

NRA South West S22

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**WESSEX AREAS
WATER RESOURCES
STRATEGY**

**CONSULTATION
DOCUMENT**



ENVIRONMENT AGENCY

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NRA

*National Rivers Authority
South Western Region*



WATER COMPANY MAJOR SOURCES

Groundwater

River Abstractions

Reservoirs

Transfers

NRA regional & sub-regional boundaries

National Parks & Areas of Outstanding Natural Beauty

NRA 628.1 (410.19)



NRA

National Rivers Authority
South Western Region

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CONSULTATION


GLOSSARY

*“No new major resource
development will be needed
during the next 20 years if
growth in domestic water use
is sufficiently contained”*

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INTRODUCTION

The National Rivers Authority (NRA) has a duty to conserve, redistribute, augment and ensure the proper use of water resources in England and Wales, whilst at the same time conserving and enhancing the environment. It is, however, the responsibility of the water companies to provide an adequate supply of good quality water to the public. The NRA's role is to regulate the water companies and other legitimate users of water to ensure that in managing water resources the right balance is achieved between the needs of the environment and those of the abstractors. Key policies to achieve this are to...

- manage water resources to achieve the right balance between the needs of the environment and those of abstractors
- plan for the sustainable development of water resources, developing criteria to assess the reasonable needs of abstractors and of the environment
- expect existing abstractors to take positive steps to control leakage before the NRA issues a licence for additional water
- promote the efficient use of water by industry, agriculture and domestic users
- investigate and where possible solve unacceptable inherited low flow problems caused by licensed abstraction
- encourage the introduction of selective domestic metering, with appropriate tariffs, by water companies where resources are under stress

NATIONAL WATER RESOURCES DEVELOPMENT STRATEGY

To fulfil the duties of the 1991 Water Resources Act, the NRA has produced a national water resource strategy to meet forecast demands for the next 30 years. This was published in March 1994.

In the national strategy current regional resources were assessed and the NRA produced demand forecasts to the year 2021. Predicting cannot be based on perfect foresight so low, medium and high predictions were produced. The three predictions were then set against present resources and this identified the need for further development. Different options to meet predicted shortfalls were examined including national transfers of water.

This regional water resource strategy consultation document complements the national strategy by providing the detail of the local options.

WESSEX AREAS

BACKGROUND

In 1993, the NRA Wessex and South West Regions merged to form the South Western Region. This consultation document relates to the former Wessex Region, now North and South Wessex Areas of the newly merged region and called 'Wessex Areas' in this document.

The Wessex Areas cover approximately 10,000 square kilometres and have a resident population of 2.54 million. They encompass the counties of Avon, Somerset, Dorset, most of Wiltshire and parts of Gloucester and Hampshire.

The largest urban and industrial areas are associated with cities such as Bristol and Bath and towns like Bournemouth, Christchurch and Poole on the south coast. The remaining population is centred around small to medium sized towns such as Yeovil, Taunton, Weston-super-Mare and the City of Salisbury.

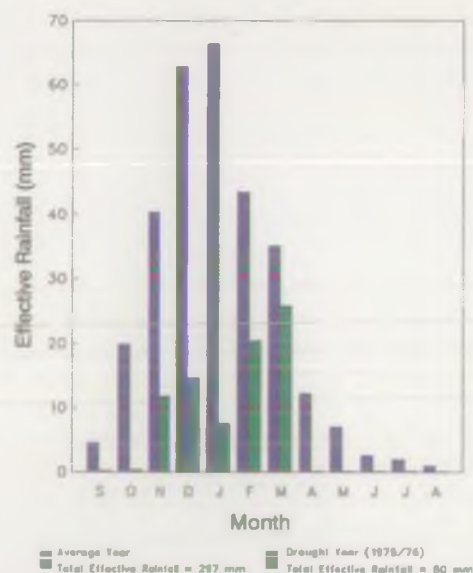
The Wessex Areas contain a rich and extremely varied landscape, incorporating parts of Exmoor National Park and the New Forest, together with several Areas of Outstanding Natural Beauty (AONBs). Much of the dramatic coastline is designated as Heritage Coast and water is a vital component of the landscape. The Wessex countryside supports an equally rich fauna and flora, the chalk rivers of South Wessex being of special wildlife interest.

The overall water resources strategy for the South Western Region will set out how the NRA would like to see water resources develop in an environmentally sound way.

This means:

- encouraging the efficient use of water
- using existing sources efficiently before new sources are developed
- approving developments that cause the minimum of adverse effects on the environment
- investigating and seeking solutions to existing unacceptable environmental problems caused by abstraction

Annual Distribution of Effective Rainfall in Wessex Areas



HYDROLOGY

The area enjoys relatively abundant rainfall under average conditions, ranging from 750 mm/year in the Somerset lowlands to 1500 mm/year on the Brendon Hills. Average annual rainfall is 866 mm but over 60% is lost through evaporation and through transpiration by plants. *See map ?*

Effective rainfall (rainfall minus evaporative losses) in an average period is 297 mm, this reduces to 80 mm in a severe drought period such as 1975/76. Effective rainfall replenishes the aquifers and rivers. It is from these sources that freshwater uses must ultimately be met. In order to sustain these resources without causing unacceptable effects on the environment the level of exploitation of the natural resource must be carefully defined and controlled.

The total water resources available in an average year in the Wessex Areas for all uses are some 8000 Ml/d. However, resources are fully stretched during drought periods (such as 1988-1992) and it is at these times that the level of exploitation can be seen to be critical.

This is because during drought periods:

- resources are depleted and under most stress
- environmental needs become critical
- demand for water is commonly at its highest

The level of developed resources must be sufficient during these periods, otherwise there is a need to resort unduly to measures which restrict the use of water such as hose pipe bans and drought orders which may affect the environment.

PUBLIC WATER SUPPLY - WATER COMPANIES

This document concentrates mainly on the provision of public water supplies, the dominant single use in the area and the one which will most likely bring about resource development.

There are four main water companies providing water supplies using the water resources in the Wessex Areas. They are:

- Bournemouth and West Hampshire Water Company
- Bristol Water plc
- Cholderton and District Water Company
- Wessex Water

Wessex Water covers the largest geographic area and is divided into three supply zones namely:

- Avon/Wiltshire zone
- Somerset zone
- Dorset zone

The water company supply areas do not correspond exactly with the boundaries of the Wessex Areas. There are small parts which are supplied by surrounding water companies; Severn Trent Water Plc, Thames Water Utilities Ltd and Southern Water Plc. These companies' resources and demands are considered in the strategies produced by neighbouring NRA regions.

PRIVATE WATER SUPPLY

Private sector use relates to abstractions which are made directly from rivers, lakes/reservoirs or groundwater rather than supplied through water company distribution systems. The water is mainly used by agriculture and industry.

