5. Design characteristics for water access entitlements and allocations

Key findings on water access entitlement design

- All entitlement frameworks should separate out the water access entitlement from water allocation, with temporary trade in the latter permitted without changing the ownership or other characteristics of the former.
- Existing entitlements meet (most) requirements for economic property rights, though there are likely to be gains in further unbundling of entitlements. A prime candidate here would be to separate delivery rights from the water access entitlement, in capacity constrained irrigation schemes especially.
- The practicality of further unbundling and other improvements in the economic characteristics of water entitlements (exclusivity and completeness), including bringing indirect users such as forestry and land-use changes into the market, should be retested periodically.
- Continuing with the present 'partially-unbundled' entitlement form means that there needs to be more constraints to trade in entitlements than would be the case were entitlement able to be completely separated from any attendant rights to delivery, site use or other factors. This is not necessarily inefficient, when the transactions costs of alternative approaches are taken into account.
- It would be desirable for relevant Governments collectively to agree on the appropriate form of salinity mitigation obligations to be imposed on irrigators, to ensure that these obligations do not bias trading outcomes between States. These and other requirements should be competitively neutral in their effect.
- Frameworks for the specification of water access entitlements should provide the capability for delivery entitlements to be held separately to any water access entitlement, and to be individually tradeable.
- For off-river irrigation districts or areas, there is likely to be greater scope for separate markets in delivery entitlements. As such markets would be inherently local, the operator of the particular irrigation scheme would be a logical choice to organise and administer any trading arrangements.
- For on-river systems where peak delivery constraints already are binding, there are a number of congestion management options which could be adopted. Mechanisms to buy-back peak delivery rights from irrigators and water users through some form of auction or other market-based mechanism may have merit.
- A range of other operational strategies are likely also to provide a means of dealing with system capacity issues, whether arising from trade or otherwise. These options may be comparatively low cost and easier to implement than some of the more complex market-based approaches.

5.1. Entitlements options for market design

Markets exist to coordinate transactions in products or services. The product traded must exhibit a number of characteristics for a market to effectively operate. Generally the economic standard for a tradeable entitlement requires that it be:

- clearly specified – the entitlement holder and the market more generally understands the benefits and obligations associated with the entitlement;
- secure – the entitlement holder's rights are protected from arbitrary modification by others, though this does not preclude the right being subject to attenuation under clearly defined terms;
- exclusive – the entitlement holder attracts all of the benefits and costs associated with the ownership and use of the entitlement;
- enforceable and enforced – the right can be monitored as to its use and transfer, and there are tangible remedies to situations where the right is infringed by others; and
- transferable and divisible – the entitlement can be traded in whole or in part (based on ACIL Tasman, 2003).

These standards need to be met for both water access entitlements and for water allocations, as there are separate, though interrelated, markets in each.

Reforms in each State and Territory have progressed towards defining water access entitlements and allocations to exhibit most of these features, or approximate them. A significant advance was severing links between water and land, which is now all but complete (although some remaining traces of past links between water and land remain in some jurisdictions). Completing this separation is fundamental to allowing the spatial reallocation of water, a necessary prerequisite for water trade.

In at least one State there is a need still to separate out the water access entitlement (the perpetual right to a share of the relevant water resource) from the water allocation (the annual amount of water available to the water access entitlement). This separation is absolutely critical to allowing the effective functioning of the temporary market, especially, and should be pursued as a matter of priority.

Some States continue to transition to new legislative arrangements and returned water access entitlement frameworks that have been introduced in recent years. In some areas of New South Wales and Queensland, for instance, entitlements to water do not reflect the water access entitlement and allocation framework in the NWI. Mostly this is a transitionary issue, and as the necessary regulatory planning processes are completed water access entitlements in their proper form will be initialised.

Across States, the major areas where a ‘textbook standard’ is missing is in the ‘exclusivity’ of entitlements (the extent to which the costs and benefits of a changed pattern of water extraction and use accrue solely to those parties directly involved in the transfer) and the universality or completeness of entitlements (in terms of their inclusion of all aspects of the integrated water cycle).

With some small differences between jurisdictions, entitlements generally are defined having regard only to part of the water cycle, managing through regulatory mechanisms issues such as implicit rights to return flows, riparian and stock and domestic water use rights, on-farm/land-use water interception, and only incompletely deal with the interaction between surface water and groundwater sources. Water quality dimensions also are not specified in entitlements.

Entitlements (mostly) are not specified at source, being defined rather at the point of extraction. In many systems there may be multiple upstream sources all of which are capable of being partially or wholly-responsible for that supply. Entitlements therefore remain bundled with delivery rights, though some jurisdictions have moved or are moving towards further separation here.

What this means is that virtually all trade changes the ‘form’ of the entitlement in some manner. It also raises the potential for impacts on third parties not directly involved in the trade.

From a market design perspective, the choice is essentially between:

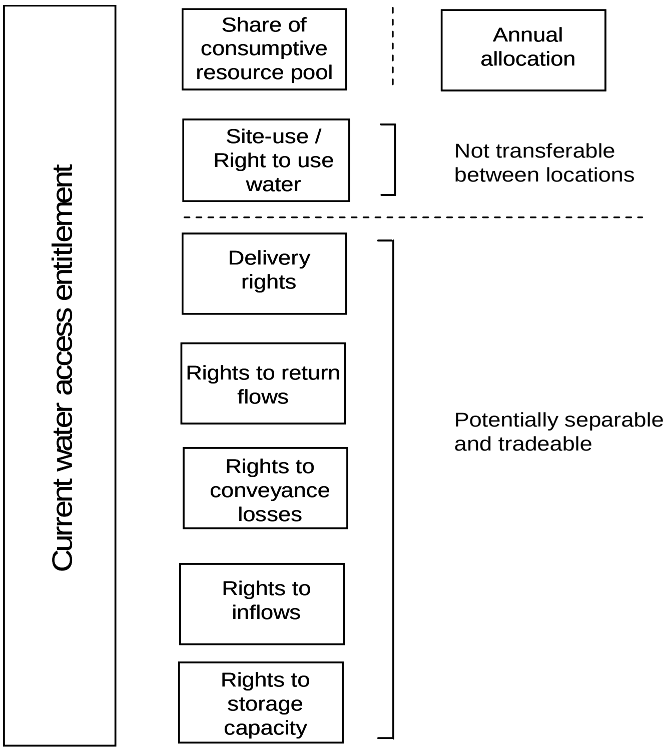
- retaining the current entitlement form, including those alterations as proposed by different States and Territories to bring their practices into line with the requirements of the NWI Agreement; or

- adopting some alternative model for water entitlements, building on the frameworks established in the NWI agreement, and perhaps involving a more ‘completely’ specified entitlement (covering more of the integrated water cycle) and further unbundling (perhaps extending to fully-unbundled ‘source’ entitlements, defined on a capacity share basis, with separate delivery share rights).

5.2. The case for further unbundling of water access entitlements

Conceptually, the first-best approach would be to completely unbundle the water resource share component of a water access entitlement from any associated rights, ultimately to an entitlement defined at source with individually-specified rights to inflows and storage capacity. The conceptual structure of this level of unbundling is depicted in Figure 3.

Figure 3: Conceptual structure for a completely unbundled water access entitlement



Source: The Allen Consulting Group (2006).

