

**SENATE RURAL & REGIONAL AFFAIRS & TRANSPORT  
REFERENCES COMMITTEE**

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**Inquiry into the management of the Murray Darling Basin**

**Canberra, 23 April 2012**

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## **National Farmers' Federation**

### **Submission to the Murray-Darling Basin Authority for the Proposed Basin Plan**

16 April 2012

Prepared by Deborah Kerr, Manager – Natural Resource Management



National Farmers' Federation

Member Organisations



CANEGROWERS



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The Pastoralists' Association of West Darling

WOOLPRODUCERS AUSTRALIA

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# Executive Summary

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The management of the Murray-Darling Basin has been the subject of much debate over the last decade, with accusations of overuse, mismanagement and state parochialism. However, the reality is that during the recent one in three hundred-year drought the fact that water was supplied for towns, stock and domestic supply, permanent plantings and some critical industries is to be admired and respected. It did not come without costs to agriculture, communities and industry and it is notable that it was achieved without the Basin Plan in place. It was done with the cooperative effort nature that was a cornerstone of the previous arrangements for the management of the Murray-Darling Basin. Other countries want to replicate this feat.

It is of concern that the Water Act 2007 (C'lth) and the Basin Plan seek to set up a management regime to recover water for the environment, based on emotions generated during a drought that essentially occurs three times every one thousand years. Such a regime undoubtedly will have longer-term implications for the sector the National Farmers' Federation (NFF) represents – agriculture – and the Basin's communities.

The NFF does not support the 2750 GL reduction in consumptive take (or Sustainable Diversion Limit (SDL)). NFF also has concerns about the Basin Plan Statutory Instrument being drafted to include only water access entitlement purchases as contributing to achieving the SDL. This was not the premise of the Murray-Darling Basin Authority in "selling" the Proposed Basin Plan to the Basin's communities and farmers. The Statutory Instrument must be amended to reflect the policy intent of the Authority and the Australian Government.

While NFF also welcomes the undertakings that the Basin Plan will not change entitlement reliability, these undertakings are not strongly enough codified in the Statutory Instrument. NFF suggests that this be worded more strongly and it be extended to clearly prescribe the mechanisms for implementation of the SDL. The proposed 2015 review also causes the NFF some concern. As drafted, it cannot compel Parliament to accept any adjustment to the SDL. The NFF proposes that the Statutory Instrument includes and embeds an Implementation Plan to ensure this occurs. The implementation plan must specify the criteria for the 2015 Review.

Along with the new arrangements for water management in the Basin, the Australian Government has spent \$10 billion on the reform effort. Of this \$3.1 billion was set aside for water acquisition and \$5.8 billion for infrastructure. Make no mistake, only \$3.4 billion of the infrastructure will be spent on water recovery efforts in the Murray-Darling Basin. The remainder includes \$0.5 billion unallocated, \$330 million for non-Murray-Darling Basin water efficiency, \$450 million for water purchases and \$1.5 billion for other initiatives that do not recover water (such as Coorong environmental works, COAG water reforms and the Commonwealth Environmental Water Holders' water charges).

Recovery of 78 per cent of the SDL gap through purchases is untenable as this has significant flow on impacts to irrigation communities and particularly vulnerable communities. NFF seeks a commitment by the Australian Government to recover a greater volume of water from non-purchase options such as water recovered through infrastructure and efficiency investment, environmental works & measures, local community projects and river operations. This emphasis must be embedded within the Basin Plan and fundamentally change the recovery approach by the Australian Government.

Moreover, such an outcome would require additional funding to deliver an altered recovery program. Additional time to implement might also be considered; and is consistent with the Federal Budget contingent liability for the Basin Plan risk assignment provisions.

The NFF also calls on the Authority and the Australian Government to ensure that, if the SDL gap cannot be recovered through the measures described above, entitlement reliability will remain unaffected. This can be done by measuring reliability against the first generation water resource plans (commencing from 2002) adjusted for the climate variability. To do otherwise is disingenuous.

Finally, the NFF recommends that the Australian Government invest in new resources for research, development and extension (R,D&E) to offset the lost production due to water purchases. This would also offset the loss of R,D&E capacity that has occurred with the closure of a number of irrigation and water related research and development programs since 2007.

While the formal public consultation period will end shortly, the NFF seeks continued dialogue with the Authority through the following months as the Authority and Government work to finalise the Basin Plan and draft and finalise the Regulatory Impact Statement.

## National Farmers' Federation

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The National Farmers' Federation (NFF) is the peak national body representing farmers and, more broadly, agriculture across Australia. It is one of Australia's respected lobbying and advocacy organisations.

Since its inception in 1979, the NFF has earned a reputation as a leader in the identification, development and achievement of policy outcomes - championing matters affecting farmers and dedicated to the advancement of agriculture.

The NFF is dedicated to proactively generating greater understanding and awareness of farming's modern role, contribution and value to the entire community.

One of the keys to the NFF's success has been its commitment to presenting innovative and forward-looking solutions to the issues affecting agriculture, striving to meet current and emerging challenges, and advancing Australia's vital agricultural production base.

The NFF's membership comprises all Australia's major agricultural commodity groups. Operating under a federated structure, individual farmers join their respective state farm organisation and/or national commodity council. These organisations collectively form the NFF.

The NFF has implemented a re-structure of the organisation. Through an associate category, this has enabled a broader cross section of the agricultural sector to become members of the NFF, including the breadth and the length of the supply chain.

Each of the state farm organisations and commodity councils deal with state-based 'grass roots' issues or commodity specific issues while the NFF represents the agreed position of all at the national and international level.

## 1. Introduction

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The National Farmers' Federation (NFF) welcomes the opportunity to make a formal submission on the Murray-Darling Basin Authority's (the Authority) Proposed Basin Plan. For NFF and its Members, getting the Basin Plan right is vital because it is a major public policy change with significant social and economic impacts. Moreover, the Basin Plan will have a major precedent in setting for water planning and management setting across the rest of the nation – even though the head of power is reliant on international environmental agreements rather than the National Water Initiative which seeks to balance social, economic and environment with transparent tradeoffs in decision making.

While this plan has been long awaited, it must be acknowledged that the protracted process leading up to this point has been extremely upsetting for the Basin's community because of the:

- Lack of any engagement leading up to the release of the Guide;
- Content of the Guide;
- Realisation by regional communities that they are to bear the brunt of any change; and
- Lack of significant movement between the Guide and the Draft Plan.

It ought to be acknowledged that the Chair of the Authority has done much to overcome this view. However, telling people about the process and seeking their views is not the same thing as engaging communities in its development from the start and truly considering their views on the trade offs. Had this occurred, undoubtedly the trepidation and scepticism of the Basin communities might have been avoided or at least lessened had the Authority approached this from the start with a view to truly balancing the needs of the environment and communities, not counting the cost to communities in favour of the environment

NFF also notes the limitations of the Water Act 2007 (C'lth) for a number of reasons – the focus on the environment due to its head of powers (external affairs) as opposed to a true balance between the needs of environment, social and economic needs. The Water Act does not consider the non-water requirements to resolve some of the environmental issues in the Basin (e.g. the management of weeds). The Water Act also has limited the way in which the Authority might have better engaged with communities in its development. Water planning takes several years and the Authority had an extremely tight timeframe. NFF outlined its preferred method of Basin Plan development in its submission to the Guide to the proposed Murray-Darling Basin Plan (Murray-Darling Basin Authority, 2010). That view remains unchanged. There remain many more instances where the Water Act has been less than optimal.

While noting the above, this submission will, primarily, focus on the statutory instrument and what NFF views as the major issues arising from that instrument. The submission will conclude with the major changes that NFF sees as most important in obtaining a better outcome for the Basin. These changes will be the responsibility of the Authority and the Government if the negative impacts are to be minimised.

## 2. NFF questions, Authority responses and NFF view

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The NFF has previously lodged a number of technical and other questions on the Proposed Basin Plan with the Authority, and received responses. To clarify, these questions should be taken to form part of the NFF submission. To avoid doubt these are appended to this formal

submission on the Proposed Basin Plan, along with the NFF's response to the Authority's answers (see Attachment 1 on page 23).

### **3. Sustainable Diversion Limits**

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The **NFF does not support the SDL of 2750 GL** as outlined in the Proposed Basin Plan. The Proposed Basin Plan has not resolved minimising the social and economic impacts, does not clearly identify how the number was derived, does not consider other alternatives to achieving environmental outcomes without requiring water – and there are numerous examples, and does not consider whether or not the recovered water could be used efficiently and effectively.

NFF believes there has been insufficient evidence given to substantiate the volume of water to be recovered. For example, the Authority's ESLT report (Murray-Darling Basin Authority, 2011) describes the flow regimes required to meet the environmental objectives. However, in selecting the ESLT options, the Authority "*by integrating the available information, and through considered judgement, MDBA established a range of sensible ESLT options*" essentially undertook a coarse Basin averaging exercise using Authority end of system flows, Authority preliminary and incomplete hydrologic modelling and an extrapolation of the Wentworth Groups work (Murray-Darling Basin Authority, 2011, p. 68). The Authority then sought to justify this position.

What has not been disclosed is an assessment of the model runs that underpin either the above work or the Proposed Basin Plan. It is disingenuous to seek to make such major changes to the water use in the Basin and not provide this information. Stakeholders and communities understand model runs having been exposed to them previously during the development of water resource plans at catchment levels. Modelling helps to inform the trade-off decisions on water use and identifies the positive and negative impacts.

A major influence on the outcome of model runs is the assumptions that underpin the model, including assumptions about how irrigators might behave in relation to water availability, water use and water trade. The Authority has not disclosed these assumptions.

**Recommendation 1 – That the Authority immediately release the model runs, and the assumptions, that underpin the decision making for the SDL contained in the Proposed Basin Plan.**

It is obvious that the Sustainable Diversion Limits (SDL) are the most contentious part of the Proposed Basin Plan – primarily because these are seen as being the driver for imposing negative social and economic impacts on the Basin. While individual irrigators may remain unaffected, impacts on rural and regional communities are real.

There are many who believe that the SDL "number" is a politically expedient number, i.e. one that might survive a disallowance motion in either the House of Representatives or the Senate. It might also be said that the proposed SDL is also one designed to ensure that no stakeholder group will obtain the outcome they are advocating.

The NFF has calculated that water recovery including pre-2004 efforts (e.g. Cap implementation and a range of state based programs) for the environment, including planned and held environmental water, is of the order of 6000 GL – which is not an insignificant number. However, a major concern for agriculture is that these water recovery efforts are fully recognised – currently this is not the case, with only part of the post 2004 efforts acknowledged. In addition the NFF believes it is essential that any water held by environmental water managers is managed efficiently and that farmers and rural communities are provided with guarantees that any

inefficient management of water resulting in poor environmental outcomes does not lead to more calls for more water recovery.

While the Authority is proposing an overall surface water SDL of 2750 GL, between 2004 and 2009 an additional 959 GL was recovered. This means that the total proposed water recovery for the implementation of the Basin Plan is some 3709 GL – very close to the upper limit of the scenarios in the Guide to the Proposed Basin Plan (the Guide) and interestingly the position held by the Australian Greens and environmental NGOs. Public commentary that the proposed SDL of 2750 GL does not achieve their outcomes is mischievous.

The Authority proposes to recover around 34 per cent of the watercourse diversions. However, governments are unlikely to recover water from towns, industry, recreation, stock and domestic or basic landholder rights, or small volume but large numbers of unregulated water users. This leaves water recovery to be borne, solely by agriculture. When the SDL recovery is recalculated to account for the above, NFF calculates that for agriculture, the cut will be in the order of 38 per cent.

This is untenable and we call on the government to adjust the final Plan to minimise these impacts.

Regardless, consideration must be given to ways to manage any impacts. One reasonable, practical and achievable way is to ensure water recovery can occur in a number of ways, such as through a range of environmental works and measures, infrastructure efficiency investment, river operations, as well as delivering the required environmental outcomes using non-water means, such as managing pests and weeds.

At present, the statutory instrument is structured in such a way that the gap will only be closed when irrigator entitlements are transferred to environmental use. This clearly does not accord with public commentary by either the Australian Government or the Authority.

The SDL must be restructured in such a way that all water recovery efforts will contribute to closing the SDL gap.

**Recommendation 2 – That the Authority and the Australian Government ensures that the final Basin Plan Statutory Instrument reflects the policy intent that all water recovery efforts will contribute to closing the SDL gap.**

It is possible that this could be framed in terms of a formula such as:

$$\text{SDL} = \text{BDL} - (\text{volume of held environmental water} + \text{environmental works \& measures} + \text{infrastructure savings} + \text{local community projects}^1 + \text{river operations} + \text{strategic purchases})$$

Importantly, this concept includes that non-water measures might be used to deliver environmental outcomes and an improved integrated catchment management outcome as a whole for the Basin. It is vital that these matters be incorporated into the Basin Plan as a Regulation.

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<sup>1</sup> For example, this might reflect the non-water environmental outcomes (e.g. weed and pest management, removal and or realigned of poorly located levee banks and roads) that is currently missing in the provisions of the Basin Plan and that is required to deliver a truly integrated catchment management approach.

**Recommendation 3 – That the Authority ensures that the SDL recovery efforts include the capacity of non-water options as an offset where these meet environmental outcomes and this policy intent is reflected in the final Basin Plan Statutory Instrument.**

The above may be achieved through the following suggested amendments:

**Recommendation 4 – that the definition of “*recovery of environmental water*” is broadened to include all water recovery measures (strategic water purchases, water recovered through infrastructure and efficiency investment, environmental works & measures, local community projects and river operations) and the term “*recovery of environmental water*” is broadened to cover closing the SDL gap.**

**Recommendation 5 – that the final Basin Plan Statutory Instrument includes a definition for “*quantity of relevant environmental water*” under Clauses 6.05 and 6.06 that reflects the policy intention of the Authority and the Australian Government that water that contributes to meeting the SDL gap includes water recovered by strategic water purchases, water recovered through infrastructure and efficiency investment, environmental works & measures, local community projects and river operations.**

For the sake of clarity, the following should be included:

**Recommendation 6 – the insertion of a new clause between 6.05 and 6.06 that clarifies that the SDL gap for water recovered towards reductions under Clause 6.05 is closed by counting all water and non-water recovery efforts, including but not limited to strategic water purchases, water recovered through infrastructure and efficiency investment, environmental works & measures, local community projects and river operations.**

There are a number of environmental issues affecting the Basin but not all require additional water volume to resolve. The major causes of degradation in the Basin include both flow and non-flow factors:

- Changes in river hydrology caused by regulation of flow and diversion of water;
- Blockage of floodplain flows caused by causeways, levee banks and structures;
- Disposal of stormwater, sewage and irrigation effluent into wetlands;
- Excessive grazing by stock, feral and native animals;
- Cropping on floodplains and lake beds;
- Introduced fish species and aquatic weeds;
- Rising saline groundwater beneath floodplains; and
- Urban and recreational developments (Murray-Darling Basin Commission, 2006).

Unless the above can be resolved, the implementation of the Basin Plan is doomed to fail, and there are justifiable concerns of the agricultural sector that there will continue to be increasing pressure in the future to take additional volumes of water from consumptive use.

**Recommendation 7 – that the Authority and the Australian Government ensures that the remaining major causes of degradation of the Basin are appropriately managed and funded, via a return to integrated catchment management rather than current flow only**

**approach to managing the Basin’s environment, and that this results in a increase in the Sustainable Diversion Limit.**

#### **4. Entitlement Reliability**

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Given that the Authority is using the States’ water models, albeit modified, the Authority ought to be in a position to provide preliminary information on the impact of implementation of the Basin Plan on the reliability of water entitlements. The State models are designed to provide entitlement reliability and there is no excuse that this information has not been released to inform development of submissions on the Proposed Basin Plan.

If the Authority were not in a position to do this, the very minimum requirement would be for the States to be asked to provide this information to assist consultation. It is very difficult to understand the impacts of the Proposed Basin Plan on entitlements when this critical piece of information has been withheld or the work has not been undertaken.

**Recommendation 8 – That the Authority immediately provides information on the impact to reliability of entitlements, including through state implementation.**

NFF are concerned about how entitlement reliability will be monitored through Basin Plan implementation, including at a State level, to ascertain whether entitlement reliability has been impacted and that cannot be accounted for (e.g. state legislation or policy change). It should be noted that it is unclear whether the States will now use the Authority amended models or their own versions. The State models are an important parameter for determining whether reliability has changed from the first generation water resource plans commencing from 2002 (climate adjusted reliability). Clarity on how entitlement reliability will be monitored for change would be most useful.

**Recommendation 9 – That the Authority releases information on what models will be used to monitor and assess changes to entitlement reliability for the purposes of Water Act 2007 (C’lth) sections 80-86.**

As reliability of entitlement underpins property rights, NFF supports those provisions (i.e. Clauses 6.15 and 9.09) in the Proposed Basin Plan that indicate that the Basin Plan itself should not change entitlement reliability. However, the Authority must include in the final Basin Plan better codification of these provisions, including that if state implementation<sup>2</sup> changes entitlement reliability then the provisions of the Water Act, sections 80-86, are triggered requiring compensation by the Australian Government<sup>3</sup>.

A further concern for NFF relates to a situation in which the Australian Government does not or cannot close the SDL gap through water recovery from a range of mechanisms. Should this situation arise, the final Basin Plan must include provisions that entitlement reliability will remain unchanged.

**Recommendation 10 – That the Authority more explicitly codifies that the final Basin Plan will not change entitlement reliability, including through state implementation of**

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<sup>2</sup> This excludes any changes arising from state legislation and policies – this being a risk assignment allocation of State Governments.

<sup>3</sup> NFF accepts that such an assessment should exclude climate variability since the first generation of water plans (i.e. related to the severe drought and flood events) and any changes arising from changes to state legislation, regulations or policy.

**the Basin Plan<sup>4</sup> and should the SDL gap not be recovered then entitlement reliability will not be used to close the gap.**

The manner in which environmental water is stored and delivered may also lead to impacts on entitlement reliability. NFF does not support any measures or mechanisms that aim to prioritise planned or held environmental water over other entitlements. Such endeavours or proposals will undoubtedly lead to a change in the characteristics of the planned or held environmental water. It is a long agreed high-level principle that perverse outcomes for third parties will not occur because of changes to the characteristics of water entitlements. As an example, proposals for shepherding water will change the nature and characteristics of entitlements and create a “super” high security type of entitlement – which is not available to other entitlement holders. Similarly, prioritising in-stream channel capacity for environmental water delivery in spring may have the effect of limiting that ability for irrigation water entitlement holders to take water in critical planting windows or watering times.

Proposals in the Guide to the Proposed Murray-Darling Basin Plan suggest prioritising water allocations to the environment first ahead of other entitlement holders, including town water supply. NFF does not support such measures and there is nothing explicitly in the Proposed Basin Plan that allays those concerns.

**Recommendation 11 – That the final Basin Plan Statutory Instrument and any supporting State Water Resources Plans do not change the characteristics of entitlements or prioritise planned and held environmental water above other water entitlement holders for either allocation or river channel capacity or amend public dam storage rights, or amend river operations that will lead to third party impacts or negative consequences to entitlement reliability.**

Any proposals to change these aspects of water management at the Basin or State level must be discussed and agreed with entitlement holders affected by such decisions, and must be shown to have no third party impacts, including to entitlement reliability.

## **5. 2015 Review**

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The provisions in the Basin Plan relating to the proposed 2015 review are of concern to the NFF. The Proposed Basin Plan does not compel the Government or the Parliament to accept any proposals to adjust the SDL contained in the Statutory Instrument.

NFF has previously suggested that the commencing SDL is lower to provide leverage to ensure that Parliament considers and adopts the adjusted SDL because of the 2015 review. NFF has been told that this position is politically unsaleable.

NFF suggests that embedding an implementation plan within the instrument, along with the criteria that would guide the review seems pragmatic.

**Recommendation 12 That the Statutory Instrument be amended to more strongly regulated the parameters of the 2015 review and to include new provisions that embed the implementation plan with the instrument.**

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<sup>4</sup> Ibid

## 6. Third Party Impacts

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NFF is concerned that the wording in the Proposed Basin Plan relating to the possible impact on private landholders in implementing environmental watering regimes is insufficiently strong enough to provide protection. The NFF seeks to have these provisions<sup>5</sup> amended to ensure that these risks are not just “considered” and set aside, but actively avoided. Where flooding of private land cannot be avoided, the Basin Plan should compel the Authority, Environmental Water Managers and governments to either pay compensation and/or seek to enter into a flood easement negotiation with the affected landholder(s).

**Recommendation 13 – that the final Basin Plan Statutory Instrument is more strongly worded in terms of avoiding rather than just considering the risks to private land and that the Authority is compelled to seek suitable agreed arrangements with affected landholders.**

## 7. Interception

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In the NFF’s response to the Guide to the Proposed Basin Plan (Guide), the NFF noted that the Authority relied on the National Water Commission’s (NWC) Interception Report (Sinclair Knight Mertz, CSIRO and the Bureau of Rural Sciences, 2010). The Authority however, had failed to explain why there is a 924 GL overstatement in interception figures between the NWC report and the Guide and now the Proposed Basin Plan. Members of NFF noted that the assumptions used in the NWC report were incorrect.

In recent discussions with the Authority, it is apparent that the NWC report was not the basis for the interception figures in the Guide or the proposed Basin Plan. The Authority has relied on an earlier report (Sinclair Knight Mertz, 2007) from the CSIRO Murray-Darling Basin Sustainable Yields Project, which attempted to project the effect of future farm dam development to 2030. Runoff dams may include irrigation but are essentially all dams greater than 5 ML capacity (basic landholder dams are less than 5 ML capacity) and are usually located off watercourses.

The figures included in the proposed Basin Plan are 591GL basic landholder rights farm dams (sourced from the 2010 NWC report) and 1793.3GL “*is calculated using data on the volume of runoff dams given in SKM (2007) and the methodology described in the NWC (2010) report*”.

To clarify, NFF understands that the floodplain harvesting figures (included in the 2010 NWC Report) are explicitly included in the surface water models and therefore are included in the surface water SDLs.

NFF understands that there are some concerns with the runoff dam figures, and is an area identified by the Authority as requiring further work, including the conversion factor on dam storages may be overestimated – only one factor, i.e. 1.1, is used right across the Basin. The second issue is verifying the classification of the dam.

**Recommendation 14 – That the Authority implements a project to ensure the veracity of the runoff and basic landholder rights dams figures included in the proposed Basin Plan as interception and includes any updates in the 2015 review.**

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<sup>5</sup> For example, Clauses 5.06, 7.36,

The proposed Basin Plan includes a “flexibility” provision that enables state governments to increase interception but this requires a decrease in surface water diversions. It would appear that there is no “reverse” flexibility provision, i.e. reduce interception and increase surface water diversions, providing the total SDL is not exceeded. Importantly, should the above work result in a reduction to the interception figures for farm and run off dams, then there must be an upward adjustment of the surface water SDLs, providing that the total SDL for the catchment and Basin does not increase.

**Recommendation 15** If the additional work on farm and runoff dams reduces the interception SDLs, then there must be an upward revision of the surface water SDLs to offset the impact on surface water users.

NFF suggests that the Authority undertakes the above work in conjunction with state governments and that basic landholder rights under state legislation are respected.

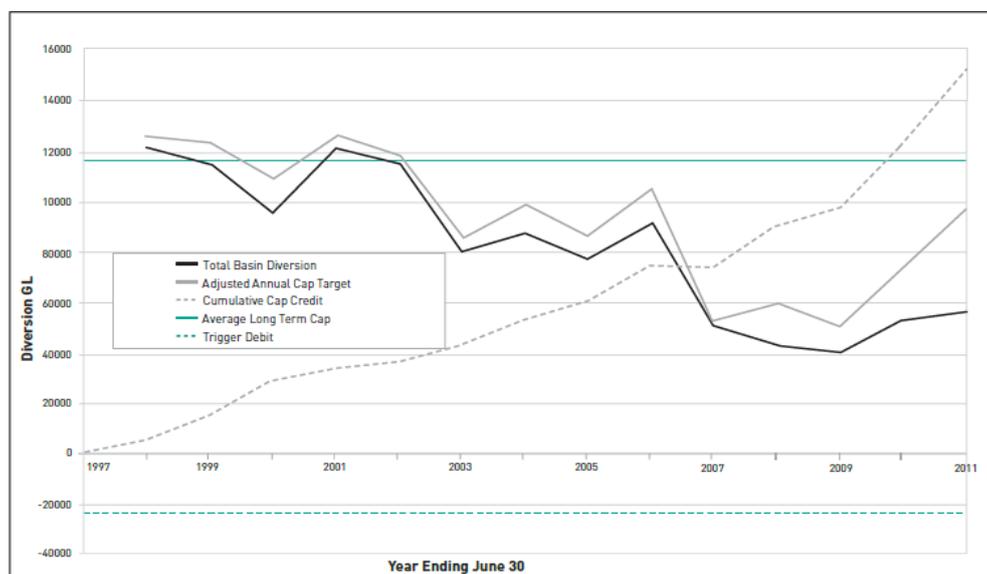
## 8. SDL Compliance

The Authority proposes to “zero” current cap management credits and debits at the commencement of the register of take on 30 June 2019 (Chapter 6, Part 4, clause 6.09(6), page 28). This means that the Murray-Darling Basin Cap credits and debits arrangements in place on 30 June 2019 will be ignored. The NFF rejects this for several reasons.

Foremost, there is a real likelihood that given that States will lose any existing cap management advantages, existing cap credits will be allocated and used to the effect of states delivering a water take close to the -20 per cent debit on 30 June 2019. This is a perverse outcome for this provision in the proposed Basin Plan.

At the time of this submission, the current accumulation of Murray-Darling Basin Cap credits and debits for the Basin as a whole is shown in Figure 1 below. This shows that in 2011, the total basin diversions were less than 6000 GL, significantly under the adjusted annual cap target of just less than 10000 GL, which was below the long-term cap of just under 12000 GL. All of these were substantially under the long-term cumulative cap credit.

**Figure 1 Murray-Darling Basin Cap compliance (Murray-Darling Basin Authority, 2011, p. 58)**



To show this information differently, the following table portrays the 2009-10 cumulative cap credits in the Cap register<sup>6</sup>.

**Table 1 Murray-Darling Basin Cap Register – Cumulative Cap Credits (Murray-Darling Basin Authority, 2011, pp. 90-91)**

System	Long Term Cap	Sch E Trigger	97-98	98-99	99-00	00-01	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10
NSW															
Intersecting streams	N/A	N/A							N/A						
Border Rivers	234	-47	-36	-38	-89						N/A				
Gwydir	350	-70	71	35	86	-25	-63	134	115	108	191	127	110	157	170
Namoi/Peel	364	-73	27	20	15	-1	-31	-50	-11	52	110	74	96	153	222
Macquarie/Castlereagh/Bogan	492	-98	-57	139	113	167	147	8	57	121	284	153	296	335	336
Darling/Lower Darling	306	-61	-31	32	109	102	113	127	43	10	34	32	-4	12	-4
Lachlan	335	-67	-5	26	-5	-31	-41	-50	-17	7	46	59	108	127	163
Murrumbidgee	2358	-472	-29	16	163	137	461	784	893	685	944	1073	1374	1415	1170
Murray	1908	-382	-9	160	719	655	435	18	230	355	468	109	203	151	662
<b>TOTAL NSW</b>	<b>6348</b>	<b>-1270</b>	<b>-68</b>	<b>391</b>	<b>1113</b>	<b>1003</b>	<b>1022</b>	<b>970</b>	<b>1309</b>	<b>1337</b>	<b>2077</b>	<b>1626</b>	<b>2184</b>	<b>2351</b>	<b>2719</b>
Victoria															
Goulburn/Broken/Lodden	2032	-406	71	26	62	172	59	-12	14	104	103	83	171	130	446
Campaspe	122	-24	34	39	42	32	14	25	32	62	81	87	106	125	146
Wimmera	159	-32	-1	29	65	72	76	86	86	114	99	102	99	111	157
Murray/Kiewa/Ovens	1696	-339	111	44	99	145	62	217	332	410	547	553	711	772	1075
<b>TOTAL VIC</b>	<b>4008</b>	<b>-802</b>	<b>215</b>	<b>139</b>	<b>267</b>	<b>421</b>	<b>211</b>	<b>316</b>	<b>463</b>	<b>689</b>	<b>831</b>	<b>824</b>	<b>1086</b>	<b>1137</b>	<b>1824</b>
South Australia															
Adelaide & Assoc Country Areas			128	84	74	109	31	31	111	187	232	100	164	87	93
Lower Murray Swamps	94	-19	0	0	0	0	0	0	0	0	0	0	-6	-8	6
Country Towns	50	-10	15	28	42	54	56	56	61	65	67	67	67	67	67
All other	450	-90	28	64	137	180	224	269	341	340	370	407	480	616	762
<b>TOTAL SA</b>	<b>594</b>	<b>-119</b>	<b>171</b>	<b>176</b>	<b>253</b>	<b>343</b>	<b>312</b>	<b>356</b>	<b>513</b>	<b>592</b>	<b>670</b>	<b>574</b>	<b>705</b>	<b>762</b>	<b>928</b>
Queensland															
Condamine Balonne	729	-146							N/A						
Border Rivers/Macintyre Brook	245	-49						N/A					0	27	80
Moonie	33	-7							N/A						
Nebine	3	-1							N/A						
Warrego	39	-8							N/A						
Paroo	0	0							N/A						
<b>TOTAL QLD</b>	<b>1049</b>	<b>-210</b>						<b>N/A</b>					<b>0</b>	<b>27</b>	<b>80</b>
ACT	40	-4							N/A						
<b>TOTAL BASIN</b>	<b>12040</b>	<b>-2408</b>	<b>318</b>	<b>706</b>	<b>1633</b>	<b>1767</b>	<b>1544</b>	<b>1642</b>	<b>2286</b>	<b>2617</b>	<b>3578</b>	<b>3024</b>	<b>3975</b>	<b>4250</b>	<b>5471</b>

If the above cumulative cap credits is averaged across all years (i.e. 1997-98 to 2009-10), the average cap credit is 2524 GL. Importantly, the table also shows that it will take at least seven or eight years for the cap credits and debits to reach the average of 2524 GL<sup>7</sup>. Should the register be reset, then it could be assumed that it may take a similar time to reach the new average. The Authority has provided no justification for resetting the cap register.

<sup>6</sup> The Water Audit Monitoring Report lags some time behind the review of cap implementation. The reports used are the latest available from the MDBA website.

<sup>7</sup> Total for each year was averaged to obtain 2524 GL

Moreover, resetting the cap credits and debits to zero will also affect the long-term management of water at a valley level. It means that the long term averaging is restarted, state management of allocations has reduced flexibility, and it reduces water availability to irrigators in the initial years of the new SDL compliance regime. The latter is of particular concern as it reduces reliability and impacts on property rights of irrigators. This could invoke risk assignment for reductions to reliability of entitlements in the Basin Plan and the Water Act 2007.

**Recommendation 16 – That the Authority ensures that the final Basin Plan Statutory Instrument rolls over existing cap credits and debits into the register of take to commence on 30 June 2019.**

For clarity, the NFF suggests the following amendment to the Proposed Basin Plan:

**Recommendation 17 – that Clause 6.09(6) is amended “When a register of take commences, the register of take for an SDL resource unit must record the closing cumulative cap credit or debit at 30 June 2019 as the opening cumulative balance of take”.**

## **9. Water Quality and Salinity Management Plan**

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The NFF notes that the existing Basin Salinity Management Strategy (Murray-Darling Basin Authority, 2001) has operated successfully for over a decade and with the strong support of the Basin states.

The BSMS has four objectives (Murray-Darling Basin Authority, 2008):

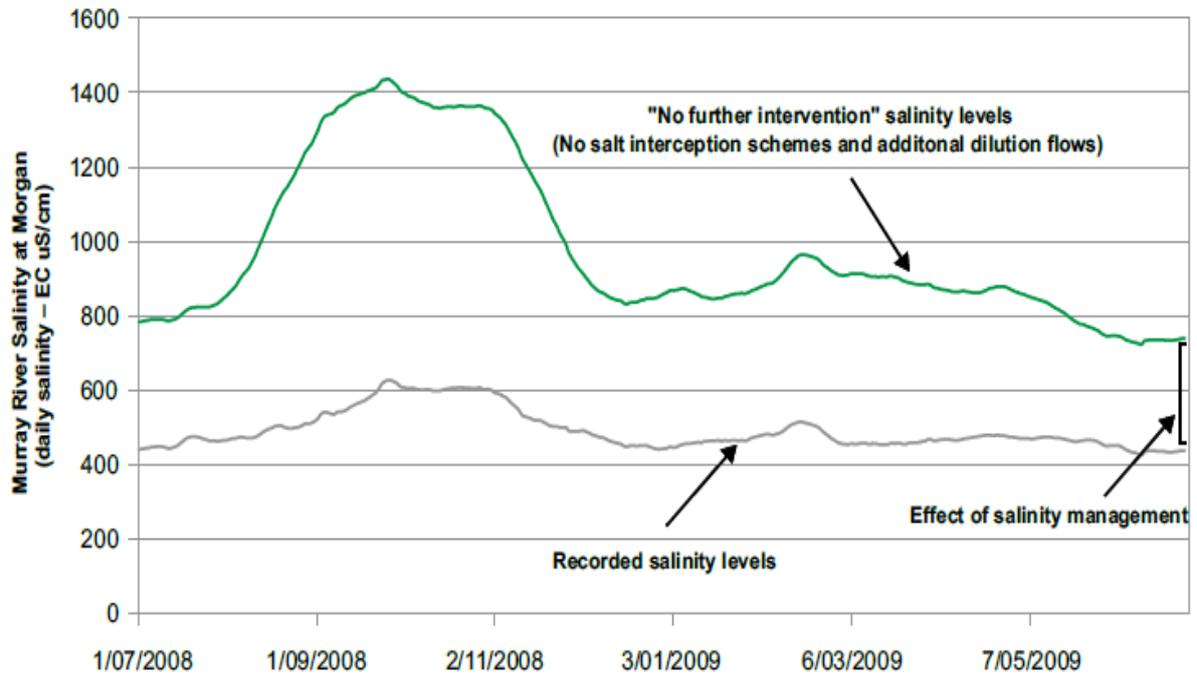
- Maintain the water quality of the shared water resources of the Murray and Darling Rivers for all beneficial uses – agricultural, environmental, urban, industrial and recreational;
- Control the rise in salt loads in all tributary rivers of the basin and, through that control, protect their water resources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

The BSMS focuses on a number of strategies including capacity development, value and asset identification, target setting, within valley tradeoffs, implementation of plans, farming system redesign, reforestation and vegetation management, salt interception works, and accountability.

The success of the BSMS (and its previous iterations) can be ascertained by the significant reduction of around 200 ECs between a “no further intervention” scenario and actual measured salinity at Morgan, as shown in

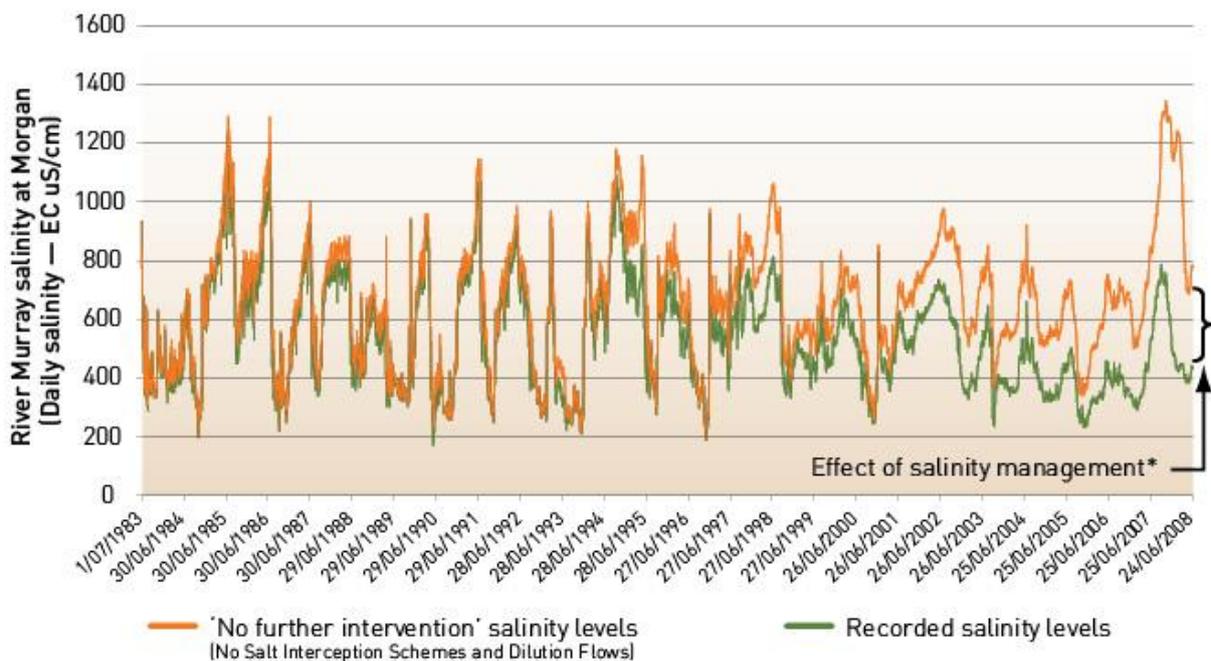
Figure 2 on the following page.

Figure 2 The effect of salinity management in the Murray-Darling Basin at Morgan, South Australia (daily salinity July 2008 to June 2009) (Murray-Darling Basin Authority, 2008, p. 5)



While the above figure shows the 2008-09 outcomes, Figure 3 below shows the long-term trend and the interventions that have enabled this outcome to be achieved, even through the drought.

Figure 3 The effect of salinity management in the Murray-Darling Basin — daily salinity levels, 1 July 1983 to 1 July 2008 (Murray-Darling Basin Authority, 2008)



In terms of other key indicators for water quality, Jennifer Marohasy analysed key water quality indicators (**Marohasy, 2003**) and showed that:

- Turbidity measured at Swan Hill and Morgan was relatively stable for the period 1978-2002 the exception being 1983 when drought breaking rains occurred;
- Phosphorous has been relatively stable since 1978 but shows more variability at Morgan than at Yarrawonga and Swan Hill, including a spike again in 1983/84; and
- Nitrate, while showing more variability than phosphorous, remains stable at Yarrawonga, Swan Hill and Morgan.

Given this has been a highly successful and well supported program, the NFF would question why there is the need to substantially change what has been a highly successful program.

**Recommendation 18 That the Water Quality and Salinity provisions (Chapter 8) in Statutory Instrument are replaced by provisions that reflect Basin Salinity Management Strategy.**

## 10. Water Trade Rules

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The water trade rules (Chapter 11) are of some concern. NFF seeks resolution in two areas. The first of these relates to the inclusion of the Australian Competition and Consumer Commission (ACCC) Water Market Rules within the Statutory Instrument. This has needlessly caused significant confusion and concern. As the ACCC rules are existing rules and managed separately, and never intended to be included in the Basin Plan, NFF seeks that these are removed.

**Recommendation 19 – That the final Basin Plan Statutory Instrument excludes clauses 11.27 – 11.35 in the Proposed Basin Plan relating to ACCC Water Market Rules for irrigation infrastructure operators.**

Furthermore, irrigation infrastructure operators are currently obliged to provide similar information to several different Australian Government agencies, such as the Bureau of Meteorology (BOM), NWC, Department of Sustainability, Environment, Water, Population and Communities (SEWPC), the Authority and Australian Bureau of Statistics (ABS). This information is in addition to the requirements of State Governments. It is highly recommended that the Australian Government in conjunction with State Governments determine a one-stop shop for the lodgement of water data for reporting requirements, including the data required and the format in which it is to be lodged.

**Recommendation 20 – That the Australian and State Governments determine a one stop shop for the collation of all water information from irrigation infrastructure operators.**

## 11. Australian Government

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Since the Australian Government has implemented the Water Act 2007 and the water recovery programs, the NFF has strongly advocated that there must be equal roll out of the purchase and infrastructure programs. To date, this is a major failing. There are several reasons for this, including the lengthy negotiation between the Australian Government and the States in relation

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<sup>8</sup> Turbidity measurement commenced at these sites in 1978 so earlier data is unavailable.

to agreed priority projects, the highly prescriptive Australian Government probity and procurement guidelines that reduced flexibility, the long time that infrastructure projects take to implement, and recent return to wet conditions across much of the Basin delaying implementation.

The result has been a purchase program that has expended around two thirds of the program funds, and infrastructure slowly rolling out. From an irrigator perspective, the initial implementation years saw only one option for farm level investment – purchase. It also alleviated financial distress caused from increased borrowings during the drought. NFF estimates that from now on, it will be increasingly difficult for the Australian Government to achieve its objectives as farmers opt to ride out any remaining drought debt with the return of production and cash flow. Moreover, this will mean that the purchase price for water will also increase in order to attract sellers. A concern of NFF is that the Australian Government will need to implement an exit strategy for the program in the shorter term and as acquisition program funds slowly dwindle. Such an approach is needed to ensure that the water market is not unduly affected by the withdrawal of the single biggest market participant.

**Recommendation 21 That the Australian Government determines an exit strategy for the purchase program and ensures that the water market is informed well ahead of time of this strategy.**

The NFF has continued to advocate for improved outcomes for delivering water recovery from infrastructure and other efficiencies. SEWPC has “pencilled” in 600 GL LTCE from water efficiency and infrastructure savings. This effectively means that 2150 GL or 78 per cent of the gap will be recovered from water purchases. Such an outcome is untenable for the social and economic well being of the Basin.

Contracted water to 31 January 2012 is 1329 GL LTCE (includes all recovery) which is 307 GL short of the local reduction SDL and is 48.3 per cent of the proposed total SDL reduction. Of this figure, 187.6 GL LTCE is infrastructure, 887.1 GL LTCE is purchases, with the remaining other recovery.

