

POLICY AND PRACTICE
FOR THE PROTECTION OF
GROUNDWATER
SOUTHERN REGION APPENDIX

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1. INTRODUCTION

Purpose of the Regional Appendix

This Regional Appendix to the NRA "Policy and Practice for the Protection of Groundwater" provides information specific to Southern Region. Details are given on the following subjects:

- * Description of Southern Region
- * Geology and Hydrogeology
- * Main Office Locations and Contacts relevant to groundwater matters
- * How to use the "Policy and Practice for the Protection of Groundwater" prior to the introduction of new maps and protection zones

This is one of ten appendices that have been produced, each one specific to a different NRA region. Although the main document is a national one there are certain considerations, within the headings listed above, that are only relevant to this Region. Each appendix is produced to the same format with the necessary extra information included. The appendices should be read in conjunction with the main document. Emphasis is given to regionally important factors such as the vulnerability of particular strata.

2. DESCRIPTION OF SOUTHERN REGION

The Southern region has an area of some 10550 km², adjoining Thames Region to the north and Wessex to the west. It includes most of Hampshire, the Isle of Wight, Sussex, Kent and part of SE London. There are also small parts of Wiltshire, Berkshire and Surrey. It is one of the most densely populated regions, with about 4.5 million people.

Over half of the Region's perimeter is formed by coastline which ranges in nature from the Chalk cliffs of Beachy Head to flat low lying areas, such as in parts of Kent and around Southampton Water. The North and South Downs form the main topographical features, together with the Weald in the South East and the Hampshire Basin in the West (Map.1.)

This map also illustrates the surface water drainage of the area. Most rivers in the east of the Region are derived from surface water run-off from the Weald and then cut through the Chalk Downs before discharging to the sea. Perennial streams emerge from the Chalk in the Hampshire Basin and north west Kent.

Much of the region is under permanent grassland, but cereal production is also widespread especially in Hampshire. The fruit farming and hop growing of Kent is well known, as is watercress production in Hampshire. Industry is concentrated mainly around the major ports such as Southampton and in South East London.

3. MAIN OFFICE LOCATIONS IN SOUTHERN REGION

Each area office has a small local team of Environmental Protection and Water Resources staff. Routine non-strategic matters are normally dealt with by these staff, but they will normally refer matters of significance to groundwater protection to the dedicated Groundwater Protection team at Worthing. All strategic and statutory consultations including Planning Applications are routed through the Worthing office.

At the end of this document a list of the District Councils in the Southern Region area is presented showing the appropriate NRA area offices. These are shown on Map 1 and names/addresses for NRA contacts at both area and head offices are tabulated at the end of this document.

4. THE IMPORTANCE OF GROUNDWATER IN SOUTHERN REGION

Southern Region relies more on groundwater for public supply than any other region. Some 76% of public water supplies is derived in this way principally from the Chalk and Lower Greensand.

Water supply in the Southern Region is mainly the responsibility of Southern Water Services and six Water Companies, though parts are also covered by Thames Water Utilities and three other Water Companies (see map 3). Most of these companies depend heavily on borehole sources, with the North and South Downs providing the bulk of resources. The total quantity of water abstracted from boreholes and shallow wells averages 1125 Ml/d (compared to 353 Ml/d from surface sources). Greatest demand for water is in the highly populated areas of North Kent, and the Brighton to Southampton coastal strip where careful groundwater management is required to avoid saline intrusion.

High quality Chalk groundwater also provides the base flow for the widely renowned salmon and trout fisheries of the Itchen and Test valleys.

5. RAINFALL AND RECHARGE

Southern Region is the third driest region of England and Wales. The annual rainfall decreases from west to east, with an average of 850mm in West Hampshire to 650mm in East Kent, though this trend is interrupted by the effects of relief, for example along the South Downs. This variation is reflected in the annual recharge values, which range from about 350mm for the Hampshire chalk, to less than 200mm in north-east Kent, with a small area in West Sussex where recharge is around 500mm. In recent years under drought conditions these figures have been severely reduced. Map 2 shows the distribution, and also includes major public water supplies greater than 10 Ml/d.

