

An integrated approach to managing river salinity impacts of water trade in the Victorian Mallee

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Introduction

In 2001 the Murray-Darling Basin Ministerial Council approved the *Basin Salinity Management Strategy 2001–2015 (MDBC, 2001)*. The objectives of the BSMS are to:

- maintain the water quality of the shared water resources of the Murray and Darling Rivers for all beneficial uses - agricultural, environmental, urban, industrial and recreational;
- control the rise in salt loads in all tributary rivers of the Murray-Darling Basin and, through that control, protect their water resources and aquatic ecosystems at agreed levels;
- control land degradation and protect important terrestrial ecosystems, productive farmland, cultural heritage and built infrastructure at agreed levels; and
- maximise net benefits from salinity control across the Murray-Darling Basin.

The BSMS attaches no blame to anything that happened prior to 1 January, 1988. However, each of the states who are party to the *Murray-Darling Basin Agreement* is now fully accountable for anything it does to increase (or decrease) river salinity. 'EC units at Morgan'¹ are the units of account.

The BSMS outlines formulas for sharing the costs, and the benefits, of works and measures to reduce river salinity. In defined circumstances state governments are entitled to increase river salinity, subject to strict accountability procedures. These entitlements are often referred to as EC credits.

For the Victorian Mallee, EC credits can be generated by: drainage diversion works, groundwater interception schemes and through improved irrigation management. On the other hand, the Victorian Mallee requires EC credits to offset the salinity impact of water transfers into the region, as well as the impact of drainage disposal schemes constructed after 1988.

In 1989 the Victorian Government enacted the *Water Act 1989*, to introduce a range of water reforms. The reforms included the intention to introduce provisions to allow for the permanent trade of water, separate to land. Trade in water would only be approved provided that impacts on the environment were minimised or mitigated. It was recognised and accepted at this time that irrigation was a major predisposing cause of raised salinity levels in the River Murray, and that further and unbridled irrigation would exacerbate river salinity levels.

Taking a planned and integrated approach

The Victorian Government decided that, prior to enacting the provisions allowing for water trade, a process to minimise and mitigate salt impacts that may be generated from this trade would need to be developed. Salinity Management Plans were at that time, the formal statutory process to manage salinity impacts. The plans once approved, bound statutory authorities and local governments to take account of the intent and detail outlined in the plans. The plans were drafted by community-based groups, whose membership included irrigators and conservation groups, with departmental support.

The focus of the *Nyah to the South Australian Border Salinity Management Plan* (Victorian Government, 1993) was to minimise salinity impacts in the context of an efficient water market. The Victorian Government through its endorsement of this plan, introduced statutory-based salinity zoning and salinity levies.

The *Nyah to the South Australian Border Salinity Management Plan* also provided the

mechanism by which the Victorian Government would manage its obligations to account for the impacts of water trade under the then, *Murray-Darling Basin Salinity and Drainage Strategy* (MDBC, 1988).

Mechanisms to manage the impacts of irrigation development on river salinity

The Victorian Mallee region is situated in north-west Victoria and is bounded on the east and north by the River Murray. An aeolian landscape of low relief, the region contains soils of both vertical and lateral variability. The regional groundwater is within 2-10 m of the surface and is connected and discharges to the River Murray, presenting challenges for the application of water to land. The salinity levels of regional groundwater are much higher than those tolerable by commercial horticulture which covers approximately 69,000 ha of the Victorian Mallee region along the River Murray, or the environment in general.

The development of the *Nyah to the South Australian Border Salinity Management Plan* was supported by an extensive assessment of the hydrogeology of the region (Thorne et al, 1990). This understanding allowed for the identification of *salinity impact zones* in the landscape. The zones reflected the relationship of salinity impacts in the River Murray, to the volume of irrigation water applied (SKM, 2001).

The *Nyah to the South Australian Border Salinity Management Plan* guides irrigation development at a number of levels. First, it guides developers away from 'High Salinity Impact Zones' (HIZ) and towards 'Low Salinity Impact Zones' (LIZ) through trading rules and incentives. Then, it guides development to lower impact areas through imposition of a graded salinity levy. Finally, it guides developers to design their plantings and irrigation systems around land capability and efficient irrigation practices through tools such as soil surveys and Irrigation and Drainage Management Plans.

Salinity impact zones

Initially, in 1993, only two salinity impact zones (high and low) were identified, however these were later revised to reflect the rapid rise of irrigation development being undertaken and further predicted development in the region.

The revision of these salinity impact zones, effected in 2002 and still current, resulted in one 'high' impact zone and multiple 'low' impact zones being defined. Low impact zones were graded, depending on the amount of salinity impact potential an irrigation development within each zone would have on the River Murray.

For the purposes of administering levies, one HIZ and four LIZ (LIZ 1-4) exist which are a condensing of the salinity impact zones used by the Victorian Government in accounting for salinity impacts under the BSMS; these zones being HIZ 1-5 and LIZ 1-7.

