submissions from a failure to follow the guidance, the cost descriptions or to properly complete the checklists. We needed to issue many queries to companies and reporters seeking their clarification to confirm:

- the consistency of standard costs with the specifications;
- the consistency of standard costs with companies' future capital investment plans;
- the reasons for not submitting costs; and
- the appropriateness of assigned EJGs.

We received satisfactory responses to the majority of the queries we issued and where appropriate, we incorporated these in the results of our analysis. Where we were not satisfied with the range of costs submitted we have excluded them from the analysis, and a list of these is provided in table 26.

Ensuring comparability between companies: levelling the playing field

We issued queries about incorrectly completed checklists, inconsistencies with the information requirement document, actual or apparent errors and inadequate return of standard costs. We considered the issue of a query was sufficient to give the company the opportunity to rethink its submission and its response was assumed to represent a considered final decision. In cases where the responses did not fully address the issues raised, we applied the following rules.

- Where the company response to a query was not modified by the reporter, we accepted the company position (change of original submission costs or otherwise) as the final figure whether or not it was fully compliant with the information requirements. Where there still appeared to be material non-compliance, we did not consider the standard costs in the benchmark selection process.

- Where a company acknowledged an omission or error in its submission but stated that the potential impact was within the tolerance of accuracy quoted (the EJG) and did not amend its costs, we accepted the submission without adjustment.
- Where a company provided a new submission but acknowledged an error in the revised figures without actually correcting it, we accepted the revised figures without further adjustment.
- Where the reporter disagreed with an original or amended company submission and provided an alternative figure or an adjustment percentage, we used the reporter's figure to adjust the company standard cost. We have advised companies of the figure used in their company specific feedback.
- Where the company response was to acknowledge non-compliance and state that it does not propose to make a correction, we accepted the submitted costs but excluded these from the benchmark selection process. Similarly, where it appeared that a company had based its costs for water and sewerage non-infrastructure on an inadequate or incomplete process train, we also excluded the costs from the benchmark selection process.
- Where company standard costs represented extreme outliers (whether high or low compared to other standard costs) and there was no adjusting response to a query, we excluded the figures from the benchmark selection process.
- Where the EJGs in the company submission appeared inconsistent with the specification in tables 1 and 2 of the cost base information requirements, we revised the EJGs to bring them in line with the specification, whether or not the reporter had raised this as an issue. We based the benchmark selection process on the revised EJGs.

Following receipt and review of responses to the questions, we adjusted the original standard costs to take account of any revised submissions by the companies and/or adjustment proposed by the reporters. We did not substitute for the company's original submission figures unless advised of a change by the company or the company's reporter. Generally, we adjusted the EJGs in a similar manner.

Company specific factors

A number of companies proposed company specific adjustments to their costs on the grounds that their construction, tender and labour costs were higher than other companies due to their location in the south of the country, particularly areas in and around London.

To assess these claims, we carried out a study of building and construction cost indices (including the effects of labour) published by the BCIS and DTI. The results supported the majority of the claims made and we have allowed a significant proportion of the cost adjustments that companies sought. We did not allow claims where the results of our analysis did not support a company's claim.

In light of one company's representation, for our final determinations we revised our analysis of these indices by modifying the way we calculate each company's regional variance.

Our results indicated that for these companies there was overall scope for regional price variation factors of between 4% and 18% when compared with the England and Wales average. We therefore made downward adjustments to these companies' standard costs in order to improve their comparability with others, prior to selecting benchmarks and assessing relative efficiency.

We applied these overall regional price factors to the typical civil construction, plant installation and supervision elements of each standard cost, which gave us the company specific regional price adjustments. These adjustments ranged from 0.8% to 17.5% for the water service and from 1.7% to 15.7% for the sewerage service.

This is the only company specific factor included in the cost base.

Benchmark selections

Our benchmark selection process builds on the cost base method used for the 1999 price review. We chose benchmark companies for each standard cost or group of standard costs based on the lowest reported cost, provided it complied with the following criteria:

- the standard cost(s) used to derive the benchmark materially complied with the standard cost specification;
- at least 3% of the industry (measured in terms of turnover) reported unit costs at or below the selected benchmark standard cost;
- the standard cost was sufficiently robust to warrant an EJG of B3 or better (mostly B2 or better);
- the chosen benchmark company's final business plan indicated significant investment planned for the type of activity represented by the standard cost; and
- our consultants, Babtie Group, independently endorsed the relevant benchmark.

Where possible, we chose a single benchmark company for groups of standard costs for the same activity, for example we used a single company's costs as the benchmark company for all 18 sewer laying activities even though their costs were not necessarily the lowest reported cost in each particular size band.

We did not consider for benchmark selection those standard costs identified as likely to be materially non-compliant with the specification or subject to adjustment following an inadequate or nil response to a query.

Overall, Babtie Group were satisfied that the selected benchmarks were representative of the lowest reported standard costs and were consistent with the cost base reporting requirements and the criteria within our assessment process as noted above.

Standard costs omitted from the analysis

We omitted 12 individual standard costs from the analysis where there were insufficient number of costs or where, from reviewing the company reports, it was clear that companies were interpreting the specification differently.

Table 26 Standard cost omissions from the analysis

Standard cost description	Number of company costs submitted	Reason for exclusion
Mains rehabilitation – pipe insertion 600 mm (1)	2	Too few standard costs submitted
Sewer laying by pipe jacking – 450 mm and 900 mm in both rural/suburban and urban highways (4)	3	
Sewer rehabilitation by pipe bursting – 225 mm, 300 mm and 450 mm (3)	2	
Sewer rehabilitation – man entry 900 mm (1)	4	Too few costs and/or too wide a variation in price
Additional ammonia removal at existing secondary works, population equivalent 40,000 (1)	8	
New enhanced sludge treatment facility, throughput 2 ttds per annum (1)	4	
Extension to existing conventional sludge treatment facility, additional throughput 1 ttds per annum (1)	3	

Substitution of industry averages

For some companies (mainly the water only companies), the number of water non-infrastructure costs submitted was low. These companies stated that most of the non-infrastructure standard costs included in the cost base had either not featured in their previous capital programmes, were unlikely to reflect the type of investment planned for the period 2005-10, or did not reflect the nature of their asset bases. As a consequence, some of these companies did not have the cost information available or experience to be able to derive standard cost estimates for these works and would therefore be reliant upon contractor quotes or nationally derived data from the water industry capital cost estimating system managed by the Water Research Centre (WRc) asset management group.

We acknowledge the inherent difficulty in selecting a reasonable range of standard costs that the majority of companies are able to cost. However, where company submissions did not comply with the information requirements guidance with regard to the standard costs submitted, it was necessary for us to substitute industry averages for some standard cost items, in order to ensure that we avoided generating unrepresentative catch-up factors for these companies.

For this purpose, we calculated industry averages using standard costs with an EJG of B3 or better. Where appropriate, we included industry average costs for the water only companies. We calculated average costs using water and sewerage company costs for the water and sewerage companies.

We decided to substitute average standard costs depending on whether a company was projecting investment in a particular asset type for which no (or only one or two) costs have been submitted.

We based our rationale for deciding which standard cost averages we should include on:

- the nature of the company's asset base;
- the detailed project information contained in the company's capital project data base included in its final business plan; or
- whether the company provided a standard cost at the 1999 periodic review.

Weighting methodology

We derived the catch-up improvements using unit costs submitted in the cost base in a two-stage process:

- calculating the adjustment for each standard cost; and
- weighting this adjustment with forecast capital investment for the next price limit period.

We describe these stages in more detail below.

Stage 1 – calculating the adjustment

In stage 1 we generated an adjustment for each standard cost submitted based on:

- the gap between the company's submitted cost and the chosen benchmark; and
- the scope to reduce this gap.

For the purposes of generating catch-up efficiency improvements from the cost base submissions for capital maintenance, we assumed that there is scope for companies with the highest cost to catch up 50% of the gap between them and the benchmark company. For capital enhancement, we assumed a 75% catch up to the benchmark companies. This is consistent with our policy development for this periodic review. Table 27 below is an extract from our model for the first stage of the analysis and is based on mains laying 200 mm in grassland.

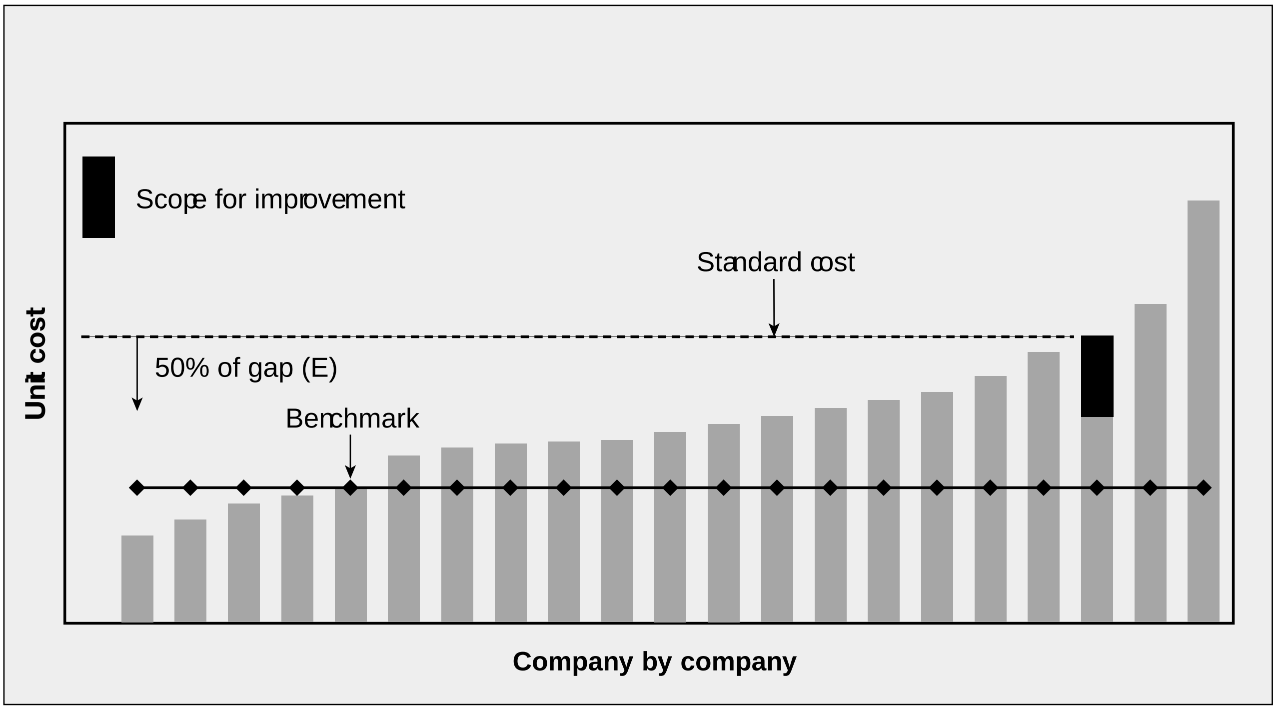
Table 27 Calculating the adjustment for each standard cost

A Standard cost	B EJG	C Chosen benchmark	D Gap (A-C)/C	E Catch-up expected	F Scope for improvement (A-C)*E	G New revised cost (A-F)	H Scope as a % of original standard cost (F/A)
£50/m	A2	£41/m	22%	50%	£4.5/m	£45.5/m	9%

In this example, the company's submitted cost is £9/m higher than the chosen benchmark of £41/m. We expect this company to be able to catch up half of this difference and therefore reduce its cost to £45.5/m. For this particular cost we took a 9% adjustment forward to be mapped against projected investment relative to this standard cost.

Figure 10 illustrates a typical histogram presentation of submitted standard costs included in stage 1 of the analysis. In this example, 21 companies submitted a standard cost and these varied by a ratio of 2 to 1 between the highest and lowest cost. This is quite typical. Following expert review and audit, we chose the fifth lowest cost as the benchmark cost. We expect those companies with costs above the benchmark to be able to catch up 50% of the gap between their cost and the benchmark.

Figure 10 Typical standard cost histogram



We derive adjustments for each submitted standard cost for each company. The standard cost histograms at the end of this appendix summarise the results of this stage of the analysis.

Where a company's submitted cost is below the chosen benchmark then we take no adjustment forward into the weighting analysis (stage 2).

Stage 2 – weighting the adjustment

In stage 2 of the analysis we mapped the adjustments for each standard cost against the companies' indicative forecast proportions of capital investment attributed to particular asset types, ie mains, sewers, treatment works, pumping stations, etc. The capital investment forecasts contained in companies' submissions include investment across all purpose categories, ie both capital enhancement and capital maintenance. These forecasts represent the company's best estimate of the capital programme for the next price limit period.

We validate the data to ensure that the range of costs submitted relates to the asset base and the breakdown of capital investment forecast by each company.

For infrastructure assets, in order to map the adjustments derived in stage 1, we calculate the proportion of infrastructure expenditure that is attributed to each individual standard cost. This utilises three items of information, namely:

A **Proportions of stock** according to size and breakdown taken from companies' Asset Inventories submission in their final business plan.

B **Forecast proportions of mains/sewer expenditure by project type and location** taken from the cost base submission.

C **Forecast proportions of water/sewerage service expenditure by asset type** taken from the cost base submission.

Worked example

Focusing on water infrastructure, the calculation required to yield the proportion of water infrastructure expenditure attributed to each standard cost is as follows:

$$\frac{\%\text{ of mains stock} \times \%\text{ of mains investment} \times \%\text{ water service for potable mains}}{\%\text{ of total water infrastructure investment}}$$

For mains laying 200 mm in grassland, the values are:

$$\frac{15\% \times 40\% \times 50\%}{60\%} = 5\%$$

From this example, we see that 15% of the company's total length of potable mains relates to mains of a nominal bore up to 200 mm. The company is estimating that 40% of its total mains investment will be spent on laying mains in grassland locations and that 50% of its overall water service investment will be spent on potable mains. We then express the product as a proportion of the total water service investment programme forecast on infrastructure assets, ie mains and communication pipes. The overall result is an allocation of 5% to mains laying 200 mm in grassland.

