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NRA Water Quality 29



NRA

*National Rivers Authority*

POLICY AND PRACTICE  
FOR THE PROTECTION OF  
GROUNDWATER

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DRAFT FOR CONSULTATION

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NOVEMBER 1991**

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**SUMMARY**

- 1 The National Rivers Authority has a duty under the 1989 Water Act (sections 106 and 125) to protect the quality of groundwater and conserve its use for water resources. This document sets out a draft policy for the protection of groundwater resources in England and Wales and provides a technical framework for its implementation. It is being circulated for comment to all interested parties.
- 2 Groundwater is unique among natural waters in the very high proportion which is used or available for use directly for water supply. It is a vital natural resource and under particular threat from human activity. That is why the Authority wishes to give a high priority to establish this national framework policy with the objective of maintaining and improving the quality and availability of groundwater.
- 3 The Authority would intend to use these statements of policy, not only to guide its own actions, but also to seek to influence the policies and decisions of the many government departments and public agencies whose own actions can influence the protection of groundwater.
- 4 The policy relies for its implementation on a series of vulnerability and protection zones maps which will be prepared over the next three years. These will be made available to all those engaged in all aspects of land use planning so that they may be aware of the potential impact of their proposals on groundwater.
- 5 Groundwater protection decisions are complex. They involve consideration of geology, soils, hydrogeology and geochemistry. They must take into account interaction with surface waters, land and air. They may require very detailed site investigations and monitoring over time before decisions can be made. The vulnerability concepts outlined in the document and the supporting maps provide a framework for decision making but may need to be qualified by detailed site-specific considerations.

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**NOTE:** THE LEGAL REFERENCES IN THE TEXT ARE TO THE ACTS CURRENTLY IN FORCE. THE WATER RESOURCES ACT 1963 AND THE WATER ACT 1989, AS THEY RELATE TO GROUNDWATER PROTECTION, ARE REPLACED ON 1 DECEMBER 1991 BY THE WATER RESOURCES ACT 1991, AND THE REFERENCES WILL BE APPROPRIATELY REVISED WHEN THE POLICY IS FORMALLY ISSUED.

## FIGURES, TABLES AND APPENDICES

Figure 1	Diagrammatic representation of water cycle showing groundwater and surface water relationships and groundwater pollution risks.
Figure 2	Examples to illustrate vulnerability.
Figure 3	Components of groundwater vulnerability protection zones.
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## **I. INTRODUCTION**

### **GROUNDWATER PROTECTION**

- 1.1 Groundwater forms that part of the natural water cycle which takes place within underground strata (aquifers); out of sight and, unfortunately, all too often out of mind.
- 1.2 The volume of water stored in the pores and fractures of the strata vastly exceeds the volumes of fresh surface water. Groundwaters have a substantial strategic significance in public water supply; they provide 35% of present demand and in many areas are the only available future resource. They also provide supplies for private abstractors who cannot obtain, or prefer not to use, water from the public mains.
- 1.3 The proper management of groundwater requires that its volume and quality is preserved. This is a difficult task. It is a problem of space, because, unlike rivers which flow in defined channels, in many parts of the country groundwater is present everywhere beneath our feet, at risk from the activity of man. It is also a problem of time, since due to the very slow movement of groundwater through the strata, problems can take a long time to manifest themselves. Groundwater is particularly at risk from distributed and diffuse sources of pollution which accumulate over many years and which may be virtually impossible, even regardless of cost, to clean up, even when the source of the problem is removed. The preservation of groundwater quality and yield is therefore of paramount concern.
- 1.4 The risk of pollution is increasing both from the disposal of waste materials and from the widespread use by industry and agriculture of potentially polluting chemicals in the environment. Pollution can occur either as discrete, point sources, such as from the landfilling of wastes, or from the wider, more diffuse use of chemicals, such as the application to land of fertilizers and pesticides. Man can also, through mineral extraction and changes in land use affect the future availability of groundwater resources by restricting recharge and diverting flow.
- 1.5 The purpose of protecting groundwater is not only to maintain the quality of water supplies from aquifers. Groundwater naturally feeds surface waters through springs and by base flows to rivers. In some areas this is a substantial component of the total river flow and thus the quality of the contributing groundwater can significantly influence surface water quality. Surface water and groundwater are intimately linked in the water cycle, with many common issues, and groundwater protection resources from the effects of man's activities is thus one part of the total protection of the water environment.

### **EXISTING PRACTICES**

- 1.6 The protection of groundwater resources is not the responsibility of any single body, which is perhaps best demonstrated by the fact that three separate bodies (NRA,

Waste Disposal Authorities and County Councils) were designated as competent authorities for the enforcement of the EC Groundwater Directive. This fact led many of the former Water Authorities, who between 1974 and 1989 had the lead responsibility, to publish Groundwater Protection Policies, a principal objective of which was to try and achieve a uniformity of action between the Water Authority and the other agencies through the various statutory and quasi-statutory procedures which existed. These policies evolved without any specific national coordination; they are different in approach and in their technical foundation and they have led to differences in practice across the country.

- 1.7 Although the Water Act 1989 has extended and strengthened the legislation relevant to the protection of groundwater, it has not, beyond transferring the regulatory role of Water Authorities to the NRA, reduced the number of agencies involved. While the National Rivers Authority is the main controlling Authority, it has to rely in many cases on legislation enforced by other bodies (see Table 2). The threats to groundwater are increasingly being recognised as substantial and widespread. Landfilling of wastes, redevelopment of contaminated land, solvent use and disposal, agricultural chemicals, storage of industrial materials and many other development and construction projects all present their own risks. The NRA therefore considers that there is an urgent need to integrate and update existing procedures. This document provides both a new technical framework so that risk can be identified by all parties involved, and establishes a set of policies which the NRA will seek to pursue, and influence others to pursue, in the interests of protecting this vital and threatened part of our water resources.

## **NRA POLICY**

- 1.8 In going about this task the NRA has reviewed the practices of the former Water Authorities. It has also reviewed practices in Europe, the United States of America and Canada. It is now consulting interested parties - other regulatory bodies, industry, agriculture and water users. It has been advised by the British Geological Survey and by the Soil Survey and Land Research Centre, who have both provided specialist technical advice and who, through their geological and soils databases, are contributing to the vulnerability mapping, which forms the basis of the definition of risk to groundwaters.
- 1.9 A key objective has been to devise a framework which covers all types of threat to groundwater, large and small, from point and diffuse sources, and by both conservative or degrading pollutants. It is designed to provide a basis for implementation of legislation in England and Wales and anticipates, as far as possible, the likely requirements of future European legislation on landfill and diffuse pollution.
- 1.10 This document provides:

**CLASSIFICATION OF GROUNDWATER VULNERABILITY** based upon the key variables identified which determine vulnerability,

- \* proximity to source of abstraction

- \* nature of strata
- \* nature of overlying soil cover
- \* depth to water table (thickness of the unsaturated zone).

The NRA is already engaged on a programme of defining source protection zones and mapping vulnerability by reference to geology and soils. This will not be completed for some time, but the policy can be applied in the meantime by reference to existing NRA maps, to standard geological or soil maps, or by direct site evaluation.

## **STATEMENTS ON GROUNDWATER PROTECTION POLICY**

This document contains policy statements on the following aspects of groundwater protection.

- \* physical disturbance of aquifers affecting quality and quantity
- \* waste disposal to land
- \* contaminated land
- \* disposal of slurries and sludges to land
- \* discharges to underground strata
- \* unacceptable activities in the Inner Source Protection Zone (Zone\_1)
- \* diffuse pollution

The policy statements are directed at potential developers, landowners and consultants for example as well as regulatory agencies and can be used to gauge the likely response of the NRA to a proposal or activity.

- 1.11 In addition each region of the NRA will be publishing an appendix giving information relevant to local circumstances and providing a statement of how maps and other documents currently existing in those regions will be interpreted in the light of this new national statement.
- 1.12 The variability of geology and soils, of hydrogeology, of wastes in the natural environment and of the various preventative measures which might be taken can mean that groundwater protection decisions are complex, dependent on local circumstances, and not capable of prescription within a general policy. On any issue the NRA will determine its position by assessment of relevant local factors, but within the framework of this policy statement.



## 2. KEY PRINCIPLES

### 2.1 WATER RESOURCE PROTECTION

The NRA was created by the Water Act, 1989 with duties which include maintenance and improvement of:

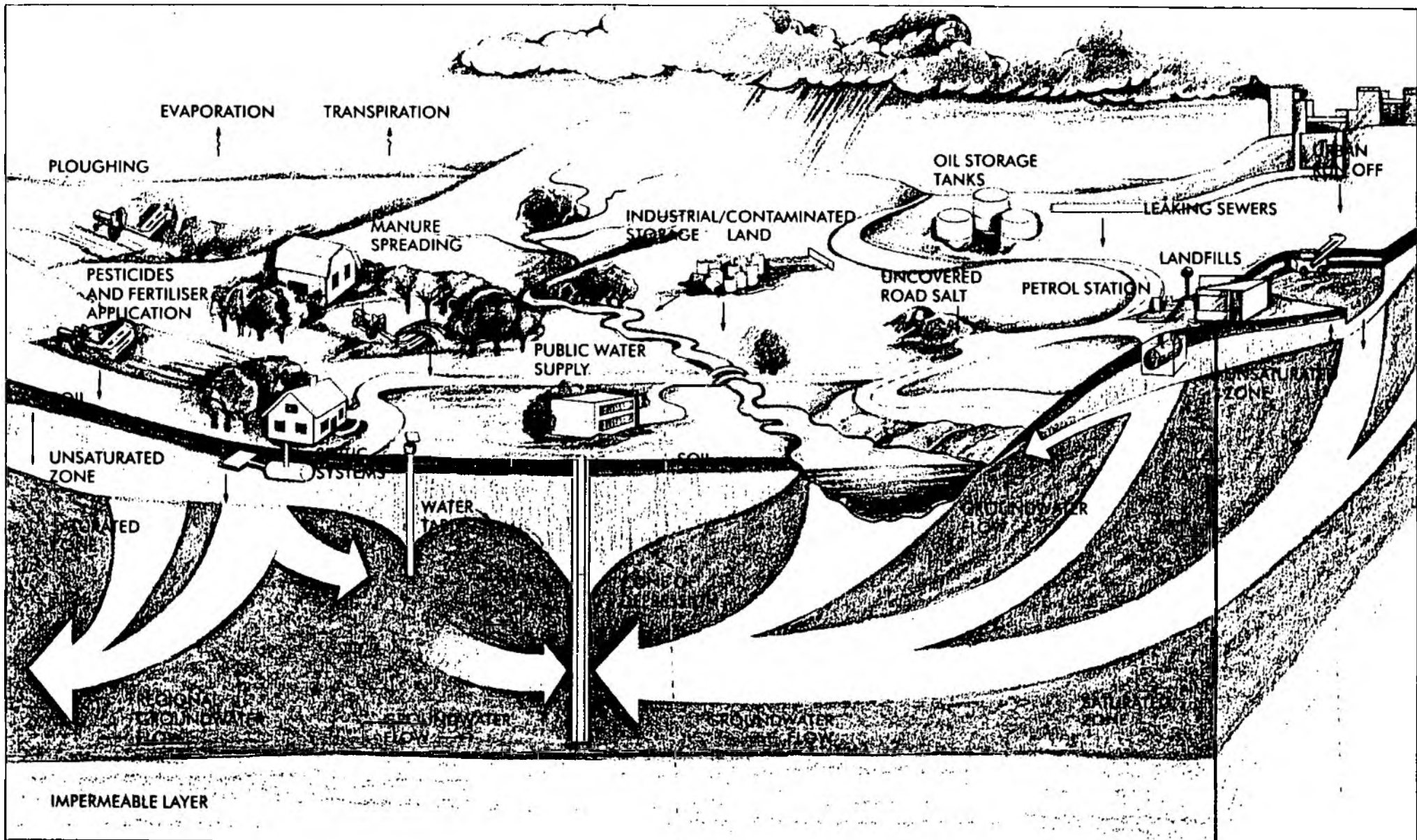
- \* water quality of controlled waters (Section 106).
- \* conservation and proper use of water resources (Section 125).

The duties lead to the need to develop policies, both for the NRA to apply in respect of its own powers, and for the NRA to encourage other bodies to apply where they have powers and responsibilities for the protection of the quality and availability of water resources. Groundwaters are controlled waters. Under Section 104 of the Water Act 1989, all controlled waters may be subject to a system of classifying water quality. Also, under Section 105, the Secretary of State for the Environment may set Water Quality Objectives for controlled waters. Water Quality Objectives require that particular waters will achieve and maintain specific targets for water quality. Protection policies are seen as one of the means by which these objectives can be achieved, particularly in respect of waters with a current or potential use for water supply. This can only be achieved by controlling activities at the surface which may lead to the deterioration of the groundwater quality and quantity.

### 2.2 GROUNDWATER PROTECTION

Groundwaters make up a very high proportion of the freshwater resources of England and Wales. Approximately 75% of all abstracted groundwater is used for public supply and it makes up 35% of the total public supply. It is also an important source for industry and agriculture as well as sustaining the base flow of rivers. Protection of groundwater quality is of critical importance for the following reasons.