PRESENT RESOURCES

The use of water resources can be categorised as follows:

- environmental needs
- public water supply resources
- private water supply resources (licensed and unlicensed)

ENVIRONMENTAL NEEDS

General Considerations:

Environmental needs are met by ensuring there is sufficient water of suitable quality in rivers, lakes and aquifers. The environmental requirements of both flora and fauna are not easily defined due to the large diversity of species and the complexities of their response to changes in water availability.

Low flows and water levels can have unacceptable impacts on:

- water quality
- landscape, amenity and recreation
- aquatic fauna and flora
- wetlands
- archaeology and cultural heritage

Water Quality

River flows must not be affected by abstractions such that treated domestic and industrial effluent is not sufficiently diluted. The aquatic ecosystem responds in a complex way, an increase in nutrients and toxic compounds may cause problems such as algal blooms, excessive plant growth which blocks channels and, in the worst cases, fish kills.

Landscape, Amenity and Recreation

Rivers, lakes and streams are essential features of the landscape, and provide unrivalled opportunities for recreation through water sports and more passive pursuits such as angling. The interests depend on water and require consideration to ensure there is no diminution in water supply or water quality due to abstraction.

Aquatic Fauna and Flora

The NRA seeks to retain or improve the natural biodiversity and productivity of aquatic ecosystems to maintain a healthy river environment. Fish are an integral part of this system.

There are three main types of fish stocks and fishery in the Wessex Areas; salmon, trout and coarse fish.

Water Company Boundaries





Chalk winterbourne late summer conditions - Dry



Chalk winterbourne winter conditions - flowing

Water availability can influence their survival and deterioration of water quality may have a profound effect on fish stocks and their supporting food chain. Healthy trout and salmon fisheries demand good river water quality. Trout fisheries are often located in the upper tributaries of catchments and are particularly sensitive to pollution. Certain high river flows are needed to promote good migration runs to the headwater spawning grounds.

There is also concern that lower flows influence the siltation of valuable gravel beds for fish spawning.

Wetlands

Water resource developments have potential impacts on wetlands. Important wetlands in the Wessex Areas include the Somerset Levels and Moors and the water meadow systems associated with the Hampshire Avon. Also of importance are the many smaller wetland areas associated with groundwater springs and periodic river flooding. These areas support important plant communities and a varied fauna, and are very sensitive to changes in the water level regime. In addition to their nature conservation value, wetlands provide an important archaeological resource and are now known to provide other valuable functions in terms of flood storage, aquifer recharge and recycling of nutrients.

Some reservoirs created for public water supply such as Chew Valley Lake, now have valued wetlands beyond their margins.

Archaeology and Cultural Heritage

Water resource developments affect not only the water environment but also the terrestrial and social environments. Archaeology and cultural heritage are two aspects which should be considered. The construction of river intake works,

treatment works, pumping stations, pipelines and reservoirs may cause direct damage to archaeological sites and have indirect impacts upon the local community - particularly in relation to reservoirs. The NRA is conscious of these issues and the need to resolve potential conflicts.

Specific Investigations

The NRA is currently investigating four major river systems in the Wessex Areas where low flow problems are of public concern:

- Allen (Dorset)
- Avon at Malmesbury (Upper Bristol Avon)
- Piddle (Dorset)
- Upper tributaries of the Hampshire Avon (Wiltshire)

Studies are still underway on three of the four catchments to identify the true nature of the problems and the remedial work which may be necessary, but indicate that it may involve the following changes to present licence arrangements.

Catchment	Possible upper limit of reduction in abstracted quantities	Water Company affected
Piddle	13.5 ML/d	Wessex Water
Wylde and Bourne	20 ML/d	Wessex Water
Allen	12.5 ML/d	Bournemouth and West Hampshire Water Company
Avon near Malmesbury	20 ML/d	Wessex Water & Bristol Water Plc

Of these reductions, only up to 4.5 ML/d in the Piddle catchment is likely to be an absolute reduction. All the other reductions can potentially be recovered through alternative resource development but these may take several years to put into effect.

The NRA is carrying out a number of research projects to improve the scientific basis for defining the flows in the river or levels in lakes and groundwater below which problems are likely to occur.

The setting of acceptable flow constraints reflects the need to maintain flows for environmental needs.

PUBLIC WATER SUPPLY RESOURCES

Present resources for public water supply can be split into types of source as follows:

- Groundwater
- River abstraction
- Reservoirs
- Transfers

Groundwater

Groundwater is the principal source of supply in the Wessex Areas, providing 42% of the resources currently available to the water companies. The three main aquifers are:

- the Chalk/Upper Greensand;
- the Jurassic Oolite;
- the Carboniferous Limestone.

These provide an important resource, as the groundwater requires little treatment and the aquifers are less sensitive than rivers to short, severe droughts. However, after prolonged

Water Company Major Sources



drought the groundwater reserves take longer to fully recover. Groundwater and river interactions are complex and abstractions, if not properly managed, can easily disturb the balance of the water environment.

The Chalk, together with the Upper Greensand, is the most important aquifer in the area providing approximately 50% of the groundwater reserves developed for public water supply. In the east it underlies the Wylfe, Upper Hampshire Avon, Ebble, and Nadder catchments and in the south the Allen, Stour, Piddle and Frome catchments. Eight sources account for over 100 MI/d.

Water from the Chalk aquifer is used to meet demand in the Cities of Salisbury and Bath and the towns of Trowbridge, Warminster, Westbury and Poole and is also pumped from the Wylfe catchment to support supplies in Somerset.

The second most important aquifer is the Jurassic Oolite, in the north and central part of the area, underlying principally the upper Bristol Avon catchment. The largest source is centred around Malmesbury and has a reliable source output of 48 MI/d in a drought year. The sources in this aquifer are used to meet demand in the Bristol Water Plc's supply area and the Wessex Water's Avon/Wiltshire supply zone.

The Carboniferous Limestone aquifer underlies the Mendip Hills and north Somerset. In addition to smaller spring sources, which are used conjunctively with the Mendip reservoirs, there are major sources at Chelvey and Banwell springs, east of Weston-super-Mare, totalling 23 MI/d.

River Abstractions

Rivers provide 22% of the developed reliable resources available to the water companies and, in general, are more sensitive to short severe droughts. The largest abstractions are on the Hampshire Avon (155 MI/d) and Dorset Stour (32 MI/d) which are used to supply the Bournemouth and West Hampshire Water Company and Wessex Water's Dorset supply zone.

Currently, there are no river abstractions of this scale in either

the Bristol Avon or Parrett and Tone river catchments. There are, however, some minor abstractions which are used in conjunction with supply reservoirs.

