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Introduction

My name is John Storer. I am an engineer and economist, currently working for Judith Stubbs and Associates. I want to say I am here as a private individual and am receiving no payment or sponsorship for my attendance. I have no vested interest whatsoever in the outcomes of the Basin Plan and am motivated only by a belief in the desirability of transparent and informed policy decisions by government to ensure the best interests of the community. I do not believe that has been the case in the development and presentation of the Basin Plan.

My concerns are at two levels. The first and most serious is whether what the MDBA has presented would represent best practice in social and economic impact assessment. I do not believe this to be the case.

The second relates to a number of errors and deficiencies in documentation produced by the MDBA, including misrepresentation of data and deficiencies in economic modelling.

Firstly, what would best practice look like? I refer to two publications, the Australian Government *Best Practice Regulation Handbook* and an SKM report commissioned by the MDBA entitled *Demonstrating Use of Best Available Scientific Knowledge and Socio-Economic Analysis.*. I apologise in advance if the discussion seems somewhat esoteric.

The SKM report identifies three approaches in order:
Cost Benefit Analysis
Cost Effectiveness Analysis
Socio-Economic Impact Analysis

The SKM report (page 9) says "most of the official national and state government guidelines for socio-economic assessments focus, and predominantly favour the use of CBA…" however it is clear that what the MDBA has provided is a Socio-Economic Impact Analysis.

The Guidelines say "In principle, CBA measures the efficiency or resource allocation effects of a regulatory change." (Guideline page 61). By comparison

"A socio-economic impact assessment traces impacts of a policy or project through an economy and measures the cumulative effects". (SKM page 39)

The primary difference is found at page 75 of the guidelines under "Common cost-benefit analysis pitfalls". "The costs and benefits of a regulatory proposal properly relate to changes compared to what would have happened in the absence of the proposal…it is inappropriate to merely calculate incremental costs and benefits compared with the status quo… this problem is particularly prevalent when assessing the impact of regulations which are part of a suite of policies…the without regulation base case should include the impacts of these complementary interventions". The last sentence is critical.

I believe that in the modelling carried out by the MDBA, there are in fact four policy proposals, but these have not been considered individually or incrementally as would be required in a transparent analysis.

Those policies proposals are diversion of irrigation water to environmental flows, the relaxation of administrative restrictions to water trade, changes in immigration policy and reimbursement to irrigators for water diverted to the environment.

Essentially, what the MDBA has done I believe is this:

Taking away irrigation water will lead to job losses, however redistribution of that water through relaxation of trade will offset these job losses to some extent as for example, 1 Gl of water goes from employing around 3 people in rice growing to 30 people in horticultural uses, and, rather than feeding our growing economy with migrants, we will feed it with people who lose their jobs. Finally, reimbursing farmers for loss of water will transfer money from other parts of the Australian economy into the MDBA.

This may be a perfectly legitimate approach but it needs to be transparent. Most particularly, if unrestricted trade was allowed tomorrow, I would expect to see massive growth in employment across the MDBA in irrigation industries, as was seen between 1996 and 2001, with some communities losers and some winners. If the water was then to be taken, the loss of jobs would be enormous. This loss of jobs is the true cost of the implementation of the basin plan in terms of opportunity cost, itself the best practice approach.

Effectively trade, changes to immigration policy and reimbursement to irrigators are mitigations to the adverse social and economic impacts of increased environmental flows at the expense of irrigation uses, and, in the interests of transparency, should be presented as such.

I will now turn to errors and deficiencies in documentation produced by the MDBA, including misrepresentation of data and deficiencies in economic modelling. I will briefly address a number of papers commissioned by the MDBA as input to the Basin Plan.

ABARE-BRS (2010c) – Assessing the regional impact of the Murray-Darling Basin Plan and the Australian Government's Water for the Future Program in the Murray-Darling Basin.

I have provided more detailed notes but there are a number of key points.

The report uses a two stage model to quantify the impacts of reductions in irrigation water as a result of introduction of SDLs. In the first stage, the Water Trade Model is used to calculate the impacts of reduced irrigation water on the Gross Value of Irrigated Agricultural Production (GVIAP). In the second stage, The AusRegion model is used to calculate the impact of changes in GVIAP on Gross Regional Product (GRP) and on employment. Two scenarios are modelled. These are introduction of SDLs only and the introduction of SDLs coupled with water purchases by government. The models are long run, that is they allow for the regional economy to redistribute factors of production such as water trade and movement of employment between industries. The models use a regional and Murray Darling Basin scale. With regard to best practice, the approach is a socio-economic impact assessment rather than a cost benefit analysis. No sensitivity analysis is reported.

Essentially

'The cushioning effect of interregional trade on the value of irrigated activities is effectively achieved by water trading away from rice, irrigated cereals, other broadacre and sheep to other activities'.[1]

Impacts of reduction in the GVIAP on the regional economy are then addressed by 'allowing for movement of labour between industries and regions'.

The Water Trade model contains two key assumptions with regard to the current analysis. The first is the calculation of the baseline scenario. The second is the assumption that the supply of land suitable for particular irrigation uses is fixed, that is any particular sector cannot expand in response to trade.[2] Variation or error in either of these key assumptions is likely to dramatically effect the outputs of the model but the sensitivity of the model to variations in these key assumptions has not been modelled. A third assumption is that water used for rice for example, can be used for horticulture. This point is not discussed here, except to note that there are differences in water security across jurisdictions and irrigation uses. Permanent plantings require water every year, whereas annual crops can be planted in response to changing availability of water. Hence such an assumption is necessarily optimistic.

The model does not appear to predict the past, to me a minimum threshold for validation.

In the ABARE baseline scenario, water use is 10,403 Gl/year. In 2005-06, actual water use was 7,370 Gl/year.[3] That is, the baseline scenario adds 3,033 Gl to the 2005-06 year, an increase of around 41%. However this addition is not seen in the calculated values for GVIAP, with the baseline scenario GVIAP increasing by only $61 million ($20,000 per Gl) or 1% by comparison with actual data. Cotton production in 2006-7, for instance was $560,000 per Gl. By one view, the ABARE-BRS (2010c) baseline scenario has added around 3,000 Gl to the 2005-06 year, however that addition has not translated into an increase in production. It is not surprising then that when they deduct 3,500 Gl, the impact on production is small. If 2000-01 is their model year, then, by comparison with empirical data, their calculated GVIAP <u>underestimates</u> production by 5.2%.

The GVIAP assigned to commodity groups is also of concern. Commodity groups differ widely in profitability on a per Gl basis. This can be seen in table 12 of

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[1] ABARE-BRS (2010C), *Assessing the regional impact of the Murray-Darling Basin Plan and the Australian Government's Water for the Future Program in the Murray-Darling Basin*, page 27.
[2] Hafi, A, Thorpe, S. and Foster, A, *The impact of climate change on the irrigated agricultural industries in the Murray-Darling Basin,* Australian Agricultural and Resource Economics Society, ABARE Conference Paper, 2009, equation 5 on page 7.
[3] *Ibid*

ABARE-BRS (2010c) where effectively in the Southern basin, water is traded from rice, hay and dairy to other uses. Furthermore the differential between commodities is significant. For example Stubbs *et al* (2010)[4], considering employment, found that horticulture was around 15 times more productive than commodities such as rice on a per Gl of water used basis.

It can be seen from the table in the **attachment** that, by comparison with both 2000-01 and 2005-06, the ABARE-BRS (2010c) baseline overstates the proportion of donor commodities such as hay and rice, and understates the proportion of recipient commodities, such as horticulture and vegetables. Again, it is not surprising that the impact of the introduction of SDLs is slight, as there is more water in uses with low productivity per Gl and this water is used as the source of the SDLs.

As stated previously, a key assumption of the Water Trade Model is that the supply of land suitable for irrigated production is fixed. There is no empirical evidence to support this, with, for example, irrigated area in the Victorian Mallee reported to have increased by 30,130 hectares or 75% between 1997 and 2009 with most of this increase by private diverters and with most growth experienced in permanent plantings.[5] The conclusion is that removal of institutional constraints to trade on their own is likely to lead to large increases in GVIAP over time. By 2018-19, when SDLs are introduced, it is likely that more water will have to be taken from more productive uses such as vegetables and horticulture then would have been the case if the SDLs were introduced in 2001 and hence the model will understate the impacts.

It is likely the constraint has been introduced by ABARE-BRS (2010c) in order to make the model more tractable. To illustrate this, Quiggin *et al*[6] model (for the Garnaut report) a range of different scenarios associated with different climate scenarios over different time periods allowing the area of horticulture to increase by 50% in response to trade.[7] The sensitivity of the modelling to such assumptions is evident with reductions in irrigated water use of 28% (similar to that modelled by ABARE-BRS (2010c)) resulting in a 65% reduction in output, 13 times the impact predicted by ABARE-BRS (2010c) for similar reductions in irrigated water use, and with the impacts on productivity much greater in quantum than the impacts on water availability.