Such an entitlement could then be managed uniquely by each holder, in accordance with their own individual risk tolerance and preferences. Trade could occur in such an entitlement with absolutely no third party impacts. Every transaction would be independent, and no entitlement transfer would affect any other entitlements, nor involve any change to rights, responsibilities or obligations below the relevant source.

While it is likely that the water market would operate more effectively, and third party interests would be dealt with more transparently and efficiently, with greater separation of entitlements into their constituent 'rights', the critical factor is whether the costs of doing so would actually be greater than the resulting benefits.

The water market is not homogeneous. The market differs greatly between States and valleys depending on a range of factors, many of which are unrelated to the administrative and legislative frameworks States have enacted to support water trade.

Aside from the core separation of water and land which is now all but complete, there are legitimate differences in the extent to which water entitlements should be further unbundled in different regions, even within the same State or Territory. There is no universally correct level at which entitlements should be unbundled.

This is because the costs and benefits that would result from a more sophisticated entitlement form are likely to differ significantly between areas, including within jurisdictions. As Heaney *et al* (2005) observed:

> … most of the third party effects of trade can be dealt with by introducing more completely specified water rights; however, because of the regionally-specific nature of third party effects, in some instances the costs of creating, implementing and enforcing these rights will be greater that the benefits they generate. Many of the third party effects … are unlikely to warrant intervention at the national or state level but may be significant at the local level.

Costs and issues relating to the further unbundling of entitlements include:

- information costs, including isolating the ‘product’ for which a separable entitlement form is being created, identifying to whom this entitlement would accrue to, and educating stakeholders as to the nature of this entitlement, its rights and responsibilities, and how it would be administered and managed;

- institutional costs, including the costs of designing and applying changed legislative, regulatory and administrative frameworks, including for instance the registration systems and interfaces with existing (or developing) water access entitlements frameworks such as entitlements registers, and allocation accounting systems;

- monitoring and enforcement costs, including the costs of whatever actions are required to monitor and secure compliance with the package of rights and responsibilities which relates to the unbundled entitlement (based on ABARE, 2006); and

- equity issues in how the newly unbundled entitlements are distributed, or ‘initialised’, and resulting efficiency implications for the market where transactions costs cause some friction in the processes of efficiently reallocating tradeable rights amongst market participants.

In some case there may be opportunities for sharing of some of these costs. This includes the sharing of systems and processes for trade in separable delivery capacity entitlements with those adopted for the ‘primary’ water access entitlement (registry systems, forms, etc.). Systems developed in one State may also be able to be picked up by other jurisdictions and applied at somewhat lesser cost.

Other costs would have an enduring impact, and sufficient assurance would be needed that the benefits of further unbundling were sufficient to recover these costs.

The significance of some of these implementation costs may change over time, just as the benefits of further unbundling may change – reflecting perhaps the increasing importance of certain third party impacts as trade develops and expands in particular directions.

As the sophistication of market participants evolves, there would be expected to be fewer difficulties in pursuing a further level of entitlement unbundling. Parallels to trading in water access entitlements could be drawn, and if similar systems and processes are used, then institutional costs of further unbundling may fall. Other technological or informational improvements may also contribute to a lessening in the costs of further unbundling. What is infeasible from a cost perspective today, may in the future be reasonably cost-effective.

5.2.1. The potential for source capacity shares

Water access entitlements are generally defined at the point of extraction. In many systems, upstream of this extraction point there may be several regulated sources and various tributary inflows, all of which are capable of contributing toward meeting supply requirements at that point.

An alternative would be to redefine each water access entitlement on an individual source capacity share basis, where the capacity share relates to a share of storage capacity and inflows. A variant on this would be to include also a share of downstream tributary inflows and in-stream losses, although these also could be further unbundled into separable rights.

In some systems existing water access entitlements already approximate this (more) unbundled form. The so-called capacity share arrangements in Queensland’s St George system, for example, allow local irrigators to individually manage the reliability of their water access entitlements, as each entitlement has an individual call on inflows and storage capacity. This has facilitated the development of trading which is uniquely suited to the particular characteristics of the irrigated agribusinesses in that area, and which suit their respective requirements.

In other systems, where a single regulated source (whether a dam or a weir) supplies a discrete irrigation area, and especially where carry-over provisions are allowed and delivery capacity issues are not significant, there may be fewer practical differences between a ‘source’/capacity share entitlement and the current practice of entitlements being defined at the point of extraction.

The past few years has seen a not inconsiderable debate over these issues. Generally the research suggests that a source capacity share arrangement is economically better, and feasible at least at the conceptual level (see, for instance, Paterson 1989). The disadvantages are the comparatively higher informational and administrative costs imposed by a capacity share arrangement, especially in systems which are supplied by more than one regulated source, and potential inefficiencies in coordinating storage management and release decisions (ACIL Tasman 2003).

Capacity share arrangements are easier to introduce and manage on systems with a single, independent supply source than for larger, multi-source integrated systems which, from an operational and yield perspective, need to be run as a single coordinated system (Marsden Jacob Associates 1999).

In the complex, interconnected southern MDB, the task of re-establishing existing entitlements to source/capacity share entitlements would be complex and, most likely, very costly. It would result in ‘winners and losers’ amongst existing entitlement holders, as ‘averaging’ effect of multiple sources all contributing to a certain level of reliability across the system would be removed.

For this and other complex systems further unbundling of water access entitlements should be a longer-term objective, adopted only where the benefits can clearly be demonstrated to outweigh the costs.

Based on the literature and research we have reviewed, we are not convinced that unbundling to source-level entitlements is absolutely necessary for the water market to function effectively. While improvements in market and environmental outcomes might be achieved, the costs of doing so likely preclude its widespread application.

For most systems then – and especially those which are more interconnected and have multiple sources all contributing towards meeting users’ water needs – the most practicable and appropriate path forward would be to retain the existing framework for entitlements, and recognise that most forms of trade, other than simple transfers of ownership, will likely involve some change to the form of the water access entitlement itself.

5.2.2. Do entitlements need to be more completely specified?

The NWI Agreement requires that, for systems which are or are approaching a fully-allocated level, all new activities which cause additional water interception above an agreed threshold shall require a water access entitlement.

This is really the first step towards a more universally defined water entitlements regime, within which all forms of activity which impact on the water cycle – extraction of surface or groundwater, changes in land-use which impact on overland flows, stock and domestic and riparian uses, harnessing of flood flows etc – are brought within a common entitlements framework and administered in an integrated way.

The relevance to market design of many of these elements is somewhat tangential. The completeness with which water entitlements are specified does not directly affect trade, and is not directly affected by trade unless trade changes the characteristics of some of the ‘non-entitlement’ dimensions of water use.

There is an important difference here between factors which create uncertainty to market participants, as opposed to creating a direct cost to a market transaction. An incompletely specified right creates uncertainty for all market participants, and unarguably the potential for attenuation of that right because of the actions of a third party would result in its value being lower than otherwise.

It is not clear, though, that this uncertainty affects buyers any more than sellers, as it does not create a cost to the transaction *per se*. While not ideal, the functioning of the market as a mechanism for reallocation of water would continue.

