Introduction

Water in most of Australia is an increasingly scarce resource. A growing population and climate change (Young et al. 2006), coupled with an increasing awareness of environmental costs of water withdrawals, will place an increasing burden on balancing supply and demand for water. Australian governments are acutely aware of the water management challenges. In 1994, the Council of Australian Governments (COAG) promoted innovations that included better–specified water rights, market–based approaches to water management, and the need for environmental flows, especially in the Murray–Darling Basin. These reforms, including a cap on withdrawals in the Murray River systems, were designed to ensure water is allocated to its highest value use while ensuring ecologically sustainable development (Quiggin 2001).

The 2004 National Water Initiative (NWI) expanded the market–based agenda with its endorsement of better–specified water access entitlements that can be recorded in reliable and nationally consistent water registers (COAG 2004). The initiative also included agreement on risk–sharing of reductions in water allocations, but its implementation remains a challenge. The NWI endorsed development of water plans that are intended to ensure environmentally sustainable levels of extraction and, eventually, perpetual water access entitlements denoted as a share of a specified water resource. To ensure water is allocated to its highest value, parties to the NWI agreed to minimise transactions costs on water trades, promote efficient water markets, and to remove barriers to water trades.

The NWI will help address critical issues of overallocation, inefficiencies, inconsistencies and lack of co–ordination across jurisdictions, and inadequate water planning. It includes key milestones such as the immediate removal of barriers to temporary trades in water, implementation of compatible and publicly accessible and reliable water registers by the end of 2006, and the establishment by 2007 of compatible institutional and regulatory arrangements to facilitate intra and interstate water trading.

In this chapter, we provide our understanding of the current state of play in terms of water trading and pricing, what can be learnt to improve the reform process, and what gaps must be addressed. Section 2 reviews the state of water markets in Australia, paying particular attention to constraints on trade and the benefits of increased trading. Section 3 examines key issues in terms of water prices, including pricing environmental externalities and the use of scarcity pricing in urban centres. In section 4, we use experiences from fisheries to offer insights for the water reform agenda. Section 5 briefly reviews key knowledge gaps and section 6 concludes.

Water Trading

2 Water Trading
Water trade in Australia is largely limited to transactions between irrigators. The most active trading region is in the southern Murray–Darling Basin, but markets have expanded considerably over the past decade and should develop further with NWI initiatives. Surface water trading by irrigators, in seasonal allocations in particular, is widespread in many irrigation districts. Markets for derivative products for water, such as leases and forward contracts, are emerging, largely in response to irrigators’ preferences for more flexible trading arrangements.

Initially, water trading was restricted to trade between irrigators within the same irrigation district. Over time, trade expanded to include intravalley and interstate trade. Interstate trade, however, is restricted to regions in the Pilot Interstate Water Trading Project. Figure 1 shows intra– and interstate trade in seasonal allocations, and Figure 2 shows intra– and interstate trade in water entitlements, both in the southern Murray–Darling Basin. Interstate trade in water entitlements is likely to expand: at the recent Summit on the Southern Murray Darling Basin, the Australian government and the governments of Queensland, South Australia, Victoria and New South Wales agreed to ensure that permanent interstate trading will commence in the southern Murray–Darling Basin States by 1 January 2007.

Publicly available data on prices and volumes of water trade over time and across regions are limited. The price of water entitlements varies temporally, with the attached level of security, and across regions. The Australian Bureau of Statistics (ABS) Water Survey of Agriculture 2002–03 provides a snapshot of traded prices. For temporary purchases, prices ranged from an average of $8 per megalitre (paid by some irrigated pasture farms in north east Australia) to $1,508 per megalitre (paid by some irrigated fruit growers in the interior of the country where there is low rainfall). Permanent trades in the same period were reported as ranging from $80 to $4,819 per megalitre (ABS and Productivity Comission (PC) 2006). By contrast, water cost charges paid by irrigators to water authorities and supply companies range from $30 per megalitre to close to $90 per megalitre in the Murray–Darling Basin (Qureshi et al. 2005).

