

# WATER AND THE ENVIRONMENT IN TIMES OF DROUGHT



**NRA**

*National Rivers Authority*

*Southern Region*

*Guardians of the Water Environment*

## Introduction

The drought of 1989/90 affected most of England and Wales, but in the drier, highly populated South East of England its effects were particularly acute. There were bans on the use of hosepipes in the garden and restrictions on "non-essential" water use such as washing buildings, railway carriages and cars. The water environment was also affected because normal protection measures had to be relaxed to give priority to public water supply.

The drought coincided with the re-structuring of the water industry, which took effect on 1 September 1989. Before that date the Regional Water Authorities had for sixteen years been responsible for both water services (water, sewage and land drainage) and the regulating and monitoring of the water environment.

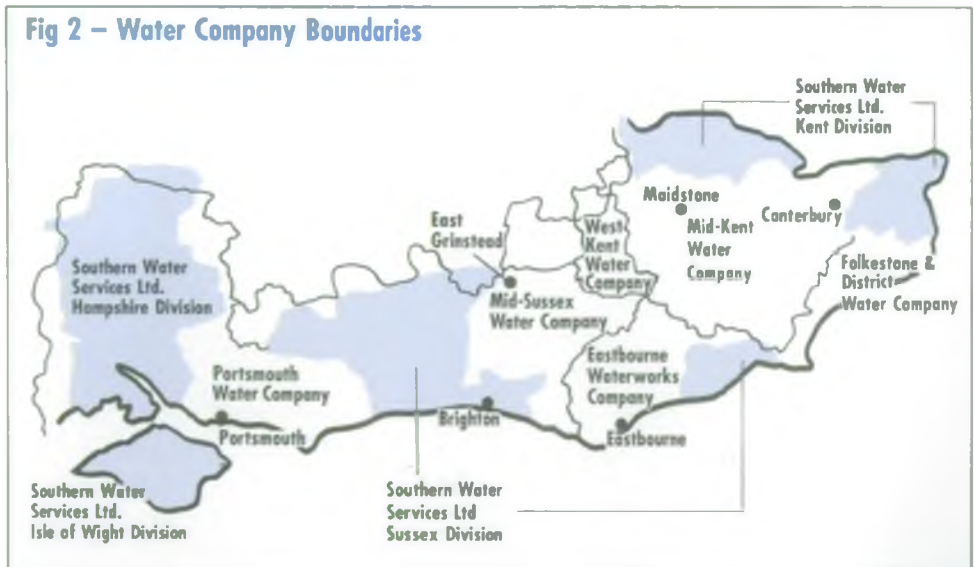
Although the water services companies were privatised, environmental care stayed in the public sector. The Government established the National Rivers Authority to take on responsibility for land drainage, flood defence, environmental monitoring and regulation, and the management of water resources. The NRA is structured in ten regions, having the same boundaries as the former Regional Water Authorities (Fig 1).

Water supply in the Southern Region is the responsibility of Southern Water Services Limited and six



statutory Water Companies (Fig 2). The level of services to be provided and the charges made to customers is regulated by the Office of Water Services.

### Fig 2 – Water Company Boundaries



## Making the most of resources

In the South the cost of metered water ranges from 28p to 65p per cubic metre. Comparison between the cost of water in the South and other parts of the country shows that although it is one of the driest parts of the country, water is relatively inexpensive. A key factor affecting cost is the availability of cheap groundwater in the region (Fig 3). Water abstracted from rivers and reservoirs, which needs full treatment, costs roughly four times as much as groundwater. Alternatives, such as desalination and piping water over long distances, would be very expensive.

Water supply systems are not designed to meet all anticipated demands during the most severe of droughts. On average, supply systems are designed to meet demand in all but 1 in 50 years. Overprovision of water supplies is not desirable as the consumer would be paying for works which would be under utilised in most years. In its role as Guardian of the Water Environment the NRA

would not wish to encourage over development of water resources which would have a detrimental impact on the water environment. As water resources in the South East become increasingly developed, the NRA would wish to be satisfied that existing resources are being efficiently used with minimum wastage.



Hydrometric technician measuring river flows.

Fig 3 – Ratio of surface water to groundwater in public water supply



## Rainfall

The weather systems crossing Britain bring rain from the Atlantic and most of it falls over the West of the country as the air lifts over the mountainous regions. The eastern side of the country lies in the rainshadow. Rainfall in Southern Region reflects this trend with a decrease in rainfall from West to East (Fig 4).

