Volumetric restrictions on water entitlement trade

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Executive Summary

This paper undertakes an economic assessment of the effect of volumetric restrictions on water trade — specifically, limits on water entitlement trades out of a geographic region. We consider the impacts on markets for water entitlements and allocations in the Murray-Darling Basin, and specifically on achievement of the objectives of water trade under the *Water Act*.

Existence of volumetric restrictions

In Victoria, there is a 4% annual limit that restricts the volume of water entitlement that may be traded out of an irrigation district and a 10% limit on the volume of water entitlement that may be held by Non-Water Users in a given water system. Both limits have prevented water entitlement trades from being completed.

In New South Wales, there is a 4% annual limit that restricts the volume of water entitlement that may be traded out of an irrigation area and an embargo on water entitlement trades to the environment. Both limits have prevented water entitlement trades from being completed.

In South Australia, there has been a 12% limit over a two year period on the volume of water entitlement that may be traded out of some irrigation districts; however, this limit has not yet been reached. This limit was lifted in 2009-10.

In Queensland and the ACT volumetric restrictions on water entitlement trade were not identified.

Framework for analysing impacts of volumetric restrictions

This paper develops a conceptual framework for considering the economic impacts of volumetric restrictions on trading of water entitlements between regions, based on standard economic welfare theory. The analysis begins with highly restrictive assumptions to provide a strong theoretical underpinning, based on first principles, and progressively builds on these results as assumptions are relaxed in order to reflect the market for water access entitlements more realistically.

We find that restricting water entitlement trade reduces economic efficiency, and the related costs are both short-run and long-run:

- To the degree that water entitlement trade facilitates flexibility in the short-run, restrictions to water entitlement trade can affect allocative and productive efficiency and the welfare losses can be observed as foregone high-value agricultural crop production. However, markets for water allocations also allow for different production decisions on existing crops and moving water between competing uses within a given irrigation season

— meaning that differences exist between the demand for water entitlements and the demand for water in irrigation use.

- Restrictions to water entitlement trade also affect dynamic efficiency by distorting long-run decisions. This is because water entitlements confer perpetual rights to access water and are the foundation of water-related investment decisions and water-related risk management. Restrictions on trade therefore result in economically inefficient long-term investment decisions in irrigation areas.

- Restrictions on trade can constrain farm business decision-making such as cash-flow management and ultimately decisions to sell assets and exit from irrigated production. This is because water entitlements are a significant proportion of the value of assets of many farming businesses. This means farm based decisions – either short or long run – are likely distorted away from those that would be economically efficient by restrictions in trade.

In assessing the efficiency impacts of these restrictions, it is important to take account of interactions between the entitlements market and the allocations market. This may mean that efficiency losses are not so much to do with the inability to move water to higher-valued uses in response to seasonal conditions, (as this can still be done via allocations trading), but may relate more to longer-term considerations such as foregone ability to:

- invest in new enterprises or divest from non-viable enterprises

- manage risk efficiently

- adjust to alternative forms of dryland or less intensive irrigated agriculture.

With reduced financial resources available to facilitate the adjustment process, local and regional economic activity may also decline.

Restrictions also provide incentives to change behaviour in the water market. In particular, uncertainty imposed by volumetric limits increases the likelihood of rushed and sub-optimal trade decisions under uncertainty.

In addition to efficiency costs, implementation of volumetric constraints imposes transactions costs for government administrators and to water users, including in relation to conducting ballots for trading applications and in strategies made to avoid the effects of the volumetric constraint.

While ostensibly designed to manage the distributional impacts of adjustment processes, volumetric constraints can also result in a number of other un-intended and detrimental distributional or equity impacts.

Empirical assessment of effects of volumetric restrictions

Firstly, we considered the extent to which limits are binding.

- In Victoria, the 4% limit has been historically reached in the majority of irrigation districts — with 94.5% of Victorian high-reliability water shares held in irrigation districts being within an irrigation district that had reached the 4% limit at the end of 2008-09. In a number of cases, the 4% limit was reached early in the season and therefore restricted trading activities for a significant period of time. Also, the 10% limit prevented the processing of 50GL of water entitlement transactions in 2009-10.

- In New South Wales, the 4% limit is thought to have only been reached in the Murrumbidgee Irrigation area in 2008-09, where the limit was reached towards the end of the irrigation season.

Secondly, we examined the impacts of restrictions when they do bind. One observable indicator of the extent to which volumetric limits are distorting water markets is any price differential that exists between regions. However, precise inter-regional pricing differentials cannot be determined in NSW and Victoria because of the aggregate way in which pricing information is reported. We therefore rely on a very high level assessment of price differentials and, by making some broad assumptions, can draw some conclusions about the efficiency impacts (and hence welfare losses) directly associated with restrictions in the combined market for water entitlements and allocations. We note that these should be treated with caution given the caveats, and suggestions for improving the data, below.

Examination of water entitlement prices in Victorian trading zone 1A suggests that two price levels may be present — namely at approximately $2000/ML and $2400/ML. If we make the simplifying assumption that this $400/ML price differential exists in Victorian irrigation districts is all due to the 4% rule then some rough quantification of the efficiency impacts of the binding restriction can be made.

- In 2007-08, it has been reported that 7.3 GL of Victorian water entitlement trades were denied due to the 4% limit. Using these estimates of price and quantity distortions in the assessment framework suggests a direct welfare loss of $1.5 million annually to buyers and sellers of water entitlements.

- If this assumed price differential is instead considered with the 34 GL of denied trades from the 2009-10 water trade ballot, then the estimate of welfare loss is nearly $6.8 million.

It should be noted that, assuming the price differential is related to the 4% limit binding, these calculations are at the lower bound of the expected efficiency losses. Other losses are incurred across the community and relate to:

- the losses associated with unprocessed trades or trades later in the season that will also be denied
- the losses caused by the ballot mechanism itself as those that most value the ability to trade are not necessarily permitted to trade
- the transaction costs from strategic reactions to trade
- time and effort put into the application and processing process for trades that are summarily rejected (notwithstanding application fees being reimbursed)
- the costs of running the ballot system.

Finally, and perhaps most importantly, the restrictions on entitlement trading can also have significant negative social and distributional impacts. Volumetric limits impede individuals that are seeking to make timely adjustment decisions by:

- preventing their sale of water assets, which means they cannot exit the industry or adapt to different, more sustainable, practices; or
- reducing the recoverable value in their water assets by limiting their available market, thereby artificially capping the return on their investment and reducing their ability to self-fund alternative investments.

We note that this is based on a high level analysis of price differentials, and that until more comprehensive price data is available, any quantification of the impact of the 4% restrictions on trade will be based on a number of assumptions and heavily caveated because of this. Furthermore, due to a paucity of data on inter-regional prices, we were unable to draw any conclusions from the NSW data.

Ideally, data on water entitlement prices should be made available for NSW and Victoria in a form where statistical analysis can be used to assess the significance of the drivers of observed price differentials between regions, including the binding of the trading limits. This would allow more certainty in attributing welfare losses from price differentials to the restrictions on trade, and quantifying these losses.

Notwithstanding this, it is clear that the restrictions on trade do create direct and indirect efficiency costs, and limit the potential for affected communities to self-determine their futures.

Effect on Basin water market and trading objectives

The analysis in this paper suggest that the volumetric restrictions on trading of water entitlements have significant potential to, and increasingly in practice do, have an adverse impact on the achievement of the Basin water market and trading objectives contained within the Commonwealth *Water Act 2007*.

Facilitate efficient water markets and the opportunities for trading

Restrictions on inter-regional entitlement trading clearly prevent some opportunities for water trading by preventing one type of transaction in the market when the limit binds. In particular, constraints on entitlement trading undermine the ability of water users to manage their risks efficiently, to undertake long-term investments, or to realise the value of their assets in response to pressures facing the industry.

Minimise transaction costs on water trades

The limits on inter-regional entitlement trading impose a number of additional costs on water market participants. They impose extra costs on those who prepare and submit entitlement trades for approvals only to have them returned. Additional transactions costs may then be incurred in seeking alternatives (e.g. trading of allocations). The need to administer and enforce the limits also impose costs on the relevant water authorities. Additional costs are also incurred in managing implementation of the limits (e.g. the costs of running ballot processes to ration available limits) and the additional allocation transfer applications that would be expected.

Enable the appropriate mix of water products to develop

The limits on trading of entitlements between regions distorts the mix of transaction in the market (i.e. substituting allocation trades for entitlement trades). Such limits also prevent irrigators and others from sourcing different products, such as entitlements from different water sources under a tagged trading regime, as a means of diversifying their water-sourcing risk.

Recognise and protect the needs of the environment

Given that the limits on inter-regional entitlement trading is being triggered largely by environmental water purchases by Commonwealth, State Governments and the Murray-Darling Basin Authority, the limits can undermine the return of water to the environment. Notably, the recently-imposed moratorium in NSW applies specifically to environmental water purchases.

This effectively frustrates these attempts to reduce over-allocation and over-use in the MDB which is a fundamental objective of the Act and water reform more generally.

Provide appropriate protection of third-party interests

This objective seeks to ensure that water trading does not impact adversely on others (e.g. other entitlement holders) that are not a party to the transaction.

The principle here is that individual entitlement holders should not have their rights as assigned in their entitlements diminished by the actions of others.

In this regard, imposing restrictions on entitlement trading once a volumetric limit is reached clearly has the effect of disadvantaging some entitlement holders at the expense of others.

An important element and part of the economic value of an entitlement is its tradeability. The fact that some individuals' entitlement are rendered less valuable (because they cannot be traded outside the region) because others have sold before them, is fundamentally inconsistent with this principle.

While addressing the financial impact of funding stranded assets on those irrigators remaining in an irrigation system when others leave after trading out their entitlement appears to have been one of the rationales for imposing the limits, there are now more direct and less distorting mechanisms in place.

Similarly, it is not clear that restricting trading of entitlements is the most effective means of managing structural adjustment in communities, where upstream and downstream industries may be affected by contractions in irrigated agriculture.

1 Introduction

1.1 Purpose of this report

The purpose of this paper is to undertake an economic assessment of the effect of volumetric restrictions on water entitlement trades out of a geographic region on markets for water entitlements and allocations in the Murray-Darling Basin, and specifically on achievement of the objectives of water trade under the *Water Act*.

1.2 Background

The ACCC is required under the Commonwealth *Water Act 2007* to formulate advice on water trading rules to inform the Murray-Darling Basin Authority's development of its 2011 (Murray-Darling) Basin Plan. More formally, the water trading rules are 'rules for the trading or transfer of tradeable water rights in relation to Basin water resources'.

As part of its advice on water trading rules, the ACCC is concerned with the existence and magnitude of any barriers or impediments to achieving the Basin water market and trading objectives contained within Schedule 3 of the *Water Act* (see Box).

The Basin water market and trading objectives and principles, set out in Schedule 3 of the Act, are to:

- facilitate efficient water markets and the opportunities for trading, within and between Basin States, where water resources are physically shared or hydrologic connections and water supply considerations will permit water trading
- minimise transaction costs on water trades, including through good information flows in the market and compatible entitlement, registry, regulatory and other arrangements across jurisdictions
- enable the appropriate mix of water products to develop based on water access entitlements which can be traded either in whole or in part, and either temporarily or permanently, or through lease arrangements or other trading options that may evolve over time
- recognise and protect the needs of the environment
- provide appropriate protection of third-party interests.

1.3 Volumetric limits on trading of water entitlements

One of the areas that could potentially be dealt with by the water trading rules relates to volumetric limits on the trading of water entitlements between regions. These limits mean that once the net traded volume of water entitlements reaches the specified percentage (e.g. 4%) of the total volume of water in entitlements within the defined region, all subsequent applications for trading of entitlement outside of the region are rejected for the remainder of the year. Importantly, this constraint applies only to trade of entitlements outside of the region and does not apply to trades of entitlement within the regions or to other types of transactions such as trading of seasonal allocations.

This limit on water entitlement trade out of a district is in line with the National Water Initiative. NWI clause 60(iv) states:

'...in respect of any existing institutional barriers to intra and interstate trade... ...immediate removal of barriers to permanent trade out of water irrigation areas up to an annual threshold limit of four percent of the total water entitlement of that area, subject to a review in 2009 with a move to full and open trade by 2014 at the latest, except in the southern Murray-Darling Basin where action to remove barriers to trade is agreed as set out under paragraph 63...'

NWI clause 63(ii) states:

'…reduce barriers to trade in the Southern Murray-Darling Basin by taking the necessary legislative and other actions to permit open trade and ensure competitive neutrality, and to establish an interim threshold limit on the level of permanent trade out of all water irrigation areas of four per cent per annum of the total water access entitlement for the water irrigation area…'

The National Water Initiative also contains provisions for the review of this annual threshold limit by 2009, with a view to raising the threshold (in the case of the southern MDB) or removing it altogether (in the rest of Australia). The commitment to review this rule has been reaffirmed by COAG, which has stated an ambition to raise the limit to 6 per cent by the end of 2009.

As noted in the brief, the most commonly cited rationale for this limit is to manage the rate of adjustment in rural communities and to address stranded asset risks.

However, the '4 per cent annual limit' was identified in the ACCC's trading rules issues paper (p. 44) as a volumetric restriction that acts as an impediment to the trade of water access entitlements.

There are however some significant differences in the precise way in which the limits are applied in each of the Basin jurisdictions.

Victoria

The four percent limit is interpreted in Victoria as applying to smaller irrigation districts within the area served by water authorities such as Goulburn-Murray Water.

Specifically, Schedule 5 of the *Trading Rules For Declared Water Systems* (a consolidation of information in the Victorian Water Act 1989) sets out the irrigation areas subject to the 4% annual limit (DSE 2009a). These are:

1. Torrumbarry Irrigation Area (excluding the Woorinen part)
2. Murray Valley Irrigation Area
3. Shepparton Irrigation Area
4. Central Goulburn Irrigation Area
5. Rochester Irrigation Area
6. Pyramid-Boort Irrigation Area
7. Campaspe Irrigation District
8. Merbein Irrigation District, Red Cliffs Irrigation District, Robinvale Irrigation District
9. Nyah Irrigation District, Tresco Irrigation District, the Woorinen part of Torrumbarry Irrigation Area
10. First Mildura Irrigation District

The limit also applies separately to different reliability classes of water access entitlements (high and low reliability water shares), and conversion to Non-Water User (disassociated from land) counts towards the 4% limit. (However, note that not all water shares are bound by the 4% limit: river diversion entitlements and Non-Water Users are not subject to the limit.)

The 4% limit is given effect via an Order known as the Trading Rules for Declared Water Systems – a subsidiary instrument under the Victorian Water Act 1989.

In June 2009 the Victorian Government announced some exemptions to the 4% annual limit on trade out of irrigation areas. The new agreement will enable the Australian Government to acquire 300 gigalitres over the next five years from 2008-09, over and above those purchases already permitted under Victoria's four per cent annual cap from irrigation districts. Under this agreement, buybacks will be targeted at less productive areas while irrigation infrastructure is modernised and reconfigured to ensure Victorian farmers have a 'more productive and sustainable future'[1].