In the three main irrigation districts in the southern Murray–Darling Basin (Murray Irrigation, Goulburn–Murray Water and Murrimbidgee Irrigation), aggregate trade in seasonal allocations represented, on average, 11 to 20 per cent of total annual allocations in 2000–01 to 2002–03. By contrast, trade in entitlements represents a much smaller share of allocations — on average, 1 to 2 per cent across the three major districts between 2000–01 and 2002–03 (Peterson et al. 2004).

The phenomenon of a higher proportion of temporary asset transactions relative to permanent entitlement sales is not unique to water markets. Thus, by itself, it does not suggest market failure (PriceWaterhouseCoopers 2006). The number of participants in the market and the volume of water traded are determined by the supply and demand for water and by any restrictions on participation in trade. A small number of buyers and sellers may reflect a number of factors, including: (1) adequate existing water allocations relative to demand; (2) homogeneous production, such that water demands
are similar across irrigation activities; (3) the inability to transfer water cost-effectively between potential buyers and sellers; and (4) restrictions on water trade, including for environmental purposes (PC 2006).

The fact that sales of water entitlements are fewer than sales of seasonal allocations also reflects the inherent market uncertainties and risk associated with ‘permanent’ trade. In the absence of risk, the value of an entitlement is the sum of expected net returns from all future allocations. However, a permanent entitlement — unlike a seasonal allocation — provides a hedge against the risk of any future reductions in resource availability, and is a risk management tool for irrigators, especially those with large and durable fixed assets (Hafi et al. 2005).

### 2.1 Constraints to water trade

A recent report by the Productivity Commission (PC 2006) reviewed potential constraints on water trade, including non–regulatory and regulatory measures and administrative arrangements. Trade in seasonal allocations is relatively free in most large irrigation districts; many remaining restrictions reflect hydrology. Nevertheless, there remain some constraints for which the rationale is not always transparent. A wider range of restrictions applies to trade in water entitlements, with restrictions greater between districts than within. Nonregulatory constraints include hydrological factors, high transaction costs, limited market information and social factors. Not all of these constraints give rise to economic inefficiencies. In some cases, it is not currently feasible to remove non–regulatory constraints. For example, water trade requires connected (natural or built) infrastructure to facilitate the movement of water from the seller to the buyer, but many catchments in Queensland are not hydrologically connected, so trade is restricted to schemes within a catchment.

Transaction costs are the costs of establishing, monitoring and enforcing property rights. All else equal, transactions costs tend to reduce trade as they reduce the net gains from selling and buying water (see Connell et al. 2005), and can be substantial (McCann and Easter 2004). Transaction costs may be fixed in the sense that the amount paid is independent of the amount of water traded, or they may change with the amount traded (such as a commission paid to a water broker). They may be imposed by regulations or arise privately. For instance, the time and effort required by a willing buyer to locate and bargain with a willing seller represent transaction costs. Compatible and reliable water registers, as proposed by the NWI, should help reduce these costs.

Other relevant transaction costs include government fees and charges, approval activities, brokerage fees and utility charges. Transactions costs for trades in permanent entitlements are generally higher than those for seasonal allocations (see PC 2006). Most significant are the recently imposed exit fees on the export of water entitlements out of some irrigation districts, which are as high as 74 per cent of the value of entitlements, and impose a significant barrier to trade (Crase et al. 2000; PC 2006). Costs also vary significantly across jurisdictions — for example, the Allen Consulting Group (2006) found that for trade in seasonal allocations, transaction costs as a percentage of the value of trade were between 2.5 and 3.1 per cent in New South Wales, Victoria and Queensland, but 21 per cent in South Australia.
Limited information and lack of transparency of water trade prices and trading rules can impede water market participation. Trading facilities, such as those managed by Waterfind, Watermove and SunWater are beginning to emerge and provide relevant information to traders. Social factors can also influence trade. Some regional communities have expressed concern about the consequences of exporting water out of a region, and there are reports of considerable social pressure being placed on potential water sellers not to trade (Fenton 2006).