6. GEOLOGY AND HYDROGEOLOGY OF SOUTHERN REGION

Geological strata encountered in the Southern Region are relatively young, ranging in age from recent deposits of peat and alluvium to the topmost formation of the Jurassic series, the Purbeck Beds. These are listed in Table 1. All deposits are sedimentary in origin. The area has been subject to east to west alpine folding and the elongate Wealden dome is the principle and most well-known geological feature of the region. Nevertheless folding is generally gentle and mostly less than 5°, except in the Isle of Wight where a monoclinial fold plunges the Chalk northwards below the younger Tertiary strata at an angle of more than 70°. Major faults in the more resistant Hastings Beds strata, occupying the heart of the Weald, produce a block-faulted terrain and its varied scenery. Some of these faults have throws of over 150m and traverse the countryside for 20km.

The Chalk outcrop occupies 35% of the Authority's area and provides approximately 76% of public water supplies. 85% of all groundwater abstracted for public and private use is derived from the Chalk. The Lower Greensand formations are the next most important strata making up 10% of the total groundwater abstraction. Of the remainder, the Ashdown Beds and valley and beach gravels are the most important aquifers.

The Chalk is a very fine grained fissured white limestone. While its overall porosity can impart a saturated water content of up to 40%, the microscopic pore size gives the Chalk matrix a relatively low permeability. Its water-yielding characteristic is derived from the presence of fissures (joints and bedding planes) which normally occupy less than 2% of the Chalk by volume. Groundwater movement is mainly by fissure-flow which, by varying degrees, is enhanced by solution. In Hampshire, Sussex and the Isle of Wight, the Chalk outcrop is largely free of superficial deposits, although these blanket the North Downs in Kent extensively. The combination of high borehole yields, speedy fissure flow and bare outcrop, means that many groundwater sources and the aquifer generally are highly susceptible to pollution. In some areas such as in south-east Hampshire, springs used for supply have a direct hydraulic link with swallow-holes and are thus particularly vulnerable.

The sands, sandstones and gravels which comprise the remaining important water-bearing formations in Southern Region have effective porosities generally around 5-10%, in which inter-granular flow predominates. Groundwater flow velocities are therefore less than in the Chalk. However, several formations, notably the Upper Greensand, Hythe Beds and Tunbridge Wells Sand, are well-bedded and jointed in some areas, and fissure flow can thus be important. This is particularly so in the Hythe Beds west of the Medway where a limestone and sands facies, known usually as "rag and hassock" is present. The Ashdown Beds, the lowest formation of the Hastings Beds series, comprises massively-bedded cemented fine-grained sandstones and siltstones and most groundwater flow is by way of inter-connecting fissures.

TABLE 1 GE

| <u>SERIES</u> | <u>FORMATION</u> | <u>THICKNESS</u> |
|---------------------------|--------------------------------------|-----------------------------|
| RECENT AND PLEISTOCENE | River Alluvium and Beach Deposits | Generally less than 10 m |
| OLIGOCENE | Hampstead Beds | Up to 80m |
| | Bembridge Marls | 20 - 40m |
| | Bembridge Limestone | 6m |
| | Osborne Beds | 25 - 35m |
| | Headon Beds | 25 - 75m |
| EOCENE AND PALAEOCENE | Barton Beds | 18 - 68m |
| | Bracklesham Beds and Bagshot Beds | Up to 160m |
| | Claygate Beds & London clay | |
| | Blackheath, Oldhaven | Up to 180m |
| | Woolwich and Reading Beds | |
| UPPER CRETACEOUS | Thanet Beds | 25 - 35m |
| | Upper Chalk | Up to 390m |
| | Middle Chalk | 60m |
| LOWER CRETACEOUS | Lower Chalk | 60 - 75m |
| | Upper Greensand | Up to 60m |
| | Gault | 30 - 90 m |
| | Folkestone Beds | Up to 60m |
| | Carstone and Sandrock (IOW) | Up to 90m |
| | Sandgate and Bargate Beds | Up to 40m |
| | Ferruginous Sands (IOW) | |
| | Hythe Beds and Atherfield Clay | |
| | Weald Clay | 120 - 370m |
| | Tunbridge Wells Sand | 55 - 120m |
| Wadhurst Clay | 30 - 70m | |
| Ashdown Beds | 50 - 150m | |
| UPPER JURASSIC | Purbeck Beds | Up to 100m |

GEOLOGICAL FORMATIONS IN SWA

DESCRIPTION AND USEFULNESS FOR WATER SUPPLIES

Locally important supplies from valley, plateau and beach gravels.

Sandy, locally useful supplies.

Clays and marls.

Massive limestone, small supplies obtained.