We then map this proportion of investment with the adjustment from stage 1. This yields a weighted adjustment that contributes to the overall catch-up improvement factors as shown in table 28.

Table 28 Mapping standard cost adjustments

	Scope as a % of original standard cost (ie stage 1 adjustment)	% of investment attributed to each standard cost	Weighted adjustment for each standard cost
Mains laying			
200 mm	9%	5%	0.45%
Standard cost 2	4%	8%	0.32%
Etc...			
Etc...			
Total		100%	4.3%

We then calculate the overall catch-up improvement by taking the total sum of the weighted adjustments as a proportion of the total investment attributed to all standard costs. In this example the catch-up improvement is therefore 4.3%.

For non-infrastructure standard costs, we take a similar but simplified approach to weighting the adjustments with the forecast proportions of investment. Specifically, we average the percentage adjustments for each standard cost from stage 1 for each asset group, for example water/sewage treatment and pumping stations, and weight these against the associated forecast proportions of investment.

We calculate cost base catch-up improvement factors for four areas of capital investment, water and sewerage infrastructure and water and sewerage non-infrastructure. We consider this method provides a reasonable assessment of the scope for catch-up improvements in efficiency to be assumed when considering companies' capital investment projections to be included in price limits.

Standard cost histograms

The histograms that follow represent the standard costs submitted by companies in their final business plans in April 2004. The horizontal line on each histogram represents the chosen benchmark cost.

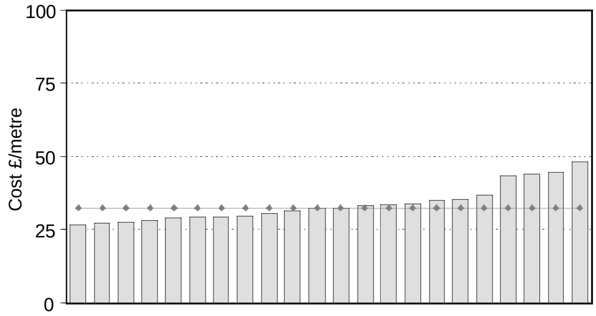
The overall bar height on each histogram represents the standard cost submitted by each company, adjusted for any compliance issues and also including company specific special factor adjustments. Where standard costs are above the benchmark, this implies scope for a reduction in capital expenditure costs equivalent to a proportion of the differences between the submitted cost and the benchmark cost.

Full specifications of each standard cost can be found in part C2 of the 2004 periodic review business plan information requirements, issued on 15 January 2004, which is available on our website (www.ofwat.gov.uk).

Water service – infrastructure

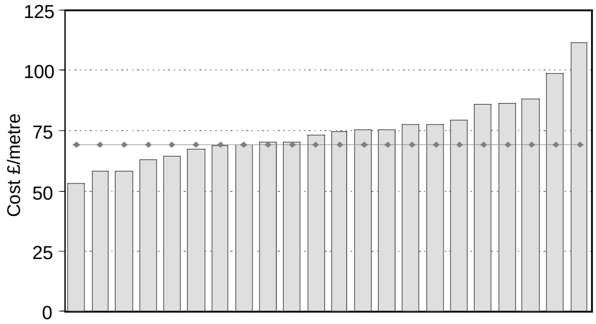
Mains laying – nominal bore 100 mm

Figure 11a Grassland



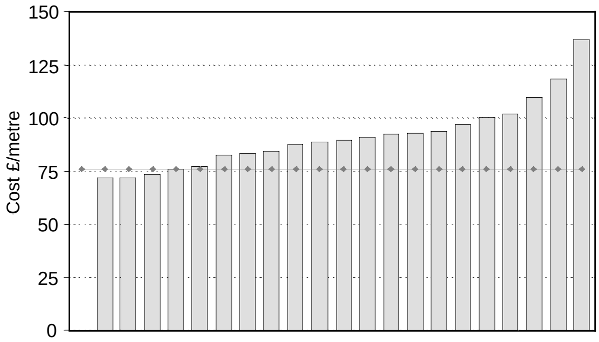
Costs range from £27 to £48 per metre
Chosen benchmark is £33 per metre with an EJG of A2

Figure 11b Rural/suburban highway



Costs range from £53 to £111 per metre
Chosen benchmark is £69 per metre with an EJG of A2

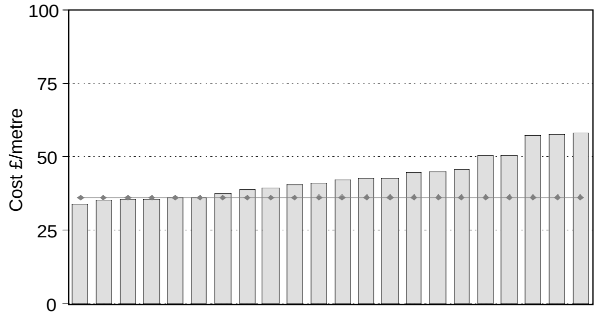
Figure 11c Urban highway



Costs range from £71 to £137 per metre
Chosen benchmark is £76 per metre with an EJG of A2

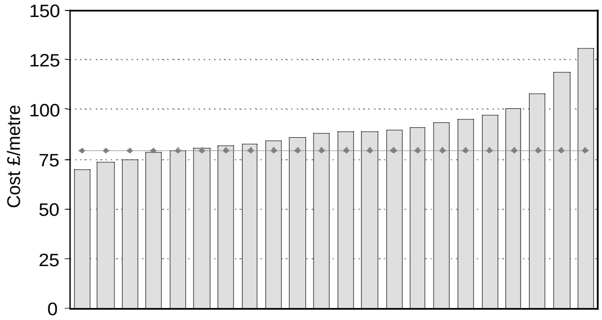
Mains laying – nominal bore 150 mm

Figure 12a Grassland



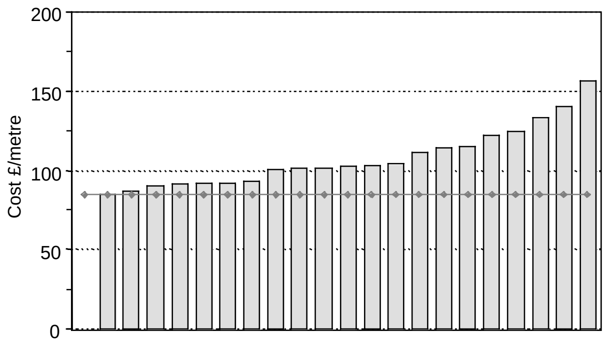
Costs range from £34 to £58 per metre
Chosen benchmark is £36 per metre with an EJG of A2

Figure 12b Rural/suburban highway



Costs range from £70 to £131 per metre
Chosen benchmark is £79 per metre with an EJG of A2

Figure 12c Urban highway

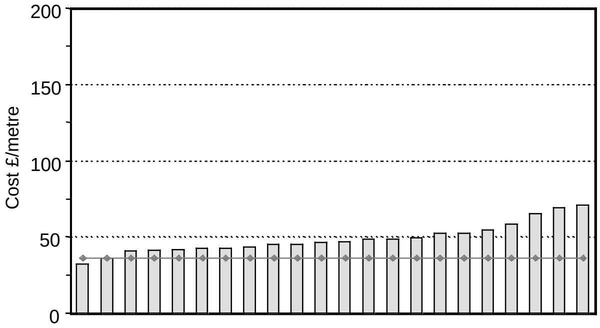


Costs range from £84 to £156 per metre
Chosen benchmark is £84 per metre with an EJG of A2

Water service – infrastructure

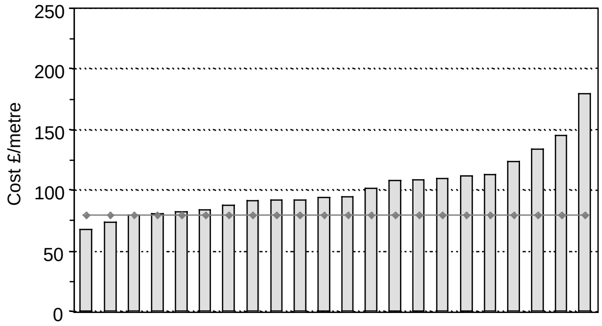
Mains laying – nominal bore 200 mm

Figure 13a Grassland



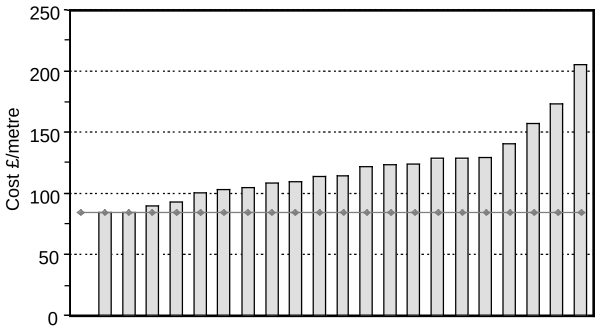
Costs range from £32 to £71 per metre
Chosen benchmark is £36 per metre with an EJG of A2

Figure 13b Rural/suburban highway



Costs range from £68 to £180 per metre
Chosen benchmark is £79 per metre with an EJG of A2

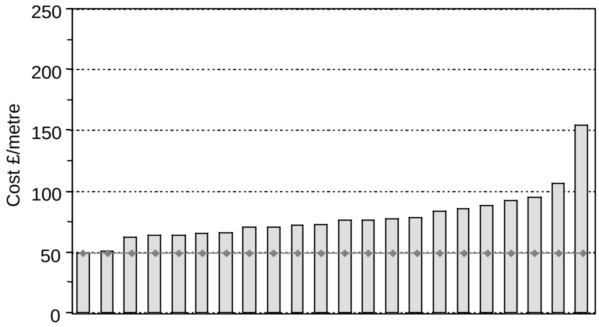
Figure 13c Urban highway



Costs range from £85 to £205 per metre
Chosen benchmark is £85 per metre with an EJG of A2

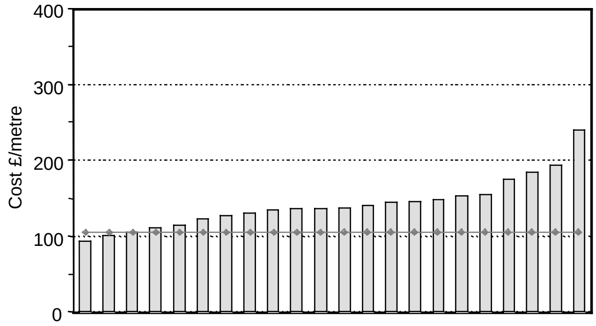
Mains laying – nominal bore 300 mm

Figure 14a Grassland



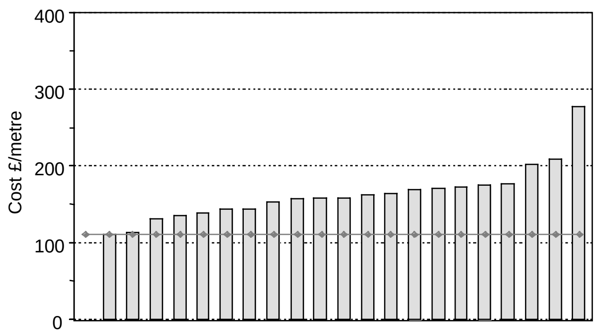
Costs range from £49 to £154 per metre
Chosen benchmark is £49 per metre with an EJG of A2

Figure 14b Rural/suburban highway



Costs range from £93 to £239 per metre
Chosen benchmark is £106 per metre with an EJG of A2

Figure 14c Urban highway

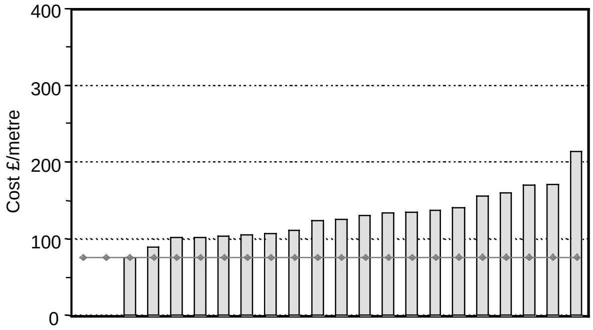


Costs range from £111 to £277 per metre
Chosen benchmark is £111 per metre with an EJG of A2

Water service – infrastructure

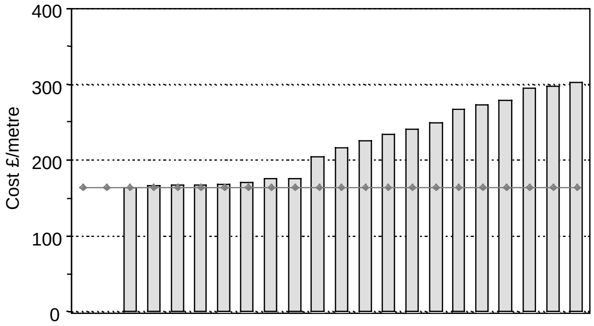
Mains laying – nominal bore 450 mm

Figure 15a Grassland



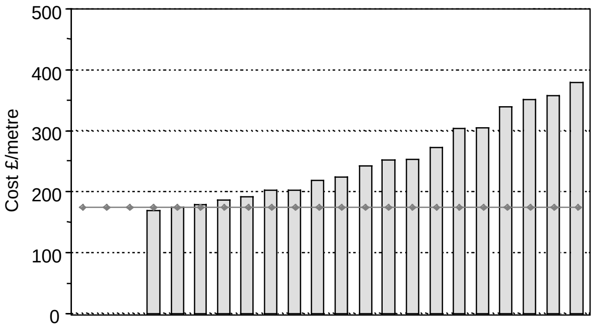
Costs range from £76 to £213 per metre
Chosen benchmark is £76 per metre with an EJG of A2

Figure 15b Rural/suburban highway



Costs range from £165 to £302 per metre
Chosen benchmark is £165 per metre with an EJG of A2