- \* If groundwater becomes polluted, it is very difficult to rehabilitate. The slow rates of groundwater flow and low microbiological activity limit any self-purification and processes which take place in surface water systems in days or weeks are likely to take decades in groundwaters. It is therefore better to prevent or reduce the risk of groundwater contamination, rather than to deal with its consequences.
- \* Its major use is for potable supply which requires that a high quality standard must be maintained for all resources.
- \* The aquifers act as storage for considerable volumes of high quality water which requires little treatment prior to use, even for potable supply. The loss of this widely available low cost water resource would require more expensive water resource options to be developed. There are significant uses for private



DIAGRAMMATIC REPRESENTATION OF WATER CYCLE SHOWING GROUNDWATER/SURFACE WATER RELATIONSHIPS AND GROUNDWATER POLLUTION RISKS.

Figure 1

potable supplies, for example in some hospitals and in bottling and food processing, independent of the public system.

It is intended that Water Quality Objectives for groundwater be established by the end of 1992 based upon the principal general use for groundwater, for water supply. Therefore the standards will relate directly to those set by the EC Directive on the Quality of Water Intended for Human Consumption (80/778/EEC).

### **2.3 RELATIONSHIP TO SURFACE WATER RESOURCE PROTECTION**

Groundwaters are part of the hydrological cycle and drain naturally to springs, streams and rivers to which they contribute a major proportion of their flow in dry weather. The protection of groundwaters thus helps to ensure the acceptable quality of this base flow. Figure 1 shows the water cycle and indicates the relationship between surface water and groundwater.

Protection strategies designed to maintain groundwater quality have implications for surface water protection in that they tend to encourage surface run off rather than seepage to underground waters. Soakaways to remove surface waters can have adverse impacts on groundwaters. These issues are addressed in the policy to ensure that an integrated approach to the protection of the water environment as a whole is followed.

There are situations where the attenuating properties of soil or rock can be as important in reducing the impact of certain pollutants in like manner to the attenuation and dispersion which occurs in rivers. However, such processes are not always available or suitable, for example in landfills where the landfill construction has removed soil.

### **2.4 AWARENESS OF GROUNDWATER PROTECTION**

Because groundwater resources are "out of sight" there is always the risk that they will be too much "out of mind" when land use management decisions are made. The lack of awareness of the importance of groundwater protection occurs within as well as outside of the field of water and environment specialists and an essential feature of the introduction of a national policy for groundwater protection is to promote publicity and education of the risks and the means of overcoming them.

Apart from the NRA there are a number of other bodies who are involved in, and have some responsibility for, or the ability to influence the protection of, groundwater. These are listed in Table 2.

### **2.5 OBJECTIVES OF THE GROUNDWATER PROTECTION POLICY**

The objectives of the policy are to provide a statement of means by which the NRA will meet its statutory responsibilities for the protection and conservation of groundwater resources and in particular;

- \* to ensure that all risks to groundwater resources, point source and diffuse, are dealt with in a common framework;
- \* to provide a common basis for decisions affecting groundwater resources within and between its regions;
- \* to encourage other bodies with statutory responsibilities for the protection of groundwaters to adopt approaches compatible with those of the NRA.

## 2.6 APPROACH TO GROUNDWATER PROTECTION DECISIONS

The NRA recognises that there are many factors affecting the risk of groundwater contamination at any location. These will vary according to the type of activity proposed and the vulnerability of the underlying groundwater to pollution from the surface. In considering the risks in any given situation there needs to be a professional assessment made of the local circumstances before any decision is made. Consideration needs to be given to the balance of interests in the water environment as well as in a wider context. Therefore the policies and principles outlined are seen as a framework for decision making and not necessarily prescriptive in any individual circumstance.

### **3. POWERS AND RESPONSIBILITIES FOR GROUNDWATER PROTECTION**

- 3.1 The National Rivers Authority has a duty to maintain and, where relevant, improve the quality and yield of groundwater resources for abstracted and indirect uses. This responsibility is implemented by the use of its own powers (Table 1) and through statutory and non statutory consultation with other regulatory agencies. There are other bodies responsible for aspects of groundwater protection in England and Wales. These are listed in Table 2.
- 3.2 Some groundwaters are unsuitable for potable supply or other uses by virtue of "natural contamination", for examples brines and metal-rich groundwaters and so for a body of water to become polluted an unnatural addition of chemical compounds or microbial contaminants has to be made. The UK legislation on groundwater protection implements the EC Directive on the Protection of Groundwater Against Pollution Caused by Certain Dangerous Substances (80/68/EEC) in which pollution is defined as 'the discharge by man, directly or indirectly, of substances or energy into groundwater, the results of which are such as to endanger human health or water supplies, harm living resources and the aquatic ecosystem or interfere with other legitimate uses of water'. The Department of the Environment/Welsh Office, in Circulars 4/82 and 20/90, state that any discharge containing certain specific substances (List I and List II) in such quantity as to require a significant difference in the degree of treatment in the receiving water before use should be regarded as falling within the scope of the Directive.

The main legislative provisions implementing the protection of groundwater in England and Wales are outlined below. They are shown together with other UK and European legislation on Tables 1 and 2.

#### **3.3 EC Directive on the Protection of Groundwater Caused by Certain Dangerous Substances (80/68/EEC)**

This Directive prohibits the direct or indirect discharge into groundwater of List I substances and limits discharges of List II substances unless prior investigation can establish that pollution of groundwater will not occur. In the UK it is currently implemented out by the Control of Pollution Act 1974, Part I, the Environmental Protection Act, 1990 (which will eventually completely supercede the Control of Pollution Act) and the Water Act 1989. The designated substances are listed in Appendix 1.

#### **3.4 Control of Pollution Act, 1974**

Part I deals with the disposal of waste to land. The Act is administered by the Waste Disposal Authorities (District Councils in Wales and the former Metropolitan County areas and Shire County Councils in England). The NRA is a statutory consultee of each Waste Disposal Authority (WDA) and may object to the Secretary of State if a

WDA proposes to issue a licence to handle waste or operate a landfill site which does not comply with its requirements to protect the water environment.

### **3.5 Environmental Protection Act 1990**

Part I of the Environmental Protection Act relates to the application of integrated pollution control to the potentially most seriously polluting industrial processes including releases of waste to all controlled waters. Part I is enforced by HM Inspectorate of Pollution (HMIP). Authorizations may not be granted if the NRA considers that a Water Quality Objective (when these are implemented) will be breached and the NRA may impose its own conditions on such authorizations.

Part II of this Act, when fully implemented, will supersede the provisions of Part I of the Control of Pollution Act, 1974. Waste management will be controlled by Waste Regulation Authorities through the granting of Waste Management Licences. These licences will remain in force until such time as their surrender is accepted. The NRA is a statutory consultee over both the issue and surrender of licences with similar powers of representation to the Secretary of State as under the Control of Pollution Act.

### **3.6 Water Act 1989**

The NRA controls the direct and indirect discharge of trade or sewage effluent onto or into land or into groundwater, as well as the direct discharge of any poisonous, noxious or polluting matter into controlled waters under Part III of the Water Act 1989. A discharge occurring as a result of a disposal licence issued under Part I of the Control of Pollution Act 1974 (or Environmental Protection Act 1990 when implemented) may obviate the need for a further consent.

### **3.7 Town and Country Planning Act, 1990**

Many developments may pose a direct or indirect threat to groundwater resources. Where planning permission is required (eg chemical stores, residential development, mineral extraction, industrial development) often the only control is by means of conditions on the permission document, or by refusal of permission. It is, therefore, important to recognise developments that may be a potential risk to groundwater resources.

TABLE 1

**GROUNDWATER PROTECTION LEGISLATION DIRECTLY CONTROLLED BY THE NATIONAL RIVERS AUTHORITY**

ORIGIN	LEGISLATION	NRA ROLE
European	EC Groundwater Directive (80/68/EEC)	Competent authority in association with Waste Disposal Authorities and Mineral Planning Authorities
	EC Directive on Diffuse Pollution by Nitrates (to be adopted in 1991)	Nomination of vulnerable areas; monitoring of achievement
U K	Water Act 1945 (s.14(9))	Powers to control waste of water resources by artesian overflow
	Water Resources Act 1963 (s.23)	Powers to control by licence most types of abstraction
	Water Resources Act 1963 (s.78)	Powers to preserve and protect groundwater during mineral exploration
	Water Act 1989 (s.105)	Provides for definition of Water Quality Objectives for controlled waters
	Water Act 1989	Powers to control discharges to controlled waters
	Water Act 1989 (s.110)	Powers under regulations to require pollution prevention measures to be taken
	Water Act 1989 (s.111)	Provision for statutory water source protection zones
	Water Act 1989 (s.112)	Provision for Nitrate Sensitive Areas (to be used to implement the EC Nitrate Directive)
	Water Act 1989 (s. 115)	Powers to take remedial action to prevent pollution occurring or continuing

TABLE 2

## OTHER BODIES WITH RESPONSIBILITY FOR ASPECTS OF GROUNDWATER PROTECTION IN ENGLAND AND WALES

AGENCY	AREA OF RESPONSIBILITY	RELEVANT LEGISLATION	LOCUS OF NRA
Department of the Environment	Sponsoring ministry of NRA	Water Act 1989	Direct Liaison
	Making of regulations under the Water Act 1989	Water Act 1989	Direct Liaison
	Determination of appeals on licences to abstract from, and consents to discharge to, groundwater	Water Resources Act 1963 Water Act 1989	Regulating Body
	Determination of appeals on waste disposal licences	Control of Pollution Act, Part I	Statutory Consultee
	EC Groundwater Directive	80/68/EEC	Competent Authority, with others
	EC Nitrate Directive		Competent Authority
	EC Landfill Directive (draft)		To be determined
	Mineral Extraction policy		Consultee
	Waste Management Policy		
	Contaminated land policy		Consultee
Her Majesty's Inspectorate of Pollution	Auditing body for waste regulation	Environmental Protection Act 1990	Indirect liaison
	Discharge to groundwater from prescribed processes	Environmental Protection Act 1990	Direct liaison
	Discharge of radioactive substances to groundwater	Radioactive Substances Act 1960	No formal contact
	Prevention of land contamination from certain substances	Environmental Protection Act 1990	No formal contact
Ministry of Agriculture	Nitrate Sensitive Areas	Water Act 1989	Direct liaison
	Pesticide Regulations		Consultee
	Code of Good Agricultural Practice	Water Act 1989	Consultee
	Mineral Water Regulations	S.I. 1985 No. 71	No formal contact
Department of Energy	Licensing of Oil Pipelines	Pipelines Act 1962	No formal contact
County Councils, Metropolitan Borough Councils, Welsh District Councils	Waste Disposal Regulation, Waste Disposal Plans	Control of Pollution Act 1974, Town and Country Planning Acts	Statutory Consultee
	Competent Authority for waste to land and redevelopment of contaminated land	EC Groundwater Directive	None
	Mineral extraction regulations	County Planning (Minerals) Act 1981	Statutory Consultee
District Councils and Unitary Authorities	Development planning and contaminated land policy	Town and Country Planning Acts	Consultee
	Registers of Contaminated Land	Environmental Protection Act 1990	Direct Contact
	Competent Authority	EC Mineral Water Directive (80/777/EEC)	No formal contact
English Nature and the Countryside Council for Wales	Consultee on issue of licences to abstract and consents to discharge with conservation implications	Water Act 1989	Direct contact
British Geological Survey	Mineral Water Regulations	SI 1985 No. 71	No formal contact



## 4. CONCEPT OF VULNERABILITY

- 4.1 Wherever groundwater is present it is to some degree at risk from the activities of man. No soil or rock is completely impermeable, no pollutant completely immobile. The concept of groundwater vulnerability recognises that risks of pollution from a given activity are greater in certain hydrological, geological and soil situations than others. By classifying vulnerability using these criteria and by preventing or controlling activities likely to cause pollution where vulnerability is greatest, protection activities can be concentrated in the areas of greatest need. In this section, the reasoning behind the zoning system used throughout the policy is explained.
- 4.2 **VULNERABILITY** depends upon the physical circumstances at a location and, in simple terms, provides a measure of the ease with which unacceptable effects upon groundwater resources can take place.
- 4.3 **RISK** arises when an activity is proposed at a given location. Risk can be mitigated by preventative measures and different levels of risk will be acceptable depending on the identified vulnerability.
- 4.4 **Vulnerability of resources** Three factors have been identified which define the vulnerability of groundwater resources to a given pollutant or activity:
- \* nature of strata (both solid and drift);
  - \* nature of overlying soil;
  - \* depth of unsaturated zone.

Any or all of these factors can be relevant in assessing risk to groundwater resources. Criteria have been developed for each based on soil, geological and hydrogeological characteristics to identify vulnerability in each of the above. The vulnerability of groundwater resources at any location can be inferred from known nearby circumstances and can be mapped with varying precision depending on the availability of relevant data. However, it can only be established with confidence by direct investigation. The balancing of risk against vulnerability in any case necessarily means a subjective decision is made.

