Establishing and managing the environmental water reserve – the interaction between different government policies

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Abstract

Policy to protect river ecosystems has changed rapidly in Australia and the mechanisms to both establish and manage environmental water are still evolving. Policy has moved from providing a fixed environmental target (albeit varying between years) to one in which the environment can actively participate in the market, with the possibility of better fulfilling variable water requirements. However, the inherent nature of the Sustainable Diversion Limit (SDL), established under the Water Act 2007, is that it represents a fixed allocation to the environment. This paper considers the interaction the new SDL for the Murray Darling Basin and potential issues arising from the interaction with the government buyback intiative. While both the SDL and buyback have been discussed extensively, the interaction between the two policies has received little debate. Pairing these two policy initiatives will have implications for the flexibility of an environmental water reserve (EWR) and the ability for ongoing trade between the environment and consumptive water users. Our position is that the SDL, or preferably rules based water, should reflect an absolute minimum limit on environmental water requirements, while the buyback should provide the EWR with tradable water rights with the flexibility to respond to shifts in the environmental water demand curve by providing environmental water over and above the SDL. If both a buyback and minimum flow rules are in place, the SDL will provide little additional benefits but increase administrative costs and reduce flexibility. This has significant implications for the way the SDL and buyback strategy are structured.

***Keywords**: Environmental water; water markets; instream flows; sustainable diversion limits (SDLs)*

1. Introduction

Protection of the instream environment historically relied on regulation, or 'command and control' approaches, using licence specifications and trading rules to maintain environmental water requirements (National Competition Council 2004). Recent water reforms in Australia reflect changing attitudes to environmental water provision, demonstrated by the establishment of an environmental water reserve (EWR) with legal rights and recognition of water entitlements similar to that of other water users.

New policy initiatives and the Commonwealth *Water Act 2007* have introduced the twin concepts of a sustainable diversion limit (SDL) and government purchase of water entitlements to provide an EWR (the Commonwealth 'buyback'). Whilst each of these concepts has been discussed in research publications, government reports and the media, they are usually considered in isolation. We argue that the formation of a consistent and more effective policy requires consideration of how these two government policy instruments will interact. For example, the Productivity Commission report on the Commonwealth buyback did not discuss interaction with the SDL (Productivity Commission 2010) and the Murray Darling Basin Authorities' Issues paper on the Sustainable Diversion Limit only briefly mentioned the Commonwealth buyback (MDBA 2009). The recent Guide to the Basin Plan ('the Guide') and Commonwealth Government policy announcements suggest that water will be purchased in order to reach the SDL(Hunt 2010), however the consequences and implementation issues around this policy decision are not discussed. Consideration of the way in which these two concepts will work together should inform the structure of both the SDL and the buyback to ensure full benefit from both these initiatives. Notwithstanding the substantial progress already achieved in providing environmental water by Commonwealth and State governments, our premise is that the SDL and the Commonwealth buyback policies cannot be developed in isolation. Rather, these initiatives should be developed in parallel with consideration for how they will interact.

This paper discusses the importance of clearly defining the roles of both the SDL and the Commonwealth buyback in establishing an EWR, and targeting their implementation to the particular strengths of each policy approach. Pairing these two policy initiatives will have implications for the flexibility of the environmental water reserve (EWR) and the ability for ongoing trade between the environment and consumptive water users. In particular, there are significant implications for the ongoing role of the Commonwealth Environmental Water Holder (who will legally hold and manage the water obtained as a result of the buyback), and the fundamental nature of the EWR itself. This paper discusses the various policy initiatives used in Australia to recover environmental water (section 2). It then discusses the importance, and difficulties, in defining environmental water requirements to capture the variability in the natural flow regime and in public priorities (section 3). This is necessary background to lead into the key discussion on how the SDL and buyback interact, considering the environment's demand curve for water (section 4). Section 5 provides discussion and conclusions.

It should be noted that policy around environmental water provision, the buyback and the SDL is still under development and is changing rapidly. This article is based on publically available information at the time.

2. Policy initiatives relating to environmental water

In keeping with historical approaches to environmental protection, instream riverine environments have been protected by limiting the impacts caused by other users of water through licence conditions and trading rules (National Competition Council 2004). In 1994, the Council of Australian Governments' (COAG) Water Reform Framework recognised the need to improve and co-ordinate water management (Council of Australian Governments 1994). As part of this reform, jurisdictions were obliged to recognise the environment as a legitimate user of water through formally allocating water to the environment, and to introduce water trading. In 1997, water diversion for consumptive uses in the Murray Darling Basin (MDB) was capped because of concerns about declining environmental health throughout the Basin. Other Australian river basins also have been capped (see for example, DSE 2004); however, the MDB cap attracts most discussion because of its size and because State boundaries cause complexities in management of the cap.

Capping water allocated for consumptive uses also led to water trading 'taking off' within the MDB. In 2004 the National Water Initiative (NWI) required clearly defined property rights to water, so that water could be traded as a water entitlement (a permanent transfer) or a nominated volume for a particular year associated with an entitlement (a temporary transfer of an annual allocation) (National Water Initiative -- 2004, Clause 23(i)). The NWI also aimed to return all over-allocated systems to environmentally sustainable extractions levels (National Water Initiative -- 2004, Clause 23(iv)).