Trading rules prevent water being traded into the HIZ. The only source of water available for HIZ irrigators who wish to increase their use, is to source water that is already being used elsewhere within the HIZ. Trade is however, allowed into the LIZ. These trading rules were core components of the *Nyah to the South Australian Border Salinity Management Plan*.

Continuous improvement and testing of the salinity impact zones is effected through mechanisms such as five-yearly reviews and development of groundwater models, incorporating data from monitoring groundwater bores and improved knowledge.

Salinity impact levies

Fundamental in the 'user pays' approach of the *Nyah to the South Australian Border Salinity Management Plan* and Government policy direction on accountability, is the existence of salinity levies on allowable trade into the LIZ.

Levies were imposed on a per unit of water basis for water traded into the LIZ. As no new water was to be traded into the HIZ, levies were not set for the HIZ. Levies were set on water traded into the LIZ based on a direct relationship to the modelled salinity impact for each zone. The salinity impact for each zone and levy were specified prior to trade commencing.

Salinity impact levies were set in the form of both up-front capital charges and ongoing operation and maintenance (O&M) charges, and were increased annually in line with the Consumer Price Index.

The capital charges of these levies are currently set at \$28.81/ML for trade into LIZ1, the 'lowest' LIZ (ie. the low impact zone where irrigation development is modelled to have the least amount of salinity impact on the River Murray), \$72.04/ML into LIZ2, \$144.09/ML into LIZ3 and \$288.17/ML into LIZ4. Levies are also set to cover trade between the graded LIZ lower to higher impact sub-zones. The O&M levy is a flat \$3.57/ML annual fee.

Improving irrigation

An annual levy of \$0.50/ML for irrigators covered by the *Nyah to the South Australian Border Salinity Management Plan* was also introduced, with revenue directed towards continuous improvement of irrigation management.

Results

The impact of policy on river salinity

The salinity impacts of all trades since 1993 have been assessed in line with the requirements of the *Nyah to the South Australian Border Salinity Management Plan* and relevant levies paid. The balance between trade of water into salinity impact zones with time is shown in Figure 1.

Under the *Nyah to the South Australian Border Salinity Management Plan* from 1993 to June 2007, a total of 137 GL of water has been permanently transferred into the Victorian Mallee region. This has resulted in approximately 32,000 ha of new irrigation geographic area covered by the Plan. The majority of this water traded has been from 2002 to 2007.

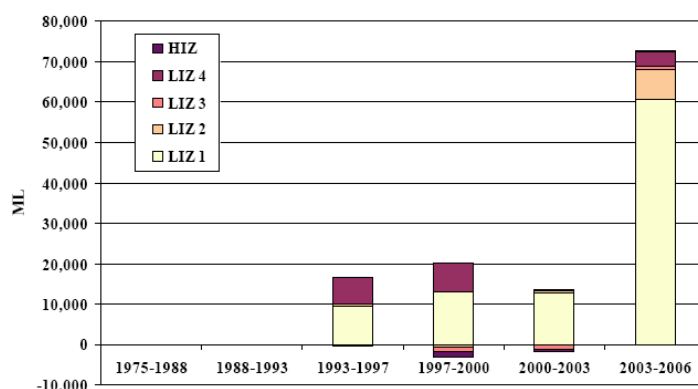


Figure 1. Permanent Water Trade by Salinity Impact Zone (1993-2006)

Source: SunRISE 21, 2007

Approximately 82% of the net water trade in the region was to LIZ1 (the lowest salinity impact zone), 6% was to LIZ2, -1% was to LIZ3, and 15% was to LIZ4. A small net trade out (-2%) from the HIZ occurred.

Whilst the pattern of water trade into salinity impact zones does not directly follow the gradation of the zones and levies, by far the largest amount of trade was into the lowest impact zone, LIZ1. It is noted that a significant amount of trade was also into LIZ4 (when it could reasonably be expected that it would be LIZ2). Factors other than the market-based instrument contributing to this may be availability, size, price, location and suitability of remaining land, and costs of pipelining. Developers may also see an advantage in developing close to existing holdings.

Analysis and Discussion

To evaluate the effectiveness of salinity impact zoning, the salinity impact from the *actual* development was compared to the potential impact had the same area of development

occurred without reference to the zones. Two scenarios were chosen; *ribbon* development and *satellite* development.

The total area of actual development for this period was repositioned to form a ‘ribbon’ along the length of the river corridor, occupying available land adjacent to the River Murray. When repositioning areas of development, economies of scale were considered, to factor in the recent trend towards larger developments (2,000 – 4,000 ha). The second scenario used the same approach as the first, except that development was assumed to be focussed around towns and amenities in a ‘satellite’ approach.