- 4.5 **Vulnerability of sources of groundwater in use** The above factors define the vulnerability of all underground waters, whether they are exploited or not. This necessary because it is a requirement of both European and national legislation are that all groundwater should be afforded protection, regardless of use. However, in certain circumstances it is also necessary to classify vulnerability in terms of a further factor,
- \* proximity to source

because of the practical need to give priority to existing uses, particularly in the case of degrading pollutants where distance from source can be a material factor in assessing risk of contamination to water in use. The special case of source protection and the definition of source protection zones is described in Section 5.

#### 4.6 NATURE OF STRATA

Three types of strata have been defined for this purpose. The classification is based upon the nature (that is, the physical, chemical and biological characteristics) of the strata. In practice, these distinctions also reflect the importance of the various strata for water resource purposes.

#### 4.7 **Aquifers - Types A and B** These are defined as areas of outcrop of the rock types which contain groundwater in exploitable quantities for any use. These strata cover about 40% of England and Wales and include a variety of aquifers of different degrees of strategic importance and different hydraulic characteristics (fissured, fissure-porous and porous) and lithology. All groundwaters are controlled waters and are afforded the same degree of protection, but in some circumstances it is convenient to subdivide the aquifers into:

Type A - Major Aquifers - These are highly permeable strata usually with the known or probable presence of significant fracturing. They are highly productive and can yield enough water for large abstractions for public supply and other purposes.

Type B - Minor Aquifers - These can be fractured or potentially fractured rocks which do not have a high primary permeability. Rocks which are not significantly fractured but are variably porous are also classed in this category. Strata where multiple layers of permeable and low permeability rock are interbedded are also included in this category. Although these aquifers will seldom produce large quantities of water for abstractions, they are important both for small local supplies and in supplying base flow for rivers.

#### 4.8 **Non-Aquifers - Type C** These are defined as areas of outcrop of rock types of negligible permeability that are generally regarded as not containing groundwater in exploitable quantities. However, few rocks can be regarded as totally impermeable and some non-aquifers can yield water supplies in sufficient quantities for domestic use. In addition, groundwater flow through such rocks, although imperceptible, does take place, and needs to be considered in assessing the risk associated with very slowly degrading pollutants.

In certain locations non-aquifers can be present as only thin deposits or even be totally removed by quarrying. In these situations the vulnerability would be related to that of the underlying strata.

4.9 Rocks with the same geological classification may be recognised as being of different vulnerability because of difference in hydrogeology in different parts of the country. Appendix 2 gives the standard national classification produced for the NRA by the British Geological Survey, but this may be varied in detail from region to region of the NRA to reflect local circumstances. Such variations will be defined in separate regional appendices.

4.10 **Drift** In many areas drift deposits are present overlying the solid geology. Such deposits are variable vertically and horizontally in both thickness and lithology. Where the Drift is of substantial thickness and of low permeability it can provide an effective barrier to surface pollutant migration. It is relevant to the assessment of vulnerability but in all cases detailed investigations are necessary to assess the local characteristics of the Drift deposits. The vulnerability maps will show where Drift is present but will make no judgement on its quality and properties in any particular location.

#### 4.11 **NATURE OF OVERLYING SOIL**

Consideration of the nature of the overlying soil is not relevant where the soil layer has been removed (eg landfill, quarrying). However, risk from pollution by activities such as spreading of sludges and manures and from many types of diffuse pollution does depend upon the attenuating characteristics of the soil. For this purpose the soil is taken to be the weathered zone affected by living organisms and undergoing seasonal change in moisture, temperature and gaseous composition. In the UK it may extend to up to 2 metres in depth. Three soil vulnerability classes have been defined on the basis of the physical properties of the soil which affect the downward passage of water and of the ability of the soil to attenuate or prevent pollution from three types of pollutant: (i) diffuse pollutants which can be retained in the soil layer (eg pesticides), (ii) conservative diffuse pollutants which can readily pass through the soil layer (eg nitrates) and (iii) liquids (from slurries and manures). The physical properties include soil texture, structure, soil water regime and the presence of distinctive layers such as raw peaty topsoil and rock or gravel at shallow depth.

**Class 1 (Soils of high vulnerability)** Soils with little ability to attenuate diffuse pollutants and in which non-absorbed diffuse pollutants and liquid discharges will leach rapidly are Class 1 soils. Three sub-classes are recognised, a) soils which are exceptionally vulnerable to liquid discharges because they are either very shallow, or susceptible to rapid by-pass flow directly to rock, gravel or groundwater. b) Deep, permeable coarse textured soils which are vulnerable to most types of pollutant because of their rapid drainage and low attenuation potential. c) Coarse textured or moderately shallow soils which are vulnerable to non-adsorbed pollutants and liquid discharges but which have some ability to attenuate adsorbed pollutants because of their relatively large clay or organic matter content.

**Class 2 (Soils of intermediate vulnerability)** Class 2 soils which have a moderate ability to attenuate diffuse pollutants or in which it is possible that some non-absorbed diffuse pollutants and liquid discharges could penetrate the soil layer. Two subdivisions are recognised.

**Class 3 (Soils of low vulnerability)** These are soils in which pollutants are unlikely to penetrate the soil layer because water movement is largely horizontal or which have a large ability to attenuate diffuse pollutants. Generally, these are likely to be clay rich soils. It must be recognised that run-off from these soils may contribute to groundwater recharge elsewhere in the catchment.

4.12 The Soil Survey and Land Research Centre have developed a classification of soil types by their physical and chemical properties into these three classes for the NRA. The variety of soils and possible pollutants is wide and classification is necessarily generalised and individual circumstances will require more detailed evaluation. Appendix 3 shows examples of soil series which fall into the three soil classes.

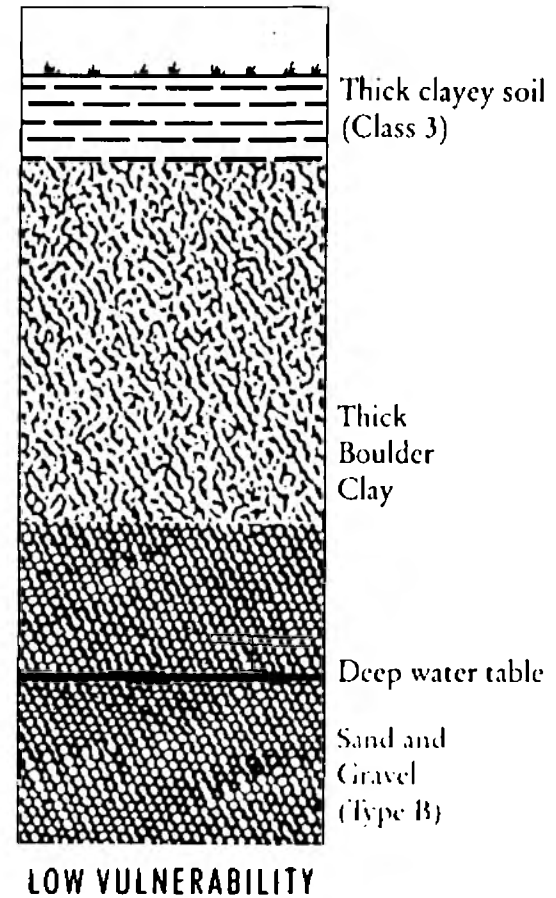
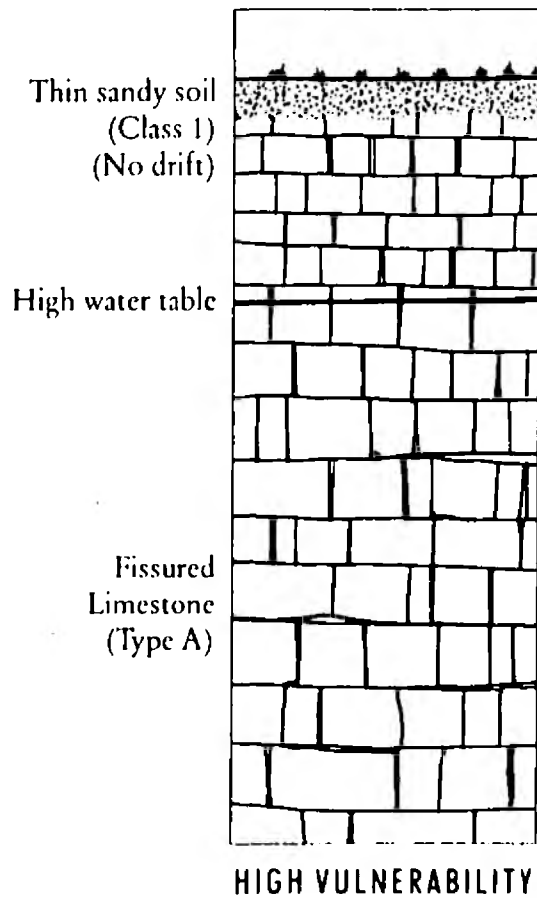
#### 4.13 DEPTH OF UNSATURATED ZONE

The unsaturated zone is that part of the aquifer which lies above the water table. It can play an important role in both attenuating pollutants, through physical, chemical and biochemical processes, and by acting as a delay mechanism. Travel times through the unsaturated zone can vary depending on the geology and the rainfall recharge. Fissures in the aquifer will allow faster movement whilst rocks where intergranular flow is predominant may act as an impediment to a significant degree. Low permeability horizons, such as clay layers, will also be highly influential in inhibiting infiltration. In these latter cases the presence of a deep unsaturated zone may be beneficial in protecting groundwater quality, whilst in fissured limestone strata, for example, little benefit will be gained. For non-degradable pollutants the delay mechanism may only be effective in allowing development of remedial action in the longer term.

The unsaturated zone in fissured aquifers can also act as a means of delaying and smoothing out the effects of severe rainfall events. These would otherwise be reflected in higher surface water flows through rapid spring discharge.

#### 4.14 ASSESSING TOTAL VULNERABILITY

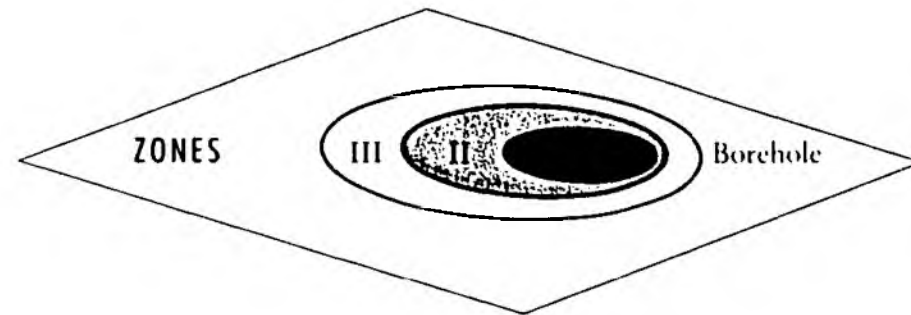
Figure 2 illustrates two situations where vulnerability varies. The fissured limestone aquifer is an example of very high vulnerability whereas the sand and gravel aquifer, overlain by low permeability clay is much less vulnerable. Not all the above factors are relevant in all circumstances. For example the type of soil is of no relevance to the assessment of risk from most types of landfilling of wastes which takes place below or in the absence of a soil layer, but is very important in assessing risk from diffuse pollution. The different factors are therefore to be considered only when relevant. Where they are relevant they act cumulatively to give an assessment of total vulnerability of the resource. This is shown conceptually in Figure 3 which shows the superposition of the various vulnerability "maps" for each factor, together with the source protection zones (described below), which may be relevant when the protection of an existing use needs to be taken into consideration. At present the base data for assessing vulnerability is incomplete and mapped to different scales but it is envisaged that, in due course, mapping of vulnerability data can be done within the framework of a geographical information system (GIS).



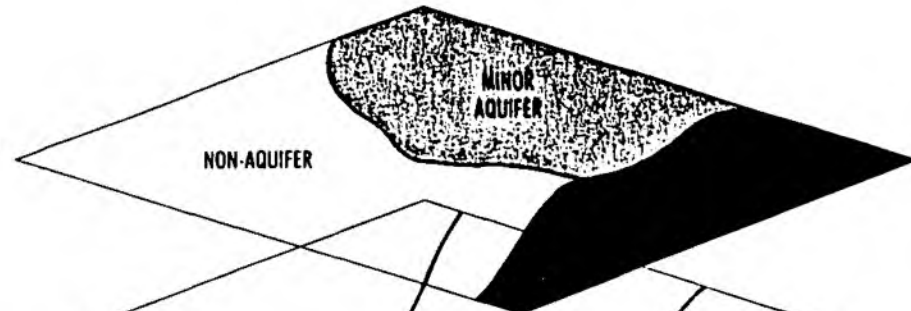
EXAMPLES TO ILLUSTRATE TOTAL VULNERABILITY

Figure 2

SOURCE  
PROTECTION



Geological Vulnerability

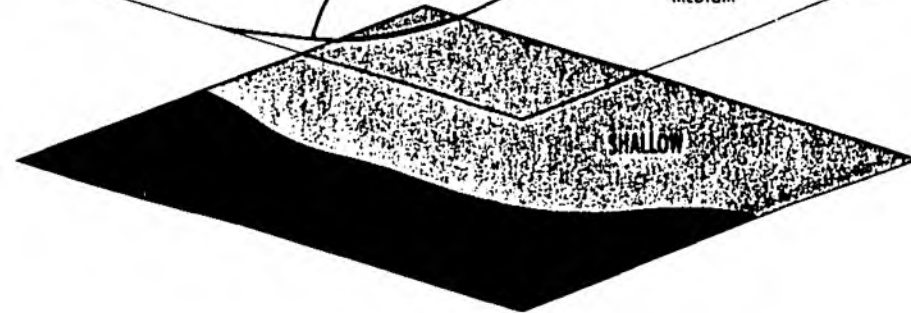


Soil Vulnerability



RESOURCE  
PROTECTION

Depth to  
Water Table



COMPONENTS OF GROUNDWATER VULNERABILITY

Figure 3

## 5. DEFINITION OF SOURCE PROTECTION ZONES.

- 5.1 The proximity of an activity to a groundwater abstraction is one of the most important factors in assessing the vulnerability of an existing groundwater use. All sources, including springs, wells and boreholes, are vulnerable to contamination and need to be protected. Normally the NRA will only predefine zones for certain sources. These will be those abstracting greater than 1 Ml/d and where the water is used for public supply, other private potable supply (including mineral and bottled water) and in commercial food and drink production.