Regulatory and administrative arrangements can constrain water trade within and between irrigation districts, as well as between types of users. Such constraints exist at both state and district levels, and are imposed by either state or territory governments, or water utilities (including irrigation companies or cooperatives). Constraints include trading rules and zones, measures imposed to address stranded assets and other costs associated with structural adjustment, inefficient institutional arrangements, and excessive charges or slow approval processes. In some jurisdictions, legislation prohibits the purchasing of water by government agencies and non–landholders. In Victoria, for example, ownership of water is currently restricted to people owning or occupying land that have access to individual water entitlements, and government agencies (including state–owned water utilities). From 1 July 2007, non–water users will be able to purchase water, but this will be limited to 10 per cent of the maximum volume of entitlement in the particular water system. Such restrictions, along with policies discouraging certain organisations from participating in water trade, can represent substantial barriers to trade.

An often overlooked, but nevertheless significant, constraint on trade is the use of administrative arrangements within water plans to allocate water. Water planning frameworks allocate portions of the water resource pool to different uses, such as the environment, agriculture and urban activities. These arrangements also allocate water use within various subsets of the water resource pool, such as groundwater and surface water. There are opportunities to use markets to substitute for these arrangements to more efficiently allocate water among competing uses, such as through the encouragement of environmental water donations, auctions for ecosystem services and other approaches (PC 2006).

Apart from regulatory and administrative arrangements directly restricting trade, other arrangements governing water entitlements and allocations — such as jurisdictional progress in separating water entitlements from land, lack of integration in water management systems, poor water accounting systems and the number and complexity of entitlement types — also reduce water trade.

2.2 Effects of freeing up trade

The efficiency impacts of constraints on trade differ depending on their nature, extent and location. They will be greater over time as resources fixed in the short term can be adjusted and moved to alternative uses. In general, the adverse economic impacts of trade restrictions are likely to be greatest where there are large differences in the water needs and valuations of water across water users and regions, and where water is relatively scarce and alternatives are not readily available. In other words, the constraints on water trade have the greatest impact where the potential benefits from
trade are greatest. Consequently, restrictions or prohibition on water trading in droughts where water is available for use has high economic costs.

Heaney et al. (2004) and Peterson et al. (2004, 2005) examined the effects of removing constraints on water trading by irrigators in the southern Murray–Darling Basin. Both studies suggest that additional trade among irrigators may be relatively small, even if impediments are removed. However, the importance of trade is likely to increase over time as producers make new investments in higher valued activities, and if more water is sourced from consumptive uses to meet environmental objectives (Heaney et al. 2004). Further, as noted by Peterson et al. (2004), the benefits of trade will be greatest in years of low water availability. This is because water reductions would have a larger effect on gross regional product (and water trade would provide larger gains through mitigating the impact on gross regional product) in years with low water availability.

Dwyer et al. (2005) used a general equilibrium model (TERM–Water) to examine the effects of expanding trade of water in South–east Australia to include both irrigators and urban users. This study demonstrated the reduction in losses in gross regional product that can arise from a reduction in water availability when water trade is allowed. When regions with relatively low levels of water consumption, such as Adelaide and Canberra, face shortfalls in water and trade with regions that use large volumes of water (such as irrigators in the southern Murray–Darling Basin), they have little effect on traded prices and quantities of water. However, the study showed that if large urban water users, such as Melbourne, traded with relatively small rural area such as Gippsland, the price effects could be substantial.

