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Creating the environment for business

Research Project into Recommendations for Groundwater Vulnerability Assessment and Associated Tools

Environment Agency

Entec was commissioned by the Environment Agency's National Groundwater and Contaminated Land Centre to develop a new framework for groundwater vulnerability assessment to potentially replace the existing system that is based on 53 Groundwater Vulnerability Maps published for England and Wales. The current groundwater vulnerability tool, which has been in existence for nearly 10 years, does not address new legislation e.g. the Water Framework Directive.

The key objectives for the new framework were:

- to be consistent with the Agency's risk-based approach to groundwater protection;
- to meet the requirements of various EC directives, including the Water Framework Directive and the Groundwater Directive;
- to allow a broad range of activities to be assessed from potential point sources of pollution such as septic tanks, to assessment of diffuse pollutants such as the application of pesticides; and
- that the vulnerability assessment could be easily updated to reflect monitoring data.

The project reviewed the different approaches to assessing groundwater vulnerability which have been developed elsewhere in the world and concluded that none of the existing techniques fully met the Agency's requirements.

The new framework has been developed so vulnerability can be evaluated on the basis of predicted concentrations and travel times. The framework allows a range of tools or algorithms to enumerate data held as a series of GIS layers. The tools / algorithms and data layers used for an activity will be selected on the basis of the properties of specific contaminants and the nature of the activity. Outputs will be produced as GIS layers that will be assessed against assessment criteria to determine groundwater vulnerability and will also be linked to appropriate planning responses, e.g. codes of practice.

Two case studies have been carried out within GIS using data available for an area of North Norfolk. The case studies have identified a number of technical, logistical and computational requirements, but none that cannot be met reasonably.

A number of work elements have been identified which would allow significant development of the proposed framework. The main development work could be progressed over a period of one to two years, with further development over a subsequent two to five year period.

The Concept of Groundwater Vulnerability

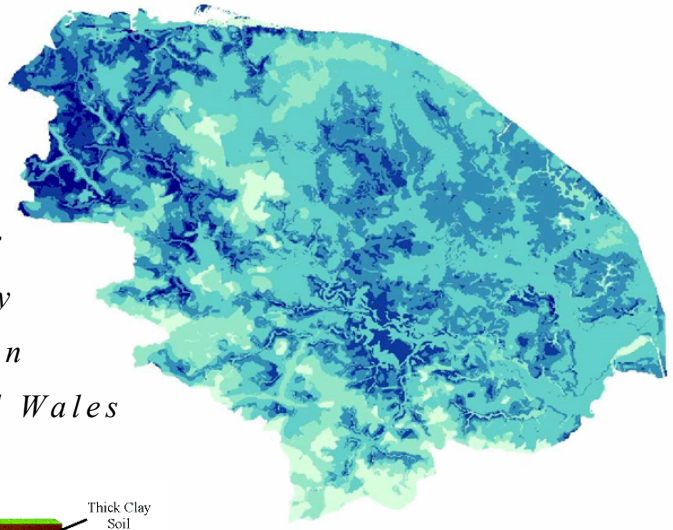
Groundwater vulnerability is the susceptibility of underground water resources to pollution by various activities and contaminants.

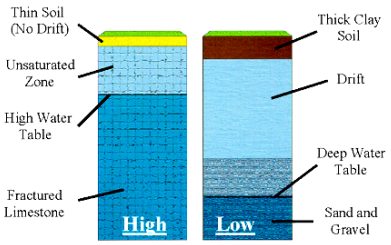
This vulnerability tends to be lower where soils and substrata are thicker and more organic and clay-rich, where there is a general absence of fissures, and where the water table is deeper (see illustration).

These factors reduce and / or slow the amount of water moving downwards and are also important in stopping a wide range of contaminants reaching the water table.

There are a large number of activities with a potential to contaminate groundwater. Examples include use of pesticides and fertilisers in agriculture, septic tank discharge, sludge spreading and landfills. A technique that can appropriately subdivide land areas into areas of high and low groundwater vulnerability to a range of activities is therefore a useful tool in identifying locations where such activities have a higher risk of contaminating groundwater. Once identified, different areas of vulnerability can then be subjected to use restrictions, codes of practice or targeted for more detailed assessment.

Developing a new framework for groundwater vulnerability assessment in England and Wales





Above:
The North Norfolk case study area: example travel time map

Left:
Vulnerability illustrated