

Likely Ecological Outcomes of the COAG Water Reforms

Professor Peter Cullen, CRC for Freshwater Ecology

Dr John Whittington, CRC for Freshwater Ecology

Mr Greg Fraser, Reengineering Australia

Cooperative Research Centre for Freshwater Ecology
University of Canberra, ACT 2601
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A Cooperative Research Centre for Freshwater Ecology report

The Cooperative Research Centre for Freshwater Ecology was established in 1993 under the Australian Government's Cooperative Research Centres Program.

The CRC for Freshwater Ecology exists to improve the condition of Australia's inland waters. It provides ecological understanding to improve inland waters through collaborative research, education and resource management.

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Ph: 02 6201 5168

Fax: 02 6201 5038

Email: pa@lake.canberra.edu.au

www: freshwater.canberra.edu.au

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Likely Ecological Outcomes of COAG Water Reforms

1. Introduction

Australia has been going through a dramatic reform of its water industry in the last few years, driven by the broad agenda of the National Competition Policy, and in particular the agreement of the Prime Minister and the State Premiers on the need for water reform (Council Of Australian Governments' Agreement, 1994). Internationally, Australia is seen by the World Bank as being at the leading edge of water reforms.

Many Australians have been concerned with the degradation of our water resources. The Cooperative Research Centre for Freshwater Ecology (CRC for Freshwater Ecology) is asked frequently by irrigators and others affected by the reforms as to whether the changes will lead to beneficial environmental outcomes. In an attempt to address this question we have compiled an overview of the progress made by each State in response to the water reform agenda, from publicly available documents, and have invited a panel of expert ecologists to consider the likely ecological outcomes. We have focussed in particular on the issue of allocations of water for the environment, but have touched on other relevant water reform issues. There are many other important issues such as water rights, trading and institutional arrangements where there has been considerable progress, and this broad sweep of the Council Of Australian Governments' (COAG) agenda is beyond the scope of this assessment.

These are difficult and contentious issues, with many different interests and fairly poor information. States have the flexibility within the COAG Agreement to develop reforms that meet their particular issues and appropriate to their aquatic systems. There is a fair variation in what the States have done. The reforms have taken longer than was originally envisaged, although in some jurisdictions considerable energy and resources have been applied to the issues, and there has been substantial progress.

This project has been partially funded by Environment Australia as part of the National River Health Program of the Natural Heritage Trust. The task was to identify the states' approaches, and then to have an expert group of ecologists assess the likely benefits of the actions being undertaken.

The assessments included in this report are based on the best information available to us as a group of ecologists. We have based our judgements on publicly available information. It may be that some jurisdictions will disagree with our assessment, and in such cases we look forward to further information being made available to us and other interested parties outside Government.

Many people have contributed to this project. As well as the participants at the workshop identified in Section 5.3, our thanks are due to critical comments on earlier drafts from Prof. Angela Arthington, Dr Leon Barmuta, A/Prof. Stuart Bunn, Dr Peter Davies, Dr Peter Gehrke, Dr Terry Hillman, Dr Paul Humphries, Prof. Sam Lake, Mr Ian Lawrence and A/Prof. Martin Thoms. Errors and omissions are however, the responsibility of the authors.

2. The COAG Water Reform Process

2.1 COAG

In 1994, COAG agreed that a strategic framework for water reform was required in order to achieve an efficient and sustainable water industry. COAG consists of the Prime Minister, Premiers and Chief Ministers of the States and Territories and the president of the Australian Local Government Association.

The framework adopted by COAG recognised that the Australian water industry needed reforming to arrest widespread natural resource degradation in all jurisdictions and that a package of measures was required to address the economic, environmental and social implications of water usage. COAG emphasised the importance of addressing both efficiency and sustainability in water services and water resource management.

The reforms cover all aspects of the water industry, including institutional arrangements for regulation, management and service provision, water allocations and entitlements, water pricing, environmental protection and community input into decision making. A summary of the basic principles of the Water Resource Policy is shown below, and more detail included in Appendix 1.

2.2 Summary of COAG Water Policy Principles

- pricing based on the principles of consumption based pricing, full-cost recovery and transparency or removal of cross-subsidies;
- future investment in new schemes, or extensions to existing schemes, to be undertaken only after appraisal indicates it is economically viable and ecologically sustainable;
- comprehensive systems of water allocations or entitlements, backed by separation of water property rights from land title and clear specification of entitlements in terms of ownership, volume, reliability, transferability and, where appropriate, quality;
- formal determination of water allocations or entitlements, including allocations for the environment as a legitimate user of water-
 - ⇒ environmental requirements, wherever possible, should be determined on the best scientific information available and have regard to inter-temporal and inter-spatial water needs required to maintain the health and viability of river systems and groundwater basins;
- trading, including cross-border sales, of water allocations or entitlements, within the social, physical and ecological constraints of catchments-
 - ⇒ where cross-border trading is possible, the trading arrangements are to be consistent and facilitate cross-border sales where this is socially, physically and ecologically sustainable. Individual jurisdictions to develop the necessary institutional arrangements, from a natural resource management perspective, to facilitate trade in water, with the Murray Basin Darling Commission being satisfied as to the sustainability of proposed trading transactions in the Murray-Darling Basin;
- administration and decision making to provide an integrated catchment management approach to water resource management and establishing arrangements to consult with the representatives of local government and the wider community in individual catchments;

- institutional separation of water resource management, standard setting and regulatory roles of government from the role of providing water services with this to occur no later than 1998;
- constituents be given a greater degree of responsibility in the management of irrigation areas;
- consultation where change and/or new initiatives are contemplated involving water resources;
- jurisdictions and water agencies individually and jointly should develop public education programs in relation to water use, the need for and benefits from reform, the cause and effect relationship between infrastructure performance, standards of service and related costs;
- appropriate water-related research necessary to progress implementation of the framework, including consistent methodologies for determining environmental flow requirements.

The water reforms have provided real challenges to science in terms of:

- clarifying the ecological outcomes to be achieved;
- deciding what interventions managers need to make to achieve these outcomes;
- measuring and demonstrating that outcomes have been achieved.

The ecological outcomes are specified in three ways:

- developments to be ecologically sustainable;
- actions to maintain the health and viability of river systems;
- consider ecological constraints of catchments.

The COAG documentation is vague about the meaning and interpretation of these broad goals, presumably because a level of ambiguity was necessary to reach agreement between the Governments. This does of course allow particular environmental issues to be considered in the different States. COAG certainly appreciated the challenges this would provide for science in trying to interpret and operationalise these broad terms, and it did specify that environmental requirements should be determined on the best scientific information available, and that research be undertaken to determine environmental flow requirements. This is being done through the National River Health Program.¹

3. Approach Adopted for this Review

This review has focused on the COAG water reforms particularly relating to the allocation of water, including the allocation of water for the environment.

It has been difficult to develop a uniform analysis of the State and Territory reforms because, as will be seen below, each jurisdiction has proceeded at its own pace, taking account of the particular circumstances prevailing there. It should be emphasised that the COAG reforms acknowledged that States and Territories were starting from different bases

¹ Cullen, P. 2000, Water Reforms, Science and Ecological Outcomes in Australia. In: *Proceedings of the World Water Congress*, Melbourne.

and that they would proceed with implementation at differing rates, having regard to their own requirements and circumstances.

The material on State and Territory progress is included in Section 4 of this report. It has been collected from publicly available sources only, such as reports and web sites. Information about, and documentation of progress, is patchy in some jurisdictions, and this has resulted in variable reporting in this paper. All States are continuing to move forward with water reforms, and so this report is based on progress made until mid 1999.

This descriptive material was used as the input to a workshop of expert ecologists who met to review progress with the COAG water reform agenda, and to come to judgements about the likely outcomes in each jurisdiction. The workshop was held at the CRC for Freshwater Ecology in Canberra on 13th May 1999. This Workshop evaluated the ecological outcomes of the reform process to date and how the proposed reforms are likely to benefit the environment in the future.

4. State and Territory Progress

In this section we document how we believe the States are addressing the COAG reform agenda, and adapting it to their special issues and requirements. For each jurisdiction, we provide the following information:

- brief description of the legislation currently used to guide the management of the State's water resource, and if appropriate, the timetable for proposed changes to this legislation;
- progress toward identifying stressed rivers and the methodologies employed to do this;
- description of the State's process for determining environmental water requirements² (EWRs);
- description of the State's process and progress towards determining environmental water provisions² (EWPs);
- other issues.

The outcomes of the water reform process are wide-ranging and sometimes poorly defined, making them difficult to assess. Below are summaries of reforms directed towards increasing the sustainability of the water resource achieved by the States. This assessment is preliminary and does not judge the effectiveness of the measures.

² Using the definitions of EWRs and EWPs outlined in the ARMCANZ/ANZECC 1996, *National principles for the provision of water for ecosystems. A policy position paper of the Agricultural and Resource Management Council of Australia and New Zealand and the Australian and New Zealand Environment and Conservation Council*, Occasional Paper #3, Task Force on Water Reform, Commonwealth of Australia.

Ecological Water Requirements - are descriptions of the water regimes needed to sustain the ecological values of aquatic ecosystems at a low level of risk.

Environmental Water Provisions - are that part of the environmental water requirements that can be met.

4.1 Australian Capital Territory

<http://www.act.gov.au/>

ACT report to NCC re: COAG

Water Resources Act 1998 [http:// www.austlii.edu.au/other/dfat/act/1998/wra.html](http://www.austlii.edu.au/au/other/dfat/act/1998/wra.html)

Legislative Basis

The right to the use, flow and control of all water in the ACT is covered under the *Water Resources Act 1998*. The objectives of the *Water Resources Act 1998* include:

- To ensure that the management of the Territory's water resources sustain the physical, economic and social well being of the people of the Territory while protecting the ecosystems that depend upon the water resources;
- To protect waterways and aquifers from damage and, where practicable, reverse damage that has already occurred.

New users of water will be subject to an allocation that is separate from property title and is tradeable. Allocations will specify volume, timing and the manner in which water can be taken.

The *Water Resource Act 1998* is to be implemented through a Water Resource Management Plan (WRMP). The WRMP includes a description of the water resources of the ACT including the flows needed to meet the environmental needs of individual waterways or aquifers. It will also indicate proposed water allocations for the next 10 years.

Allocations for groundwater and surface waters will be considered together.

Identification of Stressed Rivers

The ACT has undertaken comprehensive quality and quantity monitoring of its surface waters over a number of decades. This assessment has indicated impacts of water diversions and impoundments on the Cotter and Molonglo Rivers.

The Territory does not have a formal system for identifying and declaring stressed rivers. Consequently, the ACT has not identified any stressed rivers.

Identifying Environmental Allocations

The Water Resource Management Plan will form part of the ACT Integrated Catchment Strategy.

Environmental Flow Guidelines have been developed for the Territory. These guidelines describe the ecological water requirements of surface waters. The guidelines were determined using an Expert Panel which apparently used an holistic approach within the constraints of the knowledge base available. The environmental, economic and social impacts of the flow recommendations were considered in the preparation of the Guidelines. The Environmental Flow Guidelines have been subject to public consultation and have now been adopted by the ACT Legislative Assembly.

The Environmental Flow Guidelines will be incorporated into the Water Resources Management Plan (WRMP), which is currently being drafted. The WRMP will provide the framework for future water allocations in the Territory.

Allocating Environmental Flows

The Water Resources Management Plan provides the basis for the implementation of environmental flows. Environmental flow allocations will not be made until this plan is adopted.

Other Issues

Currently no water trading takes place within the ACT but it is anticipated that this will change as demand grows. The legislative framework for trade is provided for in the *Water Resources Act 1998*. It is likely that there will be demand for cross border water trade with NSW given the Territory's geographical location within the Murrumbidgee catchment. While the *Water Resources Act 1998* provides the legislative mechanisms for interstate trade, there are a number of issues that have to be resolved, such as drought security, before this will be developed.

The issue of the implementation of the cap on abstraction is still being negotiated with the MDBC.

4.2 NEW SOUTH WALES

DLWC web site <http://www.dlwc.nsw.gov.au/>

Stressed Rivers Assessment Report NSW State Summary 1998

Water Sharing. The way forward. 1998.

EPA web site <http://www.epa.nsw.gov.au/>

Water Act 1912 <http://www.austlii.edu.au/au/other/dfat/au/act/1912/>

Legislative Basis

The Department of Land and Water Conservation (DLWC) licenses water allocation in NSW using the *Water Act 1912*. The main pieces of NSW water legislation, in particular the *Water Act 1912*, the *Water Administration Act 1986* and the *Rivers and Foreshores Improvement Act 1948*, are to be revised. A Bill that includes all aspects of water management currently covered by these three statutes will be drafted by 2000.

DLWC indicates that NSW is at the limits of its available water resources and while acknowledging that great economic and social benefit is derived from the States water resources, there is clear evidence of degradation of the State's rivers.

The Water reform process is being managed by a whole-of-government perspective, involving primarily DLWC, EPA, NSW Agriculture, National Parks and NSW Fisheries.

Stressed Rivers

All regulated rivers in NSW are classified as stressed. Regulated rivers are those proclaimed under the *Water Act 1912* as having their flows controlled by the major Government rural dams.

Identification of unregulated stressed rivers was undertaken at the sub-catchment level. Six hundred and eighty unregulated sub-catchments were identified in the 30 catchments. Each sub-catchment was rapidly assessed and placed into a matrix that included a measure of stress due to water abstraction (hydrologic stress) and stress due to other factors (environmental stress). The process also identified sub-catchments with a high conservation value.

The level of hydrologic stress is determined by deriving an index of hydrological stress for each sub-catchment. This was achieved by proportioning estimates of water abstraction to streamflow at appropriate flow regimes. A range of indicators was used to assess the level of environmental stress, which included biological and physical elements. Expert panels also assessed the environmental stress of each sub-catchment. An overall stress classification was determined by combining the hydrologic and environmental stress values.

The stressed river classification influences the priority for producing river management plans and the volume of water available for abstraction in any sub-catchment. The stressed river classification will be reviewed each 5 years.

Identifying Environmental Allocations

The EPA has produced Interim Water Quality Objectives and River Flow Objectives for the thirty catchments identified for NSW. Meeting these objectives forms the framework for river and water management planning.

Regional stakeholder groups have the role of determining environmental allocations for NSW surface and groundwaters. In inland NSW there are separate management committees for regulated rivers, for unregulated river catchments and groundwaters. The Government expects that over a 2-year period these committees may be consolidated, as the interconnectedness of issues becomes increasingly obvious. In the meantime the aim will be to have common chairs and membership as much as is possible. Along the coast, planning for river and groundwater management has generally been combined.

Water management committees aim to form close links with 17 Regional Catchment Committees (RCCs) and 45 Catchment Management Committees (CMCs) to ensure the water management plan is consistent with the regional natural resource and environment management strategy.

As part of the NSW Water Reforms package, the government established the Healthy Rivers Commission to conduct independent inquiries into nominated catchments, to develop longer-term environmental objectives and to identify priority actions to improve individual catchment health.

River Flow and Water Quality Objectives were provided for the regulated and unregulated rivers. Each River Management Committee had the opportunity to identify and modify the objectives for their catchment. These were then used to formulate flow rules and allocations for the environment. To provide resource security, the impacts of environmental flows were not to exceed 10% of irrigation supplies for the first 5 years, after which the flow rules will be reviewed.

