National Groundwater Committee

Knowledge Gaps for Groundwater Reforms

Photo: Nick Gartrell

May 2004

National Groundwater Committee

Knowledge Gaps for Groundwater Reforms

A strategic directions paper for water researchers, based on the outcomes of a national workshop held in Canberra 12-13 November 2003 hosted by the National Groundwater Committee

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Introduction

The COAG water reform process that commenced in 1994 has produced significant changes to the way in which we view and manage water. Achieving efficient and sustainable management and use of our water resources and providing water for the environment requires ongoing effort to develop and refine the scientific understanding which supports policy developments. Technical and policy knowledge gaps had been identified by the National Groundwater Committee (NGC) as major impediments to water reforms. Several key emerging issues were identified to the Land, Water and Biodiversity Committee (LWBC) by NGC as requiring improved approaches. The LWBC supported a NGC request to hold a workshop to discuss these and other issues, and to identify and prioritise research needs.

With the proposed National Water Initiative (NWI) then under development, a workshop was held in Canberra on the 12th and 13th November 2003 to scope the full extent of the knowledge gaps relating to groundwater management.

Twenty-six senior water managers and researchers met to identify and prioritise the work needed to fill the knowledge gap areas. Only work considered essential to the NWI has been retained in this document. The workshop was divided into the following sessions:

- Groundwater dependent ecosystems;
- Integrated management of surface and groundwater resources;
- Water level response management;
- Land use changes;
- Other knowledge gap areas that impact on the NWI; and
- Strategies for Progressing Research.

This report summarises the workshop findings and earlier work by NGC and provides a priority list of research areas that, if undertaken, would support implementation of the National Water Initiative as outlined in the COAG Communique of August 2003. This report will provide a basis for meetings with key funding and research bodies to promote research needed to improve implementation of water reforms.

It became apparent early in the workshop that lack of progress in some areas of water reforms was in fact a government resourcing and priority setting issue rather than a knowledge gap (eg data to run groundwater models). The development of tools that would assist resource managers make more informed decisions was highly sought after. Data gaps are outside of the scope of the workshop and only policy[1] and scientific knowledge gaps are reported on here.

The program together with the aims for the workshop are provided in Appendix A. The Australian Government Department of Agriculture, Fisheries and Forestry funded the workshop.

Contextual Framework

The first step in identifying impediments to water reform, and in particular those foreshadowed in the COAG Communique of August 2003 on National Water Initiative involves defining their context. In general terms, the key elements of the NWI involve:

1. Nationally Compatible Water Access Entitlements;
2. Nationally Functioning Water Markets;
3. Best Practice Water Pricing;

[1] Note the term policy includes economic and social policy.

4. Integrated Management of Environmental Water;
5. Measuring, Monitoring and Information; and
6. Urban Water Reform.

Whilst the policy developments of the past 10 years have been considerable, there is more work needed. Further science and technology support is also required to help refine regulatory and institutional frameworks and to support ongoing policy development to further water reform.

As the NWI strives to improve specification of water entitlements, implement improved trading rules, and more integrated management of environmental water, there is also a need to improve understanding of our water resources and to improve the reliability of our assessments. These assessments need to be undertaken at scales ranging from the individual property scale to the whole catchment scale.

With respect to groundwater the particular aspects requiring further science and technology support are:

- **Specification of water access entitlements:** At individual water user scale, specifying individual share and seasonal allocations, and reliability level is a complex process given the unknowns of hydrogeological variability within an aquifer system. At the regional or catchment scale specifying the water available has always been unreliable as knowledge of recharge is often limited. Gaps in understanding and availability of assessment tools have often led poor specification of some elements of the water balance. Consequently, the uncertainty bounds that surround the specification of available groundwater and individual entitlements are often quite large. More scientific work is needed on long term water quality changes caused by groundwater pumping and how this might affect access entitlements. Likewise more scientific work is needed to support the specification of entitlements in a highly connected surface/groundwater system
- **Water markets:** Specifying trading rules for a water market in some aquifer systems is also subject to large uncertainty for the same reasons that lead to uncertainty in specification of a water user's entitlement. Defining trading zones in a dynamic groundwater system can also impact trading rules. Zone boundaries may need to be changeable depending on the amount and location of trades that occur. Trading between surface and groundwater systems may occur in the future under conjunctive management rules and the hydraulic/environmental relationship will need to be clearly understood.
- **Integrated management of environmental water:** Limited understanding of the links between ecosystem health and groundwater available to the ecosystem and the processes involved in these links means that it is difficult to adequately specify rules for managing environmental groundwater flows nor are we currently able to specify suitable indicators that can be used to monitor and manage system performance in response to prescribed aquifer management rules.
- **Measuring, monitoring and Information:** Specifying reliable indicators for purposes of managing environmental health of groundwater dependent ecosystems and measuring those indicators in a cost effective way requires better understanding of these ecosystems. Specifying reliable values for system performance criteria is problematic when there is inadequate understanding of catchment water balances and the processes linking the various components of the water balance.

The NWI identifies that accurate measurement, monitoring and reporting is raised to a new level of importance when there is increasing competition for water. The tools for doing this, the underpinning science and the development of more efficient technologies requires that research organisations become more involved and apply their research skills to helping solve these problems.

Groundwater Dependent Ecosystems

The emphasis that has been placed on environmental flows in surface water in previous years has not been matched in groundwater and it is reasonable to say that Australia's knowledge of groundwater dependent ecosystems (GDEs) is in its infancy. Any level of groundwater pumping will result in declines of natural discharges (or increases in natural recharges), with consequent environmental impacts (EA, 2003), There are for instance two time lags associated with GDE protection that need to be understood. The first is the hydraulic time lag between commencement of groundwater pumping and reduction in water availability to an ecosystem.. The second is the ecological response time that it takes for the ecosystem to deteriorate or die.

A major challenge is providing quantitative criteria on which to base protection of ecosystems. There is currently little knowledge of indicators of ecosystem stress that would allow adaptive management. There is also no guidance on what impacts are acceptable. Indeed, there are no accepted ways of valuing ecosystems, and no obvious way of determining costs of loss of ecosystem function.

Resource managers are regularly required to make decisions on resource access without sufficient information on the presence, value and level of dependence of nearby GDEs.

The workshop heard that the main factors causing impacts on GDEs are water level changes, salinity increases, changes to the discharge flux (both quantity and quality) and biodiversity threats such as weed infestation. The workshop included a presentation from Gayle Stewart of the Australian Government Department of Environment and Heritage who informed the workshop that a new part of the *Environment Protection and Biodiversity Conservation A*ct 1999 will allow for statutory reserves for Groundwater Dependent Ecosystems (GDEs) that have a high priority.

The **key** policy and research knowledge gaps identified in this session are given below.

Knowledge Gaps

Policy Issue

The original set of National Principles for Ecosystem Protection were developed by ARMCANZ/ANZECC and published in 1996. These principles have been redrafted but are yet to be published. The National Groundwater Committee considers that the document is mainly focused on surface water ecosystems and has provided suggested changes so that groundwater dependent ecosystems are adequately covered.

Policy Research Areas

1. Develop an agreed approach for best-practice management of GDEs across jurisdictions
2. Identify ways of improving groundwater allocation and GDE protection in non-prescribed areas or areas with a low level of management.
3. Investigate the benefits of a national register for priority GDE sites and determine what attributes should be in a register.

Technical Issue

A need to characterise and value GDEs at a catchment scale so that priority GDEs are identified and an appropriate level of protection can occur.

Technical Research Areas

1. Develop guidelines for the identification of GDEs
2. Develop methodologies for mapping GDEs at a landscape level. Test the preferred methodology in several icon catchments.
3. Develop a national manual on groundwater dependent indicator species detailing sampling protocols and approaches
4. Assess current valuation techniques and develop new ways of valuing GDEs. Apply the valuation process across icon catchments.