The Commonwealth *Water Act 2007* gives legislative force to many of the objectives of the NWI. In particular, the Act required sustainable levels of take, (or sustainable diversion limits, SDLs) to be defined across the Murray Darling Basin. The *Water Act 2007* also established the Commonwealth Environmental Water Holder (CEWH) as the environmental water manager and enabled it to actively participate in the water market, a significant shift from previous policies.

Sustainable Diversion Limit

The Water Act requires that the Basin Plan provide for "… *the establishment and enforcement of environmentally sustainable limits on the quantities of surface water and ground water that may be taken from the Basin water resources (including by interception activities)*" (Water Act Commonwealth of Australia 2007, s.20(b)). The long-term average SDL represents the volume of water available for consumptive use after the environment has received its requirement (MDBA 2010). The SDL can be defined as a particular quantity of water per year, a formula or method to calculate a volume each year or based on any other appropriate method defined by the MDBA (Water Act Commonwealth of Australia 2007, s.23(2)). The MDBA has stated that it will set the SDL at levels so that"… *water in the Basin can be taken from a water resource without compromising key environmental assets, key ecosystem functions, key environmental outcomes or the productive base of the water resource*" (MDBA 2009). The Basin Plan will set an individual SDL for each of 29 SDL areas across the MDB, and consumptive diversions within each area will be reduced so that they are within the SDL for that area. The Guide has indicated reductions in current diversions of between 22 – 37% across the Basin, with reductions of up to 45% for some individual SDL areas (MDBA 2010). The SDLs will be implemented through State water resource plans.

Government buyback: "Restoring the Balance"

The NWI and the *Commonwealth Water Act 2007* both recognise the environment as another water user who can trade with consumptive users (National Water Initative -- 2004, s.23(iii); Water Act Commonwealth of Australia 2007, s.106). Examples of governments entering the water market to purchase water for the environment include the Living Murray Initiative, Waterfind Environment Fund, and the NSW Riverbank. More recently, the Commonwealth Environmental Water Holder has been a major purchaser and the Victorian Parliament has just passed legislation to establish a Victorian Environmental Water Holder (the *Water Amendment (Victorian Environmental Water Holder) Act 2010*). However, in some areas, and for some types of environmental water, the environment's participation in the market remains limited by legislative restrictions and the lack of clearly defined, tradable environmental water entitlements (Siebert et al. 2000).

Commonwealth Government documents provide various stated objectives for *Restoring the Balance*, the buyback component of the *Water for the Future* initiative (DEWHA 2010). The Productivity Commission review concluded that the objectives for *Restoring the Balance* were "*multiple, poorly defined, and at times conflicting*", and concluded that the objectives reasonably ascribed to the program might include (Productivity Commission 2010):

- to help ease the transition to the lower levels of water availability likely under the Basin Plan;
- to provide some water for the environment, particularly to meet short-term needs; and
- to obtain water cost-effectively.

The advantages for using market mechanisms to establish (and manage) the EWR have been widely discussed and are to:

- ensure that the water market is complete, resulting in the most efficient outcome and providing appropriate signals for investment (Freebairn 2005);
- ensure that the value and cost of providing environmental flows is known and assessed (Productivity Commission 2006);
- ensure that any acquisition of water occurs voluntarily and thus with a perception of 'fairness' and 'equity' (Syme et al. 1999);
- improve management options for efficiently providing environmental water (Productivity Commission 2006);
- account for uncertainty by allowing adaptive management (Productivity Commission 2006); and,
- allow for variability in environmental requirements and society values.

Rules based (planned) environmental water

Historically, all environmental water was provided via rules that limited extraction by other users, and to this day, the vast majority of environmental water continues to be provided through rules-based mechanisms (see for example DSE 2009). Rules-based environmental water is provided by conditions on licence holders (either individual or bulk water holders) to protect minimum flows in rivers, by ensuring that 'passing flow' conditions are fulfilled, and to limit the maximum amount extracted from the system.

This is referred to as *rules-based* or *planned* environmental water. While not discussed in detail in this paper, rules-based water can be used in isolation, or in combination with either an SDL or buyback approach. In fact, it is presently unclear to what extent the SDLs will be made up of rules-based environmental water.

3. Representing environmental water requirements

Before further discussing various policy approaches to establish a EWR, we provide an overview of environmental water requirements as a context for the later discussion.

The process of allocating water between different users, and the role of the water market, comes about because there are competing uses for a limited quantity of water. For simplicity, we consider just two generic uses; consumptive and environmental. Consumptive uses include use by households, industry and irrigation of different pastures and crops. Consumptive uses of water have private good properties of rival consumption and low costs of exclusion. With well defined property rights and low transaction costs, market prices effectively tap information held by individual water users and allocate water both as an aggregate to consumptive uses and then between the different consumptive uses and users. The extensive reallocations of reduced irrigation water to different commodities and regions over the recent drought years illustrate the effective operation of a market system. Most, but not all, uses of water for the environment provide benefits which have the public good properties of non-rival consumption and high costs of exclusion. Environmental benefits include for current and future generations the knowledge that unique flora and fauna have been nutured and sustained. While this two-product model of water allocation is a simplification, it provides an effective framework to understand the process of reaching an efficient allocation of a limited natural resource between different uses.