Mainly clays and marls

Sandy beds provide useful water supplies

The upper sandy strata are locally important.

Glaucconitic clayey sands and multi-coloured sands, useful supplies.

Of little significance for water supplies.

Mainly fine sands, in contact with the Chalk.

The most important aquifer in SWA. The Middle and Lower Chalk are more clayey and less permeable.

Mainly important for spring discharges.

Clayey, no value for water supplies.

Medium clean sands. Important for water supply.

Mainly sandstones and sands, useful where sufficiently low-lying to contain water

Mainly clayey strata.

Clayey sands producing useful iron-rich groundwater

Hythe Beds are sandstones and limestones and provide useful water supply

Dark grey clays

Mainly sands and massive sandstones locally useful for water supplies
clays and mudstones.

Sandstones and siltstones, occasionally useful for water supplies
particularly the top Ashdown Beds.

Limestones, shales, gypsum, sandstones

7. USE OF NATIONAL POLICY AND PRACTICE FOR THE PROTECTION OF GROUNDWATER UNTIL NEW SOURCE PROTECTION ZONES AND VULNERABILITY MAPS ARE PRODUCED

7.1 Introduction

Groundwater vulnerability maps for the whole of England and Wales will not be available until at least 1996 and Source Protection Zones are not expected to be completed before the end of 1994. During the interim period there will inevitably be a transition period between full use of the new National Policy and use of the old Aquifer Protection Policy developed by Southern Water in 1984 and subsequently adopted by the Southern Region of the NRA. Until work on the new maps and protection zones is completed the new Policy statements and matrices will be applied in conjunction with the old Southern Region Aquifer Protection maps.

7.2 Former Southern Region Aquifer Protection Policy

7.2.1 The Southern Region Aquifer Protection Policy was based on similar principles to the new National Policy, namely the definition of Source Protection Zones. Aquifers were classified according to their importance for water supply and more recently groundwater vulnerability maps were produced with diffuse pollution from agriculture in mind. The Aquifer Protection Policy was the most comprehensive one in the UK at that time and was clearly deemed necessary because of the high reliance on groundwater for public supply.

7.2.2 Five zones were defined having regard to the nature of the geology and the use of groundwater from any particular abstraction point for potable use. As with the new policy an indication of the likely restrictions to be imposed on specific anthropogenic activities within each zone was given. The five zones were defined as follows ;

7.2.3 Zone 1 - A specific area based on a 50 day travel time in the saturated zone, drawn around all public water supply sources and any other sources requiring high quality potable water at a rate in excess of 1 megalitre per day. The dimensions of the zone were based on worst case considerations of aquifer thickness and hydraulic properties, hydraulic gradient and broad bands of abstraction rates. Standardised zone dimensions were thus defined for the chalk (+ Upper Greensand), the Lower Greensand and other granular formations. Restrictions on activities were most severe in Zone 1 areas, in order to provide the highest degree of protection. The total area designated as Zone 1 was about 15% of the Southern Water area at that time.

7.2.4 The remaining four zones were drawn up for resource protection
Zone 2 - This covered all outcrop areas of the Chalk and Upper Greensand and was also used as a buffer zone around the smaller Zone 1 areas defined for granular aquifers. This area was defined essentially to protect the Chalk,

TABLE 2

NATIONAL RIVERS AUTHORITY - GROUNDWATER PROTECTION POLICY
 CLASSIFICATION OF TYPES OF STRATA IN SOUTHERN REGION

| Major Aquifers | Minor Aquifers | | Non-Aquifers |
|--|--|---|---|
| Highly permeable formations usually with the known or probable presence of significant fracturing. High productive strata of regional importance. Often used for large potable abstractions. | Fractured or potentially fractured with or without high intergranular permeability. Generally only support locally important abstractions. | Variably porous/permeable but without significant fracturing. Generally only support locally important abstractions. | Formations with negligible permeability. Only support very minor abstractions, if any. |
| Chalk & Upper Greensand (2) Hythe Beds (3) Folkestone Beds (3) | Tunbridge Wells Sand (4) Ashdown Beds (3) Purbeck Beds (4) | Plateau and valley gravels and Beach Deposits (3/4) Hampstead Beds } Bembridge Beds } Osbourne Beds } Headon Beds } Barton Beds } Bagshot Beds } (4) Bracklesham Beds } Oldhaven and Blackheath Beds } Woolwich and Reading Beds } Thanet Beds (3) Sandgate/Bargate Beds (3) Carstone and } Lower Sandrock Series } Greensand Ferruginous Sands } on Isle of Wight | Atherfield Clay } London Clay } Gault Clay } (5) Weald Clay } Wadhurst Clay } |

(3) = Previous Southern Region APP zone designation

not only the most important aquifer in the region, but also the most vulnerable because of the predominance of fissure flow.

