



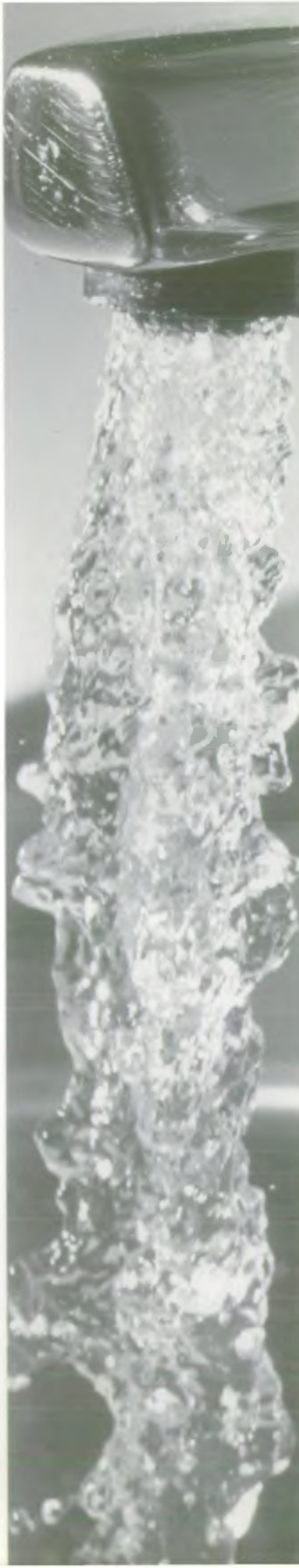
# SUSTAINING OUR RESOURCES

Southern Region  
water resources  
development  
strategy



**NRA**

*National Rivers Authority  
Southern Region*



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#### SOUTHERN REGION

Guildbourne House, Chatsworth Road,  
Worthing, West Sussex BN11 1LD

Front Cover:  
The Seven Sisters, East Sussex.  
Water Mill, River Stour, Kent.  
Beaulieu, New Forest, Hampshire.

ENVIRONMENT AGENCY



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# EVERY DROP COUNTS



Our bodies are 70% water – without water we can't live.

Water is taken from reservoirs, rivers and underground reserves, and is then treated to exceptionally high standards to ensure that it is the right quality for us to drink. It is then piped, sometimes huge distances, to precisely where we need it. Once we have used it, it is then piped again to a sewage treatment works.

But getting enough water into our homes and workplaces requires lots of energy, materials, land and chemicals. So save resources by using water wisely and make every drop count!

## YOU CAN

**1. Turn off taps fully** so that they do not drip. Push taps which are self-closing can prevent water from being wasted in this way. Fitting taps which give a spray of water instead of a single stream can cut water usage by up to 50%.

**2. Fit controls for the flushing of urinals.** A 9 litre cistern flushing every 20 minutes consumes 240,000 litres per year. With some form of controlling device fitted this can be reduced to 70,000 litres per year or less, giving a saving of about £170. You can also **fit cistern dams** or bags in the WCs to reduce their water consumption per flush.

**3. Monitor your meter.** Reading your water meter is a good way to check your water consumption, make sure you have no leaks and ensure that you are billed for your actual consumption.

**4. Look for leaks.** Even a tiny leak of just one drop per second wastes 1,200 litres of water a year. Measuring the flow overnight will tell you whether you have any leaks. Your local water company can also help you find and fix leaks.

**5. Mind that hosepipe!** Using a hosepipe to water the office flower beds or wash the vehicle fleet can use 900 litres every hour! Fit hoses with shut-off nozzles, and use water collected off the roof to water lawns and flower beds.

## Conservers at Work

*Saving Resources for a Better Environment*

Just 0.02% of  
the entire water  
supply in the world is  
available for human use  
– the rest is salty or  
locked in ice caps and  
glaciers.

## **WATER, WATER EVERYWHERE ... BUT NOT A DROP TO DRINK!**

There are an estimated 1,400 million cubic kilometres of water on our planet, and yet thousands of people die through lack of water every day. Even in Britain, with its supposedly wet climate, we can have drought conditions such as in 1988-92 and 1995-96.

It is a problem of demand exceeding supply. We can either build more reservoirs and take more water from rivers, or we can use less. By using water wisely you can prevent loss of habitats and reduce the chance of rivers drying up, so helping to conserve wildlife.

## **WATER USE IN OFFICES AND INDUSTRY**

Currently average water consumption in the UK is about 147 litres per head per day, and 35% of this is when you're at work. In offices 63% of the water used is flushed down the loo. Only around 1% of all treated "drinking" water used in offices is actually drunk – the rest goes down toilets and drains!

Industry is a major user of water. Did you know that it takes 30,000 litres to produce one car, and 8 pints to brew just 1 pint of beer? Ensure that any machinery which uses water, such as cooling towers or heating systems, is well maintained and uses the minimum amount of water necessary. Look to recycle wherever possible, and specify for low consumption when purchasing equipment that uses water.

## **SAVE WATER – SAVE MONEY**

Water costs money! On average, you are billed about £1.00 for the supply and disposal of one cubic metre of water (1,000 litres). Find all the water meters in your building and use them to assess how much water each individual uses and the cost to the company. For a standard office building, you should be getting through about 12 cubic metres per employee per year. Much more than that, and there's probably a leak or excessive usage going on somewhere. You can publish monthly usage results so that colleagues can keep track of progress.

**WATER USE  
IN OFFICES**  
WC flushing 43%  
Washing 27%  
Urinal flushing 10%  
Canteen use 9%  
Cleaning 1%

**Conservers at Work**  
*is an action packed  
membership scheme  
which helps  
individuals to reduce  
their environmental  
impact while they're  
at work. For more  
information, contact  
Melissa Roussopoulos  
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Written by: John Newton, Crane Environmental Ltd. Sources: Building Research Establishment, Environment Agency, The Environment Council, New Scientist, Severn Trent Water Limited.



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## EXECUTIVE SUMMARY

This draft document shows that NRA Southern Region can remain self-sufficient in water resources for at least the next 20 years, and accommodate planned growth without recourse to long-distance transfers from the north and west of the country. This is possible provided that a programme of water conservation, including demand management, forms the first stage in a resource development strategy. That would involve:

- Greater use of bulk supplies between Companies.
- Installation of domestic meters.
- Increased leak reduction activity by Companies.
- Public education in the wise use of water.

These measures would need to be followed by the construction of some new water resource schemes which are identified in this document. The extent to which new schemes are required will depend on the rate of demand growth that emerges in the longer term.

The NRA views conservation and demand management measures as an essential means of reducing the environmental impact of current and future demand for water.

Development of local regional sources in preference to long distance transfers is favoured on grounds of cost, energy consumption and environmental impact.

These and other key issues are put forward now for consultation, with a view to publishing the final strategy document early in 1993.



## INTRODUCTION

The drought has highlighted the importance of water resources to everyone in the South East. Customers have been inconvenienced by lengthy hosepipe bans and the once "Silvery Darent" has become a national symbol for rivers dried up by over-abstraction.

Under the 1991 Water Resources Act, the NRA has a duty to conserve, redistribute, augment and ensure the proper use of water resources. A national water resources strategy document was published for discussion in March 1992. This demonstrated the divide between the wet, less populated, North and West, and the dry more populated South and East. The Southern Region of the NRA, covering Kent, Sussex, Hampshire and the Isle of Wight is seen to be self-sufficient until at least 2021 if all currently proposed new water resource schemes are constructed. This regional report examines the need for water in the South East and sets out a 30-year strategy to meet appropriate demand whilst protecting the environment.

This regional statement is being issued as a consultative document to major abstractors, organisations representing water users and users of the water environment, planning authorities and other regulatory and advisory agencies. Certain key issues are identified later on and views are invited on these aspects in particular, but all comments received will be taken into account in finalising the water resources strategy for the region in 1993.

### SURPLUS RESOURCES IN 2021 AS % OF AVERAGE DEMAND IN 2021

Note: Assumes present resources are available together with new indigenous schemes

## NATIONAL STRATEGY

After rapid growth in the 1960s and 1970s, public water supply consumption in England and Wales has increased rather less during the 1980s, mainly as a result of economic conditions. Projections of national water demand for the next 30 years range from no growth to a requirement for an extra 5,000MI/day (equivalent to 50 Bewl Water reservoirs). The balance in 30 years' time for each Region is shown in the diagram, which indicates parity between demand and indigenous resources in Southern.

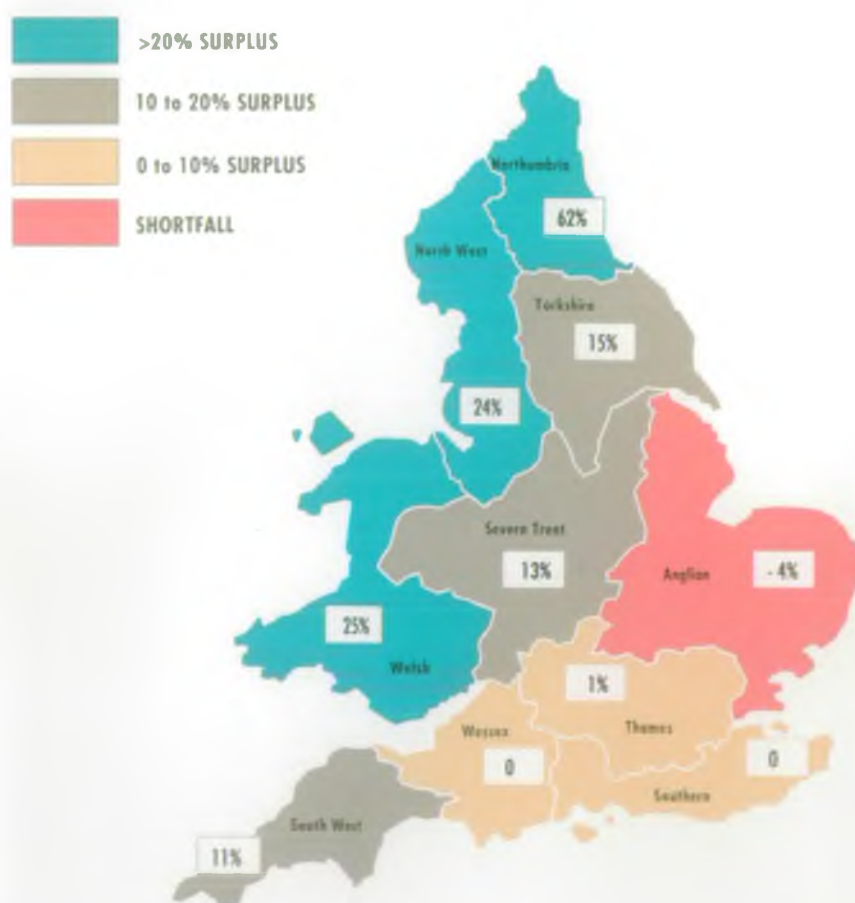
A wide range of options have been considered and their costs compared. Among the more expensive options are transfers from the North and West, either using existing rivers and canals, or by constructing a national grid for treated water. These proposals are particularly energy intensive at a time when consideration is being given to reducing energy consumption to combat

global warming. Unfortunately the Southern Region is not well placed to receive these long distance transfers. The available river and canal systems are not as accessible as in the Midlands, with London and the Thames Valley intervening.