Reservoirs

Reservoir sources provide the area with 14% of the public water supply reliable resources. The distribution of reservoirs is conditioned by the topographic and geological constraints in the Wessex Areas. Most of the reservoirs are clustered into two main groups:

- the Mendip reservoirs - Chew Valley Lake, Blagdon Lake and Cheddar together with some conjunctive use with associated sources reliably supply 92 MI/d. These reservoirs serve as supplies for the City of Bristol and associated rural areas and are important sites for recreation and nature conservation.
- The Parrett and Tone system reservoirs - Durleigh, Clatworthy, Sutton Bingham and Ashford (reliable supply 56 MI/d). These serve the Somerset towns of Yeovil, Bridgwater and Taunton and provide almost half the public water supply for Somerset.

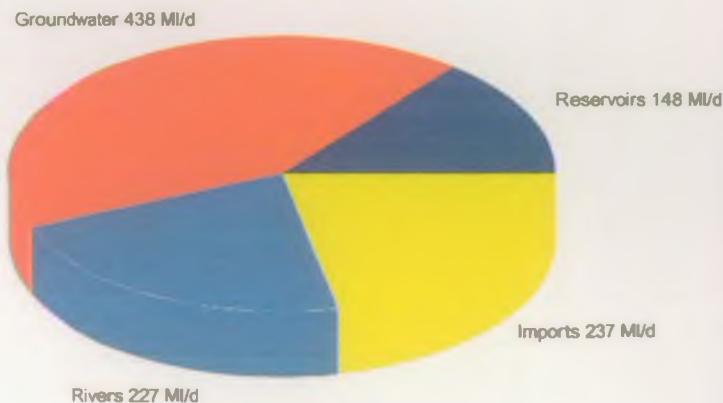
There are a number of minor conjunctive use schemes in the Wessex Areas which include the pumped augmentation of Durleigh, Sutton Bingham and Chew reservoirs. This concept should receive greater attention than it has in the past not least through a more rigorous approach to the aquatic environmental need.

Transfers

Transfers into the Wessex Areas represent 22% of the public water supply resources. There are two main sources:

- a transfer from the River Severn via the Gloucester and Sharpness Canal up to 190 MI/d
- a transfer from Wimbleball reservoir located in the upper Exe catchment to Somerset up to an average annual licensed quantity of 32 MI/d.

Public Resources available in NRA Wessex Areas



Total Resources 1050 MI/d

Water Company Resources

The total reliable resources available to the companies in a drought year are 1050 ML/d. This total can be divided as follows:

Wessex Water	Avon/Wilts zone	170 ML/d
	Somerset zone	118 ML/d
	Dorset zone	164 ML/d
	Total	452 ML/d
Bristol Water Plc		370 ML/d
Bournemouth and West		
Hampshire Water Company		227 ML/d
Cholderton and District		<1 ML/d
Water Company		
	Total	1050 ML/d

The NRA is keen to embody drought contingency plans into the accepted operating rules for sources, particularly conjunctive use resource systems.

PRIVATE WATER SUPPLY RESOURCES

Private supply refers to the licensed volumes of water abstracted from surface and groundwater sources by individuals, organisations and industrial concerns for their own purposes. These private abstractions are, in most instances, required to be licensed by the NRA. Typically, users take less than their licence entitlement, but in determining new licences the NRA must protect existing entitlements.

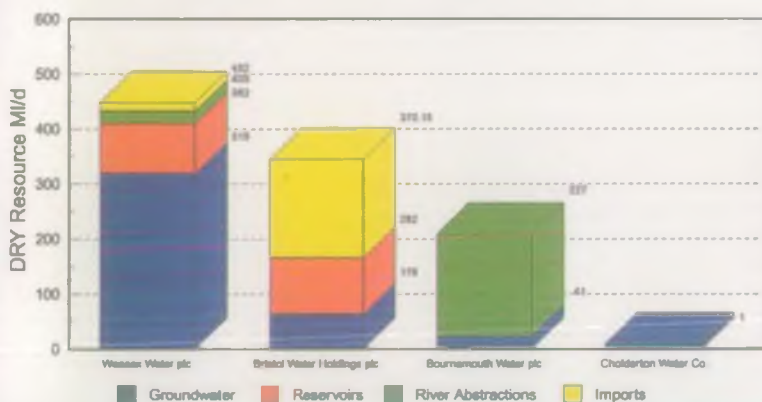
There are a number of private water use purposes; the main groups are:

	no. of licences
■ spray irrigation	626
■ agriculture (excluding spray irrigation)	4082
■ fish farming	122
■ industry/commerce	350

Crown Establishments are exempt from licensing but make abstraction returns to the NRA and pay abstraction charges as if they held a licence.

High spray irrigation usage occurs mainly in the Hampshire Avon, the Dorset Stour, the Piddle, the Frome and the upper Tone catchment, the latter being the largest potato growing area in Wessex. Spray irrigators have a high nett use of water, with little or none being returned to the catchment. In addition, the season of highest need for spray irrigation is between May - September which coincides with the period when water resources are most limited and environmental needs are high.

Water Company Resources
Source Annual Average Drought Reliable Yields



The available resources have been reduced by 2.5% from these figures to allow for 'outage'. Outage is a reduction in the total supply available caused by part, or all of a source of supply being temporarily unavailable at any one time. The NRA is researching 'outage' to seek a better measure for this allowance.

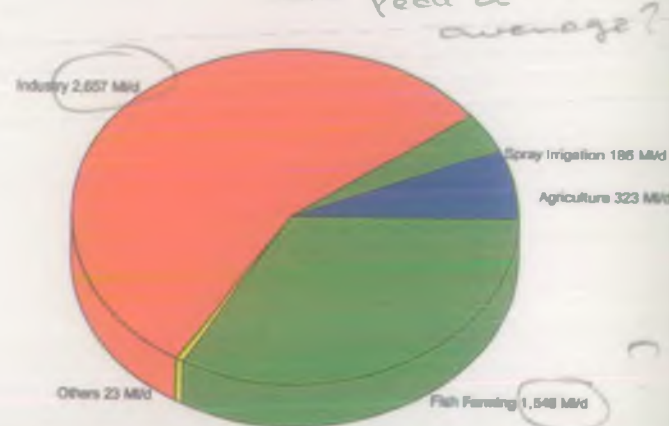
Cholderton and District Water Company, which supplies 2000 people, has been identified as needing only a minor groundwater to meet future needs. This requirement will have little impact upon the regional water resource development strategy and is not considered further.

Drought

Current standards of service guidelines are laid down by the water industry regulator OFWAT eg. a hose pipe ban not more than once in 10 years to cope during periods when resources are under stress. Other more stringent temporary powers obtained under Drought Orders are accepted by OFWAT, but the use of such measures is generally seen as unacceptable by the public.

The NRA will seek to ensure that adequate resources are developed to reduce the frequency with which water companies seek temporary powers which affect the water environment.

Gross Private Resource by water use purpose
ML/d



The Fawley oil refinery, located on Southampton Water, is Esso's principal refinery in Europe. Water is exported out of the Wessex Areas to supply the refinery from the Bournemouth and West Hampshire Water Company's river source at Knapp Mill.