Technical issue

Some ecosystems are totally dependent on groundwater (obligate) while others are only partially dependent at certain times of the year (facultative). A major challenge for management of GDEs is in providing quantitative criteria on which to base protection of priority ecosystems.

Technical Research Areas

5. Conduct specific case studies to determine the dependence of different ecosystems on groundwater availability including: extent; timing and degree of groundwater dependency and critical groundwater levels for their protection.
6. Determine the sensitivity of stygofauna to dewatering and recharge cycles in a range of aquifer types.
7. Assess the potential for on-going low level contamination of groundwater through surface run-off and infiltration, and consequent impacts on GDEs

Technical Issue

The different temporal and spatial scales that operate for hydraulically connected surface/groundwater systems is not well understood. These systems need to be conjunctively managed to achieve environmental flows whilst maintaining a productive groundwater pumping economy.

Technical Research Areas

8. Undertake case studies of the impact of groundwater extraction on environmental flows in rivers, including both regulated and unregulated flow systems and unconfined and semi-confined aquifers;
9. Develop tools to enable regional resource managers to quantify GDE requirements in terms of total catchment water balance

Technical Issue

At present in Australia there is little knowledge of species within GDEs that would be good indicators of ecosystem stress. Research should include water quality and quantity impacts.

Technical Research Areas

10.	Determine key indicator species for a variety of GDE types (e.g. mound springs, wetlands, woodlands)
11.	Develop health response curves for indicator species to reduced groundwater availability

Integrated Surface and Groundwater Management

The impact of groundwater pumping on streamflow is an issue that presents significant risk to sustainable management and use of both surface and groundwater systems where these systems are connected.

There are significant areas of hydraulic connection between rivers and major productive aquifers in New South Wales (Braaten and Gates 2003) and elsewhere in Australia (SKM, 2003 and REM 2003). In these connected systems, groundwater pumping has the potential to erode low river flows either through reducing baseflow or increasing seepage losses. This could affect the rights of river pumpers and put in-stream ecosystems at risk.

For water agencies to manage this stream depletion effect, information is needed on two factors: the proportion of groundwater pumped that results in depletion of streamflow; and the time lag or response function of this impact. These are dependent on the hydraulic connection between the river and aquifer and the proximity of groundwater pumping to the river and other potential sources of water capture.

In some systems, it may be possible to take advantage of this time lag by structuring the location and timing of extraction to shift stream depletion impacts to non-critical periods. The factors that drive the time lag in different types of aquifer systems are not well understood.

A presentation by Peter Cook from CSIRO Land and Water highlighted the importance of integrated water management.

The key policy and research knowledge gaps identified in this session are given below.

Knowledge Gaps

Policy Issue

In highly connected systems where groundwater and surface licences have been issued separately, the same megalitre of water may have been allocated twice. Furthermore some systems, which would not be considered to be over-allocated in isolation, may be over-allocated when considered together.

Policy Research Areas

1. Develop guidelines for conjunctive management of surface and groundwater which address the issues of time lag and double accounting. Guidelines should adopt a 'share of the available resource' approach rather than a volumetric approach.
2. Determine the extent of over allocation in connected surface-groundwater systems for all jurisdictions.
3. Determine the social and economic implications of implementing conjunctive management, including trading between surface and groundwater.
4. Design as an example, a joint surface and ground water management (allocation) plan. This will require a whole of catchment approach so as to maximise economic return while protecting ecosystems. This conjunctive management study should be focussed on an 'icon' site for a case study.

5.	Conduct an assessment of and collate existing work on the awareness of groundwater irrigators of their impact on rivers.

Technical Issue

The interaction between groundwater and surface water quality. There is a lack of understanding of the importance of water quality and the processes controlling water quality in the hyporheic zone; coastal zone and in the different zones in a stream/aquifer system eg. Riparian. Tools used to quantify stream-aquifer interactions have traditionally focused on managing the quantity of water flow between the two sources. There is a need to improve the tools available for including water quality in the assessment process.