Changes in land-use within higher rainfall regions do have the potential to impact significantly on downstream water yields (Keenan *et al* 2004). These concerns are mostly raised in relation to land-use changes across the wider catchment area (such as the conversion of open pasture to forestry plantations affecting, over the short- to medium-term, inflows to streams and other watercourses) and changes to land-use management and irrigation practices on farm which have the potential to impact on return flows.

These changes can occur outside of the existing water entitlements framework, although may be captured by the thresholds specified in the NWI Agreement. Importantly, they may also occur independent of any water trade.

Ignoring again transactions costs, the operation of the water market would be enhanced by more completely specified entitlements, including a requirement that all forms of land-use which impact on water interception are incorporated into this framework. A completely specified entitlement would be more secure from modification by third party behaviours, have less uncertainty and therefore support a more valuable and saleable commodity.

Some of the practical limitations in bringing forestry and other land-use changes within the entitlements framework include:

- the extent of knowledge about impacts, as although there is good information about the impact on stream flows of reafforestation or land clearing in some areas, relationships across broad catchments are not well understood. The information base needed to assign entitlements to ‘non-user’ applications would need to be substantially improved before it could be applied in a widespread fashion; and

- how to initialise entitlements, considering the significant existing stock of forestry and other activities which impact on the water cycle. Consideration would need to be given to whether or not existing plantations would need to acquire entitlements and what would happen to these entitlements once mature trees were planted (Coggan *et.al*, 2004).

Return flows introduce a further complication to the existing form of water access entitlements. Return flows occur because only part of the volume of water withdrawn is actually consumed, the remainder returns to the system. The effect of return flows may be comparatively rapid, such as where there are specific drainage works to reclaim and convey irrigation water back to a watercourse, or may take some years where water returns via groundwater recharge. Because of this lagged effect, it can be difficult to isolate whether observed streamflow variability is related to changes in return flow volumes, or simply because of the stochastic nature of river flows (Lee and Jouravlev 1998).

Water access entitlements are current specified as 'gross' volume entitlements, which refer to the volume of water able to be extracted from a certain location. At least in some areas, and with some types of irrigation practices, some proportion of this gross volume of water applied is returned to the system.

The past few years has seen a significant improvement in irrigation water use efficiency, driven in part by the ability of irrigators to realise some value in surplus water access entitlements through trading.

The effect of an increase in irrigation water use efficiency, all other things being equal, is that a higher proportion of a given entitlement is being used, and a smaller residual volume is returned. Flow volumes downstream in this scenario reduced and, although in most systems hydrological modelling is undertaken assuming zero return flows (ie, environmental flow requirements are determined assuming no contribution from return flows), the practical effect of a reduction in return flows is either/both a lower volume of water available to maintain streamflows or diminished reliability to downstream entitlement holders.

The World Wildlife Fund (2006) observed in its submission to the Productivity Commission's current inquiry into rural water use efficiency that the environmental impact of changes in returns flows arising from improved water use efficiency will vary from between locations, depending on the level of groundwater salinity and distance to the river. Groundwater salinity and water quality impacts also depend on the characteristics of the site. For areas with high groundwater salinity, a reduction in saline return flow discharge may improve water quality, despite a reduction in the volume of water available to dilute in-stream levels of salinity.

Young and McColl (2002), and others, have argued that Australia's 'gross' volume approach to entitlements is incorrect. They contend that entitlements should be specified on a 'net' basis (volume of water consumed) which would mean that, as irrigators improved their water use efficiency[9], and increased their net usage, they would need to acquire additional water access entitlements. An alternative approach is that separate entitlements be provided for return flows.

[9] Efficiency in this context refers to the proportion of total water extracted beneficially and use in some application, and not returned to the water cycle via sub-surface drainage or groundwater recharge.

The trade-off again is between the conceptual economic benefits of a more completely specified entitlement, more properly accounting for return flow effects, and the costs of formulating, implementing and administering the necessary institutional arrangements. Measuring and monitoring returns flows is difficult and costly, and information deficiencies also especially important, as the effective regulation of return flows requires reliable and timely hydrologic and hydrogeologic data (Lee and Jouravlev 1998).

The extent to which the water market has developed over recent years – a compound annual growth rate of around nine per cent in the volume of trade – suggests that the market is not being significantly impeded by the incomplete nature of existing water access entitlements. Doubtless there are some catchments or valleys where land-use changes and other factors are impacting on the performance of water access entitlements, or significant impacts may in the future emerge. Market participants mostly do not, however, regard this as a significant concern.

For return flows, existing research suggests that impacts on third parties are dominated by quality effects, rather than changes in volumes or reliability (Heaney and Beare, 2001). Water quality issues are discussed in the section following.

To the extent that the market continues with the current level of entitlements specification, only partially capturing the impacts of activities such as forestry and return flow changes from trade, then the limitations associated with this need to recognised and dealt with in some supplementary fashion.

Good information on water accounting and system performance is important here, so that States can look at the impact of changes in land use, return flows and other factors on system performance, and gauge whether the arrangements adopted under the NWI are continuing to perform satisfactorily, or require amendment.

Table 5: Summary of issues relating to the further unbundling of water access entitlements

Issue	Pros/benefits	Cons/Costs
• Source capacity share entitlements	• Conceptually feasible and desirable from an efficiency perspective • Would allow entitlement holders to manage individually their supply requirements, consistent with their risk profile	• Water businesses have opposed in the past because of complexity and cost • System managers claim a loss in flexibility and ability to maximise allocations across integrated systems • Would be a significant issue within some systems, where it is difficult to assign individual source/capacity shares • Need to educate entitlement holders as to merits of unbundling – irrigators may favour current arrangements if they believe it maximises their allocations • Usefulness reduced where tagging allows users to hold entitlements from different States/systems, including access to carry over
• Return flows	• Would assist in achieving complete water accounting	• Difficult to measure at individual level • More important to complete all measurement of supply first, through comprehensive and better metering of extractions • Return flows are presently taken into account in water management, even if they are not appropriately measured
• Transmission and conveyance losses	• Needs to be understood to properly account for water savings and impact of trade • Ideally should be consistent treatment between systems	• Significant work is required to agree standards for measurement and monitoring • Some evidence suggests transmission losses are a very small component of overall losses

Recommended actions

All entitlement frameworks should separate out the water access entitlement from water allocation, with temporary trade in the latter permitted without changing the ownership or other characteristics of the former.

Further unbundling of water access entitlements should, for most systems, be a longer-term objective, adopted where the benefits can be demonstrated to outweigh the costs.

5.2.3. Water quality and salinity impacts

An emerging concern with water trading is its impact on water quality. A review of the MDBC's pilot interstate trading project, for instance, found that the net inflow of water to South Australia in the long run was expected to exacerbate river salinity.

However, the third party and quality impacts of changing the spatial location of water use resulting from trade are enormously. In some areas water quality may actually improve with a net inflow of water from trading, in others it may decline.

Current arrangements to deal with water quality issues and mitigate the impact of increased salinity resulting from trade include regulatory controls on the areas where water may be traded, the types of activities which may be permitted in some locations, and forms of 'externality' charging, such as Victoria's salinity levy.

A direction which could be further explored would be to internalise the costs of salinity through some form of market-based instrument. Such an instrument could be used to control the contribution of individual irrigation areas to river salinity, based on individualised salinity credits, tradeable amongst irrigators and which collectively cap the level to which irrigation or other uses can impact on river salinity.

