Water Policy Initiatives Inquiry

Senate Rural and Regional Affairs References Committee

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Contacts: **Water Property Entitlements and Water Trading**

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Climate Variability and Climate Change Water Policy and Adaptation Options for Irrigated Agriculture

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Acronyms used

MDBC	Murray Darling Basin Commission
IPCC	Intergovernmental Panel on Climate Change

Table of contents

Executive Summary

Water Property Entitlements and Trading

Entitlements to water pose a challenging problem as solutions rely on good bio-physical science and sound economic analysis. Discussions of entitlements are difficult because the language and approaches have been developing across the States over the last two decades. One of the contributions of CSIRO Land and Water is to develop a systematic framework for thinking about entitlements and to suggest ways to simplify the complexity of existing systems that will assist this outcome.

The first is to develop a consistent language about water entitlements. The next step is to unbundle water titles into at least three separate components:

- Allocations
- Use
- Access

Across Australia there is emerging interest in the acquisition of access entitlements and options as a way to increase environmental allocations. An important issue that the Committee may wish to consider is the question of whether or not it is the role of the government or individuals operating in the market to finalise the amount of water that is used to improve the environment.

It has been estimated that in the River Murray system alone there are over 438 types of water entitlements and this complicates trade in water. Considerable transaction costs are incurred by those wishing to trade and by the government agencies who manage the administrative processes supporting these trades.

Climate Variability and Climate Change Water Policy and Adaptation Options for Irrigated Agriculture

There is a range of climate variability and climate change issues in the context of water policy and regional adaptation options for irrigated agriculture at the strategic and operational levels.

At the strategic level, longer term adaptation strategies and policies need to incorporate enhanced climate variability and change impacts on water quantity and quality and demand management.

At the operational level new management tools such as ocean based forecasting models for rainfall and water allocations are already available; however, there remains a need to integrate these tools into smart water management.

Well coordinated efforts by the Federal, State and Local Government agencies and industry groups are needed to incorporate risk management into national water policy and to develop adaptive local action plans.

Water Property Entitlements

Introduction

Entitlements to water continue to be a critical issue in the management of the nation's water resources. The separation of titles to land and water across the States as part of National Competition Policy Reforms has facilitated trade in water and provided incentives to change land use. Water has moved from lower value applications to higher value applications.

Entitlements in water can be used to efficiently allocate and manage water resources consisting of *consumptive and non-consumptive* water use through time. Key features of robust systems have been identified as security, economic efficiency and low cost trading and low cost administration. A robust system also must pass the conventional tests of efficiency and fairness. For this to occur in a changing world, the system must not only be built on a solid conceptual foundation, but also be flexible and adaptive, transparent and equitable.

Question being tackled:

How to define property rights to ensure the long term sustainability of the resource?

Language

One of the greatest challenges for the improvements of water allocation and management arrangements is the language used to talk about water licences among states. In particular, the meaning of the word "allocation" varies from State to State. To illustrate the point:

- In Queensland access entitlements are called "water allocations" and "allocations" are called "seasonal water assignments";
- In South Australia both access entitlements and allocations are called "water allocations"; and
- In New South Wales access entitlements are called "entitlements" and allocations are called "allocations".

As a consequence, discussion about issues associated with water titles and trading arrangements can become confusing at the national level. The language used in this submission is consistent with the National Water Initiative. The definitions used in the National Water Initiative are as follows:

> ***water access entitlement*** *– a perpetual or ongoing entitlement to exclusive access to a share of water from a specified consumptive pool as defined in the relevant water plan.*
>
> ***water allocation*** *– the specific volume of water allocated to water access entitlements in a given season, defined according to rules established in the relevant water plan.*

Unbundling

Generally, the framework set out for the definition of water entitlements is consistent with concepts developed by CSIRO scientists Mike Young and Jim McColl in a series of reports on options for the robust definition of water access entitlements, and use approvals (Young and McColl 2005b; 2003a,b; 2002). The essential proposition behind this Eureka Award winning research is that for the efficient and equitable management of water resources through time it is necessary to unbundle water titles into at least three separate components as set out in Figure 1 below.

Under this framework water access entitlements can be used to manage equity issues in water allocations; associated low cost trading arrangements can be used to ensure that water is used efficiently; and use approvals can be used to manage impacts on the environment and on adjoining land holders.