The AusRegion model compares results with what would otherwise have occurred in the economy in the absence of the scenario.[8] The reference case is 'what ABARE considers to be the likely path that the Australian economy will follow'. Some notable assumptions include 'demographic changes and investment being the key primary factors behind growth'. 'Assumptions about international migration are incorporated into the reference case'. The base case is not articulated, but it is likely to be based on ongoing growth in the economy as 'other industries absorb a

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[4] Stubbs, J, Storer, J, Lux, C & Storer, T (2010) *Report 4: exploring the relationship between community resilience and irrigated agriculture in the MDB: social and economic impacts of reduced irrigation water.*
[5] Mallee Catchment Authority, (2010), *MalleeIrrigated Horticulture 1997 to 2009,* Mildura, page 8.
[6] Quiggin. J., D. Adamson, P. Schrobback and S. Chambers. (2008). *Garnaut Climate Change Review: The Implications for Irrigation in the Murray-Darling Basin.* University of Queensland.
[7] *Ibid*, page 20.
[8] http://www.abare.gov.au/publications_html/models/models/Ausregion.pdf accessed 18 November 2010 at page 1-7.

significant proportion of the labour released from the agricultural industries'.[9] Because of the assumptions regarding international migration and the easy movement of labour, it is likely that the low level of employment loss predicted by the model arises from a replacement of externally sourced migrant labour to fuel economic expansion with internally sourced displaced labour.

However the real world may not match the ideal world of economists. As an example, the Wollongong Steelworks underwent significant restructuring in the early 1980s. "In 1981, the unemployment rate was relatively low throughout the city [of Wollongong], and close to the NSW average... By the time of the 1996 Census, areas around the steelworks had close to one-quarter of adult workers, and up to 41 per cent of young people aged 15 to 24 out of work. This was in sharp contrast to areas in the south-western escarpment foothills where only 5 percent of adults and 10 percent of young workers were not in paid employment."[10]

Some 25 years later, in 2006, unemployment in two southern Wollongong suburbs near the Steelworks of Warrawong and Cringila were 19.0% and 17.6% respectively by comparison with the NSW rate of 5.2%. We do not believe that such empirical evidence of embedded and prolonged structural unemployment is consistent with assumptions of rapid and frictionless adjustment to unemployment arising from structural change.

Other modellers used by the MDBA effectively use the same approach, and, not surprisingly, obtain similar results. They also have issues.

For example:

Mallawaarachchi,T, Adamson, D, Chambers, S & Schrobback, P (2010) Economic analysis of diversion options for the Murray–Darling Basin Plan: returns to irrigation under reduced water availability

These people produced the Garnaut report finding of a 65% reduction in output with a 28% reduction in water, but for the MDBA they found a 16% reduction in output with a 35.5% reduction in water use. As a minimum, this discrepancy needs to be explained.

Their state contingent model assumption is that chickpeas will be grown in drier years. There is no empirical evidence to support this assumption, and so the state contingent values are unlikely to represent reality. Similarly, the model forecasts an increase in irrigated area with reduced water and historical data suggests a reduction in area with reduced water. I believe no confidence can be placed in any of the predictions of the model due to its very poor alignment with empirical data.

The assumptions regarding the mitigating effect of trade are also problematic. For the southern basin, the baseline estimates the area of 'donor' crops such as rice and cereals at 44% of total area compared to 24% for actual data, an overestimate of 83%. On the other hand, the high value 'recipients' of grapes and horticulture are estimated

[9] ABARE-BRS (2010C), *op cit,* at page 33.
[10] Stubbs, J., (2003) *Battle for the Rights to the City Opportunities for an Emancipatory Social Practice in an Polarising Urban Landscape,* PhD Thesis, RMIT, Melbourne, page 49.

at 10% of total area compared to 10% for actual data, an appropriate estimate, and dairy farming is estimated at 20% compared to 42% for actual data, an underestimate of 110%. Essentially, considerably more area is given to lower value uses, providing much more opportunity for other commodities to donate water to higher value uses, and so overestimating the impact of trade.

Wittwer, G (2010) The Regional economic impacts of Sustainable Diversion Limits

The modelling predicts for example, for Condamine Balonne, a loss of 204 jobs in 2026 with a 3,500 Gl target SDL.[11] Real GDP is forecast to decline by 0.92%. The 3,500 Gl is said to be equivalent to a 33.1% reduction in water course diversions.

We have compared the forecast of the model to actual data for 2000-01 and 2005-06. Area of cotton under cultivation in Balonne Shire decreased by 51% between 2000-01 and 2005-06. Over the same period, employment in cotton decreased from 329 to 170 people, a decrease of about 48%.[12] It could be concluded the relationship is effectively linear. Taking 2000-01 as an average year, it could be concluded that the impact of a 33.1% would be a loss of 109 jobs. Assuming a multiplier of 1.9,[13] the cut would correspond to a loss of 207 jobs in Balonne Shire. Some jobs would be recovered from dryland grazing, at a rate of one job for each 12.5 lost, giving a net number of jobs of 190 lost from a 33.1% SDL. Even though Balonne Shire is one part of the Condamine Balonne region, the modelling by Wittwer suggests that it will probably account for 190 jobs or 93% of the predicted lost jobs in the region. This seems implausible, as backcalculating from tables 7 and 8,[14] total employment in Condamine Balonne in the base line is about 44,000. By contrast, in 2000-01, 2,724 people were employed in Balonne Shire, suggesting Balonne Shire represents around 6% of the economy of Condamine Balonne.

Considering the LGAs of Balonne, Dalby, Jondaryan, Wambo and Millmerran, in 2000-01, 917 people were employed in cotton and cotton ginning. A 33.1% cut would equate to a loss of 304 jobs, and with multipliers, 577 jobs. Allowing for dryland grazing as a next best use, the jobs would be around 531. This is around two and one half times the lost jobs forecast by Wittwer (2010). It is clear from such calculations that the model does not align with empirical data and appears to grossly underestimate losses in employment. As another check, 206 Gl of water is required from Condamine Balonne. In terms of opportunity cost, if all this water was to be iused for cotton, there would be an increase in employment of around 470 jobs using a 0.9 multiplier.[15] This figure is over twice the forecast job losses across the entire region.

Stubbs, J, Storer, J, Lux, C & Storer, T (2010) Report 4: exploring the relationship between community resilience and irrigated agriculture in the MDB: social and economic impacts of reduced irrigation water.

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[11] Wittwer, G (2010) *The Regional economic impacts of Sustainable Diversion Limits*, table 8.
[12] ABS census employment by usual residence, cotton and cotton ginning.
[13] Stubbs *et al, op cit*
[14] Wittwer, *op cit.*
[15] Stubbs *et al, op cit,* table 3.7.

The approach taken is quite different to that used by other modellers (ABARE-BRS (2010a and b), Mallawaarachchi *et al* (2010), Wittwer (2010)), with the model based on an empirical approach using a statistical derivation of the relationship between water usage in irrigated agricultural sectors and employment in those sectors. The economy is modelled in terms of employment. By contrast, the other approaches model the behaviour of farmers to changing availability of water given knowledge of costs and returns related to various cropping options and the availability of trade and use that approach to calculate impacts on agricultural production in dollar terms. In effect they attempt to model the response of the economy from the bottom up.

The advantages of the statistical approach is that it contains many fewer assumptions and inputs by comparison with other models and hence could be expected to be more robust. Importantly the relationship is statistically defensible as it is descriptive of the irrigation industries in the MDB in 2006. In addition, the approach can be applied at different scales, so that local and regional impacts can be understood.

We predict an annual loss of $2.7 billion associated with a 50% reduction in water availability using 2005-06 as a base year. The reduction in irrigation water between 2005-06 and 2008-09 was about 53%, with a reduction in GVIAP of $1.6 billion. Assuming GVIAP equates to added value (almost certainly an overestimate) and allowing a multiplier of 0.9 for flowons to other industries, the impact of reduced water availability was a reduction of about $3.0 billion, suggesting that our estimate is a reasonable representation of, at least, the short term impacts of reductions in water availability.

Morrison, M and Hatton MacDonald, D (2010) Economic valuation of environmental benefits in the Murray-Darling Basin

The authors estimate the value to the community of improvements in the environmental indicators of native vegetation, fish populations, water bird breeding and number of species at $3.3 billion and the value of improving the Coorong from poor to good quality at $4.3 billion. Data is presented as present value.

The approach taken in the valuation of benefits is philosophically quite different to the approach taken to the valuation of costs in other studies prepared for the MDBA. The effect is to maximise the benefits associated with the introduction of SDLs. We have contrasted the approach of the authors with the approach taken by ABARE-BRS (2010c).

If the authors had taken an approach similar to that taken by ABARE-BRS (2010c) we believe that the value placed on environmental benefits would be zero. This would be because there are other habitats available for native vegetation, fish, water bird and other species and similar areas exist elsewhere to the Coorong. This means that if people wanted to experience these benefits, they could just go somewhere else to experience them.

Alternatively, if ABARE-BRS (2010c) took a similar approach to the authors of this paper, they would estimate the opportunity cost associated with the water hypothesised to go to the environment. If we assume 3,500 Gl as a target SDL, in 2007-08 vegetable production in the MDB had a GVIAP of $5.8 million per Gl of water. Hence 3,500 Gl would equate to a total GVIAP of $20.3 billion per annum. If this was represented as net present value, and using a discount rate of 8%,[16] the figure would be $254 billion or 59 times the environmental value of the flows. While there would be some input costs to be deducted, there are also flow-ons to other industries, so this figure might be reasonably accurate in representing the opportunity cost to the community of the proposed environmental flows.