Fish farming accounts for 32% of private water abstractions, with the majority abstracted from the Hampshire Avon catchment. Fish farming has no nett loss, all water abstracted is returned to the catchment.

Industrial/commercial use includes water used in manufacturing food processing and cooling and accounts for 55% of all private use.

The MoD abstracts water for its military establishments around Salisbury Plain at 10 sites and accounts for 17 Ml/d. These are Crown properties exempt from NRA licensing constraints.

PRESENT AND FUTURE DEMAND FOR WATER

To prepare the water resources strategy, the NRA has investigated the present level of public water supply resource development and private resource commitment in the Wessex Areas. The NRA looked at the current resource/demand balance and NRA forecasts for the future needs to establish if additional resources are required.

PRESENT DEMAND

Public Demand

The water supplied by the water companies in 1991 was as follows:

Wessex Water	403 Ml/d
Bristol Water Plc	344 Ml/d
Bournemouth and West	
Hampshire Water Company	154 Ml/d
Cholderton and District	
Water Company	0.6 Ml/d
Total	902 Ml/d

Private demand

Commitment to private water resources in the Wessex Areas, as defined by the gross licensed entitlement, totals almost 4,800 Ml/d. This appears to exceed the available resources in some areas. This is because the resource commitment assumes each unit of water can only be abstracted once (100% nett use). In reality, water is often returned to the catchment (eg fish farming 0% nett use) and is re-used. This is also the case with public water supply where the effluent is returned to the river. It is therefore the nett resource commitment which is of importance.

If the following rates of nett use are assumed:

■ agriculture	20%
■ spray irrigation	100%
■ fish farming	0%
■ industry/commerce	30%
■ MOD	30%

and are then applied to gross private resource commitments, the nett commitment is estimated to be 1050 Ml/d. This is similar to the current total public water supply use but abstraction points are more dispersed.

FUTURE DEMAND FOR PUBLIC SUPPLIES

Public water supply demand can be divided into domestic and industrial/commercial water use and system losses.

The extent to which demand will increase over the next 30 years will depend on several factors including:

- population growth
- personal use of water
- number of dwellings built
- level of economic activity
- levels of water losses
- measures to reduce demand
- climate change

Until recently, demand has been predicted solely by the water companies, using component methods which combine different techniques and assumptions.

The NRA method uses a generally accepted component technique for predicting demand with three components:

- domestic demand
- industrial and commercial demand
- total water losses

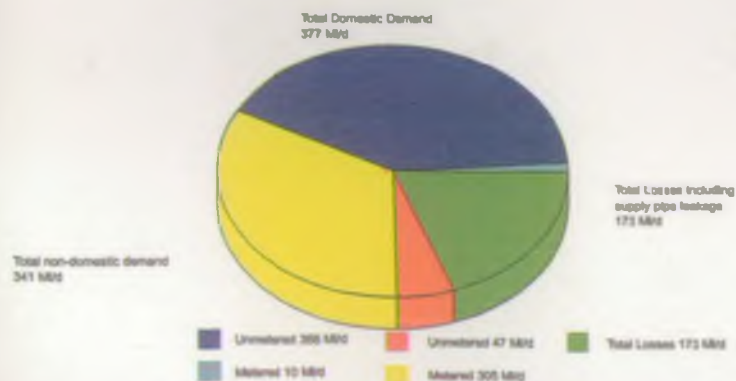
Domestic, industrial and commercial demand components are further sub-divided into metered and unmetered sub-components, and total water losses into customer and water company losses. The growth of each component is forecast using varying assumptions and then combined to give low, medium and high total demand predictions.

The high prediction combines high growth of domestic and industrial and commercial consumption with no improvements to reduce company losses to target levels, or any increase in domestic metering to reduce water use.

The medium prediction assumes lower rates of growth, company loss targets of 140 litres/property/day and installation of meters in up to 15% of domestic properties by 2021.

The low prediction assumes low domestic growth and no increase in industrial and commercial consumption, company loss targets of 120 litres/property/day and installation of meters in up to 30% of domestic properties by 2021.

Public Water Supply Split into Demand Components



The predicted demands to 2021 are shown in the four graphs: a total for the Wessex Areas and one for each of the larger water companies:

In 2021 the predicted demands are:

	2021		
	High	Medium	Low
Wessex Water			
• Avon/Wilts Zone	203	159	146
• Somerset Zone	175	144	131
• Dorset Zone	193	150	137
Sub-total	571	453	414
Bristol Water Plc	427	403	380
Bournemouth and West Hampshire Water Company	191	178	164
Cholderton and District Water Company	1	1	1
Wessex Areas	1190	1035	959

Possible Climate Change

There is international concern that increased greenhouse gases in the atmosphere may lead to global warming and cause climate change. This has been heightened in the UK by the recent incidence of droughts, followed by periods of flooding.

The burning of fossil fuels to provide energy contributes to the build up of greenhouse gases. However, the potential causes and effects of global warming are still uncertain and the processes little understood. A recent study predicted that per capita consumption of water could rise by an additional 10 litres/head/day by 2021 if a mean temperature change of up to 2 degrees centigrade occurred. If this were to be applied to the Wessex Areas, demands could increase by up to 3%.

FUTURE DEMAND FOR PRIVATE SUPPLIES

The nett private resource commitment for 1991 was calculated at 1050 MI/d. Forecasting total private demand growth is more difficult than forecasting public water supply demand. Private water use is influenced a great deal by numerous and differing political, economic and environmental factors.