Individual consumptive water users' demand for water can be represented through a curve that describes the marginal value of water as a function of the quantity consumed or allocated. The demand curve for an individual trader is determined by the individual private benefits obtained from participating in the market. To make sensible decisions about acquiring a resource and maximize gains, individuals know their own demand for those goods and willingness to buy and sell at different prices in a market based on the perceived individual benefit reaped by those who trade. The sum of all the individual private benefits (as the sum of individual quantities demanded at a particular market price) is the benefit reaped by all participants and is referred to as the Marginal Social Benefit (MSB). The MSB of water for consumptive uses can be represented as a downward sloping function, or demand curve. As more water is allocated to consumptive uses, more low water value adding crops are irrigated, production methods using more water per unit of crop production are chosen, and in some cases the extra production causes market prices to fall. Most available estimates of the price responsiveness of irrigation water demand with respect to the price of water in the MDB are in the inelastic[1]

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[1] Price elasticity is an economic measure used to describe the responsiveness of demand for goods or services to a change in price. Demand is said to be inelastic when changes in price results in minimal change to demand.

zone. For example, Dixon et al. (2010) report a long term elasticity of -0.06 but note that their model assumes away the option to reduce water per unit of crop as price rises. Hone et al. (2010) report a long run elasticity estimate of -0.30 and they note in view of the review by Appels et al. (2004) that this is at the lower end of other estimates in the literature and that the elasticity is likely to increase at higher prices as farmers switch out of irrigated pasture and cereals into dryland farming. Given well defined property rights and measurement of water use, competitive market demand curves represent the MSB function, and the market price for water equals the MSB of the last unit of water allocated to consumptive uses.

As well as working to allocate water to the most valuable uses, the market price can be used to signal the value of investments to produce more effective water and for users to find more water efficient consumptive production technology. These investments include, for example, more efficient delivery systems and plant genetic improvements.

Importantly, the demand curve for individual consumptive uses and for the aggregate consumptive use will shift over time. Demand shift forces include rainfall and other climatic conditions, changes in irrigated and other agricultural commodity prices, other input costs, and technological innovations.

In contrast to the private benefits of consumptive water uses, most environmental uses of water have public good properties of non-rival consumption and high costs of exclusion. This leads to a market failure. Individuals choose to free ride on others, and as a result—from society's perspective—too little water is allocated to the environment and too much to consumptive uses. It is this market failure which provides the case for government intervention to reallocate water from consumptive uses to environmental uses—be that in the form of an SDL, buybacks or rules based environmental water.

The logical steps in determining an environmental water demand curve are to quantify the impact of a change in flow on ecological condition, its effects on environmental service provision, and the value of the change in environmental service provision to society (Horne et al. 2009). The Marginal Social Benefit (MSB) of providing water to the environment represents the sum of the benefit reaped by individuals across the community (the sum of the Marginal Private Benefit (MPB) per unit quantity of water). Obviously, the MPB that individuals place on environmental water will vary significantly across different individuals with different preferences and incomes and across environmental assets. In reality, each stage in measuring an environmental water demand curve is encumbered by unknowns and uncertainties. The relationships between flow and ecology are scientifically uncertain and complex. Because most environmental amenity is a public good there is no market value (as compared to the case with private goods such as irrigation). Various procedures are used to infer market values or the willingness of individuals to pay for different packages of environmental amenity, including contingent valuation and choice modeling (Rolf and Bennett 2006; Bennett 2008). Despite these uncertainties and difficulties, acknowledging that, conceptually, the environment has a demand curve for water has fundamental implications for policy decisions.

The environmental water demand curve representing the MSB as a function of water allocated will generally be downward sloping, as is the case for the consumptive use demand curve. As more water is allocated to the environment, less valuable and lower iconic status reserves are effectively watered, improvements in the survival rates of flora and fauna increase at a decreasing rate, and the additional or marginal value to individuals and society of additional and/or larger natural reserves fall.

An environmental demand curve, as with the consumptive demand curve, represents the requirements for water at that particular time and it is dynamic and shifts over time. Horne et al. (2010) identified factors that would shift the response curve. These include climate, resilience and period between watering. In particular, its position depends on flows to the environment in the recent past. For example, if the flow regimes of previous years have been more than adequate to meet environmental requirements, it may be acceptable to reduce water release in the next period. Allocating water to the environment requires tradeoffs with other community values or agendas. Society's preferences for environmental amenity will shift with changes in society valuations of education, health, defence and other demands on funds to provide other public goods, with changes in community wealth, and with changes in understanding about the technical links between environmental water flows and environmental amenity provided. The volume and timing of additional flows required for environmental needs will also depend on the volume of water already instream to meet downstream consumptive demands. Thus, the requirements for environmental water will be based on decisions made by other water users (how much they have purchased, timing of deliveries, etc.). The environmental needs may even act as a constraint on downstream users demands, to reduce environmental impacts such as reversed flow seasonality.

In summary, an environmental demand curve will be both a function of how the environment responds to different flow regimes, and how the community values changes to environmental condition. Both of these influences will vary over time. Thus, an environmental demand curve is, by definition, dynamic. This concept is critical in developing policy around providing an environmental water reserve.