Restrictions in zone 2 were not as severe as in zone 1, but precautionary measures for potentially polluting activities were required, and where thin (< 6m) unsaturated zones prevail Zone 1 status was adopted. Excluding areas designated as Zone 1, Zone 2 areas made up about 18% of the Authority's area.

Zones 3 and 4 - These zones defined the outcrop of the granular formations. They were split into those formations which are important from the point of view of present and future water supplies (Zone 3), and those of less importance only likely to be developed for small local supplies (Zone 4). The slower flow velocities and greater capacity of granular formations to attenuate contaminants, particularly those with a clay content, were recognised and the restrictions imposed were therefore less onerous than for Zone 2. These zones together comprised about 42% of the Southern Water Authority area.

Zone 5 This status was given to the remaining area (25%) of the region dominated by major outcrops of clay. These formations support only very minor sources of groundwater and any restrictions in these areas were designed more for surface water protection.

The strata falling within each zone are listed in Table 2.

7.2.5 Classification of Strata

Table 2 shows the new classification of aquifer types and lists the Southern Region's strata with their old Southern Water Aquifer Protection Policy Zone designation.

7.3 Use of Old Maps with new Policy for Resource Protection

A set of 3 comprehensive maps on a scale of 1 : 100,000 was produced for the Southern Water Authority document. These have been circulated previously and for convenience will continue to be used during the interim transitional period in their original format. However in order to use them with the new Policy reference must be made to Table 3 which shows how the old Zones relate to the new Source Protection Zones and Resource Protection Zones.

Table 3

| <u>Old Southern Water Authority Aquifer Protection Zone</u> | <u>New National Policy Source and Resource Protection Zones</u> |
|---|---|
| 1 | I and II (Inner and outer Source Protection) |
| 2 | III and Major Aquifer |
| 3 | Major Aquifer |
| 4 | Minor Aquifer |
| 5 | Non Aquifer |

Clearly it is not possible to achieve a perfect correlation between the two classifications as they have been drawn up using different criteria, but as an interim measure the cross-referencing should facilitate use of the new document and provide an appropriate degree of protection. Reference to Tables 2 and 3 shows that some of the formations previously given only a moderate level of protection (Zones 3 and 4) are now given either major or minor aquifer status and will receive an improved degree of protection.

7.4 Source Protection Zones

7.4.1 It will be noted from Table 3 that the old Zone 1 areas can cover both the Inner and Outer Source Protection areas of the new policy. Initial modelling work on the new zones, using site specific data for chalk sources indicate that the new Inner Source Protection Zones will be considerably smaller than the previous Zone 1 areas, mainly because aquifer thickness figures used previously were somewhat smaller than now considered appropriate, and worst case figures were used for abstraction rates and aquifer properties. Two examples are given in Figure 1 illustrating initial model prediction for the new zones compared with the old Zone 1.

For the majority of sources which have not yet been modelled "a rule of thumb" will be adopted for the interim period. The new Zone I areas for the chalk sources will be deemed to comprise a zone defined by halving the dimensions of the old Zone 1 and the outer source protection zone (II) will be deemed to be equivalent to the original Zone 1. This will provide an appropriate degree of protection and facilitate a screening process for routine enquiries. More complex issues will require individual assessment.

7.4.2 The biggest difficulty in trying to merge the two policies is in defining the new Zone III, or total catchment zone. In south-east England, where effective rainfall is relatively low, the total catchment zones will be very extensive eg approx 18 hectares for a 10 Ml/d source. This will inevitably mean that most of the Chalk aquifer outcrop will eventually be allocated Zone III protection. Furthermore the restrictions to be applied for Zone III and major aquifers are virtually the same, so it is therefore appropriate to apply Zone III protection to all old Zone 2 areas for the time being.

7.4.3 For granular aquifers old Zone 1 protection was afforded by a circular area of 0.5km radius. Zone 2 status was given to a second outer circle of 1km radius. To assist in the use of the new policy these zones will continue to be used and the old Zone 1 and 2 will convert directly to the new Inner and Outer Source Protection Zone I and II respectively.