Also, the Victorian implementation of the 4% annual limit permits mortgagee sales outside of the volumetric limit (DSE 2009b).

[1] www.premier.vic.gov.au/premier/-new-commonwealth-victorian-water-agreement.html

Exemptions to 4% limit in Victoria

The exemptions to the 4% limit have been given effect via a new trading rule 25A. Under the Rule, an exemption may be granted to any application, received after 1 July 2009, that could otherwise be refused under Rule 25 if:

(a) the application is for transfer of a water share to the Commonwealth of Australia (the 'Commonwealth'), and -

(i) an application (an 'exit grant package application') has been made to the Commonwealth for the Murray-Darling Basin Small Block Irrigators Exit Grant Package; and

(ii) the water share is associated with land that is the subject of the exit grant package application; and

(iii) the applicant provides evidence to the satisfaction of the Minister that the Commonwealth will not accept the exit grant package application without approval of the application to transfer the water share; or

(b) the application is for transfer of a water share to the Commonwealth, and the applicant provides evidence to the satisfaction of the Minister that the transfer is being made as a result of Commonwealth assistance in achieving on-farm efficiencies; or

(c) the application is for transfer of a water share to the Commonwealth, and -

(i) the water share is currently associated with land in an area that has been identified by the relevant water corporation as being not a priority for modernisation, based on criteria such as suitability for irrigation, the environmental impact of irrigation, existing land-use change, and distance from the main irrigation 'backbone'; and

(ii) since 1 July 2009, no water share has become associated with the land with which the water share that is the subject of the application is associated; and

(iii) exemptions given since 1 July 2009 under sub-rules (a), (b) and (c) of Rule 25A collectively do not exceed a volume of 60 gigalitres.

Source: DSE (2009)

In addition to the 4% limit on entitlements traded out of a region, the Victorian Government has imposed a legislative cap on the volume of water shares that can be owned without attachment to (i.e. association with) a parcel of land, known as the Non-Water User (NWU) limit.

The NWU limit is currently set at 10% of a water system's total volume of water shares (e.g. 10% of the Goulburn system's high reliability water shares).

Until 2009-10, the NWU limit had not yet been reached in any system. However, during the processing of applications at the opening of the 2009-10 season the NWU limit was reached in the Goulburn and Campaspe systems.

In May 2009 the Brumby Government announced that it would legislate to remove the 10 per cent limit on the volume of Victorian water entitlements that can be owned without being associated with land[2]. However, the change has not yet been enacted and therefore the 10% NWU limit still applies until its anticipated removal by 31 October 2009.

New South Wales

In New South Wales, it is understood that the 4% limit applies to the entire irrigation regions controlled by different irrigation corporations and cooperatives — such as Murray Irrigation Limited, Murrumbidgee Irrigation Limited, Coleambally Irrigation Cooperative Limited, Western Murray Irrigation Limited, etc. It is understood that the limit does not apply to the large proportion of river diverters in the Murray and Murrumbidgee systems in NSW.

In NSW the limit is effected via section 71ZA of the *Water Management Act 2000*:

…(2) The Minister may order an irrigation corporation to pay a civil penalty under this section if:

(a) any provision of its constitution, of any contract entered into by it with a member of the corporation or of any other document associated with the operation of the corporation (such as transfer rules of the corporation) prevents, or

(b) the irrigation corporation conducts its operations so as to prevent,

arrangements being made for the reduction in the share component of an access licence held by it for the purpose of permanently transferring a member's entitlement to water under the access licence to another access licence that is not held by the irrigation corporation.

(3) Subsection (2) does not apply to a provision referred to in subsection (2) (a), or to the conduct of the operations of an irrigation corporation in a manner, that prevents a transfer that would result in the share component of an access licence held by the irrigation corporation being reduced, in any period commencing on 1 July in any year and ending on 30 June (inclusive) in the following year, by an amount of more than 4% of the share component that applied to the access licence at the beginning of that period…

It is understood that the legislation relates to a 4% limit on transformation of entitlement, whether or not there is trade.

In May 2009, NSW also announced an embargo on all further trade of entitlements relating to environmental purchases by the Commonwealth or other

[2] www.ourwater.vic.gov.au/__data/assets/pdf_file/0014/52511/Review-of-non-water-user-limit.pdf

agencies in response to the Commonwealth purchase of entitlements from Twynam Agricultural Group.

On 30 June 2009, NSW announced an interim restriction on the temporary trade of water from the Murrumbidgee Valley to the Murray Valley, including interstate trades. Operational reasons were cited for this — physical constraints limit the delivery of water traded between river valleys and due to the current dry conditions some of these limits have been reached. The NSW Office of Water is allowing limited water trades out of the Murrumbidgee Valley via a trade ballot. The first ballot will open on 24 August 2009 with 70,000 megalitres of water allocation available to be traded out.

South Australia

In South Australia, some irrigation districts served by Central Irrigation Trust (CIT) reached the four percent annual limit in 2008-09 which therefore had the potential to limit trade. CIT subsequently increased the interim threshold to 12 percent over two years.

South Australia passed new legislation for Irrigation Trusts on 23 April 2009 to increase consistency with the NWI and new arrangements in the MDB under the Water Act 2007. This includes preventing trusts from restricting entitlement trade out of their network, although it is unclear how these restrictions will be given practical effect. CIT has reportedly announced that any transfers that relate to irrigators wanting to take advantage of the *Australian Government Small Block Irrigator Exit Package* are exempt from its new limit of 12 percent over 2 years.

Queensland

This study has not identified any volumetric restrictions that affect water trade within or out of Queensland.

ACT

This study has not identified any volumetric restrictions that affect water trade within or out of the ACT.

1.4 Emerging issues

Although these volumetric restrictions seek to address concerns regarding the rate of change in irrigation communities, they also have the potential to distort prices and the trading decisions of market participants, and to prevent water reaching its most valuable use.

These concerns have received greater prominence in recent times as the volume of entitlement trading between regions has increased and consequently the limits have become increasingly binding (that is, they bind earlier in the year, and more

potential water trades are rejected). One of the key drivers for this has been the increasing participation in the market of the Commonwealth and State Government agencies in purchasing water entitlements for environmental purposes.

As discussed in more detail in section 3.1.1, the limit has been reached in a number of Victorian districts, given that the smaller scale of the regions means that the limit is reached earlier than it would otherwise be.

The South Australian Government has indicated that they will consider a High Court challenge against the Victorian 4% limit, and the New South Wales Government has also indicated that they may join this action.

Against this background, the role of this project is to conduct a qualitative and quantitative assessment of how these volumetric restrictions impact on achieving the Basin water market and trading objectives.

1.5 Structure of this paper

The remainder of this paper is structured as follows:

- Section 2 develops the conceptual framework for analysing the impacts of the volumetric restrictions on entitlement trading.
- Section 3 assesses the impacts of these restrictions, in quantitative terms as far as possible, using the framework.
- Section 4 draws together our conclusions on the effect of the volumetric restriction on the achievement of the Basin water market and trading objectives.

2 Framework for analysis

This section develops a conceptual framework for considering the economic impacts of volumetric restrictions on trading of water entitlements between regions.

Consistent with the terms of reference for this study, the focus is on economic efficiency impacts on water markets generally. However, the framework also considers the impacts on individuals operating within those markets, as well as wider social impacts.

The analysis begins with highly restrictive assumptions to provide a strong theoretical underpinning, based on first principles, and progressively builds on these results as assumptions are relaxed in order to reflect the market for water access entitlements more realistically.

2.1 The basic framework

The conceptual framework is based on standard economic welfare theory.

2.1.1 Supply of entitlements

The supply of water entitlements in a given system/market is determined by the water planning processes that define the volume and characteristics of water entitlements available. This means that the supply of entitlements is exogenously determined — however, we consider later the representation of entitlement purchases for the environment that reduce the number of entitlements available for consumptive users.

2.1.2 Demand for entitlements

Demand for water entitlements is a derived demand based on the expected value of water made available from entitlements. The derived demand for water entitlements will be governed by the potential use for the water (such as the value in production in irrigating industries) and the characteristics of the water made available for this use (the reliability of the entitlement and correlation with alternative water sourcing opportunities).

ABARE (Page et al 2007) use the responsiveness of water demand in production as an approximation for the elasticity of demand for water entitlements — noting that horticulturists are likely to exhibit a more inelastic demand for water than irrigators who irrigate seasonal crops. Water demand in production is directly linked to the biological characteristics of the crop planted (such as non-interruptible production systems based on perennial crops and interruptible production systems using annual crops).

The most recent estimates of demand elasticities for irrigation water in Australia are from Bell et al (2007). As an example, an estimated water use demand elasticity of -1.4 means that for every 1% increase in the price of water, there is a 1.4% decrease in demand for water by that activity.

Table 1 Water use demand elasticity estimates

Activity	Estimated water use demand elasticity
Nurseries	-0.9
Vegetables	-0.8
Grapes	-1
Fruit	-0.8
Grain & other	-1.4
Mixed crops and livestock	-1
Sheep	-1
Beef	-0.9
Dairy	-1.4
Sugar	-1.9
Cotton	-1.4
Group average	-1.2

Source: Bell et al (2007).

It should be noted that linking characteristics of demand for water entitlements to water use demand in production is an approximation only.

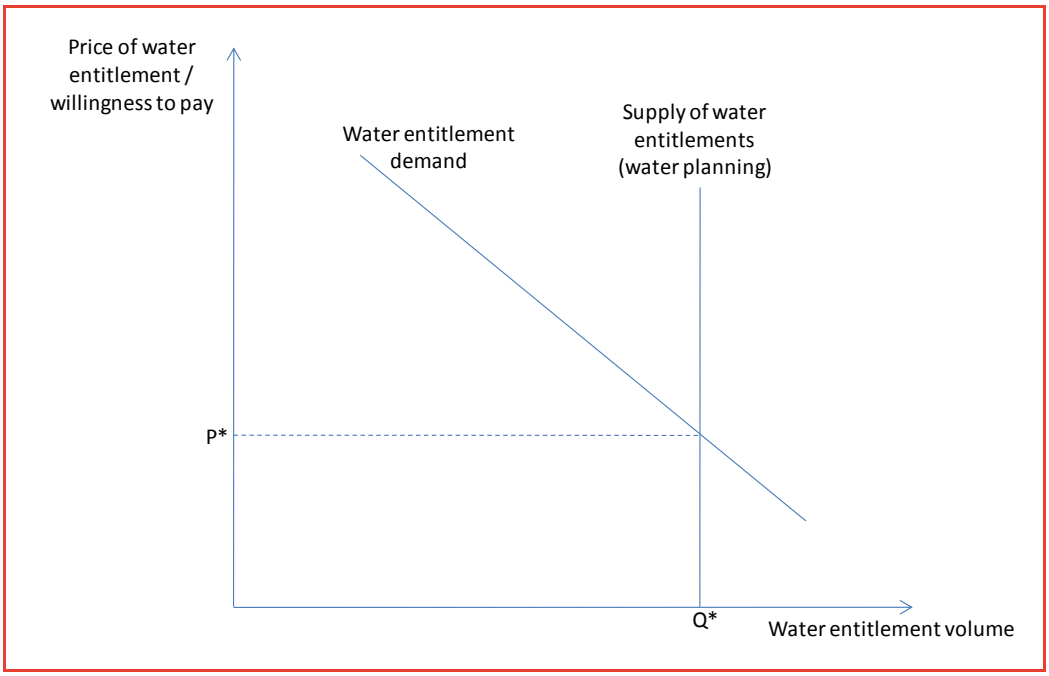
While demand for water entitlements is indirectly linked to the crops the water is ultimately being sourced for, it is also influenced by a range of factors relating to risk management and investment — for example, the alternative water sourcing opportunities that exist outside of the purchase of entitlements. This includes the purchase of water allocation within a given irrigation season and the willingness to bear the uncertainty associated with relying on spot markets for allocation.

Long-run factors of risk management and investment decisions influence the price elasticity of demand for water entitlement products in addition to short-run factors influencing water *use* demand. Thus, water entitlement demand and water entitlement market operation will influence dynamic efficiency (at current expectations / knowledge) as well as aspects of allocative and productive efficiency.

2.1.3 Market equilibrium

Within a season, supply and demand will be brought into balance at an equilibrium price of a water entitlement (P*) which would allocate the available entitlements (Q*) to those willing to pay P* or greater (figure 1).

Figure 1 Supply and demand of water entitlements in a region



2.1.4 Inter-regional trade

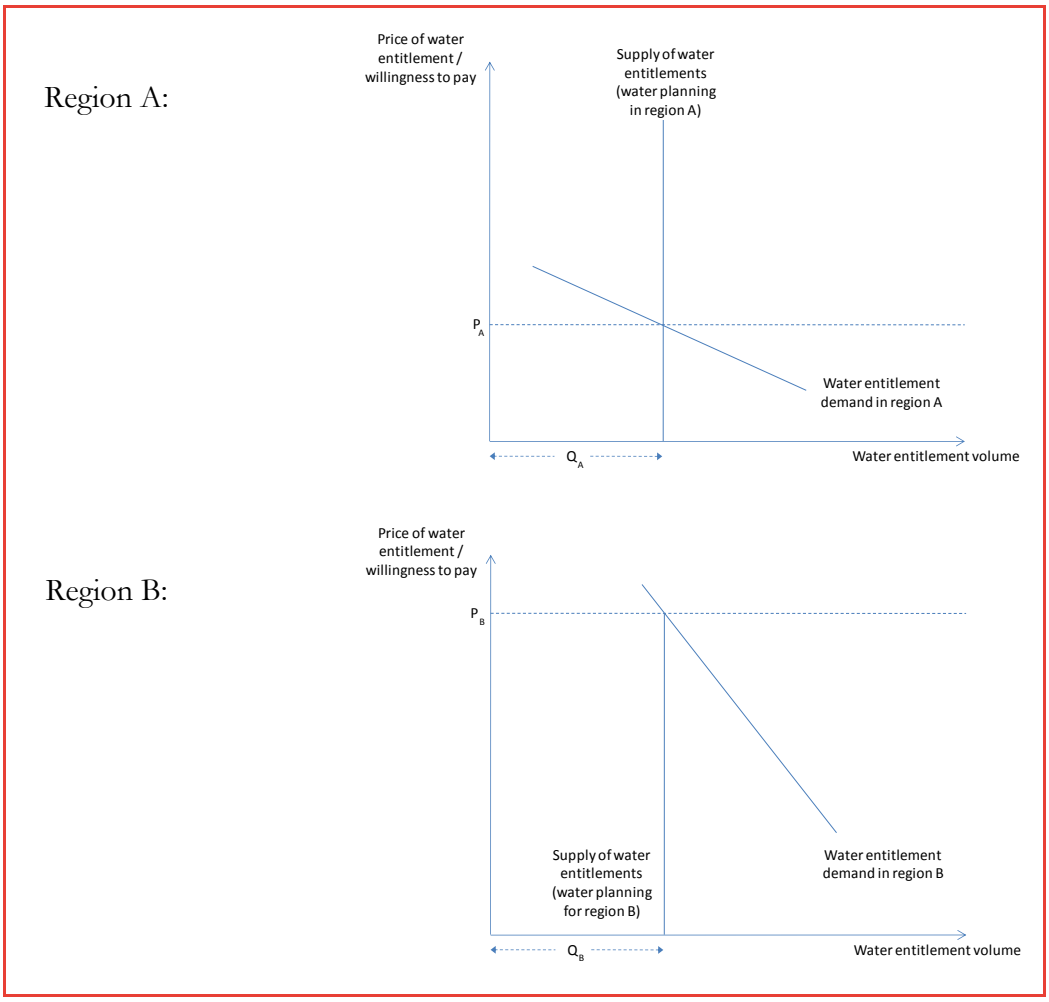
The benefits of inter-regional water trading

In order to consider issues associated with interregional trading (and restrictions on this) the framework needs to be extended to consider more than one region.