In 1968 the Water Resources Board indicated that the Southern Region should be self-sufficient in water resources beyond the year 2001. This regional strategy reviews in more detail whether this can remain the case.

## WATER RESOURCES POLICY

In June 1992 the NRA Board approved a number of Key Issue Statements on 'Managing the Drought and Water Resources'. These highlight, from a national point of view, the issues of low flow rivers, new sources and the need for the wise use of water. Main points are summarised here.



## **NRA NATIONAL POLICY – MANAGING THE DROUGHT AND WATER RESOURCES**

### **General**

The last four years have left parts of Eastern and Southern England with a deficit equivalent to ten months' rainfall.

The National Rivers Authority cannot cure a drought, but it can help to manage it. The protection of rivers and wetlands is essential whilst meeting the needs of major users who all have a role to play in helping to conserve water supplies.

### **Low Flows**

The current drought is severe and it has inevitably caused very low river flows and groundwater levels.

However, problems with some rivers are due to excessive abstraction as well as the drought. The NRA is taking positive action to solve these problems and will, where necessary, vary or revoke licences.

The NRA has been carrying out detailed investigations into rivers with depleted flow due to excessive abstraction and in appropriate situations intends to:

- Withdraw or amend abstraction licences and require abstractors to use alternative sources.
- Where alternative sources of public supply are not immediately available the NRA will amend licences on the basis that alternative supplies will be promoted to agreed timetables and programmes.
- The NRA is satisfied with its existing powers to amend and withdraw abstraction licences where their use conflicts with

conservation needs, but will be discussing the need for any further legislation and this may be included in the promised Environment Bill.

### **New Sources**

Before any new sources are developed, it is essential that water companies reduce leakage and carry out effective demand management. The NRA supports selective domestic metering in areas where water resources are stressed.

The NRA's recently published discussion document on strategic options is an important initial step in the work. Water companies must co-operate with the NRA in taking this forward.

In drought-hit areas, where there is any doubt about long term sustainability of resources, the NRA will not grant any new licences until the current drought is over and its impact assessed.

- The NRA has already announced a moratorium on new licences in the worst-hit areas.

In many parts of the country, especially the South and East, groundwater supplies are fully utilised and the scope for further groundwater development is limited.

Surface water abstraction near tidal limits is favoured.

Adequately treated effluents are an important water resource and the NRA will expect them to be discharged as far upstream as possible.

Winter abstraction with storage for summer use is encouraged. The NRA believes that in the long term users should have sufficient

water for their reasonable needs, but they must be prepared to pay the real economic cost. This will require legislative change and development of suitable techniques and the NRA will co-operate fully on these initiatives.

### **Wetlands**

It is essential that wetlands and other areas of significant environmental interest are protected.

### **River Buffer Zones**

River buffer zones of natural vegetation of 10m or more width can do much to improve the river environment by preventing pollution and silt reaching the rivers at relatively little cost.

### **Wise Use of Water**

It is essential that everyone does all they can to use water wisely, follows the advice available and heeds calls for restraint.

*June 1992*

Southern Region has adopted a policy which extends these issues to the particular conditions of south east England, which has scarce resources and a large number of Water Company supply areas.

## **SOUTHERN REGION – WATER RESOURCES POLICY**

The National Rivers Authority has a duty to conserve, redistribute, augment and ensure the proper use of water resources. In the Southern Region we seek to achieve this by adopting a Water Resources Policy. We will:

- Promote the full use of existing water resources by encouraging 'water grid' connections and the conjunctive use of reservoirs, river abstractions and groundwaters.



- Promote future re allocations of supplies between Companies, where appropriate.
- Permit new abstraction of water at the downstream limit of rivers.
- Protect river interests from the effects of abstraction by incorporating controlling flows in licences.
- Promote, where appropriate, the augmentation of chalk streams by groundwater abstraction to the benefit of all river users. We will also support river-regulating reservoirs.
- Promote the return of treated effluent to the local catchment wherever possible.
- Persuade Water Companies and consumers to adopt water saving measures.
- Persuade Water Companies to install domestic water meters with appropriate tariffs before major new resource schemes are licensed.
- Work with OFWAT to ensure that Water Companies achieve appropriate leakage targets.
- Remedy the effects of over-abstracted catchments by improved groundwater management.
- Take into account the possible effects of climate change in long term water resources planning.

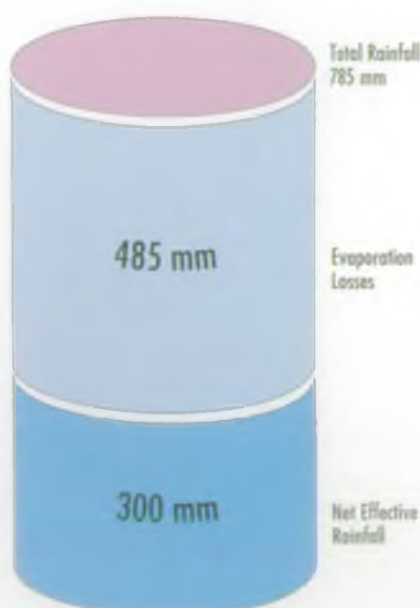
## SOUTHERN REGION

### Hydrology

Southern Region covers a total area of 10,550 Km<sup>2</sup> monitored by a hydrometric network comprising some 2,000 boreholes, 450 rainfall and climate stations and 150 river flow gauges. The average annual rainfall for the Region is just under 800 mm. This makes it the third driest region of England and Wales (and Scotland), after Anglian and Thames regions. After allowing for evaporation losses and water used by plants and vegetation, which amount to an equivalent of 485 mm on average, the net effective rainfall available to recharge aquifers and contribute to river flow averages 300 mm per year.

There is considerable variation within the region and net effective rainfall typically ranges from 350 mm in the west to less than 200 mm in north east Kent, with a small area (along the South Downs in West Sussex and eastern Hampshire) where recharge is as high as 500 mm on average. In a 1 in 50 drought

**Average annual rainfall  
in Southern Region**



year such as public water supplies are designed for, these net rainfall values are reduced to about one third, because increased losses from evaporation have a disproportionately large effect on the smaller depth of rainfall that is received.

Net effective rainfall provides the resource from which all uses of freshwater, both consumptive and non-consumptive, must ultimately be met, and its relative level of exploitation is critically important.

The map shows net effective rainfall for an average year. On it are superimposed existing major public water supply sources greater than 10 Ml/day. This illustrates the manner in which the Region's geology and topography have determined the nature of the present water supply systems.



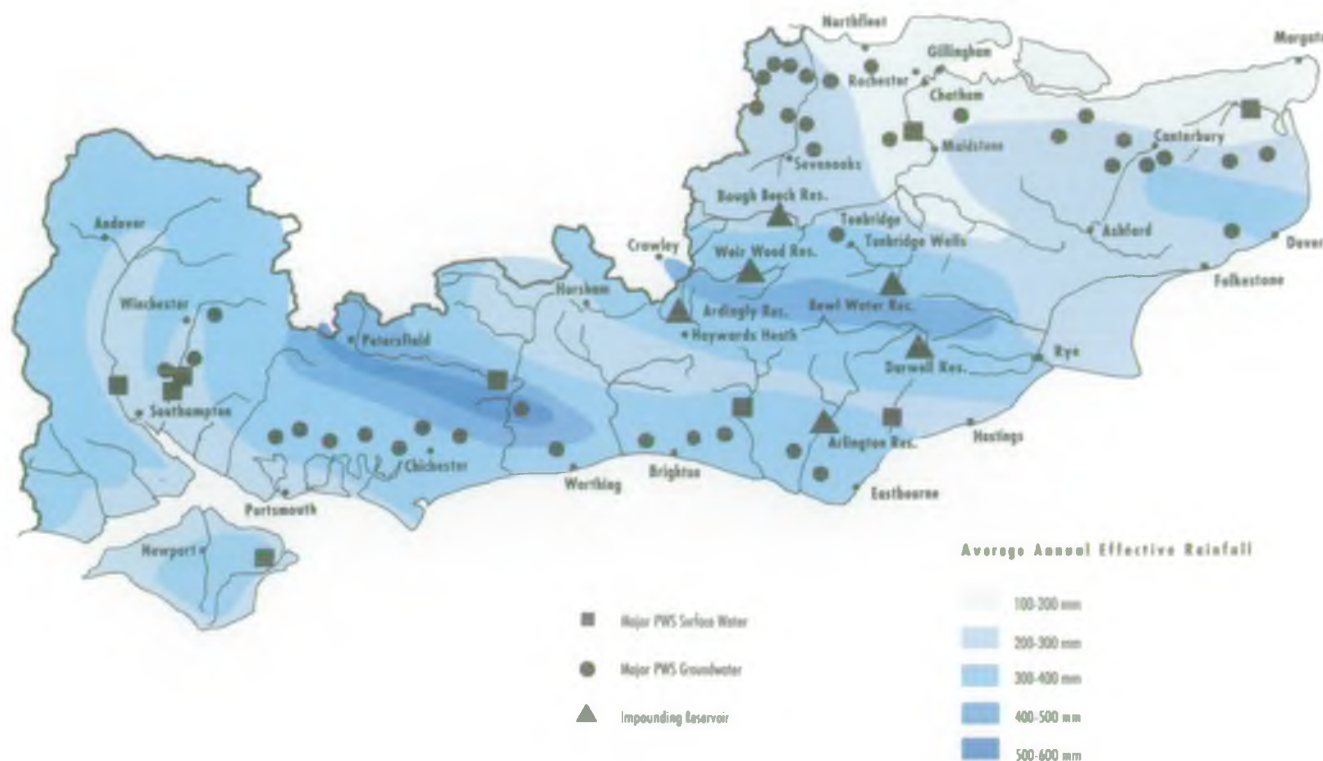
Reconstruction of Goldbridge Weir, River Ouse, Sussex.

There are two lines of major sources, along the dip slope of the South Downs and along the North Downs. Surface reservoirs are concentrated in the eastern Weald where outcrops of Ashdown Sands overlain by Wadhurst Clay provide suitable topography and geology for dam construction. Elsewhere, the permeable chalk uplands and generally flat coastal plains provide few suitable reservoir sites.

Historically, public water supplies have come from boreholes sited close to centres of population, with little need to transfer water over any great distance. It is only since 1970 that some of the larger reservoir schemes have been



## Average annual effective rainfall and location of existing major public water supply abstractions



developed to supply populations tens of miles from the source. This situation contrasts sharply with some other parts of the country where long distance aqueducts were constructed in the last century to bring supplies from large reservoirs, such as Thirlmere in the Lake District, to cities such as Manchester, with offtakes along the route supplying other towns.

As a result, a large number of local water undertakings, a mixture of local authority water departments and private companies, came into being and have only gradually amalgamated into the larger units which exist today. These are owned by nine companies, of which six have large supply areas within the Region:

Southern Water Services  
 Portsmouth Water  
 South East Water  
 Mid Kent Water Company  
 Folkestone and Dover Water Services  
 Thames Water Utilities

The other three have smaller areas around the boundary of the Region:

East Surrey Water  
 Wessex Water  
 West Hampshire Water

The map shows there is a large number of discrete operating units based on earlier water company boundaries, with limited or no connections between units. Notable exceptions to this are the Cross Solent main feeding the Isle of Wight,

joint use of the Medway Scheme by Southern Water and Mid Kent Water Company, and the Thanet main which links the two separate areas of Southern Water's Kent Division and is also used by Mid Kent Water Company.