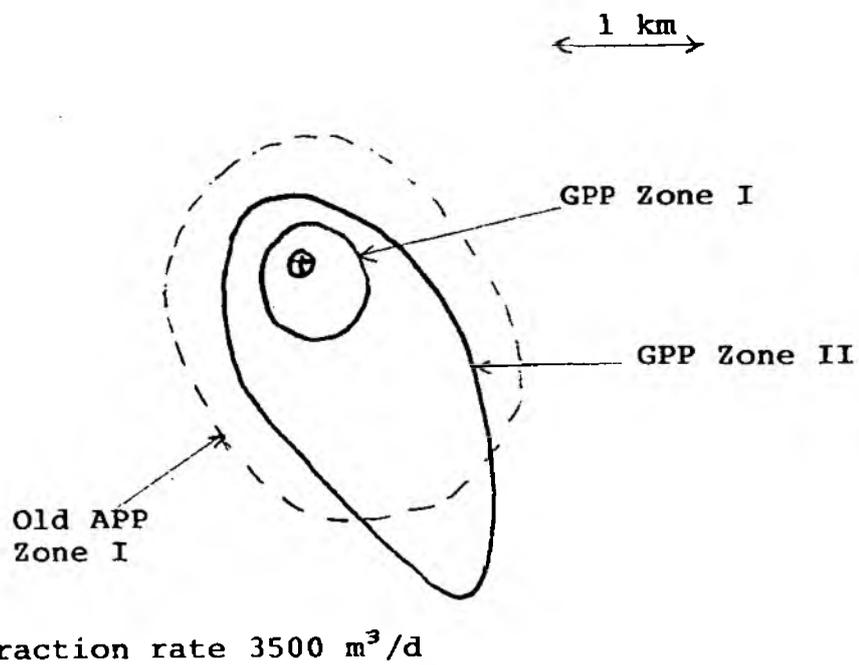
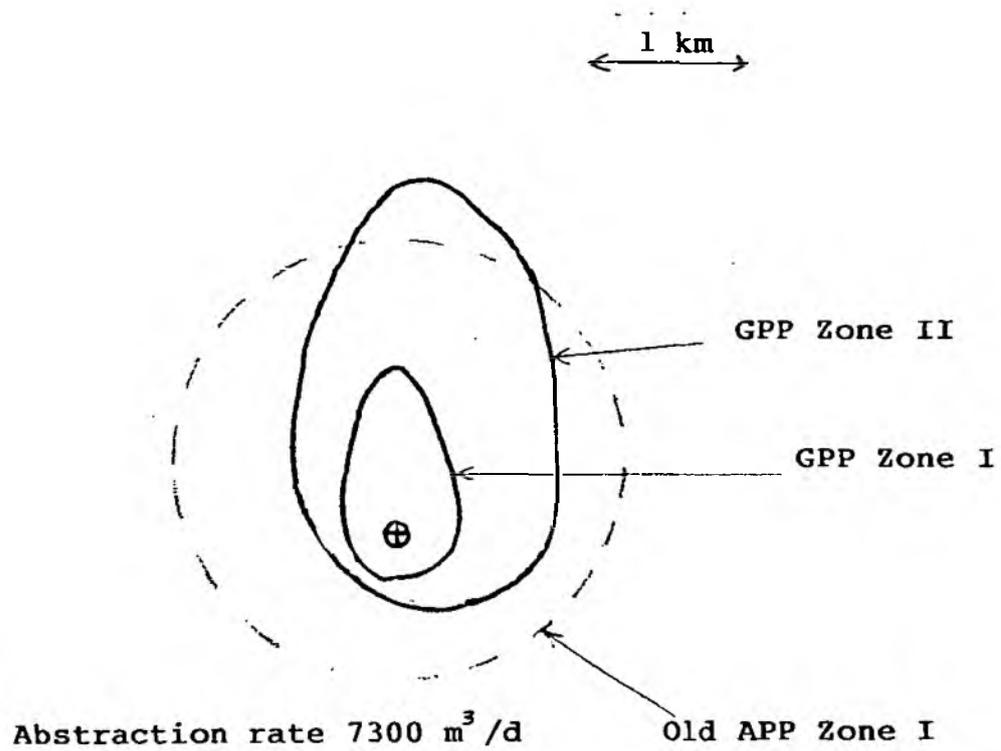


Figure 1 - Schematic illustration to compare old and new protection zones for two Chalk sources

7.4.4 These interim measures are designed to allow a transitional period between the old and new policies whilst awaiting the results of modelling and mapping. Inevitably some anomalies will arise when applying the new policy to the old maps, which are essentially for guidance only.