The relative availability of water entitlements (established through water planning) compared to the opportunities for water use (reflecting the availability of high quality soils and appropriate climatic conditions for irrigated agriculture) may differ significantly between water systems. The equilibrium price for water entitlements may therefore differ significantly between regions if trade is not possible (such as if they are not hydrologically connected, or if legal barriers prevent inter-regional water entitlement trade).

Figure 2 illustrates demand and supply for water entitlements in two regions — region A and region B. Water entitlements are relatively abundant compared to demand in region A, and water entitlements are relatively scarce in region B compared to demand — such that the equilibrium price of water entitlements is higher in region B than region A ($P_B > P_A$).

Figure 2 Supply and demand of water entitlements in two regions



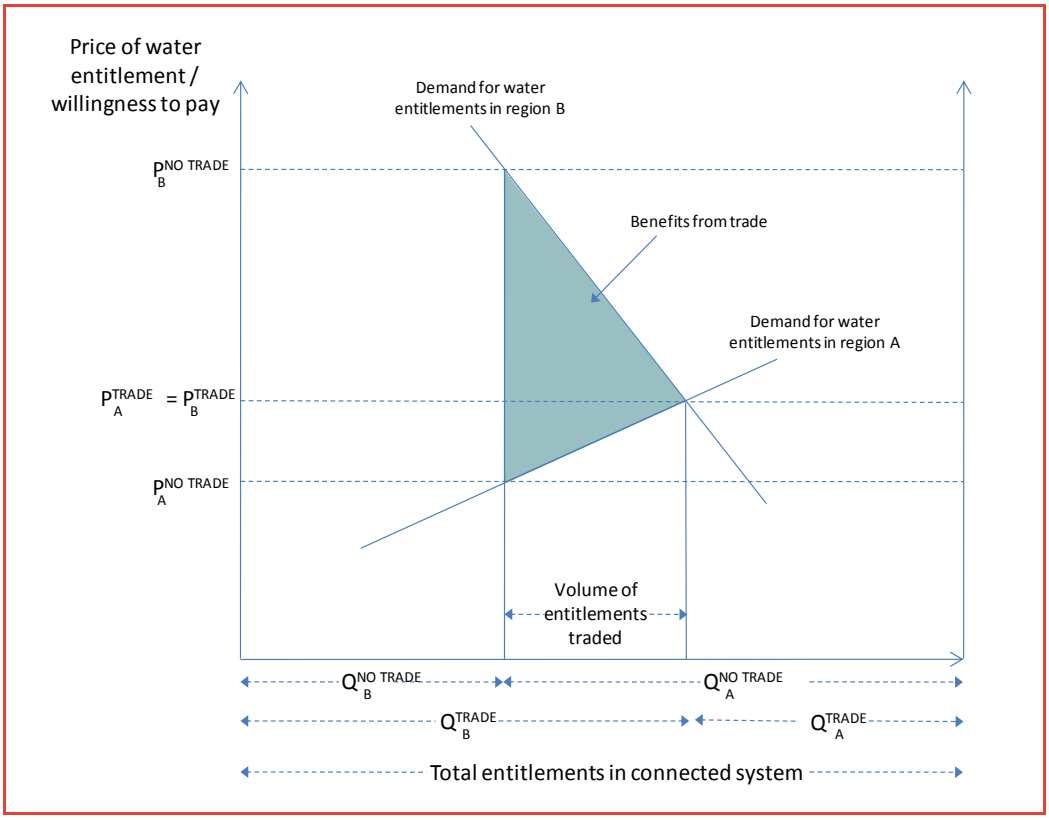
If trading were possible between regions A and B, then water trade would reallocate entitlements between water entitlement owners until a new equilibrium price is reached (P^{TRADE} in Figure 3 below). This would result in the ownership of water entitlement specified in one region by water users in another region.[3]

There are significant benefits to both buyers and sellers of water entitlements in the connected water system of the combined regions A and B. Moreover, trading

3 Under the current water market arrangement in the southern Murray-Darling Basin, this would look like tagged trade — where the water entitlement characteristics remain unchanged from the water plan under which they are defined. This means that trade between region A and region B would entail trade in two slightly different products: 'region A entitlements' and 'region B entitlements' that have different characteristics under their respective water plans. Although these can be converted to common units (such as an average measure like 'long-term Cap equivalents' in the MDB) this conversion will always be imperfect in capturing all entitlement characteristics in a single unit — due to factors such as defined entitlement reliability and distribution of inflows in the water system over which this reliability is defined. To maintain simplicity, the above basic framework considers a case where entitlements in region A and region B can be considered identical, such that a homogenous market can be analysed.

permits a more efficient allocation of water entitlements between the regions to higher-valued uses. The efficiency benefits associated with this re-allocation are represented by the shaded area in Figure 3. (Note that, for illustrative purposes in this standard gains from trade diagram, the origin for Region B remains on the LHS, but the origin for Region A is on the RHS of the diagram).

Figure 3: Supply and demand for water entitlements with inter-regional trade

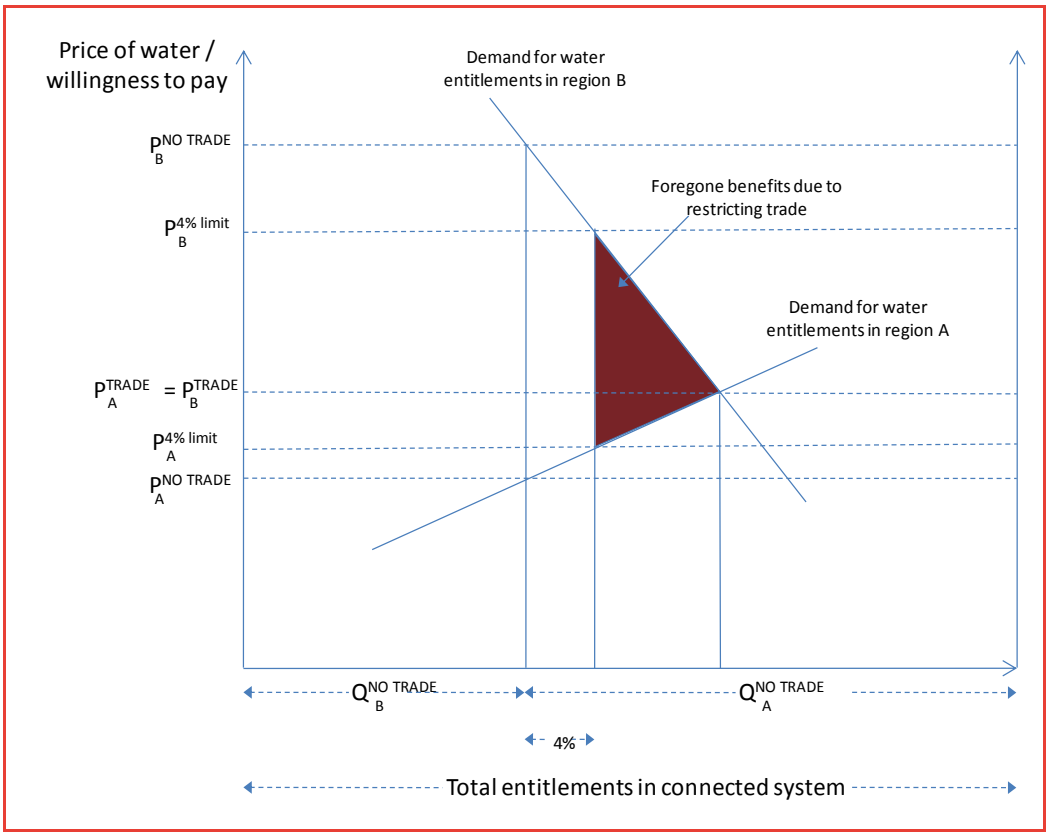


The efficiency impacts of volumetric restrictions

This analysis can also be used to evaluate the economic effects of restrictions on inter-regional trading such as through the imposition of the volumetric limits.

In particular, if volumetric limits are set on the extent of this inter-regional water trade, then the full benefits of water entitlement trade will not be realised. In figure 4, a 4% limit on water entitlement trade means that only some water entitlement may be transferred from region A sellers to region B buyers. Accordingly, all the potential benefits from trade (the shaded region from figure 3) are not realised — a price differential of $P_B^{4\%\ limit} > P_A^{4\%\ limit}$ still exists after all permitted trades have occurred — and there is a loss in economic welfare represented by the shaded area in figure 4.

Figure 4 :Economic efficiency effects of restrictions on inter-regional trade



In figure 4 (above), the shaded area is the efficiency cost of the restriction on water entitlement trade reflecting the welfare loss to trading parties. This loss is the foregone economic value of a more optimal distribution of entitlements — including foregone high-valued production, missed benefits of investing in new activities, or costs from bearing risks that could have been avoided.

The efficiency costs from restricting water entitlement trade include both short-run and long-run effects. As will be discussed in more detail later in this report:

- Water entitlement trade may be important to water use decisions in the short-run — therefore influencing production decisions on existing crops and allocations of water between competing uses within a given irrigation season — such that restrictions to water entitlement trade affect allocative and productive efficiency and the welfare losses can be observed as foregone high-value agricultural crop production.

- However, given that water entitlements confer perpetual rights to access water, they are also the foundation of water-related investment decisions and water-related risk management — such that restrictions to water entitlement trade affect dynamic efficiency by distorting long-run decisions.

- Water entitlements are also a significant proportion of the value of assets of many farming businesses, and so restrictions on their trade can constrain farm business decision-making such as cash-flow management and ultimately decisions to sell assets and exit from irrigated production.

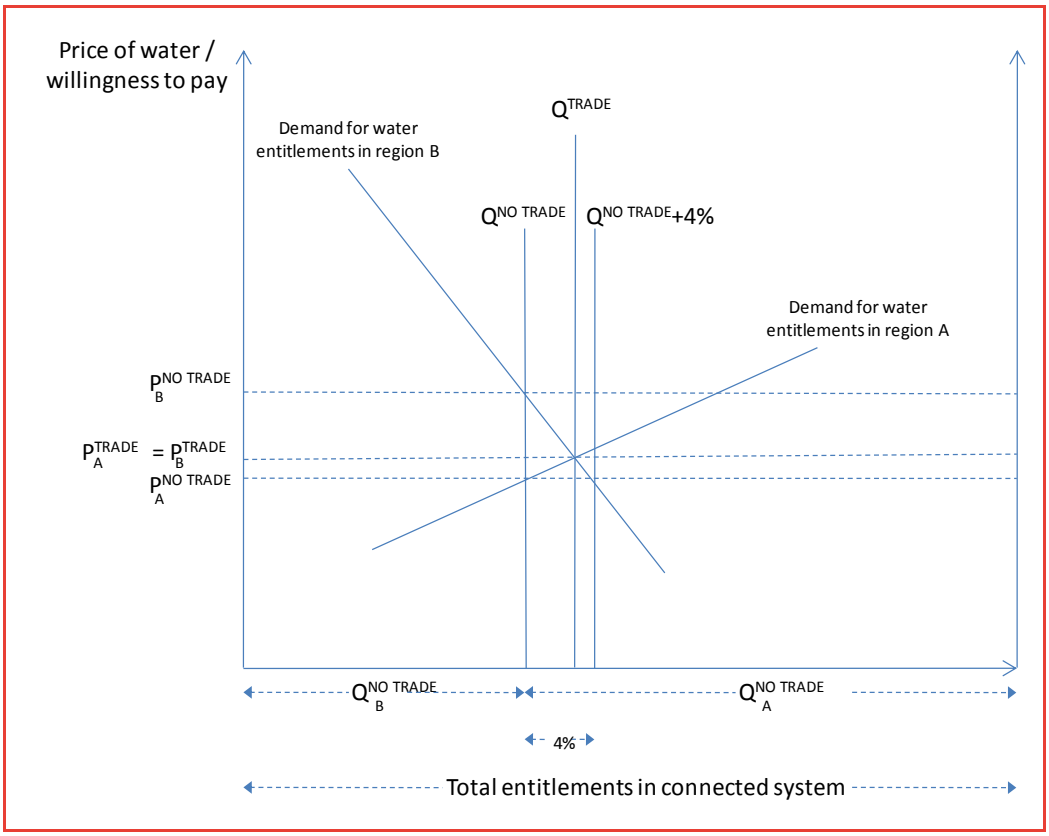
The significance of these efficiency losses will depend on a range of factors that are considered in more detail in the following parts of this section, namely:

- How 'far' the initial distribution is from equilibrium – as reflected by the existence of price differential between regions.
- Different applications of restrictions that alter the magnitude of the volumetric restriction on trade (relative to how far the initial distribution is from equilibrium) (section 2.2).
- Characteristics of water entitlement demand in the trading regions (section 2.3).
- Trade to the environment rather than other agricultural industries (section 2.4).
- The potential for strategic behaviour in the face of water entitlement trade restrictions (section 2.5).
- The extent of second- and third- round effects on related parties (section 2.6).

Importance of whether quantitative limits are binding

It is important to note that a volumetric restriction on water entitlement trades does not restrict trading activities under all circumstances — it may be that the volumes of trade permitted are sufficient for the water entitlement market to reach equilibrium in a given period (figure 5). It is only when trading is prevented from reaching equilibrium that volumetric restrictions are binding and will therefore prevent potential benefits from trade from being realised.

Figure 5 Quantitative restrictions that do not bind



2.2 Allowing for different application of restrictions

There are different applications of volumetric restrictions in relation to both the size and scope of the restrictions and the method for rationing the tradeable volume within the limit. Differences in the way that volumetric limits are applied have an effect on economic efficiency (as well as equity or distributional impacts).

2.2.1 Size and scope of the restriction

As noted in section 1.3, the precise formulation of the quantitative limits on entitlement trading out of regions varies between the MDB jurisdictions. In particular, in Victoria the limits are imposed on a more disaggregated level while in South Australia the limit has been imposed by some irrigation trusts as a 12% limit over a two year timeframe.

All else being equal, the likelihood of the limits being binding and affecting water markets is higher the smaller the area to which the limit is imposed and the shorter the timeframe to which the limit applies. This means that volumetric limits are likely to have greater efficiency consequences when implemented at a more disaggregated scale, such as at the sub-district level rather than the regional level.

