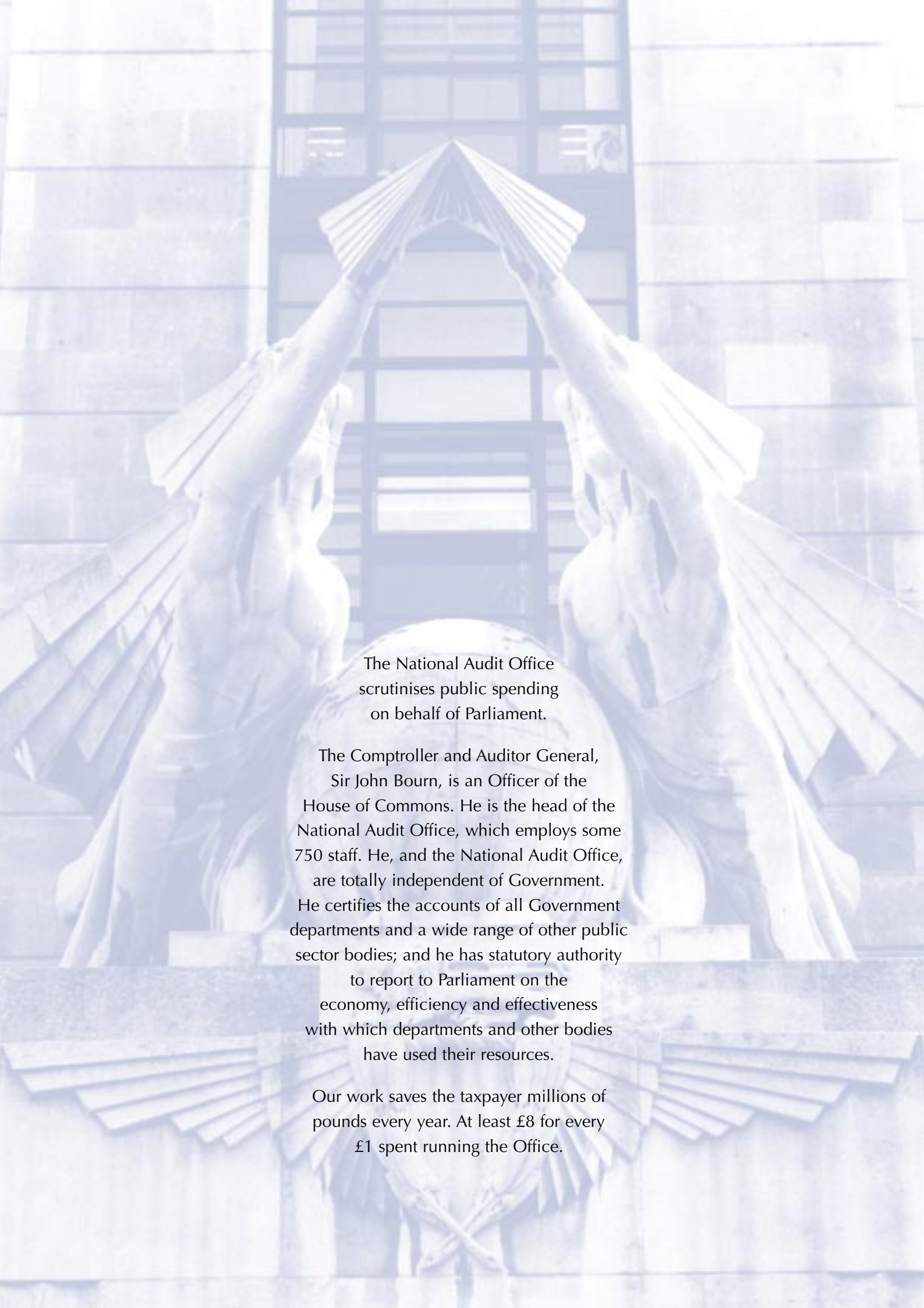
NATIONAL AUDIT OFFICE

Office of Water Services

Leakage and Water Efficiency

REPORT BY THE COMPTROLLER AND AUDITOR GENERAL
HC 971 Session 1999-2000: 1 December 2000



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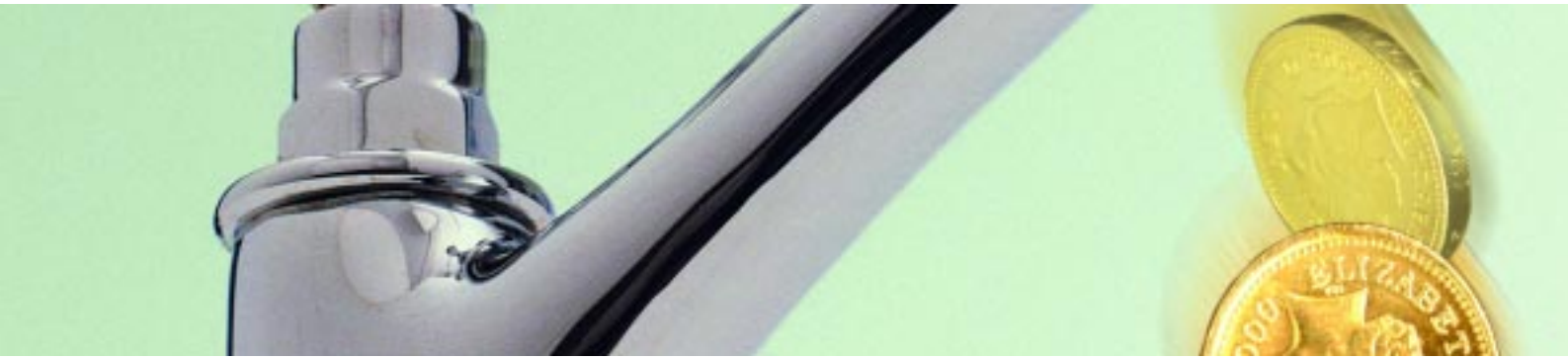

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LONDON: The Stationery Office
£0.00

Ordered by the
House of Commons
to be printed on 27 November 2000

This report has been prepared under Section 6 of the National Audit Act 1983 for presentation to the House of Commons in accordance with Section 9 of the Act.

John Bourn
Comptroller and Auditor General

National Audit Office
10 November 2000

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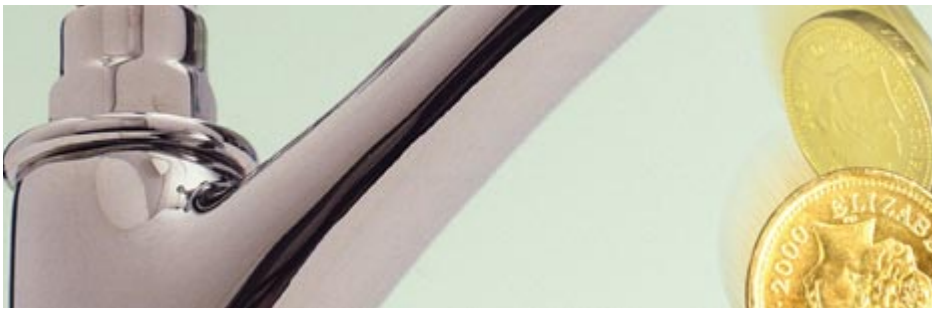
In this chapter

1 Dry weather in 1995 caused some water companies to introduce temporary restrictions on the use of water affecting 40 per cent of the population of England and Wales. The drought also highlighted the fact that some 30 per cent of the water put into water companies' distribution systems was being lost as a result of leakage. And high levels of leakage contributed to serious difficulties in maintaining water supplies in West Yorkshire.

2 At the Water Summit convened by the Government in May 1997, the Deputy Prime Minister stressed the importance of reducing leakage and promoting the efficient use of water by customers. He presented a ten-point plan for the industry, which included the setting of mandatory targets for water companies to reduce leakage and the vigorous promotion of water efficiency by companies.



3 The Office of Water Services (OFWAT) regulate the economic activities of the 24 water companies in England and Wales, and have a key rôle in ensuring that the companies secure the Government's aims for reducing leakage and promoting the efficient use of water. The level of leakage has been of concern to the Committee of Public Accounts, and its control, and the promotion of efficiency in the use of water, are important in ensuring that water companies maintain a safe margin between the demand for water and the amount they can supply.

4 This report examines the progress that OFWAT have made in ensuring that water companies achieve the Government's aims. We were assisted in our examination by WS Atkins, consulting engineers, and Frontier Economics, expert economics consultants. We also surveyed the water companies in England and Wales and commissioned IPSOS to carry out a survey of 1,919 water users.

5 OFWAT's work on leakage and water efficiency has been carried out against the background of their wider rôle in regulating water companies and the progress made by the water industry in recent years. Since privatisation in 1989 water companies have invested some £34 billion in water supply and sewerage systems and made significant improvements in the standard of drinking water and the environment. Standards of service to customers have also improved significantly. And although customers' bills initially rose to pay for this investment, customers' bills in 2000-2001 are on average nearly 13 per cent lower in real terms than in the previous year, following a review of the companies' prices by OFWAT in 1999.

OFWAT have sought to reduce the amount of water lost through leakage and since 1995 the water companies have responded positively

6 OFWAT's powers and duties are specified in legislation and the water companies' licences (Appendix 2) and do not explicitly include the regulation of leakage. They do, however, include enforcing the companies' duties to develop and maintain an efficient and economical system of water supply and to supply sufficient wholesome water for domestic customers. In doing so OFWAT have a duty to seek to promote economy and efficiency on the part of water companies and to protect the interests of customers. OFWAT are empowered to set targets relating to these duties, which can include leakage to the extent that it affects the security of water supplies to customers or economy and efficiency, and to take enforcement action if companies breach their duties.

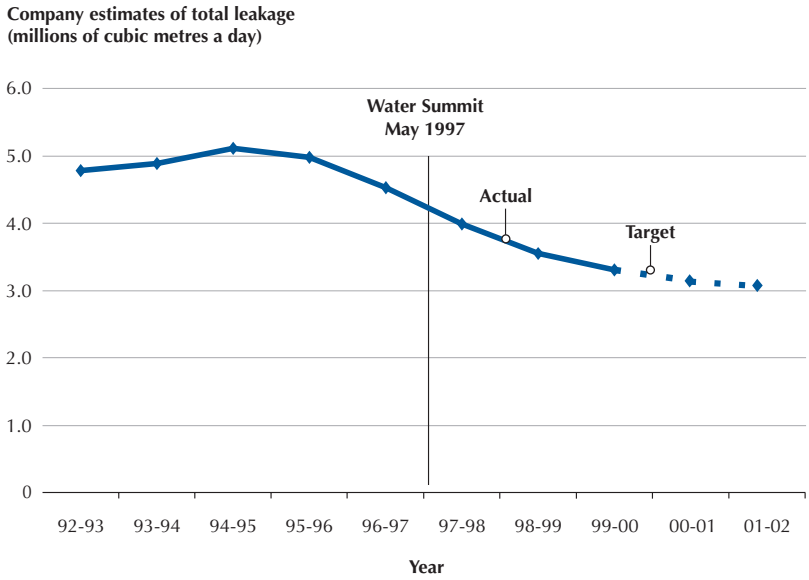
7 Following the privatisation of the water industry in 1989, OFWAT endorsed the generally held view that water companies should reduce their leakage to a level known as the economic level of leakage. This is the level of leakage that balances the cost of controlling leakage - which tends to rise as the level of leakage is reduced - with that of replacing water lost through leaks. The economic level of leakage differs from company to company depending on factors such as the condition of their water supply system and the availability of local supplies of water. Reducing leakage to the economic level minimises the cost of meeting customers' requirements for water.

8 Following privatisation, OFWAT asked companies to forecast their future leakage levels. OFWAT did not, however, set targets for leakage levels because they considered that companies already had a sufficient incentive to reduce leakage to their economic levels. This was because companies were subject to limits on their prices, and OFWAT expected companies to be able to increase their profits by reducing leakage to their economic levels. Leakage reduction appears, however, to have been a low priority for most companies; and some companies told us that they did not expect the price limits fully to reward them for reducing leakage to their economic levels. And from the point that reliable figures for leakage became available, in 1992-93, to the 1995 drought, total leakage rose by around one fifteenth, to some 5.1 million cubic metres a day.

9 In 1996 OFWAT required companies to set themselves targets to reduce leakage for 1997-98 and following the Water Summit of May 1997 set mandatory targets for all companies in 1998-99, 1999-2000 and 2000-01. Companies have generally achieved their targets and since the 1995 drought total leakage has fallen year on year, to around 21 per cent of the water put into supply in 1999-2000. In the light of the progress made and the industry's acceptance of achieving the economic level of leakage by 2002-03, OFWAT have not set mandatory targets for 16 of the companies. Instead, OFWAT will monitor these companies' progress towards their own targets based on robust estimates of the economic level of leakage. Mandatory targets have, however, been continued for the other eight companies. The targets for the companies for 2001-02 are to reduce total leakage to three million cubic metres a day, some 20 per cent of water put into supply and representing a reduction in leakage since 1994-95 of more than a third (**Figure 1**). As a result of the reductions made, total leakage levels in England and Wales are now generally better than average by international standards, and the better performing companies in England and Wales are now among the best in the world.

1 **Leakage in the water industry 1992-2002**

Leakage levels rose between 1992-93 and 1994-95, but since then have fallen.



Source: OFWAT, based on information from companies

10 The water companies told us that they acknowledged that the targets have had an important influence on the reductions in leakage they have achieved. Their behaviour has also been driven by recognition of the need to provide for a sufficient supply of water in the most economic way, and to avoid the bad publicity attendant on high levels of leakage. Their behaviour is likely to have been affected by the additional costs of some £150 million incurred by Yorkshire Water to improve water supply reliability during and following the 1995 drought.

Reductions in leakage have produced benefits, although the costs incurred are not clear

11 Reductions in leakage since 1995 have reduced the amount of water that water companies have needed to put into their distribution systems to meet customer demands. Since 1997-98 most water companies have had the capacity to supply significantly more water overall than has been needed. The balance between supply and demand is still tight in some parts of the country, but reductions in leakage have improved the water companies' ability to meet customer demands during dry years without placing restrictions on water use such as hosepipe bans in those areas. Reducing leakage has also provided the opportunity to benefit the environment by preventing over-abstraction of water from rivers (leaving them very low or dry) and postponing the need to develop new sources of water supply.

12 It is implicit in OFWAT's use of targets based on economic leakage levels that companies should understand the costs and benefits of leakage control, since the assessment of economic leakage levels relies on analysis of these costs and benefits. OFWAT, however, have not specifically monitored either the cost to companies of controlling leakage or the financial value of the water saved, as such information is not directly relevant to the approach that they have adopted to reducing leakage. We estimate that leakage control costs the water companies approximately £180 million a year, but cannot tell what proportion of this was required to achieve the reductions in leakage since 1995. We

estimate that the reductions in leakage since 1995 are saving water companies approximately £13 million to £39 million a year in operating costs. There is also a potential saving of capital costs by postponing water storage, treatment and distribution costs. Reducing leakage has also enabled water companies to maintain or improve the security of the supply of water to customers, without their having to invest in new capacity or plant, but there is insufficient information available to put a value on this benefit. The prices paid by customers since April 2000 have reflected higher expenditure by companies on leakage control, but customers are likely to benefit in the future as lower levels of leakage enable future expenditure to be avoided or postponed. Examples of this could include deferred development of new supplies of water, fewer supply interruptions and lower costs in pumping water.

There are nonetheless problems in determining how much further leakage should be reduced, which OFWAT need to resolve

13 OFWAT and the water companies agree that the aim should be for companies to reach their economic level of leakage (see paragraph 7 above) but disagree on the extent by which leakage should be reduced in practice. OFWAT have required water companies to undertake the assessment of where their economic level of leakage lies themselves, as the level varies between water systems, and its determination requires detailed economic and engineering assessments. They will monitor leakage in line with the companies' assessments for 16 out of the 24 companies in 2001-02, but this has been the first year in which the majority of assessments have been sufficiently robust for OFWAT to do so. Where assessments have not been robust, OFWAT have set their own "pragmatic" leakage reduction targets based on the balance between supply and demand for water in each company's area and leakage levels. Some water companies have told us that it had been difficult for them to identify clearly what OFWAT expected of them and that OFWAT had not given clear feedback when rejecting their assessments. Some companies were also concerned that they had received little explanation of how pragmatic targets had been arrived at, and OFWAT have now taken steps to ensure that full feedback and explanation is available to all companies.

14 Despite the progress that has been made since 1994-95, reported leakage remains at more than three million cubic metres a day - nearly half the rate of flow of the River Thames in London - and several important issues remain unresolved. These include:

- **There is uncertainty about the total amount of leakage**. Water companies cannot measure leakage directly but have to estimate its level. They commonly do this by monitoring the total amount of water they put into their distribution systems and deducting from this the amount used by customers and reconciling this to leakage with reference to minimum distribution flows. Most customers do not have water meters, so their consumption must also be estimated and the accuracy of estimates of leakage is dependent on the accuracy with which this is done. Companies' estimates of unmetered customers' consumption vary by up to 31 per cent. While some variation is to be expected, the uncertainties about reported leakage make it difficult for OFWAT to monitor progress against targets for the absolute level of leakage, and, in some cases, to assess the scope for further reductions. In addition, while it is possible for OFWAT to monitor, and set targets for, year-on year changes in leakage, this is more difficult when companies change their methods of estimation. Furthermore, these doubts make it harder to assess the impact of actions taken to make the use of water by customers more efficient.

- **The levels of leakage remain high in some areas but the need and scope for reducing leakage is unclear**. Some companies with a high level of leakage also have only a small margin between the amount of water they can supply and the amount needed by their customers. It is quite possible, therefore, that further reducing leakage could benefit the customers of these companies. Many water companies, however, consider that they have reached, or are very close to, their economic level of leakage and argue that further reductions are unnecessary and might need to be funded by an increase in water prices. OFWAT are not convinced that all companies have done enough to validate their assumptions about the costs of detecting and reducing leakage and consider that there may be scope for reducing leakage further without increasing costs overall. Furthermore, improvements in technology may reduce the costs of reducing leakage.

- **The value of water saved by reducing leakage is uncertain**. Since 1998, companies have been required to estimate the value of the water saved by estimating the long run marginal cost of producing it - the effect on their costs of changing the amount of water they supply. Companies' estimates have varied to such a degree as to indicate that they have used significantly different methods and assumptions in their estimates. OFWAT have told companies to resubmit their estimates and some companies suggested to us that there was a need to agree the method of calculation to be used.

- **There is uncertainty as to how the costs and benefits to the environment and Society of leakage and leakage control should be calculated**. In addition to the direct costs borne by companies, leakage and its control create costs and benefits for the environment and Society. For example, it is difficult to put a price on the increased risk of restricting supplies to customers (although research into customers' priorities suggests that reducing the incidence of hosepipe bans is not valued highly). Left to themselves, companies may put a lower valuation than Society on actions, such as reducing leakage, aimed at forestalling these effects. In particular, few companies have fully included environmental costs in their calculation of the economic level of leakage. Reducing leakage may, however, also impose costs on Society, for example when repairing water mains disrupts road traffic. Taking account of all of these non-financial costs may in some parts of the country show that further expenditure on reducing leakage would be worthwhile, but by how much is uncertain.

15 The Environment Agency regulate the use of water resources and the Department of the Environment, Transport and the Regions set the legislative framework for the work of both OFWAT and the Agency. In view of the uncertainties set out above, in May 2000 OFWAT, the Department and the Agency agreed jointly to commission a study of the future development of leakage targets. The study will recommend improvements to the current approach to leakage target setting and review possible adjustments that could be made to take more account of best practice in leakage management techniques. It will also seek to establish a set of key principles to be followed by the companies when they calculate their economic level of leakage, and to recommend where the quality of data used in the analysis of economic leakage levels may need to be improved and the data augmented.

