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Committee for Economic Development of Australia

March 2004

52 Growth

Water and the Australian Economy

United Water

Royal Agricultural Society of NSW

BLUESCOPE STEEL

The research for this project was co-ordinated
by Nick Dimopoulos, CEDA

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ISSN 0085-1280
ISBN 0-85801-261-8

Publication sponsored by United Water, the Royal Agricultural Society of NSW and Blue Scope Steel

Design: Origin Design
Production: Hardie Grant Magazines

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Water and the Australian Economy

Contents

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Professor Peter Cullen, FTSE, is one of the Wentworth Group of Concerned Scientists who seek to raise public awareness of natural resource issues facing Australia. He is Chair of the Victorian Water Trust Advisory Council, and a Director of Land and Water Australia and Landcare Australia Ltd. He retired last year after 10 years as Chief Executive of the CRC for Freshwater Ecology and is a Visiting Fellow of the Bureau of Rural Science and of CSIRO Land and Water and is an Emeritus Professor at the University of Canberra.

Professor Cullen was awarded the Prime Minister's Prize for Environmentalist of the Year in 2001 for his work on the National Action Plan for Salinity and Water Quality. He is a graduate in Agricultural Science from the University of Melbourne, a Fellow of the Australian Academy of Technological Sciences and Engineering, and a Member of the International Water Academy. He was one of the *Bulletin* magazine's top 100 innovators and groundbreakers, and the *Australian Financial Review*'s *BOSS* magazine's list of true leaders in 2003.

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Professor Gary Jones is Chief Executive of the Cooperative Research Centre for Freshwater Ecology (CRCFE), and Professor of Freshwater Sciences at the University of Canberra. He recently chaired the scientific reference panel advising the Murray–Darling Basin Ministerial Council on the potential ecological benefits of new environmental flows for the River Murray. As head of the CRCFE, Professor Jones leads teams of scientists and water managers from 20 research and industry groups across the eastern states, tackling the large-scale issues of the water health of Australia.

Dr John Langford is Professorial Fellow and Director of the Melbourne (University) Water Research Centre. From November 1994 to November 2003, Dr Langford was the Executive Director of the Water Services Association of Australia Inc. He was also Board Chairman of two Cooperative Research Centres investigating catchment hydrology and freshwater ecology. He has extensive experience in water resource and catchment management, urban and irrigation water supply and in managing research. Dr Langford has worked for Melbourne Water, United States Department of Agriculture, the Department of Water Resources of Victoria and the Rural Water Corporation, where he was Chief Executive. In October 1999, Dr Langford was awarded the Peter Hughes Water Award by the Australian Water and Wastewater Association for his work on water reform. This award recognises a world-class contribution to water affairs.

In his new role with the University of Melbourne, Dr Langford will be interacting with lawyers, economists, businesspeople, engineers, scientists, historians and sociologists, among others, to inform the date on Australia's important water management issues.

Fiona Melville practises law as Special Counsel with Corrs Chambers Westgarth. She holds a Master of Arts from Cambridge University and practised as a lawyer in England before immigrating to Australia in 1995. Fiona has been working in the Energy, Resources and Projects group at Corrs for the last seven years. She advises clients on energy project developments, joint ventures, market regulation, trading contracts – including trading in renewables and emissions – and general commercial issues.

Emeritus Professor Nancy F. Millis (AC MBE MAg Sc, PhD, DSc [hc], FTSE) was appointed a lecturer at the University of Melbourne in 1953, to a Personal Chair in Microbiology in 1982 and awarded Emeritus status in 1987.

Nancy is currently Chancellor of La Trobe University, consultant to Parks Victoria, Chairman of the Research Advisory Committee, Murray–Darling Freshwater Research Centre and CRC for Water Quality and was Chairman of Water Resources Strategy Committee for Melbourne.

Chloe Munro is Secretary, Department of Primary Industries, Victoria. She has worked in the public and private sectors in Victoria, New Zealand and the UK. She graduated with honours in Mathematics and Philosophy from Cambridge University and holds a Master of Business Administration.

In 1996, Chloe came to Victoria to lead the Energy Projects Division of the Department of Treasury and Finance. In 1999, she was appointed Deputy Secretary for Economic and Financial Policy, also in the Department of Treasury and Finance. In June 2000, she became the Secretary of the former Victorian Department of Natural Resources and Environment (NRE). In her current role as Secretary of the Department of Primary Industries, Chloe manages the development of strategic policies that promote sustainable development in the agriculture, fisheries, mining and petroleum sectors. She has a strong focus on innovation through the Department's research and development arm.

Claude Piccinin is Deputy Executive Director of the Water Services Association of Australia. Piccinin graduated from Monash University with a Bachelor of Economics degree (First Class Honours) and subsequently completed a Master of Economics degree at the ANU.

Claude has worked in both the public and private sectors. He has held various positions in the Commonwealth Treasury, the (then) Bureau of Transport Economics and the Department of Prime Minister and Cabinet. Claude left the public sector in the mid-1980s to work for ICI Australia (now Orica), the Business Council of Australia and the Plastics and Chemicals Industries Council.

Claude is currently the Deputy Executive Director of the Water Services Association of Australia. The Association is the peak body of the Australian urban water industry. Its 28 members provide water and wastewater services to 15 million Australians and New Zealanders, as well as many of Australia's largest industrial and commercial enterprises.

Neil Wallace is Manager of Technology and Product Development, Emerging Businesses, BlueScope Steel. Neil is a metallurgist with extensive experience in the areas of corrosion and product durability, encompassing the areas of research, consulting and product litigation. He is a member of the International Rainwater Catchment Systems Association and a NSW State Government nominee to the Shoalhaven Illawarra Water Management body. His present role directly relates to the establishment of appropriate technologies and products associated with water harvesting and distribution systems.

Executive summary

Water and the Australian Economy

Australia is the driest inhabited continent on the planet and access to quality water is a critical foundation of our society, environment and economy. The country's current water management strategies are not sustainable and this publication contains a range of views and new approaches that are needed in the management of water to restore the health of the environment and ensure minimum disruption to the economy.

The challenges of water policy for Australia

Peter Cullen argues that Australia is entering a period of water scarcity and there are pressures to use water more efficiently, both in urban and rural Australia. Our efforts to dam and control water have caused great damage to some of our few significant river systems. Australia now faces a massive bill and a period of painful re-adjustment.

He points out that water development in Australia has a long history of interested groups seeking advantage and generally wanting taxpayers to fund water infrastructure and letting the users of water avoid the true costs.

In addressing the water problems, the challenge now is to invest and allocate funds in a smart and sustainable way. Establishing a water market will let water move to its most economical use, but this alone will not redress the over-allocation issue. To address this, governments need to stand in the marketplace as an environment purchaser and recover water for the environment.

Australia is the driest inhabited continent on the planet and access to quality water is a critical foundation of our society, environment and economy.

The National Water Initiative

Chloe Munro discusses the far-reaching decisions that were made in 2003 in advancing towards sustainable management of Australia's water resources. This included the development of the National Water Initiative (NWI), and the Murray–Darling Basin Ministerial Council announced its First Step towards restoring the health of the River Murray system. A key objective of the NWI is to achieve an efficient water-market structure and to expand markets to their widest practical geographical extent, thus enabling increased returns from water use.

She points out that there is unprecedented unity of purpose among governments and the community, even as vigorous debate continues as to the specifics of desired outcomes and the instruments to achieve them. Implementation of these decisions will unfold over a period of years in which our level of knowledge will continue to improve, and adaptive, integrated natural-resource management will become a way of life.

Water reform: access to finance issues

Stephen Carroll presents the view that water reform will have a significant impact on access to finance for agribusiness, if the access to finance issues are not addressed. In this respect, it is argued that a secure title system is paramount in protecting not only the interests of mortgagees, but also in protecting and giving confidence to purchasers of water-access entitlements and ensuring that all owners of water access entitlements are protected from unauthorised dealings. A secure

and efficient title system will also minimise conveyancing costs, complexity and time to complete water transactions.

Carroll argues that given the sensitivity of the demographics of rural areas to economic change, the management of water reform needs a whole-of-government focus, not simply natural resource management.

Environmental flows

Professor Gary Jones and **Peter Cottingham** discuss, from an ecological perspective, the complexities surrounding 'environmental flows'. They argue that it is not simply an allocation of extra water for the river environment by a catchment-planning process, and point to the number of scientific, planning and engineering difficulties that must be confronted when delivering environmental flows to a river system.

It is now accepted that water entitlements should be vested with individual water users, including 'the environment' as a legitimate user of water.

The authors argue that widespread adoption of suitable technologies and new improved systems, such as sensor-regulated irrigation and solar pumping with automated control—which results in cost savings and benefits to the environment and to crop production—has been limited largely by cost, but also by inertia and traditional attitudes. To overcome resistance to the notion of a balance in the 'triple bottom line', the authors point to the need for governments, private irrigators, communities and environmentalists to work together and determine fair and equitable funding mechanisms.

Trading in water rights

Fiona Melville and **Peta Broughton** examine the history of water trading, and point out that the volumes of water traded represent only a small amount of the total water consumption in any one state. The different ways that states define their water entitlements, together with the lack of consistent trading rules and compatible recording procedures between trading districts, indicate that the development of an efficient market has some way to go.

It is now accepted that water entitlements should be vested with individual water users, including 'the environment' as a legitimate user of water, and flexible and efficient markets need to be developed to resolve resource use conflicts. Central to the pursuit of this objective is the creation of secure and clearly defined water entitlements and the separation of water entitlements from land to allow trade.

They argue that the rules for and design of the market will be critical in ensuring the objective of equitable distribution and to ensure that the rules of trade do not distort but, instead, encourage efficiency. Given that water has value far in excess of its economic value, it remains to be seen the extent to which the market is able to capture this value and the extent to which governments will be willing to submit the value of water and market forces. Governments will need to reserve power to regulate or restrict trade to ensure the environmental health of our water resources.

Urban water cycle

Emeritus Professor Nancy Millis points out that for most of Australia, only one to two per cent of the rain that falls actually finds its way into a stream on the east and south-east coast of Australia, where the majority of Australians live.

Professor Millis outlines the process by which a strategy was developed for Melbourne to allow the currently available supply of water to be managed, so that the needs of the population projected by 2050 might be satisfied. Her paper draws extensively upon the work and reports of the Water Resources Strategy Committee for Melbourne, established by the Victorian Government in October 2000. The committee's proposals have in very large measures been adopted in the recent Green Paper issued by the Victorian Government on 'Securing Our Water Future'.

Professor Millis argues that no single measure would achieve the desired result of ensuring Melbourne's water supply for the future. Rather, a multi-prong 'attack' is required: involving education to change behaviour; monetary incentives to install water-saving devices; legally enforceable regulations (i.e. requiring all new dwellings to install either a household tank or a solar hot-water service); recycling and increasing the price of water to reflect its real value and as a conservation measure.

Future water resources for irrigation (technology and sustainability)

John Blackwell and his associates highlight a different approach to managing urban and rural waste streams while maintaining and enhancing the productive capacity of our limited water resources. It is argued that what is required in addressing water challenges is some innovative thinking 'outside the square' to come up with solutions. In their paper, the authors highlight a few novel ideas for further discussion in the current, vexed, water debate.

Work undertaken by Blackwell and his associates at CSIRO Land and Water indicates that techniques such as stubble mulching can be a lateral way of managing losses from high watertables, while protecting soil productivity and environmental assets from farm to basin levels. There is a need to recognise climate variability and change in all strategic and tactical planning and management of water. Having accepted a managed system within a harsh climatic context, there is a need to be as smart and innovative as possible in achieving aims. Managing 'environmental' water is one such option.

Having accepted a managed system within a harsh climatic context, there is a need to be as smart and innovative as possible in achieving aims. Managing 'environmental' water is one such option.

Institutional and regulatory arrangements in the Australian urban water industry

Professor John Langford and **Claude Piccinin** present the view that institutional changes on the structure of the water service provider have brought about a more commercial focus. Over the last two decades, the urban water industry has improved its overall efficiency and delivered lower water prices to customers, while at the same time increasing the revenue going to its owners, either through dividend payments or tax equivalent payments. This improvement in financial performance was achieved against a background of delivering higher environmental, public health and customer-service standards.

While initially state and territory responsibility for economic regulation of water resulted in different regulatory models, a trend has emerged towards independent regulators for pricing and customer service standards and having oversight of several monopolistic industries.

1. The challenges of water policy for Australia

Professor Peter Cullen

1. Introduction

Water is fundamental to life. Australia is not only a dry country, but also one with a very variable rainfall. The 'droughts and flooding rains' that Dorothea Mackellar spoke of epitomise this variability—and the challenges the Australian people have had in adjusting to it.

The Australian environment has adapted to this variability and our natural systems depend on the fluctuations of dry and wet periods for survival. Humans, however, seek to even out this variability so as to have a more constant supply of water for cities and crops. This is normally done by building dams to store water. In Australia, much larger volumes of water need to be stored to give a certain reliability of supply than is needed to get a similar certainty in Northern Hemisphere countries.

Water is fundamental to life. Australia is not only a dry country, but also one with a very variable rainfall.

In efforts to dam and control the waters, a great wealth has been created in rural Australia—and, at the same time, caused great damage to some of the few significant river systems. Australia now faces a period of painful re-adjustment. This adjustment has the potential to liberate another burst of wealth production for rural Australia, or to destroy much of the land on which rural communities presently depend.

2. The value of irrigated agriculture

The gross value of agricultural production was around $27 billion (three per cent of GDP) in 1996–97. This agriculture feeds and clothes our population and provides around 20 per cent of Australian exports and supports 4.6 per cent of the workforce. Irrigation in Australia uses around 75 per cent of all the water harvested, and was responsible for agricultural production worth $7254 million in 1996–97. In fact, half of the profit from all Australian agriculture comes from the 0.5 per cent of the land irrigated. There has been a dramatic increase in irrigation, and water use increased by 59 per cent between 1983–96. In the last 25 years, the area of irrigated land in Australia has been increased by 26 per cent or 430,000 ha. The competition for water is becoming more intense, just as the community is starting to appreciate that the health of Australia's rivers has been degraded by over-extraction.

Irrigation has long been seen as the key to unlocking the wealth of the Australian landscape, and myths about making the desert bloom abound. In the early 20th century there was a view that any water flowing to the sea was wasted, and all that was needed was to build massive engineering works to harness the water. These 20th century myths persist among some influential Australians. There is still a strong view in rural Australia that taxpayers' funds should be spent on water infrastructure, even though the beneficiaries of such water commonly do not believe they should pay the full costs of such investments.

During the current drought, talkback radio hosts in Sydney started calling for massive engineering works to drought-proof our country to turn back the rivers and water the parched inland. This was despite a massive public campaign to restore some flows to the Snowy River, which had been decimated by such works. This led to the formation of the Wentworth Group of Concerned Scientists who answered

Table 1: Water use efficiency in Australian irrigated agriculture
(National Land and Water Audit)

$/ML return	
Pasture	300
Rice	300
(These two industries use 67 per cent of irrigation water.)	
Cotton	600
Sugar	400
Fruit	1500
Grapes	900
Vegetables	1800

these calls with the response that the nation would do better if Australians learned to live with the country and stop our futile attempts at taming it.

3. Measuring river health

While it is easy to identify the value of agricultural production coming from irrigation, it is much harder to measure the health of the river. Many have been concerned about the obvious degradation, especially in the lower reaches of the rivers, but there has not been regular measurement of river health that can demonstrate the trends that have occurred.

While it is easy to identify the value of agricultural production coming from irrigation, it is much harder to measure the health of the river.

Early attempts at assessing river health relied on the measurement of the concentration of key chemicals in the water. It was understood that excessive salt killed plants and animals and that phosphorus could drive algal blooms, but the concentrations of these substances varied so much because of rainfall patterns, and only sporadic measurements were taken, so identification of trends was difficult.

Our understanding of how to assess river health has developed rapidly over the last decade. In the 1990s it was realised that the biology of the river system gave a far better measure of river health, since the biota observed were a function of the chemical and physical environment experienced by the organism over some particular period of time.

The National Land and Water Audit reported a biotic index for many Australian rivers based on the observed communities of aquatic invertebrates. These give a consistent and useful measure of the health of the river in comparison to an unimpacted reference site.

Norris (2001) reported a snapshot of river health in the Murray–Darling based on aquatic invertebrate populations that showed widespread impacts on the river systems. Other biological measures of the degraded condition of the River Murray include:

- loss of red gums on floodplain below Euston;
- listing of Murray cod as threatened;
- decline in native fish and explosion of populations of carp;
- cold-water pollution extending up to 300 km downstream of major storages;

Table 2: Salinity trend predictions in selected rivers of the Murray–Darling Basin
(Source: Salinity Audit 1999, averages in EC units)

River valley	1998	2020	2050
Murray at Morgan	570	670	790
Murray at Renmark	400	480	550
Murray at Swan Hill	270	270	310
Murrumbidgee	250	320	350
Avoca	970	980	1480
Loddon	870	880	900
Goulburn–Broken	130	180	260
Lachlan	530	780	1150
Macquarie	620	1290	1730
Namoi	680	1050	1280
Condamine–Balonne	210	1040	1040

- almost permanent algal blooms in the lower Murray; and
- closing of the Murray mouth and the Coorong.

Despite this growing body of evidence, there are still various interest groups in denial about the health of the River Murray. Some upstream irrigators assert the river is in good condition and there is no need for them to change their irrigation practices. There are good local catches of Murray cod, but the populations have dwindled and now appear to be isolated communities (Harris and Gehrke, 1998).

4. Emerging principles to guide water reform

The Wentworth Group released its Blueprint for a National Water Plan in mid-2003, and established some broad principles on which to build a National Water Plan. Governments have not as yet committed to these principles, but they do appear to be underpinning many of the proposals to go forward. They are as follows:

- all Australians have a right to a supply of safe water for domestic use;
- all have the responsibility to use water efficiently;
- environmental health provides an essential foundation for all other uses—not an optional extra;
- those who use water to create wealth need security and must take responsibility for sustainable outcomes; and
- Australians must become water literate.

5. A vision for the Murray–Darling Basin

The choices made now will determine the sort of Murray–Darling Basin that will exist in the future. The community catchment groups throughout the Basin have demonstrated a capacity to integrate the varied conflicting pressures on the Basin and to seek a long-term sustainable future.

It has been suggested that the communities of the Basin are seeking a Basin that in 25 years:

- has doubled the GDP generated in the Basin;
- supports double the population currently supported; and
- provides a river where the water can be drunk and Murray cod can be caught in the lower reaches.

Hopefully, in 25 years taxpayers' money will no longer be spent correcting the mistakes of the past and scarce financial resources will be used to build productive assets. Perhaps there will even be two international airports within the Basin delivering fresh produce to Asian markets each day.

6. Achieving the vision

Governments can help the community achieve such a vision in three ways: government investments in infrastructure to create wealth; establishing an effective water market and establishing an environmental purchaser to restore flows to the rivers; and providing the knowledge base that regional groups need to manage their resources.

7. Investing in infrastructure

Governments have committed around $2 billion to repairing some of the mistakes of the past in terms of the National Action Plan for Salinity and Water Quality and the National Water Initiative to restore some flows to stressed river systems.

Critical infrastructure like roads, airports and communications networks could help connect rural Australia with its overseas markets.

It is tragic that so much of our limited resources have to be spent repairing the mistakes made by previous state and federal governments with regard to our resource base. Scarce funding should be able to be used to build infrastructure to create wealth from rural Australia, not to bandage mistakes. Critical infrastructure like roads, airports and communications networks could help connect rural Australia with its overseas markets, and help deliver product in a timely and efficient way. Investment in education to lift the skill base of those managing land and water would be a good investment. Research to better understand landscapes would help.

Much of the existing irrigation infrastructure is old and substandard, and in some cases it would be profitable to refurbish it. There are other situations where it would be better to close channels and use the water on more suitable land.

To make appropriate choices on investment, benchmarking needs to be undertaken of what wealth is being created from each irrigation area, including the amount of water used, and identifying the environmental externalities in terms of damaged rivers, wetlands and salt impacts on groundwater. Each river needs to have a publicly available set of water accounts so everyone can see what water is allocated to the various extractive uses, and what is reserved to maintain the health of the river, which underpins all of the extractive uses.

8. Establishing an effective water market

Society normally uses money as the key to allocating scarce resources. Governments have historically underpriced water in an effort to encourage regional development. Since the first round of Council of Australian Governments (CoAG) water reforms in 1994, a water market has been developed that is now seeing some trading of

water. This has meant that farmers on inappropriate land have been able to sell water, and new irrigation developments on better land have flourished, providing economic benefits to both.

One of the keys to creation of wealth is to provide clear access entitlements that can be traded. At present there are some 24 different water products available within the Murray–Darling Basin, all with differing securities of supply and tenure of entitlement.