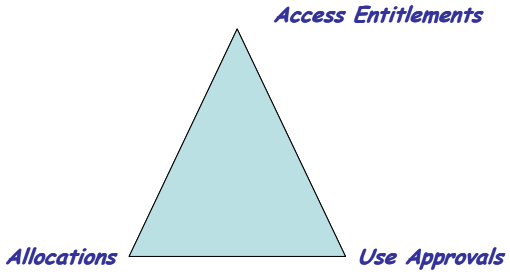

Figure 1 - Framework for the robust definition of opportunities to hold, manage and use water

Entitlement definition

As observed in the National Water Initiative and in the Committee's terms of reference, water supply arrangements need to account for the fact that water supplies and climate changes are likely to occur. Given this Young and McColl (2003) (and the National Water Initiative) reason that water entitlements are most effectively defined as shares. By defining entitlements as shares rather than as volumes of water, it is clear that any risk associated with changes to the quantity of water available in a pool is assigned to the entitlement holder.

Global experience suggests that a unit share rather than a proportional share structure should be used. To date, NSW is the only State that has moved to use unit shares as a means to define water entitlements. All States are in the process, however, of moving to the use of language that makes it clearer that water entitlements provide holders with a share of the water available.

Environmental water

Across Australia, there is increasing interest in defining the relationship between water allocated to the environment and for consumptive use. Queensland is the only State that has moved to arrangements that use a capacity share approach to define the relationship between water for the environment and water for consumptive use. However, this State has only been able to do it for smaller systems and where there is little overland flow. All other systems still use management plans to set up the rules under which the division between water for the environment and water for consumptive use is defined.

Across Australia there is emerging interest in the acquisition of access entitlements and options as a way to increase environmental allocations. An important issue that the Committee may wish to consider is whether or not it is the role of the government or individuals operating in the market to finalise the amount of water that is used to improve the environment.

Under one model, government use of planning processes determines the preferred outcome and individuals using water trusts etc are allowed to increase the allocation to the environment.

Under the other model, governments take the actions of individuals into account and decrease planned allocations as individuals acquire water and make it available for the environment.

Water accounting

The National Water Initiative states, amongst other things, that *"Parties recognise that a number of land use change activities have potential to intercept significant volumes of surface and/or ground water now and in the future. Examples of such activities that are of concern, many of which are currently undertaken without a water access entitlement, include:*

- *farm dams and bores;*
- *intercepting and storing of overland flows; and*
- *large-scale plantation forestry."*

In addition to these considerations, across Australia most, but not all, water entitlements are gross entitlements. This means that whenever one irrigator adopts a more efficient form of irrigation, the amount of water that returns to a river or aquifer decreases and hence less water is available either to other water users or to the environment. The alternative approach that Young and McColl (2003) recommend is the definition of entitlements as nett entitlements. If this approach is taken then there is no need for efficient irrigators to keep on acquiring water just to stand still while others increase the efficiency of water use.

Another accounting consideration is the current practice of installing salinity interception schemes along the River Murray without acquiring the water needed from entitlement holders, even though salinity interception functions by stopping water from entering a river and diverting this water to a basin for evaporation.

When all these effects are put together it becomes clear that there are considerable water accounting challenges still facing Australia. Table1 provides an early indicative estimate of the collective effects of all these issues. Research that seeks to identify better estimates is under way but, as yet, none of this research has been released publicly. To these estimates one must add the effects of adverse climate change and bushfires. Consideration of the information in this table makes it clear why all statements associated with the Living Murray

process describe the $500m or 500GL commitment that governments have made as a "first step."

Table 1 Estimated reduction in mean annual flow and available seasonal allocations of design omissions in the entitlement systems used to allocate water in the River Murray Basin (baseline 1993/94)

Design Omission	**Net effect**
Reduced drainage and groundwater returns to the River resulting from water use efficiency savings [a)]	- 723 GL
Reduction in water yield from catchment land-use changes like increased forestry and farm dam development [b)]	- 600 GL
Reduced groundwater flow to the River as a result of increased installation and operation of Salinity Interception Schemes [c)]	-20 GL
Reduced groundwater flow to the River from increased groundwater use [d)]	-349 GL
Estimated net reduction in mean river flow and allocations to irrigators	**-1,692 GL**

a) Source Young and McColl, 2003b.