Companies have made progress in promoting water efficiency

16 The Environment Act 1995 gave water companies a statutory duty to promote the efficient use of water by their customers and made OFWAT responsible for enforcing this duty. OFWAT have taken the view that all companies must carry out a minimum level of activity to promote water efficiency and that companies with a tight margin between the demand for water and the amount they can supply should take a more active approach. They also expect all companies to consider the contribution that water efficiency can make to balancing the demand for water with the supply available.

17 OFWAT's approach has been to require every company to develop and maintain a water efficiency plan showing how they will promote water efficiency, to scrutinise these plans, and to monitor and report companies' progress against them and the outcomes achieved. In our survey of companies, most companies told us they clearly understood OFWAT's views on water efficiency but six commented that OFWAT's approach lacked clear objectives that focused on what the companies were expected to achieve in terms of levels of reduced demand.

18 Between 1996 and 2000 companies implemented some 12 million actions to promote water efficiency. These included over five million cistern devices - mainly plastic containers placed in lavatory cisterns to reduce the amount of water used in each flush (around a third of water used in the home is for flushing lavatories). Other actions included more than four million information packs to help customers assess how they can save water, and the installation of more than one million water meters. In our survey of water customers, we found that 88 per cent said they were doing something to save water, and 57 per cent recalled seeing advice on the subject. What is less clear is what has been achieved by implementing these actions.

More needs to be done to enable water companies to determine which water efficiency measures are worthwhile

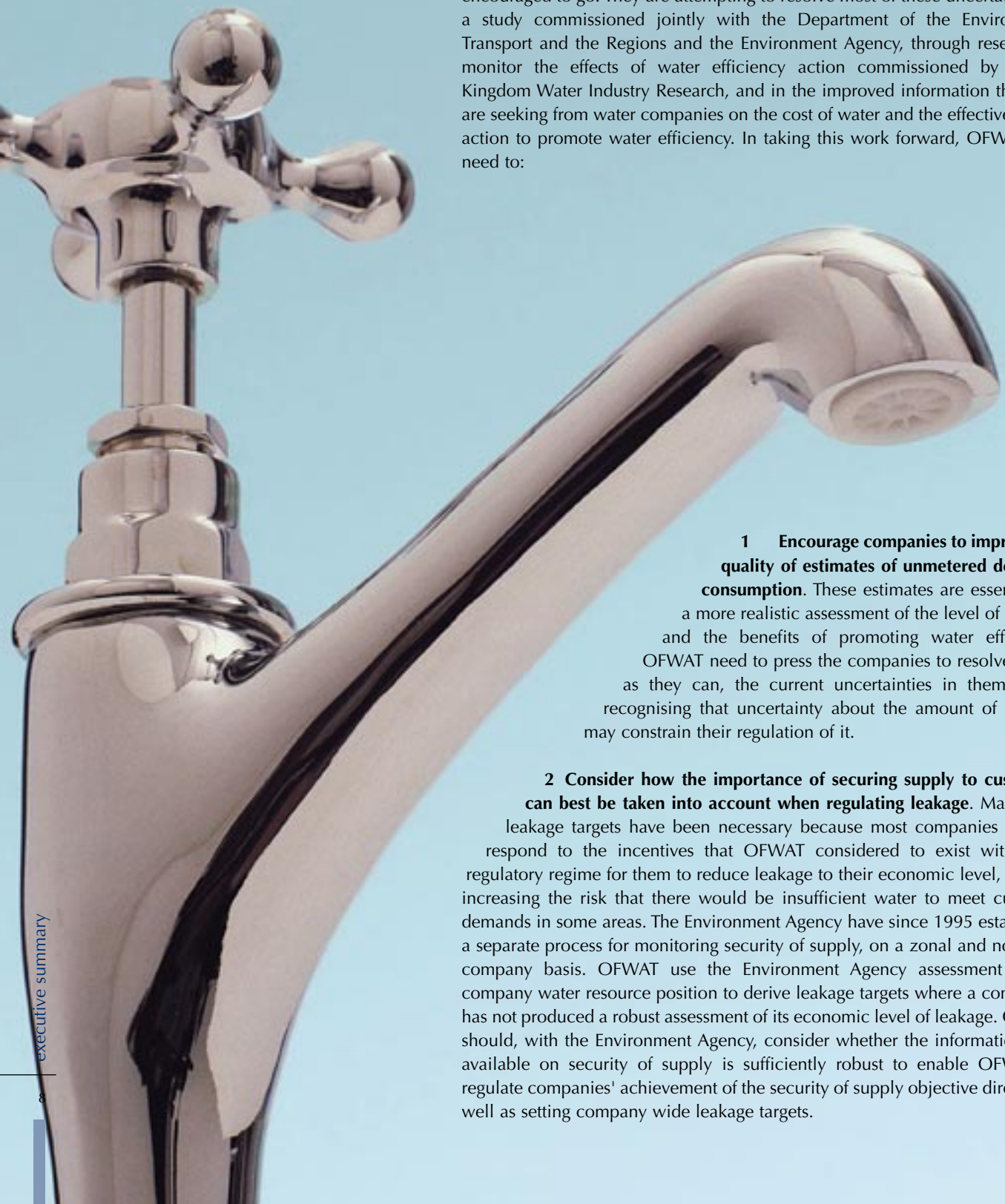
19 OFWAT have asked companies to monitor the amount of water saved by the promotion of water efficiency and some information is available on the results of some individual projects. For example, Thames Water have estimated that a scheme of theirs to help customers assess how they can save water saved around 17 litres of water per home per day (5 per cent). The information on results available is very incomplete, however, and there are significant uncertainties about the effectiveness of some types of water efficiency activity. For example, in our survey of customers we found that only half of customers who had received a cistern device were using it at the time of our survey, and research by companies has cast doubt on whether the long term savings initially expected from such devices are being achieved. Furthermore, figures for domestic consumption per head show a rising trend, in contrast to the trend in some other European countries, although it may be that water efficiency actions have slowed the growth in consumption.

20 As a result, OFWAT lack robust information on the amount of water saved by the water efficiency action being taken and on how long customers continue to save water as a result of individual initiatives. They are therefore not yet in a position to assess how much water is saved as a result of companies' action. Nor can they assess the financial value of this saving or the cost-effectiveness of the companies' action.

21 OFWAT recognise the need for better information on the impact of water efficiency actions, and have asked the companies to set out their intentions for improving the information available. They have been critical of some companies' apparent reluctance to share the findings from their water efficiency projects and have urged greater co-operation in identifying best practice. OFWAT are discussing with the Environment Agency, the companies and with Water UK (the representative body of the water companies) how best to secure this. As a result UK Water Industry Research have commissioned research, to which OFWAT are contributing, of what constitutes best practice in assessing the cost effectiveness of water company initiatives.

Recommendations

22 OFWAT have ensured that water companies have made significant progress since the 1995 drought and the 1997 Water Summit in both reducing leakage and promoting the efficient use of water by customers. They also recognise that important uncertainties need to be resolved to assess fully the value of what has been achieved and to judge how much further companies should be encouraged to go. They are attempting to resolve most of these uncertainties in a study commissioned jointly with the Department of the Environment, Transport and the Regions and the Environment Agency, through research to monitor the effects of water efficiency action commissioned by United Kingdom Water Industry Research, and in the improved information that they are seeking from water companies on the cost of water and the effectiveness of action to promote water efficiency. In taking this work forward, OFWAT will need to:



1 Encourage companies to improve the quality of estimates of unmetered domestic consumption. These estimates are essential for a more realistic assessment of the level of leakage and the benefits of promoting water efficiency. OFWAT need to press the companies to resolve, as far as they can, the current uncertainties in them, while recognising that uncertainty about the amount of leakage may constrain their regulation of it.

2 Consider how the importance of securing supply to customers can best be taken into account when regulating leakage. Mandatory leakage targets have been necessary because most companies did not respond to the incentives that OFWAT considered to exist within the regulatory regime for them to reduce leakage to their economic level, thereby increasing the risk that there would be insufficient water to meet customer demands in some areas. The Environment Agency have since 1995 established a separate process for monitoring security of supply, on a zonal and not just a company basis. OFWAT use the Environment Agency assessment of the company water resource position to derive leakage targets where a company has not produced a robust assessment of its economic level of leakage. OFWAT should, with the Environment Agency, consider whether the information now available on security of supply is sufficiently robust to enable OFWAT to regulate companies' achievement of the security of supply objective directly, as well as setting company wide leakage targets.

3 **Reflect the potential benefit to the environment of reducing leakage and improving the efficiency with which customers use water**. Few companies currently take full account of environmental and other non-financial costs in their assessments of their economic level of leakage. This may result in companies underestimating the potential benefits of further reductions in leakage. Subject to the outcome of the current tripartite study, OFWAT should consider joining with the Environment Agency in providing further guidance to companies on how to take account of such costs and on OFWAT's approach to such costs in setting future price limits.

4 **Establish the financial costs and benefits of leakage control and the scope for reducing costs through technological advances.** OFWAT are uncertain about how much it costs to control leakage and the value of the water saved, and the majority of companies cannot produce satisfactory estimates for these figures. It must be doubtful how much reliance can be put on companies' assessments of economic levels of leakage, the central purpose of which is to strike an appropriate balance between these amounts. It may be that more research into costs and benefits and clearer guidance to companies will produce more reliable estimates. If this is not the case OFWAT should instead establish what is required to maintain an adequate security of supply and then consider whether environmental considerations justify a lower level of leakage, having had regard to the effect on customers' bills.

5 **Obtain a better picture of the effectiveness of different types of action to promote water efficiency**. Ideally, OFWAT should focus their regulation of companies' water efficiency work on the outcomes achieved by companies, such as the amount of water saved and the cost effectiveness of activities, rather than on companies' inputs, such as the number of cistern devices that have been installed, in order to encourage companies to achieve such outcomes as efficiently as possible. But because of the serious uncertainties about what, if any, savings particular types of water efficiency action can make and the value of any water saved, OFWAT have lacked sound information on outcomes. Based on the results of the research by United Kingdom Water Industry Research, OFWAT will need to establish a clear plan for improving the measurement of the outcomes achieved by companies from their water efficiency work, so that they can better assess what they should expect companies to achieve from this work.

6 **Promote greater sharing by companies of the results of their monitoring of the effectiveness of action to promote water efficiency**. One way in which OFWAT are seeking to improve knowledge of the outcomes of water efficiency work is by requiring each company individually to monitor the outcome of their work on promoting water efficiency. Such knowledge would be of value to companies and might also be of use to OFWAT in comparing the performance and efficiency of companies. This work is technically demanding, however, and involves duplication of effort by companies where they take similar types of action. OFWAT should consider how the results of this work can be disseminated across the industry to provide companies with a common and well-grounded basis for taking decisions on future water efficiency initiatives. This could involve encouraging companies, or providing them with incentives, to share information that companies at present keep to themselves, for example by allowing companies to reduce the monitoring they do if they contribute to the monitoring costs of other companies taking similar types of water efficiency action.

Part 1 Introduction

1.1 The restrictions on customers' use of water imposed during the drought of 1995 brought to the attention of Parliament and the public the high levels of leakage in the water industry, and the effect that leakage could have on the ability of water companies to provide a reliable supply of water to customers. Leakage at the time accounted nationally for an average of some 30 per cent of water put into distribution systems. And high levels of leakage were an important cause of particularly severe problems encountered by Yorkshire Water, who at one point were using a fleet of 700 road tankers to carry water to the reservoirs serving West Yorkshire.

1.2 The Government convened a Water Summit in May 1997 with the objective of ensuring that the water industry distributed water to customers reliably and efficiently, and that, by example and action, it helped customers to use water in the most efficient way. At the Summit, the Government emphasised the importance of reducing leakage and promoting water efficiency in helping to secure a reliable, efficient and environmentally sustainable supply of water to customers. The Deputy Prime Minister presented a ten-point plan for the industry (Appendix 1), which included mandatory leakage targets for companies aimed at achieving a substantial reduction in the level of leakage over five years and the vigorous promotion of water efficiency by companies. OFWAT have a key rôle in ensuring that the industry secures these aims.

1.3 We examined how OFWAT carry out their responsibilities for regulating the way that water companies in England and Wales manage leakage and promote the efficient use of water by customers. This part of the report examines:

i) the rôle of water companies relating to leakage and water efficiency;

ii) the rôle of OFWAT and other Government bodies relating to leakage and water efficiency;

iii) why we examined leakage and water efficiency;

iv) the issues we examined and the methodology we used.

The rôle of water companies relating to leakage and water efficiency

1.4 The 24 water companies in England and Wales together serve more than 22 million water customers (both households and business customers) and a total population of some 52 million. **Figure 2** shows the areas served by the companies. The companies are of two types:

- Ten water and sewerage companies, which were formed from the water and sewerage businesses of the ten former water authorities and were privatised in December 1989. In 1999-2000 they served some 17 million water customers.[1]
- Fourteen water only companies, which supply water but not sewerage services. In 1999-2000 they served some 5 million water customers.

1 *The ten water and sewerage companies also provide sewerage services to almost all water customers.*

2 **The areas served by the 24 water companies**

1.5 Legislation, principally the Water Industry Act 1991, gives the water companies several duties relating to leakage and water efficiency **(Figure 3)**.

1.6 The specific duty to promote water efficiency does not have an exact parallel in relation to leakage. High levels of leakage and of water consumption by customers can seriously affect a water company's ability to provide a reliable supply of water to their customers. They are also a waste of a precious natural resource and of the money spent in obtaining water, treating it and pumping it around companies' distribution systems. But reducing leakage and promoting water efficiency also costs money, and completely eliminating leakage would be impractical. Accordingly, to maintain an efficient and economical system of water supply, the companies need to achieve a level of leakage and water efficiency that balances all the costs and benefits involved and minimises the total economic and environmental costs of meeting customers' requirements for water.

The rôle of OFWAT and other Government bodies relating to leakage and water efficiency

1.7 The Director General of Water Services (the Director General) heads OFWAT. He regulates the economic activities of water companies in England and Wales, including their charges and the standard of the services they provide to customers. He does not regulate the quality of drinking water or the effect of companies' activities on the environment.

1.8 The legislation and the companies' licences give the Director General a range of duties and powers (Appendix 2), and OFWAT's primary task is to ensure that the companies carry out, and can finance, their functions. Within this framework, OFWAT have three key responsibilities that underlie their work on leakage and water efficiency. They are to:

- enforce the relevant duties of the water companies (**Figure 3**);
- set price limits for companies at a level that enables them to carry out these duties (as well as to finance all their other statutory functions) by securing, in particular, reasonable returns on their capital;
- in doing so, seek to promote economy and efficiency on the part of water companies and to protect the interests of customers.

3 Water companies' duties relating to leakage and the efficient use of water

Every water supplier must:

- develop and maintain an efficient and economical system of water supply within their area;
- provide a supply of wholesome water sufficient for domestic purposes (e.g. for drinking or sanitation);
- provide a supply of water for other purposes, except where to do so would put at risk their ability economically to maintain domestic supplies;
- promote the efficient use of water by their customers.

Source: Water Industry Act 1991 and Environment Act 1995

1.9 OFWAT have formal sanctions available to them if a company fails to carry out its duties, including those relating to leakage and water efficiency **(Figure 4)**.

1.10 OFWAT's broad approach to leakage and water efficiency has been:

- **Leakage**: to seek to ensure that companies minimise the total cost of leakage, taking into account both the cost of leakage control and the cost of replacing water lost through leakage.
- **Water efficiency**: to ensure that companies comply with their statutory duty to promote water efficiency. OFWAT also expect companies to consider the scope for cost-effective water efficiency programmes in their assessments of the most efficient way of meeting customers' needs for water, particularly in those areas in which water supplies are limited.

1.11 In addition to OFWAT, several other regulators have responsibilities for the water industry in England and Wales. The Environment Agency have the duties of conserving, redistributing or otherwise augmenting water resources and securing their proper use in England and Wales. They carry out these duties by assessing water companies' plans for using water resources, setting out national and regional water resource strategies, and making judgements on whether leakage and other components of demand are being properly managed before allocating licences to companies to allow them to abstract water.

4 The regulatory powers available to OFWAT if a company fails to carry out its duties

- **Setting targets** – OFWAT can set targets for the quality of service that companies must provide if they are not to be considered to be in breach of their legal duty to operate an efficient and economical system of water supply. OFWAT can set such targets for aspects of companies' operations, such as the level of leakage.
- **Varying price limits** – when setting companies' price limits, OFWAT can take account of factors such as the scope for a company to reduce costs by improving its management of leakage and water efficiency.
- **Enforcement Orders** – if a company breaches its licence or its legal duties, OFWAT may make an enforcement order requiring action to remedy the breach. Failure to comply with the order would expose the company to the risk of legal action by customers who suffer loss or damage. OFWAT would also be able to seek an injunction to secure compliance.
- **Special Administration Orders** – if a company breaches an enforcement order or one of its principal duties, the Secretary of State, or, with his consent, OFWAT, may apply to the High Court for a Special Administration Order revoking the company's licence.
- **Imposing requirements on water companies** – OFWAT may impose requirements on water companies to take specific action to promote water efficiency.

Source: OFWAT

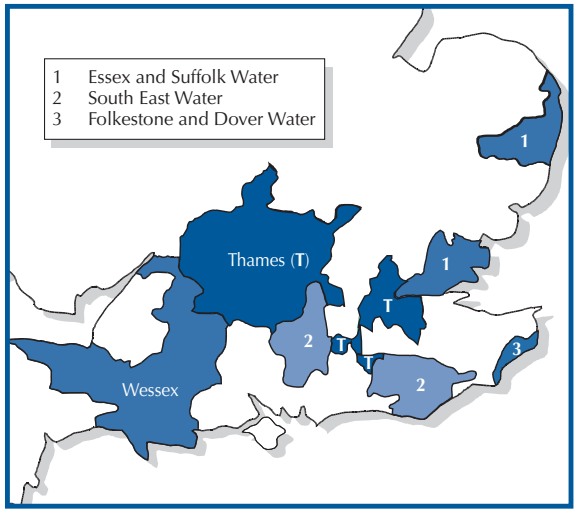
1.12 The Department of the Environment, Transport and the Regions and the Welsh Assembly set the legislative framework for the work of OFWAT and the Environment Agency on leakage and water efficiency. OFWAT also consult the Department and the Assembly when setting leakage reduction targets for companies. Their primary objectives are to ensure that excessive leakage levels do not lead to unacceptable restrictions on the use of water and that the Government's strategy on sustainable development is successfully implemented. The Department and the Welsh Assembly, advised by the Drinking Water Inspectorate, also regulate the quality of drinking water.

Why we examined leakage and water efficiency

1.13 Reducing leakage and promoting water efficiency are important features of the Government's objectives for the water industry. In their 1998 report on OFWAT's regulation of the standard of services to water customers (PAC 36th Report, 1997-98), the Committee of Public Accounts expressed concern at the level of leakage in the industry. They said that they expected OFWAT to monitor closely companies' progress in achieving their targets for reducing leakage and to act promptly if any companies failed to achieve them.

1.14 The control of leakage and the promotion of water efficiency are also important issues for customers and Society. In some areas of England and Wales, mainly in Southern and Eastern England **(Figure 5)**, the amount of water available to replace that lost through leakage is

5 Areas of England and Wales served by water companies with a narrow margin between available supply and demand in 2000



Note: Areas shown are those served by companies with a margin of 10 per cent or less between estimated demand and water available for use in a normal year.

limited. At the same time, the demand for water is forecast to increase as, for example, the number of households increases. To maintain a safe margin between water supply and demand, the companies that serve these areas need to avoid wasting water through excessive leakage and to manage customer demand by promoting the efficient use of water.

1.15 OFWAT's work on leakage and water efficiency has been carried out against the background of their wider rôle in regulating water companies and the progress made by the water industry in recent years. Since privatisation in 1989 water companies have invested some £35 billion in water supply and sewerage systems and made significant improvements in the standard of drinking water and the environment. Standards of service to customers have also improved significantly. And although customers' bills initially rose to pay for this investment, customers' bills in 2000-2001 are on average nearly 13 per cent lower in real terms than in the previous year, following a review of the companies' prices by OFWAT in 1999.