In August 2003, CoAG again considered further water reforms, and committed to a new National Initiative with the following goals:

- to improve security of water access entitlement by clear assignment of risk and returning over allocated systems to sustainable allocations;
- to ensure ecosystem health through protecting ecosystem assets;
- to ensure water goes to best use through an efficient market; and
- to encourage conservation and recycling in cities.

The outcomes sought from this further initiative were to deliver best practice water pricing, effective management of environmental water, improved monitoring and information, including water accounts and urban water reuse and recycling, more efficient technologies and review of pricing.

This was more than just an important and overdue recommitment to the 1994 water reforms, and provided $500 million to recover water for the environment and provided a clear framework to proceed. There is, however, much yet to be achieved, and whether these important outcomes will be achieved or whether the funds will be frittered away in endless wrangling and disagreement and the building of further infrastructure desired by the engineers is yet to be seen.

The Australian Government is in a position to help sort out the mess that the Constitution has given us with water. While the Constitution specifically gives the states powers for the conservation and management of waters, there are many who believe they have been ineffective in doing this. The present arrangements seem to be a barrier to interstate trade, and it is clear that interstate trade is needed if resources like the Murray–Darling are to be effectively managed. At present, there is a commitment of state and federal governments to try to develop better solutions through the CoAG. However, the temptation here is for states to loudly assert that other states must change their ways, and seek minimalist change for themselves.

Governments are expected to provide a competitive environment where business can get on and create wealth. When government structures inhibit wealth creation, governments should be expected to work together to sort out the problem. Failing this, an assertion of its constitutional power by the Federal Government or a challenge by a third party may be required to address this.

Establishing a market for water means removing some of the existing restraints on trade that prevent water being traded between valleys. While there are some hydrological and ecological constraints that must be understood and built into the market, there are constraints on trade designed to protect present water users rather than subject them to competition. This is something governments must address.

Establishing a market will let water move to its most economical use, but will not do anything to redress the over-allocation issue. To address this, governments need to stand in the market place as environmental purchasers and recover water for the environment.

Some communities are concerned by this and believe that a government in the water market will push up prices. They prefer governments to invest in infrastructure to reduce wastage. There are certainly some opportunities to do this, but many of the infrastructure proposals coming forward provide very expensive water. They basically refurbish or build infrastructure that no one would consider economically sensible. This is hardly a good use of taxpayer funds.

Governments have now committed to recovering 500GL as a first step in saving the River Murray. This is about 3.5 per cent of the water extracted from the Murray by irrigators, and one approach would be to reduce everyone's allocation by this amount. Another approach to recovering the water is a simple tender process where irrigators are asked how much of their water allocation they are prepared to sell and at what price. The governments can then draw the line at the amount of water they can acquire for the money available, and the community get it back without the taxpayers being held to ransom.

Governments have now committed to recovering 500GL as a first step in saving the River Murray.

9. Providing the necessary knowledge base

Governments have traditionally invested in research to provide the underpinnings for agricultural development. An over emphasis on production and a failure to consider issues at a landscape scale has introduced problems like salinity and algal blooms.

There are particular knowledge problems arising at the start of the 21st century. Governments are establishing regional catchment-based bodies to develop regional plans to be the investment vehicle through which governments can invest to get the sort of outcomes they seek. It is already apparent that many of the plans being developed do not reflect the best available scientific knowledge, and that there are many knowledge needs of such bodies that are not at present being met by state agencies.

Regional bodies are given some funding to develop their plans, but they are often not well resourced with the variety of expertise they need. There are three particular challenges in this area:

- to map current scientific capabilities in the area of land and water management and to develop a strategy to build capacity in the disciplines and regions where it is needed;
- to undertake the catchment scale landscape system research to permit understanding of the sorts of vegetation needed in various parts of a catchment to achieve the desired outcomes and to give agricultural systems that work in harmony with the landscapes; and
- to deliver available knowledge to the regional bodies, Landcare groups and individual landholders so that they are empowered to act in the long-term interests of the catchments.

Australia has broken new ground internationally with the National Land and Water Resources Audit. This strength needs to be built on by ensuring the necessary data is collected on vegetation condition, river health and agricultural production so as to allow knowledge-based decisions.

10. Social choice and water bodies

The decision made about scarce and valuable water resources will determine the sort of society there is in the Murray–Darling Basin and beyond. There is no simple trade-off between wealth creation and environmental degradation. The environmental damage may be experienced hundreds of kilometres from where the wealth is created, and there may be time lags of 50 to 80 years before the consequences of actions become apparent, as has been the case with dryland salinity. There is argument as to what is significant degradation. Some are concerned if thousands of square kilometres of floodplain of the lower Murray stop getting the floods they need, the river red gums and wetlands will disappear. Others say there are plenty of other river red gums so who cares if this is the price for creating wealth upstream.

There are also difficult issues of who should benefit from the wealth that can be created from Australian waters. Is it those who invested in irrigation a long time ago and may be on land that does not create a large return per megalitre of water, or should it be those who can create wealth with grapes, cotton or other crops? Should a landholder be allowed to catch water that falls on their land with farm dams, when previously this water would have gone to the rivers and supply someone with irrigation water?

They did, however, find a number of areas of high agreement between the various interest groups (urban and rural) that provide a way forward.

Nancarrow and Syme (2001) undertook a survey of various stakeholders regarding environmental flows in the River Murray. They found there was pessimism as to whether governments had the political will to resolve these difficult issues and whether greed and self-interest in the community would be a barrier to resolution. They did, however, find a number of areas of high agreement between the various interest groups (urban and rural) that provide a way forward.

These are the moral responsibility of those upstream to look after the interests of those downstream; the natural environment had the same rights to water as people do; the recognition that there will need to be some personal sacrifice if there is to be effective planning; the acceptance that water has a wider range of values than can be expressed in dollars; and the ownership of water by everyone and its management for the overall public good.

11. Conclusion

Australia is entering a period of some water scarcity, and there are pressures to use water more efficiently in both urban and rural Australia. Markets are being used as one mechanism to ensure water is used for the best purposes.

Water development in Australia has a long history of articulate interest groups seeking advantage from water, and generally wanting taxpayers to pay the bills, and letting the users of water avoid the true costs. This has led to some unfortunate developments and a massive bill will now have to be faced to redress some of the problems that have been created. It is important that the funds available are invested in a smart way to ensure they make a difference rather than fritter them on ineffective investments.

The Australian electorate is telling politicians that they need to get on and fix the water problems. In moving forward, it is essential to invest effectively in order to make a difference and with equity to ensure the burden does not fall unfairly on particular groups.

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2. The National Water Initiative

Chloe Munro

1. Introduction

In terms of advancing towards sustainable management of Australia's water resources 2003 was a critical year. In August, the Council of Australian Governments (CoAG) agreed to develop a National Water Initiative (NWI). In November, the Murray–Darling Basin Ministerial Council (MDBMC) announced its First Step towards restoring the health of the River Murray system.

At the time of writing, an intense process of policy development was under way to ensure effective implementation of these complementary decisions under the umbrella of two new intergovernmental agreements and, most likely, amendments to the existing Murray–Darling Basin Agreement. This paper explains the intentions of the NWI, and outlines the steps that will be taken to bring it to fruition.

2. Context

Many of the challenges associated with water resource management are discussed elsewhere in this publication. Readers will be left in no doubt as to the complexities, both in the dynamics of the natural environment and in the institutional framework through which water is managed.

Over time, the framework for water resources management in each state gradually diverged, as successive governments took varying approaches to promoting development.

From the early days of European settlement it was clear that common-law principles were not suitable to fulfil the colonies' needs for secure water supplies for town, mining and agricultural use. Legislation was therefore introduced to vest the right to use and control water in the Crown. When Australia became a federation in 1901, control over this vital resource remained in state hands.

In the context of the Murray–Darling Basin there was early acknowledgment of the need for coordination between the states. Intergovernmental agreements, now embodied in the Murray–Darling Basin Commission, were established: first for the purposes of navigation, then to establish rules for sharing the common water resource and, later still, for managing the impacts of resource use, such as salinity and loss of habitat.

Over time, the framework for water resource management in the states gradually diverged, as successive governments took varying approaches to promoting development. This also reflected regional variations in hydrological conditions and land capability, according to the knowledge of the time. The nature of water access entitlements and the authorities established to administer delivery were tailored to suit local conditions and political imperatives.

As a result, wide differences in outcome have emerged between regions. For example, conservative allocation practices in Victoria have meant that irrigators largely enjoy a higher level of resource security than their counterparts in New South Wales. In South Australia water has generally been applied to higher value products, perhaps as a result of greater scarcity. Thus, in 1999–2000 the value of irrigated production in South Australia's Riverland was some 10 times more per unit of water than in New South Wales and some four times more per unit of water than in Victoria.

The focus of concern has varied too. In Western Australia, groundwater is the

predominant resource, introducing quite different considerations from the surface water regimes in south-eastern Australia. South Australia is sensitive to issues of water quality as much as quantity. Competition for scarce resources has not become an issue in Tasmania or the Northern Territory, while Queensland is confronting the need to ensure that continuing agricultural development occurs in a sustainable way.

In recent decades, attention has turned from purely economic considerations to the environmental consequences of resource use. As a society we have become increasingly concerned by evidence of environmental degradation as a result of the ways in which we use water. New institutional arrangements, such as catchment management bodies, have been introduced to secure a more integrated approach to natural resource management, with water as the key to sustaining precious habitats and biodiversity at a local and regional level.

For some time, in the face of complexity and imperfect knowledge, the policy challenge has been to reform our institutional arrangements so that water can be used more productively while at the same time improving environmental outcomes. As a final element, there has been considerable anxiety that some segments of the community would bear a disproportionate share of the costs of change. The need to deal fairly with all interests is a policy principle that is readily expressed but challenging to achieve.

The needs of the environment are recognised more explicitly in decision-making and a raft of new assessment and implementation tools have been developed to deliver tangible environmental gains.

The Council of Australian Governments (CoAG) first took up these challenges in 1994 and agreed to develop a strategic framework to achieve an efficient and sustainable water industry. The Water Reform Framework was explicit in addressing both environmental and economic objectives. For example, it required the development of clear water 'property rights', separate from land title, and well specified in terms of ownership, volume, reliability and tradability. This was seen as the key to improving water use efficiency and addressing concerns of users that security of supply was being eroded, thus devaluing investment.

At the same time, the Water Reform Framework identified a range of critical environmental objectives, such as allocation of water to the environment, ensuring ecological sustainability of new developments, protection of groundwater and implementation of the National Water Quality Management Strategy.

Considerable progress has been made, with new water legislation enacted in most jurisdictions, in the spirit of the overall framework but differing in details such as the planning cycle and the provisions for altering licences to extract water. Undoubtedly, good results have been achieved by these reforms, with widespread improvements in pricing of water services and in the value derived from water use. The needs of the environment are recognised more explicitly in decision-making and a raft of new assessment and implementation tools has been developed to deliver tangible environmental gains.

Nevertheless, by 2002 CoAG observed that several impediments remained to full achievement of its 1994 reform objectives.

For example, the separation of water from land title and the introduction of entitlements with a fixed period had, in the minds of some water users, created less rather than more security. The impact on investment certainty has been exacerbated by the need to reduce water use rapidly in some over allocated

systems to meet sustainability objectives, giving rise to calls for compensation.

While water markets have proven their value in increasing irrigators' flexibility in managing risk and enabling new developments in otherwise fully allocated systems, many legal and institutional barriers to trade remain. Particular problems have arisen in the context of interstate trade. For example, licences in some jurisdictions include a provision that allows licensees to carry over any unused water from one year to the next, while others maintain a 'use it or lose it' policy.

Recently, these issues have been thrown into stark relief in the context of an extended period of below-average rainfall in many parts of Australia. While anxieties have been high among water users, advocates of the environment have also made clear that the pace of change has not been sufficient to reverse the trends in environmental decline.

Against this background, and in the context of widespread public debate, CoAG embarked on a policy process to refresh its 1994 water reform agenda: to increase the productivity and efficiency of water use, sustain rural and urban communities, and to ensure the health of river and groundwater systems. The result is the National Water Initiative.

3. The National Water Initiative

In the words of CoAG's communiqué of August 2003, the Initiative will:

- 'improve the security of water access entitlements, including by clear assignment of risks of reductions in future water availability and by returning over-allocated systems to sustainable allocation levels;
- ensure ecosystem health by implementing regimes to protect environmental assets at a whole-of-basin, aquifer or catchment scale;
- ensure water is put to best use by encouraging the expansion of water markets and trading across and between districts and states (where water systems are physically shared), involving clear rules for trading, robust water accounting arrangements and pricing based on full-cost recovery principles; and
- encourage water conservation in our cities, including better use of stormwater and recycled water.'

At the same time, agreement was reached on funding to address over-allocation in the Murray–Darling Basin.

Key elements of the actions required to meet these objectives are outlined below.

3.1 Nationally compatible water access entitlements

Under the National Water Initiative, most jurisdictions will need to consider amending their water legislation in some regard, although in most cases the change need not be extensive. It is not intended that there be a single national model; rather, there is sufficient compatibility to facilitate investment certainty and interstate trade.

The most important feature of the proposed new arrangement is that, in general, water access entitlements will be defined as open ended, or perpetual, shares of a water resource, subject to well-specified conditions that define the responsibilities of water users.

In each catchment or groundwater system, the resource that is available to be shared among consumptive users will be established through a water-sharing plan. This is the key instrument for ensuring that environmental assets are sustained. Water-sharing plans should indicate the size of the consumptive pool likely to be available over the duration of the plan and the means of determining this on a seasonal basis. Plans are to be developed and reviewed through an open, transparent process involving all stakeholders, drawing on best practice hydrological and ecological modelling and providing for regular reporting of delivery against the plan. Plans will be subject to periodic review based on monitoring data and any significant new evidence of resource conditions and environmental requirements.

In determining the duration of a plan, governments will once more be weighing up the desire for investment certainty against the need to avert environmental degradation. The key to this will be clear identification and assignment of risks between governments and water users over possible future reductions in water availability.

In each catchment or groundwater system, the resource that is available to be shared among consumptive users will be established through a water-sharing plan. This is the key instrument for ensuring that environmental assets are sustained.

Under the National Water Initiative, the principle has been established that access entitlement holders should generally bear the risks associated with natural events, such as climate change or drought, as well as risks associated with bona fide improvements in the knowledge of water systems' capacity to sustain particular extraction levels. By contrast, governments should bear the risks arising from changes to water access entitlements not previously provided for, arising from changes in government policy (for example, new environmental objectives).

In moving to this new framework, priority will be given to establishing firm pathways and open processes for returning over-allocated surface and groundwater systems to environmentally sustainable levels of extraction. Without this foundation, the reformed arrangements for water allocation will not be durable.

3.2 The Murray–Darling Basin

The question of over-allocation is particularly pertinent within the Murray–Darling Basin. In particular, the process known as the 'Living Murray' has explored opportunities to restore the health of the River Murray system through increased environmental flows.

With this in mind, and as part of the CoAG decision, member jurisdictions of the Murray–Darling Basin, with the exception of Queensland, agreed to provide new funding of $500 million over five years to address water over-allocation in the Basin. Forty per cent ($200 million) is to be contributed by the Australian Government and the balance by New South Wales ($115 million), Victoria ($115 million), South Australia ($65 million) and the Australian Capital Territory ($5 million).

This funding commitment will ensure that any adverse social and economic impacts of returning water to the environment can be minimised. The First Step decision, announced by the Murray–Darling Basin Ministerial Council in November 2003, proposes an initial focus on maximising environmental benefits to six significant ecological assets including the River Murray channel. These benefits will be secured by building up recovered water over a period of five years, using a range of possible instruments, as discussed below.

3.3 Nationally functioning water markets

A second objective of the National Water Initiative is to achieve an efficient water-market structure and to expand markets to their widest practical geographical extent, thus enabling increased returns from water use. Where there is scope for increased trade, particularly in the Murray–Darling Basin, the National Water Initiative will frame the specification of the key elements of the market environment. These will include trading rules, exchange rates, and compatibility both of the terms of water access entitlements themselves and of administrative arrangements such as registries and accounting systems.

Importantly, there are widespread barriers to trade, such as rules that limit or prevent movement of water between districts. In some cases, these barriers have been erected as a means of averting the externalities associated with trade, which may be environmental, social or economic. New ways will have to be found for managing these risks. For example, the charging of exit fees has been canvassed as a way of mitigating the so-called stranded asset problem, where it becomes increasingly difficult to finance the maintenance of a section of infrastructure as trade reduces the extent to which is it used.

The National Water Initiative will continue the focus on water pricing by establishing what can be considered best practice.

3.4 Best practice water pricing

In its 1994 agreement, CoAG placed great emphasis on the implementation of user pays and full cost recovery in the water industry. This was reinforced in 1995 by the provisions of the National Competition Policy. Progress by jurisdictions in this regard has been an important element of assessments undertaken by the National Competition Council. The National Water Initiative will continue the focus on water pricing by establishing what can be considered best practice. In particular, the basis of cost recovery will be examined and where appropriate may encompass all aspects of delivery, including resource planning and environmental impact.

3.5 Integrated management of environmental water

At the heart of the National Water Initiative is the recognition that new arrangements will be necessary to ensure that water returned to the environment at a basin, aquifer or catchment scale can be seen to deliver the anticipated environmental outcomes. Given the natural variability of the water resource and the ecosystem it supports, a sophisticated system of adaptive management will be required, so that water managers can learn from observed environmental responses to make best use of the resource available at any particular time. Such management cannot be done in isolation from the delivery of water for consumptive use.

These considerations will have immediate relevance in the Murray–Darling Basin. Implementation of both the National Water Initiative and the First Step decision of the MDBMC will require a basin-wide system of mechanisms to enable environmental water management, including through the market. CoAG noted that a flexible trading model has the advantage of being able to purchase water for the environment in a cost-effective manner when needed, and selling or leasing water back to other water users at other times. In addition, water will also be provided for the environment through targeted public and private investment in engineering works to improve leaky infrastructure, based on rigorous investment criteria.

Engineering works (including removing or adjusting infrastructure that has had deleterious effects on the environment) can also enhance the environmental benefits

achieved for a given volume of water. The MDBMC has committed to a $150 million program of infrastructure works over seven years to enable environmental water to be directed towards significant ecological assets in the most effective way.

3.6 Measuring, monitoring and reporting

Accurate measurement, monitoring and reporting is raised to a new level of importance when there is increasing competition for water and where the proposed water-management system encompasses secure entitlements, market approaches, water recovery and environmental flow management. Under the National Water Initiative, jurisdictions will establish a robust, transparent regulatory water accounting framework. Governments will continue to invest in improving the scientific understanding of our water resources, and the industries and ecosystems that depend on them. This will include careful monitoring of outcomes and feedback into the modelling on which decisions are based.

In this way, robust measurement, monitoring and reporting systems will support public and investor confidence in the amount of water being traded, extracted for productive purposes and recovered and managed for environmental outcomes. Decisions will need to be made as to the range of processes that are taken into account. Relevant factors include return flows, interactivity between groundwater and surface water and potentially the catchment-scale implications of changed land use such as increased plantation forestry.

Governments will continue to invest in improving the scientific understanding of our water resources, and the industries and ecosystems that depend on them.

3.7 Urban water reform

While much of the debate that informed the National Water Initiative was focused on the rural landscape, CoAG also recognised the challenges faced in managing water sustainably in the urban context. The urban component of the National Water Initiative will reinforce the need for urban users to use water efficiently; for example, by promoting water reuse and recycling, the adoption of more efficient technologies and by reviewing the effectiveness of pricing policies. These issues will continue to be progressed through a number of ministerial councils.

Three elements will be examined, drawing on the diversity of existing initiatives in different jurisdictions, with a view to identifying any benefits that may be gained from a national approach:

- demand management strategies, water pricing and water-use efficiency;
- regulatory options such as reuse and recycling guidelines, water-sensitive urban-design guidelines, land use planning provisions and mandatory water efficiency labelling for domestic appliances; and
- tools to stimulate innovation in urban water management, including water treatment, stormwater management and water reuse systems.

4. Next steps

It is intended that CoAG will consider a detailed intergovernmental agreement to give effect to the National Water Initiative at the first meeting in 2004. The agreement will indicate specific actions for addressing the issues outlined above in each jurisdiction. A related agreement addressing over-allocation in the Murray–Darling Basin will be considered by those jurisdictions contributing towards the $500 million.

Development of these agreements will involve advice from experts in the water industry, the environment and the finance sector, much of which is already to hand and elements of which appear elsewhere in this publication. Governments will consult with stakeholders representing industry, environment, local government and indigenous interests.