Technical Research Areas

1.	Develop predictive tools that relate surface water quality to groundwater input and can be used to predict the ecological impacts of water quality changes.
2.	Assess the temporal and spatial scale requirements to effectively model water quality processes in groundwater - surface water interaction (for example, many processes occur on small time scales, such as in ecological niches effected by tidal fluctuations in coastal zones). This involves gaining a better understanding of the processes involved in flow across the stream-aquifer interface zone - that is, through the hyporheic and parafluvial zones.
3.	Investigate the potential for irrigation to concentrate salt both in terms of the soil profile and the underlying aquifer water quality and the processes affecting time lags between irrigation activities and groundwater quality degradation.
4.	Determine if reduced surface through flow that results from changed land use will have an impact on groundwater salinity and therefore potentially impact the value and quantity of water available for allocated purposes.
5.	Determine how effectively flow and transport in stream-aquifer systems can be modelled with various levels of detail to reduce the uncertainty bounds to an acceptable level. This is essentially the question of when to stop gathering information needed to answer management questions.
6.	Conduct a study of surface water quality degradation caused by groundwater processes in a seriously degraded system, for example the Lockyer Valley. Include social and economic impacts.
7.	Define the sustainability of groundwater extraction on the basis of water quality and quantity, including salinity.

Technical Issue

The connection between streams and aquifers can vary from ‘high’ to ‘low’ and from losing to gaining streams and vice versa over relatively short distances. The response in a stream to groundwater pumping will vary greatly depending on the hydraulic connection that exists between the two and the distance from the stream.

Technical Research Areas

8.	Develop a paper that defines and characterises highly connected ground/surface water systems for the purposes of integrated management.
9.	Determine where in catchments surface water systems and groundwater systems are hydraulically connected through field studies.
10.	Based on detailed case studies, develop generic methods for rapidly assessing the hydraulic connection in other systems.

11.	Characterise through modelling studies the timing of impacts of groundwater pumping on stream flows. Determine the different temporal responses of groundwater pumping on various aquifer types (unconfined, semi-confined) and develop an appropriate management approach that best shares the resource between surface and groundwater licensees and protects the environment.
12.	Undertake research into the hydraulic parameters that most affect time lags. Determine through field studies a reasonable range for each.
13.	Develop easy to use operational tools (models) that predict the changes in surface water flows by groundwater pumping and answer other resource allocation questions, for example which water user group is most affected by increased groundwater pumping: high security, general security or environmental water.
14.	Research how best to express uncertainty associated with model predictions of groundwater -surface water interaction including applying the output of climate models on to groundwater models.

Water Level Response Management

In Australia at the present time, sustainable yields are being applied at global or zonal scales. However, hydrogeological properties and extraction vary across the aquifer or zones, which can cause local areas of unsustainable decline in water levels, even if the system as a whole is being managed within the sustainable yield. The groundwater level response approach addresses these local problems by working at sub-catchment scale. It is based on using the actual aquifer water level response as the key constraint on water use and, if necessary, reductions thereof. WLRM may be used with or without reference to sustainable yield. In either case the community will be divided on what water levels to manage to.

Two software tools have been developed for WLRM, 'Hotspots', a local scale model, and OPTIMAQ, a regional scale model. There was general agreement in the workshop that the software needs to be further developed for extensive use.

The workshop session focussed on the new, innovative technique of Water Level Response Management (WLRM) and began with a presentation by Noel Merrick from the University of Technology, Sydney

The **key** policy and research knowledge gaps identified in this session are given below.

Knowledge Gaps

Policy Issue

The process of setting target water levels or bandwidths for aquifer systems is as much a trade off between sectors of the pumping community (eg irrigators versus Stock and domestic users) as it is a technical decision.