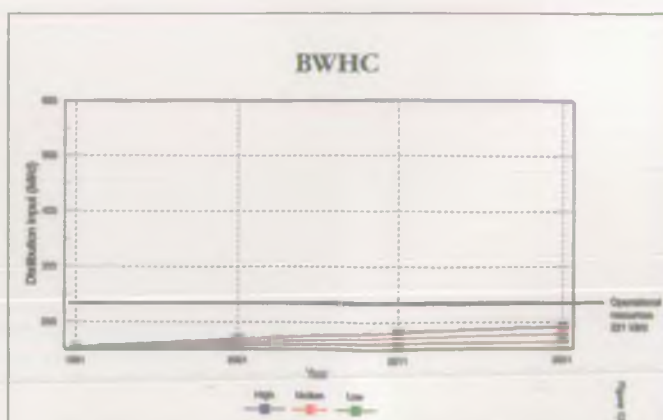
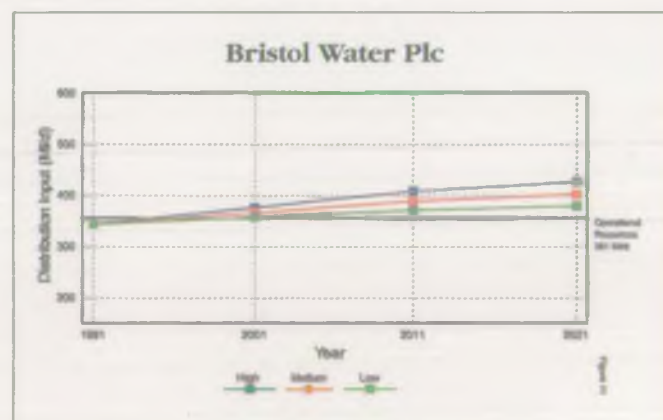
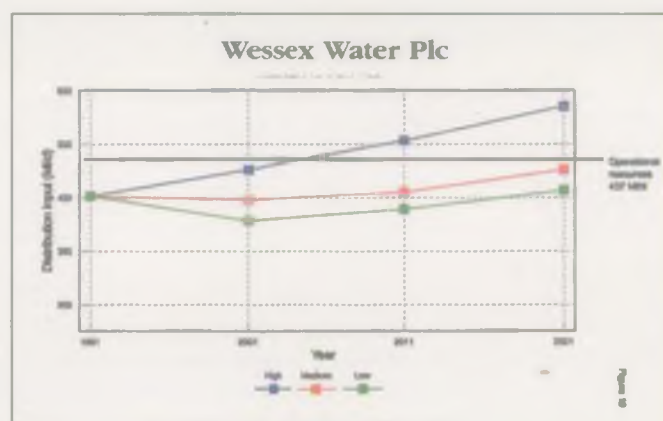
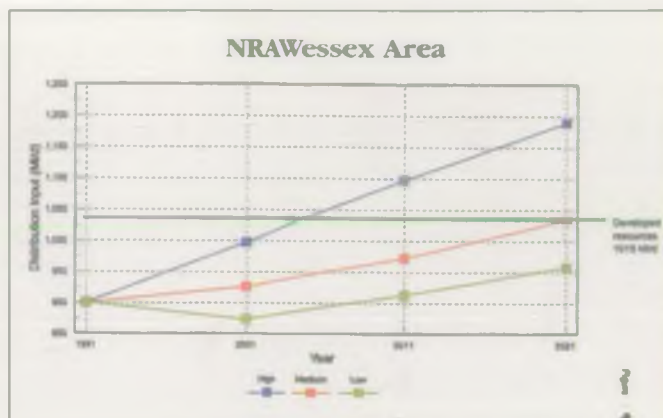
The forecast growth rate of private demand has been calculated with the following water use growth rates:

growth rate per year

■ agriculture	0%
■ spray irrigation	0.8%
■ fish farming	0%
■ industry/commerce	0.75%

Applying these rates, it is predicted that private demand will increase by some 250 MI/d by 2021. However, growth in private supplies tends to be geographically dispersed in contrast to the more concentrated point sources for public water supply.

Forecast Annual Average Demand



BALANCING DEMAND FOR WATER SUPPLY AND ENVIRONMENT

As previously discussed, water is used to meet:

- environmental needs
- public and private demand

The role of the NRA is to balance these needs, which often conflict, and ensure water resources are sustainable in the long term.

NRA Water Resources Policies:

The NRA has adopted a range of key policies to help achieve an environmentally sustainable water resources strategy. Foremost amongst these are:

Sustainable Development

ensuring there will be no long-term systematic deterioration in the water environment due to water resources development and water use.

Precautionary Principle

making sure that decisions made and measures implemented err on the side of caution if significant environmental damage may occur, or if knowledge on the matter is incomplete.

Demand Management and Better Use

ensuring due attention has been given to the management and conservation of water resources by measures to control waste and manage demand and to make best use of existing resources, before licensing the development of additional resources.

PRESENT PUBLIC WATER SUPPLY BALANCES

The current public water supply balance of resources to demands is: *

Bristol Water Plc	17 ML/d surplus
Bournemouth and West Hampshire Water Company	67 ML/d surplus
Wessex Water:	
Somerset zone:	9 ML/d deficit
Avon/Wiltshire zone:	24 ML/d surplus
Dorset zone:	22 ML/d surplus
Sub Total:	37 ML/d surplus
Wessex Areas:	121 ML/d surplus

* based on data for 1991

FORECAST PUBLIC WATER SUPPLY BALANCES

The resource-demand balance can be used to predict where and when any resource deficits will occur. Deficits are shown in the table below in red. An allowance has been made in these estimates for a long-term reduction of 4.5 ML/d from the Middle catchment to alleviate low flows.

Predicted Annual Average PWS Surpluses and Deficits in the Wessex Area

	2001			2011			2021		
	High	Medium	Low	High	Medium	Low	High	Medium	Low
Wessex-Water Avon/Wilts Zone	6	27	41	-11	24	35	-37	7	20
Wessex Water Dorset Zone	3	20	37	-20	16	27	-37	6	19
Wessex Water Somerset Zone	-24	-6	1	-38	-14	-4	-60	-29	-16
Bristol Water Plc	-16	-7	2	-49	-29	-11	-66	-42	-20
Bournemouth and West Hampshire Water Company	52	57	62	39	49	59	30	43	57
Total Surpluses/Deficits	21	91	143	-79	46	106	-170	-15	60

If the NRA's policy of encouraging demand management and leakage control is successful, there will be no need for any major new sources for 20 years or more.

On the other hand, if demands do rise at the high rate, for whatever reason, major new sources will be needed. As it is likely to take at least up to 20 years to plan, promote and build a major new source, it will be prudent to start the planning process in good time to enable realistic and environmentally acceptable schemes to be brought forward to meet high demand growth, if it does take place.

The predicted annual average surpluses and deficits do not necessarily provide a full picture for the future. Peak demands, for example during the summer holiday season, may exceed the available output from water sources. Without adequate storage or effective management of these demands this may lead to a requirement for new source developments. The NRA believes that it is good practice to design future needs in the first instance on the basis of average demands; only allowing an excess for peaks where plans for constraint on demands would be unreasonable.

FORECAST PRIVATE WATER SUPPLIES BALANCE

Predicted growth in private demand in the region by 2021 is 250 ML/d, entirely due to anticipated increased spray irrigation and Industrial/commercial use.

Growth in the spray irrigation requirement is expected in the Hampshire Avon, Dorset Stour, River Piddle and River Tone catchments. Resources in some of these catchments are already well-developed and the licensing of additional summer abstraction for spray irrigation may not be approved because of environmental flow needs at such times. It is likely in these cases that new licences will only be granted where storage of excess winter rainfall is practised.

In recent years, due to the recession and changes in the economy, there has been a marked decline in the uptake of private licensed resources for industrial use. Any future growth in industrial use will be met by uptake of these existing licensed resources and in part by the development of sustainable new resources.

just another Guffan
(on 2 charts)

DEVELOPMENT OPTIONS - PUBLIC WATER SUPPLY

Having identified from the three demand scenarios that some deficits will occur, the options for meeting these deficits can be examined. These include:

- demand management
- resource management
- resource development

The NRA must have particular regard for the statutory obligations of water supply companies to supply potable water to required level of service.