Allocating Environmental Flows

River Flow and Water Quality Objectives have been identified³ for NSW waters. These objectives are being used by the various management committees to develop Environmental Objectives for NSW waters at a catchment level. Interim flow objectives have been formulated for the regulated rivers, which have been implemented in a number of regulated rivers, eg. Murrumbidgee, Macquarie and Gwydir Rivers.

All regulated river management committees and the Barwon-Darling Water Management Committee are to prepare flow rules and water quality plans by 1999/2000. By 2003, a comprehensive management plan for the river valley that incorporates the river flow rules and water quality plans will be operating.

Catchment based reports on the State's stressed and high conservation unregulated rivers will be completed in 1999. Management plans for highly stressed and some high conservation value unregulated rivers will be prepared by 2001 and for all rivers in this category by 2003 and all major rivers by 2005.

Other Issues

NSW agencies, and particularly DLWC, are attempting to implement a method for assessing the ecological outcomes of environmental allocations. The principal program for attempting this is the Integrated Monitoring of Environmental Flows (IMEF) Program. River flow management plans developed by the management committees for each high priority sub-catchment will have specific objectives. These objectives allow hypotheses to be developed that can be tested under the IMEF program, although there are challenges in establishing appropriate time and spatial scales for such tests. For example, to achieve a river flow objective, a flow rule will be formulated which will have a predicted outcome with a measurable environmental benefit.

The State will also use State of the Rivers and Estuaries Reports to monitor the outcomes achieved with the new environmental flow rules.

The Independent Pricing and Regulatory Tribunal of NSW (IPART) has determined that by June 2000 the level of cost recovery will be 83% for regulated surface water, 87% for unregulated and 60% for groundwater. This is a significant increase on 1996/97 prices.

³ DLWC 1988, *Water Sharing. The Way Forward. A draft five year strategy for water management in New South Wales - 1999-2003.*

4.3 Northern Territory

DLPE web site <http://www.lpe.nt.gov.au>

Water Act 1992 <http://notes.nt.gov.au/dcm/legislat/legislat.nsf>

Legislative Basis

The *Water Act 1992* provides for the investigation, use, control, protection, management and administration of water resources within the Northern Territory. The Act applies across the Northern Territory including Aboriginal and Commonwealth Lands. The *Water Act 1992* does not cover mining tenements, however water discharged from mine sites is subject to licensing under the *Water Act 1992* (with the exception of Ranger Uranium Mine). Water use on mining tenements is controlled and managed by a Water Management Plan, which is administered by the Department of Mines and Energy, with input from the Department of Lands, Planning and Environment.

The *Water Act 1992* covers surface and ground waters, water quality and waste discharge.

Landholders are able to take water for domestic and stock watering purposes without licence. For other uses a licence is required which is usually granted for 2 years. Water licences are linked to property titles. The *Water Act 1992* does not fully comply with COAG water reforms and the need to reform the current Act to allow for issues such as water trading is recognised.

The Act specifies that there has to be a continuous investigation into the volume, flow, quality etc. of water and ground water.

Identification of Stressed Rivers

Most of Northern Territory surface waters are unregulated and flows are highly seasonal. The Darwin River has a water storage and the Katherine River has a number of weirs providing urban water supplies into the dry season. The most significant demand is on groundwater resources.

There is an ongoing effort to monitor and model the effects of groundwater usage on water levels within the aquifers and the effects these diversions will have on groundwater discharges to surface systems.

In the absence of any formal criteria, the Department of Lands, Planning and Environment has assessed that there are no stressed rivers in the Northern Territory. The basis for this assessment was that licensed extractions do not exceed 50% of the 10th percentile low flow in any river system.

The NT Government argues that water resources are largely untapped, and there exists the potential for an increased expansion of use by ten to twenty fold.

Identifying Environmental Allocations

A draft plan of a framework for identifying the ecological water requirements of surface waters has been developed. This plan is currently being reviewed within the Department and is not yet available for public comment.

We understand that the plan has adopted the holistic approach for the determination of ecological water requirements. Once adopted, the plan will guide the development of the Territory's surface waters. However we believe that scientific information on Northern Territory conditions is limited.

Allocating Environmental Flows

Allocation of environmental flows will not occur until the draft plan for identifying and allocating ecological water requirements for surface waters is adopted and the necessary legislative changes to implement the plan have been made.

Minimum fixed rate releases occur in the dry season below Darwin River Dam and in drought years, below Katherine River Weir.

4.4 Queensland

Draft Fitzroy Basin WAMP

Water Resources Act 1989 www.austlii.edu.au/au/other/dfat/au/legis/au/other/dfat/au/html/wra1989/wra1989.html

Water Management Planning DNR 1997

Water Allocation and Management Planning DNR 1997

Condamine Balonne Basin WAMP Newsletter 1. March 1999

DNR web site www.dnr.qld.gov.au/water/rid/homewip.html

Legislative Basis

Water allocation in Queensland is achieved through a licensing system administered by the Department of Natural Resources (DNR) under the *Water Resources Act 1989*. Applications for a licence are assessed on the availability of supply, essentially on a first-come first-served basis. Under the Act, water rights are linked to a property. As a consequence, permanent water trade requires buying and selling property, although the Act does allow for temporary (annual) transfers. Some individuals rely on floods (beneficial flooding) to fill floodplain waterholes. These users are not licensed, but impacts upon these users are considered when assessing applications for water resource development. The current allocation framework does not have specific provisions for the supply of water to the environment.

The *Water Resources Act (1989)* is restricted to extractions from the main channel of a watercourse. It does not include the harvesting of floodwaters on the land abutting or adjacent to the bed or banks of the watercourse. Given the nature of many Queensland rivers, which have extensive floodplains, frequent flood flows and major channel networks, the legislation does not cover a major component of the flow regime. Water harvesting from floodplains and diversions of off-channel tributaries represent a major water resource use.

The current *Water Resources Act 1989* has provision for the development of Water Management Plans. It is now proposed to amend this Act to legislate the WAMP process and other resource management and planning issues, and to change the regulatory framework for the water industry.

Stressed Rivers

It is recognised by the DNR that in some areas a lack of water for the environment has resulted in the degradation of the riverine ecosystem. In some rivers, existing levels of flow regulation may be too great. Overall however, the proportion of flow diverted from the State's rivers is lower than for the more developed rivers of southeastern Australia. Consequently, Queensland is in a better position to make allocations for the environment.

There is no separate program to identify the State's stressed rivers. Rather, the level of diversion relative to the total resource is assessed for rivers when developing Water Management Plans (WMPs) and Water Allocation Management Plans (WAMPs). When unallocated flows are not sufficient to meet ecosystem needs identified during the planning process, the river would be considered stressed.

Identifying Environmental Allocations

The Department of Natural Resources is currently undertaking two planning processes for the allocation and management of the State's water resources. These are the Water Allocation and Management Planning (WAMP) process and the Water Management Planning (WMP) process.

Water Management Plans are recognised by the *Water Resources Act 1989*. A WMP is intended to provide policy and direction for assessing licence applications in 'sensitive' areas of the State. At present these include the Cooper, Bulloo, Paroo, Nebine, Warrego, Moonie and Mitchell Rivers. To prepare a WMP, hydrological data are collected and the environmental and social issues such as existing entitlements, water needs of the ecosystems and impacts of beneficial flooding, are identified. Unfortunately, attempts to estimate environmental water requirements in these regions are hampered by a lack of ecological data. Using the information available, extraction options are developed and analysed for their environmental and social impacts. In consultation with a community-based advisory committee, a draft plan is developed for the plan region that has regard to the following:

- existing entitlements to water;
- the provision of water for ecosystems;
- the extent of beneficial flooding currently experienced by landowners;
- future water needs;
- stream flows;
- underground water levels.

A WMP is developed when and if the Minister decides it is necessary. For example, the Minister may call for a WMP if the granting of a licence application may significantly impact on existing entitlements, ecosystems or beneficial flooding.

The WMP process is expected to take 12 to 18 months. Trading of entitlements for water diversions granted under a WMP will not be permitted. WMPs will be reviewed after 7 years with a revised plan implemented after 10 years.

The WAMP is more detailed and rigorous than a WMP, involving considerably more detailed environmental and hydrological analyses. A WAMP does not have statutory powers. It is proposed that WAMPs will become statutory plans under the proposed amendments to the *Water Resources Act*.

A WAMP aims to provide a framework for the fair, efficient and ecologically sustainable use of water. There is a defined process for developing a WAMP:

- define total water resources in the catchment;
- identify existing entitlements in the catchment;
- estimate environmental flow provisions;
- reserve additional priority water requirements (eg for urban expansion);
- define water resources available for further allocation (if any);
- existing entitlements will be defined under the hydrologic model and, where appropriate, will become tradeable;
- rules for further allocation and management will be described.

The development of WAMPs is underway in the Border Rivers (jointly with NSW), Condamine/Balonne, Fitzroy, Pioneer, Burdekin, Barron, Burnett and Logan. The draft Fitzroy Basin WAMP was released for public comment in September 1998.

A WAMP provides for the establishment of Bulk Water Entitlements for existing and future water projects, which involve the storage, and/or regulation of stream flows. A Bulk Water Entitlement sets out the conditions under which the manager of a water project can store, divert and regulate streamflows to individual water entitlement holders.

Allocating Environmental Flows

At present no WAMPs or WMPs have been implemented.

A condition of the allocation of Bulk Water Entitlement under the WAMP is the development of a River Operations Management Plan (ROMP). The ROMP will detail the operational procedures and rules to be applied to actually achieve the Environmental Flow Objectives and Water Entitlement Objectives detailed in the WAMP.

4.5 South Australia

South Australia Our Water Our Future 1995

Water Resources Act 1997 <http://www.austlii.edu.au/do/form.pl/>

Legislative Basis

The current *Water Resources Act 1997* was enacted to overcome deficiencies in the previous Act, as part of the process of complying with COAG water reforms. The latest Act

includes provision for community consultation and formally recognises the environment as a user of water.

The Act allows the Minister to reduce allocations if the ecosystem is damaged or is under undue stress from water abstraction. Allocations may be reduced during water trading/transfer of licence if necessary. Transfers of licence must comply with water allocation plans. Transfer may be permanent or temporary.

Identification of Stressed Rivers

In 1995 the document *South Australia-Our Water, Our Future*, describing the State's water resources, the levels of abstraction and management and policies at a State level, was released. This has been adopted as the State Water Plan. A Water Resources Council has been appointed to review the State Water Plan and Catchment Water Management Plans after 5 years to see that they are complying with the intent of the Act. The current State Water Plan is to be revised. These revisions are not expected to significantly affect the existing assessment of the State's water resources.

The identification of stressed rivers is based on an assessment of the level of development pressure on the water resource. This includes an assessment of factors including: number of farm dams, volume contained in dams, percentage of run-off intercepted and percentage of flow diverted. For groundwater, assessments can be made on reductions in water table levels or groundwater pressures, increases in salinity and a comparison of use to recharge across a certain area. In future the aim is to use more detailed hydrological analysis with reference to seasonality and a biological assessment including riparian vegetation to investigate the ecological health of the water-dependent ecosystems.

Water resources considered to be stressed as a result of high levels of abstraction can be prescribed by the Minister. Once prescribed, a Water Allocation Plan is developed and a licence is required to take water from that resource (other than for riparian rights).

The Department of Environment, Heritage and Aboriginal Affairs (DEHAA) believes the term stress is misleading and prefers to use terms such as ecosystem degradation to describe the level of hydrologic stress.

Identifying Environmental Allocations

Responsibility for determining ecosystem requirements for water lies with Catchment Water Management Boards or Water Resources Planning Committees. There is provision in the Act for local water management plans to be developed by local government however, this has not yet occurred. All plans have to be reviewed after 5 years.

There are 6 Catchment Water Management Boards in South Australia: 4 in the Adelaide region, 1 in the Murray and 1 in the South East of the State. An Arid Areas Catchment Management Board for the northern regions of the State is about to be established and a Board for the Eyre Peninsula is being investigated. The Boards have community, agency and scientific representation and are entrusted to prepare and implement a Catchment Water Management Plan for their area.

The Catchment Management Board must monitor, and adopt methods where necessary, to improve the quantity and quality of its water resources and the health of the ecosystems that depend on that. Implementation of the plans is funded through a rating of residents.

A Catchment Water Management Plan must be consistent with the State Water Plan.

The catchment water management plan must include information about:

- the quantity and the quality of the water comprising the water resources of the board's catchment area;
- the health of the ecosystems that depend on that water;
- the need for water of those ecosystems;
- the water resources (if any) in the board's catchment area that are suitable for recreational use and should be preserved or enhanced for that purpose; and outline the relevant economic, environmental and social considerations relating to the management of water resources in the board's catchment area.

Most of the Water Allocation Plans in progress (13 of the 15) are in areas managed by Catchment Water Management Boards. The Board is responsible for determining the ecological water requirements. This task can be contracted to other organisations, for example, in the Barossa Catchment the CWMB contracted DEHAA to provide ecological water requirements. Once the CWMB has prepared a Water Allocation Plan it has to be approved by the Minister, which is unlikely to happen without review by DEHAA.

When a water resource does not fall within a Catchment Water Management Board region a Water Allocation Plan is developed by a Water Resources Planning Committee. This has similar environmental goals as a Catchment Water Management Plan. For example, for the Clare Valley a combination of the Scientific Expert Panel Approach and Habitat Assessment Method for determining ecological water requirements was used. The Draft Water Allocation Plan for the Clare Valley is to be released for public comment in the near future.

There are currently 23 prescribed water resources in South Australia. For these, 15 Water Allocation Plans and 6 Catchment Water Management Plans are currently being prepared.

Allocating Environmental Flows

At present, no Water Allocation Plans have been completed, however a number are close to releasing drafts.

Allocations have been reduced in a number of prescribed areas because of concerns about the susceptibility of the resource. For example, in the Marne River, Northern Adelaide Plains, Padthaway, Angus Bremer and along the Murray.

DEHAA is currently assessing how to monitor the effects of allocating environmental flows. Options include the use of AUSRIVAS, community-based flow monitoring and the use of a modified Index of Stream Condition.

Other Issues

South Australia argues that ecological understanding of environmental water requirements for seasonal and episodic streams and groundwater-dependent systems is especially poor. These types of aquatic systems predominate in SA. Also many water resource management problems in SA are occurring in small systems where farm dams and small scale direct pumping or diversions are the major form of regulation and extraction.

4.6 Tasmania

Department of Primary Industries and Fisheries web site <http://www.dpif.tas.gov.au/>

Update on the New Water Management Legislation Feb 1999

Regulatory Impact Statement. Water Management Bill 1998, Feb 1999

New Ways of Sharing and Protecting Our Water Resources: information on Tasmania's new water management legislation. Feb 1999

Legislative Basis

The present system of water allocations in Tasmania is based on the *Water Act 1957*, which is administered by the recently formed Department of Primary Industry, Water and Environment (DPIWE).

DPIWE grants commissional water rights. Commissional Water Rights give the right to a specific volume of water from a source, for a use at a location, during a specific time. These are in addition to Riparian Rights.

The current system of water allocation does not:

- allow trading (Commissional Water Rights are tied to property rights);
- formally recognise the use of water for environmental purposes;
- include ICM;
- cover cost of supply.