**Recommendation 22 The NFF calls on the Australian Government to seek to recover significantly more than 600 GL LTCE from infrastructure and other efficiency measures.**

**Recommendation 23 If the above recommendation requires additional funding, the NFF recommends that this be provided from new budget measures, or alternatively is sourced from the SDL gap contingent liability of \$320 million per annum already included in the Federal Budget from 2014-15.**

Undoubtedly, recovery from options other than purchased entitlement will deliver multiple benefits. Purchased water will only benefit the seller and the environment, effectively taking this water out of productive agricultural use, and at a time when the global environment for agriculture is positive and the future requires improved agricultural production to feed a world population of 9 billion. This loss in agricultural capacity needs to be offset by a research and development program aimed at improving the productive capacity of the remaining irrigation land and water. It will also aid in offsetting the reduced economic activity in the Basin.

However, agricultural research does take significant time to go from idea to implementation, e.g. for new grain varieties this process can take 10-15 years. Therefore, there will be some time delay prior to the beneficial effects being felt by the Basin’s community.

**Recommendation 24 That the Australian Government implements a research and development program aimed at improving the productivity of Basin’s irrigation land and water to offset the purchase of water from agriculture.**

## **12. Conclusion**

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While the premise of Basin Plan is largely supported by most sectors and indeed, many have sought certainty that the Basin Plan may deliver, the NFF supports a Basin Plan that balances social, economic and environmental objectives. The Draft Basin Plan does not meet this objective.

The NFF has made a number of recommended changes to the proposed Basin Plan that will improve the outcome for the Basin and those who live and work in it. The NFF has also made recommendations to the Australian Government to change its water recovery programs trajectories and to implement an R&D program to offset the impacts of water purchases.

The NFF welcomes further discussions with both the Authority and the Australian Government as the Basin Plan statutory instrument is finalised and presented to Parliament.

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## Attachment 1 – NFF Basin Plan issues, Authority response and NFF comment on the Authority response

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT
<b>General</b>					
			Does the draft Basin Plan go beyond what is required in the Water Act 2007, by requiring unnecessary conformity between State water management arrangements?	No. The draft Basin Plan is consistent with the requirements of the <i>Water Act 2007</i> (Cth).	Noted. No doubt this may be tested at law subsequent to the Plan being made.
			Does Schedule 2 in the Water Act 2007 require full cost recovery from water entitlement access holders to cover costs for the mandated monitoring and evaluation? What are the risks from the Basin Plan for duplication and increased transaction costs – for state governments but ultimately to entitlement holders as part of their water charges?	<ul style="list-style-type: none"> <li>Monitoring and evaluation in the Basin Plan sets obligations on states not on individual water entitlement access holders.</li> <li>The objectives of Schedule 2 of the Water Act are to promote the economically efficient and sustainable use water resources, water infrastructure assets and government resources devoted to the management of water resources; ensure sufficient revenue streams to allow efficient delivery of required services; facilitate the efficient functioning of water markets; give effect to principles of user-pays and to avoid perverse or unintended pricing outcomes.</li> <li>Costs will become clearer as more specific technical guidelines are developed. It is recognised that investment arrangements will need to be agreed between jurisdictions.</li> <li>The MDBA is working to ensure the implementation of the Basin Plan minimizes duplication and overlap with existing arrangements.</li> </ul>	While this response may be technically correct, ultimately the costs of the MDBA and States in management water will flow on to entitlement holders, including the Australian Government. Currently, the MDBA costs are passed on to water entitlement holders fully in NSW, partially in Victoria and Queensland and not passed on in South Australia (although new pricing arrangements are being established in SA so this may change).
			More generally, if there is sufficient codification of the review and subsequent adjustment to the SDLs, and there is sufficient codification that reliability of entitlement is enshrined and protected (how measured – perhaps against the existing water plan models), and if there is only voluntary acquisition of entitlement, what happens if the Government cannot meet the SDL gap? (Acknowledge that the AG will continue to acquire water over the longer term).	<ul style="list-style-type: none"> <li>The Commonwealth Government has undertaken to bridge the gap. Under clause 6.05 of the Legislative Instrument the SDL for a water resource unit cannot be finally determined until the gap has been bridged. Therefore SDLs cannot be enforced until the gap has been bridged, and thus failure of the Commonwealth to acquire enough entitlement will not impact on reliability of entitlements.</li> <li>Refer discussion under 6.15.</li> </ul>	Noted, however, the SDLs do commence through state water plans on 1 July 2019 (see 9.13(2)).
			Can state implementation of the Basin Plan impact reliability (despite undertaking)? If so, how can this be prevented?	Yes. This is a matter of the State. See discussion under 6.15.	NFF remains concerned that there is an ability to attenuate property rights through reliability and seek to have the relevant provisions strengthened.
			In delivering environmental water, can it be more strongly codified that the MDBA (and	<ul style="list-style-type: none"> <li>The MDBA along with all other environmental water managers will need to consider risks, including potential impacts on other parties,</li> </ul>	The provision does not provide any certainty to private

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT
			other holders of e-water entitlements) must avoid impacting on persons materially affected	and measures to minimise those risks when delivering environmental water (7.45).	landholders. NFF will seek stronger requirements to negotiate arrangements with private landholders rather than just “consider” the risk.
			If the 2015 review supports an adjustment upwards of the SDL, how can Parliament be compelled to pass this on (view that Parliament would pass a decrease but veto an increase). Need to understand what the Parliament’s powers are regarding future amendments to the Basin Plan regarding the SDL, i.e. can it veto amendments?	<ul style="list-style-type: none"> <li>Similar to the Basin Plan itself, any amendment to the Plan would be in the form of a legislative instrument which could be disallowed by Parliament. Accordingly, it would not be possible to compel Parliament to accept amendments arising out of the 2015 review process.</li> </ul>	The NFF will seek stronger codification of the 2015 review and that the Basin Plan implementation plan is embedded in the Basin Plan.
			Is conveyance water treated as consumptive use or as part of environmental use.	<ul style="list-style-type: none"> <li>Conveyance water is neither treated as a consumptive use nor considered as part of the environmental use.</li> <li>The Water Act (Section 86A(4)) defines conveyance water as the volume of water in the River Murray System required to deliver the volumes required to meet critical human water needs. The Basin Plan sets the volume of conveyance water to be an amount of 1596 GL per accounting period. This volume has been determined from observed losses within the River Murray System during years of low water availability and includes South Australia’s dilution flow of 696 GL plus river losses upstream from the South Australian border of 700 GL plus 150 GL of River Murray System storage losses.</li> <li>The Water Act defines consumptive use as the use of water for private benefit consumptive purposes including irrigation, industry, urban and stock and domestic use.</li> <li>Conveyance water is not considered as consumptive use as per the definition within the Water Act, however, water for critical human water needs is considered a consumptive use as per the definition within the Water Act. Only the consumptive use is considered part of the SDL (and not the conveyance water).</li> <li>The volume of water for critical human needs water is allocated from State shares from within the sustainable diversion limit, Conveyance water is also taken from state shares but does not form part of the sustainable diversion limit. This volume of water is then available to deliver the critical human water needs volumes during dry periods.</li> <li>More generally across the Basin only diversions for consumptive purposes are covered by the water use limited by the SDL.</li> </ul>	Noted.

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT
				Conveyance water is not limited by the SDL. Schedule 3 of the draft Basin plan describes the water covered under the Baseline Diversion Limit for each valley. The SDL provisions in Schedule 2 relate to these limits, less the amount required to be recovered.	
1	<b>Introduction</b>				
	3	<b>Interpretation</b>			
		1.07	<b>Definitions</b> Commercial plantation- could Lucerne be dragged into perennial woody plants? Is it prudent to suggest a clearer definition.	Suggestion noted, please include recommendations in formal submission.	Please ensure that the definition is amended.
		1.09	<b>Construction of provisions imposing obligations on States</b> <ul style="list-style-type: none"> <li>What is the implication of this clause on Basin States and conferring discretion on the Basin State to do a thing?</li> </ul>	This section is intended to preserve the operation of the provisions in the event they are found to be invalid or unenforceable. That is, if there is a provision that imposes an obligation that is inconsistent with a constitutional doctrine, then that obligation will read down as imposing a discretion rather than the provision being completely invalidated.	Noted
2	<b>Basin water resources and the context for their use</b>				
	S1	<b>Basin water resource and context for use</b>			
			<ul style="list-style-type: none"> <li>Update the two tables under 41 to reflect most recent GVIAP data, which has been released.</li> </ul>	The comments are noted and will be considered, along with other submissions, in any review or updating of Chapter 2/Schedule 1.	Noted
			<ul style="list-style-type: none"> <li>In assessment ecological health, S1 has also failed to acknowledge the positives, e.g. recovery of river red gums since December 2010 floods, i.e. it is all a negative story.</li> <li>The poor condition in lower catchments also reflects little investment over time in hydrometric measuring stations. Therefore, cannot entirely claim the condition of lower catchments is entirely due to river regulation and extraction, i.e. less capacity to measure, monitor and understand</li> <li>The condition of the CLLMM is also a strong reflection of poor local land management over a long period of time, e.g. over allocation of groundwater between CCLLM and Adelaide resulting in the loss of stream base flows, the diversion of SW drainage from the Coorong to the sea (now being changed). There is a need to complete the picture, not just paint part</li> </ul>	The comments are noted and will be considered, along with other submissions, in any review or updating of Chapter 2/Schedule 1.	Noted

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT
			<p>of the picture.</p> <ul style="list-style-type: none"> <li>The Sustainable River Audit (SRA) notes that the poor rating in most catchments was overwhelmingly due to alien fish species in upper catchments. Additional flows are not going to solve this issue, particularly carp. Moreover, the SRA sampling was undertaken in the worst drought in 300 years.</li> <li>Blue green algal blooms, while driven by low flows, are naturally occurring events in drought purely because of the low flows. Increased water in the system to resolve this will only “flush” the issue further downstream and over long river lengths.</li> <li>The watercourse diversion figures (p.127) is a coarse figure. It would be useful to have this split into the various diversion categories, e.g. town water supply, basic landholder rights (stock &amp; domestic), interception, irrigation, recreation, industry etc.</li> </ul>		
4	<b>The identification and management of risks to Basin water resources</b>				
2	<b><i>Risks and strategies to address those risks</i></b>				
		4.02	<p><b>Risks to the condition, or continued availability, of Basin water resources and consequential risks</b></p> <ul style="list-style-type: none"> <li>Vague description of the risks which may arise, open to interpretation.</li> <li>(2)(b) Whose water is required to maintain social, cultural, indigenous and public benefit values? How is ‘insufficient’ water for the environment deemed? If there is insufficient, even after the accumulation of 2750GL deemed to be the volume required, surely the responsibility for managing this insufficiency lies with Commonwealth use of CEWH water rather than a directive to Basin States?</li> </ul>	<p>This refers to the residential risk after the Basin Plan is implemented.</p> <p>Assessment of ‘insufficient’ water would be a matter for the Authority.</p> <p>Addressing this issue would be a matter for an amendment to the Basin Plan.</p>	Noted
			<b>Risks to the condition, or continued</b>		Comments noted

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT
			<p><b>availability, of Basin water resources and consequential risks</b></p> <ul style="list-style-type: none"> <li>• Draft Basin Plan Chapter 4, Part 2, 4.02 (1)(a) identifies ‘insufficient water available for the environment’ as a risk to the continued availability of water. Part 2, 4.02 (2)(a) goes on to say that a consequence of the above risk materialising would be insufficient water being available for consumptive and other economic uses in the Basin. Part 2, 4.03 then goes on to require strategies to be prepared to manage or address the risk.</li> <li>• The consequential nature of these clauses seems illogical. The Basin Plan is predicated on the idea that providing sufficient water to meet current consumption and economic uses means insufficient water is available for the environment. Logically, therefore, providing ‘sufficient’ water for the environment will lead to insufficient water being available for current consumptive and other economic uses, based on current development levels across the Basin.</li> <li>• So legally, what is the priority? If the risk in 4.02 (1)(a) materialises, then are the States legally obliged to manage or address the risk by providing more water for the environment?</li> <li>• Conversely, if insufficient water for environment also means insufficient water for consumption and economic uses, are the States obliged to address the consequence instead?</li> <li>• And what is the legal position if providing ‘sufficient’ water for the environment leads to insufficient water for consumptive and economic uses? Is there legal redress in this situation?</li> </ul>	<p>This risk is the residential risk after the Basin Plan is implemented.</p> <p>No; Basin Plan would need amendment.</p> <p>No; any work would inform Basin Plan amendment.</p> <p>This is not the purpose of this chapter.</p> <p>It deals with residual risks after the Basin Plan is fully effective and informs amendment process.</p>	

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT
			<ul style="list-style-type: none"> <li>What would be the legal benchmark to determine ‘insufficient’ water for consumptive and economic uses – is it the current level of development and therefore use when the Basin Plan is approved by the minister in late 2012? Or when the SDLs come into effect in 2019?</li> </ul>		
		4.03(3)(d)	<p><b>Strategies to manage, or address, identified risks</b></p> <ul style="list-style-type: none"> <li>Discusses the strategy of managing ‘flows’. What flows are being specifically referred to, is this relevant to the management of environmental water or all water in the Basin- including irrigation allocation. What implications does this have for those preparing the Water Resource plans and involved in the actual management of the river?</li> </ul>	The strategies listed in this section are those identified as assisting in the management of relevant risks. No implications for Water Resource Planning preparation.	Noted
		4.04	<p><b>Authority may publish guidelines</b></p> <ul style="list-style-type: none"> <li>What guidelines are currently being proposed (a number are referred to in the PBP)? What is the process for the development of guidelines? Will the MDBA be consulting?</li> </ul>	No guidelines are currently planned under 4.04. This clause sets out a requirement if guidelines are developed in this area in the future.	Noted
<b>5</b>	<b>Management objectives and outcomes to be achieved by the Basin Plan</b>				
			<ul style="list-style-type: none"> <li>Broadly, the management objectives do not provide a clear indication of the specific outcomes desired and leave much open to interpretation. How much weight do these broad objectives have in a legal sense when there are more detailed chapters on the watering plan, salinity and water quality etc also in the document?</li> </ul>	<ul style="list-style-type: none"> <li>The objectives and outcomes in this chapter are intentionally high level. Objectives and outcomes in chapters 7, 8, 9, and 12 include a greater level of detail. To increase clarity on this matter, notes are present in relevant sections of chapter 5 directing readers the subsidiary objectives in chapters 7, 8, 9, and 12.</li> <li>The Basin Plan when made will be a legislative instrument and as such the interpretation provisions in the <i>Legislative Instruments Act 2003</i> (Cth) will apply. Section 13(1)(a) of the <i>Legislative Instruments Act 2003</i> states that the principles in the <i>Acts Interpretation Act 1901</i> (Cth) apply to the interpretation of legislative instruments. Section 15AA of the <i>Acts Interpretation Act 1901</i> provides for the use of the purpose or object of provisions in interpretation under section 15AA.</li> </ul>	Noted
		5.02(1)	<p><b>Management objectives and outcomes for the for the Basin as a whole</b></p> <ul style="list-style-type: none"> <li>Draft Basin Plan Chapter 5, 5.02 (1) says</li> </ul>	<ul style="list-style-type: none"> <li>Your views on the Commonwealth water purchase program are</li> </ul>	See NFF comments earlier on cost implications for entitlement holders.

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT
			<p>the Plan’s management objective is a healthy working Basin, including a healthy working environment, strong communities and a productive economy, through the integrated and cost-effective management of Basin Resources.</p> <ul style="list-style-type: none"> <li>• So, legally, could it be argued that the Government’s buyback approach is inconsistent with the integrated and cost-effective management of Basin Resources, because it undermines viability of integrated irrigation districts and the affordability and availability of water for high-value uses?</li> <li>• Similarly, are the monitoring and evaluation requirements mandated in ..... the most cost-effective approach?</li> </ul>	<p>noted. The MDBA will pass them on to SEWPAC for consideration. You may also wish to include your views in any formal submissions on the draft Basin Plan.</p> <ul style="list-style-type: none"> <li>• While the MDBA believes the requirements in Chapter 12 are cost-effective, these will be refined following comment received during the exhibition period. In addition, the Chapter provides mechanisms for flexibility on the detail to ensure the most cost-effective arrangements, such as the ability for MDBA to enter agreements with Basin States and Commonwealth agencies.</li> </ul>	
			<p><b>Management objective and outcomes for the Basin Plan as a whole</b></p> <ul style="list-style-type: none"> <li>• With a management objective for the whole Basin of strong communities and a healthy economy, how can the SDL reduction of 2750GL ensure that these objectives are met?</li> </ul>	<ul style="list-style-type: none"> <li>• The SDL has been set to ensure the long term health and viability of basin water resources and hence communities that rely upon a healthy river system.</li> </ul>	Noted
		5.02(2)(c)	<ul style="list-style-type: none"> <li>• “Improves water security”....how? (see 5.05 1.b.)</li> </ul>	<ul style="list-style-type: none"> <li>• The SDLs in Chapter 6 provide legal certainty about the share of water that is available for consumptive use (including groundwater and interception).</li> <li>• By requiring the southern Basin States to set aside water for critical human water needs and a reserve for conveyance water we will improve security to urban and domestic water users, especially in times of extreme low water availability.</li> <li>• Water security for all uses will be improved through the establishment of a planning framework across all groundwater and surface water uses for the entire Basin. The Basin Plan will result in water resource plans covering all Basin water resources which will be accredited for 10 year periods.</li> </ul>	<p>Existing arrangements in all states prioritises water for urban and domestic water users in all years, not just low water availability years. The Basin Plan is unlikely to change this hierarchy of access.</p> <p>Water plans currently cover most of the Basin’s surface and groundwater systems – the Basin Plan will not in itself aid planning – it changes the existing framework.</p> <p>NFF remain perplexed as to how the Basin Plan will improve the</p>

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT
					security for all users against business as usual (i.e. arrangements in place now). For example, in NSW 95% of the water extracted is covered by water plans, 90% in Queensland and 87% in South Australia (these figures are for the entire state not just the Basin – see NWI 2011 Biennial Assessment, p. 34-35)
			<ul style="list-style-type: none"> <li>What about “users” (who have statutory rights)?</li> </ul>	<ul style="list-style-type: none"> <li>Schedule 1 of the draft Basin Plan sets out the users of Basin water resources and the uses to which the Basin water resources are put. The uses include agricultural use, industry use, ecosystem use, community use, recreation and tourism use and indigenous use. Not all users of Basin water resources have statutory rights in relation to water (eg many users of water for tourism and recreational purposes).</li> </ul>	Agree, but property rights are held by water entitlement holders which underpin financial borrowings.
			<ul style="list-style-type: none"> <li>Is it legally relevant that the proposed Sustainable Diversion Limit, if achieved primarily through continued general buyback tenders as favoured by the Federal Government, will undermine water security for irrigation by reducing the total volume of water available for irrigation, trade and carryover by up to 30%? Scarcity and therefore insecurity of adequate supply would be acute during drought years with low allocations.</li> </ul>	<ul style="list-style-type: none"> <li>Your views on the Commonwealth water purchase program are noted. The MDBA will pass them on to SEWPAC for consideration. You may also wish to include your views in any formal submissions on the draft Basin Plan.</li> </ul>	Please take this as part of the NFF submission.
		5.03	<p><b>Management objectives and outcome in relation to environmental outcomes</b></p> <ul style="list-style-type: none"> <li>(1) (a) What legal emphasis does “protect and restore” have?</li> <li>(2) Suggestion for ecosystems to be referred to as ‘resilient ecosystems’ rather than ‘healthy’ ecosystems.</li> </ul>	<ul style="list-style-type: none"> <li>In the context of the Basin Plan, ‘protect and restore’ refers to retaining or improving the ecological character and ecosystem functions of a site, such as connections along rivers and between rivers and wetlands, end-of-system water quality and flow, habitat diversity and food webs.</li> <li>Your comment on ecosystems is noted. You may wish to include your suggestion in a formal submission.</li> </ul>	Please take this as part of the NFF submission.
			<ul style="list-style-type: none"> <li>Australia’s obligation for RAMSAR wetlands is to maintain the listing condition. Yet it would appear that the</li> </ul>	<ul style="list-style-type: none"> <li>The Murray-Darling Basin Authority will ensure its activities are undertaken in accordance with the RAMSAR Convention. It will endeavour to facilitate improved management of RAMSAR sites and</li> </ul>	Noted.

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			PBP is proposing to improve? Is this correct and if so why?	maintain their ecological character, through the implementation of the proposed Basin Plan.	
		5.05	<p><b>Management objective and outcomes in relation to long-term average sustainable diversion limits</b></p> <ul style="list-style-type: none"> <li>(1)(b) How will the management objective provide greater certainty for all users? For consumptive water users, improved certainty will not be clearly provided. The total number/volume of water entitlements will merely be held by a difference user (the CEWH)- as such, certainty around entitlement or allocation should not materially change.</li> <li>(c) In proving time for communities to adjust to change- does this influence the actions of the CEWH and the acquisition of irrigator entitlement through either direct buyback or infrastructure investment?</li> <li>(2)(d) In what manner can Basin plan management occur which can ensure entitlement holder and communities are better adapted to a future with less water- where can the support in the document be found? Does this place a requirement on the Commonwealth to provide specific assistance?</li> </ul>	<p>maintain their ecological character, through the implementation of the proposed Basin Plan.</p> <ul style="list-style-type: none"> <li>(1)(b) Greater certainty for all water users will also be provided by the comprehensive planning framework covering the whole of the Basin described in the response to your question about 5.02(2)(c).</li> <li>(1)(c) The Authority is proposing that SDLs in the Basin Plan should not be enforced until 2019. The 2019 commencement date will give communities time to adjust to the new arrangements; and for the Commonwealth to meet its commitment to bridge the gap through purchase of entitlements and investment in infrastructure at a steady and measured pace.</li> <li>While the Basin Plan itself does not specify the method and rate of water recovery, the Australian Government has committed to this approach.</li> <li>The purpose of the Basin Plan is to provide for the integrated management of basin water resources.</li> <li>Government policies and programs to support communities in the implementation of the Basin Plan and broader water reform initiatives in the Murray-Darling Basin sit outside the scope of the Basin Plan. The Department of SEWPac and Department of Regional Australia should be contacted for information on these policies and programs.</li> <li>There is discussion on the options for managing the transition in chapter 7 of the report <i>Socioeconomic analysis and the draft Basin Plan- Part A</i>.</li> </ul>	Noted – see earlier comments and the submission proper.
		5.05(2)(d)	<ul style="list-style-type: none"> <li>Says ‘communities better adapted to reduced water availability’ will be a management outcome from water recovery measures. Is there a legal issue if the Government’s buyback approach makes it harder, rather than easier, for communities to adapt? For example, targeting high reliability entitlements disproportionately undermines the viability of high-value</li> </ul>	<ul style="list-style-type: none"> <li>Your views on the Commonwealth water purchase program are noted. The MDBA will pass them on to SEWPAC for consideration. You may also wish to include your views in any formal submissions on the draft Basin Plan.</li> </ul>	Noted

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT
			irrigation industries and disproportionately reduces the total volume of water available for irrigation, trade and carryover in drought years with low allocations.		
		5.06	<p><b>Management objectives and outcomes in relation to the trading of tradeable water rights</b></p> <ul style="list-style-type: none"> <li>There appears to be confusion about the role of MDBA in water trading and whether this conflicts with the roles of SEWPC, BOM and others. For example, why is the MDBA proposing to minimise the transaction cost of trades through good information, compatible registers, regulatory and other arrangements. Suggest that this is not the MDBA's function but BOM, SEWPC and State agencies.</li> </ul>	<ul style="list-style-type: none"> <li>Transparent, publicly available information is an important contributor to achieving an efficient and effective market. The MDBA will be working with state and Commonwealth agencies on the collection, presentation and dissemination of information required under the water trading rules in order to minimise duplication and overlap between the different functions of government agencies.</li> </ul>	Noted
<b>6</b>	<b>Water that can be taken</b>				
	<b>2</b>	<b><i>Long-term average sustainable diversion limits</i></b>			
		6.04-6.05	<p><b>Set out the Sustainable Diversion Limits, as detailed in Schedule 2 of the draft Plan where water recovery is specified in gegalitres</b></p> <ul style="list-style-type: none"> <li>Further, 6.05 (4)(b) expressly says the water must be 'held' water or water available under an access right converted into planned environmental water.</li> <li>Does this mean legally that the States must reduce diversions by the set volumes of water by 2019, regardless of whether environmental outcomes equivalent to all or some of the water being applied, can be achieved instead through other measures such as environmental works, improved river operations, or improved catchment management and invasive species control?</li> <li>Can this section be rewritten to allow flexibility in the water recovery volumes if the same environmental outcomes can be achieved in other ways?</li> </ul>	<p>SDLs do take effect from 1 July 2019. However, if environmental outcomes can be achieved through other measures such as environmental works, improved river operations, or any other matter, adjustment to the SDL can occur under clauses 6.06, 6.07 and an associated amendment to the Basin Plan.</p> <p>Given that this process can accommodate changes to SDLs as a result of any type of activity we believe that this provides flexibility while remaining within the requirements of the Act.</p>	These comments do not provide any surety that these other water recovery measures will be counted towards the SDL. The NFF has made specific comments about amendments to the statutory instrument that may aid clarification and ensure delivery of the policy outcomes espoused by both the Australian Government and the Authority.

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT
		6.05	<p><b>SDL resource unit shared reduction amount</b></p> <ul style="list-style-type: none"> <li>Shared reduction purely listed as a volume which needs to be acquired, no management requirements or outcomes are articulated.</li> <li>Why have some catchments in the North been excluded from contribution to the Northern Basin zone shared reduction volume? What if there is the capacity for contribution/irrigator led proposal?</li> </ul>	<p>The environmental watering plan described in Chapter 7 includes overall environmental objectives for water dependent ecosystems and arrangements to coordinate environmental water use across the Basin, aiming to maximise the benefits/efficiency of environmental water. The Commonwealth Environmental Water Holder is responsible for managing the Australian Government's water holdings and must manage this water in line with the objectives and framework of the environmental watering plan.</p> <p>The Gwydir, Paroo, Warrego and Nebine SDL resource units have been excluded from contributions to the northern Basin shared reduction volume because of their low hydrologic connectivity. A future proposal that would result in a worthwhile contribution could be dealt with through clauses 6.06, 6.07 and an associated amendment to the Basin Plan.</p>	<p>The NFF reiterates that the response reflects water only outcomes not the best outcomes targeted to relieve the identified environmental issue. This may be water only, water in concert with other non-flow measures or non-flow measures alone.</p> <p>Comments noted.</p>
		6.05(4)	<ul style="list-style-type: none"> <li>This would appear to codify that contributions to the shared volume occur only after the local catchment reduction is exceeded (or met). Does this assist or hinder us? This would appear to support that if there is an upfront lower starting point, that might justifiably be the local SDL reduction volume.</li> </ul>	<p>Yes. Contributions to the shared reduction volume can only occur after the local reduction amount is exceeded. However this only relates to the recovery of water. The environmental watering plan will coordinate the use of environmental water (including the water recovered to date) and establish priorities between local catchment and downstream environmental watering.</p>	<p>Noted</p>
		6.06	<p><b>Authority may express its view in relation to possible adjustments to SDL's</b></p> <ul style="list-style-type: none"> <li>What legal standing does the Authority have to see its view regarding the reduction in the SDL's actually implemented. What is the purpose of the Authority expressing its views if the findings cannot be incorporated into the Basin Plan?</li> </ul>	<p>The legal standing of the Authority's views in relation to amending SDLs in the Basin Plan is established through the Authority's roles and responsibilities set out in the Act. The purpose of this clause is to ensure proposals to adjust SDLs are dealt with in an open and transparent way.</p>	<p>See the NFF submission.</p>
			<ul style="list-style-type: none"> <li>Not codified enough, i.e. "the Authority may express its view" as against "the Authority must ...". Although this is rather bizarre wording.</li> </ul>	<p>The Authority's view is that the wording is appropriate.</p>	<p>See the NFF submission.</p>
		6.07	<p><b>Review of SDLs in 2015</b></p> <ul style="list-style-type: none"> <li>Suggestion for the removal of 6.07 Reviews of SDLs in 2015. There will not be sufficient certainty provided to irrigators with a review of the Basin Plan</li> </ul>	<p>The 2015 Review of the SDL is considered a significant milestone in progressing toward the implementation of the SDL, particularly with respect to potential adjustment to the SDL resulting from activities consistent with 6.06.</p>	<p>See the NFF submission.</p>

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT
			coming in three short years after the legislation is intended to be cleared in parliament. An alternative is for an audit of environmental works and measures achieved to be carried out and an assessment of the accreditation of offsets.	Current wording of 6.07 provides the Authority sufficient flexibility to deal with projects that may present SDL offsets while ensuring the Authority's roles and responsibilities are performed consistent with the Act.	
			<ul style="list-style-type: none"> <li>Can the 2015 MDBA review be more strongly codified to ensure that the review is undertaken and must lead to SDL adjustment under 6.06, e.g. at 6.07(3) perhaps the addition of (c) Should the Authority determine that the SDL are to be adjusted, the Authority must prepare an amendment to the Basin Plan by XXX? This cannot be left to the "note" where it states that the "Authority may prepare and amendment".</li> </ul>		See the NFF submission.
<b>4</b>	<b><i>Method for determining compliance with the long-term annual diversion limit</i></b>				
		6.09(6)	<b>Register of take</b> <ul style="list-style-type: none"> <li>Reject the zeroing of the credits and debits balance from cap management. Will lead to perverse outcomes (States might increase take between now and 2019 to ensure this is zero in 2019). Has third party impacts. Will dis-benefit states that have used less water than allowed. Will also disadvantage farmers recovering from drought? Any MDB cap credits &amp; debits must be rolled into the new register from 2019.</li> </ul>	<p>There is a fundamental difference between the Cap and SDLs. For example, the Cap was introduced to limit further growth in diversions whereas SDLs are required to be set at a level that is environmentally sustainable. Because of this difference the Authority's view is that it is not appropriate to roll over Cap balances when SDLs come into effect in 2019.</p> <p>Regarding the statement that zeroing of credits might lead to States increasing take to ensure Cap credits are zero in 2019, the Authority believes it is unlikely that States would be able to significantly increase take and reduce credits because of the constraints of their existing water plans and water management law.</p>	See the NFF submission.
		6.11(1)	<b>Calculation of annual permitted take and annual actual take</b> <ul style="list-style-type: none"> <li>Will permitted take be climatically adjusted?</li> </ul>	The quantity of water permitted to be taken in an SDL resource unit must be determined consistently with the method used to determine the long-term annual diversion limit. The method is likely to include adjustment for climatic conditions for the majority of permitted surface water take.	Noted
		6.12(4)	<b>Record the difference between annual actual take and annual permitted take</b> <ul style="list-style-type: none"> <li>Does this mean that under use from one year is added to the subsequent year's available water or permitted take?</li> </ul>	Compliance is determined by reconciling actual and permitted take within a given water accounting period to form a cumulative balance and then adjusting that balance to account for the buying and selling of environmental water. The adjusted balance is reconciled against the SDL for the resource unit. If there is a cumulative debit (adjusted to take into	Noted

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT
				<p>account any buying and selling of environmental water) equal to or greater than 20% of the SDL, and the Basin state does not have a reasonable excuse for this, the SDL resource unit is non-compliant.</p> <p>Under use as reflected by an accumulated credit in the above arrangements does not mean that this amount will be directly added to available water of permitted take in the following year. Available water and permitted take are determined by the accredited water resource plan. However accumulated credits can offset a year when actual take is higher than permitted take.</p>	
5		<b>Allocation of risks in relation to reductions in water availability</b>			
		6.14	<p><b>Risks arising from reductions in diversion limits</b></p> <ul style="list-style-type: none"> <li>For the purposes of risk assignment, if the MDBA is working from a different set of numbers to those in interim or transitional water plans (i.e. BDL&gt;SDL Vs water plan), what is the effect on entitlement holders? Free hit?</li> </ul>	The Basin Plan BDLs are based on existing state water plans. Therefore there are no hidden impacts on entitlement holders.	Noted. However, with no model runs released to provide clarity and transparency, this remains of concern.
		6.15	<p><b>Risks arising from other changes to the Basin Plan</b></p> <ul style="list-style-type: none"> <li>while this clause indicates that nothing in the plan requires a change to the reliability of entitlement, what would occur if the reduction listed in the Basin Plan are not acquired before 2019- would there be implications on the State government (and in effect water users) as the developers of the water resource plans if the SDL reduction has not been met by 2019?</li> </ul>	The Commonwealth Government has undertaken to bridge the gap	See previous comments.
			<ul style="list-style-type: none"> <li>The undertaking that the BP will not change reliability must be more strongly codified.</li> </ul>	The clause reflects the policy that the Basin Plan must identify changes to reliability referred to by Subdivision B of Division 4 of Part 2 of the Act. The legislative Instrument has been carefully drafted to ensure this outcome. The Authority's view is that the current wording is clear.	See the NFF submission.
			<ul style="list-style-type: none"> <li>What happens if the states, in implementing the BP, affects reliability? How can this be measured, particularly if the MDBA is using different models to those which determined the existing water resource plans?</li> </ul>	If a state were to make a water resource plan which affected reliability of entitlements, in a way not required by the Basin Plan, that would be a matter for the particular state. Measurement of the change would presumably be done by comparing the status quo with results of a model with the new rules.	See the NFF submission.

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	S2		<b>Matters relating to surface water SDL resources units</b> <ul style="list-style-type: none"> <li><i>The limit is the BDL minus 18GL per year (local reduction amount) minus the SDL resource unit shared reduction amount.</i></li> <li>When will a reduction target actually be met when the target is theoretically unknown (as the shared reduction amount has not been apportioned?) Suggest that “minus the SDL resource unit shared reduction amount” be removed from the schedule. This statement is too open-ended and unclear as the actual volumes of water which is required to be recovered.</li> <li>Should these listed reductions not be met by 2019 when the new SDL is introduced, what are the implications for the State government? Despite the clause stating that the reliability of entitlement will not alter, would this force Basin States to either acquire water directly/place restrictions on allocation/alter the reliability of the system?</li> </ul>	<p>The actual total volume which is required to be recovered is clear. It is a reduction of 2750 GL/yr from the baseline diversion limits. This includes two shared reduction amounts. Once each shared reduction amount has been recovered, it will be clear how the amount is distributed across SDL resource units.</p>	Noted
7			<b>Environmental watering plan</b> <b>Draft Basin Plan Chapter 7 and Schedule 7</b> <ul style="list-style-type: none"> <li>Schedule 7 sets out intermediate and longer term targets to measure progress towards the Plan’s environmental objectives.</li> <li>The intermediate target requires no further environmental loss or degradation up to 30 June 2019. The longer term target requires improvement in various indicators, such as connectivity, the Murray mouth opening regime and water-dependent plant, animal and bird species.</li> <li>The legal question is: are the targets legally binding and if so, what is the benchmark against which these targets will be measured?</li> <li>For example, is it the Basin’s</li> </ul>	<p>Targets are not mandatory (please see section 7.07). A baseline will be determined as part of guidelines to be developed for the BP Monitoring &amp; Evaluation Program (Ch.12) and will take practical considerations into account (eg: data availability). MDBA will consult on development of Guidelines (which may identify baselines) before publish them.</p> <p>Section 7.08(c) requires that the Authority must have regard to climatic conditions when assessing the progress towards objectives in Part 2.</p>	Noted

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			<p>environmental condition as of the Plan’s approval in, say, late 2012? Is it the Basin environmental condition during the last 10 years of drought?</p> <ul style="list-style-type: none"> <li>• If the plan sets legally binding targets, are the MDBA and the Government obliged legally to identify the benchmark against which compliance will be measured?</li> <li>• What is the legal position if the Basin returns to drought between 2012 and 2019, and environmental health unavoidably declines from its current excellent condition after 18 months of wet conditions?</li> <li>• If the objectives or targets set out in chapter 7 and Schedule 7 are not met, who is legally responsible for actions to meet the targets?</li> <li>• If meeting the targets requires more water to be recovered than the 2750GL mandated in Chapter 6, but the States and Commonwealth cannot change the SDLs accordingly, is there a legal liability for non-compliance with the environmental targets?</li> </ul>	<p>The objectives in Chapter 7 are for the water dependant ecosystems of the whole Basin and are general rather than specific. They guide environmental watering and are a basis for reviewing Environmental Watering Plan (EWP) every five years. They do not seek to create a compliance test for any specified party. Therefore MDBA will seek to work co-operatively with all parties to ensure that/their objectives are met.</p> <p>Section 7.07 (b) states that if a target is not achieved, this does not mean in itself that a person has acted inconsistently with EWP.</p> <p>The degree to which targets are achieved will be relevant consideration when the Environmental Watering Plan is reviewed (five yearly).</p>	
			<ul style="list-style-type: none"> <li>• In ensuring that international agreements have been met, is there a liability transferred to the State government as a component of the development of their water resource plans?</li> <li>• Opening of the Murray Mouth (7.05 (3)(d)) must be at frequencies to ensure that there is sufficient tidal exchange to maintain the Coorong’s water quality. Will this be influenced by political calls for the mouth of the Murray to be open nine years out of 10?</li> <li>• A number of objectives with Chapter 7 are rather subjective, does this make the achievements against the Basin Plan</li> </ul>	<p>The Environmental Watering Plan does not specify that international agreements be met and therefore a liability will not be transferred onto state governments.</p> <p>The tidal exchange to maintain the Coorong’s water quality will be influenced by scientific knowledge and data.</p> <p>As the Basin Plan is a disallowable instrument, it can be disallowed by either house of the Commonwealth Parliament.s.</p> <p>If the term ‘challenge’ refers to legal challenge, NFF should obtain independent legal advice.</p>	Noted

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT
			objectives easier or more difficult to challenge?		
	2	<b>Overall environmental objectives for water-dependent ecosystems</b>			
		7.04(2)(c)	<p><b>Protection and restoration of water dependent ecosystems</b></p> <ul style="list-style-type: none"> <li>What does “support episodically high ecological productivity and its ecological dispersal” mean?</li> </ul>	This refers to ecosystems which may be dormant for considerable periods but which, when wetted, have very large/huge productivity which is important in a wider context.	Noted
			<ul style="list-style-type: none"> <li>What is the requirement regarding water quality, i.e. are the targets and or objectives aspirational or mandatory? Is the MDBA able to provide a comparison over recent years to whether these can be met if mandatory? How is the monitoring to be done, i.e. any given measurement might trigger action under the BP (e.g. CHWN Tier 3 provisions). Is it reasonable, given that there are many causes of water quality and salinity and not all is related to water volume, timing?</li> </ul>	<p>Please refer to answers on objectives and targets in Chapter 7 which are set out above.</p> <p>Monitoring methods will be determined as part of guidelines to be developed for the BP Monitoring &amp; Evaluation Program (Ch.12), referred to above.</p>	Noted
		7.06(5)	<p><b>Ensuring water dependent ecosystems are resilient to risks and threats</b></p> <ul style="list-style-type: none"> <li>How will the MDBA mitigate impacts from poor management of environmental water application? This must not be used to affect consumptive use, e.g. black water events to avoid degraded water quality.</li> </ul>	The principles and methods in Parts 5, 6 and 7 of Chapter 7 address this.	Noted
		7.06(6)	<ul style="list-style-type: none"> <li>How will the MDBA minimise habitat fragmentation? Does this refer to aquatic, terrestrial or both?</li> </ul>	<p>Basin States and MDBA will work to produce Water Resource Plans (WRPs), Long Term Watering Plans (LTPs) and Basin annual priorities. This planning framework will work towards achieving all the objectives of the EWP, including minimising fragmentation of water-dependent habitat (i.e. aquatic habitat).</p> <p>Environmental water managers, including the MDBA, will help to minimise habitat fragmentation through the application of environmental water. All objectives in the EWP relate to water dependent ecosystems, consistent with the requirements of the Water Act. Please refer to Section 7.27 (b).</p>	Noted

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT
	3	<b>Targets by which to measure progress towards objectives</b>			
		7.07(1)	<b>Targets by which to measure progress</b> <ul style="list-style-type: none"> <li>The reference to Schedule 7 appears before Schedule 5 in the chapter. Should the two be change around?</li> <li>See comments in S7 re targets.</li> <li>Do the objectives (7.03-7.06) trump the targets set out in S7?</li> </ul>	<p>Noted, thank you. We will advise the drafters.</p> <p>Please see answers above regarding objectives and targets.</p>	Noted
	4	<b>Environmental management framework</b>			
			<ul style="list-style-type: none"> <li>What happens if the State water plans deliver the same outcomes using less water. Can the SDL be adjusted upwards?</li> </ul>	<p>There will be a review of the SDLs in 2015 that will allow for an evaluation of the current proposed SDL's. Any change to the SDL would require a change to the Legislative Instrument.</p>	Noted
		7.13	<b>Identification of e-water requirements</b> <ul style="list-style-type: none"> <li>Says long term environmental watering plans must identify 'priority' environmental assets, and their watering requirements.</li> <li>A 'priority' asset is one that can be managed with environmental water (Part 5, 7.27 (b)).</li> <li>But the targets in Schedule 7 apply to both 'assets' and 'priority assets', so is this a legal requirement to meet the targets for assets, even if they are not covered by an environmental watering plan that identifies their watering needs?</li> </ul>	<p>Schedule 7 refers only to 'priority environmental assets'.</p> <p>Please refer to the answers above re Objectives and Targets.</p>	Noted
		7.25	<b>Authority must prepare Basin annual environmental watering priorities</b> <ul style="list-style-type: none"> <li>What are the <i>Basin annual environmental watering priorities</i>? Authority modelling to develop the SDL should logically be used as a basis to inform these priorities.</li> </ul>	<p>Basin annual environmental watering priorities are priorities the Authority will publish, (please refer to Section 7.25) that set out, at a Basin Scale, the priorities for environmental watering on an annual (or more frequent basis, as required). These priorities will be informed by a range of information, including the work undertaken to identify the environmental sustainable level of take (ESLT).</p>	Noted
			<ul style="list-style-type: none"> <li>There is no date by when the MDBA annual watering priorities are to be set. States are required by 31 May but this leaves little time for MDBA. Will require significant consultation? Is the MDBA likely to run into any timing issues? Is it NFF's problem?</li> </ul>	<p>Thank you. We will give this further consideration. We are currently working with States to fine tune issues relating to timing.</p>	Noted
	5	<b>Methods for identifying environmental assets and ecosystem functions and their environmental water requirement</b>			