The first option includes looking at the more efficient usage of water, for example by the extension of domestic metering. The second option embraces the more efficient use of the sources already developed, and the third includes development of new sources, from groundwater, surface waters or transfers from other areas.

DEMAND MANAGEMENT

Metering

Almost all industrial and commercial public water supply customers in the Wessex Areas pay for their water through metering. In contrast, only 3% of domestic properties are metered at present.

Metering of domestic supplies is seen by many to be a more equitable basis of charging for domestic water than the present rating systems; and is recognised by OFWAT as having the potential, with the appropriate tariff structure, to restrain excessive use and to reduce and control demand.

The demand savings which can be achieved through metering of domestic properties is still the subject of much debate. Large scale national metering trials show that on average an 11% reduction may be expected. Reductions of as much as 22% have been reported on the Isle of Wight. On the other hand, it has yet to be proved that such reductions will be sustained in the long-term.

Whilst the NRA does not expect companies to meter all domestic properties due to the costs and uncertainties involved, the NRA encourages the installation of water meters in all new properties and a policy of selective metering in areas where water resources are under stress. The widespread use of domestic metering is a genuine technical alternative to the development of new water sources.

Once the true cost becomes clear of meter installation, reading and billing, this option can be properly assessed.

Limited levels of metering may be economic in areas where:

- peak demands are particularly high due to seasonal factors; or
- new sources cannot be developed in time to prevent the onset of a resource deficit; or
- new sources can only be secured at high capital or environmental cost.

At present the three largest water companies in the Wessex Areas have policies to meter all new properties. They have however made no commitment to more general metering as yet, even on a localised basis.

Efficient Water Use

Efficient use of water encompasses:

- voluntary restraint in the use of water achieved through better public information
- the development and public acceptance of domestic appliances and plumbing systems that are more efficient in their water use; and
- the promotion of more efficient industrial use of water, eg recycling and reuse.

Examples of more economical use of water are ...

- toilet cisterns having a 6 litre flush or less
- Washing machines requiring less than 20 litres/kilogram of load as are common in other European countries compared with a typical figure of 35 litres/kilogram in 1980 in this country
- use of showers rather than baths
- greater recycling of industrial process and cooling water
- application of water to crops and gardens during the cooler evening hours.

In particular, the NRA supports moves toward the use of water efficient domestic appliances to economise on consumption. An aim likely to be stimulated by more widespread domestic metering.

RESOURCE MANAGEMENT

Leakage Control

Leakage is the collective name for water lost from overflows, burst pipes, leaking joints and dripping taps. Since this treated water is lost in leakage and not used for its intended purpose, it represents a waste of resources.

The NRA expects leakage to be reduced to economic levels and in considering applications for increases in public water supply abstractions will expect water companies to be taking steps to reduce leakage, especially in areas where levels are high.

We would like to see leakage targets of around 120 litres/property/day for water companies in the Wessex Areas before any further resource development is approved.

Operational Improvements

The existing yield available from a resource can sometimes be enhanced by undertaking operational and structural improvements to the supply system. These include:

- conjunctive use
- resource integration - the inter-connection of sources
- inter-company transfers
- effluent recycling

Conjunctive Use

The NRA encourages the better usage of groundwater and surface water with emphasis being placed on greater use of surface water during the winter months and early spring when

there is generally ample water to meet both supply and environmental requirements.

As previously stated, there are several examples of sources being operated conjunctively in the Wessex Areas. The following schemes have been identified with potential for extending this principle:

- Wembleball Reservoir pumped storage
- groundwater augmentation of the Hampshire and Bristol Avons

The pumped augmentation of Wembleball is a conjunctive use scheme where the resource allocation is currently under investigation. Water would be pumped into Wembleball from the River Exe during the winter to help ensure the reservoir has sufficient capacity for the following summer. The planned pumped storage scheme is estimated to potentially enhance the yield available to Wessex Water by up to 10 Ml/d.

In the case of groundwater augmentation, the aquifer acts as a reservoir with water being pumped seasonally to the river and abstracted downstream. There are two aquifers with close association to major river systems, and relative positions with respect to the demand centre that make them evident candidates for further study. These are the Chalk in the Upper Hampshire Avon catchment and the Jurassic Oolite in the Malmesbury Avon catchment. In both cases, water is at present abstracted continuously from the aquifer and taken by pipeline to the areas of demand.

Conversion of reservoirs to river augmentation schemes and groundwater pumping to augment flows for downstream abstraction can have a stabilising effect on the river environment. The largest quantity of water is retained within the river for the greatest possible length, to the benefit of the river's wildlife. Although there are negative aspects, the NRA feels that they are outweighed by the environmental benefits and the development of this type of scheme will be encouraged.

Resource Integration

Water resources are supplied to the areas of demand through the water company's distribution system. In any water company area there will be areas where there is a surplus of resources and areas where there are impending deficits. If resources are to be managed effectively, the number and scale of these imbalances should be minimised. This can be achieved through an extension and expansion of the main distribution system to increase the inter-connection between the resources and areas of demand although there are economic and practical limitations to this process.

The distribution systems in the Bristol Water Plc area are well integrated. There is some potential for improvement in the systems of the Bournemouth and West Hampshire Water Company area.

Initial analysis of the Wessex Water system also pointed to potential for improved integration but later information which the NRA is investigating could show there is little scope for improvement.

Currently in the three Wessex Water zones a deficit exists in the Somerset zone and surpluses in the Wiltshire and Dorset zones. The deficit in the Somerset zone is met by a transfer from groundwater sources in Wiltshire. This represents a nett loss as water is not returned as effluent to the source catchment.

Inter-company Transfers

The pattern and range of forecast surpluses and deficits clearly shows that at any one time a water company may have a deficit in its area of supply adjacent to an area of surplus of a neighbouring water company. The possibility of short or long term inter-company transfers should be examined as an alternative to new resources or as a means of delaying development of new schemes.

Effluent Re-cycling

Effluent reuse is the return of suitably treated waste water usually to the river to augment flows which may then be abstracted further downstream.

Effluent re-use is common in the UK, particularly on large rivers, with towns discharging effluent to rivers with public water supply abstraction points downstream. By this means, the river flows between the discharge and the abstraction points are augmented and the reliable supply of the river system is increased. Modern water treatment technology can ensure the maintenance of wholesome drinking water supplies.

The NRA will have regard to the point of effluent discharge in relation to the abstraction point when considering abstraction proposals.

Abstraction Licensing Procedure

The process of granting an abstraction licence has a requirement on the applicant to assess the effect of the abstraction on the environment. This will be independently reviewed by the NRA in all cases. Current legislation does not provide for the subsequent revocation of licensed rights without the risk to the NRA of an unspecified compensation payment. Historically, abstraction licences have thus been issued on the basis of a virtually assured permanence despite the known environmental uncertainties.