Three of these groundwater **SOURCE PROTECTION ZONES** are recognised:-

- \* Zone I (Inner Source Protection);
- \* Zone II (Outer Source Protection); and
- \* Zone III (Source Catchment).

The orientation, shape and size of the zones are determined by the hydrogeological characteristics of the strata and the direction of groundwater flow.

### 5.2 **ZONE I (INNER SOURCE PROTECTION)**

This zone is located immediately adjacent to the groundwater source and is designed to protect against the effects of human activity which might have an immediate effect upon the source. It is the area defined by a 50 day travel time from any point below the water table to the source and as a minimum of 50 metres radius from the source. This 50 day travel time zone is based on the decay period for biological contaminants and on established practice in many other countries. The zone is not defined where the aquifer is confined beneath substantial impermeable cover.

In situations where there is a deep unsaturated zone or thick drift cover it may be appropriate to take into account vertical unsaturated zone travel time in the definition of Zone 1.

Included within this zone is the land immediately adjacent to the source and within the ownership of the operator of the source, where operating procedures designed to minimise pollution should be in force. The NRA has established a best practice statement relating to this operational area which it expects source owners to apply.

### 5.3 **ZONE II (OUTER SOURCE PROTECTION)**

This zone is of larger areal extent than Zone I and is the area defined by a 400 day travel time from any point below the water table to the source. The travel time is based upon that required to provide delay and attenuation of slowly degrading

pollutants. Because of the need to ensure a reasonable level of dilution and to allow for the variable and unpredictable presence of fissuring in porous aquifers, Zone II will not be less than 25% of the source catchment area. This zone is not generally defined for confined aquifers.

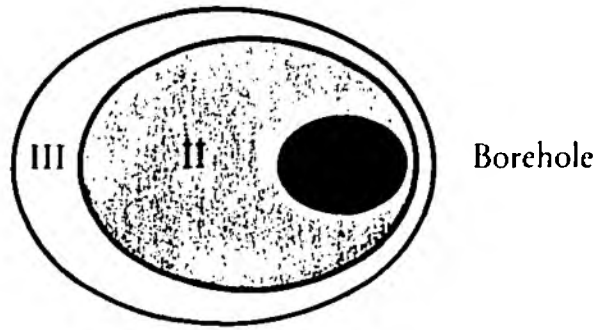
#### 5.4 ZONE III (SOURCE CATCHMENT)

This zone defines the complete catchment area of a groundwater source such that all groundwater within it will eventually discharge to the source. It is defined as an area needed to support the abstraction from long term annual groundwater recharge (effective rainfall). For wells and boreholes the area will be defined on the authorised abstraction rate whilst, for springs, the area will be defined by the best known value of average annual total discharge. In areas where the aquifer is confined beneath impermeable cover the source catchment may be some distance from the actual abstraction.

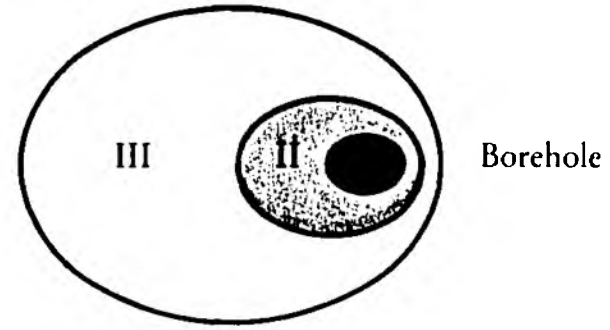
- 5.5 The relationship between the three zones and the groundwater source is shown in Figure 4. The diagram shows the variation in the relationship of the zones in four situations. These are abstractions from a low effective porosity Chalk aquifer, a high effective porosity Triassic Sandstone aquifer, a confined aquifer and a spring. These situations show a range of possible relationships and are necessarily idealised cases. In reality, the size, shape and relationship of the zones will vary significantly depending on the soil, the geology, the amount of recharge and the volume of water abstracted. It is unlikely that any two abstractions will have the same shaped zones but the broad differences indicated in the diagram will still hold true. For example the catchment area for a given abstraction will be greater if effective rainfall is less. The area drawn on by a pumping borehole in an aquifer with relatively low effective porosity or storage, like the Chalk, is greater (and the travel times faster) than in an aquifer with higher storage capacity like the Triassic Sandstones. This will have the effect that in a sandstone aquifer Zone II is likely to be significantly smaller than Zone III whereas in a Chalk aquifer the sizes will be more comparable.

The areal extent of Zone III will largely depend on the volume abstracted and the effective rainfall. It could vary from tens to a few thousands of hectares in area. The shape will be variable as outlined above. The outer edge of Zone III could be around 5 km from an average source in the Triassic Sandstones but may be several times greater than this for a large borehole in the chalk situated in the drier eastern part of the Country.

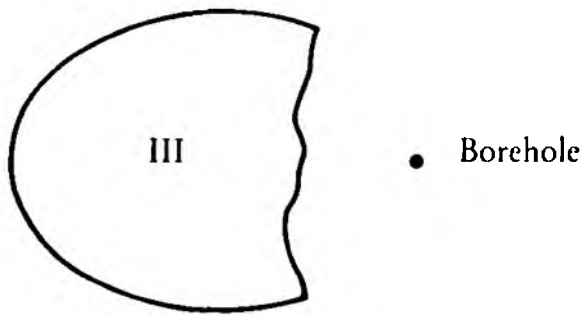




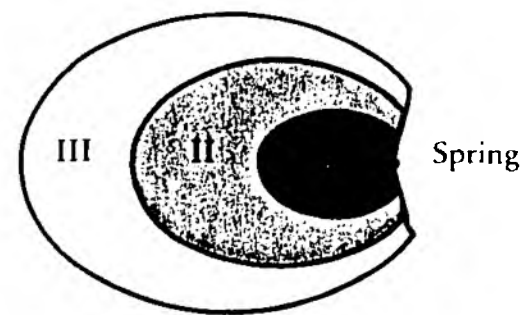
CHALK SOURCE



TRIASSIC SANDSTONE SOURCE



CONFINED SOURCE  
(Zones I and II not defined)



SPRING SOURCE

THE RELATIONSHIPS BETWEEN SOURCE PROTECTION ZONES

Figure 4

## 6. GROUNDWATER PROTECTION POLICY STATEMENTS

Groundwater resources, both in quality and yield, are placed at risk by a wide range of human activities. These can range from specific point sources of potential pollution to diffuse pollution spreading over a wide area. Such activities are controllable to varying degrees by legislation, which is either operated by the NRA or by other bodies. They may also be subject to guidelines and codes of practice which will have varying degrees of statutory force.

The following sections set out the policy objectives of the NRA with respect to different types of threat to groundwater resources.

The policy statements are subdivided into:-

- A. Physical disturbance of aquifers and groundwater flow
- B. Waste disposal to land
- C. Contaminated land
- D. Disposal of sludges and slurries to land
- E. Discharges to underground strata
- F. Unacceptable activities in the Inner Source Protection Zone (Zone I)
- G. Diffuse pollution

The policy statements are supported by "Acceptability Matrices" which relating the

**ACTIVITIES** to **SOURCE PROTECTION ZONES** and **RESOURCE PROTECTION ZONES**.

Where the protection of an existing use is important then the **SOURCE PROTECTION ZONES** are paramount and for this reason these are shown to the left of the matrix.

The NRA will seek to achieve the objectives in the statements either through its own legislation or by statutory and non-statutory consultation with other agencies. Where objectives cannot be met through existing provisions the NRA will, in appropriate cases, seek additional powers, for example under Section 111 of the Water Act 1989, for the establishment of statutory water source protection areas.

## **A. PHYSICAL DISTURBANCE OF AQUIFERS AND GROUNDWATER FLOW**

The NRA is concerned about the increasing range and intensity of activities which physically disturb aquifers and groundwater flow. In some cases there is a "consequential" effect on springs and stream flow.

The NRA's powers under the Water Resources Act, 1963 are limited to the control of licensable abstractions (Section 24) and to a limited range of other activities which may disturb aquifers and affect groundwater flow under Section 78. Activities which may affect groundwater and which are not covered by the NRA's own powers include:

- \* all forms of groundwater abstraction outside those controlled by abstraction licences;
- \* quarrying and gravel extraction above and below the water table whether worked wet, or dry by dewatering;
- \* mining;
- \* construction of highways, railways, cuttings and tunnels;
- \* landfill using low permeability materials and any other activities likely to impede groundwater flow;
- \* borehole construction and abandonment; and
- \* any activity which interconnects naturally separate aquifers.

The NRA will ask for appropriate control of these activities via the Town and Country Planning Acts and other similar legislation under which the NRA is consultee.

The following policies will apply when dealing with these issues:-

- A.1 THE OBJECTIVE OF THE NRA IS TO MINIMISE THE EFFECTS OF ANY PROPOSAL OR ACTIVITY WHICH PHYSICALLY DISTURBS GROUNDWATER OR AQUIFERS WHERE THERE IS A RISK OF A LOSS OF ABSTRACTION OR WHICH COMPROMISES THE INTEGRITY OF ANY WATERCOURSE OR OTHER WATER FEATURE DEPENDENT UPON GROUNDWATER.**
- A.2 THE NRA WILL RESIST ANY NEW PROPOSALS FOR MINERAL EXTRACTION WITHIN SOURCE PROTECTION ZONES I-III UNLESS THE IMPACT ON THE WATER ENVIRONMENT OF THE REMOVAL OF SUCH MINERALS CAN BE DEMONSTRATED TO THE NRA'S SATISFACTION TO BE OF NO SIGNIFICANCE. IN FISSURE FLOW AQUIFERS SUCH CONCERNS ARE LIKELY TO RELATE TO THE WHOLE OF RESOURCE PROTECTION ZONES (AQUIFER TYPES A AND B).**

The unsaturated zone is vital to both the quality and the quantity of water resources. Water percolating through this zone can be purified by filtration of suspended solids and by the breakdown of pollutants by oxygenation and biological action. In fractured or fissured aquifers particularly, the unsaturated zone acts as a buffer which delays and attenuates flood peaks and makes a very important contribution to dry weather flow. The restoration of mineral extractions in such zones may pose an unacceptable threat to groundwater quality depending on the restoration method proposed.

- A.3 THE REMOVAL BY MINERAL WORKING OR OTHERWISE OF AREAS AND THICKNESS OF THE UNSATURATED ZONE IN RESOURCE PROTECTION ZONES (AQUIFER TYPES A AND B) WILL BE UNACCEPTABLE IF IT LEADS TO A SIGNIFICANT REDUCTION IN THE AVAILABILITY OF WATER RESOURCES.**

Where low level restoration is proposed resulting in a reduced thickness of the unsaturated zone, restrictions on the after use and on certain agricultural practices may be sought through the planning procedure.

- A.4 THE NRA WILL OBJECT TO ANY PROPOSAL INVOLVING LOWERING OF THE GROUNDWATER LEVEL WHERE THERE IS A RISK TO ANY ABSTRACTION, WATERCOURSE OR OTHER WATER FEATURE DEPENDENT UPON GROUNDWATER.**

Of particular concern are the operations below the water table of mining, quarrying and gravel extractions where dewatering takes place and also large scale dewatering of construction sites. Such activities are exempt under the Water Resources Act 1963 and the NRA has no control over the dewatering of mineral extractions.

- A.5 IN THE CASE OF ANY WORKS SUCH AS BOREHOLES OR PITS BELOW THE WATER TABLE CONSTRUCTED FOR THE PURPOSE OF DEWATERING UNDERGROUND WORKS, THE NRA MAY SERVE A CONSERVATION NOTICE UNDER SECTION 78 OF THE WATER RESOURCES ACT 1963 WHICH WILL REQUIRE THE APPLICANT TO TAKE REASONABLE MEASURES TO CONSERVE WATER RESOURCES.**

This does not apply to the direct dewatering of quarries and gravel pits where specific separate dewatering works are not involved but in these cases the NRA may object as stated in A.4 above.