### Existing Sources

Although groundwater sources dominate water supply for the Region, there are four main types of abstraction for public water supply:

### Water Companies in Southern Region



### From unregulated rivers

These depend on a steady baseflow component throughout the year and use the natural groundwater storage in upper parts of catchments to maintain flow in the lower river by natural means. Rivers used in this way are:

R. Test at Testwood – Southern Water Hampshire Division serving Southampton.

R. Rother at Hardham – Southern Water Sussex Division serving Horsham and Crawley areas.

Wallers Haven at Hazards Green (with compensating discharges from boreholes) - Eastbourne Water Company.

R. Stour at Plucks Gutter – Southern Water Kent Division serving Thanet.

The total quantity at present abstracted by this means averages 112 Ml/day.

### From regulated rivers

Southern rivers are regulated from surface storage and from groundwater, although full groundwater augmentation, as opposed to compensating discharges, has only been developed in Hampshire on the R. Itchen, and on the Isle of Wight with the R. Yar.

Abstractions of this type are:

R. Itchen at Otterbourne - Southern Water Services Hampshire Division serving Eastleigh and the eastern part of Southampton.

R. Itchen at Gaters Mill – Portsmouth Water Company.

R. Eastern Yar at Sandown using groundwater augmentation from R. Medina catchment – Southern Water Isle of Wight Division.

R. Ouse at Barcombe using Ardingly reservoir – Mid Sussex Water Company serving Haywards Heath area.

R. Medway at Maidstone using Bewl Water – Southern Water Kent Division and Mid Kent Water Company serving Medway Towns and Maidstone.

The total quantity abstracted by this means averages 160Ml/day.

### From impounding reservoirs

Concentrated in the Weald area where somewhat higher net rainfall (in the

Ardingly – Mid Sussex Water Company serving Haywards Heath area.

The total quantity abstracted directly from these reservoirs averages 80 Ml/day.

### From boreholes

The principal aquifers are the Chalk and Lower Greensand, with smaller but locally important supplies obtained



Bewl Water, Kent

range 300 mm - 400 mm per year), geography and topography have combined to produce factors favourable to reservoir construction.

There are six major reservoirs:

Bewl Water (augmented by pumped storage) – serving Southern Water and Mid Kent Water Company.

Weir Wood – Southern Water Sussex Division serving Crawley and providing a bulk supply under agreement to Mid Sussex Water Company.

Darwell – Southern Water Sussex Division serving Hastings.

Arlington – Eastbourne Water Company serving Eastbourne.

Bough Beech – East Surrey Water Company serving Reigate area.

from Hastings Beds and Valley Gravels. All Companies' supply areas, with the exception of Southern Water Services Hastings area and the southern part of Hampshire Division, depend heavily on borehole sources. However, the figure shows that the North and South Downs are the pre-eminent aquifers, with sources extending along the dip slopes over extensive areas. Historically, local sources have been developed to meet the needs of nearby urban areas and the degree of strategic linking of these sources is small. For obvious reasons trunk mains have largely been contained within Water Company boundaries. The total quantity abstracted from boreholes and shallow wells averages 1,125 Ml/day, some 76% of public water supply.



## PRESENT WATER USE

The total quantity of water abstracted in 1989 from rivers, reservoirs and underground sources for public water supply, industry and agriculture, but excluding the use of tidal estuaries, amounted to 2,680 Ml/day, equivalent to a depth of 93 mm spread across the Region. This is 30% of the net rainfall received in an average year and 52% of the 1989 net rainfall. Although a drought year, 1989 was not considered to be of design severity, usually taken as

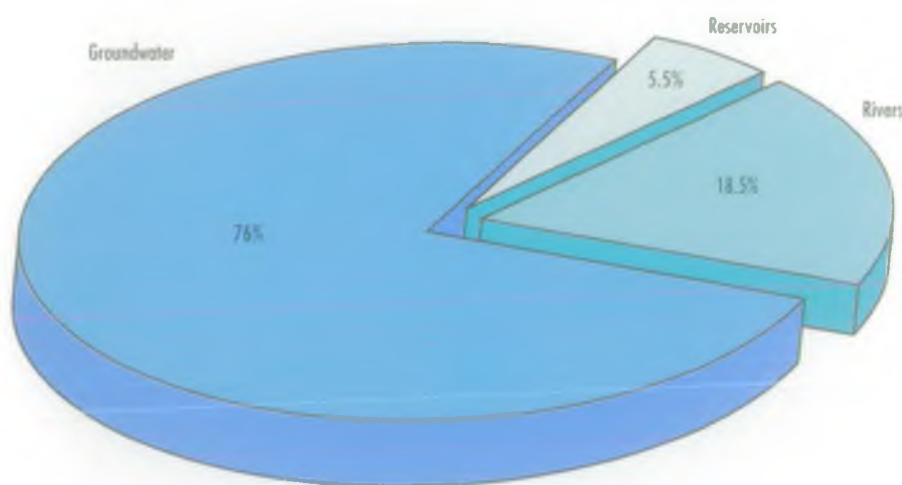
terms of rainfall equivalent so that the level of development can be put in the context of the total available resource.

### Drought Year Recharge

In a one in 50 year drought, the Region receives about 100 mm of effective rainfall. The present total level of abstractions amounts to more than 90% with public water supplies amounting to 50% (Effective rainfall and water use graph page 8). Storage in the form of reservoirs and aquifers provides a buffer to some extent and conditions cannot be

it amounted to 1,476Ml/day, equivalent to a depth of 50 mm rainfall across the Region. On average, some 80% of the water abstracted is returned to the environment after treatment, but in the South the typical pattern of supply consists of inland abstraction from groundwater sources for use in coastal towns and subsequent discharge to the sea. As already noted, there is relatively little opportunity for effluent re-use in the Region. As a result demand management of public water supplies is particularly beneficial in coastal towns.

Existing public water supply sources.  
NRA Southern Region



### Low Flow Rivers

Present drought conditions have brought increased public awareness of rivers with depleted flows due to excessive abstractions. There is a new determination on the part of the NRA to act to restore the worst of them. Nationally, there are 40 such high priority sites, of which six are in the Southern Region. These are:

River Darent  
Wallop Brook  
Bourne Rivulet  
Little Stour  
River Meon  
River Hamble

one in 50 years. However, conditions during the year caused concern because of the shortage of rain that began in August 1988 and continued on through 1989, affecting groundwater levels in particular.

It is not the purpose of this document to establish what level of exploitation is acceptable. This is a fundamental question which is being addressed on a catchment basis in the NRA's Catchment Management Plans, and in the context of specific water resource development schemes, where a balance between environmental and consumptive needs has to be struck after consideration of local requirements. Reference is made however to the level of abstractions, both current and future, in

judged simply on the basis of annual totals because there is a 'carry-over' from one year to another. Nevertheless there is already a high level of development of resources overall, particularly since there is limited opportunity for re-use in a Region having its main centres of population spread along its coastline and relatively few large inland towns discharging effluent to rivers where it can be re-abstracted.

### Public Water Supplies

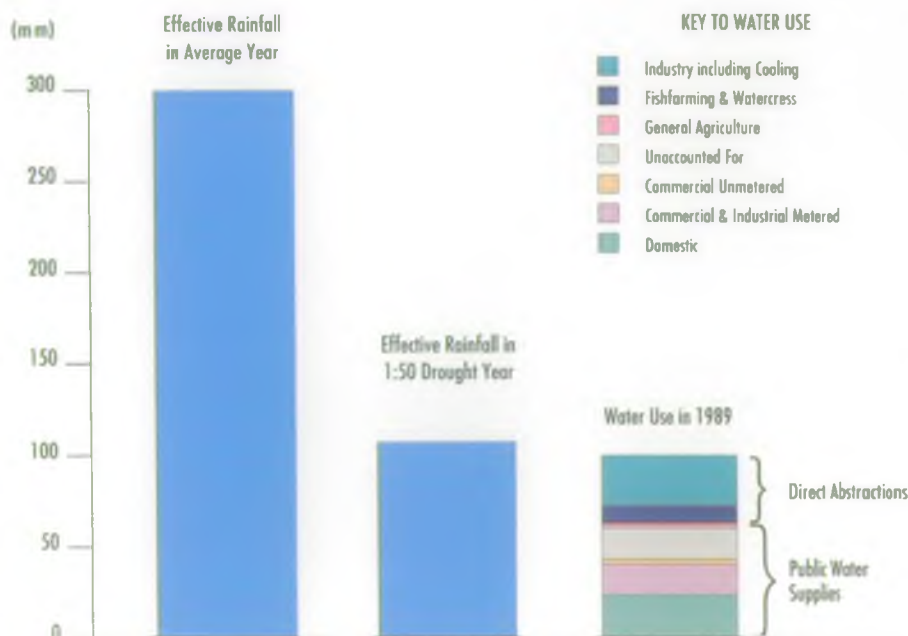
This document concentrates on the provision of public water supplies because of the primary importance of this use, and because it is the dominant consumptive use in the Region. In 1989

The scale and causes of the problem vary greatly between catchments. All are affected to a greater or lesser extent by abstractions, which may be for public water supply or other uses. In some cases the streams are winterbournes, that is the flow would diminish or cease naturally for part of the year along some of their lengths. However, abstraction from the rivers or nearby boreholes has exacerbated the problem and the long term solution will lie in reducing this.

Studies are being carried out for all six of the rivers mentioned above and in some cases long term solutions have been identified. These involve the use of alternative sources of supply or the construction of pipelines to discharge



## Effective rainfall and water use- NRA Southern Region



water back into the river above the point at which it is taken out. Solutions cannot be instant but the NRA has already entered into negotiations with some of the Water Companies involved. The NRA has now set a timetable for agreeing action in the worst affected river, the Darent, and the NRA Chairman, Lord Crickhowell, in his announcement of 15th June 1992, made it clear that the NRA would take action to reduce abstraction if agreement is not reached.

The total quantity required to restore all six of the high priority sites could be up to 50 Ml/day, which represents resource

development costs of at least £50M at present prices.

## DROUGHT

The drought of 1988-92 has had a significant effect on water supply in the South East because of the combination of four successive dry winters and intervening hot, dry summers. This has a particular impact in Kent where high dependence on groundwater is combined with particularly low winter rainfall.

There have been considerable variations in recent years between locations in the South East such as Kew, Winchester and

Canterbury. Across the Region there is a gradient from less severe conditions in the west to extremely dry conditions in the east.

The diagram below shows how the rainfall deficit has persisted and built up to an extraordinary amount, particularly at Canterbury. The other diagram shows that significant variations in average rainfall have occurred in the past 300 years.

The current drought has been, and continues to be, as severe a test of groundwater resources in Kent as any this century. Recent experience of the drought is causing Water Companies to re-assess source yields and the NRA to review aquifer yields and environmental effects.