Where there is uncertainty about the environmental impact of a proposed new abstraction and it is practicable for the abstractor, a licence can be granted for a limited time period to allow the effects to be assessed. This can ensure that these uncertainties are resolved without irreversible risk to the environment.

Licensed entitlement and actual usage are often very different quantities. The granting of a new licence may be constrained by water resources already committed to existing licences. In such circumstances, it may be possible either by partially or fully revoking unused licences, to make resources available for other new legitimate uses.

Possible alternative ways of releasing the potential of under-utilized abstraction licences could be by:

- granting all new licences on a time limited basis
- incentive charging to encourage non-users to revoke their licences.

Resources can also be better utilised by encouraging winter abstractions with bank-side or off-stream lined storage. This is especially the case with a high nett use, such as spray irrigation.

When determining any licence application the NRA will...

- ensure the abstraction will not be in excess of the renewable resources
- consider the effects on existing abstractors and will not allow abstractions which derogate existing rights to abstract unless suitable remedial arrangements are agreed

- consider the impact on river flows to ensure that flows are not reduced to environmentally unacceptable low levels
- consider the potential effect on wetlands and pools, and not allow abstractions which would be damaging to them
- consider the effect of any associated infrastructure on the environment.

Those catchments which are already currently considered over-exploited for abstraction will be targeted by the NRA and opportunities taken to redress the balance.

RESOURCE DEVELOPMENT

The amount of new resource development needed by 2021 will depend upon the success of the demand and resource management measures which the NRA is advocating. If these measures are implemented by the water companies and have the anticipated effect, demands will be contained to the low level. In this case, the deficits in 2021 would be limited to 16 ML/d in the Somerset zone of Wessex Water and 20 ML/d for Bristol Water plc. *8 250 for small water!*

At the medium level of predicted demand the deficits in 2021 would be 29 ML/d in Wessex's Somerset zone and 42 ML/d for Bristol Water Plc.

At the high level of demand the 2021 deficit would be a total of 200 ML/d, as follows:

2021 Deficits at High Demand Level (ML/d)

Wessex Water			Bristol Water Plc
Avon/Wilts	Dorset	Somerset	
37	37	60	66

Any new development should fully address the environmental needs and where possible seek an environmental gain. This will be achieved by practical measures such as:

- protective abstraction licence provisions, eg prescribed flow conditions
- provision of freshet releases from reservoirs
- augmentation of low river flows

Groundwater Options

Wessex Water have plans, under an existing abstraction licence, to abstract up to around 18 ML/d from the Upper Greensand/Chalk aquifer at Lulworth Dorset. These resources will be used to meet demand deficits in the Dorset supply zone. However, the potential for inducing saline flow into the aquifer has been identified as a possible constraint on the reliable supply.

There are areas in the Upper Hampshire Avon and Dorset Frome catchments where there is relatively little development of groundwater resources. In view of the effect caused by abstraction in other parts of the Chalk aquifer, any applications for development would require rigorous investigation. The NRA is presently persuaded that conventional development of this type of groundwater for direct pumping to public water supplies is not the most efficient use of resources.

Surface Water Options

Wessex Water already has an abstraction licence for 30 ML/d from the Bristol Avon at Newton Meadows, downstream of Bath. The source and infrastructure are not yet developed but could be used to meet growth in demand in the Wiltshire supply zone.

Bristol Water Plc has undertaken studies of an abstraction point on the lower reaches of the Bristol Avon. Bristol Water Plc has estimated that by using the Newton Meadows source for pumped augmentation of the existing Chew Valley reservoir, an additional 55 ML/d could be available. Such a scheme might be of shared value to Wessex Water.

None of the other rivers in Wessex Areas have the potential for further substantial resource development without provision of reservoir storage.

Reservoirs

Reservoir development opportunities in the Wessex Areas are limited. Potential schemes include:

- Chew Valley reservoir pumped augmentation and enlargement
- River Stour, Hampshire Avon and Dorset Frome bank-side storage

The pumped augmentation of the Chew Valley reservoir as discussed previously would provide an estimated 55 ML/d. A study showed that raising of the reservoirs water level by 2 metres could provide a further 55 ML/d of yield. Full development of Chew could therefore provide an additional 110 ML/d subject to a more detailed assessment of the environmental needs of the river Avon upstream of Bristol.

Raising of the level of Chew Valley Lake is not likely to be environmentally acceptable. The whole of the reservoir is designated a SSSI, being noted for its bird populations and extensive marginal wetland habitats disturbance of which would be met with considerable resistance. The pumped augmentation of the reservoir would have minimal impact on the lake, but the raising of the dam would cause the loss of important semi-natural plant communities and wetland created by the reservoir construction some 40 years ago. *Less plants*

The reliable abstraction from the rivers Stour and Hampshire Avon could be enhanced if they are used conjunctively with bank-side storage. Both Wessex Water and Boumemouth and West Hampshire Water Company are investigating the possibility of excavating or extending existing gravel pit workings to provide bank-side storage at Blashford and Longham. Sites for similar storage in the vicinity of the Dorset Frome may be possible. The reliable supply from these reservoirs could be up to 100 ML/d.

The present bank-side storage scheme at Blashford Lakes, owned by Wessex Water, is used successfully. It is however small compared with the potential new reservoirs which would be difficult to develop. Large amounts of gravel would need to be excavated in order to provide the storage volumes to support abstraction through the year. The rate at which the gravel can be extracted and therefore the amount of storage available for development will be constrained by the demand for aggregates by the construction industry. The timescales may also differ. There are also landscape planning constraints and water-tightness concerns of the reservoirs to be considered.

A number of potential reservoir schemes associated with the lowland rivers of Somerset have been considered. In the Parrett catchment, several reservoir sites have been studied. In the Brue catchment, the Avalon Lakes scheme which would make use of abandoned peat workings on the Somerset Levels has been assessed. The studies have shown these schemes to be unattractive either environmentally or at the appropriate time, financially.

Transfers

Bristol Water Plc will by 1995, with the enlargement of Purton water treatment works, complete phase 1 of the River Severn transfer scheme to give an additional 55 ML/d. Phase 2 would provide a further 55 ML/d and is licensed by the NRA with supporting resources in the River Severn catchment already committed. A third phase 55 ML/d transfer would depend on the further development of resources in the River Severn or Wye catchments, since recent demand forecasts indicate that the Shropshire groundwater is likely to be fully committed by the time the Wessex Areas need the water.

Wessex Water is currently discussing with South West Water the possibility of a share of the increased yield from Wimbleball once the proposed pumped storage scheme is in place. This has the potential to provide Wessex Water with up to 10 ML/d.