To illustrate this, consider three regions with 100 units of water entitlement (region A, B1 and B2) with water entitlement demands as set out in table 1.

Table 2 Example water entitlement demands at given prices

	Price ($/ML)							
	5	10	11	12	13	14	15	20
Region A	175	150	145	140	135	130	125	100
Region B1	116.7	100	96.7	93.3	90	86.7	83.3	66.7
Region B2	100	50	40	30	20	10	0	–

In this example, the equilibrium price without trade is:

- $20/ML in region A
- $10/ML in region B1
- $5/ML in region B2.

If each region is subject to 25% volumetric restriction on water entitlement trade:

- Region B2 sells 25ML to region A, but the trading limit is reached and the price in region B2 is $7.50/ML
- Region B1 sells 10ML to region A, and the equilibrium price in region A and B1 is $13/ML.

If the 25% volumetric restriction on water entitlement trade is instead at the level of A and B (where B is the aggregate region merging B1 and B2 with a total of 200ML of entitlement):

- Region B sells 50ML to region A — all of which is sourced from sellers in sub-region B2. The equilibrium faced by all buyers and sellers of water entitlement is $10/ML.
- Compared to case above (where each region is subject to 25% volumetric restriction) water entitlement ownership is 15ML greater in region A, 10ML greater in sub-region B2, and 25ML less in sub-region B2 — with benefits to buyers and sellers.

This demonstrates that, all other things being equal, a volumetric limit will be more distorting if it is implemented in a more disaggregated manner.

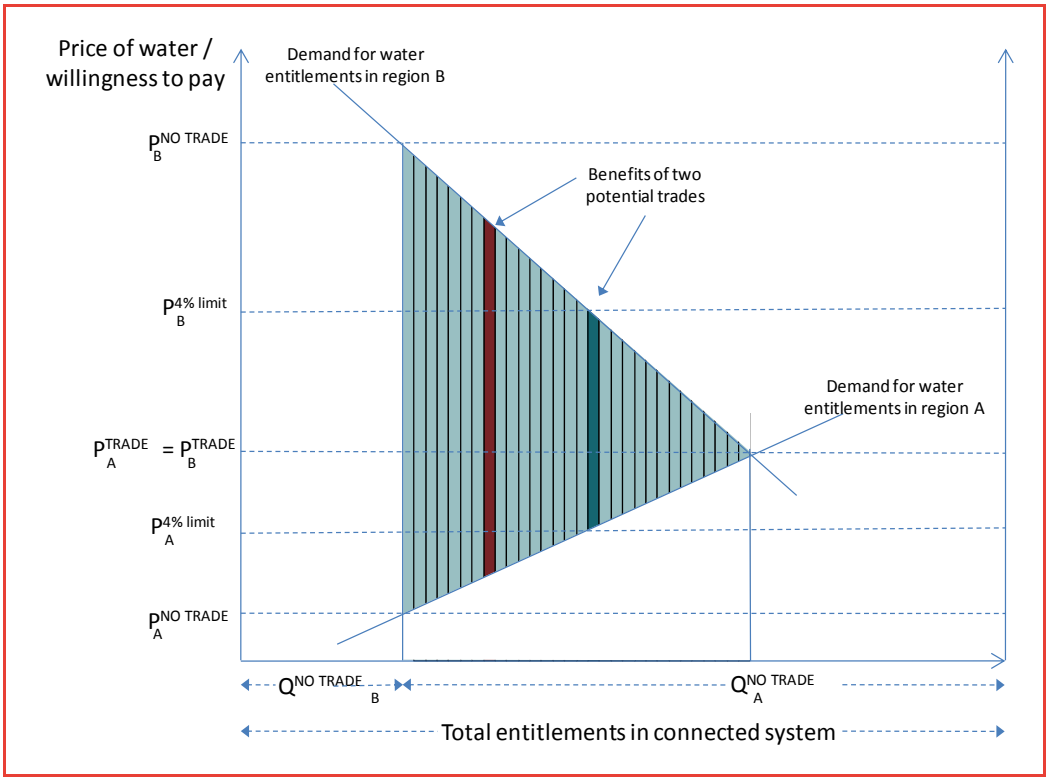
2.2.2 Method of rationing approved trades

Where a volumetric restriction on trade is in place, there are a number of ways of rationing the volume of trades which are approved, including:

- 'First come first served'.
- Ballot or lottery system.
- Double sided auction.

The choice of rationing method will have efficiency consequences, because some trades between different potential buyers and sellers will have different potential benefits. This is demonstrated in Figure 6.[4]

Figure 6 Economic benefit of particular possible trades



Each method of rationing can be compared to the most efficient approach to rationing, which would be to allow trades to occur in descending order from those with greatest efficiency gains from trade to those with the least gains from

4 The figure considers the simplified case where the buyer with the highest valuation trades with the seller with the lowest valuation, the buyer with the second-highest valuation trades with the seller with the second-lowest valuation, etc. In fact, a trade may occur between any buyer and seller if they can agree on a price between their respective valuations — however adding such complexity does not significantly contribute to the efficiency analysis of rationing mechanisms.

trade (from left to right in Figure 6, such that the dark red trade is approved in preference to the dark blue trade).

However, when considering the overall efficiency implications, it is important to consider the transactions costs associated with the rationing method (e.g. mechanism design and administration costs).

First come, first served

The simplest approach to implementing the volumetric restriction would be on a 'first come, first served' basis whereby specific applications for trade between a seller and a buyer are processed in the order that they are received. This approach would be administratively simple and relatively costless if the volumetric limit is not reached.

However, once the volumetric limit is reached, all additional trades would be declined. This would result in minor additional transactions costs (i.e. to monitor the extent to which the limit has been filled and notify unsuccessful applicants). More importantly, this method means that trades that provide relatively greater 'net benefits' might be rejected if they are made after the limit has been reached (i.e. made later in the irrigation season).

The probability of rejection then provides an incentive for trades to be undertaken earlier in the season. This is exactly what has occurred in Victoria in recent years, with applications placed before the commencement of the irrigation season (see Section 3.1.1). Equity concerns (i.e. which trades are accepted and which are not) have led to the adoption of a ballot system at the start of the season, when it is considered that there is some likelihood of the volumetric limit being reached during the processing of the applications placed at the opening of the season.

Ballot

A ballot or lottery system allows all applications for trade submitted before a certain date to have an equal probability of acceptance. However, this method creates the same type of efficiency losses associated with the 'first come, first served' approach. That is, the ballot system means that trades that provide high 'net benefits' (i.e. total surplus to buyers and sellers) have equal probability of acceptance as those with low net benefits. As show in Figure 7, there is a very high likelihood that the allocative efficiency gains from trade under a ballot system will be less than those under the most economically efficient approach to rationing the available volume — because the benefits of some approved trades are less than some of the denied trades. In the figure, red shaded areas are trades that are approved under the ballot.

Figure 7 Ballot for rationing the volume of approved trades

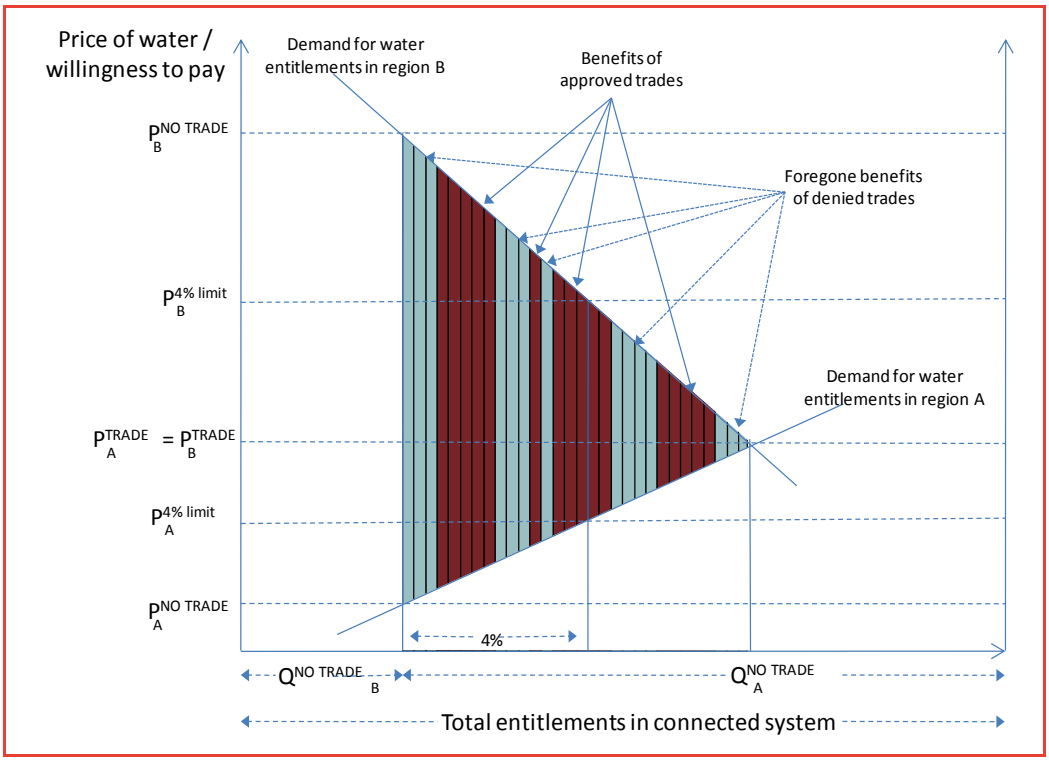


Figure 8 is an alternative representation of the trades approved in Figure 7, decomposing the loss in economic efficiency due to the ballot mechanism.

Figure 8 Decomposing the outcomes of a ballot

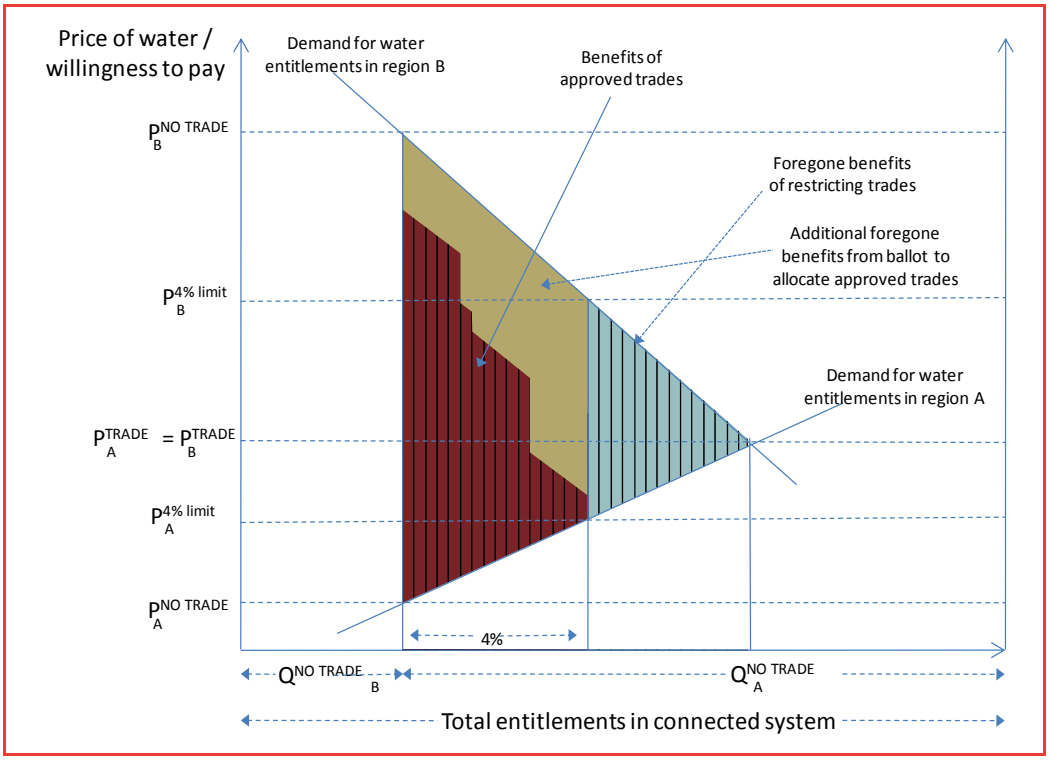
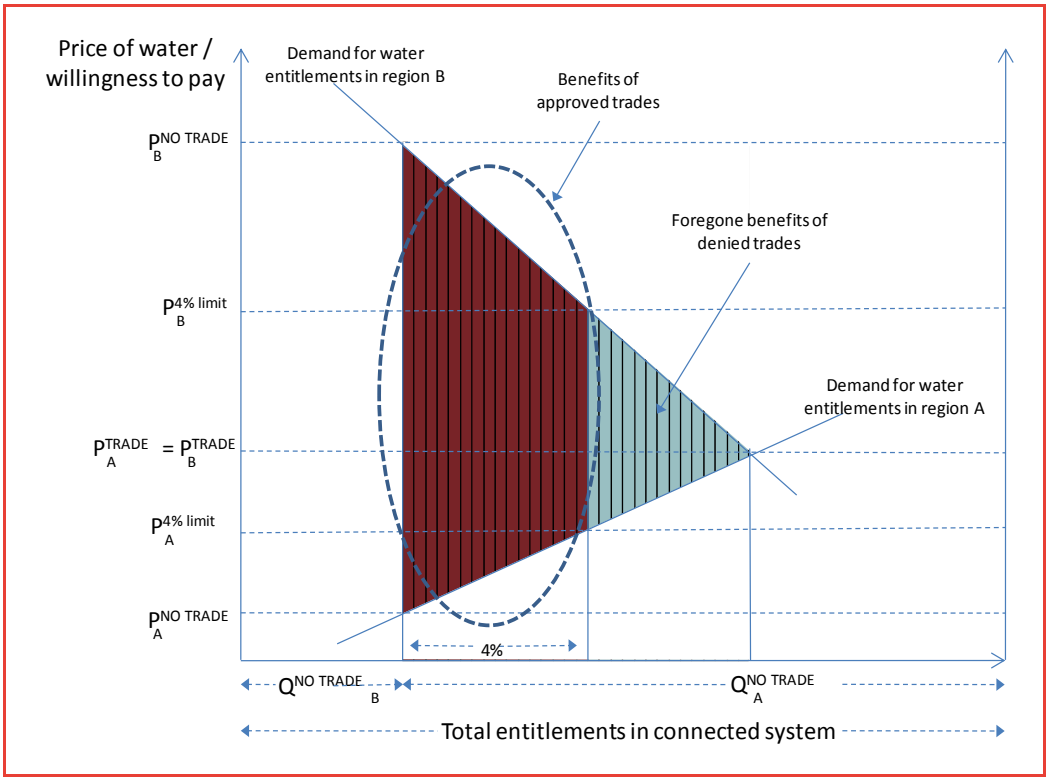


Figure 7 and Figure 8 show that there may be trades between buyers with relatively higher willingness to pay and sellers with relatively lower willingness to accept that are rejected through the ballot system, thus increasing the allocative efficiency losses of the volumetric restriction (compared to if the restricted volumes were allocated to the most beneficial trades). This occurs because trades between two parties are submitted to the ballot, and the trade is approved or denied, rather than an offer to buy or sell from a single party — as in a double-sided auction (below).

