Thematic Week: Water Economics and Financing

Thematic Axis: Water Markets

Title: Trading into and out of trouble Australian water allocation & trading experience.

Authors: Prof. Mike Young

Research Chair, Water Economics and Management, The University of Adelaide, Adelaide, South Australia.

Abstract:

In the early 1990s, Australian governments committed the nation to a major water reform program that focused on establishment of a much more competitive and more market-orientated approach to the management of water resources. With a focus on the development of water trading and the emergence of water markets, this paper attempts to summarise the key lessons learned, and the difficulties in making water markets work in a cost-effective manner.

Keywords:

Trading into and out of trouble Australian water allocation & trading experience.

Introduction

In Australia, the right to manage and allocate water is defined as a public good, and all governments use a licensing system to allocate water.

Whilst there is a plethora of detail, as a general rule all licences in an irrigation area are defined in the same way. Moreover, as Australia has an extremely variable climate, in some areas, two types of licence exist – "high security" and "general security" licences. In times of scarcity, allocations are made first to high security licences, then any water that is left over is allocated to general security licences.

Water within each of these security pools is allocated to entitlement holders on a pro-rata basis in proportion to the number of entitlement (shares) they have. Typically, shares are nominated in volumetric units and allocations announced as a percentage of water that volume that is now available for taking. Both water entitlements (shares) and water allocations are tradable. This approach makes it possible for some farmers to invest efficiently in permanent plantings, and others to take a more opportunistic approach, irrigating annual crops and pasture when water is available.

From a trading perspective, one of the most important reforms was a decision to convert most licences from licences to irrigate an area of land to volumetric entitlements. In the Murray-Darling Basin this happened many years ago – mostly in the 1960s and 70s. Without metering and the allocation of volumes of water, many of the water trading arrangements in place today would not be possible.

Today almost all water use is metered, with allocations to licence holders strictly enforced. Those who take more water than they are entitled to are penalised. Water theft is not a major problem.

Progressive Unbundling and Separation of Function

Water trading in Australia began cautiously in the 1980s. Before the development of competition policies, in the 1993/94s water licences were attached to a land. Whilst possible, water trading was administratively difficult and time consuming. So much so, in fact, that many of the early inter-regional trades involved a person purchasing a farm with a water surplus and then arranging to transfer this surplus water to another farm, where this water could be used more productively. Once the transfer had been completed, which could take years, the selling farm was often sold with less water.

In 1993/94 Australian governments decided collectively that it should be possible to hold a water licence without having to attach it to a land title. Arrangements where also put in place to make all water users pay the full cost of delivering water to them. The result, it was argued, would be a series of reforms that ultimately would allow water to trade to the place where it would contribute most to the economy – its highest and best use.

As indicated in Figure 2, since 1993/94, when it was decided to allow water entitlements to be held independently of a land title, the volume of trade has increased significantly. Considerable investment and innovation has occurred. Whilst there has been considerable angst, on the whole, irrigation communities are much richer than they otherwise would have been (Frontier Economics 2007; Young *et al.* 2006).

In regions like the Murray-Darling Basin two markets gradually emerged – a "temporary" water market and a "permanent" water market.

Temporary markets involve the trade of a volume of water that has been allocated for use within a season. They are called "temporary" trades because, in the early stages of the development of trading, in order to execute a trade, it was necessary to temporarily transfer a licence from one farm to another so that a volume of water could be removed from it. Once this volume of water had been removed from the licence, the licence was then returned to its original (permanent) owner.

A "permanent" trade involves the transfer of all or part of a licence from one farm to another farm. Once the trade is completed, the buyer of the licence is entitled to receive and use all future allocations made to that licence.

Having separated water licences from land titles, it soon became clear that further undbundling was needed and trading arrangements generally improved. Recognising this and a host of other reforms to do with water accounting, planning and pricing a new intergovernmental agreement was negotiated in 2004. Known as the National Water Initiative, the ultimate result was the emergence of a regime that makes it possible to use separate instruments to pursue separate objectives (see Figure 1). Entitlement shares define a person's equity or stake in the system. Trade in allocations facilitates efficient use of the available water resource at any point in time, whilst use licences (approvals) are used to manage environmental externalities.

