



Groundwater Quality Protection



Discussion Paper



Water at e r

Groundwater Quality Protection

Discussion Paper

© COMMONWEALTH OF AUSTRALIA 2002

[ISBN 0 9578245 4 8]

[Printed by National Capital Printing]

[Design by AFFA Public Relations]

NATURAL RESOURCE MANAGEMENT STANDING COMMITTEE

In June 2001 the Australian Commonwealth and State/Territory governments created several new Ministerial Councils from the amalgamation and redirection of the work of several existing Councils. These changes saw the winding up of the Agriculture and Resource Management Council of Australia and New Zealand, the Australian and New Zealand Environment and Conservation Council and the Ministerial Council on Forestry, Fisheries and Aquaculture, and the establishment of several new Councils among which is the Natural Resource Management Ministerial Council. The objective of this new Council is:

“to promote the conservation and sustainable use of Australia’s natural resources”.

The Natural Resource Management Ministerial Council, which consists of Australian Federal, State/Territory and New Zealand Ministers responsible for natural resources management policy issues has principal responsibility for, amongst other things, water issues.

The Council is supported by a permanent Standing Committee, titled the Natural Resource Management Standing Committee. Membership of the Standing Committee comprises relevant heads/CEOs of Commonwealth, State/Territory and New Zealand government agencies.

The Standing Committee agreed to release this HLSG discussion paper, *Groundwater Quality Protection*, for targetted consultation and finalisation of a Policy Position Paper for consideration by the Natural Resource Management Ministerial Council, at its second meeting in November 2001.

FURTHER INFORMATION

Enquiries concerning this publication should be directed to:

Secretariat, NRMCC

GPO Box 858

CANBERRA ACT 2601 Australia

Tel: (02) 6272 3933 Fax: (02) 6272 5161

TABLE OF CONTENTS

	Page
1. INTRODUCTION	1
2. WHY WE MUST PROTECT GROUNDWATER QUALITY.....	2
3. KEY REFORMS	3
3.1 Fundamental Principles.....	3
3.2 Impediments to Implementation	4
3.3 Application of Beneficial Use.....	5
3.4 Groundwater Management Plans.....	5
3.5 Remediation	6
3.6 Diffuse Contamination.....	7
3.7 Assessment of Groundwater Quality Protection Outcomes.....	7
3.8 Tools for Groundwater Quality Protection	8

1. Introduction

The 1994 COAG Water Reform Agreement required ARMCANZ to provide advice to jurisdictions on improvement in groundwater management, with particular reference to pricing of groundwater. To meet this requirement, the ARMCANZ Policy Position Paper (1996): *Allocation and Use of Groundwater: A National Framework for Improved Groundwater Management in Australia* was produced. This policy approach was confined to groundwater quantity issues. It did not consider groundwater quality protection since this had been covered in the *Guidelines for Groundwater Protection in Australia* (1995), a module in the National Water Quality Management Strategy (NWQMS).

The COAG Water Reform Agreement also required jurisdictions: “To support ARMCANZ and ANZECC in their development of the National Water Quality Management Strategy, though the adoption of a package of market-based and regulatory measures including the establishment of appropriate water quality monitoring and catchment management policies and community consultation and awareness.”

Currently, the 1995 NWQMS Groundwater Protection Guidelines is the only national document specifically covering groundwater quality protection. Though it refers to a number of approaches to groundwater protection, often expressed in broad terms, the degree to which these have been taken up by States¹ is very limited and inconsistent. Moreover, the Guidelines are focussed mainly on the broad-scale protection of groundwater quality and make only limited reference to the management of groundwater near contaminated sites or to the remediation of contaminated groundwater.

There is concern among groundwater resource managers that groundwater quality protection is not being adequately addressed at the policy level. The ARMCANZ High Level Steering Group on Water has therefore prepared this paper with the aim of promoting improved protection, and where necessary enhancement, of groundwater quality.

¹ In this paper the term “States” is used to denote States and Territories; “Jurisdictions” denotes States, Territories, and the Commonwealth.

2. Why we must protect groundwater quality

There is growing concern throughout the world about the contamination of groundwater as a result of human activities. Causes of groundwater contamination include use, spillage, or disposal of pesticides, fertilisers, petroleum hydrocarbons, industrial chemicals, and waste products. Contamination can also result from changes in the existing land use.

