

Research Projects

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Photo: Bill van Aken

Protection of groundwater from pollution

National guidelines for assessing groundwater vulnerability

Without groundwater, many communities wouldn't be able to get enough potable water. This vast underground supply of water, invisible to the casual eye, is a precious resource. However it is susceptible to pollution arising from everyday life like farm chemicals and fertilisers, septic tanks, and leaking petroleum storage tanks. Once groundwater has become polluted, the problem is there for a long time because the movement of groundwater is typically measured in centuries.

We need to treat our groundwater resources with care, and a first step in doing this is to make people aware of how vulnerable the water under their feet is to contamination. Spillage of chemical products onto the sandy

ground above a shallow aquifer (in Perth, for example) could have grave consequences for the local water supply, but septic tanks leaching into the ground above a deep, layered aquifer in the rocky out-skirts of Sydney is of less concern.

How can planners and state water authorities gauge how strong environment protection regulations need be to protect this resource in each location? CSIRO scientists at the Centre for Groundwater Studies have developed guidelines that could help these people devise appropriate groundwater protection strategies and management plans. The guidelines available as a CGS Report have been endorsed by the National Groundwater Committee (CGS Report No. 85).



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Making assessments

Making an assessment of vulnerability is a difficult exercise because vulnerability cannot, in itself, be measured. Related information that can be measured or mapped, such as data sets on depth to water table, geological maps, and maps of soil types are often used to develop a groundwater vulnerability map. Combining all this information into one map of vulnerability requires modelling, statistics, case studies, and often the intuitive judgement of experts.

Interest in groundwater vulnerability assessment has grown over the last 5 years, particularly for state water resource management. Assessments usually have had a regional focus and catchments with extensive agriculture or high-yielding aquifers have been prime cases for examination.

There are two main types of assessments:

- Intrinsic vulnerability assessments focus on hydrogeological settings and the natural protection against contamination provided by physical characteristics; and
- Specific vulnerability assessments focus on the properties of specific contaminants and their behaviour in the sub-surface environment.

The starting point for any investigation is to consider all groundwater to be vulnerable. Over the last decade, our scientists have worked on many different methods of producing vulnerability maps. No one method can really be said to be 'the best'. The approach chosen should always consider why the map is needed, and the scale of interest – local or regional, short-term or long-term. For example, if the aim is to educate the general public of the value of groundwater a different method and output may be required than

when output is used to make groundwater management decisions. And if land use planning is the goal groundwater vulnerability assessments should be used in conjunction with environmental impact assessments.

Only a guide

Because of inevitable lack of precision, vulnerability assessments are best described as guides, and are not substitutes for proper, detailed impact studies. In most cases vulnerability assessment methods determine only the likelihood of the vertical movement of contamination in shallow groundwater. Lateral migration is an additional possibility that needs consideration, as is the fluctuation in groundwater levels over time.

To assist groundwater management it is recommended that a tiered approach to vulnerability assessment be used. Here the decision to undertake more detailed studies is based on the results of a screening level analysis to determine intrinsic vulnerability as shown in Figure 1.

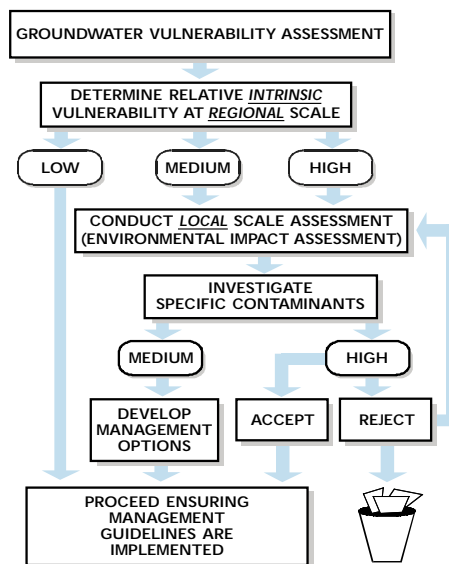


Figure 1. Recommended use of groundwater vulnerability assessment

This recognises the uncertainty involved in evaluating vulnerability and provides an opportunity to gather knowledge

on areas of most concern while minimising investigation costs.

Validation and management issues

Because of the many variables in the assessment process – notably the uncertain time frames over which contamination might occur and the unknown depth and area below ground through which contaminants might spread – vulnerability assessment methods can not be validated in the strict scientific sense. Explicit plans for subsequently testing, reviewing, and refining the assessment need to accompany the work. Groundwater vulnerability assessment is a dynamic process requiring the full cooperation of the relevant policy makers, resource managers, and technical experts.

For a successful assessment, clear objectives should be set early on. To ensure their needs are accommodated, the people who will use the completed assessment should be involved from the start and consulted regularly as the assessment proceeds – it makes little sense to use a complex method and model, the output of which can only be interpreted by technical experts, if the end-users will be lay people.

Vulnerability assessment offers good opportunities for promoting public awareness of the risk of groundwater contamination. Case studies have shown that vulnerability assessments make significant contributions to everyone's understanding of the scope of the problem, and help to raise community awareness.

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