Young et al. (2006) also used TERM–Water to investigate the effects of allowing urban–rural trade. This study incorporated projections of population increases to the year 2032, and also considered scenarios involving new sources of water, such as from desalinisation. They found that allowing urban water utilities to purchase water from irrigators significantly reduces the potential increase in the price that equates supply with demand. Modelling developments beyond TERM–Water are, however, required to distinguish between trade in seasonal allocations and trade in entitlements, and how choices may change within an irrigation season.
Gains from removing some constraints on water trade

Heaney et al. (2004) assessed the economic impacts of water trade among irrigators under freer administrative arrangements and alternative charging options for rural water delivery. Using a partial equilibrium model of water markets in the southern Murray–Darling Basin, this study suggested that removal of administrative impediments to water trade will result in around 600 gigalitres (around 15 per cent of total water entitlements in the region at that time) of additional trade in permanent water entitlements. Heaney et al. considered that this partly reflects the large sunk investment in on– and off–farm infrastructure. They suggested that the volume and value of entitlement trade will increase as infrastructure assets near the end of their life and as other water demands (such as demand for water for environmental purposes) increase.

Peterson et al. (2004, 2005) examined the effects of hypothetical reductions in water availability in the southern Murray–Darling Basin, under scenarios of no trade, intra–regional trade (by irrigators) only, and both intra– and inter–regional trade by irrigators. The study indicated that allowing both intra and interregional trade by irrigators would halve reductions in gross regional product due to a hypothetical decrease in irrigation water availability of 10 per cent (from 1 per cent — $356 million in 2003 — to 0.5 per cent). The modelling approaches of both studies involved a number of simplifications and assumptions. Neither study considered the effect of changes in water trade on environmental conditions (such as salinity), nor the effects of environmental externalities or other third–party impacts on water trade.


3 Water Pricing

Competitive markets allow water to be traded so that those users with the highest marginal value (after accounting for transport and transaction costs) are able to purchase water from lower value uses. This exchange is welfare enhancing to the buyer and the seller and promotes efficiency. Trading establishes the market price — that changes with environmental conditions and economic circumstances — which signals to all water users its relative value. However, if markets do not operate effectively then the price signal and the incentive it provides to water users is distorted. This reduces efficiency and can have important distributional effects. For example, if a large purchaser of water has market power in the sense that its actions affect the price paid then it is possible that sellers of water may receive less for their water than if the market were competitive. This benefits the buyer at the expense of sellers, can reduce the amount of water traded, and may also distort the price of other
goods that use water as a factor of production. The high volume of trade in seasonal allocations in the southern Murray–Darling Basin suggests little cause for concern about the exercise of market power, but the lower volume of trade in permanent entitlements could provide an opportunity for opportunistic behaviour. Greater information about what water is available, such as through water registers, will assist in promoting competitive markets, as will greater transparency regarding the prices paid for water in different catchments and jurisdictions.

3.1 Externalities
Many different environmental changes are associated with the supply and use of water including changes in habitat, water quality and ecological conditions. These environmental costs are called externalities if the costs (increased salinity, reduced water supply downstream, etc.) imposed on others (downstream users, recreational users, etc.) are not accounted for by those withdrawing water for use. Where negative externalities exist, too much water is used relative to the benefits delivered and inappropriate signals are provided to water users in terms of their land and water–use practices. Under the NWI, COAG agreed to continue to manage environmental externalities through a range of measures. As well as adopting regulatory approaches, it was agreed to examine the feasibility of using market–based instruments such as pricing to account for both positive and negative externalities associated with water use, and to implement pricing that includes environmental externalities where feasible and practical (clause 65 ii). At present, only South Australia and the ACT have explicit environmental management charges levied on water consumed (Dwyer et al. 2006), but in neither case is this directly related to the external costs imposed by water users.

However, environmental charges may not be suitable for all water–related externalities (Hatton MacDonald 2004). Dwyer et al. (2006) consider the complexities of implementing a tax or charge related to the costs of negative externalities. Characteristics of an externality affect the likelihood of private sector solutions being effective, and also influence the effectiveness of alternative public policy instruments. While a tax equal to the marginal external costs at each level of output could improve efficiency, and in the long term provide incentives to undertake abatement activities, the design of such a tax is non–trivial.