More importantly, good practice would require the consideration of a number of ways of achieving purported environmental benefits, and select that method that maximises the difference between cost and value. That is, dilution or additional flow might not be the best way of achieving the environmental outcomes.

ABS (2010) Experimental Estimates of the Gross Value of Irrigated Agricultural Production 2000-01 to 2007-08

While the data gives an understanding of the impacts of drought and reductions in the availability of irrigation water, there are two important caveats when interpreting the data. The **data has <u>not</u> been adjusted for inflation**, and this adjustment is required to properly understand trends over time. Adjusting for inflation, GVIAP **<u>fell</u>** by 5.8% between 2000-01 and 2005-06, however the unadjusted figures show an 8.6% increase. Dr Stubbs has previously provided updated data to you and I will provide that again.

Changes in GVIAP reflect changes in both commodity prices and in output. Some preliminary calculations suggest that the decrease in GVIAP between 2005-06 and 2007-08 is about half what would be expected from reductions in water. An alternative explanation is that that massive efficiency gains have been made. For example, in 2007/08, 60% less water grew the same amount of grapes. Such figures seem implausible, except perhaps in the case of dairy production and livestock production, where feed may have been imported.

I am particularly concerned that this data set has been consistently misrepresented to minimise the likely impacts of the introduction of SDLs on regional and local economies, both by the MDBA and by external commentators, including those in the environmental movement, through a failure to properly consider the impacts of inflation and of commodity price changes.

This misleading representation, that is without adjusting for inflation, is found at page 29 dot point 1 of the basin plan and has been quoted to you as recently as 2 March 2011 by Professor Quentin Grafton from the Wentworth Group of Scientists in support of the limited social impact of water reductions.

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[16] Refer for example NSW treasury guidelines for cost benefit analysis

Appendix A: Review of selected documents

A number of reports and studies have been critically reviewed in preparation of this submission. A summary and targeted critique has been undertaken and is provided here as supporting documentation for this submission. Documents critiqued include:

ABARE–BRS (Australian Bureau of Agricultural and Resource Economics – Bureau of Rural Sciences) (2010a) *Environmentally sustainable diversion limits in the Murray–Darling Basin: socioeconomic analysis*, report for the Murray–Darling Basin Authority, Canberra.

ABARE–BRS (2010c) *Assessing the regional impact of the Murray–Darling Basin Plan and the Australian Government's Water for the Future program in the Murray–Darling Basin*, report for the Department of Sustainability, Environment, Water, Population and Communities, Canberra.

Mallawaarachchi,T, Adamson, D, Chambers, S & Schrobback, P (2010) *Economic analysis of diversion options for the Murray–Darling Basin Plan: returns to irrigation under reduced water availability*, unpublished paper for the Murray–Darling Basin Authority, Risk and Sustainable Management Group, University of Queensland.

Productivity Commission (2010) *Market mechanisms for recovering water in the Murray–Darling Basin*, Productivity Commission research report, Canberra.

Stubbs, J, Storer, J, Lux, C & Storer, T (2010) *Report 4: exploring the relationship between community resilience & irrigated agriculture in the MDB: social and economic impacts of reduced irrigation water*, report for Cotton Catchment Communities CRC, Narrabri.

ABS (2010) *Experimental Estimates of the Gross Value of Irrigated Agricultural Production 2000–01 to 2007-08*, Canberra.

Morrison, M & Hatton MacDonald, D (2010) *Economic valuation of environmental benefits in the Murray–Darling Basin*, report for the Murray–Darling Basin Authority, Canberra.

Wittwer, G (2010) *The regional economic impacts of sustainable diversion limits*, unpublished report, Centre of Policy Studies, Monash University, Melbourne.

ABARE-BRS (2010a) Environmentally sustainable diversion limits in the Murray–Darling Basin: socioeconomic analysis

This report provides an economic analysis of the effects of the proposed sustainable diversion limits (SDLs) as proposed by the MDBA as per the Guide to the Proposed Basin Plan. The impacts of these proposals are identified for the wider Australian community and economy; as well as people, communities, regional economies and industry sectors within and outside the Basin that depend on Basin water resources.

With regard to the economic modelling approach taken

Aspects of the economic modelling approach are discussed elsewhere in this submission. Some key points raised in ABARE-BRS (2010a) with critiques where applicable are set out below.

The report states that "ideally, the Basin plan would be subject to a cost–benefit analysis, with the net benefits being expressed in dollar values. However, in practice valuing non-market environmental benefits remains a difficult task. This report focuses on estimating the costs of restricting access to irrigation water, and makes no attempt to value the benefits from providing additional water for environmental assets".[1]

We note the clear reference to a cost-benefit analysis (CBA). A review of documentation suggests that what has been carried out is in fact a Socio-Economic Impact Assessment (SEIA).[2] Such an approach is quite different in general principle to a CBA and does not represent best practice.[3] Importantly, "the costs included in a CBA represent the opportunity cost, which is the cost of what has to be given up to gain the good or service".[4] Essentially the opportunity cost of something is the best alternate use. An SEIA does not assess opportunity cost, and opportunity cost is not assessed by ABARE-BRS (2010a), with this being a notable shortcoming of the analysis. The analysis needs to be carried out in accordance with best practice and properly assessing all costs, including opportunity cost, associated with the proposed SDLs.

We believe the best way to conceptualise the opportunity cost of an SDL of 3,500 GL is to consider that water as being in the hands of government. It can allocate the water to irrigation, and if the water was, for example, auctioned off, it would presumably go to the most efficient use in each region or interlinked region, and those efficient uses

[1] ABARE-BRS (2010a) *Environmentally sustainable diversion limits in the Murray-Darling Basin; socioeconomic analysis,* page 2.
[2] SKM (2010) *Demonstrating Use of Best Available Scientific Knowledge and Socio-Economic Analysis- Part 2: Best available Socio-Economic Assessment,* report to the Murray-Darling Basin Authority, page 12.
[3] *Ibid,* page 9.
[4] *Ibid,* page 23.

would not necessarily be the current uses of the water, as these are constrained by a variety of restrictions to trade. Those efficient uses could be used to calculate the opportunity cost of the water, as represented as additional employment or production. ABARE-BRS (2010a) does not calculate, or attempt to calculate, this opportunity cost.

The alternative for government is to give the water to environmental flows. While this second option (the value of environmental flows) may be difficult to quantify, techniques exist such as revealed or stated preference. In the extreme, Australians have an avenue, parliament, for expressing community values. If our elected representatives are prepared to pay the properly calculated and expressed price, calculated as the opportunity cost in lost productivity or employment from an efficient allocation of the water, giving due consideration to mitigations such as economic growth and deregulation of trade, then they will have valued the environmental outcomes as greater in value than the economic costs. Effectively, their actions will reveal their preference.

Finally, we are also of the view that in the area of public policy, and in accordance with best practice, the cost to the whole of community must be considered. Hence the cost of all externalities needs to be included in the cost. In the case of introducing SDLs, externalities could include losses associated with ancillary businesses and in households through loss of jobs or depreciation of assets such as houses. For these reasons, the cost of SDLs is much more than the market price of the water. Again, such costs have not been considered.

Some other important points include:

- "The effects of the SDLs may vary over different time scales. In this report, modelling results (from both the WTM and AusRegion) represent long-run estimates unless stated otherwise. The short run is often taken to refer to the period of time over which certain key factors of production remain fixed. By definition, the effect of a given shock is expected to be higher in the short run than in the long run, given the reduced flexibility of individuals, firms and regions".[5]

Presentation of long run results lacks transparency and is misleading. By definition, any and all systems will adapt in the long run, including environmental systems. Unfortunately, they may incur considerable pain (for example species extinction) along the way. We believe that the long run adjustment is best conceptualised as a mitigation against the loss of productivity associated with the introduction of SDLs.

- "At an aggregate level, it is estimated that the 3500 GL Basin plan scenario (comprising a 29.1 per cent reduction in total water use) will reduce average annual GVIAP in the Basin by around 15 per cent (approximately $940 million) relative to the baseline scenario, with interregional water trade. Average annual irrigation profits are estimated to fall by 7.8 percent under this scenario".[6]

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[5] ABARE-BRS (2010a) *op cit,* page 3.
[6] *Ibid,* page 3.

This is the estimated direct cost of the introduction of SDLs. However, there are some important riders. The calculation does not reflect the total cost as it gives no regard to multipliers arising from agricultural production, it does not include the cost of externalities such as depreciation of assets and it is not transparent, as it conflates SDLs with interregional water trade when in reality they are two separate policy initiatives and could be introduced independently of each other. For these reasons, the estimate grossly underestimates the real cost to the community.

- Opportunities for mitigation through alternative uses of agricultural land are limited, as "the gross value of non-irrigated agriculture per unit of land is substantially lower than that of irrigated agriculture, particularly within the MDB, given the relatively modest rainfall in many of the Basin regions".[7]

The importance of this is that, for communities such as Balonne Shire, where the only opportunities for industry diversification are other forms of agriculture, moving from irrigated agriculture to dryland agriculture will result in a significant decrease in the size of the local economy, with a commensurate diminished ability to provide employment or maintain current levels of employment.