Double-sided auction

One way of ensuring an efficient rationing of available volume would be to develop a double-sided auction (Figure 9). In such an auction, buyers and sellers would submit a series of bids (price and volume). Once all bids have been lodged, a market clearing house mechanism would then ration the available limit to buyers based on their willingness to pay (from highest to lowest buy price) and sellers in order based on their willingness to accept (from lowest to highest sell price). The clearing price for buyers and sellers ($P_B^{4\% \text{ limit}}$ and $P_A^{4\% \text{ limit}}$, respectively) would be determined with all trades occurring at the market clearing price, and the benefits of trade shared between buyers and sellers (depending on the auction rules for sharing the difference between buyer and seller prices).

Figure 9 Double-sided auction for rationing the volume of approved trades



Importantly, this mechanism does not require specific trades to be agreed between a buyer and a seller prior to the auction, which could reduce transactions costs to market participants. If the volumetric limit was not reached in the series of opening season offers to trade, all trades up to a common clearing price would be approved.

If designed and implemented effectively, this approach could ensure the most efficient rationing of the volumetric limit. However it would entail some additional mechanism design costs, which may be offset by reductions in costs to water users who do not have to agree on deals prior to trade applications being submitted. It will also have efficiency losses associated with applicants rushing sales decisions (as with the first come first served and ballot mechanisms), given that submissions would need to be submitted by a given date.

2.3 Allowing for alternatives to water entitlement trading

Water access entitlements are typically a perpetual or open ended share of water available in a water source. Annual volumetric water allocations are made to these shares based on seasonal conditions, which can be used for productive purposes or traded.

As such, in analysing the potential effects of quantitative limits on inter-regional trading of entitlements, it is important to consider the role of entitlement trading in the market and the potential for alternatives to water entitlement trade, such as water allocation trade or limited term leases, to manage water use in the short- to medium-term. That is, if an irrigator is constrained from buying or selling entitlements by a volumetric restriction, they could buy or sell annual allocations or enter a limited term lease in order to manage their water supply in a given season.

The existence of these alternatives means that limits on trading of entitlements do not necessarily preclude the ability to move water between alternative uses. In particular, the co-existence of the market for entitlements with the market for seasonal allocations (that latter of which are not subject to the volumetric limits) means that the allocation market can be used to re-allocate scarce water to higher-valued uses within an irrigation season. Indeed, in principle, the annual repetition of a water allocation trade in perpetuity could be seen as having the same effect as a once-off entitlement trade.

Some previous analyses of the impacts on water trading restrictions (e.g. Hyder Consulting and Access Economics unpublished) have made the simplifying assumption that the entitlement was to be used as a water allocation where it was held (i.e. there was no subsequent movement of water on the temporary market). This approach would imply that the impact of the restriction is to prevent high-valued production. However, in practice, the role of the allocation market in enabling within-season re-allocations means that the real costs associated with

limiting entitlement trading are not the loss of higher-valued production in the short term. To examine the real costs it is important to consider some of the other properties of water entitlements, compared with an expected ongoing stream of water allocations, and the impacts of volumetric restrictions on the ability to undertake longer-term risk management or investments related to structural adjustment (i.e. the impacts on dynamic efficiency).

One key difference between entitlements and a series of allocations relates to the extent that investment risks (related to long term returns and cash flow considerations) associated with variable water availability can be managed through a portfolio approach to investment in water products.

If an irrigator has a relatively inelastic demand for water and is risk averse, they may prefer to hold a relatively high proportion of entitlements, rather than purchasing allocations in seasons when the price for allocations is high. This phenomenon has been observed in new Sunraysia horticultural developments which have purchased large volumes of entitlements in order to underpin investment decisions. These developments have then been observed selling water allocations that are excess to their water demands in some seasons. As such, the substitutability of entitlements and allocations is dependent on the outlook of investors to risk and the interruptibility of their production system.

Financial considerations also become important from a cash flow perspective. Irrigators may prefer to hold entitlements to offset the risk of needing to purchase high priced allocations in seasons when production may also be limited by lack of water availability, for example. In this way, water entitlements provide a type of portfolio benefit to farming businesses because the dividends of a water entitlement (the market value of the water allocations they provide) may be counter-cyclical to other returns from the farming enterprise — in drought, the value of production may fall, but the value (price times quantity) of water allocations that accrue to their entitlement may rise[5].

Another difference between entitlements and a stream of annual allocations is access to storage. Typically, water access entitlements are bundled together with storage rights and often the ability to carry over water from one season to another. Such additional benefits of entitlements are not available to water users that rely *solely* on allocation markets.

In addition to dynamic efficiency costs to those wanting to invest in an optimal portfolio of entitlement products and allocations, there are dynamic efficiency constraints to water users wanting to make adjustment decisions away from irrigated agriculture. There are a number of reasons why limitations on entitlement trading may lead to suboptimal adjustment outcomes. For example, entitlement holders may incur additional information costs in order to monitor

5 This effect is most prevalent for 'high reliability' type water entitlements.

the allocation market, and determine when and at what water price to sell each year, despite no longer being involved in irrigation activities. If a business is seeking to exit irrigated agriculture, they are likely to wish to dispose of assets primarily involved in irrigated agricultural production (i.e. water).

More importantly, an inability to sell entitlements may reduce the financial resources available to adjust to alternative farm enterprise and business structures. That is, there are price penalties for intra-district trades once the inter-district limit is reached as the market for water is artificially constrained by the limit. With only the low price available, irrigators may not have sufficient financial resources to relocate or to reinvest in alternative farming systems (e.g. dry land agriculture), they may chose to defer adjustment decisions, or the type of adjustment may change.

As such, the limit on entitlement trade may limit the mobility of labour and other bundled capital assets, land and equipment. Importantly, there will likely be less financial resources for those irrigators who have randomly been excluded from inter-regional trade by the ballot system, and these irrigators will have to make adjustment decisions at the lower price.

It should be noted that the lower price for intra-district trades benefits water entitlement buyers within the district because they can source water for below the free-market price for production purposes or for sale at a later date. This 'fire sale' of water entitlement assets is effectively a transfer from irrigators wishing to exit/sell to remaining irrigators.

In summary, the primary efficiency costs associated with limits on entitlement trading are likely to relate more to long-term dynamic investment efficiency, rather than short-term allocative efficiency.

2.4 Allowing trade to the environment

Water is valued for environmental purposes in a manner similar to water for agricultural production, urban use or any other competing water use. This means that efficiency will be similarly impeded if the environment is considered as a possible buyer or seller in the above analysis. Water entitlement demand by environmental purchasers would be a component of the aggregate demand for water entitlement outside of the trade restricted region.

An important feature of water entitlement demands for environmental use is that these purchases are often associated with actions to address overallocation and overuse of water resources and ultimately prevent continued environmental degradation. Some environmental degradation will result in irreversible damage leading to species extinctions and the permanent loss of ecosystem function.

This means that the potential costs of restricting trade not only includes foregone agricultural production and investment, but also foregone environmental benefits

(or future environmental costs) that are difficult to assess. This is particularly likely to be the case where the limits apply specifically to environmental purchases (as in the recent NSW moratorium).

2.5 Allowing for behavioural responses to uncertainty

A further enhancement to the analytical framework is to recognise that the existence of volumetric limits may create uncertainty regarding whether trades will be approved and lead to changed behaviour in the market. In particular, sellers of water entitlements will have an incentive to sell their water in a way that avoids the expected price penalties that would be faced if trying to sell once the volumetric limit is reached (because the price for sales within the region is lower than that which could be received if selling outside the region).

2.5.1 Altered timing of entitlement trades

One strategy is to sell entitlements at the start of an irrigation season. This may gives rise to inefficient transactions where sellers rush into a sale without making a sufficiently informed decision.

As discussed above, the emergence of this issue has resulted in a ballot tool being implemented in Victoria in order to ration the available volumetric limit. This lottery-style approach does not ensure that water entitlements are sold by the lowest value entitlement owners, nor that water entitlements are sold to those with the highest valuation for entitlements.

The incentives for getting in early and selling before volumetric limits are reached are significant enough to lead to the Victorian ballot for the 2009-10 season having over 1000 applications and being significantly oversubscribed.

The incentive to bring forward entitlement trade decisions may mean that less information is available to sellers and buyers in relation to short-term seasonal water availability, which may be a significant factor driving adjustment decisions in the context of drought. With less information available, the likelihood of optimal decision-making is reduced — with potential efficiency consequences.

For example, imagine an irrigator with significant farm debts as a result of the prolonged drought faced with the decision to either sell all entitlements and move away from irrigated agriculture, or to hold on for one more season in hope of high seasonal allocations and favourable market conditions in order to pay off some debt. Where there is a volumetric limit on entitlement trade, that irrigator might be more likely to rush into selling the entitlement — in the absence of sufficient information on seasonal water availability and market conditions — to avoid being constrained to selling within the irrigation district (where there might be less buyers and lower prevailing prices). Without the limit, they may have waited for more information to become available, thus increasing the chances of making an optimal decision.

2.5.2 Efficiency and equity impacts of conversion to Non-Water User status

An important strategy observed in southern Murray-Darling Basin water markets is sellers who administratively 'disassociate' their water entitlements from their land (and hence from their irrigation district/region) so that they are no longer bound by annual volumetric restrictions on entitlement trade out of their home irrigation district. In Victoria, this disassociation involves the conversion to a Non-Water User (NWU) water entitlement.

This strategy provides irrigators with the flexibility to sell their entitlement to buyers outside the irrigation district at any time during the season. In the recent Victorian ballot, it is understood that almost half of the applications were solely based on conversion to NWU status (Goulburn-Murray Water 2009a), providing strong evidence to suggest that there is significant benefit in pursuing strategies that eliminate this constraint. Conversely, strong demand for conversion to NWU status indicates that there is a significant cost of the volumetric limit to irrigators associated with decision making under additional uncertainty.

Transactions costs

As suggested, conversion to a NWU right enables successful ballot applicants to avoid having to take the lower intra-district price if they do need to sell later in the season. However it incurs inefficiency associated with the administrative costs from the conversion to a NWU right (the fee for this conversion is $129.70 per application in 2009-10). If the price difference were of the order of, for example, $400 per ML, then there would be significant incentive to convert to NWU even if there was only a small likelihood of needing to sell later in the season, or in subsequent seasons.

Dynamic efficiency (adjustment) and equity impacts

Given that disassociation is counted towards volumetric limits in Victoria, it also means that the disassociation strategy crowds out other sellers of water entitlements who are trying to sell before the volumetric limit is reached. As shown in the following discussion, this has important implications for dynamic efficiency (adjustment) and for equity, as it significantly affects the distribution of the benefits from trade.

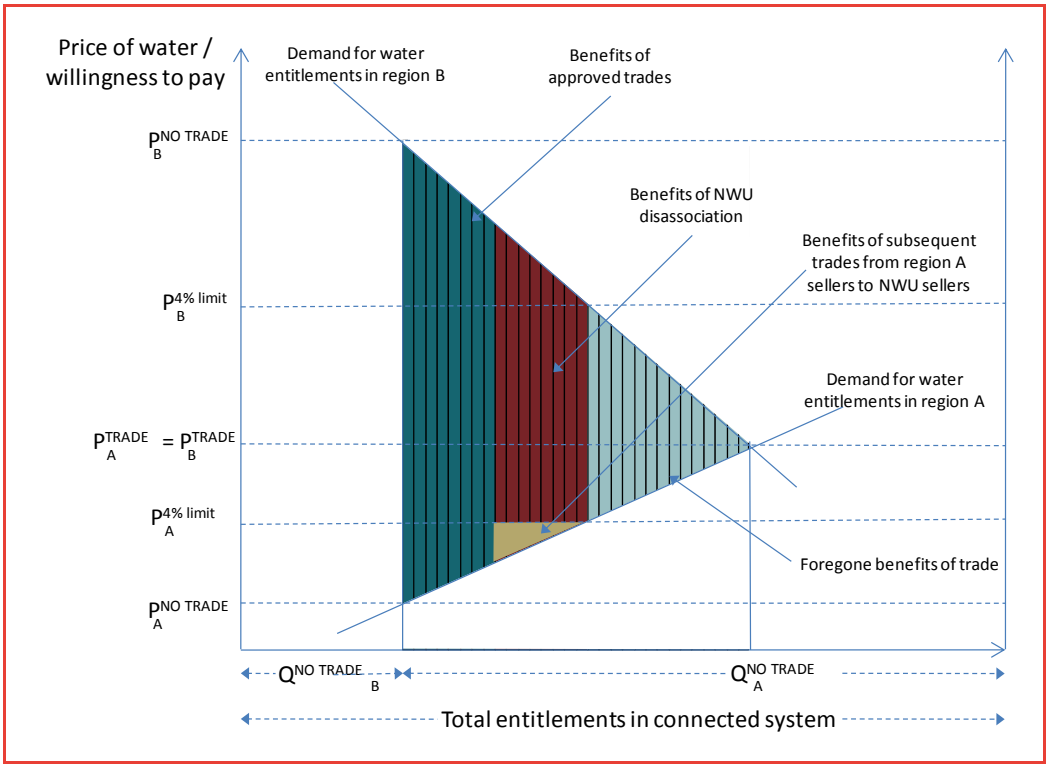
To demonstrate these effects, assume that rationing of the available volumetric constraint (e.g. the four per cent limit) comprise an equal mix of sellers that are seeking:

- to convert to NWU status (as discussed below, this group could consist of those with some chance of selling later in the current season, those likely to sell in future seasons, and those likely to continue to hold a portfolio of entitlements)

- adjustment opportunities (i.e. those wishing to sell entitlements as part of a strategy to either move out of irrigation altogether, move to opportunistic irrigation based on a high proportion of allocation purchases in wet seasons, and those wishing to sell both land and water entitlements).

Under a balloting mechanism, it would be expected that 50% of each type of seller would be successful under the 4% limit. That is, only 2% of sales would go through between inter-district buyers and sellers, with the other 2% converted to NWU status (Figure 10). The dark blue and the red stripes indicate the trades and disassociations approved up to the limit, with the light blue representing the foregone benefits of trade.

Figure 10 NWU market strategies



Unsuccessful applicants would then be constrained to the market price within the district $P_A^{4\%\ limit}$, whereas NWUs would be able to sell to inter-district buyers at future point in time[6]. In these cases where the inter-district market is constrained, NWUs would be able to extract the full gains from trade by selling at the inter-district price.

6 If the NWU chose to remain holding the water entitlement for use within the district, they could sell the NWU entitlement at the open-market price and purchase district entitlement at the lower $P_A^{4\%\ limit}$.

Despite the small administrative fee for conversion to NWU in Victoria, this analysis shows that there is a strong incentive for any irrigator to shift to NWU status as it allows them the flexibility to undertake inter-district trade at any time once they have converted to the NWU status.

