National Rivers Authority

Policy and Practice for the Protection of Groundwater

GROUNDWATER VULNERABILITY OF ENGLAND AND WALES

Scale 1:1 000 000

10 0 10 20 30 40 50 60 70 80 Kms

10 0 10 20 30 40 50 Miles

NRA

National Rivers Authority

PRINCIPLES

Water resources in England and Wales can be divided into groundwater and surface water. Groundwater is contained within underground strata (aquifers) of various types across the country. Abstractions from these aquifers provide water for potable water supplies and many varied industrial and agricultural uses. Some aquifers are highly productive and are of regional importance as public water supplies, but lower yielding aquifers are also important on a more local basis. In England and Wales groundwater constitutes 35% of water used for public supply.

Groundwater is usually of high quality and often requires little treatment prior to use. It is however, vulnerable to contamination from both diffuse and point source pollutants, from both direct discharges into groundwater and indirect discharges into or onto land. Groundwater decontamination is difficult, prolonged and expensive and therefore the prevention of pollution is highly important.

The map is part of a series which identifies the vulnerability of groundwater to contamination. To assess the vulnerability, consideration must be given to the leaching characteristics of the overlying soils and the characteristics of the strata in the unsaturated zone. Information on the geological strata, such as lithological type and permeability characteristics (see geological classification), is combined with the physical properties of the soil (see soil classification), to produce varying degrees of vulnerability.

Similar but more detailed maps are planned for each county in England and Wales. These will be a valuable components of the National Rivers Authority's Policy and Practice for the Protection of Groundwater and will be used in the protection and management of the aquifers. The soil and geological classification used in the production of these vulnerability maps will also be used in the assessment of land use practices and developments on aquifers where these could have an impact on ground-water quality.

GEOLOGICAL CLASSIFICATION

Geological strata which contain groundwater in exploitable quantities are termed Aquifers, whereas rocks which are largely impermeable and which do not readily transmit water are termed Non-Aquifers. Aquifers vary in their general and hydraulic characteristics (fissured, fissure-porous and porous) and in the unsaturated zone this variation determines the vulnerability of the groundwater to pollution.

All groundwaters are controlled waters but it is convenient to subdivide permeable strata into the categories of Major Aquifers and Minor Aquifers, the former having generally less capacity for attenuating contaminated recharge entering at their surface. This division is to a considerable extent also co-incident with their water resource potential.

Major Aquifers

These are highly permeable strata usually with a known or probable presence of significant fracturing.

Minor Aquifers

These can be fractured or potentially fractured rocks which do not have a high primary permeability or other formations of variable permeability. Major Aquifers may occur beneath Minor Aquifers.

Non Aquifers

These are formations with negligible permeability that are generally regarded as containing insignificant quantities of groundwater. However, 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. Major or Minor Aquifers may occur beneath Non-Aquifers.

SOIL CLASSIFICATION

A classification has been devised which groups the many different soils in England and Wales into 3 classes based on soil physical properties which affect the downward movement of pollutants. These properties include: texture, structure, soil water regime and the presence of distinctive layers such as raw peaty topsoil and rock or gravel at shallow depth. This classification is applied across all Major Aquifers.

Soils of High Leaching Potential

Soils with little ability to attenuate diffuse source pollutants and in which non-adsorbed diffuse source pollutants and liquid discharges will percolate rapidly. 3 sub-classes are recognised:

H1 Soils which readily transmit liquid discharges because they are either shallow, or susceptible to rapid by-pass flow directly to rock, gravel or groundwater;

H2 Deep, permeable, coarse textured soils which readily transmit a wide range of pollutants because of their rapid drainage and low attenuation potential; and

H3 Coarse textured or moderately shallow soils which readily transmit non-adsorbed pollutants and liquid discharges but which have some ability to attenuate adsorbed pollutants because of their large clay or organic matter contents.

Soils of Intermediate Leaching Potential

Soils which have a moderate ability to attenuate diffuse source pollutants or in which it is possible that some non-adsorbed diffuse source pollutants and liquid discharges could penetrate the soil layer. Two sub-classes are recognised:

I1 Soils which can possibly transmit a wide range of pollutants; and

I2 Soils which can possibly transmit non- or weakly adsorbed pollutants and liquid discharges but are unlikely to transmit adsorbed pollutants.

Soils of Low Leaching Potential

Soils in which pollutants are unlikely to penetrate the soil layer because water movement is largely horizontal or they have a large ability to attenuate diffuse pollutants. Generally, these are soils with a high clay content. It must be recognised that run-off from these soils may contribute to groundwater recharge elsewhere in the catchment.

The small scale of this map does not allow the sub-classes identified above to be shown clearly and they are therefore omitted.

GROUNDWATER VULNERABILITY CLASSIFICATION

Geological classes	*Soil classes*
Major Aquifer	*High*
	Intermediate
	Low
Minor Aquifer	
Non-Aquifer	

Low permeability drift deposits which include till, head, peat, lacustrine deposits, clay-with-flints, and brick earth.

SSLRC SOIL SURVEY AND LAND RESEARCH CENTRE

BRITISH GEOLOGICAL SURVEY

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