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT
		7.26	<p><b>Environmental assets and ecosystem functions database</b></p> <ul style="list-style-type: none"> <li>States the MDBA must establish and maintain a database identifying information about environmental assets and functions requiring watering.</li> <li>However, such a database will depend on the priority assets and functions identified in the Environmental Watering Plans yet to be prepared by the States.</li> <li>If the priority assets and functions have not yet been identified, then how will the MDBA measure compliance with the objectives and targets in Chapter 7 and Schedule 7?</li> <li>Does this mean that the Environmental Watering Plans will set the benchmarks against which progress will be measured?</li> </ul>	<p>Priority assets and functions are to be identified via State LTP that must be prepared by states and which must be provided to the Authority no later than 2 yrs after BP commencement (unless otherwise agreed). Reflecting this, reporting requirements for these matters under the BP Monitoring &amp; Evaluation Program will commence in 2015 (Item 10 &amp; 11, Schedule 10).</p>	Noted
		7.27-7.28	<p><b>Method for identifying e-asset/functions watering requirements</b></p> <ul style="list-style-type: none"> <li>Along with Schedule 5 and 6 set out the criteria determining an environmental asset that requires watering.</li> <li>In turn, the State environmental watering plans will determine how much and how often the asset needs water to meet the targets in Schedule 7.</li> <li>But if we still don't have a database identifying firstly the assets (including the number, location and extent of each asset) and environmental watering plans secondly identifying the water each assets requires to meet the targets, then on what basis were the SDLs calculated?</li> <li>Is there a legal inconsistency in mandating a level of water recovery (2750GL), but then mandating environmental targets for as-yet unidentified assets with as-yet undefined water needs?</li> </ul>	<p>The SDL's have been calculated by determining the ESLT. The following documents describe how the ESLT was determined:</p> <ul style="list-style-type: none"> <li>Proposed ESLT for surface water of the Murray-Darling Basin Method and Outcomes report link:</li> <li><a href="http://download.mdba.gov.au/proposed/ESLT_MDBA_report.pdf">http://download.mdba.gov.au/proposed/ESLT_MDBA_report.pdf</a></li> <li>'Hydrological modelling' fact sheet link: <a href="http://download.mdba.gov.au/proposed/FS_HydMod.pdf">http://download.mdba.gov.au/proposed/FS_HydMod.pdf</a></li> <li>'Proposed ESLT for surface water of the Murray-Darling Basin' link: <a href="http://download.mdba.gov.au/proposed/FS_ESLT.pdf">http://download.mdba.gov.au/proposed/FS_ESLT.pdf</a></li> </ul> <p>The SDL review and EWP reviews will be opportunities to reassess the ESLT. However, any change to the SDL will require a change in the legislative instrument and this would also be a disallowable instrument (please see answer above also).</p> <p>The Authority is confident that the draft Basin Plan complies with the requirements of the Water Act and is internally consistent. The NFF should consider obtaining own independent legal advice regarding any questions of legal inconsistency.</p>	Noted

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT
			<ul style="list-style-type: none"> <li>What if, having satisfied 7.27 and 7.28, it is found that the mandated 2750GL of extra mandated through the SDL is not enough to meet the mandated environmental targets for the priority assets? Does that mean legally that the 2750GL and SDLs must be revised to be consistent with the requirements identified in the watering plans under 7.27 and 7.28?</li> <li>The criteria in Schedule 5 is also so wide that every small wetland and every remnant vegetation patch will qualify as an asset in need of watering (indeed, possibly a 'priority' asset, as per point 10 above!).</li> </ul>	<p>Although the objectives relate to the water- dependent ecosystems of (the whole) Basin, it will not be possible to protect and restore all Basin's water-dependent ecosystems and it is recognised that not every site in the Basin can be actively watered. This is consistent with the Water Act.</p> <p>The Water Act requires a method for identifying assets that will require environmental watering. This implies that not every asset can be watered, even with a significant increase in environmental water.</p> <p>The term priority asset was included on the basis that not all sites that are identified by applying the criteria in schedule 5 and 6 could or should be watered. Deciding which asset is to be considered a priority is a matter for each Basin state in preparing LTPs (in partnership with other environmental water holders) when applying the method. It will also be considered by the MDBA when determining the Basin annual environmental watering priorities.</p>	
		7.27(b)	<ul style="list-style-type: none"> <li>How many assets are likely to be not an identified "priority asset" and therefore, unlikely to receive water?</li> <li>Which ones are likely to be priority? Are they identified already? Or does the list change annually?</li> </ul>	This will be determined through the process of states developing LTPs. LTPs can be amended if new information becomes available but are distinct from an annual process.	Noted
		7.28(b)	<ul style="list-style-type: none"> <li>Ditto for ecosystem functions?</li> </ul>	Please see immediately above.	Noted
			<ul style="list-style-type: none"> <li>What happened to the productive base – is this only a groundwater issue?</li> </ul>	Productive Base is relevant to both surface water and ground water. Meeting the ecosystem functions objectives will provide for the productive base. Appendix A page 192 of the ESLT report explains about the consideration of productive base and key environmental outcomes. This can be found at the following link. <a href="http://download.mdba.gov.au/proposed/ESLT_MDBA_report.pdf">http://download.mdba.gov.au/proposed/ESLT_MDBA_report.pdf</a>	Noted
		7.29	<p><b>Determination of the e-watering requirements of environmental assets and ecosystem functions</b></p> <ul style="list-style-type: none"> <li>In determining the water requirements of assets &amp; functions, there is no reference to the SDL. Good or bad?</li> <li>Need for feedback loop to adjust SDLs, particularly if outcomes can be delivered using less water.</li> </ul>	The ESLT work that underpins the SDL will be part of the database referred to in Part 5 and thus a feedback loop is created. However, we note that this could be made clearer and will instruct legal drafters accordingly.	Noted

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT
	6	<i>Principles and methods to determine the priorities for applying environmental water</i>			
			<ul style="list-style-type: none"> <li>To whom do these principles apply? (also relevant to Part (7) – MDBA, States, CEWH, SEWPC, any holders of environmental water?</li> </ul>	All parties identified by Sections 34 and 35 of the Water Act. These are: the Authority and other agencies of the Commonwealth (s34) and the Basin Officials Committee, an agency of a Basin State, an operating authority, an infrastructure operator or the holder of a water access right (s35).	Noted
		7.33(b)(ii)	<b>Principle 3 – Flexibility and responsiveness</b> <ul style="list-style-type: none"> <li>Is it good enough that the MDBA only “has regard to...persons materially affected by the management of environmental water”?</li> </ul>	Yes, the MDBA should take into consideration the views of persons materially affected by the management of environmental water. The MDBA is also of the view that it should be responsible for determining basin annual watering priorities consistent with its functions under the Water Act.	See the NFF submission.
		7.35(b)	<b>Principle 5- Likely effectiveness and related matters</b> <ul style="list-style-type: none"> <li>What are the limitations on the effectiveness and cost effectiveness of the application of environmental water?</li> </ul>	In Section 7.35 the word ‘limitations’ applies only to the effectiveness of environmental watering and refers to the likely improvement that environmental water will induce, noting that often environmental water will not be sufficient by itself to achieve a desired outcome.	Noted
		7.35(c)	<b>Principle 5- Likely effectiveness and related matters</b> <ul style="list-style-type: none"> <li>A number of concerns arise from the inclusion of this clause suggesting that an environmental water plan should take advantage of non-environmental water flows and releases from storage for consumptive use.</li> <li>Should this be allowed to occur, what will be the implications for consumptive water users. Does this principle place a requirement on which users will take precedence for the use of these flows?</li> <li>How does a resource availability scenario have an impact on the determination of watering priorities when the environmental watering plan? (Noting that an environmental watering plan can be consistently reviewed) How long a duration is expected to be achieved from an environmental watering plan- ie despite reviews which may occur, how long is the</li> </ul>	<p>This principle is consistent with existing practices, for example, the Victorian Northern River Sustainable Water Use Strategy identifies the use of consumptive water en route as an innovative way to achieve environmental benefits. Similarly, combining consumptive and environmental water can achieve additional benefits.</p> <p>The principle does not create any precedent.</p> <p>Resource availability is an assessment of how much environmental water is likely to be available, relative to antecedent conditions.</p> <p>Section 7.11 sets out how often LTPs must be updated. The Environmental Watering Plan must be reviewed every 5 years.</p>	Noted

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT
			watering plan anticipated to be used for initially?		
		7.36(a)	<p><b>Principle 6 – Risks and related matters</b></p> <ul style="list-style-type: none"> <li>• MDBA again only having regarding to...flooding private land, delivery impediments etc and measures to minimise the risk.</li> </ul>	The risk of flooding private land must be taken into consideration by the MDBA when implementing the environmental watering plan. Please refer also to Note 1 in 7.03 which states, <i>the fact that water storages and properties (including floodplains) are under the control of various persons will restrict the capacity to actively manage all water-dependent ecosystems.</i>	See the NFF submission. NFF notes that the “notes” are not part of the legal instrument but inform interpretation.
		7.36(c)	<ul style="list-style-type: none"> <li>• Is the concern about water in the river for environment being extracted perceived or real. Entitlements have conditions and are capped on how much water can be taken and sometimes when (flow rates etc). So why is this a concern. If it’s about theft, then what are the management mechanisms to prevent theft? Where is the COAG framework on this?</li> </ul>	The capacity to deliver environmental water to a particular priority environmental asset or priority ecosystem function may be limited by existing legislative or administrative arrangements.	Noted. The same applies to all entitlement holders and may not be just applicable to the environment.
	7	<b>Principles to be applied in environmental watering</b>			
		7.44	<ul style="list-style-type: none"> <li>• <b>Principle 3- Maximising environmental benefits</b></li> <li>• Focus once again on enhancing existing flow events and coordinating environmental watering with flows regulated for consumptive use. Obvious difficulties exist in this coordination where water orders are only placed by irrigators in the days before delivery is required.</li> <li>• Who is responsible for conveyance water, who is able to take their entitlement first?</li> <li>• What happens if there are losses suffered throughout the water delivery?</li> <li>• What responsibilities do this place on the resource manager to ensure delivery of all entitlements?</li> </ul>	We agree that there will be limitations in co-ordinating flows and these vary across the Basin. However, efficiencies are possible, particularly in the management of bulk flows. That is why this is a principle, rather than a mandated outcome. As a principle it does not override existing water management rules. (Please see also the reference to the rules review, below)	Noted
		7.44(b)(ii) and (c)	<ul style="list-style-type: none"> <li>• How will the MDBA account for the additional losses incurred in delivering water off river? Will this be borne by consumptive use or from e-water entitlements? In the Murray, the provisions for conveyance water would appear not to</li> </ul>	Environmental watering entitlements will be treated the same as all other water entitlements.	Noted.

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT
			include additional volumes for environmental water delivery? How is this to be accounted for?		
		7.45	<p><b>Principle 4 – risks</b></p> <ul style="list-style-type: none"> <li>In assessing the risks of delivery of environmental water, what is the impact of the extraction of environmental water for other uses. There is a need to protect existing arrangements where environmental water is re-used for consumptive use, particularly if this does not have the effect of offsetting the SDL requirement. The one example is Barmah Millewa forest outflows.</li> </ul>	<p>The risks will depend on the scenario and conditions. The impacts will need to be assessed according to the principles set down in Chapter 7.</p> <p>We anticipate this would be considered in the ‘rules review’ agreed to by State and Commonwealth Ministers.</p>	Noted. Any changes to rules must not result in third party impacts, including to entitlement reliability.
		7.45(b)	<ul style="list-style-type: none"> <li>What is mean by the “inadequate accounting of water flows”? Is this an issue?</li> </ul>	Accounting has evolved to service the needs of consumptive users. Accordingly it does not always apply effectively to environmental watering. This also relates to the previous question and response.	The use of water by the environment remains another “consumptive use”. There may be some challenges, however, any changes must comply with the principle to avoid third party impacts.
		7.51	<p><b>Principle 10- Other management and operational practices</b></p> <ul style="list-style-type: none"> <li>What requirements does this clause place on the state/MDBA- does it place a legal requirement for a review to occur?</li> </ul>	No, this is a principle only. Any change would need to be undertaken as part of water resource planning or the rules review.	Noted. See above comments.
			<ul style="list-style-type: none"> <li>Does this refer to the review of river operations? Or is this something additional? If this is part of the 2015 review then this should be removed from the Basin Plan provisions.</li> </ul>	See above	See above comments.
	<b>8</b>	<b><i>Planning for the recovery of additional environmental water</i></b>			
		7.53	<p><b>Planning for the recovery of additional environmental water</b></p> <ul style="list-style-type: none"> <li>Is this merely referring to the total volume of water which has already been flagged for recovery to meet the SDL, or is this in fact additional water. What is the legal interpretation of the clause?</li> </ul>	<p>Recovery of environmental water means the acquisition of a water access right for the purpose of achieving an environmental outcome.</p> <p>The term relates to one of the purposes of the Environmental Watering Plan set out in Section 28 of the Water Act.</p> <p>The clause relates principally to ensuring that held environmental water is held in the most appropriate form, security and location. Any change to the SDL would require a change to the Legislative Instrument.</p>	Noted

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT
			<p><b>Planning for the recovery of additional environmental water</b></p> <ul style="list-style-type: none"> <li>• This provides for additional environmental water recovery with recommendations to include priority areas, types of water and reasons (including modelling).</li> <li>• Could this be used to justify and increase to the SDL (i.e. further reductions) especially if the long term trends on environmental health remains in decline?</li> <li>• Could this be used by environmental NGOs to justify acquiring further water for the environment if consistent with s.7.53? Should this be rejected if consistent with market principles, i.e. willing sellers?</li> </ul>	<p>No. Any change to the SDL would require a change to the Legislative Instrument.</p> <p>Given the purpose this appears unlikely. The actions NGO's might take in the water market are unrelated.</p>	Noted
	<b>S7</b>	<b>Targets to measure progress towards objectives</b>			
			<ul style="list-style-type: none"> <li>• The immediate targets up to 2019- what is the baseline year from which there will be “no loss of or degradation in”?</li> <li>• Similarly for the longer term targets from 2019 – assumption that these longer term targets are from 2019 and the introduction of the reduced SDL as a baseline?</li> <li>• 7.07 indicates that the targets have been developed to measure progress towards achieving the objectives of chapter 7, however if they are not met it doesn't mean that a person has acted inconsistently with the environmental watering plan. Does this essentially make these targets aspirational?</li> </ul>	<p>The Baseline will be determined as part of guidelines to be developed for the BP Monitoring &amp; Evaluation Program (Ch.12) and will need to take practical considerations into account (eg: data availability). See previous answers on targets and baseline.</p>	Noted
			<ul style="list-style-type: none"> <li>• The intermediate targets (to 2019) require no change to current. However, although currently the environment is responding to recent flood events, do we know enough about the lag legacy effects of past management to ensure there will be no change. Suggest not.</li> <li>• It is the wrong paradigm to talk about system recovery or deterioration over any</li> </ul>	<p>In part these targets do take into consideration the lag effect, phase in of the SDL, etc. Notwithstanding this, we think this is an appropriate target.</p> <p>The Commonwealth Government has committed to bridging the gap via</p>	Noted

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT
			<p>5-10 years. Should be more about the long term risk profile (given resilience to drought/flood). The recent improvement may be regardless of the longer term trend.</p> <ul style="list-style-type: none"> <li>• The concern for NFF is, if conditions deteriorate (e.g. because its dry or drier or drought) what will the MDBA do before 2019 to increase flows, i.e. will they intervene or do they have the capacity to intervene?</li> <li>• Will there be adjustment to the SDL?</li> <li>• The schedule 7 targets are largely driven by the lowest common denominator. Is this relevant?</li> </ul>	<p>buyback and efficiencies and SDL's will have effect from 2019. Any change to the SDL would require a change to the legislative instrument (please see also answers above referring to Parliament's role in such changes.)</p> <p>We are not sure what is being asked here in relation to the lowest common denominator.</p>	
8	<b>Water quality and salinity management plan</b>		<p><b>Does the draft Basin Plan go beyond what is required by the Water Act 2007 by setting new standards for water quality and salinity across the Basin?</b></p> <p>The Water Act 2007 Part 2, Division 1, Section 25 requires a water quality and salinity management plan, including objectives and targets.</p> <p>The Basin's current salinity target is set out in the Basin Salinity Management Strategy 2001-2015. The target is to keep salinity at Morgan in South Australia at less than 800EC for 95% of the time over 15 years.</p> <p>The draft Basin Plan is consistent with this strategy in setting a target of 500mg/L salt at Morgan 95% of the time (Chapter 8, Part 4, Division 6, 8.18). All Basin States have agreed that meeting this target is cost-effective, achievable and practical.</p> <p>The draft Plan, however, goes much further by effectively setting new and additional standards to apply across the Basin for raw water for human consumption, irrigation water and recreational water. It also introduces three new salinity monitoring points with targets,</p>	<p>Section 25 of the Water Act requires that water quality and salinity targets be set. Section 25 also requires the Authority and the Minister to have regard for the National Water Quality Management Strategy (NWQMS) when setting water quality and salinity objectives and targets, and the Authority has done so. The Authority has also recognised the salinity targets adopted under Schedule B to the Murray-Darling Basin Agreement.</p> <p>The NWQMS provides guidance on procedures for determining water quality target values, on the environmental values (beneficial uses) of water, and through a set of factsheets provides guideline values for a very wide range of water quality characteristics.</p> <p>The Basin Plan establishes certain obligations regarding water quality and salinity targets.</p> <p>Firstly, operational decisions must have regard for certain target values (salinity operating targets, dissolved oxygen and the targets for recreational water quality). These targets will assist river operators and decision makers when planning water management within year or season, and for implementing actions to meet the target values, and by users to test the suitability of water for a specific use. However, failure to meet a target does not mean a person has acted inconsistently with the Basin</p>	See the NFF submission.

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT
			<p>downstream from Morgan.</p> <p>The Basin Plan’s raw water for human consumption target (Division 3, 8.13) is set at 500mg/L total dissolved solids (salinity), to achieve a ‘palatability’ (taste) rating of ‘good’. This compares with the Australian Drinking Water Standard 2011, which allows up to 600mg/L.</p> <p>Similarly, the draft Basin Plan is more stringent in requiring its target to apply to raw water, whereas the drinking water standard applies to <i>treated</i> water.</p> <p>The irrigation water quality target in the draft Plan for the northern Basin is set at 670mg/L; which is inconsistent with the raw water for human consumption target above. The irrigation quality target for the southern Basin is set at the same as for raw water human consumption.</p> <p>The problem is that some naturally salty catchments, such as the Loddon, will never be able to comply with Basin Plan’s standards. Similarly, the Basin Plan sets standards for three new monitoring points below Morgan without agreement with the States on whether the standards at these locations are practical, cost-effective and achievable.</p> <p>The Basin Plan’s salinity and water quality targets, along with the Sustainable Diversion Limits, are the only easily measurable, hard and fast targets in the Basin Plan – legally, could they become the proxy benchmarks against which progress towards environmental targets (schedule 7, see below) is measured?</p> <p>What is the legal remedy if these new and more stringent targets are not met? Whose water would be called on, if dilution is considered the appropriate remedy? Would it be from the environmental reserve or from the consumptive pool?</p> <p>And finally, is setting new standards of this</p>	<p>Plan, and the targets place no legal obligations for provision of dilution flow. With respect to salinity, modelling of post Basin Plan scenarios indicates the proposed salinity operating targets on the Murray will be achieved, while the target value on the Darling can be achieved in 90% of years rather than the proposed 95% of years. This value will be further reviewed. The additional salinity target location proposed at Murray Bridge is in line with recommendations from the Authority’s independent Salinity Auditor.</p> <p>Secondly, section 22(3)(f) of the Water Act establishes that water resource plans prepared by the states must include requirements in relation to water quality and salinity objectives. The Basin Plan implements this requirement through water quality management plans, as a component of the water resource plans. States in developing their Water Resource Plans may utilise locally derived water quality targets, and may use existing instruments and programs to meet this requirement.</p> <p>The Authority has met the requirements of the Water Act and has proposed standards that are either already recognised by the states through the NWQMS (and its underlying strategies), or in the case of salinity, are achievable (noting the lower Darling discussion above), and has not set new standards.</p> <p>The Australian Drinking Water Guideline value for a palatability rating of ‘good’ was revised by the National Health and Medical Research Council from 500mg/L to 600mg/L after the draft Basin Plan was finalised and this point of difference is noted.</p> <p>Irrigation salinity targets were set independently of drinking water considerations and were developed in consultation with the States, and in consideration of the crop types and soil conditions. The targets apply at irrigation district water supply offtake points. Catchments with elevated salinity are not utilised for irrigation district water supply.</p>	

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT
			nature across the entire Basin, without first determining if they are cost-effective, achievable and practical, legally inconsistent with the Water Act's requirement for integrated and cost-effective management of Basin Resources?		
			<ul style="list-style-type: none"> <li>Water quality objectives need to be consistent for all uses, as essentially we are taking about the same product of water.</li> </ul>	NWQMS recognises a range of environmental values (beneficial uses) for water, with differing water quality targets. A common objective of 'fit for use' applies.	See the NFF submission.
	<b>2</b>	<b><i>Key causes of water quality degradation in the MDB</i></b>			
		8.01	<b>Simplified outline</b> <ul style="list-style-type: none"> <li>Note states that the WQSMP must "have regard to" National Water Quality Management Strategy. What is the NFF position on this document, is it relevant, what was its intended purpose, is there a need to review it, what input did agriculture have in its formation?</li> </ul>		See the NFF submission.
	<b>3</b>	<b><i>Water quality objectives</i></b>			
			<ul style="list-style-type: none"> <li>Are the targets a snapshot in time or are the targets measured in trends/over what periods?</li> </ul>	Targets may be the prevailing water quality (for example, dissolved oxygen) or an annual average (nutrients) or modelled over a particular climatic sequence (Schedule B salinity targets).	See the NFF submission.
		8.05(c)	<b>Objectives for raw water treatment for human consumption</b> <ul style="list-style-type: none"> <li>Places greater weight on the quality of water than merely palatability. What parameters does this clause actually place on the quality of water for consumption?</li> </ul>	Drinking water may have both aesthetic related quality targets (such as salinity, taste, and colour) or health related (such as pesticide level, or toxin). Raw water quality targets apply to the water quality management plans that the states prepare. These plans would include actions to mitigate the risk of drinking water targets being exceeded should this be a specific risk in the relevant catchment.	See the NFF submission.
		8.06	<b>Objectives for irrigation water</b> <ul style="list-style-type: none"> <li>"Does not result in crop loss or degradation" is extremely subjective with different crops and soil types having differing tolerances.</li> </ul>	The targets apply in a 'best management practice' context. With increasing salinity, increased care is required in selecting crop and management alternatives if full yield potential is to be achieved. At higher salinity levels, there are likely to be soil and cropping problems or decreased yields.	See the NFF submission.
	<b>4</b>	<b><i>Water quality targets</i></b>			
		8.11	<b>Certain target values to inform operational decisions</b> <ul style="list-style-type: none"> <li>Basin Officials Committee must have regard to the targets in the Agreement relating to the management of water flows. What takes precedence, the Agreement or</li> </ul>	Clause 48 of the Agreement – water quality objectives formulated under the Agreement cease to have effect after the Basin Plan first takes effect.	See the NFF submission.

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT
			the Basin Plan?		
<b>9</b>	<b>Water resource plan requirements</b>				
			<ul style="list-style-type: none"> <li>The use of the “annual” versus the “average” is very confusing. Even after reading the Water Act 2007, while it does provide for “annual”, not really sure I understand it. Is it relevant to use “annual” if there is no temporary diversion provisions? Creates unnecessary confusion.</li> </ul>	<p>Section 22(1) of the Water Act specifies the matters that must be included in the Basin Plan. Items 6 and 7 are relevant to this comment. Put another way it refers to the average water use on an annual basis ( ie it is GL/y not GL/d or total GL )</p> <p>It is necessary to provide for ‘annual’ to ensure that it include the temporary diversion provision, even though the latter is zero.</p>	Noted
<b>2</b>	<b>Identification of water resource plan area and other matters</b>				
		9.09(1)	<b>Change in reliability</b> <ul style="list-style-type: none"> <li>Change in reliability must be strengthened to guarantee that there will be no change, i.e. codify much more strongly. Moreover, state implementation via water plans must guarantee no change to reliability.</li> </ul>	The Basin Plan is not requiring a change in reliability, but is not intended to prevent States making changes through their own water planning and management arrangements that may impact reliability.	See the NFF submission.
		9.09(2)	<ul style="list-style-type: none"> <li>How can this be implemented in practice?</li> </ul>	This provision will be implemented by careful development and assessment of water resource plans.	Noted
<b>3</b>	<b>Incorporation, and application, of the long-term annual diversion limit</b>				
		9.11(1)	<b>Identification of planned e-water and register of held environmental water</b> <ul style="list-style-type: none"> <li>On what basis is the planned environmental water estimated, e.g. long term average, long term annual (are these any different)? The register must identify all long-term average/annual volumes of planned water.</li> </ul>	This clause is flexible and is to be implemented according to the best available information – as such the planned environmental water may be identified by title and characteristic where it is not possible to estimate the volume. It is recognised that in some cases it will be very difficult to estimate the volume of planned environmental water.	Noted
		9.11(2)	<ul style="list-style-type: none"> <li>The register must include all planned and entitled environmental water and their long-term average/annual volumes.</li> </ul>	It is currently proposed that only held environmental water must be included in the register. The suggestion of expanding this to include planned environmental water is noted.	Noted. NFF highly recommends that planned water is included, and that all environmental water can be “converted” to a common volume, i.e. LTCE.
		9.12-9.19	<b>Take for consumptive use</b> <ul style="list-style-type: none"> <li>Take for consumptive use. Section needs to be re-written. If referring to TDP, then state this. If referring to SDL, state that rather than the “annual” etc.</li> </ul>	<p>The reference to ‘annual’ is these provisions include both the SDL and the temporary diversion provision (SEE s 22(1) items 6 &amp; 7)</p> <p>The MDBA is considering possible editing of these provisions to clarify understanding without changing the intention. In addition, it is intended that guidelines will be prepared to explain these and other provisions.</p>	Noted
		9.13(3)	<b>Maximum long-term annual average quantity of water that can be taken</b> <ul style="list-style-type: none"> <li>How can the plan demonstrate that take</li> </ul>	The plan will be required to demonstrate this using an objective method, most likely to be a model which includes assumptions of year to year behaviour of water users.	Noted

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT
			will not exceed the SDL. Will this place restriction on the volume of water, which can be allocated to consumptive use if inflows are excessive?	For surface water, this is required to model the historic period, 1895 to 2009 (see definitions section of the draft Basin Plan).	
			<ul style="list-style-type: none"> <li>Over what timeframe? For example, XX% over the time.</li> </ul>	Clause 9.13 is not intended to remove flexibility to manage overs and unders.	
		9.13	<p><b>Maximum long term annual average quantity of water that can be taken</b></p> <ul style="list-style-type: none"> <li>Why is there a “maximum” long-term annual average quantity of water if managing SDL compliance through a system of credits and debits. Does this remove flexibility to manage overs and unders, and ultimately lead to less overall long-term use?</li> </ul>	Clause 9.16 relates to annual allocations (ie where actual access to water is established for any given year).	
		9.16	<p><b>Annual allocations must be determined</b></p> <ul style="list-style-type: none"> <li>As water allocations must be determined consistently with the estimated volumes in 9.13, it seems like there is a clear restriction on the capacity for the upper limit of allocation.</li> </ul>	Clause 9.13 provides for the annual expression of the long-term average limit (SDL) using an objective method (such as modelling). Clause 9.16 specifies that the annual allocation must be made using a consistent method ( ie they have to be related but not necessarily the same ) such that the SDL is not exceeded. The intention to ensure that the resource is managed within the SDL. In many cases by 2019 this will be a lower limit than currently exists but this is not intended to reduce State’s flexibility to manage annual allocations taking account of water user behaviour and other factors.	Noted
		9.16(2)	<p><b>Annual allocations must be determined</b></p> <ul style="list-style-type: none"> <li>Does this provision reduce the states flexibility to priorities water according to its priorities (e.g. water to alleviate frost in citrus in winter Vs. e-flows Vs. town water supply Vs. reserves)?</li> </ul>	This provision is not intended to change the present system for determining allocations.	Noted
		9.19(5)	<p><b>Effects and potential effects on water resources</b></p> <ul style="list-style-type: none"> <li>Could this be used to bind coal seam gas operations in the MDB regardless of Water Act not covering the GAB?</li> </ul>	Only in so far as water use by those activities have impact on Basin water resources.	Noted
		9.20(2)(a)	<p><b>Determination of actual take</b></p> <ul style="list-style-type: none"> <li>Held environmental water sold into the consumptive use will affect entitlement holders who do not participate as their allocations will be held be to comply with</li> </ul>	This clause needs to be read in conjunction with Clause 9.17(2), which aims to ensure that the disposal and acquisition of held environmental water is accounted for in a way that does not alter the determinations made in accordance with 9.14 and 9.15 (ie the quantity of water allocated for consumptive use). Rules made under 9.17 will need to be consistent	Noted

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT
			the Basin Plan, i.e. reliability reduced overall. This is an individual gain but third party impacts. Can irrigators' claim compensation for the change to reliability that may arise?	with 9.20. 6.13(1)(a) is also relevant.	
	4	<b><i>Sustainable use and management</i></b>			
		9.22	<b>Priority assets &amp; functions – surface water</b> <ul style="list-style-type: none"> <li>• Could these provisions re surface water be used perversely, e.g. to allocate all winter/spring flows to environmental assets &amp; functions at the expense of consumptive use?</li> </ul>	These provisions recognise that sustainable use and management of water resources depends on a range of factors – not just the total volume diverted. The intention is to ensure that appropriate consideration is given to the range factors and is related to the assessment of risks undertaken in accordance with Part 9 of Chapter 9. In addition, it is not intended that the Basin Plan requires a change in reliability.	Noted
		9.23	<ul style="list-style-type: none"> <li>• Could these provisions re groundwater water be used perversely, e.g. to allocate all winter/spring flows to environmental assets &amp; functions at the expense of consumptive use?</li> </ul>	As above.	Noted
		9.24	<b>Groundwater and surface water connection</b> <ul style="list-style-type: none"> <li>• Could these provisions re surface water groundwater connectivity be used perversely, e.g. to allocate all winter/spring flows to environmental assets &amp; functions at the expense of consumptive use?</li> </ul>	As above.	Noted
		9.25(1)(a) - (b)	<b>Productive base of groundwater</b> <ul style="list-style-type: none"> <li>• Would drilling and re-boring agricultural bores come under these arrangements? If so, this would create some issues. Sounds like someone thinks the Windsor/Waters EPBC bills were a good idea!</li> </ul>	The intention of these provisions is that any activity that poses a risk to the matters listed should be considered and if the risk is sufficient, the water resource plan may need to include rules relating to ensure adequate construction standards and appropriate local management rules. The rules applied in any particular water resource plan would be commensurate with the risks to the particular resources being managed. It is not clear what issues arise from these provisions that are of concern.	Noted
		9.25(2)	<ul style="list-style-type: none"> <li>• Same comment as for 9.22-9.24</li> </ul>	See response for 9.22-9.24	Noted
		9.26(1)	<b>Environmental outcomes for groundwater</b> <ul style="list-style-type: none"> <li>• Focussed on unacceptable levels of salinity and contaminants. How can this be managed when many groundwater systems are saline to varying degrees.</li> </ul>	The intention of these provisions is to provide for rules to be included, if necessary in the particular circumstances, to avoid an unacceptable increase in the level of salinity or contaminants.	Noted
		9.26(2)	<ul style="list-style-type: none"> <li>• Same issues as 9.22 but additional requirements. This is a major issue for agriculture, where sometimes saline water is shandied with fresh surface water to</li> </ul>	The concern expressed is unclear and the provision is not intended to stop the practices mentioned, rather it is intended to avoid an unacceptable increase in the level of salinity or contaminants.	Noted.

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT
			irrigate, or if farmers use the saline groundwater sparingly, e.g. as a drought reserve.		
	<b>5</b>	<b><i>Interception activities</i></b>			
		9.28(1)	<p><b>Listing classes of interception activity</b></p> <ul style="list-style-type: none"> <li>The definition of significant impact is a wider issue than MDBP. However, MDBP proposes activity or cumulatively. Can mitigating factors be considered, e.g. policy trade off between water impact and salinity benefit? Might this be included as an item under 9.28(4)?</li> </ul>	It is anticipated that actions put in place to mitigate the impact or projected growth of the class of activity can be considered when determining whether a particular class of activity will have a significant impact. However, it is important to note that the requirements are to list and monitor the identified activities. Mitigating actions of the kind mentioned here may be put in place to manage an unanticipated increase in activity or impact.	Noted
	<b>6</b>	<b><i>Planning for environmental watering</i></b>			
		9.33	<p><b>No net reduction in the protection of planned environmental water</b></p> <ul style="list-style-type: none"> <li>Protection of existing planned e-water. This is quite vague. Planned water will be affected, e.g. by climate change but other entitlement holders should not be affected by this. How will planned water be adjusted? Is this only to do with the rules itself rather than the average yield?</li> <li>Neither does the clause provide for how this might be remediated? Possibly a good thing.</li> </ul>	The intention of the clause is to ensure that there is no overall reduction in the level of protection currently provided under State existing state laws. The provision is broadly written to allow for the range of circumstances across of the Basin whereby planned environmental water is currently protected and managed. Reflects s21(5) of the Act.	Noted
	<b>7</b>	<b><i>Water quality objectives</i></b>			
		9.36(3)	<p><b>WQM Plan to identify water quality target values</b></p> <ul style="list-style-type: none"> <li>Despite objectives in Ch8 and targets in Sch 7, if the water quality actual value is less than the target value – how can this be assessed if the actual value is about averages? Last reading, last year average, historical average? Should this be left as flexibility for the States to manage?</li> </ul>	The clause includes reference to objectively determined value of the water quality characteristic. This is intended to provide a flexible approach to accommodate a range of assessment approaches.	Noted. See earlier comments in relation to Chapter 8
		9.37(3)	<p><b>WQM Plan to identify measures</b></p> <ul style="list-style-type: none"> <li>WQMP measures to achieve water quality objectives may include land management. But how can this be regulated?</li> </ul>	The intention of the provision is to provide states a degree of flexibility in relation to the range of measures that may be put in place to work towards the achievement of the water quality targets. The targets are not mandatory and this is not a regulatory provision. At the time of accreditation and throughout the life of the plan the effectiveness of the	Noted. See earlier comments in relation to Chapter 8

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT
				measures will be assessed and monitored with the intention of providing an adaptive management approach that leads to continuous improvement and achievement of the target.	
		9.39	<p><b>Impact of WQM Plan on another Basin State</b></p> <ul style="list-style-type: none"> <li>WQMP must have regard to the ability for other States to meet their water quality targets. This will be a significant issue in SA for upper states? Might be able to better understand the implications if some modelling was available comparing historical actual values to the proposed objectives and targets.</li> </ul>	<p>The main water quality impact that is expected to be relevant for this provision is salinity.</p> <p>The salinity targets that apply to 9.39 are modelled values already agreed under the Basin Salinity Management Strategy and are the values of Appendix A Schedule B of the Murray-Darling Basin Agreement. States already undertake a range of actions to meet these targets. To meet the provisions of chapter 9, it is anticipated that states would be likely to reflect the same actions into the water resource plan.</p> <p>Other water quality characteristics like nutrients or cyanobacteria cell counts being non-conservative don't lend themselves to a modelling approach.</p>	Noted. See earlier comments in relation to Chapter 8
<b>10</b>	<b>Critical human water needs</b>				
			<ul style="list-style-type: none"> <li>There is a need to clarify that this Chapter only relates to the Murray River (not even its Tributaries).</li> </ul>	<ul style="list-style-type: none"> <li>10.03 states that critical human water needs refer to communities dependent on the River Murray System. In extreme circumstances, tributary water may be required to help meet critical human water needs.</li> </ul>	Noted
			<ul style="list-style-type: none"> <li>The Chapter is confusing. The use of CHWN terminology for the normal conveyance water provisions in the Agreement creates confusion. NFF suggests using CHWN terminology only with reference to the Tiers 1-3 provisions. Even here, the CHWN conveyance requirement should be around 1240 GL (700 GL upstream of the SA border and 490 GL for SA).</li> </ul>	<ul style="list-style-type: none"> <li>The term 'conveyance water', is often used to describe the extra water needed to delivery water to its point of use. However, in the Water Act it is specifically related to the delivery of water for critical human water needs. Clause 110 of the MDB Agreement deals with losses, and has some links to conveyance water.</li> </ul>	Noted
<b>2</b>	<b>Water required to meet CHWN</b>				
		10.02	<p><b>Meaning of water account year</b></p> <ul style="list-style-type: none"> <li>Why is there a need to have a separate accounting year for CHN (i.e. 1 June to 31 May)?</li> </ul>	<ul style="list-style-type: none"> <li>The MDBA has a long standing practice of a 31 May to 1 June water year for its water assessments for the states. The MDBA water year must start before the state water years, so our water resource assessments can be consider in their allocation policies.</li> </ul>	Noted
		10.03	<p><b>Amount of water required to meet CHWN</b></p> <ul style="list-style-type: none"> <li>It should be clear that these volumes are the responsibility of the states to set aside as reserves and manage, i.e. not a shared</li> </ul>	<ul style="list-style-type: none"> <li>While critical human water needs are a state responsibility, shared action may be required in extreme circumstances.</li> <li>The MDB Agreement requires that one of the three water sharing</li> </ul>	Noted

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT	
			<p>responsibility.</p> <ul style="list-style-type: none"> <li>Also this appears to be a permanent feature when it is supposed to be related to the Tiers 1-3 triggers?</li> </ul>	<p>arrangements is always in place. Critical human water needs must be set aside under all water sharing tiers, and as such is a permanent feature.</p>		
		10.05	<p><b>Water quality and salinity trigger points</b></p> <ul style="list-style-type: none"> <li>There is a need to first ascertain the cause of the WQ trigger issue and source not just deciding to just add water. Then need to determine the right solution, e.g. dryland salinity issues cannot be resolve by triggering water quality additional flows.</li> <li>Should the trigger be at any given location and time or be triggered on so many days above a certain level (perhaps use of rice chemical protocols and management actions, i.e. below XX do y and below XXX do z.</li> </ul>	<ul style="list-style-type: none"> <li>The trigger points in the draft Basin Plan are designed to come into effect when local and state based responses are no longer effective or when a system wide response is needed. Dilution is one possible action but will only be used when it is the best available option.</li> <li>The triggers have been designed to give the states flexibility, so they can determine if escalation is needed based on such things as the extent, or forecast duration of the problem</li> </ul>	Noted	
	<b>3</b>	<b><i>Monitoring assessment and risk management</i></b>				
		10.07(3)	<p><b>Process for managing risks to CHWN associated with inflow prediction</b></p> <ul style="list-style-type: none"> <li>Is this the normal protocol now? i.e. does the MDBA assess with the states the risks to CHWN or conveyance water before issues water to the States? Don't believe so....implications might be risk to allocations is MDBA self assessing CHWN requirements. Doesn't agreement protocols kick in and doesn't this impact on state shares?</li> </ul>	<ul style="list-style-type: none"> <li>The MDBA considers managing risks to critical human water needs as part of its inflow prediction process. This is done in consultation with the states through the Water Liaison Working Group (a Committee established under clause 203 of the Water Act). The states are to meet their critical human water needs from their share of the River Murray System, allocated according to the MDB Agreement. State shares could be impacted in extreme circumstances if a state is required to advance water to one or more states. This is allowed for in Schedule H to the MDB Agreement.</li> </ul>	Noted	
		10.07(4)	<ul style="list-style-type: none"> <li>Does the management of CHWN risks go beyond the MDB Agreement provisions, particularly to consider water quality and the provisions to set aside and draw upon conveyance reserves.</li> </ul>	<ul style="list-style-type: none"> <li>The requirements for critical human water needs were established in the Water Act 2007 (Cth). They are complementary to the MDB Agreement. The Agreement has been amended to support the requirements of the draft Basin Plan.</li> </ul>	Noted	
		10.08(4)	<p><b>Risk management approach for inter-annual planning</b></p> <ul style="list-style-type: none"> <li>Is this consistent with our understanding? i.e. whether water is made available for uses other than CHWN? (additional flexibility) What does this mean as the</li> </ul>	<ul style="list-style-type: none"> <li>The states must meet critical human water needs from their share of the River Murray Resource. The states have control over the use of this water, but must be able to demonstrate to the MDBA that their critical human water needs can be met.</li> </ul>	Noted	

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT
			MDBA will only control 1596 GL as all other water must be allocated (under the Agreement) to the states?		
		10.08(4)(b)	<ul style="list-style-type: none"> <li>What is the MDBAs conveyance reserve policy?</li> </ul>	<ul style="list-style-type: none"> <li>The provisions in the draft Basin Plan and the Agreement will ensure the conveyance reserve of 225 GL is set aside.</li> </ul>	Noted
4		<b>Tier 2 water sharing arrangements</b>			
		10.14(3)	<b>Arrangements for carrying water over in storage</b> <ul style="list-style-type: none"> <li>Does this conflict with 10.07(4)?</li> </ul>	<ul style="list-style-type: none"> <li>10:14(3) reconfirms that the states are responsible for meeting their critical human water needs from their share of the River Murray System. 10.07(4) sets out how the MDBA will manage risks to critical human water needs associated with inflow prediction. Inflow predictions are vital for determining state shares, and if risks to critical human water needs are identified, we will use our existing processes with the states to ensure appropriate action, with as little impact on state shares as possible.</li> </ul>	Noted
5		<b>Tier 3 water sharing arrangements</b>			
			<ul style="list-style-type: none"> <li>Tier 3 can be triggered for water quality issues. Is this appropriate?</li> </ul>	<ul style="list-style-type: none"> <li>Water quality of an appropriate quality is just as important to critical human water needs as water quantity. Section 86E(2)(b) of the Water Act requires Tier 3 to include a water quality trigger.</li> </ul>	Noted
11		<b>Water trading rules</b>			
	2	<b>Restrictions on trade of tradeable water rights</b>			
		11.11(2)	<b>Trade of water allocation which has been carried over</b> <ul style="list-style-type: none"> <li>Why would a carryover announcement need to be made before carry over water is traded. Are there any existing provisions in the Basin? If not, it should be removed.</li> </ul>	<p>Due to the differences in the administration of carryover in different states, this rule needed to address situations where a carryover announcement is made in order for carryover to be deemed to be available (such as NSW), or there is policy in place for the administration of carryover, such as Victorian spillable water accounts.</p> <p>The MDBA is considering a suggestion of removing the words 'or traded' in 11.11(2)(a) and in the definition of 'carryover announcement' as they may be redundant—once water is deemed to be available to be taken it should be allowed to be traded.</p>	Noted. Amendment suggestion is supported.
		11.12(2)	<b>Access to carryover for traded water access rights</b> <ul style="list-style-type: none"> <li>Carry over is a right attached to entitlements through state water plans. So under what circumstances might this provision apply? If entitlement is converted to an entitlement in another catchment or state, it's characteristics would change to the destination</li> </ul>	<p>Tagging may not be the process that is used in all types of water resources in all Basin States to transfer an entitlement from one location to another. There may be instances where the state cancels an entitlement in one resource and then issue a entitlement in the destination resource. 11.12 (2) provides the ability for a state—despite 11.12(1)—to apply the carryover rules that apply to the resource where the entitlement is being moved to (destination water resource) when using a cancel reissue process to administer the trade.</p>	Noted but tagged entitlement trading is strongly supported to avoid third party impacts.