With such strong incentives, it might be expected that an increasing proportion of water users will apply to become NWUs. This is currently constrained by the 10% limit on NWUs in Victorian systems. It is our understanding that the 10% limit has now been reached in the Goulburn and Campaspe systems (Goulburn-Murray Water 2009a). While this limit is to be removed through legislation to be enacted at the end of October 2009, and ballot applications are to be put aside until this time (Goulburn-Murray Water 2009b), these delays are will come at a cost to buyers and sellers. At the end of the initial processing of the 2009-10 Victorian water trade ballot, 280 applications totalling 50,227.8ML have been retained to be processed once the 10% limit is repealed.

From an adjustment perspective, the presence of NWUs crowding out real adjustment opportunities reduces the benefits (or financial resources) available to those seeking to use entitlement sales as a tool to enable adjustment. That is, as discussed previously, the price for intra-district sales to enable adjustment is $P_A^{4\% \text{ limit}}$, whereas NWUs obtain the price $P_B^{4\% \text{ limit}}$. The price in an unconstrained market would be $P_A^{trade} = P_B^{trade}$. With only the low price available, irrigators may choose to defer adjustment decisions, or the pattern of adjustment could change. Importantly, there will be less financial resources for irrigators making adjustment decisions at the lower price.

From an equity perspective, successful applicants for NWU status obtain greater gains from trade than unsuccessful applications for NWU status constrained to intra-district markets. Furthermore, there is potential for NWUs to take advantage of the price wedge created by a constrained water market. That is, if any irrigator (even those that knew they would continue to require water entitlements in the long run) expected the volumetric limit to be reached, and expected a price wedge between subsequent intra- and inter-district trade to result, they could enter the ballot to sell outside of the district or convert to NWU. If successful, they could then purchase intra-district entitlement from an adjusting irrigator at the low intra-district constrained price thus capturing all the gains from trade (refer to Figure 10). While this strategy could be pursued without NWU status, conversion to NWU reduces the associated risks.

Finally, the Victorian implementation of the 4% annual limit permits mortgagee sales outside of the volumetric limit (DSE 2009b). This could potentially lead to the case where a farm business cannot satisfy a bank regarding aspects of an existing debt (due to depressed water prices for intraregional entitlement sales when the 4% limit is reached) but the water entitlement assets can be sold for an increased amount if the assets are seized by the mortgagee.

2.6 Social and distributional impacts

The conceptual framework developed above is primarily focused on analysing economic efficiency impacts. The restrictions on entitlement trading can also have significant social and distributional impacts.

As noted above, for individual irrigators who are prevented from selling their entitlement because the limit has already been reached, the limit in effect results in a loss of value in their entitlement because they are precluded from realising what may be a significantly higher market price in other regions. This impact may be particularly acute for irrigators in financial distress who are then forced to sell their entitlement to others within the region for a lower price than they may be able to receive outside the region. These within-region buyers are the arbitrary beneficiaries.

It is also recognised that volumetric limits on inter-regional entitlement trade are intended to manage the rate of adjustment in rural communities and to address stranded asset risks.

It is beyond the scope of this paper to undertake a detailed assessment of whether the volumetric limits have been successful in achieving these outcomes. However, a key policy question is whether there are alternative ways of achieving these objectives that do not require restrictions on water trading and their associated consequences.

In this context, targeted structural adjustment measures may be a more effective means of managing community adjustment than volumetric restrictions on entitlement trading, which arguably impede rather than facilitate structural adjustment by individual irrigators.

While there may be some 'smoothing' benefits to regional communities from limiting the rate of change facilitated by water entitlement trade when water ownership is in a relative equilibrium, these are likely to be difficult to demonstrate and limiting the rate of change in the face of significant adjustment pressures may be costly. Furthermore, as shown above, when irrigators are forced to adjust at the lower 'within district' price, the financial resources they have are reduced. This may mean that local and regional expenditure and investment by these exiting irrigators may decrease — as such, the volumetric limit may actually reduce local and regional economic activity, at least in the short term, and possibly in the longer term.

2.7 Summary

Based on the economic framework developed above, restrictions on inter-regional water entitlement trading do in-principle have the scope to adversely affect the efficient operation of water markets and to impose significant losses in economic efficiency.

The extent to which they do so in practice depends largely on whether the existing distribution of water entitlements is currently in an expected equilibrium or whether there are pressures for significant adjustment — such as through expected impacts of changing market conditions, climate change and environmental water buybacks. The more binding the restrictions are, the greater the costs they are likely to impose.

In assessing the efficiency impacts of these restrictions, it is important to take account of interactions between the entitlements market and the allocations market. This may mean that efficiency losses are not so much to do with the inability to move water to higher-valued uses in response to seasonal conditions, (as this can still be done via allocations trading), but may relate more to longer-term considerations such as foregone ability to:

- invest in new enterprises or divest from non-viable enterprises
- manage risk efficiently
- adjust to alternative forms of dryland or less intensive irrigated agriculture.

With reduced financial resources available to facilitate the adjustment process, local and regional economic activity may also decline.

Restrictions also provide incentives to change behaviour in the water market. In particular, uncertainty imposed by volumetric limits increases the likelihood of rushed and sub-optimal trade decisions under uncertainty.

In addition to efficiency costs, implementation of volumetric constraints imposes transactions costs for government administrators and water users, including in relation to conducting ballots for trading applications and in strategies made to avoid the effects of the volumetric constraint.

While ostensibly designed to manage the distributional impacts of adjustment processes, volumetric constraints can also result in a number of other un-intended and detrimental distributional or equity impacts.

3 Empirical assessment of effects of volumetric restrictions

This section applies the framework developed in the previous section to assess and quantify the impacts of restrictions in practice.

3.1 Impacts on economic efficiency

In order to attempt to quantify the likely efficiency impacts of the entitlement trading limits in accordance with the framework outlined in the previous section, the following discussion examines empirical evidence on:

- the extent to which the limit is binding (i.e. how many regions in which the limit is reached and the time of the season when the limit is reached)
- the likely impacts on the market if the limits do bind
- changed market behaviour in response to the limits.

3.1.1 Extent to which limit is binding

The most direct evidence on whether the limits are binding is available information on the numbers of regions in which the volumetric limits have been reached, and when this limit is reached during the irrigation season. The earlier in the season that the limit is reached, the more binding the limit is in terms of preventing inter-regional trading of entitlements.

Victoria

The 4% limit has already been hit in the large irrigation districts for the 2009-10 irrigation season (as at 3 August 2009), despite the ballot process used to process applications for transfers for the beginning of the season (at the start of July) not being completed. Some 22GL of entitlement trading (of the cap of 60GL of exemption) has been granted in addition to this.

Table 3 Victorian 4% limit in 2009-10 (ballot in progress)

Irrigation Area	Reliability Class	4% Tradeout Limit (ML)	Net Water Traded Out - excluding exemptions (ML)	Proportion of tradeout limit used
Campaspe Irrigation District	High	715.9	652.3	91%
Campaspe Irrigation District	Low	396.4	0	0%
Central Goulburn Irr. Area	High	13,668.60	12,086.40	88%
Central Goulburn Irr. Area	Low	6,229.60	4,009.80	64%
Murray Valley Irrigation Area	High	10,002.40	9,952.80	100%
Murray Valley Irrigation Area	Low	4,633.80	4,615.90	100%
Nyah, Tresco and Woorinen	High	1,159.90	494.4	43%
Nyah, Tresco and Woorinen	Low	223.6	168.5	75%
Pyramid-Boort	High	7,849.30	7,412.50	94%
Pyramid-Boort	Low	3,583.30	1,177.10	33%
Rochester Irrigation Area	High	6,684.00	4,297.50	64%
Rochester Irrigation Area	Low	3,018.40	2,013.60	67%
Shepparton Irrigation Area	High	6,443.80	2,893.40	45%
Shepparton Irrigation Area	Low	2,959.00	1,421.00	48%
Torrumbarry Irrigation Area	High	12,474.70	12,474.40	100%
Torrumbarry Irrigation Area	Low	5,718.80	4,176.20	73%

Source: Victorian Water Register, 3 August 2009.

In 2008-09, eight of the ten irrigation districts reached the 4% limit — meaning that 94.5% of Victorian high-reliability water shares held in irrigation districts were held in irrigation districts that had reached the 4% limit.

Table 4 Victorian 4% limit in 2008-09

Irrigation Area	Reliability Class	4% Tradeout Limit (ML)	Net Water Traded Out (ML)	Proportion of tradeout limit used
Campaspe Irrigation District	High	751.9	817	109%
Campaspe Irrigation District	Low	402.5	152.8	38%
Central Goulburn Irr. Area	High	14,267.20	14,833.90	104%
Central Goulburn Irr. Area	Low	6,475.80	6,234.00	96%
First Mildura Irrigation District	High	2,547.10	599.3	24%
Murray Valley Irrigation Area	High	10,462.00	11,729.80	112%
Murray Valley Irrigation Area	Low	4,826.90	4,974.30	103%
Nyah, Tresco and Woorinen	High	1,171.60	369.2	32%
Nyah, Tresco and Woorinen	Low	225.9	99	44%
Pyramid-Boort	High	8,176.10	8,169.40	100%
Pyramid-Boort	Low	3,960.20	3,924.20	99%
Robinvale, Red Cliffs and Merbein	High	3,891.80	3,884.20	100%
Rochester Irrigation Area	High	6,975.50	7,238.40	104%
Rochester Irrigation Area	Low	3,152.50	3,235.20	103%
Shepparton Irrigation Area	High	6,712.40	6,822.90	102%
Shepparton Irrigation Area	Low	3,028.00	1,579.80	52%
Torrumbarry Irrigation Area	High	13,097.80	15,720.00	120%

Note: The 4% trade-out limit was exceeded in some cases in 2008-09 due to – (1) correction of wrong locations given to some water shares at unbundling, (2) sale of water shares by a mortgagee (the Water Act does not currently require this to be subject to the 4%), or (3) processing issues.
Source: Victorian Water Register, 2009.

In 2007-08, the limit did not affect as many areas (Table 5).

Table 5 Victorian 4% limit in 2007-08

Irrigation Area	Reliability Class	4% Tradeout Limit (ML)	Net Water Traded Out (ML)	Proportion of tradeout limit used
Campaspe Irrigation District	High	779	770	99%
Campaspe Irrigation District	Low	410	182.6	45%
Central Goulburn Irr. Area	High	14859	13010.6	88%
Central Goulburn Irr. Area	Low	6723	5544.1	82%
First Mildura Irrigation Trust	High	2664	48.9	2%
Murray Valley Irrigation Area	High	10906	10832	99%
Murray Valley Irrigation Area	Low	4957	1660.5	33%
Nyah, Tresco and Woorinen	High	1184	425.6	36%
Nyah, Tresco and Woorinen	Low	227	20.3	9%
Pyramid-Boort	High	8550	9342.6	109%
Pyramid-Boort	Low	3893	3879.6	100%
Robinvale, Red Cliffs and Merbein	High	3919	1049.2	27%
Rochester Irrigation Area	High	7242	6551.3	90%
Rochester Irrigation Area	Low	3273	3138.7	96%
Shepparton Irrigation Area	High	6982	6978.6	100%
Shepparton Irrigation Area	Low	3145	3144.5	100%
Torrumbarry Irrigation Area	High	13639	13267.2	97%

Note: The limit was exceeded during 2007/08 in one case, due to correction of earlier incorrect refusal of an application.
Source: Victorian Water Register, 2009.

Since the advent of the Victorian Water Register in 2007-08, the water trade approval authority no longer consistently publicises the suspension of trade through media releases. For example, in 2008-09 no Goulburn-Murray Water

media releases could be identified that announced the 4% limit being reached despite this happening in eight out of ten irrigation districts.[7]

Prior to this, information was published on when the 4% was reached within a season (Table 6).

The degree to which these volumetric limits are binding can be informed by considering:

- The timing, within the season, when the limit was reached — if the limit is reached early in a season then it is likely that there will be more trades (that would have occurred) that would be rejected or are not forthcoming due to the limit being reached.

- The number of trades rejected due to the limit being reached — this observed number of rejected trades would be a minimum estimate of the trades that would have otherwise occurred because some applications may no longer be made if it is already known that they will be rejected due to the volumetric limit.

In some cases the annual limit on water entitlement trade has been met very early in the irrigation season (such as Central Goulburn in 2005-06) or even before the season commenced when sufficient applications to trade water entitlement were lodged (such as for Pyramid-Boort in 2004-05). Table 6 lists the districts, seasons and dates when the suspension of water access entitlement trade has come into effect, due to the limit being reached.[8]

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7 One small reference to timing is a 7 November 2008 media release that notes 'According to the Victorian Water Register, the 4 % limit on net trade out of an irrigation area is yet to be reached in the Shepparton and Murray Valley Areas for high reliability water shares'

8 Suspension is introduced after entitlement trading for the irrigation season reaches the allowable limit for water entitlement leaving the region. The annual limit was 4% in 2008-09, 2007-08 and 2006-07, and 2% in previous years. If transfers of entitlement into the region reduce the net trade out to less than the annual limit during the irrigation season, transfers out will be allowed until the annual limit is reached again. For example, Torrumbarry ended the 2004-05 season with a net transfer out of 1.86%, despite trade being suspended (Frontier Economics et al 2007).

Table 6 Suspensions of water entitlement trade due to limits being reached

Irrigation area/District	Irrigation season	Date of suspension	Timing within season
Campaspe	2004-05	13-Dec-04	Mid
Campaspe	2005-06	19-Jan-06	Mid
Campaspe	2006-07	29-Dec-06	Mid
Campaspe	2007-08	3-Oct-07	Early
Campaspe	2008-09	Before 21-Nov-08	Early-mid
Central Goulburn	2003-04	7-Jan-04	Mid
Central Goulburn	2004-05	30-Aug-04	Early
Central Goulburn	2005-06	28-Jun-05	Early
Central Goulburn	2006-07	19-Feb-07	Late
Central Goulburn	2007-08	3-Oct-07	Early
Central Goulburn	2008-09	After 21-Nov-08	Mid-late
Murray Valley	2008-09	Before 21-Nov-08	Early-mid
Murray Valley	2009-10	3-Jul-09	Early
Pyramid-Boort	2003-04	8-Jul-03	Early
Pyramid-Boort	2004-05	29-Sep-03	Early
Pyramid-Boort	2005-06	19-May-05	Early
Pyramid-Boort	2006-07	8-Mar-07	Late
Pyramid-Boort	2008-09	Before 21-Nov-08	Early-mid
Robinvale, Red Cliffs and Merbein	2008-09	After 21-Nov-08	Mid-late
Rochester	2003-04	12-Mar-03	Early
Rochester	2004-05	10-Nov-04	Mid
Rochester	2005-06	27-Mar-06	Late
Rochester	2006-07	8-Mar-07	Late
Rochester	2007-08	3-Oct-07	Early
Rochester	2008-09	After 21-Nov-08	Mid-late
Shepparton	2005-06	15-May-06	Late
Shepparton	2008-09	Before 21-Nov-08	Early-mid
Torrumbarry	2004-05	30-Jun-04	Early
Torrumbarry	2005-06	19-Jul-05	Early
Torrumbarry	2008-09	Before 21-Nov-08	Early-mid
Torrumbarry	2009-10	3-Jul-09	Early

Note: The annual limit was 4% in 2009-10, 2008-09, 2007-08 and 2006-07, and 2% in previous years.
Information for 2008-09 is informed by a snapshot of the Victorian Water Register on 21 November 2008.
Source: Goulburn-Murray Water media releases from website.