This work has been entrusted to a Senior Officials Group on Water, led from the Department of Prime Minister and Cabinet and including representatives of other relevant agencies from the Australian Government, the states and territories. Five task teams, have been formed with separate but interrelated terms of reference, which can be found at www.pmc.gov.au. Periodic updates will be posted as they become available, including the text of any documents released for consultation.

In summary the teams are as follows:

Water access entitlements and water markets

This team is addressing the development of:

- a water entitlements framework that clarifies the risks for water users from changes in government policy, is compatible across jurisdictions, competitively neutral and has low transaction costs;
- an efficient water-market structure, expanding markets to their widest practical scope, removing barriers to trade, and adopting consistent best-practice administrative procedures and compatible water entitlement regimes;
- efficient functioning of markets by providing best practice water pricing; and
- an understanding of the dimensions of the adjustment issues that may arise during implementation of the NWI, and possible approaches to managing them.

Integrated management of environmental water and strategic infrastructure improvements

This team is addressing:

- improved environmental outcomes, including river and aquifer health and the protection of water dependent ecosystems, through the provision of adequate environmental water regimes for management at basin or catchment scale; and
- options and protocols for recovering water for the environment through market and regulatory mechanisms including strategic government and private investment in infrastructure.

Water resources accounting

This team is responsible for the development of adequate measurement, monitoring and reporting systems to support public and investor confidence in the amount of water being traded, extracted for productive purposes and recovered and managed for environmental outcomes.

Urban water reform

This team is pursuing improvements in urban water-use efficiency through measures including water pricing, catchment planning, demand management, and

the increased re-use and recycling of wastewater and more efficient management of stormwater.

The Murray–Darling Basin

This team is charged with drafting the terms of the intergovernmental agreement committing $500 million to address water over-allocation in the Murray–Darling Basin. This task is closely related to the implementation of the First Step decision of the Murray–Darling Basin Ministerial Council and for that reason its chair (Chloe Munro) and several of its members are also members of the Murray–Darling Basin Commission's 'Living Murray' Board. See www.thelivingmurray.mdbc.gov.au for more details.

5. Conclusion

The workload of these task teams is substantial, as we progress from general principles to the specific terms of the agreements. The implementation task for each jurisdiction as contained in the agreements will be little more than an outline and so considerable ancillary effort will be needed to settle every practical aspect.

Clearly at every level there will be a continued need for expert input and thoughtful consultation with stakeholders. Extensive consultation on water reform has already taken place in various forums leading up to the CoAG and MDBMC decisions. At the time of writing, peak stakeholders have been advised of the terms of reference of the task teams and invited to draw any relevant information to the attention of the respective chairs. To this end, when relevant papers are adequately developed, the Senior Officials Group will consult formally with relevant peak industry and community bodies. At this stage, it is anticipated that formal consultation will take place in the early part of 2004.

Far-reaching decisions have been made in the course of 2003. There is unprecedented unity of purpose among governments and community, even as vigorous debate continues as to the specifics of desired outcomes and the instruments to achieve them. Implementation of these decisions will unfold over a period of years in which our level of knowledge will continue to improve and adaptive, integrated natural resource management will become a way of life.

There is unprecedented unity of purpose among governments and community, even as vigorous debate continues as to the specifics of desired outcomes and the instruments to achieve them.

3. Water reform: access to finance issues

Stephen Carroll

This paper focuses on water reform issues that have the potential to impact on access to finance. The Australian Bankers' Association supports the sustainable management of natural resource assets and believes that water reform can produce better environmental and economic outcomes. However, maintaining water users' access to finance on reasonable terms is critical to facilitating this dual outcome.

Water users, such as irrigators, need to have access to mortgage finance with water as security on similar terms and conditions as they have with a mortgage over land. This necessity is a result of a history of mortgage finance practice in which security value has been based on land, with an assumption that the water on the land is available for the term of the loan.

Water users, such as irrigators, need to have access to mortgage finance with water as security on similar terms and conditions as they have with a mortgage over land.

Quite apart from such considerations as the marginal nature of many farms' cash flows from a viability perspective, access to finance is critical if farmers are to be able to invest in best practice water use. The 'quality' of the specification of water 'access entitlements' needs to facilitate this.

A secure title system is not only required to protect the interests of mortgagees, it is also essential to protect and give confidence to purchasers of water access entitlements and to ensure that all owners of water-access entitlements are protected from unauthorised dealings. A secure and efficient title system will also minimise conveyancing cost and time.

Water reform can create major issues for providers of mortgage finance. The separation of water from land creates uncertainty about:

- current mortgage lending arrangements;
- future mortgage lending arrangements;
- potential reductions in water allocations, which may reduce the sustainability of agribusinesses that are supported by mortgage lending; and
- the potential for water to be transferred without mortgagees' knowledge.

These issues can be grouped as impacting on asset values, cash flows and the commerciality of the title and are detailed here.

1. Uncertainty about current financial arrangements

The uncertainty about current financial arrangements is due to uncertainty about whether existing mortgagees' interests will be protected in the process of separating water from land, or to preserve existing arrangements and maintain the security value of the previously combined assets, whether or not costly new mortgage documentation will be required from farmers to maintain current levels of borrowed capital.

Where required, new mortgage arrangements can be costly. There is also the potential for a seriously negative impact on the borrower/lender relationship.

2. Uncertainty about future financial arrangements

Uncertainty about future financial arrangements relates to whether the separate

collateral security values of water-access entitlement mortgages and land mortgages when aggregated will meet existing loan-to-collateral security value ratios. There is further uncertainty about the comparative security status of a water-access entitlement mortgage compared to a land mortgage,[1] because the water-access entitlement title registries do not guarantee title, like land registration systems.

3. Uncertainty about the impact of reductions in access to water

There is uncertainty about the economic sustainability of agribusinesses post-reform. That is, whether current agricultural enterprises that are supported by borrowed capital will be able to generate sufficient cash flows to meet their contractual obligations to lenders of capital if water allocations are reduced. This is compounded by uncertainty over whether farmers will be compensated and/or assisted to adjust for changes to water allocations, which means that they cannot generate enough cash flow to meet the cost of existing borrowed capital.

The focus by governments has been on achieving environmental control without fully appreciating how issues impact on economic outcomes.

4. Uncertainty about control of separate water assets

Separating water from land creates the potential for water to be sold without mortgagees' knowledge. There are also issues relating to the ability of mortgagees to deal with water entitlements where a customer is in default.

The 'quality' of the specification of water 'access entitlements' needs to minimise uncertainty over those entitlements that could otherwise become access to finance issues. However, reluctance by governments about defining water as a property right has frustrated this outcome.

In the mid-1990s when the Council of Australian Governments (CoAG) agreed to the water reform agenda, this did not appear to be a major issue. In 1994, part of what CoAG agreed to included:

'implement comprehensive systems of water allocations or entitlements backed by separate water property rights from land title and clear specification of entitlements in terms of ownership, volume, reliability, transferability and, if appropriate, quality.[2]

In relation to trading entitlements, CoAG's objective was for:

'water to be used to maximise its contribution to national income and welfare, within the social, physical and ecological constraints of catchments.[3]

Over the last decade, water reform has been managed by state departments that generally, until then, had had a natural resource focus. This necessitated a fresh approach, balancing the objective of managing water reform to maximise the desired economic outcome within environmental constraints. The focus by governments has been on achieving environmental control without fully appreciating how issues impact on economic outcomes. The consequences of this impact have received little attention until recently. To fully realise the water-reform objectives, the economic impacts must be properly managed to deliver robust trading markets.

There still remains the preoccupation of state governments with environmental control, as highlighted in the Chief Executive Officers' Group on Water report to CoAG in 2003:

'Rights to water do have a few similarities to rights in land, e.g. both can be modified by regulations. But the analogy to land breaks down because water is a variable and mobile resource, which has strong public good characteristics. Thus, in every state the 'right to the use and control' of water has for over a century been clearly vested in the Crown. States then allocate 'entitlements' to use the water to individuals. For this reason the CEOs Group on Water is of the view that the use of the term water 'property right' in itself causes false perceptions and prefers to use the term water 'access entitlements'.[4]

The point is made by the CEOs' Group that water is variable, mobile and has public-good characteristics. Unfortunately, this misses the point about what the critical property-right issue is with relation to access to finance. Farming is about managing production risk associated with climate variability. Financiers back the ability of farmers to manage these types of risks. However, farmers and their financiers cannot manage uncertainty caused by the potential for ad hoc government intervention on perhaps the most critical risk to their farming activity: water.

The issue is about certainty of rights surrounding the use of water-access entitlements and the holder's right to deal with the entitlement.

The property-right issue is about protecting the commerciality of the holder's right to the access entitlement, not simply ownership. If the holder's rights are commercially viable and the commerciality of the holder's right is protected, it does not matter who the owner is. The issue is about certainty of rights surrounding the use of water access entitlements and the holder's right to deal with the entitlement, and also the right of third parties with an interest in the entitlement to deal with it. Government intervention that significantly impacts on the commerciality of a holder's right should be subject to compensation so as to protect the sustainability of existing commercial arrangements.

In 2003, CoAG announced the National Water Initiative—National Compatible Water Access Entitlements. This encourages investment and maximises the economic value created from water use, while ensuring that there is sufficient water available to maintain healthy rivers and aquifers with:

- access entitlements to be defined as open-ended;
- clear identification and assignment of risks between governments and water users over possible future reductions in water availability; and
- governments to bear the risk arising from changes to water access entitlements not provided for that arise from changes in government policy (e.g. new environmental objectives).

Of course, farmers and the rural economies that rely on them continue to bear the risk of climatic change and seasonal risk associated with variability in volumetric allocations.

While after nearly 10 years CoAG has reaffirmed that the objectives of access entitlements are to encourage and maximise economic value created from water use, there has been little progress in identifying on a national basis the necessary property right characteristics that access entitlements require facilitating access to reasonable-cost finance.

Water entitlements in Queensland and New South Wales can be mortgaged and mortgagee interests registered. However, this in itself does not mean that finance

will be able to be provided on equal terms and conditions as where land of similar value is available as security.

One of the reasons for this is that the title to a water entitlement is not guaranteed as under the system of Torrens land titles. The issue here is that governments appear reluctant to incur the cost of underwriting titles (for example, against title fraud) as they do for land title.

ABA is working with farming organisations and governments to get the specification of water access entitlements titles as near as possible to the Torrens title specification of land in order to minimise the impact on access to finance. Similar to land, a fundamental attribute of a water-access entitlement needs to be perpetuity.

The following is a brief outline of the issues that need to be covered by state legislative policy to enable farmers to have access to finance on terms that are similar to those that would be available if land of similar value as water was available as security.

Similar to land, a fundamental attribute of a water-access entitlement needs to be perpetuity.

Note that there are significant variations between states on these issues. Where the states via their CEOs' Group or CoAG via the proposed National Water Initiative have recently expressed views relevant to these issues, this paper has attempted to identify them.

4.1 Access to finance issues

(a) Ability to mortgage
Legislation must ensure water-access entitlements can be mortgaged in a similar manner to land.

(b) Recognise previous mortgage arrangements
Legislation needs to protect existing mortgage arrangements when water is separated from land (i.e. there is no loss of security value upon separation).

(c) Power of sale
The power of sale, which a mortgagee may exercise on default, needs to be similar to a Torrens land title mortgagee power of sale and specified in legislation.

(d) Power to take possession
A power to take possession of the mortgaged interest and bring notice of the fact to the public needs to be provided for.

(e) Power to appoint a receiver
A mortgagee should have power to appoint a receiver of the mortgaged interest and lodge notice of that fact on the water access entitlement register after which, while the receivership was on foot, only the receiver could deal with the mortgaged interest.

(f) Statutory foreclosure
A statutory process is required, similar to Torrens land title, so that if the mortgaged debt exceeds the value of the water-access entitlement, the mortgagee can foreclose in a summary way rather than incur the cost of court foreclosure.

(g) Notice of cancellation, surrender, renewal, etc.
The mortgagee, as a registered security interest holder, should be given notice of

events affecting the water-access entitlement, including material defaults, amendment, cancellation, surrender and renewal. Notice should also be given to the mortgagee if conditions will be imposed on a water-access entitlement after it is granted. The mortgagee as interest holder should be given an opportunity to make submissions.

(h) Remedy default

The mortgagee should be given an opportunity to remedy a default, reinstate a cancellation or surrender the water-access entitlement if it agrees to be bound by the same obligations as the licence holder.

(i) Right of renewal

The mortgagee should have a right to renew the water-access entitlement if the water-access entitlement holder fails to renew it and do so in its own name or as agent for the licence holder.

(j) Caveats (or a similar procedure)

A procedure should be introduced for freezing the water-access entitlement register to protect a mortgagee or other interest holder prior to registration of its mortgage or interest. The procedure should generally be available for all dealings as a disincentive to the water-access entitlement holder creating inconsistent but competing interests.

(k) Water access entitlement registry

The water-access entitlement registry should be of a Torrens freehold land style with indefeasibility for water-access entitlements.

CEOs' Group view

Access entitlements are recorded in reliable registers, which enjoy public confidence and unambiguously define who holds them and under what terms.

(l) Protected priority

The priority for all registered dealings should be the same as for land or other property.

(m) Leases and other dealings

The water-access entitlement should be capable of being dealt with in the same way as land.

CEOs' Group view

The access entitlement can be sold, given, bequeathed or leased to another holder, as long as any transfer has minimal adverse effect on other users and the environment.

(n) Broad definition of security interests

The definition of 'security interest' should not be limited to interests arising under written instruments. A mortgage by deposit of the title of the land accompanied by an oral arrangement between the bank and a customer provides a valid security. It is a traditional method of giving security and may be sought by a long-term customer for short-term financing at minimal cost in documentation. Traditional methods of giving security should not be excluded by relevant Acts.

(o) Ministerial consent to transfers and other interventions

The ABA does not believe there is a substantive case that justifies the need for a minister to consent to transfers (sales). However, if the potential for ministerial intervention is to prevail, guidelines should be agreed to give some comfort

around transfers (sales) so that mortgagees can seek out only potentially suitable purchasers, thereby minimising unnecessary costs associated with a sale or marketing program to a broader audience. If a water entitlement cannot be transferred (sold) at fair market price under such guidelines, the minister should be required to acquire the water-access entitlement at fair market price.

National Water Initiative principle
Governments should generally bear the risks arising from changes in water-access entitlements not previously provided for that arise from changes in government policy (for example, new environmental objectives).

CEOs' Group view
Terms should be sufficiently long to allow for efficient investment, or else renewal can generally be presumed; and the entitlement is secure during its term and cannot be resumed (unless the entitlement itself says otherwise and compensation is paid).

(p) Limiting the impact of reductions on access to water
Uncertainty regarding permanent reductions in water-access entitlements should be minimised by limiting how much access to water can be reduced without compensation, and by giving notice or lagging implementation of reductions by at least five years.

National Water Initiative principle
Access entitlements to be defined as open-ended (i.e. perpetual).

CEOs' Group view
It is important to have adequate breathing space between reviews, and also to ensure that the nature of the risks borne by entitlement holders are reasonably clear so that reviews do not lead to large shocks; and it may be feasible to give water users reasonable notice before actually implementing reductions in the consumptive pool decided on by the resource manager.

It is important to have adequate breathing space between reviews, and also to ensure that the nature of the risks borne by entitlement-holders are reasonably clear so that reviews do not lead to large shocks.

The ABA's concerns with regard to the above issues vary between and within states. Within states there are a range of entities that facilitate access to water, which include irrigation corporations and irrigation trusts. Access to finance issues in these local systems can be significantly different to the state-managed systems. For example, in some local systems, the availability of land that can be irrigated may be in short supply.

The ABA has commissioned research to identify deficiencies in state legislation and policy in addressing the above issues, and it will also identify issues relevant to the various types of entities within states. This research will be provided to the CoAG Senior Officials Group on Water to assist them in formulating the CoAG agreements for the National Water Initiative and the Murray–Darling Basin.

5. Potential impact on rural economies if these issues are not addressed

Water reform will have a significant impact on access to finance for agribusinesses if the access to finance issues are not addressed. There is also likely to be a negative impact on rural economies that rely on water-use industries. There is a risk that the viability of regionally based, value-adding industries may be compromised, or they may find it attractive to relocate closer to ports with better access to imported

primary products for processing. Another possibility might be for these industries to relocate offshore.

6. Summary

This chapter has focused on water reform issues that have the potential to impact on access to finance. The ABA supports the sustainable-management natural-resource assets and believes that water reform can produce better environmental and economic outcomes. However, maintaining water users' access to finance on reasonable terms is critical to facilitating this dual outcome.

A secure title system is not only required to protect the interests of mortgagees; it is also essential to protect and give confidence to purchasers of water-access entitlements and to ensure that all owners of water-access entitlements are protected from unauthorised dealings. A secure and efficient title system will also minimise conveyancing costs, complexity and time to complete water transactions.

Given the sensitivity of the demographics of rural areas to economic change, the management of water reform needs a whole-of-government focus, not simply natural resource management. While taking nothing away from the importance of the environmental issues, the economic futures of communities are also at stake.

Endnotes

1 This issue is the same under a land mortgage. The issue of reductions is discussed in point 3.

2 National Competition Policy Agreements Part 2 (2nd edition 1998), pp105.

3 National Competition Policy Agreements Part 2 (2nd edition 1998), pp106.

4 Chief Executive Officers Group on Water Final Report to the Council of Australian Governments April 2003, pp4.

4. Environmental flows

Professor Gary Jones and Peter Cottingham

Healthy working river: a managed river in which there is a sustainable compromise, agreed to by the community, between the condition of the natural ecosystem and the level of human use. (Whittington, 2002)

It is unarguable that the damming of Australia's inland rivers and the allocation of significant volumes of river flow for human uses, including irrigation, have brought great economic and social benefit to this nation. For example, national water consumption increased by 60 per cent between 1983–84 and 1996–97, and total annual profits from irrigated agriculture averaged $3.8 billion from 1991–92 to 1996–97 (Whittington and Liston, 2003). But it is now recognised that unbridled use of river flows to drive this economic expansion has come at a cost to the 'health' of many of those rivers and the plants, animals and floodplains that depend on them. These externalities of economic development have, until recently, received little attention from rural economists (Siebert et al., 2000).

The reasons for declining river health in inland Australia are complex, and not entirely related to water use by humans. Widespread, indiscriminate clearing of vegetation is one key factor recognised as causing damage to land and water quality. Much management attention is being given to dealing with this problem, and much has been written about the issue elsewhere (see, for example, Boulton and Brock, 1999; Young, 2001).

Governments at all levels in Australia are responding to the challenge of returning water to river systems as 'environmental flows'.

In Australia and overseas, scientific studies as well as environmental audits and 'expert panel' evaluations have consistently identified changes to the flow regime in rivers (for example, the timing and volume of flow) as a major reason for changes in the condition of the rivers and their associated floodplains and wetlands (see Thoms et al., 2000; NLWRA, 2002; IUCN, 2003). Governments at all levels in Australia are responding to the challenge of returning water to river systems as 'environmental flows'. Their aim is to secure the sustainable use of water resources and the protection of natural heritage and resources for current and future generations.

The Council of Australian Governments (CoAG) water-reform agreement, commencing in 1995, has been the key government process driving environmental flow allocations in Australia. The 1995 agreement was provisionally updated in 2003 under the new National Water Initiative, which is to be finalised this year. To enact the CoAG agreements, state and territory governments have amended existing water resources legislation or created new Acts to enshrine the rights of the environment in water allocation policy and management (see chapter 3 in Jones et al., 2001). The environmental provisions of these Acts are implemented in most states through prescribed catchment planning or water sharing (or bulk allocation) processes. Water allocation, for both irrigation and the environment, is at their core. Also central to federal and state water allocation policy under CoAG is the development of an open market for water trading.

So what exactly is an environmental flow? An environmental flow can be defined as water released from a water storage in a manner designed to achieve specific ecological outcomes. In an unregulated river (one without large water storages) the environmental flow is essentially the water left in the river after human extractive use. Usually, the aim of an environmental flow is to protect or enhance the

biological diversity and ecosystem service values assigned to rivers and their floodplains. Biological diversity is promoted by providing conditions suitable for the spawning and development of fishes, or the breeding and fledging of waterbirds. Ecosystem services are characteristics consistent with a 'healthy' environment, which provide benefits to humans; for example, good quality drinking water or sustainable fish populations for commercial and recreational fishers. These conditions in turn help to protect social and economic values.

From an ecological perspective, an environmental flow is much more complex than just an allocation of extra water for the river environment by a catchment-planning process (even though this may be the most contentious and difficult part of the planning process on which to reach agreement). Rivers that are dammed need an actively managed regime of environmental flows, not just a bulk volume of water released when convenient. A well-managed flow regime incorporates correct distribution of the environmental allocation along the river and across its floodplain, in the right seasons, and released from dams and weirs at the right flow rate and temperature.