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT
			entitlement and its rules. But mostly use of tagged trading rather than use of conversion factors to convert the entitlement.		
		11.17(1)(c)	<p><b>Restrictions allowable for physical or environmental reasons</b></p> <ul style="list-style-type: none"> <li>This will create an additional constraint on trade, i.e. introducing a trade barrier basically because the trade may compromise environmental watering requirements – but what does “environmental watering requirements” mean. Does this refer to delivery of environmental water. NFF should reject this as creating not reducing barriers to trade.</li> </ul>	<p>11.17 does not impose a restriction, rather it sets out the relevant reasons, for which a State may impose a reasonable restriction where such a restriction would otherwise be inconsistent with 11.15 or 11.16. Restrictions imposed by states will still need to be consistent with the water trading rules in subdivision A. Also, the rules can only relate to trade and trading restrictions, rather than ordering restrictions which may be imposed generally (i.e. not discriminate between traded and non-traded water).</p> <p>Under Clause 3 Schedule 3 of the Water Act 2007, one of the objectives for Chapter 11 is to recognise and protect the needs of the environment. Due to this objective, it was necessary to create a link to Chapter 7 of the Basin Plan to ensure that the two chapters are consistent. Chapter 7 Part 5 of the Basin Plan sets out the method that will be used to identify environmental assets and their environmental watering requirements.</p>	Noted. However, where environmental water is the same as water access entitlements, this should not be afforded any higher protection than previously enjoyed. The same could also be said of planned environmental water, which normally has a higher priority in water plans that held water. To do otherwise may impinge on other property rights and result in third party impacts.
		11.27-11.30	<p><b>Trade of water delivery rights held against IIOs</b></p> <ul style="list-style-type: none"> <li>This is duplicating ACCC water market rules and will create confusion. Why not just reference the ACCC trade and market rules?</li> </ul>	<p>In developing Chapter 11, the MDBA liaised with the Australian Competition and Consumer Commission (ACCC) and the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC), specifically on areas involving water delivery and irrigation rights.</p> <p>The water market rules cover the process that is triggered once a customer requests transformation of their irrigation right, and ensure that the policies or administrative requirements of irrigation infrastructure operators do not represent a barrier to trade. The water market rules and the water charge (termination fees) rules do not cover trade of water delivery rights.</p> <p>The Water Act requires that the water trading rules relate to the trade of water delivery right (see s.26 and the s.4 definition of ‘tradeable water rights’). S11.27 - 11.30 provide all customers within an IIO the ability to trade delivery rights within the irrigation network without that trade being unreasonably refused or delayed by the IIO.</p>	See NFF submission
	<b>3</b>	<b><i>Information about water delivery rights and irrigation rights</i></b>			
		11.31-11.35	<ul style="list-style-type: none"> <li>As a general comment, this is also</li> </ul>	In developing Chapter 11, the MDBA liaised with the ACCC and DSEWPaC, specifically on areas involving water delivery and irrigation	See NFF submission

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT
			duplication of the ACCC water market rules. Delete or just reference the ACCC rules.	rights. The water market rules cover the process that is triggered once a customer requests transformation of their irrigation right, and ensure that the policies or administrative requirements of irrigation infrastructure operators do not represent a barrier to trade. The water trading rules under the Basin Plan apply to all tradeable water rights held by water market participants, including irrigation infrastructure operators and their customers. S11.31 - 11.35 will ensure that all IIO members are informed of the water delivery rights and irrigation rights they hold. In the absence of this rule, this requirement would only be triggered at the point that a member requests transformation under the water market rules.	
	<b>5</b>	<b>Information and reporting requirements</b>			
		11.40-11.43	<p><b>Information about water access rights</b></p> <ul style="list-style-type: none"> <li>Again is this duplication with the BOM? If the BOM's roles is the collect data, then the MDBA should just obtain the information from BOM. There is a need to minimise the transaction costs of organisations being required to provide the same information to multiple organisations.</li> </ul>	<p>The MDBA have had several discussions with BOM and have determined that under the current BOM regulations there is no unnecessary duplication (information such a labels identifying the data is necessary, but there is no duplication of substantive data). The MDBA has always been concerned about possible duplication in this area and with this in mind has drafted a set of information provisions that have flexibility in both collection and reporting by using the prescribed form as set out under s11.42, and this will allow us to work with other parties to minimise compliance.</p> <p>Also the information requirements in 11.40 - 11.43 only apply to water access rights, which in the Water Act 2007 (S4 definitions) only apply to a right under state law, rather than irrigation rights or water delivery rights held against an IIO. The intent is that S11.40 - 11.43 will only apply to Basin States.</p>	See NFF submission
		11.46	<p><b>Price to be reported as a condition of trade approval</b></p> <ul style="list-style-type: none"> <li>What happens for a zero consideration trade, e.g. for business to business trades?</li> </ul>	The MDBA recognises that reporting a zero dollar trade on a trade application may be valid in some circumstances (especially business to business transfers) and therefore would not be breaching Chapter 11 as long as it is recorded on the transfer application form as \$0.	Noted. NFF assumes this will be adequately communicated to entitlement holders and water brokers.
		11.47-11.49	<p><b>Allocation and policy information to be made available</b></p> <ul style="list-style-type: none"> <li>There a need to reference state legislation as allocation announcements provisions are legislated?</li> </ul>	<p>The intent of these rules is to ensure that allocation and policy decisions are made generally available to the market and that persons aware of these announcements before they are generally available restricted from trading. Regardless of whether allocation announcement provisions are legalised through a legislative framework, the rules would apply.</p> <p>The information requirements in 11.47 - 11.49 only apply to water access</p>	Noted

CH	PT	CL	NFF ISSUE	AUTHORITY RESPONSE	NFF COMMENT
				rights, which in the Water Act 2007 (S4 definitions) only apply to a right under state law, rather than irrigation rights or water delivery rights held against an IIO. The intent is that S11.47 - 11.49 will only apply to Basin States.	
<b>12</b>	<b>Program for monitoring and evaluating the effectiveness of the Basin Plan</b>				
	<b>2</b>	<i>Principles</i>			
			<ul style="list-style-type: none"> <li>While the AG supports MERI and program logic (designed for NRM), is this the best option for water? Are the States in agreement?</li> </ul>	While MERI and program logic are widely associated with the NRM sector, they are generic frameworks/tools that have been applied in a diverse range of sectors, including community development, social justice, health, education, water and international development. While States have expressed a range of views both for and against MERI/program logic, no better alternatives have been put forward and it is not seen as a significant issue relative to other issues.	Noted. NFF assumes that the MDBA will work constructively with the Basin States to come to an agreed monitoring and evaluation framework.
<b>S8</b>	<b>Key causes of water quality degradation</b>				
			<ul style="list-style-type: none"> <li>The causes appear to be dated, especially in regard to current agricultural practices (influenced by overseas issues)?</li> <li>What is the measured water quality/salinity history compared to the targets proposed?</li> <li>What are the appropriate land management &amp; infrastructure solutions?</li> <li>Water quality testing is usually limited (e.g. pesticides are not measured except on restricted basis such as rice industry). So how can these targets be measured and more importantly monitored?</li> <li>What is the impact of non-irrigation causes like dryland salinity and salt water intrusions from drought and how can these be resolved (hopefully not with the Basin Plan)?</li> </ul>		The MDBA did not comment.

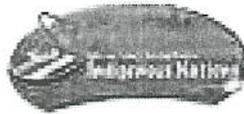


# **MLDRIN STATEMENT**

to the

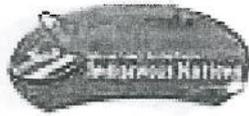
*proposed Basin Plan*

March – April 2012



***In representation of the following  
Sovereign First Nations:***

- Barapa Barapa
- Dhudhuroa
- DjaDja Wurrung
- Latji Latji
- Maraura
- Mutti Mutti
- Nari Nari
- Ngarrindjeri
- Ngintait
- Nyeri Nyeri
- Tatti Tatti
- Taungurung
- Wadi Wadi
- Wamba Wamba
- Waywurru
- Wergaia
- Wiradjuri
- Wotjobaluk
- Yaitmathang
- Yita Yita
- Yorta Yorta



## Foreword

Since time immemorial our inheritance has been our identity. Water is and always will be a sovereign right. It has sustained cultural, social, spiritual and economic life throughout the Murray-Darling basin. This history and deep connection with the river systems which feed this region are as much a natural part of life today as they have been historically.

The deep significance of this region to our history, our life today and our future is reflected through our heritage landscapes connected to country, our gathering places and our social and economic wellbeing.

It is on this basis that we present our submission to the future and ongoing management of how our river country is managed throughout the Murray Lower Darling Basin. We do so as 21 United Sovereign First Nations and Traditional Owners from the southern areas of the Murray-Darling Basin.

Our people are the descendants of the original inhabitants of the lands and waters of the Southern Murray-Darling Basin. Our motivation is driven by an acute sense of this history and a desire to ensure the preservation and continuation of our Cultural Principles within Country.

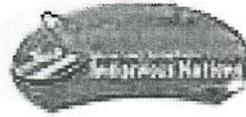
Our people consider that all things are connected, including the land, water and sky. These waters represent a fundamental element of our environment that binds land, body and spirit.

Our people see water as integral to life, culture and spirituality. Water is the life blood of our Country; its meaning does not exist as a commodity and across tens of thousands of years we have had no contemplation of a life or Culture without water.

While the contemporary western view of water is based on scarce supply and rationing, this concept of water allocation does not exist as a Cultural principle. Water is not seen as an independent resource existing outside or separate to a wholly integrated view of our world.

This, of course, does not mean that water has not been used or managed efficiently. To the contrary, our Culture instinctively associates water with living and caring for our environment – a precious resource to share. We are driven by Cultural responsibilities to care for Country and to conduct our lives in accordance with unwritten lore's existing for all time.

These laws unite our Cultural and ecological landscapes where plants, trees, birds, fish and animals live in harmony with the land, the water and the sky. Where the past, the present and the future are connected.



## Executive Summary

**As representatives of our Sovereign First Nations and Traditional Owners we have been asked to comment on the Murray Darling Basin Authority's *proposed Basin Plan*. We have welcomed the right to extend our views in relation to this *proposed Basin Plan*.**

There are 43 autonomous Sovereign First Nations representing 200,000 Traditional Owners in the Murray-Darling Basin. The Murray Lower Darling Rivers Indigenous Nations (MLDRIN) and the Northern Basin Aboriginal Nations (NBAN) constitute the representative delegates for these Nations.

MLDRIN ([www.mldr.in.org.au](http://www.mldr.in.org.au)) is a confederation of 21 Sovereign First Nations representing those in the southern part of the Murray-Darling Basin. It is our obligation, to our people, of past, present and future to protect, preserve and maintain our rights to water through our lore and laws.

We highlight that Sovereign First Nations People within the Murray-Darling Basin not only view water as inextricably connected to the land and rivers, but also view themselves as an integral part of the river system. It is because of this holistic understanding and connection that Sovereign First Nations and Traditional Owners feel a strong responsibility for the health of rivers.

It is our view that the *proposed Basin Plan* does not accurately recognise and resource the Cultural rights of Sovereign First Nations People to ensure the provision and delivery of Cultural Water / Flow. We adopt the text of the *UN Declaration on the Rights of Indigenous People* (Declaration). Our Statement is strongly aligned with the fundamental principles listed in the Declaration and, in particular, we make reference to Article 25 and 26 as follows:

*"Indigenous people have the right to maintain their distinctive spiritual relationship with their traditionally owned or otherwise occupied and used lands, territories, waters and coastal seas and other resources and to uphold their responsibilities to future generations in this regard."*

*"Indigenous people have the right to the lands, territories and resources that they have traditionally owned, occupied, or otherwise used or acquired."*

*"Indigenous people have the right to own, use, develop and control the lands territories and resources that they possess by reason of traditional ownership or other traditional occupation use as well as those they have otherwise acquired."*



*States shall give legal recognition and protection to these lands, territories and resources. Such recognition shall be conducted with due respect to the customs, traditions and land tenure systems of the Indigenous people concerned.*

The *proposed Basin Plan* is marred with conflicting scientific opinion. Much of this opinion is from eminent people in the field. This further erodes our confidence. 'Cultural Knowledge' is a science in its own right.

We demand that proper consultation and research takes place. This must recognise and respect the rights of Sovereign First Nations People. Further, this research must be instigated and controlled by Sovereign First Nations and Traditional Owners and it must seek to bring 'expert' scientific opinions together.

## **Sovereign First Nations People and our Cultural Water / Flows!**

Sovereign First Nations People within the Murray–Darling Basin talk of how the rivers sustain their life and identity.

Sovereign First Nations People not only view water as connected to the land and rivers, but also view themselves as an integral part of the river system.

The term **Cultural Water / Flows** is new to natural resource managers. It translates the complex relationship described by Sovereign First Nations and Traditional Owners into the language of water planning and management.

### **Our Definition of Cultural Water / Flows**

MLDRIN have defined 'Cultural Water / Flows'. NBAN have also adopted this definition. It is as follows:

*Water entitlements that are legally and beneficially owned by the Indigenous Nations and are of a sufficient and adequate quantity and quality to improve the spiritual, cultural, environmental, social and economic conditions of those Indigenous Nations. This is our inherent right.*

It is our belief that the *proposed Basin Plan* fails to articulate Sovereign First Nations and Traditional Owners rights to water.

The *proposed Basin Plan* also provides discretion to the States in relation to Cultural Water / Flows. This creates uncertainty and potential division. We need greater certainty and we advocate that this be clarified by the Commonwealth Government and the MDBA.



Under section 105A of the *Australian Constitution* we call upon the state and territory governments to refer to the Commonwealth Government powers to make laws for Cultural Water / Flows for Sovereign First Nations and Traditional Owners within the Basin.

MLDRIN objects to the principle that the states should be charged with the allocation of water licenses for surface and sub-surface water. The priority must be the management of surface and sub-surface water.

There are no provisions in the *proposed Basin Plan* with regard to Floodplain Resource Plans and how they would be accredited. This is of major concern to the Nations of the Southern Basin because it destroys our Cultural responsibility to our land and waters. This includes the many resources that the floodplains provide to our People within the Sovereign First Nations and Traditional Owners economy in relation to trade, subsistence and our way of life. These provisions must be included in the Basin Plan. Sovereign First Nations and Traditional Owners view water and the landscape as holistically interconnected.

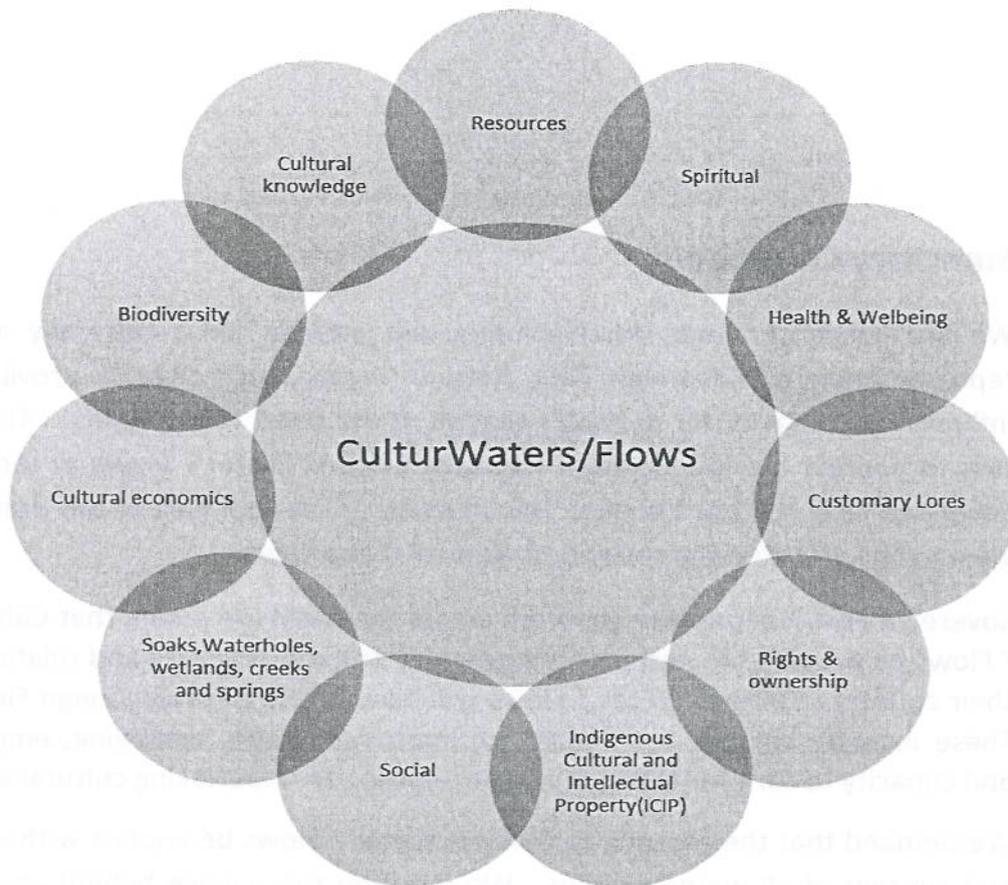
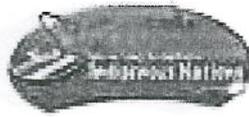
Cultural Water / Flows must translate our cultural principles. This is not just how much water is needed but how it flows and how often it flows.

An outcome must be that we ensure there is enough water to ensure Cultural Water / Flows and provide Indigenous water rights. This right must be recognised as a priori right – access to this water before anyone else.

These rights are attached to our Cultural rights, interests and responsibilities. These rights precede all other rights and require that water flows into Country and meets localised cultural needs.

The management of water must include specific uses that support Cultural spaces such as wetlands where birds, fish, plants and animals and the allocation of use of water by our people for the purposes of Cultural and other activities.

We refer you to the following **Diagram 1** as this is a visual representation of our Cultural Water / Flows and the relationship it has with Sovereign First Nations and Traditional Owners Cultural principles.



**Diagram 1.** A visual representation of our Cultural Water / flows and the relationship it has with Sovereign First Nations Cultural Principles.

## Background

MLDRIN comprises Sovereign First Nations and Traditional Owners in the lower southern part of the Murray-Darling Basin. We came together to establish MLDRIN in 1998 at a gathering of Sovereign First Nations and Traditional Owners along the Murray River.

MLDRIN is the representative body of the Nations and has always done business – by caring for Country and talking to their traditional neighbours upstream and downstream on the Murray and its sister rivers, creeks, lakes, billabongs and waterways.

Our cultural, ethical principles and practices are built on equality, mutual respect and recognition. The Sovereign First Nations and the Traditional Owners are best placed to talk for their relevant Country.



## Summary Comments

We are concerned that the Plan does not provide for a culturally appropriate representation of Sovereign First Nations Peoples nor does it provide us with influence or capacity for decisions that sit at the heart of our rights. The Plan also fails to address the independent issues of Cultural Water / Flows as they relate to Sovereign First Nations Peoples. This must be an integral part of the Basin Plan and we must be afforded the capacity to control these flows.

Sovereign First Nations Peoples from across the Basin are asking that Cultural Water / Flows be provided to sustain their on-going cultural practices and relationship with their country. Cultural Water / Flows will have benefits for Sovereign First Nations. These include, but are not limited to, improved health, wellbeing, empowerment and capacity to care for their Country in addition to undertaking cultural activities.

We demand that the essence of Cultural Water / Flows be implicit within the intent and content of all water regimes. We question the science behind environmental flows and their lack of attention to Cultural Water / Flow issues.



## Response Detail

We are happy with the acknowledgement at the forefront of the *proposed Basin Plan* but strongly encourage that MLDRIN AND NBAN and their Nations are individually recognized as part of this acknowledgement.

The terms Cultural Water / Flows needs to be acknowledged as follows within the *proposed Basin Plan*:

*Water entitlements that are legally and beneficially owned by the Sovereign First Nations and are of a sufficient and adequate quantity and quality to improve the spiritual, cultural, environmental, social and economic conditions of those Indigenous Nations. This is our inherent right.*

The *proposed Basin Plan* identifies cultural water but does not define what Cultural Water is. Cultural Water /Flows must be 'front and centre' as an integral part of the Basin Plan.

The *proposed Basin Plan* must address this issue and must reflect greater in-depth research with **localised** input. This research must address ownership, management and control by Sovereign First Nations, and Traditional Owners, and have regard to cultural heritage issues.

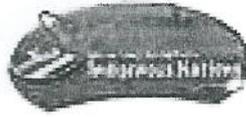
The *proposed Basin Plan's* reference to 'Good Faith' must be underpinned by Free, Prior and Informed Consent.

We, as the Sovereign First Nations of MLDRIN, assert our inherent water rights and entitlements which will allow us to exercise our Cultural rights, responsibilities and obligations to Country and all living things.

We strongly object to the states allocating water licences for ground water to cover their inadequate management of the surface water. This practice prioritises big business and selfish outcomes over Sovereign First Nations and Traditional Owners and their natural and cultural landscape.

The cultural principles of Sovereign First Nations must be respected and acknowledged. We assert and demand greater respect through all approval and accreditation processes. We call on the MDBA, through their legislative powers, to recognise and enact all Sovereign First Nations and Traditional Owners priori rights to water.

The *proposed Basin Plan* must provide greater clarity and certainty for the Sovereign First Nations and Traditional Owners. The role of MLDRIN needs to be more specifically outlined through an agreement process which is integral to the forward planning processes.



Under the *Convention on Biological Diversity*, article 8 (j), governments must meet their international and domestic obligations. We consider the *proposed Basin Plan* to be discriminatory, a cultural breach, and potential breach of the *Racial Discrimination Act 1975* (Cwlth).

It is essential that the standards achieved reflect accountability to international, national and state statutory requirements on water law and policy and the Cultural principles and practices of Sovereign First Nations and Traditional Owner groups.

The *proposed Basin Plan* fails to make reference to the legislative requirements of the Heritage Acts; Commonwealth, State or Federal. This is an oversight that must be addressed immediately for the protection and preservation of our Cultural Heritage sites, places and landscapes.

Integral to meeting these standards is that clarification is given on the intent to restore past and ongoing destruction to environs. Further, that planning is in place to protect and restore the quality and functions of these water dependent ecosystems and to ensure they remain resilient to further threats and risks.

Critical to the sustainability of the ecology and biodiversity of the Murray-Darling Basin system is end of system flow (flow through the Murray Mouth). The management of this must take highest priority in purifying the ecosystems on the floodplains of the working Basin. This is not about a compartmentalised approach but rather a holistic approach that addresses the restoration and ongoing management from the 'very top to the very bottom'.

Appropriate resources are essential for the ongoing operations of the MLDRIN delegation as a collective voice across the Southern Murray-Darling Basin.



## Glossary

**Cultural flows** - Water entitlements that are legally and beneficially owned by the Indigenous Nations and are of a sufficient and adequate quantity and quality to improve the spiritual, cultural, environmental, social and economic conditions of those Indigenous Nations. This is our inherent right.

**Free prior informed consent** – implies no coercion, intimidation or manipulation, should imply consent has been sought sufficiently in advance of any authorisation or commencement of activities and respect time requirements of indigenous consultation/consensus processes and should imply that information is provided that covers (at least) the following aspects:

- a. The nature, size, pace, reversibility and scope of any proposed project or activity;
- b. The reason(s) or purpose of the project and/or activity;
- c. The duration of the above;
- d. The locality of areas that will be affected;
- e. A preliminary assessment of the likely economic, social, cultural and environmental impacts, including potential risks and fair and equitable benefit sharing in a context that respects the precautionary principle;
- f. Personnel likely to be involved in the execution of the proposed project (including indigenous peoples, private sector staff, research institutions, government employees and others)
- g. Procedures that the project may entail.

Source: ([http://www.hreoc.gov.au/social\\_justice/nt\\_report/ntreport05/app3.html](http://www.hreoc.gov.au/social_justice/nt_report/ntreport05/app3.html))

**Priori right** - Relating to and denoting reasoning or knowledge which proceeds from theoretical deduction rather than observation or experience (Oxford Dictionary).

**Sovereign First Nations** – Refers to Aboriginal nation groups within the Murray-Darling Basin including those as follows:

Barapa Barapa; Dhudhuroa; DjaDja Wurrung; Latji Latji; Maraura; Mutti Mutti; Nari Nari; Ngarrindjeri; Ngintait; Nyeri Nyeri; Tatti Tatti; Taungurung; Wadi Wadi; Wamba Wamba; Waywurru; Wergaia; Wiradjuri; Wotjobaluk; Yaitmathang; Yita Yita and Yorta Yorta.

Our fundamental principles are to have free, prior and informed consent.



**National Irrigators' Council**

Level 2, NFF House, 14-16 Brisbane Ave  
Barton ACT 2600

# **A balanced plan for the Murray Darling Basin**

A Submission to the Murray Darling Basin Authority from the  
National Irrigators' Council

April 2012

Contact: Tom Chesson  
**CEO - National Irrigators' Council**

## **Purpose of this Submission**

This Submission is designed to provide an overview of the key issues that irrigators believe are necessary to deliver a balanced plan for the Murray Darling Basin. In our view, the MDBA's plan can only form *part* of a wider Plan for the Basin – one that involves both State and Commonwealth Governments, delivers on the principles of integrated catchment management and carefully balances environmental, social and economic outcomes.

This paper is not intended to provide comprehensive solutions to all the issues facing the Basin. Simply it is an overview of the key matters we believe need to be addressed.

## **Executive Summary**

The National Irrigators' Council (NIC) is the peak body representing irrigators in Australia. NIC currently has 34 member organisations covering all MDB states, regions and commodities. Our members represent water entitlements of about 7 million megalitres. While this document has been prepared by the NIC, each member reserves the right to independent policy on issues that directly relate to their areas of operation, or expertise, or any other issues that they may deem relevant.

Irrigators support the development of a Basin Plan and the principle that some water must be returned to the environment to ensure sustainable extraction into the future. We believe that the National Water Initiative (NWI) which was signed off by all Basin States and the Commonwealth Government in 2004, should remain the driver for water reform. That process sought to achieve economically efficient water use and investment that maximises the economic, social and environmental value of Australia's water resources.

It is our view that the current trajectory of reform is too heavily biased towards water as the only management solution, and that the environment takes precedence over people, communities and food and fibre production. Irrigators have been, and remain, committed to genuine reform. However, reform must take a sensible path that does not destroy communities and industries and maintains a viable, productive irrigated agriculture sector in the MDB.

The National Irrigators' Council believes the Sustainable Diversion Limit (consumptive use) needs to be increased. There has been no justification for the massive social and economic dislocation the recovery of 2750 Gl/y of long term cap equivalent water will unleash on communities across the Murray Darling Basin. Nor has there been adequate explanation of how the water recovered for the environment will be used, where it will be used and for what purpose it will be used.

We believe the 2015 review needs teeth to ensure its findings can be acted upon and the Review must take into consideration environmental, social and economic outcomes; localism and until the review has been completed and the Government has proven they need and can deliver the water there should be a reverse onus of proof by limiting the volume of held entitlement that can be recovered.

The NIC believes water recovery targets should be consistent with the triple bottom line approach. The water accounting methodology needs to be changed so that water recovery can include such things as rules changes, works and measures and efficiency projects.

Priority should be given to works and measures and efficiency projects identified under the localism model. In addition water recovery should not just be focused on privately held water entitlement

and must also look at operational efficiency of seventy percent of water flows in the MDB already allocated to the environment.

Any rule and operating changes must see the characteristics and reliability of water entitlements maintained and must have no third party impacts unless agreed to by all stakeholders.

The National Irrigators' Council will continue to work with the Basin States, the MDBA and the Commonwealth Government however we reserve the right to withdraw from the process if our concerns are not addressed and our local social, environmental and economic fabric is placed in jeopardy by the Basin Plan.

### **Critical Analysis of the Draft Basin Plan and its' implementation**

The National Irrigators' Council has members from all Basin States and therefore is in the position of being able to provide a national perspective regarding the Plan. The NIC has found that the Draft Basin Plan in its current form is undeliverable and without changes there is the very real risk of catastrophic environmental, social and economic mistakes being made.

Irrigation communities will bear the brunt of a bad Basin Plan. We are concerned that there is an over reliance by some policy makers on untried and untested models. Local knowledge within the basin is not being fully utilised and local input into key decisions has been ignored.

We are worried a 'bad' basin plan will cost thousands of jobs, put pressure on food prices and threaten family farms and regional communities and will not deliver healthy working rivers. Irrigators want a healthy working river system we rely on it more than most. However we need a balanced plan that considers the needs of people, communities and food and fibre production as well as the environment. The current ideology of "just add water" is not a solution to a complex web of environmental problems in the basin.

The draft Murray-Darling Basin Plan and the Government policies surrounding its' implementation contain a number of flaws which could be fatal to the plan's success if not addressed. These include but are not limited to:

- Lack of justification for the scale of the proposed reduction in the Sustainable Diversion Limit by 2750 GL/y long term cap equivalent.
- Lack of specific environmental watering objectives – particularly at an SDL Unit (catchment) level and the failure to detail when, where, why and how environmental water will be delivered to specific environmental assets.
- Many of the technical assumptions are unproven, and haven't been explained to stakeholder satisfaction during the public consultation stage.
- Grossly inadequate data on the likely socio-economic impacts of the plan.
- No solutions to problems of invasive fish species, riparian vegetation, urban pollution, cold-water pollution etc with too much emphasis on just adding water.
- The 2015 Review of the Plan, Chapter 6 clause 6.07 is too weak and will be ignored unless amended to require that Parliament act on the review's recommendations. The review timeframe should be extended.
- Chapter 11 adds excessively bureaucratic green tape which should be dealt with under existing ACCC trading rules.
- A need for a one stop portal designed to facilitate all Commonwealth Water Reform related reporting requirements.

- The mixed messages about water efficiency versus energy efficiency (carbon footprint) with policies such as the Carbon Tax penalising water efficient infrastructure by artificially increasing the cost of energy whilst condemning the green credentials of gravity fed channel schemes which have no carbon foot-print.
- The physical and policy-based constraints in the Basin system (i.e. through infrastructure, environmental works and measures and rule-changes) which if not rectified will guarantee the Commonwealth Environmental Water Holder is not able to deliver the environmental water to key environmental assets.
- The failure to incorporate 'Localism' and 'adaptive management' into the Plan.
- The mistaken belief draft Basin Plan is a drought proofing plan
- The slow roll out of infrastructure and environmental works and measures and the diversion of infrastructure funding is not good enough especially when compared to the accelerated 'no regrets' water buyback programme.
- The failure of country's largest irrigator, the Commonwealth Environmental Water Holder, which already controls and coordinates over two million megalitres of water entitlements, to have any staff located outside of Canberra in the communities where it is flood irrigating wetlands.
- Ongoing funding issues between the Commonwealth and State bodies tasked with holding and delivering environmental water, long term environment water plans and other functions required by the Water Act 2007

**The National Irrigators' Council believes in order to deliver a 'good' Basin Plan:**

1. *The MDBA must provide better explanations on how they have modelled and calculated the SDL's.*
2. *The MDBA must devise a sensible and transparent plan for the management of the Water Entitlements held by the Commonwealth Environmental Water Holder*
3. *Recognise the Basin Plan will not Drought-Proof the Murray-Darling Basin*
4. *Must acknowledge all of the constraints to the delivery of environmental water within the Murray-Darling Basin, and must factor in these constraints when modelling the water needed to achieve deliverable environmental outcomes.*
5. *The MDBA must investigate the feasibility of Environmental Works and Measures that improve environmental outcomes without compromising the consumptive pool.*
6. *Will require trade-offs to ensure the needs of the environment are balanced with those of communities and food and fibre producers.*
7. *Successful environmental outcomes will require more inputs than additional water volume alone. There must be commitment to integrated catchment management, clear definition of the environmental outcomes sought and a transparent and realistic environmental watering plan.*
8. *Infrastructure efficiency programs are preferable to buyback and should be prioritised.*
9. *Increased investment in research, development and extension will also help irrigators adjust to a future with less water.*
10. *The Commonwealth must take account of community impacts with its water purchasing program and should aim to leave a legacy of more efficient and viable irrigation districts.*
11. *Works and measures can deliver water more efficiently to the environment and must be pursued to reduce the impact of water recovery on Basin communities.*
12. *There needs to be genuine engagement that takes on board and incorporates the views of all affected communities and actively involves the States as managers of the resource. Local communities must be engaged in the delivery of environmental and economic solutions.*

13. *The Water Act 2007 is fundamentally flawed and amendments need to be passed by Parliament. However we will work with Government to attempt to achieve a balanced Basin Plan.*
14. *Elected and accountable politicians need to make informed judgement calls based on best available environmental, economic and social science and genuine community engagement. Science cannot be the sole arbiter of water sharing decisions.*
15. *Water resource decisions must treat all use of water, including interception, equitably. Irrigators will not accept reductions in their access to water that do not apply to other users.*
16. *Previous efforts to return water to the environment must be accounted for and used to offset any reductions under proposed SDLs.*
17. *The Commonwealth Environmental Water Holder (CEWH) must provide a transparent business plan and operational protocols to provide guidance to the market on its approach to trade.*
18. *The MDBA, CEWH and governments generally must provide clear guidance on their approach to environmental water delivery and the practical and economic implications of increased environmental flow events.*
19. *Monitoring, evaluation and reporting of environmental outcomes and independent audits of plan implementation must be undertaken to instil community confidence in the reform process.*
20. *We support the decision to align all water resource plan starting dates to 2019. Consistent with this decision and Victoria's planning framework, all states should adopt 15 year schedules for water resource plans.*
21. *A plan for the Murray Darling Basin must be developed with consideration of broader issues including Australian population policy, domestic and international food security challenges, manufacturing policy, regional development and carbon policy which will have extensive ramifications for all farmers.*
22. *Governments must provide structural adjustment assistance to communities where necessary.*
23. *The plan must include the past two years of high river flows into its modelling and consequently into the calculation of the SDL's*
24. *Chapter 11 – Water Trading Rule should ideally be excised or failing that rewritten*

**1. *The MDBA must provide better explanations on how they have modelled and calculated the SDL's.***

One question which the MDBA has repeatedly failed to answer is how it can calculate a definitive amount of water needed to be recovered, (2750 Gl/y), yet still not know which environmental assets will actually utilise this water?

The draft Basin Plan makes it clear that the largest holder of irrigation water entitlements in the MDB is currently operating under a long-term watering plan that won't be written for at least another 24 months after the commencement of the Basin Plan; or within another timeframe agreed to by the MDBA and a Basin State.

Basin States have been given the responsibility under *Chapter 7—Environmental watering plan; Part 4—Environmental management framework; Division 2—Preparation of long-term watering plans* for developing the long term watering plans for the environmental assets contained within their boundaries. Given the long term environmental watering plans have not yet been written by the Basin States it is difficult to believe that the MDBA can calculate how much water the environment

requires without actually knowing how, when, where or for what purpose the water they are seeking to be recovered will actually be used.

## ***2. The MDBA must devise a sensible and transparent plan for the management of the Water Entitlements held by the Commonwealth Environmental Water Holder***

Given the sheer volume of water already recovered for the environment by the State and Federal Governments and held or controlled by the Commonwealth Environmental Water Holder, there is an urgent need for a Basin wide long term environmental watering plan to manage this water.

However, communities are already questioning the ability of the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC), to physically deliver the Basin Plan. There are legitimate concerns about DSEWPaC being given the power to make life and death decisions over millions of native and introduced animals, insects, plants and water dependent communities across the Murray Darling Basin guilty of nothing more than being on the wrong side of a decision made in Canberra especially during times of drought when water is scarce. Rightly or wrongly, in light of the 'pink batts affair', DSEWPaC, has a terrible reputation for service delivery in many communities.

The current floods highlight the impossible task the Commonwealth Environmental Water Holder has in delivering the volume of water needed to create an artificial flood event to mimic natural events so that environmental water can overflow the river's banks and regularly water a fraction of the 30,000 plus wetlands found throughout the Murray Darling Basin.

The current physical and policy-based constraints in the Basin mean that unless huge sums of money are invested in infrastructure, environmental works and measures, purchasing easements over private land, building, moving or upgrading roads, bridges, railway lines, overpasses, levee banks, shifting towns and rule-changes, the flood events required to water the upper reaches of floodplains will cause or exacerbate flooding to large numbers of homes and private property and damage many wetlands through overwatering.

Through programs like the Living Murray Program, the Commonwealth Government does have some limited experience in delivering large scale environmental watering events. However as the CSIRO 's 'Assessment of the ecological and economic benefits of environmental water in the Murray–Darling Basin' report has found the costs of purchasing and delivering environmental water does not come cheap. The report found that The Living Murray program, which has been running since 2004, has recovered almost 500 GL/y (478 GL/y) at a cost of approximately \$700 million. The aim of The Living Murray program is to ensure that environmental water requirements are met for six iconic sites.

The report states;

*'A further **\$250 million** has been allocated to building infrastructure works at some of the six Icon Sites to improve delivery of the recovered environmental water.'*

Until the Basin States have completed their long term environmental watering plans required by the draft Basin Plan, it is will not be known how many of the 30,000 plus wetlands the Government is planning to water, however it will be considerably more than six. If it has cost the Living Murray Program \$250 million to improve the delivery of recovered environmental water to less than six sites, the cost to taxpayers of delivering water to just the 2442 key environmental sites identified in the Guide to the Basin Plan, will be astronomical. It is unclear how much funding the Government has allocated for new environmental works and measures to deliver environmental water. How

much has been budgeted for maintenance of these works and measures and for monitoring the environmental watering events is still a mystery.

### **3. Recognise the Basin Plan will not Drought-Proof the Murray-Darling Basin**

It has been mentioned a number of times by some Politicians and commentators that the Basin Plan will ensure that the environment and communities in the Murray Darling Basin will become immune from the worst effects of drought if the Basin Plan is adopted. This is incorrect.

There is still a very European view prevailing among Australia's policy makers that if the rivers are not holding a significant amount of water and everything is not green and lush, then our rivers are dying and the connected ecosystems are at tipping point and an irreversible disaster is just around the corner. Whilst that maybe true in many parts of the world, in the Murray Darling Basin, droughts are an unfortunate reality of life; and when it doesn't rain, rivers stop flowing and the animals and plants and the ecosystem which support them shrink and 'die'.

Michael McKernan's book 'Drought – the red marauder' highlights the plight of an environment accustomed to severe droughts. It points out that in the severe droughts of the past, not only did the environment suffer, people perished too.

In his book Mr McKernan states:

*“Writing in 1858, Charles Edward Strutt reported being told by '(aboriginals)of the Murrumbidgee' of a great drought about 120 years ago (around 1738). 'It persisted so long, 'that the Murrumbidgee became perfectly dry, which events reduced the (aborigines) to the utmost distress, as there was no water nearer than the Murray. Many ... died, not wishing to risk the journey. Those who reached the Murray found it to be but a chain of water-holes.”*

McKernan's book also quotes extensively from the diary of Joseph Jenkins, who migrated to Australia and was based in Maldon, in central Victoria.

In 1881, Jenkins recorded: 'there is not enough grass in the bush for a man to wipe his back parts.' A year later, 'there is not enough feed for a lean goose around here.' In February 1882, Joseph recorded that it was 46 degrees in the shade; he wrote 'no life without water' and 'nothing will be left tomorrow.' In reflecting on whether it was wiser to pray for rain or put in infrastructure Jenkins wrote 'It is wiser to make dams and preserve the waste water'.

In September 2008, the Murray Darling Basin Commission (MDBC) stated that the Murray River was reported to have stopped flowing between Tocumwal and Moama in 1850, and again in 1902 (for six months). In the 1914-1915 drought, flows in the Murray reached very low levels.