3.2 Scarcity Pricing
An important initiative of the NWI is urban water reform that includes the goal of efficient water use, improved pricing and a review of the effectiveness of temporary water restrictions (clauses 90 and 91). In many urban centres the possibility exists for rural–urban water trading given the large disparity in costs to users, even accounting for the extra cost of water treatment and delivery to urban users (see Quiggin 2006; Chapter 6 this collection). In addition to facilitating urban–rural trades, urban water pricing reforms are also needed to account for the large temporal variations in supply that are currently managed with quantitative water restrictions.

A recent study of Sydney water suggests that should another low rainfall period reoccur similar to that of 2001–2005 the city would become critically short of water, even with expected increases in supply from groundwater and recycling. An alternative to on–going water restrictions is to have the price of volumetric water adjust flexibly upwards as the amount of water in storage declines (Grafton and
Kompas 2006). Pricing urban water to balance demand with available supply is economically efficient, and also provides the appropriate signals to users as to the value of water they are using (Sibley 2006). Such pricing also promotes innovation in terms of supply. The key point is that the price of water must reflect its opportunity cost in use and non–use, balance supply with demand, and provide appropriate signals for conservation and efficiency.

4 Adaptable Knowledge

The NWI places Australia in the forefront of world–wide policy reform in terms of water markets, planning and institutional developments. Although a great deal of knowledge already exists as to how to move forward on the reform agenda on water rights (PC 2003; PC 2006; ACIL Tasman in association with Freehills 2004; PriceWaterhouseCoopers 2006), much can be learnt from other resource sectors that have initiated market–based reforms at an earlier date.

The fisheries harvesting sector offers a number of possible insights for the water reform process. Fish are mobile and are not homogenous, and differ in size and type that depends on where and when they are caught. The mobility and the spatial and heterogeneous qualities of fish have significant parallels with water. Moreover, as with water use, the capture of the resource frequently imposes cost on others, and how it is appropriated also affects the environment. The fishing industry in Australia and other jurisdictions has also experimented with and refined the use of market–based instruments. These rights are typically defined as a share of the total allowable catch (TAC) and are called individual transferable quotas (ITQs). The use of these rights offers insights to the issues of overallocation, incentives and third–party effects in water reform.

5 Overallocation

The fishing analogy for surface water overallocation is overcapacity. In the case of fisheries, overcapacity refers to the case where the inputs used in fishing (vessels, nets, etc.) exceeds what is required to catch the available quantity of fish. In the case of water, overallocation means that water infrastructure and existing water–use activities exceed what is feasible given the available water supply. Overallocation has environmental consequences because it makes it much more difficult to reallocate water for environmental flows when there is no ‘surplus’ water, especially in drought conditions. Similarly, in terms of overcapacity, fishery managers find it difficult to reduce fishing inputs to meet sustainability goals if this imposes hardship on marginal fishers. This process is made much more difficult where uncertainties over the impacts of reduced flows collide with social and economic interests, and when ecological risk boundaries are neither clearly defined nor widely accepted (Grafton et al. 2006b).

The way forward to resolving the overcapacity problem in fisheries has been to change the incentives faced by harvesters. By implementing ITQs, more profitable fishers can acquire a greater share of the harvesting rights thereby encouraging the exit of less profitable operators. To be successful, however, the total harvest must be set appropriately to ensure sustainability and a profitable fishing industry. The same applies for water users — caps or limits on water use must be consistent with
environmental sustainability. To accelerate autonomous adjustment with ITQs, whereby vessels that exit are bought out by more profitable operators, governments have initiated ‘buybacks’ of fishing rights (Kompas 2006). When undertaking buybacks, explicit attention should be given to the differences between ‘active’ and ‘latent’ fishing licenses otherwise the risk is that inactive rights may be reactivated following the buyback. Australian governments are beginning to purchase water entitlements to meet environmental objectives, and to speed the transition to more efficient water outcomes. Such purchases would, however, need to take into account potential activation of water rights ‘sleepers’ (water rights that have never been used) and ‘dozers’ (water rights not currently used). Water tenders that force rights holders to undertake water efficiency improvements as a condition of sale will also raise the cost per litre of water purchased (Grafton and Hussey 2006).