Where major development proposals are involved and/or the adoption of the standard interim measures are disputed (as being either too onerous or too lenient) every attempt will be made to evaluate proposals on an individual basis, using the best data available. Applicants will be asked to provide such data where there is nothing available.

7.5 New Maps and Source Protection Zones

New source protection zones are being drawn up by Consultants. This involves groundwater flow modelling after an extensive data collection exercise. Zones for approximately half of the public water supply abstraction sources will be available by summer 1993, but it will take at least another year before all zones have been drawn. The new zones will be used as they become available.

Simultaneously a national project is underway to produce groundwater vulnerability maps on a 1:100,000 County scale. These will take into account the influence of soil type on the major aquifers. In Southern Region a set of such maps using similar (but not identical) criteria was produced in 1990. These maps consider the combined effects of Drift and Soil cover on all aquifers within the Region. They were produced by the Soil Survey of England and Wales and the British Geological Survey and define four levels of vulnerability from "Extreme", for fissured aquifers with no drift cover and only thin sandy soils, to "Low", for a granular aquifer with clayey Drift cover and thick loamy soils.

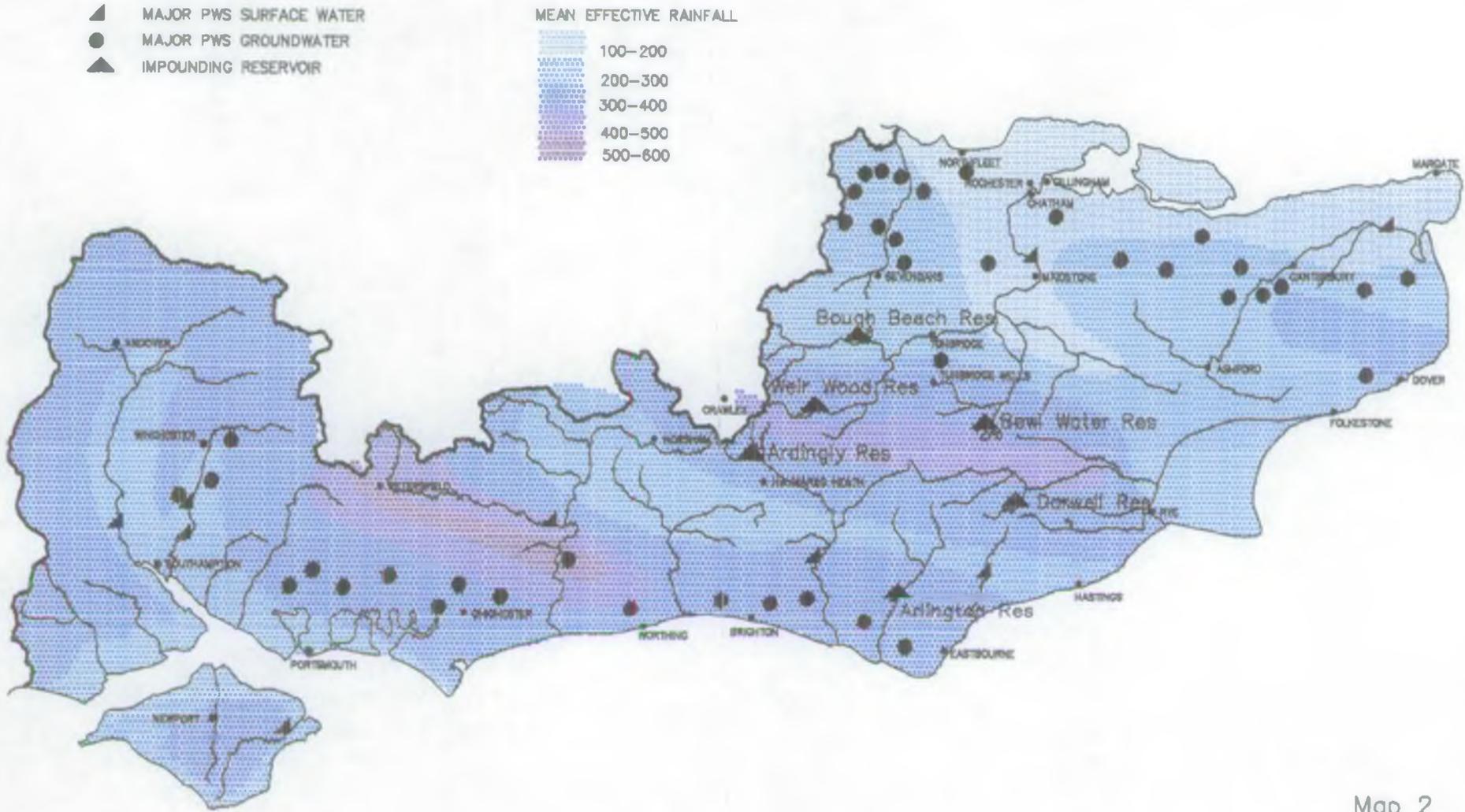
Their main use will be in the assessment of groundwater vulnerability to diffuse pollutants applied to the land surface such as nitrate and pesticides. It will also be possible to determine the Resource Protection status of any area by cross-referencing with Table 2.