The issues we examined and our methodology

1.16 Against this background we examined how OFWAT are carrying out their responsibilities for regulating the way water companies in England and Wales manage leakage and promote the efficient use of water. We looked at two main issues:

- what progress has been made in reducing leakage (Part 2);
- what OFWAT have done to encourage water companies to promote the efficient use of water by their customers (Part 3).

1.17 Appendix 3 describes our methodology in detail. In brief we:

- collected and evaluated information from OFWAT relating to leakage and water efficiency; this included OFWAT's annual reports on leakage and water efficiency, and OFWAT's correspondence files with water companies on their leakage control work and economic level of leakage assessments; we also conducted a detailed examination of files at OFWAT, and conducted interviews with OFWAT staff, to analyse their approach to leakage and water efficiency;
- collected and evaluated information and publications from OFWAT, the Environment Agency and the Department of the Environment, Transport and the Regions, relating to leakage and water efficiency;
- conducted interviews with the Environment Agency and their National Water Demand Management Centre; seven water companies, Water UK (the body representing all water companies), Eaga Partnership Limited (formerly the Energy Action Grants Agency), and the Department of the Environment, Transport and the Regions;
- appointed WS Atkins, engineering consultants, in conjunction with Frontier Economics and Mr Allan Lambert, Principal Consultant, International Water Data Comparisons Ltd, to review our methodology and report, and to advise on technical and economic issues;
- sent a questionnaire to twenty-five water companies in England and Wales asking their views on how OFWAT regulate leakage and water efficiency (Appendix 4);[2]

2 *Hartlepool Water are now owned by Anglian Water, reducing the number of companies to 24.*

- commissioned IPSOS to undertake an omnibus survey of 1,919 water customers in England and Wales to ascertain their views on water efficiency (Appendix 5).

1.18 Our examination drew on our 1998 report "Improving Energy Efficiency Financed by a Charge on Customers" (HC 1006 1997-98) which examined a scheme introduced by the Office of Electricity Regulation under which local electricity companies help their customers use electricity more efficiently. We also drew on four previous reports touching on the regulation of the water industry:

- "The Work of the Directors General of Telecommunications, Gas Supply, Water Services and Electricity Supply" (HC 645 1995-96).
- "Regulating and Monitoring the Quality of Services Provided to Customers by the Water Industry in England and Wales:" (HC 388 1997-98).
- "How the Utility Regulators are Addressing the Year 2000 Problem in the Utilities (HC 222 1998-99).
- "The Year 2000 Problem in the Utilities: Update Report" (HC 843 1998-99).

Appendix 6 outlines the conclusions of previous reports by the Public Account Committee which are relevant to this report.

Part 2 Leakage

2.1 The control of leakage by water companies is not an end in itself, and it costs money to achieve and sustain reductions in leakage. There are four main reasons why this expenditure can be justified:

- it reduces or delays some other costs of the water companies, such as processing water and developing new sources of supply;
- it reduces the likelihood of customer supply being restricted or interrupted as a result of low rainfall or disruption of a key source of supply, for example due to water quality problems;
- by reducing the total amount of water that has to be put into the system, it may remove the need for water to be taken from water sources in an environmentally damaging way, for example, leading to rivers drying up in the summer, and protect the amenity or recreational value of open water; and
- it may encourage consumers to be more responsible in their use of water if they know that water is not being wasted through leakage, although there is only anecdotal evidence to this effect.

2.2 In this context we examined:

- how successful OFWAT have been in encouraging water companies to control leakage;
- the impact of reductions in leakage on the supply to customers and the environment;
- the financial consequences of changes in leakage levels for water companies and customers; and
- the scope for achieving further benefits by reducing leakage.

2.3 The last of these issues is being considered as part of a review sponsored by OFWAT, the Department of the Environment, Transport and the Regions and the Environment Agency (the tripartite study). We have sought to flag up matters that the review could usefully take into account.

OFWAT's success in encouraging reductions in leakage

Reported leakage rose before the 1995 drought

2.4 Following the privatisation of the water industry in 1989, OFWAT endorsed the generally held view that companies should reduce leakage to the point where the additional cost of saving water by further reducing leakage exceeded the cost of other ways of meeting the demand for water, such as developing new sources of water. This level is known as the economic level of leakage. Although in 1989 OFWAT asked companies to provide details of estimated and forecast leakage and their intentions on leakage control, they did not set companies leakage targets. They considered this to be unnecessary on the grounds that companies had an incentive to reduce leakage to the economic level because they would reduce their costs, and hence increase their profits, if they did so. OFWAT were also concerned that setting targets would create an incentive for companies to distort their reported leakage levels. And they were concerned that, in the absence of robust information on the companies' economic level of leakage, setting targets might result in companies incurring unnecessary costs in reducing leakage.

2.5 In the years immediately following privatisation in 1989, leakage figures reported by water companies were subject to significant uncertainties. As a result, the first reasonably reliable figures for the industry as a whole date only from 1992-93. OFWAT estimates of the leakage performance of the ten water and sewerage companies between 1989-90 and 1992-93 indicate, however, that during this period only two of the companies made significant leakage reductions, three made some leakage reductions and five made little change in their leakage level.[3]

2.6 From 1992-93, when the water companies were able to provide OFWAT with more reliable figures, the level of leakage rose significantly until the 1995 drought. There were high levels of leakage among some of the largest water companies and between 1993 and 1995 Thames Water, Wessex Water and Yorkshire Water all reported increases in leakage levels. By 1995 the volume of water that was being lost nationally through leakage was 5.1 million cubic metres per day.[4] This was nearly three times the amount used per day by the customers of the biggest water company, Thames Water. It represented some 30 per cent of the total amount of water put into their distribution systems by the companies, and the rate at which water was being lost through leaks was equivalent to nearly three-quarters of the average rate of flow of the River Thames in London.

Following the 1995 drought OFWAT introduced leakage targets and leakage has fallen

2.7 The high and rising level of leakage in the period before the 1995 drought showed that there were problems with OFWAT's approach to regulating leakage control. In our discussions with companies, some companies told us that before the drought leakage reduction had not been a priority in the industry, and that it did not get the attention that it needed. Some also commented that they did not expect the price limits set by OFWAT fully to reward them for reducing leakage to its economic level. The high level of leakage indicated that most companies were not responding to the incentive that OFWAT considered existed to reduce leakage to economic levels, and the 1995 drought showed that this had put at risk their ability to meet customers' requirements for water in some areas.

2.8 In particular Yorkshire Water had come very close during the drought to having to introduce "rota cuts" in which sections of the water supply system would be cut off for 24 hours at a time. In a subsequent investigation of the company's performance, OFWAT found that there had been serious failures by the company in their arrangements for maintaining adequate supplies of water, in particular in controlling leakage. They also found that Yorkshire Water had not paid sufficient attention to its leakage performance and did not have adequate plans to deal with the consequent problems.

2.9 Water companies responded to the 1995 drought by taking action to reduce leakage and improve the security of supplies. The ten water and sewerage companies also committed themselves to voluntary targets to reduce leakage. OFWAT acted to encourage these processes by:

- Sending a clear signal that the failure by Yorkshire Water to control leakage and maintain the supply of water to customers could not be tolerated. OFWAT persuaded Yorkshire Water to forego a previously agreed 2.5 per cent price increase, thereby reducing the company's income by £40 million over the three years to 1999-2000. Yorkshire Water did not attempt to pass on to customers £47 million of exceptional operating expenditure incurred during the drought, such as on hiring water tankers. And in the 1999 review of water price limits, OFWAT did not recognise approximately half of the £100 million invested by the company in improving water supply reliability in Yorkshire following the drought.
- Requiring every water company to set themselves a target for reducing leakage, initially for 1997-98. They also told companies that they must demonstrate that their work on leakage economics was improving and was based on well-informed analysis of the costs of leakage reduction and of alternatives for balancing supply and demand.

2.10 OFWAT changed their view on the need for targets following a review of the performance of the industry in managing leakage which led them to conclude that leakage had been higher than previously estimated and that leakage figures remained subject to significant uncertainties. They considered that companies often had not fully understood the effect of leakage on the costs of operating their water supply systems and there were serious deficiencies in their knowledge of the most cost-effective means of reducing leakage. OFWAT therefore required the companies to set themselves leakage reduction targets and said that if companies missed these targets, they would take action, for example by recommending mandatory targets to the Secretary of State.

3 OFWAT Water estimated that of the ten water and sewerage companies, two (Anglian Water and Southern Water) made significant reductions in leakage, three (North West Water, Thames Water and Wessex Water) made some reductions and five (Dŵr Cymru (Welsh Water) , Northumbrian Water, Severn Trent Water, South West Water and Yorkshire Water) made little change in leakage levels. However, it was subsequently found that Anglian Water and Thames Water had underestimated their leakage levels and that their level of leakage, while still reduced, was higher than previously believed.

4 Amounts of leakage quoted in this report are of total leakage, which consists of water lost from leaks in both companies' distribution systems and in pipes (generally owned by customers) connecting customers to companies' systems.

2.11 OFWAT's use of targets increased following the 1997 Water Summit, when the Deputy Prime Minister announced that OFWAT would set tough mandatory targets for total leakage to enforce a "substantial reduction" in leakage over five years. Since then OFWAT have set mandatory targets for all companies in 1998-99, 1999-2000 and 2000-01, and for eight of the 24 companies in 2001-02. They have not set mandatory leakage reduction targets for the remaining companies in 2001-02 because these companies have made robust analyses of their economic leakage levels, but they will monitor progress against the companies' own targets.[5]

2.12 Most water companies have succeeded in achieving the leakage targets:

- Between **1995-96** and **1996-97**, total leakage across the industry fell by nearly ten per cent as companies sought to meet the commitment they had made to reduce leakage.
- All but three companies met the **1997-98** targets they had set themselves. In two cases[6] OFWAT accepted the companies' explanations that this had been because they had improved their information on leakage, and found that it was higher than they had thought when they had set their targets, but OFWAT were nonetheless satisfied that they had reduced leakage. The other company[7] had higher leakage levels because previously it had underestimated leakage and OFWAT set it a revised and more challenging target for 1998-99.
- The total leakage reported by companies for **1998-99** was two per cent below the total of their targets, and only two companies[8] failed to meet their targets. OFWAT asked both companies to provide them with detailed reports on a quarterly basis to ensure that the companies met future targets.[9]
- The total leakage reported by companies for **1999-2000** was less than one per cent below the total of their targets. Two companies[10] failed to meet their targets and OFWAT have asked them both to provide quarterly progress reports.

2.13 As Figure 1 (on page 3) shows, reported total leakage levels began to fall in 1995-96, the year of the drought, and by 1999-2000 they were down to 3.3 million cubic metres a day, 21 per cent of the total amount of water put into supply and nearly half the rate of flow of the River Thames in London. Compared to 1996-97, the year immediately preceding the May 1997 Water Summit, the total reduction to 1999-2000 was 1.2 million cubic metres a day, representing a reduction of more than a quarter in the total amount of leakage.

2.14 In our survey of companies, 14 companies told us that they had been motivated to reduce leakage because it was a cost-effective way of balancing the supply and demand for water (Appendix 4). Several also said that managing leakage effectively was an important part of their customer relations. Most companies said, however, that OFWAT's use of mandatory targets had been the main factor affecting the amount of work they had put into leakage reduction and that the targets had ensured that leakage levels had been reduced more quickly than they otherwise would have been.

There is uncertainty about the total amount of leakage

2.15 Figures for leakage are widely quoted but it is in fact difficult to estimate leakage accurately. The two most common techniques that water companies use to estimate leakage are the minimum night flow method and the total integrated flow method **(Figure 6)**. OFWAT expect companies to use the total integrated flow method and to reconcile their results with those they attain using the minimum night flow method.

6 Methods for estimating leakage

The total integrated flow method: companies measure the amount of water they put into their distribution systems and the amount that has been used by metered customers. The difference between these amounts is the total of three elements: the amount used by unmetered customers, the amount used by the company for operational purposes or taken without charge (for example from fire hydrants) and the amount lost by leakage. Deducting estimates of the first two elements then leaves a remainder, which is taken to be the amount lost through leakage.

Thus, in 1999-2000

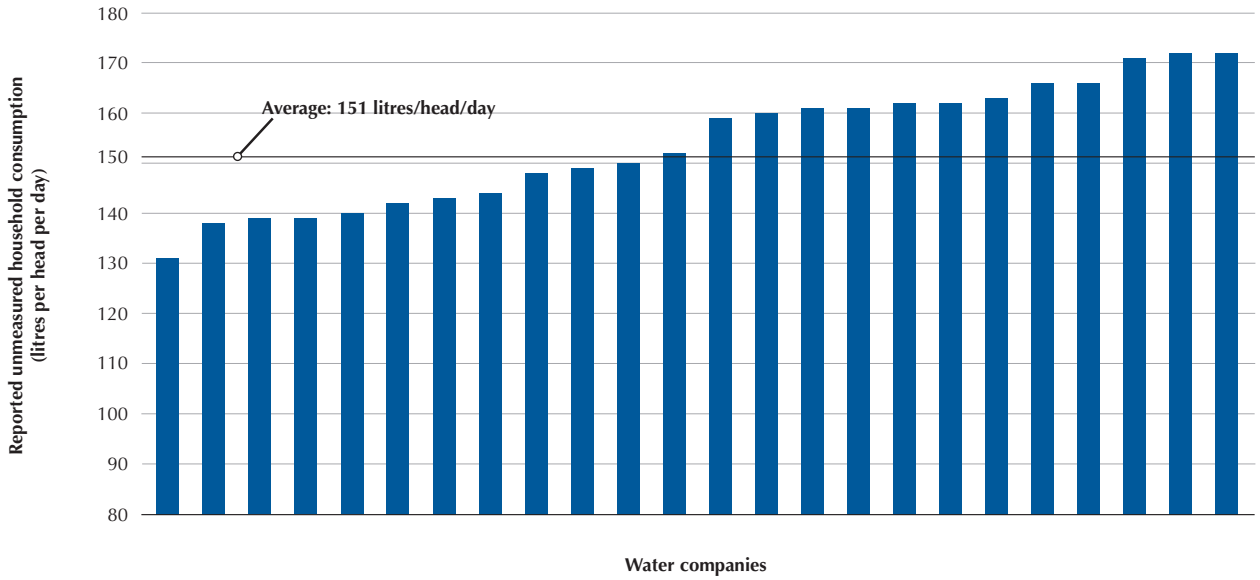
Companies put into supply	15.6 million cubic metres a day
Metered customers used	5.3 million cubic metres a day
The balance was	10.3 million cubic metres a day
Estimated water for operational use or taken without charge	0.2 million cubic metres a day
Estimated unmetered usage by customers was	6.8 million cubic metres a day
Estimated leakage was therefore	3.3 million cubic metres a day

The minimum night flow method: flows of water into districts of 1,000-3,000 properties are measured at night when consumption is at a minimum. After deducting an allowance for consumption by customers the rest is classified by the company as leakage.

5 Dŵr Cymru (Welsh Water) had made a robust assessment of their economic level of leakage but were set a mandatory target because of uncertainties over their ownership and management.
6 Portsmouth Water and Mid Kent Water.
7 Anglian Water.
8 Bournemouth and West Hampshire Water and South East Water. Bournemouth and West Hampshire Water's failure to meet its target resulted from improved monitoring which showed that it had under-recorded the volume of water put into supply.
9 From April 2000 in the case of South East Water.
10 Dee Valley Water and South East Water.

7 Company estimates of consumption by unmetered domestic customers 1999-2000

There are substantial variations between companies in the estimated level of consumption by unmetered customers



Source: OFWAT

2.16 Nearly half of water consumption is by unmetered customers (nearly all of whom are domestic customers), so company estimates of consumption by such customers have an important effect on the level of leakage they report. For example, if in 1999-2000 companies had estimated unmetered customers' usage to be 6.3 million cubic metres a day rather than the 6.8 million they actually estimated, reported leakage would have been 3.8 million cubic metres a day rather than 3.3 million, 18 per cent higher.

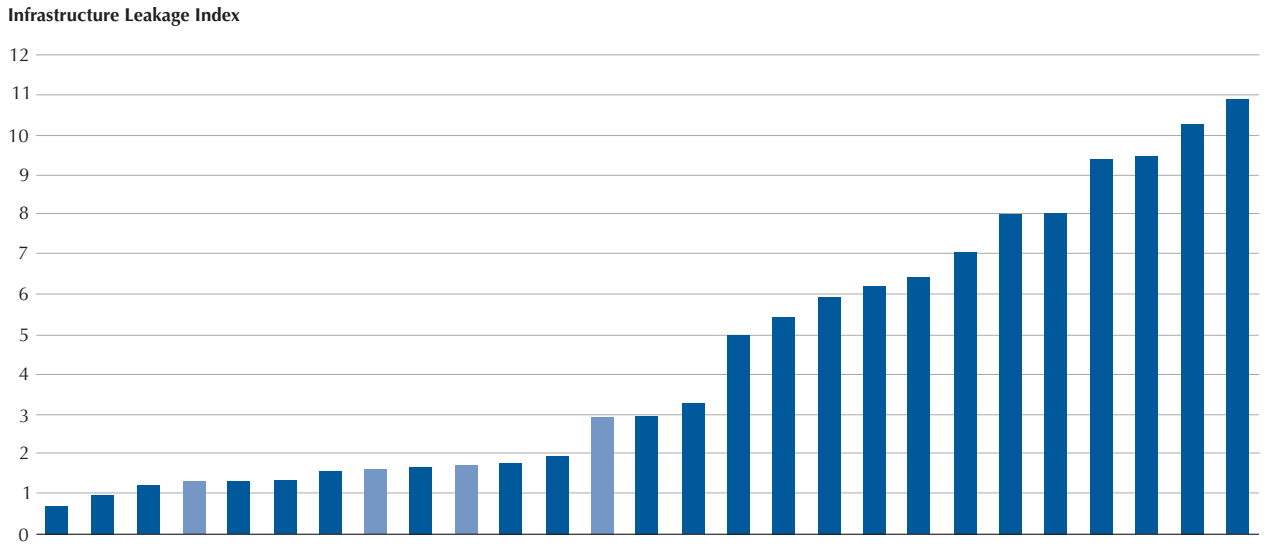
2.17 Companies' estimates of consumption by unmetered customers vary considerably, and there is a 31 per cent difference between the highest estimate and the lowest **(Figure 7).** There are good reasons why such estimates should vary between companies, such as variations in the ownership of domestic appliances and the proportion of homes with large gardens, and companies' average estimates of consumption by unmetered customers have not changed greatly since 1995-96. Companies can also use the minimum night flow method of monitoring leakage (Figure 6) to cross check their estimates and companies' estimates are subject to checks by independent engineers that OFWAT require them to employ. But the extent of the variation shows the scope that could exist for a company to manipulate their estimates to improve their reported leakage performance. OFWAT have been concerned about the scope that exists for companies to do so. Some of the companies also told us that there was anecdotal evidence to suggest that estimates of consumption by unmetered customers had been overstated within the industry to allow some companies to meet their leakage targets. Such unreliable data on leakage undermines OFWAT's ability to monitor progress against targets for the absolute level of leakage, and, in some cases, to assess the scope for further reductions. In addition, while it is possible for OFWAT to monitor, and set targets for, year-on year changes in leakage, this is more difficult when companies change their methods of estimation. Furthermore, these doubts make it harder to assess the impact of actions taken to make the use of water by customers more efficient.

2.18 OFWAT have challenged companies to explain their estimates of consumption by unmetered customers where they appear to be out of line with other companies. And they have told companies that they should implement the best practice methodologies for estimating unmetered household consumption that have emerged from the work of UK Water Industry Research - an organisation which provides a framework for common research by water companies.