The WLRM, used in conjunction with sustainable yield management, could provide an alternative approach and provide for better specification of water rights.

Policy Research

1. Develop a robust framework for setting and managing to water level triggers and targets
2. Determine how to best achieve community consensus on water level targets or band widths.
3. Determine how the WLRM area should be defined.
4. Determine the socio-economic implications of coupling WLRM with and without sustainable yield management.

Technical Issue

Technical Research Areas

1. Enhance existing WLRM modelling tools to address water allocation, trade, GDE protection and water quality management. Determine which features should be included e.g. automatic calibration, salinity simulator, horizontal and vertical gradients modules, etc.

2. Extensively test the WLRM philosophy and its practical implementation through the wider application of ‘Hotspots’ or ‘OPTIMAQ’ modelling.
3. Determine a compliance approach, statistical or other for exceedance of target water levels.
4. Develop tools that will help determine the relationship between groundwater pumping water levels and land subsidence, and between groundwater pumping water levels and water quality change.
5. Conduct studies into the importance of aquifers changing from confined to unconfined to determine the importance of the issue and the pressure drops aquifer integrity can withstand. Move?

Land Use Change

Changed land use can increase or decrease water availability by changing the balance between surface runoff and groundwater recharge, and it is not currently possible to accurately predict the effects of land use change on a catchment water balance or in water quality. Contemporary water resource management relies heavily on having a quantitative understanding of the water budget to provide secure and sustainable allocations.

The workshop session, heard a presentation by Neil Power from the South Australian Department of Land and Biodiversity Conservation, recommending greater integration of land use planning and water resource allocation decision-making. He highlighted the knowledge gaps using the specific land use examples of plantation forestry, intensive agriculture and horticulture, revegetation and regional residential developments.

The **key** policy and research knowledge gaps identified in this session are given below.

Knowledge Gaps

Policy Issue

Land use changes have the potential to reduce the security of water access rights in a catchment through decreased recharge/streamflow. For groundwater systems it is important to have a good handle on the recharge processes and how these may change as a result of land use change. The social impact of land use change and implications for different water resource management approaches is also important.

Policy Research

1. Conduct research into applying a market based approach to land use changes that impact on the security of water access entitlements. Investigate the social implications.
2. Research the institutional impediments of integrating land use change into water allocation processes and advise on policy and legislation requirements.

Technical Issue

The hydrological impacts of different land-use types on aquifer behaviour, including the change in the volume of recharge, the change in discharge patterns, flooding and waterlogging is not well understood. This would be greatly assisted by the development of robust recharge and discharge estimation techniques.

Technical Research Areas

1. Research and develop tools for estimating recharge under various land uses. Field test at icon sites.
2. Develop a map to show where new plantations will have a minimal impact on the hydrology of the catchment.
3. Determine the impacts of recharge and run-off increasing during fallow periods in the clear felling approach to forest harvesting.

4. Investigate the impacts of plantation forestry on recharge in different geological systems, including sedimentary basins versus fractured rock. Determine how to best scale up research findings
5. Determine the impact on recharge of clearing trees in tropical savannahs and replacing them with native grasses
6. Determine the impacts of using soil and water conditioners on aquifer recharge**.**
7. Determine the impact of the rates of river and aquifer recharge on the rates and magnitude of sediment build up in rivers and streams.

Technical Issue

The significant impacts of land use on groundwater quality, particularly, the location of waste disposal sites, aquifer storage and recovery programs, effluent treatment/irrigation sites, intensive agriculture, mining activities and residential development.

Technical Research Areas

8. Determine the impact of waste water reuse on soil and water including the impact on salinity and redistribution of salts;
9. Determine the potential for degradation of the aquifer through the use of poor quality water in aquifer storage and recovery techniques;
10. Develop an assessment tool to determine the distribution coefficients of pollutants including both dispersion and decay;
11. Improve understanding of Australian soils to improve the remediation of pollution plumes.