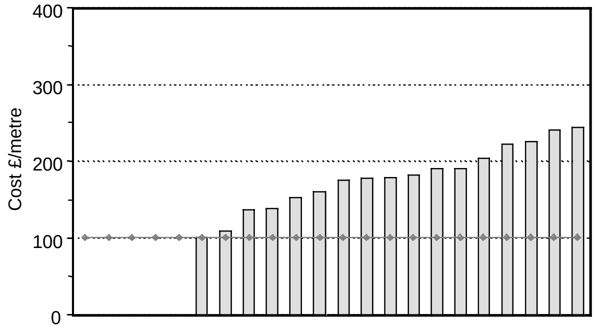
Figure 15c Urban highway



Costs range from £169 to £379 per metre
Chosen benchmark is £175 per metre with an EJG of A2

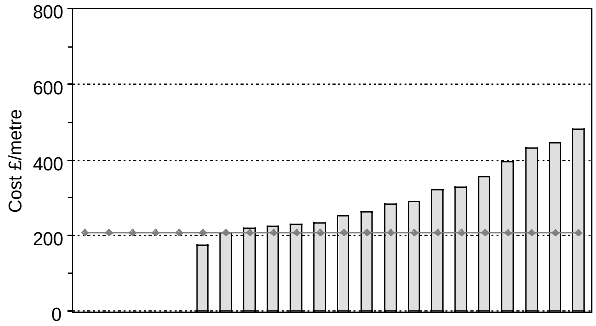
Mains laying – nominal bore 600 mm

Figure 16a Grassland



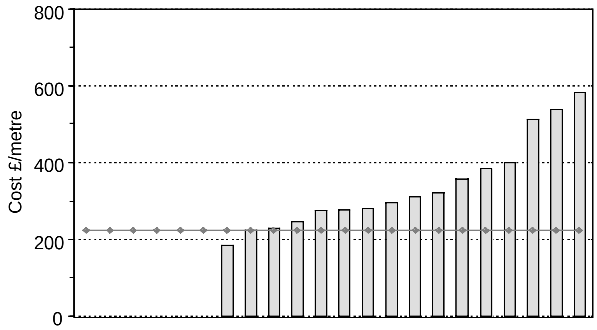
Costs range from £101 to £244 per metre
Chosen benchmark is £101 per metre with an EJG of A2

Figure 16b Rural/suburban highway



Costs range from £175 to £481 per metre
Chosen benchmark is £206 per metre with an EJG of A2

Figure 16c Urban highway

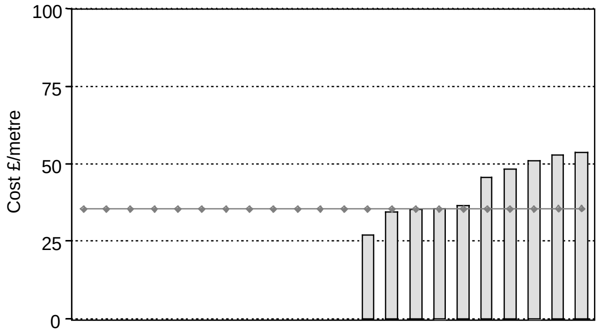


Costs range from £185 to £581 per metre
Chosen benchmark is £223 per metre with an EJG of A2

Water service – infrastructure

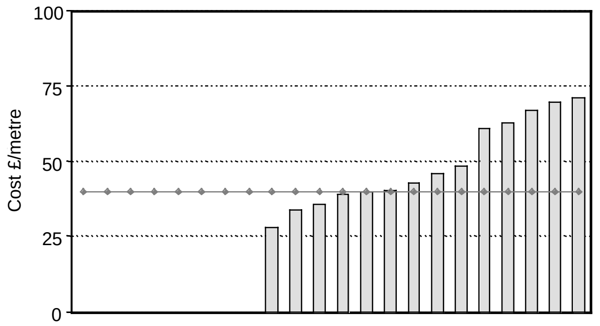
Mains laying by directional drilling – nominal bore 100 mm

Figure 17a Grassland



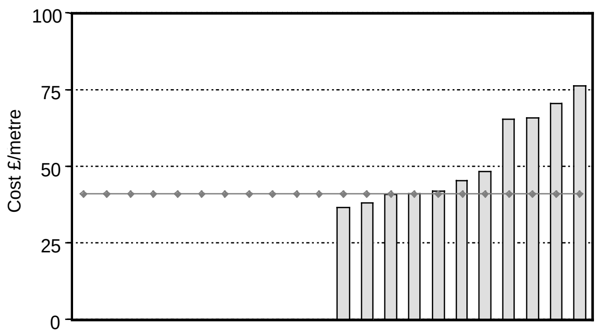
Costs range from £27 to £54 per metre
Chosen benchmark is £35 per metre with an EJG of A2

Figure 17b Rural/suburban highway



Costs range from £28 to £71 per metre
Chosen benchmark is £40 per metre with an EJG of A2

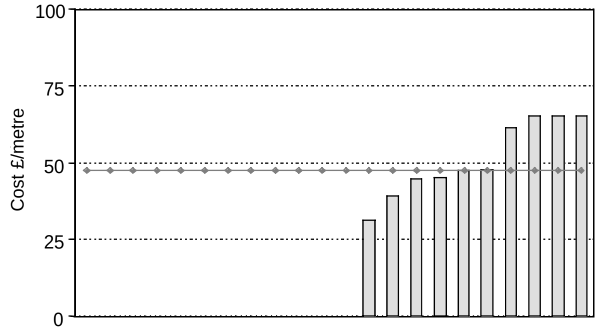
Figure 17c Urban highway



Costs range from £37 to £76 per metre
Chosen benchmark is £41 per metre with an EJG of A2

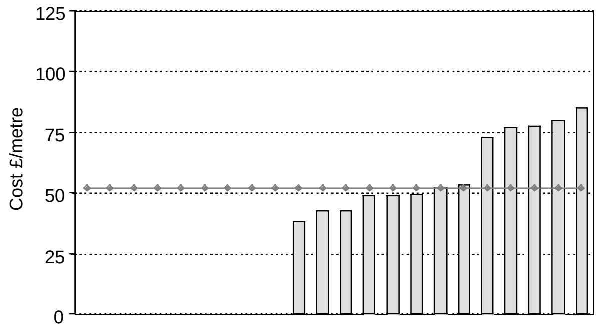
Mains laying by directional drilling – nominal bore 150 mm

Figure 18a Grassland



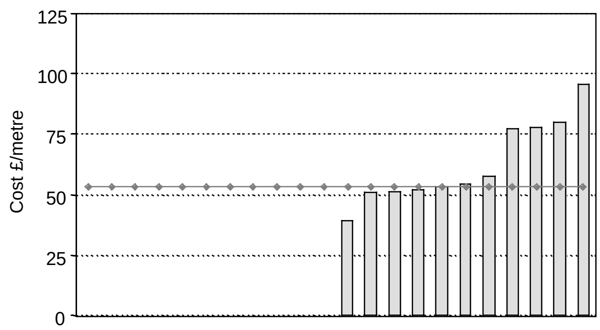
Costs range from £31 to £65 per metre
Chosen benchmark is £47 per metre with an EJG of A2

Figure 18b Rural/suburban highway



Costs range from £38 to £85 per metre
Chosen benchmark is £52 per metre with an EJG of A2

Figure 18c Urban highway

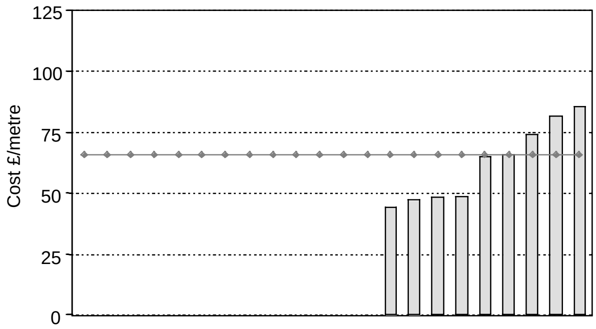


Costs range from £39 to £95 per metre
Chosen benchmark is £53 per metre with an EJG of A2

Water service – infrastructure

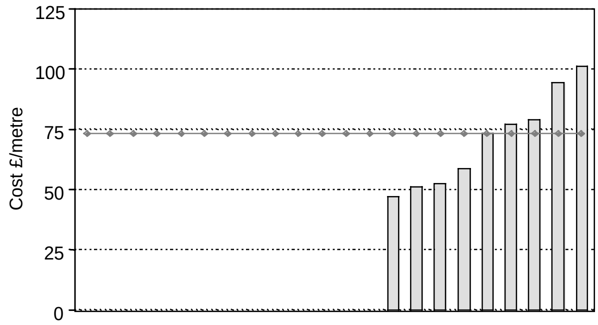
Mains laying by directional drilling – nominal bore 200 mm

Figure 19a Grassland



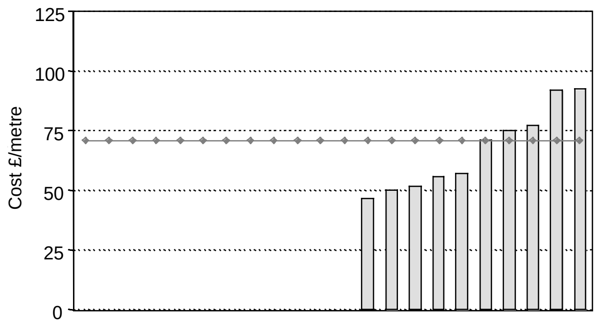
Costs range from £44 to £86 per metre
Chosen benchmark is £66 per metre with an EJG of A2

Figure 19c Urban highway



Costs range from £47 to £101 per metre
Chosen benchmark is £73 per metre with an EJG of A2

Figure 19b Rural/suburban highway

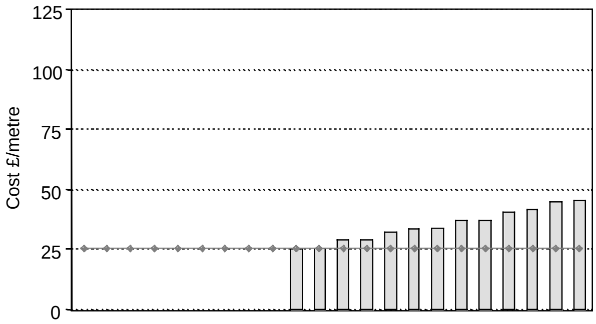


Costs range from £46 to £93 per metre
Chosen benchmark is £71 per metre with an EJG of A2

Water service – infrastructure

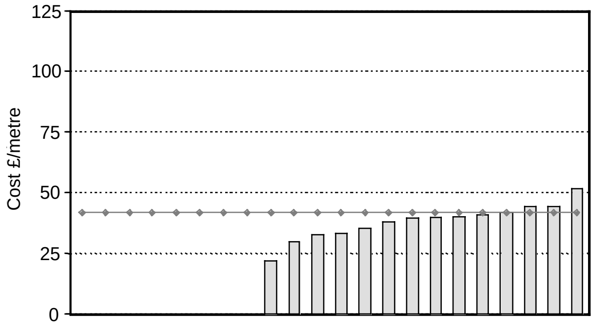
Mains rehabilitation – nominal bore 100 mm

Figure 20a Surface applied internal coating



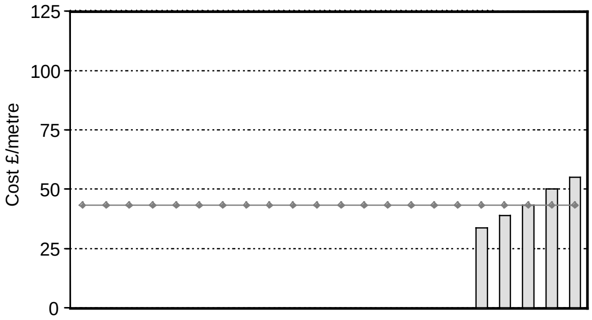
Costs range from £25 to £46 per metre
Chosen benchmark is £26 per metre with an EJG of A1

Figure 20c Pipe insertion



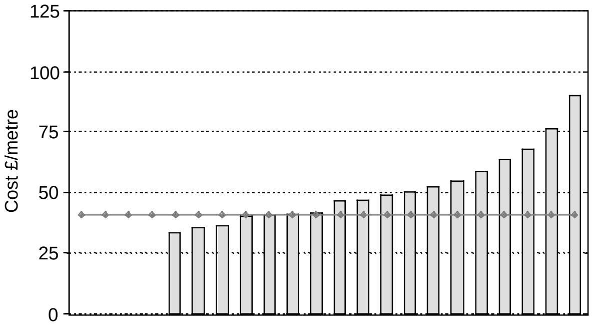
Costs range from £22 to £52 per metre
Chosen benchmark is £42 per metre with an EJG of A2

Figure 20b Sliplining



Costs range from £34 to £55 per metre
Chosen benchmark is £43 per metre with an EJG of A1

Figure 20d Pipe bursting

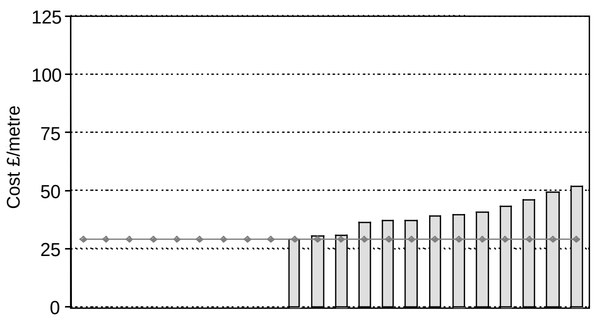


Costs range from £33 to £90 per metre
Chosen benchmark is £41 per metre with an EJG of B2