- "For the MDB as a whole, the 3500 GL Basin plan scenario was estimated to lead to a 1.3 percent reduction in gross regional product (GRP). At a national level, the SDL scenario is estimated to lead to a 0.1 percent reduction in gross domestic product (GDP), compared with the baseline scenario. These small percentage changes are to be expected given the baseline size of the MDB ($59 billion) and Australian ($760 billion) economies relative to the change in GVAP (around $870 million)".[8]

This figure is almost certainly an underestimate, as it is not calculated using an opportunity cost approach, but rather based on the conflation of two policies, SDLs and deregulation of trade. The first, SDLs, is the policy initiative, while the second, deregulation of trade, is better understood as a mitigation strategy to offset the impacts of the introduction of SDLs. Transparency would require the two to be considered and reported separately.

- "Relatively smaller percentage reductions in employment are estimated by AusRegion, with a 0.10 per cent reduction in employment across the MDB as a result of the Basin plan, relative to the baseline. This small change in employment largely reflects the long-run nature of the AusRegion model, in which labour markets are able to adjust and displaced agricultural labour is able to gain employment in other regions and/or industries".[9]

There are two concerns with this approach. The first is that the approach is unlikely to consider opportunity cost, as deregulation of trade is coupled with introduction of SDLs. A correct approach would be to identify the impact on employment if trade was deregulated, with and without the introduction of SDLs. This would show the

[7] *Ibid,* page 4.
[8] *Ibid,* page 4.
[9] *Ibid,* page 4.

true opportunity cost. The focus on the "long-run" means that the model is not transparent, as the long run adjustment will be achieved at the cost of significant dislocation at a local level. Properly stated, the AusRegion model is predicting that because of economic growth generally, there will probably be opportunities for displaced labour to be employed elsewhere in the economy. However, the community as a whole is worse off than it would be otherwise with the allocation of a resource, irrigation water, to a non-productive use.

- "Any decline in irrigated output as a result of the Basin Plan may have implications for the amount of downstream processing undertaken in some regions. The WTM results suggest that annual activities such as irrigated rice, cotton and dairy will experience more significant declines in GVIAP than perennial activities. Significant downstream processing of rice occurs in southern NSW, cotton processing occurs in a number of northern Basin regions, while dairy processing is concentrated mostly in northern Victoria. Predicting the likely effects on processing facilities is difficult given the uncertainties involved".[10]

We are concerned that this modelling does not include the effects on downstream processing. Data on employment in downstream industries is readily available from the ABS, and statistical techniques exist for determining the interrelationship between employment in agricultural sectors and in processing and in general service sectors.[11] The failure to include such effects will understate the impacts of the introduction of SDLs, noting particularly that sectors such as vegetables, grape growing and fruit growing are likely to have significant employment in downstream processing. For cotton in 2005-06, there were 1,852 people employed in the category of cotton growing and 399 employed in cotton ginning across the MDB and the cotton growing areas in Queensland outside of the MDB. For grapes, 5,608 people were employed in grape production across the MDB, and 5,114 were employed in wine and other alcoholic beverage manufacturing.[12] Failure to consider downstream processing, even though data is readily available, underestimates the impacts on cotton growing areas by at least 21.5%, and in grape growing areas by at least 91%. From another perspective, the modelling would seem to assume that wineries, packing sheds, cotton gins and rice mills will continue to operate without product to process.

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[10] *Ibid,* page 5.
[11] See for example Stubbs *et al, op cit,* where ABS employment data sets are analysed to determine processing employment associated with agricultural industries, and linear regression analysis is used to understand the relationship between agricultural employment and employment in other sectors at a local level.
[12] ABS, 2006, employment by place of usual residence.

ABARE-BRS (2010c) – Assessing the regional impact of the Murray-Darling Basin Plan and the Australian Government's Water for the Future Program in the Murray-Darling Basin.

The report uses a two stage model to quantify the impacts of reductions in irrigation water as a result of introduction of SDLs. In the first stage, the Water Trade Model is used to calculate the impacts of reduced irrigation water on the Gross Value of Irrigated Agricultural Production (GVIAP). In the second stage, The AusRegion model is used to calculate the impact of changes in GVIAP on Gross Regional Product (GRP) and on employment. Two scenarios are modelled. These are introduction of SDLs only and the introduction of SDLs coupled with water purchases by government. The models are long run, that is they allow for the regional economy to redistribute factors of production such as water trade and movement of employment between industries. The models use a regional and Murray Darling Basin scale.

There are a number of caveats in the report around scaling with regard to time and geography. These include:

- *...in the longer term labour can move from agriculture to other sectors*[13]

- *...small towns that are more dependent on irrigation could be significantly affected. For example, some small towns highly reliant on irrigated agriculture could be quite susceptible, especially if they are surrounded by irrigated annual cropping activities such as rice and cotton.*[14]

- *The AusRegion employment estimates represent long run predictions, in which displaced individuals and firms have time to adjust to the change in agricultural output. In the short run, it may be that employment effects are more pronounced.*[15]

- *While the introduction of new SDLs in the MDB have the potential to significantly affect some towns in the Basin...*[16]

- *...AusRegion allows for movement of labour between industries and regions. ...While production and employment in the agricultural industries declines, other industries absorb a significant proportion of the labour released...*[17]

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[13] ABARE-BRS (2010c) *Assessing the regional impact of the Murray-Darling Basin Plan and the Australian Government's Water for the Future program in the Murray-Darling Basin*, report for the Department of Sustainability, Environment, Water, Population and Communities, Canberra. Pg, 3.
[14] ABARE-BRS (2010c) *op cit,* page 4.
[15] ABARE-BRS (2010c) *op cit,* page 4.
[16] ABARE-BRS (2010c) *op cit,* page 31.
[17] ABARE-BRS (2010c) *op cit,* page 33.

- *The broader regional effects estimated by AusRegion depend on a range of assumptions, including those over the extent to which displaced agricultural labour in a given region will find employment in other industries within the region or migrate to other regions inside or outside the MDB.*[18]

- *...The impacts... are likely to be more substantial in smaller regional towns than in larger regional centres.*[19]

- *Some towns that are highly reliant on irrigated agriculture could be quite susceptible to changes in water availability, especially if they are surrounded by irrigated activities such as rice and cotton.*[20]

<u>Assessment of the modelling approach</u>

What is the best science?

ABARE-BRS (2010c) presents the results from an economic analysis of the effect on agriculture and regional economies from the implementation of Government policies related to SDLs and Water for the Future.[21] The MDBA has commissioned a separate report titled *Demonstrating Use of Best Available Scientific Knowledge and Socio-Economic Analysis.*[22] This report appears to set out guidelines to provide confidence to the MDBA that Socio-Economic Assessments are 'developed with and to an appropriate quality'.[23] By reference to that report, the modelling approach appears to be a Socio-Economic Impact Assessment (SEIA) even though "most of the official national and state government guidelines for socio-economic assessments focus, and predominantly favour the use of Cost Benefit Analysis".[24] With respect to analysis, the base case is very important, being listed at the top of Table 6 and Table 13 with the tables setting out the Level 1 framework: High level checklist for two assessment methods. Importantly Table 6 states 'The base case option does not always mean a continuation of current policies and expenditure'. Under section 3.5.1.2 the report states, 'although the baseline mainly refers to the current profile, it is also important to forecast changes to that profile under the do nothing scenario (i.e. without the policy or project going ahead)'. This is an important point, and suggests that policy initiatives should be evaluated one at a time, rather than being bundled together or conflated.

Sensitivity analysis is also important. Table 6 states '... it is essential that all CBAs include a sensitivity and risk assessment'. At page 24 the report states 'All variables used in a CBA, whether for estimating the base case, or quantifying and monetising the impacts are subject to risk and uncertainty. ...The impact of these risks and

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[18] ABARE-BRS (2010c) *op cit,* page 34.
[19] ABARE-BRS (2010c) *op cit,* page 35.
[20] ABARE-BRS (2010c) *op cit,* page 36.
[21] ABARE-BRS (2010c) *op cit,* page 1.
[22] Sinclair Knight Mertz (SKM) (2010) *Demonstrating Use of Best Available Scientific Knowledge and Socio-Economic Analysis - Part 2: Best Available Socio-Economic Assessment,* report to the Murray-Darling Basin Authority.
[23] *Ibid,* page 1.
[24] *Ibid,* page 9.

uncertainties should be captured in the analysis and their impact on the final decision assessed.'

We believe that ABARE-BRS (2010C) does not meet these threshold tests relating to base case for the reasons discussed below.

What does the model do?

The Water Trade model allows water to trade between various uses so that it is allocated to the most profitable use. This mitigates the impacts of reductions to irrigation water through SDLs. The effect on GVIAP is then calculated.

'The cushioning effect of interregional trade on the value of irrigated activities is effectively achieved by water trading away from rice, irrigated cereals, other broadacre and sheep to other activities'.[25]

The AusRegion model then models the impacts of reduction in the GVIAP on the regional economy. It does this by 'allowing for movement of labour between industries and regions'.

What are some of the key assumptions and are they supportable?