Other Knowledge Gaps

The aim of this session was to address other knowledge gap areas considered important to the National Water Initiative but not addressed in the other sessions. These included trading of groundwater and returning overallocated systems to sustainable levels.

The **key** policy and research knowledge gaps identified in this session are given below.

Knowledge Gaps

Policy Research Areas

1. Develop a trading framework between surface and groundwater for conjunctively managed surface-groundwater systems.
2. Determine the socio-economic benefits and disbenefits of inter-aquifer groundwater trading.
3. Determine the impediments and benefits (if any) of interstate groundwater trading.
4. Define all parameters to be used in a national survey of groundwater management costs. Undertake a national survey of costs and cost recovery.
5. Determine the best model for returning over-allocated groundwater systems to sustainable levels. The model should optimise resource use and minimise regional economic losses. Recommendations on how to manage 'sleeper' licences should be included.
6. Develop a policy on fossil water use.

Technical Issue

Knowledge gaps identified as impediments to the sustainable use and management of groundwater include:

- inadequate understanding on the salinisation of aquifers;
- poor understanding of seawater intrusion processes
- lack of understanding on how climate variability should be accounted for in groundwater management (e.g. sustainable yield, accounting rules, water level management);
- water accounting frameworks;
- fossil waters (high storage/low recharge); and
- data accessibility.

Technical Research Areas

1. Conduct research into understanding the soil, regolith and groundwater salt stores, including mobility dispersion processes caused by pumping and determine how to optimise the use of the groundwater resource in a short and long term context in terms of salinity trade offs.
2. Develop rapid assessment predictive tools for determining the timing and the rate of increase of the salinity of aquifers. Consider both the horizontal and vertical fluxes of salt water.
3. Conduct research into understanding the movement of seawater into coastal aquifers in response to aquifer development and improve the tools to model seawater movement and assess management strategies.

4.	Conduct research into understanding the risks that climate variability/ climate poses for reductions in water availability and consider any socio-economic implications.
5.	Review water accounting frameworks nationally and determine an accounting system that would support nationally functioning markets and interstate trade.
6.	Conduct research into recharge events for fossil water and determine how to incorporate this into extraction management.
7.	Research how problems with data accessibility , data collection and information transfer are impeding decision making in water resource management.
8.	Develop whole of system modelling that links physical with economic modelling.

Strategies for Progressing Research

At the workshop a session was allocated to identifying strategies that would communicate government priorities on groundwater research to relevant research organisations. The intent being to influence such organisations into undertaking research relevant to the National Water Initiative.

Strategy	Target
Develop/ identify key research programs linking to the NWI and obtain high level endorsement.	Natural Resources, Policies and Programs Committee; Natural Resource Management Standing Committee
Provide key information to and meet with the Prime Minister and Cabinet secretariat for the NWI.	Council of Australian Governments
Demonstrate the value of the work to researcher collaborators and obtain their endorsement.	Land and Water Australia, Murray Darling Basin Commission
Work with other programs / processes to build groundwater into consideration, eg the NHT, NAP and NRM regional organisations	NAP regional and local processes
Provide information to State Government processes directly with strategic planning and a white paper	State Governments
Raise the issues identified in the report with the new Chief Executive Officer of CSIRO Land and Water	CSIRO Land and Water
Influence the new bid of the CRC for Catchment Hydrology to include groundwater	CRC for Catchment Hydrology
Collaborate with the CRC for Irrigation Futures to raise awareness of groundwater as an irrigation issue	CRC for Irrigation Futures
Collaborate with the CRC for Freshwater Ecology to raise awareness of groundwater	CRC for Freshwater Ecology
Collaborate the Land and Water National Program for Sustainable Irrigation to raise awareness of groundwater as an irrigation issue	Land and Water Australia
Take strategic plan to the Cotton Research and Development Corporation and other research and development corporations to influence funding into groundwater related research and development	Research and Development Corporations
Provide input to the Wentworth Group's deliberations	Wentworth Group and Governments
Establish links with ANSTO	ANSTO
"Meet the Scientists"- communicate the relevance and importance of groundwater to Members of Parliament	Members of Parliament
Talk to major conservationist organisations such as the Australian Conservation Foundation and state organisations	Conservation Groups
Sponsor a key groundwater conference drawing scientists, resource managers and industry	Groundwater researchers and managers
Consult with universities and the Bureau of Rural Sciences	Groundwater researchers