5.1 Incentives

The key insight from fisheries is that price signals and incentives are critical to generating sustainable and profitable fisheries outcomes. In a review of over a dozen fisheries worldwide, Grafton et al. (2006a) show that without appropriate incentives and adequate monitoring and enforcement, fishers frequently fail to adopt sustainable practices. The key is to ensure that fishers have durable property rights. The insight for water reform, and recognised in the NWI, is the importance of creating durable property rights for water. In particular, holders of water rights should be able to trade their entitlements and seasonal allocations, the price of water should reflect the costs of use on the environment, and non-compliance with regulations in terms of water withdrawals must be identified and remedied in a timely fashion.

The use of ITQs in fisheries also illustrates the need for on-going management and innovation in terms of rights-based fishing. For instance, ITQs provide appropriate market signals over the use of target fish species, but do little to address concerns over bycatch of vulnerable non-target species, or activities that may impose environmental costs on others. Similarly, trading of water entitlements does not directly address issues of water quality, such as salinity. Additional instruments are required to account for water quality, such as appropriate environmental charges in terms of water quality or, as is currently the case, restrictions can be imposed on trades that might reduce water quality (Heaney et al. 2006). The fundamental insight from fisheries is that operators need appropriate incentives to address water quality issues, and when faced with such incentives, they will act in ways to minimise these external costs.

The fisheries experience also stresses the importance of inclusivity of rights. Where ITQs have been applied and exemptions given, such as to operators of small vessels in Iceland, this has encouraged large expansions in fishing effort in the exempted categories (Grafton et al. 2006a). In the case of water, metering and pricing of surface water use has, in some cases, encouraged greater withdrawals from groundwater sources that may have detrimental impacts on downstream users and future water supplies.

5.2 Third-party Effects
Where property rights are poorly specified, there are potentially unintended effects on other entitlement holders or the environment due to changes in water use decisions. Van Dijk et al. (2006) identify six factors that are currently poorly accounted for in property right specifications — long term climate change, afforestation, groundwater extraction, changes to irrigation water management, farm dams and bushfires — all of which impose significant risks on the resource availability of water entitlement holders. Improvements in water accounting arrangements are also needed so that a sufficiently comprehensive system can be developed to underpin water use and environmental water allocation decisions (PC 2006).

Heaney et al. (2006) identify a number of third-party effects related to water trade, where the costs or benefits of trading are not fully captured by holders of property rights. These include impacts on reliability of supply and delivery, storage and delivery charges, and water quality. These can be mitigated through more completely specified water rights although, in some cases, the costs of establishing property rights may be higher than the benefits they generate. In the case of fisheries, the concern has been that trades of harvesting rights will transfer fish out of one region to another, with possibly negative social costs to some fishing communities. Some fishers have argued for restrictions on trade out of disadvantaged regions to address this challenge. The problem with this approach is that it ‘freezes’ the current state of affairs and does not allow resources (fish) to go where they are most valued. Although superficially beneficial, trade restrictions provide no signal to resource users to adjust their behaviour and improve productivity which is the ultimate promoter of economically viable communities.

The fisheries experiences with third-party effects offer insight for the trading of water. Constraints on water trading designed to protect communities or benefit remaining members of irrigation districts will, by themselves, fail to maintain viable communities. If fixed costs of supplying water are too high for the remaining operators after water trading, there exist competitive pressures to change water use and how water is supplied. Maintaining the status quo via arbitrary trade restrictions or exit fees merely postpones the inevitable, and fails to give timely signals to water users to change existing practices.

6 Research gaps

To effectively implement the NWI a number of important research gaps must be addressed. First, and foremost, is a need for a better understanding of the ecosystem requirements of surface water to maintain desired environmental goals. This also requires better knowledge of groundwater and surface linkages, the consequences of climate change, and the interactions between land use practices and their environmental impacts. This knowledge is required to manage risks (van Dijk et al. 2006), and also to determine the appropriate caps and targets in terms of water use. To this end, at the Summit on the Murray–Darling Basin it was agreed that CSIRO would report progressively by the end of 2007 on sustainable yields of surface and groundwater systems within the Murray–Darling Basin, including examining sustainable yield assumptions.