Planners and river managers need to understand their river before deciding on appropriate environmental flows.

1. Challenges in defining and delivering environmental flows

Many scientific, policy, planning and engineering difficulties must be confronted when delivering environmental flows to a river system. For example, water in some river systems is already fully allocated, and securing water for environmental flow releases can pose significant policy challenges, such as deciding from whom the water is to be obtained and who will pay for it, and technical challenges, such as whether or not a sufficient volume of water can be released at the right time and at an appropriate temperature. Water released from deep in a dam is often much colder than is suitable for river-dwelling plants and animals, and can upset their lifecycles. Surface water from a dam is of a suitable temperature, but surface releases present engineering problems, as well as water quality problems due to seasonal toxic blue-green algal blooms.

Planners and river managers need to understand their river before deciding on appropriate environmental flows. For example, the flow regime required to promote a 'healthy' environment in and around a regulated river (that is, one in which peak flows during wet periods are captured in one or more large dams and released for human uses in drier times) can differ markedly from that required for an unregulated river (one in which water is pumped directly from the flowing river channel, as and when allowed under state licensing provisions).

Operational challenges also differ between regulated and unregulated rivers. In regulated rivers, dams dampen most of the natural rainfall driven flow pulses—that is, bursts of fast-moving high flow that are of major ecological importance. Flow pulses scour away sediment deposited in river channels during slower flows, bring water to low lying floodplain wetlands, and may provide cues for fish movement and breeding. Environmental flows can be designed to meet these needs if dams have appropriate design features. In south-eastern Australia, where the highest natural flows are generally in the winter and spring, agricultural releases from dams are highest in summer and autumn. This 'seasonal inversion' of the natural flow regime can affect the biology and ecology of river biota adapted to low summer flows, particularly if water quality from the dam is poor. Addressing the seasonal inversion issue is very challenging: to restore low-flow conditions below dams in

summer entails reducing summer discharges from the dam. Alternative delivery methods (such as pipelines) may be required to supply the water needed for agriculture.

Managing an environmental flow regime in an unregulated river, where water is diverted directly from the run of the river, can pose different challenges. Again, demand for water is generally greatest during summer at a time when flows may be naturally low. An environmental flow regime for these systems generally emphasises the protection of minimum flows, usually to maintain in-channel habitat for river inhabitants such as fish. Many unregulated rivers have only limited flow-gauging equipment, often installed for monitoring flood levels rather than low flows. While local landholders are licensed to divert water from the river, it is only recently that they have been required to meter their diversions. The combination of ungauged river reaches and unmetered diversions creates a situation in which there is a real risk of rivers being drawn down to unsustainable levels. Ensuring an environmental flow regime is maintained in such circumstances requires cooperation between landholders and regional resource management agencies.

River rehabilitation, including the provision of a suitable environmental flow regime, is guided both by the science called 'restoration ecology' and by concepts such as the 'healthy working river', defined at the beginning of this chapter. Early attempts to define environmental flow regimes for rivers focused on the relatively simple in-channel needs of individual species (such as Murray cod) or communities of species (such as macro-invertebrates—'water bugs'). In recent years, the emphasis has shifted to more holistic approaches that consider river systems and their ecology at larger scales, including whole river channels and their associated floodplains (Arthington et al., 1998).

A major concern for both scientists and managers is how to set meaningful ecological objectives against which to monitor the outcomes of environmental flows, and rehabilitation in general, in any particular working river. Comparison of existing conditions with those that would be expected in minimally disturbed river systems ('near natural', defined by reference to unregulated rivers in similar environments) helps to highlight the extent to which a particular river system has been modified and the attributes that may be the focus of rehabilitation efforts. However, rehabilitation is highly unlikely to achieve 'near natural' conditions in a working river and would not aim to do so. Most of our major rivers have a long history of management and regulation to provide for the human populations and industry that have developed in catchments and on floodplains.

Acknowledgement that humans are an integral part of a functioning and healthy catchment is a recent development in policy and planning. It differs from the traditional environmental protection thinking that views people, industries, farms and so on as external to the environment, being essentially 'stressors' upon it. This conceptual shift has led to the notion of a 'healthy working river'; that is, one that still retains many of the natural attributes associated with healthy river systems in spite of having a history of water resource development. Such attributes may include (but are not limited to) good water quality, stable native fish communities, a diverse invertebrate community, intact riparian cover and wetlands that support aquatic and riparian vegetation and waterbirds.

Responsibility for setting desirable objectives for river rehabilitation and

Acknowledgement that humans are an integral part of a functioning and healthy catchment is a recent development in policy and planning.

environmental flow releases falls, nowadays, on the people of the catchment, usually operating through the catchment management group. They must decide on the level of decline from natural conditions that they are willing to accept for a river system in exchange for the social and economic benefits. Ultimately, the objective setting process is about striking a sustainable balance between ecological, economic and societal values and needs. In most states the catchment plans, 'blueprints' or water sharing plans are the vehicles for negotiating and agreeing on this balance.

It is often not recognised that the setting of ecological objectives is much more than a purely scientific process. Trade-offs must be made between conditions that may be desirable, such as a fully functioning and healthy river, and those that are realistic given the existing irrigation or industrial investments in the river catchment. It may be pointless to set an objective such as 'abundant stands of healthy floodplain vegetation throughout the river valley' if to do so requires the complete exclusion of sheep and cattle from all sections of the river floodplain, as well as additional environmental water. A more realistic situation may be to have targets for specific river sections that recognise the existing activities and opportunities in that section. For example, reaches that are relatively less used for irrigation and grazing purposes might be available for restoration. In some cases, these may already be areas with high conservation value; for instance, wetland complexes listed in the international Ramsar Convention on Wetlands. This is how the states that comprise the Murray–Darling Basin Commission are handling the initial steps towards restoration of the River Murray (MDBMC 2003).

The people of the catchment … must decide on the level of decline from natural conditions that they are willing to accept for a river system in exchange for the social and economic benefits.

The relatively new science of restoration ecology has been fundamental to the process of defining and implementing environmental flow regimes. Continued scientific investigation is essential so that the ecological benefits can be optimised within the scope of the environmental water resources available. Investigations that clarify ecological responses to various flow regimes will help to refine understanding of the volumes and timing of releases required to meet ecological objectives. This information will be fed into existing and future decision-support systems such as the Murray Flow Assessment Tool (MFAT), which was developed to evaluate the potential ecological benefits of supplying additional water for the River Murray system (Scott et al., 2003). Decision support systems such as MFAT integrate diverse bits of scientific knowledge on the functioning of a river system and its response to flow. They provide a consistent and transparent mechanism through which scientists can reach consensus on the evidence available to guide environmental flow decisions, and allow the user to come up with answers to management questions of importance to the river community.

2. Institutional and governance issues

The scientific and engineering challenges involved in assigning and providing suitable environmental flow regimes are very difficult. But perhaps the greatest challenges currently lie in the institutional and policy issues around water recovery and governance of the environmental 'account'.

Simply put, government has three options for recovering water for environmental purposes from users to whom the water is already committed. Governments can (i) take it, (ii) receive it voluntarily, or (iii) buy it.

(i) Being the legal owner and manager of water resources under the Australian Constitution, the Crown can withdraw given volumes of water from the pool available for consumptive human use. At the present time this legal tool is largely unpalatable to state and federal governments. Moreover, irrespective of the constitutional right to water management held by the Crown, there would inevitably be legal contests of any decisions of this nature that did not have very broad public support. Whether the states will choose to exercise their powers under the Constitution in the future remains to be seen.

(ii) Catchment and water-sharing plans in some states have led to ostensibly voluntary returns of water to the environment by catchment stakeholders. It is clear in state water resources Acts and in the guidelines to catchment or water sharing plans that voluntary return of a minimum volume of water to the environment is in everyone's best interest in ensuring an agreement is reached on other water uses (including irrigation). Government can also implement changes to licensing water security entitlements, which can have the effect of increasing water availability for the environment.

(iii) Government has a number of options if it decides to spend money to obtain extra water. These include:

(a) Investment in upgrading irrigation system infrastructure to improve water supply efficiency. System improvements could include off-farm actions, such as reducing seepage and evaporation out of delivery channels and improved water routing systems (often through automation), and on-farm actions, such as paddock laser levelling and automated drip irrigation systems. Water 'saved' through system efficiency gains can be returned to the environment as part of those rivers' environmental flow regimes. If public–private partnerships are developed to fund the infrastructure upgrades then the saved water may be shared between the private users and the environment.

(b) Acquisition through a controlled process such as a government tender scheme. Tenders could be compulsory—(irrigators compelled to make some water available for sale)—or voluntary. Voluntary tender systems have already been used in Victoria to purchase vegetated land for biodiversity conservation.

(c) Purchase of water in an open market from willing sellers. Fully functioning markets do not yet exist in any broad-scale sense, but their creation is a central platform in the new National Water Initiative announced in 2003.

Some economists have warned of the dangers of market distortion that may arise if governments enter an open water market in a careless manner.

Some economists have warned of the dangers of market distortion that may arise if governments enter an open water market in a careless manner. Consequently, state and federal governments are giving considerable thought to the right policy and market based tools for sustainable recovery of environmental water.

Creation of public water trusts or other forms of charitable organisation, combined with changes to legislation regarding who can 'own' water, would also allow public philanthropic investment in environmental water recovery through open-market purchases.

The Murray–Darling Basin Commission (MDBC) recently developed a set of principles for environmental water recovery. These aim to ensure that water recovery mechanisms provide equity between water access holders, limit impacts on

the water market, are administratively efficient, and optimise environmental benefits (MDBC, 2003).

Once a pool of environmental water has been made available (through whatever mechanism), there are various opinions about how the environmental water 'account' should be managed and operated. Broadly speaking, there are currently two community views of how this should occur. One sees government organisations (such as the MDBC or state water resources management agencies) as having the strongest operational knowledge base and necessary experience with water management. Conversely, there are others who believe that government has a rather poor track record in protecting the environment, and who would prefer to see independent environmental trusts managing the environmental account.

Whatever governance vehicle is ultimately chosen, it is vital that an active adaptive environmental management process is used to implement the chosen environmental flow regimes. Active adaptive management is a cyclic 'learning by doing' undertaking. It has well-articulated and well-funded steps—planning, implementation, monitoring, evaluation, reflection, refining—in a continuous loop. The undertaking includes evaluation of ecosystem responses to environmental flows in order to demonstrate effectiveness and guide future decisions.

History shows that many, perhaps most, rehabilitation projects fail if objectives and outcomes are not clear.

History shows that many, perhaps most, rehabilitation projects fail if objectives and outcomes are not clear, and if management is not set in an adaptive framework. Moreover, there must be long-term support and resources for monitoring and evaluation to help guide future decision-making. For many ecological processes, the time lag between management rehabilitation action and ecosystem response will be large; there may be decades before substantial improvements can be observed. Unless commitment to rehabilitation exists over the long term, there is a risk of wasting both resources and opportunities for making real gains towards more sustainable management of water resources.

3. Summary

It is already known that much water can be gained for the environment by adopting water-efficient practices, without reducing the overall yield of irrigated crops. Suitable technology is available, and new improved systems, such as sensor-regulated irrigation and solar pumping with automated control, are continually emerging. These technologies are being applied by forward thinking water users, with noticeable cost savings and benefits to the environment and to crop production. To date, widespread adoption has been limited largely by cost, but also by inertia and traditional attitudes. Resistance to the notion of a balance in the triple bottom line could hinder the development of the concept of environmental flows and healthy working rivers. Together, governments and private irrigation interests must decide on fair and equitable funding mechanisms to support the required gains in efficiency. Landholders should not be expected to foot the bill for upgrading infrastructure and then be forced to return the saved water to the environment. Under the new round of CoAG water reforms, this cooperation is beginning to happen, but more is needed, especially in the area of public–private partnerships.

Stakeholders should not expect guaranteed outcomes before acting to protect the environment. On the other hand, decisions should not be made that have high

financial costs and potential impacts on irrigators and the national economy without sound scientific evidence and transparent assessment that such decisions are necessary. There will always be uncertainties in analyses of the environment; ecological systems are complex and difficult to accurately predict, even when the very best data and minds are brought to the task. The tools needed for predicting rivers' ecological responses to management actions are currently being developed by Cooperative Research Centres, the CSIRO and universities across Australia. But this is not just an academic challenge. Any lasting solution will require good communication and trust between scientists and rural communities, a shared interpretation of the available information, and agreement on the strength of the evidence that is needed to support investment and action.

It is important that a commitment is made to the long haul in establishing and managing environmental flows. Sustainable, healthy working rivers will be built by strong and long-term partnerships between government, communities and environmentalists. With smart management, trust and cooperation, it can be ensured that, in time, working rivers not only serve human needs but also maintain many of the ecological characteristics of natural river systems that make them both desirable for recreation by city people and sources of economic prosperity and wellbeing for those who live in their catchments.

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5. Trading in water rights

Fiona Melville and Peta Broughton

1. Why trade in water?

1.1 Competing priorities for water use

It is now realised that most of the Murray–Darling Basin water resources are fully or over exploited and water entitlements[1] need to be constrained or, in some cases, reduced. Recently, the Murray–Darling Basin Ministerial Council announced that it would provide 500GL for environmental flows at key areas along the River Murray and it is accepted by participating state and federal ministers that this is only the first step. Scientists suggest that a minimum of 1500GL will be required to restore health to the river's aquatic and ecosystems.[2]

The need to reform the way we use and manage water is urgent, but achieving a reasonable balance between economic, environmental and social outcomes in the allocation of water is a complex task. State and federal governments now accept the view that water entitlements should be vested with individual water users, including 'the environment' as a legitimate user of water, and that flexible and efficient markets need to be developed to resolve resource use conflicts. Central to the pursuit of this objective is the creation of secure and clearly defined water entitlements and the separation of water entitlements from land to allow trade. This article examines some of the issues that arise from water trading, including benefits and detrimental effects, and considers some of the essential elements that must underpin the design of an efficient, non-distorting, water market.

The creation of secure water entitlements in the context of increasing and urgent environmental demands places additional responsibility on governments to effectively balance the needs of competing water users.

1.2 Optimising water allocation decisions

It is estimated that in New South Wales, licences and water allocations equal 120 per cent of the available water resource. Most of Victoria's rivers are also heavily allocated and in poor states of health. This over-allocation and decreasing quality of our water resources is due to various factors, including the current drought, land use practices, a lack of scientific knowledge of catchment hydrology and a history of poor management.

In the Murray–Darling Basin, concerns about limits of extraction and rising salinity led to the intergovernmental decision in 1995 to impose a cap on the amount of water taken from all Basin waterways.[3] In Victoria, South Australia and New South Wales the cap is designed to stem long-term average consumptive use at 1994 levels of development. The cap is not intended to reduce allocations but to limit further diversions.

In over-allocated systems south of the Divide, the Victorian Government is now proposing to cease allocating new entitlements and apply caps.[4] The cap will effectively require new entitlements to be purchased from existing water users. New South Wales has embargoed the issue of new water entitlements since 1983, and in order to redress over-allocation there will need to be, at some point, a reduction in allocations.

The creation of secure water entitlements in the context of increasing and urgent environmental demands places additional responsibility on governments to effectively balance the needs of competing water users. The establishment of an efficient water market to assist in moving water to where it is most needed should help secure more sustainable utilisation of the nation's water resources.

1.3 Facilitating adjustment to high value uses

Most commentators agree that the overall benefits to the broader community of moving water to more productive uses is positive.[5] The example generally cited is the new level of production achieved in the Barossa Valley by irrigators as a consequence of the trial of interstate trading on the River Murray in 1998.

Water availability at prices where concepts of scarcity and value play an important role is a relatively new concept in Australia. However, government-proposed caps on the level of water extraction, and policy decisions to desist from the further issue of water entitlements, will encourage water market participants to turn to trading mechanisms to adjust demand for this scarce resource in order to either undertake or enhance new or existing investments.

1.4 Returns and public good as drivers on where and how water is used

Evidence that governments recognise the inflexible characteristics of water entitlements is emerging. For example, the Water Management Act (WMA) 2000 (NSW) will make it possible to:

- use a water access licence as security for a loan;
- move an access licence from one property to another without having to cancel the licence and issue another licence;
- obtain all necessary approvals for a full irrigation development, and purchase water in stages as the development is rolled out, without the need for environmental review each time;
- subdivide an access licence and sell off the parts; and
- sell the property but keep the licence as an asset, making a return by selling annual allocations from year to year.

These measures are intended to provide flexibility to water licence holders in connection with the potential exploitation of this asset. The legislative focus has been on the entitlement. However, one of the characteristics for efficiency in trading is to ensure that a consistency exists in the nature of a water entitlement so as to encourage certainty in trading these instruments, not only within a jurisdiction but also across jurisdictional borders.

One of the characteristics for efficiency in trading is to ensure that a consistency exists in the nature of a water entitlement so as to encourage certainty in trading these instruments, not only within a jurisdiction but also across jurisdictional borders.

Water trading may provide a mechanism by which environmental water can be acquired from existing participants in the water industry. The creation of entities to acquire and manage water for the environment introduces a new participant to purchase entitlements from those who have them and are prepared to sell at market-induced prices. The capacity of trading to provide a mechanism for the acquisition of water for this use ought to reduce the need for government to intervene in both the supply mechanism (via caps) and in the pricing of the commodity.

While there are benefits to trading, there is a real concern that some will be left to shoulder the burden of stranded water infrastructure assets. The net loss of water from a rural community will also lead to a lower rating base and loss of rate revenue for local councils. Governments are aware of this risk and it must be addressed in any transfer rules. Some have suggested imposing 'exit fees' on those water users who permanently trade out their water. Such fees would assist in spreading the liability of stranded irrigation assets more broadly across the community.

Another major concern is the influence on a water market of the 'water baron'—the non-land-owning, city-dwelling, speculator buying up water entitlements and selling to farmers in need with a view to making a profit. The Victorian Government has suggested imposing a cap on the amount of water that can be owned by non-land owners or, alternatively, retaining a loose land requirement. Other states' water legislation contains discretionary powers to refuse to approve a transfer that could possibly be used to help stem the 'rise of the water baron'. Striking the balance between an efficient market and protection of community values is clearly a difficult task for governments.

2. Recent experience in water trading

2.1 What is traded and where?

Unofficial localised trading has occurred since the 1940s. Since the mid-1990s there has been a large increase in trade involving up to 90 per cent of irrigators in some regions. Most of the trade has been temporary trading rather than permanent.

Most trade is between farmers and takes place in regulated systems. Around 90 per cent of trade occurs in northern Victoria.

It is estimated that significant volumes of water are traded temporarily within all the Murray–Darling Basin states. However, in comparison to total water consumption, the percentage of water in trade is not that high. In Victoria, approximately three to eight per cent of all water rights and diversion licences is traded temporarily and around only one per cent is permanently traded.[6] This figure is much less when total water consumption (including bulk entitlements which are entitlements for large users of water such as councils, water authorities and electricity generators) is considered. We expect that the amount of water traded as a percentage of total water consumed is similarly small in the other Murray–Darling Basin states.

2.1.1 Victoria

While trading has occurred in Victoria for many years, temporary trade of water rights[7] was given legislative approval in 1987. In 1991, the introduction of the Water (Permanent Transfer of Water Rights) Regulations 1991 (Vic.) permitted the permanent transfer of water rights, initially only within certain irrigation districts. Trade between certain irrigation districts was permitted in 1994. Temporary trade interstate and in diversion licences was allowed in 1995. Permanent interstate trade was legislated for in 1997 and has been the subject of a pilot scheme managed by the Murray–Darling Basin Commission (MDBC) since then, with most interstate trade going to South Australia.

Most trade is between farmers and takes place in regulated systems. Around 90 per cent of trade occurs in northern Victoria, in the Goulburn/Loddon, Broken, Campaspe, Ovens and Murray systems, which are all physically interconnected. An average of 25,000 ML per year is traded permanently and between 100,000 and 250,000 ML is traded temporarily. The water is generally being traded away from low-yield enterprises to high-value dairying and horticulture, such as wine grapes, stone fruit, almonds and olives.[8]

2.1.2 South Australia

Permanent trading was introduced in 1983 in the River Murray region when legislation separated ownership of land from water rights. Unlike Victoria, where temporary trade is for an irrigation season only, temporary trade in South Australia

can be for a specified period, making it possible to 'lease' a water allocation. Each prescribed area of South Australia is subject to transfer rules contained in the relevant water allocation plan. The average volume of water permanently traded in the River Murray region in 2002–03 was 60,000 ML, and temporary trade averaged 190,000 ML.[9] Located downstream of Victoria and New South Wales, interstate trade is increasingly important to South Australian users with most water traded under the pilot interstate scheme going to South Australian capital-intensive horticultural activities (mostly wine grapes).