- A.6 THE NRA WILL OBJECT TO ANY PROPOSED HIGHWAY, RAILWAY, MINING OPERATION, BOREHOLE OR SHAFT INCLUDING TUNNELS OR CUTTINGS WHERE IT WILL ADVERSELY AFFECT WATER RESOURCES BY INTERCEPTING GROUNDWATER OR MAKING AN INTERCONNECTION BETWEEN AQUIFERS.**

Activities such as mining or the construction of highways and railways with the associated construction of tunnels, cuttings and borrow pits can in certain circumstances cause problems by draining groundwater from an aquifer or by diverting groundwater due to interception of the water table or by interconnecting different aquifers.

A Conservation Notice under Section 78 of the Water Resources Act 1963 may be served on any person intending to drill any borehole in connection with mineral or hydrocarbon exploration.

- A.7 THE NRA WILL OBJECT TO ANY PROPOSAL SUCH AS LANDFILL OR DEEP CONSTRUCTION WORKS LIABLE TO IMPEDE GROUNDWATER FLOW, WHERE THERE IS THE POSSIBILITY OF CUTTING OFF OR REDUCING GROUNDWATER TO ANY ABTRACTOR OR TO ANY WATERCOURSE OR OTHER WATER FEATURE DEPENDENT UPON GROUNDWATER. THE NRA WILL ALSO OBJECT TO PROPOSALS WHERE IMPEDING OF GROUNDWATER FLOW IS LIKELY TO CAUSE UNDESIRABLY HIGH GROUNDWATER LEVELS LEADING TO FLOODING.
- A.8 THE NRA WILL SEEK TO CONTROL THE BACKFILLING OF ANY ABANDONED SHAFT, WELL, BOREHOLE, TUNNEL OR ADIT IN ORDER TO PREVENT POLLUTION OR LOSS OF WATER RESOURCES.

There are preferred methods for dealing with these, largely dependent on geology. The NRA will offer advice on the correct method of filling or sealing disused boreholes, shafts and tunnels.

The NRA will also exercise its powers under Section 14(9) of the Water Act 1945 to prevent the waste of water resources from the uncontrolled artesian overflow of any borehole or shaft.

#### NOTE ON TERMINOLOGY

Prior to the implementation of the Environmental Protection Act 1990, the relevant sections of the Control of Pollution Act 1974, Part 1 remain in force to control the disposal of waste to land and other waste related activities. After the implementation of the relevant sections of the Environmental Protection Act 1990 read:

'Waste Regulation Authority' for 'Waste Disposal Authority'  
'Waste Management Licence' for 'Waste Disposal Licence'

## **B. WASTE DISPOSAL TO LAND**

The NRA is a statutory consultee of the Waste Disposal Authorities (WDA's) for the issue of waste disposal licences and will seek to maintain an active liaison with WDA's throughout the life of any landfill site. It is also a statutory consultee of the Planning Authorities under the Town and Country Planning Acts. A valid planning permission is required before a waste disposal licence can be issued. The planning permission is the means by which aftercare provisions on closed landfill sites can be regulated, because the Waste Disposal Licence only relates to the operational phase of any site. This is mainly achieved through the use of Section 106 agreements (Town and Country Planning Act 1990) between the applicant and the Planning Authority. However, the provisions of the Environmental Protection Act 1990 will require waste management licences to regulate the landfill in its post-operative phase until the pollution risks have been minimised and the surrender of the licence can be accepted. When the relevant sections of the Act are implemented the use of planning permissions and agreements for this purpose will become redundant.

It is recognised that a wide range of waste disposal operations require a waste disposal licence. These include scrap yards, transfer stations incinerators, waste storage etc. However, the greatest threat to groundwater is posed by landfill activities. In view of this major pollution risk the following policy statements concentrate mainly on waste disposal to land. The matrix following the policy statements refers only to landfill.

- B.1 THE NRA WILL LIAISE WITH PLANNING AUTHORITIES AND OTHERS TO ENCOURAGE THE LOCATION OF NEW LANDFILL SITES IN AREAS WHICH ARE LEAST VULNERABLE TO GROUNDWATER POLLUTION.**
- B.2 THE NRA WILL NORMALLY OBJECT TO ALL ACTIVITIES REQUIRING A WASTE DISPOSAL LICENCE WITHIN ZONE I (INNER SOURCE PROTECTION).**
- B.3 THE NRA WILL OBJECT TO LANDFILL WITHIN ZONE II (OUTER SOURCE PROTECTION) OF ANY GROUNDWATER SOURCE UNLESS IT CAN BE SHOWN THAT THE WASTE MATERIALS DO NOT CONTAIN BIODEGRADABLE OR OTHER POTENTIALLY POLLUTING MATTER AND THAT THE SITE WILL HAVE OPERATION SAFEGUARDS ACCEPTABLE TO THE NRA.**
- B.4 THE NRA WILL ONLY AGREE TO LANDFILL WITHIN ZONE III (SOURCE CATCHMENT) AND IN RESOURCE PROTECTION ZONES (AQUIFER TYPES A AND B) SUBJECT TO ENGINEERING AND OTHER PRECAUTIONS ACCEPTABLE TO THE AUTHORITY.**
- B.5 LANDFILL SITES WHICH CAN BE SHOWN TO PRESENT A RISK OF CONTAMINATION TO THE WATER ENVIRONMENT BY VIRTUE OF THE NATURE OF THE WASTES AND/OR THE VULNERABILITY OF THE GROUNDWATER WILL ONLY BE ACCEPTABLE TO THE NRA IF OPERATED ON CONTAINMENT PRINCIPLES AND WITH AN APPROVED LEACHATE MANAGEMENT SCHEME.**

If the nature of the waste and the hydrogeological conditions are such that the NRA judges that its deposit does not pose a threat to controlled waters then a site may be operated on non-containment principles with acceptable operational safeguards.

- B.6 THE NRA WILL NOT NORMALLY OBJECT TO LANDFILL OF WASTE IN RESOURCE PROTECTION ZONE C FOR GROUNDWATER POLLUTION REASONS BUT THE NRA MAY OBJECT TO LANDFILL IN THIS ZONE IN ORDER TO PROTECT SURFACE WATER QUALITY, FLOOD DEFENCE OR FISHERIES INTERESTS.**

Although this refers to a non-aquifer area, the infrastructure and control for leachate management must be as rigorous as for any other site.

- B.7 THE NRA WILL OBJECT TO WASTE DISPOSAL ACTIVITIES WHICH EXTEND TO OR BELOW THE WATER TABLE IN SOURCE PROTECTION ZONES. WITHIN RESOURCE PROTECTION ZONES THE PRESENCE OF THE UNSATURATED ZONE IS PREFERABLE BUT A LANDFILL OPERATED ON CONTAINMENT PRINCIPLES, MAY BE CONSIDERED ON A SITE SPECIFIC BASIS.**

- B.8 THE NRA WILL SEEK TO ENSURE THAT AS PART OF THE ORIGINAL PLANNING PERMISSION, OR WASTE DISPOSAL LICENCE, ADEQUATE PROVISION IS MADE FOR MONITORING AND PREVENTING POLLUTION OF CONTROLLED WATERS. ADEQUATE PROVISION MUST ALSO BE MADE FOR LONG TERM MAINTENANCE AND MONITORING OF LEACHATE CONTROL AND DISPOSAL SYSTEMS AND FOR THE INTEGRITY OF ANY CAP, BASAL OR SIDE SEALS. MONITORING FACILITIES AND PROGRAMMES WILL BE AGREED WITH THE OPERATOR AND THE NRA.**

To achieve this policy objective the NRA will request Planning Authorities to use Section 106 of the Town and Country Planning Act 1990, until Section 39 of the Environmental Protection Act, 1990 is implemented.

- B.9 THE NRA WILL ADVISE THE WASTE REGULATION AUTHORITY NOT TO ACCEPT THE SURRENDER OF A LICENCE UNLESS AND UNTIL NRA IS SATISFIED BY THE RESULTS OF MONITORING THAT THE LANDFILL IS UNLIKELY TO CAUSE POLLUTION OF THE WATER ENVIRONMENT.**

This statement addresses the long term problems which are likely to arise after the active operation of the site has ended and when daily supervision and control have ended. Co-operation between the NRA and WRA's will be necessary to agree criteria for surrendering licences for aftercare and land use.

**NATIONAL RIVERS AUTHORITY - GROUNDWATER PROTECTION POLICY  
LANDFILL ACCEPTABILITY MATRIX**

**MATRIX 1**

ACTIVITY	ZONE	SOURCE PROTECTION			RESOURCE PROTECTION		
	I Inner Zone	II Outer Zone	III Catchment Zone	A Major Aquifer	B Minor Aquifer	C Non-Aquifer	
1. Hazardous	Not acceptable	Not acceptable	Not acceptable	Not acceptable	Not acceptable	Acceptable subject to evaluation on a case by case basis and adequate operational safeguards.	
2. Municipal (domestic commercial, industrial)	Not acceptable	Not acceptable	Only acceptable with engineered containment and operational safeguards	Only acceptable with engineered containment and operational safeguards	Only acceptable with engineered containments and operational safeguards	Acceptable only with adequate operational safeguards	
3. Construction and demolition industry wastes (low polluting potential)	Not acceptable	Acceptable subject to evaluation on a case by case basis and adequate operational safeguards	Acceptable subject to evaluation on a case by case basis and adequate operational safeguards.	Acceptable only with adequate operational safeguards.	Acceptable only with adequate operational safeguards.	Acceptable	
4. Inert wastes (limited polluting potential)	Not acceptable	Acceptable only with adequate operational safeguards	Acceptable only with adequate operational safeguards.	Acceptable	Acceptable	Acceptable	

**Footnotes**

- 1) This matrix is a summary sheet only and should be used in conjunction with the policy statements themselves.
- 2) This matrix refers specifically to groundwater protection. In addition, particularly in the case of Non-Aquifers further requirements in respect of surface water protection will need to be considered.
- 3) Operational safeguards will include, amongst other things, leachate management as appropriate.
- 4) These activity categories are designed to conform with the Draft EC Landfill Directive. Co-disposal sites accepting a high proportion of municipal waste and other wastes acceptable under the Directive (2) are permitted.



## C. CONTAMINATED LAND

The NRA is concerned about the groundwater pollution risks associated with contaminated land, both when dormant state and as a result of the disturbance caused during redevelopment.

The NRA will seek appropriate control to protect the water environment from the redevelopment of contaminated land through an interface with Planning Authorities under the Town and Country Planning Acts. The NRA will also liaise with Her Majesty's Inspectorate of Pollution (HMIP) in respect of its powers to promote integrated pollution control.

Contaminated Sites include land previously used as:

- \* gas works
- \* landfill sites
- \* chemical works
- \* heavy industry
- \* waste lagoons
- \* mining
- \* waste disposal
- \* sewage treatment works
- \* oil refineries.

The following policies will apply in dealing with this issue.

**C.1 THE NRA WILL SEEK TO MINIMISE GROUNDWATER POLLUTION FROM ANY CONTAMINATED SITE IN ZONES I - III AND WILL PURSUE REMEDIAL ACTION WHENEVER FEASIBLE.**

**C.2 THE NRA WILL CONSIDER BRINGING A PROSECUTION IN RESPECT OF ANY CONTAMINATED SITE WHERE IT CAN BE DEMONSTRATED THAT A DISCHARGE INTO UNDERGROUND STRATA IS OCCURRING OR HAS OCCURRED AND THREATENS OR CAUSES POLLUTION OF GROUNDWATER RESOURCES.**

On sites where redevelopment is proposed, to ensure that groundwater quality interests are covered, it is essential that consultation takes place between the developer and the NRA as early as possible and preferably before any site investigations commence.

**C.3 THE NRA MUST BE CONSULTED BY LOCAL AUTHORITIES ABOUT ANY PLANNING APPLICATION FOR DEVELOPMENT OR OTHER WORKS ON SITES LIKELY TO BE CONTAMINATED. THE POSSIBILITY OF CONTAMINATION SHOULD BE CLEARLY INDICATED BY THE LOCAL AUTHORITY OR THE APPLICANT. EARLIER DIRECT CONSULTATION BY LAND OWNERS AND DEVELOPERS IS STRONGLY ENCOURAGED.**

On sites where contamination of the ground and groundwater pollution is highly likely a thorough site investigation should take place prior to any application for Planning

Permission. Investigations should include an assessment of the leaching characteristics of contaminants in the ground and of the geology/hydrogeology of the site, including existing groundwater quality. This information should support subsequent Planning Applications which should include a strategy for dealing with contamination and minimising groundwater pollution. Where the site investigation reveals significant groundwater pollution the development proposals should include remedial action.

C.4 THE NRA WILL OBJECT TO PLANNING APPLICATIONS FOR THE REDEVELOPMENT OF CONTAMINATED SITES WHERE WATER RESOURCES COULD BE ADVERSELY AFFECTED UNLESS THE PROPOSALS INCLUDE MEASURES FOR THE PROTECTION OF GROUNDWATER AND SURFACE WATER QUALITY. IT WILL ALSO OBJECT WHERE INSUFFICIENT OR TECHNICALLY WEAK INFORMATION HAS BEEN PROVIDED.