The MBDC report states:

*“Modelling has also been used to simulate flows in the Murray under natural conditions; in other words, if all dams and weirs did not exist and no water was extracted from the system. This modelling demonstrates that under natural conditions the Murray would have ceased flowing during the more severe droughts, including the current dry period. In the last couple of years, a continuous flow along the length of the Murray has been maintained by drawing upon water stored upstream, particularly in Hume and Dartmouth Reservoirs when other tributary inflows are low.”*

In a South Australian Government document titled 'Controlling the River Murray in South Australia' it states;

*"The River Murray in its natural state was far different from the river we are now familiar with. During long drought periods, not necessarily in South Australia but in the river's catchment region, the river ceased to flow and became a series of salty water holes."*

The simple unavoidable fact is that if we didn't have human intervention in MDB then the Murray River and many of its tributaries would have become dust bowls incapable of supporting life during the last drought. Many more native species both fauna and flora would have perished and whole communities would have had to have been evacuated.

Droughts have always inflicting a terrible toll on Australia ecosystems, and form a very natural part of our ecosystems lifecycles and evolution. To combat droughts, and stop people from perishing, we have evolved highly regulated river systems involving dams, weirs, locks and irrigation schemes to ensure there is water when and where it is needed. This ensures the 2.1 million people who live in the MDB have access to water even during times of climate extremes. Another five million people from Melbourne and Adelaide rely on water piped out of the MDB when their own water catchments are running low. Despite having direct access to seawater for desalinated water, both these cities increased their reliance on water taking water from an already stressed system.

The Water Act 2007 section 86A(1) states that:

*"The Basin Plan must be prepared having regard to the fact that...:*  
*(a) critical human water needs are the highest priority water use for communities who are dependent on Basin water resources; and*  
*(b) in particular, to give effect to this priority in the River Murray System, conveyance water will receive first priority from the water available in the system."*

Critical human water needs refer to the water requirements for core human consumption and non human consumption that a failure to meet would cause prohibitively high social, economic or national security costs.

In January 2007 advice to the Basin States and Commonwealth Government made the point that over 30 towns in New South Wales, Victoria and South Australia, including Mildura and Bendigo, were considered at risk of running out of water and had no alternative water supplies. Hence the then Murray-Darling Basin Committee (MDBC) recommended to the governments that:

*"unless there are very substantial early inflows (into storages in the basin) there will be insufficient water available to allow any allocation at the commencement of the 2007-08 water year for irrigation (not including stock and domestic licenses), the environment or any purpose other than critical domestic supplies."*

As a direct result, existing water sharing agreements were suspended and emergency measures were introduced. Since 2007 the only major infrastructure works to increase water security in the MDB were undertaken in the Australian Capital Territory which is building a new dam (interception scheme) twenty times larger than the dam it is replacing, and will transfer up to 100 megalitres of water per day from the Murrumbidgee River through a 12 kilometre underground pipeline to Burra Creek in NSW. The ACT Government official policy is to recognise that during dry times when Canberra's population faces Water Restrictions it is appropriate that environmental flows also be

reduced. Melbourne has built a billion dollar pipeline with the capacity to take water out of the MDB when its' own water supplies fall below 30 percent.

If similar drought conditions were to occur again after 2019, the Basin Plan would also be suspended to ensure that not only the needs of people who live in the MDB, but those of Melbourne and Adelaide are also met. Therefore, the current Murray-Darling Basin Plan cannot be considered a tool that could potentially be used to mitigate the effects of severe drought on the MDB.

No affordable Plan can fully drought proof the Murray Darling Basin. The draft basin plan will not stop the desolate scenes witnessed throughout the Basin during a drought as severe as the drought we have just lived through.

Ironically, the worst drought on record was followed by record breaking rains and flooding which reinforces what a highly variable climate we live in and the difficulty faced by Governments to work out what an 'average' year looks like.

***4. Must acknowledge all of the constraints to the delivery of environmental water within the Murray-Darling Basin, and must factor in these constraints when modelling the water needed to achieve deliverable environmental outcomes.***

A concern with the modelling used by the MDBA to determine the water required to achieve environmental outcomes is that this modelling has failed to factor in all of the constraints to delivery in the Murray-Darling Basin.

The MDBA has acknowledged there are constraints in the MDB that will limit the deliverability of environmental water, its publication 'River Management – Challenges and Opportunities'<sup>1</sup>. Whilst the MDBA has acknowledged some of the constraints there is insufficient funding in place to address all of the systems constraints. These constraints include both physical and policy based barriers to delivering water.

While NIC's acknowledges that some constraints are factored into the modelling, and some constraints can be overcome through minor environmental works and policy changes, we believe this is only the case for a small proportion of the constraints identified. In many cases, to overcome the constraints, large investments in environmental works and measures are required, and in some instances these measures lead to alternative negative impacts on the environment.

The challenge of physical constraints was highlighted in MDBA's own discussion paper which states:

*“Modelling of the environmental watering requirements on which the SDL's are based indicates that, in some cases, the environmental objectives that would otherwise apply at particular locations cannot be fully met due to constraints. As a result, not all of the environmental outcomes targeted by the draft Basin Plan can be fully realised under the SDL's currently proposed, and may not be fully achievable even with higher volumes of environmental flows.”*

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<sup>1</sup> MDBA, *River Management – Challenges and Opportunities*, 25 November 2011, <http://www.mdba.gov.au/files/bp-kid/1870-River-management-discussion-paper.pdf>

*“In the absence of works and measures to enable delivery of large flows and the implementation of strategies to manage third-party impacts, as well as the reflection of changes in operating practices, not all environmental outcomes targeted for achievement through the draft Basin Plan can be fully realised.”*

*“One of the drivers for constraints is the risk of third-party impacts associated with overbank flows and resultant inundation of private land. Clearly it would not be acceptable for private property to be damaged as a result of active intervention without appropriate arrangements to manage that impact.”<sup>2</sup>*

One example of the complexity of these constraints given in the document ‘River Management – Challenges and Opportunities’ relates to the Lowbidgee Floodplain, between Redbank and Balranald:

At current the delivery of environmental flows from the Murrumbidgee to the Murray is limited to 9,000 ML/d, representing channel capacity. This is largely due to significant evaporation and seepage to the floodplain around Chapton’s Cutting, and in the areas around Redbank and Balranald. It has been suggested that Works and regulators to raise the channel from Redbank to Balranald could conceivably increase channel capacity to 12,000 ML/d.

Need for Increased flows past this point:

- To contribute to outcomes at downstream sites, such as the Chowilla floodplain and the Murray Mouth.
- To allow more of the shared reduction for the southern Basin to be delivered from the Murrumbidgee, improving the environmental outcomes achievable downstream in the Murray.

Effects/Constraints of increased flows past the Lowbidgee Floodplain:

- Large flows required would lead to the constant wetting and inundation of local ecosystems beyond that which may be desirable for local environmental needs. Constant watering would lead to water-logging of floodplain which requires a natural wetting and drying regime and other negative outcomes for the local environment.
- To address the point above, and allow for flows of 12,000 ML/d past this point, substantial changes along the Murrumbidgee are required:
  - Works and regulators are needed to raise the channel from Redbank to Balranald.
  - However these works and regulators would disconnect the Murrumbidgee River from its floodplain, reducing lateral connectivity in all but extremely large floods.
  - Hence more regulators would be required to ensure the Lowbidgee floodplain can be watered at appropriate times, while water can be delivered past the Lowbidgee at other times.
  - However, reducing natural spilling onto the floodplain would still impact on the interaction between the biota of the floodplain and river, and would impact on the graziers, private owners of red gum forest and organic farmers in the area, who rely on beneficial overbank flows
  - If these impacts cannot be addressed, this option is not practicable.

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<sup>2</sup> Ibid, p.5

Another example of the lack of reality surrounding the debate on deliverability of environmental water involves the recent flood events in Queensland, New South Wales and Victoria. While these floods have caused extensive damage to communities in upstream locations, they have failed to produce any flood event in the mid and lower reaches of the Murray. The South Australian Government's River Murray Weekly Flow Report evidences this:

*“The Bureau of Meteorology advised on 21 March (2012) that flows from the Murray, Murrumbidgee and Darling Rivers are not expected to cause any flooding or access problems to towns along the River Murray. Based on current flow projections, river heights at other forecast locations, such as Swan Hill, Robinvale, Echuca, Euston and Wentworth, are expected to remain below their respective minor flood levels.”*

The South Australian River Murray Weekly Flow Report dated the 31<sup>st</sup> March 2012 states ‘the peak flow (in SA) is forecast to remain under 65,000 ML/day and is projected to arrive during mid to late April 2012.’ It states the inability of these flood events to continue down the river is ‘due to large potential losses ... as a result of water flowing across expansive floodplains ...’

The February 2011 floods caused hundreds of millions of dollars of damage and flooded hundreds of homes and properties, in Victoria alone. The flows from these floods peaked at 93,800 ML/day as they flowed across the South Australian border and the MDBA estimates sixty percent of the Chowilla Floodplains were inundated. The February/March 2012 floods damaged hundreds of homes and properties and caused extensive damage to public infrastructure including road and rail infrastructure throughout QLD, NSW and Victoria. Both these floods pale in comparison to the mega floods being demanded by some environmental organisations.

For example a number of environmental organisations are demanding flows of ‘... up to 125,000 ml/day for a week at least 13 years in a hundred’ to water the Chowilla Floodplains in South Australia. They claim they do not want to see peoples’ homes flooded, yet without extensive and expensive environmental works and measures such as more regulators, pipes and pumps this is exactly what would happen if these massive of flows were to occur.

The fact that it is impossible for the river operators (or the basin plan) to physically deliver such large flows across the South Australian border without major natural flooding upstream cannot be ignored. The current physical and policy-based constraints in the Basin mean that unless huge sums of money are invested in infrastructure, environmental works and measures, purchasing easements over private land and rule-changes, the flood events required will cause or exacerbate flooding to large numbers of homes and private property and cause extensive damage to upstream wetlands through overwatering.

Hence unless the MDBA proposes realistic and practical solutions to constraints in the MDB, outlines how the projects will be funded and when they will be completed, the draft Basin Plan cannot accurately predict what a realistic SDL would be and whether the environmental water recovered could actually be physically delivered.

**5. The MDBA must investigate the feasibility of Environmental Works and Measures that improve environmental outcomes without compromising the consumptive pool.**

The National Irrigators' Council has previously identified environmental works and measures (see attached additional submission to the Regional Development Australia Inquiry) and acknowledges that the Murray Darling Basin Ministerial Council meeting communiqué released on 4<sup>th</sup> November, 2011 noted progress of the \$6million funding package for 17 feasibility studies for environmental works and measures across the MDB.

If environmental objectives can be maximised and achieved by using less water by building new or upgrading existing environmental works and measures, then the SDL should be continuously increased as these works and measures are implemented. This would offset the social and economic damage caused by removing consumptive water from communities and would also allow for the watering of environmental assets.

The National Irrigators' Council is concerned that there have been no environmental works and measures identified in what is collectively known as the 'Lower Lakes' in South Australia. This is despite irrigators on Lake Alexandrina and Lake Albert identifying numerous environmental management and infrastructure issues which, if not addressed, will see the continued degradation of Lake Albert, Alexandrina and the Coorong irrespective of how much water is recovered from upstream users.

We would strongly urge the MDBA and the relevant State and Federal Governments to immediately provide funding for feasibility studies to be undertaken as soon as possible into each of the five projects identified by the Meningie Narrung Lakes Irrigator Association, in what is now widely known as the Five Point Plan.

The Five Point Plan Consists of:

- I. Removing the Narrung Ferry Causeway will return the entrance to the Narrung Narrows to nearer the original state.
- II. Clearing the remnants of the Narrung Bund along with the silt wave that the Bund's construction caused (as promised by the South Australian Government).
- III. dredging the Narrow's (linking Lake Alexandrina to Lake Albert), preferably close to the 1960's bathymetry.
- IV. A connector (channel and/or a pipeline) at the Southern End of Lake Albert to the Coorong
- V. Returning natural flows to the southern end of the Coorong. (SE drains)

**6. *Will require trade-offs to ensure the needs of the environment are balanced with those of communities and food and fibre producers.***

Irrigators support the objectives of the *Water Act 2007* to "optimise economic, social and environmental outcomes" from the use of the Basin's water resources. This does not mean, as the Act and draft Basin Plan suggest, that environmental needs should be met first and then social and economic impacts taken into account.

In our view, all three should be treated equally. This will necessarily require trade-offs. Irrigators are prepared to accept reductions in water availability in the productive pool, just as the wider community should accept that we will not be returning the Basin to a pre-development level of health.

This process of treatment must involve the public within local regions. For instance, they need to be able to select preferences from different levels of environmental outcome or the maintenance of particular environmental assets.

In particular we rejected the MDBA's attempt to define optimisation in the "Guide" as:

*"...seeking to maximise the benefit to the environment, while minimising the economic and social impacts".<sup>3</sup>*

This did not treat all three outcomes equally. Whilst the MDBA has recognised the 'constraints' in the system, the draft Basin Plan does not deliver a balanced triple bottom line outcome.

We believe it is difficult to judge exactly what is "sustainable" given the high variability of the Basin environment, but we reject the notion that sustainability can only be achieved by returning 2750 GL of long term cap equivalent of water or more to the environment.

**7. Successful environmental outcomes will require more inputs than additional water volume alone. There must be commitment to integrated catchment management, clear definition of the environmental outcomes sought and a transparent and realistic environmental watering plan.**

A concern of the Act, and indeed the entire Basin reform process, is the focus on water and flow alone as a solution to the environmental problems of the river system.

This is a repudiation of some 30 years of integrated catchment management in this country that has acknowledged that management must extend to matters such as land use, riparian vegetation, thermal pollution, noxious weeds, invasive species and foreign fish species.

Former Productivity Commission commissioner and Wentworth Group member Neil Byron puts it very well:

*"While reducing extraction for irrigation might be necessary in many (but not all) of the rivers in the Basin, it is unlikely to be sufficient. The problems are more complex than that. Excessive extraction of water by irrigators is not the sole (and might not even be the greatest) threat to ecosystem health and sustainability in the MDB."<sup>4</sup>*

The Sustainable Rivers Audit (SRA) was relied on heavily by the MDBA in developing the Guide and as justification for the need for a Commonwealth to become more fully involved in the management of water resources in the MDB. Overall results of the SRA indicate that only three of the 23 river valleys were assessed as being in "good" or "moderate" ecosystem health and the remaining 20 were rated "poor" or "very poor". However on the hydrology measure, the result is almost exactly reversed: only five valleys were in the "poor to moderate category", while the remaining 18 are rated "moderate to good".

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<sup>3</sup> Guide to the proposed Basin Plan, Vol 1, pg 107

<sup>4</sup> Neil Byron, "What can the Murray-Darling Basin Plan Achieve? Will it be enough?", Basin Futures: Water Reform in the Murray Darling Basin.

So the SRA indicates that the problem is not just lack of water, but the only solution currently being proposed is more water. “Just add water” is not a solution to a complex problem.

To have any realistic hope of achieving real and durable improvements in environmental health, the basin needs to be managed holistically, incorporating all the factors that impact on environmental health and managing them in concert with the Commonwealth Environmental Water Holder (CEWH) water assets. The *Water for the Future* program must be implemented in concert with a boosting of investment in the *Caring for our Country* or other land and catchment management programs.

To date Governments are too inclined to focus on the **numbers** in this process and ignore the **outcomes**. The outcomes can be achieved better by holistically managing all factors affecting them, rather than focussing on only one, albeit very important, factor in water.

### *Native Fish Strategy*

An example of work that can be undertaken to improve river health is the Native Fish Strategy. It is five years into a 50 year program and has already shown great signs of success. Importantly, while its focus is on the recovery of native fish stocks, in doing this it delivers a more integrated approach involving removal of weeds and alien fish species, improving fish passage, rehabilitation of riparian zones, re-snagging of river channels and modification of large dams to help mitigate thermal pollution.

An integrated and successful plan for the Basin would include a commitment to ongoing funding of this Strategy.

Any plan for the Basin must also include a clear and transparent environmental watering plan that is targeted to achieve the outcomes sought, is realistic and practical given geographic, hydrologic and community constraints, and has been developed with community input.

***8. Infrastructure efficiency programs are preferable to buyback and should be prioritised. Increased investment in research, development and extension will also help irrigators adjust to a future with less water.***

Irrigators support the recommendation of the Regional Australia committee that more focus should be placed on delivery of water savings through irrigation infrastructure. We are extremely frustrated at the slow pace of roll-out of infrastructure programs. More efficient infrastructure provides a win-win outcome – water savings are shared with the environment while irrigators are able to produce (at least) the same amount of product with less water – maintaining productivity, jobs and economic activity in local communities and downstream industries. For this reason we reject the notion that infrastructure programs are a subsidy directed only at one section of the community.

***9. Increased investment in research, development and extension will also help irrigators adjust to a future with less water.***

Recommendation 14 is one of the most important yet largely ignored recommendations from the Regional Development Australia, Parliamentary Inquiry into the Murray–Darling Basin water reforms: “that the Commonwealth Government focus greater investment into research and development to improve irrigation efficiency”.

If we do not substantially increase funding for agriculture research, development and extension services the nation's food security will be severely compromised. We cannot keep doing more with less.

While Recommendation 14 was adopted "in principle" by the government, this in principle support has not stop the Government from previously abolishing Land and Water Australia, or the Irrigation Futures, Cotton and Forestry Cooperative Research Centres.

We are only too aware that science in this country is underfunded and our productivity is declining because of it. We need increased funding for the practical scientific endeavours that will enable us to produce more with less and also to better understand the environment in which we live.

We are however, concerned that the prostitution of scientific opinion in Australia is devaluing science in general and turning some scientists into activists, often resulting in a high degree of mistrust which is unfortunately increasing. The lack of dialogue between farmers and scientists is creating levels of mistrust that will increase unless addressed.

Irrigators are front line environmentalists and food producers. We are not Luddites. We take research and apply it on a daily basis in our operations. Without it we would not be internationally competitive.

Agriculture in Australia is recognised as the best enabler of new technology of any industry in the country. The drought saw farmers embrace a range of new technologies, proving that necessity is the mother of all invention yet, it is also obvious that we need extension services that take the research from the lab to the paddock.

This is particularly true of the "precautionary principle" concept. While it has a role to play, it is being used far too often by some scientists to justify their advocacy. When the precautionary principle is coupled with the old "trust me, I'm a peer-reviewed scientist with heaps of journal articles to my name", facts often become the first casualties. There needs to be greater 'ground truthing' of scientific concepts before they are endorsed as facts.

Increased Research, Development and Extension funding should be a priority for State and Federal Governments.

***10. The Commonwealth must take account of community impacts with its water purchasing program and should aim to leave a legacy of more efficient and viable irrigation districts.***

Irrigators support the buyback program as a means of "bridging the gap" to new SDLs, but it should be secondary to investment in other water saving projects. The notion that buyback is "cheaper" may be true in the short-term and in a strictly fiscal sense, but longer-term the economic and social costs will be very high.

The Commonwealth needs to understand that the buyback program is not just about returning water to the environment – it should also aid in the adjustment and rationalisation of irrigation districts to leave behind more viable and efficient irrigation systems. The "no regrets" approach to buyback does not achieve this aim.

"Public good" investment in purchasing environmental water when exercised in irrigation districts can destroy the efficiencies built into earlier "public good" investments with the consequences of poor overall resource use and serious inefficiencies in processing and community infrastructure.

This becomes reflected in economic and social disruption far greater than those caused by standard variables (exchange rate, energy prices, commodity price fluctuations).

Currently the buyback and infrastructure programs work in isolation to each other. In order to deliver the dual objectives of more water for the environment and more efficient irrigation systems, there must be better integration of the two programs.

***11. Works and measures can deliver water more efficiently to the environment and must be pursued to reduce the impact of water recovery on Basin communities.***

Engineering solutions and environmental works and measures are critical to the delivery of a balanced outcome for the Basin. We welcome commitments by Federal and State Ministers to further feasibility work on such projects.

Irrigators are being asked to, and have, become a lot more efficient, and this should apply equally to watering of key environmental sites. For example, with the installation of a weir and some regulators, a 5000 ha section of Lindsay Island on the Murray near the SA border can be watered with 90 gigalitres instead of 1200. There are a lot of projects that can be completed to get the same or similar environmental outcomes with a lot less water.

Irrigators expect all options will be considered including projects that may reduce water losses and/or deliver improved environmental outcomes around the Lower Lakes and Coorong.

Not only are many of these works projects desirable, they are critical to a successful environmental watering regime – given the level of river regulation and human settlement, it is impossible for water managers to deliver large overbank events to some environmental assets. To achieve environmental outcomes will require the use of structural works in many instances.

***12. There needs to be genuine engagement that takes on board and incorporates the views of all affected communities and actively involves the States as managers of the resource. Local communities must be engaged in the delivery of environmental and economic solutions.***

It is widely accepted that the draft Basin Plan does not adequately reflect the consultation and engagement that has occurred with affected communities.

An acceptable plan for the Basin will be the result of consultation and engagement that genuinely incorporates the views of these affected communities.

The MDBA and the Commonwealth must also consult with and actively involve State Governments who manage the resource and who hold the bulk of scientific and historical data relating to the rivers.

Irrigators and Basin communities will not tolerate an approach that does not consider their concerns, fears and aspirations. They will also reject any approach that appears to be a “box-ticking exercise” by the bureaucracy – governments must recognise the difference between “telling” and “listening”.

The best solutions for delivering environmental and economic outcomes valley by valley will come from those directly affected. Irrigators believe that local communities, supported by technical and financial assistance from governments, are best placed to deliver lasting outcomes.

**13. *The Water Act 2007 is fundamentally flawed and amendments need to be passed by Parliament. However we will work with Government to attempt to achieve a balanced Basin Plan.***

NIC has long made known its concerns about the *Water Act 2007*.

In our view, the Act is biased to the needs of the environment given its reliance on the external affairs powers to achieve a head of power under the Constitution. The external affairs powers focus almost exclusively on delivering the needs of the environment in order to meet our international treaty obligations. We do not claim that there is *no* consideration of social and economic impacts, but under the Act they are only considered “subject to” the delivery of the environment’s needs.

We acknowledge assurances from Water Minister Tony Burke and MDBA Chair Craig Knowles that they can deliver a balanced Basin Plan within the confines of the current Act. We hope they can deliver because the worst outcome would be the delivery of a balanced Basin Plan that is ultimately torpedoed in the courts because it is inconsistent with the Act as it currently stands.

**14. *Elected and accountable politicians need to make informed judgement calls based on best available environmental, economic and social science and genuine community engagement. Science cannot be the sole arbiter of water sharing decisions.***

The sharing of water resources in the MDB is a highly contentious issue that cannot be solved by science alone. Quality, peer-reviewed science should inform a decision, but it should not be the sole basis for any decision.

How best to maximise this natural resource for the whole community is not a technical question – ultimately it is a political one that must be made by the Parliament, accountable to the people and based on judgement informed by science.

**15. *Water resource decisions must treat all use of water, including interception, equitably. Irrigators will not accept reductions in their access to water that do not apply to other users.***

The National Water Initiative set out a process for all jurisdictions to regulate water use by intercepting activities (such as plantation forestry and farm dams). In the main, this agreement has not been implemented. The Guide suggested that 20 per cent of “take” in the MDB is through interception, yet clearly implied that no reduction should be applied to these users.

This is unfair and unacceptable. NIC acknowledges that dealing with interception is a difficult policy challenge but we will not accept irrigators being forced to carry the burden for other users, particularly when that use continues to grow.

At the very least, we expect a plan for the Basin to outline policy proposals for practical measures to account for and licence interception.

**16. *Previous efforts to return water to the environment must be accounted for and used to offset any reductions under proposed SDLs.***

Irrigators in the MDB have been participants in water reform for nearly two decades and there would be few who have not lost water in that time, mostly without compensation. Significant policy

reform has seen water returned to the environment through state water resource planning processes, the Living Murray, Water for Rivers and other programs.

We expect all of this water will be accounted for in environmental calculations and available to offset SDLs.

***17. The Commonwealth Environmental Water Holder (CEWH) must provide a transparent business plan and operational protocols to provide guidance to the market on its approach to trade.***

Irrigators, communities and water market participants need clarity with respect to the likely approach to trading of the Commonwealth Environmental Water Holder. The CEWH is already the largest single owner of water entitlements in the country and will become significantly larger.

Its trading behaviour could have significant impacts on the water market – both positive and negative – and may determine to some degree how great the economic impacts of reform are to Basin communities.

The CEWH must outline its approach to trading before the final Basin Plan is adopted by Parliament.

***18. The MDBA, CEWH and governments generally must provide clear guidance on their approach to environmental water delivery and the practical and economic implications of increased environmental flow events.***

The CEWH must also engage regional communities to develop and attain ownership of any plans and protocols including its approach to environmental water delivery. Too little attention has been paid so far to the practical aspects of water delivery. Issues like environmental water management in water storages, carry-over use, water discharge timings and consequent flooding need to be discussed with those affected.

***19. Monitoring, evaluation and reporting of environmental outcomes and independent audits of plan implementation must be undertaken to instil community confidence in the reform process.***

The CEWH, MDBA and all jurisdictions must also commit to regular monitoring, evaluation and reporting of environmental watering outcomes. If communities are to be impacted by water reform they need to at least be able to see that environmental outcomes are being delivered.

***20. We support the decision to align all water resource plan starting dates to 2019. Consistent with this decision and Victoria's planning framework, all states should adopt 15 year schedules for water resource plans.***

Currently all MDB states other than Victoria maintain a 10-year time schedule for the implementation and review of water resource plans. Given the long-lead times and horizons for capital investment in irrigation and related industries, 15 years is a more appropriate time-scale providing greater certainty for investment and planning.

***21. A plan for the Murray Darling Basin must be developed with consideration of broader issues including Australian population policy, domestic and international food security challenges, manufacturing policy, regional development and carbon policy which will have extensive ramifications for all farmers.***

Governments must recognise that the Basin does not exist in isolation. A range of factors must be considered in setting policy directions for its future, not the least are domestic and global food challenges, potential impacts on downstream food and fibre processing industries and regional development priorities. In a nation where many of our cities are bursting at the seams, further government-induced depopulation of inland Australia would appear to make little sense.

**22. Governments must provide structural adjustment assistance to communities where necessary.**

Irrigators recognise that much of the adjustment assistance by way of buyback and infrastructure investment is focussed on their industry.

Irrespective of the broader economic advantages of infrastructure investment, there will likely be flow on effects to local communities, including local government and other businesses. Government should recognise these impacts and provide support where necessary.

**23. The plan must include the past two years of high river flows into its modelling and consequently into the calculation of the SDL's**

Dr Rhondda Dickson of the Murray-Darling Basin Authority has acknowledged in a letter dated the 20 March 2012, that

“It is true that adding the two extra years of inflows will change the long term average of inflows (by 0.13%)”<sup>5</sup>

The NIC submits that the past two years of high river flows should be included in the modelling of long term average inflows. The NIC also submits that this inclusion should have a direct and corresponding effect on the proposed SDL's, i.e. increase the SDL's by 0.13%. This would mean that the amount of water required to be returned to the environment, being currently 2750GL, could be reduced by as much as 32 gegalitres, equating to large reductions in job losses and increases in production for basin communities.

It is only just that, if the recent record-breaking drought is to be included in the modelling, then the recent period of above-average rainfall should also be factored in.

This is a very sensible proposal that has no negative effects for the environment, yet provides social and economic benefits to the Basin communities, and Australia more generally.

The plan must include the past two years of high river flows into its modelling and consequently into the calculation of the SDL's

**24. Chapter 11 – Water Trading Rule should ideally be excised or failing that rewritten**

The National Irrigators Council (NIC) is a strong advocate of sensible Water Trade within the Murray-Darling Basin. We believe that a market mechanism is very beneficial in allowing water to move to where it is in most demand, and has allowed flexibility and diversity for irrigators and other market players.

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<sup>5</sup> MDBA, “We weren't wrong on flood data”, 20 March 2012, [http://www.mdba.gov.au/media\\_centre/media\\_releases/we-were-not-wrong-on-flood-data](http://www.mdba.gov.au/media_centre/media_releases/we-were-not-wrong-on-flood-data)

However NIC does not support chapter 11 of the Draft Murray-Darling Basin Plan in its current format. If the rules are adopted as they currently stand, they will have significant negative impacts on our members. Our concerns with these rules can be categorised in to 5 main subject areas listed below, with the related recommendations also listed. This section of our submission will further explain these concerns:

1. Accountability of Basin State Agencies

- 1.1 Exclusion of Government Agencies from Liability for Loss/Damage

Relevant Rule: 11.05

Rule 11.05 excludes Basin State Agencies from liability for Loss/damage suffered by any person, as a result of conduct of the Basin State Agencies that contravenes a rule (listed in a table in Rule 11.05) that forms part of the Water Trading Rules.

This is a discriminatory principle that must be removed. The agencies of the Basin State act as regulators, approvers of trades, water market intermediaries, and policy and process developers and implementers. The fact that the Basin State Agencies are so heavily intertwined in the Water Market means that the chances of these Agencies being found liable to a market participant at some stages is high.

This rule may result in a party who suffers loss/damage innocently as a result of the actions of the Basin State Agency, having no remedy for the loss they have suffered. Alternatively the disadvantaged party may choose to pursue a third party, for example an intermediary, to remedy the loss. However if the result is caused by the Basin States Agencies actions, then this path is unlikely to be successful, and will cause significant costs to the party who has already suffered loss due to the actions of the Basin State Agency, as well as the party who is legally pursued. Both this scenario's result in significant injustice for the affected parties, and cannot be allowed to occur. A likely example of this rule having a serious impact on a market participant is if one Basin State Agency refuses to approve an allocation trade because it has not received the appropriate material from another Basin State Agency. In this situation there is no recourse for the person who is impacted by that decision.

Ensuring the Basin State Agencies can be found liable, will not only provide security to Market participants in the case of loss/damage that has already occurred, but will also provide a further layer of protection for market participants, as these agencies will be required to be more cautious regarding the negative impacts their actions will have on these Participants, in order to avoid future legal action.

Recommendation 1.1: the words 'other than an agency of a basin state' be removed from Rule 11.05 of Chapter 11 of the Murray Darling Basin Plan. This will allow Basin State Agencies to be held liable for loss/damage suffered by a market participant as a result of their actions.

- 1.2 Exclusion of Basin State Agencies from Regulation of Service Standards

The Basin State Agencies are only subject to Service Standards, and do not face a penalty for noncompliance with these standards. This is currently leading to inefficient and ineffective processes in Water Trade. For example it takes a significant amount of time for these agencies to process a Water Trade, and trading still occurs in paper form. This can be contrasted against the trading of

stock on the ASX, where a trade will be processed in 3 – 5 days, and can occur electronically. This inefficiency is a burden to market participants.

Recommendation 6.2: Basin State Agencies be subject to penalties for non-compliance with sensible Service Standards

## 2. Cost of compliance

Relevant Rules: 11.01 2 (b), 11.03, 11.06, 11.27, 11.28, 11.29, 11.30, 11.31, 11.32, 11.33, 11.34, 11.35, and 11.45

### 2.1 Increased Cost of Compliance

A major concern for NIC members is that many of the rules in Chapter 11 further increase compliance costs for Irrigation Infrastructure Operators, with in-turn are passed on to irrigators, yet provide no benefits in regards to water trading. For example the rules may cause IIO's to engage consultants to evaluate Water Delivery Right transfer requests even if from experience the IIO's know that hydraulically the transfer cannot occur. Another example is the requirement that IIO's provide members with information regarding their water rights. This requirement is not only duplicated in other legislation, but has proved to be a very costly practice in the past.

One of our member IIO has previously completed a study into the increases in the cost of compliance as a result of Water Reform, and found that Water Reform is currently costing there organisation approximately an additional \$400,000 per annum. Compliance with these rules will further add to these costs.

Recommendation 2.1: The MDBA should apply a cost benefit analysis to each rule in chapter 11, and if the cost of compliance is large and the benefit received small, then the rule should be removed from the Murray-Darling Basin Plan.

### 2.2 Duplication of regulations

The Water Market Rules and the Water Charge (Termination Fee) currently already ensure that customers of IIO's have the right to free and unfettered trade of Water Entitlements, and these legislative instruments are currently working very effectively.

The Chapter 11 rules require that IIO's provide their members with certain information regarding their rights against the IIO. However the Water Market Rules and the Water Charge (Termination Fee) Rules and State Legislation already ensure that these members can determine their Rights. Currently most IIO's have already provided this information to their customers.

Further, the Water Market Rules and the Water Charge (Termination Fee) Rules further provide protection for these members, by allowing them to transform to a private Water Access Entitlement if unhappy with the services provided by the IIO.

Also water rights in an irrigation district are continuously altered due to trading, transformation and termination occurring in that district. So a right identified at one point in time, may have different characteristics soon after. Meaning there is little benefit in providing the information required, unless the member needs that information at that specific point in time. If the MDBA feels the

provision of this information is absolutely necessary, a much more appropriate alternative is that IIO's be required to provide this information only on the request of their member.

Recommendation 2.2(a): Any reference to the provision of information from Irrigation Infrastructure Operators to members regarding their rights against the IIO be removed from the Murray-Darling Basin Plan

Also rule 11.45 requires that the IIO's provide their members with the IIO's rules that govern the trade of Water Rights. However the Water Market Rules and the Water Charge (Termination Fee) Rules provide the process and rules for trade of Irrigation Rights. IIO's generally do not have a separate set of rules. Additionally these legislative instruments already currently require that the rules be provided to members on request.

Also, in regards to any other water trading such as allocation trading, it is difficult to provide water trading rules as they are subject to government rules which change frequently and sometimes without notice. The recent embargo in allocation trade by the VIC, NSW and SA Governments provide testament to this argument. Further any other water trading such as allocation trading is in the best interest of IIO's and their members, therefore these IIO's readily provide assistance to their members in these activities. Hence there is little benefit in requiring IIO's provide these rules to members.

Recommendation 2.2(b): Rule 11.45 be removed from the Murray-Darling Basin Plan

### 2.3 Need for Central Reporting Agency

Another major concern and frustration for our member organisations (very closely related to the compliance costs and duplication of regulation concerns) is the many different agencies the IIO's are required to report to, and the different forms these reports must take, as a result of the numerous different pieces of Water Reform legislation. IIO's are currently required to report to the ACC, NWI, DSEWPac, BOM and other agencies just regarding water, and often the information reported is very similar (if not identical).

While currently the MDBA has not officially outlined the reporting framework for the Chapter 11 reporting requirements, a member has noted that the MDBA stated at a consultation session that it will establish a compliance team (separate to the ACCC compliance team) who will be responsible for overseeing the chapter 11 reporting requirements. Hence this will another agency that IIO's are required to report to.

Recommendation 7.3: The MDBA recommend that a single system and form be established for all Water Reform related reporting.

### 2.4 Regulation of Water Delivery Rights

Relevant Rules: 11.01 2 (b), 11.03, 11.06, Part 2 Division 2 (11.27, 11.28, 11.29, 11.30)

NIC feels that the rules relating to the Trading of Water Delivery Rights should be excluded from the Murray-Darling Basin Plan. The reasons for this are that Delivery Entitlements are not "water", are unique to each delivery system and are not actually required to use water in irrigation systems.

There is no "basin wide market" for delivery entitlements, and the trading of Water Delivery Rights does not affect Water trading in any way. The experience of our Irrigation Infrastructure Operators

to date affirms this statement. The allocation and trading of Water Delivery Rights is a complex issue and not one simply resolved.

Additionally, it should be noted that a business imperative for Irrigation Infrastructure Operators is to maximise water delivered, and consequently they will do everything possible to maximise the efficient and effective use of their system where there is a return on any investment if required. Recommendation 2.4: Any references to 'Water Delivery Rights' be removed from Chapter 11.

### 3. Exclusion of Domestic Water from Rules

Rule 11.08(2) states that stock and domestic water rights are excluded from the Rule 11.08(a), meaning conditions may be placed on the Stock and Domestic right, relating to its use (trade restrictions). NIC cannot see any logical reason for this discriminating principle. If the owner of a stock and domestic licence wishes to trade that licence they should be free to do so. If it results in a property becoming a dry property then this will be reflected in the property asset value.

Recommendation 3: Rule 11.08(2) be removed from the Murray-Darling Basin Plan

### 4. Environmental water given precedence:

Rule 11.17(c) states that "restrictions may be necessary because of the need to avoid compromising environmental watering requirements." This effectively gives preference to water for environmental purposes in water trading.

This is a significant change from how restrictions are currently imposed and requires extensive analysis and presentation to the States and industry as to how compromising environmental watering requirements is defined.

The MDBA and SEWPAC have emphatically stated that all water purchases for the environment would retain the same characteristics as purchases made for other purposes. Section 11.17 (c) is in direct contrast to the promises made to our members and their communities. We believe that the promises made should be upheld and respected in this legislation.

Recommendation 4: Rule 11.17(c) be removed from the Murray Darling Basin Plan

## Conclusion

The National Irrigators' Council believes that a 'good' basin plan which achieves a balance between social, environmental and economic outcomes can be achieved. However the proposed Basin Plan does not deliver the desired outcome and will need changes if it is to be acceptable to irrigators and the communities we live in.

We have been very frustrated with the process undertaken both by the MDBA and the wider Government. The process since the announcement by the previous Government of a National Plan for Water Security has been drawn-out, opaque, confusing and ultimately damaging for our members and their communities. The nature of the process has breached trust with industry and jeopardised support for reform. The MDBA and the Government have considerable work to do to rebuild any semblance of that trust.

The long legislative process which will culminate with a Basin Plan will not on its own deliver a 'healthy working river system'. With the implementation and delivery of the Basin Plan still to be

finalised it is important that the Government recognise that irrigators have argued consistently for a 'good' Basin Plan grounded in reality. To this end, submissions to just some of the numerous inquiries, Parliamentary Committees and 'consultation' rounds have been attached as appendices.

We have engaged in the process in good faith, however our patience is not unlimited and our communities in the MDB, not political quick fixes or key seats in Adelaide, will come first and will ultimately guide whether we accept the Basin Plan.

## **Appendices**

- ❖ [Submission by the National Irrigators' Council to The Senate References Committee on Legal and Constitutional Affairs - Inquiry into provisions of the Water Act 2007](#)
- ❖ [Submission by the National Irrigators' Council to the House of Representatives Standing Committee on Regional Australia - Inquiry into the impact of the Murray-Darling Basin Plan in Regional Australia](#)
- ❖ [Supplementary Submission by the National Irrigators' Council to the House of Representatives Standing Committee on Regional Australia - Inquiry into the impact of the Murray-Darling Basin Plan in Regional Australia](#)
- ❖ [Submission by the National Irrigators' Council to the Senate Standing Committee on Rural Affairs and Transport - Inquiry into the management of the Murray-Darling Basin](#)
- ❖ [Submission to the MDBA Sustainable Diversion Limit Issues Paper](#)



# CSIRO Submission on the Proposed Murray-Darling Basin Plan

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# Executive Summary

## Background

A substantial amount of work has gone into the preparation of the proposed Basin Plan and it draws upon extensive data, information and prior research. CSIRO recognises the challenging task of accessing and using best available scientific information to develop the Basin Plan, and recognises the constraints of time and resources available to prepare the proposed Basin Plan.

CSIRO has undertaken research and provided scientific advice to underpin the development of the proposed Basin Plan. All CSIRO research related to the proposed Basin Plan has been peer-reviewed and has been made publicly available. An overview of CSIRO research relevant to the development of the proposed Basin Plan is available on the CSIRO website at:

<http://www.csiro.au/Organisation-Structure/Flagships/Water-for-a-Healthy-Country-Flagship/Sustainable-Yields-Projects/MDBscience.aspx>

CSIRO provided feedback to the Murray Darling Basin Authority (MDBA) on the *Guide to the Proposed Basin Plan* in October 2010, noting some concerns with the technical underpinnings of the *Guide*. This was published by the Murray-Darling Basin Authority on their website at:

[www.mdba.gov.au/files/submissions/CSIRO\\_Basin%20Plan%20Guide.pdf](http://www.mdba.gov.au/files/submissions/CSIRO_Basin%20Plan%20Guide.pdf)

Since the publication of the *Guide*, CSIRO has undertaken two important additional pieces of work for the MDBA. First, we led (together with experts from other institutions) a science review of the methods for estimating an “environmentally sustainable level of take” for the Basin. This review generally found the approach and methods used by the MDBA to establish an Ecologically Sustainable Level of Take (ESLT) are defensible in the context of current scientific knowledge. The review is available on the MDBA website at:

[http://download.mdba.gov.au/proposed/CSIRO\\_ESLT\\_Science\\_Review.pdf](http://download.mdba.gov.au/proposed/CSIRO_ESLT_Science_Review.pdf)

Second, we led an assessment and valuation of the likely environmental and social benefits of the proposed Basin Plan; this is also available on the MDBA website:

[http://www.mdba.gov.au/files/bp-kid/2017-Assessment\\_Ecological\\_Economic\\_Benefits.pdf](http://www.mdba.gov.au/files/bp-kid/2017-Assessment_Ecological_Economic_Benefits.pdf).

As a member of the Goyder Institute for Water Research, CSIRO has contributed scientific input to the South Australian Government on the likely ecological outcomes in South Australia of the proposed Basin Plan. This advice was based on a rapid Expert Panel interpretation of South Australian Government hydrologic and hydrodynamic assessments of the proposed Basin Plan. CSIRO has also provided scientific input to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities on options for water savings at Menindee Lakes; this is available on the DSEWPaC website at:

<http://www.environment.gov.au/water/publications/action/pubs/darling-water-savings.pdf>

Consistent with our role as the national science agency we provide further scientific input, including indicating whether the concerns that were raised in our feedback on the *Guide* are still pertinent.