2.19 In 1999-2000, OFWAT and South East Water jointly commissioned an independent investigation of the company's system and procedures, in response to concerns held by OFWAT at the accuracy of reported leakage levels. The investigation found that leakage levels for the preceding two years had been considerably higher than previously reported, and OFWAT have required South East Water to report quarterly on progress towards achieving their 2000-01 leakage target. OFWAT have also been concerned about the quality of the leakage data provided by

8 How leakage performance in England and Wales compares internationally

Leakage levels in England and Wales are now generally better than average by international standards



In June 2000, the International Water Association published statistics on the leakage performance of 27 water supply systems in 20 countries. The statistics compared a measure of the leakage performance of each system called the infrastructure leakage index. Four England and Wales companies were included in the comparison (light blue columns in the graph) including companies with both high and low levels of leakage. The comparisons showed that, by international standards, these companies were all achieving a better than average performance.

Source: International Water Association

Thames Water and independent assessment of the data reported by the company in 2000[11] found that the company was not using best practice methods to calculate their leakage. OFWAT have continued to require Thames Water to report leakage quarterly. Thames Water told us that they had not updated their leakage monitoring practices because they believed OFWAT required a consistent year on year approach to leakage levels. They have, however, now undertaken to bring their procedures into line with best practice.

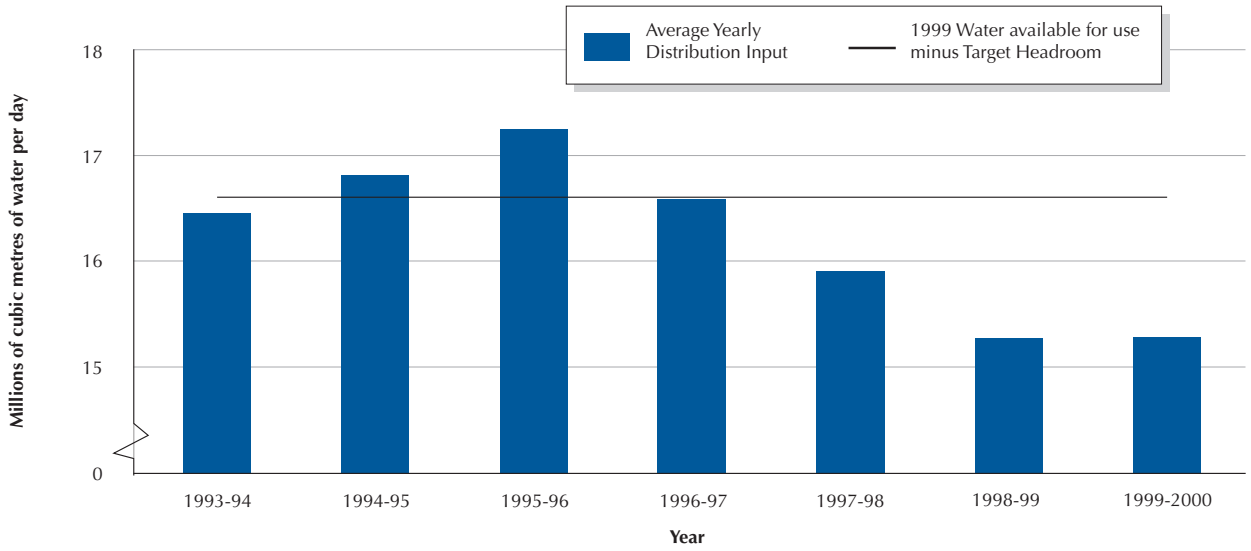
2.20 In our survey only three companies told us that they were less than satisfied that the methodologies that OFWAT are suggesting they should adopt to estimate unmetered domestic consumption will produce reliable estimates. Water UK and Yorkshire Water commented that some companies' data is now reliable enough to monitor changes in leakage fairly accurately, even though the absolute level of leakage remains somewhat uncertain due to the need for various assumptions in monitoring estimates. Some of the companies which were satisfied with the best practice methodologies also pointed out, however, that without extensive metering of households there would always be scope for companies to interpret their unmetered domestic consumption figures to present their leakage performance in a more favourable light. The rising trend of domestic unmetered consumption per head over the past seven years (Figure 18 on page 37) would be consistent with this concern, but metered consumption has risen even faster, so overall the evidence is inconclusive.

2.21 The tripartite study (paragraph 2.3) is not explicitly addressing the accuracy of leakage estimates. It will, however, examine whether the current approach taken by OFWAT in interpreting companies' analyses of their economic leakage levels is appropriate or needs modification and this will involve an assessment of leakage estimation. In addition, OFWAT are reviewing practices in the industry for assessing the consumption of unmeasured customers, to help them in scrutinising the leakage and consumption information to be provided by companies in 2001. So long as the level of unmetered consumption remains so large and uncertain, there is likely to be continued uncertainty as to the exact level of leakage. This may affect OFWAT's assessments of the scope for cost-effectively reducing leakage further, while uncertainties about unmetered consumption affect water companies' ability to measure the impact of initiatives to reduce domestic consumption (covered in Part 3).

11 The independent assessment was carried out by a "Reporter", an independent professional employed by the company, with a duty of care to OFWAT, to report to OFWAT on the compilation of information provided by the company.

9 The balance between supply and demand

Since 1995-96, lower leakage levels have reduced the amount of water that companies have needed, and the margin between supply and demand has increased.



Source: OFWAT, based on information from companies

Leakage levels in England and Wales are now generally better than average by international standards

2.22 Comparing the leakage performance of water companies in England and Wales with that of water suppliers in other countries has been very difficult. There have been problems with inconsistent definitions of key concepts, such as whether to count leaks in the pipes owned by customers that join their properties to the mains, and good quality data has been difficult to obtain.

2.23 Our engineering consultants, WS Atkins, and Mr Allan Lambert, Principal Consultant, International Water Data Comparisons Ltd, examined the scope to make such comparisons. They found that in June 2000 the International Water Association had completed two four-year studies that had dealt with many of the problems of making such comparisons (a summary of our consultants' findings is at Appendix 7). On the basis of a comparison of the performance of four companies from England and Wales with that of 23 other companies operating in other countries, but in otherwise comparable situations (**Figure 8**), the Association found that leakage levels in England and Wales were now generally better than average by international standards. And the best performing companies in England and Wales are now among the best in the world.

The impact of reductions in leakage on the supply to customers and the environment

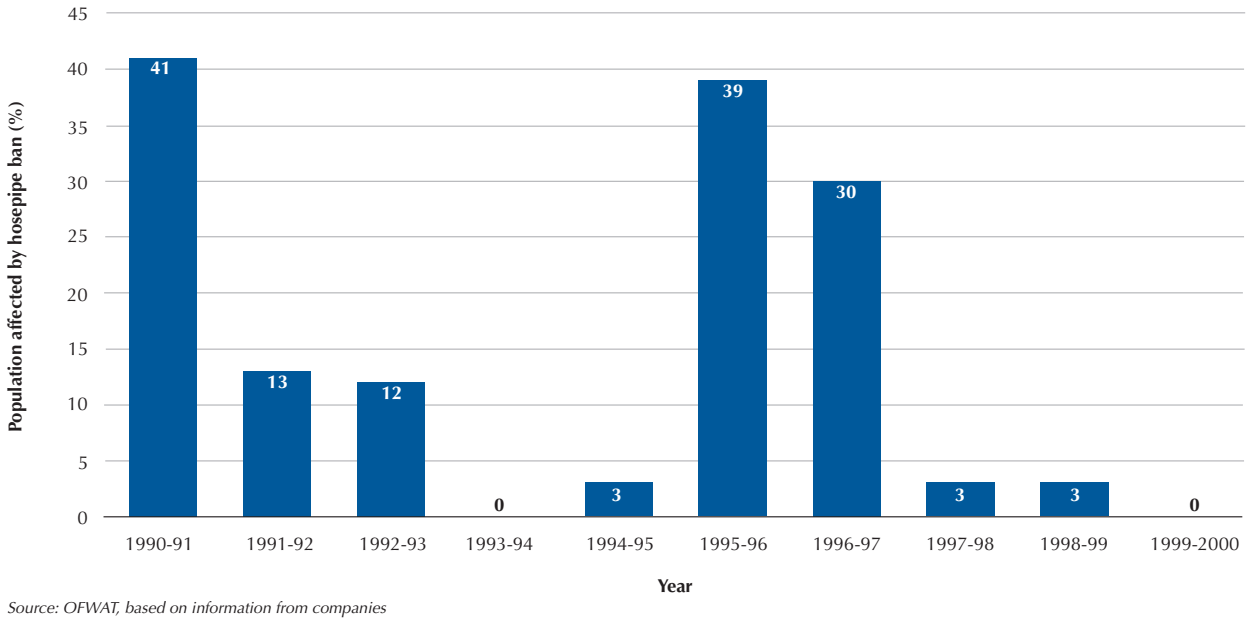
The risk of restrictions on customer supplies has fallen since 1995

2.24 Water companies are limited in the amount of water they can supply to their customers by factors such as the capacity of water treatment works and the amount of water held in reservoirs, or available from rivers or boreholes. Both the amount of water available and the level of demand vary from year to year according to the weather and other factors. Forecasting the supply and demand for water is subject to uncertainty, as a result, for example, of the possibility of equipment failures in water treatment or distribution systems and the difficulty of predicting factors such as the state of the economy. As a result, if a company were to attempt to ensure that it could always meet all possible demands for water, it would need to invest in water supply capacity which would be used very rarely, and some of which might never be used at all.

2.25 On the basis of surveys of customers, OFWAT do not believe that customers wish to pay for companies to carry out the investment needed to ensure that they can always meet all demands for water. Accordingly, they expect companies to plan for occasional temporary restrictions on the non-domestic use of water, such as hosepipe bans, in very dry weather. OFWAT have not set a standard for how often companies should plan to use such restrictions. But they would regard it as

10 Restrictions on the use of hosepipes: 1990-91 to 1998-99

The extent of hosepipe restrictions has fallen considerably since 1995



Source: OFWAT, based on information from companies

acceptable for a company to plan on the basis of customers being subject to hosepipe bans on average once every ten years. Yorkshire Water also told us that the key priority expressed by their customers was to avoid the need for emergency measures, and that occasional hosepipe bans were seen as a lesser inconvenience.

2.26 Companies' assessments of the likelihood of water restrictions focus on the margin between the amount of water available to companies and the level of demand they expect in a dry year, a concept known as "headroom". Companies plan to maintain a target amount of headroom, based on their assessment of the scope for demand and supply to vary from the level expected in a normal year, and the frequency with which they plan to need to impose temporary restrictions on the use of water. If a company's actual amount of headroom is less than the target level then the company is likely to need to impose restrictions more often than planned.

2.27 Until OFWAT started to require and then set leakage targets, there was a risk that some companies might allow headroom to fall, and hence take the risk of having to impose temporary restrictions on the use of water, by reducing expenditure on controlling leakage and letting leakage levels rise. The effect of the leakage increases before 1995 was to erode headroom, but relatively wet weather meant that this did not immediately result in restrictions on the use of water. In 1995, however, dry weather combined with the loss of headroom to produce the widespread, and in some areas severe, restrictions.

2.28 The reductions in leakage made since 1995 have contributed to an increase in headroom, and reduced the likelihood of companies needing to impose restrictions on water use. This is shown by **Figure 9**, which compares the amount of water put into supply by companies - which is equal to the amount used by customers plus the amount lost in leakage - with the amount currently available to companies, minus their target headroom. It shows that the amount of water available now substantially exceeds the amount companies are putting into supply, showing that headroom has increased and that the likelihood of restrictions has been correspondingly reduced. There are, however, geographical differences in the supply/demand balance and in some areas of England and Wales, mainly in Southern and Eastern England, water resources remain scarce (Figure 5 on page 14).

2.29 Since 1995 restrictions on water have fallen steeply because of wetter weather, and action by water companies to improve the supply network and reduce leakage. As **Figure 10** shows, the percentage of the population subject to hosepipe bans has fallen from 39 per cent in 1995-96 to 3 per cent in 1998-99. And since 14 May 1998 there have been no hosepipe bans in England and Wales.

The Environment Agency and OFWAT have started to monitor the security of supply to customers

2.30 Before the 1995 drought OFWAT monitored companies' ability to meet customers' requirements by requiring each company to report the number of its customers at risk of experiencing restrictions on the use of water more often than a "reasonable" reference level set by the company. However, as we reported in our report "Regulating and Monitoring the Quality of Service Provided to Customers by the Water Industry in England and Wales",[12] the drought revealed serious deficiencies with this process. For example, in 1994-95 86 per cent of the total population in England and Wales reported to be at risk of water shortages lived in areas served by Thames Water, but in the 1995 drought Thames Water did not impose any formal restrictions on the use of water. The drought was much more severe in other parts of the country, however, and two of the three companies that imposed hosepipe bans throughout their areas in 1995 had reported in 1994-95 that none of their customers were at risk of water shortage.

2.31 Following the drought, in October 1996 the Department of the Environment and the Welsh Office published "Water Resources and Supply: Agenda for Action". This restated Government policy on water resources strategy, and on leakage recommended that water companies should take the lead in measuring leakage, assessing economic levels of leakage and adopting programmes for controlling leakage at economic levels. In addition, OFWAT in conjunction with the Environment Agency reviewed their monitoring of companies' ability to meet customers' requirements for water. As a result, the Agency took the lead responsibility for assessing whether companies had sufficient water at their disposal to meet customers' requirements and whether they had satisfactory contingency plans for coping with droughts. The Agency have required water companies to prepare water resource plans and drought contingency plans for this purpose.

2.32 Most companies are limited in the extent to which they can move water around within the areas they serve. Where this is the case, the water resources plans have focused on the water available within "zones" - the areas within which water can be readily moved around - rather than the whole of companies' areas. This provides an important degree of precision that was missing before, as shortages in one of a company's zones can co-exist with surpluses in others, as happened with Yorkshire Water in 1995. By the end of 1999 all the water companies had produced plans for all their zones which the Agency considered to be satisfactory. This focus on zones contrasts with OFWAT's approach of monitoring target setting at the company level. The price limits set by OFWAT in 1999 did, however, make allowance for those companies that were able to demonstrate security of supply problems at the zonal level, for example Southern Water's Sussex North, and Thames Water's London, resource zones.

2.33 The Environment Agency are monitoring companies' performance in securing the levels of water supply capacity identified as needed in their water resource plans. It remains OFWAT's responsibility to take enforcement action in the event that performance proves unsatisfactory and to monitor expenditure on improving the security of supply where companies have been allowed to pass on their planned costs to customers. For the future, OFWAT need to decide whether the monitoring arrangements put in place, and their ability to take enforcement action if necessary, are sufficient to ensure that companies are providing a reliable and secure supply of water to customers and provide an effective substitute for leakage targets as a means of doing so.

Reductions in leakage have benefited the natural environment

2.34 If companies reduce leakage they also reduce the amount of water they need to take from water sources, which in some places has caused significant environmental damage, for example by reducing the flow of rivers or by damaging sensitive habitats, such as wetlands. Reducing leakage has therefore provided an opportunity to benefit the environment in such places. An example of this is provided by the case of the River Darent (**Figure 11**), where a reduction in leakage by Thames Water has helped to stop the river drying up in the summer. The Environment Agency have worked with water companies to reduce environmentally damaging water abstraction in 22 completed schemes, with a further 114 schemes in progress or planned.

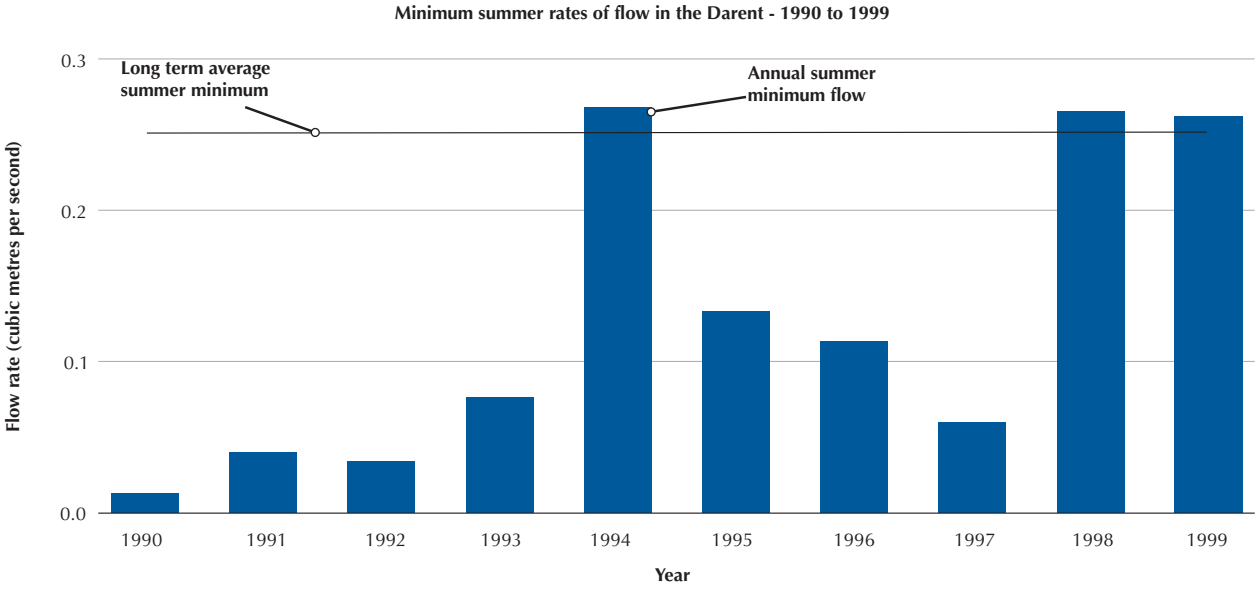
2.35 Reducing leakage can also remove or postpone the need to construct new reservoirs which would otherwise be needed to provide sufficient headroom in areas where water is in short supply. The last large new reservoir in England and Wales was completed in 1992. None are planned in the immediate future, although some smaller reservoirs are being built and Water UK told us they believed that in the long term customers' expectations of security of supply meant that some development of increased of water supplies would be needed.

2.36 Although the Environment Agency have a leading rôle in securing improvements to the environment, OFWAT's leakage targets influence how much 'spare' water there is to enable reductions in environmentally damaging abstractions to be made or the need for new sources of

12 *HC 388 Session 1997-98*

11 Using leakage reductions to benefit the River Darent

Since 1998 the minimum rate of flow in the Darent has been restored to near its long term average, after being severely reduced in the early 1990s



The River Darent lies mainly within Kent, but includes some of the suburbs of south east London and parts of Surrey. Water is taken (abstracted) from the area's rivers and groundwater (underground water supplies) for a range of uses including public water supply, agriculture and industry. Several water companies draw water from these sources. Water abstraction has reduced summer flows in the Darent, and in recent years stretches have dried up several times. This has damaged the wildlife and habitats of the river, the quality of water taken for drinking, and the recreational use of the river.

The Environment Agency are working with supporters of the river and Thames Water to improve flows and the river environment. Eight artificial springs have been drilled to boost flows in the river, and Thames Water reduced the amount of water it takes from local groundwater, making up the shortfall partly by transfers from other areas and partly by reducing leakage. These measures have prevented the lower stretches of the river drying out, and helped to maintain a healthy and diverse community of river life. They have also have improved the general health of the river and the quality of water for users.

Source: Environment Agency

water to be developed. It is therefore important that leakage targets properly take account of environmental costs and benefits, which may also have implications for water prices. Paragraphs 2.66 to 2.67 below examine the calculation of these costs and benefits.