Table 1. Comparison of two scenarios against actual impacts

N2B⁸ Irrigation development 1993-2006	Actual or modelled EC impact 1993-2006	Δ EC impact	Annual salinity cost effect (A\$ million)
<i>Actual</i> development	6.2	n/a	1.61
<i>Ribbon</i> scenario	24.8	18.6	6.45
<i>Satellite</i> scenario	16.8	10.6	4.37

The actual EC impact is taken as the accountable action as approved by Murray-Darling Basin Commission and entered on the MDBC (2006) Salinity Register.

The calculated EC impact for the ribbon scenario is 24.8 EC and 16.8 EC for the satellite scenario. This is a substantially greater impact than the accountable impact of 6.2 EC for actual irrigation development. Available ECs are capped and this amount of ‘unrestricted’ development in a ribbon pattern would have breached available ECs and hence development would have needed to cease at some stage under these scenarios.

The salinity cost effect of an EC in the Victorian Mallee is approximately \$260,000/yr. This equates to \$6.45 million/yr for the ribbon scenario and \$4.37 million/yr for the satellite scenario. These are both substantially higher costs than for the actual development.

Furthermore, the accumulated losses to downstream water users due to an unrestricted development program from 1993 to 2006 are estimated to be \$27 million. Comparatively, with ‘controlled’ development, this cumulative loss has been constrained to around \$9 million.

The benefit in terms of reduced impacts came about partly as a consequence of irrigation being capped in the HIZ and partly as a consequence of developers choosing to develop in the lower impact zones and hence avoid a higher levy. By developing in the lower impact zones, developers reduced the risk of their future plans being curtailed by a capping of ECs.

Comparing a range of actions

A comparison of the economic effectiveness of a range of local catchment actions designed to minimize salinity impacts was undertaken using Bayesian Network modelling (RMCG and Cummins, 2005). The model was used to assess the effect of policies on drainage levels and therefore river salinity. The modelled factors included: salinity impact zones, irrigation systems and incentives. The study concluded that salinity impact zoning has had the greatest salinity reduction benefits.

The assessments suggest that incentives have had a relatively minor effect on rates of conversion to pressurised irrigation systems, but they have had an additional advantage of aiding irrigation design standards and irrigation scheduling. It is unlikely that there are any additional actions that could have been adopted, to offset the magnitude of salinity increase that would have occurred in a scenario without zones.

The imposition of a levy commensurate with the impact was a substantial disincentive for irrigators to develop in the *higher* impact zones. Although formal appeal mechanisms exist, there have been no formal appeals in this area. This is taken as an indication of a community

acceptance of salinity impact zones and levies.

Summary and Conclusions

The *Nyah to the South Australian Border Salinity Management Plan* provides an accountability mechanism for water trade under the Basin Salinity Management Strategy. The Plan brings together two key natural resource objectives, allowing trade in irrigation water and protection of water quality to be managed cooperatively and within a market environment.

Irrigation developers have paid the upfront and ongoing costs in order to develop in the Victorian Mallee region. By implementing environmental and management standards, irrigation resulting in significant economic value and associated 'spin-off' industries, has been facilitated with consideration of the environment.

The integrated approach taken in the Victorian Mallee has proved to be a very effective system, allowing irrigation development to proceed, minimising impacts on the River Murray, and charging a fee commensurate to the impact. It also is effective because it is a streamlined system providing irrigation developers with clarity from the outset.

The arrangements for managing salinity impacts outlined in the *Nyah to the South Australian Border Salinity Management Plan* may be relevant for management of salinity impacts elsewhere, and also may have relevance for managing other impacts such as carbon sequestration and release.

Acknowledgements

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References

- Murray-Darling Basin Ministerial Council (1988). *Murray-Darling Basin Salinity and Drainage Strategy* (1988). MDBC, Canberra.
- Thorne R, Hoxley G and Chaplin H (1990). *Nyah to the South Australian Border Hydrogeological Project*. Rural Water Commission of Victoria Investigations Branch Report no. 1988/5.
- Government of Victoria (1993). *Victorian Government Support for Salinity Management Plans – Nyah to the South Australian Border*.
- Murray-Darling Basin Ministerial Council (2001). *Basin Salinity Management Strategy 2001-2015*. MDBC, Canberra.
- SKM (2001). *Mallee Region Salt Impacts of Water Trade - A Proposed Method for Accounting for the EC Impacts of Water Trade in the Victorian Mallee*. Mallee CMA.
- Murray-Darling Basin Ministerial Council (2005). *Basin Salinity Management Strategy Operational Protocols Version 2.0*. MDBC, Canberra (MDBC Number 35/05).
- RMCG, Tim Cummins and Associates (2005). *The Role of Policy in Reducing the Impact of Irrigation on River Salinity within the Victorian Mallee*. Mallee CMA.
- SunRISE 21 (2007a). *Victorian Mallee Water Trade and Irrigation Development 1975-2006*. Mallee CMA.
- SunRISE 21 (2007b). *Victorian Mallee 2006 Crop Report*. Mallee CMA.