The Southern Region maps are available now and will be used on a trial basis before deciding whether a new set, using the national criteria, will eventually supersede them.

8. CONCLUSION

In the past the Southern Region of the NRA has been fortunate to have a comprehensive aquifer protection policy of its own. This must now be adapted to comply with the national policy and a transitional period of several years is currently operating. This will be operated by reference to the policy statements and matrices contained within the new National Document, the Source Protection Zones shown on the old Southern Region aquifer protection maps, and the groundwater vulnerability maps, until such time as new Source Protection Zones and maps become available. Where anomalies occur in combining the two documents, and where major contentious issues are involved, individual assessment of proposals will be undertaken.

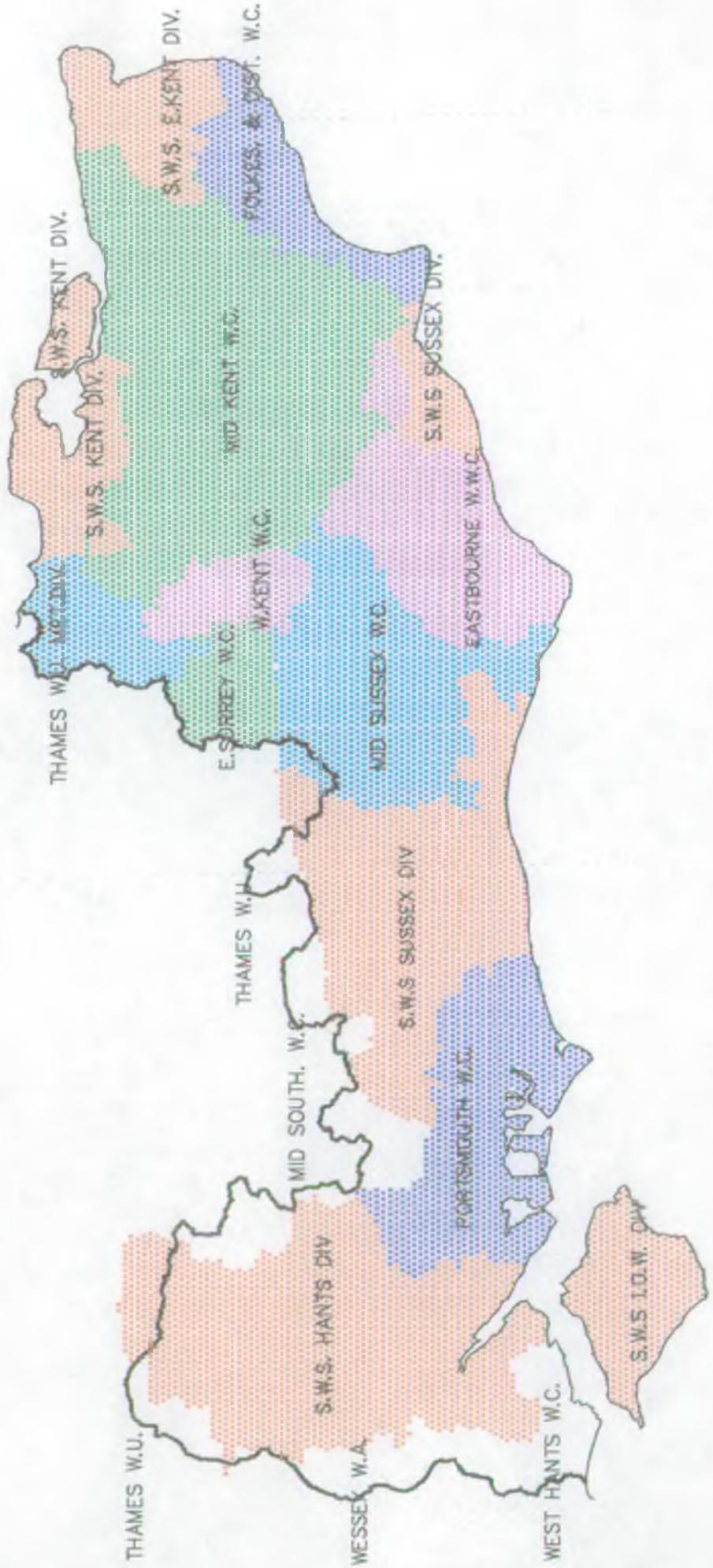
AVERAGE ANNUAL EFFECTIVE RAINFALL AND LOCATION OF EXISTING MAJOR PUBLIC WATER SUPPLY ABSTRACTIONS