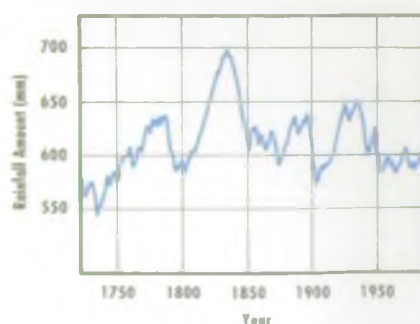
The drought has focused attention on the conflicting needs for water. Dried up river beds have become a familiar image on our television screens. This had led the NRA to review the balance between abstraction and the environment in times of drought and this is reflected in the regional strategy.

## CLIMATE CHANGE

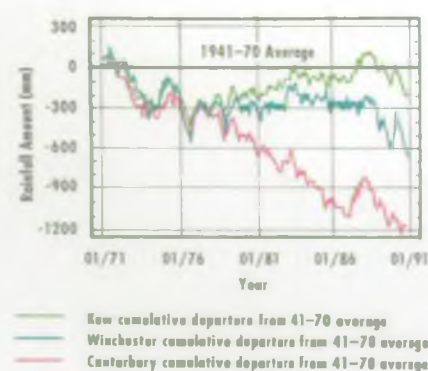
The rainfall regime is naturally variable and the recent drought is within the range of previous experience. However, there is international concern that global warming will cause further climate change. The burning of fossil fuels (oil, coal and gas) to provide energy contributes to the so-called greenhouse gases, and increased concentration of these gases in the atmosphere could lead to global warming.

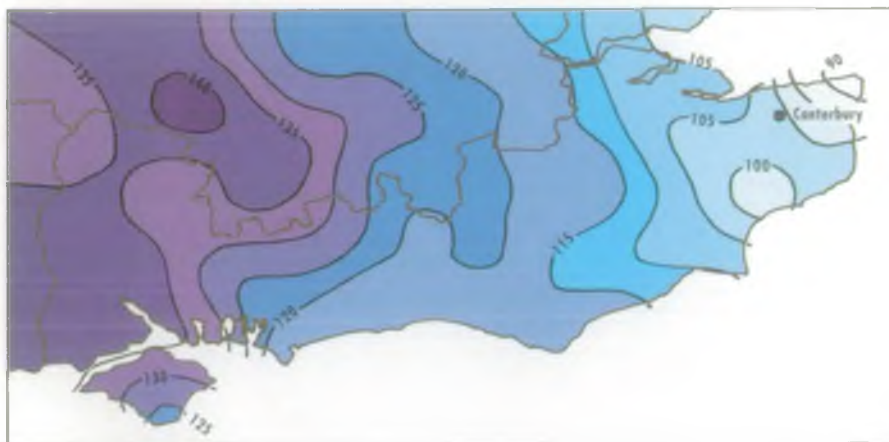
There is more work to do on observing the world's climate, improving our climate models and understanding climate processes. This international work will take some 15 years to complete, halfway through the planning period for this strategy. In the meantime the Government says the risks clearly

### 20 year moving averages of annual rainfall



### Cumulative deficit below 1941-70 average





justify action now to begin to reduce greenhouse gases.

As the Government believes that this generation has a duty to act to meet the threat of global warming, this strategy takes into account the likely effects of climate change on:

- Demands for water – in the home and in the environment.
- Water resource yields.
- Low energy means of balancing supply and demand.

Climate change could increase the average total demand for public water supplies in the South East by about 4% by 2011 and by about 6% by 2021, as a result of increased garden watering and personal showering, and could also lead to higher peak consumption.

The effect on water resources schemes will depend on the particular characteristic of each. Yields from the smaller reservoirs could be reduced by up to 10%, but groundwater yields may not change much.

Climate change puts extra strain on water demand and resources; warmer weather increases demand. This reinforces the need for the NRA and Water Companies to take climate change

into account in their planning scenarios. The NRA argues for making the best possible use of local sources by demand management and reducing leakage losses by customers and Water Companies. The energy component of major inter-regional long distance water transfers must be identified and minimised.

## DEMAND GROWTH

### Downturn in Demand

In the 20-year period up to 1989, the volume of public water supplies grew by some 55%. This includes all domestic, industrial and agricultural consumers supplied from the mains, but excludes all supplies taken directly from private wells, boreholes or river sources. 1989 marked the start of a pronounced downturn which has continued into 1992 and has been experienced in the west of the Region as well as the drought-affected east.

Factors contributing to this are:

- The general economic downturn.
- Hosepipe restrictions.
- Drought publicity and public awareness.
- Reduced leakage as a result of Water Company activity.

- Domestic metering (on the Isle of Wight).
- Improved bulk metering leading to more accurate and smaller estimates of consumption.

It is clear this downturn now exceeds that experienced in the mid seventies after the oil-induced economic crisis and the 1976 drought. The timing and speed of the recovery are a matter for conjecture but for the time being consumption is at the level of the early 1980s. Were it to resume at pre-1988 rates of increase from now on then the 1988 level would be regained by 1996, an eight-year standstill in growth.

### Factors Influencing Growth

The extent to which demand will increase over the next few decades will depend on the following main factors:

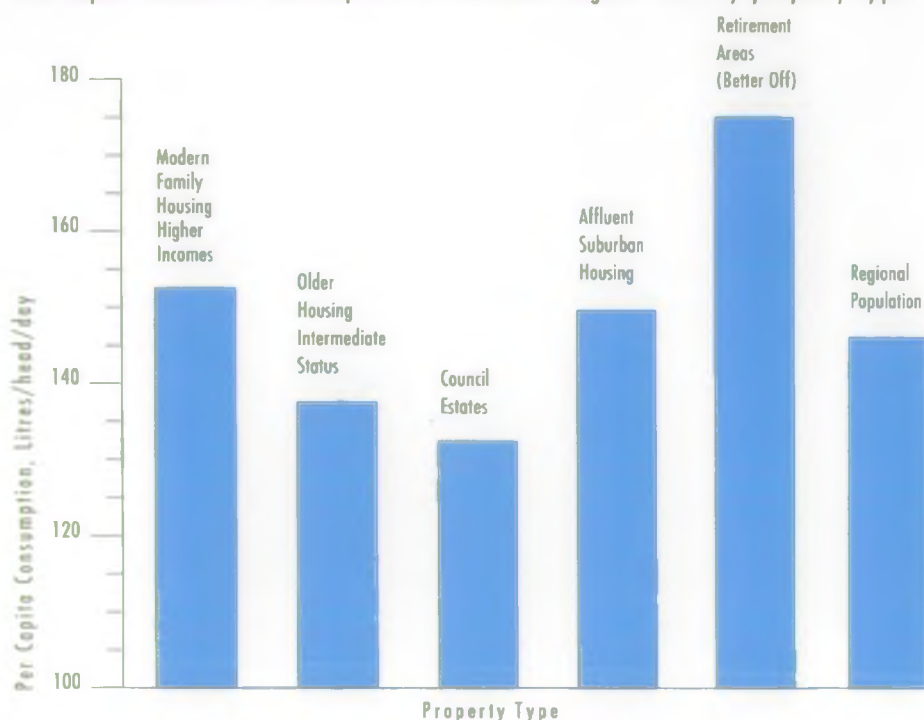
- Population growth and household size.
- Number of new dwellings built.
- The level of general economic activity.
- The extent of any new large water using industrial sites, such as power stations.
- The method of charging for water services and the price level adopted.
- Water consumption of household appliances and their level of ownership.
- Gardening habits.
- Climate change.
- Levels of leakage from distribution systems and consumers' plumbing.

### Forecasting Domestic Use

Population and dwelling numbers can be projected with reasonable confidence, based on Census information and County Structure Plans. Over the next 20 years the Regional population is expected to increase by 350,000 (9%).



Per capita domestic consumption in Southern Region 1989 by property type



However population increase and development are not the dominant factors in determining future levels of demand. Individual per capita consumption is now the most important feature, and there are two approaches to forecasting future trends:

- i) an assumption that things will continue much as in the past
- ii) an analysis of household water use, appliance ownership and projected likely future levels of ownership and use.

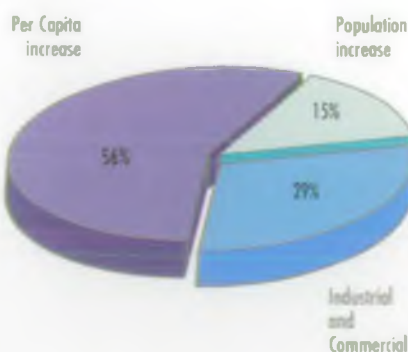
The first of these leads to a higher estimate and is useful in giving an upper limit to probable demand growth. The second, more analytical approach leads to a better estimate, particularly in the long term of 20-30 years ahead. In view of the need to err on the side of safety in planning public water supplies, the NRA considers it reasonable to plan up to a maximum line. Justification for this will need to be closely examined in future particularly as opportunities to influence the trend emerge through demand management measures. Early results from National Metering Trials in the UK indicate this could be very significant.

### Monitoring Domestic Use

The importance of establishing accurate information on domestic consumption was appreciated in the early 1980s and steps were then taken to set up a representative network of monitoring sites across the Region. These continuously measure the consumption in groups of domestic properties (not individual houses) and are entirely separate from the more recent National

### Components of increase in demand in Southern Region to 2011

Leakage reduced to Water Company target levels



Metering Trials. As a result of this initiative, which is maintained jointly by the Water Companies and the NRA, there now exists in Southern Region comprehensive information on domestic consumption which forms a firm factual basis from which forecasts can be made. Results for 1989 illustrate how water consumption varies between different types of property.

### Regional Demand Forecast

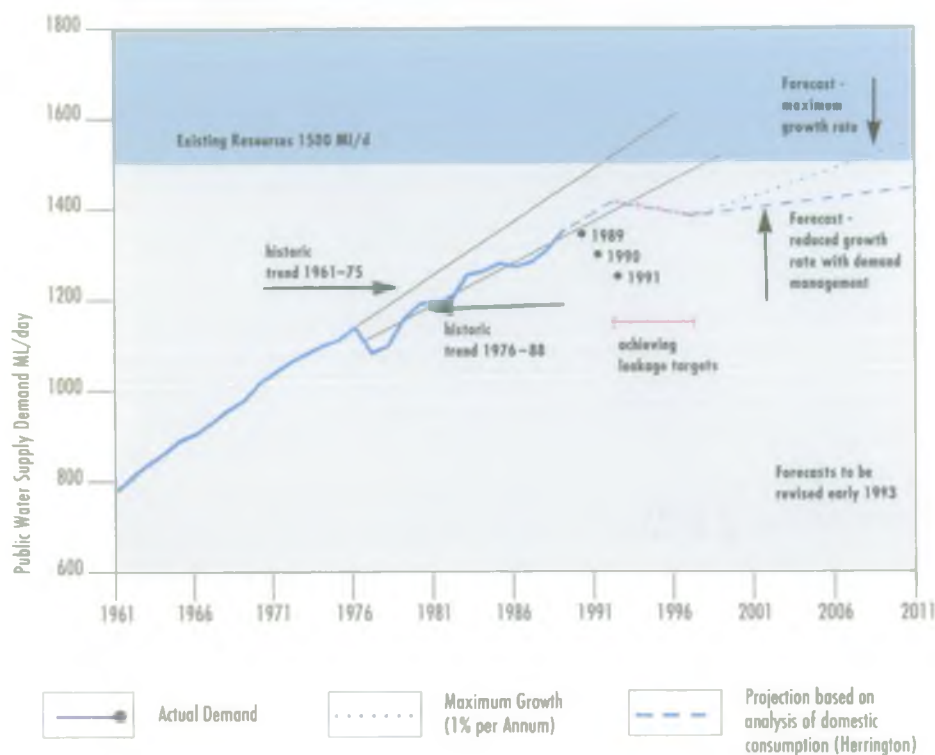
This information, along with population and housing projections from County Council Structure Plans and OPCS population projections, is used by the NRA in its forecasting of future demand for water. This is carried out periodically as part of the NRA's duty under the 1991 Act to manage water resources. The most recent forecast for public water supply, which includes industrial supplies, was published in 1990 and is shown in the diagram on page 11.