2.1.3 New South Wales

Trading in volumetric allocations was introduced on New South Wales regulated rivers in 1983 and permanent transfers of licence entitlements followed in 1989. By 1997 up to 50,000 ML was transferred by permanent licence transfer and up to 700,000 mL by way of temporary transfers. The annual value of trade on regulated rivers is estimated at between $5 million in a wet year and $40 million in a dry year.[10]

The annual value of trade on regulated rivers is estimated at between $5 million in a wet year and $40 million in a dry year.

2.1.4 Queensland

Permanent trading in water allocations was introduced in Queensland with the Water Act 2000 (Qld). However, such transfers are largely dependent on resource operation plans with transfer rules being in place. There has been limited trading following the recent approval of the first resource operations plan (the Burnett Resource Operations Plan), which commenced on 2 June 2003. Previously water entitlements could only be traded through the assignment of water licences attaching to land upon the sale of the land.

Department of Natural Resources and Mines records indicate that for the period from July to November 2003 there has been approximately 100 registered dealings involving water allocations. Of these almost a third represent sales of water allocations together with land. Almost half of the transactions relate to subdivision of water allocations with the allocations being retained by the same holder, and approximately 15 relate to actual transfers of water allocations in stand-alone transactions. To date, approximately 335 ML of water allocations have been transferred in stand-alone transactions. The combined transfers of land and water allocations account for a total volume of 2900 ML and transfers under wills or as gifts (associated with property succession) represent approximately 1750 ML.

3. Characteristics of an efficient and effective water-trading market

3.1 Features of water entitlements

What should a secure water entitlement look like? In 1995 the Agriculture and Resource Management Council of Australia and New Zealand published a set of guidelines that indicated that an efficient market-based system of tradeable water entitlements requires the entitlements to be:

- in demand;
- well specified;
- exclusive;
- enforceable and enforced; and
- transferable and divisible.[11]

The Chief Executive Officers' Group on Water (operating under the auspices of the Natural Resource Management Ministerial Council) in a report to CoAG in 2003 suggested that there are three characteristics of water entitlements that are particularly important:

(a) secure tenure—where the terms of the right are sufficiently long to allow for efficient investment or else renewal can be generally presumed and the entitlement is secure during its term and cannot be resumed unless compensation is paid;

(b) transferability—that the right can be sold or leased as long as any transfer has minimal adverse effects on other users or the environment; and

(c) clear specifications—that water allocations are well defined, publicly known and not subject to arbitrary change, that the responsibilities and obligations of holders are transparent and understood and access entitlements are recorded in reliable registers.[12]

Recently, the Productivity Commission released a report that examined various water right arrangements in Australia and overseas (California, Colorado, Chile, Mexico and South Africa).[13] The Report identified the following attributes of efficient water entitlements:

(a) universality—all available water resources are covered by a single system of entitlements;

(b) predictability—users have a reasonable expectation of the volume of water that can be extracted;

(c) enforceability—the right can be protected against encroachment by others;

(d) certainty of title—entitlements are legally recognised and protected;

(e) duration—specified time period over which the user has the right;

(f) exclusivity—the benefits and costs of having and exercising the right accrue to the holder;

(g) detached from land and use restrictions—the right is free of any requirement to hold land or use the water in a particular way; and

(h) divisibility and transferability—the right can be subdivided and is freely transferable.

3.2 Compatibility of water entitlements

Essential to an efficient interstate water market are clearly defined and compatible water entitlements. If water entitlements in the different states were compatible, administration costs would be reduced, but the central issue is for the entitlements to be clearly defined.

The precise legal nature of water entitlements is by no means agreed upon and certainly is not consistent among the states. Water is a public good and all water belongs to the Crown. Consequently, the idea of private individual rights to water has, until recently, been repugnant to the way water is conceptualised, legally and socially. As ownership of water vests in the Crown and water entitlements are not property rights to the water itself; rather, the right entitles the holder to take and use the water. Water entitlements are properly considered personal property, not real property. Only the South Australian Water Resources Act 1997 (SA) expressly recognises this.

The degree of security or certainty of water entitlements is likely to differ between the states because local and unique catchment needs will determine how much water is needed to ensure environmental flows and how much can be extracted. Despite this inevitable variation, water entitlements must nevertheless be underpinned by consistent legal principles. The renewal of such entitlements must be relatively certain or predictable and not subject to the exercise of arbitrary discretion.

An important question, and one that goes to the issue of the value of water, is whether a reduction in entitlement will give rise to a right to compensation. If the loss of water entitlements are compensated for in one state but not in another, what effect will that discrepancy have on the value of the water rights? CoAG's National Water Initiative proposes to compensate water entitlement holders for reductions due to changes in government policy, although at this stage it is unclear how this will operate.

Furthermore, the various water entitlements in the different states should not be subject to unique use restrictions. Entitlements should facilitate the transfer of water between a wider range of alternative uses and users at the lowest possible cost. The timing of when water entitlements can be used is also an issue that needs to be addressed in the regime.

Entitlements should facilitate the transfer of water between a wider range of alternative uses and users at the lowest possible cost.

It is generally accepted that, given the importance of local catchment conditions and the differences between the states, an interstate water trading system will not be effected by a nationally uniform piece of legislation. Rather, it is expected that existing state legal regimes will be amended to ensure national consistency or compatibility.

3.3 Scope for range of transactions

In New South Wales, the WMA authorises five main types of access licence dealings:

(a) Transfers—a transfer from a licence holder to a purchaser requires the access licence certificate to be lodged with Land Property Information (LPI) New South Wales for registration and will require the minister's consent. The dealing takes effect when it is registered. Where the licence is mortgaged, the mortgagee's consent will also be required to release the mortgage from the licence.

(b) Changes to an aspect of the licence—a licence holder can request a change to the nominated work, enabling the licence to be used at a different location. This will be required whenever a licence is transferred separately from land. The minister's consent is required for the change.

(c) Assignments of part of a licence or of water allocations from one access licence to another—in other words, if the share component is for 200 ML, a licence holder could assign 100 ML from its licence to another licence holder. An assignment of a water allocation involves the recording of the allocation from one water allocation account to another.

(d) Subdivisions and consolidations—a licence holder will be able to subdivide the licence into two or more licences or, conversely, consolidate two or more licences into one.

(e) Registration of security interests—there will be a register of security interests.

Registration gives the mortgagee priority over any later encumbrances and gives the mortgagee the right to veto transfers and some other dealings. The process for registering security interests will be virtually identical to the process used for land transactions with a prescribed form being completed and lodged with LPI for registration.

Future consideration is being given to allow licences to be temporarily assigned analogous to leasing and to provide for registered options to buy, sell or temporarily assign in the future.

Queensland and South Australia's trading regimes permit permanent transfers as well as temporary transfers for specified periods—effectively, leasing.

Victoria's current regime, in comparison, is restrictive. Permanent transfers of the whole or part of a water right or licence allocation are permitted. Temporary transfers are permitted for the irrigation season only. The purpose of the Victorian Government's recent proposal to unbundle water entitlements (into a right to the water itself, a right to have the water delivered and a right to use the water) is to facilitate the free trade in water and to encourage various trading options, such as leasing and derivatives trading.[14]

While discretion is important to ensure the sustainable management of water, such discretion must be exercised in a transparent manner and should be subject to review by those affected by decisions.

3.4 Efficient, cost-effective and transparent transfer and approval processes

The current regulatory regimes in each state require the minister (or, if delegated, the relevant water authority) to approve the transfers of water entitlements. With this power generally comes discretion to amend the licence, vary the conditions or reduce the allocation.

An efficient and effective water-trading market requires the approval process to be based on clearly identified criteria. In New South Wales, ministerial discretion is not based on clearly identified criteria. It was introduced in the WMA to address the risk of speculation—the expectation being that the discretion would not be exercised unless speculators start buying a significant portion of water licences.

In contrast, the Victorian Water Act 1989 (Vic.) sets out the factors the minister (or, in practice, the water authority) must have regard to in approving a transfer of a diversion licence. These include, among other things, the availability and quality of the water, any adverse effect of the transfer on existing uses of water or on a water resource, the volume of water to which the applicant is already entitled, environmental protection and conservation, government allocation policies, the purpose for which the water is intended, the needs of potential users and the impact of subsidies.

Given competing uses for water and the need to consider impacts of trade on the environment, communities and other users, there is a need for some intervention. However, while discretion is important to ensure the sustainable management of water, such discretion must be exercised in a transparent manner and should be subject to review by those affected by decisions.

3.5 Accuracy and transparency of price and volumes bought and sold

A water trading market is facilitated by the availability of market intelligence. It is crucial that participants are armed with market knowledge and are able to assess their positions and trade accordingly.

The South Australian Department of Water, Land and Biodiversity Conservation has responded to this by developing a water trading website, which provides up-to-date water-trading market information, including volumes, prices and licence types for every trade, plus rolling totals and averages for year to date. The site also provides a water-trading noticeboard where potential buyers and sellers can advertise their respective water-allocation details for sale or purchase. Negotiation of trade is by private agreement.

Goulburn–Murray Water established the Northern Victoria Water Exchange in August 1998. Now called Watermove, the exchange matches buyers with sellers based on set of trading zones in northern Victoria. Details of trades are available on the site.

In anticipation of an interstate trading regime, a national trading platform will need to be established.

3.6 Appropriately structured registry systems

The WMA will establish a register of water access entitlements, and currently work is underway to update the ownership status of entitlements. There will be transitional provisions to allow banks to register mortgages in the new register. Mortgagees will be entitled to register existing mortgages for up to two years from the date the provisions commence and, in doing so, retain the priority the mortgagee had before transition (this will create certainty for mortgagees).

The register will be maintained by LPI and accessible on the internet. It will include details as to the licence holder, licence terms and conditions (including share volume) and any trading actions. It will also note the water-sharing plan to which the access licence is currently linked. The register will enable interests to be recorded against access licences and the establishment of priorities between competing interests. The register will assist access licence holders to obtain loans in that the licence can be used as security by allowing the lender's interest to be listed against the access licence.

To ensure security and confidence, state governments should also be prepared to guarantee the register, as is the situation with registration of land title under the Torrens system.

The New South Wales Government is not intending, at this stage, to guarantee the register of water entitlements, unlike the Torrens title system in relation to land. Consequently, the quality of the register will be an additional element of risk faced by potential purchasers of water entitlements.

Approvals granted under the WMA will be on a public register, which will be managed by Department of Infrastructure, Planning and Natural Resources and be available on the internet.

A register of water entitlements similar to the one proposed for New South Wales is essential to support an open, free and efficient market. To ensure security and confidence, state governments should also be prepared to guarantee the register, as is the situation with registration of land title under the Torrens system.

3.7 Robust accounting and audit procedures

An efficient interjurisdictional market depends not only on compatible water entitlements but also requires compatible recording and accounting procedures. Accurate registers are necessary to ensure market certainty so that the person who alleges ownership of an amount of water does actually own that amount of water. It

is also necessary to ensure that catchment authorities can make correct and effective decisions such as a decision to cease trade in compliance with a cap.

Water, like land is a very valuable asset (and, in many instances, more valuable than the land on which it is used). It is therefore crucial that authorities responsible for trade maintain a clear division in roles, particularly between processing and approval roles, implement robust accounting procedures, are subject to verification procedures and audits, and use nationally compatible recording procedures.

3.8 Minimisation of adverse effects of water use and trade on third parties

In order to minimise adverse effects of water use and trade on third parties and the environment, water management plans or catchment specific trading rules need to impose restrictions on the movement of the extraction of water from one place to another to ensure that dealings do not result in increased stress on water sources or adversely impact other water users' ability to extract.

The provision of direct incentives for water-use efficiency will have a positive environmental outcome.

Such plans and rules need to be sensitive to the particular environmental conditions of the area and, ideally, be established with community consultation.

Because inefficient use of water can contribute to environmental degradation, the provision of direct incentives for water-use efficiency can have a positive environmental outcome. Water trading can provide environmental benefits by encouraging conservation of water and the opportunity to transfer water away from use on degraded lands.

4. Limitations in current trading models

4.1 Lack of clearly defined and compatible entitlements

State-based water legislation across Australia provides variously for water licences, rights or allocations. There is no compatibility in the terms used to describe the particular right to water. Moreover, the duration of entitlements varies. Most of the states provide for licences to be for a set term, generally up to 15 years; however, some water authorities might grant licences for only two years. Currently, in New South Wales the government is considering some of the aspects of the National Water Initiative such as licences to be issued in perpetuity, administrative enhancements to facilitate trading, and clearer assignment of risks between the government and water users for possible further reductions in water availability.

A regime of water entitlements, clearly defined and issued in perpetuity coupled with roll-over limits on water-sharing plans would create a much better regime to enable trading of entitlements to develop with associated environmental and economic benefits.

4.2 Establishment of broader market access and reduced barriers to trade

Allowing a separation of water entitlements from land means increased opportunities for non-farmers and irrigators to enter into the market.

Speculators can provide market depth by giving licence holders additional people to sell to and buy licences from. This is important for a structural adjustment in response to changing markets and as a response to environmental problems. By increasing the number of buyers and sellers, a truer market price is possible. Governments will be monitoring the market as it develops to see whether further regulation is necessary in the future.

4.3 Markets are fragmented

The restrictions on transfers between water sources means that there are multiple market prices for water. This is a consequence of the physical system and, while it may be possible to remove some of the barriers to assist in broadening the market, certain natural restrictions are inevitable.

Work is currently being done to determine the best way to establish interstate trading within the boundaries of the individual state systems. This might involve a tagging system, which would tag a water licence/allocation to its source and provide that the rules applicable to the allocation would be the rules applicable to the source rather than the state in which the allocation is transferred to. Alternatively, conversion factors could apply such that allocations transferred interstate would undergo a conversion but would then be subject to the rules in place in the state in to which the water is allocated.

The key challenges to expanding interstate trade are:

(a) smoothing out the differences between the states in relation to:

- definitions of water entitlements and their legal status;
- principles of compensation for loss of entitlements;
- allocation policies;
- barriers to trade out of districts;
- rules for managing system constraints;
- administrative systems;
- water accounting and registration; and

(b) establishing appropriate measures to deal with local and regional concerns about losing water.

Volumes of water traded represent only a small amount of the total water consumption in any one state.

5. Conclusion

Despite a long history in trading, at least in localised areas, the amount of water traded in a year in Australia is marginal and the states' frameworks for trading are still in their infancy. Volumes of water traded represent only a small amount of the total water consumption in any one state. The different ways that states define their water entitlements, together with the lack of consistent trading rules and compatible recording procedures between trading districts, indicate that the development of an efficient market has some way to go. Which brings us back to the first question: Why trade?

Recognising that water is valuable and scarce, coupled with a significant rethinking of the way we prioritise competing water uses, there is now a clear expectation among Australian governments that with the creation of the environment as a serious and significant participant in the water allocation system, there is a need to rely on market mechanisms to ensure an equitable distribution of a scarce resource. In short, the water for the environment has to come from somewhere.

The rules for and design of the market will be critical in ensuring the objective of equitable distribution and to ensure that the rules of trade do not become distorted but, instead, encourage efficiency. Given that water has value far in excess of its

economic value, it will be interesting to see the extent to which the market is able to capture this value and the extent to which governments will be willing to submit the value of water to market forces. Governments will need to reserve power to regulate or restrict trade to ensure the environmental health of our water resources and catchments. It is hoped that the National Water Initiative and the details of the intergovernmental agreement to be fleshed out early to mid 2004 will strike that balance and provide clear guidelines for state governments to manage competing uses of water through use of the market.

Acknowledgements

We are indebted to the assistance provided by my colleagues Paul Careless and Paul Rainey.

Endnotes

1 This article refers generically to water entitlements. Different states use different terminology, which includes water rights, licences, allocations and access rights.

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5 Mark Hampstead, 'NSW Legislation and Policy Overview', paper presented at The A–Z of Australian Water Trading Conference, 29–30 September 2003, Sydney.

6 Victorian Department of Natural Resources and Environment, December 2001, The Value of Water: A Guide to Water Trading in Victoria, 12pp.

7 'Water rights' in Victoria refers to the water entitlement that attaches to a land holding in an irrigation district.

8 ibid, 12–13pp.

9 Smith, M. 'Update on Water Trading in South Australia', paper presented at The A–Z of Australian Water Trading Conference, 29–30 September 2003, Sydney.

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14 See note 4.

6. Water sustainability: corporate best practice

Richard Jefferies and Neil Wallace

FEATURE

One company dealing with the day-to-day issues of water policy and reform is BlueScope Steel Limited, Australia's largest steel company. BlueScope Steel uses substantial volumes of fresh, salt and recycled water in its manufacturing operations across the country. For BlueScope Steel, the increasing focus on water as a precious resource has created both challenges and opportunities. The challenge has been to find ways of using water more efficiently in its own operations and, in particular, to substantially cut its intake of freshwater. The opportunity is to build on the company's many years of experience supplying AQUAPLATE® to the domestic market to develop a range of steel-based products for use in rainwater harvesting, irrigation and stormwater management to help governments, business, farmers and householders meet economic and environmental needs.

1. BlueScope Steel Limited

BlueScope Steel (formerly known as BHP Steel) is the leading steel producer in Australia and New Zealand, suppling the majority of flat steel products sold in these markets. BlueScope Steel's principal customers are in the building and construction, automotive, packaging and general manufacturing industries, and are located across the Asia Pacific region.

Flat steel products include slab, hot rolled coil, cold rolled coil, plate and tinplate, as well as branded value-added products such as COLORBOND® pre-painted steel, ZINCALUME® zinc/aluminium alloy-coated steel, and LYSAGHT® building products.

The company's steelworks at Port Kembla is Australia's largest, and one of the world's lowest-cost, producers of hot rolled coil. The other major Australian manufacturing operation is at Western Port in Victoria.

Steel rolling, coating and painting plants are located in Australia, New Zealand, Thailand, Malaysia and Indonesia, and the company has a network of rollforming facilities across the Asia Pacific region. BlueScope Steel also has a 50 per cent interest in a steel mini-mill in Delta, Ohio, US.

BlueScope Steel is a major Australian exporter, with the value of exports of finished and semi-finished steel products exceeding $1 billion per annum.

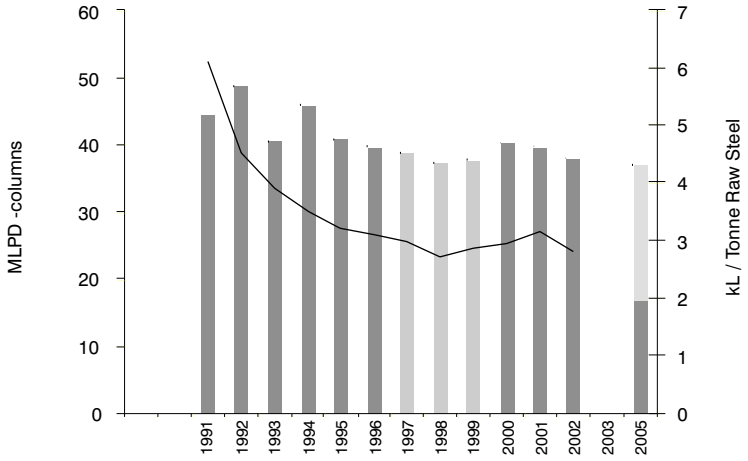
Since 1976, the company has invested over $300 million in environment improvements at the Port Kembla Steelworks. On 3 February 2003, BlueScope Steel announced the details of its fifth Environmental Improvement Plan for the Steelworks, which had been negotiated with the New South Wales Environmental Protection Agency. One key component of the plan is a stormwater management plan for the site.

BlueScope Steel has a long-standing commitment to water conservation within its operations. Access to water is critical to the safe operation of many of its plants and processes.

2. Water efficiency

BlueScope Steel's Port Kembla Steelworks is the largest consumer of freshwater in the Illawarra region of New South Wales, with around 35 million litres used

Table 1: Port Kembla works water use



throughout the plant every day, along with 850 million litres of saltwater used for cooling the process. Most of the site's manufacturing operations involve intense heat, and water is critical to the cooling of both plant and equipment, and the products and by-products of the steel-making process.

Over the last 10 years, the company has implemented major programs to significantly increase the amount of recycled water used, both from outside sources and by reusing water from the processes used to make iron and steel. A priority has also been to reduce the amount of water required in the production processes. Through these endeavours, the Steelworks has increased its water use efficiency from almost five kL of water used per slab tonne of steel produced in 1992, to 2.5 kL water/slab tonne currently. These initiatives have greatly reduced the amount of freshwater and seawater used in the plant, and also reduced discharges of water from the plant into Port Kembla harbour.

A significant associated part of BlueScope Steel's water initiatives has been the implementation of programs to ensure water that does leave the plant does not harm the environment.

2.1 Case study: water recycling benefits region

An important award-winning water recycling initiative between BlueScope Steel and Sydney Water will play a major role in preserving precious water supplies, while providing a significant environmental outcome for the Illawarra.