The Water Trade model contains two key assumptions with regard to the current analysis. The first is the calculation of the baseline scenario. The second is the assumption that the supply of land suitable for particular irrigation uses is fixed, that is any particular sector cannot expand in response to trade.[26] Variation or error in either of these key assumptions is likely to dramatically effect the outputs of the model but the sensitivity of the model to variations in these key assumptions has not been modelled. A third assumption is that water used for rice for example, can be used for horticulture. This point is not discussed here, except to note that there are differences in water security across jurisdictions and irrigation uses. Permanent plantings require water every year, whereas annual crops can be planted in response to changing availability of water. Hence such an assumption is necessarily optimistic.

The baseline for the Water Trade Model is set out at table 6. A baseline year of 2000-01 was selected, although data was not available for that year. For these reasons a baseline was constructed 'from a variety of sources'. ABS has published data on GVIAP for the Murray Darling Basin for 2000-01, 2005-06, 2006-07 and 2007-08.[27] As discussed elsewhere, that data has not been adjusted for inflation. The table below shows that data (CPI adjusted to 2010) for 2000-01 (the model year), 2005-06 and for the ABARE-BRS (2010C) base case.

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[25] ABARE-BRS (2010C), *Assessing the regional impact of the Murray-Darling Basin Plan and the Australian Government's Water for the Future Program in the Murray-Darling Basin*, page 27.
[26] Hafi, A, Thorpe, S. and Foster, A, *The impact of climate change on the irrigated agricultural industries in the Murray-Darling Basin,* Australian Agricultural and Resource Economics Society, ABARE Conference Paper, 2009, equation 5 on page 7.
[27] ABS, *Murray-Darling Basin – Gross Value of Irrigated Agricultural Production, 2000-01 to 2007-08,* (2010).

While GVIAP can vary with commodity price as well as with area under cultivation, using this data has the advantage of being inductive (based on observation) rather than deductive and provides an empirical basis to evaluate the validity of the ABARE-BRS (2010C) baseline scenario.

Table 1: Gross Value of Irrigated Agricultural Production (GVIAP), Murray-Darling Basin

	2000-01	2000-01 CPI (1) adjusted ($AUD2010)	2005-06	2005-06 CPI (1) adjusted ($AUD2010)	ABARE-BRS (2010C) base case
Commodity groups	**($m)**	**($m)**	**($m)**	**($m)**	**($m)**
Cereals for grain and seed	148.7	191.3	180.3	201.0	185.0
Total hay production	79.9	102.8	160.5	179.1	171.0
Cereals for hay	6.1	7.8			
Pastures for hay	73.9	95.0			
Pastures for seed	3.5	4.5			
Cotton	1,110.6	1,428.6	797.9	890.0	1,293.0
Rice	349.2	449.2	273.6	305.1	476.0
Sugar cane		0.0			
Other broadacre crops		0.0			41.0
Fruit and nuts	701.2	901.9	1,011.0	1,127.7	1,006.0
Grapes	785.2	1,010.0	720.8	804.0	715.0
Vegetables for human consumption and seed	467.7	601.5	554.6	618.6	657.0
Nurseries, cut flowers and cultivated turf	90.3	116.1	149.8	167.1	
Dairy production	803.6	1,033.7	901.4	1,005.4	909.0
Production from meat cattle	382.8	492.4	592.5	660.9	612.0
Production from sheep and other livestock	125.3	161.1	143.3	159.8	155.0
Total GVIAP	**5,085.4**	**6,541.1**	**5,522.0**	**6,159.0**	**6,220.0**

Table notes:
(1) for June 2001, the CPI (Australia) was 133.8. For June 2006 the value was 154.3 and for June 2010, the value was 172.1

In the baseline scenario, water use is 10,403 Gl/year. In 2005-06, water use was 7,370 Gl/year.[28] That is, the baseline scenario adds 3,033 Gl to the 2005-06 year, an increase of around 41%. However this addition is not seen in the values for GVIAP, with the baseline scenario GVIAP increasing by only $61 million or 1%. By one view, the ABARE-BRS (2010c) baseline scenario has added around 3,000 Gl to the 2005-06 year, however that addition has not translated into an increase in production. It is not surprising then that when they deduct 3,500 Gl, the impact on production is small. If 2000-01 is their model year, then, by comparison with empirical data, their calculated GVIAP <u>underestimates</u> production by 5.2%.

The GVIAP assigned to commodity groups is also of concern. Commodity groups differ widely in profitability on a per Gl basis. This can be seen in table 12 of ABARE-BRS (2010c) where effectively in the Southern basin, water is traded from rice, hay and dairy to other uses. Furthermore the differential between commodities is significant. For example Stubbs *et al* (2010)[29], considering employment, found that horticulture was around 15 times more productive than commodities such as rice on a per Gl of water used basis.

[28] *Ibid*
[29] Stubbs, J, Storer, J, Lux, C & Storer, T (2010) *Report 4: exploring the relationship between community resilience and irrigated agriculture in the MDB: social and economic impacts of reduced irrigation water.*

Table 2: Gross Value of Irrigated Agricultural Production (GVIAP), Murray-Darling Basin – proportional breakdown by commodity group

Commodity groups	2000-01 ($m)	2005-06 ($m)	Base line ($m)
Cereals for grain and seed	2.9%	3.3%	3.0%
Total hay production	1.6%	2.9%	2.7%
Cereals for hay	0.1%		
Pastures for hay	1.5%		
Pastures for seed	0.1%		
Cotton	21.8%	14.5%	20.8%
Rice	6.9%	5.0%	7.7%
Sugar cane	0.0%		
Other broadacre crops	0.0%		0.7%
Fruit and nuts	13.8%	18.3%	16.2%
Grapes	15.4%	13.1%	11.5%
Vegetables for human consumption and seed	9.2%	10.0%	10.6%
Nurseries, cut flowers and cultivated turf	1.8%	2.7%	
Dairy production	15.8%	16.3%	14.6%
Production from meat cattle	7.5%	10.7%	9.8%
Production from sheep and other livestock	2.5%	2.6%	2.5%
Total GVIAP	**100.0%**	**100.0%**	**100.0%**
Combined horticulture and vegetables	40.2%	44.1%	38.2%
Combined hay and rice	8.4%	7.9%	10.4%

It can be seen from the table above that, by comparison with both 2000-01 and 2005-06, the ABARE-BRS (2010c) baseline overstates the proportion of donor commodities such as hay and rice, and understates the proportion of recipient commodities, such as horticulture and vegetables. Again, it is not surprising that the impact of the introduction of SDLs is slight, as there is more water in uses with low productivity per Gl and this water is used as the source of the SDLs.

The Water Trade Model

As stated above, a key assumption of the Water Trade Model is that the supply of land suitable for irrigated production is fixed. This has important implications for the ongoing deregulation of trade. The Water Trade Model states that 'While there are institutional constraints currently affecting interregional trade, these are expected to be removed when the Basin plan comes into effect'.[30] In policy terms, removal of institutional constraints and the introduction of SDLs are two different things. It seems likely that with the gradual removal of institutional constraints, water will be diverted from less productive to more productive uses via the market system provided there is suitable land available for expansion. There is empirical evidence to support this, with irrigated area in the Victorian Mallee reported to have increased by 30,130 hectares or 75% between 1997 and 2009 with most of this increase by private diverters and with most growth experienced in permanent plantings.[31] The conclusion is that removal of institutional constraints to trade on their own is likely to lead to large increases in GVIAP over time. By 2018-19, when SDLs are introduced, it is likely that more water will have to be taken from more productive uses such as vegetables and horticulture then would have been the case if the SDLs were introduced in 2001 and hence the model will understate the impacts. ABARE-BRS (2010C) models three alternative futures. In the baseline scenario there is no trade

[30] ABARE-BRS (2010C), *op cit,* page 15.
[31] Mallee Catchment Authority, (2010), *MalleeIrrigated Horticulture 1997 to 2009,* Mildura, page 8.

and no SDLs, and in the other scenarios there is trade and SDLs. In no scenario is there growth in area under irrigation, coupled with trade and with no SDLs modelled.

It is likely the constraint has been introduced by ABARE-BRS (2010c) in order to make the model more tractable. To illustrate this, Quiggin *et al*[32] model a range of different scenarios associated with different climate scenarios over different time periods. In particular, and by comparison with ABARE-BRS (2010c), they allow the area of horticulture to increase by 50% in response to trade.[33] The sensitivity of the modelling to such assumptions is evident in the output of Quiggin *et al*, with their table 9 showing (for 2040), reductions in irrigated water use of 28% (similar to that modelled by ABARE-BRS (2010c)) resulting in a 65% reduction in output, 13 times the impact predicted by ABARE-BRS (2010c) for similar reductions in irrigated water use, and with the impacts on productivity much greater in quantum than the impacts on water availability.

It is particularly concerning that assumptions appear to have been selected that will put the impact of the introduction of SDLs in the best light. It is also likely that the outputs of the model will be highly sensitive to varying assumptions around the baseline scenario and growth in irrigated area. In addition, the conflating of trade with SDLs is not transparent. Finally, alternative futures are not compared, rather the model appears to compare the present with a future in which trade and SDLs exist.