The importance of groundwater as a resource to the nation cannot be overstated. It is estimated that in the order of 30 000 000 ML/yr of groundwater is available for use. Of this, about 5 600 000 ML/yr is used. There are approximately 500 cities and towns that depend upon groundwater for drinking purposes. Almost all of inland Australia is strongly dependent upon groundwater.

In Australia, groundwater has considerable value both for its economic and social uses (i.e. drinking water, agriculture, industry, and recreation), and for its role in maintaining a range of ecosystems at the surface and below ground. The contamination of groundwater can have adverse effects on these uses, ultimately leading, as water quality deteriorates, to the groundwater being unable to support or maintain these beneficial uses. In most cases this degradation is irreversible. Remediation is very expensive and is often unsuccessful. Consequently, adequate protection of groundwater quality must be a primary aim.

Groundwater and surface water are often intimately linked, and changes to quality or quantity in one resource frequently impacts on the other. Groundwater contributes to streams, lakes and wetlands, and is particularly significant in maintaining these surface water ecosystems in dry periods. Furthermore, surface water quality can affect groundwater quality through seepage and where surface water directly enters groundwater.

Protection of surface water quality is often considered to be of paramount importance because impacts of contamination or poor water quality are readily observed. However, given the value of groundwater to the nation and the connections between surface water and groundwater, protection of the quality of groundwater should be given at least equal prominence to that of surface water. Additionally, there is a need for a greater awareness of groundwater, its key role in supporting a range of economic, social and environmental values, its significance in the hydrological cycle, and the need to protect these valuable but invisible resources.

The approach to groundwater quality protection and enhancement varies not only between States but also within them. Within some States, different agencies have differing responsibilities for groundwater quality. This gives an impression to industry and the community that groundwater quality protection in Australia is generally inconsistent and uncoordinated. It is important for groundwater management that responsibilities are clearly defined, coordinated and accepted by each agency. Furthermore, there is a “duty of care” responsibility on all agencies to act upon the information they receive.

This paper provides recommendations on key reforms required for there to be a consistent approach to improved groundwater quality protection and enhancement². The scope of the paper does not cover the management of water quality changes as a consequence of salt or sea water intrusion, groundwater salinisation, or the consequences of poor bore construction.

² “Enhancement” of groundwater quality is analogous to its “remediation”

3. Key Reforms

3.1 Fundamental Principles

A fundamental principle underlying groundwater protection is the identification and maintenance of current or potential groundwater “beneficial use” (a term analogous with “environmental values”). The benefits of groundwater use or non-use cover a range of exploitative benefits as well as a range of environmental and conservation benefits and values. These include ecosystem protection, recreation and aesthetics, raw water for drinking water supply, agricultural water, and industrial water. This is not a comprehensive list and other beneficial uses may be identified on a site specific basis (e.g. mineral water, social and cultural values).

In many cases groundwater protection is not implemented because there is no clear understanding or definition of the basis for protection, and as a consequence no identification of the beneficial use to be protected. The remediation of polluted groundwater also requires specified clean-up goals and these can be set most clearly following identification of the current and/or potential groundwater beneficial uses.

When seeking to protect a particular beneficial use, a variety of measures need to be implemented. Technically sound and appropriate interpretation of the available data should be undertaken, for example through vulnerability and risk assessment. Such an understanding is not always currently available and without it, protection measures may not be well targeted or effective. In many cases the implementation of these measures will lie with agencies responsible for land use planning.

It is essential for adequate protection of groundwater quality that the various agencies responsible for groundwater protection develop a coordinated approach as part of their duty of care responsibilities. This may require significant improvement in communication. Indeed, clear National guidelines are needed to help coordinate action between States, and to build on the collective experiences with groundwater quality protection in the various jurisdictions.

The regulatory means (e.g. prohibition of uncontrolled waste discharge, waste discharge and extraction licensing) by which the protection measures are implemented are important for promoting compliance. Economic and market measures also offer potential.

Groundwater quality protection can also be promoted by increasing public awareness. This can not only promote best practice by individuals but also encourage acceptance of, and improved compliance with, regulatory measures. Currently, public awareness of groundwater quality issues and best practices is still in its infancy.

None of these measures alone will improve groundwater quality protection. An integrated approach is required. In protecting groundwater quality, the interactions between surface water and groundwater, and between water quality and quantity must be taken into account.