b) This assumes that a mean of 8,734 GL is used for consumptive purposes in the River Murray System. Since 1993/4 there has been considerable investment to increase water-use efficiency. If 1,500 GL is withdrawn from irrigation, it can be expected that irrigators will respond by increasing water-use efficiency further. It is assumed that the collective long run effect of reduced groundwater return, reduced surface water return in those systems where licences are defined in gross not net terms, and increased investment in the capture and use of run-off will be around 10% of the remaining water.

c) It has been estimated that from 2002, increased plantation forestry stimulated by financial incentives will reduce recharge across the entire Murray Darling Basin by 1,300GL (Hairsine, pers. com.; Vertessy *et al*., 2003). Assume that this reduces mean flow into the River Murray System by 600GL. The estimate is intentionally conservative. More accurately, an estimate of the impact from 1993/94 to 2002 could also be included. In our original text we did not include an estimate for farm dam development. More recent advice to us suggests this impact could be as big as that caused by forestry development in high rainfall areas.

d) At present, pumping of saline water and its subsequent evaporation as part of a salinity interception scheme is not defined as an extractive use which needs to be managed under the cap. This estimate of 20 GL is also conservative. The MDBC has since advised that 40 GL is a more appropriate estimate of the impact of existing and planned schemes (Close, pers. com.).

e) Results from MDBC studies (currently embargoed) are understood to have estimated that increasing groundwater development will erode the Cap by somewhere between 4 and 7%.

Water Trading

The National Water Initiative seeks, among other things, to improve water trading arrangements.

Significant progress is being made towards the removal of barriers to trade and these will be helped by the unbundling processes that have occurred in Queensland and New South Wales, and are now underway in Victoria and Western Australia. There is, however, considerable variation in the application fees set and charges made. Stamp duty is charged in at least one but not all States.

Where trading costs are low, unbundling is enabling people to place their water entitlements in tax effective structures. It is, for example, possible to place one's water in a self managed superannuation trust and then lease it to one's business. Water users in States where this type of arrangement is not possible are at a significant disadvantage.

Another water trading issue is the question of how to reduce the many types of water entitlement that exist in Australia. Shi (2004) has estimated that in the River Murray system alone there are over 438 types of water entitlement. He observes that

"A type of water entitlement is most easily identified by asking whether or not a trade involves only a change to the entitlement ownership. If other changes have to be made, for example, to

- *the allocation pool that the water is drawn from, or*
- *the management zone or region where the water is held,*

then the trade involves conversion from one type of entitlement to another type of entitlement.

When considering only the regulated surface water system, a total of 438 types of water entitlements can be identified:

- *132 types of regulated surface water entitlements in NSW;*
- *191 types of regulated surface water entitlements in Vic; and*
- *115 types of regulated surface water entitlements in SA."*

Conceptually it should be possible to rationalise these arrangements via a series of unbundling and simplification processes. How far Australia can move to standardise arrangements and align water entitlements is debatable. Australia has, however, been able to establish a single register for its companies. Moreover, a significant number of countries in the European Community have been able to align the currency management and ultimately adopt a single currency.

The Committee may like to consider the challenges that States involved in the Murray Darling System would need to overcome in moving to the development of a uniform approach to water entitlements in the Murray Darling. CSIRO is not yet convinced the benefits of such an effort outweigh the costs but considers the idea worthy of consideration.

The National Water Initiative states, among other things, that *"Full implementation of this Agreement will result in a nationally-compatible, market, regulatory and planning based system of managing surface and groundwater resources for rural and urban use that optimises economic, social and environmental outcomes."*

Climate Variability and Climate Change Water Policy and Adaptation Options for Irrigated Agriculture

Introduction

Several changes in water policy have been formulated in recent times with the objective of striking a balance between the consumptive and environmental components of flows in Australian catchments. Some of the developments that affect irrigated agriculture include:

- The Council of Australian Governments Water Reforms;
- MDBC CAP;
- Environmental flow rules; and the
- National Water Initiative.

At a strategic level global climate change threatens the viability of irrigated agriculture and other industries. Under the present water reforms, longer term water security is not guaranteed since these reforms do not explicitly take into account threats to water quantity and quality due to enhanced climate variability and change.

The Committee may like to consider the need for Australian water legislation and policy to be revisited to incorporate climate change and adaptive management options for balancing the need for high tech irrigation and associated greenhouse gas issues due to increased energy requirements.