The efficient allocation of water between consumptive water users and the environment is illustrated in Figure 1. For simplicity a fixed quantity of water Q^ is available. As explained above, the MSB for both consumptive and environmental water (or society demand curves for water in the two broad category uses) are shown as downward sloping curves with respect to the left hand and right hand vertical axis, respectively. From a society welfare maximization perspective, the efficient allocation of the scarce water between the alternative uses is given by the point where the Marginal Social Benefit of water to the environment (MSBe) equals the Marginal Social Benefit of water to consumptive water users (MSBc). This is shown by allocation ***Q**** in Figure 1.

The premise of current policies to reallocate further water from consumptive users to the environment is that at present we are at a point such as ***Q*** where water is over allocated to consumptive use. If the allocation of water is moved from point ***Q*** to ***Q****, the efficiency benefits, or increase in social benefit, is given by the area of triangle ***a***. A move from an allocation of ***Q*** to ***Q**** will result in an increase of market price from ***P*** to ***P****. The price increase will be larger when the consumptive demand curve is steeper or less elastic, and the larger the gap between MSBe and P = MPBc at point ***Q***.

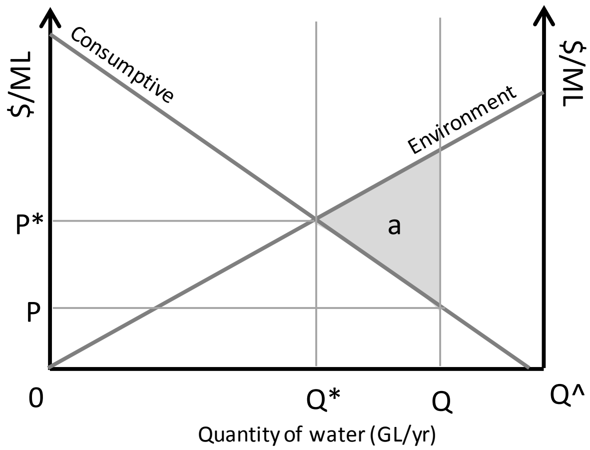

Figure 1 Efficient allocation of water between different users.

A shift in either the consumptive demand curve or the environmental demand curve will change the ideal allocation of water. Similarly, a change in total water availability due to climate change, or engineering solutions such as investment in delivery systems to reduce evaporation, will also change the ideal allocation of water. Any policy around allocation between environmental and consumptive water users needs the flexibility to be able to adapt to these changes. This is an important concept and will be returned to when examining the interaction between the SDL and buyback in later sections of the paper.

This section has highlighted the importance of considering the environment having a demand curve for water, and understanding that both environmental and consumptive demands are dynamic. Returning to the basic framework of markets and allocation principles of economics provides a logical basis to discuss and assess different policy approaches to reallocate water from consumptive to environmental uses.

4. The role and interaction of the various EWR policies

The discussion in Section 3 focused on the efficient allocation of water between consumptive and environmental water users. When assessing policy options for the provision of environmental water, there are a number of objectives that must be considered, including:

- Allocation efficiency in both static and dynamic senses (with both inter-annual shifts and secular shifts of the consumptive and environmental demand curves);
- Redistribution and equity;
- Transparency in property rights; and
- Operational simplicity and cost.

The role of the SDL and buyback (both outlined in Section 2) will be discussed in the context of these objectives. While these objectives will be discussed separately, the nature of this topic is that threads are interrelated and have layers of complexity. The discussion is structured to build these layers of complexity.

An important aspect that will be considered is the interaction between the two policies. The positioning of the environmental water holdings (obtained via the Commonwealth buyback) relative to the SDL has direct implications on the ability of the policies to make water available in accordance with the environmental demand curve. The MDBA's issue paper on the SDL stated (MDBA 2009):

> Because the use of environmental water in accordance with the environmental watering plan will not compromise the 'environmentally sustainable level of take characteristics' of a water resource, it will not be taken that is limited by the SDL. The Commonwealth Environmental Water Holder is an example of an entity that must use its water holdings in accordance with the environmental watering plan.

The Government further supported this view suggesting during the 2009 election campaign that the full volume of water required for the SDL would be met through Commonwealth buybacks (Hunt 2010). In this instance, rather than government buybacks allowing additional water on top of the SDL, the buybacks provide a mechanism to adjust to the SDL. The following discussion highlights the significance of these policy decisions and the potential limitations of this approach.

Allocation Efficiency

Section 3 introduced the concept of allocation efficiency and identified the ideal allocation between the environment and consumptive water users.

If we consider a static representation of both consumptive and environmental demands, the SDL, the buyback, or some combination of these policies can achieve an efficient aggregate split of water between consumptive and environmental uses. For example, consider Figure 1 above: the SDL could be used alone and set at allocation $\boldsymbol{Q^*}$ through a rules based or a regulation approach, leaving the volume $\boldsymbol{Q^\wedge - Q^*}$ for the environment. Alternatively, government could purchase the volume $\boldsymbol{Q^\wedge - Q^*}$ for the environment.