The upper line represents continuing growth as in the past and is the NRA's estimate of the maximum likely demand. This reaches 1,580 MI/day by the year 2011, an increase of 260 MI/day over the 1989 figure. The lower line represents the best estimate of growth based on the more analytical approach to household water use devised by Paul Herrington of Leicester University. This reaches 1,444 MI/day, or an increase of 120 MI/day over the 1989 demand. In both cases the level of leakage is reduced from present levels to Water Companies' own target figures by 1996, and maintained at that level thereafter.

Also shown in the diagram is the total reliable yield of sources currently available, 1,500 MI/day. This reliable yield is assessed on the basis of a drought that occurs only once in 50 years and in the main is based on information provided by the Water Companies. It can be seen that this is reached by the year 2005 by the upper line, but not until well after 2011 by the 'best estimate' line.



## NRA Southern Region 1990 demand forecast



This overall regional balance does not tell the full story however, because:

- Peak demands must be taken into account, particularly in groundwater dependent areas.
- The region is long and narrow and it is not economical to transfer water over great distances by pumping.

The diagram also illustrates the significance of reduced leakage, which is built into the forecast in the period up to 1996. The overall effect of achieving current targets is the deferment of new resource developments by a number of years. Leakage reduction also has the important effects of reducing, or minimising, the increase in the quantity abstracted from the environment from existing sources, the quantity pumped and treated at source and hence the energy consumed.

### Peak Demands

The figures so far discussed relate to annual average quantities, which form the basis for planning the long term,

i.e. 20-30 year, future. However there is considerable seasonal variation in demand due, in most parts of Southern Region, either to domestic garden watering or agricultural use. The latter is

important in those parts of the area, notably Thanet and certain parts of West Sussex, where crops are irrigated using mains supplies. This means summer peak demands are highly dependent on weather conditions in scale and duration.

It is normal to consider the maximum supply rate over seven consecutive days as the critical figure and this has particular significance where much or all of the demand has to be met from groundwater sources without the buffering effect of reservoir storage. Peak week demands have, therefore, also been estimated along with annual averages for each Water Company area in the Region. These peak demand estimates do not allow for any attenuation effect that would occur if domestic meters were to be installed in large numbers in existing properties.

### Balancing Supply and Demand

In order to assess the scale of potential deficiency that might occur in the Region, average annual and peak week

Table 1

NRA Estimates of Maximum Deficiencies by the Year 2011 Assuming No New Resource Development Schemes		
Company	Average Annual ML/day	Peak Week ML/day
Southern Water Services:		
Isle of Wight	(5)	6
Hampshire	(42)	(20)
Sussex	34	70
Kent	19	16
Portsmouth Water Company	10	42
Mid Sussex Water Company	10	5
West Kent Water Company	8	5
Eastbourne Water Company	12	25
Mid Kent Water Company	26	35
Folkestone and Dover Water Services	4	8
(quantities in brackets are surplus)		

demands for the year 2011 are compared with the existing level of resources available to each Company and results are shown in Table 1. This shows the scale of the deficiency that may need to be bridged within the next 20 years by means of demand management, greater use of bulk supplies between Companies and new resource development schemes. There will also be requirements for the restoration of low-flow catchments.

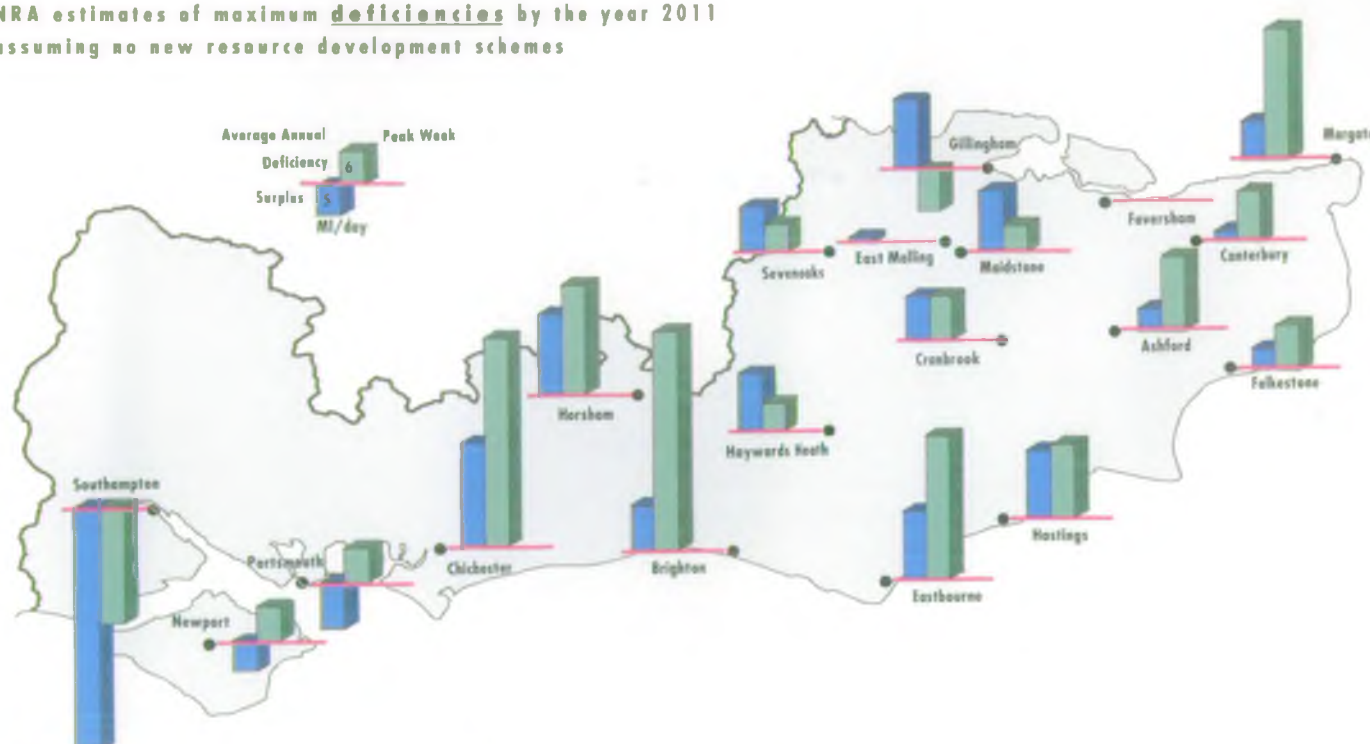
main areas of deficit are Eastbourne, Hastings, the Medway Towns and Maidstone, with peak demands a potential problem in the Brighton/Worthing, Thanet and Ashford areas.

The situation illustrated is that resulting from a 'do-nothing' strategy in terms of resource development, demand management, or resource redistribution and it is important to bear in mind:

## FUTURE OPTIONS

The NRA has a duty to ensure future public water supply demands are met in the least damaging manner to the environment. The NRA is also looking for opportunities to rectify existing cases of over-abstracted catchments. The 20-year increases in demand described above represent a level of abstraction some 23% above that

**NRA estimates of maximum deficiencies by the year 2011 assuming no new resource development schemes**



These are considered later in this document.

In absolute terms the largest increases in demand are likely to arise in the urban areas of south and east Hampshire. These are, however, the best endowed in terms of available resources in hand, and so are expected to remain in surplus beyond the year 2011. The situation changes as we move into West Sussex, where likely demand increases in the Chichester, Horsham, Crawley and Haywards Heath areas, although on a more modest scale, exceed existing resources. This is shown in the map, which illustrates the distribution of the deficits and surpluses in the table shown on the previous page. Further east, the

- Future growth may turn out to be less than that illustrated, which is the maximum likely.
- No future water resource development schemes are included in the available supply figures.
- Possible effects due to climate change are not included.
- Unaccounted-for water is assumed to be reduced only as far as Water Company target levels, and in future lower target levels may apply in some areas.
- Possible reductions in available resources in over-abstracted catchments have not been included here but are incorporated in Table 3.

experienced at present. If added to the existing level of private water supply abstractions, this represents an equivalent depth of rainfall of 104 mm, some 35% of the average annual recharge, but more than 100% of the one in 50 drought year recharge.

Even allowing for the fact that there is already a significant element of re-use from abstractions returned to the environment, it is imperative that future increases in abstraction are kept to the lowest possible level needed to meet legitimate water supply needs. These must be located in those catchments best able to sustain the new load with the least environmental damage.



This can be achieved by a mixture of measures acting on both the demand and supply sides and by making optimal use of resources available at any time.

## DEMAND MANAGEMENT

Demand management measures can be applied to water used in the home, industry, agriculture, public water supplies and private abstractions.

Equipment and techniques already exist to achieve reduced consumption in many cases and in others development work is required. Experience in other countries has shown that pricing is an effective spur and this can be reinforced by appropriate byelaws.

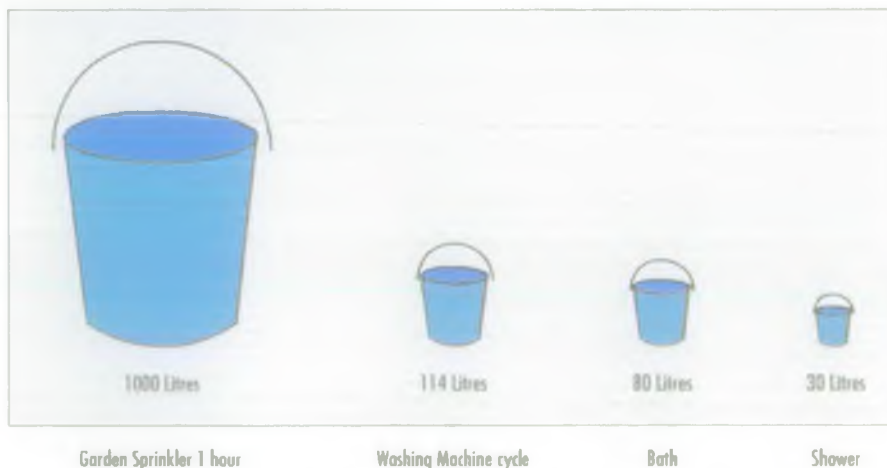
### Economical Water Use

Examples of the more economical use of water are provided by:

- WC cisterns having a 6-litre flush or less.
- Washing machines requiring less than 20 litres/kg of load compared with a typical figure of 35 litres/kg in 1980.
- Use of showers rather than baths for personal hygiene.
- Replacement of spray irrigation by the more efficient trickle or drip irrigation, which does not lose water on the leaf canopy.
- Application of water to crops during cooler evening and night time hours.
- Greater recycling of industrial process and cooling water.
- Reduced losses from Water Company distribution systems by increased leak detection and repair activity.
- Reduced loss from household plumbing fittings by improved maintenance.