However, we would be reticent to suggest that such a scheme was a necessary precursor to expanded water trade. A property rights solution to water quality impacts, such as salinity, would be complex in its design and would likely take some time to develop and implement. There would be difficulties in adequately specifying these 'rights' and likely problems in creating an effective and liquid market in them. Resolving these issues would take time and if trading was put on hold for this period then the potential gains from trade would be deferred.

Any salinity mitigation program would also need to consider the impacts of trade on salinity levels in soil, floodplain and wetlands.

Recognising these technical complexities, a form of tradeable salinity entitlement administered at the irrigator level – whether in the form of a cap and trade scheme, or alternatives such as baseline and credit – should be a medium-term priority. For example, approaches such as that pursued in the Qualco-Sunlands irrigation area in South Australia should be examined and the findings of the Productivity Commission's current research into the use of market based instruments to encourage rural water use efficiency also considered.

The design of such a scheme is beyond the scope of this report, though as far as entitlement specification is concerned, we would simply note that the key issue, again, is the comparison between the informational, establishment and monitoring costs of such a scheme, relative to the benefits it might deliver from more efficient behavioural responses.

The current practice of site-specific restrictions on inbound trade to 'high impact' salinity areas, or various forms of externality charging, are likely to be the best immediate path for the water market. Structured appropriately, such schemes need not unduly constrain trade, and to the extent that trade is curtailed, there should be reasonable assurance that the environmental benefits that result justify this.

These schemes are generally well understood by the market, the administrative systems supporting them are in place, and there is a substantial body of continuing work on how these schemes can be redesigned and improved.

For those water markets which extend across State and Territory borders there is however at least the potential that a difference in the marginal cost (to the market participant) of complying with local regulatory obligations will influence trade in water access entitlements.

In Victoria, for instance, a salinity levy applies for the transfer of water into the Mallee Catchment Management Authority (CMA) area. This levy varies between zones (from $27.98 to $279.83 per ML, for permanent trade, and $2.80 to $28.00 per ML for temporary trades) and is supported also by proscriptions on trade into certain 'high impact' salinity areas. South Australia also prohibits trade into certain high impact zones, but does not charge users for the external salinity costs caused by irrigation activity, whether existing or increased as a result of inbound trade.

An ideal market design would be supported by a consistent response across jurisdictions to issues such as salinity impacts. This need not involve a uniform charge – in fact this would be very unlikely to be efficient – but should support the concept of competitive neutrality between jurisdictions.

A competitively neutral market requires that trades not be encouraged or discouraged by differences between originating and receiving jurisdictions as to whether irrigators or the community more broadly (through the Government) should bear the cost of external salinity impacts relating to water use. Currently, there is a significant financial difference between inbound trade to certain areas in Victoria and inbound trade to relatively proximate areas across the border in South Australia.

As a way forward, it would be desirable for the Governments of Victoria, South Australia and New South Wales to collectively agree on the appropriate form of salinity mitigation obligations to be imposed on irrigators, to ensure that these obligations do not bias trading outcomes.

A competitively neutral market need not require that all water users within a defined salinity zone, not just those trading into the area, incur a levy equivalent to the marginal external costs of the salinity caused. The issue is how irrigators' behaviour might change in response to such a levy.

Although it might be perceived as fairer that all those within a particular area contribute towards the external costs of salinity, the economic test of whether such a response is appropriate depends on the reaction to such a levy. If imposing a levy causes no immediate reduction in water use by existing irrigators (even though it is set at the correct, marginal cost level), then efficiency cannot be said to have been enhanced. Over a longer period of time, though, existing irrigators may have some incentive to reduce their water use and thus there may be some longer-term efficiency impact.[10]

Recommended actions

The Governments of Victoria, South Australia and New South Wales should review and collectively agree on the appropriate form of salinity mitigation obligations to be imposed on irrigators, to ensure that these obligations do not bias trading outcomes and are competitively neutral in their application.

[10] These issues are explored in detail in a recent Productivity Commission staff working paper, Dwyer, Douglas, Peterson, Chong and Maddern (2006), *Irrigation externalities: pricing and charges*, Productivity Commission Staff Working Paper, Melbourne, March. Sourced from www.pc.gov.au.

5.3. Mechanisms for sharing delivery capacity

In certain geographic areas, infrastructure and delivery constraints are binding on market participants, at least during peak periods. These operate to constrain trading possibilities, by limiting the amount of water that can be traded into certain districts, or across certain in-river constraints.

The level of reliability associated with different types of water access entitlements may also affect delivery capacity rights. For example, under the Murray Darling Basin Agreement, South Australian Entitlement Flow has precedence over any New South Wales or Victorian irrigation demands in terms of delivery.

While trading which changes the geographic pattern of water extraction is an obvious mechanism through which existing system capacity limitations might be tested, it is possible that these constraints might be breached without trade. Any change in the temporal pattern of water use by an existing entitlement holder – such as a compression in deliveries to the peak summer months, December through February – might result in supply requirements during this period exceeding delivery capacity during summer.

A recent report for the Victorian Department of Sustainability and Environment (SKM 2006), for instance, observed that there has been an increasing shift in the Sunraysia region and elsewhere towards high value, high summer use applications such as horticulture and viticulture. It was this shift in irrigation practices, more so than trade from upstream, which was contributing to system capacity issues.

To date, jurisdictions have adopted a range of approaches alternative to separately specifying delivery rights to manage capacity constraints in systems. For example, in the Tumut River in New South Wales, State Water uses a rostering system to ration demand in peak periods on some river tributaries. In other cases, where the potential for congestion exists and may adversely impact third parties, trade is limited or prohibited.

Capacity constraints are not unique to water and are sometimes experienced in other utility/common-user systems. The responses to these types of constraints vary, depending in part on the nature of the commodity and the underlying market arrangements.

In gas transmission, markets have developed around two contrasting systems known as contract carriage and common carriage (refer Box 2, below).

A critical difference is that under a contract carriage arrangement, shippers are able to trade forms of capacity rights, whereas under a common carriage models such trade is not supported.

Box 2. Contract Carriage and Common Carriage – Gas Transmission

The term 'market carriage' is unique to the National Gas Code. Market carriage is analogous to the more commonly applied concept of 'common carriage'. The market carriage regime covered by the Code is essentially a common carriage regime that incorporates some of the features of a contract carriage regime in order to manage constraints on the pipeline system. Conceptually, it is better to contrast the features of a contract carriage regime with those of a common carriage regime.

Contract carriage is the most common framework for access to pipeline capacity. Shippers are required to book pipeline capacity by entering into a contract to reserve an amount of capacity for their use and are obliged to pay for the capacity whether they use it or not. If a shipper flows more gas in a day than its contracted capacity, it will often be liable for penalties or have its gas flow curtailed if the overrun impacts other users. Accordingly, under contract carriage, a shipper has certain rights in relation to being able to use the capacity that they have contracted for, and penalties may apply if they exceed that capacity.

Common carriage, on the other hand, does not require capacity to be booked. Capacity is available to all users and paid for when used. A shipper thus does not have rights in relation to being able to use capacity nor would it face penalties for exceeding a certain capacity.