Water service – infrastructure

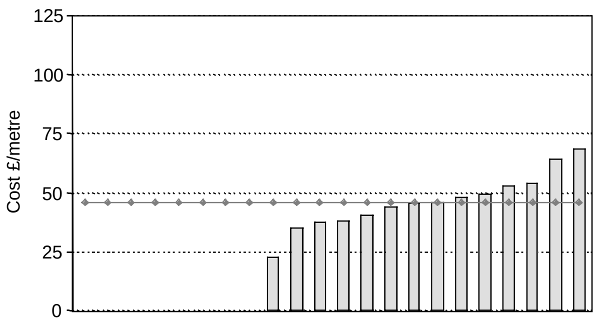
Mains rehabilitation – nominal bore 150 mm

Figure 21a Surface applied internal coating



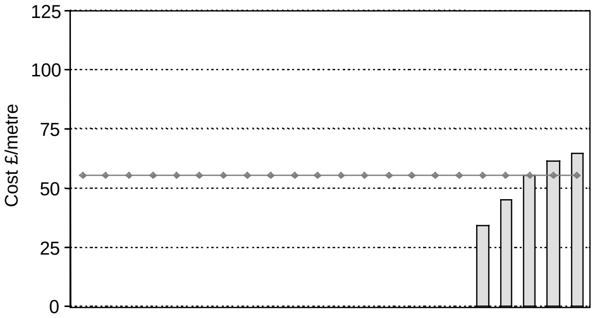
Costs range from £29 to £52 per metre
Chosen benchmark is £29 per metre with an EJG of A1

Figure 21c Pipe insertion



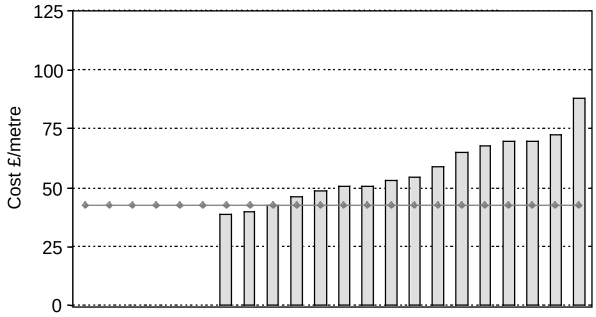
Costs range from £23 to £69 per metre
Chosen benchmark is £46 per metre with an EJG of A2

Figure 21b Sliplining



Costs range from £34 to £65 per metre
Chosen benchmark is £55 per metre with an EJG of A1

Figure 21d Pipe bursting

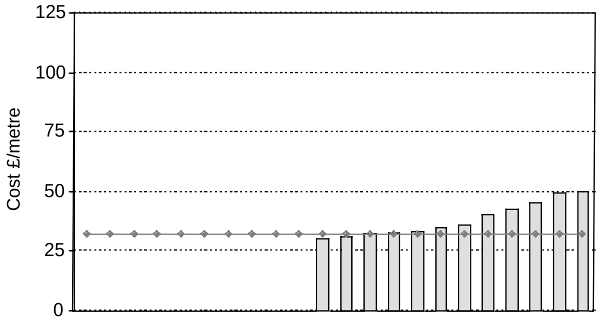


Costs range from £38 to £88 per metre
Chosen benchmark is £43 per metre with an EJG of B2

Water service – infrastructure

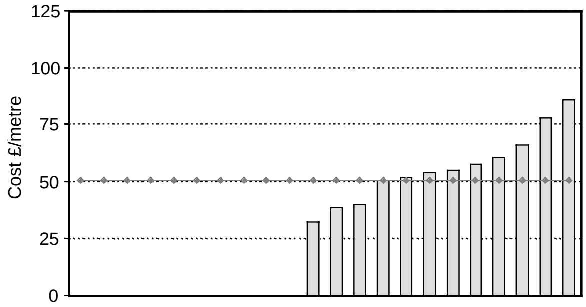
Mains rehabilitation – nominal bore 200 mm

Figure 22a Surface applied internal coating



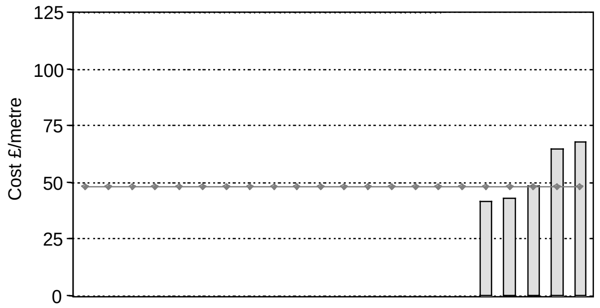
Costs range from £30 to £50 per metre
Chosen benchmark is £32 per metre with an EJG of A1

Figure 22c Pipe insertion



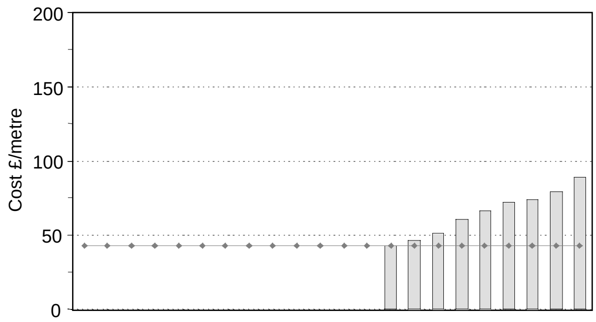
Costs range from £32 to £86 per metre
Chosen benchmark is £51 per metre with an EJG of A2

Figure 22b Sliplining



Costs range from £41 to £68 per metre
Chosen benchmark is £48 per metre with an EJG of A1

Figure 22d Pipe bursting

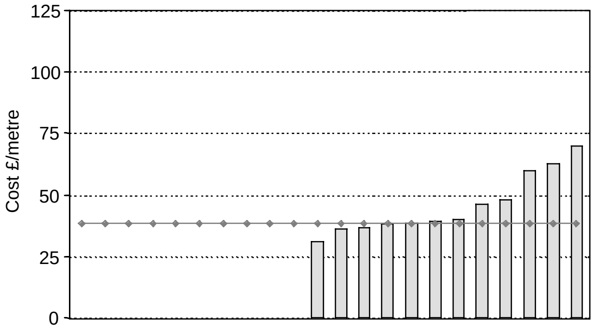


Costs range from £43 to £89 per metre
Chosen benchmark is £43 per metre with an EJG of B2

Water service – infrastructure

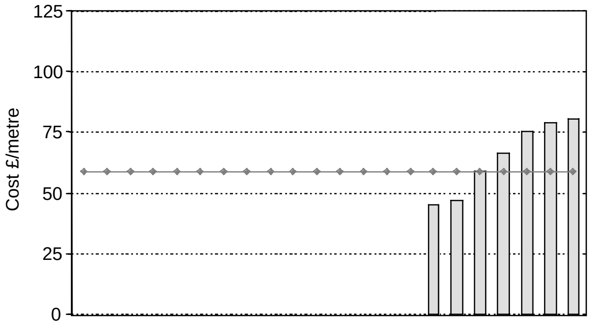
Mains rehabilitation – nominal bore 300 mm

Figure 23a Surface applied internal coating



Costs range from £31 to £70 per metre
Chosen benchmark is £39 per metre with an EJG of A2

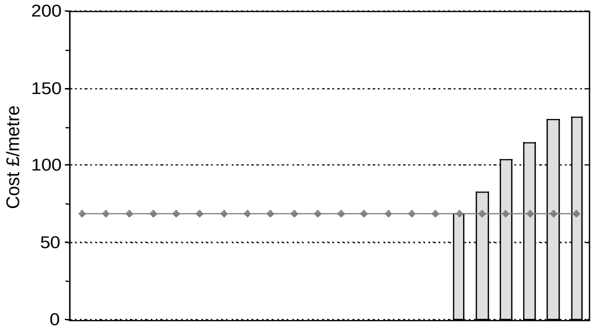
Figure 23b Pipe insertion



Costs range from £45 to £80 per metre
Chosen benchmark is £59 per metre with an EJG of A2

Mains rehabilitation – nominal bore 450 mm

Figure 24 Pipe insertion

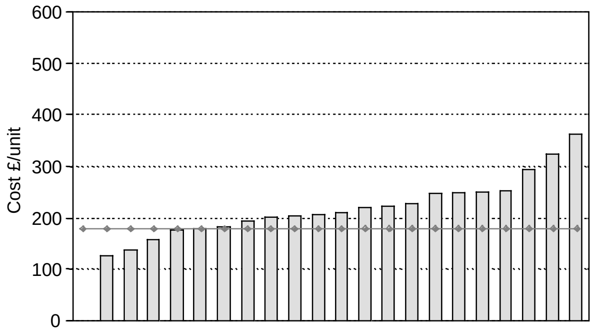


Costs range from £69 to £132 per metre
Chosen benchmark is £69 per metre with an EJG of A2

Water service – infrastructure

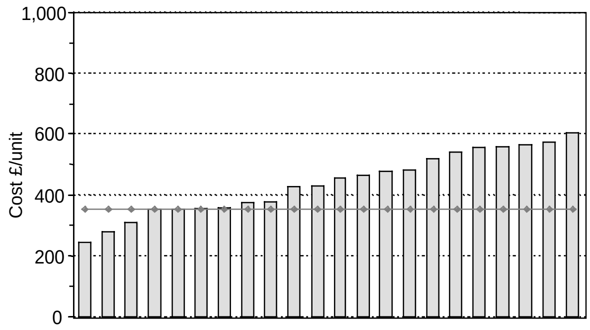
Communication pipes

Figure 25a New – long side



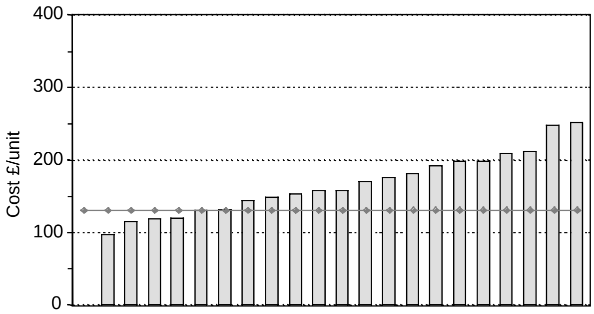
Costs range from £126 to £362 per unit
Chosen benchmark is £179 per unit with an EJG of A1

Figure 25c Renewal – long side



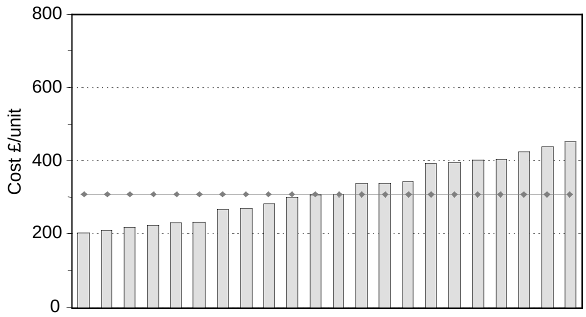
Costs range from £242 to £604 per unit
Chosen benchmark is £354 per unit with an EJG of A1

Figure 25b New – short side



Costs range from £97 to £252 per unit
Chosen benchmark is £130 per unit with an EJG of A1

Figure 25d Renewal – short side

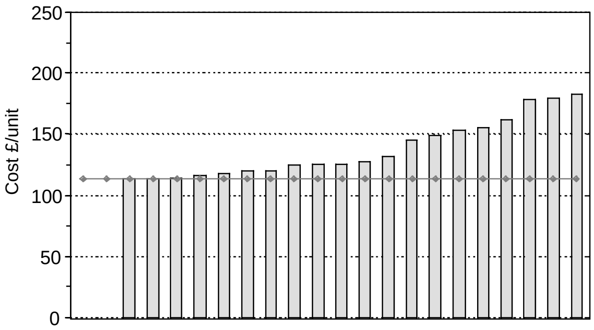


Costs range from £202 to £451 per unit
Chosen benchmark is £308 per unit with an EJG of A1

Water service – non-infrastructure

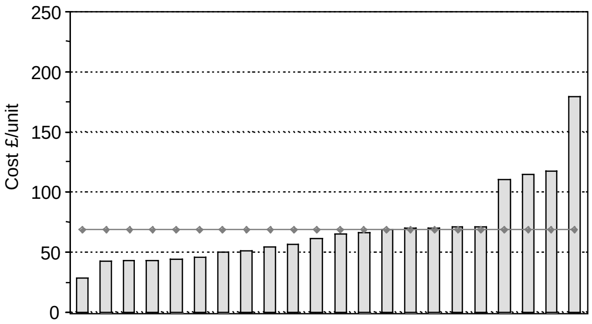
New household meters

Figure 26a Internal



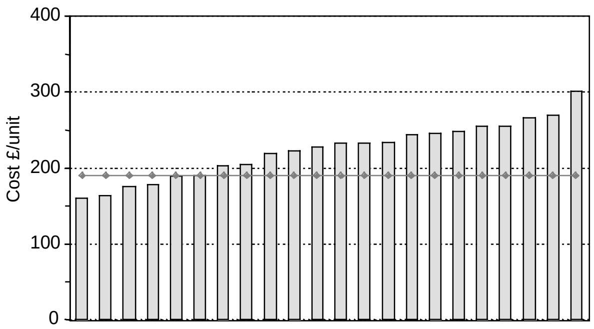
Costs range from £113 to £183 per unit
Chosen benchmark is £113 per unit with an EJG of A1

Figure 26b External (excluding boundary box)



Costs range from £29 to £179 per unit
Chosen benchmark is £69 per unit with an EJG of A1

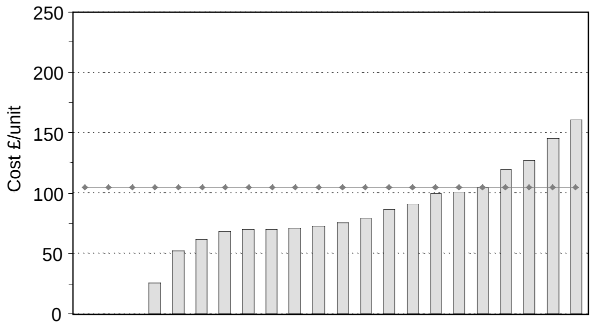
Figure 26c External (including boundary box)