## Interception and Water Availability Assessment

The proposed Basin Plan seeks to manage all surface water take (including catchment interception and main-stem diversions) in a water resource area with a single Sustainable Diversion Limit (SDL). This creates a risk of increasing levels of environmental impact at a constant level of take. This could occur if, for example, current farm dam water use in the upper catchment were to be replaced partially or entirely by volumetrically equivalent diversions further downstream. CSIRO notes that because of system losses, the

locations of water recovery by government will influence the actual volumes of environmental water that can be delivered to meet needs at specific downstream locations.

The water resource assessment that supports the proposed Basin Plan appears to overestimate the total resource. A more integrated approach to water resource assessment that adjusts for inconsistencies amongst available data and models and explicitly represents surface-groundwater interactions and system losses would provide a more robust scientific underpinning to the proposed Basin Plan.

The proposed Basin Plan allows a more flexible approach to water recovery than that proposed in the *Guide* by specifying “shared reduction” components for the northern and southern basins. However, it is unclear to CSIRO how the MDBA will ensure these shared reductions are achieved across multiple water resource plans.

### Climate Change

Climate change is likely to lead to reductions in the average levels of future water availability. The proposed SDLs do not explicitly take into account future climate change, but accept the climate change risk sharing in current planning arrangements.

While recovery of additional entitlement-based environmental water will provide some greater protection for the environment during extreme dry periods, the majority of environmental water is not entitlement-based and these volumes would be significantly reduced over the long term under a drying climate.

CSIRO suggests that between now and 2015, a rigorous analysis of the implications of future climate change for the environmental outcomes being sought from the Basin Plan be undertaken. This would provide a basis for informing and communicating the future SDL reductions that would be required if it was agreed that the same level of environmental performance as can be achieved with the proposed SDLs should be sought under a drier future climate.

### Surface Water SDLs

The methods used by the MDBA to establish an Environmentally Sustainable Level of Take (ESLT) are defensible in the context of current scientific knowledge. However, it will be important to develop and implement a program of research that strengthens these methods and improves the scientific basis for adaptive management.

MDBA publications indicate that the Environmental Water Requirements (EWR) that reflect the environmental objectives of the proposed Basin Plan are not fully met in the scenario modelling for the proposed surface water SDLs. The MDBA acknowledges that the proposed Basin Plan represents a balance between the different environmental, economic and social outcomes Australians value from the water resources of the Basin.

The MDBA has emphasised that river system constraints prevent delivery of higher flows to secure greater environmental outcomes. However, not all EWR shortfalls relate to high flows and it is likely that some existing constraints could be relaxed or removed to allow improved environmental outcomes. CSIRO suggests that rigorous whole-of-system analysis of constraints be conducted between now and 2015, complemented by modelling of realistic operational management of environmental water to guide efficient use of this water.

CSIRO notes a significant risk associated with the method for testing SDL compliance in the proposed Basin Plan that appears to allow unlimited credit to accrue. A more robust compliance test would prevent unlimited credit.

### Water Recovery

Investment in more water-efficient irrigation infrastructure can “free up” water, which can then be re-allocated, including to environmental uses. However, a significant fraction of the “losses” associated with

irrigation systems drain to the river and form part of the existing environmental water share. More efficient irrigation infrastructure may reduce these “return flows”, thus reducing irrigation losses does not necessarily deliver equivalent increases in environmental water. CSIRO suggests that careful scrutiny of the “water savings” involved in all infrastructure projects be undertaken to ensure new entitlement-based environmental water does not simply replace (in part or in full) existing “planned environmental water” from irrigation return flows.

Changed operation of Menindee Lakes could deliver one of the largest single water savings in the Basin. CSIRO has analysed a specific package of changed operations, entitlement transfers and new works would meet the environmental water regime for the lakes and secure Broken Hill’s water supply, while recovering an average of 150 GL/year of water for the environment with no impacts on downstream water users.

### Groundwater

The proposed Basin Plan increases the total allowable groundwater use across the MDB by 85% to almost 2000 GL/year above the baseline diversion limit. For a number of the increases, CSIRO questions whether there is sufficient evidence to indicate that the proposed SDLs represent an ESLT for groundwater.

CSIRO notes that the proposed increase in allowable groundwater extraction would also lead to impacts on surface water resources, most of which would not be fully apparent until well beyond the planning period. The total additional future streamflow impact that would result from the proposed groundwater SDLs is likely to be in the order of 500 GL/year. This impact would be distributed over a large area, nonetheless this can be considered as a future increase in surface water use partially offsetting over the long term the proposed 2750 GL/year reduction in surface water use.

CSIRO suggests that a stronger evidential base for groundwater SDLs would be achieved by undertaking a rigorous surface water impact analysis and by further development of the risk management framework for groundwater use. Ongoing adaptive management (that allows SDLs to be increased in the future if appropriate as better information becomes available) would complement the risk management framework.

### Salinity Management

The Water Quality Management Plan within the proposed Basin Plan is founded on a robust history of salinity management in the Basin and a strong evidence base.

Achieving the proposed salinity targets for the Coorong will depend on how environmental water is managed. It is expected that the largest volumes of environmental water will be applied in the downstream-most reaches of the Murray River and hence salinity concentrations will improve along much of the river. However, salinity risk is most associated with infrequent high salinity conditions, the frequency of which is dependent on specific operating conditions and risk mitigation procedures. Current models need improving to properly assess these conditions.

The minimum salt export target for the Basin would be met more often under the proposed Basin Plan than under current operating conditions, but would not be met for the driest 10-year period in the historical climate record. The ecological consequences of such an occurrence are not well understood.

### Economic Issues

CSIRO research shows an average reduction in irrigation diversions of 2800 GL/year would reduce the gross value of irrigated agricultural production across the Basin by about 3% per year on average. CSIRO assessments of the economic benefits of an average increase in environmental water of 2800 GL/year show that while not all benefits can be monetised, those that can have economic value in range \$3–8 Billion.

Water trade in the southern Basin during the recent drought significantly reduced the impacts of reduced water availability on the gross value of irrigation production. Increased water trading in future could present either risks and/or opportunities. CSIRO suggests that further economic studies would help

understand the dynamics and impacts of water trade and the associated risks and/or opportunities; ongoing monitoring of the environmental and economic consequences of water trade would sensibly support these studies.

#### Adaptive Implementation

Given limitations of the existing scientific knowledge base, CSIRO supports an adaptive approach to implementing the Basin Plan, based on monitoring of outcomes that helps improve scientific knowledge.

CSIRO considers that the key to effective adaptive management will be establishing governance arrangements that allow management agencies, various stakeholder groups and research institutions to efficiently share data and information and to collaborate in water management, experimental investigations and environmental performance monitoring.

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# 1 Introduction

CSIRO has a long history of conducting research on water resources, irrigation, ecosystems, natural resource economics and water policy. We have a track record of peer-reviewed research on the Murray-Darling Basin and have research facilities within the Basin.

A substantial amount of work has gone into the preparation of the proposed Basin Plan and it draws upon extensive data, information and prior research. CSIRO recognises the challenging task of accessing and using best available scientific information to develop the Basin Plan, and recognises the constraints of time and resources available to prepare the proposed Basin Plan.

In the CSIRO-led review of the MDBA method for estimating an “Environmentally Sustainable Level of Take” (ESLT) (Young et al., 2011), an assessment was made of the work involved in the determination of surface water Sustainable Diversion Limits (SDLs). The review report presents CSIRO’s view of the scientific strengths and weaknesses of these components of the technical work underpinning the proposed Basin Plan. The overall findings of the review are captured in the summary responses to three “questions of sufficiency” posed by the MDBA; these are repeated below:

**1. Overall, is the body of science sufficient to make an informed decision on an environmentally sustainable level of take for the Basin?**

Given the knowledge derived from over thirty years of Australian water research, and in the context of an adaptive management framework proposed for the implementation of the Basin Plan, there is sufficient scientific knowledge to make an informed decision on an ecologically sustainable level of take.

**2. Are the methods adopted fit for purpose?**

In the context of an adaptive process for managing the level of take in the Basin, the methods adopted are considered fit for purpose. In line with this adaptive approach, recommendations are given in the CSIRO report on how to improve the methods over the short, medium and long term.

**3. Does the body of work undertaken represent a sufficient basis to begin an adaptive management process around the level of take in the Basin?**

The body of work that has been undertaken is substantial and is considered to represent a sufficient basis to begin an adaptive management process around the level of take. At the time of the CSIRO review the technical documentation of this body of work was incomplete.

The ESLT science review also made a series of recommendation to MDBA for future analysis and investigation between now and 2015. The MDBA has publicly stated they “support the recommendations for future work to strengthen the scientific basis of the method for determining an environmentally sustainable level of take (ESLT) for the Basin as part of its adaptive management approach to implementing the Basin Plan”.

This submission focuses on aspects of the proposed Basin Plan including water resource assessments, groundwater SDLs, salinity and economic issues. For each of the issues raised in our submission on the *Guide to the Proposed Basin Plan*, we note whether or not these are now resolved.

## 2 Interception and Water Availability Assessment

### Key points

- The proposed Basin Plan seeks to manage all surface water take (including catchment interception and main-stem diversions) in a water resource area with a single SDL. This creates a risk of increasing levels of environmental impact at a constant level of take. This could occur if, for example, current farm dam water use in the upper catchment were to be replaced partially or entirely by volumetrically equivalent diversions further downstream.
- CSIRO notes that because of system losses, the locations of water recovery by government will influence the actual volumes of environmental water that can be delivered to meet needs at specific downstream locations.
- The proposed Basin Plan allows a more flexible approach to water recovery than that proposed in the *Guide* by specifying “shared reduction” components for the northern and southern basins. However, it is unclear to CSIRO how the MDBA will ensure these shared reductions are achieved across multiple water resource plans.
- The water resource assessment that supports the proposed Basin Plan appears to overestimate the total resource. A more integrated approach to water resource assessment that adjusts for inconsistencies amongst available data and models and explicitly represents surface-groundwater interactions and system losses would provide a more robust scientific underpinning to the proposed Basin Plan.

### 2.1 Recovering water for environmental needs in downstream regions

A key concern of CSIRO with the *Guide* was the way in which catchment interception of runoff (by farm dams and commercial forestry) had been used when calculating the reductions to water use required from tributary valleys of the Murray and Darling Rivers. This method produced very high relative reductions in watercourse diversions in valleys that had high levels of existing interception by farm dams and plantations. This related to our broader concerns on how downstream environmental water requirements were attributed to tributary valleys.

This method has been abandoned by the MDBA for the proposed Basin Plan and the mechanisms by which downstream requirements from tributary valleys is no longer directly specified. Rather, the proposed Basin Plan specifies “shared reduction” volumes for northern Basin zone and the southern Basin zone.

This new approach provides greater flexibility in water recovery. Two risks remain with the approach: (i) it is unclear how the MDBA will ensure these shared reductions are achieved across multiple water resource plans, and (ii) the locations of water recovery within each zone will determine the volumes of new environmental water that can be delivered to meet needs at specific downstream locations.

The second risk is most relevant in the northern Basin where there are significant differences in the efficiency of water delivery to downstream locations across the different valleys. For example, recovery of 100 ML from the Namoi for the shared reduction would deliver significantly more water on average to meet the environmental needs in the lower Darling than recovery of 100 ML from the Condamine-Balonne. In the southern Basin where the efficiencies of water delivery are higher, the risk while smaller, is still relevant during low flows – that is, for delivery of instream environmental flows during dry periods.

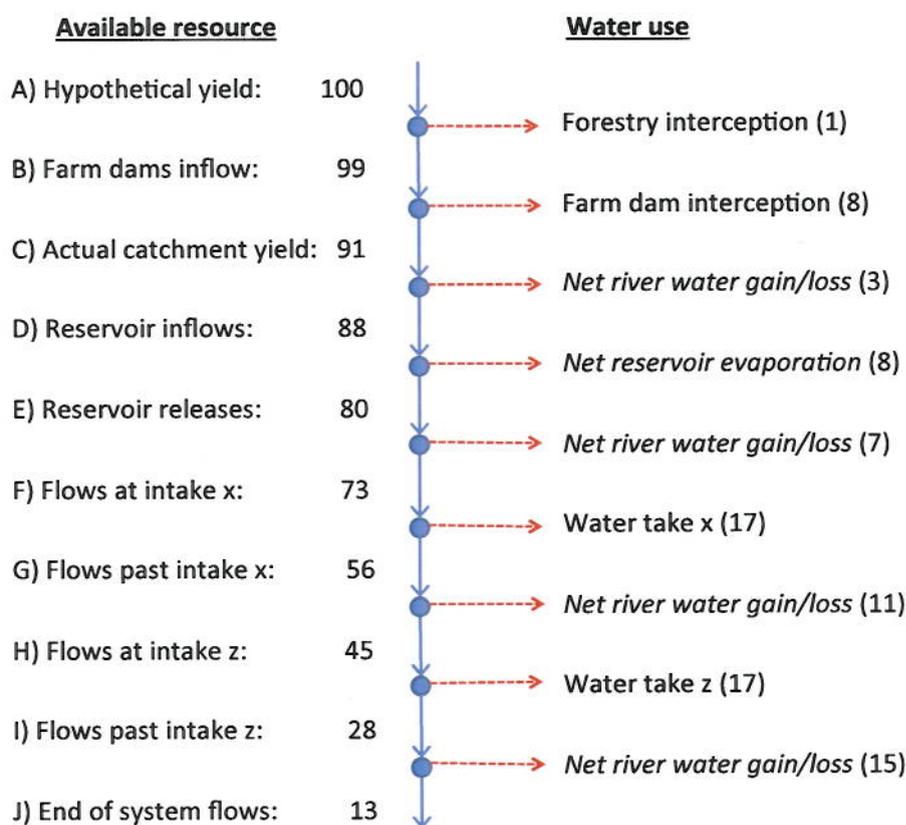
### 2.2 Assessing the size of the water resource

Another concern raised by CSIRO in its submission on the *Guide* related to how intercepting land uses had been considered in estimating the total water resources across the Basin. This remains a concern – not in terms of the conceptual approach used by the MDBA to defining the resource, but rather the way in which this has been applied by the MDBA.

Providing an assessment of the size of the Basin water resource is a part of the mandatory content of the Basin Plan (Section 22 of the *Water Act*). This assessment is provided in Schedule 1 of the proposed Basin Plan where it indicates the total long-term water resource (assessed for the period 1895-2009) is 32,553 GL/year. The supporting report (MDBA, 2011b; including an Errata dated January 2012) indicates this is comprised of: inflows (28,472 GL/year), adjustment for estimated unmodelled diversions (297 GL/year), adjustments for estimated interceptions (2721 GL/year) and other adjustments (1064 GL/year) primarily inter-basin transfers.

There are different ways to define the surface water resource; the most appropriate definition depends on the specific water management issue or question being posed. The most commonly used definitions (Figure 1) are:

- A: hypothetical catchment yield in the absence of any intercepting activities or diversions)
- C: actual catchment yield incorporating the effects of intercepting activities but also any (net) river losses to direct and floodplain evaporation and direct pumping
- D: total reservoir inflow
- E: reservoir releases as a measure of the average volume of resource that is effectively regulated, and either including or excluding safety spilling
- F: resource at a particular location, e.g. the first major off-take.



**Figure 1.** Reductions in available surface water (from 100 per cent), moving from the MDB headwaters to the barrages. Net river water gains and losses include long-term net exchanges with groundwater, net gains or losses from rain or direct evaporation and net floodplain losses. A part of these losses support environmental health. The percentage reductions in this simplified illustrative example are based on Leblanc et al. (2012, Fig 2; reproduced below).

In the Murray-Darling Basin Sustainable Yields (MDBSY) Project (CSIRO, 2008), alternative assessments of the total Basin resource were presented. Greatest prominence was given to two assessments:

- the sum of inflows to river models plus inter-basin transfers in these models (location C in Figure 1), and

- the sum across the Basin's rivers of the water availability assessed for without-development flow conditions at the most reliable mid-valley gauges which are typically situated close to the location of major water diversions and in most cases are near to where losses begin to exceed additional inflow gains (location F in Figure 1).

The second of the above assessments (under the historical 1895-2006 climate) provided a resource estimate of 23,417 GL/year; this assessment also included minor adjustments to remove the estimated impacts of current and past groundwater use. This assessment was provided as context for managing water diversions from watercourses – with the focus on regulated watercourses.

To be comprehensive as an assessment in the context of managing watercourse diversions, an adjustment for the river diversions not represented in the current river models would be appropriate. However care is required in any such adjustment because while diversions “upstream” of the current river models are not explicitly represented, they may be partly or wholly reflected in the inflows to these models, depending on the period for inflow calibration and history of diversions. If river model inflows are calibrated to a period of flow record that is not impacted or only partly impacted by current unmodelled diversions, there will be a double-accounting error in the resource assessment.

The Basin Plan seeks to manage interception take as well as watercourse diversions. Future State water resources plans will need to account for and manage interception take. Hence it is appropriate to consider the resource available to interception take and not just the resource available for watercourse diversions. This is the hypothetical yield of location A in Figure 1. The “hypothetical” yield cannot be measured directly and so must be inferred from a mixture of observations and modelling.

Conceptually, the approach taken by the MDBA to assess the “hypothetical” yield is sound. However, the methods used by MDBA have a number of uncertainties or weaknesses that appear not to have been fully addressed. Most importantly, because the assessment of hypothetical yield is based on multiple data sets with various different embedded assumptions, the overall assessment does not represent a fully consistent water balance. CSIRO considers that there are two specific issues that need to be addressed to ensure a consistent water balance:

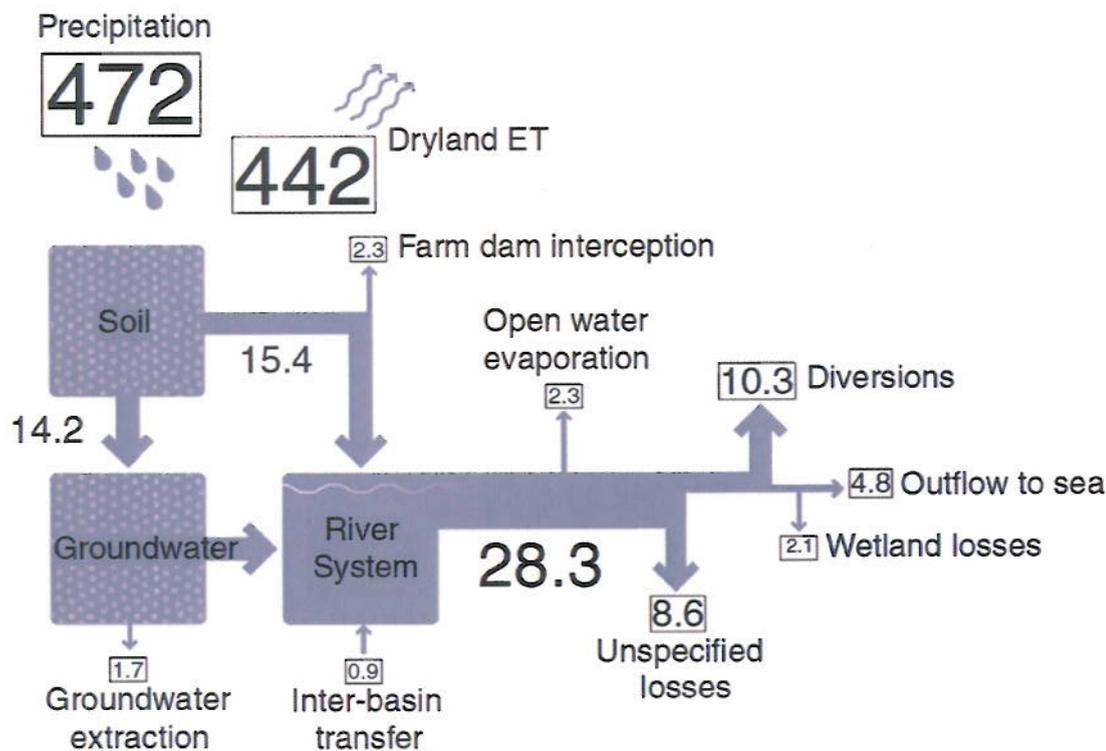
- (i) Several of the current water resource models in Basin are known to provide unrealistic estimates of inflows. These are a result of different approaches to model calibration (and are partly due to a high proportion of inflows being ungauged in some valleys). For some models the inflows are artificially inflated, with this inflation compensated for by artificially inflated losses downstream. In these models the modelled streamflow (including modelled outflow) is reliable, but neither the inflows nor the losses are reliable (Van Dijk et al., 2008). Using these inflows for estimating the total basin resource inflates the overall estimate. CSIRO suggests that downward adjustments to inflated inflows should be made in arriving at a total resource estimate – for example, by assuming that all unspecified model losses are not real.
- (ii) The available estimates of interception for the entire Basin are known to be very uncertain (SKM, CSIRO and BRS (2010)). Additionally, there are significant risks of over-estimating inflows when adjusting for interception, depending on the extent to which current interception levels are implicit in the inflow calibrations in the current river models. Estimated river model inflows should be adjusted for the volume of interception reflected in the observed inflows to which the model is calibrated. Where additional intercepting uses post-date the model calibration period for inflows, there will be an over-estimation of inflows. This over-estimation also applies to adjustments made for unmodelled diversions. It is unclear to CSIRO whether the MDBA has effectively addressed this issue either for interception take or unmodelled diversions. CSIRO suggests that a careful comparison of model calibration periods with the timing of both interception take and unmodelled diversions is required to ensure over-estimation of inflows is avoided; this is required for the all the forms of interception the Basin Plan seeks to manage. Results from the MDBSY provide this information, as well as a means of prioritising such an assessment for the catchments and tributaries most affected by intercepting activities.

CSIRO suggests that a remaining underlying risk with the MDBA's approach to assessing the water resource is related to the natural losses of water that occur as flow moves downstream through the river system.

With all surface water take in a water resource area managed by a single SDL, there remains a risk of increasing environmental impact at a constant average level of take. This could occur, for example, if catchment interception was partially or entirely replaced by volumetrically equivalent (on average) diversions much further downstream. This effect is highlighted in the incremental losses along the river system illustrated in Figure 1.

There are various ways this risk could be addressed, including defining different SDL resource unit areas for interception take and for watercourse diversions, or setting separate SDLs for these different forms of take. Trade between these forms of take could be allowed provided appropriate exchange rates were applied to trade to account for expected natural losses.

The above discussion of arriving at a full internally consistent water balance has focused on surface water. A more complete picture should also encompass groundwater. Leblanc et al. (2011) provide a useful review of the water balance of the Basin and Figure 2 from that review provides a helpful synthesis of available data. This view helps emphasise the scale-dependency of different water resource assessments and the water losses that occur through various natural processes in the Basin.



**Figure 2.** Approximate overall water balance for the Murray-Darling Basin under the historical climate and current water sharing arrangements. Taken from Leblanc et al. (2011) based on data from MDBA (2010a), CSIRO (2008) and Van Dijk et al. (2008).

Having corrected for the issues described above, CSIRO suggests that it would be helpful for MDBA to present its hydrological assessments in a manner similar to Figure 2. This could be usefully done for without-development conditions, current arrangements and the proposed Basin Plan. This could be replicated for the historical climate and for potential future climates. It could be also used to demonstrate the very small difference that one or two additional years of record make – even when these years are far from average years.

### 3 Climate Change

#### Key points

- Climate change is likely to lead to reductions in the average levels of future water availability. The proposed SDLs do not explicitly take into account future climate change, but accept the climate change risk sharing in current planning arrangements.
- While recovery of additional entitlement-based environmental water will provide some greater protection for the environment during extreme dry periods, the majority of environmental water is not entitlement-based and these volumes would be significantly reduced over the long term under a drying climate.
- CSIRO suggests that between now and 2015, a rigorous analysis of the implications of future climate change for the environmental outcomes being sought from the Basin Plan be undertaken. This would provide a basis for informing and communicating the future SDL reductions that would be required if it was agreed that the same level of environmental performance as can be achieved with the proposed SDLs should be sought under a drier future climate.

CSIRO was critical of the approach adopted by the MDBA in dealing with climate change presented in the *Guide*. Subsequently, the MDBA has substantially changed its approach and adopted a different policy position with respect to climate change. Comments on how climate change is considered in the proposed Basin Plan are presented below.

For the proposed Basin Plan, surface water SDLs have been derived using 1895–2009 observed and modelled (extended and gap-filled) climate and streamflow data. These SDLs do not therefore explicitly take into account future climate change. The MDBA documentation supporting the proposed Basin Plan discusses the likely decline in future surface water availability, particularly in the southern parts of the Basin (informed by MDBA climate change studies, MDBSY, South Eastern Australian Climate Initiative and elsewhere).

Although there remains considerable uncertainty around the future climate change impacts on water availability, climate change is likely to lead to reductions in the average levels of future water availability. CSIRO considers that with a changing climate, longer-term water resource planning needs to consider multiple plausible scenarios of future water availability and the risks to desired outcomes under these different scenarios.

The 1997–2009 drought demonstrated that droughts more severe than those experienced in the past can occur and CSIRO suggests that future planning should consider this possibility. The plain English guide to the proposed Basin Plan states: “Because the median projected climate change impacts on streamflow are currently within the range of natural variability, MDBA selected the historical 1895–2009 climate as the climate baseline in preparing the proposed Basin Plan.” Similarly, MDBA (2012a) states “The average impact on water availability due to projected climate change is less than the climate variability to be experienced during the life of the Basin Plan.” While it is true that the long-term average reduction in streamflow under a median ~2030 climate change scenario is less than the inter-annual variability in streamflow, this appears to be a confusing trend (changes in the long-term average over a period of more than 100 years) with variability (changes from year-to-year) under an equilibrium climate.

The driest years under the median ~2030 climate change scenario are drier than any years in the historical record, and both the frequency and the severity of droughts are greater under the median ~2030 climate change scenario than under the historical record. This is not acknowledged in the plain English guide to the proposed Basin Plan that states that the “median projected impact of climate change is within the range of water availability being considered in the Basin Plan” – again confusing trend with variability. There is a

higher risk of severe drought in the future than past conditions would indicate and a risk that future droughts will be more severe.

CSIRO notes that while there is currently considerable uncertainty in the assessments of water availability under future climate change (primarily due to differences amongst global climate models in regional rainfall projections), there is no guarantee that this uncertainty will be greatly reduced in the near future.

The proposed Basin Plan makes no direct allowance for long-term reductions in average water availability. The proposed Basin Plan requires new water resource plans to ensure appropriate sharing of water during extreme dry periods of the severity experienced in the past, and indicates that revisions of the Basin Plan including reviews in 2015 should take into account the future impacts of climate change. The proposed Basin Plan accepts the risk sharing for climate change reflected in current planning arrangements, which the recent drought showed provide poor protection for the environment.

CSIRO suggests that MDBA consider actively communicating to all stakeholders the short-term risks to achieving the Basin Plan objectives that the current approach to climate change represents and the likely longer-term SDL adjustment required to manage likely climate change impacts.

A median climate change scenario for ~2030 would see a reduction in the overall water available in the river system of ~2500 GL/year on average (CSIRO, 2008). An extreme dry climate change scenario for ~2030 would see a reduction of ~7900 GL/year (CSIRO, 2008). The median scenario represents an ~11% reduction in the overall available water and under current water sharing arrangements would reduce flows through the Murray Mouth by nearly 25%. The extreme dry scenario represents a reduction ~34% reduction and under current water sharing arrangements this would reduce flows through the Murray Mouth by nearly 70% on average.

While the securing of entitlements for new environmental water provides some protection to the environment from the impacts of climate change, the majority (~75%) of environmental water will remain as planned environmental water that as shown by CSIRO (2008) is poorly protected from climate change. This risk is illustrated by water balances under different climate situations (Table 1). Total environmental water can be considered as the sum of environmental losses and outflows. A median climate change scenario would see a reduction in environmental water of around 2200 GL/year on average – around a 15% reduction. The volume of environmental water that would be lost under a median climate change scenario by 2030 is equivalent to 80% of the environmental water the proposed Basin Plan seeks to recover. An extremely dry climate change scenario would see a reduction in environmental water of around 6500 GL/year on average – around a 43% reduction. Diversions are also reduced by climate change under the proposed Basin Plan, but to a far lesser extent.

Development	None	Current	Proposed Basin Plan	Current	Proposed Basin Plan	Current	Proposed Basin Plan
Climate	Historical	Historical	Historical	Median 2030	Median 2030	Dry Extreme 2030	Dry Extreme 2030
Water availability	23,500	23,500	23,500	21,000	21,000	15,500	15,500
Diversions and associated losses		11,500	8,500	11,000	8,200	9,000	7,000
Environmental losses	11,500	7,500	8,000	6,500	7,000	4,500	5,000
Outflows	12,000	4,500	7,000	3,500	5,800	1,500	3,500

Table 1: Approximate impacts of climate of climate on the overall water balance (GL/year) of the Basin under current arrangements and under the proposed Basin Plan. The water balance view presented here considers “water availability” as assessed at F in Figure 1. Based on data from CSIRO (2008) and the proposed Basin Plan; all values rounded. Climate change impacts under the proposed Basin Plan are estimates as these have not been comprehensively modelled.

CSIRO suggests that between now and 2015, a rigorous analysis of the implications of future climate change for the environmental outcomes being sought from the Basin Plan be undertaken. This would provide a basis for informing and communicating the future SDL reductions that would be required if it was agreed

that the same level of environmental performance as can be achieved with the proposed SDLs should be sought under a drier future climate. This is important to ensure transparency with stakeholders about the likely need for additional downward adjustments in average total water use, and to enable government to assess the likely need for additional future investment in the Basin water reform process.

The proposed Basin Plan requires new water resource plans to be prepared based on an analysis of system behaviour under a repeat of historical climate conditions. CSIRO considers that the accreditation of these plans could consider expected performance during dry periods more extreme than those experienced in the past.

## 4 Surface Water SDLs

### Key points

- The methods used by the MDBA to establish an Environmentally Sustainable Level of Take (ESLT) are defensible in the context of current scientific knowledge. However, CSIRO suggests that a program of research that strengthens these methods and improves the scientific basis for adaptive management be implemented as a matter of priority.
- The MDBA publications indicate that the Environmental Water Requirements (EWR) that reflect the environmental objectives of the proposed Basin Plan are not fully met in the scenario modelling for the proposed surface water SDLs. The MDBA acknowledges that the proposed Basin Plan represents a balance between the different environmental, economic and social outcomes Australians value from the water resources of the Basin.
- The MDBA has emphasised that river system constraints prevent delivery of higher flows to secure greater environmental outcomes. However, CSIRO considers that not all EWR shortfalls relate to high flows and it is likely that some existing constraints could be relaxed or removed to allow improved environmental outcomes.
- CSIRO suggests that a rigorous whole-of-system analysis of constraints be conducted between now and 2015, complemented by modelling of realistic operational management of environmental water to guide efficient use of this water.
- CSIRO notes a significant risk associated with the method for testing SDL compliance in the proposed Basin Plan that appears to allow unlimited credit to accrue. A more robust compliance test would prevent unlimited credit.

### 4.1 An environmentally sustainable level of take

The Water Act (2007) requires the Basin Plan to establish a long-term Environmentally Sustainable Level of Take (ESLT) from surface water sources to ensure that environmental objectives are met.

Central to the ESLT approach is the definition of water-dependent ecosystems as specific sites or biota, termed key environmental assets (KEA) or key environmental functions (KEF) and associated environmental watering requirements (EWR). At the request of the MDBA, Young et al. (2011) reviewed the scientific basis for the establishment of the surface water ESLT and made a series of recommendations for short and longer-term improvements to the ESLT approach.

One of the key short-term recommendations of Young et al. (2011) was providing documentation to improve the transparency and defensibility of the proposed Basin Plan. Subsequent to the release of the proposed Basin Plan in November 2011, the MDBA published as a supporting document *The proposed "environmentally sustainable level of take" for the surface water of the Murray-Darling Basin: methods and outcomes* (MDBA, 2011b).

Although Young et al. (2011) generally found the approach and methods to establish an ESLT to be defensible in the context of current scientific knowledge, they identified specific areas to be strengthened via future work. The detailed articulation of the methods used in establishing the KEAs, KEFs, and the EWRs (MDBA, 2011b) highlights the importance of developing and implementing a plan of research that addresses longer-term recommendations to improve the scientific basis for the adaptive management framework embraced by the MDBA.

The recent experience of extreme drought followed by extreme floods in the southern Basin demonstrates the dynamic, highly variable hydrology of the Murray-Darling Basin. Consistent with understanding the Basin's dynamic nature, Young et al. (2011) identified the need for:

- (i) the development of quantitative data and models of ecological responses to variation in flow that account for the dynamic range in possible ecological outcomes,
- (ii) the incorporation of uncertainty estimation, and

- (iii) a biophysical classification scheme that represents the geographic range over which ecological response models are applicable and that provides the basis for extrapolation of site- or asset- specific models. Other recommendations encourage the development of a well-designed and ongoing environmental monitoring program.

CSIRO (2012) assessed the ecological benefits likely to arise from recovering 2800 GL/year for environmental water. The approach used existing ecosystem or habitat suitability models to compare incremental changes in floodplain vegetation, native fish, waterbird breeding for the Coorong ecosystem resulting over a long term with and without 2800 GL/year recovered to support environmental flows. This approach was taken because the EWRs, as noted by Young et al. (2011), cannot be used to predict or model the magnitude of ecological change likely to occur as a result of environmental water. Given the short timeframe for study completion, CSIRO used the best existing models that, in many cases, have not been updated with new data in the past decade. Nevertheless, the overall findings taking multiple lines of evidence show positive incremental improvements in ecological outcomes from the recovery of 2800 GL/year. The ecological response models and approach used in CSIRO (2012) could be improved if the recommendations of Young et al. (2011) were implemented.

## 4.2 Likely environmental outcomes under the Basin Plan

Whilst Young et al. (2011) generally found the approach and methods to establish an ESLT to be defensible in context of current scientific knowledge, CSIRO considers that this does not mean that the proposed surface water SDLs fully meet specified EWR. Indeed, the documents published in support of the proposed Basin Plan (MDBA, 2011b, 2012a) show that the EWR that reflect environmental objectives of the proposed Basin Plan are not fully met in the scenario modelling for surface water SDLs. This is also the view of Lamontagne et al. (2012) who conclude that, while significant environmental benefits would accrue in South Australia under the proposed Basin Plan, various aspects of environmental health would not improve and there would remain risks to some components of the river system.

The MDBA acknowledges that the proposed Basin Plan represents a balance between the different environmental, economic and social outcomes Australians value from the water resources of the Basin. The MDBA has placed considerable emphasis on the “constraints” in the river system that prevent delivery of higher flows to secure greater environmental outcomes. It is clear that there are a series of constraints related to existing water infrastructure, flood risks to private property and efficient delivery of irrigation water through the river system, and an initial description has been provided (MDBA, 2011c). However, not all the shortfalls in meeting EWRs relate to higher flows – some relate to providing sufficient water during extended dry periods (e.g. for the Coorong, Lower Lakes and Murray Mouth) and hence recovery of additional environmental water (more stringent SDLs) would deliver greater environmental benefits. Additionally, CSIRO considers that it is likely that some of the existing constraints could be relaxed or removed to allow either better outcomes to be achieved from the volumes of environmental water proposed under the Basin Plan or to enable better outcomes to be achieved with additional recovery of environmental water to be directed towards higher flows.

CSIRO suggests that a rigorous whole-of-system analysis around system constraints should therefore be conducted between now and 2015, including determining the extent to which constraints preclude meeting environmental objectives, and an analysis of the costs and benefits associated with the removal or relaxation of different constraints. CSIRO also suggests that this be complemented by modelling and analyses of operational management of available environmental water to guide efficient use of this water.

An unquantified but potentially significant risk associated with the proposed surface water SDLs relates to the uncertainty in the flow volumes and flow regime reaching the Coorong, Lower Lakes and Murray-Mouth (CLLMM). In the modelling undertaken by the MDBA, a significant fraction of the environmental water needs of the CLLMM are met via return flows from environmental watering of floodplain and wetland assets further upstream. The current river models are calibrated to the historical patterns of flow that reflect current river operations. These calibrations determine the losses of water to the floodplain.

Overall, current river operations have greatly reduced these losses (see Table 1, where natural environmental losses of 11,500 GL/year have been reduced to 7500 GL/year under current operations).

As more water is returned to floodplain environments, these losses will increase in total. In the existing models however, the loss relationships are most reliable for the current operating conditions reflected in their calibrations. The more that operating conditions depart from historical conditions, the greater the uncertainty in these loss relationships and hence the greater the uncertainty in the return flows to the river. These uncertainties accumulate in the downstream direction and thus are greatest for the CLLMM region. The health of the CLLMM region, as shown in CSIRO (2012), represents one of the highest economic benefits associated with the proposed Basin Plan.

MDBA (2012a) acknowledges the uncertainties associated with modelling losses and the difficulties that this has created in the modelling of an ESLT. In the period up until the 2015 review, CSIRO considers that it will be important to undertake further modelling and analysis to assess the sensitivity of meeting downstream EWR to the uncertainties and assumptions in upstream loss modelling. For the reasons outlined above this is particularly important for the CLLMM region.

Given much of the new water that will reach the CLLMM region under the Basin Plan will also be return flows from upstream environmental watering, there will be significant uncertainty in environmental water management in achieving the required flow regimes for the CLLMM region. CSIRO suggests that this should be a critical focus for the adaptive approach to implementation, including improving the monitoring of losses, flows in the lower river and lakes and the resulting environmental conditions throughout the CLLMM region. This would enable the currently very uncertain water balance modelling of the Lower Lakes during dry times to be improved.

### 4.3 Determining SDL compliance

Part 4 of Chapter 6 of the proposed Basin Plan describes the proposed method for determining compliance with SDLs. The approach is based around the maintenance of a register of take with annual assessments of take compared against permitted annual take. The method limits the maximum permissible debit to 20% of the long-term average diversion limit, but appears to allow for an unlimited credit to accrue.

CSIRO considers that that if a large credit accrues over multiple years, actual take in one year or a series of years could be significantly higher than the permitted annual take and still be compliant with the long-term average. This test thus might not ensure that at an annual level water use represents a sustainable level of take.

Current water licence conditions (including limits on water carry-over between years) may help limit unintended outcomes under application of the proposed compliance test, however, State governments have the power to change water licence conditions. Accordingly, ensuring a robust compliance test is appropriate. Possible ways to strengthen this include placing a cap on the maximum credit that can be carried forward and limiting the debit in any one year to some proportion of the permitted take in that year, rather than a proportion of the long-term average limit.

## 5 Water Recovery

### Key points

- Investment in more water-efficient irrigation infrastructure can “free up” water, which can then be re-allocated, including to environmental uses. However, a significant fraction of the “losses” associated with irrigation systems drain to the river and form part of the existing environmental water share. More efficient irrigation infrastructure may reduce these “return flows”, thus reducing irrigation losses does not necessarily deliver equivalent increases in environmental water.
- CSIRO suggests that careful scrutiny of the “water savings” involved in all infrastructure projects is required to ensure new entitlement-based environmental water does not simply replace (in part or in full) existing “planned environmental water” from irrigation return flows.
- Changed operation of Menindee Lakes could deliver one of the largest single water savings in the Basin. CSIRO has analysed a specific package of changed operations, entitlement transfers and new works would meet the environmental water regime for the lakes and secure Broken Hill’s water supply, while recovering an average of 150 GL/year of water for the environment with no impacts on downstream water users.

As noted in the Plain English summary of the proposed Basin Plan, the Australian Government has committed to ‘bridge the gap’ between current and proposed diversion limits; that is, to acquire all water through voluntary water buybacks or investment in irrigation infrastructure.

Water use efficiency can be improved via investment in new irrigation infrastructure, “freeing up” water for environmental use. The Australian Government’s *Sustainable Rural Water Use and Infrastructure* program includes an *On-farm Efficiency* program. Proposals for investment under this program are assessed in terms of the water losses that can be overcome by new infrastructure; a proportion of these “water savings” are transferred as water entitlements to the Australian Government.

The approach adopted by the Australian Government to these investments ensures that water entitlements are transferred to the Government to meet environmental water needs and reduce the total entitlements used for irrigation. However, depending on how the “water savings” are evaluated, there is a risk that these infrastructure investments can also reduce return flows to the river from irrigation enterprises, thus effectively reducing planned environmental water further downstream.

CSIRO suggests that the “water savings” involved in all infrastructure projects be carefully scrutinised. Quantification of the fraction of “water savings” that represents water that currently returns to the river should be a component of the assessment of all such projects. The assessment process should consider the net change in total environmental water (entitlement-based and planned) in evaluating an appropriate transfer of entitlements to ensure adequate overall contribution towards meeting the environmental objectives of the Basin Plan.

### 5.1 Water savings from Menindee operations

Since 2006, the NSW and Australian Governments have been exploring water reform initiatives in NSW that include the operation of the Menindee Lakes storage. In July 2010, the two governments signed a Memorandum of Understanding for the “cooperative investigation and implementation of key water reform initiatives in NSW, including Broken Hill’s urban water supply and Menindee Lakes operational arrangements”. In addition, as part of the process to develop a proposed Basin Plan, initial environmental filling requirements for Lakes Menindee and Cawndilla were specified by the MDBA.

CSIRO were commissioned by the Commonwealth Department of Sustainability, Environment, Water, Population and Communities to investigate options for the hydrological management of the Menindee Lakes storage. CSIRO in collaboration with the MDBA used hydrological modelling to determine operating rules for the storage that would result in no impact on downstream users but maximise water for the environment and reduce evaporation losses (Podger, 2011). This work builds on earlier modelling undertaken for the Darling River Water Savings Project and uses the latest models and model configuration (Barma, 2010). Impacts were assessed against an agreed set of indicators.