Under common carriage demand for pipeline capacity could at times exceed the capacity of the pipeline - leading to congestion. Thus, common carriage regimes require a congestion management mechanism (hence, the hybrid market carriage regime as provided for in the Code). Most regimes for access to pipeline capacity are in fact hybrids of contract and common carriage regimes.

It is emphasised that these regimes relate to access to pipeline capacity. Entitlements to gas are covered by other arrangements.

In electricity transmission, at the national level, the market has been designed around a form of common carriage (refer Box 3).

Box 3: Transmission constraints and energy markets – National Electricity Market

In the case of Australia's National Electricity Market (NEM) delivery constraints in the electricity transmission and distribution networks are managed under a common carriage model because of the unique characteristics of electricity. Electricity cannot be stored, so supply and demand must always be in balance in real time, and it is not possible to identify which generator (ie, producer) is supplying electricity to a particular customer. In the NEM, a generator pays a connection charge to gain access to the electricity transmission and distribution networks and is free to sell electricity via contract to any retailer in the wholesale market. The generator is not allocated any network capacity. At the same time, the retailer pays a connection charge and a use of system charge for access to the transmission and distribution networks. The retailer may also purchase electricity via contract from any seller without booking or being allocated any transmission network capacity.

Major transmission delivery constraints are then managed in the physical spot market by dividing the NEM into electrical regions based on the major transmission constraints between each region. Transmission network delivery constraints for balancing the supply and demand for electricity are priced in the physical spot market by allowing spot prices to diverge between electrical regions. If there are no delivery constraints then the spot price for electricity is the same across all regions adjusted for electrical losses.

Thus the common carriage approach allows the marginal value of a transmission constraint (ie, the volume of electricity that flows over the transmission line times the difference in spot prices between the two regions) to be determined based on the offers from generators and demand side bids from retailers in the physical spot market. A separate market for transmission network capacity rights is not required.

By contrast, in many parts of the USA a contract carriage model (eg, contract paths) is used for electricity transmission where a buyer or seller must purchase transmission capacity and book a contract flow in the dispatch process between the seller and the buyer. This approach was rejected by COAG when the NEM was designed because the evidence showed that the contract carriage model could become a major barrier to competition. The successful power markets in the USA located in New England, New York, and Pennsylvania -New Jersey -Maryland (PJM) do not use the contract carriage model for the same reason.

In markets such as PJM, Financial Transmission Rights (FTRs) are auctioned to assist market participants in hedging price risk when delivering energy on the grid. FTRs are financial instruments that entitle the holder to a stream of revenues (or charges) based on the hourly energy-price differences across the transmission path in the Day-Ahead Market. The FTRs provide a hedging mechanism that can be traded separately from transmission service. This gives all market participants the ability to gain price certainty when delivering energy across the grid.

Variations on these market designs have been suggested for the water market. Options range from a fully unbundled system in which irrigators (or other users) hold individual and tradeable capacity rights to certain in-river or built supply system constraints (akin to contract carriage, from above), to demand side responses where users can either submit a price for which they would be prepared to forgo supply or otherwise take a more ‘interruptible’ form of entitlement.

Other options include forms of ‘peak’ congestion charging. Here delivery charges are set based on the marginal cost of congestion with the objective of rationing available capacity to those whom value it most highly.

A congestion charge approach requires that the implementing entity estimate a value for peak capacity, a task which would be information intensive and which would need to be repeated frequently (at least every year), and for every system in which it is applied. Such an approach also raises some equity concerns in ‘taking away’ delivery rights which users might otherwise have perceived they already had, as well as the practical problem of what to do with the revenues generated.

For any alternative market-based framework to work a mechanism needs to be devised to both define the ‘right’ in question and to initialise the allocation of it to existing users. There are different issues here for ‘in river’ delivery systems and for off-river irrigation areas, with their constructed channel and piped delivery infrastructure.

Some jurisdictions have sought already to legislatively separate the ‘resource share’ and ‘delivery’ components of water access entitlements. In other jurisdictions, there is no indication that relevant governments intend to pursue such an approach:

- In New South Wales, legislation provides for the separation of the delivery from the resource share component of a water access entitlement.

  Water Access Licences in New South Wales are defined as a “share component” (specified shares in the available water within a specified water management area or from a specified water source) and an “extraction component” (to take water at specified times, at specified rates or in specified circumstances or in any combination of these, and in specified area or from specified locations) under section 56 of the *Water Management Act 2000* (NSW).

  Specifically, section 56(2) of the *Water Management Act 2000* (NSW) states an access licence may be specified as a “proportion of storage capacity of a specified dam or other storage work and a specified proportion of the inflow to that dam or work.” Share components and extraction components of a water access entitlement are separately tradeable.

  To date, the policy frameworks that would operationalise s56(2) of the Act and introduce the specification of share components as a proportion of storage capacity or other inflow have not been developed.

- In Victoria, amendments to the *Water Act 1989* (Vic) to take effect from 1 July 2007, will unbundle a water access entitlement into:

  - a water share: a legally recognised, secure share of water available for consumption;

  - a delivery share: entitlement to have a specified volume of water delivered to a property within a specified time frame; and

  - a water-use licence: authority to use water for irrigation on a property.

  Water use rights will be treated separately from the right to a share of available water.

- In South Australia, the resource share and delivery components are bundled together and specified as a single water access entitlement.

  However, the Act does recognise the concept of delivery capacity. Section 46 of the *Natural Resources Management Act 2004* (SA) states that a water access entitlement holder may contract with the relevant Natural Resource Management Group to have water delivered.

  The South Australian Government has indicated it is considering separating water access entitlements into resource share and delivery components to possibly coincide with Victoria's reforms on 1 July 2007.

- In Queensland, a water allocation holder is entitled to water, together with the circumstances of delivery and priority. Accordingly, water access entitlements (which are specified as allocations in Queensland) represent a bundle of rights.

  The notion of delivery capacity is recognised within regulated irrigation schemes in Queensland. Irrigators may contract with the holder of a Resource Operations Licence (such as SunWater) to receive a portion of that allocation.

  However, overall in Queensland it currently appears that there is little scope for the formation of separate markets in delivery capacity under existing legislation. Although within irrigation schemes such as SunWater's, markets in delivery capacity may evolve depending on how delivery is specified.

The nature of a capacity constraint will determine the most appropriate policy approach to be adopted. As constraints are dynamic, the tool used to manage demand should be sufficiently flexible to manage changes in these constraints. The types of delivery constraints and the factors that influence congestion may also vary significantly between and within systems, catchments and jurisdictions.

Accordingly, the approach adopted should reflect the nature of a specific constraint. Importantly, the most appropriate method to manage capacity may not be to further unbundle a water access entitlement, given the transaction costs associated with such an approach.

5.3.1. In-river delivery systems

In some rivers the maximum flow capacity of the river channel, or certain sections of it, can affect the feasibility of changes in the pattern of water extraction.

The constraints imposed by the Barmah Choke on the Murray system, for instance, have the potential to affect the reliability of delivery to downstream irrigators, encompassing a large proportion of the southern MDB system. In other systems, the effects of congestion are largely localised and may vary considerably both between systems and over time.