Conclusion 1

Groundwater quality protection should be pursued through an approach that is:

- based on the beneficial use concept and
- implemented through an integrated approach, utilising a range of measures, including the key measures of:
 - risk and vulnerability assessment;
 - land use planning and management;
 - regulatory measures (e.g. licensing)
 - economic and market mechanisms (e.g. trading)
 - education and awareness.

The approach should also account for managing interactions between water quality and quantity and between surface and groundwater.

3.2 Impediments to Implementation

Within each State there are significant impediments to the implementation of effective groundwater protection. These include lack of technical expertise and/or number of people to identify what protection is required; poor communication between agencies responsible for groundwater protection; inadequate identification of agency responsibilities; inadequate tools for the identification and implementation of protection programs; and lack of resources or regulatory tools to adequately check compliance and enforcement of groundwater protection.

To improve groundwater quality protection it is considered a priority that States identify the impediments that hamper effective protection.

Conclusion 2

There is a need to identify impediments to implementation and enforcement of an effective groundwater quality protection program. Strategies to address the impediments and issues also need to be developed, considering the following:

- human, financial and technical resourcing
- compliance
- institutional arrangements
- availability of appropriate regulatory tools
- appropriate economic and market mechanisms
- community awareness and education.

3.3 Application of Beneficial Use

Though the Beneficial Use concept is accepted by each State, there is currently no nationally agreed approach about how it should be applied. For some States it is based almost solely on water quality criteria, in others public consultation plays an important role. In some States, classification has been straightforward, whereas in others no accepted methodology has been identified. The means by which potential beneficial uses can be identified can also be a problem since different stakeholders can have different views on how to apply the beneficial use criteria.

Risk-based approaches are increasingly being adopted for assessing the impact of point sources of potential and actual pollution on beneficial uses of groundwater, particularly within environmental protection agencies. These approaches need to be integrated within accepted groundwater quality protection policies based on the beneficial use approach so that conflicts and inconsistencies do not occur in the management of groundwater quality.

States should be accountable for the determination of Beneficial Use for all groundwater management units.

Conclusion 3

There is a need to develop a nationally consistent approach to applying the Beneficial Use. This should include integration of risk based approaches.

There is a need to develop State level programs for Beneficial Use classification for all groundwater management units.

3.4 Groundwater Management Plans

The development of groundwater management plans has been encouraged by ARMCANZ (1996) and most States are now beginning to develop such plans for important and high use groundwater resources. These plans are generally quantity focussed and are frequently dealing with over allocated systems. The 1998 NWQMS *Implementation Guidelines* propose a broad range of measures for inclusion in a groundwater quality management planning process. However, in many cases none of these activities is integrated or linked with the quantity focussed groundwater management plans currently being developed by the States.

It is considered essential that groundwater management plans also include a groundwater quality protection component. If groundwater becomes contaminated, its beneficial use may be adversely affected, and plans in relation to groundwater quantity may become redundant.

Conclusion 4

In the development of groundwater management plans, strategies to protect groundwater from contamination and maintain its Beneficial Use (including ecosystem values) should be included.

3.5 Remediation

When groundwater becomes polluted, its potential beneficial use has by definition been adversely affected. Environmental protection agencies increasingly tend to adopt a risk-based approach when assessing point source remediation goals. These do not always take account of the current or potential beneficial uses of groundwater, to the detriment of the long-term management of the resource. It is important that the risk-based approaches be integrated with groundwater quality protection policies based on the Beneficial Use concept.

Identification of existing and potential beneficial uses of a groundwater resource can be difficult, and subject to differing interpretations depending on the agency or individual viewpoint. However, it is essential that these are identified and agreed prior to setting remediation goals for locally contaminated groundwater.

It is often not technically feasible or economically viable to remediate polluted groundwater. In such circumstances, it is important to identify both the extent of the groundwater pollution, and the measures necessary to limit or restrict the long-term impact of the moving contaminant plume upon the existing beneficial uses of adjacent groundwaters and groundwater-fed surface waters. In many States, such management of polluted groundwater is not taking place.

Conclusion 5

There is a need to integrate the Beneficial Use concept and risk based approaches in the remediation of polluted groundwater.

When remediating polluted groundwater, due consideration should be given to the maintenance of existing and future beneficial uses.