Because the population is also higher in the flatter, eastern half of the country, the highest demand for water coincides with the lowest rainfall (Fig 5). Comparing population density with rainfall for the NRA regions shows that in the Southern Region there is about 600m<sup>3</sup> (132 thousand gallons) per person per year, whilst in Wales it is ten times as much – 6000m<sup>3</sup> (1.32 million gallons) per person per year.

Annual and Seasonal rainfall can vary significantly from year to year. For example a raingauge in West Sussex with 160 years of record has an average of 975mm per annum, but under 600mm in the driest year and over 1,500mm in the wettest year.



Fig 5 – Average annual rainfall (mm)

Fig 4 – Decrease in rainfall from West to East across Southern Region

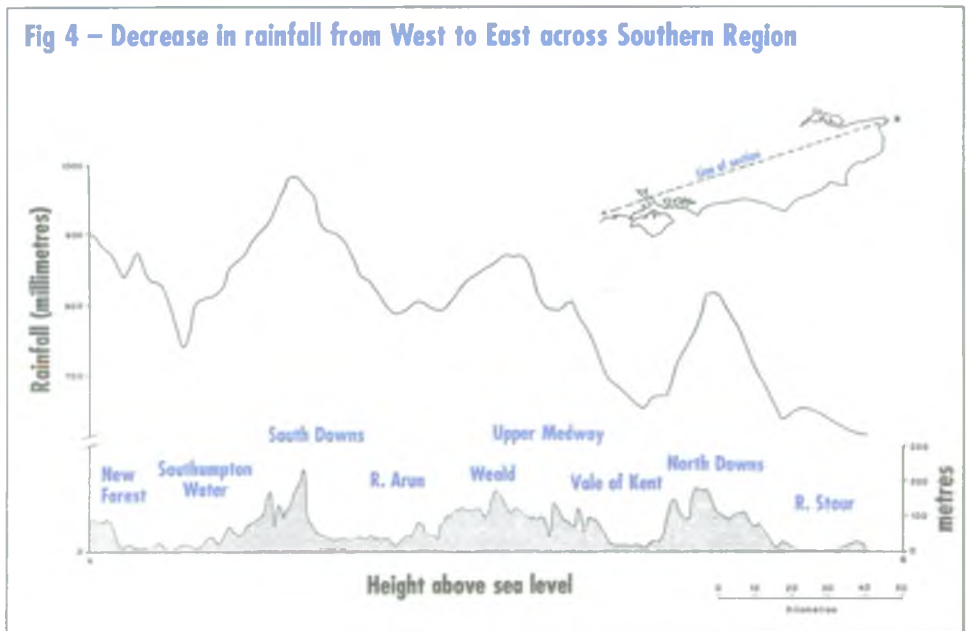
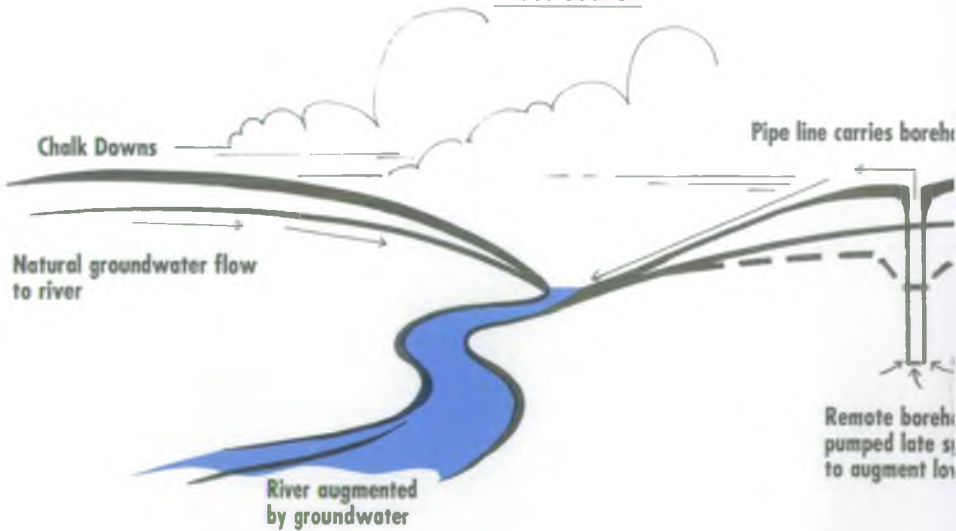
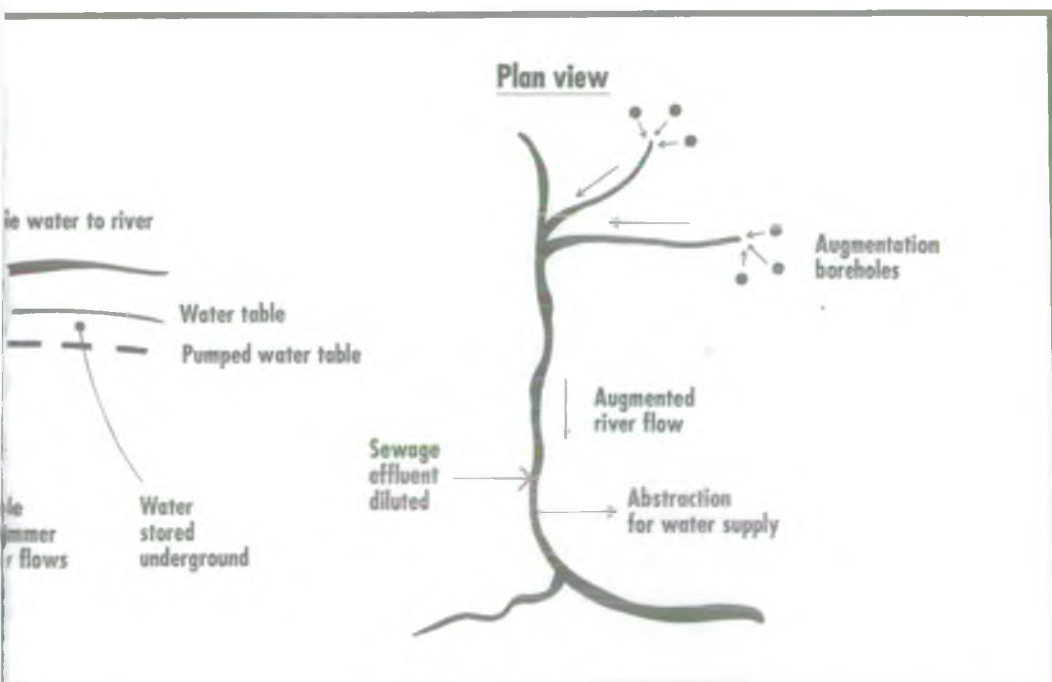
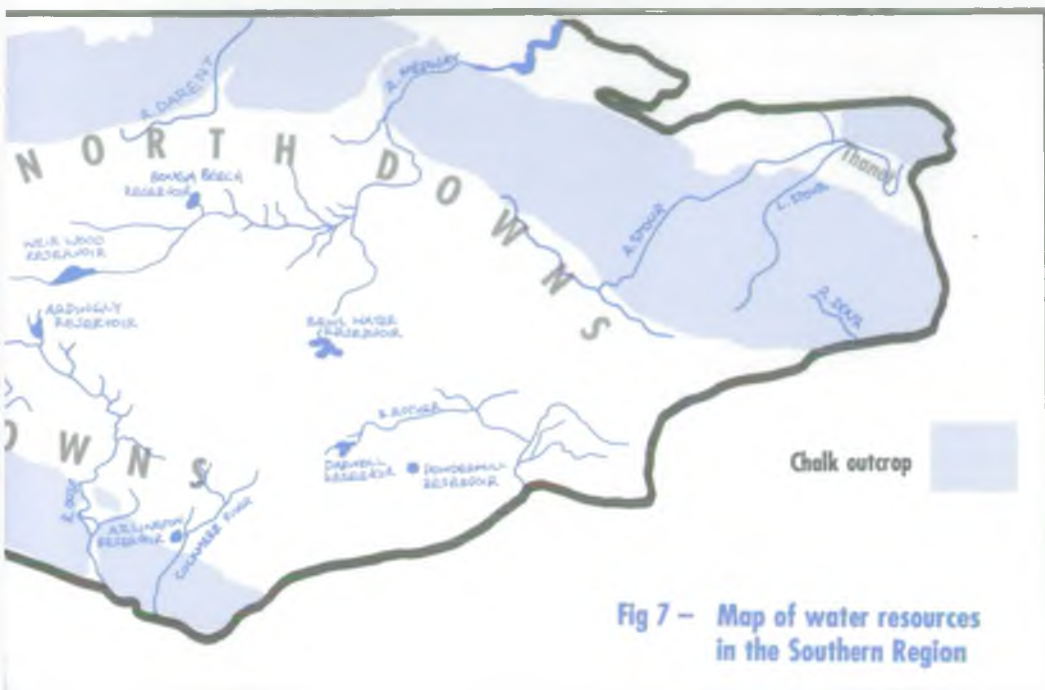