The State has decided that the best means for correcting the deficiencies in the current water resource management arrangements and for meeting the COAG Water Reform principles is to replace the current *Water Act 1957* with more appropriate legislation in the form of a new Act.

The proposed Water Management Bill recognises that the available water in many of Tasmania's catchments is currently almost fully allocated, especially for hydro-electricity and irrigation. Under the new legislation, water allocations will be able to be traded temporarily or permanently. Water trading will not be permitted if it will cause serious environmental harm. There is provision in the new legislation for the claw back of part of traded water if there is a need to decrease the impact of diversions on the ecosystem. Water pricing will change to reflect the cost of supply.

The new legislation will provide for the formal allocation of water for maintaining river health and protecting agreed environmental values established under the State Policy on Water Quality Management.

The Water Management Bill has now been passed and regulations are being drafted.

Under the Act, water allocation becomes the responsibility of DPIWE. The HEC will have to comply with the Bill, but it has special provisions to protect the Hydro-Electricity Commission (HEC) water resource security.

Stressed Rivers

The draft Bill requires the preparation of a State Water Plan. The State Water Plan may include the assessment of the quantity and condition of the State's water resources, provide for the identification of risks and damage to water resources and include an assessment of changes in the condition of water resources. It will be prepared as soon as practicable after the commencement of the Act.

To identify stressed rivers DPIWE has identified all of the State's catchments, the environmental values and the level of abstraction for each. From this information Technical Panels comprised of stakeholders and interest groups identified high priority catchments for the development of a Water Management Plan.

Environmental values were determined using AUSRIVAS, a modified Index of Stream Condition, levels of abstraction and other changes in flow regime, for example the effects on the flow regime of hydroelectricity generation, conservation status of the river and reference to estuarine systems.

The priority setting system has identified that most stress is associated with summer irrigation, though it is recognised by DPIWE that electricity generation is causing problems in some rivers.

Identifying Environmental Allocations

The draft Bill provides for the development of Water Management Plans (WMPs) which will set rules for issues such as environmental flows, licensing arrangements, water allocations, water restrictions, license transfers, management of groundwater bores and works in rivers. Currently in Tasmania, some rivers have Water Management Strategies in place but these have no legislative backing and so are limited in their powers.

For high priority rivers, WMPs are being or are about to be prepared. The process includes:

- defining values of the catchment. Community and user groups define the consumptive and recreational values and the technical panels described above define the scientific values;
- ecological water requirements for the river are assessed. Until now assessments have been on summer irrigation demand rivers using the In-stream Flow Incremental Methodology (IFIM), eg. Meander River. As assessments of other types of impacted rivers are undertaken, they will attempt to use the holistic and building block methods;
- once community values and ecosystem requirements have been determined a Water Management Plan can be developed by a focus group that includes key stakeholders (eg. trust, forestry, fisheries etc.). This group has the responsibility for finding a compromise between competing uses of the water resource. After public

consultation the Plan is ready for adoption. Plans will not be implemented until the proposed Water Management Bill is enacted;

- WMPs are to be reviewed on a 5 yearly basis with consideration given to new values and developments.

The Water Management Plan must include an assessment of the water required by the ecosystems that depend upon the resource and include an assessment of any detrimental effects water abstraction may have on any other water resource (eg. groundwater recharge). The WMP may provide for the allocation and use of water. WMPs can include provision for claw back of allocations when necessary to ensure that environmental requirements are met. The DPIWE must include public consultation in its development of a WMP. The WMP will/can link into existing Catchment Management Plans (CMPs).

The Board of Environmental Management and Pollution Control sits under the *Environment Pollution Control Act 1994*. It can have input into developments that affect the environment, including water. For example, minimum flow regimes to maintain or improve the health of Tasmania's rivers may be set by the Board of Environmental Management and Pollution Control, based on the scientific input of DPIWE.

At present, we understand that up to 5 Water Management Plans have been developed, however, they will not be implemented until the proposed Water Management Bill is enacted.

WMPs are to be implemented by a 'water agent'. A water agent can be a council, a Government Business Enterprise, a body corporate, a co-operative society, a trust formed under the Act or a group of landholders who represent the majority of licensees for the relevant resource.

WMPs are made at the level of a Water District. A Water District can be defined as a whole or a part of a catchment, watercourse or lake. There are also other types of districts, eg. hydroelectric district, riverworks district etc.

Other Issues

Perhaps more than other jurisdictions, Tasmania has a number of competing in-stream uses. In particular, the development of flow regimes to favour native fish or introduced trout, which provide a significant tourist industry, has to be resolved. Hydroelectricity is a major water use, and whilst it is not an extractive use, it does cause significant alterations to flow regimes and to the temperature regimes downstream of dams.

4.7 Victoria

NRE web site <http://www.dce.vic.gov.au/>

Water Act 1989 [http://www.austlii.edu.au/other/dfat/special/water/act1989/](http://www.austlii.edu.au/au/other/dfat/special/water/act1989/)

Legislative Basis

The purposes of the Victorian *Water Act 1989* include:

- provision of integrated management of the water cycle;
- promotion of the orderly, equitable and efficient use of water resources;
- making sure that water resources are conserved and properly managed for sustainable use for the benefit of present and future Victorians;
- maximising community involvement in the making and implementation of arrangements relating to the use, conservation or management of water resources;
- eliminating inconsistencies in the treatment of surface and groundwater resources and waterways;
- providing a definition of private water entitlements and the entitlements of Authorities;
- providing a formal means for the protection and enhancement of the environmental qualities of waterways and their in-stream uses;
- providing for the protection of catchment conditions.

Victoria recognises that past developments were made with little regard to, or understanding of, the water requirements of the ecosystem. Consequently, many of the State's rivers and streams have been degraded by altered flow regimes. The provision of water for the environment is now recognised as a legitimate component of water allocation.

Stressed Rivers

A scientific panel that included agency representatives and freshwater ecology experts from Universities and CRCs assessed stressed rivers in Victoria. The scientific panel assessed rivers by looking for gross changes in the flow regime. These included reductions in volume, altered seasonality in flow, reductions in flooding frequency and changes in low flow volumes. If the existing flow regime did not meet the scientific panel's assessment of the ecosystem's requirements, the river was classed as stressed. By these criteria many of the States rivers were considered to be stressed.

The scientific panel then determined the likelihood of successful rehabilitation for the various stressed rivers. This assessment was used to develop a list of 8 priority rivers for immediate planning and rehabilitation. Assessment considered both the environmental significance of the river (for example, if it was an important habitat for a rare organism), and the potential for improving environmental flow regimes. Other considerations included the possibility of other complementary restoration work, public interest, the availability of baseline data, the scale at which rehabilitation would need to be attempted and the river's appropriateness as a case study. The priority rivers identified do not represent the 8 most stressed rivers in the State, but rather the rivers with the greatest potential for significant ecological rehabilitation.

It was recognised that in many cases inadequate flow regimes are only one factor contributing to poor river health. Consequently, rehabilitation will require improvement of flow regimes in conjunction with other river restoration works.

Identifying Environmental Allocations

Victoria has developed a two-stage process to provide water to the environment. Stage 1 is aimed at protecting and enhancing environmental flows through water entitlement agreements and Stage 2 aims to rehabilitate stressed river systems.

The bulk water entitlement (BWE) process is being used in regulated systems to convert poorly-defined access rights to water of existing users to well-defined property rights consistent with the *Water Act 1989*. This is a volumetric allocation with identified security of supply. This established the basis for a legal, regulated water market. In doing so, it caps the rights of existing water users and ensures that there will be no further incremental increases in total diversions. It also protects any existing environmental flows in Victorian rivers.

A BWE is determined at any diversion site for urban extraction, major irrigation supply or for hydroelectric power generation. Water Authorities apply to convert an existing use into a BWE. The BWE defines and constrains existing entitlements so that further development cannot occur unless the environmental water requirements of the system are met. Environmental assessment includes a review of the hydrology (natural vs regulated), site inspections by freshwater ecologists and review of the operating rules of a dam, weir or supply system. In large systems, expert panels have been used to provide advice on environmental flows. It must be recognised that this process focuses on converting existing rights and there may be little scope for improving environmental water provisions in overcommitted systems.

The BWE process allows for the definition and protection of water remaining in the river for the environment. Generally, the unallocated flow remaining after existing users have been granted entitlements is what is available for allocation to the environment. 112 BWEs have been completed and in 87% of those a better outcome for the environment was negotiated than would have occurred if no changes were made, although in many cases no BWE for the environment has been made. A better outcome does not necessarily mean that the environmental allocation meets fully the ecological requirements of the river, because there is commonly insufficient unallocated water to meet these needs. At this stage, one BWE has been granted to the environment in the Murray system.

For unregulated catchments, abstractions by private diverters are managed by Streamflow Management Plans. Unlike other parts of Australia, private diverters in Victoria do not have the infrastructure to significantly harvest and alter high flow events. Therefore, DNRE argues that in unregulated catchments, the current level and type of diversions are generally only significant during the dry months. However, it is recognised that an increase in the number of water-fill licences, either through new diversions or transfers of existing licences, may have an impact on high flow events.

In SMPs, ecosystem water requirements have typically been determined following a full environmental flow study using site inspection.

The streamflow management plan sets:

- water trading rules;
- environmental flows;
- contingencies for low flow periods (for example, the minimum flow in the Merri River is now set at 12ML/day, where prior to the SMP diversions could reduce flow to 2ML/day);
- mechanisms for reallocating water over time where negotiated environmental flows fall short of meeting objectives.

Streamflow Management Plans are to be reviewed every 5 years or at the request of a stakeholder. Many of the rules within an SMP will often be based on limited information, eg. most private diversions are not currently metered. It is expected that SMPs will be improved with a further five years of data, particularly on water usage. Streamflow Management Plans have been completed for 2 rivers but not yet endorsed by the Government. Seventeen SMPs are currently underway and another 30 are proposed for the next 2 years.

Stage 2 involves the development of River Restoration Plans (RRPs) for rivers where the environmental provisions made through the bulk entitlement process are considered to be insufficient to meet environment objectives. RRP will build on the current environmental provisions. They will set clear environmental objectives, set priorities for any additional water, identify mechanisms to provide additional water, identify complementary in-stream and riparian habitat works that will maximise environmental gains and establish agreed cost sharing for implementation.

The Victorian Government expects proponents of new water developments to finance an environmental flow determination as part of the development of the proposal. The onus is placed on the developer to clearly demonstrate that environmental values will be maintained. New developments can only occur where identified environmental water requirements (EWR) are being met. It is expected that the majority of new demands for water will be met through a water market rather than the development of new water resource projects.

Allocating Environmental Flows

From the 8 priority rivers identified by the Scientific Panel, the Thomson and Avoca Rivers will be the first two for which rehabilitation will be attempted. For these rivers the process is currently underway to develop work plans. The work plans are developed in consultation with Catchment Management Authorities and key stakeholders. The plans provide:

- objectives to improve river health;
- mechanisms to enhance flow regime - this includes investigating ways of improving environmental flow regimes;
- detailed river rehabilitation and streamside revegetation works;
- an agreed basis for sharing costs of implementing plans.

Streamflow management plans which have provisions for environmental flows have been developed after consultation with local users for the Gellibrand and Merri rivers, and are presently before the Government for endorsement. Flow rules developed for the Streamflow Management Plan for the Merri River were implemented last summer, even though the SMP has yet to be endorsed by government.

Through the BWE process, environmental water requirements have been identified and some environmental flow provisions have been made. As mentioned previously, in cases where existing passing flows were insufficient for environmental purposes, better environmental flow regimes were negotiated in 87% of cases. For example, environmental flow achievements include:

Wimmera and Glenelg Rivers

Environmental flows of 17,200 ML per year have been provided as a result of the completion of stages 1, 2 and 3 of the Northern Mallee Pipeline Project.

Goulburn River

Environmental flows from Lake Eildon have increased from 120 to 250 ML/d. An 80,000 ML flush in November will provide water for wetlands adjacent to the river.

Thomson River

Environmental flows in the lower river were increased from 25 to 125 ML/d.

Latrobe River system

Environmental flows were not specified for the river itself in the past. Environmental flows are now set at 500 ML/d at Rosedale, and 750 ML/d at Swing Bridge. Releases from Blue Rock Reservoir have been increased from 75 to 90-150 ML/d (depending on the month), with environmental flows from Moondarra Reservoir to be increased from 8 to 30 ML/d.

Moorabool River

Environmental flows below Lal Lal Reservoir have risen from 5 to 20 ML/d. Further downstream at Sheoaks, environmental flows of 40 ML/d were specified for the first time.

Other Issues

Victoria recognises that one of the major threats to the riverine environment is a rapid increase in the number of catchment dams. These are dams built to capture surface run-off but are not sited in watercourses. Dams sited in watercourses have to be licensed. Dams outside of watercourses do not fall within the *Water Act 1989* and so do not require licensing by the Department. A draft document has been developed that aims to tighten the definition of watercourse to include flow period and rainfall areas (eg. it is a water course if it flows for more than 2 weeks annually in a 500mm rainfall zone).

4.8 Western Australia

Water Law Reform Guide to Legislative Change August 1998

Water and Rivers Commission

Rights in Water and Irrigation Act 1914 <http://www.austlii.edu.au/do/form.pl/>

Legislative Basis

The *Rights in Water and Irrigation Act 1914* is currently the major water legislation in Western Australia and is in the process of being reformed to bring water resource management in WA in line with COAG Water Resource Policy.

The proposed amendments to the *Rights in Water and Irrigation Act 1914* have undergone extensive community consultation and are before the Parliament in late 1999. It is anticipated they will be implemented early in 2000.

The new legislation's objectives are to promote:

- the sustainable management of the State's water resources. Sustainable management means:
 - ⇒ Ensuring water resources are available to meet the needs of future generations,
 - ⇒ Safeguarding the life supporting capacity of water resources,
 - ⇒ Avoiding, remedying or mitigating significant adverse effects of activities on the environment;
- the integrated management of the State's natural resources;
- the orderly, equitable and efficient use of water resources;
- members of the community taking an active role in managing these resources.

The Water and Rivers Commission (WRC) anticipates the change will be a slow staged process based on creating local management rules.

Under the new legislation, water trading will be permissible with the approval of the Commission subject to local rules. The Commission can reduce or increase the total entitlement during trading. The Commission may buy entitlements to reduce the use in an area, where current use is deemed inappropriate.

Currently licence fees do not cover the full cost of supplying water in most jurisdictions. The proposed legislation will allow licence charges to increase.

Stressed Rivers

The Water Resources Commission does not favour the term 'stressed river' in reference to allocation pressure alone because of the confusion it creates with the issue of secondary salinisation stress. Some WA rivers are naturally saline.

River stress as such is not assessed. In establishing priorities for developing implementation plans as required under COAG, the rivers and groundwater systems are assessed on the basis of both allocation levels and environmental significance. Priority for establishing plans is given to those systems where:

- allocations levels are high (>70% of sustainable yield) or have the potential to become so within the next five years, or
- environmental significance of the river or groundwater dependent ecosystems is high or moderate, or
- there is, or has the potential to be a high level of conflict between water users.