For these reasons, sensitivity analysis is required, with model output provided across a range of scenarios including those used by ABARE-BRS (2010c). These should include modelling land use scenarios which align with 2000-01 and 2005-06 GVIAP data, and should include models which allow for 25%, 50%, 75% and 100% increase in irrigated land area. (If a growth value was selected based on evidence, the 75% value would be defensible based on Victorian Mallee data). Different futures should be modelled explicitly and the data presented in a transparent way, comparing, for example, a future with trade and no SDLs and a future with trade and SDLs. Because of the likely complexity and dynamic nature of the model, it could be theoretically expected that the model is quite sensitive to some critical assumptions. A scientific paradigm would require testing of the hypothesis that the model reflects the operation of irrigation dependent regional economies. This is quite straightforward to test. For example, and as discussed above, the model can be run to see if it predicts the rural economy measured in 2000-01. (A review of data above suggests that the model fails this most basic test). Alternatively, 2000-01 data could be used to calibrate the model, and then the year 2005-06 could be modelled, and that output compared to empirical data.

The AusRegion model

The AusRegion model compares results with what would otherwise have occurred in the economy in the absence of the scenario.[34] The reference case is 'what ABARE considers to be the likely path that the Australian economy will follow'. Some

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[32] Quiggin. J., D. Adamson, P. Schrobback and S. Chambers. (2008). *Garnaut Climate Change Review: The Implications for Irrigation in the Murray-Darling Basin.* University of Queensland.
[33] *Ibid*, page 20.
[34] http://www.abare.gov.au/publications_html/models/models/Ausregion.pdf accessed 18 November 2010 at page 1-7.

notable assumptions include 'demographic changes and investment being the key primary factors behind growth'. 'Assumptions about international migration are incorporated into the reference case'. The base case is not articulated, but it is likely to be based on ongoing growth in the economy as 'other industries absorb a significant proportion of the labour released from the agricultural industries'.[35] Because of the assumptions regarding international migration and the easy movement of labour, it is likely that the low level of employment loss predicted by the model arises from a replacement of externally sourced migrant labour to fuel economic expansion with internally sourced displaced labour.

There is evidence to suggest that the movement of labour is not frictionless. Economic orthodoxy on this matter is quite straightforward.

- "Taken literally, the classical model implies that there is no unemployment. In equilibrium, everyone who wants to work is working. But there is always some unemployment... Because it takes some time for an individual to find the right new job, there will always be some **frictional unemployment** as people search for jobs... It is also possible that there is *mismatch* between the skills available in the work force and the skills required by firms attempting to create employment... This is called **structural unemployment.**"[36]

However the real world may not match the ideal world of economists. As an example, the Wollongong Steelworks underwent significant restructuring in the early 1980s. "In 1981, the unemployment rate was relatively low throughout the city [of Wollongong], and close to the NSW average... By the time of the 1996 Census, areas around the steelworks had close to one-quarter of adult workers, and up to 41 per cent of young people aged 15 to 24 out of work. This was in sharp contrast to areas in the south-western escarpment foothills where only 5 percent of adults and 10 percent of young workers were not in paid employment."[37]

Some 25 years later, in 2006, unemployment in two southern Wollongong suburbs near the Steelworks of Warrawong and Cringila were 19.0% and 17.6% respectively by comparison with the NSW rate of 5.2%. We do not believe that such empirical evidence of embedded and prolonged structural unemployment is consistent with assumptions of rapid and frictionless adjustment to unemployment arising from structural change.

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[35] ABARE-BRS (2010C), *op cit,* at page 33.
[36] Dornbusch, R., Bodman, P., Crosby, M., Fischer, S. and Startz, R. (2003), *Macroeconomics*, McGraw Hill, Roseville.
[37] Stubbs, J., (2003) *Battle for the Rights to the City Opportunities for an Emancipatory Social Practice in an Polarising Urban Landscape,* PhD Thesis, RMIT, Melbourne, page 49.

Mallawaarachchi,T, Adamson, D, Chambers, S & Schrobback, P (2010) Economic analysis of diversion options for the Murray–Darling Basin Plan: returns to irrigation under reduced water availability

The report uses a water trade model to quantify the impacts of reductions in irrigation water as a result of introduction of SDLs. The model uses historical data to develop three states of nature, normal, dry and wet with associated probabilities and contains a range of assumptions regarding yield, prices and costs. A baseline scenario is calculated using the model data, with outcomes represented for area irrigated, water used, surplus (profit) and the Gross value of irrigated agriculture with no trade allowed between catchments. Two outputs are provided, an expected value (probability by state value) and a state contingent model reflecting a more flexible agricultural model where producers can change from one crop to another more easily.

The model is then rerun using the proposed SDLs and two sets of outputs are provided. One is based on trade in water within valleys only, that is water can be moved within valleys to different uses, and the other is based on trade within valleys in the southern connected Murrumbidgee and Murray Rivers.

There are a number of caveats in the report. These include:

- *The analysis does not take into account variations in the security attached to water entitlements such as low and high reliability.* (page 3)

- *... Consequently, farmers' actual yields, prices received and the costs associated with irrigated production will vary significantly from the gross margin budgets used here* (page 14)

- *...estimates for GVIAP are presented in current (2007-08) prices; therefore changes between the years shown in these tables partly reflect the effects of price changes (ABS 2009c)* (page 18)

Assessment of the modelling approach

What is the best science?

As discussed previously (under ABARE-BRS (2010c) above), critical areas include the base case and sensitivity of the model to variation in parameters. Furthermore, the testing of a hypothesis with regard to empirical data is fundamental to the scientific method.[38] Importantly, unsupported hypotheses should be modified or rejected. As discussed below, it is likely that the model is highly sensitive to assumptions embedded in the model. By comparison with empirical data, the predictions of the model are not supported, suggesting that the hypothesis that the model represents the 'real' world should be rejected.

[38] See for example http://teacher.pas.rochester.edu/phy_labs/appendixe/appendixe.html

What does the model do?

The model makes a range of assumptions, and uses these to predict the behaviour of farmers. The baseline is calculated by the model, rather than through adopting empirical data, or using such data to calibrate the model.

Water use is optimised to maximise economic returns. The model allows area to expand in response to change in factors. In the state contingent approach, farmers are modelled to change their crops in response to changing conditions. Cotton farmers are modelled to grow cotton in normal, wet and dry years or to grow chickpeas in dry years.

The Baseline

By contrast with the ABARE model discussed above, the RSMG model develops a baseline based on the assumptions inherent in the model.

There are a number of concerns with the model output for the baseline and the alignment with empirical data. These are discussed in turn with reference to empirical data.

The model predicts at table 3 that as conditions become drier, more land will be irrigated. In the wet climate, 1,367 thousand hectares are irrigated, increasing by 51% in a normal year to 2,067 thousand hectares and further increasing by 8% in a dry year to 2,229 thousand hectares. For Maranoa Balonne, the irrigated area is said to remain constant in dry, normal and wet years at 45,000 hectares.

By reference to Table 3 and Table 9, we have assumed that 2000-01 was a wet year, 2005-06 was an intermediate year between dry and normal and 2006-07 was a very dry year. A comparison is shown below with the baseline for a range of factors.

Table 3: Comparison of baseline with empirical data

Parameter	2000-01		2005-06		2006-07	
	Actual data	Baseline prediction (wet)	Actual data	Baseline prediction (normal)	Actual data	Baseline prediction (dry)
Total area irrigated (,000 ha) (Tables 3 and 7)	1,824	1,367	1,654	2,067	1,101	2,229
% change	NA	NA	-9%	+13%	-33%	+8%
GVIAP ($million) (Tables 3 and 6) (2)	6,256	14,629	5,891	10,238	5,144	6,224
% change	NA	NA	-6%	-30%	-13%	-39%

Irrigated cotton area Balonne (1) ('000 ha)	45	45	21	45	Not known	45
% change	NA	NA	-53%	0%	Not known	0%

Table notes:

(1) From ABS 71250DO016_200506 Agricultural Commodities: Small Area Data, Australia, various years.

(2) From ABS Murray-Darling Basin - Gross Value of Irrigated Agricultural Production, 2000-01 to 2007-08 and CPI adjusted to 2007-08

It can be seen that the model is very poor at predicting the behaviour of farmers, finding for example that irrigated area should increase as years become drier while empirical data shows the converse and predicting that farmers in Balonne should irrigate the same area whereas the actual response of cotton farmers to reduced water is to plant less cotton.

The assumptions regarding the mitigating effect of trade are also problematic. For the southern basin, the baseline estimates the area of 'donor' crops such as rice and cereals at 44% of total area compared to 24% for actual data, an overestimate of 83%. On the other hand, the high value 'recipients' of grapes and horticulture are estimated at 10% of total area compared to 10% for actual data, an appropriate estimate, and dairy farming is estimated at 20% compared to 42% for actual data, an underestimate of 110%. Essentially, considerably more area is given to lower value uses, providing much more opportunity for other commodities to donate water to higher value uses, and so overestimating the impact of trade.