The financial consequences of reducing leakage

OFWAT do not know how much has been spent on reducing leakage

2.37 OFWAT's use of targets based on economic leakage levels requires companies to have an understanding of the costs and benefits of leakage control. The control of leakage and changes in the level of leakage affect many of the costs of water companies, and costs must continue to be incurred to maintain leakage once it has been reduced to a given level. These costs may also affect the prices paid by customers, if OFWAT allow for them when they set prices. The main costs concerned are:

Costs of leakage control

- **Finding and repairing leaks**. For example: providing a means for customers to report leaks; using meters in the water distribution system to identify areas of high leakage; locating leaks by inspection or by using listening equipment; and repairing leaks once they have been found. An active programme of leak detection and repair may typically cost between 25 and 50 pence per cubic metre of water saved.

- **Reducing the water pressure**. This is one of the most cost-effective methods of reducing leakage, provided that sufficient pressure is retained in the water system to maintain a satisfactory flow of water to customers. Lower water pressure reduces the rate at which water is lost through leaks and can reduce the number of bursts that occur.

- **Replacing water mains**. This is rarely cost-effective on its own, but lower leakage can be a valuable additional benefit when mains are replaced for some other reason. Replacing poor condition water mains can typically cost around £1.50 or more per cubic metre saved.

Costs potentially saved by leakage control

- **Short run costs**, such as the running costs (mainly chemicals and electricity) of operating existing water treatment and distribution systems. Estimates made by companies for OFWAT in 1996 indicated that the short run cost of replacing water lost through leakage is typically between 2 to 6 pence per cubic metre.

- **Long run costs**, in developing increased supplies of water from water sources, for example by building reservoirs and additional water treatment and distribution capacity. Recent estimates by companies have mainly been between 40 and 60 pence per cubic metre.

2.38 Because the costs of leakage and of changes in its level include a mixture of short run and long run costs, assessments of the economic level of leakage can be significantly affected by the time scale over which costs are considered. This appears to have been an important factor in the apparently low priority given to leakage by some companies before the 1995 drought (paragraph 2.7). In our discussions with companies, some agreed with OFWAT's view that it was in companies' own interests to reduce their leakage to their economic level, based on an assessment of both short run and long run costs. Others, however, said they had not been confident that price limits set by OFWAT in their five-yearly reviews of prices would fully reward companies for reductions in long run costs (for example, by deferring investment in developing new water supplies) made as a result of short run expenditure on leakage reduction. They therefore did not agree that they had had an incentive to reduce leakage all the way to its economic level, although they agreed that they needed to keep it low enough to ensure a secure supply of water for customers.

2.39 The costs of leakage and of changes in its level are also affected by the level of leakage, and it generally costs more to maintain leakage at a relatively low level that at a higher one. They also vary considerably from company to company. OFWAT do not have detailed information on these costs, which means that we cannot accurately assess the financial consequences of the high levels of leakage in the mid 1990s, and the subsequent costs of reducing them. Figures are available for Dŵr Cymru (Welsh Water). In their 1998 economic level of leakage assessment, Dŵr Cymru assessed their annual leakage control costs to amount to some £15.7 million, mostly the cost of labour employed on detecting or repairing leaks. Extrapolation on the basis that Dŵr Cymru accounts for 8.6 per cent of all leakage in England and Wales, suggests that the total cost of controlling leakage to the industry is in the region of £180 million a year. This is consistent with the figure for controlling leakage of between £15 million and £16 million that Anglian Water gave us.

2.40 New technology has, however, assisted some of the reductions in leakage levels made in recent years, both by reducing leakage detection costs, and by detecting leaks more quickly thereby reducing the amount of water lost before they are repaired. Several companies told us that the pace of development of such technology has increased as a result of the attention given to leakage reduction since the 1995 drought and the 1997 Water Summit, and that the United Kingdom is now an international leader in the techniques and technology of leakage control.

OFWAT do not know the financial benefits of reducing leakage

2.41 OFWAT do not monitor how much money companies have saved as a result of not having to replace water that would otherwise have been lost in leakage. OFWAT have taken the view that it is in the companies' own interests to minimise costs by reducing leakage to their economic level and they therefore do not require companies to report the cost of doing so.

2.42 On the basis of short run costs of around 2 to 6 pence per cubic metre, however, the short-run saving from the 1.8 million cubic metres a day reduction in leakage between 1994-95 and 1999-2000 is likely to have been between £13 million to £39 million a year. But to the extent that the lower level of leakage has allowed companies to avoid or postpone the much larger long run costs involved in developing new water sources, or in increasing the capacity of their water treatment and distribution systems, the savings would have been substantially greater.

Leakage control costs have had some effect on customers

2.43 Since privatisation the charges paid by water customers have been controlled by OFWAT. Each company has had a separate price control, permitting companies to increase their charges each year only by the rate of inflation (as measured by the retail prices index) plus or minus an amount specified in their control. The Department of the Environment set the initial price controls in 1989 to cover the period to 31 March 1995. Since then OFWAT have revised the price controls twice: in 1994 for charges from April 1995 to March 2000 and in 1999 for April 2000 to March 2005.

2.44 The price controls set charges in advance, so that charges are not directly linked to changes in companies' actual costs during the five years covered by a control. The charges paid by customers have not, therefore, been immediately affected by changes in companies' expenditure either on leakage control or on replacing water lost from leakage. This means that any costs arising from the excessive levels of leakage before the

1995 drought, or any additional costs incurred by companies in reducing leakage since then, have not been immediately passed on to customers. Customers could have been affected, however, if OFWAT in their 1994 and 1999 reviews of price controls had subsequently allowed companies to recover such costs.

2.45 As indicated above, OFWAT have not obtained figures for the costs of leakage, but such costs have had an important bearing on OFWAT's scrutiny of:

- Investment in increasing supplies of water and associated water treatment capacity. An important issue for OFWAT has been to make sure that companies do not raise charges to pay for investment needed only to replace water lost as a result of excessive leakage.

- General operating costs. OFWAT need to make a reasonable allowance for the general operating costs of companies, to cover costs such as the running costs of treating and pumping water, and routine repair and replacement of water mains. They have also been anxious not to allow companies to raise charges to pay for the increased operating costs of reducing leakage from its past excessive levels.

2.46 In both Periodic Reviews OFWAT reviewed companies' planned investments in increasing water supplies. As a result of the 1994 Review, OFWAT allowed for investment of some £1 billion between 1995 and 2005, but most of this expenditure was for investment required to serve new housing development, which would be paid for by the developers concerned and did not increase charges for other customers. And in the case of South West Water, the Monopolies and Mergers Commission allowed for further expenditure on leakage reduction to meet growth in demand, after the company had appealed against the price control set by OFWAT. In the 1999 Periodic Review, OFWAT allowed for capital expenditure of £1.1 billion to balance the supply and demand for water from 2000-01 to 2004-5, again mostly for new housing development. OFWAT allowed for capital and operating expenditure of only £127 million to enhance the security of water supply to be spent by companies, such as Folkestone and Dover Water, whose supplies of water were particularly limited, and were still inadequate despite reducing leakage to its economic level. In October 2000 three companies, which considered that they had been affected by major changes to their operating position, revenues and costs, sought an interim determination of their price limits.

2.47 OFWAT based their assessment of allowable general operating costs on the actual expenditure of each company in a base year (1997-98, for example, for the 1999 Periodic Review). They then adjusted this amount to take account of factors such as their judgement of how efficient each company was in comparison with the rest of the water industry, and their assessment of the scope available for all companies to improve efficiency in the future. They also allowed companies to plan to incur additional operating costs where these were necessary to reduce leakage to the level of mandatory targets set on the basis of assessments of economic leakage levels.

2.48 Most of the costs of controlling and reducing leakage fall within this category of operating expenditure, while most of the costs of replacing water lost through leakage do not. Accordingly, excessive levels of leakage before the 1994 Periodic Review of prices would be accompanied by 'insufficient' spending on general operating costs. Therefore, to the extent that companies have been spending too little on controlling leakage, customers will actually have benefited by paying lower water prices in the period for which prices were set in this review (April 1995 to March 2000). The 1999 Periodic Review, however, will have been based on company expenditure in 1997-98, by which time companies had begun to increase expenditure in order to reduce leakage following the 1995 drought, and the prices paid by customers since April 2000 have reflected this increased expenditure. Provided that this expenditure is no more than is required to reduce leakage to an economic level, customers should benefit in the future as lower levels of leakage enable expenditure on developing new supplies of water to be avoided or postponed. But customers would be paying too much for water if OFWAT required companies to reduce leakage to below their economic level and to pass through to customers the cost of doing so. It is therefore important that companies accurately assess their economic levels of leakage and one of the tasks of OFWAT's tripartite study (paragraph 2.3) is to establish key principles to be followed by companies in making such assessments.

The scope for achieving further benefits by reducing leakage

OFWAT and the water companies disagree on the extent by which leakage should be reduced

2.49 It is important for water companies to have reliable information on the costs and benefits of reducing leakage. These are illustrated in **Figure 12**, which is derived from the understanding of OFWAT and water companies. It shows how the unit cost of reducing leakage rises as the level of leakage falls because, for example, leaks tend to be harder to find when they are rare. One water company illustrated this to us by analogy with searching for needles in a haystack. As the number of needles (leaks) in the haystack falls it becomes progressively harder to find any more. As a result, for any water supply system there is a level of leakage below which the cost of saving further water by reducing leakage exceeds the cost of obtaining the same amount of water from another source. This means that reducing leakage below the most economic level can result in a significant increase in costs.

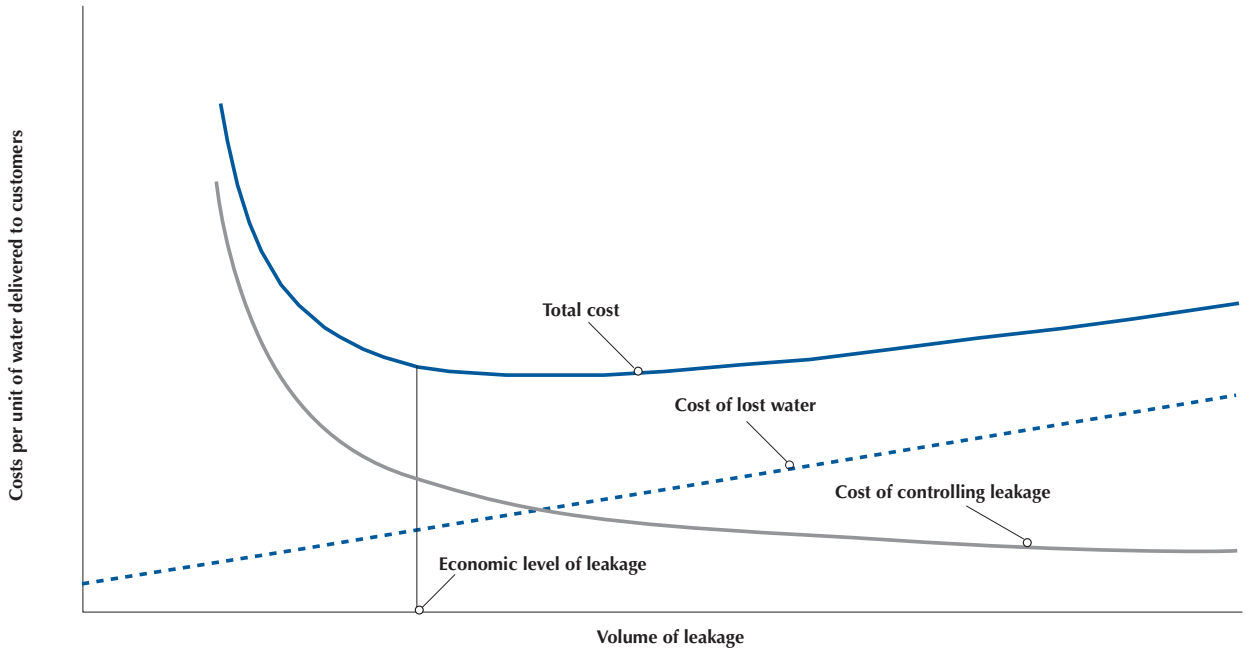
2.50 The costs of controlling leakage and of replacing water lost through leakage vary between different water supply systems, and over time, depending on factors such as the age of the system and the availability of local supplies of water. As a result, the economic level of leakage also varies between systems and determining it for any given area requires detailed economic and engineering assessments of the local water supply system.

2.51 OFWAT's approach to setting mandatory leakage targets has emphasised the importance of companies assessing, and then reaching, their economic level of leakage, but OFWAT did not need to know what the economic level was until they started setting mandatory targets. At the time that they set the 1998-99 targets, robust analyses of the economic level of leakage were not available and OFWAT set what they termed "pragmatic" targets. The pragmatic targets, which were intended to act as a proxy for economic levels of leakage, were set on the basis of an assessment, in consultation with the Environment Agency, of each company's current leakage level and water resource position (**Figure 13**). They then set the targets so that the companies with the highest leakage levels and the tightest balance between supply and demand needed to make the biggest reductions in leakage.

2.52 For the 1999-2000 targets, OFWAT required all companies to assess the economic level of leakage in their areas, and **Figure 14** shows the criteria used by OFWAT to appraise the assessments. Six companies submitted assessments that OFWAT considered were robust and OFWAT set these companies' targets on the basis of their proposals. In the remaining 18 cases, OFWAT were not satisfied that the assessments were robust, and instead they again set pragmatic targets.

12 The cost of reducing leakage and of replacing lost water

Very low and very high levels of leakage cost more than leakage at its economic level



Source: National Audit Office discussions with water companies and OFWAT

13 Criteria for assessing the water resource position of companies

OFWAT used assessments by the Environment Agency of the water resource position of companies, which classified companies' positions as being tight, marginal or adequate, according to the following criteria:

Tight: Companies with a margin of less than 10 per cent between the amount of water available for use and the estimated demand in a normal year.

Marginal: Companies with a margin of between 10 and 20 per cent.

Adequate: Companies with a margin of more than 20 per cent.

Source: OFWAT and the Environment Agency

2.53 OFWAT continued with this approach for the 2000-01 targets, requiring all companies to resubmit their assessments of their economic level of leakage. Ten companies were considered to have completed assessments sufficiently robust for OFWAT to use them for setting targets, and 14 companies were set targets on a pragmatic basis. Several companies told us that OFWAT's leakage targets have required them to reduce leakage below its economic level, and that either they have no use for the water thereby saved, or that it would be cheaper for them to use water from elsewhere rather than reduce leakage further. They have also argued that they should be able to pass the cost of reducing leakage below its economic level onto customers in charges.

14 The criteria used by OFWAT to appraise companies' assessments of their economic level of leakage

OFWAT's appraisal of the companies' assessments concentrated on five evaluative criteria, focusing both on companies' assumptions and results and on how they compared with those of other companies in the same region.

The five criteria were:

- The methodology used to derive the potential costs and benefits of leakage control policies.
- The quality of the data used in the calculations.
- Whether the company had examined a sufficient range of policy options.
- How robustly the company had calculated the components of the water balance, in particular the amount of water used by unmetered customers.
- Whether the company had assessed the various options to balance supply and demand in a consistent fashion.

Source: OFWAT

2.54 Water companies also criticised aspects of OFWAT's implementation of the targets:

- **OFWAT's explanation of what they expected companies to achieve when assessing their own economic level of leakage**. Nine companies commented that it had been difficult to identify clearly what OFWAT expected from them. Other comments were that there had been little information or clarification from them since the five evaluative criteria had been established (Figure 14). In addition, the analysis that underpinned calculations of the economic leakage level appeared to be secondary to OFWAT's desire that companies should meet their mandatory leakage targets, and OFWAT took little account of the local conditions facing companies when they set targets.
- **The feedback given by OFWAT to companies whose assessments of economic leakage levels have been rejected**. Seven companies that had had their assessments of economic leakage levels rejected by OFWAT considered that OFWAT had not fully explained what they were required to do to develop an acceptable assessment. Many companies believed that OFWAT had not justified clearly why they had rejected certain assessments and that they should provide greater detail in the explanations they gave to companies. Some companies were also concerned that OFWAT provided them with guidance only after the company had pressed them to do so.
- **The explanations given by OFWAT when setting pragmatic targets**. Companies that had pragmatic targets set by OFWAT commented that OFWAT had explained clearly to them the process they would follow to set the targets. They were concerned, however, that little explanation had been provided as to how they had arrived at the actual target that they had set. Some companies also disputed the Environment Agency's assessment of their water resource position (Figure 13).

2.55 OFWAT consider that all companies have more work to do when assessing their economic level of leakage, and have required those companies who were not considered to have robust appraisals to submit revised assessments for setting 2001-02 targets. They have told companies that these assessments should pay greater attention to:

- **The quality and accuracy of the data used in the calculations** - significant differences between the companies remain in areas such as the costs of different leakage detection policies.
- **The use of real cost-benefit data in models** - companies have not yet fully validated their predictions of the cost of leakage control against their actual achievements.

- **The proper identification of the value of water** - there are significant inconsistencies between the selling price of water and the value placed by companies on the water saved through leakage reduction.
- **The environmental and social benefits of leakage control** - companies' assessments have yet to take much account of the potential environmental damage caused by the abstraction of water. Potential social costs include those resulting from the disruption caused by digging up roads to repair leaks and from the greater number of pipe bursts likely when leakage levels are higher.

2.56 OFWAT have refined their approach to setting leakage targets for 2001-02, in recognition of the progress made by many companies in reducing leakage and in assessing their economic level of leakage. For the six companies that have already reached their economic level of leakage, they will not set targets for further leakage reduction, but expect these companies to keep leakage down to its economic level. For ten of the eleven companies that have made a robust assessment of their economic level of leakage, and are on course to reach it by 2002-03, OFWAT have also not set targets but will monitor progress against these companies' own targets[13]. For the remaining eight companies, OFWAT will continue to set mandatory targets.

A Tripartite Study has been established to provide a clearer view of how leakage should be regulated

2.57 OFWAT, the Department of the Environment, Transport and the Regions, and the Environment Agency have asked the consultants carrying out their tripartite study to review trends in the costs of leakage detection and repair. The tripartite study will seek to establish a set of key principles to be followed by the companies when they calculate their economic level of leakage. It will also seek to recommend where improvements in the quality of data used in the analysis of economic leakage levels could be made and consider the possible need for additional data collection. The study is being overseen by a steering group including representation from the industry. The issues which the study is addressing are important given the following issues which we examine in the remainder of this Part of the report:

- leakage levels remain high in some areas but the need and scope for reducing leakage is unclear;
- the value of water saved by leakage reduction is uncertain; and
- companies are not well placed to quantify the impact of leakage, and its control, on the environment and Society.

Leakage levels remain high in some areas but the need and scope for reducing leakage is unclear

2.58 The tripartite study is examining whether companies have sufficient information on leakage costs and the demands of their customers to enable proper assessments of current and future economic levels of leakage, and whether leakage control forms an appropriate part of companies' strategies to maintain the balance between water supply and demand. It is evident that these are important issues, given the continuing high levels of leakage and the risk that further reducing leakage may in due course increase costs to customers.

2.59 About a quarter of the water put into public supply by the water companies still leaks out before it reaches the customer. This need not matter where there is ample water but leakage levels are still high in areas where water resources are tight or the demand for water is growing. Thames Water, for example, which OFWAT consider to have tight water resources, was losing 660 thousand cubic metres of water a day through leakage in 1999-2000 (approximately 27 per cent of water put into supply) and serves an area in which the demand for water is likely to grow.

2.60 OFWAT classify two other companies[14] as having high leakage levels and a water resource position that is only marginal. And five companies with medium levels of leakage have a water resource position that is either tight or marginal using OFWAT's classification. These companies run the highest risk of not being able to maintain supplies to their customers in periods of dry weather and continue to have scope to use leakage reduction to improve their supply/demand balance whilst avoiding the cost of developing new sources of water resources. Given the concerns about the additional costs incurred by water companies, it will be important that this study establishes a clearer basis for assessing how far and how quickly it is economically justifiable for companies to go in reducing leakage.