State level strategies need to be developed for dealing with long term management of polluted groundwater where remediation is not effective or practical.

3.6 Diffuse Contamination

Diffuse sources of contamination are difficult to regulate since they are by their nature widespread. Unlike point sources which can be specifically targeted by regulations and licensing, the management of diffuse source contamination generally relies on a suite of large-scale planning and best practice approaches. Since the impact of diffuse sources can be widespread, specific polluters can be hard to identify, and the groundwater contamination can be difficult or impractical to clean up, the beneficial use of groundwater over wide areas can be adversely affected. It is essential for the conservation of the groundwater resource that practices are implemented which seek to minimise the impact of diffuse sources.

Conclusion 6

To address diffuse source pollution, jurisdictions need to work with industry, local government and other stakeholders to develop a suite of approaches, including land use planning and management, codes of practice, load based application approaches, economic instruments, waste minimisation, monitoring, and education.

NRMCC should co-ordinate this at the National level.

3.7 Assessment of Groundwater Quality Protection Outcomes

The effectiveness of groundwater quality management and protection relies on enforcement and a comprehensive, targeted monitoring program. Since monitoring often must be undertaken over the long term, it often suffers budget cuts or is neglected due to lack of resources. However, if baseline trends are not known, early response to potentially adverse impacts is not possible. Monitoring is a key activity to enable identification and protection of groundwater beneficial use.

There is a growing trend for companies and individuals to self-monitor groundwater where there is a potential for contamination. This places the cost on the potential polluter, but will prove ineffective if the monitoring is poorly undertaken. It is considered essential that there be improved standards and quality control placed on self-monitoring, and that there be an adequate mix of government monitoring and self-monitoring.

Also, monitoring data is frequently collected but not always analysed. Often it is not placed in an effective archive/retrieval system such that it is effectively inaccessible. For the monitoring to be of value and to serve its purpose, there should be regular reporting, review and analysis of the monitoring results. Both government agencies and the potential polluters should be subject to “duty of care” requirements. The ability for the monitoring results to be collated at State and National levels will enable auditing and assessment of the groundwater protection measures

and of the quality of the groundwater resource. Public availability of the results will ensure that information of public concern is openly available, and will encourage the carrying out of duty of care responsibilities.

Conclusion 7

Groundwater quality monitoring adequate to assess the achievement of water quality objectives set for designated Beneficial Uses need to be put into place in priority areas. Regular reporting should be at the groundwater management unit scale and capable of being collated at National and State levels and be publicly available.

3.8 Tools for Groundwater Quality Protection

There are a variety of means or tools that can be used in protection of groundwater quality. The application of each tool is one element of a larger whole, which can assist in groundwater quality protection. Groundwater protection in all States would be improved if these tools were better identified and implemented.

The development of Wellhead Protection Plans around important wells, especially urban supply wells, is regarded as good practice. These plans are specifically designed to protect the groundwater from pollution, be it locally and/or regionally.

Codes of Practice are an important means by which the impact of diffuse source of pollution, in particular, can be reduced. Protection from both diffuse and point sources of pollution can be assisted through the use of land use planning control measures in combination with assessments of the vulnerability of groundwater to contamination and the risk of adverse effects. Economic instruments applied to the potential polluter, and community education and awareness are other tools that can lead to the protection of groundwater quality.

A growing practice within water resource management that can have an impact on groundwater quality is artificial recharge using potable waters or treated waste-waters. These recharge schemes are used to enhance the sustainable development of aquifers, or as part of waste-water reuse schemes. The operation of such schemes, particularly recharge using waste-waters, can be limited by environmental protection legislation on waste-water disposal, even though the impact on groundwater beneficial use may be small and transient (i.e. water is stored and then recovered). Such schemes have considerable potential benefit for water resource management and the economy generally. Since this is a practice that is becoming increasingly widespread, a national approach should be developed to ensure that artificial recharge schemes are framed within overall water quality protection strategies. These should consider the impacts on both surface water quality (which may be improved) and on groundwater quality within a single water resource management framework.

Conclusion 8

The following tools can be used to protect groundwater resources:

- wellhead protection plans
- vulnerability assessment
- codes of practice
- economic instruments
- education, community awareness and involvement
- land use planning.

In particular, there is a need for development of a National approach to the establishment and operation of artificial recharge schemes with respect to their potential impact on Beneficial Uses of groundwater.