The landmark recycled water agreement with Sydney Water will reduce the Steelworks' freshwater consumption by more than 50 per cent, and greatly reduce the amount of wastewater going to ocean outfalls.

BlueScope Steel Port Kembla is the biggest single consumer of water in the Wollongong area. Working with Sydney Water, the company's employees developed the project that will see the Steelworks take 20 megalitres of treated water per day from the Wollongong Sewage Treatment Plant for a variety of industrial and environmental applications.

The scheme, which will commence in December 2004, will more than halve the Steelworks' freshwater consumption, reducing Wollongong's total freshwater consumption by up to 24 per cent. It will also make the Steelworks less vulnerable to water restrictions during times of drought.

Additionally, it will allow Sydney Water to consolidate its Wollongong operations at a new state-of-the-art sewage treatment facility just north of the Steelworks, and involves the closure of two ageing and outdated plants at Bellambi and Port Kembla.

A number of water conservation projects already undertaken, including increased efficiency and internal recycling of water, have increased the Steelworks' water use efficiency from five kilolitres of water used per slab tonne of steel produced in 1993, to 2.5 kilolitres water/slab tonne currently. This new recycling initiative will increase that efficiency again and see freshwater consumption drop to below 20 megalitres per day and efficiency at Port Kembla increase to below 1.5 kilolitres water/slab tonne.

Added benefits of this recycling plan are not only that of significantly reducing freshwater consumption for the entire region, but helping make Wollongong's beaches cleaner by taking and using the 20 megalitres of wastewater that would otherwise have been pumped into the ocean.

The initiative's significance was recognised when it won the Environment category of BHP Billiton's 2001 Health Safety Environment and Community Awards, though at that point the contract had only just been signed with Sydney Water, successfully competing against projects from the company's operations around the world.

2.2 Case study: harvesting rainwater for reuse

BlueScope Steel has, like many businesses in regional Australia, been impacted by drought and is now putting in place strategies and programs to reduce its reliance on freshwater by capturing and using stormwater and increasing its use of recirculated water.

Since commissioning in the 1970s, BlueScope Steel's Western Port Works in Victoria has captured rainwater falling on-site for reuse in its operations. This arrangement, under normal conditions, provides 30 per cent of the water for the plant's recirculating cooling water systems.

All stormwater falling on the Hot Strip Mill building is collected and saved in a water storage known as Lake Shegog, from where it is used to feed the manufacturing process. However, with the onset of periodic drought, this water storage dries up and the company has to revert to using reticulated water.

BlueScope Steel has entered into an Environmental Improvement Plan with the Environmental Protection Agency (EPA) to reduce freshwater consumption at Western Port by 10 per cent per year for the period of 2001–06. The result has been that although the 10 per cent reduction target was initially achieved, the impact of the most recent drought led the company to explore other opportunities to reduce water consumption. Among these opportunities is the interlinking of Lake Shegog and another stormwater lagoon on site, which will boost the supply of stormwater to the Hot Strip Mill Lagoon.

The company is also examining other small step improvements to help achieve this target.

In March and April 2003, BlueScope Steel Western Port and the Victorian EPA joined together to undertake a Pilot Integration Study (a Victorian first) to examine site water use, among other things. Two of the key recommendations from this study related to water-saving opportunities. The first recommendation was to interlink the two lagoons to use more saved stormwater (as mentioned above) and the second was to reuse an existing wastewater stream to further reduce reliance on freshwater.

The Western Port site extensively uses recirculating cooling water as a preference to once-through systems, so that 98 per cent of all water used on-site is recirculated.

In early 2004, the company will be working with South East Water to meet the Authority's target of a 15 per cent reduction in the water consumption by industry. This is expected to take the form of a site-wide audit, followed by recommendations and assistance to achieve further reductions.

3. Water the future—pragmatic observations on the need for early implementation

BlueScope Steel's track record in the use and reuse of water resources has led the company to look beyond its internal operations to new business opportunities. Specifically, the company is developing a range of innovative, steel-based solutions that will deliver user benefits while also having excellent sustainability attributes.

The challenge for BlueScope Steel is to create affordable solutions to move, store and reclaim water and eliminate waste. There are many ways to approach this, and the following illustrates BlueScope Steel's proactive position in water management.

In Rainwater Harvesting, the traditional steel rainwater tank is a familiar sight out-of-town. BlueScope Steel produces AQUAPLATE®—corrosion resistant steel with a food-grade polymer coating—which customers use to manufacture rainwater tanks. In addition to the traditional round design, tanks made from AQUAPLATE® steel are now available in a wide range of shapes, sizes and fashion colours, to suit almost any site and style of building. By designing space-efficient 'footprints', tanks now become appealing and practicable for city dwellers. Thus, millions of metropolitan residents will be able to harvest their own water resource and make an individual but very welcome contribution to the environment.

In urban areas, stormwater management has typically been treated as a drainage issue rather than as a valuable resource. Australia's ageing stormwater systems are designed to flush water away to rivers and oceans. Instead of wasting stormwater, potential uses include non-potable water for large urban irrigators—such as parks, golf courses and sports grounds—and domestic applications through the installation of a third pipe system.

BlueScope Steel is developing stormwater products that could be used to tap this important resource.

Securing sustainable water supplies for our cities and for industry is only part of the equation: there is an equally pressing need to modernise the irrigation infrastructure that supplies our agricultural production, and restore environmental flows to our river systems.

In the large-scale irrigation regions of Victoria and New South Wales, some

25 per cent of the water diverted from rivers is lost due to evaporation and leakage before it reaches farms. Even where such losses are not perceived as the major problem, 19th century open channel systems do not allow the accurate management of irrigation water that 21st century industry needs.

The Victorian Government has a target to raise the efficiency of water authority distribution systems by 20 per cent (by 2020) and BlueScope Steel is developing steel pipeline products that could play an important role in achieving this goal.

In summary, all Australians—individuals, communities, governments and corporations—have a collective responsibility to 'do it right'. There is no quick fix to the water issues confronting this country, so users, operators and suppliers need to embark on the long haul without delay.

There is no single material that is totally 'right'. Indeed, at BlueScope Steel, state-of-the-art composites are a key part of new solutions. However, steel's ability to be recycled *ad infinitum* and excellent life-cycle analysis credentials convey another message: products and solutions initiated now should advance 'best practice sustainability' and deliver net positive benefit to the communities, economies and environments where they are deployed.

CASE STUDY

7. Urban water cycle

Emeritus Professor Nancy F. Millis

1. Background

Australia's urban populations live predominantly in large centres on the relatively well-watered coastal plains in an otherwise dry continent. It is worth recalling that only one to two per cent of the rain that falls actually finds its way into a stream on the east or south-east coast of Australia, where the majority of Australians live, and 10 per cent of the rainfall is captured in streams; in the Adelaide region the yield is less than one per cent.

Water is not only in short supply, but the rainfall is highly variable. The history of the catchments for Melbourne shows severe drought at intervals of about 20 years; the current seven-year drought was preceded by similar dry periods in the 1960s and again in 1982. In the past, as populations in the cities expanded, authorities responded by building dams that held considerably more than the annual demand. The choice of site was governed by the availability of a valley relatively close to the city with the right configuration and geological properties, preferably on Crown land or in an area that was not intensively farmed. The diversity of the flora and fauna, the conservation values of the site and the effect downstream of the dam on the environment and the aquatic biota did not figure largely in the decision. The general philosophy was that water running to the sea was water wasted and that city dwellers, having paid their rates, had every right to an unlimited supply.

Today there is a far greater awareness and concern for environmental matters among the general public. Governments are also sensitive to this issue as well as to the very large cost associated with constructing and servicing yet another large dam.

This has prompted four states (Victoria, Western Australia, New South Wales and South Australia) to establish expert committees to provide them with a strategy to deal with the needs for their respective capital cities, 20 to 50 years ahead, bearing in mind the projections for increase in population, the expectations that the community holds for a safe and secure water supply, environmental values and the desirability of not building a new dam. Above all, it is recognised that the community must be informed and their views sought on any proposed options.

2. Urban water authorities

Urban water authorities in Australia have evolved separately, answering to their respective state governments, and each state has evolved a different management framework. Regulations governing the activities permitted in water catchments vary from those for Melbourne where virtually all catchments are closed to housing, agriculture and recreational activities, to others like those for Adelaide. Here, a wide range of activities is permitted in the catchments in the Mt Lofty Ranges, which provide 60 per cent of Adelaide's water; the remainder is drawn from the River Murray. In Perth, on the other hand, a major part of their supply (60 per cent in summer) comes from groundwater.

3. Quality control

The very different quality of the raw water from these sources has a major impact

upon the complexity of the treatment and disinfection processes required to ensure that the water complies with the recommendations of the Australian Drinking Water Guidelines (ADWG). For example, the water for Melbourne is stored for up to two years in deep reservoirs and requires only fluoridation and light chlorination, whereas Adelaide must flocculate and filter its water to remove organic matter before fluoridation and chlorination.

The ADWG have recently been reviewed and now include a Risk Management Framework to assist water managers to identify potential hazards to water quality and safety that may arise at any point in the chain of events occurring as water is collected in the catchment, is stored, treated, disinfected and distributed to individual households. In the past, the ADWG tended only to consider the characteristics of the water at the customer's tap. This is important information, but as the tests take one to two days to complete, water managers are handicapped in adopting a proactive position in identifying problems. The risk framework codifies a monitoring regime that identifies critical control points in the water treatment train, recommends emergency response procedures if equipment fails or water quality breaches recommended levels. Results at all control points must be regularly reported and reviewed and improvements in process developed as necessary. Importantly, the framework clearly identifies the responsibility of operators, managers and the board of directors.

This proactive approach to hazard identification was pioneered in Australia and the concept is now being taken up by the World Health Organisation in its recommendations on water quality and safety. All urban water authorities use the ADWG as the benchmark for water quality and their annual reports record their performance against this. However, whereas the day-to-day management of the supply is an on-going challenge, it does not include strategic planning for the needs of future generations.

4. Melbourne's water supply for the future

The rest of this chapter considers the process by which a strategy was developed for Melbourne to allow the currently available supply of water to be managed so that the needs of the population projected by 2050 (4.6 million) might be satisfied. It draws extensively upon the work and reports of the Water Resources Strategy Committee for the Melbourne Area, established by the Victorian Government in October 2000.

The Melbourne community is served by four state-owned corporations: Melbourne Water, which manages the catchments, dams and main aquifers; and three retail corporations, Yarra Valley Water, South East Water and City West Water, which reticulate water to customers and collect their wastewater for subsequent treatment by Melbourne Water.

In Victoria, 77 per cent of the water extracted from rivers is used for irrigation, 15 per cent is used by rural towns and industries and eight per cent is used by Melbourne. The Victorian Government permits Melbourne Water to extract 670,000 ML from its catchments in any one year and of this, 566,000 ML is currently available. Melbourne now uses about 480,000 ML, so this leaves a relatively small margin for emergencies and growth. The strategy committee established by the Victorian Government was thus faced with two boundary conditions—the likely increase in demand arising from a one-third increase in population and severe constraints on the possibilities of increasing supply.

CASE STUDY

5. Process adopted

The committee first gathered critical information from current and historical records of the sources of water and its use by the community. In Melbourne, 60 per cent is used in residences, 28 per cent by commerce and industry, eight per cent is lost by leakage and four per cent goes to miscellaneous non-revenue uses.

Within the household, 35 per cent is used outdoors, 26 per cent in the bathroom, 19 per cent for the toilet, 15 per cent in the laundry and five per cent to the kitchen. Melbourne has a population of 3.49 million, expected to reach 4.6m by 2050 (32 per cent increase), and households will increase from 1.29 million to 2.01 million (56 per cent increase) in that time.

Models of the trend in demand showed that the rate of increase in use was exponential from the 1930s to 1982. In the 1960s, there were drought periods followed by a particularly severe drought in 1982 when serious water restrictions were imposed. When these were lifted, the rate of increase in water use dropped from about three per cent per year before 1982 to just below one per cent, which is the current figure. This is attributed to a vigorous education campaign to save water, plus a change in the billing regime. All water used was charged by volume instead of a free allowance based on property value and a charge made only if an excess was used.

The trends shown in the model were extrapolated to the year 2050 for the current population, and with the population increased by a third, and with no change in the use per capita. The model showed that if there is no reduction in demand, severe restrictions would be required by about 2012–15, with the current population, but with 4.6m people and no change in demand, the current supply would not be appropriate beyond 2007 (see Figure 1).

Faced with these possibilities, the committee developed a document it called a Discussion Starter, which set down the background statistics and model predictions. It outlined possible ways in which society could modify its use of water and the savings such changes would make. It provided this information on the internet as well, and invited comment on these suggestions and any others the community

Figure 1: Water demand scenarios

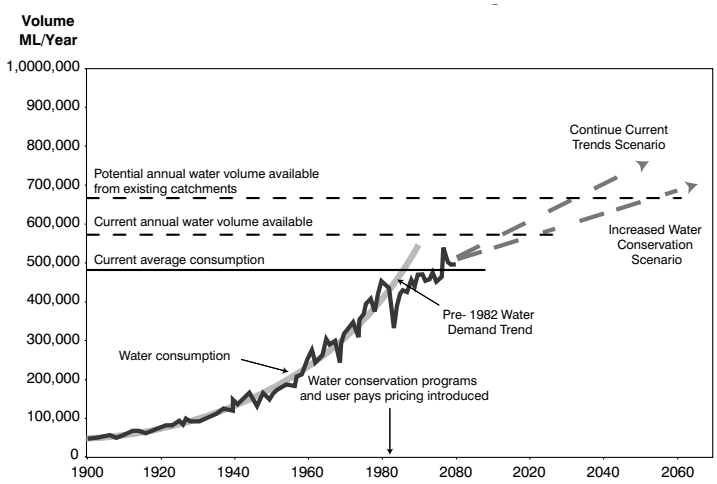
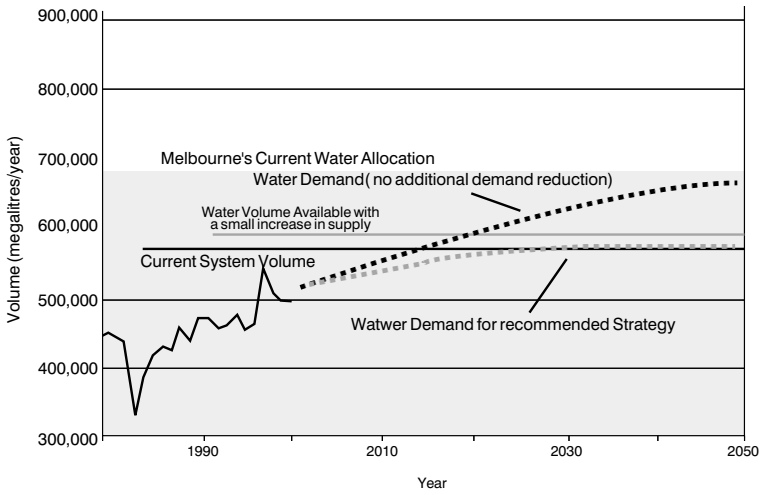


Figure 2: Water demand and supply



wished to offer. In addition, the committee commissioned expert reviews on particular topics. Using the reviews and community comments the committee developed four scenarios incorporating all suggestions for reducing demand. The most restrictive scenario aimed at using less water in 2050 than currently used; the other three were progressively less stringent and some allowed a minor increase in supply. The committee itself offered a preferred set of measures and all five scenarios were published as the Strategy Directions Report and released for comment. The Discussion Starter elicited 3720 website visits, the Strategy Directions Report 5200; the committee received some 300 written submissions for each document.

From comment on the Strategy Directions and further reviews the final report was presented in October 2002 to the Victorian Government.

6. Measures proposed

The committee recognised that no single measure would achieve the desired result and its recommendations encompassed measures involving: education; incentives; regulation; recycling; pricing and improving the quality of the water from the Tarago reservoir—currently not included in the distribution system.

Another recommendation was to install a new pipeline to draw more water from O'Shannassy reservoir or to withdraw more water from the Yarra River.

7. Education

It was recognised that all sectors of the community—schools, special interest groups, professionals, industry, municipalities and the wider public—must become familiar with the facts about the water cycle, and of the issues involved in managing in a cost-effective and environmentally acceptable way the demands for water of an increasing population. This responsibility lies with both the government (through its education and resource departments) and the retail and wholesale water agencies through their customer service networks.

Changing behaviour requires constant reinforcement; for example, enclosures with all

water bills reminding people to take shorter showers, to clean their teeth with the tap off, to use garden mulch and timers and dippers to water the garden, use covers on swimming pools and not to hose down paths.

8. Incentives

Monetary incentives will undoubtedly encourage the installation of water-saving devices, such as efficient washing machines, for householders to install household tanks and for developers to adopt water-sensitive urban design.

9. Regulations

Certain measures are best and most equitably achieved by legally enforceable regulations. The committee recommended that AAA-rated shower roses should be the only type on sale by 2005 and that only AAAA-rated washing machines should be sold after 2010. The Victorian Government's Green Paper issued in October 2003 has proposed this legislation be enacted by the governments of the Commonwealth and all states and territories. This approach has been highly successful in the wide adoption of dual-flush toilets.

The Green Paper also proposed to require all new dwellings to install either a household tank or a solar hot water service. Those installing a household tank in a house already built receive a $125 rebate.

10. Recycling

The committee recognised that large subdivisions offer the best opportunity for recycling greywater (laundry, bathroom and stormwater). This water must be treated and disinfected in a central plant and returned in a third pipe to houses for toilets and garden watering.

The cost of recycling schemes in large developments is estimated at about $2000 per block, and incentives are recommended to assist in their adoption. Similar recycling of treated greywater should be installed in all new high-rise complexes to supply toilets and garden water. The committee believes the public health risks and adverse environmental considerations make greywater recycling by individuals in built up areas inappropriate.

11. Industries and municipalities

Retail companies can readily identify the large industrial consumers of water. The committee recommends and the Green Paper endorses the proposal that over the next two years, the retailer assists each company and municipality to conduct an audit of their use of water and develop plans to minimise the use of potable water, maximise recycling and generally adopt best-practice procedures.

12. Increasing supply

In the Melbourne distribution system, the O'Shannassy reservoir frequently spills; it is possible that another pipeline could be constructed to collect a further 22,000 ML. A similar volume could be added from the Tarago reservoir, which is currently not connected to the distribution system because water quality is poor. A treatment plant costing some $40 million would enable this water to be added to the system.

Logging could be phased out, or further water could be extracted from the Yarra

River and still remain within Melbourne Water's cap. All of these latter measures have possible impacts on the aquatic environment and this would require careful scrutiny. The committee's preferred scenario suggested that the quality of the water in the Tarago reservoir should be improved at an estimated cost of some $40 million. This would add 22,000 ML to the supply.

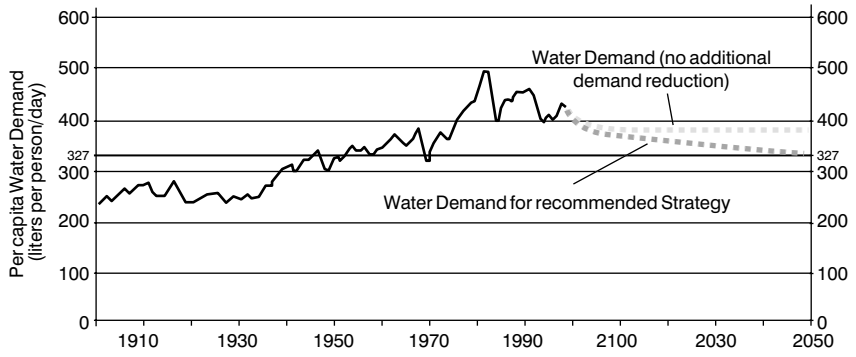
13. Pricing

The responses from many in the community indicated that water is undervalued. Water is charged in two parts – a fixed tariff for the service to provide water and a volumetric charge. The average percentage of the bill relating to volume varies with the retailer but is between 69 and 84 per cent of the total.

The committee considered a number of ways in which the price of water might be increased both to reflect its real cost and as a conservation measure. The ratio of fixed charge to volumetric charge could be varied.

At present, 75 per cent (on average) is volumetric and 25 per cent fixed; this could be changed to raise the volumetric charge to 90 per cent. If this were done, consideration would need to be given to large families and others for whom this change would be a serious socio-economic hardship.

Figure 3: Per capita water demand



The charge could be varied either by a step tariff where a lower rate is charged for a specified volume, with a higher rate applied for water used in excess of that volume. Alternatively, a lower rate could be charged in winter than in summer.