At an operational level current water allocation systems do not take into account the state of the art in climate forecasting methods, and therefore it is often not until after the irrigation season is well underway that irrigators have any idea of how much water will be available. Thus there is considerable risk associated with planting and crop establishment decisions, and therefore there is a need for climate forecasting tools aimed at risk management.

Questions being tackled

- Monitoring drought and predicting farm water demand
- The implications for agriculture of predicted changes in patterns of precipitation and temperature

Climate Variability and Climate Change

Climate change and its impacts on water resources are widely accepted in the scientific community.

Studies by the Intergovernmental Panel on Climate Change (IPCC) show that water flows in the Murray Darling basin could fall by as much as 35 per cent by 2050. Associated rainfall scenarios predicted by CSIRO show decreases of 0 - 8 per cent by 2030 and 0- 20 per cent by 2070 for much of Australia. These forecasts also include temperature increases of between 0.8 - 3.9 ^{o}C by 2050 and 1.0 - 5.9 ^{o}C in 2080.

There are significant knowledge gaps in terms of the impact of climate change on irrigation and river management and how it will impact on regional planning and national economies. Considering current water reforms, it is crucial to understand the impact climate change would have on water demand and potential land use changes as water is traded to higher value production.

At the **strategic level**, a multi-stakeholder national initiative is needed to consider climate change impacts on farm to regional levels, and to devise robust policy options for the viability of irrigated agriculture, hydroelectric power generation, rural industries and regional communities.

There is a need to incorporate climate variability and change scenarios into understanding the sustainable footprint of irrigation, irrigation demand management, whole farm planning and environmental management. Future water savings through technology improvements need to be analysed in the context of higher energy demand and greenhouse emissions.

At the **operational level** there is a need to integrate climate forecasting tools with water resources management. Examples of new climate/drought forecasting tools include a neural network model developed by CSIRO to predict water allocations in the Murrumbidgee Valley using the sea surface

temperatures, historic rainfall, river flows and water allocation rules (Khan et al, 2004).

Developments to date have shown good relationships between sea surface temperatures and inflows to Burrinjuck and Blowering dams. The software package is being presented to irrigators as a simple user-interface requiring only three pieces of data (start of the season water allocations, acceptable farming risk and sea surface temperatures) to obtain a prediction of the next season's water allocation. Development of this model is exciting for irrigators and water managers as it makes possible the prediction of irrigation water allocations leading up to or at the beginning of an irrigation season. This may lead to improved irrigation efficiency due to well informed cropping and water trading decisions, spreading of irrigation demand over summer and winter periods and better environmental management by overcoming system constraints such as limited capacity of rivers and channels. It is anticipated that farmers will be able to gain lead times up to six months in advance.

Due to the adaptive nature of the neural network method, the model will continuously improve in the future as more data becomes available. Trials for this new model have been carried out during 2004/05 and show very promising results. There is a need to integrate such efforts with the State water allocation procedures.

Appendix 1 - References

Water Property Titles including water trading

Shi.T. (2004) Simplifying Complexity: A Framework for the Rationalisation of Water Entitlements in the Southern Connected River Murray System. CSIRO Land and Water.

Vertessy, R.A., Zhang L., and Dawes W.R. (2002). Plantations, river flows and river salinity. Australian Forestry, Vol. 66, No. 1: 55-61.

Young, M.D. and McColl (2005b) Defining tradable water entitlements and allocations: A robust system. Canadian Water Resources Journal 30(1):65-72.

Young, M.D. and McColl, J. C. (2003a) Robust reform. The case for a new water entitlement system for Australia. Australian Economic Review 36(2):225-34.

Young, M.D. and McColl, J. C. (2003b) Robust Reform: Implementing robust institutional arrangements to achieve efficient water use in Australia. CSIRO Land and Water.

Young, M.D. and McColl, J.C. (2002) Robust separation: A search for a generic framework to simplify registration and trading of interests in natural resources. Policy and Economic Research Unit, CSIRO Land and Water, Adelaide.

Climate Variability and Change Water Policy and Adaptation Options for Irrigated Agriculture

Khan, S., Robinson D, Beddek R, Wang B, Dharma D, Rana T (2004). Hydro-climatic and Economic Evaluation of Seasonal Climate Forecasts for Risk Based Irrigation Management. CSIRO Land and Water Technical Report 5/04. http://www.clw.csiro.au/publications/technical2004/tr5-04.pdf