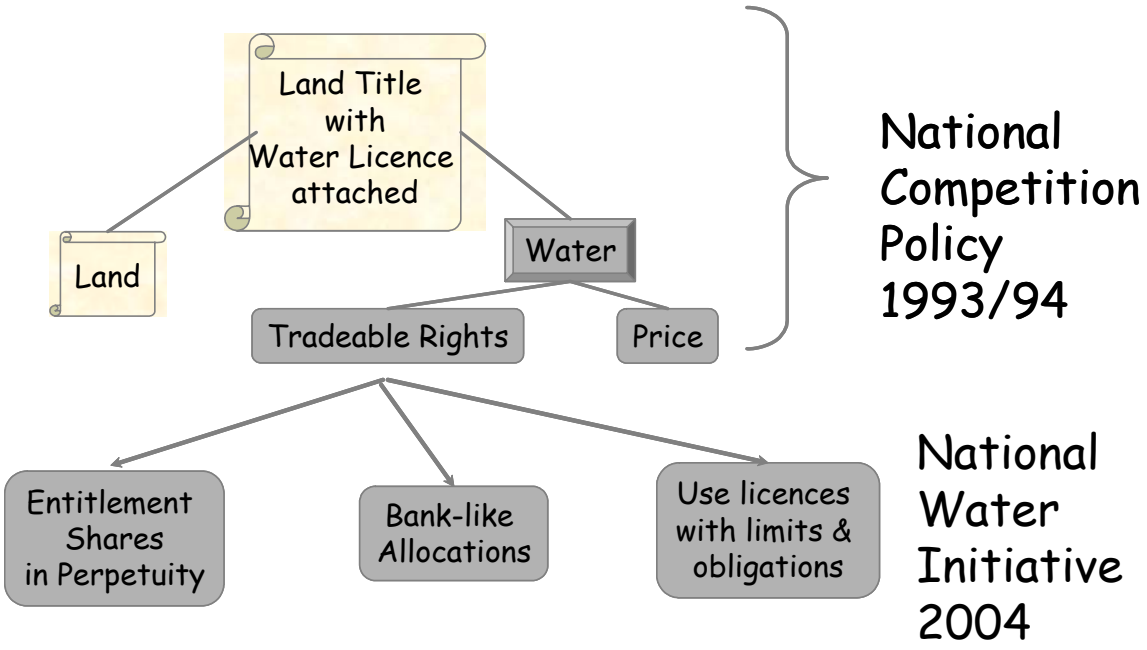


Figure 1 Evolution of water reform in Australia and the progressive separation of water licences from land and their subsequent unbundling into separate components Source: After Young and McColl (2005)

In the Murray-Darling Basin water entitlements are issued and water allocations made by state governments. A pilot interstate water trading trial began in 1999, and following several reviews, was ultimately replaced by a permanent set of arrangements designed to facilitate interstate trade. Figure 2 summarises the rate of growth in water trading in Australia's Murray-Darling Basin from 1983 with data separated into intra and inter state trades.

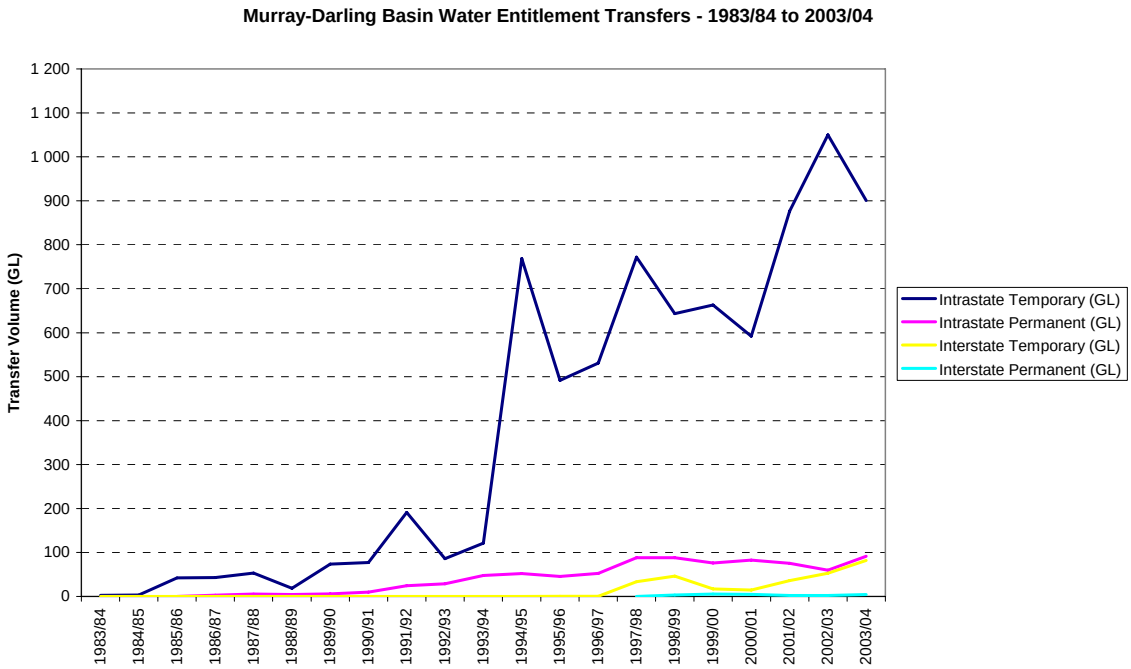


Figure 2 Growth in water trading in the Southern Connected portion of the Murray Darling Basin 1983 to 2004
Source: Murray Darling Basin Commission, 2007, pers. com.

Benefits and costs of water trading

There have been many assessments of the impacts of water trading on the economy and the environment. Many mistakes have been made and many lessons learned (Young and McColl 2008b).

From an individual water entitlement holder perspective the benefits of holding a water entitlement have been considerable. Recently Bjornlund and Rossini (2007) have modeled the return from simply holding a water entitlement and selling all allocations made to the entitlement on the water market. The results, summarised in Figure 3 and Figure 4, show annualized returns in excess of 20 percent per annum. As noted above, this has stimulated significant innovation and the adoption of new technology (Young 2008).

Bjornlund and Rossini's data also show how, in the early stages of market development, the greatest returns come more from capital gains than from the use of water allocations. Returns from the annual sale of water entitlements follow once the appropriate suite of land use and other changes are put in place and market reforms completed. The most likely explanation of the reason why this system occurs is that capital markets are quick to see opportunity, but investment and development of the means to realize these new opportunities takes time.