Hence, there is a need for a case-by-case assessment as to whether a property rights/tradeable delivery entitlement solution is preferable, or whether alternatives are better. One option might include the present response. This generally is to prohibit trade where it would cause an increase in congestion at certain constraint points, and to rely on alternative operational strategies to deal with (or ideally avoid) congestion incidents.

A necessary precursor for any market response is to define some form of in-river delivery capacity entitlement. A significant practical issue here is that existing water access entitlements mostly are not defined as to a particular source, but rather to an overall system which may have several sources and various tributary inflows.

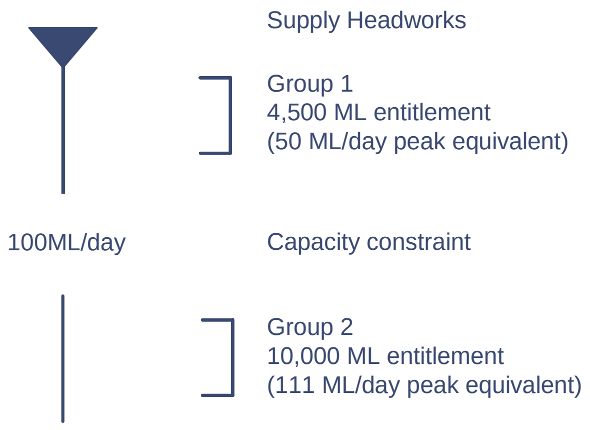
In such systems it is very difficult to determine whether any particular water access entitlement below the constraint (including those below the confluence of the Goulburn or Loddon Rivers, for instance, if considering the Barmah Choke) would hold a capacity entitlement to some of the 8,500ML of entitlement which can pass through the Choke each day.

Consider the following hypothetical examples, depicted in Figures 4 and 5, below.

The first (Figure 4) shows a very simple regulated system, in which a single source supplies two groups of irrigators, one above an in-river capacity constraint, and the other below. The constraint has a daily flow limit of 100ML/day. This equates to a peak delivery capacity of 9,000ML over the 90 day summer period which, in this system, is when irrigators prefer to take water.

There is insufficient delivery capacity for all irrigators below the constraint to use their full entitlement volume over the peak delivery period. Trade from irrigators in group 1 downstream to irrigators below the constraint would potentially exacerbate congestion.

Figure 4: Supply system with in-river delivery constraint

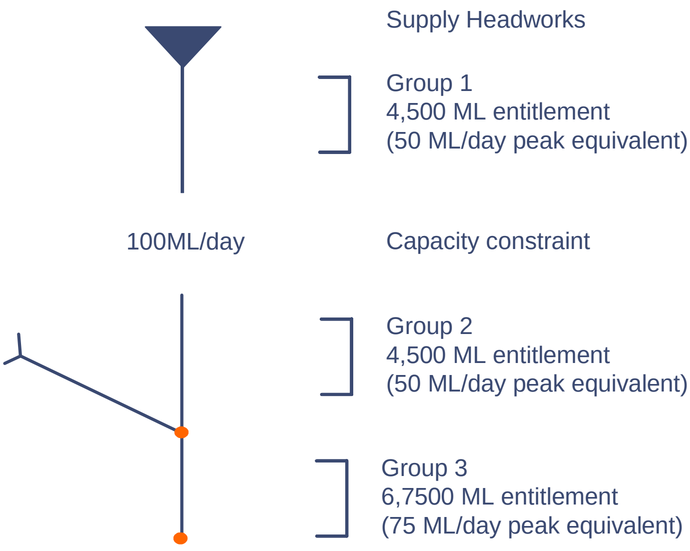


In this example a delivery right to the channel constraint is to be created. One option would be to auction these rights (or use some other market mechanism, such as a tender), though the more conventional approach is to grandfather to existing entitlement holders, whom in effect would be deemed to be incumbent holders of these rights. Irrigators in Group 2, therefore, might receive a proportionally distributed peak entitlement, based on each individual's share of the total volume of water access entitlements below the constraint. From here a market would be relied upon for irrigators to redistribute available peak capacity according to whom values most the assured access to delivery capacity in the peak summer period.

Trade in water access entitlements between irrigators in Group 1 and 2 would be unfettered. An irrigator below the constraint would however need to acquire a peak delivery entitlement to be assured that water could be delivered over the summer period. The market price of the delivery entitlement would presumably reflect the expected marginal value of irrigation during this period.

In the second example (Figure 5, below), the system is more complicated. A single regulated source still supplies irrigators on the main river channel, but irrigators farthest downstream (Group 3) are able to be supplied via tributary inflows. Entitlements for all irrigators, however, have been specified and system rules developed such that each entitlement has an equivalent level of reliability.

Figure 5: Supply system with in-river delivery constraint and downstream tributary inflows



Here, the distribution of peak delivery rights is somewhat more complicated. A landing needs to be reach as to how much of the capacity constraint should be allocated to group 2 irrigators, whom can only be serviced through it, and to those in group 3, whom can also receive supply from the downstream tributary.

This initialisation process is not impossible, but it does raise some equity issues. Although a market might be capable of reallocating these rights to achieve an optimal distribution, different initialisation processes will adversely affect either irrigators in Group 2 or 3. In all cases, however, trade in water entitlements would be unaffected – it is only the processes for securing *delivery* of water that are involved.

Current policy generally is to prohibit trade which exacerbates channel congestion. Trade in water access entitlements in Victoria from above the Barmah Choke to below it, for example, is not permitted unless there has been a preceding trade in the reverse direction (in New South Wales, trade from upstream to below the Choke is precluded altogether). However, existing water access entitlement holders below channel constraints are allowed to compress the period over which water deliveries are sought, with the costs of any resulting delivery capacity congestion shared across the system.

To the extent capacity constraints are binding, and the impact of the constraint has a material value to water users, the market might be expected to stratify between those entitlements which are held on either side of the constraint. Such an outcome is not necessarily inefficient.

It is in fact somewhat similar to arrangements in the National Electricity Market (refer Box 3, above). In simple terms, where congestion is not binding on interjurisdictional interconnectors, then the NEM will clear to a uniform energy price. However, once an interconnect reaches its capacity, then the market separates into regional sub-markets, and the energy price in each adjusts to clear supply and demand.

A market with a spike in energy demand, and insufficient interconnection capacity to fully satisfy this, will see spot prices rise, relative to the other NEM jurisdictions. Various contractual risk management mechanisms have developed to assist generators and retailers manage their exposure to price risk that might result from transmission constraints. However, these operate outside of the core market in energy.

Provided markets on each side of the constraint function effectively, then the price differential between them will reflect the marginal value of congestion. This price differential would serve as a signal to the market as to the value of avoiding congestion, and encourage users to search for strategies to avoid peak periods.

For existing users, should price differentials be large enough, then an incentive would be created for some users downstream of the choke to look for ways to realise the value of their ‘unwanted’ peak delivery rights. One option might be to sell their (higher value) water access entitlement below the choke, and purchase an equivalent volume, but cheaper, water access allocation above it. Water allocation could then be traded seasonally, depending on system delivery capacity, to an extraction point below the Choke.

Practical issues in specifying delivery entitlements

While a separate market for delivery capacity rights might, at least in theory, deliver a more efficient outcome, there are some practical constraints which require consideration.