Western Australia has river and groundwater systems that are stressed by factors such as salinity and urban contamination rather than by over allocation. In these cases the system may not be given a high priority for allocation planning, but is given a high priority under other programs such as the State Salinity Action Program or one of the “Clean Up” programs. Flow management would be considered as one element as appropriate within those programs.

WRC is concerned about the effects of groundwater abstraction on water levels in coastal wetlands. High priority areas are identified by agencies (CALM, EPA, WRC) and recognise existing and potential Ramsar sites in the process.

Identifying Environmental Allocations

There are three levels of Allocation Plans that form the basis for water allocation decisions in WA. The plans have defined purposes, make explicit provision for water for the environment and have a defined process for their preparation. They are:

Regional Allocation Plans -which guide overall management of water resource in a region by setting values for the resource, including environmental values.

Sub Regional Allocation Plans - which facilitate development of water resources by specifying bulk water allocations. These will set environmental water provisions. For example, the Harvey Basin Allocation Plan.

Local Management Plans -Allocation and water use management policies for the local water resource. These plans set specific licence conditions.

Local water management plans are to be administered by Local Water Management Committees. These Committees will have community representation and will be formed once the new legislation is enacted. Presently there are 12 advisory committees, overseeing about 10% of the State’s water resource. These committees will also become Local Water Management Committees.

The amendments to the legislation will make these various plans statutory and specify the process for their preparation, including the public consultation.

Western Australia has released a Draft Environmental Water Provisions Policy that aims to guide the WRC in allocating water for the environment. In formulating the Environmental Water Provisions Policy, the Commission has been guided by the "National Principles for the Provision of Water for Ecosystems" (ARMCANZ/ANZECC 1996). The current practice for determining environmental water provisions was independently reviewed by

Welker (1998)⁴ who determined that it is generally in accordance with COAG requirements.

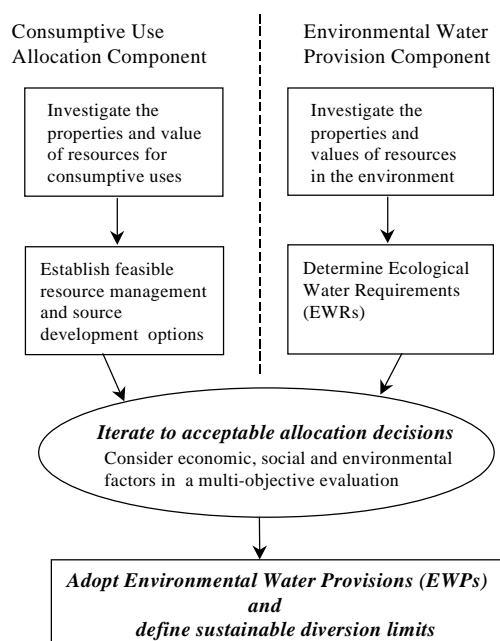
The period for public submissions for the draft Environmental Water Provisions Policy has closed and the document is being reviewed in the light of the submissions received. The implementation of this environmental water provision policy is not dependant on the legislation, and is already being applied, the most recent example being the East Gngara Groundwater Environmental Water Provision Plan.

The policy uses the ARMCANZ/ANZECC 1996 definitions (with some slight modification) for EWR and EWP (see footnote 2, pge 7). The following diagram indicates how EWPs are formulated from EWRs. A major principle is that when sharing water between competing demands, the amount of water needed for the environment must be determined and provision made for it, before water is provided for other uses.

The Environmental Water Provisions Policy uses the holistic approach of Arthington *et al* (1992)⁵ for determining water for the ecosystem. When limited information is available, interim allocations using the best information available will be implemented until more detailed information becomes available.

Plans are subject to the *Environmental Protection Act* and must be approved by the EPA. The EPA may require a full EIA if it deems necessary.

Water Resource Allocation Planning



⁴ Welker 1998, *A Review of Environmental Water Provisions Policy and Processes in Western Australia*. Prepared for WRC by Welker Environmental Consultancy, March 1998

⁵ Arthington, A. H. et al. 1992, Development of an holistic approach for assessing environmental flow requirements of riverine ecosystems. In: *Proceedings of an International Seminar and Workshop on Water Allocation for the Environment* Eds. Pigram, J. J. and Hooper, B. P., Centre for Water Policy Research, Armidale, pp. 69-76.

Allocating Environmental Flows

At present Environmental Water Provisions have not been completed or implemented for any surface waters.

The aim is to have water allocation planning and associated EWP decision-making made ahead of development pressures. The EWP process will proceed at a variety of scales from regional (eg. Busselton/Walpole region and the Kimberley are being assessed at present) to local depending on the current assessments of demand pressure. There may be some need to reassess effects below existing impoundments.

4.9 Summary of State Approaches to Defining Stressed Rivers

The COAG reforms require States to make substantial progress on rivers that have been over-allocated or are deemed to be stressed. The Agreement left the definition of stressed up to each jurisdiction.

<p>Australian Capital Territory</p>	<p>The ACT has undertaken comprehensive quality and quantity monitoring of its surface waters over a number of decades. This assessment has indicated impacts of water diversions and impoundments on the Cotter and Molonglo Rivers. However, the Territory does not have a formal system for identifying and declaring stressed rivers. Consequently, the ACT does not identify any stressed rivers.</p>
<p>New South Wales</p>	<p>All regulated rivers in NSW are classified as stressed. Regulated rivers are those proclaimed under the <i>Water Act</i> as having their flows controlled by the major Government rural dams.</p> <p>Identification of stressed rivers for unregulated rivers was undertaken at the sub-catchment level. Six hundred and eighty unregulated sub-catchments were identified across NSW. Stress due to water abstraction (hydrologic stress) and stress due to other factors (environmental stress) was rapidly assessed. The process also identified sub-catchments with a high conservation value. By combining indices of hydrologic and environmental stress, an overall stress classification was determined.</p> <p>The stressed river classification influences the priority for producing river management plans and the volume of water available for abstraction in any sub-catchment. The stressed river classification will be reviewed after 5 years.</p>

<p>Northern Territory</p>	<p>Most of Northern Territory's surface waters are unregulated and flows are highly seasonal. There are storages (dams and weirs) on the Darwin and Katherine Rivers for provision of urban water supplies that will have an impact on the ecosystem. In the Northern Territory the most significant demand is currently on groundwater resources.</p> <p>The NT Government has determined there are no stressed rivers in the Territory.</p>
<p>Queensland</p>	<p>It is recognised by Queensland's Department of Natural Resources that in some areas a lack of water for the environment has resulted in the degradation of the riverine ecosystem. However, there is no separate program to identify stressed rivers. Rather, the level of stress is to be determined during the development of Water Management Plans and Water Allocation Management Plans. During the planning process, when unallocated flows are not sufficient to meet ecosystem needs, determined by the level of diversion relative to the total resource, the river would be considered stressed. This would then be taken into consideration in determining the volume of diversions permitted.</p> <p>Also, the EPA is developing separately a State Water Plan that will identify significant ecosystems in the State and is identifying what will be sustainable use.</p>
<p>South Australia</p>	<p>The identification of stressed rivers in South Australia is based on an assessment of the level of development pressure on the water resource. This includes an assessment of factors including, number of farm dams, volume contained in dams, percentage of run-off intercepted and percentage of flow diverted. For groundwater, assessments can be made on reductions in water table levels or groundwater pressures, increases in salinity and a comparison of use to recharge across a certain area.</p> <p>In future, the aim is to use more detailed hydrological analysis with reference to seasonality and a biological assessment including riparian vegetation to investigate the ecological health of the water-dependent ecosystems.</p> <p>The Minister can prescribe water resources considered to be stressed as a result of high levels of abstraction. Once prescribed, a Water Allocation Plan has to be developed which will set the conditions upon which water can be diverted from that resource.</p>

Tasmania	<p>To identify Tasmania's stressed rivers, the environmental values and the level of abstraction for each of the State's catchments have been identified.</p> <p>Environmental values were determined using AUSRIVAS, a modified Index of Stream Condition, levels of abstraction and other changes in flow regime. Environmental values considered the effects on the flow regime of hydroelectricity generation, the conservation status of the river and considered the effects on estuarine systems. Technical Panels comprised of stakeholders and other interest groups have used this assessment to identify high priority catchments for the development of Water Management Plans.</p> <p>The priority setting system has identified that most stress is associated with summer irrigation, though it is recognised that hydroelectricity generation is causing problems in some rivers.</p>
Victoria	<p>A scientific panel that included agency representatives and freshwater ecology experts from the Universities and CRCs determined Victoria's stressed rivers. The scientific panel assessed rivers by looking for gross changes in the flow regime. These included reductions in volume, altered seasonality in flow, reductions in flooding frequency and changes in low flow volumes. If the existing flow regime did not meet the scientific panel's assessment of the ecosystem's requirements, the river was classed as stressed. By this criteria many of the States rivers were stressed.</p> <p>This assessment was used to develop a list of 8 priority rivers for rehabilitation. The priority rivers identified do not represent the 8 most stressed rivers in the State, but rather stressed rivers with the greatest potential for significant ecological rehabilitation.</p> <p>It was recognised that in many cases inadequate flow regimes are only one contributing factor to the poor river health. Consequently, rehabilitation will require restoration of flow regimes in conjunction with other river restoration works.</p>
Western Australia	<p>The current level of diversions relative to the total divertible volume has been used to determine stressed rivers in Western Australia. Water resources with a high diversion relative to flow can be proclaimed, which brings them under the Act. Proclaimed water resources will then be subjected to more detailed reporting and the development of environmental water requirements and provisions. The first State of the Water Resources Report identifies the current status of surface and groundwaters in WA.</p> <p>Secondary salinisation is recognised as one of the greatest pressures on the riverine ecosystem. For this reason the Water and Rivers Commission does not favour the term stressed rivers when it is defined by hydrologic stress alone. In their systems there are other serious stress factors, such as a salinity which must be considered in setting priorities.</p>

5. Assessing the Ecological Benefits of State Actions

5.1 Concepts of River Health

The community seeks “healthy rivers”, but defining river health is an ongoing challenge⁶. While the metaphor of health is readily grasped, the applicability of a model based around birth, growth, senescence and death is perhaps not all that appropriate to rivers.

Because of their general lack of ecological expertise, many water agencies initially treated river restoration as a hydrological and perhaps physical problem. It was assumed that if some flow pulses could be returned, the original biota would be restored. In some jurisdictions it is now appreciated that simply returning flow pulses might not be sufficient to restore rivers where there are other factors causing degradation. For example there are 1500 major artificial barriers to fish movement in NSW rivers (weirs and dams), which are thought to be one of the major factors in the loss of around 93% of the silver perch populations over the last 50 years.

It is now generally agreed that health is expressed in the biological system, so while chemistry, geomorphology and hydrology may be important determinants there are other factors which determine the biological assemblages. Using chemical, physical and hydrological measurements as surrogates for river health has not been effective. Firstly, they are inputs when we are concerned to measure outcomes, and secondly they are not the sole determinants of the biological system, which is also affected by habitat availability, predation, disease and competition.

The challenge of operationalising the concept of river health is to determine how to measure and report the biological state of the waterway. The concept of ecoregions has helped us appreciate that there is no universal “ideal” and benchmarks need to be based on comparable water bodies within the same ecoregion. This has led to the development of the concept of reference sites from which departure can be assessed, rather than having some standard (often set on another continent) that has been common with water quality guidelines.

The simplest approach to assessing the biological state of a waterbody is to use the fish communities. Indeed, this is how the public commonly make their assessment. The public rarely consider the entire fish community, but have some much loved “icon” species, and some much loathed “pest” species by which they come to these judgements. Fish communities have, however, been widely used as a measure of river health. The CRC for Freshwater Ecology has used these techniques in a comprehensive survey of fish communities in NSW rivers⁷.

The assemblages of aquatic invertebrates that live in a stream have also been shown to be a useful indicator of stress. The AUSRIVAS models being developed give us a useful

⁶ Norris, R. H. & Thoms, M. C. 1999, What is river health? *Freshwater Biology*, 41, 197-209.

⁷ Harris, J. & Gehrke, P. 1997, *Fish and Rivers in Stress. The NSW Rivers Survey*. CRC for Freshwater Ecology, Canberra and NSW Fisheries, Sydney.

measure of departure from some reference condition, and give a predictive capacity. Aquatic invertebrates have perhaps been the most widely used indicators of river health, and certainly are the main approach supported by the National River Health Program in Australia, funded by the Commonwealth Government.

There are other integrating tools for structural analysis of river health including the Index of Biotic Integrity based on various fish measures⁸.

A somewhat wider approach to structural analysis that incorporates a number of abiotic factors is the Index of Stream Condition developed in Victoria⁹. This index incorporates hydrology, geomorphology, habitat, riparian condition, water quality and biota (largely invertebrates). This index has been developed to be relatively simple and useful for Catchment Management Authorities to make periodic assessments of the condition of their streams.

Australian Governments at all levels are now producing “State of the Environment” reports. The Federal Government is undertaking an ambitious National Land and Water Audit. As Governments undertake the agreed reforms under COAG, irrigators who lose access to water to provide environmental allocations seek some demonstration of the benefits that arise. The problem is that it is not clear as to the appropriate time and space scales at which this can be achieved. Integrating biology, hydrology and chemistry in systems that have such variability and unpredictability is a difficult. Detecting minor improvements in a wildly fluctuating signal will continue to be a challenge, although the capacity of the aquatic ecosystems to integrate over time scales appropriate to their life cycles is a useful element.

5.2 Measuring Ecological Outcomes

It is not realistic to attempt to measure ecological outcomes as yet, since many of the reforms have not been implemented in a widespread manner.

Assessing beneficial outcomes is going to be a difficult task. Many Australian rivers are highly variable, and have evolved in that context. We commonly have runs of dry or wet years that may last 5 or 10 years. So in many parts of Australia the systems are naturally highly variable.

This variability is one of the key reasons to maintain biodiversity in our waterways, so that there will be groups of biota that can thrive under any of the expected conditions. The variability also increases the need for systematic and well planned long-term monitoring to allow changes to be detected. This is a research need. Even if change can be detected in such noisy systems, the issue of causality is still a problem since there are many factors impacting on the health of the river.

⁸ Harris, J. H. & Silveria, R. 1999, Large-scale Assessments of River Health Using an Index of Biotic Integrity with Low Density Fish Communities. *Freshwater Biology*, 41, 235-252.

⁹ Ladson, A., White, L. J., Doolan, J. A., Finlayson, B. L., Hart, B. T., Lake, P. S. & Tilleard, J. W. 1999, Development and Testing of an Index of Stream Condition for Waterway Management in Australia. *Freshwater Biology*, 41, 453-468.

In some jurisdictions there is a good water quality record, a good hydrologic record and reasonable ecological assessment and surveys. In these jurisdictions we believe it might be possible to measure and demonstrate improvement, but advise that this is not a simple task, and we should start developing appropriate monitoring and auditing techniques as a matter of priority. In other jurisdictions where there is very poor measurement of the “before” condition, it will be difficult to demonstrate any change. The National survey using aquatic invertebrates (AUSRIVAS) is one important tool for observing change if reference streams are available. This approach identifies invertebrates to the Family level and it may not be able to detect very subtle changes. Other groups of biota such as fish and plants need to be included in comprehensive assessment, although there are limitations with using any of these groups of biota.