Costs range from £160 to £301 per unit
Chosen benchmark is £191 per unit with an EJG of A1

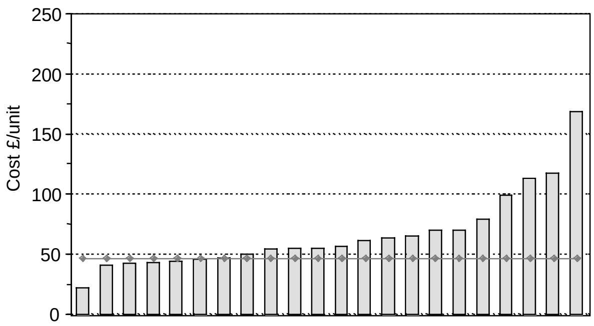
Renewal of household meters

Figure 27a Internal



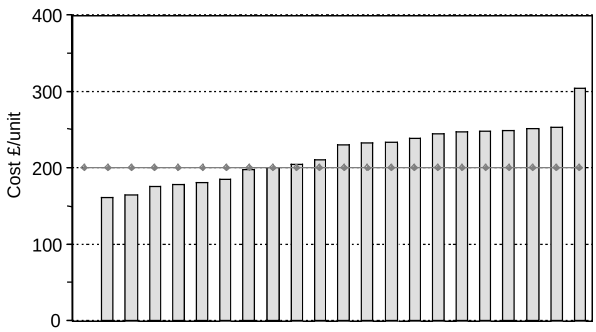
Costs range from £26 to £160 per unit
Chosen benchmark is £105 per unit with an EJG of A1

Figure 27b External (excluding boundary box)



Costs range from £22 to £169 per unit
Chosen benchmark is £47 per unit with an EJG of A1

Figure 27c External (including boundary box)

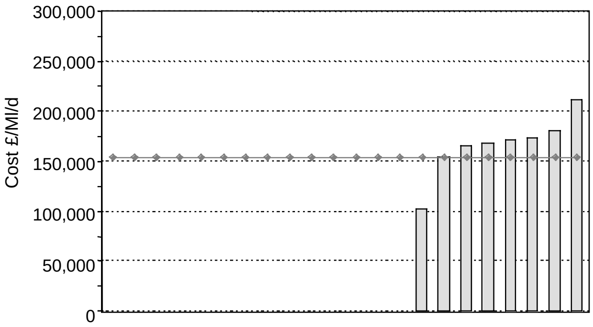


Costs range from £160 to £304 per unit
Chosen benchmark is £200 per unit with an EJG of A1

Water service – non-infrastructure

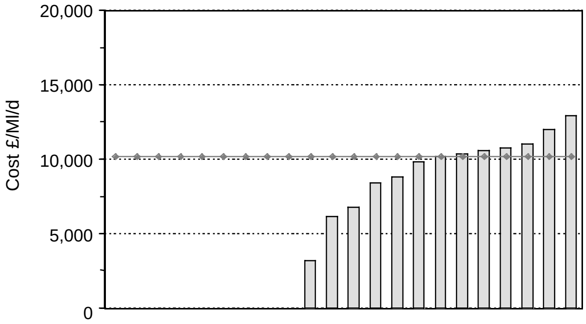
Water treatment works

Figure 28a New treatment works type SW2, output 30 Ml/d



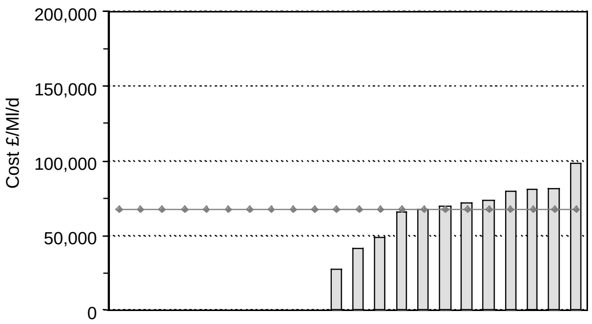
Costs range from £102,400 to £211,600 per megalitre per day
Chosen benchmark is £153,800 per megalitre per day with an EJG of A2

Figure 28d New plumbosolvency control to borehole works, output 8 Ml/d



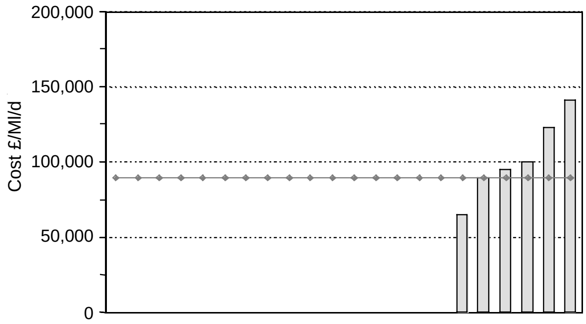
Costs range from £3,200 to £12,900 per megalitre per day
Chosen benchmark is £10,200 per megalitre per day with an EJG of B3

Figure 28b Replacement filtration system at a SW2 works, output 30 Ml/d



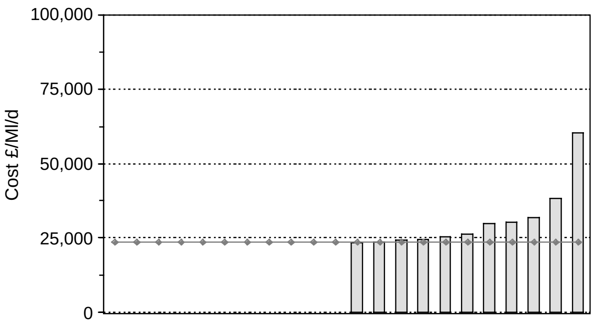
Costs range from £27,100 to £98,200 per megalitre per day
Chosen benchmark is £67,600 per megalitre per day with an EJG of B3

Figure 28e Alterations to an SW2 works, output 30 Ml/d



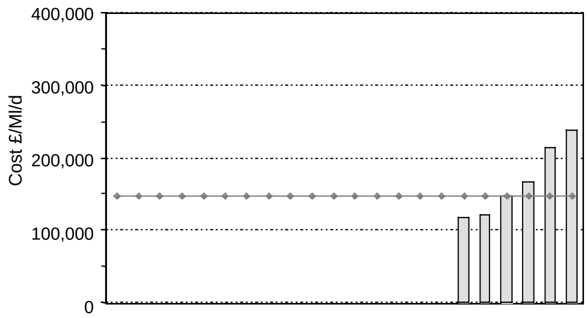
Costs range from £65,000 to £141,000 per megalitre per day
Chosen benchmark is £89,400 per megalitre per day with an EJG of B2

Figure 28c New borehole works with simple disinfection, output 8 Ml/d



Costs range from £23,100 to £60,300 per megalitre per day
Chosen benchmark is £23,500 per megalitre per day with an EJG of A2

Figure 28f Installation of nitrate removal at a borehole works, output 10 Ml/d

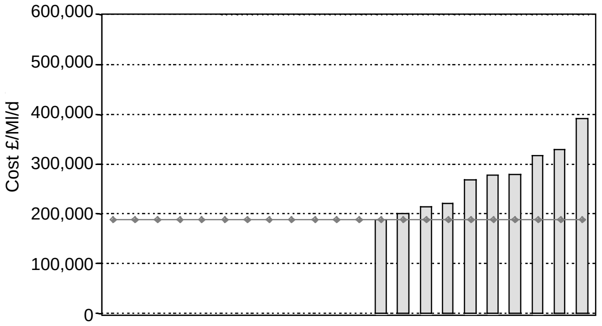


Costs range from £116,900 to £237,300 per megalitre per day
Chosen benchmark is £146,900 per megalitre per day with an EJG of B2

Water service – non-infrastructure

Water treatment works

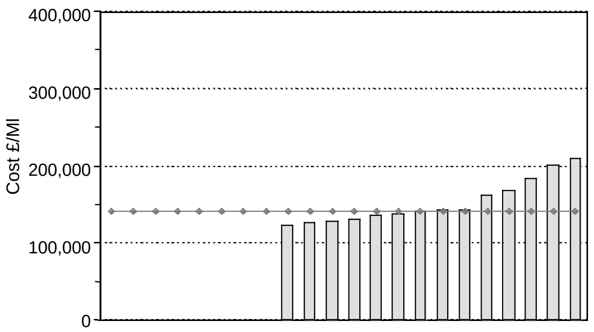
Figure 28g Cryptosporidium protection to a borehole works, output 2.5 Ml/d



Costs range from £189,300 to £391,900 per megalitre per day
Chosen benchmark is £189,300 per megalitre per day with an EJG of B2

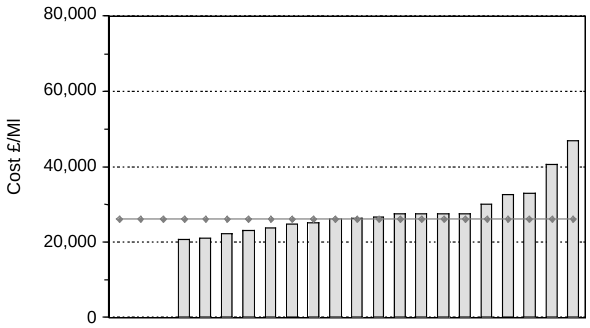
Water storage

Figure 29a New service reservoir, capacity 4 Ml



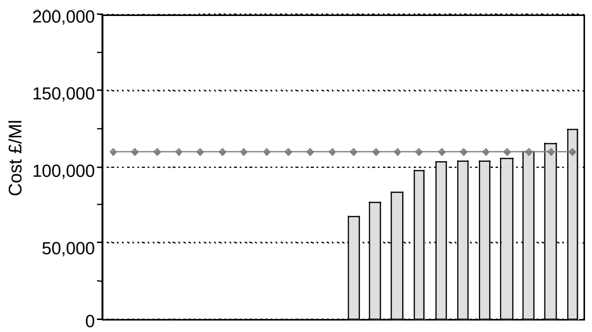
Costs range from £121,600 to £209,100 per megalitre
Chosen benchmark is £141,400 per megalitre with an EJG of B2

Figure 29c Refurbishment of service reservoir, capacity 6 Ml



Costs range from £20,800 to £47,000 per megalitre
Chosen benchmark is £26.200 per megalitre with an EJG of A2

Figure 29b New service reservoir, capacity 15 Ml

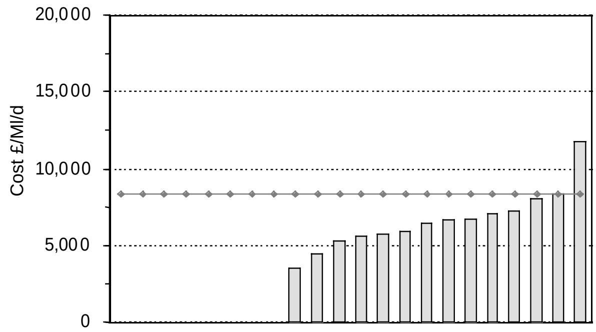


Costs range from £67,300 to £124,200 per megalitre
Chosen benchmark is £109,900 per megalitre with an EJG of B2

Water service – non-infrastructure

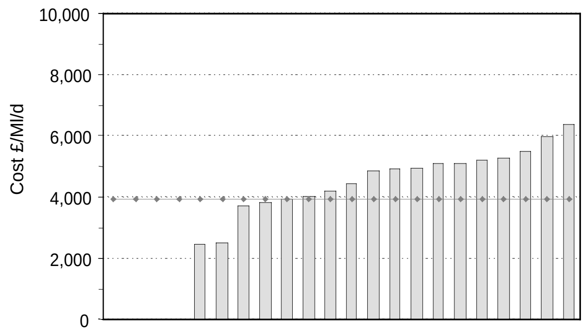
Water pumping stations

Figure 30a Replacement of variable speed pumps, output 6 to 9 Ml/d



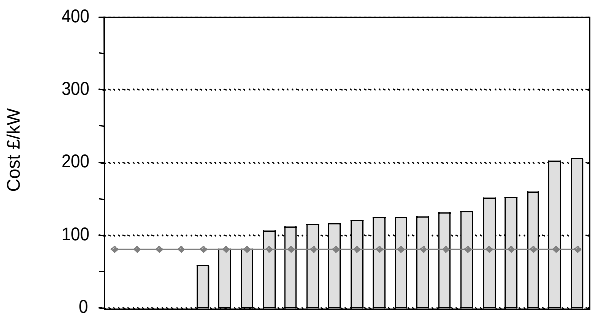
Costs range from £3,600 to £11,700 per megalitre per day
Chosen benchmark is £8,400 per megalitre per day with an EJG of B2

Figure 30d Replacement borehole pumpsets, output 10 Ml/d



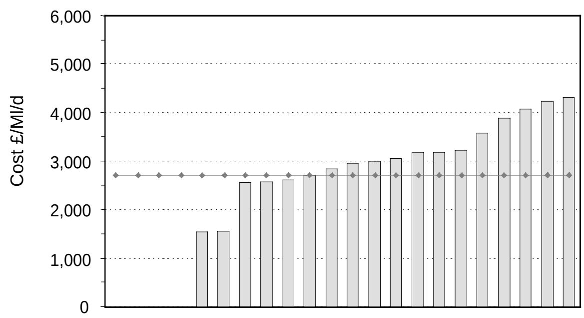
Costs range from £2,500 to £6,400 per megalitre per day
Chosen benchmark is £3,900 per megalitre per day with an EJG of B2

Figure 30b Replacement of variable speed pump motors, rated 110 kW



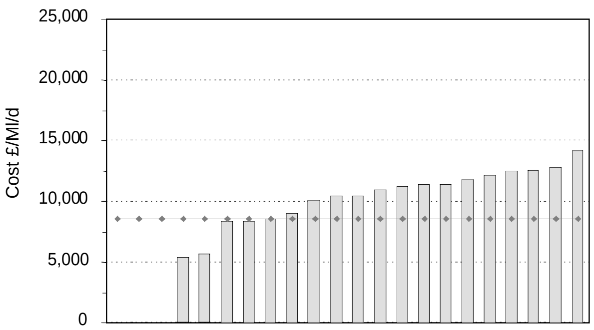
Costs range from £59 to £206 per kilowatt
Chosen benchmark is £80 per kilowatt with an EJG of B2