In practice, with large numbers of irrigators with individual demand curves, the SDL will be a more costly way to acquire a given quantity of water for the environment than purchases from the market. Inevitably, the individual irrigator demand curves vary by slope or elasticity, and individuals know more about these details than government. With a buy back scheme for acquiring water for the environment, water is voluntarily surrendered by individual sellers at the market price and the least valuable irrigation uses of water are transferred to the environment. At any market price the share of water sold by individual irrigators will vary from all to none. By contrast, a typical SDL imposes a common reduction of water supply to all irrigators. At the SDL, the value or opportunity cost of the last unit of water surrendered for the environment will vary from one irrigator to another. Of course, this relative inefficiency of the SDL can be undone if irrigators are then free to exchange through the market for consumptive water at a market price which equates the value of marginal water across the different irrigators. But, this process takes time and involves additional transaction costs.

Rather than a static or constant known consumptive and environmental water demand curves, consider the reality that both the environmental and consumptive demand curves are dynamic, and also that the available water quantity changes over time. A comparative assessment of the different policy approaches becomes more complex. In particular, the efficient allocation of water to equate the marginal social values in both consumptive and environmental uses varies with these changes. Following the format of Figure 1, Figure 2 illustrates the effects of a change in the demand for water for the environment. Figure 2(a) reflects an increase in demand associated with, for example, higher incomes demanding more environmental amenity, and Figure 2(b) reflects a reduction in environmental demand associated with, for example, more efficient way of using water to sustain an icon reserve. The demand shift changes the efficient water allocation from ***Q*** to ***Q'***. Failure to reallocate the water involves losses of society well being or efficiency represented by the shaded triangles. Note that although not represented in Figure 2, in practice the consumptive demand curve would also change. In general, the water trading option, both to buy and sell water for environmental use, is a more flexible policy instrument than is changing the SDL each and every time the different water demand curves and the available aggregate water supply change.

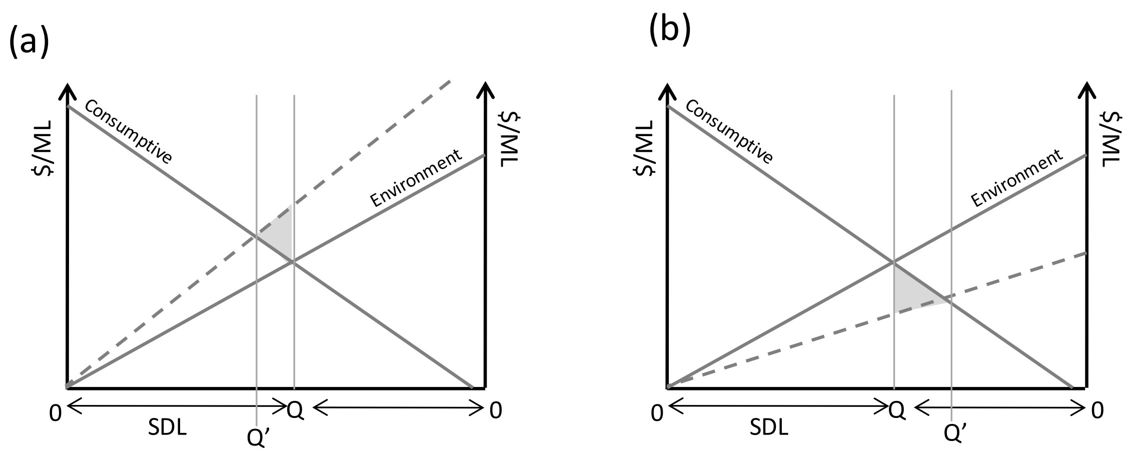

Figure 2 Impact of a change in community values on the environmental demand curve and the ideal allocation between consumptive users and the environment (a) the change in demand curve should result in a greater allocation to the environment (b) the change in the demand curve should result in a decrease in allocation to the environment.

If both the SDL and environment participation in the market are to be used in allocating water to the environment (in the context of dynamic demand curve shifts and changes in aggregate water availability), recognising that the SDL is the less flexible instrument, our analysis provides guidelines on the choice of the SDL. Rather than representing some ideal volume of water for the EWR, the SDL should represent a maximum limit on extraction (or minimum allocation to the environment), with the option to provide additional environmental benefits through the buyback. The buybacks or entitlements then sit inside the SDL, and can be purchased and sold using the market to represent tradeoff decisions between environment and consumptive users. This is demonstrated in Figure 3, where the environmental demand curve is represented to show some point at which it is essential to provide this allocation (shown by the vertical demand curve at allocation *Q*). The market can then be used to make the adjustment from ***Q*** to ***Q'***, which represents the ideal allocation between the environment and consumptive users at this particular point in time. This has the advantage of allowing the market to provide flexibility in the allocation of water between the environment and consumptive users. It also allows the CEWH to buy and sell water on an ongoing basis without complicated accounting mechanisms. If the environmental demand curve has no such requirement for some absolute minimum volume, this would suggest that the SDL provides no added benefit over and above government buybacks.