Limited information is available regarding the number of trades rejected in relation to areas where a 4% limit is applied.

Hyder Consulting and Access Economics (unpublished) present some of this information for Victoria in 2007-08. They report that the total volume of trades refused in Victoria because of the 4% limit was 7,378 ML.

Goulburn-Murray Water and the Victorian Water Register report that they do not generally maintain information on applications rejected or the relative number of trade and disassociation applications received (Goulburn-Murray Water, pers. comm., 13 August 2009). However, in the previous ballots of 2007-08 and 2008-09, it is understood that the 4% limit was not reached when ballot application processing was completed.

In the ballot conducted at the opening of the 2009-10 Victorian irrigation season, 1010 ballot applications were received, totally 191 GL.

On 11 August 2009 (Table 7), 542 applications totalling 99GL had been approved and 132 applications totalling 34GL were rejected due to the 4% limit being reached in the Murray Valley and Torrumbarry Irrigation Areas on the Victorian Murray system (Table 3). Importantly, 280 applications totalling 50GL were not processed due to the 10% limit being reached in the Goulburn and Campaspe systems — which is significantly greater than remaining volume permitted to be traded out of Goulburn and Campaspe irrigation districts under the 4% limit.

This suggests that the applications received in the 2009-10 ballot would have been sufficient for the 4% limit to be reached in the vast majority of Victorian irrigation districts at the commencement of the 2009-10 water year.

It is also interesting to note that 45% of the ballot applications were for disassociation from land (rather than trade) (Goulburn-Murray Water 2009a) which may be for entitlement owners who are not currently selling, but wish to avoid the possibility of facing price penalties from the 4% limit at a later date).

Table 7 Victorian water trade ballot outcomes, 2009-10

All ballot applications (High and Low reliability shares) (All systems and all Irrigation Areas)	Volume (ML)	Number
Approved including exempt applications	99,496.60	542
Returned with refund to applicants (Murray Valley and Torrumbarry Irrigation Areas where 4% limit has been reached)	33,889.20	132
Sent back to applicants for further information/requirements (Application was incomplete or incorrect)	6,506	34
Returned due to duplication or refused	1,759	22
Retained to be processed once 10% limit is repealed	50,227.80	280
TOTAL	191,878.60	1010

Source: Goulburn-Murray Water 2009b.

New South Wales

In NSW, the 4% limit is thought to have only been reached in the Murrumbidgee Irrigation area in 2008-09, where the limit was reached in March 2009 (Murrumbidgee Irrigation 2009). At this time, approximately five applications for the external transfer of Murrumbidgee entitlements were pending (pers. comm., Murrumbidgee Irrigation, 28 July 2009) but these were returned to applicants since Murrumbidgee Irrigation announced that applications would no longer be accepted or approved (see Box).

Murrumbidgee Irrigation will begin processing applications for 2009-10 entitlement transfers on 20 August 2009 (pers. comm., Murrumbidgee Irrigation, 13 August 2009). Applications received before this time are given a sequence number and will be processed on a 'first come, first served' basis. It is not known if the 4% limit will be reached when initial applications are processed (pers. comm., Murrumbidgee Irrigation, 13 August 2009).

An embargo on water entitlement trade to the environment was announced by the NSW Government in May 2009 and media reports[9] suggest that it has prevented a number of trades to the MDBA's Environmental Water Purchase Program.

[9] www.abc.net.au/news/stories/2009/07/02/2614361.htm?page=fullpage

MIA announcement on the 4 per cent limit

In light of continuing interest in water issues such as water permanently leaving regions, either through external trade to other water users or government purchases for the environment, and reduced allocations, Murrumbidgee Irrigation believes it is important to keep our customers and other parties updated with the current situation in the MIA.

Murrumbidgee Irrigation advises that applications have been approved for permanent trade out of the MIA for the 2008/09 season, and the maximum to be approved (the MIA 4% cap) has been reached. The approved quantities are:

Private water users	60 ML
MDBC (Water efficiency programs with ricegrowers)	240 ML
ACTEW (Canberra, Govt. owned company)	4,231 ML
NSW government	38,300 ML
TOTAL	42,831 ML

Virtually all (90%) of the buying has been on behalf of State government for Snowy River return flow or Living Murray programs, with almost all the remaining 10% being for Canberra water security.

Directors of Murrumbidgee Irrigation have significant continuing concerns over the impacts on the company due to inequities in the Federal Government's treatment of interstate schemes, particularly those government owned schemes in Victoria. There are grave concerns that if the current rules and arrangements in Victoria are allowed to operate it may have serious implications for the future viability of Murrumbidgee Irrigation and the MIA. Obviously this has major implications for shareholders.

The concerns are based on the deliberate creation of trade barriers in Victoria that are contrary to interstate agreement on water reform. The Commonwealth Government has delivered water reforms that are applied differently in NSW and South Australian Corporations as compared to government-owned Victorian schemes. This is resulting in a bias of government purchasing out of NSW and SA.

Murrumbidgee Irrigation is raising these concerns with the Federal Minister for Climate Change and Water and the NSW Premier and Minister for Water over coming days and until a speedy solution to the market distortion is identified, there is no change to the position announced in December. That is, that Murrumbidgee Irrigation will not accept or deal with any further external permanent transfer applications, and that applications for the 2009/10 season will not be accepted until arrangements for that year are announced. This includes limits and Termination Fees.

Directors of Murrumbidgee Irrigation regret that they are forced to take this approach due to the trade barriers in place in Victoria the inequitable effect these barriers have on irrigators in NSW and SA and in particular our shareholders.

Source: www.mirrigation.com.au/extpermtrade08_09.html (viewed 28 July 2009).

South Australia

In South Australia, the irrigation trusts managed by CIT have had a limit of 12% of water entitlements to be traded out in a two year period. It is thought that no trades have been declined to date, and that this limit was lifted in 2009-10.

As noted, it is understood that 4% of trade out was reached, however, in response to the wishes of irrigators, the volumetric limit was lifted to be 12% over a two year period.

Summary

In summary, there is evidence that the volumetric limits are becoming increasingly binding, particularly in the Victorian sub-districts but also in other States.

3.1.2 Impacts of restrictions when they do bind

The next step in attempting to quantify the impacts of limits on entitlement trading involves assessing how far the distribution of entitlements is away from equilibrium that would occur if there was an open market. As discussed in section 2, one observable indicator of the extent to which volumetric limits are distorting water markets is any price differentials that exist between regions.

Evidence from Victoria

Information is available from the Victorian Water Register on prices and volumes of water entitlement traded in various trading zones, but not at the level of the districts within these trading zones at which the 4% limit is implemented. The concordance of 4% limit regions and water trading zones is:

- Goulburn 1A (Shepparton, Central Goulburn, Rochester and Pyramid-Boort irrigation areas except the Boort irrigation area (which is in 1B).
- Vic Murray Dartmouth to Barmah 6 (Murray Valley irrigation area, excluding Lower Broken Creek).
- Vic Murray Barmah to SA 7 (Torrumbarry irrigation area; Tresco irrigation district, Nyah irrigation district; Robinvale irrigation district; Red Cliffs irrigation district; Merbein irrigation district; First Mildura irrigation district).
- Campaspe 4A (Campaspe irrigation district).

Unfortunately, it is not possible to undertake statistical analysis to assess the significance of the drivers of observed price differentials between irrigation districts within a water trading zone because of the aggregate way in which pricing information is reported. However, even it if is not possible to be

definitive about what is driving price differentials, we can discern some price differentials between regions.

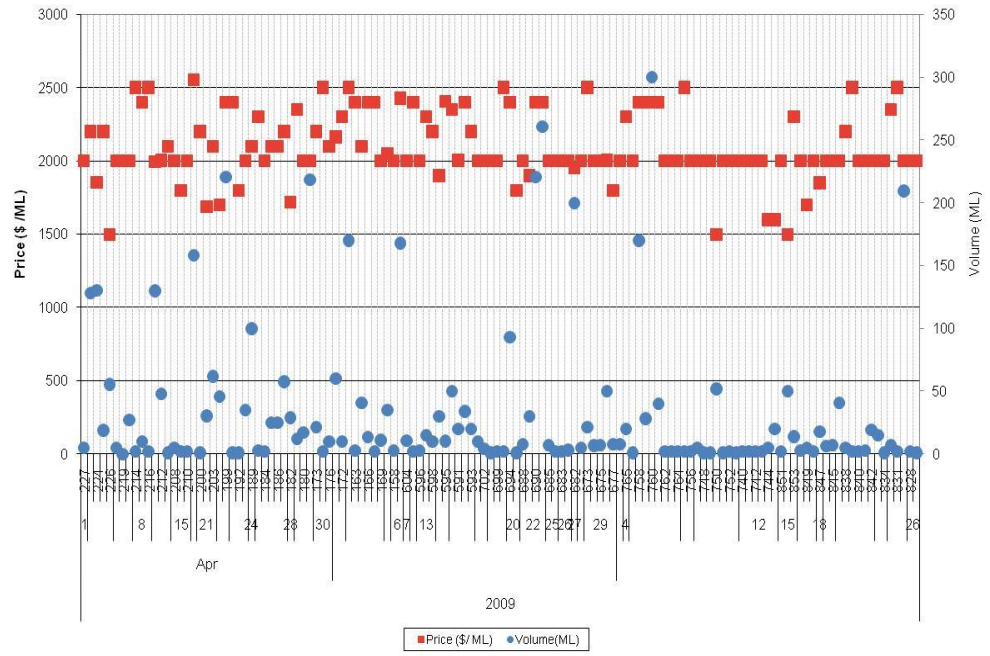
For example, inspection of the Goulburn 1A price data (Figure 11 Victorian Goulburn high reliability water share prices – trading zone 1A – April to June 2009) suggests that there may be a number of prevailing prices with sub-regions of the trading zone — such as Shepparton, Pyramid-Boort and Rochester — compared to an unrestricted equilibrium price.

It could be that all the trades at around $1600-1700/ML are for internal trades within Pyramid-Boort, and that all the trades at around $2000/ML are for internal trades within Shepparton and Rochester, compared to trades of $2400/ML elsewhere.

However, it could also be possible that there is significant variation in the trade price of water entitlements due to limited information of market participants — such that no clear segregation by irrigation district exists.

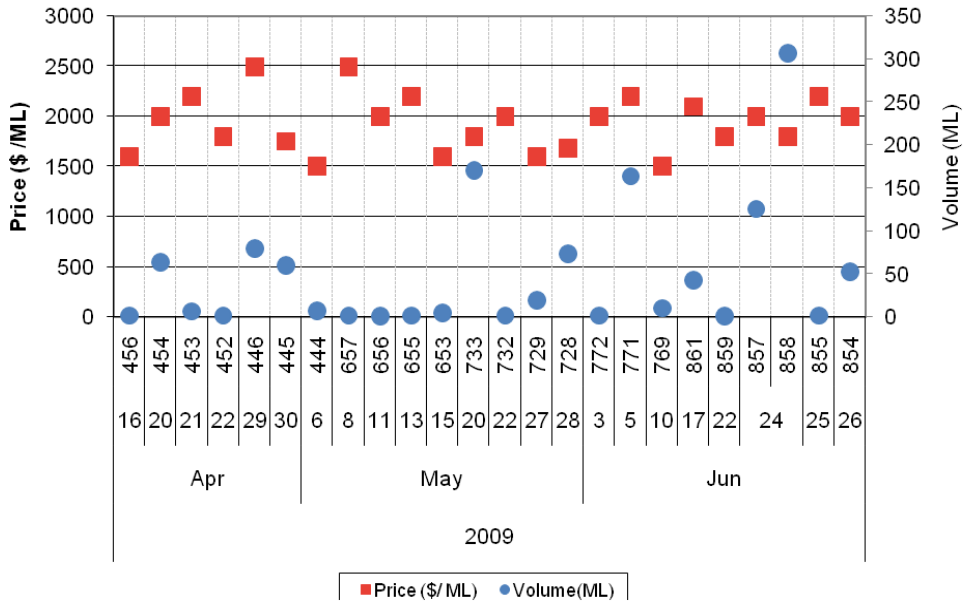
Until price data can be collected that identifies the irrigation district of trades with the reported price (as is done for volumes of trades in order to conduct 4% limit reporting), then strong evidence for price differentials is not available.

Figure 11 Victorian Goulburn high reliability water share prices – trading zone 1A – April to June 2009



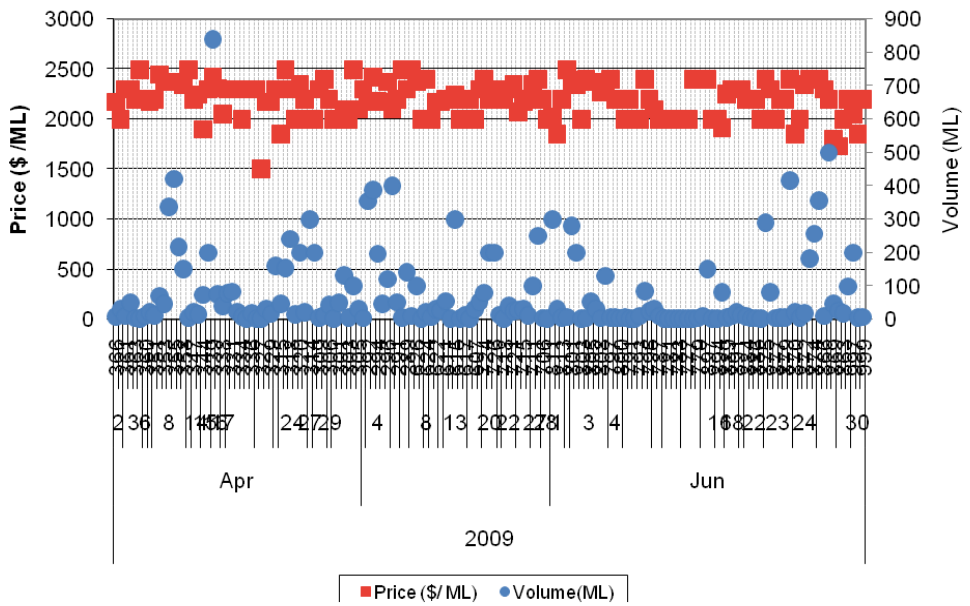
Source: Victorian Water Register 2009.

Figure 12 Victorian Murray above Barmah high reliability water share prices – trading zone 6 – April to June 2009



Source: Victorian Water Register 2009.

Figure 13 Victorian Murray below Barmah high reliability water share prices – trading zone 7 – April to June 2009



Source: Victorian Water Register 2009.