Meeting the environmental filling regime for Lakes Menindee and Cawndilla – as specified by the MDBA (2010b) – securing Broken Hill’s water supply, and recovering up to 150 GL/year (long-term cap equivalent) of environmental water with no impact on downstream water users could be achieved by:

- Implementing a ‘185/185 rule’ for the lakes whereby MDBA controls releases when the lakes are above 185 GL and NSW controls releases at levels below 185 GL,
- Purchasing 28 GL/year of NSW General Security Murray license to offset any potential impacts to downstream users in the lower Murray River,
- Providing secure water supply for Broken Hill from surface water supplemented from managed groundwater sources,
- Increasing Lake Menindee outlet capacity to 14,400 ML/day and improve the Lake Pamamaroo outlet channel to improve flow management into and out of the lakes,
- Revising target curves for filling lakes Pamamaroo and Wetherell, and
- Returning 24 GL/year of the water savings generated (a total of 174 GL/year on average) to NSW to provide a further buffer for downstream users to offset the impacts of extended periods of low flow on delivery of water.

The above scenario would increase the water available to the environment by 150 GL/year, on average. These savings could offset reductions in water use required elsewhere in the Basin under the proposed Basin Plan. Other benefits include an increase in flows to the lower reaches of the Darling and Murray Rivers (and the lower lakes and Coorong), improved allocations in dry years, reduced water restrictions in South Australia and improved allocations in the lower Darling and Lake Victoria.

The modelling indicated minor negative outcomes associated with the above suite of measures, firstly, small reductions in flows and lake levels in the Menindee Lakes storage during drier periods, secondly, a loss of reserve water supplies (held in Menindee and Cawndilla to meet flow requirements to South Australia during dry periods, and thirdly, small increases in downstream salinity, however, these could be offset using Australian Government salinity credits.

In addition to the changes to the operational rules proposed for Menindee Lakes, a range of infrastructure actions have been proposed and costed to assist in generating water savings and improving the management efficiency of the Lakes (Sinclair Knight Merz et al., 2010).

The above analysis assumed that Broken Hill’s water supply is secured from groundwater. This was assessed by Geoscience Australia (2008) on the basis of known groundwater resources and aquifer storage options within 150 km of Broken Hill. Geoscience Australia (2011) indicates, with a high level of confidence, that groundwater resources, used in conjunction with the existing surface water supply from the Darling River and Menindee Lakes, could ensure a secure water supply for Broken Hill.

This is one of the largest single potential savings in the Basin. However, CSIRO understands that this particular option and/or variants will be considered further by governments.

## 6 Groundwater

### Key points

- The proposed Basin Plan increases the total allowable groundwater use across the MDB by 85% to almost 2000 GL/year above the baseline diversion limit. CSIRO suggests that for a number of the increases there appears to be insufficient evidence to indicate that the proposed SDLs represent an ESLT for groundwater.
- The proposed increase in allowable groundwater extraction would also lead to impacts on surface water resources, most of which would not be fully apparent until well beyond the planning period. The total additional future streamflow impact that would result from the proposed groundwater SDLs is likely to be in the order of 500 GL/year. This impact would be distributed over a large area, nonetheless this can be considered as a future increase in surface water use partially offsetting over the long term the proposed 2750 GL/year reduction in surface water use.
- CSIRO suggests that a stronger evidential base for groundwater SDLs would be achieved by undertaking a rigorous surface water impact analysis and by further development of the risk management framework for groundwater use. Ongoing adaptive management (that allows SDLs to be increased in the future if appropriate as better information becomes available) would complement the risk management framework.

In addition to work undertaken in the MDBSY (CSIRO, 2008), CSIRO and Sinclair Knight Merz have undertaken groundwater analyses for the MDBA prior to the release of *The Guide to the Proposed Basin Plan* (CSIRO and SKM, 2011). This work was well reflected in the Guide, but is less well reflected in the proposed Basin Plan.

In its submission on the Guide, CSIRO noted that the small cuts proposed for groundwater use (relative to those proposed for surface water) reflected the history of reform in groundwater use (reducing entitlements) that has already taken place – particularly in NSW.

The proposed Basin Plan presents very different SDLs for groundwater than those presented in the Guide. The proposed groundwater SDL across the MDB has increased to be almost 2000 GL/year above the baseline diversion limit – an 85% increase. The baseline diversion limit has increased since the Guide, apparently as a result of updated and improved data on current levels of extraction.

The proposed Basin Plan supporting documents indicate the increase in groundwater SDLs is a result of:

1. Further consideration of the extent to which identified aquifers can sustain additional extraction
2. Consideration of existing schemes to reduce groundwater extraction limits
3. Inclusion of deeper aquifers, not included in the Guide.

For groundwater management units for which a SDL is being developed for the first time or for which there is a large proposed increase in the SDL (1&3 above), it is prudent to consider the uncertainty in the analysis and the risks of setting SDLs too high in cases where scientific evidence is weak. Historically, improved scientific information has required reduction in diversion limits (entitlements) and the schemes to achieve this have provided to be both expensive and contested.

It is not clear for many of the groundwater SDL units with large unassigned water volumes (areas with the potential to increase groundwater extraction without compromising ESLT characteristics (MDBA, 2012b)) whether there is a future demand for this water. For the recharge risk assessment method (RRAM) analyses, which apply to most of the relevant units for 1&3 above, CSIRO has been explicit about the uncertainties associated with recharge estimates derived from the WAVES model. Even in areas where other analyses are available, uncertainty will generally still be high. Therefore, a large increase of the SDL to a significant fraction of recharge is likely to represent a significant risk.

The maximum extraction limit that will meet ESLT criteria is dependent on the spatial pattern of extraction. If all extraction were to occur in less than 10% of the groundwater SDL area, the extraction limit would need to be less than 10% of the recharge. Even in the major alluvial groundwater systems, if extraction were spread more evenly than at present, the extraction could not be increased much more than the current levels. In most cases however, there are reasons for the current spatial patterns of extraction related to the quality of water and the transmissivity of the aquifer. However for those groundwater units where the current use is much less than the SDL, it is unclear what the spatial pattern of future extraction may be – whether it will be focussed in one area, and whether it will impact on streams. This creates even more uncertainty than the other aspects of the RRAM analysis.

If such a large increase in the total allowable groundwater extraction were to lead to much increased groundwater use, CSIRO considers there will inevitably be an impact on surface water resources. Some of this impact may not be fully apparent until well beyond the planning period, especially for the deeper basins or large regional systems. Some of the impact may be beneficial by reducing saline water discharge to rivers. However, a large component is from upland catchments with relatively fresh water, for which currently available evidence suggests substantial surface-groundwater connectivity (Parsons et al., 2008). Where the level of connectivity is uncertain, the precautionary principle would suggest assuming high connectivity. The MDBSY project showed that even with a less conservative assumption, there would be a significant impact on surface water resources.

Although existing modelling methods could provide reasonable estimates of the impact on surface water of the proposed groundwater SDLs, the MDBA has not reported having undertaken any such analysis. The MDBSY project assessed the surface water impacts of both current groundwater use and potential future groundwater use (CSIRO, 2008).

MDBSY indicated the total eventual streamflow impact of current groundwater use would be a loss to groundwater of nearly 450 GL/year on average. Some of this impact is captured in the calibrations of the river models developed by State agencies and used by the MDBA. The MDBA incorporated approximately an additional 75 GL/year of this eventual impact into the baseline models used for the proposed Basin Plan (MDBA, 2011a). CSIRO estimates, however, that around 200 GL/year of future streamflow impact from current groundwater use is not captured in the Basin Plan hydrologic modelling. Much of this is expected to occur in areas without detailed groundwater modelling at present, making it difficult to accurately account for this future loss. Given the uncertainty associated with these assessments, CSIRO considers that a precautionary approach, supported by adaptive management would be appropriate.

The scenario considered in the MDBSY project for potential future groundwater use considered the maximum additional use that was indicated by State agencies as being allowable under existing planning arrangements. This scenario was for groundwater use increasing to 3956 GL/year by 2030; the assessed total eventual reduction in surface water that would result from this was 840 GL/year (CSIRO, 2008).

The Basin-wide groundwater SDL in the proposed Basin Plan is 4340 GL/year. This is not directly comparable to the above MDBSY scenario because the proposed SDLs include deeper aquifers not considered in MDBSY, as well as different spatial patterns of future groundwater use. However, in both cases (the MDBSY scenario and the proposed SDLs) included large and comparable increases in use from the fractured rock aquifers in New South Wales. It is the increased use in these aquifers that is likely to lead to significant reductions in streamflow over the long term. In relative terms these streamflow impacts would be greatest in low flow years, when the environmental impacts especially in tributary streams would also be greatest.

Based on the MDBSY assessments, the total eventual additional future streamflow reduction as a result of the groundwater SDLs in the proposed Basin Plan may be in the vicinity of 500 GL/year. This impact would be distributed over a large area and the majority would not be evident within the current planning period. Nonetheless, this can be considered as a future increase in surface water use partially offsetting over the long term the proposed 2750 GL/year reduction in surface water use.

CSIRO considers that a stronger evidential base for groundwater SDLs would be achieved by undertaking a rigorous surface water impact analysis and by further development of the risk management framework.

Ongoing adaptive management (that would allow SDLs to be increased in the future if appropriate as better information becomes available) would complement the risk management framework.

The inclusion of deeper aquifers in the proposed Basin Plan is appropriate, particularly given potential development of unconventional gas. However, there appears to be inconsistency in the consideration of deeper aquifers: the exclusion of the Bowen Basin in Queensland (compared to the Gunnedah-Oxley Basin in NSW) is rationalised by it being unlikely that the resources will be developed in the period of the first Basin Plan. Yet elsewhere in the proposed Basin Plan, SDLs have been increased well beyond current demand.

The Bowen Basin is already used as a groundwater resource, mostly outside of the MDB, and there is likely to be interest in its development once the overlying Surat Basin becomes more highly developed. The relatively high SDL for the Gunnedah-Oxley Basin – relative to recharge, not to storage – appears to be based on little evidence (see p16 of MDBA, 2012b). The proposed Basin Plan recognises that new knowledge may inform a change to these SDLs as part of the 2015 review of the Basin Plan. CSIRO suggests that, a more consistent approach that incorporates the precautionary principle is required.

For those systems with a high degree of stress (2 above: areas with existing schemes to reduce groundwater extraction limits), CSIRO suggests an adaptive management approach be adopted. This would allow for the impact of current reductions in groundwater extractions to be assessed, provided (i) management objectives and trigger levels are defined (ii) associated monitoring occurs and (iii) formal review dates and criteria are defined. Many of these systems have large storage and hence are appropriate for adaptive management. The best-documented evidence for these systems (CSIRO and SKM 2011) indicates that the proposed SDLs do not meet ESLT criteria for key groundwater SDL resource units (Upper Namoi, Lower Namoi, Lower Macquarie, Lower Lachlan).

CSIRO's feedback on the Guide noted the ambiguity in how proposed groundwater SDLs related to water quality. This ambiguity – especially with respect to salinity – remains unresolved. Many of the major groundwater systems contain both good and poor quality water. In the RRAM analyses, preliminary extraction limits are provided for each salinity class but these have been aggregated for groundwater resource unit areas. For the modelled areas, however, the SDLs are based largely on current extraction patterns and hence good quality water, even though potentially much larger volumes could be used in the low quality water areas.

Apart from the inconsistency that this creates between groundwater SDL resource units (e.g., between the Mallee units and the Lower Murrumbidgee), the lack of separation between beneficial use classes could lead to firstly, a lack of use of brackish and saline water by industry if SDLs are based largely on good quality water, or secondly, further exploitation of good quality water where use of saline water is included in SDL estimation. CSIRO acknowledges that the use of water quality in implementing SDLs is difficult at the groundwater SDL resource unit area, however it would be feasible to have management zones in the regional water sharing plans that reflect water quality with targets set for each zone, with this being accredited through the MDBA process.

In summary, the evidence in MDBA (2012b) supporting the large proposed increases in groundwater SDLs is unclear, including for:

- the increase in baseline diversion limits (p9);
- the proposed SDLs for the deeper Basins (p16);
- the assumption that losing streams are disconnected (p19);
- the assumption of salinity of the certain groundwater units (p19);
- the reasons for the change in assumptions regarding the connectivity of the large fractured rock aquifers (pp20-21);
- the information in relation to the ASGE process used to dismiss the numerical modelling (p22);
- and the connectivity for the Lachlan Fold Belt (p32).

## 7 Salinity Management

### Key points

- The Water Quality Management Plan within the proposed Basin Plan is founded on a robust history of salinity management in the Basin and a strong evidence base.
- CSIRO considers that achieving the proposed salinity targets for the Coorong will depend on how environmental water is managed.
- It is expected that the largest volumes of environmental water will be applied in the downstream-most reaches of the Murray River and hence salinity concentrations will improve along much of the river. However, salinity risk is most associated with infrequent high salinity conditions, the frequency of which is dependent on specific operating conditions and risk mitigation procedures. CSIRO suggests that current models need improving to properly assess these conditions.
- The minimum salt export target for the Basin would be met more often under the proposed Basin Plan than under current operating conditions, but would not be met for the driest 10-year period in the historical climate record. The ecological consequences of such an occurrence are not well understood.

Historically, the MDBA and its predecessors have been responsible for coordinating a salinity plan for the Basin, either under the Salinity and Drainage (S&D) Strategy or the Basin Salinity Management Strategy (BSMS). These strategies have provided a strong evidence base and innovative thinking upon which to base the salinity component of the proposed Basin Plan. CSIRO considers that what is presented in the proposed Basin Plan with respect to salinity is robust.

CSIRO provides comment here on three different aspects of salinity: (i) salinity concentration targets, (ii) environmental impacts of salinity and (iii) Basin salt load targets.

- (i) Much of the focus in previous strategies has been on salinity concentration targets; these are especially relevant to drinking water, industrial and domestic use and irrigation applications. The proposed Basin Plan uses the National Water Quality Framework to specify standards in addition to the current BSMS end-of-valley targets (e.g., salinity targets are specified for both the Northern and Southern Lagoon of the Coorong. The effect of the proposed Basin Plan on these targets will depend on how environmental water is used. It is expected that the largest volumes of environmental water will be applied in the most downstream reaches and hence salinity concentrations will improve along much of the Murray River. However, salinity risk is most associated with less frequent high salinity concentrations, and the frequency of these conditions is dependent on specific operating conditions and risk mitigation procedures. CSIRO considers that current models would need to be improved to properly assess these conditions.
- (ii) The Lower Murray floodplains and wetlands have been affected by flow regulation and local irrigation, resulting in high salinity levels and significantly degraded environmental values. Long-term improvement of these areas can be achieved through a range of actions including environmental watering, weir pool manipulations, regulators and groundwater pumping. The proposed Basin Plan allows environmental watering to occur in these areas and places some limits on the impacts of other local actions.
- (iii) The BSMS previously defined maximum salt load targets at number of stations. The BSMS and the previous S&D Strategy tried to minimise the movement of salt around the MDB. There is an extremely large salt store within the Basin and the annual salt export is a very small fraction of this. Prior to the adoption of the S&D Strategy in late 1980s, the best estimates were that there was a

net salt export from the MDB and now there is close to a net balance. The proposed Basin Plan no longer recognises the salt export targets under the BSMS, but specifies a minimum Basin salt export, which would be met on a long-term average. However, the annual salt discharge is highly correlated with annual water discharge and hence is much lower in dry years. The target in the proposed Basin Plan is for a 10-year rolling average. This target is met more often under the proposed Basin Plan than under current operating conditions but is not met for the driest 10-year period in the historical record. The effect of not meeting the target would be higher salinity in the Lower Lakes and surroundings areas. The ecological consequences of such an occurrence are not well understood.

In future, active environmental watering will increase, as will other manipulations that are likely that improve environmental health. Other measures may also be adopted to shift salt from current salt storages. How this active environmental management occurs within the constraints of salinity targets and a variable climate will require a degree of sophistication that is not captured by current modelling approaches. CSIRO suggests that improved modelling and analytical tools will be developed to guide active salinity management.

## 8 Economic Issues

### Key points

- CSIRO research shows an average reduction in irrigation diversions of 2800 GL/year would reduce the gross value of irrigated agricultural production across the Basin by about 3% per year on average.
- CSIRO assessments of the economic benefits of an average increase in environmental water of 2800 GL/year show that while not all benefits can be monetised, those that can have economic value in range \$3–8 Billion.
- Water trade in the southern Basin during the recent drought significantly reduced the impacts of reduced water availability on the gross value of irrigation production. Increased water trading in future could present either risks and/or opportunities. CSIRO considers that further economic studies would help understand the dynamics and impacts of water trade and the associated risks and/or opportunities; ongoing monitoring of the environmental and economic consequences of water trade would sensibly support these studies.

CSIRO has not undertaken a comprehensive analysis of the regional or Basin-wide economic costs of the proposed Basin Plan – nor have we assessed secondary economic impacts for regional centres including associated employment consequences. CSIRO did assess the economic costs to South Australia of the *Guide* scenarios for the Goyder Institute for Water Research (CSIRO, 2010), and more recently we have undertaken a basin-wide assessment of the impact of the proposed Basin Plan on the gross value of irrigated production (Kirby et al., 2012a). The latter study estimated that an average reduction in irrigation diversions of 2800 GL/year would reduce the gross value of irrigated agricultural production by about 3% on average, consistent with observations of reduced water availability in the recent drought (Kirby et al., 2012b; Connor et al., 2012).

CSIRO has led an assessment of the economic benefits to Australia from the improvement in environment conditions and the associated ecosystem services (CSIRO, 2012). This analysis indicated that while not all benefits could be monetised, those that can be monetised have a significant economic value in the order of \$3–8 Billion.

During the worst year of the drought (2008/09) about 500 GL of water (net) was traded from the Murrumbidgee and mid-Murray to the lower Murray in Victoria and South Australia (NWC, 2010). In the following year, with conditions easing, the volume was about 230 GL. It is not yet known whether the extent of downstream trading was a one-off response to the drought, or whether it is a new and permanent behaviour now trading is commonplace. Increased trade under the Basin Plan could present risks and/or opportunities. CSIRO considers that further economic analyses of the impacts of trade would help to better understand these dynamics; such analyses would be best informed by ongoing monitoring of the environmental and economic impacts of trade.

One of the trade-related issues highlighted earlier in this submission is the need to apply appropriate exchange rates for downstream trades. Exchange factors are currently fixed between given trading zones, whereas in reality losses are a function of the level of flow and hence accurate exchange rates would vary with flow. For example, drought exchange rates would be much lower than normal flow exchange rates, so that where at average flows an exchange rate might be 0.85, during a severe drought this would fall significantly. CSIRO suggests that more detailed analyses of the variability of proportional losses as a function flow would help inform the determination of accurate exchange rates.

Changes in irrigator behaviour and river operations over recent decades, the future transfer of entitlements to environmental uses, along with the next generation of water resource plans and new environmental watering plans all indirectly influence the reliability of irrigation entitlements. Most economic assessments of the impact of the proposed Basin Plan on irrigation have only considered either long-term averages or

single-year scenarios. CSIRO studies have considered the impact on the distribution of water across multiple years (e.g. Kirby et al. 2012a). These analyses show changes in irrigation allocation reliability are likely under the proposed Basin Plan; the nature of these changes will depend on how the Basin Plan is implemented and how irrigators respond to the new arrangements.

For the proposed Basin Plan there may be significant risks and/or opportunities to irrigation according to approaches to implementation (i.e. new water resource plans and environmental watering plans) with different resultant allocation reliabilities. Both the reliability of allocations and how different irrigation sectors adjust (through shifts in capital and trading) are important in determining the overall economic consequences of the Basin Plan. CSIRO suggests that further modelling and analyses be undertaken to guide options for mitigating economic impact during the implementation phase of the Basin Plan.

## 9 Adaptive Implementation

### Key points

- Given limitations of the existing scientific knowledge base, CSIRO supports an adaptive approach to implementing the Basin Plan, based on monitoring of outcomes that helps improve scientific knowledge.
- CSIRO considers that key to effective adaptive management will be establishing governance arrangements that allow management agencies, industry and community groups and research organisations to efficiently share data and information and to collaborate in water management, experimental investigations and environmental performance monitoring.

CSIRO is supportive of the adaptive approach to implementation of the Basin Plan being proposed by MDBA, because limitations in the existing scientific knowledge base lead to uncertainties in the outcomes that the Basin Plan will deliver. Ongoing monitoring of the outcomes will lead to incremental improvement in the scientific knowledge base and consequential reductions in the uncertainty with what the Basin Plan can achieve. Strategic adaptive management can collectively frame environment watering, environmental monitoring, research and investigations (including modelling) and compliance, review and auditing.

Young et al. (2011) provided recommendations for important future research and investigations. These focussed on reducing the uncertainties in SDLs and maximising the likelihood of the Basin Plan delivering on its stated objectives.

In summary, Young et al. (2012) identified the following key areas for future investigation:

- Strengthening the ecological knowledge base underpinning the determination of an ESLT, including developing a classification of environmental assets and building a fuller understanding of key environmental functions and the flows required to protect them. This work should include further investigation of ecosystem services and their valuation to enable the Basin Plan to provide a broader view of environmental outcomes than just biodiversity;
- Modelling a range of scenarios of relaxing or removing various systems constraints to explore the potential for improved outcomes from water management across the Basin;
- Modelling a range of climate change futures to explore the risks to Basin Plan outcomes and the opportunities (including revised SDLs) to mitigate these risks;
- Monitoring the outcomes from environmental watering and using this information to improve the understanding and modelling of environmental water requirements. Improved modelling should include Basin-wide inundation modelling and associated ecological response modelling. While all steps in the adaptive management cycle are important, adequate resourcing of well designed and well targeted monitoring programs is absolutely critical.
- Building integrated information management and decision support systems that combine and compare observations of the real world with model predictions to
  - facilitate adaptive management,
  - support model improvements,
  - communicate planning and outcomes to stakeholder groups and
  - facilitate accountability for the use of environmental water;
- Improving the assessment of surface-groundwater connectivity and monitoring the dynamics of groundwater systems and river base flows, especially in cases where the Basin Plan allows for increases in groundwater use.

For adaptive management to be effective, CSIRO suggests that it will be important to establish appropriate governance structures that allow management agencies, industry and community groups and research

organisations to efficiently share data and information and collaborate in water management, experimental investigations and environmental performance monitoring.

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# Science Review of the estimation of an environmentally sustainable level of take for the Murray–Darling Basin

Young WJ, Bond N, Brookes J, Gawne B and Jones GJ

Final Report to the Murray–Darling Basin Authority

November 2011



Water for a Healthy Country Flagship Report series ISSN: 1835-095X

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# Science Review of the estimation of an environmentally sustainable level of take for the Murray–Darling Basin

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November 2011

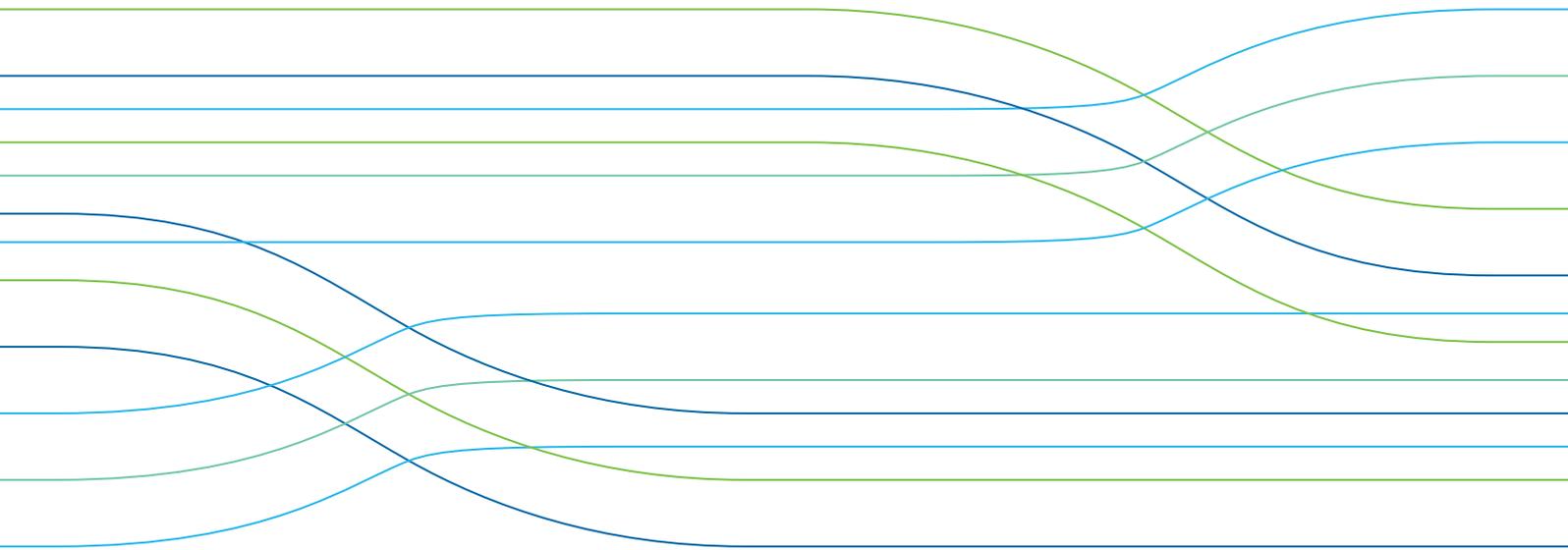
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# Acknowledgments

CSIRO was commissioned by the Murray–Darling Basin Authority (MDBA) to undertake this science review. CSIRO brought together a review team representing leading relevant expertise from across the national innovation system. CSIRO thanks the panel members and their respective institutions for contributing at short notice to this important work.

The review team relied on the MDBA for access to documents, provision of briefings and for organising various meetings and interviews. Jody Swirepik, MDBA Executive Director, Natural Resource Management, provided oversight to the review process and acted as liaison with the MDBA Chief Executive, the Chair of the MDBA Board and other Board members. Several officers from MDBA provided helpful briefings and supporting information. The panel thanks all the MDBA officers who supported the review process.

The review was funded by MDBA on a cost-recovery basis.

# Disclosures

The authors have strived to provide a fully independent review guided by strong professional and ethical standards. The authors all have long experience in water-related science in the Murray–Darling Basin. This being the case, it is inevitable that they have associations with the MDBA and past associations with the former Murray–Darling Basin Commission. Below, for each of the review panel members, are details of their institutional affiliations and their current and recent relevant relationships with MDBA and other organisations involved in research relevant to the Murray–Darling Basin Plan.

**Dr Bill Young (Review Chair)** is Director for the CSIRO Water for a Healthy Country National Research Flagship. CSIRO has received funding from MDBA for several projects related to the development of the Basin Plan. CSIRO made a submission on the Guide to the proposed Basin Plan. Dr Young is a member of the Board of the Goyder Institute for Water Research in South Australia. The Goyder Institute has published reports describing assessments of the adequacy of the scenarios described in the Guide to the proposed Basin Plan for meeting the environmental objectives of the South Australian Government. Dr Young was seconded from CSIRO to MDBA from March 2009 until May 2010 as Director, Basin Plan Modelling. In this role he led the early development of the river modelling work for the Basin Plan, some of which (albeit much progressed) is considered by this review. He led the preparation of some of technical reports documenting the hydrologic modelling work. Dr Young was also the Project Leader for the CSIRO Murray–Darling Basin Sustainable Yields Project from late 2006 to mid-2008. This project provided important underpinning hydrologic assessments, especially on the likely impacts of future climate change, and developed the integrated hydrologic modelling system used to guide development of the Basin Plan. Dr Young was a member of the MDBA Living Murray Program Scientific Reference Panel (2001–03 and 2006–07).

**Dr Nick Bond** is a Senior Research Fellow at Griffith University. Prior to this Dr Bond was a Senior Research Fellow at Monash University and a program leader in the eWater Cooperative Research Centre (CRC). Dr Bond was involved in an earlier review of the proposed methodology for ‘determining the environmentally sustainable level of take’ as part of the Basin Plan development process. This earlier review is published on the MDBA website. Dr Bond was also involved in a peer review of the Native Fish Strategy for the MDBA in 2009. In 2010 Dr Bond collaborated on a

project examining the impacts of climate change on aquatic ecosystems in the MDBA led by Griffith University and a project on ecosystem responses to water regimes in Hattah Lakes being undertaken for the MDBA by the eWater CRC.

**Dr Justin Brookes** is Director of the Water Research Centre at the University of Adelaide. Dr Brookes has received funding from the MDBA for intervention monitoring and reviewed reports for condition monitoring for the MDBA, administered through South Australian government agencies. He led the CLLAMMecology Cluster, funded by CSIRO, that provided scientific knowledge to inform environmental planning and management for the Coorong. He has had no prior involvement in the development of the Basin Plan.

**Dr Ben Gawne** is Director of the Murray-Darling Freshwater Research Centre which is an incorporated joint venture between CSIRO, La Trobe University and MDBA. In addition to providing core funding, MDBA has contracted MDFRC to undertake numerous projects in recent years, some related to the development of the Basin Plan. In particular Dr Gawne led a review of river condition for the MDBA that was published in 2011.

**Prof Gary Jones** is Chief Executive of eWater CRC and a professor at the University of Canberra. MDBA is a partner in eWater CRC and provides funding to support its research, model development and adoption activities. eWater CRC has used the Living Murray Program icon sites, primarily Hattah Lakes, for trialling its ecological modelling tools. Professor Jones led the Living Murray Program Scientific Panel (2001–04) and was a member of the earlier 1999–2000 expert panel investigation of the River Murray (Thoms et al, 2000). Prior to this review Prof Jones has had no involvement in the development of the Basin Plan.

# Acronyms

BPKID	Basin Plan Knowledge and Information Database
ESLT	Environmentally sustainable level of take
IRSMF	Integrated River System Modelling Framework
IWRM	Integrated Water Resources Management
KEA	Key environmental asset
KEF	Key ecosystem function
iKEA	Indicator key ecosystem asset
MDBA	Murray–Darling Basin Authority
SDL	Sustainable diversion limit

# Executive summary

Under the *Water Act (2007)* (Cwlth) the Murray–Darling Basin Authority (MDBA) is required to prepare a Basin Plan on the basis of best available scientific knowledge and socio-economic analysis. The Basin Plan is required to establish environmentally sustainable limits on water diversions.

In June 2011 MBDA invited CSIRO to lead a review of parts of the information base and analyses used by MDBA to determine an environmentally sustainable level of take (ESLT) for surface water and thus establish proposed sustainable diversion limits (SDLs). The review was limited to a consideration of the environmental and hydrologic science, modelling and analyses used by MDBA. CSIRO assembled a team of leading Australian water scientists from several institutions to undertake the review.

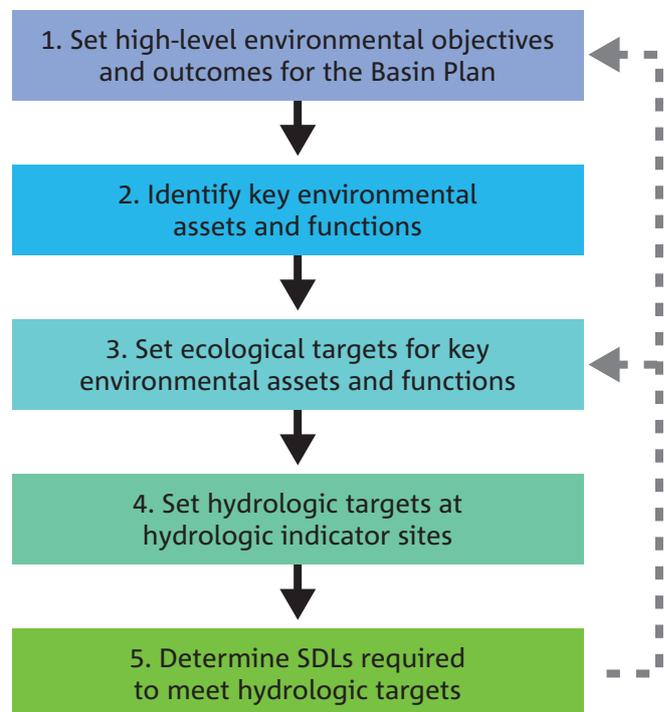
This review builds on previous reviews of individual components of the technical methods undertaken prior to the release of the Guide to the proposed Basin Plan. The review considers recent refinements to the methods and their combined application in guiding the preparation of the proposed Basin Plan. The review was conducted from July 2011 to October 2011 in response to documents and information provided progressively by MDBA.

The review was based on a consideration of:

- ♦ published reports from MDBA and consultants to the MDBA
- ♦ unpublished and incomplete MDBA reports
- ♦ iterations of unpublished tabular and graphical summaries of modelling results
- ♦ interactive discussions with MDBA staff regarding methods and assumptions.

A listing of the reports considered – both published and unpublished – is provided in an appendix to this report.

The terms of reference for the review required the articulation of a conceptual framework that captures the main steps in the process of SDL determination. A comprehensive framework was developed and is included in this report, but the simplified version below encapsulates the overall process. This sequence of steps is used to structure aspects of this review. Recommendations are made for how MDBA can strengthen the elements of work within the last four steps of this framework.



Important caveats on the comprehensiveness of this review against the terms of reference are (i) that at the time of the review the documentation to describe the large body of technical work was incomplete, and (ii) a comprehensive synthesis of the modelling results against targets and objectives was not available for consideration by the panel.

The original terms of reference for the review were focussed on nine specific questions that frame an assessment of the ESLT method and its implementation. The initial assessment against these questions was presented to MDBA in an Interim Report in September 2011. In response to this report MDBA broadened the terms of reference to include three more general questions seeking an assessment of the sufficiency of the work undertaken.

Summary assessments against the three questions of sufficiency are presented below, followed by summary assessments against the nine more specific questions from the original terms of reference. Finally, recommendations for short-term work that is considered critical to support effective consultation around the proposed Basin Plan are summarised. Recommendations for medium and longer-term work are made in the body of the report.

## Questions of sufficiency

*Overall, is the body of science sufficient to make an informed decision on an environmentally sustainable level of take for the Basin?*

Given the knowledge derived from over 30 years of Australian water research, and in the context of an adaptive management framework being adopted for the implementation of the Basin Plan, there is sufficient scientific knowledge to make an informed decision on an ecologically sustainable level of take.

*Are the methods adopted fit for purpose?*

In the context of an adaptive process for managing the level of take in the Basin the methods adopted are considered fit for purpose. In line with this adaptive approach recommendations are given in the report on how to improve the methods over the short, medium and long term.

*Does the body of work undertaken represent a sufficient basis to begin an adaptive management process around the level of take in the Basin?*

The body of work that has been undertaken is substantial and is considered to represent a sufficient basis to begin an adaptive management process around the level of take. At the time of the review the technical documentation of this body of work was incomplete.

## Original specific questions

The review findings against the nine questions in the original terms of reference are summarised below. These questions focus on the scientific robustness of the hydrologic and environmental aspects of the ESLT method and its implementation to determine surface water SDLs.

We stress however, that determination of the magnitude of the ESLT and thus SDLs involves consideration not only of environmental objectives but also of social and economic objectives for the Basin Plan. Determining this balance across objectives requires policy judgments made in the context of the requirements of the Water Act and reflecting multiple trade-off decisions. Consideration of the social and economic dimensions of ESLT determination is outside the terms of reference of the review.

## Foundation information

*Has the best available scientific information been accessed?*

MDBA has accessed much of the existing relevant formal scientific information. MDBA could have accessed additional scientific information that would have strengthened the scientific basis of the proposed Basin Plan. There is no evidence however, that this would have materially changed the magnitude of the proposed ESLT and SDLs.

Because of limited formal scientific knowledge to guide environmental water planning, expert opinion remains an important component of best available scientific information. MDBA has made limited use of expert scientific opinion in developing the proposed Basin Plan.

*Have the best available hydrologic and environmental models been used?*

The best available hydrologic models for the Murray–Darling Basin have been used enabling integrated basin-wide modelling of water sharing scenarios. For the Coorong, the best available hydrodynamic model has been used together with a simple ecosystem state model.

MDBA has made limited use of available floodplain inundation models, and other than for the Coorong, has not used available ecological response models. As a part of an adaptive approach, broader application of, and improvements to, such models would both reduce ESLT uncertainty and provide a more comprehensive description of the expected ecological outcomes from the Basin Plan.

## Interpretations and assumptions

*Has the use of scientific information been consistent and defensible?*

The use that MDBA has made of individual items of scientific information is defensible. The use that MDBA has made of the collected body of scientific information is not fully consistent because of the absence of a clear overarching conceptual ecological model linking site-based key environmental assets (KEA) and key ecosystem functions (KEF) assessments to regional and Basin-scale ecological condition and flow regime change.

To-date the work lacks a biophysical classification able to demonstrate that the indicator key ecosystem asset (iKEA) and KEF indicator sites adequately represent the

full range of ecosystem types across the Basin. While this is unlikely to materially affect the Basin-scale SDL, it may introduce significant uncertainty for individual water resource plan areas if indicator sites within a water resource plan area are not adequately representative of the range of ecosystem types in that area.

MDBA has modelled the likely impacts of climate change to 2030 on water availability and this modelling is robust. MDBA has not used this information in the determination of SDLs for the proposed Basin Plan but rather has determined SDLs using only the historical climate and inflow sequences. The panel understands that this reflects a policy decision by MDBA to initially accept the climate change risk sharing amongst users that is represented in current water sharing plans. Under most current water sharing plans planned environmental water is the least secure water share under a drying climate.

*Is the approach to determining KEA and KEF scientifically defensible and are the resulting targets clear and appropriate in the context of a managed water resource system?*

The method for determining KEA is scientifically defensible and appropriate given currently available environmental data sets. The ecological and hydrologic targets for KEA are all clear. Not all the targets being used at the time of the review are appropriate in the context of a managed water resource system.

The method for determining KEF is not fully defensible because the KEF classification is scientifically weak, the links between KEF and hydrologic variability are poorly described and there is a lack of scientific evidence to justify the hydrologic targets adopted.

*Is the concept of indicator sites sound?*

The use of indicator sites to assess overall environmental water requirements is an appropriately pragmatic approach, as is using sites with high water requirements rather than using random (or stratified-random) approach to site selection. It has not been demonstrated that the indicator KEA are ecologically representative of the range of water-dependent ecosystems across the Basin.

MDBA has assumed that the water requirements of iKEA encompass the water requirements of the full set of KEA yet this assumption is untested. This assumption is unlikely to be an important source of uncertainty at the Basin-scale but may be an important source of uncertainty for individual water resource plan areas.

*Are the expressions of environmental water requirements to meet specified objectives and targets scientifically sound?*

The expressions of environmental water requirements are scientifically sound. The expressions of water requirements are primarily – although not solely – based on the robust information available on the water requirements of floodplain vegetation. Incorporating into the analysis information available on the water requirements of other species associated with iKEA would increase the confidence in the specification of iKEA water requirements.

## **Modelling, analysis and results interpretation**

*Are the hydrologic and environmental modelling and associated analyses transparent, appropriate and defensible?*

The hydrological and environmental modelling and analyses undertaken to guide ESLT and SDL determination were not fully documented by the conclusion of this review (October 2011) making it difficult to assess the appropriateness and defensibility of this work.

The draft documentation and verbal descriptions provided suggest that the hydrologic and environmental modelling and analyses are appropriate. Undocumented assumptions and modelling choices are a source of uncertainty in SDL determination. The modelling of environmental flow regimes for the unregulated rivers of the Basin appears to have been problematic with lower confidence in the modelling results for these rivers.

The modelling has used current carry-over rules designed for irrigation water use. These are likely to be sub-optimal for environmental water management given the need to reinstate small-medium overbank flow events. This is likely to have influenced which hydrological targets have been met in the modelling.

*Have model outputs been synthesised and reported in appropriate ways that are simple to comprehend and explicitly link to stated objectives and targets?*

Modelling results for iKEA, indicating the expected frequency of watering events for floodplain and wetland iKEA and various flow metrics for the Coorong-Lower Lakes-Murray Mouth region compared to targets, were provided during the review. During the review the panel provided feedback to MDBA on how to improve the presentation of these results including clearer linking back to the ecological targets. The most recent summary of model outputs seen by the panel (dated 10 August 2011) provided a simple to comprehend synthesis of iKEA results, but did not explicitly link back to ecological targets.

Few modelling results were provided for KEF hydrologic metrics. The hydrologic targets developed for KEF have not been linked to specific ecological targets. This is largely because of an inadequate knowledge base to specify robust and meaningful ecological targets but has been confounded by inadequate work on KEF classification and attribution to flow. These shortcomings mean that even when results for KEF hydrologic metrics become available, they will not be able to be linked directly back to environmental objectives.

A coherent synthesis of the all modelling results and their interpretation against ecological targets in the context of a robust basin-scale conceptual ecological model has not yet been produced.

### Policy integrity

*Are the final expressions of an ESLT evidence-based and consistent with stated environmental objectives and targets?*

The panel's assessments are based on modelling results (date 10 August 2011) provided by MDBA for a 2800 GL/yr reduction scenario. The modelling results for this scenario provide a sound evidence base for the expected degree of flow regime change and the extent to which this would meet specified hydrologic and thus ecological targets.

The results indicate that for this level of change in consumptive water use, and assuming appropriate management of new environmental water, valuable ecological benefits could be delivered across the Basin including meeting several of the specified ecological targets. As modelled, the proposed SDLs deliver environmental benefits on the areas of the floodplain that can be watered more easily but deliver some disbenefits for areas of the floodplain that are more difficult to water. This highlights that there are trade-offs to be made between environmental outcomes when managing environmental water.

The modelled 2800 GL/yr reduction scenario considered by the panel does not meet several of the specified hydrologic and ecological targets. In some cases operational constraints prevent delivery of environmental water to meet targets implying that some of the current ecological targets are not consistent with unavoidable operational constraints. In other cases, the shortfalls against targets appear to be a result of insufficient environmental water, shortcomings in modelling environmental flow regimes in the unregulated rivers of the Basin, or a combination of these factors.

Further analyses, including modelling of water use reduction scenarios above the 2800 GL/yr scenario, are required to more fully assess the reasons for the modelled shortfalls. Given the current evidence base the level of take represented by the 2800 GL/yr reduction scenario is not consistent with the hydrologic and ecological targets provided in the review.