Figure 30e New fixed speed pumpset, output 10 Ml/d



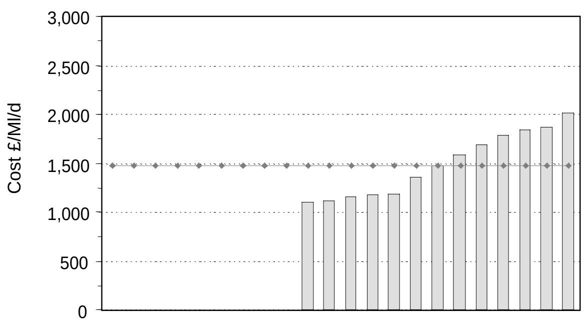
Costs range from £1,500 to £4,300 per megalitre per day
Chosen benchmark is £2,700 per megalitre per day with an EJG of B2

Figure 30c Replacement of borehole pumpsets, output 4 Ml/d



Costs range from £5,300 to £14,200 per megalitre per day
Chosen benchmarch is £8,600 per megalitre per day with an EJG of B2

Figure 30f New fixed-speed pumpset, output 30 Ml/d

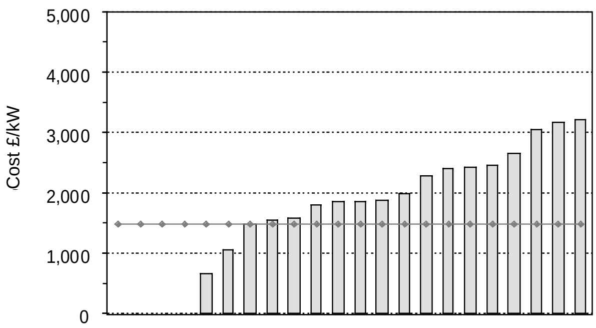


Costs range from £1,100 to £2,000 per megalitre per day
Chosen benchmark is £1,500 per megalitre per day with an EJG of B2

Water service – non-infrastructure

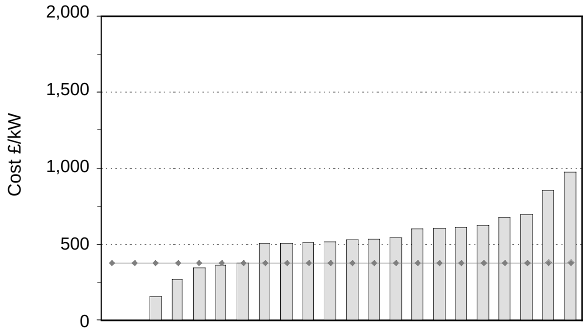
Water pumping stations

Figure 30g Replacement MCC for variable speed station, capacity 15 kW



Costs range from £600 to £3,200 per kilowatt
Chosen benchmark is £1,500 per kilowatt with an EJG of B2

Figure 30h Replacement MCC for variable speed station, capacity 90 kW

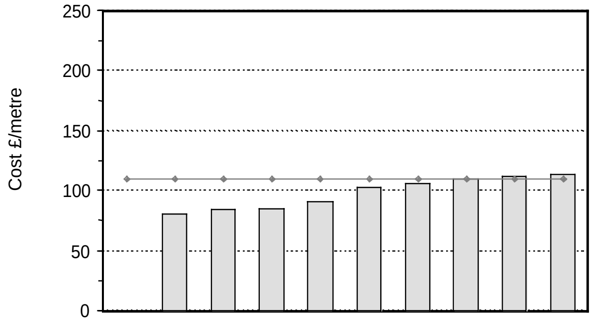


Costs range from £160 to £970 per kilowatt
Chosen benchmark is £375 per kilowatt with an EJG of B2

Sewerage service – infrastructure

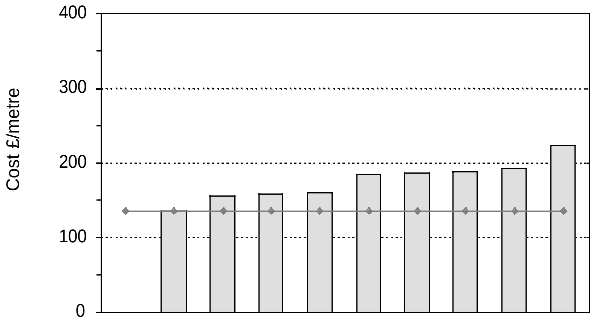
Sewer laying – nominal bore 150 mm

Figure 31a Grassland



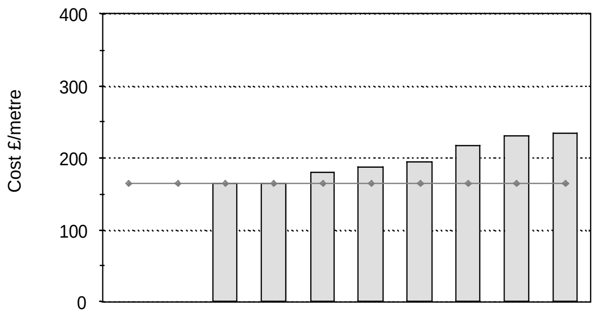
Costs range from £81 to £113 per metre
Chosen benchmark is £110 per metre with an EJG of A2

Figure 31b Rural/suburban highway



Costs range from £136 to £223 per metre
Chosen benchmark is £136 per metre with an EJG of A2

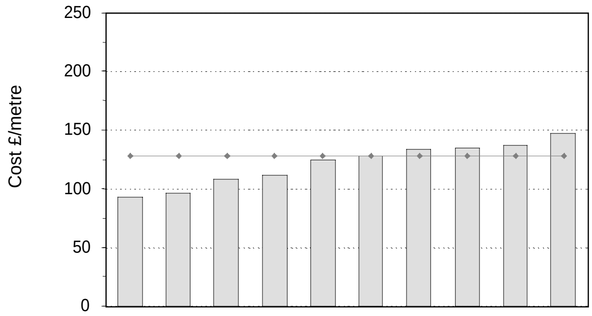
Figure 31c Urban highway



Costs range from £165 to £233 per metre
Chosen benchmark is £165 per metre with an EJG of A2

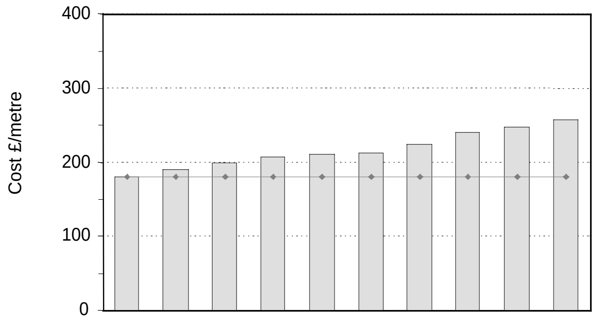
Sewer laying – nominal bore 225 mm

Figure 32a Grassland



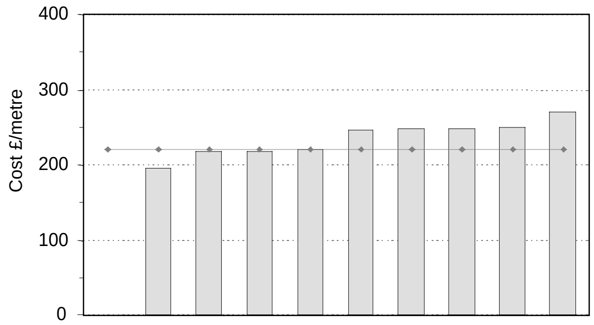
Costs range from £92 to £147 per metre
Chosen benchmark is £127 per metre with an EJG of A2

Figure 32b Rural/suburban highway



Costs range from £180 to £258 per metre
Chosen benchmark is £180 per metre with an EJG of A2

Figure 32c Urban highway

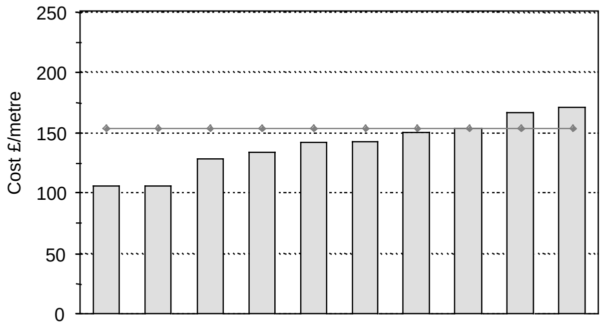


Costs range from £197 to £271 per metre
Chosen benchmark is £220 per metre with an EJG of A2

Sewerage service – infrastructure

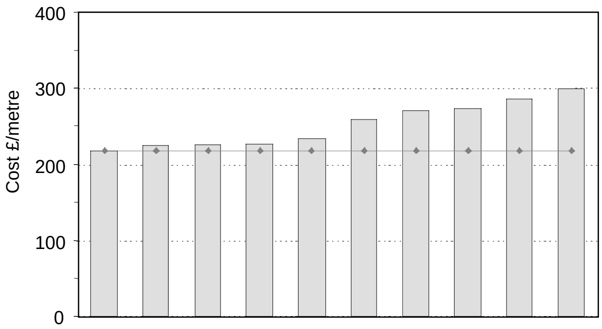
Sewer laying – nominal bore 300 mm

Figure 33a Grassland



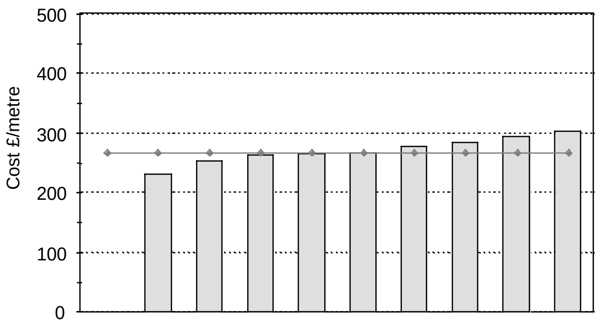
Costs range from £106 to £172 per metre
Chosen benchmark is £154 per metre with an EJG of A2

Figure 33b Rural/suburban highway



Costs range from £218 to £299 per metre
Chosen benchmark is £218 per metre with an EJG of A2

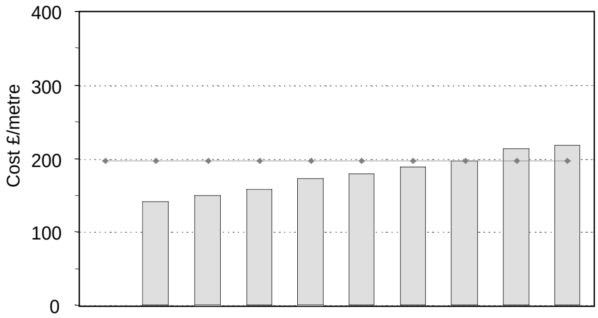
Figure 33c Urban highway



Costs range from £231 to £302 per metre
Chosen benchmark is £267 per metre with an EJG of A3

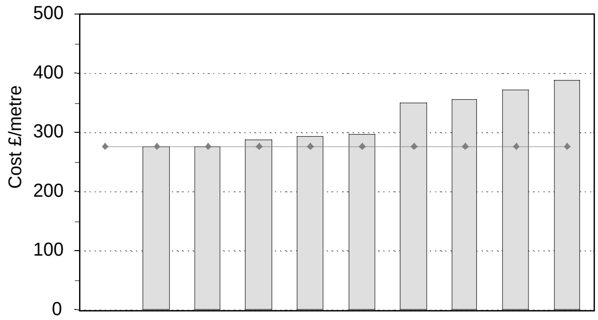
Sewer laying – nominal bore 450 mm

Figure 34a Grassland



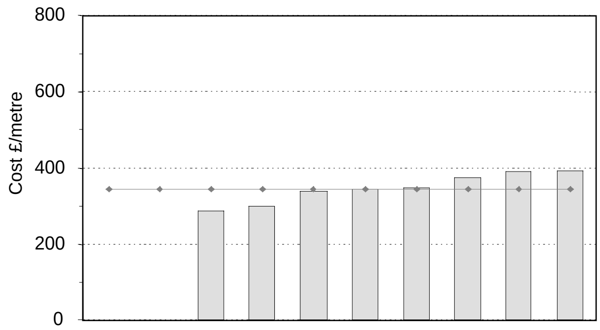
Costs range from £140 to £219 per metre
Chosen benchmark is £196 per metre with an EJG of A2

Figure 34b Rural/suburban highway



Costs range from £276 to £389 per metre
Chosen benchmark is £277 per metre with an EJG of A2

Figure 34c Urban highway

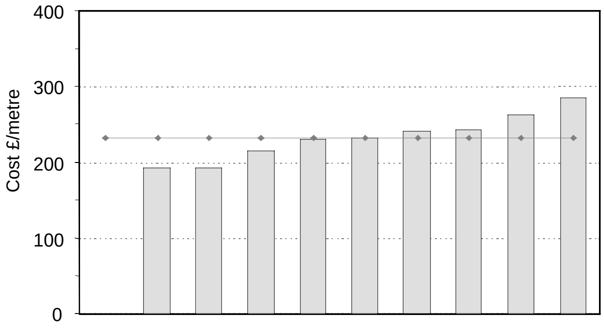


Costs range from £286 to £395 per metre
Chosen benchmark is £345 per metre with an EJG of A2