The committee recognised that water pricing is fixed by the Essential Services Commission but believed that the extra revenue derived from any one of these possibilities needs careful analysis and that incentives to encourage conservation should be met in part from the increased revenue. The committee estimated that reform of pricing could increase revenue by $40 million and save 12,000 ML of water.

The many issues considered by the Strategy Committee were all carefully assessed for their impact on demand and for their feasibility. Figure 1 and 2 summarise its major findings and Figure 3 shows the use of water per capita projected to eventuate by the year 2050, if the recommendations were implemented.

CASE STUDY

The committee's proposals have in very large measure been adopted in Minister Thwaites' Green Paper issued in October 2003, 'Securing Our Water Future'. The Green Paper emphasises the importance of continuing education on the need to conserve water and accepts that it is possible for Melbourne to maintain its reputation as a highly desirable city in which to live but we must change our behaviour with respect to water, and remember that every time we turn on a tap, we are taking water from a river somewhere.

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8. Future water resources for irrigation (technology and sustainability)

John Blackwell, Shahbaz Khan, Nihal Jayawardane, Tapas Biswas and Evan Christen

1. Background

'Drought has focused Australia's attention on our water resources, reawakening the debate on equitable distribution, security of access rights for water and the impact of commercial production on the environment'. (Murrumbidgee Irrigation Annual Report, 2002–03)

Will the advent of the inevitable 'flooding rains' quell the debate, or is it here to stay?

Either way, irrigation is a crucial component in the world's food supply, helping to produce 30 per cent of total food and 50 per cent of the two major staples, wheat and rice (Hillel, 1991). Maintaining irrigated food supply and creating sustainable irrigation systems are, therefore, imperative for global population wellbeing.

In Australia, 26 per cent ($7 billion per annum) of the gross value of all agricultural production comes from irrigated farming, producing flow-on economic benefits of five times this value. Irrigation is profitable, producing 50 per cent of Australia's farm profits from one per cent of the agricultural land. Irrigation, like most other human pursuits, has an effect on its environment that, if not well managed, can have environmental implications for the broader environment. The two most obvious effects are: water withdrawal from rivers and streams to satisfy irrigation requirement, resulting in less water available for other consumptive uses or the environment; and discharge of irrigation drainage and wastes, either to watercourses or aquifers.

There is a plethora of irrigation techniques now available to improve the application efficiency of water to more closely match the crop's water requirement, plus the requisite leaching fraction.

Sustainable irrigation requires a downward movement of water through the root-zone to leach it of accumulated salts. This salt accumulation is more rapid in a high evaporation environment, as experienced in most of Australia's irrigation areas.

Drainage, either natural or constructed, is, therefore, an important prerequisite of a sustainable irrigation system.

2. Technology

There is a plethora of irrigation techniques now available to improve the application efficiency of water to more closely match the crop's water requirement, plus the requisite leaching fraction. These range from improved methods of surface irrigation through pressure-based sprinkler systems and micro (drip, subterranean drip and micro spray) systems to hydroponics and even aeroponics. Many of these systems are not suited to large-scale agriculture, and for all of them to function efficiently good management is required.

To be able to manage well in an irrigation context we must be able to measure parameters such as water flow, water quality, soil water, plant water use and the hydrological effect of our actions. Again, there are numerous techniques available to measure most of these parameters. What seems to be missing in many cases is the ability to integrate them all, and also their effective extension to end users.

In spite of the technologies available to us, and our profession of good management, many irrigation areas now suffer from shallow and, in many cases, saline watertables

(Blackmore and Lyle, 1993). Often, the ability of underlying aquifers to dissipate any additions below the root-zone is limited. For example, in the Murrumbidgee Irrigation Area it can be less than 10 mm per year, unless farming practices are confined to well-connected aquifers (Khan, et al., 2003). Given reasonably effective winter rainfall in our southern irrigation areas, artificial drainage will be necessary into the foreseeable future. Once again, the tools are available to design efficient drains, however, it is difficult to know what to do with the resulting drainage. Historically, in some areas, it has been put back into the river, which is causing many environmental problems. More recently, it has been directed into evaporation basins for 'disposal', which is surely a waste of a resource.

What is needed is some innovative thinking outside the square to come up with solutions, which address all of these problems and supply the hackneyed 'triple bottom line' benefit.

Outlined in the following paragraphs are a few novel ideas that are worthy of further discussion in the current, vexed water debate.

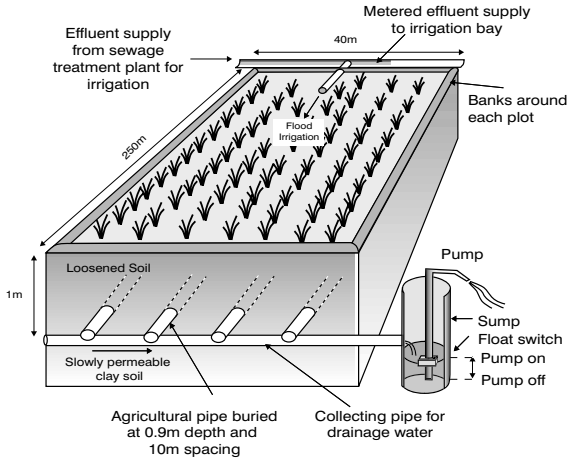
3. Using 'wastewater' as a substitute for freshwater supplies

Using secondary treated sewage effluent for irrigation is fraught with difficulties unless full recognition of drainage requirements is made in the planning and design stage. The practice is often rendered uneconomic because of the cost of winter and wet weather storage when irrigation is not required. CSIRO has been working on environmentally sustainable and economically viable low-technology irrigation-cum-drainage and zero discharge techniques (e.g. FILTER and SBC) for the treatment and use of sewage effluent for intensive agriculture and aquaculture. An exciting advantage of these systems is that they do not need to be developed on prime agricultural land and are ideal for peri-urban agriculture and/or aquaculture, which are often major suppliers of vegetables and fish for cities, particularly in developing countries.

(a) FILTER—The FILTER (Filtration and Irrigated Cropping for Land Treatment and Effluent Reuse) system (Jayawardane, 1995) is a novel system for land-based treatment of secondary treated effluent, addresses the problems above and is potentially both environmentally and economically sustainable. The FILTER system (see Figure 1, opposite), has been tested for five years as a co-operation between Griffith City Council and CSIRO Land and Water. FILTER uses a system of flood irrigation and subsurface agricultural drains to process sewage effluent by stripping out nutrients, pathogens, suspended solids and BOD using a combination of volatilisation, oxidation, reduction (i.e. denitrification) and soil adsorption processes. The quality of the treated effluent (≤ 10 mg/L N and ≤ 0.4 mg/L P) meets current New South Wales Environmental Protection Agency limits for discharge to surface water bodies (Biswas et al., 1999).

(b) Description of the FILTER system—FILTER operations can be planned on a fortnightly cycle, where effluent is applied (100 mm to 150 mm) over two days, followed by a one-to-two day post-irrigation equilibration period and an eight-to-10 day pumping period during which the effluent slowly passes through the soil to 0.9 to 1.2 m deep agricultural drains and a collection sump. This is followed by a one-to-two day post-pumping equilibration period. The cycle is then repeated. The subsurface drainage system provides suitable soil conditions for crop growth, even

Figure 1: Schematic layout of a typical FILTER Bay



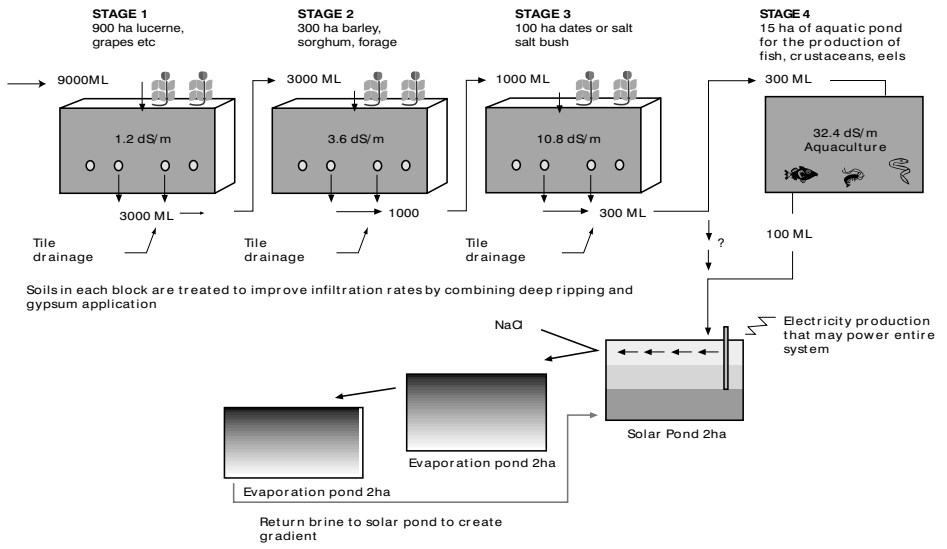
during heavy rainfall and low evapotranspiration periods, obviating the need for expensive storage. Effluent flow rates through the soil profile, and the depths of the watertable in the FILTER plots are controlled through regulated pumping from sumps. During this regulated flow of effluent, nutrients are adsorbed on the surface of soil particles or taken up by the crop and weeds.

The FILTER system can operate with a variable leaching fraction; 33 per cent or more is common, thus, it is also an effective biological salt concentrator that can be adapted to manage salt in many natural, or artificial, saline waste streams.

4. Using saline waters

Sequential Biological Concentration (SBC) based on the above FILTER system takes saline water through a series of six potentially productive cells or stages. It enables

Figure 2: Schematic representation of possible layout, flows and concentrations of the SBC system



farmers and communities to achieve environmentally sound management of salt, while generating many income streams from a deleterious waste.

The Serial Biological Concentration (SBC) system (see Figure 2, page 63) replicates three stages of the FILTER system to produce drainage waters with three times the salinity of the incoming water, due to the 33 per cent leaching fraction. Discharge from the aquaculture in the SBC system has the potential for electricity generation using a solar pond and, finally, for salt production using evaporation basins.

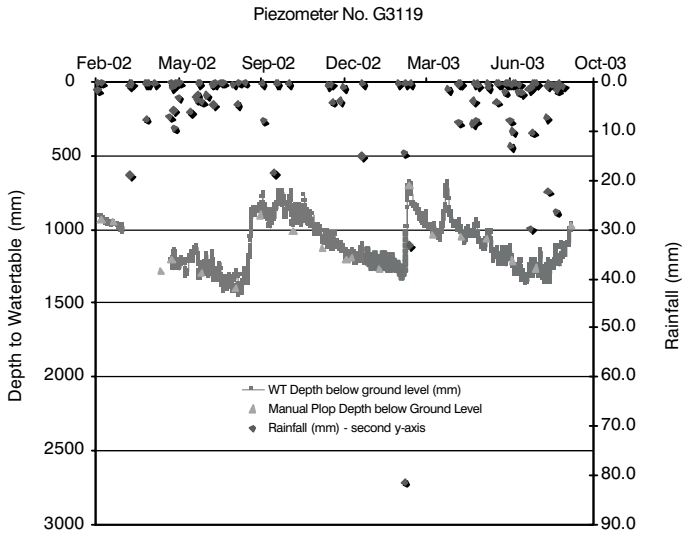
FILTER and SBC in combination, thus, offer opportunities to handle high volume saline discharges in a sustainable manner—this is by reusing the resource, protecting the broader environment and, at the same time, protecting the reuse site and its environs from the adverse impacts that can accompany traditional irrigated land treatment systems.

5. Mulch farming

In line with the environmentalist argument for a more natural system, it would seem prudent to revert as far as possible to a mulch system of farming. Nature, in spite of millions of years of evolution, has never come up with any sort of mechanical plough. Other than biomass generation in the root system of plants, and some detritus accumulation in soil cracks, all natural organic incorporation into soil is by organisms biologically incorporating surface litter (McCalla and Dudley, 1943). Once a high watertable has developed in an irrigation area, much of the water lost from the area is by soil evaporation due to capillary rise from the watertable. Surface mulching reduces direct soil evaporation.

Figure 3 illustrates groundwater response in a limited regional groundwater outflow situation, such as in many parts of the Riverina. This equilibrium is the fate of all irrigation systems if the groundwater recharge exceeds groundwater outflow capacity. The watertable fluctuates at around 1.5 metres and groundwater

Figure 3: Groundwater response in a limited groundwater outflow capacity

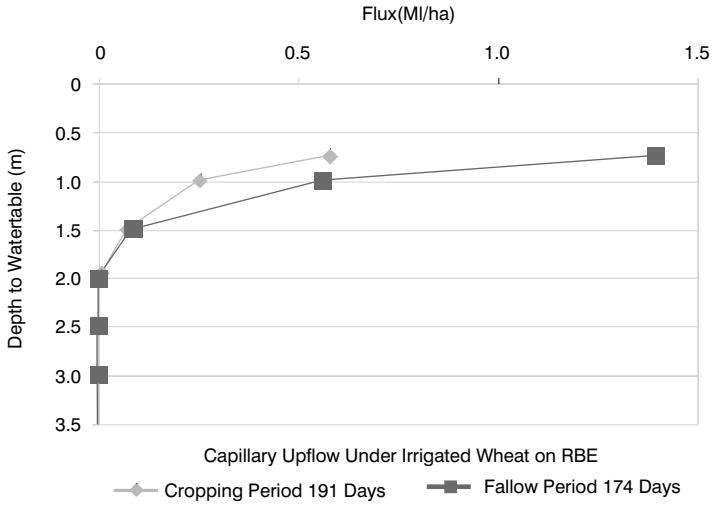


responds rapidly to minor inputs of rainfall or irrigation. For example, there was around a 1 m rise of watertable for 80 mm of rain during March 2003. The decline in watertable depth is restricted to around 1.5 m. This decline is mainly due to capillary upflow that presents a risk of salinisation of land. It is obvious that such areas are in a water equilibrium situation, and now the challenge is to manage the salt equilibrium using improved management of irrigation, land and drainage.

In situations where groundwater salinity is low, shallow watertables represent a resource that can be utilised by growing crops to use the watertable. Muirhead (1967) found that barley sown after rice extracted up to 20 per cent of its water requirement from the watertable. Humphreys, et al. (2001) showed that wheat sown after rice can access up to 1 mL/ha of stored water. In a review, Ayars (1996) showed that many crops can use large amounts of water from shallow watertables, even when those watertables are relatively saline.

For most land uses, when the watertable is 1 m or less, capillary upflow volume is 0.5 to 1.5 mL/ha (Khan, et al. 2000) with a potential for 2 to 4 t/ha upward movement of salt for a groundwater salinity of 5 dS/m (e.g. Figure 4 for irrigated wheat). When the watertable is deeper than 1.5 m to 2 m, most soils show negligible capillary upflow.

Figure 4: Modelled capillary upflow under irrigated wheat on a transitional red-brown earth



5.1 Why mulch?

To mechanically incorporate residue consumes extra fuel. To burn the residue, a common practice in many rice/wheat producing areas of the globe, constitutes an environmental and health risk of monumental proportions. By using surface mulch techniques, the plant water use can be improved from shallow watertable areas, which will reduce waste of the water resource and reduce the risk of salinisation of topsoil layers. Direct seeding without incorporation or burning is the solution. However, no 'Zero Till' seeder known (to the authors) is capable of sowing direct into a heavy, mechanically harvested, rice straw crop.

The Happy Seeder is an innovative approach to the problem developed by CSIRO

Land and Water. This has overcome the difficulties encountered by engineers addressing this problem for the last 40 years. The approach simply combines the attributes of two machines: the forage harvester and any direct till drill. The forage harvester cuts, chops and lifts the straw, presenting to the drill an eminently suitable soil surface for direct drilling. The chopped material is dropped directly behind the drill as mulch on the seedbed (right).

The Mark 3 Happy Seeder sowing wheat into rice stubble in the Punjab, India

Four machines have been constructed in conjunction with the Punjab Agricultural University in India. Field trials in India last year confirmed the efficacy of the approach and the claims made above.

6. Improving environmental water use efficiency

In the current water debate, much is made of the need for all current users of water to improve their water use efficiency in order to supply water thus saved as a contribution to environmental flow. The environmental flow required to have any positive effect (Murray–Darling Basin Commission 'Living Murray' 2003) is in excess of 1500 GL. The environment should also be charged with maximising its water use efficiency.

Connectivity between the river and its floodplain is one of the five key river system level attributes that are assessed in the Living Murray initiative. However, at present there is no way to flood these areas in a timely and efficient manner without creating a flood down the whole river. This practice is potentially wasteful, and potentially damaging to other environments and infrastructure. If water can be applied to the floodplain to fill wetlands and billabongs without raising the river to high levels, a major portion of the environmental objective will have been met while saving water.

What is needed is a method of watering and dewatering Wetlands and Billabongs without the need for piggybacking environmental flows on top of an already high river.

Conceptual thinking needs to progress into design details and operational methods for a floating or amphibious barrage that can get to any point in the relevant river reach, can create its own temporary weir pool, even at low flow, for efficient high-volume lift-pumping or gravity flooding of the target area. In many cases, it may even generate its own hydropower with any power excess to requirements being channelled into the grid at suitable sites.

The most cost-effective options for the barrage system need to be investigated, including permanent or temporary anchorage systems, hydropower generation

feasibility and scale factors. This work will be highly relevant to the 'Living Murray' debate in providing a practical alternative to the generation of large floods in rivers to water environmental assets. The major economic benefits are associated with reducing the environmental flows required from year to year and making this water available for irrigation. The alternative may be a healthy river but few people living by it. Artificial floods for environmental purposes can be made safe and avoid infrastructure and community damage and disruption.

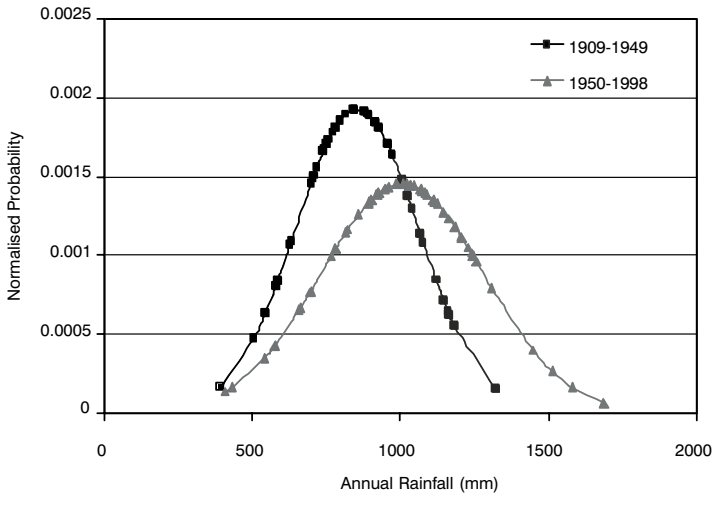
7. Climate change

No matter how possible it is to create and manage a sustainable irrigation area, perhaps making use of some of the novel ideas cited above, the spectre of climate change and the ability to predict its effect and timing hangs over all human endeavour.

8. Climate Variability in Australia

Rainfall and run-off variability in Australia is higher than most parts of the world, except for Southern Africa (Shiklomanov, 2000). There has been a major climate shift in south-eastern Australia since the 1950s. Figure 5 shows the normalised distribution of annual rainfall at Burrinjuck Dam, located in the upper part of the Murrumbidgee Catchment in NSW. This was arrived at by dividing the total rainfall data into two periods, before and after 1950. After the 1950s, mean annual rainfall has increased as has the overall variability of rainfall, which indicates more frequent extreme low and higher rainfall events.

Figure 5: Normalised annual rainfall distribution at Burrinjuck—Upper Murrumbidgee Catchment



It is not only rainfall that shows this extreme variability in south-east Australia; river flows also show similar patterns. For most Australian rivers, the ratio of maximum to minimum annual stream flow is in the range of 300 to 1000 (Burton, 1980) compared to three to 10 for most European rivers and three to 15 for North American rivers.

Figure 6 (page 68) shows the annual flow variability of the Lachlan River at Forbes.