2.61 OFWAT believe that further leakage reductions can be achieved cost-effectively. In our survey of companies, however, eight companies[15] told us that they are either already at or very close to their economic level of leakage and that further reductions would not be justified. Anglian Water told us they would have to put considerable effort into maintaining leakage at its

13 OFWAT set Dŵr Cymru (Welsh Water) a mandatory target because of uncertainties over their ownership and management.
14 Dŵr Cymru (Welsh Water) and South Staffordshire Water.
15 Bournemouth and West Hampshire Water, Three Valleys Water, Tendring Hundred Water, South Staffordshire Water, Hartlepool Water, Southern Water, South West Water, Anglian Water.

current level and that further reductions, which are unlikely to be as significant as those achieved in the past, will be dependent on technological advances. Thames Water believed that the reductions in leakage required by their 2000-01 target were premature and would generate water that would not be needed to provide the level of headroom expected by OFWAT. The additional costs incurred by water companies in reducing leakage further than they consider necessary cannot currently be recovered from customers but are likely to have a bearing on future price controls.

2.62 On the other hand, OFWAT, the Environment Agency and the Department of the Environment, Transport and the Regions believe that in response to the mandatory leakage targets, companies will continue to improve their leakage control technologies and techniques to reduce the cost, and improve the effectiveness, of leakage control. Such improvement may make it economic for companies to reduce leakage even more than is currently considered economic, and therefore provide the scope for further cost-effective reductions in leakage levels and, where otherwise necessary, postpone or avoid capital investment in developing new sources of water supply.

The value of the water saved by reducing leakage is uncertain

2.63 It is intended that the tripartite study should identify the most appropriate method of valuing water saved from reducing leakage, taking into account issues such as the time period over which costs should be considered. This valuation is an essential part of the companies' assessments of their economic level of leakage. OFWAT require this assessment to be based on the cost of replacing water that would otherwise be lost if leakage was not controlled. Assessment of this cost is also important in setting the price of water for metered customers, so that water prices reflect the cost of producing the water supplied. And the value placed on water has an important bearing on the cost-effectiveness of different types of action to promote water efficiency, as considered in the next Part of this report.

2.64 OFWAT require the companies to focus their assessments on the "long run marginal cost" of water, that is the additional cost of a unit increase in their output of water, taking into account both short term running costs and longer term costs such as capital investment and the regular renewal of long lived assets, such as water mains. Companies were first required to submit their estimates in June 1998, and provided updated estimates in April 1999. These estimates showed a very wide variation in the companies' assessments of long run marginal costs based on steady demand assumptions (**Figure 15**). The majority of the estimates were between 40 and 60 pence per cubic metre, but they varied from 14 to 377 pence per cubic metre. Some companies subsequently revised their estimates, but the estimates still varied considerably, from 11 to 135 pence per cubic metre.

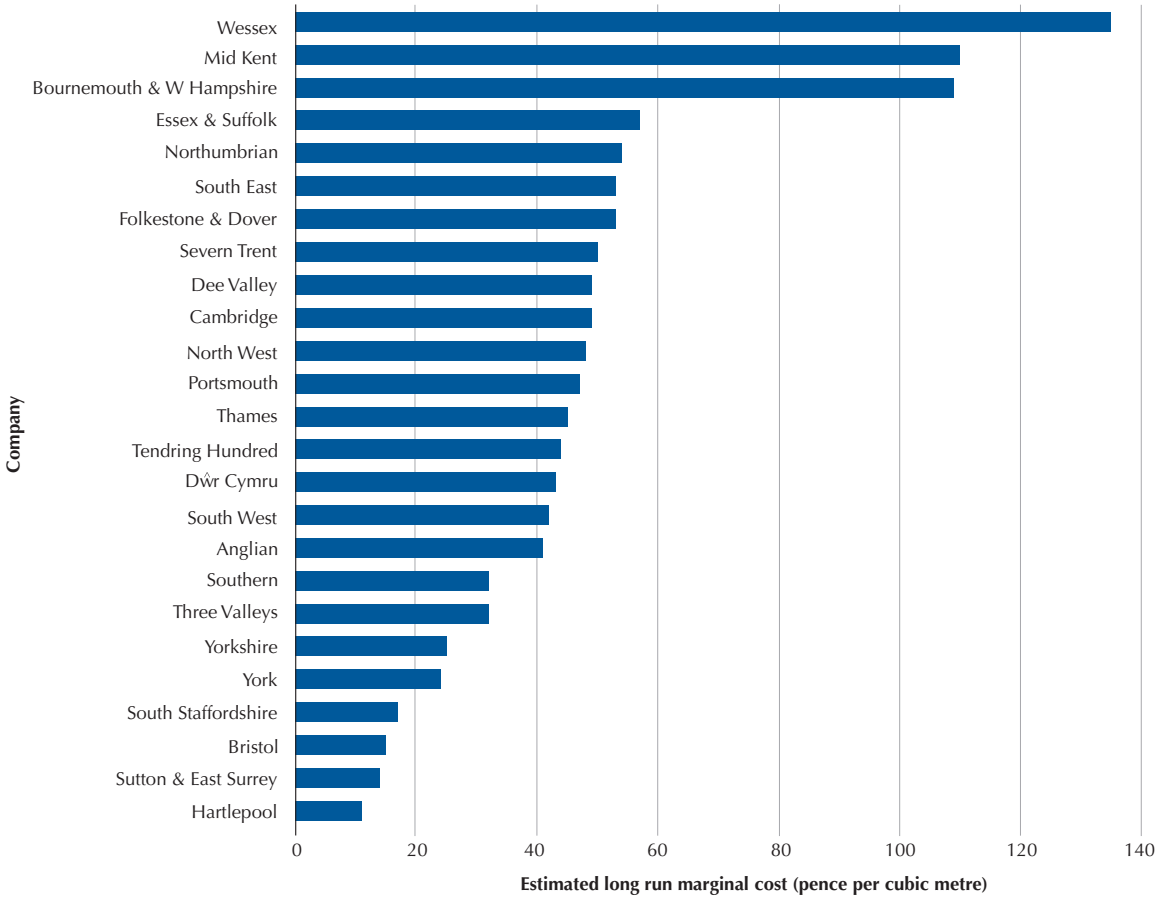
2.65 Some variation in estimates is to be expected because of the varying circumstances of the individual companies, but the size of the variations indicated that companies also differed in the methods and assumptions they were using to calculate their costs. OFWAT have recognised this, and in February 2000 published a paper setting out their views on the principles that companies should apply in calculating their costs. They have told companies to re-submit long run marginal cost estimates by July 2000 and intend to collect estimates of long run marginal costs from companies annually from 2001 onwards. However some companies told us that OFWAT's guidance had not suggested a method for calculating long term marginal costs and there was a need to agree what method of calculation should be used. Until there is greater consistency in the methods used by the companies' to assess long run marginal costs however, the robustness of the assessments of economic levels of leakage based on them must also be considered doubtful.

There is uncertainty as to how the costs and benefits to the environment of leakage control should be calculated

2.66 Leakage and its control may result in environmental costs and other costs not borne by the companies themselves. For example, taking water from water sources may affect the environment, while digging up roads can impose costs on the public from noise and traffic delay. OFWAT have told companies that their economic level of leakage assessments should undertake a fully integrated appraisal of all of the costs of leakage and its control, including financial, social and environmental costs. And if this shows that additional reductions in leakage are worthwhile to reduce environmental or other non-financial costs, OFWAT are prepared in principle to allow for the cost of such reductions in companies' price limits, although they have yet to actually do so.

15 Company estimates of their long run marginal costs, April 1999

The companies' April 1999 estimates of their long run marginal costs varied widely



Note: Figures shown include revised figures submitted by three companies after April 1999.

Source: OFWAT, based on information from companies

2.67 In practice, however, there is uncertainty as to how the costs and benefits to the environment of leakage and leakage control activities should be calculated. Although the Environment Agency have produced guidelines on environmental impacts and associated costs and benefits, and UK Water Industry Research have published research on environmental and social costs and benefits, few companies have taken full account of such costs in their assessments. The tripartite study will consider how improvements can be made in accounting for the environmental costs associated with taking water from water sources and for the disruption costs caused by intensive repairs.

Part 3

Water efficiency

3.1 This part of the report examines

(i) OFWAT's strategy on the efficient use of water;

(ii) what has been achieved so far.

OFWAT's strategy on the efficient use of water

Water efficiency matters

3.2 Promoting the efficient use of water by customers helps water companies secure a reliable and environmentally sustainable supply of water to customers. A company that has developed an effective water efficiency strategy will have greater scope to reduce or postpone spending on controlling leakage and developing new sources of water supply which might otherwise be needed to maintain an adequate security of supply. The effective promotion of water efficiency is especially important for companies with very limited water resources.

Legislation provides a framework for regulating water efficiency

3.3 The Environment Act 1995 amended the Water Industry Act 1991 to add a new Section 93A, which since 1996 has given every water company a duty to promote the efficient use of water by their customers. OFWAT are responsible for ensuring that water companies meet this duty. Under Section 93B of the amended Water Industry Act 1991 they have the power to require a company to take action, or to achieve overall standards of performance, in carrying out this duty. This power is similar to that underlying the Energy Efficiency Standards of Performance scheme, under which the Office of Gas and Electricity Markets (OFGEM) have required electricity companies to spend some £25 million a year on projects to improve the efficiency with which customers use electricity. OFWAT, however, unlike OFGEM cannot require the companies to spend a specified amount each year on the promotion of efficiency. The Energy Efficiency Standards of Performance scheme was the subject of our 1998 report "Improving Energy Efficiency Financed by a Charge on Customers"[16].

3.4 The Water Industry Act 1999 has made changes to the water charging system in England and Wales to help in achieving sustainable development objectives. These changes include entitling all domestic customers to opt for a meter free of installation charge and allowing water companies whose areas are designated "areas of water scarcity" to meter compulsorily domestic customers. Other water companies are prevented from compulsorily metering household customers, other than in certain prescribed conditions of high discretionary use.

OFWAT have developed a strategy for regulating water efficiency

3.5 Following the enactment of the Environment Act 1995, OFWAT asked the water companies in December 1995 to show how they intended to carry out their new duty. Their responses indicated that some companies were well advanced in developing their plans but that others had made less progress. In June 1996 OFWAT told each company to submit a water efficiency plan to show how they intended to meet its duty.

3.6 The water companies' duty to promote water efficiency is not qualified by a requirement for it to be cost-effective for them to do so, but in enforcing the duty OFWAT are required to have regard to such matters. OFWAT consider that there is a minimum level of activity that can be expected from all companies, but for some companies with more limited water resources, a more active approach is necessary. And they expect all companies to consider the contribution that water efficiency can make to keeping the demand for water in line with available supply.

3.7 OFWAT evaluated the water efficiency plans, after consultation with the Environment Agency, against four criteria:

- Companies needed to complement the promotion of water efficiency with water pricing that provided customers with appropriate incentives to implement good practice and to sustain the efficient use of water. This included the development of water metering. In the price limits they set for 2000-05, OFWAT allowed for water companies to spend £255 million over five years on installing water meters. This allowance assumed levels of take-up lower than projected by most companies. If take-up is significantly higher than assumed, companies are able to apply for an adjustment of their price limits.
- Companies should maintain a long-term programme to inform customers of the need to use water sensibly.
- The costs of the water efficiency activity must make economic sense in the context of the company's water resource position. Where there is only a small margin between the demand for water and the available supply, such as in much of South East England, a company should be more active than a company that serves an area with a water surplus.
- Companies should particularly promote water efficiency to those customers who could benefit most, for example by providing advice and assistance to help metered customers manage their water use. Companies should also actively promote water efficiency among non-domestic customers, such as schools, that would benefit from better management of water bills.

3.8 After amendments to some plans in the light of this scrutiny, OFWAT approved all company plans in April 1997. They told the companies to keep their strategies under regular review. Companies must also submit annual reports to OFWAT on:

- amendments or additions to the company's strategy;
- an indication of the scale of activities being undertaken by each company in implementing their strategy;
- the outcome of these activities.

3.9 In addition in 1999, OFWAT have required the five companies classified as having a "tight" water resource position[17] to report on their budgets and targets for individual activities for promoting water efficiency. The companies submitted this information in July 2000 and it is currently being assessed by OFWAT.

Companies generally understand OFWAT's water efficiency strategy

3.10 Our survey of water companies showed that 15 respondents believed that they were clear about OFWAT's views on the purpose of promoting water efficiency and that 11 of the respondents were clear about what OFWAT considered to be an acceptable water company efficiency strategy.

3.11 Many companies told us, however, that they were concerned about OFWAT's strategy for the promotion of water efficiency. They commented that OFWAT's approach had been too prescriptive and lacked clear objectives that focused on what water efficiency was expected to deliver in terms of reducing demand. Anglian Water, Portsmouth Water and Dŵr Cymru (Welsh Water), for example, said that OFWAT had been too concerned that companies undertake certain initiatives to promote water efficiency without having the evidence that the initiatives were cost-effective, and that some devices were promoted without proof of their effectiveness. And some companies with adequate water, such as North West Water, Northumbrian Water and Tendring Hundred Water did not believe that OFWAT took full account of companies' overall resource positions and individual circumstances when they examined water company strategies.

What has been achieved so far

Companies have provided over 12 million items of water efficiency help since 1996

3.12 We examined the action that water companies have taken to promote the efficient use of water by their customers and carried out a national opinion survey of 1,919 members of the public to assess public attitudes to water efficiency and the impact of the companies' work. The key findings of our customer survey are summarised in Appendix 5.

3.13 Companies have promoted water efficiency in a number of ways (**Figure 16**). They have:

- provided information to customers;
- helped customers to audit their own water use and undertaken audits of households and businesses themselves;
- provided customers with water-saving devices;
- carried out repairs free of charge to customers' supply pipes;
- offered the free installation of meters to customers

17 *Thames Water, Wessex Water, South East Water, Essex and Suffolk Water, and Folkestone and Dover Water.*

16 The types of action taken by companies to promote water efficiency

All companies provide their customers with literature advising them how they can use water more efficiently

Cistern devices can be installed in toilet cisterns to displace some water and so reduce the volume of each flush

By auditing water use some companies have helped customers to monitor and reduce their water consumption

By linking the amount paid with the amount of water used meters give customers the opportunity to reduce their bills by using water more efficiently

Source: OFWAT

3.14 **Figure 17** shows that the industry provided some 12 million items of water efficiency help between 1996 and 2000. Our survey of the public also showed that 88 per cent of respondents use various methods to save water in their homes, that 30 per cent save water in their gardens, and that only 12 per cent of customers do nothing at all to save water. We looked at the evidence of what this action has achieved.

Providing information

3.15 All companies provide information to households and non-households on how to use water wisely. Some also provide customers with the means to obtain more in-depth information on request. OFWAT specify a minimum amount of information that household and business customers should receive and compare the methods of disseminating information used by each company, such as placing information on the company's website, or visiting customers.

17 Action by water companies to promote water efficiency - 1996 to 2000

Since 1996, companies have provided over 12 million items of water efficiency help.

Type of action	Number implemented
Cistern devices issued	5,608,090
Household self audit packs issued	4,814,155
Meters installed	1,676,379
Supply pipes repaired or replaced	260,625
Water butts/spray guns issued	253,017

Source: OFWAT, based on information from companies

3.16 In our survey, 57 per cent of respondents recalled seeing advice on how to save water. The most common forms of advice that respondents recalled seeing were leaflets (30 per cent), radio and television advertisements (27 per cent) and newspaper and magazine advertisements (12 per cent). Respondents in the south east of England, where water resources are scarce, were most likely to recall seeing advice on saving water (67 per cent), but in London, which is also an area with scarce water resources, only 50 per cent of respondents recalled seeing such advice.

3.17 Most companies also visit schools, or send them information, to tell children how they can save water. For example, Southern Water, in collaboration with Facepack Theatre, visited 40 schools with a play, "Are You A Drip?" which encourages school children to think about water saving. The play was seen by over 3,500 children.

Auditing water use

3.18 Most companies offer "self-audit" packs for households containing, for example, a checklist to help them identify opportunities to save water. Our survey showed that only 21 per cent of respondents were aware that their water company could provide an information pack to help them check whether they are wasting water and only 9 per cent had received such a pack. Awareness of the packs was slightly higher in the drier regions of England and Wales. Of those who had received a pack 35 per cent said they had saved water as a result of using the information it contained.

3.19 Water companies have also offered household audits, where the company pays for a full audit of the household. Eaga Partnership Limited offers the "Watersmart" audit, an integrated initiative combining a range of types of action to promote water efficiency to reduce household water consumption. Essex and Suffolk Water implemented "Watersmart" in the Chelmsford area and estimated an initial saving of 10 per cent of water per property per day. Approximately 51 per cent of the water saved was through cistern devices, 29 per cent through repair of leaks, 12 per cent through detection of plumbing losses and 8 per cent through waterbutts and replacement of showerheads.

3.20 Audits of larger institutions, such as schools and local authority buildings, demonstrate financial savings for the customer through reductions in bills. For example, a water audit at Nelson Thomlinson School, as part of the Solway water conservation project jointly funded and managed by North West Water and the Environment Agency, cost £2,787, but was found to save the school 3,917 litres per day, resulting in a bill reduction for the school of £1,644 per annum. The

school recouped the investment in less than two years. EAGA Partnership Limited told us that they had concluded surveys and studies that had shown possible savings of up to 50 per cent. In their view, the majority of commercial and public buildings were unknowingly wasting water through inefficient appliances and fittings and the lack of good practice guidance and education. OFWAT have encouraged companies to maintain good relationships with local institutions and to provide water audits to help them reduce bills where possible.

Water saving devices

3.21 Companies have issued over 5 million lavatory cistern devices since 1996. These devices, such as "Hippos", are installed in the cistern and, if properly fitted, reduce the amount of water used each time the lavatory is flushed. They cost a few pence to produce, and most are distributed by post to be installed by the customer, so the unit cost of installing the device is generally insignificant. Such devices are claimed to save between one and three litres per flush, depending on the size of the device. This translates to an average water saving of over ten per cent. Most companies report cistern devices to be a cost-effective method of saving water, because water savings can be achieved at low cost to the company.

3.22 In our survey of customers we found that six per cent of respondents in England and Wales have received and are continuing to use a lavatory cistern device. In the drier regions of England and Wales (East Anglia, London and the South East) the figure was nine per cent and it was more than twice as high for customers with meters (13 per cent) than for those without (5 per cent). In addition, 70 per cent of respondents in England and Wales said they would either definitely or probably install such a device if they were given one.

Supply pipe repairs

3.23 All companies carry out repairs free of charge to the pipes (known as supply pipes) that connect customers' homes to the mains, even though such pipes are usually the responsibility of the customer. This contributes to the promotion of water efficiency and reduces leakage. Individual companies' rates varied in 1999-2000 from around six repairs/replacements per 10,000 properties (York Waterworks) to over 77 per 10,000 properties (South West Water).

Metering

3.24 Companies told us that they consider metering to be the most effective means of getting customers to use less water, because metered customers save money by doing so. Of the 15 per cent of respondents in our survey who had their water bills based on the amount of water they use, 68 per cent said that they considered that having a meter had encouraged them to save water. Anglian Water told us that their customers typically reduced their consumption by up to 20 per cent when they went on a meter. And the Department of the Environment, Transport and the Regions told us that they believed that metering encouraged customers to purchase appliances, such as washing machines, that use water more efficiently, when replacing pre-existing ones.

3.25 OFWAT believe that there is a significant difference between the reductions in consumption that are made by customers who opt to have a meter and those who are selectively metered. The National Water Metering Trials held between 1989 and 1993 showed a reduction in consumption by customers of around 10 per cent on average when all the customers in the Trial area were metered. In addition there are savings to be made from the repair and replacement of leaking supply pipes at the time of meter installation.