Sewerage service – infrastructure

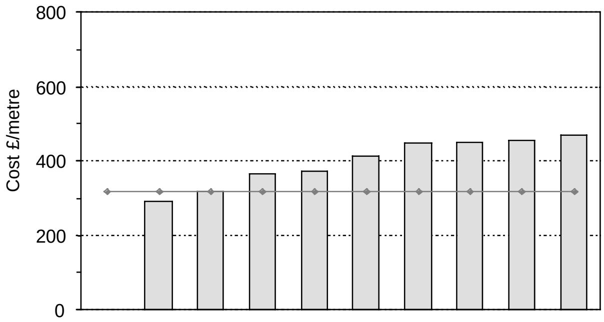
Sewer laying – nominal bore 600 mm

Figure 35a Grassland



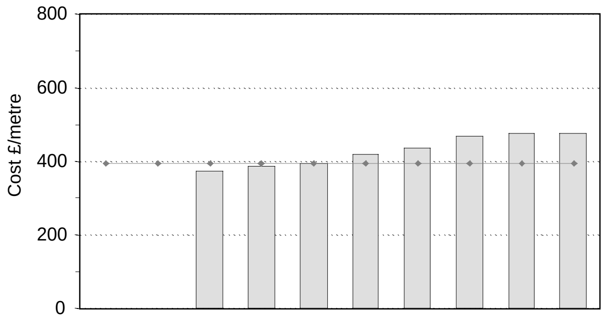
Costs range from £193 to £285 per metre
Chosen benchmark is £232 per metre with an EJG of A2

Figure 35b Rural/suburban highway



Costs range from £293 to £469 per metre
Chosen benchmark is £316 per metre with an EJG of A2

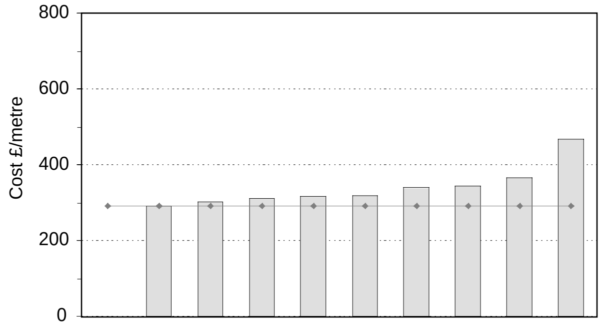
Figure 35c Urban highway



Costs range from £374 to £477 per metre
Chosen benchmark is £394 per metre with an EJG of A2

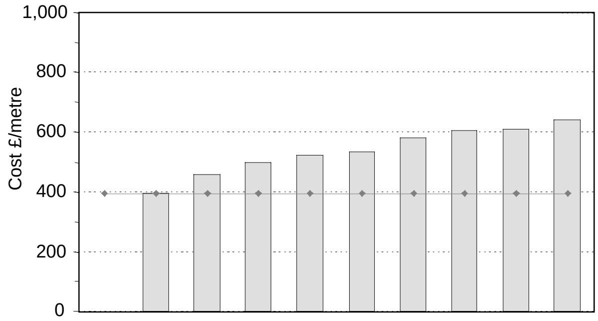
Sewer laying – nominal bore 900 mm

Figure 36a Grassland



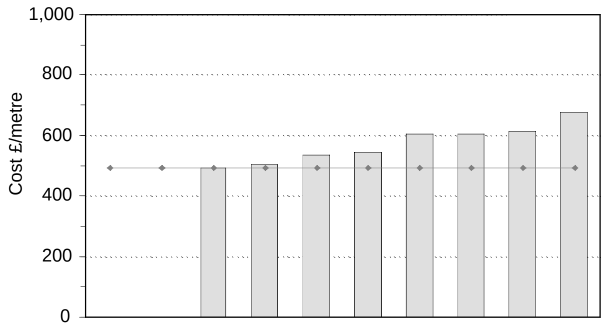
Costs range from £291 to £467 per metre
Chosen benchmark is £291 per metre with an EJG of A2

Figure 36b Rural/suburban highway



Costs range from £394 to £641 per metre
Chosen benchmark is £394 per metre with an EJG of A2

Figure 36c Urban highway

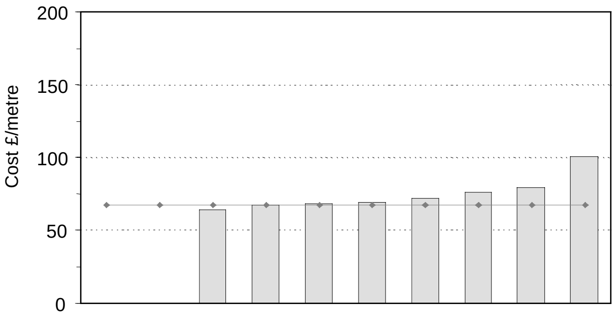


Costs range from £494 to £677 per metre
Chosen benchmark is £494 per metre with an EJG of A2

Sewerage service – infrastructure

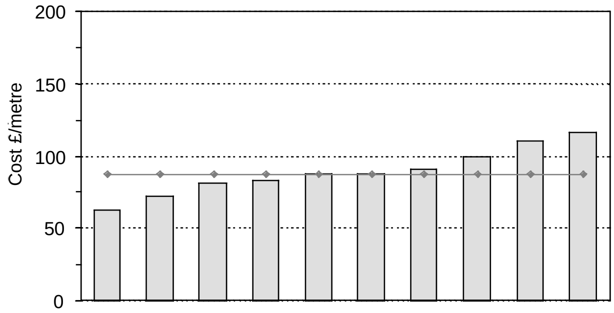
Sewer rehabilitation – Insituform

Figure 37a 150 mm



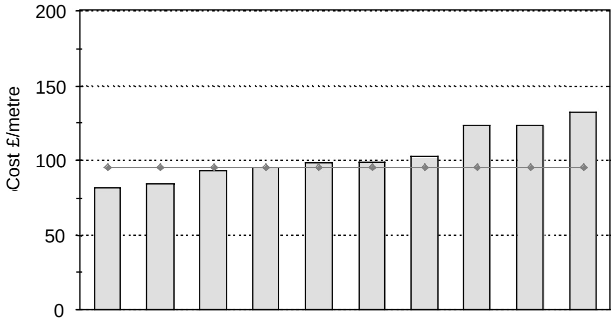
Costs range from £64 to £101 per metre
Chosen benchmark is £67 per metre with an EJG of B2

Figure 37b 225 mm



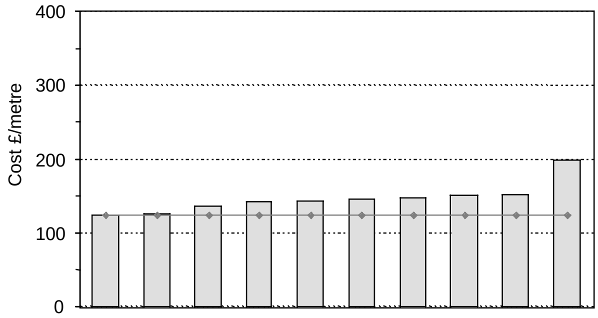
Costs range from £63 to £116 per metre
Chosen benchmark is £87 per metre with an EJG of B1

Figure 37c 300 mm



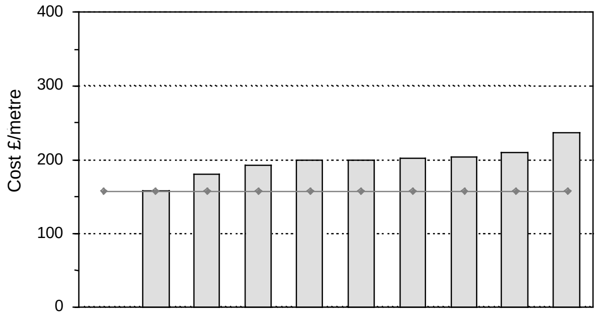
Costs range from £82 to £132 per metre
Chosen benchmark is £95 per metre with an EJG of B1

Figure 37d 450 mm



Costs range from £123 to £198 per metre
Chosen benchmark is £123 per metre with an EJG of B1

Figure 37e 600 mm

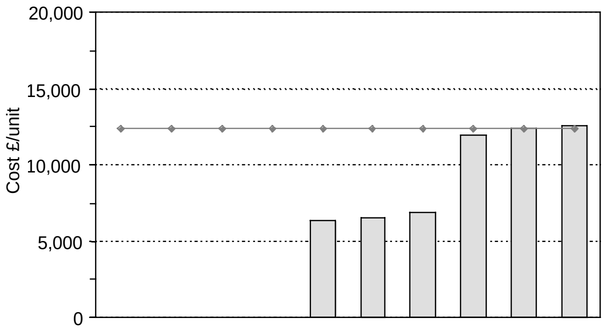


Costs range from £157 to £237 per metre
Chosen benchmark is £157 per metre with an EJG of B1

Sewerage service – infrastructure

Other sewerage activity

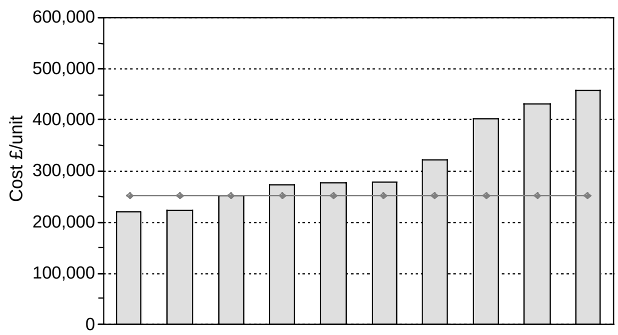
Figure 38 Self-contained pumping unit



Costs range from £6,400 to £12,600 per unit
Chosen benchmark is £12,400 per unit with an EJG of B2

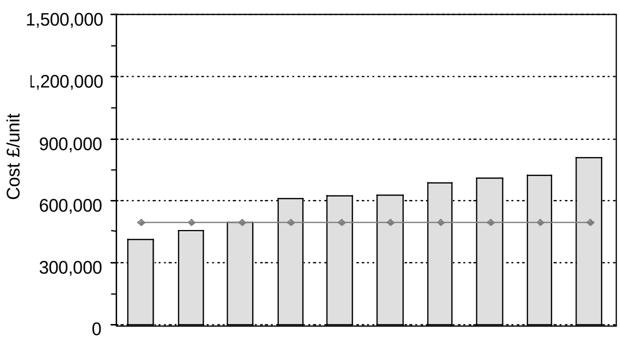
Sewer structures

Figure 39a Storage tank to combined sewer overflow, capacity 750 m³



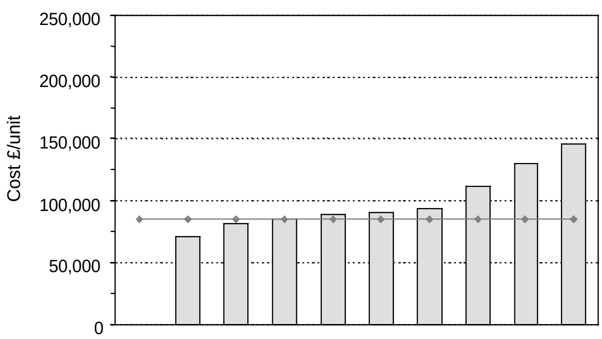
Costs range from £220,700 to £457,000 per unit
Chosen benchmark is £251,600 per unit with an EJG of A3

Figure 39b Storage tank to combined sewer overflow, capacity 3,000 m³



Costs range from £409,800 to £810,600 per unit
Chosen benchmark is £495,300 per unit with an EJG of A3

Figure 39c Combined sewer overflow chamber with powered screen

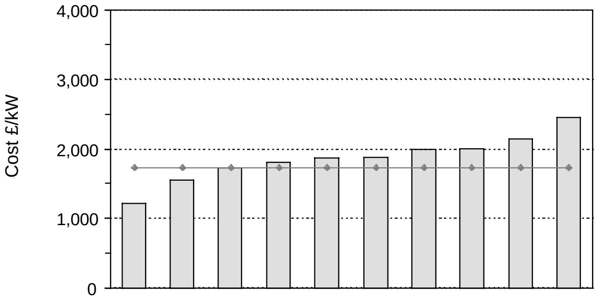


Costs range from £71,400 to £145,600 per unit
Chosen benchmark is £85,200 per unit with an EJG of B3

Sewerage service – non-infrastructure

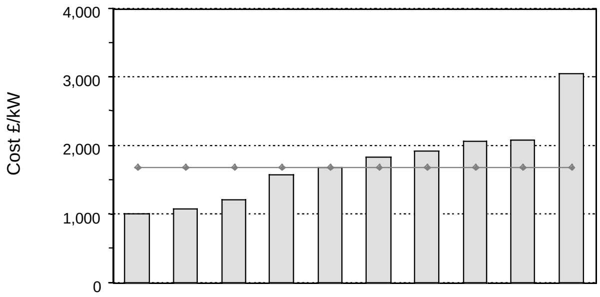
Sewage pumping stations

Figure 40a Replacement dry well pumps and motors, capacity 12 kW



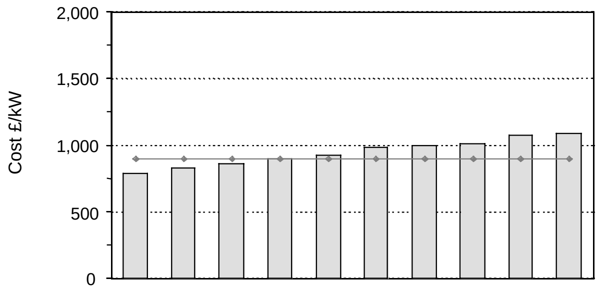
Costs range from £1,200 to £2,500 per kilowatt
Chosen benchmark is £1,700 per kilowatt with an EJG of B2

Figure 40d Replacement submersible pumps, capacity 12 kW



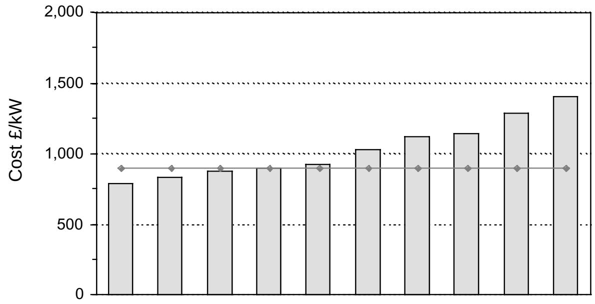
Costs range from £1,000 to £3,000 per kilowatt
Chosen benchmark is £1,700 per kilowatt with an EJG of B2