As well as these difficulties of definition and measurement it is important not to assume that the stress observed in rivers or wetlands has stabilised. It has taken 50-70 years for the impacts of tree clearing on salinity to be expressed, and it is by no means clear that the symptoms that will be observed from over extraction of water are already evident. It is expected that the interventions being put in place by Governments will lead to an improvement, or at least slow the current rate of degradation.

The State jurisdictions generally recognise that flow is only one of a number of stresses on our rivers. Many additional stresses (other than flow *per se*) are associated with water resource development, for example, barriers to fish movement by weirs, cold water releases from large storages and the introduction of pesticides and nutrients from agriculture. Catchment condition invariably reflects itself in stream condition, so in some places, other stresses such as secondary salinisation may have a much greater impact than flow regulation alone.

Commencing the monitoring program simultaneously or after the commencement of environmental flow regimes greatly weakens the power of those programs to demonstrate an environmental benefit. This is understood by at least some of the scientists involved. To avoid future backlashes, care must be taken to ensure public expectation of the benefits of these programs are realistic, particularly in light of the inherent variability of these systems and the modest size of many of the environmental allocations being considered..

In some areas, there are widely held beliefs that providing an elevated and constant base flow in the river is an improvement and that the water quality and the amount of 'habitat' available for aquatic organisms is better than in stagnant water holes. However, we emphasise that the Australian biota has evolved under such extremes. Making flow conditions more constant and predictable may be at the expense of our native biota and favour exotic species.

In summary, measuring ecological outcomes will be difficult because of the noisy signals due to rainfall variability, our as yet poorly developed indicators of river health, and the time it may take for benefits to become apparent or measurable. Nevertheless, this is a challenge for the water research community and the relevant water resource management agencies, and is already being addressed in a number of ways. We need to ensure high level scientific scrutiny and effective sharing of ideas and approaches across jurisdictions.

5.3 Assessing Actions Likely to Lead to Beneficial Outcomes

The task of reviewing the State's various responses to COAG reforms from an ecological perspective and identifying actions that are necessary to achieve ecological benefits is simpler than measuring ecological outcomes. In reviewing the various actions, we have developed a set of principles we regard as essential to developing beneficial outcomes.

The main principles used in this assessment are:

- a) *Efficient water use.* Any extraction of water has impacts on the river ecosystem. By ensuring water is used efficiently these impacts can be minimised and kept within levels that are acceptable to the community. This requires that water be sold at prices that reflect full cost recovery and are consumptive based as well as the establishment of clear property rights for water, the separation of land and water property rights, and the ability to trade water. An effective market will set appropriate prices, and COAG requires that Government stop, or at least make transparent, subsidy in this area. This will help to reduce wastage and encourage the provision of infrastructure to reduce water losses.
- b) *Comprehensive assessments.* Ensure that new water resource development proposals undergo comprehensive whole system assessment and consider impacts on groundwater and receiving estuaries and coastal waters, as well as on the freshwater resources and associated floodplains and wetlands. The ecological impacts of inter-basin transfers, including the introduction of exotic species and genetic strains, must be professionally assessed. Assessments must consider the whole system, not just some aspects of it. In some cases this whole system analysis must go beyond State borders. This would normally be undertaken through a comprehensive Impact Assessment process.
- c) *Range of aquatic ecosystems.* In making environmental allocations it is essential to appreciate the needs not only of in-channel ecosystems, but also floodplains, wetlands, terminal wetlands, groundwater systems and estuaries. Flow-related processes link these various sub-systems. Areas of high conservation priority may need special allocations to maintain them, although it must not be assumed these systems need constant allocations each year.
- d) *Measured volumetric allocations.* Water allocations need to be based on actual volumes rather than permission to pump for certain hours or when the river reaches certain levels. Under some circumstances volumetric allocations might still be delivered under rules relating to timing or water level, where these rules result in a potential ecological benefit. Where on-farm storage exists, schedules for water diversion can be set to minimise ecological damage. Groundwater controls need to be linked with surface water controls.
- e) *Water quality considerations.* The effects of extraction policies on water quality must be assessed. The water quality aspects must consider ecosystem health as well as the needs of various extractive users. This includes assessment of the effects on dilution flows of pollutants such as nutrients and salt (including the flexibility to respond to pollution events), the impacts of any return flows from agriculture and the impacts of river regulation structures on water temperature and oxygenation.

- f) *Manage water in a catchment context.* Water allocations and management need to be set in the context of catchment management plans that consider land uses, riparian areas and other catchment issues. Farm dams can trap significant water and prevent it reaching rivers and off-river storages can have impacts on groundwater. The harvesting of floodplain flows can have significant impacts on downstream water users and ecosystems. In some situations excess water may have serious economic impacts, including flooding, and salinisation issues.
- g) *Adaptive management.* Our present state of knowledge of aquatic ecosystems is imperfect, although it is improving. It is necessary to review water allocations in the light of what we learn, and learn from the allocations we make. It is a high cost on society to grant water rights in perpetuity and then have to purchase these rights back. On the other hand, water users will not make the necessary investments in adequate water infrastructure unless they have a reasonable period to get a return on the investment. Adaptive management requires that effective monitoring be in place to permit an assessment of outcomes and make adjustments as needed. We believe there must be a capacity to review allocations over periods of 5-8 years. This is consistent with the precautionary principle adopted by Governments in their ESD strategies.
- h) *Knowledge strategy.* Recognising the uncertainty of much of our water management, it is necessary to have an effective knowledge strategy in place to ensure research focuses on the critical knowledge gaps that must be addressed to manage these systems in a sustainable way. This develops the COAG requirement to undertake appropriate research to support management.
- i) *Information exchange.* It is important to have transparent processes and sharing of information if effective partnerships between agencies, technical experts, landholders and community groups are to be formed.

5.4 The Assessment Workshop

We invited a range of expert ecologists from different parts of Australia to come together for a one day workshop to pool their knowledge and make assessments of the likely ecological outcomes of the COAG water reforms. We selected people that were generally not part of State agencies developing their actions, but who were closely involved and had a good understanding of the issues. We sought people who could analyse rather than advocate. Many of the participants had worked or advised in several States, and had international experience in this area. Prior to the workshop, participants were given material on what steps the States had implemented.

At the workshop, the participants first reviewed the material on State activity, and then considered the critical actions required to deliver desirable ecological outcomes, and this resulted in the list of principles given above (Section 5.3). Following this a discussion on each State was held to evaluate the progress made. It must be stressed that these findings are those of a group of expert ecologists made on the basis of publicly available information on the activities of each State. The resultant output (see Section 6) is an

assessment of current management viewed from a basis of ecological expertise. It is not intended as a detailed discussion of potential ecological outcomes.

There are clear limitations with this approach, which is based on the knowledge of the participants. The experts involved were knowledgeable about surface water systems, but did not include specific expertise on groundwater - surfacewater interactions, an undeveloped field so far in Australia. A number of people have provided information on what is actually happening in each State, but the information available is variable. The judgements of the panel have been made available to State agencies who have made comments in some cases. The State agencies have not been asked to endorse the descriptions of actions or the judgements of the likely outcomes, and in some instances have advised they disagree with our judgements. These remain the responsibility of the authors and the workshop participants. Workshop participants:

Prof Angela Arthington	Griffith University	Qld
Dr Leon Barmuta	University of Tasmania	Tas
Dr Andrew Boulton	University of New England	NSW
A/Prof Stuart Bunn	Griffith University	Qld
Prof Peter Cullen	CRC for Freshwater Ecology	ACT
Dr Peter Davies	University of WA	WA
Mr Greg Fraser	Re-Engineering Australia	ACT
Dr Ben Gawne	CRC for Freshwater Ecology	Vic
Dr Peter Gehrke	CRC for Freshwater Ecology	NSW
Dr Paul Humphries	CRC for Freshwater Ecology	NSW
Ian Lawrence	CRC for Freshwater Ecology	ACT
A/Prof. Martin Thoms	CRC for Freshwater Ecology	ACT
Dr John Whittington	CRC for Freshwater Ecology	NSW

6. State Assessments

6.1 Australian Capital Territory	
Overview of issues	The ACT is an upstream jurisdiction, although it does receive some of its water from NSW. There is little irrigation and little use of groundwater. The main water demand is for the urban area of Canberra. Some 20% of urban water supply demand is now met from treated wastewater and stormwater reuse. The average annual net ACT water consumption is just 3% of the Mean Annual Flow at Burrinjuck Dam.
Status of legislation	<i>Water Resources Act 1998</i> meets COAG requirements.
Efficient use of water - Separate property rights - Capacity for trading - Full cost pricing	Water allocation is separate from land title and is tradeable. Full cost pricing of water allocation through independent pricing control.
Comprehensive assessments of new developments - Impacts on groundwater - Estuaries and coastal waters - Rivers - Floodplains and wetlands. - Inter-basin transfers	Any development or change in land use potentially impacting on downstream water quality, groundwater, floodplain or wetlands triggers a mandatory requirement for an Environmental Assessment.
Environmental allocations - In-channel - Floodplains - Wetlands and terminal wetlands - Groundwater - Estuaries	Determined using Expert Panel approach in a reasonably comprehensive manner. Statutory Environmental Flow Guidelines adopted by Legislative Assembly 27 th May 1999.
Volumetric allocations	Yes
Water quality - Monitoring system - Adequate reporting - Impacts of dams	Reasonable monitoring program and adequately integrated with flow management. Reported on Web. The ACT has had in place a statutory based designation of environmental and use values of waters, together with water quality guidelines related to protecting these values, since 1987.

<p>Catchment context</p> <ul style="list-style-type: none"> - TCM framework - Riparian areas - Farm dams - Harvesting floodplain waters 	<p>A statutory based TCM Plan since 1987, inter-relating land use and management practice to protection of downstream environmental and use values using water quality models, supported by extensive streamflow, water quality and biological monitoring. Catchment wide policies and agreements revised in 1997 through a Joint Government Regional Strategy Plan for the catchment. Riparian areas along Murrumbidgee River and Molonglo River corridors through the ACT are integrated into river corridor management zones, with full fencing and exclusion of stock. Farm Management Plans required to address protection of riparian zones for leases fronting on to other rivers.</p>
<p>Adaptive management</p> <ul style="list-style-type: none"> - Ability to alter licences - Monitoring and assessment 	<p>Has ability to change allocations. Ecological monitoring using AUSRIVAS. The ACT maintains a comprehensive program of water quality and ecological monitoring. Through a series of Strategic Planning and Management reviews, the performance of land use and management strategies in securing environmental objectives is reviewed, and modifications made to strategies and implementation.</p>
<p>Knowledge strategy</p> <ul style="list-style-type: none"> - Local research capacity - Linkages to management - Identification of knowledge needs 	<p>Both the ACT Government and ACTEW are partners in CRCFE. There is strong CSIRO and other University capacity and a history of good linkages and investment in research. Needs more effort to articulate knowledge needs.</p>
<p>Information exchange</p>	<p>Streamflow and water quality data base, and other water quality and ecological information is available on the ACT Government Web page. Reporting on water issues is part of ACT State of Environment reporting.</p>
<p>Other issues</p>	
<p>Summary and findings</p>	<p>The ACT is a small jurisdiction that is handling its water planning and management well and is moving towards meeting COAG requirements. It should be noted that ACT was one of the only two states/territories considered by the NCC to be making good progress on the COAG agenda and not required to undertake additional reviews.</p>

6.2 New South Wales	
Overview of issues	NSW has extensive development of its water resources to support a significant irrigation industry. In some catchments it has allowed excessive extraction of water and is now moving to remedy this. Undertaken through a whole of Government perspective involving 5 major State agencies with extensive community involvement.
Status of legislation	New Legislation is in preparation to replace the <i>Water Act 1912</i> and other Acts.
Efficient use of water - Separate property rights - Capacity for trading - Full cost pricing	Water rights have been separated and trading allowed on regulated rivers. State has an independent price regulator and is moving towards full cost pricing although progress seems slow. Aiming to have 83% cost recovery on regulated rivers by mid 2000.
Comprehensive assessments of new developments - Impacts on groundwater - Estuaries and coastal waters - Rivers - Floodplains and wetlands - Inter-basin transfers	There is limited scope for further development which is only possible in rivers that are not considered to be already over allocated. Assessments generally weak in regard to groundwater and estuarine impacts. Inter-basin transfers occur in relation to the Snowy Mountains Scheme. There has been little assessment of genetic impact of transfers.
Environmental allocations - In-channel - Floodplains - Wetlands and terminal wetlands - Groundwater - Estuaries	Allocations on regulated rivers further advanced than unregulated rivers. River Management Committees (RMC) give regional input. State agencies developed Interim River Flow Objectives (RFO) for all catchments, which each RMC adapts to their region. Some RMC's have done this, some are yet to form and others have not altered the interim RFOs. In-channel considerations adequate, but not using a consistent methodology. Floodplain issues being addressed by some RMCs eg Murray River. Wetlands – some allocations achieved – Macquarie Marshes and Gwydir Wetlands.

	<p>Groundwater – limited knowledge of resource and poor connection to environmental flow planning.</p> <p>Terminal wetlands are acknowledged and water allocated to them in specific cases, however the volumes allocated may be inadequate.</p> <p>Estuarine systems – acknowledged, but water allocations not well done.</p>
Volumetric allocations	On regulated rivers but not yet on unregulated rivers.
Water quality - Monitoring system - Adequate reporting - Impacts of dams	<p>EPA has identified water quality objectives. Each RMC is adapting these to their region.</p> <p>There is intent to include them with river flow objectives in the water allocation process. Impacts of dams and structures poorly considered.</p>
Catchment context - TCM framework - Riparian areas - Farm dams - Harvesting floodplain waters	<p>There is an overlap of committees. 45 Catchment C'tees, 17 Regional Catchment C'tees, River Management C'tees and Groundwater C'tees may cover the same geographic region. There is concern about coordination of these bodies. Considerable planning for and talking of TCM but delivery is weaker. Patchy linkage with State agencies.</p> <p>Farm dams are an issue. New rules allow for 10% of run-off to be stored without licence. Floodplain harvesting an issue in the North West of State but the extent of the practice and problem is unknown. Inter-basin transfers occur but there is a poor understanding of the ecological consequences.</p>
Adaptive management - Ability to alter licences - Monitoring and assessment	<p>Review of allocations after 5 years. To provide resource security, no allocations are to be reduced by more than 10% in the first 5 years.</p> <p>Implemented IMEF program to monitor changes and assess outcomes of flow reforms will be attempted with methodologies now being developed. These are based on testing clearly stated hypotheses, which we applaud as an approach. The State has poor base line water quality data from which to demonstrate an impact of environmental flows and so is unlikely to be able to show outcomes of flow changes. The biological data are also patchy. There is a one-off comprehensive fish survey, and AUSRIVAS has been implemented.</p>

<p>Knowledge strategy</p> <ul style="list-style-type: none"> - Local research capacity - Linkages to management - Identification of knowledge needs 	<p>Some ecological research capacity in DLWC, EPA and State Fisheries. DLWC, Sydney Water and EPA are members of CRCFE, and DLWC also in CRC Catchment Hydrology. There is strong CSIRO presence in NSW. Needs more effort to articulate knowledge needs although environmental flow work has identified major knowledge gaps.</p>
<p>Information exchange</p>	<p>There is a central group producing good information but whether this is being disseminated to the RMCs is uncertain. There is seen to be relatively poor integration and communication between government agencies.</p>
<p>Other issues</p>	<p>Activation of sleeper licences has been poorly handled. Definition of a watercourse is a problem for the north western floodplain rivers.</p>
<p>Summary and findings</p>	<p>NSW is making a serious effort to address the over allocation issues using extensive local involvement and available research data. There has been limited on-ground impact as yet of much of this planning although the actions being undertaken are appropriate and if implemented should lead to improved outcomes.</p>

6.3 Northern Territory	
Overview of issues	Northern Territory has limited surface water resources and these are largely unregulated and are highly seasonal in their flow. The Territory is very dependent on groundwater.
Status of legislation	<i>Water Act 1992</i> needs reform to meet COAG agenda.
Efficient use of water - Separate property rights - Capacity for trading - Full cost pricing	Not met.
Comprehensive assessments of new developments - Impacts on groundwater - Estuaries and coastal waters - Rivers - Floodplains and wetlands - Inter-basin transfers	Act does cover surface and groundwater, as well as water quality and waste discharge. Licences required for extraction for other than stock and domestic use.
Environmental allocations - In-channel - Floodplains - Wetlands and terminal wetlands - Groundwater - Estuaries	Most rivers unregulated and flows are highly seasonal. Most pressure is on groundwater. A draft plan and process for ecological water requirements has apparently been developed but not yet made public.
Volumetric allocations	Under consideration.
Water quality - Monitoring system - Adequate reporting - Impacts of dams	No information.