Whilst the early policy rhetoric focused on the benefits of letting water move to its highest and best use, in more recent times the emphasis has shifted to pointing the role of markets in facilitating structural adjustment and managing scarcity.

Arguably, the benefits of water trade during times of adversity are much greater than the returns from trade in times of abundance. Both Young et al. (2006) and Frontier Economics (2007) have found that water users state repeatedly that it was the ability to buy and sell water allocations that has enabled them to survive the long-drought that has plagued Australia.

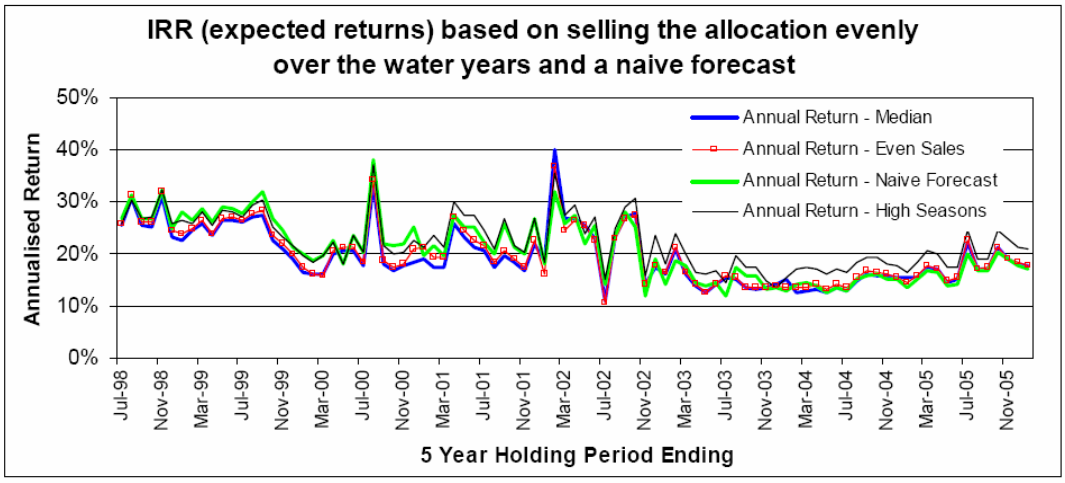


Figure 3 Internal rate of return from selling allocations evenly under different selling strategies
Source: Bjorlund and Rossini (2007)

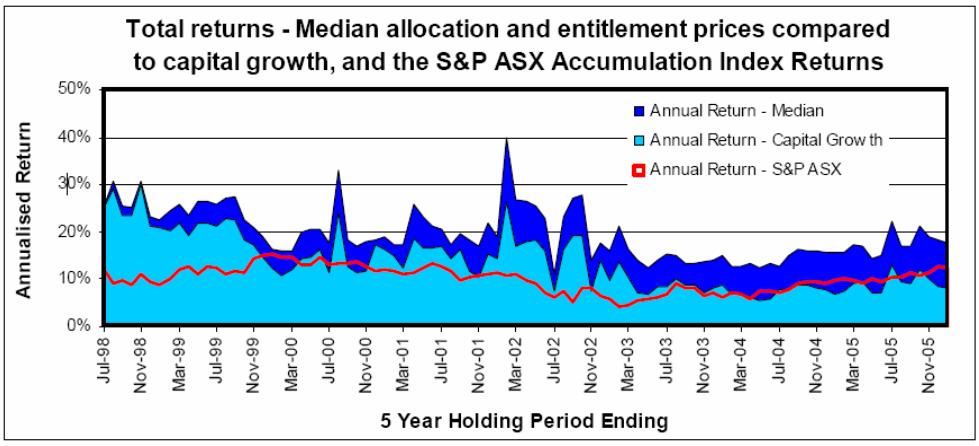


Figure 4 Annual returns from selling allocations (dark blue) and capital growth (light blue) in the value of a water entitlement compared with an index of the value of shares in the Australian Stock Exchange, Goulburn Murray System, Murray Darling Basin's
Source: Bjornlund and Rossini (2007)

As stated earlier, many of the necessary property right conditions and administrative arrangements for the development of water trading in Australia have been in place for many years. Unfortunately this has meant that trade was introduced without sufficient attention to detail. It was assumed that trade could be bolted onto existing licencing and allocation systems. As a result, a host of implementation problems have emerged. Indeed some of the problems Australia now faces are so severe that one could argue that the Australia's market approach should have been abandoned. However this, is not the case. Almost all analysts and all administrators are of the opinion is that the way forward is to trade out of trouble and retain access to the significant benefits from trading. The main problem is one of over-allocation, storage mismanagement and a failure to account for water use in a manner that has hydrological integrity.

Most analysts, however, will admit that the costs of failing to get the fundamentals right have been high – especially at the system level. Markets operate according to rules and, when the rules for their operation are mis-specified, they quickly reveal the extent of the flaws. The most commonly discussed problem is that of over-allocation.

In Australia over-allocation is said to occur **"**where with full development of water access entitlements in a particular system, the total volume of water able to be extracted by entitlement holders at a given time exceeds the environmentally sustainable level of extraction for that system" (CoAG 2004). Over-allocation occurs because either too many entitlements have been issued and/or allocations are being made to them at a rate that is not environmentally sustainable.