Better ecosystem knowledge and indicators of river health will provide useful information for valuing non-market benefits of environmental flows. These non–
market benefits, at relevant spatial scales, provide the basis for pricing water not currently in use and the value of tradeoffs between water withdrawals and environmental flows. At present these trade-offs are only implicit and are determined by planning processes in terms of ‘set asides’ of water for environmental flows.

Improved water outcomes for Australia depend a great deal on the ability to support cost–effective water trading. Important research gaps include a lack of knowledge on water prices, transaction costs of water trades, and also the potential consequences of trades on communities. Research on these knowledge gaps will help to identify what policies may be needed to promote trades that contribute to efficiency, help resolve third–party effects, and mitigate the social and environmental impacts of water trading.

7 Conclusion

This review of existing water trading and water pricing in Australia identifies key issues in the ongoing water reforms initiated as part of the NWI. First, it supports the NWI agenda to remove many of the restrictions on water trading. Second, it stresses the importance of water prices (including non–market values) and full–cost pricing as signals as to the relative scarcity and value of water. Third, it emphasises the need to reduce reliance on inefficient regulations and controls to manage demand.

Much can be achieved in the coming years. The success of the water reform process, however, will be constrained by a lack of knowledge of the effects of water extractions on system–wide and local environments, non–market values of environmental flows, easily accessible and reliable water trading and pricing data, and an understanding of the social and economic impacts of trades.

8 References


Authorship is alphabetical. The views expressed in this paper are those of the authors and do not necessarily reflect those of the Productivity Commission.

Trade in water entitlements, sometimes called ‘permanent trade’, involves moving the property right of a water entitlement in perpetuity. Trade in water allocations, sometimes called ‘temporary trade’, involves moving water allocations on a short term basis, usually within an irrigation season.

Some of these derivatives can also have financial management and taxation benefits, compared with water entitlements.
Figure 1  
**Seasonal allocation trade in the southern Murray–Darling Basin**


Figure 2  
**Water entitlement trade in the southern Murray–Darling Basin**

Water & Salinity Markets

R. Quentin Grafton

Crawford School of Economics and Government
Australian National University

quentin.grafton@anu.edu.au

Presented at

Policy Choices for Salinity Mitigation:
Bridging the Disciplinary Divides

1-2 February 2007
Outline

- History of water markets
- Water use and entitlements
- Water trading in Australia (especially MDB)
- Salinity trading in Hunter River
- Ways forward
Early history of water markets

- Originally surface water was treated under ‘common law’ with riparian rights in the form of privileged access to water — ownership only existed if right-of-access had been exercised.
- In late 19th C states enacted legislation that gave Crown the right to use, flow & control of surface water. These statutory rights were used to encourage economic development, primarily in agriculture.
Current State of Play

- By 1980s concerns raised over sustainability of water supplies, especially in agricultural use.
- Scarcity concerns led to the 1994 COAG and a creation of a ‘cap’ of water use in Murray-Darling along with market-based approaches.
- Market-based agenda has greatly expanded with the 2004 National Water Initiative with goals for: (1) removal of barriers to trade, (2) water registers, and (3) regulatory arrangements for interstate water trading.
Snapshot of water use

- In 2004-5 total Australian water consumption was some 19,000 GL or about 8% of total run-off or less than 1% of total rainfall
- Agriculture accounts for 65% of total use (12,100 GL) with households and manufacturing accounting for 11% and 3% respectively
Water entitlements exist for 29,000 GL, or amount 50% greater than 2004-05 consumption.

About 76,000 surface water access entitlements that represent 76% of total entitlement volume.