Figure 6: Annual flow variability—Lachlan River at Forbes

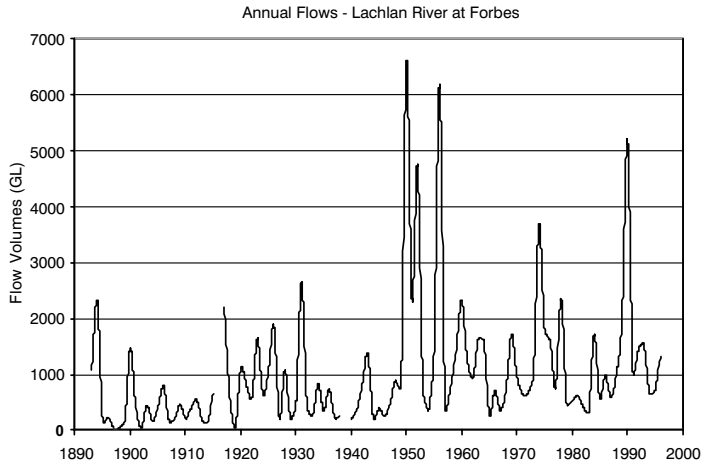
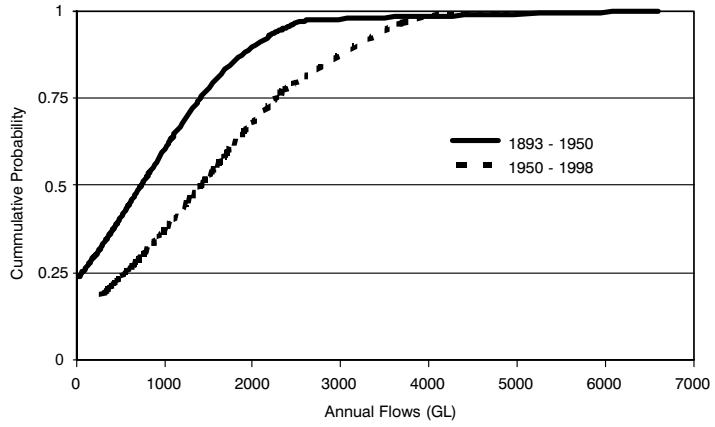


Figure 7: Cumulative annual flow probability—Lachlan River at Forbes



Increased flows in catchments may be due to a climate shift confirmed by a similar shift in rainfall, or enhanced run-off due to clearing of land—or a mix of both. Shift in annual flow volumes can be quantified by plotting cumulative probability of flows. Results of such an exercise for the Lachlan River at Forbes (see Figure 7) show that overall availability of water increased after the 1950s. With a 50 per cent cumulative probability, flows at Forbes on the Lachlan River show an annual shift from 750 GL to 1420 GL.

The increased 'wetness' of the later part of the last century may have mislead policy makers, resulting in an over allocation of surface and groundwater resources in many parts of Australia.

8. Conclusion

This paper has clearly highlighted a different approach to managing urban and

rural waste streams while maintaining and enhancing the productive capacity of our limited water resources. Techniques such as stubble mulching can be a lateral way of managing losses from high watertables while protecting soil productivity and environmental assets. There is a need to recognise climate variability and change in all strategic and tactical planning and management of water in this, the most arid, continent. Having accepted a managed system within a harsh climatic context, we must be as smart and innovative as possible in achieving our aims. Managing 'environmental' water is one such option.

However, it is important to not be arrogant enough to believe these technologies will not cause other unforseen problems, which, again, will have to be addressed. The need to continuously reassess the ability to manage the biophysical resource base is crucial.

Evolution is a continuous process, and there are no panaceas to the problems that will be encountered on the journey.

Acknowledgements

In undertaking the work for these various projects, the authors acknowledge the funding and help afforded by many organisations and individuals, including Griffith City Council, ACIAR, NHT, DLWC, the MIA Sustainable Development Committee and DPIE.

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9. Institutional and regulatory arrangements in the Australian urban water industry

Dr John Langford and Claude Piccinin

1. Introduction

Australia is a federation of state and territory governments. Under this system of government, the Constitution gives responsibility for oversight of water matters to state and territory governments.[1] Given the diversity of demographic, socio-economic and geographic profiles among the various jurisdictions, it comes as no surprise that the institutional arrangements and regulatory frameworks for water services in Australia vary between states and territories.

The diversity of institutional arrangements and regulatory approaches has provided a virtual laboratory experiment of industry reform across the nation. This experiment offered a unique opportunity to observe and learn from the experiences of the various approaches taken in different jurisdictions.

The CoAG institutional reform principles aim to promote a commercial focus for water-service providers and also call for an integrated approach to natural resource management.

While economic regulation of the Australian water industry is state, or territory, based, the National Competition Policy agreement reached between the Commonwealth, the states and territories delivered a common and consistent aim for all the regulatory regimes. The national competition principles and their application in respect of the water industry is best articulated in the National Competition Council's (NCC) Water Resource Policy attachment to its Compendium of Agreements. It should also be noted that the Trade Practices Act extends to water utilities and, accordingly, the Australian Competition and Consumer Commission retains oversight regarding business practices of water-service providers and consumer protection for their customers.

2. The CoAG reforms

The Water Resource Policy was shaped by a number of agreements reached during a series of meetings of the Council of Australian Governments (CoAG) and the then Agricultural and Resource Management Council of Australia and New Zealand (ARMCANZ). The agreed nationally consistent framework of reform[2] applicable to the urban water industry covers a number of aspects aimed at promoting a more efficient, customer-driven service provision. The reform principles target: natural resource management; pricing; trading in water entitlements (CoAG references to trading are in respect of rural water reforms, but future applications may be wider); institutional reform; and improved public consultation.

The reform principles for the urban water industry go into detail in respect of institutional, pricing and public consultation reforms and these are summarised here.

The CoAG institutional reform principles aim to promote a commercial focus for water service providers and also call for an integrated approach to natural resource management. In terms of the institutional requirement for a commercially focused water service provider, the principles explicitly leave it to the discretion of each state and territory government to choose from contracting out, corporatisation or privatisation. The reform principles call for the institutional separation of water resource management, standard setting, regulatory enforcement and service provision. There is also a requirement for interagency performance comparison to ensure service providers seek to achieve international best practice (the NCC has adopted WSAA*facts* as the industry publication that meets this requirement).

The pricing reform principles further reinforce the commercial focus of the CoAG reforms. The reforms require the adoption of a volumetric charge for bulk water and a two-part consumption-based tariff for retail water, the elimination of cross subsidies, the identification of remaining subsidies through a transparent reporting of community-service obligations (CSOs) and full-cost recovery.

The reforms introduced by CoAG have had considerable impact on the urban water industry's pricing practices. Australia is one of the few countries[3] where there is almost universal metering of urban residential properties. The reforms were able to leverage from this opportunity. The CoAG reforms have resulted in almost all major cities[4] introducing a two-part water tariff for their residential customers.[5] The urban water industry is also currently revisiting the issue of pricing structures to determine whether alternative pricing structures could play a role in further water conservation.[6] This is a timely development, given the emphasis on water conservation in the new CoAG reforms (see below).

Full cost recovery includes externalities—that is the inclusion of all relevant costs and benefits associated with the service provision that were not the primary intent of the original transaction. While it is the intent of the CoAG reforms that externalities should be included in full cost recovery, this has yet to take place.

The reforms further require that pricing for water services leads to earning of real rates of return. This aim has been achieved by most Australian urban water utilities. Finally, the CoAG reforms require the payment of tax, or tax-equivalent payments, to ensure competitive neutrality between private and public sector providers. The Commonwealth has put into place arrangements to ensure that tax-equivalent payments from corporatised state-owned enterprises are retained by the state governments.

The reforms further require that pricing for water services lead to earning of real rates of return. This aim has been achieved by most Australian urban water utilities.

The CoAG Communiqué of August 2003 signposted the direction of future water reforms. The communiqué highlighted the principal elements of future reforms to be negotiated in the coming months. These elements, which form the National Water Initiative, include: improving the security of water entitlements; expansion of water trading across state boundaries; and promoting water conservation in urban areas.

It is possible that these reforms will in turn have implications for the institutional and regulatory arrangements of the urban water industry. It is conceivable to envisage new institutional and regulatory arrangements for each of the above areas.

3. Institutional arrangements—water service providers

State and territory jurisdiction regarding water matters resulted in the establishment of various water-service providers of very different scale and scope. The impact of the CoAG reforms on water service providers was principally felt in the separation of water resource management, standard setting and regulatory enforcement—roles previously carried out by an independent water board or local government.

Western Australia, South Australia, the Northern Territory and Australian Capital Territory (ACT)[7] opted for state and territory-wide water service providers.[8] In all these states and territories, the water service provider is vertically integrated. In both Western Australia and the Northern Territory the water service provider owns and operates its assets. In South Australia, the water service provider owns the assets but maintenance of the infrastructure has been outsourced through a long-term contract

to United Water, a consortium of private firms. The provision of water services in the ACT is undertaken by ActewAGL. ActewAGL is jointly owned by Actew (owned by the ACT government, which retains ownership of the water assets) and AGL (a private company listed on the Australian Stock Exchange).

The remaining states (New South Wales, Victoria, Queensland and Tasmania) opted for local water service providers. In some cases ownership rests with local government while in others with the state government. In Victoria, the institutional arrangements were reformed in various stages until the existing structure emerged. The water service provider for the city of Melbourne was disaggregated into a wholesaler (Melbourne Water) and three retailers (Yarra Valley Water, South East Water and City West Water). The remainder of the state of Victoria is served by a number of regional water service providers (the result of a series of amalgamations of smaller local government and independent water bodies). These amalgamations have generally resulted in regional utilities with a clear focus on water services, substantially greater scale of service provision with commensurate gains in operational capability, efficiency and skill base.

The reform process, and its emphasis on a commercial focus for the water service provider, has also impacted on the operating structure of the various water service providers.

In New South Wales, the state government owns the water service providers for the cities of Sydney and Newcastle; elsewhere in the state local government is the owner of the water service providers. All are vertically integrated with the exception of Sydney (where the Sydney Catchment Authority is responsible for the bulk water provision and Sydney Water is responsible for water treatment and retailing and wastewater services). Another development in some of the other states was the formation of wholesalers owned by a number of local governments and, in some cases, the state government (e.g. Sydney Catchment Authority, Hobart Water, Gladstone Area Water Board, SEQWater).

The reform process, and its emphasis on a commercial focus for the water service provider, has impacted on the operating structure of the various water service providers. Many of these providers have evolved from water boards and authorities through various stages of commercialisation. In some cases these utilities have been corporatised (e.g. the Water Corporation and Hunter Water Corporation). Most of the non-metropolitan water service providers are either authorities or part of the local government council. The service provider for the ACT (e.g. ActewAGL) has evolved into joint ventures with the private sector.

4. Regulatory arrangements

4.1 Economic regulation

Economic regulation in New South Wales is the responsibility of the Independent Price and Regulation Tribunal (IPART). IPART determines pricing and return on capital matters after public hearings, during which any interested observers can make submissions. It is important to note that IPART oversees other utility industries such as gas and electricity. To date, IPART has also monitored customer-service standards set out in operating licences and customer contracts. In 2001, IPART began a series of reviews to determine customer service standards.

In Victoria, the then Office of the Regulator-General (ORG) had responsibility for monitoring performance in respect of customer service standards as set out in the operating licences of the three Melbourne retailers. ORG had price oversight for other utilities (e.g. gas and electricity) but not for water. The previous government had

stated its intention to hand regulation of water prices to the ORG but did not do so. The state treasury previously determined prices for the metropolitan water service providers. The process was not subject to public scrutiny. The price setting role was later passed to the Department of Natural Resources and the Environment for the last price determination (prices had been frozen until July 2001). The existing state government has established the Essential Services Commission, which will become the independent water price regulator as well as having responsibility for monitoring and setting customer service standards. The Essential Services Commission, like its predecessor ORG, will have oversight responsibility for other utility industries.

The Queensland Competition Authority (QCA) has the responsibility for economic regulation for utility industries, such as water and has an obligation to ensure adherence to competitive neutrality principles and responsibility regarding any third-party access regime. The provision of water services in Queensland is undertaken by local government and, to date, pricing is a matter for the individual councils through their budgetary processes. However, an amendment to QCA Act has given QCA surveillance powers over water prices. QCA has recommendatory powers in respect of enterprises owned by local government but deterministic powers regarding private companies or those owned by the consortia of state and local governments. Its findings, however, are made public. The state government can declare which water businesses would come under the price oversight of QCA under its own initiative, at the request of the local government or at that of QCA. The Department of Natural Resources and Mines is the customer service regulator and has also responsibility for strategic asset management (including the power to appoint third-party or spot audits.

The existing state government has established the Essential Services Commission, which will become the independent water price regulator as well as having responsibility for monitoring and setting customer service standards.

In Western Australia, the Office of Water Regulation (OWR) and the Minister for Water Resources shared responsibility for economic regulation of the state-wide water service provider (the Water Corporation). The OWR licensed the Water Corporation, setting the customer-service standards and monitoring performance. Price setting was within the minister's remit, following consultations with the treasurer and the Cabinet. More recently, however, the State Government reshaped the ministerial portfolios, leaving water allocation with the Minister for Water Resources, but placing the Water Corporation under the responsibility of the Minister for State Enterprises and announcing the intention to create the Economic Regulation Authority (ERA)—a multi-utility regulator. ERA will report to the Treasurer. ERA would also cover the water industry and monitor and determine customer-service standards. Price setting will remain with the State Government. An unusual development has been the establishment of a separate water policy body with a broad remit. It is also worth noting that Western Australia has a clear and transparent method of estimating CSOs. These CSOs predominantly arise from the application of uniform water pricing throughout the state.

South Australia also has a state-wide water service provider, SA Water. Customer service standards are set by the Minister for Water Resources in SA Water's performance statement. The document covers all other performance aspects (including financial performance, which is negotiated with the Treasury). In terms of economic regulation, the Minister for Water Resources determines prices, short-term return on assets and CSOs after Cabinet consultation and submissions from SA Water. There is no independent oversight of customer service standards. In 1996, SA Water had been declared for price oversight by the Competition Commissioner. However, after

the commissioner issued a report on pricing principles, the State Government rejected the recommendations and the declaration lapsed in 1999. The state government has established the Essential Services Commission of South Australia. The extent to which the powers of the commission extend to water remains to be determined.

As in Queensland, local governments in Tasmania have kept the responsibility for the provision of water services. There is no regular monitoring by regulators but water authorities have internal reports for customer-service standards and also provide reports to their owner and customers. Local governments set prices for customers on their own initiative. The Government Prices Oversight Commission sets target rates of return for assets and recommends pricing principles and maximum revenue levels for Hobart Water, the city's water wholesaler. Cabinet discusses these and the minister announces the outcome.

The principal areas of regulation impacting the urban water industry, aside from economic regulation, are public health, the environment and water allocation.

The ACT has a regulator (ICRC) that sets the scene for economic regulation but the administration of those arrangements is contracted out to the New South Wales economic regulator in respect of pricing and rate of return on capital. Customer-service standards are not regulated but the water service provider reports its performance outcomes in its annual reports.

The shift from ACTEW to the joint venture between ACTEW and AGL took place on 1 October 2000. The institutional shift was accompanied by a new regulatory regime. The joint venture service provider reports to the regulator regarding performance standards and be subject to external audits and financial penalties for any breaches.

In the Northern Territory, economic regulation has also changed. Price setting has been shifted from ministerial oversight to the same territory regulator that regulates electricity prices. The Commonwealth Government provides CSO payments to the water service provider.

4.2 Other regulation

The principal areas of regulation impacting the urban water industry, aside from economic regulation, are public health, the environment and water allocation. Some jurisdictional differences are in evidence, but to a much lesser extent than is the case for economic regulation.

In New South Wales, NSW Health determines public health regulatory requirements. Environmental oversight is through the Department of Environment and Conservation (formerly the EPA). Water allocations are issued through the Department of Infrastructure, Planning and Natural Resources.

The Department of Human Services sets out the public health standards for each service provider in Victoria. Environmental oversight is provided by the state EPA and water allocation is determined by the Department of Sustainability and Environment.

In Queensland, public health regulation is the responsibility of the Department of Health. The Department of Natural Resources and Mines determines water allocation and the EPA has environmental oversight for service providers.

In Western Australia, the Department of Health has responsibility for public health regulation and the Department of Environment has environmental oversight. Water allocation used to be the responsibility of the Water and Rivers Commission but the responsibility has been transferred to the Department of Environment.

The state EPA and the Department of Human Services, respectively, have regulatory oversight in South Australia for environmental and public health matters. Water allocation is the responsibility of the Department of Water, Land and Biodiversity Conservation.

In Tasmania, the Department of Health and Human Services oversees public health regulation and the Department of Primary Industry, Water and Environment has responsibility for water allocation and environmental matters.

In the ACT, water allocation and environmental regulation are the responsibility of the EPA, whereas public health oversight is the responsibility of ACT Health.

In the Northern Territory, water allocation and environmental matters are regulated by the Department of Infrastructure, Planning and Environment, while oversight of public health issues is the responsibility of the Department of Health and Community Services.

5. The regulatory experiment

It is clear that Australian economic regulatory models span the entire gamut from completely arm's-length regulation of prices, return on capital and monitoring of customer-service standards to self-determination of prices and customer-service standards. There remains a middle ground of ministerial or departmental determination of prices and customer-service standards. This middle ground suffers from the obvious conflicts of interest of the shareholder wanting higher dividends, a government having an obligation regarding consumer protection from monopolistic behaviour, and a political aversion to higher prices. The virtual laboratory experiment with economic regulation has, however, converged towards arm's-length regulators[9] spanning several utility industries with monopolistic features.

The only jurisdiction that seems content with leaving retail pricing to the discretion of the water authorities is Tasmania.

The only jurisdiction that seems content with leaving retail pricing to the discretion of the water authorities is Tasmania. However, that self-determination is limited to small local government water retailers[10] (the wholesaler for the city of Hobart faces a recommendation by an independent price regulator and a determination by a minister).

The regulation of customer-service standards has a clear trend towards the same independent regulators with price oversight and with the regulator setting, as well as monitoring, service standards. Queensland has chosen departmental oversight. Tasmania's water retailers are quite small but South Australia, with a state-wide service provider, opted for self-reporting.[11]

Regulation of public health and the environment are uniformly the responsibility of the state departments and authorities having respective responsibility for health and the environment. There are, however, differences in respect of regulation of water allocation in the different jurisdictions. In most states and territories the responsibility rests with the environmental authority. In a minority of states that responsibility has been given to the authority having responsibility for natural resources. The approach taken by the minority of states has the attraction of placing all potential users of the scarce resource (e.g. the water utilities, irrigators, environmentalists) on an equal footing in putting forward their claims.

6. Conclusion

The institutional changes of the structure of the water-service provider have brought about a more commercial focus. Over the last 15 years, the urban water industry has improved its overall efficiency and delivered lower water prices to customers, while at the same time increasing the revenue going to its owners either through dividend payments or tax equivalent payments. This improvement in financial performance was achieved against a background of delivering higher environmental, public health and customer-service standards. The amalgamation of the non-metropolitan water utilities, in particular, substantially increased the scale of operations of small local government operations. This proved beneficial to the utilities and their customers.

While initially state and territory responsibility for economic regulation of water resulted in different regulatory models, a trend has emerged towards independent regulators for pricing and customer-service standards and having oversight of several monopolistic industries.

Regulation of public health and the environment are uniformly the responsibility of the state departments and authorities having respective responsibility for health and the environment. There is some diversity regarding the responsibility for water allocation between the various jurisdictions. In Victoria, Western Australia, South Australia, Tasmania, the ACT and the Northern Territory the environmental department (or authority) has jurisdiction, while in New South Wales and Queensland this is the responsibility of the department having oversight for natural resources.[12] One could argue that the latter approach is more transparent since it places all competing stakeholders (i.e. water users and the environment) on an equal footing.

Until the details of the National Water Initiative are negotiated in detail it is too early to speculate whether the new reforms will lead to additional institutional and regulatory developments. Clearly, however, the need for such changes cannot be ruled out.

Endnotes

1 The Australian Constitution gives state and territory governments responsibility for water from rivers. By extension this power has been thought to extend to lakes and underground aquifers. It may be, therefore, that state and territory powers over desalinated water may not be exclusive. Furthermore, the Commonwealth could, if it chose, use its external powers to circumvent almost any state power.

2 The impact of the CoAG reforms on the urban water industry has been substantial. However, it would be incorrect to conclude that the industry had not been subject to earlier reforms. Indeed, one could suggest that the CoAG reforms ensured a nationally consistent application of earlier successful reforms undertaken in a number of state jurisdictions.

3 For example, in the UK only 20 per cent of residential properties are metered.

4 Hobart is the only Australian capital city where residential properties are not metered and, therefore, volumetric charging is not possible.

5 The CoAG reforms ensured that the user pays approach to pricing for water, pioneered in Western Australia as early as 1978 and in Newcastle in 1982, was universally applied in Australian cities.

6 For example the Water Corporation's pricing structure already includes inclining block tariffs.

7 While the ACT is a territory, it is essentially the city of Canberra.

8 There are exceptions. For example, mining developments generally provide their own infrastructure, including water and wastewater services.

9 The only exception being South Australia, which started with price oversight by an independent regulator only to shift to ministerial determination.

10 All jurisdictions with small local government-owned water-service providers exempt them from economic regulation.

11 It will be interesting to see how customer-service standards will be handled once the government establishes the Essential Services Commission.

12 Until recently this was also the approach adopted by Western Australia.

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