Sy*stem-wide Challenges*

The water allocation and entitlement framework that Australia has developed emerged and evolved over time. No-one ever put together a grand design. In essence existing entitlement regimes were bolted together (Young and McColl 2003a). There is, however, some underlying theory which can be used to develop guidelines about the best way to specify water entitlement arrangements if one wishes to reap the benefit of trading without experiencing un-necessary costs.

One of the key building blocks for success is to recognise that markets have little if any role in making system wide decisions. Great care must be taken to separate system wide management issues from issues associated with the management of individual entitlements and allocations. In particular, individual entitlement and allocation arrangements must be able to operate no matter how system wide plans are written or changed. Under such a regime, whenever a system-wide change is made, it is not necessary to change an entitlement or use approval.

In a trading environment it is critically important to understand that the role of the system manager changes to one of market facilitation. The role of government is, first, to set up the trading rules, then decide how much water can be allocated and make these allocations. Once this is done, the market takes over to determine where and how this allocated water will be used – constrained by a set of land use and land management rules designed to prevent unacceptable environmental problems from emerging.

Table 1 summarises the structure that is now starting to emerge in Australia. Management of system wide institutional arrangements is now being implemented using processes that are separate from those used to manage individual entitlements and allocations.

Table 1 An overview of the unbundled framework for the management of system-wide and individual attributes for the allocation of water in Australia

Scale	Policy Objective		
	Distributive Equity	**Economic Efficiency**	**Environmental Externalities**
System-wide Strategic Instruments	Plans and agreements that define entitlement priorities and rules for allocating water	Trading Protocols (Exchange rates, registers, etc.)	Plans that define protocols for the application of water to land. Protocols for management of river flow, quality, etc
Operational Market Instruments	Entitlements defined as unit shares	Allocations defined as volumes of water for use or trade within a specific period. In regulated systems, carry forward may be possible	Farm by farm water-use approvals that place limits on the way water may be applied to land with a view to manage local environmental and other impacts

Source: Adapted from Young and McColl (2008b) and Young and McColl (2005).

Storage management

Before trading was introduced, centralised planning processes were used to determine how much water should be allocated to users and how much was kept in storage. Moreover, the regime that emerged was designed to take account of the fact that in most years a considerable amount of water would be left over at the end of a season and returned back to the allocation pool for use in the following year. The result was a regime that appeared to optimise the amount of water kept in storage and that which was used in any year. In practice, however, the reverse occurred. The storage management regime and the nature of the supply infrastructure associated with it determined how much irrigation occurred.

When trading was introduced, however, it suddenly became possible for people to sell unused water and, as a result, storage management policies became sub-optimal. So much so that in States, like Victoria, Brennan (2007a,b) has shown that the costs of storage mis-management have been greater than the benefits of trading. Her research has shown that, unless irrigators are allowed to carry forward unused water from one year to the next, trading will force virtually all allocated water to be used in each year and, as a result, increase supply variability, and through this increase the severity of droughts. Working out how much water to save and how much to use is a process that requires continuous analysis and revision as conditions change. It also requires access to market and technical information that is poorly understood by government officials (Young and McColl 2007).

The solution to this problem is simple and requires the development of carry-forward policies. Carry forward policies are policies that allow allocations with appropriate adjustments and delivery restrictions to be left in storage and used at a later date.

As a result of the growing recognition of the importance of allowing market processes to help optimise storage, all Murray-Darling Basin states have now introduced carry over arrangements (Young and McColl 2007). The most sophisticated carry forward arrangements can be found in

Queensland where a range of continuous accounting processes have been put in place and markets established for delivery entitlements and storage capacity as well as for entitlements and allocations (Vanderbyl 2007).

Design challenges

Arguably one of the biggest mistakes that early Australian water licensing systems made was to assume that a similar mean volume of water would always be available. As a result, considerable effort was put into the definition of entitlement reliability and arrangements that would ensure that the requisite volumes would be available. In retrospect Australian planners should have paid much more attention to the development of management regimes that are designed to cope better with the emergence of long dry periods or for the adverse climate change. As a result, many systems have become over-allocated in the sense that too much water has been allocated to users and not enough for system maintenance and to the environment.

As the experience with the city of Perth's water supply shows, this is a serious error. In the 34 years since 1974, the water supply system used to supply much of the city of Perth has never once received its "mean" rainfall. As can be seen in Figure 5, the mean amount of water flowing into the system since 1974 has been less than half that received before then. Moreover, since 1974 inflows have never reached the previous average. As a result of experiences like these, Australian water managers are now coming to understand that systems do get drier and, when they do, inflows into rivers and storages drop dramatically.

The crude rule of thumb is that for every 1% decline in mean rainfall, storage inflow drops by, at least, 3%. In Perth's case, 14% less rain meant 48% less inflow and 20% less rain has meant 66% less inflow into their main storage (see Figure 5).