Water use in the home



### The Price Mechanism

There is no doubt that where the price of water used is a consideration, an individual's or company's choice of equipment and methods is influenced. This in turn is passed on to manufacturers of the equipment in the form of increased demand for low water-using

products. The process would be aided by clear labelling of products that meet certain standards of low water use; for example the proposed ECO label for washing machines using 16.8 litres/kg or less. There is also room for much improvement in the maintainability of household plumbing fittings.

There are three points at which the price mechanism for using water can be applied:

- At the point of abstraction from river or aquifer.

This impinges on all those who abstract water, whether for public water supply, industrial or agricultural use, but in terms of incentive is limited at present because charges are set only to cover the cost of administering the Water Resources function of the NRA, although factors such as the season of the year and the amount returned to the environment are taken into account and enable some incentive to be applied. Raw water abstraction charges are typically 2p per m<sup>3</sup>, compared with average treated water charges of 50p per m<sup>3</sup>.

- At the point of supply to the Water Company consumer.

At present, only 6% of the population in the Region pays for domestic water consumption which has been metered. This figure is higher than the national average because of the 53,500 metered households on the Isle of Wight.



Charges levied on metered consumption provide a direct incentive to economise in discretionary use, such as garden watering, and an indirect incentive to the production and installation of more economical water using appliances and fittings. The metered charge for water on the Isle of Wight is 44.4p per m<sup>3</sup>, plus sewerage and an administrative charge.

- At the point of discharge of effluent to the environment.

The charge made for discharging effluent is currently based on the volume, content and location of the discharge but, like the charge for abstraction, is limited to recovering the NRA costs involved. Further development of the charge could provide greater incentives to economise on water use by greater recycling and by discharging above the point of abstraction and so re using the water.

There is currently a great deal of attention focused on the method of charging to be adopted at the point of supply to the domestic consumer. The significance of this from the environmental point of view is illustrated by the pie diagram on page 10 which represents the growth components in the Regional potable water supply forecast for the year 2011. Growth in individual per capita consumption is the dominant factor and the size of this component will be particularly significant in the overall total abstracted.

### National Metering Trials

National metering trials have yet to be concluded, but evidence available indicates that net in-house domestic consumption is at least 10% lower overall and that evening peaks due to garden watering are suppressed by as much as 30%. The effect of this would be to reduce the overall increase in demand for public water supplies to

three-quarters of the amount required without metering, i.e. a total increase of 195 Ml/day over the next 20 years, rather than 260 Ml/day. The difference, 65 Ml/day, is equivalent to one large impounding reservoir scheme.

In the longer term, it is likely that consumers who are metered would adopt more economical water using habits as a way of life and would demand the more economical water using appliances which are becoming available. In Germany, where household meters were installed in the 1970s and water is twice as expensive as in the UK, domestic consumption has not grown for a decade.

The reduction of peak demands caused by garden watering is particularly important where supplies are dependent on groundwater, as they are in much of Southern Region. This means that domestic metering has particular potency as a demand management measure in such areas.

### Why Demand Management Now?

Reasons for adopting widespread demand management methods, principally metering, at the present time include:

- Short time scale (2-3 years) to implement in an area.
- Reduced consumption and hence reduced abstraction from rivers and aquifers.
- Can be staged flexibly in time and by area.
- The present downturn in consumption provides a window of opportunity before demand again picks up.
- Early experience with a significantly large number of metered households on the mainland of south east England will enable initial experience on the Isle of Wight to be confirmed

or otherwise, and provide actual case history for future planning.

- Consumer groups have expressed a preference for this method of charging.

It must be recognised that there is an impact on the urban environment in the process of meter installation and that a tariff structure would need to be devised that achieved both an overall reduction in consumption, at the supply area level, and a safeguard for individuals and families needing large volumes of water.

An important result from the installation of meters is the reduction in leakage from damaged and corroded supply pipes, which are renewed or repaired when the meter is installed. This is an important feature, cutting overall leakage by up to half. The meter should be installed at the external property boundary to have the greatest demand management effect.

### Water Losses

Water losses from Water Company distribution systems and on consumers' premises (i.e. the water that is treated by the Companies and put into mains but not received at the point of use in home, office or factory) amount to about one quarter of the total. The NRA recognises that to reduce distribution system losses a continuous effort is required on the part of the Companies, and that this has cost implications. There is no doubt that leakage detection and reduction activities have been increased in some areas and progress made, but before granting licences for major new schemes the NRA will expect to see leakage targets that represent an overall level of unaccounted-for water no greater than six litres per property per hour in the medium term.

In the longer term, the balance of cost between embarking on major new resource developments and increases in the capacity of distribution systems on



Water Company repairing leaking main.

Photo: Southern Water

the one hand and increased leak reduction activity on the other should determine an appropriate level of unaccounted-for water.

Losses on consumers' premises will only become fully apparent when external meters are installed revealing leaks and providing an incentive to repair them.

Estimates of present levels of unaccounted-for water are still being refined but on the basis of present evidence the potential saving in achieving a level of six litres/property/hour across the Region would be some 80 MI/day, so demand increases resulting from maximum (1%) and most probable growth scenarios would be 180 MI/day and 115 MI/day respectively.

### Using Water Wisely

Issues of leakage, economical water use, the method of payment for water services and future development planning are brought together in the DOE Consultation Paper 'Using Water Wisely' published in July 1992. This emphasises the role of demand management measures in achieving a satisfactory, sustainable environment.

## SUPPLY MANAGEMENT AND DEVELOPMENT

As far as managing the supply side is concerned, it is possible to identify two stages which are, in order of application:

- Securing optimal use of existing resources.
- Developing new schemes.

### Optimal Use of Existing Resources

Obtaining the greatest benefit from existing resources requires that trunk mains are constructed between areas of surplus and areas of deficit, water treatment works are expanded and, where appropriate, separate resources are managed in an integrated manner to secure a greater output than from the sum of the individual parts. All of these measures require works to be carried out and so have financial and environmental consequences, at least in the short term. These must be offset against the longer term savings arising from reduced resource development costs and reduced environmental impact. There is, for example, a balance to be struck between the short term environmental impact of laying a main through an urban area and

the long term impact of increased abstraction from an aquifer or river.

The pattern of surplus and deficit described in section six shows, as an example, that southern Hampshire is a self-sufficient area which could provide increased supplies to West Sussex through enlarged and extended trunk mains.

The provision of such mains linking major sources and demand centres also brings the benefit of greater security against risk of failure by one of the sources, as well as optimising on source use.

Making full use of existing resources by distributing from areas of surplus to areas of deficit, will involve the construction of strategic trunk mains. New links can then distribute supplies from new sources as they are developed: e.g. Darwell and Broad Oak reservoirs. This may involve new agreements between Companies for the use of bulk supplies.

The integrated management of separate sources can provide an increase in reliable yield for the system where component sources have different hydrological characteristics.

Opportunities for such conjunctive use are not great in this region because of the predominance of the chalk aquifer but the benefit in areas having potential should be established. These will occur mainly where reservoirs, existing or new, can be balanced against groundwater sources.

Full use of existing licensed abstractions can also be achieved by building raw water reservoirs at the point of abstraction. These enable surplus water to be stored at times of low demand and high river flow, and can be used to augment the direct abstraction when peak demand exceeds the licensed amount. An example of this is the Testwood Lakes scheme in Hampshire.



## Developing New Schemes

Of the four main types of public water supply scheme discussed previously unregulated rivers are protected by residual flows and, with the possible exception of the R. Test and R. Itchen, offer no further scope for abstraction above currently authorised limits.

Aquifers are now fully exploited in most parts of the Region and only small quantities of additional groundwater will be available in future.

The major schemes identified for possible development are outlined in the next section. They represent the last remaining development options within the region. Once fully utilised, it would be necessary to look further afield to more expensive long distance transfers or desalination if demand were to continue to rise. The geographic position of Southern Region means such transfers would be costly compared with regional schemes and demand management measures.

## PROTECTING THE ENVIRONMENT

### Licence Reductions

Nationally and regionally the NRA is committed to identifying and alleviating problems caused by over-abstraction. In a number of Southern Region locations authorised abstraction is such a high proportion of effective rainfall that there is little left for the natural environment, particularly during drought. These abstractions are generally authorised under Licences of Right issued following the introduction of abstraction licensing in the Water Resources Act 1963. The legislation allowed licences to be issued to authorise available abstraction capacity at the time, without regard to environmental effects. In some cases these anticipated growth in demand over 30 years. All new licences after 1963 contained conditions to protect the water environment where necessary.

The NRA has powers under the Water Resources Act 1991 to vary or revoke licences. The main reason would be to implement the NRA's duty to 'conserve, redistribute, augment and ensure proper use of water resources.' The NRA also has a specific duty to enhance the water environment. Licences may also be revoked for non-payment of charges.

In 1990 the NRA issued a policy statement on over-abstraction river catchments. One of the options for consideration included variation or revocation of licences.

Water Companies who have sources that are being considered for licence variation include:

Thames Water Utilities – River Darent

West Kent Water (South East Water) – River Darent

Table 2

INDICATIVE COST £ million/Ml/day	OPTION	COMMENTS
0.1 - 0.5	<ul style="list-style-type: none"> <li>• Demand Management including Leakage Control</li> <li>• Groundwater Development</li> <li>• Direct River Abstraction</li> </ul>	<p>Some aspects of demand management would lie outside the range of indicative costs</p> <p>Very limited potential</p> <p>Limited potential</p>
0.5 - 2.5	<ul style="list-style-type: none"> <li>• Effluent Re-Use</li> <li>• Reservoir Schemes</li> <li>• Domestic Metering</li> <li>• Inter-Regional Transfer Schemes</li> </ul>	<p>By indirect methods</p> <p>Direct supply and regulation</p> <p>Key to demand management</p> <p>Those in the lower range of likely cost</p>
2 - 5	<ul style="list-style-type: none"> <li>• Transfer from Europe</li> <li>• Inter-Regional Transfer Schemes</li> </ul>	<p>Lack of spare resources in France</p> <p>Those not included in the above category and likely to apply to Southern Region</p>
4 - 6	<ul style="list-style-type: none"> <li>• National Grid</li> <li>• Desalination</li> </ul>	
Much greater than 6	<ul style="list-style-type: none"> <li>• Transfer by Ship</li> </ul>	

New major water supply developments will therefore inevitably be concentrated in a few areas from regulated rivers or reservoirs, or a combination of the two. The NRA will seek to ensure that new abstractions are located as far downstream as possible to minimise any adverse impact on the flow regime.

Options given in Table 2, which is drawn from the NRA's National Development Strategy discussion document, show the capital cost of each unit of reliable yield.



Mid Kent Water – River Stour  
Folkestone Water – Little Stour  
Southern Water – Little Stour,  
Wallop Brook

The NRA's approach is to discuss proposals with Water Companies when considering their long term plans for new sources, so that their investment plans can take into account NRA policies.

### Regional Licensing Policy

Pressure on water resources in the South East is reflected in a tough licensing policy. Abstractions from rivers are controlled by prescribed minimum flows or levels. There is a general policy of presumption against further abstraction from the Chalk and Greensand groundwaters, unless certain conditions are met, such as 100% return of water to source. This will effectively rule out new groundwater abstractions for public water supply and spray irrigation. The region continues to encourage the storage of surplus winter rainfall in reservoirs or lakes for summer use.