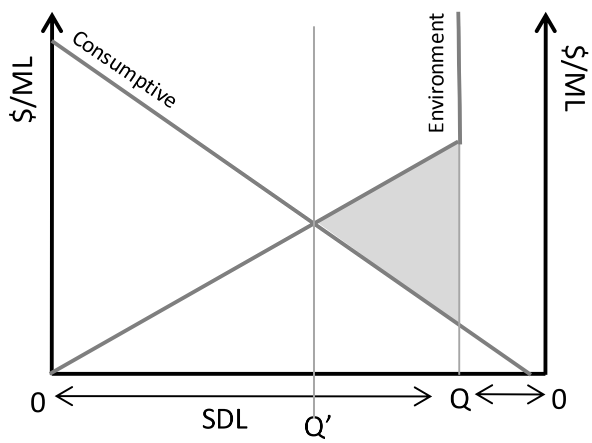

Figure 3 Conceptual representation of SDL representing a limit, with the CEWH purchases allowing a shift from minimum environmental allocation to an ideal allocation at a particular point in time.

It is acknowledged that it is not an easy task to define this limit or minimum environmental water requirement. This decision requires an understanding of both community values and scientific information. However, conceptually, this describes the objective for the SDL relative to the water purchased through the Commonwealth buyback. The environmental water that sits outside the SDL is that which requires guaranteed reliability and is non-negotiable.

The discussion to this point has focused around the broad allocation of a limited quantity of water between consumptive users and the environment. There is another layer of allocation efficiency around the ability to use environmental water to target individual environmental demands or assets. Arguably, providing the CEWH (or other environmental water managers) with water entitlements similar to those of commercial entitlements provides the CEWH maximum flexibility in allocating water to best effect over different sites, regions and time, more so than fixed SDL quotas. Flexibility for the CEWH is likely to be particularly important given that some of the inter-temporal requirements of the environment are different to those of consumptive uses. In particular, many of the environmental needs are for large quantities of water for flooding every few years, whereas many consumptive needs are for relatively more constant allocations each growing season. The ability to purchase and sell entitlements on an ongoing basis enables the CEWH to develop the suite of environmental entitlements it will need in the future to meet environmental needs (i.e. a portfolio of water entitlements with differing reliabilities), and over any given period, determine what will deliver the best environmental outcome at least cost. Also, revenue from the sale of that water may be used to greater effect for investment in environmental infrastructure (such as water delivery mechanisms to improve watering efficiency). However, this flexibility is limited if the environmental entitlements sit outside the SDL as trade between SDL areas becomes complicated without potential third party impacts.

Redistribution and equity

Changes in the allocation of water between the environment and consumptive users will redistribute income and wealth, and the redistribution may require careful management to ensure equity issues are adequately considered. This is particularly important when considering the scale of adjustment proposed in the Guide (MDBA 2010).

The process of the government purchasing water to meet environmental requirements redistributes water between willing buyers and sellers in a mutually beneficial deal. The selling farmer has voluntarily sold water for a net gain in wealth. At the same time, other water holders who have not sold have more valuable water rights (although residual land values may fall to largely offset the gains). Society in general, including taxpayers funding the buyback, gain an approximately compensating increase in more and better environmental amenity. There may be short term adverse impacts on non-farm rural communities and the need for structural adjustment for these communities may depend on the speed at which the transition occurs. Any impact on the wider community due to changes in food and fiber prices will be limited as these product prices are set by world markets with Australia being a price taker. Less water for irrigation will reduce agricultural production, but most of the impact will be on the quantities of food and fibre imports and exports and not on their prices. In this instance, the government purchasing strategy should primarily be focused around best achieving efficient structural adjustment outcomes.

In contrast, implementing the same reallocation of water to the environment as a regulation in the form of a smaller allocation per entitlement (implementing the SDL alone with no buyback) represents a windfall loss to all consumptive water users. Similar impacts will be experienced by the non-farm rural communities (and perhaps more so to the extent that selling farmers will not spend their windfall in the community). However taxpayers will save a large outlay and the broader community will gain from the increase in environmental amenity.

One of the stated objectives of the buyback is to ease the transition to the SDL, with the implication that this is a once-off adjustment. If the environmental entitlements (or buyback) sit outside of the SDL, the SDL only limits what can be extracted in aggregate for consumptive use. With freely tradable water rights within the SDL, individual irrigators can still purchase entitlements or allocations from other irrigators who become willing sellers at the higher market water prices. Figure 4 provides an illustration of a given SDL, or minimum allocation for the environment, where intra-consumptive water trades shift from many irrigators with small entitlements in (a) to a smaller number with larger entitlements in (b). The water is still purchased from willing sellers, however, the Commonwealth buyback acts to ease the reliability impacts on remaining irrigators.

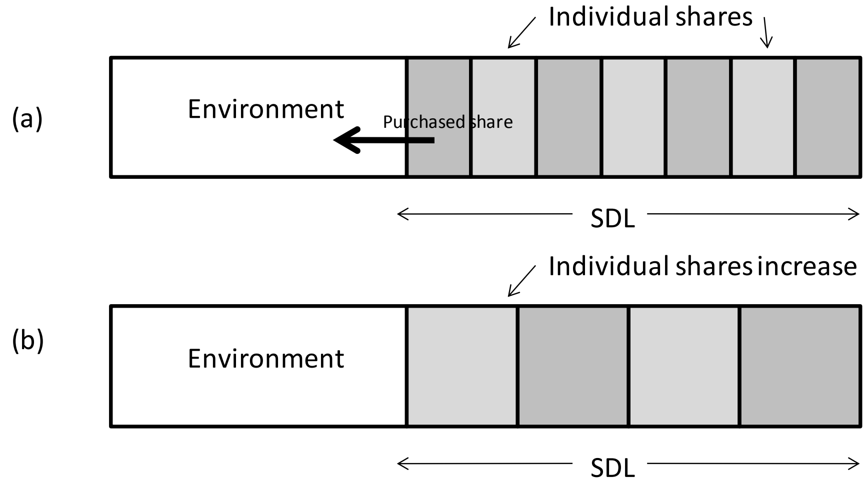

Figure 4 Conceptual representation of improved reliability to remaining water access right holders if the CEWH move from inside to outside of the SDL without an adjustment in the SDL itself (a) pre purchase (b) post purchase