C.5 THE NRA WILL SEEK TO ENSURE THAT PLANNING PERMISSIONS CONTAIN CONDITIONS DESIGNED TO PROTECT WATER RESOURCES. THE USE OF CONDITIONS UNDER SECTION 106 OF THE TOWN AND COUNTRY PLANNING ACT 1990 TO CONTROL AND MONITOR GROUND AND GROUNDWATER CONTAMINATION DURING AND AFTER REDEVELOPMENT IS STRONGLY ENCOURAGED. THESE SHOULD REQUIRE A REMEDIATION PLAN/METHOD STATEMENT TO BE SUBMITTED FOR APPROVAL BY THE NRA. THEY SHOULD INCLUDE DETAILS OF FURTHER SITE INVESTIGATION, CHEMICAL ANALYSIS, CRITERIA AND STANDARDS FOR REMOVAL OF CONTAMINATED SOIL AND FINAL RESTORATION. DETAILS OF FOUNDATIONS, COVERING MATERIAL, DRAINAGE, GROUNDWATER QUALITY MONITORING PROGRAMMES SHOULD ALSO BE INCLUDED.

Regarding the clean up of contaminated sites where groundwater resources are at risk the NRA will advocate the removal or suitable treatment of material with a significant water pollution potential. Target concentrations for key contaminants should be specified. These should relate to the leached concentration, not total concentrations specified by the ICRCCL. An estimate of the quantity and quality of any discharge beneath the developed site should be made.

C.6 THE NRA WILL WISH TO ENSURE THAT ANY DISCHARGE, SEEPAGE OR DRAINAGE RESULTING FROM THE DEVELOPMENT WILL BE OF A QUALITY AND QUANTITY SUCH THAT NO SIGNIFICANT DETERIORATION IN GROUNDWATER QUALITY WILL OCCUR.

In some areas where historical groundwater pollution has occurred from a number of possible sources it would be extremely difficult to pinpoint individual sites or incidents. Where old urbanised industrial areas were located on aquifer outcrop, groundwater pollution is almost inevitable. In these situations the benefits and feasibility of any groundwater clean up operation must be carefully considered. In many cases the situation may be beyond repair and efforts should then be directed towards the removal of any remaining source, and monitoring of groundwater quality ensuring that any redevelopment does not cause further deterioration.

C.7 IN AREAS WHERE HISTORICAL INDUSTRIAL DEVELOPMENT IS KNOWN TO HAVE CAUSED WIDESPREAD GROUNDWATER CONTAMINATION THE NRA WILL REVIEW THE MERITS AND FEASIBILITY OF GROUNDWATER CLEAN UP HAVING REGARD TO LOCAL CIRCUMSTANCES AND AVAILABLE FUNDING.

It is important to recognise that contaminated land is continually being created. The NRA wishes to ensure that such areas are minimised in the future especially where new industries are located in green field sites.

## D. THE APPLICATION OF SLUDGES AND SLURRIES TO LAND

The Control of Pollution Act 1974 Part I (until it is replaced by Part II of the Environmental Protection Act 1990) and the Water Act 1989 form the primary legislation which controls the deposit of waste materials onto land. However, both the Control of Pollution Act and the Environmental Protection Act (and the regulations under the former Act) define controlled waste so as to exclude agricultural wastes. The Control of Pollution Act Regulations provide extended definitions of the different categories of controlled waste and exclude certain wastes from licensing provisions provided that they conform to specific requirements. The current definitions of controlled waste include sewage sludge (although not sewage) and additional Regulations also give consideration to the EC Sewage Sludge Directive (86/278/EEC). In terms of the waste origins and control mechanisms which the NRA seeks to exert over sludge disposal to land it is therefore convenient to divide the types of sludge/liquid waste into three:-

- \* controlled waste;
- \* sewage sludge; and
- \* farm waste.

Controlled wastes may be exempted from the provisions of Waste Disposal Site Licensing by virtue of Schedule 6(13)(3) of the Collection and Disposal of Waste Regulations 1988 (ie if it can be of agricultural benefit). Providing that the Waste Disposal Authority (WDA) is notified beforehand by the disposer and that the operation is considered not to present an environmental hazard then the operation does not require a Disposal Licence and there is no formal consultation procedure with the NRA. Particulars of regular or frequent deposits of wastes of similar compositions are only required to be given to the WDA every 6 months.

The Sludge (Use in Agriculture) Regulations 1988 apply to the Water Companies and are controlled by Her Majesty's Inspectorate of Pollution (HMIP). The NRA has no control under the legislation.

### D.1 THE RATE AND METHOD OF APPLICATION OF SLUDGES TO LAND MUST TAKE ACCOUNT OF RISKS TO WATER POLLUTION AND MUST BE DETERMINED BY THE CROP REQUIREMENTS AND SOIL CHARACTERISTICS. SLUDGE APPLICATIONS TO LAND SHOULD NOT BE USED PRIMARILY FOR WASTE DISPOSAL PURPOSES.

The NRA recognises the beneficial effects of applying sludges to land, whether fertilisation or soil conditioning, but this must be done without causing a risk of contamination of water resources.

## CONTROLLED WASTES

Controlled wastes vary greatly in character and consequently have differing polluting potential. For this reason a full assessment of risks to water resources cannot be made without detailed knowledge of the composition of the waste

- D.2 THE NRA WILL SEEK TO ENSURE BY CLOSE LIAISON WITH EACH WDA THAT ALL NOTIFICATIONS OF LIQUID WASTE OR SLUDGE TO LAND ARE MADE KNOWN TO THE NRA FOR ASSESSMENT. WHERE IT IS CONSIDERED BY THE NRA THAT SUCH A DEPOSIT WILL CAUSE AN ENVIRONMENTAL HAZARD BY POLLUTING GROUNDWATER RESOURCES, OR POLLUTING SURFACE WATER COURSES, REPRESENTATIONS WILL BE MADE TO THE WDA REQUIRING THAT THE OPERATION IS SUBJECT TO THE PROVISIONS OF SECTION 5 OF THE CONTROL OF POLLUTION ACT, 1974.

Where any application of Controlled Waste is made to land from fixed plant, as opposed to mobile tankers, then the NRA may use the provisions of Section 107 of the Water Act 1989 to issue a prohibition notice and consent if necessary. It is important that the waste to be deposited should be sampled on a regular basis to ensure that no contamination of the water resource occurs. The NRA will require a full chemical analysis of the waste, including of any List I or List II substances before consideration for application to land can be given.

- D.3 THE NRA WILL OBJECT TO ANY WASTE CONTAINING LIST I SUBSTANCES BEING SPREAD ON ANY SOURCE PROTECTION ZONES OR RESOURCE PROTECTION ZONES (AQUIFER TYPES A AND B), UNLESS IT CAN BE SHOWN BY PRIOR INVESTIGATION TO THE SATISFACTION OF THE NRA THAT POLLUTION OF WATER RESOURCES WILL NOT OCCUR.
- D.4 IN GIVING ANY APPROVAL UNDER THE ABOVE PROCEDURES THE NRA WILL REQUIRE RECORDS TO BE KEPT BY THE DISPOSER TO ENSURE THAT ONLY THE SLUDGE FROM THE APPROVED SOURCE IS APPLIED TO LAND.

### **SEWAGE SLUDGES**

Included in this category are wastes from sewage treatment (both liquid and solid), the "broad" irrigation of settled sewage as a disposal method and "domestic" waste from septic tanks and cesspools.

These disposal of these wastes is not controlled directly by the NRA whose powers are limited to taking action once pollution has occurred.

- D.5 THE NRA WILL LIAISE WITH THE WATER COMPANIES AND THE LANDOWNER ON THE DISPOSAL OF SEWAGE SLUDGE TO LAND AND SEEK TO THE LOCATION, QUANTITY AND TIMING OF APPLICATIONS TO PREVENT POLLUTION OF WATER RESOURCES.

In some areas there is an increasing use of intensive application of sewage sludge as a disposal route which could threaten underground water quality.

- D.6 THE NRA WILL SEEK TO MINIMISE THE USE OF AND RESIST THE NEW DEVELOPMENT OF "DEDICATED LAND" AREAS IN SOURCE PROTECTION ZONES AND RESOURCE PROTECTION ZONE (AQUIFER TYPES A AND B).**

### **FARM WASTES**

Within this category are manures and slurries from farming activities such as cattle, pigs, chickens and sheep.

The wastes are not directly controllable by the NRA but guidelines have been developed by The Ministry of Agriculture (MAFF) for use to define a code for good agricultural practice.

The NRA recognises the beneficial effects of applying sludges, whether fertilisation or soil conditioning, but this must be done without causing contamination of water resources.

The NRA has powers under Control of Pollution (Silage, Slurry and Fuel Oil Agricultural Regulations 1991) to ensure that certain farm wastes are stored in a manner designed to minimise pollution to water resources.

Best practice for the management of farm wastes in relation to the protection of water is given in the MAFF Code of Good Agricultural Practice, 1991. Reference should also be made to the NRA Farm Waste report, 1991.

- D.7 THE RATE AND METHOD OF APPLICATION OF SLUDGES TO LAND MUST TAKE ACCOUNT OF THE RISKS OF WATER POLLUTION AND BE DETERMINED BY THE CROP AND SOIL REQUIREMENTS. SLUDGE APPLICATIONS TO LAND SHOULD BE BENEFICIAL FOR AGRICULTURAL USE AND SHOULD NOT BE USED PRIMARILY FOR WASTE DISPOSAL PURPOSES.**

NATIONAL RIVERS AUTHORITY - GROUNDWATER PROTECTION POLICY  
 SLUDGES AND SLURRIES TO LAND ACCEPTABILITY MATRIX

MATRIX 2

ACTIVITY	SOURCE PROTECTION			RESOURCE PROTECTION		
	I Inner Zone	II Outer Zone	III Catchment Zone	A Major Aquifer	B Minor Aquifer	C Non-Aquifer
1. <u>CONTROLLED INDUSTRIAL WASTES</u> Containing EC List 1 Substances	Not acceptable	Not acceptable	Not acceptable	Not acceptable	Not acceptable	Subject to investigation
Containing EC List 2 Substances, Other Inorganic or Persistent Chemicals	Not acceptable	Not acceptable	Only acceptable subject to evaluation and conditions (*) (presumption against)	Acceptable subject to evaluation and conditions	Acceptable subject to evaluation and conditions	Acceptable subject to evaluation and conditions
Organic Biodegradable Wastes	Not acceptable	Only acceptable with full investigation and subject to strict controls (presumption against)	Acceptable subject to evaluation and conditions (*)	Acceptable subject to evaluation and conditions	Acceptable subject to evaluation and conditions	Acceptable subject to evaluation and conditions
2. <u>FARM AND SEWAGE SLUDGE</u> Spreading to land	Not acceptable	Acceptable subject to conditions (*) (presumption against)	Acceptable subject to conditions (*)	Acceptable as subject to conditions	Acceptable subject to conditions	Acceptable subject to conditions
Maintaining Slurry Lagoons	Not acceptable	Acceptable to silage and slurry regulation standards	Acceptable to silage and slurry regulation standards	Acceptable to silage and slurry regulation standards	Acceptable to silage and slurry regulation standards	Acceptable to silage and slurry regulation standards

Footnotes for Matrix 2

\* The conditions for any approval for spreading of sludges and slurries to land are:

- 1) Application complies with good agricultural practice
- 2) Complies with MAFF fertilizer recommendations
- 3) Complies with sludge regulations
- 4) No sub-soil injection
- 5) In high nitrate areas - MAFF Advisory Code



## **E. DISCHARGES TO UNDERGROUND STRATA**

Most known discharges into the ground are via soakaway of surface water runoff from roofs and impermeable areas such as major roads, amenity areas, car/lorry parks, storage areas, etc. In areas where main sewers are not present many individual properties, small housing estates and commercial developments discharge partially treated sewage effluents into ground via soakaways. Trade effluent including discharges from cooling plant and dewatering, process effluents and farm effluents are also often discharged into the ground via soakaways. The NRA accepts that in certain areas the discharge of surface water and some sewage and trade effluents via soakaway, borehole or well may not result in pollution of controlled waters. However, in areas of high vulnerability significant long term groundwater contamination and surface water pollution can occur.

The control of discharges to land via soakaways is effected by the issue of a prohibition notice under the Water Act 1989. The NRA often becomes aware of activities which may result in a discharge to land through the Planning consultation process or through referrals from Local Authorities under Building Regulations.

- E.1 THE NRA WILL SEEK TO PROHIBIT ANY DISCHARGE INTO UNDERGROUND STRATA WHICH MAY RESULT IN POLLUTION OF GROUNDWATER OR SURFACE WATER. THE NRA WILL SEEK TO CONTROL DISCHARGES INTO UNDERGROUND STRATA WITHIN AREAS WHERE GROUNDWATER IS JUDGED TO BE AT RISK IN ACCORDANCE WITH SECTIONS 107 AND 113 OF THE WATER ACT 1989.**

The NRA will control all discharges greater than 5 m<sup>3</sup>/d of sewage and trade effluent to soakaway. Discharges of less than 5 m<sup>3</sup>/d will only be controlled within areas where groundwater is judged to be at risk.