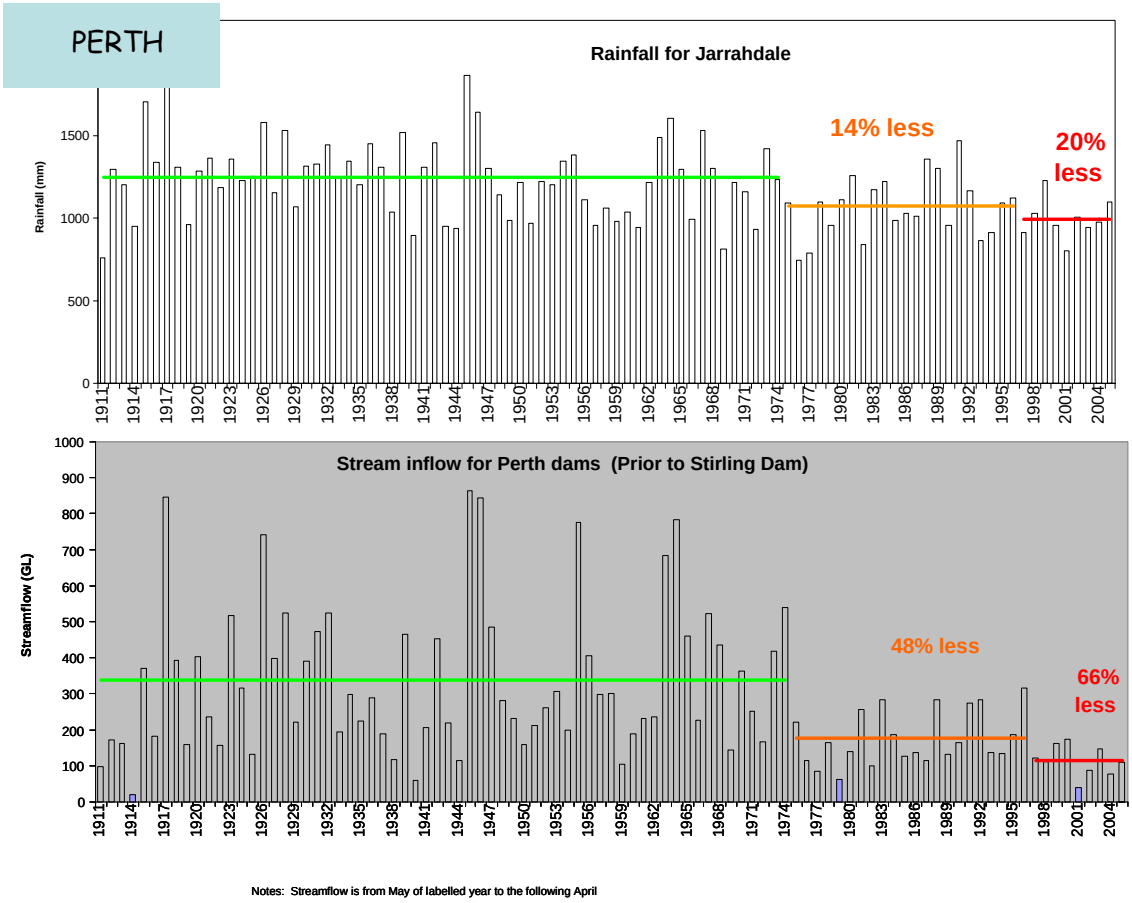


Figure 5 Decline in the volume of water flowing into Perth's main surface water supply system and its relationship with rainfall as measured at the Jarrahdale the rainfall station most closely associated with it

As a result, despite the fact that most systems state that the environment should be given first priority, Australia is now in the unenviable position of having to buy back water entitlements for system maintenance and for the environmental use. Recognising the folly in doing this, the National Water Initiative policy requirement is that environmental water entitlements be defined as shares so that in the future it will not be possible for allocations to be made in a manner that erodes the environment's interest.

Another challenge, particularly when there is a shift to a drier regime as appears to have occurred in Australia, is to set aside enough water to enable water allocations to be conveyed from one end of a river system to another.

With the benefit of hindsight, it is now becoming clear that the first water allocation priority should be to put aside enough water to maintain the water level in a river at a minimum level so that entitlements at the end of the system can be honoured. In regulated river systems and as set out in Figure 6, the remaining non-flood water can then be shared between users and the environment. In the past Australia has used a combination of formal entitlements to irrigators and other water users and water sharing plan processes to determine how much water is to be allocated to the environment and water conveyance and how much allocated to users. As a result of the failure of this system, in the River Murray system, managers are now buying back entitlements from irrigators and moving to a regime where the environment will hold an entitlement of equivalent security as that was held by all other water users.

When x% of the shared water resource is formally allocated to users and (100-x)% formally allocated to the environment, it is not possible to favour one side over the other. Some water must always be allocated to the environment and some to all other users. To optimise water use under

such a regime, however, it is necessary for both sides to have an unrestricted right to carry-forward water from one year to the other and be empowered to manage inter-seasonal supply risk independently of one another. The result is a regime that is robust in the sense that it can be expected to with stand the test of time and be described as a regime that is likely to work well under all climatic regimes, including extremely dry ones. Neither side can erode the interests of the other (Young and McColl 2008a).