Map 2

WATER COMPANIES NRA SOUTHERN REGION

Map 3



NATIONAL RIVERS AUTHORITY

SOUTHERN REGION ADDRESSES AND TELEPHONE NUMBERS

AREA OFFICES (RESOURCES/ENVIRONMENTAL PROTECTION)

Headquarters:

Guildbourne House
Chatsworth Road
Worthing
West Sussex BN11 1LD

Telephone (0903) 820692
Facsimile (0903) 821832

Groundwater Protection Team: Dick Flavin
Polly Meanley
Kathy Howard

| DISTRICT | AREA RESOURCES OFFICER | AREA ENVIRONMENTAL PROTECTION OFFICER | LOCATION | TELEPHONE NO | FAX NO |
|------------|-----------------------------------|---------------------------------------|--|--------------|-------------|
| Winchester | Peter Midgley | Ray Fisher | Sarum Court, Sarum Road, Winchester, Hants SO22 5DP | 0962 713267 | 0962 841573 |
| Chichester | Simon Vipond | Richard Hammond | Oving Road, Chichester, West Sussex PO20 6AG | 0243 786431 | 0243 780098 |
| Pevensay | John Headey | Keith Loy | Coast Road, Pevensay Bay, East Sussex BN24 6ND | 0323 762691 | 0323 767499 |
| Rye | John Headey (located at Pevensay) | Mike Duckett | Scots Float Depot, Military Road, Playden, Rye E Sussex TN31 7PH | 0797 223256 | 0797 226711 |
| Leigh | Steve Oakes | Colin Buckle | Medway House, Power Mill Lane, Leigh, Tonbridge Kent TN11 9AS | 0732 838858 | 0732 838868 |
| Canterbury | Derek Duly | George Rippon | Sturry Road, Canterbury, Kent CT2 0AA | 0227 765061 | 0227 762981 |

COUNTY AND DISTRICT COUNCILS IN NRA DISTRICTS

| AREA OFFICE | DISTRICT COUNCIL | | COUNTY COUNCIL |
|-------------------|--|--|--|
| <u>Winchester</u> | Basingstoke East Hampshire Eastleigh Fareham Gosport Havant Kennet | Medina Newbury Portsmouth Salisbury South Wight Southampton Winchester | Isle of Wight West Sussex Hampshire Wiltshire |
| <u>Chichester</u> | Adur Arun Brighton East Hampshire Horsham | Hove Lewes Mid Sussex Waverley Worthing | East Sussex West Sussex Hampshire |
| <u>Pevensey</u> | Eastbourne Hastings Lewes | Mid Sussex Rother Wealden | East Sussex |
| <u>Rye</u> | Ashford Hastings Rother | Shepway Tunbridge Wells Wealden | East Sussex Kent |
| <u>Tonbridge</u> | Ashford Bexley Bromley Dartford Gravesham Maidstone Mid Sussex | Rochester upon Medway Sevenoaks Tandridge Tonbridge & Malling Tunbridge Wells Wealden | Kent |
| <u>Canterbury</u> | Ashford Dover Gillingham Maidstone Rochester upon Medway | Shepway Swale Thanet Tonbridge & Malling | Kent |