Surface water runoff, with the exception of clean roof water, will be controlled in areas where groundwater is judged to be at risk and will generally be subject to standard conditions, such as installation of petrol/oil interception where applicable. Where control is necessary the NRA will require a hydrogeological assessment to be carried out to identify the potential impact of the discharge on ground and surface water quality.

Discharge of sewage effluent from septic tank/soakaways serving single properties (equivalent to less than 1 m<sup>3</sup>/d) will normally be acceptable subject to standard conditions. However, in areas where groundwater is judged to be at risk and for large discharges from multiple dwellings or developments a more extensive ground investigation may be required from which it will be concluded either that:

- the proposed discharge is acceptable;
- or, further effluent treatment or "engineering" of the soakaway will be necessary;
- or, the proposed discharge is not allowable because of the likely impact on ground and surface waters.

All discharges of trade effluent to soakaway will be controlled. Applications for consent to discharge trade effluent will be assessed in accordance with the potential impact identified by consideration of the characteristics of the effluent and soakaway ground conditions.

- E.2 THE NRA WILL SEEK TO IDENTIFY, VIA LOCAL AND OTHER AUTHORITIES, PROPOSALS WHICH INVOLVE THE DISCHARGE OF CONTAMINATED SURFACE WATER RUNOFF, SEWAGE AND TRADE EFFLUENTS TO SOAKAWAY. CONSENTS TO DISCHARGE WILL NOT BE GRANTED WHERE THERE IS A THREAT TO GROUNDWATER OR SURFACE WATER QUALITY.

The NRA may become aware of a proposed discharge to soakaway via a number of different routes. These include consultation procedures with Local Authorities (District and Borough Councils) under the Town and Country Planning Act 1990 and Building Regulations 1972 (revised regulation 1990). Others arise through direct consultation between the NRA and person proposing to make a discharge, their agent or consultant.

At the pre-planning or planning application stage the NRA will identify, where possible, whether the discharge requires control. For discharges from multiple dwellings or commercial developments information seldom accompanies the application to enable a detailed assessment to be made. The NRA will object until sufficient information has been obtained. This will include use of its powers under the Water Act 1989. This is to avoid creating the situation where construction can take place but it is only subsequently found out that discharge consent conditions cannot be met or the discharge is not allowable.

- E.3 THE NRA WILL REFUSE THE DISCHARGE OF LIST I SUBSTANCES INTO UNDERGROUND STRATA AND LIMIT THE ENTRY OF LIST II SUBSTANCES IN ACCORDANCE WITH THE EC GROUNDWATER DIRECTIVE (80/68/EEC).

These substances are present within some industrial and agricultural effluents. Disposal of toxic and persistent contaminants to soakaway poses a significant risk of groundwater pollution and alternative acceptable disposal arrangements should be found. Exceptions may be made where the quality and concentration of the substances is such that groundwater pollution will not occur; e.g. for discharges of domestic effluent from an isolated dwelling; for the purposes of aquifer recharge of water used for geothermal purposes or where the groundwater is found to be permanently unusable for other uses.

- E.4 THE NRA WILL REFUSE THE DISCHARGE OF SEWAGE OR TRADE EFFLUENT BELOW THE WATER TABLE. ONLY WHERE THE QUALITY OF EXISTING GROUNDWATERS ALLOWS OR WHERE THE GROUNDWATER IS ISOLATED FROM THE WATER CYCLE WILL A DIRECT DISCHARGE BE CONSIDERED.

Within all source protection zones and resource protection zones A and B the NRA would seek to control the depths of all soakaways used for the disposal of sewage and/or trade effluent by means of the consent to discharge procedure.

The NRA will undertake technical appraisal of all proposals to assess the pollution potential to controlled waters. Depth limitation will be imposed on the soakaways based on the information provided on quality and quantity of the effluent to be disposed, thickness of unsaturated zone, geological conditions and proximity of existing water resource interests.

**E.5 THE NRA WILL SEEK TO CONTROL THE DEPTHS OF ALL BOREHOLES, WELLS AND DEEP SOAKAWAY SYSTEMS FOR THE DISCHARGE OF SURFACE WATER DRAINAGE.**

The NRA is concerned that boreholes, wells and deep soakaways designed for clean water disposal could offer a conduit for rapid containment transport to a groundwater system. The NRA will seek to control the depths of these soakaways by recommending maximum penetration depths and a requirement that the water table should not be intersected.

**E.6 THE NRA WILL SEEK TO CONTROL THE USE OF SEALED EFFLUENT STORAGE TANKS (CESS PITS/POOLS) WITHIN ZONE I.**

Sealed storage tanks or cess pits for containment of domestic sewage effluent are often poorly constructed and maintained and many discharge poor quality effluents into the ground. The NRA will seek to identify proposals for sewage disposal to sealed tanks located within Inner Source Protection Zone I areas at the planning stage. Agreement will be sought within any planning permission for subsequent connection to new or improved mains sewer and maintenance of emptying records to include the date, volume and tanker company will be encouraged. The NRA will encourage the proper disposal of tank effluent to sewage treatment works or approved disposal sites.

**E.8 THE NRA WILL REFUSE DIRECT DISCHARGES TO GROUNDWATER UNLESS IT CAN BE SHOWN THAT GROUNDWATER POLLUTION WILL NOT OCCUR OR THAT THE DISCHARGE WILL BE CONFINED TO GROUNDWATER BY REASONS OF ITS QUALITY IS UNUSABLE.**

This statement is intended to cover deep well injection of trade effluents and other matter.

NATIONAL RIVERS AUTHORITY - GROUNDWATER PROTECTION POLICY  
DISCHARGES TO UNDERGROUND STRATA ACCEPTABILITY MATRIX

MATRIX 3

ACTIVITY	SOURCE PROTECTION			RESOURCE PROTECTION		
	I Inner Zone	II Outer Zone	III Catchment Zone	A Major Aquifer	B Minor Aquifer	C Non Aquifer
<b>A. DISCHARGES OF SURFACE WATER TO SOAKAWAY FROM:-</b> (Note 1)						
Roof Drainage	No objection (R5)	No objection (R5)	No Objection (R5)	No objection (R5)	No objection (R5)	No objection (R5)
Impermeable Areas						
- public/amenity	Not acceptable (R1)	Acceptable (R4)	Acceptable (R4)	Acceptable (R4)	Acceptable (R4)	Acceptable (R4)
- car/lorry parks	Not acceptable (R1)	Presumption Against (R2)	Presumption Against (R2)	Acceptable (R4) (with interceptor)	Acceptable (R4) (with interceptor)	Acceptable (R4) (with interceptor)
- garage forecourts	Not acceptable (R1)	Presumption Against (R2)	Presumption Against (R2)	Acceptable (R4) (with interceptor)	Acceptable (R4) (with interceptor)	Acceptable (R4) (with interceptor)
- major roads	Not acceptable (R1)	Presumption Against (R2) Acceptable only if investigation favourable	Presumption Against (R2) Acceptable only if investigation favourable	Acceptable (R4) (subject to investigation and with interceptor)	Acceptable (R4) (subject to investigation and with interceptor)	Acceptable (R4) (with interceptor)
- Industrial Sites	Not acceptable (R1)	Presumption Against (R1)	Presumption Against (R1)	Presumption against (R2) Acceptable only if investigation favourable	Acceptable (R4) (subject to investigation)	Acceptable (R4) (subject to investigation, with interceptor)

Notes: 1. Direct discharge into groundwater of surface water runoff is not acceptable with the exception of clean uncontaminated roof water.

NATIONAL RIVERS AUTHORITY - GROUNDWATER PROTECTION POLICY  
DISCHARGES TO UNDERGROUND STRATA ACCEPTABILITY MATRIX

MATRIX 4

ACTIVITY	SOURCE PROTECTION			RESOURCE PROTECTION		
	I Inner Zone	II Outer Zone	III Catchment Zone	A Major Aquifer	B Minor Aquifer	C Non-Aquifer
B. <u>DISCHARGES TO TREATED SEWAGE EFFLUENT TO SOAKAWAY</u> (Note 2)	< 5m <sup>3</sup> /d	Not acceptable (R1)	Presumption (R2) against (subject to investigation)	Acceptable (R3/4) (subject to investigation/standard conditions)	Acceptable (R3/4) (subject to investigation/standard conditions)	Acceptable (R4) (subject to standard condition)
	> 5m <sup>3</sup> /d	Not acceptable (R1)	Not acceptable (R1)	Presumption Against (R2) (Only acceptable in exceptional circumstances)	Acceptable (R3) (subject to investigation)	Acceptable (R4) (subject to standard conditions)
	Storm Sewage Overflows to Soakaway	Not acceptable (R1)	Not acceptable (R1)	Presumption Against (R2) (Only acceptable in exceptional circumstances)	Presumption Against (R2) (Only acceptable in exceptional circumstances)	Presumption Against (R2) (Only acceptable in exceptional circumstances)

Notes: 2. Direct discharge of sewage effluent to groundwater via a borehole or well is normally not acceptable.

3. Discharge of greater than 25m<sup>3</sup>/d of sewage to soakaway is unlikely to be acceptable.

NATIONAL RIVERS AUTHORITY - GROUNDWATER PROTECTION POLICY  
DISCHARGES TO UNDERGROUND STRATA ACCEPTABILITY MATRIX

MATRIX 5

ZONE  ACTIVITY	SOURCE PROTECTION			RESOURCE PROTECTION		
	I Inner Zone	II Outer Zone	III Catchment Zone	A Major Aquifer	B Minor Aquifer	C Non-Aquifer
<u>C. DISCHARGE TO TRADE EFFLUENT TO SOAKAWAY</u> (Note 4)						
Cooling Water (Note 5)	Presumption (R2) against (acceptable only if investigation favourable)	Acceptable (R3) (subject to investigation)	Acceptable (R3) (subject to investigation)	Acceptable (R3) (subject to investigation)	Acceptable (R3) (subject to investigation)	Acceptable (R4) (subject to standard conditions)
Dewatering Water	Not acceptable (R1)	Presumption (R2) against (acceptable only if investigation favourable)	Presumption (R2) against (acceptable only if investigation favourable)	Acceptable (R3) (subject to investigation)	Acceptable (R3/4) (subject to investigation/ standard conditions)	Acceptable (R4) (subject to standard conditions)
Process Effluent  - via soakaway or Permeable Lagoons	Not acceptable (R1)	Presumption Against (R2) (acceptable only if investigation favourable)	Presumption Against (R2) (acceptable only if investigation favourable)	Presumption Against (R2) (acceptable only if investigation favourable)	Acceptable (R3) (subject to investigation)	Acceptable (R3) (subject to investigation)

- Notes: 4. Direct discharge of trade effluent into groundwater is not acceptable with the exception of some cooling water and geothermal return waters subject to investigation.
5. Where the cooling water is discharged to an aquifer with similar physical properties and chemical composition to the natural groundwaters the Authority will then have no objections to standard conditions. (R4)

## DISCHARGES TO UNDERGROUND STRATA

### KEY TO ACCEPTABILITY MATRIX 3,4 and 5.

#### Response Code

**R1 - Prohibit/object in principle**

**R2 - Presumption against**

**R3 - Prohibition notice/Consent to discharge**

**R4 - No objections subject to standard conditions R5 - No objections**

#### Response 1 - Prohibit/object in principle

The NRA will normally object in principle to such activities which would involve a high risk of contamination to controlled waters or a source.

#### Response 2 - Presumption against

The NRA will normally seek to prohibit this activity. Only in exceptional circumstances or where detailed investigation can demonstrate that the activity does not represent a high risk of contamination to controlled waters and can be adequately controlled by conditions that form part of a statutory consent or agreement will an objection be withdrawn.

#### Response 3 - Prohibition notice/Consent to discharge

The NRA will normally have no objection in principle to this type of discharge providing an appropriate consent is obtained.

Initial screening of a consent application will identify whether further investigation and assessment is required prior to consent being determined. Consent conditions may restrict the quality and quantity of effluent discharged and where assessment identifies a potential for significant change in groundwater quality, long term monitoring of both the discharge and remote observation points may be required.

#### Response 4 - No objection subject to standard conditions

The NRA will normally have no objection in principle to this discharge subject to standard conditions to protect the quality of controlled waters or a source. An investigation may be required to determine the risk of contamination and the formulation of appropriate conditions. Long term monitoring of controlled waters in the vicinity of such activities may be required.

#### Response 5 - No objection

The NRA will normally have no objection in principle to this discharge which it considers will have no discernible impact on water resources or quality. No conditions or monitoring are likely to be required.

**F. UNACCEPTABLE ACTIVITIES IN THE INNER SOURCE PROTECTION ZONE (ZONE I)**

In addition to the activities identified in the preceding policy statements, the NRA may wish to restrict the following practices, activities or developments within areas defined as Zone I. Many of these practices will be subject to planning permission or other approvals before development. An objection will be made at the time of consultation with the NRA where appropriate.