Figure 14 Victorian Campaspe system high reliability water share prices – trading zone 4A – July 2008 to June 2009

In zone 4A, 85.5ML of high reliability water shares were traded at a price of $2000/ML and 1536.5ML traded at a price between $2300-2500/ML. Other reported trades did not have price reported.

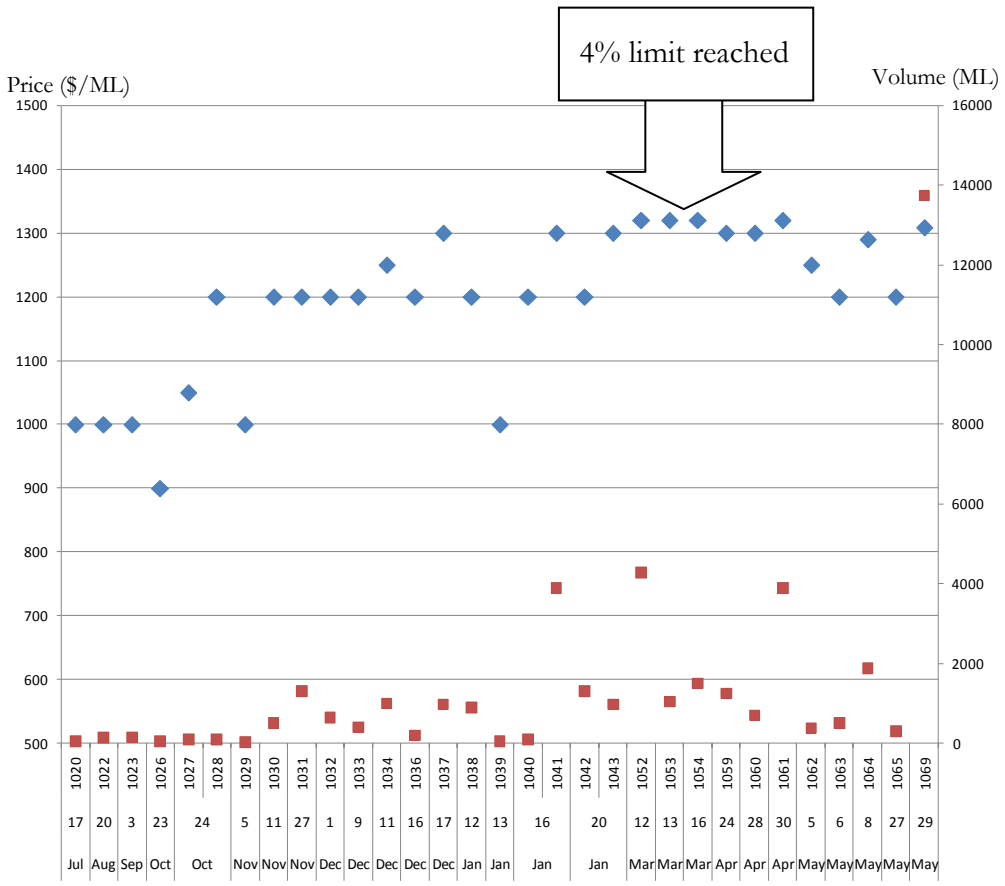
Source: Victorian Water Register 2009.

Evidence from New South Wales

Information is available from the NSW DNR register on prices and volumes of water entitlement traded in various water systems, however reporting the price at which trades occur is not complete. For example, in 2008-09, 68% of trades were reported to have occurred at a price of $0/ML.

From the price data that is available, it is difficult to observe a significant price differential between intra- and inter- Murrumbidgee Irrigation Limited transactions (Figure 15). This is due to the limited number of trades and because all Murrumbidgee regulated water resource trades are aggregated (i.e. they are not broken down between Murrumbidgee Irrigation Limited irrigator trades and private diverter trades).

Figure 15 NSW Murrumbidgee general security water entitlement prices – 2008-2009



Source: DNR Water register 2009.

3.2 Quantifying market impacts

As discussed, data on the impact of volumetric restriction is hard to observe given the paucity of water entitlement trading data. This means that, in order to attempt to quantify market impacts, it is necessary to make a number of assumptions.

For example, Hyder Consulting and Access Economics (unpublished) make the following key assumption in order to analyse the impacts of the 4% limit in Victoria: 'If it is assumed that the entitlement was to be used as a water allocation where it was held (i.e. there was no subsequent movement of water on the temporary market)" (p. 30). The results of this assessment are in the box below. Section 2.3 considered the potential limitations of ignoring water allocation markets as a water sourcing opportunity for agricultural production.

An assessment of the costs of the Victorian 4% limit

A recent assessment of the Victorian 4% limit found that overall agricultural production in Victoria in 2007-08 would be $5.1 million higher without the 4% limit. In order to conduct this quantitative analysis, it was assumed that the entitlement was to be used as a water allocation where it was held (i.e. there was no subsequent movement of water on the temporary market).

The agricultural industries most affected by this prevented movement of water are 'pasture', 'fruit' and 'grapes'. In particular, pasture production would be $1.5 million lower without the prevented trades, grape production would be $4.8 million higher, and fruit production would be $1.6 million higher.

Economic modelling estimated that the net incremental output associated with the trades would have generated an additional $5.92 million in Gross State Product for the irrigation year 2007-08. An additional 40 full time equivalent jobs would have been associated with the water trades across Victoria in the same year.

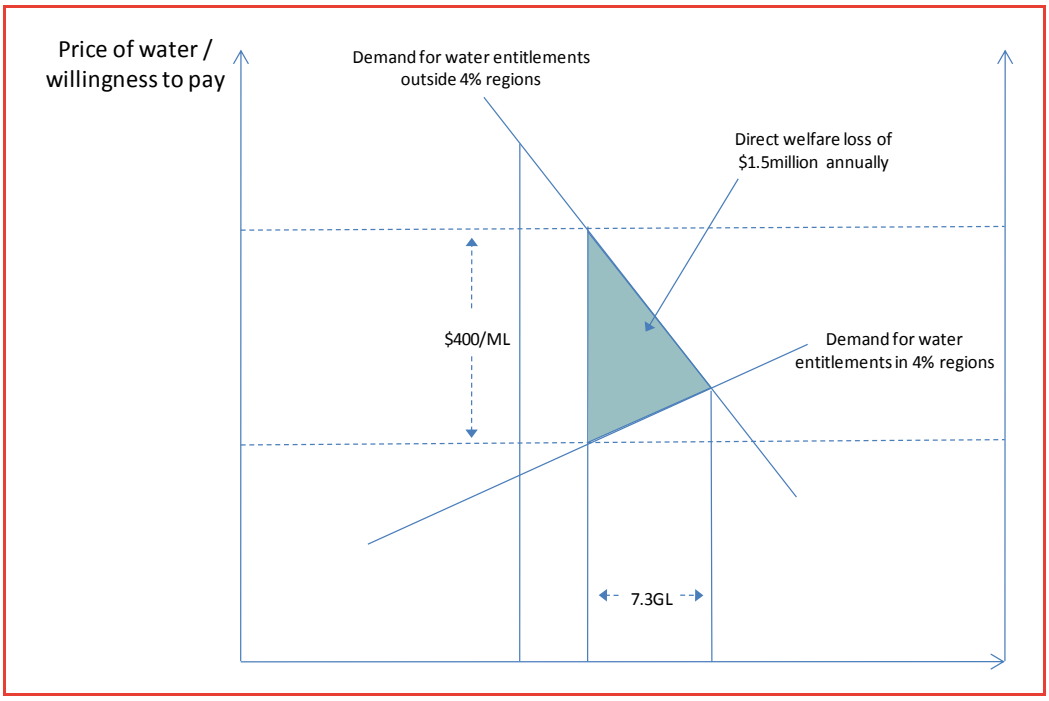
Source: Hyder Consulting and Access Economics, unpublished.

Frontier Economic considers that, in making the assumptions necessary to facilitate a quantitative analysis, it is most appropriate to maintain the focus on the efficiency impacts (and hence welfare losses) directly associated with the combined market for water entitlements and allocations. Observed outcomes in water entitlement markets will reflect the distortion that exists after substitution opportunities such as water allocations have been taken up. (In contrast, the approach adopted by Hyder and Access Economics seems to assume zero substitution between entitlement and allocation markets, as discussed in Section 2.3.)

For example, examination of Figure 11 suggests that two price levels may be present in Victorian trading zone 1A — namely at approximately $2000/ML and $2400/ML. If it is assumed that this $400/ML price differential exists in Victorian irrigation districts due to the 4% rule (as per the analysis framework set out in this paper), then some rough quantification of the efficiency impacts can be made. In 2007-08, it has been reported that 7.3 GL of Victorian water entitlement trades were denied due to the 4% limit.

Using these two estimates of price and quantity distortions in the assessment framework suggests a direct welfare loss of $1.5 million annually to buyers and sellers of water entitlements (the shaded area in the diagram below if demand schedules are approximately linear = 7300 x 400 x 0.5).

Figure 16: Estimating the efficiency impacts of restrictions on inter-regional trade



If this assumed price differential is instead considered with the 33,889.20 ML of denied trades from the 2009-10 ballot, then the estimate of welfare loss is nearly $6.8 million. If these assumptions hold, the total welfare loss would be even greater given the unprocessed trades or trades later in the season that will also be denied, as well as the additional efficiency losses caused by the ballot mechanism itself (Section 2.2.2).

Importantly, until more comprehensive price data is available, any quantification of the impact of the 4% restrictions on water entitlement trade will be based on a number of assumptions and should be treated with caution.

3.3 Transactions costs

As set out in section 2.5.2, strategic reactions to the 4% limit in Victoria provide an incentive for entitlement holders to convert their right to a Non-Water User entitlement. The fee for this conversion is $129.70 (in 2009-10).

If it is assumed that all of the 45% of the 1010 ballot applications were for this strategic purpose, then this suggests up to $60,000 of transaction costs were incurred, just in direct application fees. Other transactions costs to government and irrigators include the time and other costs for each irrigator converting to NWU in terms of the application and processing process.

Rejected trades also incur transaction costs. Even though application fees are reimbursed, rejected trades incur time and other costs in the application and processing process.

3.4 Social and distributional impacts

Volumetric limits on inter-regional entitlement trade are ostensibly intended to manage the rate of adjustment in rural communities, however, as discussed in section 2.6 the restrictions on entitlement trading can also have significant negative social and distributional impacts.

For individual irrigators who are prevented from selling their entitlement because the limit has already been reached, the limit in effect results in a loss of value in their entitlement because they are precluded from realising what may be a significantly higher market price in other regions. This impact may be particularly acute for irrigators in financial distress who are then forced to sell their entitlement to others within the region for a lower price than they may be able to receive outside the region.

By attempting to manage the rate of adjustment within a region by using a water trading policy, volumetric limits impede individuals that are seeking to make adjustment decisions by preventing their sale of water assets or by resulting in a reduced recoverable value in their water assets.

It is difficult to quantify such negative impacts, however, anecdotal evidence in rural media suggests these negative impacts are real.

In Victoria:

'Debt-ridden irrigators have been denied the right to sell their water…Irrigators say they are desperate to sell some or all of their water in the face of drought and a massive slump in milk prices…I don't know what they're going to do (if they can't sell their water). It's their last resort…What happens next is they won't be able to meet their financial commitments, especially when so many are mortgaged up to the hilt' — Weekly Times, 4 August 2009.

In New South Wales:

'many farmers are facing huge financial pressure because they are unable to sell their water licences due to a state-wide embargo…many farmers from the Murrumbidgee to the Murray have been keen to sell their water rights to boost their cash reserves…But that has all changed because of the State Government's decision to slap an embargo on water sales to the Commonwealth…the embargo has left many farmers under financial pressure…if you were counting on that money to retire a debt or to buy something else, suddenly there is a big black hole that you are going to struggle to fill' — ABC News, 2 July 2009.

4 Conclusions

The analysis in this paper suggest that the volumetric restrictions on trading of water entitlements have significant potential to, and increasingly in practice do, have an adverse impact on the achievement of the Basin water market and trading objectives contained within the Commonwealth *Water Act 2007*.

Facilitate efficient water markets and the opportunities for trading

Restrictions on inter-regional entitlement trading clearly prevent some opportunities for water trading by preventing one type of transaction in the market when the limit binds. In particular, constraints on entitlement trading undermine the ability of water users to manage their risks efficiently, to undertake long-term investments, or to realise the value of their assets in response to pressures facing the industry.

The existence of the limit may also distort incentives for behaviour in the market. For example, it may encourage irrigators to rush to get in first with entitlement trades early in the season before the limit is reached. It may also encourage irrigators to unbundle their entitlements so as to avoid the limit if they may wish to trade later on.

Minimise transaction costs on water trades

The limits on inter-regional entitlement trading impose a number of additional costs on water market participants.

They impose extra costs on those who prepare and submit entitlement trades for approvals only to have them returned. Additional transactions costs may then be incurred in seeking alternatives (e.g. trading of allocations).

The need to administer and enforce the limits also impose costs on the relevant water authorities. For example, the need to check and advise people as to when the limit is reached imposes another administrative step/cost, and requires authorities to report on status of the 4% limit. Additional costs are also incurred in managing implementation of the limits (e.g. the costs of running ballot processes to ration available limits) and the additional allocation transfer applications that would be expected.

Enable the appropriate mix of water products to develop

The limits on trading of entitlements between regions distorts the mix of transaction in the market. For example, irrigators whose applications for entitlements trades are refused because the limit has been reached may have to substitute trading in allocations for entitlement trades. Such limits also prevent irrigators and others from sourcing different products, such as entitlements from

different water sources under a tagged trading regime, as a means of diversifying their water-sourcing risk.

Recognise and protect the needs of the environment

Given that the limits on inter-regional entitlement trading are being triggered largely by environmental water purchases by Commonwealth and State Govts/MDBA, the limits can undermine the return of water to the environment. Notably, the recently-imposed moratorium in NSW applies specifically to environmental water purchases.

This effectively frustrates these attempts to reduce over-allocation and over-use in the MDB which is a fundamental objective of the Act and water reform more generally.

Provide appropriate protection of third-party interests

This objective seeks to ensure that water trading does not impact adversely on others (e.g. other entitlement holders) that are not a party to the transaction.

The principle here is that individual entitlement holders should not have their rights as assigned in their entitlements diminished by the actions of others.

In this regard, imposing restrictions on entitlement trading once a volumetric limit is reached clearly has the effect of disadvantaging some entitlement holders at the expense of others.

An important element and part of the economic value of an entitlement is its tradeability. The fact that some individuals' entitlement are rendered less valuable (because they cannot be traded outside the region) because others have sold before them, is fundamentally inconsistent with this principle.

While addressing the financial impact of funding stranded assets on those irrigators remaining in an irrigation system when others leave after trading out their entitlement appears to have been one of the rationales for imposing the limits, there are now more direct and less distorting mechanisms in place.

Similarly, it is not clear that restricting trading of entitlements is the most effective means of managing structural adjustment in communities, where upstream and downstream industries may be affected by contractions in irrigated agriculture.

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