<p>Catchment context</p> <ul style="list-style-type: none"> - TCM framework - Riparian areas - Farm dams - Harvesting floodplain waters 	<p>There is limited development of TCM in the Territory. Two plans have been formulated, the Mary River ICM Plan and the Ti Tree Regional Water Resource Strategy. These plans have advisory committees representative of the catchment community.</p>
<p>Adaptive management</p> <ul style="list-style-type: none"> - Ability to alter licences - Monitoring and assessment 	<p>Allocation licences for other than stock and domestic are for 2 yrs.</p>
<p>Knowledge strategy</p> <ul style="list-style-type: none"> - Local research capacity - Linkages to management - Identification of knowledge needs 	<p>Seems limited in all regards, although there has been a significant effort to develop integrated research activity to address issues.</p>
<p>Information exchange</p>	
<p>Summary and findings</p>	<p>NT recognises linkage between groundwater usage and surface water and is attempting to develop an integrated whole system approach.</p>

6.4 Queensland	
Overview of issues	Queensland has not as yet developed their water resources to the extent of the southern States, but there are strong pressures to develop. There are significant groundwater issues.
Status of legislation	<i>Water Resources Act 1989</i> Amendments are proposed to meet COAG reform agenda.
Efficient use of water - Separate property rights - Capacity for trading - Full cost pricing	Act requires Water Management Plans to be developed. DNR requires Water Allocation and Management Plans (WAMPs), which include environmental allocations but at present these have no legal backing. Water licences presently linked to property although annual trading allowed. Pricing currently inadequate but under review. Charging a minimal fee with no charges on some unregulated rivers and for floodplain harvesting. Permanent trading will be allowed after the completion of the WAMP process but not under the presently legislated WMP process.
Comprehensive assessments of new developments - Impacts on groundwater - Estuaries and coastal waters - Rivers - Floodplains and wetlands - Inter-basin transfers	Licensing controlled by DNR and allocations made on availability and first-come first-served basis. There are many large-scale development plans in the State. They are currently on hold as they are assessed through the WMP/WAMP process. Whilst these approaches are sound they seem poorly resourced and are proceeding slowly. The EPA is a new player and is developing a State Water Plan that will identify significant ecosystems in the State and also identify sustainable levels of water use. Many inter-basin transfers have been proposed that would likely have huge impacts on the spread of exotic and native organisms. Limited knowledge of the ecological impacts.

<p>Environmental allocations</p> <ul style="list-style-type: none"> - In-channel - Floodplains - Wetlands and terminal wetlands - Groundwater - Estuaries 	<p>No specific allocations to the environment under present legislation, but are addressed in WAMP process. The WAMP and WMP processes are as much about identifying potential development as they are about controlling existing diversions. It is unclear as to what process the Minister uses to decide whether it is necessary to initiate a WMP or WAMP.</p> <p>There are no completed WAMPs or WMPs. The WAMP process identifies environmental allocations and diversion volumes but the next stage of the planning process, the ROMP, determines how these are to be met. The ROMP process has not yet been attempted.</p> <p>In-channel issues are addressed in WAMP. Definitional problems of what is a channel and what is not in the western part of the State.</p> <p>The limited knowledge of the water requirements of the complex floodplain systems in western Qld makes allocation decisions difficult. Limited knowledge gives no predictive capacity for these systems. The State is conscious of the problem and attempts with GIS and other methods on Cooper Creek are commendable.</p> <p>Issues for mound springs of over abstraction of artesian groundwater where high numbers of poorly controlled bores have led to a 'declining aridity' in western Queensland.</p> <p>Links between flow and commercial fisheries catch in estuaries have been identified.</p>
<p>Volumetric allocations</p>	<p>There is a move to volumetric licences with flow triggers. Pressures for compensation if this reduces access to water. There is an issue of how to handle sleeper licences.</p>
<p>Water quality</p> <ul style="list-style-type: none"> - Monitoring system - Adequate reporting - Impacts of dams 	<p>Patchy data available and is generally not flow related. There is limited use of water quality data in IQQM model but there is pressure to change.</p>
<p>Catchment context</p> <ul style="list-style-type: none"> - TCM framework - Riparian areas - Farm dams - Harvesting floodplain waters 	<p>ICM philosophy and process is underway in a number of catchments but progress is variable.</p> <p>There must be an effort to licence on farm storages, particularly the large floodplain storages and a number of planning studies are now underway.</p>

<p>Adaptive management</p> <ul style="list-style-type: none"> - Ability to alter licences - Monitoring and assessment 	<p>Intent to review allocations under WMP and WAMP. Poor baseline data in Qld that will make benchmarking impossible in many catchments and so will not be possible to demonstrate environmental change.</p>
<p>Knowledge strategy</p> <ul style="list-style-type: none"> - Local research capacity - Linkages to management - Identification of knowledge needs 	<p>Limited ecological expertise in agencies although several strong University groups are working with DNR. DNR is a member of CRCFE and CRCCH. The WAMP process is clarifying the knowledge gaps. There is a need for increased investment to address these knowledge gaps. This needs to be done on a strategic basis.</p>
<p>Information exchange</p>	<p>Decentralised resource management requires good communication within central agencies and between central agencies and regional offices. There is clearly room for improvement in these areas.</p> <p>Seen by some to be poor communication between government agencies, which include DPI, EPA, DNR, Fisheries, SE Qld Water Board.</p> <p>There was an example of poor communication between DNR and some key stakeholder groups during the first WMP process. Limited consultation with the scientific committees, for example, has led to the perception of keeping the process 'in-house' and confidential. These issues are being addressed.</p>
<p>Other issues</p>	<p>Important surface water and groundwater resources for NSW and SA originate in Queensland. There are a number of cross-border issues that need to be resolved through mechanisms such as the MDBC, the Border Rivers Commission and the Proposed Lake Eyre Agreement.</p> <p>The extreme variability of flow in the State's rivers, particularly in the west and north is in conflict with needs of irrigated agriculture that depend upon a regular supply and make it difficult to make long term planning decisions. Limited knowledge of the surface water - ground water interaction</p>
<p>Summary and findings</p>	<p>Queensland has a reasonably undeveloped water resource base, with strong economic pressures to develop. It is important to avoid the mistakes of the southern States, which are turning out to be very costly to remedy. The processes in place have merit but progress is very slow. The issue of floodplain harvesting must be addressed.</p>

6.5 South Australia	
Overview of issues	South Australia has limited water resources, and receives water from upstream States.
Status of legislation	The <i>Water Resources Act 1997</i> does meet COAG requirements and the effort is now on implementation. Considerable devolution of power to regional Boards.
Efficient use of water - Separate property rights - Capacity for trading - Full cost pricing	Act formally recognises environment as a use of water but leaves allocations to Catchment Water Management Boards where present. There is separation of property rights and trading allowed.
Comprehensive assessments of new developments - Impacts on groundwater - Estuaries and coastal waters - Rivers - Floodplains and wetlands - Inter-basin transfers	Depending on the scale and location of development, there are 3 different assessment processes under the Water Resources Act (1997), Development Act (1993) and the Environment Protection Act (1993). Any development assessed by Catchment Water Management Boards under the Water Resources Act (1997) would be assessed against the relevant plan and must meet the object of the Act for sustainable development. There is an EIS process required under the Development Act for large projects Extractions from prescribed water courses have to be licensed. There are 23 prescribed water resources in the State identified by the level of water resource development.
Environmental allocations - In-channel - Floodplains - Wetlands and terminal wetlands - Groundwater - Estuaries	The underlying principles are sound but implementation is still in the planning and community consultation stages. Environmental flow provisions and priorities appear community driven rather than ecosystem driven. In-channel and floodplain needs – Wakefield, Broughton, Light and Gawler R, developed by expert panels using a modified habitat assessment method.

	<p>Floodplain – aim is to keep water off urban floodplain to minimise flooding. Ignores out of channel requirements in urban regions. In some non-urban areas floodplain needs are being addressed particularly along the Murray.</p> <p>The State is aware of the difficult problems associated with the Lower Murray River wetlands. Consideration given to Coongie Lakes, Chowilla and Coorong. There has been significant progress in urban wetlands - MFP and Adelaide plains. Significant drainage of SE Wetlands for farming has led to massive decline in wetland area. Drainage has increased freshwater flows to the ocean in SE that may have impacts on marine fisheries but this has not been investigated.</p> <p>Groundwater – Well considered in some regions in areas of prescribed groundwater and where groundwater is seen as a major contributor to base flows. Does not appear to be linked to environmental flows.</p> <p>Terminal Wetlands – The State has special value terminal aquatic ecosystems in the Lake Eyre Basin. The State has driven Lake Eyre Basin Management Initiatives, and is preparing a Ramsar plan for the Lower Lakes and the Coorong.</p> <p>The requirements of the Onkaparinga Estuary and the MFP wetlands have been considered when planning flows.</p>
<p>Volumetric allocations</p>	<p>Variable. Nor seen as best approach in some systems.</p>
<p>Water quality</p> <ul style="list-style-type: none"> - Monitoring system - Adequate reporting - Impacts of dams 	<p>A comprehensive whole of Government approach linking various agencies and Boards has been developed. State legislation has adopted ANZECC guidelines. Linked to State of the Environment reporting.</p>
<p>Catchment context</p> <ul style="list-style-type: none"> - TCM framework - Riparian areas - Farm dams - Harvesting floodplain waters 	<p>There are 6 Catchment Water Management Boards but they do not cover whole of State. There are 4 in the Adelaide Hills region, one for the SE of the State focussing on groundwater issues and a Murray Board. A Catchment Board for the northern arid regions of the State is to be established and a Board for Eyre Peninsula is being investigated. Clare Valley is covered by a water allocation plan. Serious exceptions include the Fleurieu Peninsula, and Kangaroo Island.</p> <p>Choice of catchments/issues is issue and pressure</p>

	<p>driven.</p> <p>Farm dams seen as an important issue, especially in Mt Lofty ranges, Clare and Barossa valleys.</p> <p>Floodplain harvesting is not an issue but off stream harvesting of run-off is an issue and will be controlled in the Barossa and Clare valleys.</p> <p>Inter-basin transfers poorly considered except Onkaparinga, although it is expected they will be addressed in future water plans</p>
<p>Adaptive management</p> <ul style="list-style-type: none"> - Ability to alter licences - Monitoring and assessment 	<p>This is strong in SA. Act allows allocations to be reduced if the ecosystem is damaged. CMB must monitor and improve quantity and quality of water and the health of aquatic ecosystems.</p> <p>Plans under which licensing is granted have to be reviewed every 5 years.</p> <p>Developing appropriate monitoring strategies is critical and the Board's capacity to achieve this is unclear. The recently developed State water monitoring strategy will assist. Without this the State will not be able to measure ecological benefits of the reforms. Some reliable baseline data for important wetlands is available, eg. data for Lower Murray River and Coongie Lakes and macroinvertebrate data for some of the rivers on the Northern Plains.</p>
<p>Knowledge strategy</p> <ul style="list-style-type: none"> - Local research capacity - Linkages to management - Identification of knowledge needs 	<p>There is strong capacity at the University of Adelaide and some within agencies.</p> <p>Much of the State's baseline data collection has been University driven. The State runs a flow gauging network, a groundwater monitoring program, a surface water quality monitoring program and uses the AUSRIVAS system. The State has identified that it needs further knowledge of ephemeral streams. However, there is no strategy and poor investment in place to acquire this knowledge.</p> <p>Research effort tends to be <i>ad hoc</i> and reactive to particular crises. The State targets investment where there is a community desire to improve river health, where there are clear ecological needs and areas coming under development pressures. R and D effort considered to be better in urban areas than rural.</p>
<p>Information exchange</p>	<p>Patchy. A team has now been established to address these issues and a communications strategy is under development. Materials are being developed for Boards.</p>

<p>Other issues</p>	<p>SA receives much of its water resource from other States (eg. ground water from Artesian Basin, Surface waters from Lake Eyre and Murray-Darling Basins). Therefore SA needs a special focus on what other States are doing. SA should take the initiative on issues concerning the management of water resources that cross State boundaries. South Australia also appreciates the need for management of seasonal and episodic flowing rivers, as well as groundwater dependent systems.</p>
<p>Summary and findings</p>	<p>SA has established regional structures that are appropriate to moving towards effective and sustainable water management. There are concerns about the access of regional Boards to appropriate expertise, and a concern that flow allocations need to be driven by an understanding of ecosystem needs as well as community aspirations.</p>

6.6 Tasmania	
Overview of issues	Tasmania has extensive development of hydroelectricity, which while not an extractive use since the water is returned, does have major impacts on flow regimes and water quality, including temperature. Much of the available water is fully developed. There is concern that with the development of BassLink, there will be greater demand for hydroelectricity and this will increase pressure on the State's rivers used for hydro-electricity generation, and alter downstream flow regimes to suit the supply of peak power loads. More than other jurisdictions, Tasmania has tensions between in-stream uses; between ecosystem protection, sport fishing and hydro-electricity generation.
Status of legislation	Legislation has been passed and regulations are being developed.
Efficient use of water - Separate property rights - Capacity for trading - Full cost pricing	Not met under existing legislation which is the <i>Water Act 1957</i> . This Act allows for commissional water rights and riparian rights. Does not separate land and water property rights, does not allow trading and does not require full cost pricing.
Comprehensive assessments of new developments - Impacts on groundwater - Estuaries and coastal waters - Rivers - Floodplains and wetlands - Inter-basin transfers	The current system does not necessarily provide comprehensive assessment of water issues.
Environmental allocations - In-channel - Floodplains - Wetlands and terminal wetlands - Groundwater - Estuaries	Presently there are no environmental allocations. The State is in the process of preparing Water Management Plans for a number of high priority rivers which cannot be implemented under existing legislation. DPIWE is utilising a coordinated and sound approach to planning environmental water requirements including IFIM and habitat assessment. The current planning process is identifying environmental flow provisions for 5 rivers, with others to follow. There is concern that some