- \* Storage of chemicals (bags, drums or in bulk; including oil storage)
- \* Storage of waste materials
- \* Industrial processes which involve the use or production of chemical compounds.
- \* Production, use and storage of any substance in List I or in List II of the Annex to the EC Groundwater Directive (80/68/EEC)
- \* Storage of farm wastes (for example, manure heaps)
- \* Intensive livestock housing
- \* The use of chemical sprays for weed, fungal or insect control (unless previously agreed approved substances)
- \* The use of chemical or microbiological agents for pest control
- \* Graveyards and animal burial sites
- \* Sewage treatment works
- \* Foul sewers and overflows
- \* Oil/Hydrocarbon pipelines
- \* Major roads (Motorways and Trunk Roads)
- \* Railway sidings
- \* Areas for extensive vehicle parking
- \* Garages and filling stations
- \* Airport runways and maintenance areas

**F.1 THE NRA WILL SEEK TO RESTRICT THE ABOVE TYPES OF DEVELOPMENT WITHIN ZONE I THROUGH THE PLANNING CONSULTATION PROCESS UNDER THE TOWN AND COUNTRY PLANNING ACTS OR BY THE USE OF OTHER RELEVANT LEGISLATION. THE USE OF SECTION 106 AGREEMENTS WILL BE ENCOURAGED WHERE APPROPRIATE.**

**F.2 EXISTING FACILITIES WITHIN THE ABOVE LIST WHICH ARE WITHIN ZONE I WILL BE SUBJECT TO MONITORING. WHERE POLLUTION IS OCCURRING, OR THERE IS POTENTIAL FOR POLLUTION TO OCCUR, THE NRA WILL SEEK CESSATION OF THE ACTIVITY, OR INITIATE REMEDIAL ACTION BY THE OPERATOR OR SITE OWNER. WHERE APPROPRIATE THE NRA WILL SEEK TO MAINTAIN GROUNDWATER QUALITY THROUGH THE USE OF ITS POWERS UNDER THE WATER ACT 1989.**



## **G. DIFFUSE POLLUTION OF GROUNDWATER**

Diffuse pollution is pollution spread over space and time which is not caused by local and specific discharges or events. It is caused by the areal spread of pollutants or by the cumulative effect of many individual and often ill-defined events. Examples of the former are the deposition of atmospheric pollutants and the leaching to groundwater of fertilisers and pesticides. Examples of the latter are the combined effects within a catchment of bad management practices involving potential pollutants, such as industrial solvents or farm wastes, which individually are small and hard to detect but which cumulatively have a significant impact on water quality.

Diffuse pollution is a problem for both surface and groundwaters. It is hard to detect and it is hard to relate cause to effect. Both because of these factors and because a specific identifiable discharge is often not involved, control under normal pollution control legislation is seldom possible.

In the case of groundwater, the problem is greater because of the long residence times in aquifers which means that diffuse pollutants can accumulate for many years before being detected. When detected the cause may be remote in time and space. This is well demonstrated in the case of the nitrate problem in groundwater, where current land management practices may have no relation to the quality of water in the aquifer beneath. The groundwater may have been polluted by action taken in a different location many years previously.

Where an individual discharge can be identified it can be controlled by the NRA under Sections 107 and 113 of the Water Act, 1989. Where new developments are proposed which, in the NRA's experience, are likely to give rise to the risk of diffuse pollution, the NRA has often been successful in getting controls imposed through the Town and Country Planning Act, 1990, depending on the degree of support the Local Planning NRA is prepared to offer.

Sections 111 and 112 of the Water Act, 1989 allow the NRA to request the Government to designate areas of land where land use practices may be controlled to prevent the pollution of water. Section 111 provides for the NRA to request the establishment of "Water Source Protection Areas" from the Government for it to make Orders controlling any land management practice in the interest of preventing pollution of controlled waters. No designations have so far been made.

Section 112 relates to Nitrate pollution only and following recommendation by the NRA, MAFF and DoE may designate Nitrate Sensitive Areas (NSA's). Farmers within the area are encouraged to enter into agreements to follow a defined scheme of agricultural management practices. Ten areas have so far been designated, all in respect of groundwater. At present the voluntary pilot scheme will operate until 1996. The EC Nitrate Directive will be implemented in England and Wales through Section 112 and is likely to lead to many more NSA's.

The NRA considers that the risks to the long term quality of groundwater resources are such that, in vulnerable groundwater areas, there will be a need to impose greater controls on relevant land management practices than are currently in force.

- G.1 IN RELATION TO SPECIFIC SOURCES OF GROUNDWATER SUPPLY WHERE IT IS APPARENT THAT A CONTINUATION OF PRESENT LAND MANAGEMENT PRACTICE WILL LEAD, IN THE SHORT OR LONG TERM, TO FAILURE TO MAINTAIN OR IMPROVE GROUNDWATER QUALITY, THE NRA WILL REQUEST ORDERS TO BE MADE UNDER SECTIONS 111 or 112, AS APPROPRIATE, FOR THE CONTROL OF THOSE PRACTICES.

IN MAKING THESE REQUESTS THE NRA WILL HAVE REGARD TO:

A) THE NRA'S VIEW ON THE PRIORITY FOR GROUNDWATER PROTECTION IN RELATION TO THE WATER RESOURCE STRATEGY FOR THE REGION.

B) THE RESULTS OF CONSULTATIONS WITH THE WATER SUPPLY COMPANIES AND OTHER ABSTRACTORS ON THEIR WATER SUPPLY NEEDS AND THEIR VIEWS ON RELATIVE PRIORITIES FOR RESOURCE PROTECTION,

C) THE RESULTS OF RESEARCH ON THE MOVEMENT OF DIFFUSE POLLUTANTS IN SOILS AND GROUNDWATER ON THE EFFECTIVENESS AND TIMING OF THE IMPACT WHICH LAND MANAGEMENT CHANGES HAVE ON GROUNDWATER QUALITY.

This policy recognises that, even when a need has been identified, it may not be practical immediately to formulate proposals because of the considerable complexity of the technical information required to support an application to the Secretary of State. The imposition of controls through Section 111 or 112 may impose considerable hardship for organisations or individuals who are required to change their established and previously acceptable practices. They must be therefore be seen to be both necessary and soundly based. This scale of the task is such that priority must be given to the situations of greatest concern and need.

Normally the designation of land subject to controls would be within Zone III (Source Catchment Zone). In order to provide a basis for designation under Section 111 or 112, the NRA is undertaking a programme of definition of the Catchment Zone for the 750 most vulnerable groundwater sources in England and Wales to be completed by July 1993.

- G.2 TO PROTECT GROUNDWATER RESOURCES IN GENERAL FROM DIFFUSE POLLUTION THE NRA WILL PROMOTE DIRECTLY, AND INDIRECTLY BY SEEKING THE SUPPORT OF OTHER BODIES, PRACTICES WHICH MINIMISE THE USE OF POTENTIAL POLLUTANTS WITHIN VULNERABLE AREAS.

This policy will be fulfilled by:

- \* preparing and making available national and regional groundwater vulnerability maps, so that areas of risk can be made known,
- \* by directly promoting awareness of the risks to groundwater among industry and agriculture,
- \* by seeking the support of Government, other regulatory bodies and trade associations to incorporate the concepts of groundwater vulnerability in their own regulations and guidelines, and by providing technical support and research advice to make this possible.

**G.3 THE NRA WILL USE ITS OWN POWERS UNDER SECTION 107 AND 108 OF THE WATER ACT 1989 AND SEEK THE SUPPORT OF LOCAL PLANNING AUTHORITIES TO USE POWERS UNDER THE TOWN AND COUNTRY PLANNING ACT, 1990 TO SUPPORT, WHERE APPROPRIATE, CONTROLS ON DIFFUSE POLLUTION.**

Where an area has been designated for the control of certain practices then the NRA will seek to ensure that parallel controls are put in place through other legislation to ensure that complementary practices are not allowed which frustrate the objectives. As an example the NRA would expect the controls on agricultural practices in Nitrate Sensitive Areas to be supported by controls on non-agricultural activities which release nitrate. The NRA's own direct powers of prevention are limited and the most appropriate method in many cases will be through development controls.

**G.4 WHERE APPROPRIATE, THE NRA WILL SEEK GENERAL CONTROLS OR PROHIBITIONS ON PRACTICES OR PROCESSES WHICH MIGHT LEAD TO GROUNDWATER POLLUTION.**

The localised nature of groundwater sources and vulnerable aquifers makes the control or prohibition of practices within a given area a practical management proposition. Where these practices are presenting a general threat to the water environment the only realistic course of action may be to seek general controls under Section 110 of the Water Act.

## APPENDIX 1

### LIST I AND LIST II SUBSTANCES AS DEFINED BY EC GROUNDWATER DIRECTIVE (80/68/EEC)

#### LIST I OF FAMILIES AND GROUPS OF SUBSTANCES

These substances should be prevented from being discharged into groundwater.

List I contains the individual substances which belong to the families and groups of substances enumerated below, with the exception of those which are considered inappropriate to List I on the basis of a low risk toxicity, persistence and bioaccumulation.

Such substances which with regard to toxicity, persistence and bioaccumulation are appropriate to List II are to be classed in List II.

- 1 Organohalogen compounds and substances which may form such compounds in the aquatic environment.
- 2 Organophosphorus compounds.
- 3 Organotin compounds.
- 4 Substances which possess carcinogenic, mutagenic or teratogenic properties in or via the aquatic environment (1).
- 5 Mercury and its compounds.
- 6 Cadmium and its compounds.
- 7 Mineral oils and hydrocarbons.
- 8 Cyanides.

#### LIST II OF FAMILIES AND GROUPS OF SUBSTANCES

Discharges of these substances into groundwater should be minimised.

List II contains the individual substances and the categories of substances belonging to the families and groups of substances listed below which could have a harmful effect on groundwater.

- 1 The following metalloids and metals and their compounds:

- |          |           |
|----------|-----------|
| 1 Zinc   | 11 Tin    |
| 2 Copper | 12 Barium |

3 Nickel	13 Beryllium
4 Chrome	14 Boron
5 Lead	15 Uranium
6 Selenium	16 Vanadium
7 Arsenic	17 Cobalt
8 Antimony	18 Thallium
9 Molybdenum	19 Tellurium
10 Titanium	20 Silver

- 2 Biocides and their derivatives not appearing in List I.
- 3 Substances which have a deleterious effect on the taste and/or odour of groundwater, and compounds liable to cause the formation of such substances in such water and to render it unfit for human consumption.
- 4 Toxic or persistent organic compounds of silicon, and substances which may cause the formation of such compounds in water, excluding those which are biologically harmless or are rapidly converted in water into harmless substances.
- 5 Inorganic compounds of phosphorus and elemental phosphorus.
- 6 Fluorides.
- 7 Ammonia and nitrites.

(1) Where certain substances in List II are carcinogenic, mutagenic or teratogenic they are included in category 4 of List I.

NATIONAL RIVERS AUTHORITY - GROUNDWATER PROTECTION POLICY  
CLASSIFICATION OF TYPES OF STRATA

TYPE A MAJOR AQUIFERS	TYPE B MINOR AQUIFERS		TYPE C NON-AQUIFERS
<p>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.</p>	<p>Fractured or potentially fractured but without high intergranular permeability. Generally only support locally important abstractions.</p>	<p>Variably porous/permeable but without significant fracturing. Generally only support locally important abstractions.</p>	<p>Formations with negligible permeability. Only support very minor abstractions, if any.</p>
<p>Chalk and Lower Greensand Jurassic Limestones Permo-Triassic Sandstones Magnesian Limestones Carboniferous Limestones</p>	<p>Coal Measures Millstone Grit Old Red Sandstone Some igneous and metamorphic formations</p>	<p>River gravels Glacial sands and gravels Crag deposits Tertiary sands and gravels Upper Greensand Hastings Beds Spilsby Sandstone</p>	<p>All clays, shales, marls and siltstones. Most igneous and metamorphic formations</p>

Note: This may be subject to minor variations in some NRA regions to reflect local circumstances and relative importance of different strata

NATIONAL RIVERS AUTHORITY - GROUNDWATER PROTECTION POLICY  
COMMONLY OCCURRING SOIL SERIES WITHIN SOIL VULNERABILITY CLASSES

CLASS 1 (High vulnerability)			CLASS 2 (Intermediate vulnerability)	CLASS 3 (Low vulnerability)
a	b	c		
Andover	Bearsted	Aberford	Adventurers	Beccles
Blackwood	Bridgnorth	Anglezarke	Altcar	Brickfield
Downholland	Bromsgrove	Badsey	Batcombe	Cegin
Elmton	Cuckney	Eardiston	Blacktoft	Clifton
Fladbury	Fyfield	Munslow	Bromyard	Denchworth
Halstow	Newport	Neath	Burlingham	Dunkeswick
Longmoss	Wick	Panholes	Carstens	Foggathorpe
Newchurch		Rivington	Coombe	Hafren
Sherborne		Shirrell-Heath	Curtisden	Ragdale
Sollom		Sonning	Denbigh	Salop
Wallasea		Swaffham Prior	East Keswick	Wickham
Wisbech		Waltham	Evesham	Wilcocks
			Hanslope	Windsor
			Ludford	Winter Hill
			Manod	
			Milford	
			Whimple	
			Worcester	



NRA

*National Rivers Authority*