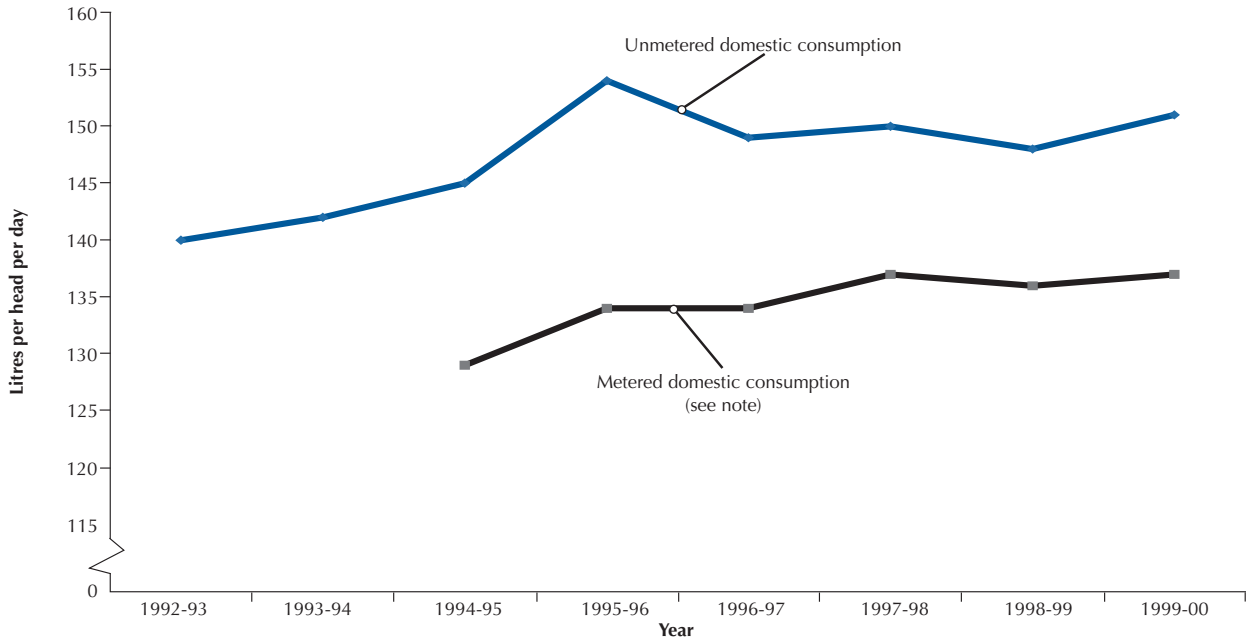
Information on the cost effectiveness of water efficiency action is incomplete

3.26 **Figure 18** shows that since 1992-93 per capita consumption has increased by 8 per cent for unmetered domestic customers and since 1994-95 by 6 per cent for metered domestic customers.

3.27 This increase has coincided with an increase in the number of households and a reduction in the average size of households. It is well established that smaller households tend to use proportionately more water than larger households. The period has also seen a greater use of water-intensive appliances such as dishwashers and power showers. All other things being equal, some increase in consumption might therefore have been expected and it is possible that water efficiency actions may have slowed the growth in consumption. There are also doubts about the accuracy of estimates of unmetered consumption (paragraphs 2.15-2.21). On the other hand, Environment Agency research has shown that in several other European countries, where customers are generally metered, such as Germany and Denmark, domestic water consumption has either stabilised or reduced.

18 **Per capita domestic water consumption 1994-95 to 1999-2000**

Per capita domestic water consumption has increased between 1992-93 and 1999-2000



Note: Figures for metered household consumption are only available from 1994-95

Source: OFWAT

3.28 OFWAT have been keen that water companies in areas of tight water resources should be particularly energetic in promoting water efficiency, and if water efficiency actions have been effective, their effect might be expected to be most pronounced in these areas. Domestic water consumption by unmetered customers in those areas served by four of the five water companies with tight water resources is higher than the industry average (**Figure 19**), although in most of these areas it has risen by less than the national average. There is little evidence, therefore, that water efficiency actions have yet had any pronounced effect on domestic consumption.

3.29 OFWAT consider that water companies should now focus on those water efficiency activities that are demonstrably cost-effective and will continue to have an effect in the longer term. In 2000 they required companies to submit strategies for the next five years in which companies were required to have:

- set out their plans for ensuring that all customers have access to cistern water saving devices and the advice necessary to promote their effective use;
- review their existing customer information plans and set out a longer-term programme for providing customers with water saving advice on self-audits of household water consumption, over the following five years;
- set out plans for promoting advice on self-audits for schools, hospitals and other community premises.

The companies submitted their strategies in July 2000. OFWAT are currently assessing the strategies.

19 **Domestic consumption for companies with tight water resources**

Consumption by customers of four of the five companies with tight water resources is higher than the industry average.

Company	Average household consumption in 1999-2000 (litres per head per day)	Change in average household consumption since 1994-95 (per cent)
Thames Water	165	+6.3
South East Water	160	-2.5
Folkestone and Dover Water	159	+0.1
Essex and Suffolk Water	156	-0.5
Wessex Water	137	-4.4
Industry average	**149**	**+3.2**

Source: OFWAT, based on information from companies

3.30 Information from companies indicates that some types of action are clearly cost effective. For example:

- **Providing information to customers** can be very cheap, for example when information is provided to customers with their bills. There are also long-term benefits in raising customer awareness of the need to use water wisely, although it is difficult to measure the impact of education in terms of direct savings in water used.
- **Auditing water use**. Thames Water, for example, estimated that a "self-audit" scheme undertaken by them could save some 17 litres of water per property per day, based on assumptions derived from market research. It cost the company around £1 to supply each pack, which is equivalent to 16 pence per cubic metre of water saved if customers continued to save this amount of water every day for a year.

3.31 There are serious uncertainties, however, in assessing the cost-effectiveness of more elaborate types of water efficiency action. To assess fully the cost effectiveness of a type of action, companies need to know:

- the cost of installing it;
- the designed saving from each installation;
- the number of installations;
- the actual amount of water saved when it is used by customers;
- how long customers continue to use it;
- the value of the water saved.

3.32 Frequently, however, only the first and second of these are known with any certainty. For example, although companies have distributed over five million cistern devices, our survey of customers found that only 57 per cent of respondents who had received such a device were using it at the time of our survey. The remainder had either never been used, or had been used and then discarded. And Anglian Water and Portsmouth Water both told us that research by companies had cast doubt on the savings claimed for cistern devices. Anglian Water, for example, told us that their research indicated that the lavatory cistern devices that they distributed - which reduced the average flush volume by about a tenth - would save no water at all if the customer has to double flush the lavatory on just one in ten occasions.

3.33 OFWAT have required companies to provide data on customer take-up of various initiatives, and to set out what steps they were taking to quantify the likely savings from each initiative. They have asked companies to set out clearly their intentions with respect to assessing the effectiveness of various initiatives, and to improve their estimates of any savings achieved. Only six companies, however, have comprehensive monitoring strategies that monitor the impact of each activity and confirm whether theoretical savings are achieved in practice. Most companies, therefore, are not yet in a position to say which initiatives are cost effective.

3.34 The slow reporting of results is also due to a lack of awareness or agreement among companies on how to measure and calculate the water saved through water efficiency initiatives. A further problem is that in 1999-2000 only 17 per cent of domestic water customers had water meters, making it difficult to assess how domestic customers' water consumption is affected by the implementation of action to improve water efficiency. Even if a household is metered, there may be difficulties in attributing water savings to specific initiatives, whose effect can be masked by other changes, such as the effect of garden watering in a dry summer.

3.35 In our survey of companies, most companies agreed that promoting water efficiency is worthwhile, and can be a useful means of enhancing the reputation of the company. But several companies suggested that the burden imposed on them in reporting water efficiency work was out of proportion to the importance of water efficiency as a means of managing their supply/demand balance. Some companies suggested that before OFWAT require implementation of water efficiency initiatives they should work more closely with the industry and the Environment Agency to facilitate research into the long term cost effectiveness of the initiatives, and that providing companies with guidance on how to measure the benefits of water efficiency initiatives, would accelerate the process of identifying which initiatives are cost effective. Water UK told us that they also supported the view that companies and regulators needed to work together in partnership.

3.36 All the water companies we surveyed said that they were prepared to share information with other companies on how best to promote water efficiency. Three companies expressed concern, however, that some of the research they have done in this area has cost them money and that they would expect to recover some of their expenditure when sharing best practice. OFWAT have, however, been critical of some companies' apparent refusal to share the findings from their water efficiency projects. They are discussing with the companies, the Environment Agency and Water UK (the representative body of the water companies) how best to secure the wider dissemination of best practice. UK Water Industry Research have commissioned research, to which OFWAT are contributing, into what constitutes best practice in assessing the cost effectiveness of individual water efficiency initiatives. OFWAT also propose to sponsor a new category in the Water UK and Environment Agency Water Efficiency Awards for the company that has done most to improve the understanding of the economics of water efficiency.

Appendix 1

The Deputy Prime Minister's ten point action plan for the water industry

Action point	Progress to date
1 The Director General will set tough mandatory targets for total leakage which will enforce a substantial reduction in leakage over the next five years.	OFWAT set mandatory leakage targets for 1997-98 based on company leakage forecasts. They based subsequent targets on estimates of economic levels of leakage where they were reliable.
2 The Government expect all water companies to provide a free leakage detection and repair service for supply pipes owned by household customers.	All companies normally offer free repairs to supply pipes. Twenty-one companies operate a free telephone leakline.
3 Water companies will be placed under a statutory duty to conserve water in carrying out their functions.	The Government have promised legislation at the earliest opportunity.
4 Water companies must carry out with vigour, imagination and enthusiasm their duty to promote the efficient use of water by customers. For example, they should all: ■ provide free simple devices to reduce lavatory flush volumes; ■ offer free water efficiency audits to domestic customers; and ■ make greater efforts to encourage water-efficient gardening.	Most, but not all, companies offer free lavatory cistern devices. To date the companies have issued over five million devices. Most, but not all, companies offer a DIY water efficiency audit checklist to customers. To date the companies have issued 229,294 water butts and 23,723 spray guns to encourage water efficient gardening.
5 Water companies should consider the rôle that the Government's Environment Task Force can play in improving the efficiency of water use.	The Government consider that companies are now playing an active rôle in the Task Force.
6 The Government will make new water regulations that will include significantly tighter requirements for water efficiency. The Government will also explore other ways of encouraging water efficiency in industry and agriculture, including the use of best practice programmes like those which have been successful in the energy sphere.	New regulations came into force from 1 July 1999 (the Water Supply (Water Fittings) Regulations 1999) and there is a water conservation theme in the "Are You Doing Your Bit?" efficiency campaign. The Departments of Trade and Industry and of the Environment, Transport and the Regions have established the Environmental Technology Best Practice programme to advise water users on how to reduce their impact on the environment, including using less water.

Action point (continued)	Progress to date (continued)
7 The Government will review the system of charging for water including future use of rateable values and metering policy. The review will cover debt recovery arrangements (including disconnection) and use of pre-payment units.	The Water Industry Act 1999 implements the findings of the review. Disconnections are now banned for households and other key premises, such as schools and residential care homes.
8 The Government are asking all water companies which have not already done so to agree with the Director General the amendments to their licences, requiring compensation payments to customers affected by drought-related restrictions. All water companies should consider making compensation payments to customers who are advised to boil water or refrain from using mains water because potentially harmful contamination has occurred.	All water companies are now obliged to pay compensation to their customers under such conditions.
9 All water companies should publish at local level easily understood details of their performance in meeting targets for leakage reduction, water supply and drinking water quality, together with information on investment in the water service and the resulting benefits to the environment.	The Government consider that improved reporting systems are now being put in place.
10 The Government will review the water abstraction licensing system and arrangements for bulk transfer of water. A key aim will be to ensure that the environment is given due weight in decisions on the use of water. The Government expect each water company to agree a detailed, publicly available drought contingency plan with the Environment Agency. This will be made a statutory requirement when the opportunity arises.	The Government's policy decisions were published in March 1999 in "Taking Water Responsibly". The Department of the Environment, Transport and the Regions are preparing draft legislation.

Appendix 2 Duties and powers of the Director General of Water Services

1 The Water Act 1989, the relevant provisions of which, following consolidation, are now included in the Water Industry Act 1991, provided for the appointment and functions of the Director General of Water Services (the Director General).

2 The Director General is required to exercise and perform his powers and duties in the manner he considers is best calculated to:

a secure that the functions of a water undertaker and of a sewerage undertaker are properly carried out as respects every area of England and Wales; and

b secure that companies holding appointments as water undertakers or sewerage undertakers are able (in particular, by securing reasonable returns on their capital) to finance the proper carrying out of the functions of such undertakers.

3 Subject to these duties, he must also exercise and perform his powers and duties in the manner he considers is best calculated:

a to ensure that the interests of every customer or potential customer are protected as respects: the fixing and recovery of water and sewerage charges; the other terms on which water and sewerage services are provided and the quality of those services; and benefits that could be secured for them from the sale of land;

b to promote economy and efficiency in the carrying out of the functions of a water undertaker or sewerage undertaker;

c to facilitate effective competition between persons holding or seeking appointments as a water undertaker or sewerage undertaker.

4 The powers of the Director General include the power to:

a review, and if appropriate amend, the permitted annual increase in prices charged to customers and the level of infrastructure charges specified in companies licences;

b enforce company compliance with the conditions of licences and some of their statutory duties;

c ask the Secretaries of State to set performance standards, with which companies must comply, and guaranteed standards, failure to provide which entitles customers to compensation;

d consider complaints referred by a Customer Service Committee, from customers dissatisfied with a Committee's handling of their original complaint, relating to alleged contraventions by companies of their licenses, about companies' use of their powers to carry out works on private land, or alleging unfair trading practices;

e determine certain disputes relating to matters such as the right of a customer to a payment under the Guaranteed Standards Scheme;

f approve companies' Codes of Practice and complaints procedures;

g request and publish information;

h make inset appointments allowing a new supplier to provide services within the area of an existing supplier, subject to certain conditions;

i make references to the Competition Commission under either the Water Industry Act, the Fair Trading Act 1973 or Competition Act 1980;

j amend a licence, either with the agreement of the company concerned, or after an adverse finding in a report of the Competition Commission on a reference by the Director General under the Water Industry Act 1991;

k appoint Customer Service Committees' Chairmen and members;

l enforce the duty of companies under section 93A of the Water Industry Act 1991 to encourage efficiency in the use of water by customers;

m approve water companies' charges schemes.

5 The Competition Act 1998 prohibits anti-competitive agreements and the abuse of a dominant market position. The Director General has concurrent powers with the Director General of Fair Trading to enforce the Act in the water industry.

Appendix 3 Our study methods

Analysis of information from OFWAT

- We collected and evaluated information and publications from OFWAT, relating to leakage and water efficiency. This included OFWAT's annual reports on leakage and water efficiency, and OFWAT's correspondence files with water companies on their leakage control work and economic level of leakage assessments.
- We examined the terms of reference for the joint study into leakage between OFWAT, the Environment Agency and the Department of the Environment, Transport & the Regions.

Structured interviews with key parties

- We interviewed key staff at OFWAT, to understand their approach to regulating how companies control leakage and promote water efficiency to their customers.
- We interviewed representatives of seven water companies - Anglian Water, Bournemouth and West Hampshire Water, Essex and Suffolk Water, Portsmouth Water, South East Water, Thames Water and Yorkshire Water - and also representatives of Water UK, the organisation representing all water companies, to discuss their experience of leakage control and promotion of water efficiency, and how OFWAT regulate these issues.
- We interviewed representatives of the Environment Agency, and representatives of the National Water Demand Management Centre, which is part of the Environment Agency, to discuss issues from an environmental perspective.
- We interviewed representatives of the Department of the Environment, Transport & the Regions, to discuss issues from the Government's perspective.
- We met representatives of Eaga Partnership Limited (formerly the Energy Action Grants Agency), a not for profit company which offers water efficiency services, to discuss the practical nature of the promotion of water efficiency.
- We collected and evaluated information and publications from the Environment Agency and the Department of the Environment, Transport and the Regions, relating to leakage and water efficiency.

Expert advice

- We appointed WS Atkins, engineering consultants, in conjunction with Frontier Economics and Mr Allan Lambert, Principal Consultant, International Water Data Comparisons Ltd, to review our methodology and report, and to advise on technical and economic issues.
- We met Mr Paul Herrington, senior lecturer in Economics at University of Leicester, to discuss the economic implications of leakage control and promotion of water efficiency.

Opinion research

- We commissioned IPSOS to undertake an omnibus survey of 1,919 water customers in England and Wales, to ascertain their views on water efficiency.
- We sent a questionnaire to the twenty-five water companies in England and Wales, asking their views on how OFWAT regulate leakage and water efficiency.[18]

18 Hartlepool Water are now owned by Anglian Water reducing the number of companies to 24.

Appendix 4 The survey of companies

Survey objectives and methodology

1 In June 2000 we asked all of the water companies in England and Wales to complete a short questionnaire. This sought their views on how OFWAT have regulated leakage and the promotion of water efficiency. 23 replies were received from 25 companies[19], a response rate of 92 per cent.

Leakage

Incentives affecting the amount of work companies put into leakage management

2 Seventeen water companies said that OFWAT's use of mandatory leakage targets had affected the level of work they had put into controlling leakage to date and planned to put into controlling it in the future. OFWAT's comparisons of how effectively companies had performed had also actively encouraged three companies to control leakage.

3 Fourteen companies also felt that they had an incentive to control leakage where it represented the least cost solution to managing their supply/demand water balance. The Environment Agency's policy of not allowing a company to take water from the environment unless that company has acceptable leakage levels was a further reason why three companies had worked to control their leakage. Nine companies said that managing leakage effectively played an important rôle in establishing good customer relations.

Learning from other companies

4 Companies considered there was a range of work that represented best practice in the industry on leakage measurement. The most common were the use of extensive district metered areas, the management and analysis of nightflow data and the use of acoustic equipment to locate leaks. Many companies also saw these practices as important in reducing leakage along with the management of water pressure.

5 Nearly all companies said that they were prepared to share information with other companies on how best to measure and reduce leakage. Only two companies expressed concern that their commercial advantage could be jeopardised by sharing information with other companies. Many said there was already an exchange of information between companies at seminars and conferences, between companies under shared ownership and through industry bodies such as Water UK and UK Water Industry Research.

OFWAT's rôle in encouraging companies to share best practice on leakage issues

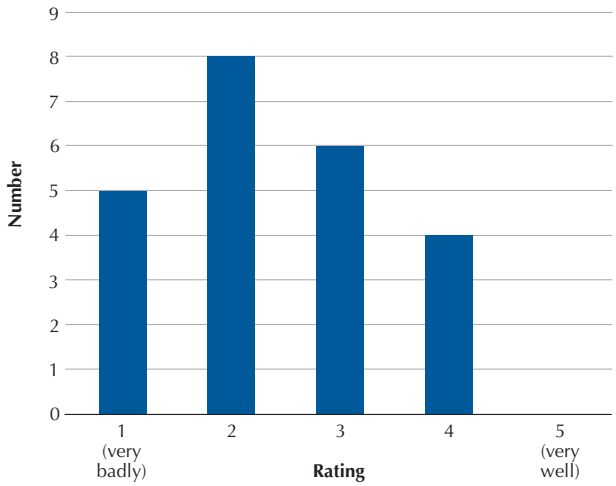
6 Seven companies believed that OFWAT could have more open and transparent discussions with the industry about issues surrounding the economic level of leakage and that OFWAT could share with the industry the conclusions they have reached on the practices and performance of all companies. Other suggestions included a regular national forum and organised workshops.

7 Other companies considered that the industry was fairly active in sharing information anyway and that it was the rôle of UK Water Industry Research and not OFWAT to share best practice among companies.

OFWAT processes and procedures for regulating leakage

8 We asked respondents to score the performance of OFWAT in explaining to them what the company was expected to achieve when assessing the economic level of leakage. We used a five-point scale with 1 representing very badly, 3 average and 5 very well. OFWAT achieved 2.4.