It is important to consider the current specification of the SDLs as presented in the Guide. The SDLs do not represent the additional environmental watering requirements of the specific catchment, but rather, the impacts of reduced allocations have been shared amongst upstream catchments based on the level of development in each catchment (MDBA 2010). When there is no compensation, a mechanism for sharing the impact is sensible, but if the Commonwealth Government continues to purchase entitlements as a form of compensation, this proposed distribution of the SDLs impact perverts the water market's capacity to identify the best value allocation of water. If the purpose of the buyback is to help meet the SDL, the SDLs would be better defined as total upstream impacts, allowing the Commonwealth to purchase water from willing sellers anywhere upstream. As a result, the water market would be able to determine the best value water (via prices set by individual willing sellers). As an example, the Guide states that there is no additional environmental water required in the Ovens basin itself, however, to meet downstream requirements, the SDL will lead to a 40-45% reduction in the Ovens River (MDBA 2010). This effectively fixes the volume of buyback required in the Ovens River Basin. However, in reality, this water is required to meet downstream environmental water demands and therefore could be purchased on the market anywhere upstream of South Australia. It also fails to consider the ability of water products in each region to effectively match the environmental watering plan requirements. To further investigate the Ovens River example, this basin contains a mix of unregulated entitlements (licences to extract, which are of limited value outside the Ovens basin and whose reliability entirely depends on the available water instream) and entitlements held in storage (however, as this is an annual storage, these entitlements also have limited value outside the Ovens basin).

The Guide presents the SDL as a single adjustment, however the Guide also has indicated that the SDLs it proposed have already considered the impact to other water users, and will not provide the full environmental needs (MDBA 2010). The capacity for the CEWH to trade with other users in the future therefore will be crucial to generate the extra water needed in some years to deliver all environmental watering requirements. This highlights that it is unlikely that a single redistribution of allocation will be appropriate, and more likely that ongoing flexible adjustments between consumptive and environmental water needs will be required.

Transparency in property rights

As discussed above, if the environmental entitlements (or buyback) sit outside of the SDL, there is an option to either adjust the SDL with purchases, or leave the SDL fixed. This decision will depend on the overall objectives of the buyback and SDL. It is important to note the implications this decision has on the transparency of property rights. If trade between the environment and consumptive users causes a movement of some entitlements from inside to outside of the SDL (or vice versa) there are potential implications for the reliability of water allocations for remaining property right holders. This process needs to be transparent in order for third parties to understand these impacts, and ideally there should be accounting procedures in place to protect against these impacts.

In general, when a trade occurs, the water entitlement purchased should retain the same characteristics as that which was sold. However, if water purchased for the EWR sits outside the SDL, there is a fundamental difference between the type of entitlement purchased (inside the SDL, individual entitlements receiving allocations each year) and the water it will become (outside the SDL, set by fixed rules to meet specified environmental needs). As a result, determining how much water to purchase in order to reduce the burden of the SDL is a further complication. In order to ensure that the SDL has <u>no</u> impact on remaining consumptive water users, the volume of entitlement purchased must match the SDL volume with 100% reliability in all years.

Different water entitlements have different reliability profiles. Water allocated each year against each category of entitlement will vary between years. The question arises: how reliable must the EWR be to meet the environmental water requirements? The mechanisms provided to the EWR should be matched to the specific elements required in the local environmental watering regime. Where a volume is required at 100% reliability (e.g. minimum flow arrangements in permanent rivers), rules-based or planned environmental water is perhaps a better mechanism than entitlements that do not have a guaranteed allocation. However, where the environmental needs vary from year to year, flexible environmental entitlements that receive allocations which may be traded to other users may be better suited to achieve over time the maximum environmental outcome at minimum cost.

A further complication is the States' capacity to plan for environmental watering requirements. Water Resource Plans will generally specify rules-based water so that the allocation policies, or water sharing arrangements, are clear to water access right holders. However, if part of the environmental water requirements are to be met by environmental water holdings rather than rules based water, the volume of environmental water holdings must be known prior to setting the planned environmental water. However, the volume of held environmental water is not certain as allocations against entitlements will vary from year to year. There is perhaps some argument, should the buyback sit outside the SDL, that the entitlements be dissolved into rules based water once purchased to eliminate this confusion. This, similarly to the SDL itself, removes the flexibility of the entitlements themselves.

A clear difficulty arises in defining environmental water and consumptive water as distinct elements. The SDL implies that water inside is consumptive and water outside is environmental. In reality, there are numerous examples where both environmental and consumptive water needs are met by the same flow, such as providing consumptive water deliveries via the Campaspe River to provide environmental benefits en-route (Lowe et al. 2009). This outcome was the result of environmental managers and Goulburn-Murray Water working together to generate a win-win outcome.