The contingent state approach seems to be unrealistic for Balonne. Land use data suggests that the response of cotton farmers to reduced water is to grow less cotton. In 2005-06, there were 3,600 ha of legumes grown in Balonne compared to 3,400 ha in 200-01, however over the same time, cotton area decreased from 45,000 to 21,000 ha, and suggesting that chickpea production is largely constant across wet and dry years. We have not examined other systems as to their alignment with empirical data.

Productivity Commission (2010) Market mechanisms for recovering water in the Murray-Darling Basin

In this report the Productivity Commission, amongst other things, considered the regional impacts of the introduction of SDLs.

- "While the impacts of the buyback should be moderate at the southern Basin level, some towns and regional centres could experience large reductions in gross product. As mentioned above, the Basin-level impacts are moderated by the small share of irrigated agriculture in the Basin economy. By contrast, some towns are heavily reliant on irrigated agriculture (for example, Coleambally), and moreover, could experience substantially larger reductions in water availability than the southern Basin average. The impacts of the buyback could be substantial in these communities. The impacts of the buyback in the northern Basin have not been modelled. However, the overall impacts are unlikely to be substantially different from those in the southern Basin. The percentage of workers employed in agriculture is a key determinant of the impact of a contraction in agricultural activity on the regional economy. In 2006, this was around 6 per cent in the Victorian MDB and 8 per cent in South Australian MDB. This is similar to the Queensland MDB, where around 7 per cent of the labour force was employed in agriculture."[39]

It is clear that the regional or local adverse impacts will be significant, and will be experienced differentially.

The Productivity Commission had a number of broad criticisms related to the Water Act and the setting of SDLs. In particular, it strongly recommended that the opportunity cost of water be considered when allocating water to the environment.

- "SDLs must be based on scientific assessments of the amount of water that is required to avoid compromising key environmental assets and processes. Good science is a necessary but not sufficient basis for optimising the use of the Basin's water resources. The value people place on environmental outcomes, the opportunity cost of foregone irrigation, and the role of other inputs, such as land management, must also be considered. If the Water Act 2007 (Cwlth) precludes this approach, it should be amended".[40]

The commission was also critical of subsidising infrastructure as a measure to return water to the environment.

- "The same cost effectiveness tests should be applied to all water recovery options. Purchasing water from willing sellers (at appropriate prices) is a cost-effective way of meeting the Government's liability for policy-induced changes in water availability. Subsidising infrastructure is rarely cost effective

[39] Productivity Commission (2010), *Market Mechanisms for recovering water in the Murray-Darling Basin,* Appendix D, page 344.
[40] *Ibid,* page xxii.

in obtaining water for the environment, nor is it likely to be the best way of sustaining irrigation communities".[41]

[41] *Ibid,* page xxii.

Stubbs, J, Storer, J, Lux, C & Storer, T (2010) Report 4: exploring the relationship between community resilience and irrigated agriculture in the MDB: social and economic impacts of reduced irrigation water.

Assessment of the modelling approach

The approach taken is quite different to that used by other modellers (ABARE-BRS (2010a and b), Mallawaarachchi *et al* (2010), Wittwer (2010)), with the model based on an empirical approach using a statistical derivation of the relationship between water usage in irrigated agricultural sectors and employment in those sectors. The economy is modelled in terms of employment. By contrast, the other approaches model the behaviour of farmers to changing availability of water given knowledge of costs and returns related to various cropping options and the availability of trade and use that approach to calculate impacts on agricultural production in dollar terms. In effect they attempt to model the response of the economy from the bottom up.

The advantages of the statistical approach is that it contains many fewer assumptions and inputs by comparison with other models and hence could be expected to be more robust. Importantly the relationship is statistically defensible as it is descriptive of the irrigation industries in the MDB in 2006. In addition, the approach can be applied at different scales, so that local and regional impacts can be understood.

The model may overestimate impacts as it considers average, rather than marginal impacts, and does not allow for trade or reuse of infrastructure. At the same time, the authors believe this is likely to be more than offset by other factors such as underestimation of employment, drought effects in 2006 and cumulative and threshold effects from water reduction.[42]

Table 4: Changes in GVIAP (CPI adjusted to 2007-08) and water usage over time

Year	GVIAP (CPI adjusted) ($\$m_{2007\text{-}08}$)	% change in GVIAP	Water use (Gl)	% change in water use
2000-01	6256.0		10516 (1)	
2005-06	5890.6	-5.8%	7370	-29.9%
2006-07	5143.8	-12.7%	4458	-39.5%
2007-08	5078.9	-1.3%	3142	-29.5%
2008-09	4286.6	-15.6%	3493	+11.2%

Source: ABS, Murray-Darling Basin - Gross Value of Irrigated Agricultural Production, 2000-01 to 2008-09 and calculations
Table notes:
(1) Data not published by ABS. Mallawaarachchi *et al* (2010) report this value at table 9 referencing ABS.

Stubbs *et al* predict an annual loss of $2.7 billion associated with a 50% reduction in water availability using 2005-06 as a base year. As can be seen from the table above,

[42] *Ibid*, page 1.

the reduction in irrigation water between 2005-06 and 2008-09 was about 53%, with a reduction in GVIAP of $1.6 billion. Assuming GVIAP equates to added value (almost certainly an overestimate) and allowing a multiplier of 0.9 for flowons to other industries, the impact of reduced water availability was a reduction of about $3.0 billion, suggesting that the estimate of Stubbs *et al* is a reasonable representation of the short term impacts of reductions in water availability.

There is considerable fluctuation in GVIAP, as the makeup changes depending on annual crops and commodity prices. In particular, the sustained GVIAP in 2007-08 is probably because of high commodities prices and differential impacts on sectors. Reductions in irrigation water are not evenly distributed between irrigation uses as shown in the table below. In particular, reductions are differentially experienced in industries such as rice and cotton, with low levels of employment per Gl. The data probably reflect, in addition to overall reductions in the level of irrigation water used, diversion of irrigation water in the northern basin from cotton to cereals, and in the southern basin, from rice to fruit and nuts, grapes, vegetables and nurseries.

Table 5: Relationship between changes in irrigation water and GVIAP, with preliminary calculation of the impact of commodity price changes

Commodity groups	**Reduction in irrigation water 2005/06-2007/08**	**% change**	**Reduction in GVIAP 2005/06-2007/08 (m_{2007-08}$)**	**% change**	**Estimated price rise (1)**
Cereals for grain and seed	181,589	29%	76.9	40%	9%
Total hay production	-308,150	-47%	-32.6	-19%	53%
Cereals for hay					
Pastures for hay					
Pastures for seed					
Cotton	-1,291,867	-82%	-657.7	-77%	28%
Rice	-1,225,217	-98%	-284.5	-97%	50%
Sugar cane					
Other broadacre crops	-32,325	-27%			
Fruit and nuts	-56,571	-14%	103.5	10%	28%
Grapes	-80,957	-16%	334.9	44%	71%
Vegetables for human consumption and seed	-27,985	-18%	126.7	21%	48%
Nurseries, cut flowers and cultivated turf	-2,790	-23%	65.7	41%	83%
Dairy production	-662,577	-64%	-0.1	0%	180%
Production from meat cattle	-395,234	-71%	-467.5	-74%	-10%
Production from sheep and other livestock	-307,613	-70%	-59.5	-39%	103%
Total volume applied	-4,228,148	-57%	-811.7	-14%	100%

Source: Murray-Darling Basin - Gross Value of Irrigated Agricultural Production, 2000-01 to 2007-08 and calculations

Table notes:

(1) For example, for hay, estimated price rise = (1-.19)/(1-.47)=.53

It should also be noted that some of the variation in GVIAP is likely to be because of price changes rather than solely from changes in output. Assuming output is linear to water use (that is if water use is halved, production such as tonnes of crop is halved), then the differential between the change in GVIAP and in water reduction for 2007-08 can be attributed to price change.[43]

[43] An alternative explanation is improvements in efficiency, but this would suggest for example producing the same amount of nursery product with half the water. The magnitude seems unlikely but the hypothesis could be tested with reference to production data rather than GVIAP data.

ABS (2010) Experimental Estimates of the Gross Value of Irrigated Agricultural Production 2000-01 to 2007-08

This data set has been discussed briefly above. While the data gives an understanding of the impacts of drought and reductions in the availability of irrigation water, there are two important caveats when interpreting the data. The **data has <u>not</u> been adjusted for inflation**, and this adjustment is required to properly understand trends over time. Adjusting for inflation, GVIAP **<u>fell</u>** by 5.8% between 2000-01 and 2005-06, however the unadjusted figures show an 8.6% increase.