Communication

The National Groundwater Committee will meet with the identified organisations to promote groundwater research that helps progress water reforms. Research priorities will be discussed with each group.

NGC will develop a list of icon sites that can be used for research studies and will help distribute the research findings into relevant jurisdictional organisations so that they can be used to make better management decisions.

NGC members will foster links with planning staff in State Governments so that more integrated planning and water allocation decisions can be made.

NGC will continue to communicate an understanding of groundwater processes through the development of educational materials and programs targeted at water managers, water users and environment groups. The new focus will be to explain the nature and extent of surface/ groundwater connections and the implications for extractive use through conjunctive management.

APPENDIX A

PROPOSED PROGRAM

National Workshop - Knowledge Gaps in Groundwater Reforms

Wednesday 12th – Thursday13th (half day) November 2003

Location: Edmund Barton Conference Centre
(in courtyard between Cores 1 and 2)
Edmund Barton Building, Barton, Canberra

Facilitator and Chair: Michael Williams

Atendees:
Relevant State/Territory staff

Commonwealth policy and resource management staff
Researchers and scientific experts

	Day One – Wed. 12 Nov. 2003	**Speakers**
9.00	Welcome and Introduction	George Gates
	Opening – Ross Dalton (DAFF) - Theo Hooy (DE&H)	
10.00	Session 1 "Improved management and Protection of Groundwater dependent Ecosystems" • Lead Speaker • Open forum	Gayle Stewart (10min)
11.15	*Morning tea*	
11.30	Session 2 "Integrated Surface-Groundwater Management" • Lead Speaker • open forum	Peter Cook (10min)
1.00	*Lunch*	
1.45	Session 3 "Water Level Response Management" • Lead Speaker • open forum	Noel Merrick (10min)
3.00	*Afternoon tea*	
3.20 5.00	Session 4 " Other knowledge gap areas related to NWI" • Lead speaker • open forum	Facilitator

NOTE: Day 2 will be held in the lecture theatre C4L4W5

	DAY TWO – Thurs. 13th Nov	Speaker
8.30	Session 5 "Impacts of Land Use Change on Groundwater" • Lead Speaker • open forum	Neil Power (10min)
10.00	*Morning Tea*	
10.20	Session 6 "Strategy for Moving Forward" • Research priorities • How to get researchers aligned with NRM priorities	Facilitator
12.00	Close	

National Groundwater Committee

Workshop - Knowledge Gaps for Groundwater Reforms

(12 –13 November 2003 Canberra)

Background: Agreement has been given by LWBC for NGC to hold a small workshop to scope the full extent of policy and technical impediments to water reform implementation.

Aim of Workshop: The aim of the workshop is to identify the knowledge gaps which need to be addressed to support implementation of policy on management and use of groundwater resources, with particular reference to the proposed National Water Initiative announced by CoAG on 29 August 2003. Issues will include, but will not be limited to:

1. A more integrated management of surface water and groundwater resources;
2. Improved management and protection of groundwater dependent ecosystems;
3. A better understanding of land use changes on groundwater resources; and
4. Water level response management as a micro-management tool.

Outcomes:

- Identification of knowledge and data gaps that impact on the full implementation of water reforms;
- Identification of research priorities;
- A strategy for communicating government research priorities on groundwater to relevant research organisations.

Product: A report identifying priority research areas for groundwater. This will be used as the basis for meetings with key funding and research bodies to promote and further identify R&D projects that will assist with implementing water reforms.