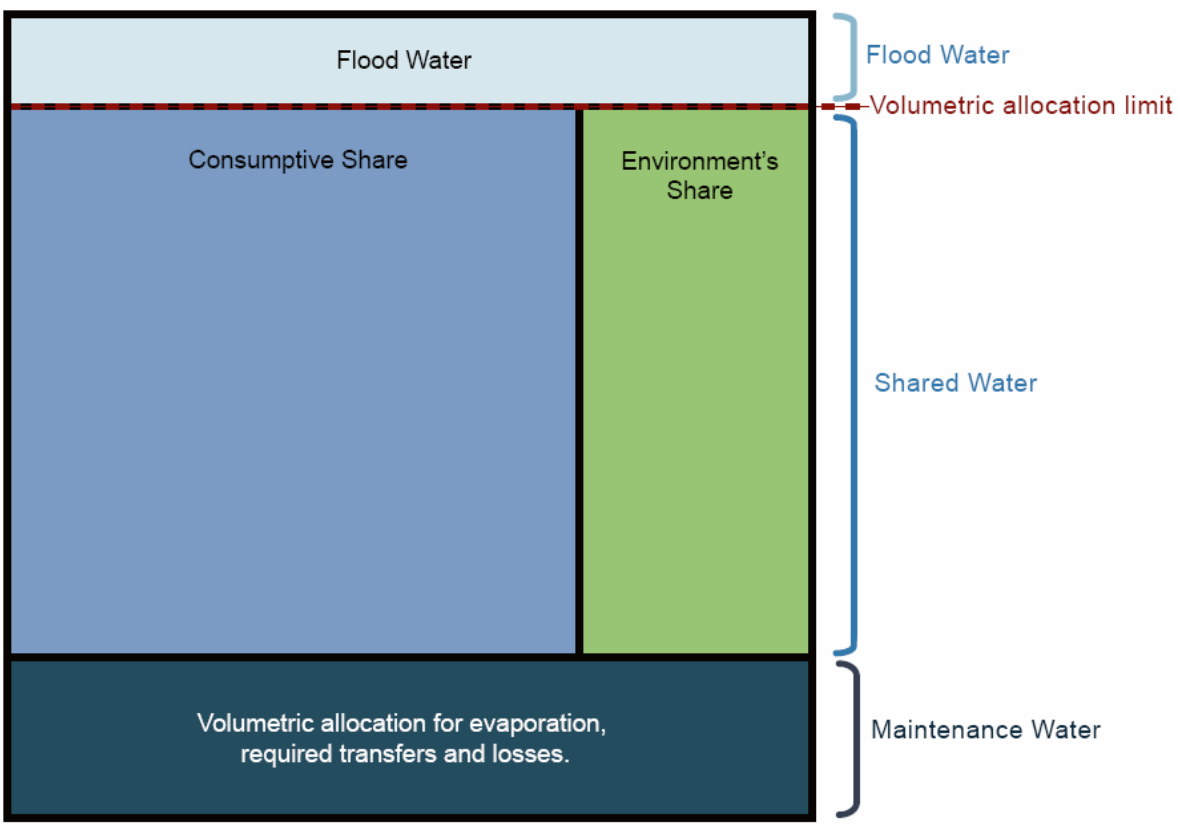


Figure 6 Indicative structure of a robust water entitlement regime
Source: Young and McColl, 2008a

Preparing for Trade

Over-entitlement

Another extremely painful experience that Australia has had to deal with is the difficult question of what to do with water entitlements which, before the introduction of trading, were either never or rarely used. In a non-trading environment, allocations to these unused entitlements have option value and were typically held as a hedge against future supply risk and to secure a future development opportunity. Hence many people sought to hold them. While these entitlements were not being used, however, the water assigned to them remained unordered and, unfortunately, was typically made available to other irrigators. As a result and with the passage of time, irrigators became accustomed to having access to more water than would be the case if all entitlements were fully used. When trading was introduced, however, it became possible for the holders of these entitlements to sell their unused allocations with two consequences. First, those who under the pre-trading regime were forced to buy water that was previously available to them, with the consequence that there could be a significant shift in wealth. Second, in systems where too many entitlements had been issued, governments needed to decide whether to reduce allocations per entitlement or find a way to buy back entitlements so that the system remains in balance

With the benefit of hindsight, the advice now being given is to never issue entitlements to more than 100% of the available resource. When this in done, over-entitlement problems do not emerge.

Return Flows

Unlike many allocation regimes used in the United States of America, Australia has typically allocated entitlements to take water and never specified an obligation to return a percentage of this water back to the system from which it was taken. When irrigation is technically inefficient, a significant proportion of this water tends to return back to the system and is then used by others or assigned to the environment. Once markets are introduced, however, there is a strong incentive for each irrigator to invest in water saving technology and, hence, reduce the amount of water that returns to the system (Young 2008). Once again, the result is the need to either reduce allocations to the environment and or all entitlement holders. In practice there are two ways of dealing with this return flow problem. Either:

a) entitlements can be defined in nett terms so that as technical efficiency of water use is increased the amount that can be pumped is reduced or, alternatively

b) allocations per entitlement are decreased as the technical efficiency of water use in a system increases.

Whilst Australia still has to formally determine which of these two approaches it prefers, in practice the approach taken in most systems is to more like the latter approach. As mean water use efficiency increases, allocations per entitlement and to the environment are reduced.

Interception

Still another water management issue that Australia has struggled with is the issue of how to account for all forms of water use including those that are unmetered and, in many cases, unmeterable. Two prominent examples of increases in unmetered water use are increases in small farm dam construction and increases in farm forestry. When processes like these are not included in the water allocation planning processes, the result can be a significant erosion of the amount of water that can be allocated to entitlement holders. If supply reliability is to be maintained, over-allocation problems emerge. Reluctantly as over-allocation and over-entitlement problems have worsened, Australian administrators are now in the process of developing arrangements that require those whose actions decrease run-off and, through this, river flow to offset these effects by purchasing and either not using or surrendering entitlements equivalent to the effects of these actions (Young and McColl 2008a).