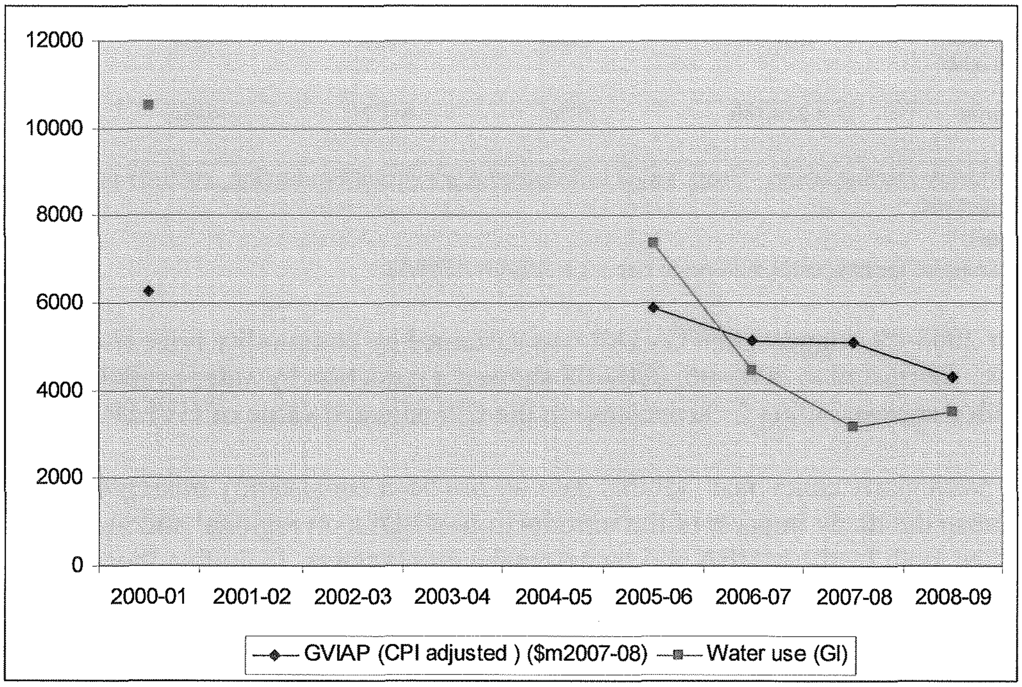

Figure 1: GVIAP (CPI adjusted) 2000-01 to 2008-09
Source: ABS

Changes in GVIAP reflect changes in both commodity prices and in output. Some preliminary calculations carried out elsewhere in this submission suggest that the decrease in GVIAP between 2005-06 and 2007-08 is about half what would be expected from reductions in water. Data is shown in the table below. An alternative explanation is that that massive efficiency gains have been made. For example, in 2007/08, 60% less water grew the same amount of grapes. Such figures seem implausible, except perhaps in the case of dairy production and livestock production, where feed may have been imported.

Table 6: Relationship between changes in irrigation water and changes in GVIAP 2005/06-2007/08

Commodity groups	Reduction in irrigation water 2005/06-2007/08	% change	Reduction in GVIAP 2005/06-2007/08 (m_{2007-08}$)	% change	Estimated price rise (1)
Cereals for grain and seed	181,589	29%	76.9	40%	9%
Total hay production	-308,150	-47%	-32.6	-19%	53%
Cereals for hay					

Pastures for hay					
Pastures for seed					
Cotton	-1,291,867	-82%	-657.7	-77%	28%
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Sugar cane					
Other broadacre crops	-32,325	-27%			
Fruit and nuts	-56,571	-14%	103.5	10%	28%
Grapes	-80,957	-16%	334.9	44%	71%
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Nurseries, cut flowers and cultivated turf	-2,790	-23%	65.7	41%	83%
Dairy production	-662,577	-64%	-0.1	0%	180%
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Total volume applied	-4,228,148	-57%	-811.7	-14%	100%

Source: Murray-Darling Basin - Gross Value of Irrigated Agricultural Production, 2000-01 to 2007-08 and calculations
Table notes:
(1) For example, for hay, estimated price rise = (1-.19)/(1-.47)=.53

Data for 2008-09, suggests that GVIAP was sustained by commodity price rises in 2007-08. Compared to 2005-06, 2007-08 showed a reduction in water availability of 53% with a corresponding 27% decrease in the CPI adjusted value of GVIAP.

We are particularly concerned that this data set has been consistently misrepresented to minimise the likely impacts of the introduction of SDLs on regional and local economies, both by the MDBA and by external commentators, including those in the environmental movement, through a failure to properly consider the impacts of inflation and of commodity price changes.

Morrison, M and Hatton MacDonald, D (2010) Economic valuation of environmental benefits in the Murray-Darling Basin

The authors estimate the value to the community of improvements in the environmental indicators of native vegetation, fish populations, water bird breeding and number of species at $3.3 billion and the value of improving the Coorong from poor to good quality at $4.3 billion. Data is presented as present value.

The approach taken in the valuation of benefits is philosophically quite different to the approach taken to the valuation of costs in other studies prepared for the MDBA. The effect is to maximise the benefits associated with the introduction of SDLs. We have contrasted the approach of the authors with the approach taken by ABARE-BRS (2010c).

If the authors had taken an approach similar to that taken by ABARE-BRS (2010c) we believe that the value placed on environmental benefits would be zero. This would be because there are other habitats available for native vegetation, fish, water bird and other species and similar areas exist elsewhere to the Coorong. This means that if people wanted to experience these benefits, they could just go somewhere else to experience them.

Alternatively, if ABARE-BRS (2010c) took a similar approach to the authors of this paper, they would estimate the opportunity cost associated with the water hypothesised to go to the environment. If we assume 3,500 Gl as a target SDL, in 2007-08 vegetable production in the MDB had a GVIAP of $5.8 million per Gl of water. Hence 3,500 Gl would equate to a total GVIAP of $20.3 billion per annum. If this was represented as net present value, and using a discount rate of 8%,[44] the figure would be $254 billion or 59 times the environmental value of the flows. While there would be some input costs to be deducted, there are also flow-ons to other industries, so this figure might be reasonably accurate in representing the opportunity cost to the community of the proposed environmental flows.

More importantly, good practice would require the consideration of a number of ways of achieving purported environmental benefits, and select that method that maximises the difference between cost and value. That is, dilution or additional flow might not be the best way of achieving the environmental outcomes.

[44] Refer for example NSW treasury guidelines for cost benefit analysis

Wittwer, G (2010) The Regional economic impacts of Sustainable Diversion Limits

This modelling takes a similar approach to that used by ABARE-BRS and Mallawaarachchi *et al.* Similar critiques can be made of this model as made for the other models. These include failure to align with empirical data, unrealistic or optimistic assumptions, lack of transparency and a failure to properly compare alternative futures.

We have compared the forecast of the model to actual data for 2000-01 and 2005-06. Area of cotton under cultivation in Balonne Shire decreased by 51% between 2000-01 and 2005-06. Over the same period, employment in cotton decreased from 329 to 170 people, a decrease of about 48%.[45] It could be concluded the relationship is effectively linear. Taking 2000-01 as an average year, it could be concluded that the impact of a 33.1% would be a loss of 109 jobs. Assuming a multiplier of 1.9,[46] the cut would correspond to a loss of 207 jobs in Balonne Shire. Some jobs would be recovered from dryland grazing, at a rate of one job for each 12.5 lost, giving a net number of jobs of 190 lost from a 33.1% SDL. Even though Balonne Shire is one part of the Condamine Balonne region, the modelling by Wittwer suggests that it will probably account for 190 jobs or 93% of the predicted lost jobs in the region. This seems implausible, as backcalculating from tables 7 and 8,[47] total employment in Condamine Balonne in the base line is about 44,000. By contrast, in 2000-01, 2,724 people were employed in Balonne Shire, suggesting Balonne Shire represents around 6% of the economy of Condamine Balonne.

Considering the LGAs of Balonne, Dalby, Jondaryan, Wambo and Millmerran, in 2000-01, 917 people were employed in cotton and cotton ginning. A 33.1% cut would equate to a loss of 304 jobs, and with multipliers, 577 jobs. Allowing for dryland grazing as a next best use, the jobs would be around 531. This is around two and one half times the lost jobs forecast by Wittwer (2010). It is clear from such calculations that the model does not align with empirical data and appears to grossly underestimate losses in employment. As another check, 206 Gl of water is required from Condamine Balonne. In terms of opportunity cost, if all this water was to be iused for cotton, there would be an increase in employment of around 470 jobs using a 0.9 multiplier.[48] This figure is over twice the forecast job losses across the entire region.

The model appears to contain some optimistic assumptions that are likely to skew output towards minimising impacts. Those that can be gleaned from the documentation include:

[45] ABS census employment by usual residence, cotton and cotton ginning.
[46] Stubbs *et al, op cit*
[47] Wittwer, *op cit.*
[48] Stubbs *et al, op cit,* table 3.7.

- The use of a drought year, 2005-06 as a baseline. This assumes that communities will never recover from the drought but this is at odds with historical data.[49]
- Compensation for water is modelled to remain in the area rather than being used to retire debt. This is at odds with the findings of Rizza (2010) discussed above.
- The model lacks transparency. The model is stated to "include detail of the economic structure of the rest of Australia".[50] It could be inferred that general economic growth, coupled with reductions in immigration, act as a significant offset to the impacts of reductions of SDLs. The model almost certainly conflates trade with SDLs as evidenced by the low levels of job losses predicted in the southern basin.
- The model almost certainly fails to compare alternative futures. This can be clearly seen. For example, consider the effect if 3,500 Gl of water was taken from environmental flows and made available for irrigation in 2026. If that water was used to grow rice or cotton, then it would equate to an extra 4,725 jobs, and nearly 9,000 jobs with multipliers. In fact the model predicts a loss of 354 jobs.

[49] Wittwer, *op cit,* page 14.
[50] *ibid,* page 6.