The policy around the EWR needs to be flexible enough to ensure that initiatives that aim for conjunctive water use, providing both environmental water benefits and consumptive water use, are not just permitted, but encouraged. If these initiatives are not provided for, there is some risk that establishing an SDL will reduce the incentive for such approaches. The SDL is effectively calculated as the inverse of water required to meet the environmental watering plan in the long term, based on current system operating rules (MDBA 2010). There needs to be flexibility to allow for mutual benefits, including to consumptive users, to encourage changed system operating rules to maximize conjunctive outcomes.

Operational simplicity and cost

Assuming an SDL approach is adopted; locating environmental entitlements inside the SDL requires little operational change from current arrangements. Once the SDL is established, ongoing trade between the environment and consumptive users can occur easily within the current trade registers and accounting system.

If environmental entitlements are located outside of the SDL, accounting procedures become more complicated. Water entitlement registers likely will require adjustment to keep track of the intended use (environmental or consumptive) of particular entitlements. This is particularly the case if environmental entitlements other than the CEWH holdings sit outside the SDL.

A further option may be to have the environmental entitlements sit outside the SDL, but adjust the SDL (or compliance requirements) as trades between the CEWH and consumptive users occur. This effectively allows the variability in changing preferences for environmental values. However, at this point the SDL is no longer a "limit" and the additional administrative complexity for the market and water accounting mechanisms would be hard to justify. While adjusting the SDL to account for trade, there would still be a need to keep track of the absolute limit (the absolute 'SDL') to ensure that the CEWH does not sell off water below the limit. This option therefore still requires a cap on consumptive use of water of some kind—which makes it hard to distinguish between the option of setting the SDL as a limit and having environmental entitlements sit inside the SDL, making it an overly complex operational approach for a similar outcome.

Overall assessment

Environmental entitlements, in combination with rules based water, provide both mechanisms to meet both required minimum flows and variable demands. It is unclear what additional benefit is provided through the SDL.

The necessity to have both an SDL and a buyback in combination depends on the construct of the environmental demand curve. If an SDL is implemented, it ideally is suited to providing that element of the environmental water requirement that is required under every circumstance (i.e. a vertical component of the demand curve in Figure 3). This could also equally and arguably more efficiently, be provided through rules based water. The SDL provides a reliable allocation to the environment in all years. For this to be an efficient allocation between users, this non-negotiable allocation to the environment must be a true reflection of the demand curve. The SDL is then effectively the inverse, or what is left over, after rules based water is provided to the environment. The environmental buybacks and participation in the market provide flexibility for dynamic environmental and consumptive demand curves. The positioning of the environmental water holdings inside the SDL provides a more effective means to meet environmental needs over the long term. Key benefits of this approach include:

- Flexibility to meet future environmental needs, including capacity to buy and sell water;
- Appropriate suite of environmental entitlements with different characteristics within the portfolio;
- Transparency around the additional environmental benefits provided by the CEWH and the environmental water holdings; and
- Appropriate use of the buyback in the context of the water market, and the capacity of the water market to provide pricing signals to the CEWH, the consumptive users and society at large.

However, should an SDL be in place—and if correctly structured—the buyback also provides a means of equitable redistribution between consumptive users and the environment. If the buyback does not provide this compensation mechanism, alternative structural adjustment packages may be required.

5. Conclusions

Policy announcements and publications to date have tended to consider either the SDL, or the buyback, in isolation. However, these two policy approaches are intrinsically linked and the assumptions and objectives of one must inform the other. The interaction between these two policies has direct implications for their implementation:

- If the water obtained through the Commonwealth buyback will be located outside of the SDL, then the buyback is primarily a mechanism to ease the impact on remaining consumptive water users and the purchasing strategy should reflect this.
- If the water obtained through the buyback will be inside the SDL, then it is required to achieve additional environmental benefits (above and beyond the SDL) and the purchasing strategy should reflect this.
- If the buyback is to sit inside the SDL, then the method to determine the SDL should ensure that it is an absolute limit rather than some ideal allocation reflecting our values at a particular point in time.

It is worth considering that if the SDL is set to represent a maximum limit on extraction (or minimum allocation to the environment), rather than some ideal volume, it will almost certainly be implemented as rules based environmental water (such as minimum flows in permanent rivers). Given that there are already mechanisms for rules based water available and implemented in legislation across the jurisdictions, it is difficult to see what additional achievements are made through adding an SDL. Arguably, the existing mechanisms of rules based water and environmental entitlements can provide the same outcomes in a more transparent and operationally efficient means than also incorporating an SDL. At best, the SDL would be a formalization of existing arrangements throughout the Murray-Darling Basin, and a confirmation that such rules based water is part of the EWR.

The correct mix of policy approaches to provide the EWR will depend on the overall objectives and flexibility required. In recognition that both the environment demand curve and the consumptive demand curve will vary over time, and so will the aggregate quantity of water available for allocation, policy approaches must be able to adapt with these changes. It is argued that ideally the buyback should operate in combination with rules based water. However, if the SDL is implemented, the buyback should sit inside the SDL to efficiently, transparently and flexibly provide for changing demands and quantities over time.

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