For instance, there are technical limitations in existing metering and meter-reading systems. In some systems meters are only read once or perhaps twice a year. Accordingly, consumption during peak periods can be difficult to determine. This is especially relevant if the ‘peak’ is prone to shift, and does not correlate to a fixed time period each year (and especially so if the peak occurs only infrequently, and then only for several days or weeks at a time). Metering arrangements are considered further in Chapter 8.

There are difficulties too in organising any market response quickly. Irrigators may place water orders a week or more in advance, to allow time for water to flow downstream. Were an unanticipated capacity constraint to emerge then there would be practical problems in bringing together the necessary participants in any organised market form so that they collectively determine how to ration supply.

Finally, there is a need to consider how significant the constraint actually is, and whether complex market-based arrangements are warranted. A recent analysis of various trade scenarios on the Murray system looked at the permanent transfer of between 150GL and 300GL to the Sunraysia system, from upstream (but below the choke) and the consequent effect of the Barmah Choke (SKM, 2006).

This analysis suggested that, over a 25 year period and given certain assumptions regarding system operating conditions and water use, there would be just three instances where capacity in the Barmah Choke limited supply to downstream users, the largest of which extended for just more than two weeks. The volume of water unable to be delivered over this period was just less than two per cent of the total water use in the Sunraysia region.

Available price data (refer Table 6, below), albeit derived from very limited trading volumes, also suggests not discernible differences in market value between entitlements above and below the choke. This table shows the prices for permanent trade (of both used and unused entitlements) in Victoria for the trading zones directly above and below the Choke.

Table 6: Permanent trade, above and below the Barmah Choke

Year	Hume to Barmah (Zone 6)	Barmah to Nyah (Zone 7)
2005-06	$1,000-$1,200/ML	$1,005-$1,200/ML
2004-05	$930-$1,200/ML	$1,200-$1,220/ML
2003-04	$1000	$1,150-$1,200/ML

Note: Includes both permanent used and unused entitlements.
Source: www.watermove.com.au (accessed 20 April 2006).

This might support a view that market participants do not consider the prospect of congestion at the choke to be material to the value of water access entitlements.

Some other research, however suggests that channel capacity constraints, such as the Barmah Choke, are far more significant and impact more frequently. A report by the Bureau of Transport and Regional Economics, *Investment Trends in the Lower Murray Darling Basin*, observed that “in times of peak demand, water volumes needed to flow through the Barmah Choke can *often exceed its 8,500ML a day capacity*.” (p.13, emphasis added). Our consultations also revealed that, operationally, the constraints imposed by the Barmah Choke are becoming more frequent and more difficult for the system operator to manage, without having to resort to rationing.

The point is that the existence of a capacity constraint does not automatically warrant some form of market response. An administrative system of capacity sharing rules may in some cases be the least cost approach.

Were one to be adopted, any market-based response would need to:

- be able to be organised well in advance of any capacity constraint emerging;

- be practicable, and create a sufficiently liquid market with interest across as wide a cross-section of the market as possible;

- be reconciled to the practical issue of what we are trying to achieve - a market in delivery rights may be of little practical use if the market participants share a common value perspective, such as if they are all producing similar crops and all require the water over the same summer irrigation period;

- explicitly account for the transactions costs of the proposed approach, to the administering jurisdiction or system operator and to participants, and balance these against the benefits that might accrue; and

- consider the potential impacts of Governments purchasing large volumes of water for environmental flow purposes. Provided these flows are not released during peak summer periods, there is at least the potential that purchasing water for environmental flow purposes may have the synergistic benefit of alleviating some in-river capacity issues.

Auctions for supply interruptibility

A possible option for some systems might be to allow entitlement holders to bid a price to accept a lower level of delivery priority during peak periods. Such a process might be repeated periodically - say, annually for the following season - or once-only. Through this process an irrigator would bid a price at which they are prepared to accept a more ‘interruptible’ supply over peak delivery periods.

The attraction of such an option is that it would:

- be voluntary;

- self-select participants whom value peak delivery the least;

- involve only those whom wish to participate, and therefore keep transactions costs low; and

- could be implemented well in advance of any constraint occurring and hence avoid the timing complications of ordering and delivery.

Under such an approach, the hydrological reliability of the primary water access entitlement would not be affected, rather the entitlement holder’s ability to have it delivered below a constraint during defined peak period would be reduced. Such a process might be attractive to those entitlement holders whom use water throughout the year, and for whom peak delivery rights are comparatively less valuable.

This approach would still require, however, a process to decide whom could participate and to what level. Much like the example in Figure 3, above, this process needs to define some administrative rules, based on hydrological modelling, as to how much peak capacity each downstream user has, and thus what they are being compensated for ‘giving up’. A possible response to this is explored in Box 4, below.

Box 4: Auction to surrender peak capacity delivery rights

An auction is proposed under which irrigators are to be allowed to bid a price at which they are willing to surrender their (existing) peak delivery rights. The hydrological reliability of their water access entitlement would not be affected, only their ability to have it delivered to a nominated extraction location, below an in-river delivery constraint.

Investigations have revealed that the capacity constraint is limited to a flow of 100ML/day, yet irrigators below the constraint hold entitlements of some 11,250ML, equivalent to 125ML/day if all of this volume were sought over the 90 day peak summer irrigation period. The auction proposes to 'buy back' up to 25ML/day of peak delivery rights – or an annualised 2,250ML, assuming a 90 day peak delivery period.

Although all irrigators have water access entitlements with the same nominal reliability, the system benefits from tributary inflows which feasibly can only supply one group of irrigators (group 3). The issue is whether a bid from an irrigator below the confluence with this tributary should be treated the same as one from an irrigator above it (but still below the in-river constraint).

The proposed approach is to apply a reduction factor to bids below the confluence, which recognises the hydrological significance of the downstream inflows. Thus bids from group 3 irrigators attract a reduction factor of 0.66, which would be applied to the volume bid in the auction.

Bids are received from a number of irrigators in groups 2 and 3, as shown in the table below. The result of the auction is that the first three bids, and part of the fourth, are accepted, with a price of $140/ML paid to all bidders.

Group	*Bid volume (ML)*	*Adj. Bid[#] (ML)*	*Bid ($)*	*Cumulative volume*
Group 2	450	450	$100	450
Group 2	500	500	$110	950
Group 3	1,800	1,188	$132	2,138
Group 2	450	450	$140	2,588
Group 3	450	297	$165	bid rejected

In this example the market is proposed to operate in much the same way as do several of the well-known water exchanges. Sellers are prioritised based on ascending order of bids, and the marginal price of the last bid accepted sets the market clearing price for all bidders. This ensures that all sellers get at least the bid price offered.

[#] After applying the reduction factor, in this case assumed to be 0.66.

A further complication is whether water access entitlements of differing reliability on the same system would be deemed to have the same level of delivery priority. Generally, we consider that they should. The reliability of the underlying water access entitlement refers to its hydrological reliability and not the precedence of its access to limited water distribution assets (natural or built).

From a market design perspective, the change that would be necessary to facilitate this would be to record water access entitlements in terms of delivery priority.

This attribute would endure despite any future trade, though would have no practical relevance were trade to result in the relocation of the water access entitlement to above the particular channel constraint.