Summary of Resource Development Options

The new resource options in the Wessex Areas are:

Scheme	Estimate of reliable resource (ML/d)	To Supply
Lulworth groundwater	10	Wessex Water (Dorset)
Bristol Avon, at Newton Meadows	30	Wessex Water (Wilts)
Chew Valley Lake pumped storage	55	Bristol Water Plc/Wessex Water (Wilts)
Wimbleball pumped storage	5 - 10	Wessex Water (Somerset)
H Avon and Stour, pumped storage reservoirs and groundwater augmentation of rivers.	50 to 100	Wessex Water (Dorset) and Bournemouth and West Hampshire Water Company
Imports via Sharpness Canal	100+	Bristol Water Plc/Wessex Water

For the low demand prediction, deficits can be met by the combination of small groundwater schemes, the Bristol Avon at Newton Meadows, the Wimbleball pumped storage scheme and some development of reservoirs in gravel pits adjacent to the Hampshire Avon and Stour.

With the medium demand prediction, a choice will need to be made between developing the Chew Valley Lake scheme and increasing imports via the Sharpness Canal.

If the high demand prediction is approached the Wessex Areas could not be self sufficient and substantial imports would be inevitable. The NRA's national strategy has allowed for the provision of Wessex Areas's needs through transfers from the Severn, via the Sharpness Canal. This may, in turn, depend upon the availability of water to supply the Sharpness canal, via new developments in the Severn catchment. This matter is being addressed through NRA's national water resource strategy. Within the Wessex Areas, there would also need to be development of trunk mains to transfer the imported water to areas of deficit in the south and west of the region.

PREFERRED STRATEGY

All new resource developments will require a full environmental assessment before being considered. The assessment will identify the positive and negative impacts of any scheme and where applicable the measures necessary to mitigate any negative impacts. The NRA is also keen to see schemes which incorporate an element of environmental gain. *Germy positive!*

Some low environmental impact options may be expensive to develop and conversely, some options with high impact may be economically attractive. To develop a water resources strategy which is acceptable to the developer and water users without unacceptable effect on the environment, there has to be an understanding about the cost of environmental conservation.

The NRA has a clear commitment both to resource and to demand management before any new resources are developed. This is reflected in the policy statements on both leakage and metering.

Increased domestic metering to a moderate level (30%) and leakage targets of 120 litres/property/day could reduce demand by around 230 ML/d by 2021 compared with taking no action. This is equivalent to several major resource developments. (Some water companies elsewhere in England have made a commitment to general domestic metering.) *not?*

Transfer of surplus water between companies would mean that only in the case of the higher predictions becoming a reality would further resources be required. The NRA will support studies of new schemes which may be needed in the event of the higher demands materialising. However, the decision to proceed with the construction of new schemes should not be taken unless demands have been found to continue rising despite the introduction of measures to manage demands and reduce leakage.

The water resource development options listed in the table are the type of scheme favoured in principle by the NRA. But as stated already each development will be considered in the light of a full environmental assessment of the proposed scheme.

The NRA favours schemes which:

- allow augmentation of rivers at times of drought or provide benefit to low flow rivers;
- make use of under-utilised water resources, rather than development of new sources, including reallocation between companies;
- have net environmental benefits such as the provision of releases which improve the water environment;
- avoid piecemeal development, except where this is relatively small development to meet local demand;
- benefit all classes of abstractor;
- make use of development opportunities within the local catchment in preference to inter-basin transfers if the overall impacts and costs are judged to be similar;
- are economically efficient;
- return treated effluent of a high standard at or near the point of abstraction or at a site which will augment other stressed resources.

CONSULTATION

NRA staff have a regular dialogue on water resource matters with water companies, major abstractors and interest groups representing water uses and environmental matters. This report is now being sent for comment to a wide range of consultees including:

- NRA Regional Committees
- Water Companies
- OFWAT
- English Nature
- Countryside Commission
- English Heritage

as well as being made generally available to all. Consultation with the public is important and will help finalise the strategy.

Your comments on the document, in particular the NRA preferred strategy, are invited and should be sent to:

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The Consultation Period ends on 30 September 1994.

The South Western Regional water resources strategy will be produced for publication in 1995, taking into account responses to this document, the NRA National Strategy and the consultation document 'Water for the South West' (published 1992) for the Cornwall and Devon Areas, the former South West Region.

Public Information

The wise use of water involves everybody. Most dwellings are connected to public water supplies so use of water in the homes does affect the quantity of water abstracted from the environment. Individuals use on average about 140 litres (30 gallons) each day.

The NRA is committed to a programme of continued public education about water resources particularly for children.

Further background information on water resources is available in main libraries from two documents.

NRA Water Resources Strategy, 1993 - ISBN, 87316048 8 and Water, Nature's Precious Resource, March 1994 - ISBN 011 886523 4.

The NRA is committed to the principles of stewardship and sustainability. In addition to pursuing its statutory responsibilities as Guardians of the Water Environment, the NRA will aim to establish and demonstrate wise environmental practice throughout all its functions.

GLOSSARY

"Water resources" in this context is a general term describing the reliable quantity of water available for abstraction from sources such as rivers, reservoirs or groundwater without significant long term damage to the environment.

"Abstraction" is the removal of water from sources. Most abstractions of water require an "abstraction license" from the NRA permitting water abstraction up to a given maximum daily and annual quantity. Many licences have conditions attached which restrict the quantity abstracted or even cause it to cease where it is necessary to protect river flow, the river environment and existing abstractors rights.

"Reliable output" is the amount of water reliably available during critical dry periods.

"Distribution system" describes the pipework and pumping stations owned by the water companies by which water from the source and treatment works is transferred to the customer.

"OFWAT" The Office of Water Services, regulates the business of the water companies.

"Conjunctive use" is the operation of two or more sources in a systematic manner, to provide a yield greater than the sum of those sources if operated independently.

"River regulation" is the support of a downstream river abstraction by releases from an upstream reservoir at times of low flow.

"Reservoir pumped storage" is the supplementation of natural inflow to reservoirs with river water abstracted and pumped at times of high flow. Pumped storage ensures the reservoir is refilled sufficiently for the start of the next summer drawdown period.

"Groundwater augmentation" is the supplementation of summer river flows and support of a river abstraction from a groundwater source.

The volume of water used is expressed in metric units as megalitres per day (a million litres per day) abbreviated to Ml/d, when describing water supply systems or river flows.

*This brochure was prepared by the Public Relations and Water Resources Sections, National Rivers Authority, Manley House, Kestrel Way, Exeter, EX2 7LQ.
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Telephone the emergency hotline to report all environmental incidents, such as pollution, poaching and flooding, or any signs of damage or danger to our rivers, lakes and coastal waters. Your prompt action will help the NRA to protect water, wildlife, people and property.

NRA emergency hotline

0800 80 70 60

24 hour free emergency telephone line