	<p>allocations could be driven by the needs of trout rather than ecosystem requirements; biggest problem is with getting any sort of environmental flow for currently over-allocated rivers. In-channel – The planning approach being used is appropriate. Wetlands issues in the North East of the State have had some study. Terminal wetlands are not seen as an issue. Groundwater is an issue, but currently little work done to link to surface water management.</p> <p>Estuarine Systems – variable approach. Estuary requirements are considered in the preparation of water management plans although generally linked to preserving aquaculture industries so driven by water quality concerns.</p>
Volumetric allocations	<p>Currently not a volumetric license but will be under the proposed legislation. Difficulties will be encountered, as there is no metering on many of the abstractions.</p>
Water quality - Monitoring system - Adequate reporting - Impacts of dams	<p>Seems adequately linked to flow setting process through Board of Environmental Management and Pollution Control.</p>
Catchment context - TCM framework - Riparian areas - Farm dams - Harvesting floodplain waters	<p>This is promised under the new legislation. What happens in the HEC catchments is unclear. A number of urban local governments have catchment management plans. HEC undertakes extensive inter-basin transfers. The ecological consequences are poorly understood and not adequately addressed. There has been little research on this issue; one major project examining downstream effects of hydro storages under way, but no published findings as yet.</p> <p>Farm dams are recognised as an issue, but little effective action as yet.</p> <p>Floodplain harvesting is not an issue.</p>
Adaptive management - Ability to alter licences - Monitoring and assessment	<p>Reviews proposed in new legislation, with provision to claw back a proportion of traded water.</p> <p>Patchy ecological data set, though fish and crayfish distribution data is good, and AUSRIVAS database is being developed.</p>

<p>Knowledge strategy</p> <ul style="list-style-type: none"> - Local research capacity - Linkages to management - Identification of knowledge needs 	<p>A good knowledge base and good research capacity in University and some agencies. Environmental Flow planning done well. No coordinated knowledge strategy.</p>
<p>Information exchange</p>	<p>Patchy. Perceived to be poor communication between HEC, DPIWE and Inland Fisheries Commission (IFC). Organisational changes in response to COAG and slow implementation of recommendations of reviews of IFC have led to a loss of expertise.</p>
<p>Other issues</p>	<p>Until the new Act is approved by the Tasmanian Parliament, there will be no implementation of the Water Management Plans. Concern is expressed about how the new legislation will be implemented and enforced in rivers managed by the HEC. HEC is generally not an abstractive user but electricity generation does have a significant impact by altering flow regime. For example, rapid alterations in flow, loss of high flows. The roles of the IFC as manager of in-stream wildlife and having oversight of new commercial developments in inland fisheries needs to be resolved.</p>
<p>Summary and findings</p>	<p>Tasmania has done some quality planning for environmental flows and has a good knowledge base. Ecological outcomes are dependent on the legislation passing both houses without major amendment.</p>

6.7 Victoria	
Overview of issues	Victoria's water resources are highly developed. There is little scope for further development and the imperative is to better manage existing diversions and protect remnant ecosystems.
Status of legislation	<i>Water Act 1989</i> does recognise needs of environment and largely meets COAG requirements.
Efficient use of water <ul style="list-style-type: none"> - Separate property rights - Capacity for trading - Full cost pricing 	<p>Diversions from regulated streams have undergone the bulk water entitlement (BWE) process that has converted existing poorly defined rights to an entitlement that specifies volumes, caps, security, rates of extraction and environmental flow provisions. The BWEs have generally codified existing use, and in doing so, have capped existing extractions.</p> <p>The process identifies environmental flow requirements and uses these as a basis for negotiation. In general, the rights of existing uses are protected and improvements to the environmental flow regimes can only be achieved with the agreement of all stakeholders.</p> <p>Streamflow management plans are required for unregulated streams. These plans consider environmental objectives and set rules for trading. Within the Victorian basins in the MDB, rules exist which specify that trading can only occur downstream and must return 20% to the environment unless a SMP exists. There is an active market for the trading of irrigation entitlements on both a permanent and temporary basis. There is also capacity for trading BWEs.</p> <p>Pricing reform is well advanced. In most years irrigators are allocated greater than 100% of their water rights.</p>
Comprehensive assessments of new developments <ul style="list-style-type: none"> - Impacts on groundwater - Estuaries and coastal waters - Rivers - Floodplains and wetlands - Inter-basin transfers 	There is limited opportunity for further large-scale development of the State's water resources and these should only be considered following intense planning and assessment of wastage and inefficiencies in present distribution systems. Any undeveloped rivers should be considered of high conservation value. There is an EIA process in place. Inter-basin transfers occur in relation to the Thomson River – Upper Yarra

	<p>River systems and Rocklands – Wimmera River system. There has been little in the way of assessment of genetic impact of transfers. In general, proposals for new developments are for small dams in the upper catchments. These are dealt with in the SM planning process.</p> <p>Streamflow Management Plans that have provisions for environmental flows have been developed for two rivers but have yet to be endorsed by government; however, flow rules developed for the Merri River were adopted.</p>
<p>Environmental allocations</p> <ul style="list-style-type: none"> - In-channel - Floodplains - Wetlands and terminal wetlands - Groundwater - Estuaries 	<p>First stage is to protect and where possible enhance environmental flows through BWE, and the second stage involves more comprehensive restoration.</p> <p>Most environmental allocations are made on the basis of relatively simplistic assessment of the requirement of a few large native species. The use of Expert Panels is an improvement over this base approach, although it should be seen as providing interim solutions to be tested through adaptive management.</p> <p>Some 112 BWEs have been completed and in 87% of cases more water has been allocated than at present, although whether this is sufficient to show any environmental benefit is unproven. Within the BWE process, conditions defining environmental flows are clearly specified within the operational rules of the BWE. Water Authorities are accountable for these and must report on compliance. Moreover, annual basin accounts must be collated by a specified Resource Manager.</p> <p>In most cases, these improvements did not fully meet environmental flow requirements. There is currently one BWE for the environment and part or all of this has been traded on several occasions.</p> <p>In-channel approach has often focussed on setting a minimum flow, because this is often the aspect of the flow regime that has been most impacted, but the operational rules in a BWE have often been designed to protect other aspects of the flow regime, eg. high flow events. In addition, the approach has considered floodplains.</p> <p>Excellent knowledge of the groundwater resource but less clear how the connection between surface and groundwater resources will be managed.</p> <p>Terminal Wetlands – Consideration has been given to the terminal wetlands in the Mallee with increased allocations achieved by reducing transmission losses.</p> <p>Estuarine systems are not well considered. The Port</p>

	Philip Bay Study did not comment on environmental flows. The impacts of changes in flow on the Gippsland Lakes are being investigated through the development of a hydrodynamic model. The Thomson and Macalister Rivers Expert Panel was not asked to consider the estuarine requirements.
Volumetric allocations	In place with metering.
Water quality	Statutory based system of State Environmental Protection Policies which either regionally or statewide set water quality standards. In addition, catchment nutrient management plans are being developed in 16 catchments where nutrients are an issue. Reasonable water quality monitoring network. Excellent waterwatch network with 2000 sites being monitored by 600 groups
Catchment context - TCM framework - Riparian areas - Farm dams - Harvesting floodplain waters	Victoria has devolved much of the responsibility to Catchment Management Authorities (CMA) who work with regional water authorities. CMAs have extensive community networks and a requirement that they involve the community in decision-making. The implementation of river rehabilitation is the responsibility of the CMAs. Farm dams are recognised as an issue and being addressed by redefinition of watercourse. Floodplain harvesting is not an issue. There is limited scope for this to occur. Inter-basin transfers occur but there is poor understanding of the ecological consequences.
Adaptive management - Ability to alter licences - Monitoring and assessment	Benchmarking of environmental conditions will be performed in each catchment using the Index of Stream Condition (ISC) every 5 years by CMAs for approximately 3000 sites (1000 stream reaches) across Victoria. Victoria has a comprehensive water quality and quantity monitoring network and has undertaken biological monitoring for many years. This has been extended by AUSRIVAS. Much of this is available on the Web. Monitoring to measure the effectiveness of environmental flows for wetlands is currently being developed and piloted in the Barmah Forest and other specific wetlands. Review Streamflow Management Plans after 5 years

	<p>although BWEs are in perpetuity. This means further water to the environment would be acquired using market mechanisms.</p> <p>Victoria has a good baseline data set for some rivers, but it is unclear whether it is good enough to detect ecological changes. There is good distribution data but poor population data for fish.</p>
<p>Knowledge strategy</p> <ul style="list-style-type: none"> - Local research capacity - Linkages to management - Identification of knowledge needs 	<p>DNRE is a member of both CRCFE and CRCCH, as are some of the water authorities. There is freshwater research capacity at both Arthur Rylah Institute and within the EPA. However, budget cuts in the last few years have reduced State agencies' research capacity in these areas. In addition, there is strong capacity at both the University of Melbourne and Monash University with reasonable links to management agencies.</p> <p>There are some good biological studies, for example, fish-flow relationships considered by MAFRI. The Campaspe project will assess the ecological outcomes of altering a flow regime, and is seen as a significant national study.</p>
<p>Information exchange</p>	<p>Water quality and groundwater information available on the Web.</p> <p>Initially the leader in SoE reporting, in recent years this program was suspended but has now been reinstated.</p>
<p>Other issues</p>	<p>The unregulated Ovens and Mitchell Rivers have a high conservation value and require protection.</p> <p>The loss of floodplain habitats makes the conservation of the remaining habitats a high priority.</p>
<p>Summary and findings</p>	<p>Victoria's approach to establishing a range of poorly identified rights into well specified BWEs in perpetuity means that if further water is required for the environment it will be acquired through market mechanisms (eg. some return on sales, transfer of summer licences to winter fills, or direct buy back) or through investment in infrastructure that reduces wastage. It should be noted that Victoria was one of only two states/ territories considered by the NCC to be making good progress on the COAG agenda and not required to undertake additional reviews.</p>

6.8 Western Australia	
Overview of issues	WA has many rivers that are stressed by secondary salinisation rather than flow modification. 40-60% of Perth's drinking water is from groundwater and WA recognises the need to integrate surface and groundwater management , especially given the extensive dryland salinity in the State.
Status of legislation	New legislation is being debated in State Parliament.
Efficient use of water - Separate property rights - Capacity for trading - Full cost pricing	The existing <i>Rights in Water and Irrigation Act 1914</i> does not meet COAG requirements. In most regions, current licensing fees do not cover the cost of water provision, for example in the Ord Stage 1. The new legislation does address these issues.
Comprehensive assessments of new developments - Impacts on groundwater - Estuaries and coastal waters - Rivers - Floodplains and wetlands - Inter-basin transfers	Water allocation plans are generally initiated by development pressure. EPA can assess all plans and they can call for a thorough EIS process if deemed necessary. Serious concern that groundwater abstraction on the Swan Coastal Plain is impacting on wetlands and wetland-dependent vegetation has triggered formal environmental assessments and led to the development of three Environmental Protection Policies to protect groundwater quality and wetlands.
Environmental allocations - In-channel - Floodplains - Wetlands and terminal wetlands - Groundwater - Estuaries	A river has to be proclaimed before it comes under the Act. The level of demand initiates this process. The State is in the process of adopting a Policy for Environmental Water Provisions. Only 2 river systems have so far had detailed plans developed. They used the holistic approach. Detailed plans have been developed for several groundwater aquifers. Floodplain issues have not been seen as an issue except for the Ord River and are being considered in that context, and will be part of planning for the development of other northern rivers. Groundwater dependent ecosystems in the NW of the State are now being assessed with several studies in the Pilbara and Canning groundwater basin. Estuarine systems are well studied but not being adequately considered and linked into environmental

	<p>flows except for the Swan River. Many of these systems have higher flows following land clearing, and so are not seen as an allocation issue. There are well known nutrient issues in estuaries (eg. the eutrophication of the Peel-Harvey and other SW estuaries). Management focus of these estuaries has been on the export of phosphorus from the catchment with limited consideration to environmental flows. Flow modification is not the major threatening process for these estuaries.</p>
<p>Volumetric allocations</p>	<p>Licences to divert surface water are currently volumetric and will continue to be so under the new legislation.</p>
<p>Water quality</p> <ul style="list-style-type: none"> - Monitoring system - Adequate reporting - Impacts of dams 	<p>Secondary salinisation is recognised as a dominating influence over many rivers and is the primary focus of much land and water management. The State has a good history in nutrient management planning, especially with regard to estuarine impacts.</p>
<p>Catchment context</p> <ul style="list-style-type: none"> - TCM framework - Riparian areas - Farm dams - Harvesting floodplain waters 	<p>WA takes the view that a thorough investigation of all degrading processes in the catchment and waterway is necessary before priorities can be set. It is not seen as appropriate to give a high priority to flows when other aspects of the catchment are seen as more important for effective rehabilitation.</p> <p>ICM has concentrated on nutrient and salinity issues rather than flow issues, as these are the major cause of stress. Environmental flows are considered in developing ICM plans.</p> <p>Farm dams have not been adequately considered although an emerging issue in the southwest of the State and is currently handled at a regional level. Floodplain harvesting is not an issue at present but may become one in the north. WA believes its new legislation will be adequate to address any issues that arise.</p> <p>There is potential for inter-basin transfer, but this has not occurred to any extent so far. Where transfers are proposed (eg. from the Harris to the Stirling) detailed assessments are required under the EPA Act. Some consideration has been given to the translocation of fish.</p>

<p>Adaptive management</p> <ul style="list-style-type: none"> - Ability to alter licences - Monitoring and assessment 	<p>The proposed legislation may provide mechanisms for adaptive management which do not exist at present. There are good long term data sets in southwestern WA and some hot spots in the north west, which gives the basis for assessing changes in both wetlands and in rivers. Data sets are good for fish, macroinvertebrates and hydrology.</p>
<p>Knowledge strategy</p> <ul style="list-style-type: none"> - Local research capacity - Linkages to management - Identification of knowledge needs 	<p>WA has some strong water research capacity in the Universities, which is connected to the management agencies. Most of the relevant ecological flow expertise is within the Universities. There is a poor in-house capacity for research. R and D in environmental flows is “needs” driven. There has been research in surface-groundwater interaction in WA. There has been no strategic or systematic assessment of research needs, although we are advised an R and D Committee has been established.</p>
<p>Information exchange</p>	<p>There is a perception of poor communication between agencies such as CALM and WRC, although there are formal coordinating mechanisms, especially around salinity. There is a strong focus on Perth issues with less emphasis beyond Perth.</p>
<p>Other issues</p>	<p>Salinisation of rivers in the SW of WA limits their development for agricultural, industrial and domestic supplies. In these rivers, reforms may not show any benefit because of the effects of the salinity. Most effort and knowledge is within a few hundred kilometres of Perth. Further away, the information is poor although the demand for new developments in the North is likely to increase. Institutional reforms have produced a funding model where the regulator does not appear to have adequate resources to carry out its charter, especially in comparison to the service provider.</p>
<p>Summary and findings</p>	<p>WA clearly has a number of different issues to the other States. Catchment management is fundamental to addressing the salinity issue which is the dominant cause of river degradation. Development pressures in the North cannot be soundly assessed without a better knowledge base.</p>