Fig 8 – A typical groundwater scheme

Cross section

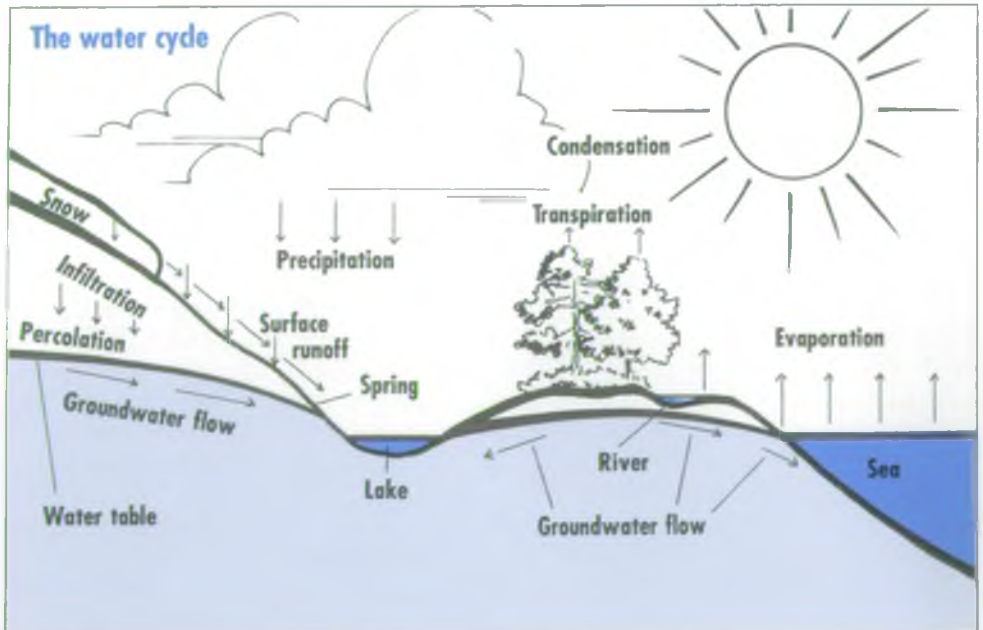
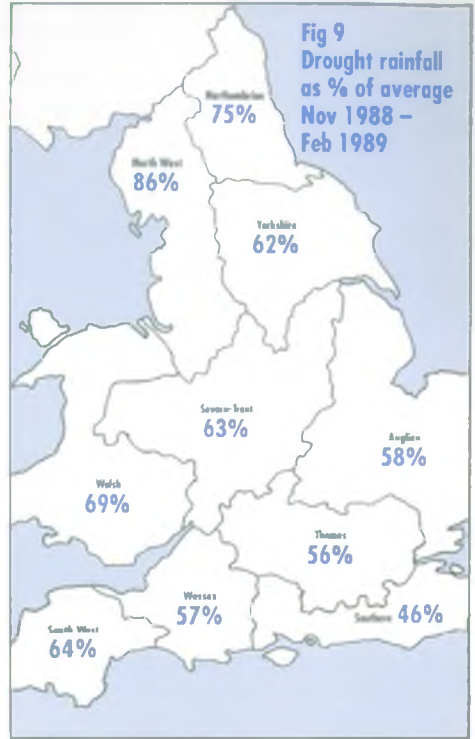




## Where do our water supplies come from?

In Southern Region 75% of the water supply comes from groundwaters. These are natural underground waters held in porous rocks such as chalk and sandstone which behave like a sponge. The chalk of the North and South Downs, and the Hampshire Downs (Fig 7) provides an excellent natural long term storage of rainfall, producing good quality water which requires minimal treatment. The water is pumped to the surface from wells and boreholes which have been drilled deep into the chalk.

The remaining supplies come from rivers and reservoirs. In summer it may be necessary to boost river flows to allow large abstractions to continue. To provide this facility a reservoir such as Bewl Water can be built higher up the catchment. Stored water can then be released to the river at times of low flow to support the abstraction. This also benefits the river between the reservoir and the abstraction point. Some rivers such as the Itchen can be augmented by pumping from major groundwater sources into the headwaters, thus using underground reserves in the same way as reservoirs (Fig 8).