Interconnectivity

A related but even more challenging issue is the question of the best way to manage connected ground and surface water systems. Depending upon the direction of flow from one system to another, changes in the use of one part of these systems results in a change to the other. In the case of a river that tends to gain flow from a groundwater system that is connected to it, increases in the rate of groundwater extraction, for example, tend to reduce river flow. At the time of writing, Australian river and groundwater managers are still debating the best way to manage the effects of system inter-connectivity. Options under consideration and being tested include the definition of all groundwater extraction close to a river as extraction from the river and the assignment of groundwater shares to the river (Young and McColl 2008c).

Register validation and allocation account development

As indicated earlier, Australian irrigation entitlement systems have evolved with time and in the early stages the licences issued in each part of the system were subtly different. Unbundling these licences into their various parts has enabled more standardisation of the way that entitlements and allocations are defined and, in turn, made allocations and entitlements more fungible. More

fungible in the sense that fewer types of entitlement and allocation are needed. As a result markets are much deeper and prices higher than they otherwise would have been.

In the process of doing this, in particular the separation of water licences from land titles, it has been necessary to establish formal water licence registers so that changes in the people entitled to use a water entitlement can be managed efficiently.

As a general rule, without going into the detail, register validation is a time consuming process , The final result, in Australia, has been a change to a regime where registers rather than pieces of paper are used to define ownership and an entitlement sale becomes, in effect, a contract to change the names recorded on a register. Under such a regime, ownership changes when and only when the name on the entitlement register is changed. Arrangements have also been put in place to allow entitlements to be mortgaged and other financial interests recorded on these registers.

As a general guideline, it is recommended that early attention be given to register validation as the process requires painstaking attention to detail. In Australia many of the names recorded on a licence were not the same as those recorded on the land title with which it was associated. Wrestling with the difficult issue of who actually owned the licence, the usual default position has been to assume that all people who have an interest in an area of land to which a licence is attached have an interest in the water entitlement at the time the licence is separated from the land title. All these legal entities have to consent to any dealing with the new entitlement.

Unbundling has also meant that formal water allocation accounts have had to be set up. The most advanced of these allocation accounting systems operate in a manner that is similar to the way bank accounts function. Whenever an allocation is announced, this amount is immediately credited to an account that can be accessed over the internet. In a similar manner, use is debited from the account as it occurs. Under such an arrangement, allocation trades involve the debit of water from one account and its credit to another. In the most sophisticated of these systems, account owners can use the internet to instantaneously transfer water from one account to another.

Market design and management

As markets develop and expand a host of management and transparency issues need to be managed. In particular, the administrative processes and procedures need to be fair and be seen to be fair. Great care needs to be taken to ensure that those involved are not accused, for example, of insider trading and all receive equally opportunity to access information.

As a result Australia has begun to limit policy announcements to one or two days per month and provide advance notice of when an announcement is likely to be made. Brokers have also begun to publish market price information. In an ideal world, at least daily trade and volume information would be available and all interested parties able to watch offers and bids being made.

In Australia brokers are not yet required to be registered, but codes of practice are being developed and recommendations for broker registration are becoming more common. As a general rule most brokers now hold any money received in a trust account and do not speculate in the market. One view is that the industry is capable of self regulation (Allen Consulting Group 2007). At least one large broker, however, is of the view that formal registration is required (Waterfind 2007).

Market Development

As opportunities for trade have expanded, different marketing formats have been tried and tested. The first of these tended to involve bulletin boards and notices in papers. People, typically a real estate agent then began operating as brokers and specialists in handling the paperwork necessary to complete a sale. This was followed by the development of a formal market in Victoria known as Watermove. Watermove works by recording all offers to sell and buy as they are submitted during a week and then at the end of the week setting a single clearing price. Those who offered to sell water at less than that clearing price are paid the clearing price and those who offered to buy at more than that price only have to pay the clearing price.

More recently several internet based trading platforms have emerged. Two of these are run by independent water trading companies – Waterfind and the Water Exchange. Many irrigation water supply companies and at least one industry organisation run similar services.