7. Overall Assessment of Progress and Emerging Issues

Following an assessment of progress to date with the implementation of the COAG water reforms at the workshop of ecologists, the following broad conclusions can be drawn:

- COAG has accelerated the reform of water management in most jurisdictions. In all cases, water for the environment is now accepted as a legitimate need; the issue is now one of how much water and how it is to be delivered.
- Legislative reforms to give effect to the COAG reforms in such areas as pricing, licensing, separating water rights from property rights, water allocations and development controls are still pending in New South Wales, Northern Territory, Queensland and Western Australia. In these jurisdictions legislative change is required to meet the COAG requirements.
- Existing legislation in some jurisdictions is “Eurocentric” and fails to acknowledge that many Australian rivers do not conform to the notion of a single river channel, with relatively constant and predictable flows that remain within the high banks.
- States have chosen to define “Stressed Rivers” in a variety of ways. Some are using an assessment of Stressed Rivers to identify rivers that are over-allocated, and hence to establish priorities for development of management plans, others are not. Other jurisdictions are considering factors beyond the degree of stress due to water allocation in setting these priorities.
- Generally, most jurisdictions do not have adequate baseline data available to readily enable an assessment of the ecological outcomes of the water reform process. This results, in most cases, in estimates of environmental water requirements being made, usually by a technical/scientific panel, with limited ecological data. This situation is exacerbated by pressure to develop water resources in some of Australia's least studied systems.
- Research and development programs in most States and Territories tend to lack a strategic approach, but rather focus on particular “hot spots”.
- Whilst devolving water resource management to regional and local bodies is a positive element of the COAG reform agenda, here is a concern that it may have led to a loss of Statewide perspective. While this community involvement will enhance the chances of new flow rules being accepted locally it will complicate the achievement of integrated approaches to the planning and management of water resources both within and between catchments. The challenge however, is that the chance of achieving ecological benefits outside that local scale are significantly reduced. River systems can span a considerable number of regional management groups. For instance, the Murrumbidgee group may allocate its environmental flows in a manner likely to maximise benefits to the Murrumbidgee system, but there is no mechanism for considering possible downstream benefits to the Murray. When such out of region issues are raised at regional community meetings they are commonly dismissed.
- The COAG Reforms require that environmental allocations be based on the best available scientific advice, and they also require public consultation. Some jurisdictions appear to have confused these elements and have substituted community aspirations for

scientific advice. It has to be recognised that the community is not always technically equipped to deal with all the issues, nor should it be expected to be. For example, it is hard to see how community groups are equipped to select ecological indicators and the design of monitoring programs. The challenge here is to ensure the science is accessible and useful to community groups who have the role of making value judgements on what issues are to be given priority.

- There are concerns about the adequacy of communication and integration between agencies, and between agencies and community groups in most jurisdictions.
- Generally, there appears to be poor integration of the management of groundwater systems and surface water systems despite their acknowledged physical connectedness. Western Australia is the exception to this where there is a strong appreciation of the need to assess surface and groundwater in an integrated way. Allocation decisions for surface or groundwater resources will generally impact on demand for the other.
- Some jurisdictions have now appreciated the impact of farm dams and on-farm storages on river flow and are starting to analyse this situation. Victoria has some information on farm dams, the other States less so. All States need better information and controls in this area.
- In some regions, activation of ‘sleeper’ licenses may lead to further water abstraction. A consequence of this is that existing ‘environmental’ allocations may be reduced as ‘unclaimed’ entitlements are taken up.
- Concerns have been expressed that the resources available to regulatory agencies in some jurisdictions are inadequate relative to the resources of the service providers.
- Notwithstanding multi-jurisdictional cooperative management arrangements, such as those for the Murray-Darling Basin and the Lake Eyre Basins, there are concerns that some States are not taking sufficient account of the impacts of their management of water resources outside their boundaries. For example, it is essential that water planning in Queensland take into account the impacts on downstream receiving waters in NSW and SA.
- There is concern that resources to community organisations are inadequate to enable them to fully participate in planning and management processes of agencies.
- Whilst considerable effort has been focused on planning for environmental allocations, there are concerns about their implementation, particularly where implementation does not yet have legislative backing.
- There is considerable difficulty in defining channels, and therefore floodplains, in some of Australia's lowland rivers. This has led to extensive uncontrolled harvesting of floodwaters in several jurisdictions with unknown but potentially serious ecological consequences.
- Floodplain management is a significant issue for environmental flow management, although few environmental flows will reach the floodplain (Barmah-Millewa allocation in Hume is a notable exception). The condition of the riparian area contacted by flows is a major determinant of their ecological effectiveness. There are important instances in which floodplain land-use impinges on environmental flow possibilities. For example, the threat of legal action by landholders along the River Murray downstream of Lake Hume restricts the potential for environmental releases.

Management may need to address issues like flood easements on such properties in such situations. Enhanced flows from Burrinjuck cannot exceed 30,000ML for the same reason. In Victoria (DNRE) floodplain management is restricted to levee management and flood protection/relief with little or no consideration to the floodplains' environmental water requirements. The new CMAs are yet to improve on this performance.

- There is limited understanding of the impacts of land use changes on water yield in many catchments. Pressures to convert farming land into forest will have significant impacts on stream flow that need to be assessed and managed.

The COAG water reform agenda had a number of objectives to improve the efficiency of water use as well as to provide for the environment. We have not attempted to assess the improvements in institutional arrangements and in productivity, but many observers believe they are significant. They have not been easy reforms to implement for Governments, officials, landholders and conservation interests. The States have adopted different strategies in the light of their particular issues and positions. The emergence of water trading is already allowing water to move from inappropriate areas to places where it can be used to earn a greater return with less environmental impact. This is already providing an environmental benefit.

There is obviously more to be done in all jurisdictions. It is apparent that many involved in the use of water do not understand the rationale of the reforms being implemented and better communication is needed. Some who feel they are disadvantaged by the reforms believe compensation is warranted, and this is a difficult and contentious issue.

There are major issues for the water research community. Better definition of river health, better monitoring procedures and better understanding of the ecological processes governed by the flow regime are all needed.

Appendix 1. COAG Water Resource Policy

Water Resource Policy adopted by the Council of Australian Governments (COAG) at its Hobart, February 1994 meeting.

Water Resource Policy

In relation to water resource policy, the Council agreed:

1. that action needs to be taken to arrest widespread natural resource degradation in all jurisdictions occasioned, in part, by water use and that a package of measures is required to address the economic, environmental and social implications of future water reform;

2. to implement a strategic framework to achieve an efficient and sustainable water industry comprising the elements set out in (3) through (8) below;

3. in relation to pricing:-

(a) in general-

(i) to the adoption of pricing regimes based on the principles of consumption-based pricing, full-cost recovery and desirably the removal of cross-subsidies which are not consistent with efficient and effective service, use and provision. Where cross-subsidies continue to exist, they be made transparent,

- Queensland, South Australia and Tasmania endorsed these pricing principles but have concerns on the detail of the recommendations,

(ii) that where service deliverers are required to provide water services to classes of customer at less than full cost, the cost of this be fully disclosed and ideally be paid to the service deliverer as a community service obligation,

(b) urban water services-

(i) to the adoption by no later than 1998 of charging arrangements for water services comprising an access or connection component together with an additional component or components to reflect usage where this is cost-effective,

(ii) that in order to assist jurisdictions to adopt the aforementioned pricing arrangements, an expert group, on which all jurisdictions are to be represented, report to COAG at its first meeting in 1995 on asset valuation methods and cost-recovery definitions, and

(iii) that supplying organisations, where they are publicly owned, aim to earn a real rate of return on the written-down replacement cost of their assets, commensurate with the equity arrangements of their public ownership,

(c) metropolitan bulk-water suppliers -

(i) to charging on a volumetric basis to recover all costs and earn a positive real rate of return on the written-down replacement cost of their assets,

(d) rural water supply -

(i) that where charges do not currently fully cover the costs of supplying water to users, agree that charges and costs be progressively reviewed so that no later than 2001 they comply with the principle of full-cost recovery with any subsidies made transparent consistent with 3(a) (ii) above,

(ii) to achieve positive real rates of return on the written-down replacement costs of assets in rural water supply by 2001, wherever practicable,

(iii) that future investment in new schemes or extensions to existing schemes be undertaken only after appraisal indicates it is economically viable and ecologically sustainable,

(iv) where trading in water could occur across State borders, that pricing and asset valuation arrangements be consistent,

(v) where it is not currently the case, to the setting aside of funds for future asset refurbishment and/or upgrading of government-supplied water infrastructure, and

(vi) in the case of the Murray–Darling Basin Commission, to the Murray–Darling Basin Ministerial Council putting in place arrangements so that, out of charges for water, funds for the future maintenance, refurbishment and/or upgrading of the headworks and other structures under the Commission's control be provided,

(e) groundwater-

(i) that management arrangements relating to groundwater be considered by Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) by early 1995 and advice from such considerations be provided to individual jurisdictions and the report be provided to COAG;

4. in relation to water allocation or entitlements:-

(a) the State Government members of the Council would implement comprehensive systems of water allocations or entitlements backed by separation of water property rights from land title and clear specification of entitlements in terms of ownership, volume, reliability, transferability and, if appropriate, quality,

(b) where they have not already done so, States would give priority to formally determining allocations or entitlements to water, including allocations for the environment as a legitimate user of water,

(c) in allocating water to the environment, member governments would have regard to the work undertaken by ARMCANZ and Australian and New Zealand Environment and Conservation Council (ANZECC) in this area,

(d) that the environmental requirements, wherever possible, will be determined on the best scientific information available and have regard to the inter-temporal and inter-spatial water needs required to maintain the health and viability of river systems and groundwater basins. In cases where river systems have been over allocated, or are deemed to be stressed, arrangements will be instituted and substantial progress made by 1998 to provide a better balance in water resource use including appropriate allocations to the environment in order to enhance/restore the health of river systems,

(e) in undertaking this work, jurisdictions would consider establishing environmental contingency allocations which provide for a review of the allocations five years after they have been determined, and

(f) where significant future irrigation activity or dam construction is contemplated, appropriate assessments would be undertaken to, inter alia, allow natural resource managers to satisfy themselves that the environmental requirements of the river systems would be adequately met before any harvesting of the water resource occurs;

5. in relation to trading in water allocation or entitlements:-

(a) that water be used to maximise its contribution to national income and welfare, within the social, physical and ecological constraints of catchments,

(b) where it is not already the case, that trading arrangements in water allocations or entitlements be instituted once the entitlement arrangements have been settled. This should occur no later than 1998,

(c) where cross-border trading is possible, that the trading arrangements be consistent and facilitate cross-border sales where this is socially, physically and ecologically sustainable, and

(d) that individual jurisdictions would develop, where they do not already exist, the necessary institutional arrangements, from a natural resource management perspective, to facilitate trade in water, with the proviso that in the Murray–Darling Basin the Murray–Darling Basin Commission be satisfied as to the sustainability of proposed trading transactions;

6. in relation to institutional reform:-

(a) that where they have not already done so, governments would develop administrative arrangements and decision-making processes to ensure an integrated approach to natural resource management,

(b) to the adoption, where this is not already practised, of an integrated catchment management approach to water resource management and set in place arrangements to consult with the representatives of local government and the wider community in individual catchments,

(c) to the principle that, as far as possible, the roles of water resource management, standard setting and regulatory enforcement and service provision be separated institutionally,

(d) that this occur, where appropriate, as soon as practicable, but certainly no later than 1998,

(e) the need for water services to be delivered as efficiently as possible and that ARMCANZ, in conjunction with the Steering Committee on National Performance Monitoring of Government Trading Enterprises, further develop its comparisons of inter-agency performance, with service providers seeking to achieve international best practice,

(f) that the arrangements in respect of service delivery organisations in metropolitan areas in particular should have a commercial focus, and whether achieved by contracting-out, corporatised entities or privatised bodies this be a matter for each jurisdiction to determine in the light of its own circumstances, and

(g) to the principle that constituents be given a greater degree of responsibility in the management of irrigation areas, for example, through operational responsibility being devolved to local bodies, subject to appropriate regulatory frameworks being established;

7. in relation to consultation and public education:-

(a) to the principle of public consultation by government agencies and service deliverers where change and/or new initiatives are contemplated involving water resources,

(b) that where public consultation processes are not already in train in relation to recommendations (3)(b), (3)(d), (4) and (5) in particular, such processes will be embarked upon,

(c) that jurisdictions individually and jointly develop public education programs in relation to water use and the need for, and benefits from, reform,

(d) that responsible water agencies work with education authorities to develop a more extensive range of resource materials on water resources for use in schools, and

(e) that water agencies should develop, individually and jointly, public education programs illustrating the cause and effect relationship between infrastructure performance, standards of service and related costs, with a view to promoting levels of service that represent the best value for money to the community;

8. in relation to the environment:-

(a) that ARMCANZ, ANZECC and the Ministerial Council for Planning, Housing and Local Government examine the management and ramifications of making greater use of wastewater in urban areas and strategies for handling stormwater, including its use, and report to the first Council of Australian Governments meeting in 1995 on progress,

(b) to support ARMCANZ and ANZECC in their development of the National Water Quality Management Strategy, through 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,

(c) to support consideration being given to establishment of landcare practices that protect areas of river which have a high environmental value or are sensitive for other reasons, and

(d) to request ARMCANZ and ANZECC, in their development of the National Water Quality Management Strategy, to undertake an early review of current approaches to town wastewater and sewage disposal to sensitive environments, noting that action is under way to reduce accessions to water courses from key centres on the Darling River system (it was noted that the National Water Quality Management Strategy is yet to be finalised and endorsed by governments.);

9. in relation to water and related research, member governments would:-

(a) give higher priority to the research necessary to progress implementation of the strategic framework, including consistent methodologies for determining environmental flow requirements, and

(b) to greater coordination and liaison between research agencies to more effectively utilise the expertise of bodies such as the Land and Water Resources Research and Development Corporation, the Murray–Darling Basin Commission and other State and Commonwealth organisations;

10. in relation to taxation:-

(a) that a sub-committee of Commonwealth and State officials, established by the Working Group on Micro-economic Reform, meet to discuss taxation issues of relevance to the water industry with a view to reporting, through the Working Group, to the Council within 12 months,

(b) to support water-related taxation issues being examined in the proposed Industry Commission Inquiry into Private Sector Infrastructure Funding, and

(c) to accept any future consideration of tax compensation payments involving the water industry being dealt with through the Commonwealth–State Working Group established at the July 1993 Financial Premiers' Conference; and

11. in relation to recommendations (3) through (8):-

(a) that the Working Group on Water Resource Policy would coordinate a report to the Council for its first meeting in 1995 on progress achieved in implementing this framework including reductions in cross-subsidies, movement towards full-cost recovery pricing in urban and rural areas and the establishment of transferable water entitlements, and

(b) that as part of the monitoring and review process, ARMCANZ, ANZECC and, where appropriate, the Murray–Darling Basin Ministerial Council and the Ministerial Council for Planning, Housing and Local Government, would report annually over the succeeding four years, and again at its first meeting in 2001, to the Council of Australian Governments on progress in implementing the various initiatives and reforms covered in this strategic framework.