OFWAT's performance in explaining what companies are expected to achieve when assessing economic levels of leakage



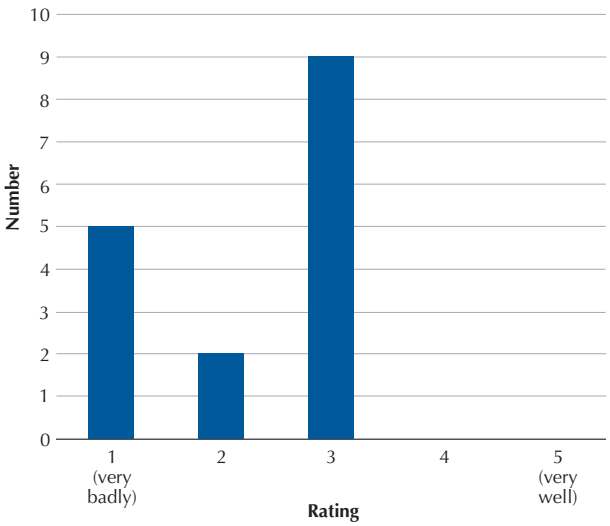
19 *Although Hartlepool Water are now owned by Anglian Water, we received separate replies from the two companies.*

9 Nine companies commented that it was difficult to identify exactly what OFWAT expected them to produce in assessing the economic level of leakage and that it was not clear how OFWAT had established what constituted an acceptable performance and what was best practice. Four companies said that OFWAT had only provided them with feedback when they had asked for it.

10 Two companies were concerned that the economic arguments put forward by a company for having a particular level of leakage appeared to be secondary to OFWAT's desire for the achievement of mandatory targets. Two companies were also concerned that OFWAT did not understand the technical complexities of leakage measurement because staff were primarily economists rather than leakage practitioners.

11 We asked respondents to rate the performance of OFWAT in setting leakage targets based on companies' leakage performance and their water resource position. We used a five-point scale with 1 representing very badly, 3 average and 5 very well. OFWAT scored 2.3.

OFWAT's performance in explaining the basis of setting pragmatic leakage targets

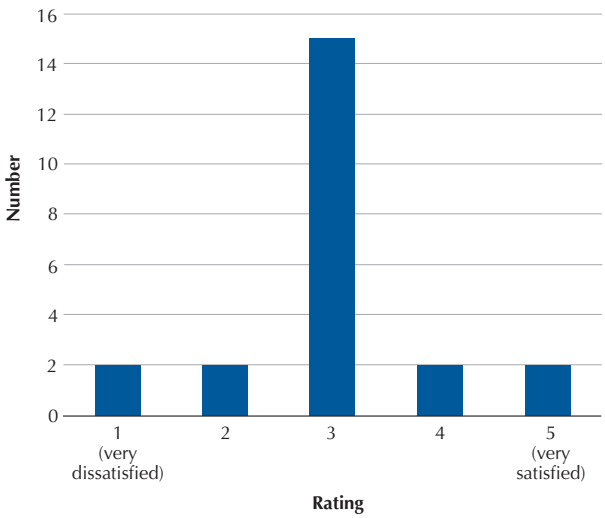


12 Nine companies believed that although OFWAT had outlined clearly to them the methodology they had used to set the target they had given them little or no explanation of how they had arrived at the actual target itself.

Prospects for the future regulation of leakage

13 We obtained the views of water companies on the methodologies that OFWAT are suggesting that companies should adopt to produce more reliable estimates of unmetered domestic consumption. We used a five-point scale with 1 representing very dissatisfied, 3 average and 5 very satisfied. The companies rated the methodologies as 3.0.

Company satisfaction with methodologies for calculating unmeasured domestic consumption



14 Five companies commented, however, that the methodologies still contain scope for interpretation due to the statistical sampling and extrapolation involved. Five companies consider that the monitoring of the consumption patterns of a sample of customers has provided them with information that allows them to make more reliable estimates of unmetered domestic consumption. Three other companies thought that such monitoring was expensive and that the data produced would not be useful unless it could be demonstrated that the sample of customers used was representative.

The promotion of water efficiency

Incentives affecting the amount of work companies put into promoting water efficiency

15 Thirteen companies said that the statutory duty which requires them to undertake the work and the regulatory pressure exerted on them by OFWAT determine the level of work they put into promoting water efficiency to their customers. Ten companies had also promoted water efficiency because giving advice on how to save water had improved their customer relations. Seven companies also mentioned that they promoted water efficiency for environmental reasons.

Learning from other water companies

16 We asked the companies what type of work they regarded as good examples of activities to promote water efficiency in the homes. The companies gave a large variety of answers including the audit of water consumption in customers' homes; the use of lavatory cistern devices; initiatives involving third parties such as councils and housing associations and long term education programmes aimed at changing the behaviour of customers.

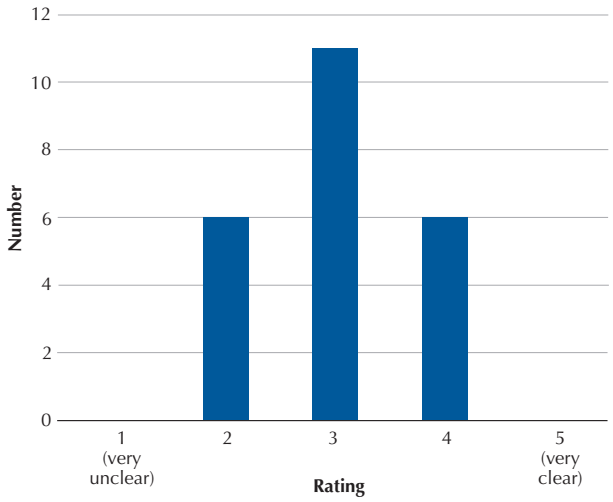
17 All of the companies said that they were prepared to share information with other companies on how best to promote water efficiency and that this is already done through conferences and seminars. Three companies expressed concern that some of the research they have done in this area had cost them money and that they would expect to recover some of their expenditure when sharing best practice.

18 There was a mixed view as to whether OFWAT could do more to encourage companies to share best practice on the promotion of water efficiency. Five companies wanted OFWAT to put the promotion of water efficiency on a more sound scientific basis with agreed procedures and processes for determining the costs and benefits of initiatives as part of a national strategy aimed at providing a more consistent message to the public. Four companies thought that the industry was already doing enough and three of them thought that if any further work needed to be co-ordinated it should be the responsibility of the Environment Agency.

Processes and procedures

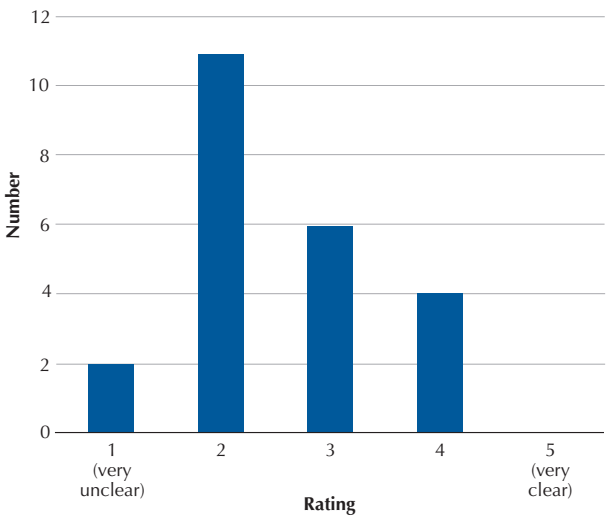
19 We asked respondents to score the performance of OFWAT in explaining to them their views on the purpose of promoting water efficiency. We used a five-point scale with 1 representing very unclear, 3 average and 5 very clear. OFWAT achieved 3.0.

How clear companies are about OFWAT's views on the purpose of promoting water efficiency



20 Six companies commented that OFWAT did not have a strategy as such and that the ultimate purpose of water efficiency work was unclear. Four companies were also concerned that OFWAT's prescriptive approach to the amount of work that companies are expected to undertake did not fit in with their view that the measures needed to be cost-effective.

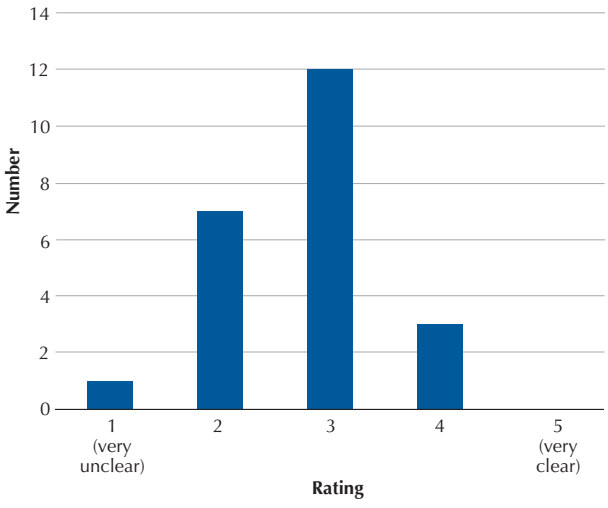
How clear companies are on OFWATís views on what is an acceptable water efficiency strategy



21 We also asked respondents to score the performance of OFWAT in explaining to them what they considered to be an acceptable water efficiency strategy. We used a five-point scale with 1 representing very unclear, 3 average and 5 very clear. OFWAT achieved 2.6. Six respondents thought that the strategies which were adopted by the companies should be allowed to take closer account of the local resource position.

22 We asked respondents to score the performance of OFWAT in explaining to them what they considered to be an acceptable strategy for monitoring the promotion of water efficiency. We used a five-point scale with 1 representing very unclear, 3 average and 5 very clear. OFWAT achieved 2.7. Four companies said that the lack of clearly auditable data did not help them to monitor savings and that this had resulted in OFWAT being unable to give a clear indication of what constituted best practice.

How clear companies are on OFWAT's views on what is an acceptable water efficiency monitoring strategy



Prospects for the future regulation of the promotion of water efficiency

23 When we asked the companies what else OFWAT should be doing or not doing with regard to the promotion of water efficiency we received a number of suggestions. Among the most common were that OFWAT should contribute to the UK Water Industry Research project to establish best practice in measuring the effects of efficiency measures; focus on the outcomes of the initiatives rather than the inputs to the process; co-ordinate more closely with the Environment Agency and other national bodies to provide a united message to the public and allow for an appropriate level of costs for promoting efficiency when setting water company prices.

Appendix 5

The survey of customers

1. The National Audit Office conducted a survey to ascertain the public's view on water efficiency. We commissioned IPSOS to carry out the survey using their weekly omnibus survey CAPIBUS. A representative sample of 1,919 respondents in England and Wales aged 15 years and over were interviewed face to face between 2 and 8 June 2000. The survey results for a sample of 1,919 have a sampling error of up to two per cent at a 95 per cent confidence level.

Most people have seen advice on how to save water

2. In the survey 57 per cent of respondents said they recalled seeing advice on how to save water in the home or garden (**Figure 20**). Lower income groups were the least well informed about how they could save water, with 51 per cent recalling such advice. Respondents in the south east of England were the most well informed (67 per cent) and those in London were the least well informed (50 per cent).

3. The most common forms of advice that respondents recalled seeing were leaflets (30 per cent), and advertisements on radio and TV (27 per cent) and newspapers and magazines (12 per cent).

20 **Do you recall seeing advice on how to save water in the home or garden? If so, where?**

Leaflets and advertisements were the most common forms of advice recalled by respondents.

	Per cent
In leaflet/newsletter with water bill	30
Radio/TV advertisements or articles	27
Magazine advertisements	12
At garden centre	2
Special offers on water butts or spray guns	2
Through children's school or projects	1
At work	1
At electrical, DIY or other stores	1
Other	1
Have not seen any advice	43 (note 1)

Note: 1. Percentages total more than 100 because some people recalled seeing advice in more than one place.

Sample size: 1,919

Nearly all customers try to save water in some way

4. Eighty-eight per cent of respondents said they used one or more of a variety of methods to save water in their homes compared to 30 per cent of respondents who save water in their gardens (**Figure 21**). Only 12 per cent of customers do nothing at all to save water. Customers in Yorkshire and Humberside, the South East and London were most likely to do something to save water.

5. Those customers who save water in their homes do so mainly by not leaving taps running, taking showers rather than baths and only washing full loads in the washing machine and dishwasher. Customers who save water in their gardens do so mainly by using rainwater or saved water to water the garden and using sprinklers carefully.

21 **Which, if any, of the following ways of saving water do you use?**

Nearly nine in ten respondents reported doing something to save water.

In the home	Per cent	In the garden	Per cent
Not leaving taps running	77	Using rainwater/ saved water	18
Taking shower rather than bath	47	Using sprinklers carefully	12
Only washing full loads in washing machine/ dishwasher	40	Using gravel or mulch on flower beds	8
Mending leaks and dripping taps	37	Using plants that can manage with less water	6
Lagging pipes to avoid bursts in freezing weather	31	Using water butts and spray guns	3
Using washing machine/ dishwasher that uses less water	13		
Putting something in lavatory cistern to reduce flushed water	9		
Using dual-flush lavatory	8		
Other	1		
Total reporting at least one way of saving water	88		30

Sample size: 1,690 people who use some method of saving water in the home or garden

Customers save water for a number of reasons

6. The main reasons given by customers for saving water were that they were concerned about water shortages (40 per cent), they wanted their water bills to be lower (38 per cent) and they were concerned about the effect on the environment of using too much water (37 per cent). Most customers who did not save water said that they were not wasting much water as it was (49 per cent) and they had not really thought about saving water (17 per cent).

Few customers use lavatory cistern devices or have received information packs on how to save water

7. In England and Wales 11 per cent of respondents had received a lavatory cistern device (a device that reduces the amount of water in each flush) but only six per cent were still using it. In the drier regions of England and Wales (East Anglia, London and the South East) the latter figure was nine per cent. 70 per cent of respondents in England and Wales said they would either definitely or probably install such a device if they were given one.

8. Only 21 per cent of respondents in England and Wales were aware that their water company could provide an information pack to help them check whether they were wasting water and only 9 per cent said they had received such a pack. Respondents in the drier regions of England and Wales were slightly more likely to be aware of the information packs and to have received one. Of those who had received an information pack, 35 per cent said they had saved water by using the information it contained.

9. Most metered customers consider that having their bills based on consumption encourages them to save water - of the 15 per cent of respondents who had their water bills based on the amount of water they use, 68 per cent said that having a meter had encouraged them to save water.

Appendix 6

Previous Conclusions of the Public Accounts Committee on Leakage and Water Efficiency

NAO Report	PAC Conclusion
The Work of the Directors General of Telecommunications, Gas Supply, Water Services and Electricity Supply (HC 645 1995-96)	To avoid the risk that profits might again rise above a reasonable level we recommend the Directors General set price controls which will ensure that profits should be no more than sufficient to provide the return required to attract the necessary funds for investment in future periods.
	We note that in striking a balance between the interests of customers and shareholders the Directors General have regard to the long term interest of customers and that companies should be able to undertake necessary capital investment.
	We consider that service standards require constant attention from regulators, since reduced standards are an effective price increase. We are very concerned that Yorkshire Water in 1995 may have been one such example of a company reducing costs by cutting corners and levels of service. We welcome the fact that the action taken by the Director General of Water Services in that case included a reduction in Yorkshire Water's price limits, making clear the link between service standards and prices in regulated industries.
Regulating and Monitoring the Quality of Services Provided to Customers by the Water Industry in England and Wales (HC 388 1997-98)	We expect OFWAT to ensure that companies have satisfactory plans to maintain reliable supplies to customers.
	We look to OFWAT to conclude their review of arrangements for monitoring the number of people at risk of water shortage without further delay and introduce more reliable measures for monitoring who is at risk and what is being done to reduce that risk.
	We expect OFWAT to monitor closely companies' progress in achieving their targets or reducing leakage and to act promptly if any company fails to achieve them.

Appendix 7

International comparisons of leakage levels

1. We commissioned our engineering consultants WS Atkins, and Mr Allan Lambert, Principal Consultant, International Water Data Comparisons Ltd, to prepare a report for us on how leakage levels in England and Wales compared with those in other countries.

2. The key conclusions of the report were as follows:

   - Since the 1995-96 drought, and the imposition of mandatory leakage targets by OFWAT, all water companies in England and Wales have reduced total leakage, by a total of over 1600 Megalitres/day[20].
   - However, the total leakage targets up to 2002-03 show a significant 'levelling out' effect, indicating that companies appear to be getting close to economic leakage levels.
   - OFWAT are to be congratulated on setting an example to the rest of the United Kingdom industry by rejecting, as being misleading, the common practice of quoting leakage levels as a percentage of distribution input for purposes of assessing performance in the management of distribution systems. This has been confirmed by the 'Best Practice' report of the International Water Association (IWA).
   - However, OFWAT does not yet have a valid method for making international comparisons of performance in managing real losses.
   - In the 1997-98 report, OFWAT effectively rejected the early work of the IWA Water Losses Task Force, stating (without sound basis) that "were good quality international data available, then it is likely that the traditional 'per property' and 'per length of mains' measures would prove adequate for making comparisons".
   - The IWA Task Forces have shown that even if OFWAT replaced 'properties' by 'service connections' their conclusion would only apply to the most basic (level 1) performance indicator (PI).
   - In OFWAT's 1998-99 Report, the manner in which the comparisons with two Australian cities were reported was misleading - 'total leakage' was compared with 'distribution losses'- resulting in an incorrect conclusion.
   - For national comparisons, average pressure is a key factor which OFWAT does not take into account. It is recommended that OFWAT should also express total leakage and distribution losses in litres/service connection/day/metre of pressure.
   - For international comparisons of total leakage, the IWA Detailed Level 3 PI of Infrastructure Leakage Index (ILI) is required, to allow for density of service connections per kilometre of mains, leakage on private pipes, and average operating pressure.
   - Comparisons based on the IWA water losses international data set, which includes 4 England/Wales companies with Level 1 total leakage spanning the England/Wales data, show that most England/Wales companies are now achieving, or close to achieving, ILI values in the range 1.0 to 1.5, which is the lower quartile of the international data set.

20 1,600 Megalitres = 1.6 million cubic metres.

Appendix 8 Timetable of key events

Date	Event
1990	OFWAT request companies to report their total estimated leakage for 1989 and 1990; to forecast it for the years to 1995; and to outline their intentions on leakage control between 1989 and 1995.
Summer 1995	The drought and Yorkshire Water's problems with water supply.
October 1995	The water and sewerage companies announce voluntary action to reduce leakage.
February 1996	Introduction of the statutory duty on companies to promote the efficient use of water by their customers.
May 1996	OFWAT publish 1997-98 leakage targets set by companies.
June 1996	OFWAT require water companies to set out their strategies in a written plan for meeting their duty to promote the efficient use of water.
October 1996	The Department of the Environment publish "Water resources and supply: an agenda for action".
April 1997	OFWAT assess all companies' water efficiency plans as acceptable.
May 1997	The Water Summit. The Deputy Prime Minister announces that OFWAT will set mandatory leakage targets for 1998-99.
July 1997	Companies submit to OFWAT their proposals for mandatory leakage targets for 1998-99. OFWAT assess the proposals and set leakage targets after looking at the companies' resource position and leakage levels. OFWAT also publish companies reported leakage figures for 1996-97, which show a nine per cent reduction.
October 1997	OFWAT require companies to monitor the effectiveness of their water efficiency strategies.
July 1998	Companies report on the progress of their water efficiency strategies.
October 1998	OFWAT report that leakage in 1997-98 has fallen by 12 per cent. They set out mandatory leakage targets for 1999-2000. Six companies have their targets based on their own analysis.
December 1999	OFWAT report that leakage has fallen by 11 per cent and that only two companies failed to meet their 1998-99 targets. They set out leakage targets for 2000-01. Ten companies have their targets based on their own analysis.
May 2000	OFWAT, the Environment Agency and the Department of the Environment, Transport and the Regions begin study into determining an approach to setting future leakage targets.
July 2000	OFWAT report that leakage in 1999-2000 has fallen by seven per cent.