Ideally, beneficiaries (in most cases the holders of water access entitlements in the relevant system) would fund such a buy-back. A practicable way in which this could be achieved would be to have the relevant water supply authority fund the auction process and then recover the costs of doing so through bulk water charges. However, other alternatives, including funding from general government revenues and cost sharing between jurisdictions (for shared systems) might also be explored.

The usual auction design issues, such as whether a reserve price should be set, and whether bids should be transparent or sealed, we have not sought to resolve.

While this option could be effective at identifying those existing entitlement holders whom value peak delivery rights the least, it would be less capable of dealing with issues of trade. This is because there would be no direct means through which a water access entitlement holder from above the constraint could acquire a right to have it delivered to below the choke during peak periods.

What it would achieve, though, is a means through which any existing imbalance between system delivery capacity and users' peak delivery requirements could be redressed, in a comparatively efficient manner.

5.3.2. Off-river irrigation areas and districts

As for in-river systems, an alternative approach for capacity constrained off-river irrigation areas would be to further unbundle water access entitlements into a separate delivery right/water share. Under this arrangement the delivery right would be established separate to the water access entitlement and tradable individually. This unbundling has already been foreshadowed by some jurisdictions, though not yet formally implemented.

Given the continued shift towards irrigated production requiring heavy application of water during peak (summer) months, and the attendant congestion this can cause in some systems, a ‘peak’ delivery entitlement could both:

- provide a market for the creation of new delivery capacity (bringing on additional delivery capacity would essentially allow a system operator to create more entitlements, and sell these onto the market); and

- provide a price signal to irrigators as to the economic benefit of alternative operating practices, on-farm storage or other strategies to get around peak delivery constraints.

The design of such rights would follow the standard script for other ‘cap and trade’-type schemes: define the allowable quantum of rights, determine a process by which these are to be allocated (whether grandfathered to incumbents, auctioned or otherwise), establish systems to monitor and enforce the rights, and the frameworks needed to support trade.

Such arrangements are likely to be easier for off-river delivery systems than for natural river channels, at least for some systems, and thus there is likely to be greater scope for the application of such separate delivery rights arrangements.

Given that such markets would be inherently local, the operator of the particular irrigation scheme would be a logical choice to organise and administer any trading arrangements. This would allow for the costs of such schemes to be recouped from users within the scheme. Where users have to pay for the costs of a trading scheme, it provides also a discipline on them to propose schemes only where the benefits are greater than the costs.

However, the same cautions apply in that what may be appropriate for some systems will be inappropriate for others. Hence a uniform solution cannot and should not be mandated. Individual scheme operators (and their constituent irrigators/users) should determine whether or not to implement a system of delivery capacity rights/trading.

In terms of market design, it would be desirable for the design of the water market to have the capability to incorporate separable delivery rights, for those situations in which they are deemed necessary and desirable.

Table 7: Summary comparison between alternative delivery capacity management systems

Option	Description	Feasibility	Flexibility	Cost
Administered sharing rules	A system of administrative rules determining whom would receive diminished supply during periods of constrained delivery	Generally easy to administer, though quite complex rules may be required in some systems	Inflexible to changes in conditions or users' preferences. Difficult to accommodate the impacts of water trade	Low cost from an administrative perspective, though potentially high cost in terms of the opportunity cost to high-value uses/users. This cost depends on the likelihood and significance of the constraint occurring
Demand-side responses	Systems where users can self-nominate to avoid deliveries during peak periods. May involve peak pricing or options such as auctions to accept a lower-priority delivery (as described above)	Feasibility depends on characteristics of relevant systems and underlying market. Options which rely on rapid responses from users may be less feasible	Some options can be reasonably flexible, though accommodating the dynamic influences of trade may challenge other demand side options	Cost depends on nature of response. Options which target the most pressing delivery constraints, and which rely less on detailed information, would be less costly from an administrative viewpoint.. There is a need to consider both revenue needs of any 'buy-back' option, plus what to do with revenue from peak pricing
Supply-side responses	Where the system operator (or another party) brings on additional supply capacity to address delivery constraints	May be technically feasible in some circumstances (such as in off-river channel or pipe systems), but less so for some in-river delivery systems	Relatively inflexible option. Once adopted, generally supply-side responses cannot be reversed	May be very high cost, depending on system characteristics. Relies on information as to the value of the existing constraints, and a mechanism to capture a sufficient proportion of this value to recover the costs of any supply side response. In some situations, though, the costs imposed by the constraint may be such that it warrants a supply side intervention, even if the rights to this capacity cannot clearly be allocated and no direct revenue recovery mechanisms exist
Tradeable delivery capacity	Delivery entitlement which can be traded separate to water access entitlement. Depending on the nature of the system constraint, the delivery entitlement may be for peak periods only, or may be a fully-specified capacity right	Feasible in some systems, where the constraint is clearly definable, the necessary competitive market characteristics can be established, and the benefits of further unbundling entitlements are not outweighed by costs	Very flexible, including in response to changes in the spatial pattern of water use brought about by trade. Can be tailored to the individual circumstances of particular systems	There may be a high net cost in some systems. Likely to be most cost-effective for off-river irrigation areas/districts (see below)

Criteria which should be considered in deciding between alternative options for managing capacity constraints include:

- the magnitude and incidence of congestion costs:

  - the higher (and more frequent and more likely) the costs of congestion, then logically the greater the argument for a response strategy which itself will be costly. Conversely where congestion costs are low, or congestion incidents infrequent or improbable, then the case for a strategy to ameliorate these costs will be more difficult to make;

  - congestion costs may be localised or widespread in their incidence, affecting many or few market participants. Where there are fewer affected participants, then the transactions costs of a market-based response may be lower and more manageable. Having fewer affected parties also may mean that the costs are more significant for each, and hence options which allow them to manage or reduce these costs will be more valuable;

  - where costs impacts are relatively uniform in their distribution then market-based responses may be less suitable. Here, options such as administrative sharing rules may be more feasible. Some heterogeneity in congestion cost impacts between participants, however, would suggest that a market-based approach to reallocating delivery capacity rights is more tenable;

- the relative costs of supply responses versus demand side strategies.

  - in some situations, the cost of trying to organise a sophisticated market response may actually be greater than the cost of simply augmenting the supply system to remove the constraint. A sensible strategy may be to incur the costs of the supply-side response, and then recover this through increased charges on (all) users.

Recommended actions

In States and Territories where legislation does not provide for separability of ‘delivery’ and ‘resource share’ entitlements (this is the case in all States and Territories other than New South Wales and Victoria), legislation should be amended to explicitly provide for these components.

- Where legislation does provide for separable delivery capacity entitlements, the frameworks necessary to create the entitlement and allow for trade should be implemented, such as in New South Wales.

- Any change in the specification of a water access entitlement should occur with priority given the potential impact of a change in a statutory right held by an individual that may have encumbrances, etc over the asset. Market uncertainties and change have the potential to limit trade, and changes in the nature of risk associated with holding entitlements should be reflected in the price of the good.

Each State and Territory in conjunction with the relevant rural water services provider, should identify where capacity constraints exist, or where there is potential for capacity constraints to emerge.

Tools to manage these constraints should be considered having regard to the relative feasibility and cost effective of the alternatives, including both market and non-market responses.