As the greatest demand for new licences is for public water supply, the question of need is being carefully scrutinised. A recent statement by the NRA Chairman is particularly appropriate in the South East.

“Before any new sources are developed, it is essential that water companies make sure that they are doing all they can to reduce leakage and to carry out effective demand management. The NRA supports selective domestic metering, with an appropriate tariff, in areas where water resources are stressed.

Where it can be shown that proper attention is not given to the control of leakage, or where appropriate consideration has not been given to the introduction of selective metering, the

NRA will not grant licences for new sources.”

### Licence Structure

Abstraction licences for strategic sources should carry conditions which properly reflect environmental and resource management problems locally. These should be subject to periodic review by the NRA and provide an opportunity to take account of climate change and other factors which may affect the future balance of resources.



River Darent, Kent

## WATER RESOURCE SCHEMES

A number of schemes which would increase the total reliable yield available within the region have been identified over a period of years. In some cases these have been investigated to a level of detail that enables both benefits and disadvantages to be evaluated. Others still require full feasibility and environmental impact to be established.

The high level of existing groundwater development leaves little scope for any further schemes. Those included in this section are for groundwater augmentation of rivers where water is then abstracted for supply downstream. Others are for the construction of new reservoirs or the enlargement of existing ones.

### Broad Oak Reservoir

A dam is proposed across the Sarre Penn Valley three miles north of Canterbury to form a new reservoir filled mainly by pumping from the Great Stour at Plucks Gutter. Alternative top water levels of 41.5 m and 47 m AOD have been proposed. Water would be drawn from the reservoir and treated at the site, for supply to parts of Mid Kent, Folkestone and Dover, and Thanet. Yield will depend on the top water level and abstraction conditions set for Plucks Gutter, which will need to protect existing water users and safeguard water quality in the Stour estuary for fisheries and general environmental purposes. The scheme could facilitate reductions in groundwater abstractions in the Nailbourne and Dour catchments. Yield 40 - 90 Ml/day.

### Darwell Reservoir Enlargement

The existing reservoir on a tributary of the R. Rother north of Bexhill would be enlarged by constructing a new dam up

to a maximum top water level of 53 m AOD, from a present level of 40 m AOD.

This would increase the storage from the present 4,700 Ml to 20,000 Ml, and it would be filled from an enlarged pumping station on R. Rother at Robertsbridge where there is an existing intake. The scheme would supply the Hastings and Eastbourne areas and, via a Rother-Medway pipeline link, the Medway, West Kent and Mid Kent areas. It could also indirectly supply parts of the Mid Sussex area through a new link between Arlington (Eastbourne) and Barcombe (Mid Sussex) reservoirs. The promoters of the scheme are Southern Water Services, owners of the existing Darwell, and Eastbourne Water, part of South East Water. An NRA requirement from the scheme will be improved low flows in the R. Rother with more water available for agriculture in the Romney Marshes. Yield up to 42 Ml/day.

### Yalding

This scheme consists of a new intake and pumping station on R. Medway at Yalding, six miles south-west of Maidstone. Water taken in times of high flow would be pumped through a pipeline to be laid in the valley of the Teise, into Bewl Water, for release in times of low flow. This is an extension of the existing Medway Scheme and would enable the reservoir to be refilled more rapidly after being drawn down, and would increase the yield of the present scheme. It would supply the Medway and Mid Kent areas and, via a Rother - Medway pipeline link, could supply Hastings and Eastbourne.

The NRA granted a licence for this scheme in 1992, but it has not yet been constructed, and so has been omitted from available resource figures given in this document. A feature of the licence

is a provision requiring a proportion of the water released from Bewl Water to remain in the river and so benefit the lower reaches of the R. Medway. Yield 29 Ml/day.

### Rother-Medway Link

A link between the reservoirs at Bewl and Darwell would enable surplus supplies in either reservoir to be transferred to the other catchment to meet deficits in the supply area of the other reservoir. It would also add an element of security to both reservoirs. Darwell supply area is currently finely balanced in terms of resources and demand. Transfers from Bewl to Darwell could, therefore, play a part in the short to medium term once the Yalding scheme has been completed. In future supplies from an enlarged Darwell could be transferred northwards into Bewl to meet increased demands in the Medway catchment. It is likely that the link would be constructed in phases, firstly for north to south transfers and secondly for the reverse. Yield up to 8 Ml/day.

### Hardham

The existing source at Hardham is an intake and treatment works on the R. Rother (West Sussex) near Pulborough, operated in conjunction with boreholes in the lower greensand which are pumped when the river falls below its prescribed limit. Artificial recharge experiments were carried out in the 1970s with a view to future expansion of the source beyond its present licensed capacity of 75Ml/day, but it has always operated well below this limit. The source supplies Horsham and part of Crawley and it could potentially meet increased demands in that area as well as towards the coast. The realistic expansion limit of the source now needs to be determined.



Table 3

WATER BALANCE SHEET					
FUTURE WATER USE			WATER AVAILABILITY		
	Annual Average	Peak Week		Annual Average	Peak Week
Maximum deficiencies from Table 1	123	212	Transfer of internal surplus resources	35	27
Amelioration of Low Flows	50	50	Reduced leakage	80	80
Increase due to Climate Change	60	80	Domestic Metering	65	175
			New Resource developments	247	270
Total future increase	233	342	Total new resource	427	552
All figures in Ml/day					

This assumes that growth in per capita consumption continues at 1% per annum and that the effect of domestic metering would be to reduce average domestic demand by 10% below the unmetered level. The level of residual unaccounted-for water is taken as six litres/property/hour.

With a lower growth rate such as has been considered earlier, the resources balance would be more favourable and the situation of self sufficiency would last even longer. This would enable long distance transfer schemes, which are expensive in energy terms as well as in capital cost, to be postponed until well after the end of the present 30-year horizon.

From the information in the table it is clear that reallocating supplies from surplus to deficit areas, adopting demand management measures of widespread metering and the reduction of unaccounted-for water to a level of six litres/property/hour, would in themselves be sufficient to meet most of the likely 20 year deficiencies.

There is a fundamental decision to be made over the next few years. In the past the route of supply expansion has been followed with little or no planned use of demand management as a long-term measure. Most demand management measures have been brought in as short term techniques to deal with unplanned situations caused by drought.

Resource strategy: Main features and opt



# NRA Resource Development Strategy

The NRA's proposed sequence of water resource development from now on puts demand management first and envisages a general sequence:

- Demand management: leakage reduction and domestic metering.
- Transfer of internal regional surplus to areas of deficit.
- Construction of new schemes in Southern Region.
- Transfers from other parts of the country.

The extent to which demand management measures are pursued will in practice be determined by economic and financial considerations as well as environmental issues. The NRA expects cost savings which accrue from postponement of major capital schemes will be set against the cost of imple-

menting such measures. This issue is still developing and as a better understanding of the savings in consumption resulting from metering is obtained so the significance in terms of postponing new schemes will become clearer.

The various elements already discussed have been brought together in the larger map, with other major new trunk mains. Underlying all is a presumption that unaccounted-for water is reduced to no more than six litres/property/hour and that domestic meters have been installed before new source developments proceed. The NRA's view of priorities for metering is indicated on the smaller map, which divides the Region into High, Medium and Low categories. Timescales associated with these would be roughly within five years, within ten years and after ten years.

The elements are in rough chronological order, so that those near the top of the

list would be expected before items near the bottom. Numbers also appear on the map for identification.

1. Yalding Scheme providing increased supplies from the Medway Scheme at Bewl Water and Maidstone for Southern Water and Mid Kent Water Co. This was licensed in April 1992 by the NRA. Yield 29 Ml/day. Completion date 1994/95.
2. Rother – Medway link between Bewl Water and Darwell. Initially from north to south but in the longer term also south to north. Yield up to 8 Ml/day. First stage by 1994/95.
3. NRA Itchen groundwater augmentation scheme to maintain flow and quality in R. Itchen and support further abstraction at Gaters Mill. Licence granted in 1992; works constructed. Additional yield available from R. Itchen 70 – 90 Ml/day.





### Testwood Lakes

The Testwood Lakes scheme being promoted by Southern Water Services and supported by the NRA will provide an additional operational facility by storing surplus water from the River Test for use in times of peak summer demand. This scheme, for which planning approval has been given, is expected to be completed in about ten years' time and will store about 2,000 Ml of raw water. This, with the provision of a South-North strategic mains network, will ensure maximum use is made of the existing abstraction licence from the Test.

### Test Groundwater Scheme

To enhance the modest capacity provided by the Testwood Lakes scheme further abstraction would be possible if river flows were supported by groundwater augmentation. The scheme would consist of boreholes in the upper Test catchment discharging to the river for abstraction at Testwood and could be promoted by the NRA. This would also be available to meet any Isle of Wight deficit via an additional Cross Solent link, if required. Initial experience with domestic metering on the Island suggests however that this may not be needed before 2011. Yield 20 - 30 Ml/day.

### River Itchen Development

Increased abstraction from R. Itchen at Gaters Mill could be supported by the NRA's Candover and Alre groundwater augmentation schemes. These are designed to maintain water quality in the lower reaches of the Itchen and to augment abstraction. A new main would be required to link the Chichester supply area of Portsmouth Water Company with the western supply area. Thus deficits in the Chichester area would be met from a surplus in the Portsmouth area, plus additional R. Itchen water. Yield 70 - 90 Ml/day.

### Chillerton Reservoir

A site on the Isle of Wight in the Medina catchment south of Newport was investigated as a possible dam site in the late 1970 s. The reservoir would have a capacity of 2,200Ml and could provide supplies to the Island, if required, beyond the present planning horizon. Yield 8 - 10 Ml/day.

### Havant Thicket Reservoir

This new reservoir near Rowlands Castle would be filled by surplus winter flows from Havant and Bedhampton springs, and could then be used to meet peak demands in the Portsmouth Water Company area. It is estimated to have a capacity of 8,700 Ml. Yield 30 Ml/day.

### Crawley Effluent

Crawley is supplied from Weir Wood reservoir in the Eden catchment and

Hardham source in the West Sussex Rother catchment and at present is a route through which resources are exported from Southern Region into the R. Mole and hence into the Thames catchment. Diversion of Crawley effluent back into the R. Ouse or R. Eden would increase the supplies obtainable from their lower reaches, subject to satisfactory water quality conditions being achieved and adequate replacement being available for abstractions from the R. Mole. Alternatively some measure of source substitution for Crawley may be sought, thereby releasing Hardham for use within the Southern Region.

This proposal is at an early stage and the feasibility remains to be established. In effect, it would be the first stage in importing resources into this region.



River Itchen  
Augmentation, Hampshire.