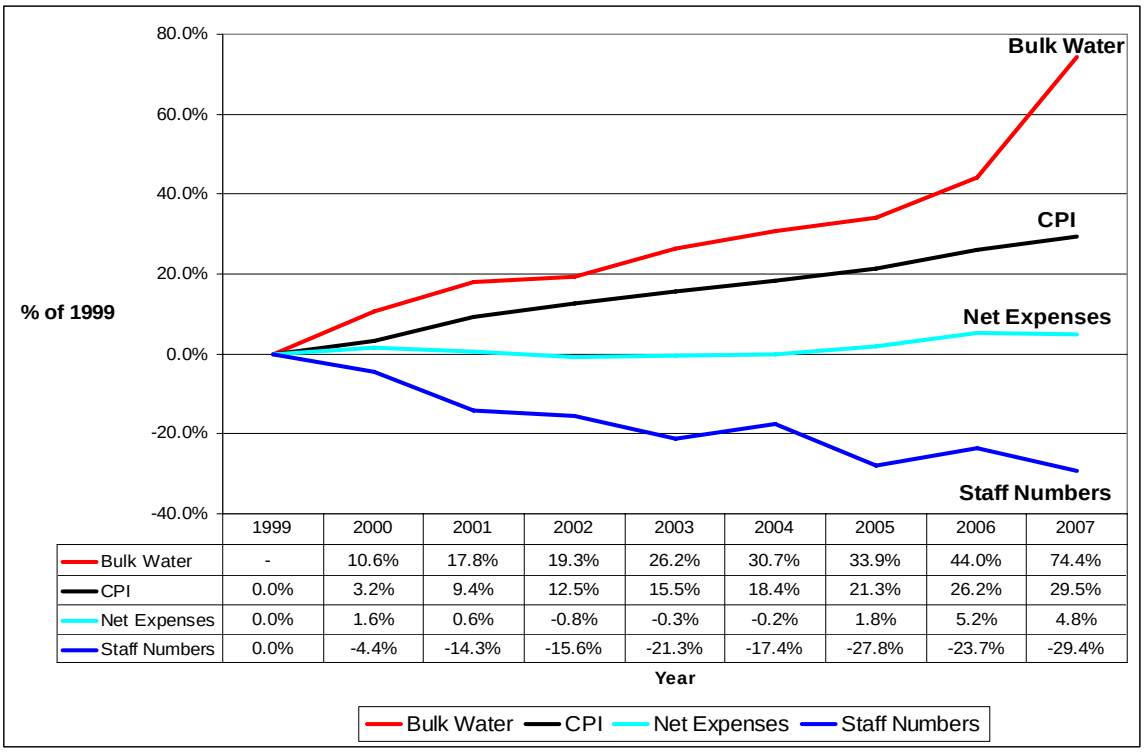
Supply and delivery charges

If a market is to produce an efficient outcome, then amongst many other things, water charging arrangements must be consistent both within and among regions. When charging arrangements are inconsistent, water entitlements and allocations will tend to move to the areas where supply arrangements are most subsidised.

In an effort to progress this issue and ensure that trading produces efficient outcomes, under the National Water Initiative all states are now required to move towards what is called "lower bound" pricing. Australia's National Water Initiative defines lower bound pricing as

> *"the level at which to be viable, a water business should recover, at least, the operational, maintenance and administrative costs, externalities, taxes or TERs (not including income tax), the interest cost on debt, dividends (if any) and make provision for future asset refurbishment/replacement. Dividends should be set at a level that reflects commercial realities and stimulates a competitive market outcome."*

In several states progress towards this goal has been assisted by an earlier Competition Policy Initiative that required administrative separation of water supply from water policy processes. As a result, governments were required to set up independent water supply companies, focus on policy and extricate themselves from the business of water supply and infrastructure management. Whilst some of these companies are still government-owned entities several have been converted into businesses that are owned by irrigators. As a general rule this latter form of corporatisation was achieved by issuing shares in proportion to the number of entitlements held. Figure 1 shows the result of corporatizing the Murrumbidgee Irrigation System. Administrative separation followed by the transfer of ownership and responsibility for water supply to irrigators has enabled irrigators to substantially reduce operating costs at a time when government bulk water charges have continued to rise.



	1999	2000	2001	2002	2003	2004	2005	2006	2007
Bulk Water	-	10.6%	17.8%	19.3%	26.2%	30.7%	33.9%	44.0%	74.4%
CPI	0.0%	3.2%	9.4%	12.5%	15.5%	18.4%	21.3%	26.2%	29.5%
Net Expenses	0.0%	1.6%	0.6%	-0.8%	-0.3%	-0.2%	1.8%	5.2%	4.8%
Staff Numbers	0.0%	-4.4%	-14.3%	-15.6%	-21.3%	-17.4%	-27.8%	-23.7%	-29.4%

Figure 7 Index of water supply and delivery costs in real terms since the transfer of ownership and control of water supply assets to Murrumbidgee Irrigation compared with New South Wales government bulk water changes

Whilst administrative separation from government has brought about significant savings to irrigators, it has also enabled these same water supply companies to protect their businesses by putting in place barriers to the trade of water out of their district. In response to this, Australia is now struggling with the question of whether or not to allow companies to set exit fees or termination fees and, if so, how to set them. In retrospect, it has become clear that every water user should operate under a formal supply contract and that exit arrangements should have been negotiated at the time ownership of the supply system was transferred to irrigators, and not left as a problem to be solved when it emerged (ACCC 2007).

Concluding comments

As can be seen from this paper the Australian experience in the development of water trading arrangements is rich and deep in insight. In retrospect it is clear that the development of water trading arrangements takes time and that sequencing is important. Moreover, it is critically important to begin with an entitlement and allocation regime that is designed for trade, avoiding the temptation to introduce trading without changing the allocation and entitlement regime.

A principled reform agenda is needed. Markets follow the signals they are given. Get the foundations wrong and the market will happily trade river and aquifer systems into trouble. So much so that the costs of trading can outweigh the benefits. The good news, however, is that with good design and careful reform sequencing it is possible to realise many economic, social and environmental benefits that trading can bring.

Whilst many point to the economic benefits of moving water to its highest and best use, Australian water economists and policy maker now prefer to point to the power of markets in managing increasing water scarcity. Shifts to long dry periods do occur and adverse climate change is possible. Getting by with a lot less water is difficult but *much less difficult* when well-designed entitlement regimes and water markets are allowed to assist.

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