Figure 40b Replacement dry well pumps and motors, capacity 30 kW



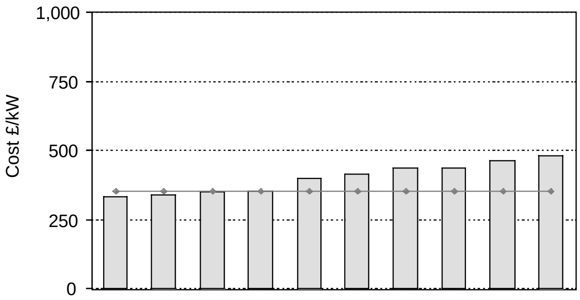
Costs range from £790 to £1,100 per kilowatt
Chosen benchmark is £900 per kilowatt with an EJG of B2

Figure 40e Upside dry well in-line pumping station from 12 kW to 30 kW



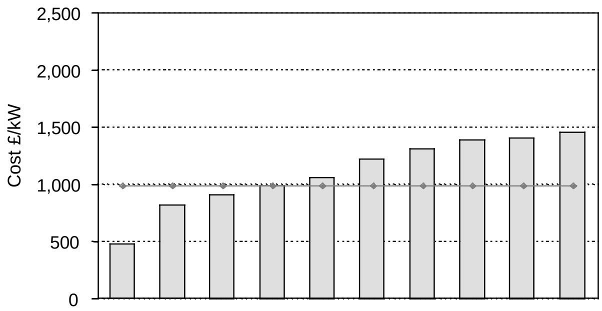
Costs range from £790 to £1,400 per kilowatt
Chosen benchmark is £900 per kilowatt with an EJG of B2

Figure 40c Replacement dry well pumps and motors, capacity 100 kW



Costs range from £330 to £480 per kilowatt
Chosen benchmark is £350 per kilowatt with an EJG of B2

Figure 40f Upside wet well in-line pumping station from 12 kW to 30 kW

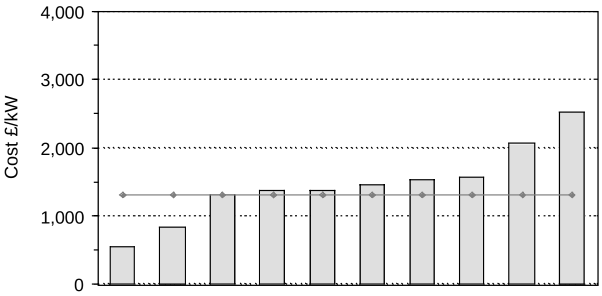


Costs range from £470 to £1,500 per kilowatt
Chosen benchmark is £1,000 per kilowatt with an EJG of B2

Sewerage service – non-infrastructure

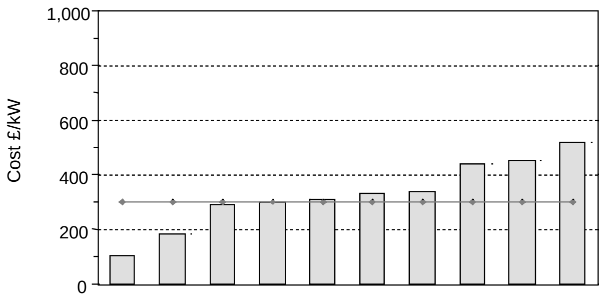
Sewage pumping stations

Figure 40g Replacement MCC for a fixed speed station, motor capacity 15 kW



Costs range from £550 to £2,500 per kilowatt
Chosen benchmark is £1,300 per kilowatt with an EJG of B2

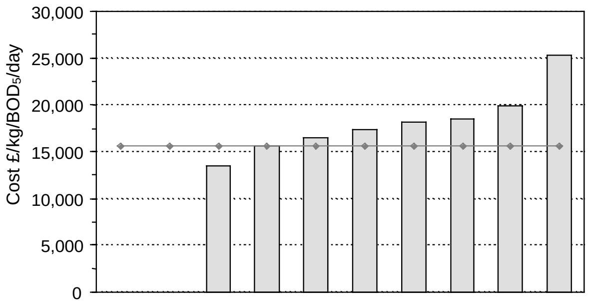
Figure 40h Replacement MCC for a fixed speed station, motor capacity 90 kW



Costs range from £100 to £520 per kilowatt
Chosen benchmark is £300 per kilowatt with an EJG of B2

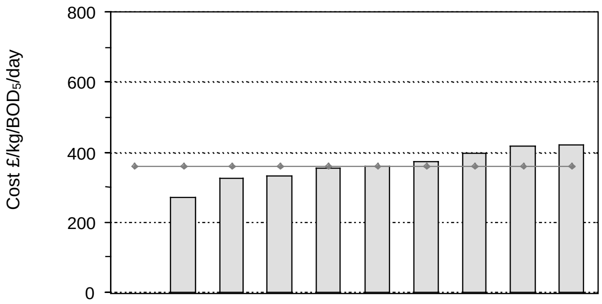
Sewage treatment works

Figure 41a First time rural sewage treatment, population equivalent 200



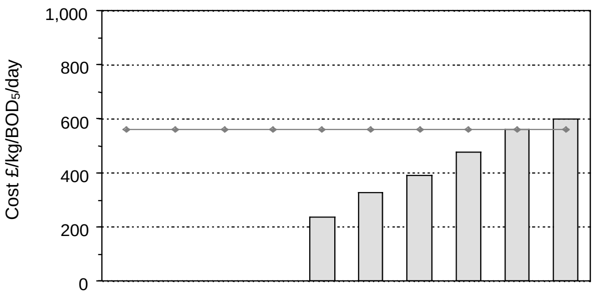
Costs range from £13,500 to £25,300 per kg BOD_5 per day
Chosen benchmark is £15,500 per kg BOD_5 per day with an EJG of A2

Figure 41c Additional nutrient removal, population equivalent 12,000



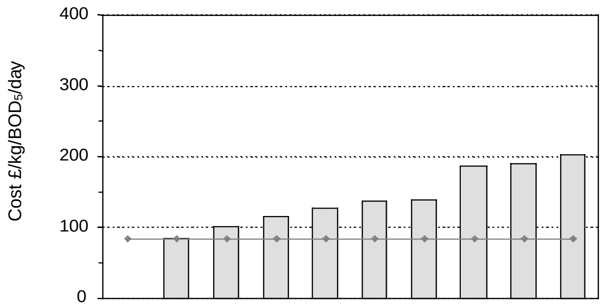
Costs range from £270 to £420 per kg BOD_5 per day
Chosen benchmark is £360 per kg BOD_5 per day with an EJG of A3

Figure 41b Installation of denitrification, population equivalent 40,000



Costs range from £240 to £600 per kg BOD_5 per day
Chosen benchmark is £560 per kg BOD_5 per day with an EJG of A2

Figure 41d Additional nutrient removal, population equivalent 40,000

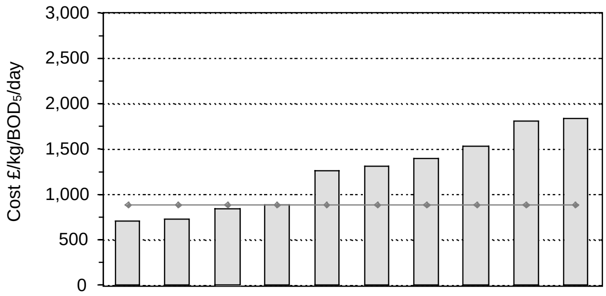


Costs range from £84 to £203 per kg BOD_5 per day
Chosen benchmark is £84 per kg BOD_5 per day with an EJG of A3

Sewerage service – non-infrastructure

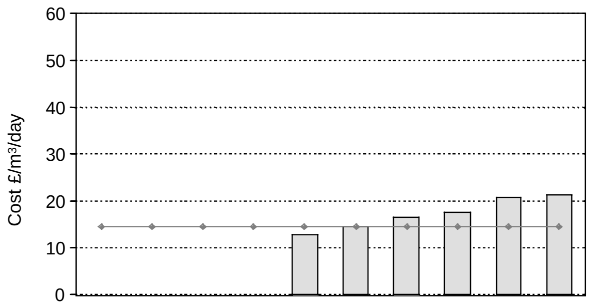
Sewage treatment works

Figure 41e Additional ammonia removal, population equivalent 2,000



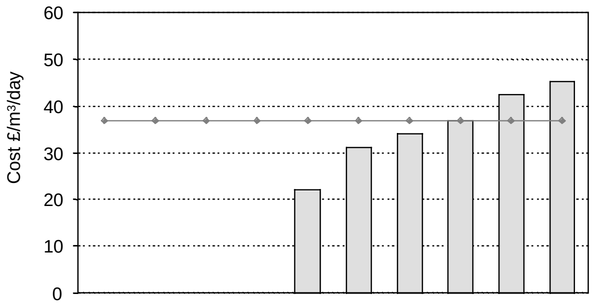
Costs range from £710 to £1,800 per kg BOD_5 per day
Chosen benchmark is £900 per kg BOD_5 per day with an EJG of A3

Figure 41g Additional UV disinfection, population equivalent 40,000



Costs range from £13 to £21 per cubic metre per day
Chosen benchmark is £15 per cubic metre per day with an EJG of A2

Figure 41f Additional UV disinfection, population equivalent 5,000



Costs range from £22 to £45 per cubic metre per day
Chosen benchmark is £37 per cubic metre per day with an EJG of A2

Appendix 4: Background on operating and capital maintenance costs

Definition of operating costs

Operating costs include employment costs, energy costs, materials, and hired and contracted services. They exclude the costs of third party services and exceptional costs, such as restructuring. Both third party and exceptional costs can vary considerably from year to year, distorting underlying trends. We exclude costs relating to assets, such as depreciation and infrastructure renewals, from operating costs. We also exclude capital spending and the cost of financing capital.

Breakdown of operating costs

For reporting purposes, companies break down their operating costs in two complementary ways, by function and by activity (see figure 42).

Atypical operating costs

Companies identify and report atypical costs that are not part of the continuing operation of the business. Such costs include:

- provisions for restructuring;
- extreme climatic events;
- costs associated with takeover bids or bid defence;
- compensation payments to customers; and
- abnormal changes in pension contributions.

Some companies declare these and similar items as ‘exceptional items’ in their accounts. Others report them within normal costs. We have noted atypical costs reported by companies within normal costs where they are more than 1% of operating costs for each service in figure 43. We exclude third party costs, local authority rates and Environment Agency costs from our econometric modelling. Therefore, we have not shown unusual changes in these costs in figure 43.

Inflation effects

We have presented costs in a common price base, 2003-04, so that we consider the effects of inflation. We have made the adjustments using the average Retail Price Index for the financial year.

Figure 42 Breakdown of operating costs

Function	**Water service**	Water resources and treatment Water distribution Business activities
	Sewerage service	Sewerage Sewage treatment Sludge treatment and disposal Business activities
Activity	**Direct costs**	Employment Power Hired and contracted services Agencies Materials and consumables Environment Agency charges Bulk imports (water) Other
	General and support	
	Business operating expenditure	Customer services Scientific services Rates Doubtful debts Other

Figure 43 Atypical operating costs in 2003-04

	Cost £ million	Percentage of water/sewerage service operating costs	Reason
Water service			
Anglian	-2.20	-1.74	Pension holiday, release of power provisions, restructuring
South West	1.08	2.05	Bad debt, dry weather costs, compensation
Thames	3.30	1.30	Restructuring
United Utilities	4.40	2.22	Bad debt, release of provisions for road occupation
Yorkshire	4.41	3.76	Restructuring, dry weather costs
Bournemouth & W Hampshire	-0.14	-1.00	Pension holiday, Avon Valley investigations, regulation costs, dry weather costs
Bristol	-1.10	-3.15	Release of provisions for road occupation
Folkestone & Dover	-0.27	-3.83	Release of provisions, bulk supply costs
South East	4.94	9.95	Pensions, re-branding, IT costs, dry weather costs, sale of company costs, bulk supply adjustment, various write-offs
South Staffordshire	-0.60	-1.81	Pension holiday, dry weather costs
Tendring Hundred	0.17	2.99	Prior year over charges, vacant post, insurance costs, bad debt, regulation costs, pensions
Sewerage service			
Anglian	-2.60	-1.60	Pension holiday, release of power provisions, restructuring
South West	0.97	1.86	Bad debt
Thames	2.60	1.12	Restructuring
United Utilities	14.30	7.30	Bad debt, British Waterways Board
Yorkshire	2.37	2.32	Restructuring, sludge tankering, various back charges, flooding costs

Notes:

1 We have taken atypical operating costs from the June return 2004 commentaries to tables 21 and 22, from subsequent responses to queries and from the final business plans.

2 Negative numbers represent unusual savings. Positive numbers represent unusual costs.

3 Only atypicals that total 1% or more of companies' operating expenditure are shown in the table above.

Definition of capital maintenance costs

Companies incur capital maintenance costs to maintain stable levels of serviceability from their assets. For reporting purposes, companies break down their costs in two complementary ways. These are by operational asset classification and by accounting asset classification (see figure 44).

Figure 44 Breakdown of capital maintenance costs

Operational asset classification	**Water service**	Water resource facilities Water treatment works Water distribution mains Service reservoirs and water towers Pumping stations Management and general
	Sewerage service	Sewerage Sea outfalls and headworks Sewage treatment works Sludge treatment works Sludge disposal In-line pumping stations Terminal pumping stations Management and general
Accounting asset classification	**Infrastructure assets**	Underground systems Impounding and raw storage reservoirs Dams Sludge pipelines and sea outfalls
	Non-infrastructure assets – operational assets	Intake works Pumping stations Treatment works Boreholes Operational land Offices, depots and workshops Residential properties directly connected to supplies Land held for the purpose of protecting the wholesomeness of water supplies
	– other tangible assets	Non-operational plant Machinery Vehicles Surplus land

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ISBN 1 904655 16 5

Printed on 75% minimum de-inked post-consumer waste paper.