## What is a drought?

The strict meteorological definition of a drought is a period of fifteen or more consecutive days with less than 0.25mm of rain per day. More generally a drought is any period of significantly low rainfall.

A winter drought means that there is not enough rainfall to replenish reservoirs and the huge natural underground reservoir of the chalk groundwater. Small reservoirs fill and empty quickly over a winter and summer. Larger reservoirs, and especially the natural chalk reservoir, take two or three winters to fill and perhaps two summers to empty. For the chalk, two or three consecutive winters of low rainfall means that groundwater levels do not naturally recover, so that it is prudent to cut back on pumping boreholes.

A summer drought has little effect on resource replenishment, which normally takes place in winter. But it can have a major effect on the demand for public water supply. Over a hot weekend in May, simply the use of garden hoses can raise water consumption by as much as 20%.

When hot, dry summers follow dry winters great pressure is put on water supply systems.

## The 1989/90 drought

The origins of the 1989/90 drought date back to 1988. November 1988 to February 1989 was exceptionally dry, the driest such period in 100 years in the East of the region, when only 46% of long term average rainfall was received in the Southern region (Fig 9). The very dry winter of 1988/89 failed to restore reserves of water and this was followed by an exceptionally hot summer, creating a very high demand. To make matters worse, the winter of 1989/90, although wetter than normal in most areas, only just reached average in Kent. The NRA calculated that over twice average winter rainfall was needed to restore groundwater levels to their normal state by April 1990. Furthermore, the rain that did fall was very intense. Continuous steady rain would have been far more useful for replenishing underground water reserves than the intermittent downpours of last winter.

Throughout this period resources in Hampshire held up well and there were no restrictions on usage at all, although the Itchen groundwater scheme was used for a record nine months to boost river flows. By contrast,

groundwater resources and river flows fell to very low levels in the eastern parts of the Region. Groundwater storage fell to record low levels in the worst affected areas in Kent and on the Sussex coast.

The 1989/90 drought affected most parts of England and Wales and hosepipe bans and drought orders were in force from the South West to the North West. There were supply restrictions whether or not consumers lived in normally 'wet' areas, and whether or not they had large lakes and reservoirs to support supply.

Newspapers were full of quotes about the exceptional weather conditions—"driest three months for 100 years", "hottest spring for 300 years", "driest summer since records began". Clearly climatic conditions have been very exceptional.

## Greenhouse Effect?

Meteorologists who study the natural cycles of high and low rainfall say that so far the drought of 1989/90 is unusual, but it still falls within the range of conditions that might be expected over the last thousand years or so. However, climatologists studying the temperatures of the world have found evidence of global warming which they say may lead to climate changes and increased sea levels. Early suggestions as to the possible effects on Europe point to hotter drier summers with slightly wetter winters, having 5–10% more rainfall than at present. Current scientific knowledge does not permit accurate predictions for countries, let alone regions within countries.

As water resources take a long time to develop, the NRA is in touch with the latest research on the greenhouse effect and global warming, and has consultants advising on the possible effects on water resources.

## Supply and Demand

There are two main parts to the water supply system:

- **Sources (boreholes, reservoirs, rivers)**
- **Transmission works (treatment plant, distribution mains, local supply reservoirs)**

When consumers take large amounts of water during hot weather there may be two reasons why it is not possible to meet that demand:

- **The source has a reduced yield because of the drought and**
- **the transmission works do not have enough capacity to deliver the higher demands.**

In fact there may be much more expense in increasing the capacity of the transmission or delivery system than in building a new reservoir for example. A new reservoir may also need an improved distribution system. Greater reliability of supply can be achieved if major sources are interlinked, perhaps over longer distances and between water companies, but long distance transfers from the wetter parts of the country to the drier South East are unlikely to be economic. Desalination is another option which is likely to be many times more expensive than traditional sources of water.

## Protecting the water environment

Drought can be harmful to river and groundwater environments. The NRA has a responsibility to protect them. If river flows fall too low, the associated wildlife and fish may suffer. Healthy flows are required to dilute effluents, to prevent sea-water pushing too far into rivers and to provide a sufficient wetted area for the water life which is an essential part of the food chain. In times of drought river temperatures rise and fish become overcrowded, increasing the risk of disease.

The NRA has identified a prescribed flow for each major river in the Southern Region which is the minimum desirable flow. Since 1963 the Authority has been able to set conditions in the licences it grants to water users which ensure that abstraction stops once flows reach this minimum desirable level. The rivers may only be taken below the prescribed flow by a legal mechanism called a Drought Order.