NSW has the largest entitlement volume or about 45% of Australian total.
Trades of entitlements

- Approx 1,300 GL water traded in 2004-05, or about 7% of total consumption or 5% of total entitlements
- Trades included approx. 15,000 transfers of which almost 90% were temporary rather than permanent
Water Trading

- Trade largely restricted to irrigators
- Well established, active markets in seasonal allocations
- Smaller, but growing volume of trade in entitlements
- Markets for derivative products, such as leases and forward contracts, emerging
- A number of significant constraints to trade remain
Seasonal allocation trade in the southern Murray–Darling Basin

Transfer Volume (GL)

- Intrastate
- Interstate

Water entitlement trade in the southern Murray–Darling Basin

![Graph showing water transfer volumes from 1983-84 to 2004-05. The graph compares intrastate and interstate water transfer volumes, with intrastate volumes generally higher than interstate volumes. The trend shows an increase in transfer volumes from 1983-84 to 1998-99, followed by a decrease in the early 2000s and a slight increase by 2004-05.]
Transaction costs

- Reduce trade by reducing net gains from selling and buying water
- Recently imposed exit fees on export of water entitlements significant
  - as high as 74% of the value of entitlements
- Costs vary by jurisdiction and type of water right
Other factors reducing trade

- Other arrangements governing water entitlements and allocations also reduce water trade:
  - lack of integration in water management systems
  - poor water accounting systems and the number and complexity of entitlement types
Who can trade?

- In some jurisdictions, legislation prohibits purchase of water by non-landholders (e.g. Victoria)
- Use of administrative arrangements within water plans to allocate water (to environment, urban use, …)
- With a few exceptions, very limited urban-rural water trades
Current approaches to managing salinity in the Murray-Darling Basin

In the MDB salinity mitigation has been undertaken with:

- Salinity credits
- Engineering to intercept saline water
- Restrictions on trades into high impact zones with levies applied to trades in lower impact zones
- Codes of practice (such as Ricegrowers’ Association of Australia)
Market-based instruments for salinity

- Cap and trade of salt by irrigation areas
- Offsets for groundwater recharge
- Salt or land-use levies on farm practices
- ‘Bush Auctions’ for land-use change that reduce salinity
Hunter River salinity (1)

- Hunter river originates in Barrington Tops and discharges into the sea (after joining with other rivers) at Newcastle.
- Salinity is an ongoing problem in the river exacerbated by the catchment’s geology dominated by marine sediment deposits.
- Estimated 80% of salinity comes from ‘natural’ seepage and about 20% from point and non-point sources.
Low salinity is highly correlated with high water flows. Thus salinity varies substantially over a season — higher salt loads in dry weather conditions.

Salinity is higher downstream than upstream.

Major salinity point sources are 35 coal mines in the region via groundwater inflow/seepage.
Since 1970s saline discharge from mines allowed provided mines had a ‘trickle discharge’ licence

By 1990s, with proposed expansion of mines and increased concerns of salinity, NSW adopted a salinity trading scheme
Hunter River salinity trading (2)

- Trading scheme divides the river into 3 sectors with different salinity maximum limits, not to be exceeded, and allowable discharges on sectors that depend on river flows (in low flows no discharge is permitted)
- Discharge permitted only with credits that are tradeable. Each individual permit (1,000 allocated) represents 0.1% of total allowable salt load discharge which, itself, is determined by river flow and salinity conditions
Over 1995-2002 period only 22% of the time were permit holders allowed to discharge

Total discharges with permits represented about 5% of salt load in river

Total of 157 trades over the period

Proportion of permits made available via auction as permits have limited tenure
Ways forward

- Water markets are expanding in Australia and offer cost-effective ways of addressing overallocation.
- Current water markets based on quantity with quality issues addressed via regulatory approaches (such as environmental water allocations).
Ways forward

- Market-based approaches offer potential ways to reduce salinity in cost-effective ways.
- Point sources offers greatest potential for cost-effective ways of salinity mitigation, but salinity from non-point sources can be addressed via land-use change incentives (bush tenders, salt levies, best practices, etc.)