## NRA STRATEGY FOR MANAGING SUPPLY AND DEMAND

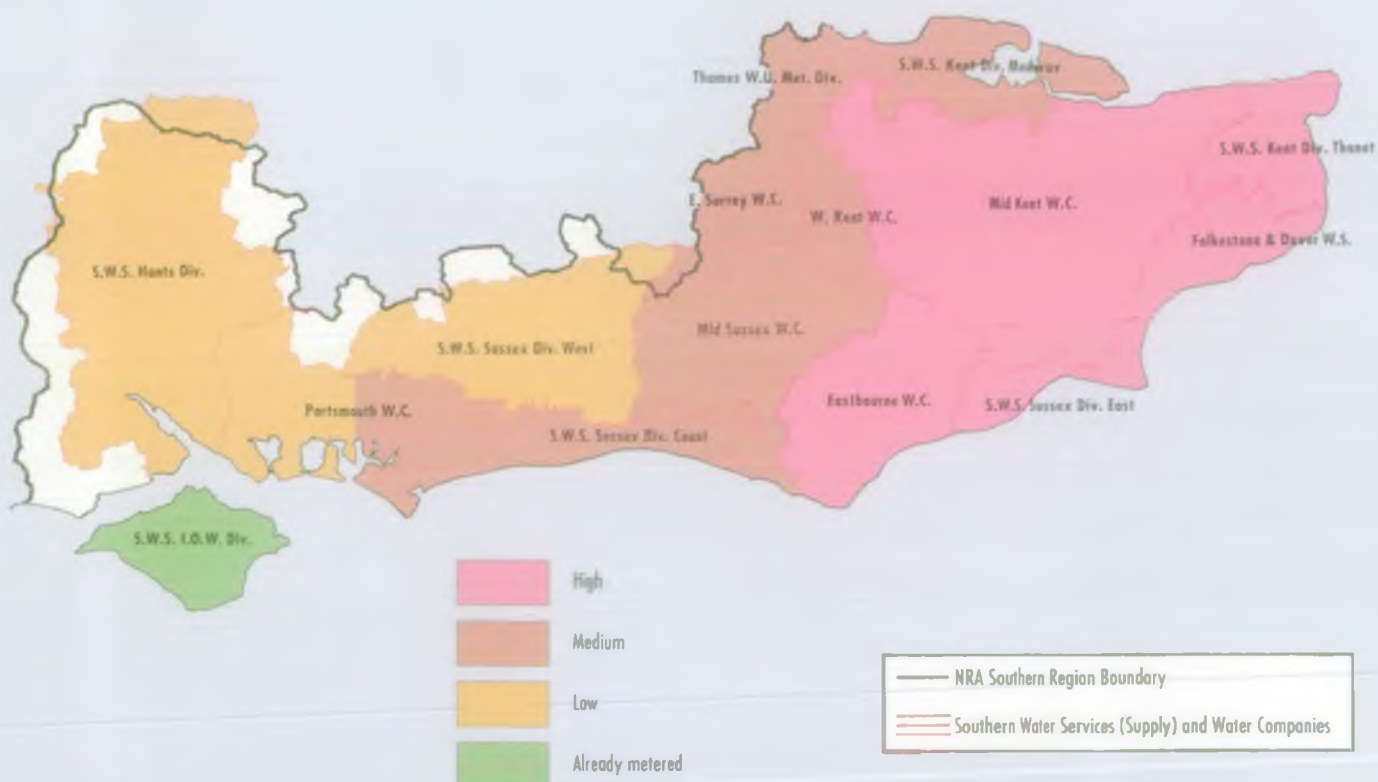
Previous sections have shown how public water supply demand is likely to grow, where deficiencies may occur, the demand management measures that are available and the water resources schemes that might be developed to meet remaining needs.

Arriving at a satisfactory position in 20-30 years' time will depend on adopting a balance between these different measures in the meantime, such that environmental, water supply and cost considerations are all taken into account. There is no doubt that the Southern Region can remain self-sufficient in water resources for at least the next 20 and probably the next 30 years, without requiring transfer schemes from the north or west of the country, as the balance overleaf shows:



4. Bulk supplies from Southern Water Services Ringwould source to Folkestone and Dover.
5. Bulk supplies from Mid Kent Water Co. Barham source to Folkestone and Dover.
6. Eastbourne Water Co. Arlington reservoir linked to Mid Sussex Water Co. River Ouse source at Barcombe, for transfers in either direction.
7. Bulk supplies from Southern Water and Mid Kent Water Co. Bewl Water Reservoir to West Kent Water Co. at Tunbridge Wells.
8. Southern Water Services Darwell Reservoir enlarged jointly with Eastbourne Water Co. to supply Hastings and Eastbourne, and indirectly Mid Sussex. Yield 42 Ml/day.
9. Increased use of Portsmouth Water Co. Gaters Mill intake on R. Itchen to supply the eastern part of the Company area.
10. Increased use of Southern Water Services Testwood intake on R. Test to supply Andover area and, in the longer term, additional supplies to the Isle of Wight.
11. Broad Oak Reservoir promoted by Southern Water, Mid Kent Water Co. and Folkestone and Dover to supply East Kent. Yield 40 – 90 Ml/day.
12. Expansion of Southern Water Services Hardham source to supply the Sussex Coastal area and growth in West Sussex.
13. Bulk supply from Mid Sussex Water Co. R. Ouse source at Barcombe for Southern Water.
14. NRA Test Groundwater augmentation scheme. Yield 20 – 30 Ml/day.
15. Possible redirection of effluent from Crawley into R. Ouse catchment to support downstream abstraction, or an alternative source in R. Thames catchment to supply growth at Crawley. After 2011.
16. Havant Thicket Reservoir in the Portsmouth Water Co. area. Yield 30 Ml/day. After 2021.
17. Chillerton Reservoir on the Isle of Wight. Yield 8 – 10 Ml/day. After 2021.

#### Water metering priority areas



## KEY ISSUES

The National Rivers Authority welcomes views on all aspects of the regional strategy discussed in this document, but particularly on the following key issues:

### a) Demand Management

Demand management measures, particularly domestic metering and reduced leakage, are proposed as the first steps before major new resources schemes are developed. The NRA believes that the costs involved are finely balanced, but there are long term benefits for the environment which have not yet been quantified. Is there general support for embarking on the demand management route now?

### b) Regional Self Sufficiency

This document proposes a policy of developing resources indigenous to the region so far as possible, before calling on long distance transfers from the north and west, because of the high cost and energy consumption involved. The NRA National Strategy indicates such transfers would be at least twice as expensive as local schemes. Is this policy supported?

### c) Level of Service of Public Water Supply

The current drought has demonstrated that resources designed for a one in 50 year drought can withstand a more severe event, with the imposition of restrictions on water use. The NRA believes it would be inappropriate, for reasons of environmental impact, to adopt a more stringent design criterion from now on. Use of metering would in any case

reduce the incidence of restrictions by virtue of reduced demands, particularly peak demands. Adoption of a more stringent design standard would require greatly increased investment which may be considered unjustified by the modest return available.

### d) Balance Between Abstraction and the Environment

This document foresees an increase in the overall level of abstraction in the Region of nearly 25% over the next 20 years, concentrated in six rivers and located at or near tidal limits in four (Test, Itchen, Medway, Stour). In the other two (the two Rother) abstraction will be balanced by reservoir storage or groundwater. Against this, significant reductions in abstraction from R. Darent, Nailbourne, Wallop Brook and possibly R. Hamble and R. Meon will contribute towards better aquifer management and provide good environmental improvements. Does this policy strike the right balance between the needs of water users and the water environment?

### e) Funding Alleviation Works in Low Flow Catchments

These works will require considerable future investment, exceeding the NRA water resources capital expenditure programme, which at present is the source of any direct funding or compensation payments to abstractors. This raises the question of whether further funding for alleviation should come from:

- Regional Abstraction Charges (as at present)
- A National Levy raised by NRA
- Successors to the agency responsible for the problem

- A new Environmental charge raised from taxes

These options cover the range of possibilities corresponding with views that range from treating Low Flows as local problems to be solved locally, to national problems that should be solved on behalf of the nation. Departure from the present method of funding would require legislative changes.

### f) Re-use of Water

In future the NRA will look to less marine disposal and greater inland treatment of effluent, with the possibility of re-use through downstream abstraction near the tidal limit. By discharging treated effluent as far upstream as possible the resource potential of rivers will be enhanced without increasing the overall level of abstraction.

It is acknowledged that this course of action may risk changes in trophic status in the watercourse and hence give rise to changes in designation of sensitivity as set down in the UWWID 91/271 EC. The cost and impact of such changes would be taken into account.

### g) Education

There is no doubt that great savings can be achieved through careful use of water in homes, industry and agriculture. The NRA is uniquely well placed to raise public awareness of the complete water cycle and the effects of water use and aims particularly to target the young. This document provides base data on rainfall, water sources, water conservation, use, future growth and development which will be drawn upon in compiling educational material.



## OTHER PLANNING ORGANISATIONS

The NRA's national and regional water resources strategy has implications for Local Authority planning which is conducted at three levels:

- Department of Environment and regional planning organisations, such as the South East Regional Plan (SERPLAN).
- County Councils, through structure plans.
- District Councils, through local plans and planning procedures. Water resources strategy is relevant to all three levels.

are an important consideration and the Southern Region of the NRA is in dialogue with Kent County Council and the water companies.

The County Structure Plans are the most important level of interaction between the NRA and planners. NRA demand forecasts are all firmly based on County Council forecasts of populations and dwellings.

The NRA provides advice on the constraints on water resource development and proposes appropriate policy statements for inclusion in Structure Plans. Regular liaison meetings are held with County Council members and senior officers.

groundwater storage capacity.

This document is intended to be of particular use to County and District Council Members and Officers and their response is invited.

## CONSULTATION

The NRA staff have a regular dialogue on water resource matters with water companies, major abstractors and interest groups representing water users and environmental matters. This report was considered by the Southern Regional Rivers Advisory Committee on the 8th September 1992 and is now being sent to a wide range of consultees.

NRA Regional Committees  
Local Planning Authorities  
(County and District)  
MPs  
Customer Service Committees  
Water Companies  
English Nature  
Countryside Commission  
CPRE  
OFWAT

Comments on the document and key issues are invited and should be sent to:

Mr G A Burrow  
Principal Water Resources Officer  
National Rivers Authority  
Guildbourne House  
Worthing  
West Sussex BN11 1LD

by January 31 1993.

A final regional strategy will be produced in 1993, taking into account comments received from consultees on this statement.

Serplan - South East Region Counties and NRA Southern Region



The NRA's Southern Region is a significant part of the SERPLAN area. Together with the Thames and Anglian Regions discussions have been held with SERPLAN on water resources for the South East Region. The proposals for developing the East Thames Corridor

The NRA is consulted by county and district councils on planning applications. The main consideration is usually protecting groundwater resources from pollution by waste disposal sites and quarrying of chalk or gravel which can remove valuable

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## Glossary

Aquifer	Rock formation containing water in recoverable quantities.
Augmentation	The addition of water from an alternative source to increase flow.
Effective Rainfall	The quantity of rainfall remaining after losses due to evaporation and transpiration by plants.
Groundwater	Water occupying all voids within an aquifer.
Regulated Rivers	Rivers where the flow is augmented through the addition of water from another source.
Surface Water	All streams, rivers, lakes, ponds and watercourses occurring at the ground surface.
One in 50 year drought	A drought so severe it is likely to occur only once every 50 years.
1 m <sup>3</sup> (1 cubic metre)	= 1000 litres or 220 gallons.
1 Ml (1 megalitre)	= 1000 m <sup>3</sup> or 220,000 gallons.
1 gal (1 gallon)	= 4.546 litres





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