Groundwaters must also be protected in times of drought as these reserves are not being replenished by rainfall. If groundwater levels drop too low in coastal areas, sea-water may be drawn into the porous rocks, tainting the groundwater and making it unusable.

## Managing a drought

The NRA plays a key role in conserving resources and minimising the environmental impact of drought. As early as February 1989, Southern Region NRA advised water companies to apply for Drought Orders. This enabled them to top up their reservoirs with river water in winter rather than having to deplete rivers in warmer summer conditions.

Many industrial and agricultural abstractors have conditions in the licences issued by the NRA which prevent them abstracting during drought periods. For example the high demand for spray irrigation in dry periods can cause local water resources problems. In these circumstances the NRA has the power to ban its use.

The NRA plays a co-ordinating role with the water companies, giving guidance on the allocation of available resources and ensuring a consistent approach to public relations and restrictions. The NRA has a clear duty to protect the water environment and would object if water conservation measures, such as bans on the use of hosepipes, were not in place before Drought Orders were sought. In a serious drought the NRA provides regular reports to the Department of the Environment.

There are a number of definite stages in the development of a drought:

- 1 Water companies apply for Drought Orders in winter to relax licence conditions controlling abstractions eg River Medway.
- 2 Water companies and NRA may apply for Drought orders to use unlicensed sources (usually marginal, or awaiting licensing) eg North Kent groundwater sources.
- 3 Water companies apply for Drought Orders in summer to relax licence conditions controlling abstraction. In this case it is NRA policy to object unless a hosepipe ban

## Restrictions on Non-Essential Water Use

Watering by hosepipe – parks, gardens, bowling greens etc.

Filling swimming pools and ponds

Mechanical car washes

Washing road vehicles

Automatic cisterns in unoccupied buildings

Cleaning buildings

Cleaning industrial premises

Ornamental fountains

has been introduced first. Fisheries and river water quality should not be put under pressure unless consumers are also making savings.

- 4 Restrictions imposed on non-essential water use by water company Drought Order eg washing buildings, fountains and car washes. (See separate box on page 10.)
- 5 Pressure reductions under Emergency Drought Order to ration and share out supplies between local districts.
- 6 Rota cuts introduced under Emergency Drought Order to ration and share out supplies between local districts.
- 7 Standpipes and water tanker supplies introduced under Emergency Drought Order.

All these steps are controlled by the issue of Drought Orders by the Department of the Environment. Drought Orders have to be advertised in local newspapers and the public may make representations to DoE, which may hold a local inquiry.

In addition the NRA has special powers to restrict or prohibit abstractions for spray irrigation where they affect rivers. However, this is not often necessary as many farmers have their own reservoirs filled during the winter. If a water company asked the NRA to ban spray irrigators who were affecting public water supply abstraction, the NRA would require the water company to implement a hosepipe ban first.

The final step of introducing standpipes happens very rarely. In the 1976 drought only a small number of locations in the South West Region needed standpipes.

None were needed anywhere in 1989. During these very extreme conditions the water companies work closely with local authorities to ensure that emergency services, the elderly and housebound are properly looked after.

During droughts water companies examine every possible source of water which could be used, including those which are normally uneconomic. They also redouble their efforts to find and mend leaks in the distribution systems.

## What can you do?

Saving water during a drought will help protect the environment — but it will also save money for you and your water company in the long run. Here's what you can do:

- Make sure you know which company supplies you with water.
- Find out whether there are restrictions in your company area and comply.
- Be sure to comply with hosepipe bans in your area — this is a major saving in water use.

## Tips to Save Water

- Check dripping taps and overflow pipes.
- Take a shower instead of a bath.
- Use a rainwater butt and watering can.
- Re-use bath and sink water on the garden.
- If you must wash your car, use a bucket, not a hose pipe.

**In its role as Guardian of the Water Environment the NRA aims to assess, manage, plan and conserve water resources and to maintain and improve the quality of water for all who use it. In Southern Region the NRA is responsible for 2,746km of main river. It looks after 190 river gauges, 2200 observation boreholes and 450 raingauges and climate stations.**

NRA



ENVIRONMENT AGENCY

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please phone:

Southern Water Services:

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Hampshire Division	0962 714585
Sussex Division	0273 606766
Kent Division	0634 830655

Portsmouth Water Company	0705 486333
Mid Sussex Water Company	0444 457711
West Kent Water Company	0732 452307
Eastbourne Water Company	0323 411411
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# Help the rivers survive



# Please save water

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