### Recommendations

The review makes four general recommendations and 26 specific recommendations for future work over the short to long term to strengthen the scientific basis of ESLT method and its implementation and to reduce SDL uncertainty.

The most important short-term work is to more clearly articulate the ecological framing for the ESLT method and to publish a coherent and comprehensive description of the ESLT method and its implementation. This will greatly improve the transparency and clarity of the technical work and thus increase its defensibility.

We recommend that the documentation include:

1. A coherent conceptual ecological model linking flow regimes to ecological responses, across multiple spatial scales and biogeographic zones, both as a means for guiding the compilation of scientific data and evidence underpinning an ESLT and to support effective communications of the science and analyses.
2. Description of the final modelling methods stating the key assumptions and sources of uncertainty.
3. A summary of the modelling results that support the proposed ESLT and SDLs indicating which hydrologic targets can be met under current constraints, the likely overall ecological consequences and the extent to which these are consistent with the higher-level environmental objectives of the Basin Plan.
4. A Basin-scale synthesis of expected environmental benefits from the proposed ESLT and SDLs.

# 1 Review context and terms of reference

## 1.1 Context for the review

### Threats to river health

Water diversions and other types of flow regime change have led to significant changes in river health in the Murray–Darling Basin. This review is focussed on the science and analyses to guide recovery and management of water for increased environmental flows. The panel recognises however, that in addition to water diversions, land-use change and land management, invasive species, river ‘improvement’ works, water resources infrastructure and their operation all influence river health. The outcomes that can be achieved with a well-designed environmental flow regime cannot be achieved by other management options. However, integrating environmental flows with strategic use of water infrastructure and catchment management is likely to be synergistic. More comprehensive treatment of these issues is given in Thoms et al. (2000), Norris et al. (2001) and Gawne et al. (2011).

### Requirements of the Water Act

Under the *Water Act (2007)* (Cwlth) the Murray–Darling Basin Authority (MDBA) is required to prepare a Basin Plan to promote the objects of the Act. Central to the focus of this review is the requirement that the Basin Plan provide for:

- a. The establishment and enforcement of environmentally sustainable limits on the quantities of surface water and ground water that may be taken from the Basin water resources (including by interception activities);
- b. Basin-wide environmental objectives for water-dependent ecosystems of the Murray–Darling Basin and water quality and salinity objectives; and
- c. The use and management of the Basin water resources in a way that optimises economic, social and environmental outcomes.

Section 21 of the Act outlines the general basis on which the Plan is to be developed. Particularly relevant as context to this review are the following:

Para (2) The Basin Plan must be prepared having regard to: (i) the fact that the use of the Basin water resources has had, and is likely to have, significant adverse impacts on the conservation and sustainable use of biodiversity; and (ii) the fact that the Basin water resources require, as a result, special measures to manage their use to conserve biodiversity. The Plan must promote sustainable use of the Basin water resources to protect and restore the

ecosystems, natural habitats and species that are reliant on the Basin water resources and to conserve biodiversity.

Para (3) The Basin Plan must also: (i) promote the wise use of all the Basin water resources; and (ii) promote the conservation of declared Ramsar wetlands in the Murray–Darling Basin.

Para (4) In preparing the Basin Plan the Authority must: (i) take into account the principles of ecologically sustainable development; and (ii) act on the basis of the best available scientific knowledge and socio-economic analysis.

In November 2010, MDBA released for consultation and stakeholder comment, the Guide to the proposed Basin Plan. The Guide reported “analysis undertaken indicates that the amount of additional surface water needed for the environment is between 3,000 GL/y and 7,600 GL/y (long-term average)” and after socio-economic considerations presented a set of “Sustainable Diversion Limit (SDL) scenarios” for consideration of reductions in long-term average annual surface water use of 3000, 3500 and 4000 GL/yr.

In late 2011 the MDBA intends to take to community consultation the proposed Basin Plan that will specify SDLs for the Basin as a whole and for each water resource plan area. These SDLs are required under the Act to “reflect an environmentally sustainable level of take”. MDBA requested CSIRO, acting through its Water for a Healthy Country National Research Flagship, to assemble a team of appropriately qualified experts to undertake a review of the determination of the environmentally sustainable level of take (ESLT).

Prior to the publication of the Guide, MDBA commissioned several peer review processes and these are now compiled and available on the MDBA website. These reviews focus on the development of the central methods and approaches used in preparing the Guide. A high-level international review of the overall approach to the Basin Plan was also undertaken. The international review panel provided advice and recommendations on nine themes. The most pertinent as context for the review activity reported herein is the comment under the heading *A Critical Need for Strategic Direction*:

“Our single most important concern is about the lack of strategic direction very late in a process with a goal to produce a plan which is clear and would achieve broad public acceptance. Our conclusion is that much excellent work has been done on the components and details of the plan. But how the parts add up to a whole is not clear to us.”

## Integrated water resources management

The Water Act recognises that managing the water resources of the Basin is a multi-faceted challenge requiring an integrated approach. Over the past two decades Integrated Water Resources Management (IWRM) has evolved into a consistent approach that is widely adopted internationally as best practice for complex water resource management problems.

A widely accepted definition developed by the Global Water Partnership defines IWRM as “a process that promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.”

IWRM is thus about finding socially equitable ways to share the benefits from water resources between different interest groups and between current and future generations. IWRM involves policy judgment, but should be informed by a robust, transparent and accessible evidence base of environmental, social and economic information and analysis.

The second of the four IWRM Guiding Principles articulated in the Dublin Statement from the 1992 International Conference on Water and the Environment calls for a participatory process:

“water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels.”

A participatory process does not necessarily lead to consensus and conflict resolution mechanisms are often required.

Solving the complex water resources problems thus requires robust science and technical analyses, a consideration of environmental, social and economic values, and broad participation in the decision process. This review deals only with the first of these ingredients.

## Prior environmental flow assessments for the Murray-Darling

A brief summary of the findings of prior environmental flow assessments for the Murray-Darling river system provides useful context for this review of recent modelling and analysis.

Environmental flow assessments prior to the Guide focussed on the connected southern system: the Murray, Goulburn and Murrumbidgee rivers and the Darling River below Menindee Lakes. Jones et al. (2002) assessed five environmental flow scenarios. One of these – an additional 3350 GL/yr – was assessed as having a high probability of achieving a “healthy

working River Murray system”. SRP (2003) assessed three environmental flows – additional flow volumes of 350, 750 and 1500 GL/yr relative to the 1993/4 Cap on Diversions – and concluded “a further 1500 GL/yr can provide moderate whole of river and local ecological habitat benefits”.

The Guide suggested that for the entire Basin restoration of 60-80% of flow volumes across the full range of natural variability would require an additional 3000-7600 GL/yr. The Guide considered three scenarios (3000, 3500 and 4000 GL/yr) in more detail and concluded that under the 3000 GL/yr scenario not all the environmental targets would be met. CSIRO (2011) assessed the ability of the Guide scenarios as modelled to meet MDBA and South Australian Government environmental objectives for the River Murray in South Australia. CSIRO (2011) concluded that these scenarios represent sufficient average annual volumes to meet MDBA environmental water requirements in South Australia and, with the exception of the 3000 GL/yr scenario, also present sufficient average annual volume to meet the South Australian government environmental water requirements for the Riverland–Chowilla.

## 1.2 Review terms of reference

This review considers the environmental and hydrologic modelling and analyses undertaken to inform the determination of an ESLT. It does not consider the socio-economic analyses and policy judgments that have also influenced the determination of an ESLT.

The original terms of reference are:

1. Assemble a panel of suitably qualified and experienced individuals to undertake the review. Seek MDBA endorsement of the proposed panel membership.
2. Work with MDBA to develop an agreed conceptual framework that captures the main elements of the development of surface water SDLs, focussing on the part of this process being considered by this review.
3. Use the agreed conceptual framework to guide the review. The review will address the critical questions around the access and use of available environmental and hydrological science and around ensuring the integrity of evidence-based policy shown in Table 1. The review will consider the Basin-scale focus and the time constraints imposed on the MDBA. The review will consider:
  - a. The completeness and relevance of the knowledge base of existing environmental and hydrological scientific literature and data sets accessed by MDBA in the development of the Basin Plan.

- b. The published and unpublished documents prepared by MDBA and its consultants describing the methods, analyses and modelling undertaken to guide development of the proposed Basin Plan, including any relevant previous peer reviews of components of the work.
  - c. Presentations from, and interviews with, senior MDBA staff around components of the scientific and technical work, especially those components for which documentation is currently incomplete.
  - d. The documents being drafted by MDBA to describe the technical methods, analysis and modelling for use the consultation process for the proposed Basin Plan.
4. Deliver a draft review report to MDBA for comment by early July 2011 accompanied by a briefing on the draft findings to members of the Authority Board and the senior executive. (This time frame was extended by MDBA to allow the Panel to critique the draft documentation on the technical methods).
  5. Publish the final review as a CSIRO report to MDBA at a time to be determined in consultation with MDBA. This report will be authored by the Panel members, will note their institutional affiliations and give full disclosure of the current and past relationships between MDBA and the individuals and their respective institutions.

In late September 2011 following consideration of the Interim Report, MDBA invited CSIRO to address, in this Final Report, a broader terms of reference.

The additional questions (Questions of Sufficiency) that MDBA invited CSIRO to consider are:

1. Overall, is the body of science sufficient to make an informed decision on an environmentally sustainable level of take for the Basin?
2. Are the methods adopted fit for purpose?
3. Does the body of work undertaken represent a sufficient basis to begin an adaptive management process around the level of take in the Basin?

The second and third of these questions were posed in the context of the recommendations for improvements to the methods and the documentation of the methods that were made in the Interim Report and that included also in this Final Report.

Although the responses to these additional questions rely heavily on the detailed assessment for the questions in the original terms of reference, they are presented here in Section 3 before the more detailed responses as they are more overarching and forward-looking and thus are judged to be of more immediate interest to many readers.

During the review period, and in response to early recommendations from the review panel, the MDBA began the process of producing more comprehensive and coherent documentation of the scientific and technical work undertaken to inform development of the proposed Basin Plan.

Table 1 Review questions

REVIEW FOCUS	KEY QUESTIONS
Foundation information	<ul style="list-style-type: none"> <li>- Has the best available scientific information (climate, hydrology and ecology) been accessed?</li> <li>- Have the best available hydrologic and environmental models been used?</li> </ul>
Interpretations and assumptions	<ul style="list-style-type: none"> <li>- Has the use of the scientific information been consistent and defensible?</li> <li>- Is the approach to determining key environmental assets and key environmental functions scientifically defensible and are the resulting objectives and targets clear and appropriate in the context of a managed water resource system?</li> <li>- Is the concept of <i>indicator sites</i> sound?</li> <li>- Are the expressions of environmental water requirements to meet specified objectives and targets scientifically sound?</li> </ul>
Modelling, analysis and result interpretations	<ul style="list-style-type: none"> <li>- Are the hydrologic and environmental modelling that has been undertaken and the associated analyses transparent, appropriate and defensible?</li> <li>- Have model outputs been synthesised and reported in appropriate ways that are simple to comprehend and explicitly link to stated objectives and targets?</li> </ul>
Policy integrity	<ul style="list-style-type: none"> <li>- Are the final expressions of an <i>environmentally sustainable level of take evidence-based and consistent with the stated environmental objectives and targets?</i></li> </ul>

# 2 Conceptual framework

As required under the terms of reference for the review, a conceptual framework or program logic to illustrate the main elements of the development of surface water sustainable diversion limits (SDLs) (Figure 1). This evolved from an early version prepared by CSIRO and was refined with input from and through dialogue with the Murray–Darling

Basin Authority (MDBA). Figure 1 indicates the portion of the process that is the focus of the review. The focal review questions relate to the key steps within this portion of the process. The review however, does not consider the steps outside of the red box in Figure 1 nor groundwater SDLs or the associated issue of surface-groundwater connectivity.

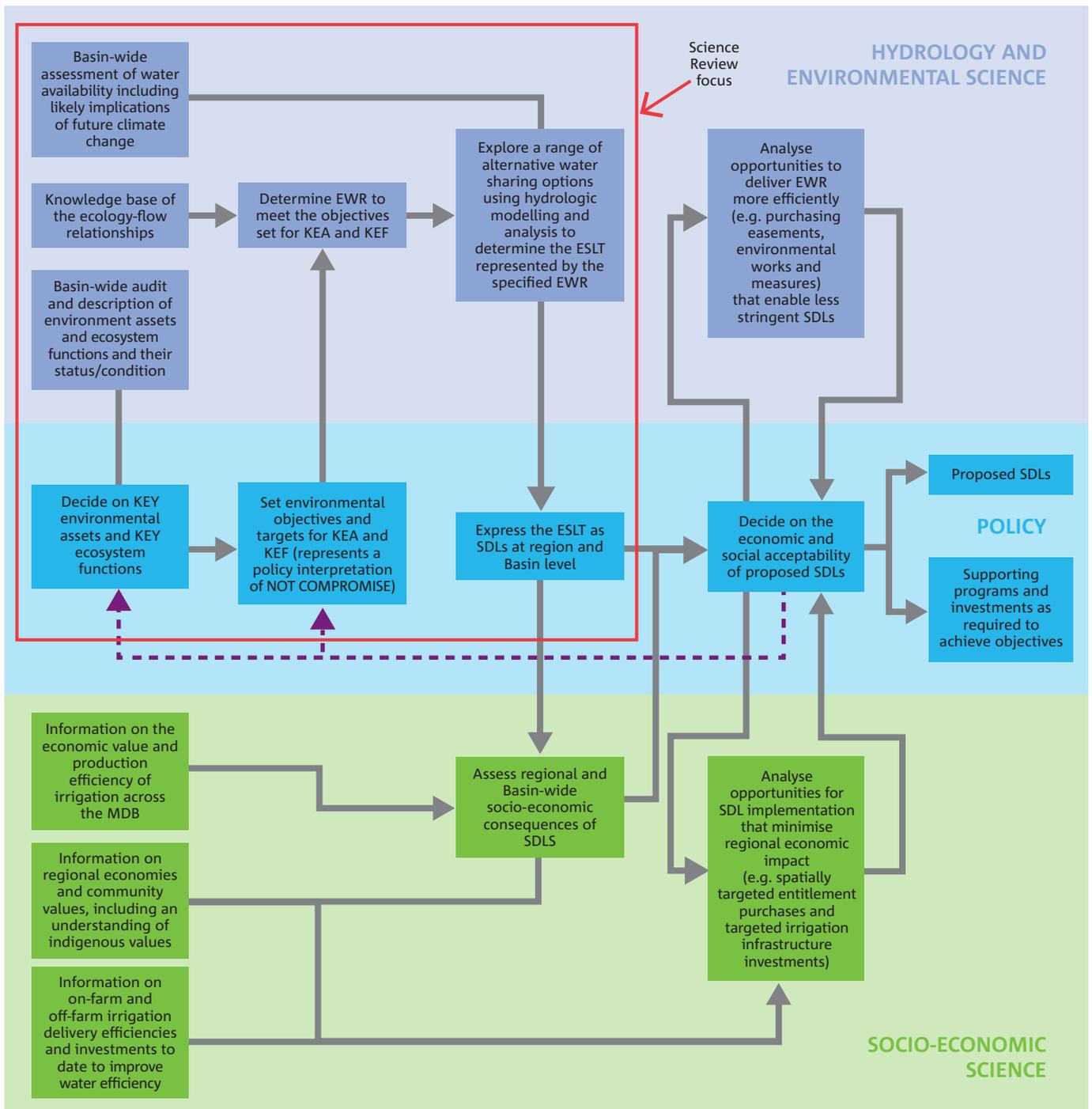


Figure 1 Conceptual framework for surface water SDL determination

For the consideration of the technical work guiding determination of surface water SDLs it is useful to use a simpler sequence of steps in the environmentally sustainable level of take (ESLT) method (Figure 2) that encapsulates the core aspects of the more detailed conceptual framework.

The first step of establishing high-level environmental objectives and outcomes for the Basin Plan is primarily a policy judgment reflecting implicit trade-offs with social and economic outcomes from the consumptive use of water. This step is however, informed by scientific knowledge. Step 2 involves the scientific task of identifying and describing environmental assets and functions and the policy judgments (informed by scientific information) of determining which of these are 'key'.

Step 3 involves determining ecological targets, which while primarily a scientific task, includes the policy judgment of what targets are required to 'not compromise' key assets and functions. Step 4 is entirely a scientific task of determining appropriate hydrologic targets that if met will ensure ecological targets are met. Given the partial knowledge base available this step necessarily requires scientific judgment.

Step 5 involves several modelling tasks including determination of environmental water demands to include in the model and iterative model runs with proposed SDLs in order to identify SDLs required to meet the hydrologic targets. Step 5 is primarily a scientific or technical step requiring technical judgments in several tasks, however, the policy judgment is also involved if not all targets are fully met, as is the case for the proposed SDLs. In the case where not all hydrologic targets are met there are critical feedback loops firstly to assess and interpret the likely ecological consequences, and secondly, where these consequences are significant, a loop back to assess whether or not the high-level environmental objectives are expected to be met.

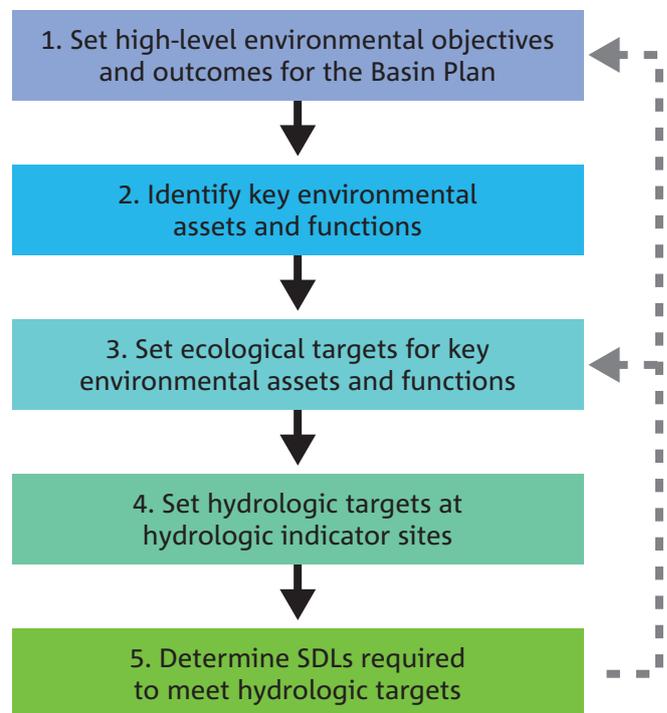


Figure 2 Sequence of steps (with important feedbacks) in the ESLT method linking desired environmental objectives and outcomes through to proposed SDLs

# 3 Questions of sufficiency

In response to the panel’s Interim Report to the Murray–Darling Basin Authority (MDBA) that addressed the original terms of reference for the review, MDBA posed three new questions of sufficiency around the knowledge base and body of work undertaken. The assessment against these questions below is based on the more detailed assessments provided in Sections 4–7.

## 3.1 Overall, is the body of science sufficient to make an informed decision on an environmentally sustainable level of take for the Basin?

Given the knowledge derived from over 30 years of Australian water research, and in the context of an adaptive management framework being adopted for the implementation of the Basin Plan, there is sufficient scientific knowledge to make an informed decision on an ecologically sustainable level of take.

In this context, it is important that two key issues be understood. Firstly, just like economic, social and cultural systems, Basin-scale ecosystems are complex and dynamic. Scientific understanding of such complex ecosystems – as they are now and as they may be in the future under different water management and climate regimes – will always be imperfect and incomplete. Nevertheless, it is unequivocal that the majority of Basin ecosystems are under very significant hydrological stress and are consequently in poor or declining ecological health.

Secondly, while noting issues relating to delivery constraints and current water management rules (e.g. carry-over rules), the scientific evidence presented to the panel indicates that an environmentally sustainable level of take (ESLT) based on a water recovery target larger than 2800 GL/yr would be required if all the ecological targets being considered by MDBA at the time of the review are to be met. The scientific rationale and method(s) by which the available body of science is used to allocate the final ESLT for the Basin to individual river valleys requires further explanation.

## 3.2 Are the adopted methods fit for purpose?

The adopted methods can be disaggregated into those applied for each of steps 2–5 in Figure 2 above. Detailed assessments of the fitness for purpose of the methods are provided in Sections 4–7 and recommendations for improvements to these methods are provided in Section 9. The improvements recommended represent opportunities to reduce ESLT uncertainty. However, as indicated in Section 8, many of the current methodological limitations do not contribute strongly to ESLT uncertainty. Summary statements of fitness for purpose of the methods are given below for each step of the ESLT method.

**Identify key environmental assets (KEA) and key ecosystem functions (KEF):** this step is only a minor source of ESLT uncertainty. The methods adopted are fit for purpose in the context of initiating an adaptive management process. Several recommendations are made for improving these methods (and the underlying knowledge base) in the short, medium and long term.

**Specify ecological targets:** this step is a moderate source of ESLT uncertainty. The methods adopted for KEA are fit for purpose (for KEF no ecological targets have been specified) in the context of initiating an adaptive management process. Some recommendations are made for improving these methods (and the underlying knowledge base) in the short, medium and long term.

**Specify environmental water requirements and hydrologic targets:** this step is a moderate source of ESLT uncertainty (primarily associated with KEA water requirements). The methods adopted are fit for purpose in the context of initiating an adaptive management process. Several recommendations are made for improving these methods (and the underlying knowledge base) in the short, medium and long term.

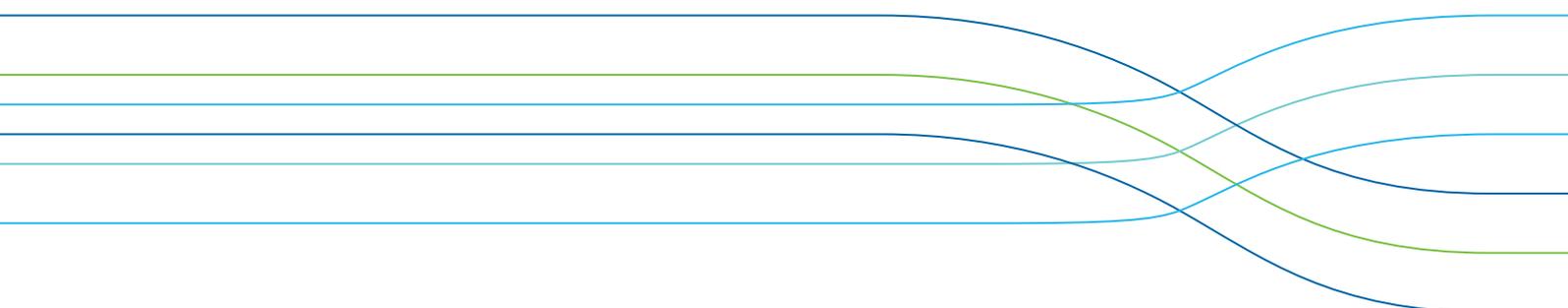
**Determine sustainable diversion limits (SDLs) that meet targets:** this step is a moderate source of ESLT uncertainty. The methods adopted are fit for purpose in the context of initiating an adaptive management process. Many recommendations are made for improving these methods (and the underlying knowledge base) in the short, medium and long term, including a number of short-term tasks that are critical for supporting consultation on the proposed Basin Plan.

### 3.3 Does the body of work undertaken represent a sufficient basis to begin an adaptive management process around the level of take in the Basin?

As noted above, the body of work undertaken can be considered for each of steps 2–5 in Figure 2 above. As in Section 3.2 the overall assessment is that the body of work undertaken is substantial and represents a sufficient basis to begin an adaptive management process around the level of take. In response to early recommendations from the panel, MDBA increased their effort on developing the necessary documentation. At the time of the review the technical documentation of this body of work was incomplete.

As noted in Sections 3.1 and 3.2 and described in more detail later in this report, there are inevitable gaps in the current scientific knowledge base and available relevant models. It is unrealistic to expect these to be overcome in the short term – many, if not most, will require long-term monitoring of environmental responses to hydrologic variability driven by both planned and unplanned watering events. An appropriate approach to dealing with such uncertainty is to adopt an adaptive management approach, which ‘embraces uncertainty’ (Walters and Martell, 2004) by using existing knowledge and models to derive plausible ‘candidate’ management options, which are then tested over time (Walters, 1986; Walters and Martell, 2004). Success in adaptive management depends strongly on long-term commitment to the process, including engagement with stakeholders and with the science community.

There is of course a tension in the adaptive management approach between acknowledging uncertainty and the potential need to alter policies in the future, and the goal of providing certainty for those affected by those policy decisions. Many of the uncertainties identified in this report will remain unresolved in the short to medium term. Importantly though, the panel’s view is that the current knowledge base, and application of that knowledge in the Basin Plan, is a suitable starting point to begin an adaptive management process.



## 4 Foundation information

The panel was provided with a number of documents that the Murray–Darling Basin Authority (MDBA) indicated were important foundation information for the development of the environmentally sustainable level of take (ESLT) method (Appendix A). The MDBA has also compiled the Basin Plan Knowledge and Information Database (BPKID) of several thousand publications and datasets relevant to the development of the Basin Plan. The review considered documents in BPKID where directly relevant.

### 4.1 Has the best available scientific information been accessed?

#### Summary assessment

MDBA has accessed much of the existing relevant formal scientific information. MDBA could have accessed additional scientific information that would have strengthened the scientific basis of the proposed Basin Plan. There is no evidence, however, that this would have materially changed the magnitude of the proposed ESLT and sustainable diversion limits (SDLs).

Because of limited formal scientific knowledge to guide environmental water planning, expert opinion remains an important component of best available scientific information. MDBA has made limited use of expert scientific opinion in developing the proposed Basin Plan.

#### Detailed assessment

Identification of best available science is complicated (Ryder et al., 2010) as is defining what constitutes best available science in the context of the determination of an ESLT for the Basin. It is more useful and appropriate to comment on the science MDBA has accessed and the possible effects of including or excluding parts of the current knowledge base.

The panel considers environmental flows to be a relatively new scientific discipline and thus a significant fraction of what can reasonably be considered as best available science is still in the realm of ‘expert opinion’ rather than in the scientific literature. While MDBA consulted with the science community in the early stages (2009) of developing the ESLT method, this consultation ceased after a month or so and the method was then developed and applied with no close expert input or guidance other than formal peer reviews.

The determination of an ESLT required steps outlined in Figure 2. These steps required application and integration of a large body of material. In some cases it has been

possible to evaluate the material used, but in other cases MDBA has relied on material developed for other processes (primarily state government processes), for which the primary sources of information are not documented.

The first step in the process – defining high-level environmental objectives – is primarily a policy process and thus is outside the terms of reference for this review. Nonetheless, setting these high-level environmental objectives should be informed by science (at least in an advisory sense), as should the feedback loop to this step indicated by the dotted arrow on Figure 2. The science used for steps 2-4 is discussed in the sub-sections below. The final step is dependent on the modelling and the access to and use of models is discussed in Section 4.2

#### Identification of key environmental assets and functions

The list of key environmental assets (KEA) has been compiled using best available science. Notwithstanding, there remains a critical need to strengthen the knowledge base through an adaptive approach to water management and targeted research.

MDBA has used a variation of the criteria developed by the Australian Government for identifying high conservation value aquatic ecosystems to identify more than 2000 KEA across the Basin. Assessment against five criteria was undertaken using data from Commonwealth and state government databases. Different government agencies have collected data to describe assets at different scales and using different methods, creating difficulties for the uniform application of the criteria.

The inclusion of key ecosystem functions (KEF) in the ESLT method represents a challenge, as the relevant knowledge base is more limited than for KEA. The identification of KEF was based largely on Alluvium (2010) and in isolation this work does not represent best available science. Alluvium (2010) relied heavily on environmental flow determinations undertaken in other systems for other processes and as a result, the identification of KEF lacks a robust ecological framework. As earlier peer reviews of this work observed, some important functions (e.g. recruitment) are not included while others (e.g. hydraulic habitat) are included inappropriately. MDBA has advised that they are working to strengthen the conceptual basis for this work following early recommendations from the panel.

#### Setting ecological targets for KEA and KEF

For KEA, ecological targets were developed for 18 ‘indicator’ sites linked to asset-specific objectives that in

turn were based on the asset-specific selection criteria. The approach focussed on setting targets for the vegetation communities or habitat types that support the species that were identified in nominating the site as a KEA. In most cases the ecological targets are to maintain vegetation communities in good condition. In the context of the indicator key ecosystem asset (iKEA) approach (see Section 5.3 for comments on this approach), the scientific information that has been used is appropriate.

Many of the iKEA ecological targets include an areal extent, however, the basis for setting these areal extents is unclear. In many cases the target is 100 percent of the existing area of particular ecological community, while in other cases the target is for a lesser area. For some of these cases the lower targets are linked to the 'threshold of acceptable change' in the Ramsar character descriptions (e.g. Gunbower-Koondrook-Perricoota forest). In other cases however, no justification is given for targets set at less than 100 percent of the current area.

In addition to vegetation communities and habitat types, ecological targets have also been set for waterbirds on the basis that birds are 'at the top of the food chain and therefore serve as useful indicators of overall ecosystem health' (Scott, 1997). Robinson (2011) suggests that waterbirds are not a good indicator of individual asset condition as they respond to habitat availability at continental scales and readily move between wetland systems. Waterbirds are, however, the focus of international treaties and their protection is important.

Ecological targets have not been specified for KEF. This is primarily because of the limited knowledge of relationships between flow and ecological functions for rivers of the Murray–Darling Basin. In the absence of ecological targets for KEFs, surrogate hydrological targets have been set. These hydrological targets have been set using generic approaches either as a proportion of the without-development flow regime (for base flows) or as restoration of specific in-channel flow events (freshes – these being the flow events relevant to KEF that had the greatest in-channel water demand). There is considerable uncertainty associated with this method, however, the consequences for SDLs are likely to be small. Hydrologic targets for KEF are potentially significant for water sharing during extended droughts and so further work is recommended over the longer term to reduce the uncertainties in this component of the method. Despite the high uncertainty in this component of the work, and the conceptual weaknesses noted above in the identification of KEF, the targets set for KEF appear to have accessed best available science. Location-

specific hydrologic targets may be possible for some KEF and this could be investigated in the medium-term.

Underpinning the specified ecological targets are descriptions of ecological values for KEA and KEF. KEA values were based on the information used to identify KEA and thus reflect the selection criteria. The criteria focus on biodiversity and hence the KEA value descriptions list ecosystem types and species present, but do not consider ecosystem services, ecosystem functions and 'support for the productive base'. MDBA has commissioned work to improve the understanding of key ecosystem services. But limited knowledge of these values means it is currently unlikely to be possible to develop meaningful and robust ecological targets for KEA based on values beyond biodiversity.

KEF values have been poorly described, in part reflecting the limited knowledge of the relationship between flow regime and KEF for rivers of the Murray–Darling Basin. Scientific information is available to describe the value of some KEF to water-dependent ecosystems, and some of this appears to have been accessed indirectly through reports on the development of environmental flows that do consider the primary literature. Clearer specification of the sources of scientific information used for this work is recommended.

### **Specification of water requirements and hydrologic targets**

The specification of environmental water requirements for KEA was based on estimation of water requirements to meet the ecological targets for the 18 iKEA. iKEA were characterised as being comprised of a limited number of ecosystem types characterised by their physical habitat or dominant vegetation. The species of value were linked to one of the ecosystem types and the water requirements of that ecosystem type were used to develop the overall iKEA water requirement.

This approach relies on the strength of the relationship between the persistence of an ecosystem type and nominated species. As knowledge of the water requirements of many species is limited this approach has several advantages:

- ♦ it is a scientifically justifiable simplification enabling an estimate of water requirements to be developed comparatively easily
- ♦ it is based on the water requirements of a small group of species for which there is robust knowledge
- ♦ it simplifies modelling to enable workable evaluation of scenarios.

There is however, additional scientific information that could be incorporated into future refinements of the determination of water requirements. This includes existing information on the water requirements of other species such as Moira grass, lignum, Golden Perch and Silver Perch. Assessment of other species' water requirements would provide an estimate of the uncertainty around the habitat modelling estimates and help identify any species for which the water requirements exceed those of their primary habitat. This would help determine if there are species still at risk under the initial SDLs.

For KEF, hydrologic metrics were defined for assessment at a further 88 hydrologic indicator sites. The hydrologic targets for these metrics were set simply as ranges for ratios to the without-development flow regime value – typically as either 60-80% of 80-100% of the without-development value. Current scientific knowledge is not sufficient to set more definitive targets (especially with respect to any important thresholds in the flow-ecology relationship), so these targets are best considered as hypotheses to be testing through an adaptive management approach.

## 4.2 Have the best available hydrologic and environmental models been used?

### Summary assessment

The best available hydrologic models for the Murray–Darling Basin have been used enabling integrated basin-wide modelling of water sharing scenarios. For the Coorong, the best available hydrodynamic model has been used together with a simple ecosystem state model.

MDBA has made limited use of available floodplain inundation models but other than for the Coorong has not used available ecological response models. As a part of an adaptive approach, broader application of, and improvements to, such models would both reduce ESLT uncertainty and provide a more comprehensive description of the expected ecological outcomes from the Basin Plan.

### Detailed assessment

MDBA has used the currently best available hydrologic models as originally developed by MDBA and state agencies and as linked to form a basin-wide model by CSIRO in the Murray–Darling Basin Sustainable Yields Project. This Integrated River System Modelling Framework (IRSMF) (Podger et al., 2010) has been further improved for MDBA by CSIRO and partners to enable it to be applied to the complex Basin Plan task. These improvements have enabled MDBA to run many hundreds of scenarios and ensure a full audit trail of all modelling inputs and outputs. The modelling methods adopted using IRSMF are discussed under Section 5.1.

The complexity of the existing hydrologic modelling suite means that setting up and running large numbers of scenarios while possible, is very time-consuming – especially the manual steps of preparing data inputs (such as time series environmental water demands) and processing outputs into easily understood results summaries. The development of a simpler scenario model for the entire Basin (still based on all available hydrologic data but using simplified representations of water management) is recommended. This would enable rapid screening of multiple alternative scenarios and exploration of parameter sensitivity prior to comprehensive modelling. A simplified model could also be useful in stakeholder engagement and communication of modelling results.

MDBA is a key participant in the eWater Cooperative Research Centre (CRC). The main effort of the CRC has been the development of a new generation of modelling tools (eWater Source) for water resources planning and management. Over the longer-term, it is expected that MDBA and Basin state agencies will transition to a new Murray–Darling Basin Source-based modelling suite. Implementation of new detailed models will improve the consistency of approach to hydrological modelling and provide the opportunity to more fully represent environmental aspects of water management. eWater Source would also be the appropriate basis for developing any simpler model as described above.

Several models exist for simulating the inundation of floodplains, wetlands and riverine lakes across the Basin. These range from simple statistical models predicting total inundation areas, to complex hydrodynamic models predicting flow paths, depths and velocities. Various models also exist to assess the ecological responses to alternative environmental watering scenarios. Saintilan and Overton (2010) describe many of the available models. These models enable the ecological consequences of different watering regimes for floodplain environments to be modelled. During the review the panel was not provided with information to indicate whether models of this type were used in the development of the Basin Plan. However, in response to the panel's Interim Report, MDBA advised it had used some inundation models (and/or the relationships captured in these models), not to evaluate SDL scenarios, but help set ecological and hydrologic targets.

While comprehensive analysis using such models may not have been warranted for the development of the Basin Plan, given time and resource constraints, application for key locations such as the Riverland-Chowilla floodplain would help assess the sensitivities of the SDLs to different extents and frequency of inundation in the hard-to-achieve high-flow range. It is recommended that greater use, with appropriate further development, be made of inundation models and ecosystem response models to guide an adaptive approach to implementation of the Basin Plan. Such models have particular utility in guiding the development of efficient and effective environmental watering regimes in order to optimise the use of environmental water.

At the Basin-scale, an example of such a model that is under ongoing development is the Murray–Darling Basin Flood Inundation Model (MDB-FIM) (Overton et al., 2009). This model could be used to explore the number and types of KEA across the Basin that are likely to be inundated under the target flow regimes described for the iKEA. This would provide evidence to support the hypothesis implicit in the ESLT method that watering iKEA will also adequately water all KEA across the Basin. Use of this model would also help demonstrate current infrastructure and operational constraints on floodplain environmental watering regimes.

EcoModeller – a tool developed by eWater CRC – includes a library of ecological response models. Other ecological response models also exist. The response models in the EcoModeller library are refinements of the models originally developed as components of the Murray Flow Assessment Tool (MFAT) (Young et al., 2003), which was used in the development of the Living Murray Program. These ecological response models are based on habitat preference curves, underpinned by conceptual models articulated by experts and parameterised primarily using expert opinion. It is recommended that targeted use and improvements to models of this type would be beneficial in guiding adaptive implementation of the Basin Plan, especially at the regional scale in consultation with stakeholder groups.

Appropriate use has been made of a one-dimensional hydrodynamic model of the Coorong developed by Webster (2007) to explore the barrage flows required to maintain a healthy Coorong, especially with respect to salinity levels in the south lagoon. Similarly, appropriate use has been made of the simple ecosystem state model for the Coorong (Lester and Fairweather, 2009), noting its limitations, that uses outputs from the hydrodynamics model.

# 5 Interpretations and assumptions

## 5.1 Has the use of scientific information been consistent and defensible?

### Summary assessment

The use that the Murray–Darling Basin Authority (MDBA) has made of individual items of scientific information is defensible. The use that MDBA has made of the collected body of scientific information is not fully consistent because of the absence of a clear overarching conceptual ecological model linking site-based key environmental assets (KEA) and key ecosystem functions (KEF) assessments to regional and Basin-scale ecological condition and flow regime change.

To date the work lacks a biophysical classification able to demonstrate that the indicator key ecosystem asset (iKEA) and KEF indicator sites adequately represent the full range of ecosystem types across the Basin. While this is unlikely to materially affect the Basin-scale sustainable diversion limit (SDL), it may introduce significant uncertainty for individual water resource plan areas if indicator sites within a water resource plan area are not adequately representative of the range of ecosystem types in that area.

MDBA has modelled the likely impacts of climate change to 2030 on water availability and this modelling is robust. MDBA has not used this information in the determination of SDLs for the proposed Basin Plan but rather has determined SDLs using only the historical climate and inflow sequences. The panel understands that this reflects a policy decision by MDBA to accept the climate change risk sharing amongst users that is represented in current water sharing plans. Under most current water sharing plans planned environmental water is the least secure water share under a drying climate.

### Detailed assessment

The application of individual items of scientific information is defensible. Collectively, however, the use of scientific information is not fully consistent because of the absence of a clear overarching conceptual ecological model linking site-based KEA and KEF assessments to regional and basin-scale ecological condition. Additionally, some important assumptions have not been tested. In particular, it is asserted that the iKEA are representative of the range of ecosystem types found across the Basin, however, this has not been demonstrated. A classification of KEA based on biophysical characteristics is needed to test this assumption.

MDBA has adopted the ecological terms used in the *Water Act (2007)* (Cwlth) but has given insufficient attention to ensuring the definitions and interpretations of these terms are couched within a clear and well documented conceptual ecological framework. For example, the KEF currently identified overlook the basic population functions of breeding and recruitment even though the water requirements to trigger these functions are central to the water requirements described for most iKEA. These shortcomings are unlikely to have had a material impact on SDL determination, but they hinder clear communication and dialogue about the approaches used and their scientific basis.

The modelled historical without-development time series has been used as the sole basis for setting objectives for iKEA and for determining likely water availability. Given that scenarios of water availability in the Basin do exist for a range of possible climate futures, it is not clear why an investigation of the risk climate change poses to the environmental objectives of the Basin Plan has not been undertaken.

MDBA has made a policy choice not to directly address the projected impacts of future climate change on water availability in the determination of SDLs for the proposed Basin Plan. MDBA has determined SDLs using the historical climate and inflow sequences and has not modelled the consequences of future climate on the ability to meet the hydrologic targets under the proposed SDLs. No view has been given on whether the ecological targets would be changed should the climate change as projected. If climate change impacts do unfold as projected lower SDLs would be required to maintain the level of environmental protection offered by the currently proposed SDLs. This represents a significant risk in the longer term and a smaller risk in the short term.

The panel understand MDBA's policy approach to climate change to be an extension of an underlying policy position of "not *requiring* a change to water users' rights". The Australian Government's policy position of 'bridging the gap' by acquiring entitlements, either through purchases or savings from infrastructure projects, means the Basin Plan will not require a change in entitlement reliability. Future climate change is expected to reduce entitlement reliability both for irrigators and the Commonwealth Environmental Water Holder. The policy position on climate change has been explained to the panel by MDBA as "accepting the climate change risk sharing amongst users that is represented in the current water sharing plans".

As clearly demonstrated by CSIRO (2008), most existing water sharing plans significantly protect entitlement holders from the impacts of future climate change, and

shift the majority of the impact to non-entitlement water, especially during extended dry periods. As the majority (70-80 percent) of environmental water is non-entitlement water, and will remain so under the Basin Plan, this policy represents a significant risk to the environment during future extended dry periods, especially should these be more severe than in the past as a result of future climate change. A dry period more extreme than has occurred in the past could occur during the first implementation period for the Basin Plan. The planning approach adopted by MDBA does not consider such an eventuality.

## 5.2 Is the approach to determining KEA and KEF scientifically defensible and are the resulting targets clear and appropriate in the context of a managed water resource system?

### Summary assessment

The method for determining KEA is scientifically defensible and appropriate given currently available environmental data sets. The ecological and hydrologic targets for KEA are all clear.

The method for determining KEF is not fully defensible because the KEF classification is scientifically weak, the links between KEF and hydrologic variability are poorly described and there is a lack of scientific evidence to justify the hydrologic targets adopted.

The appropriateness of the targets set is considered in other sections of this report.

### Detailed assessment

MDBA have defined KEA as water-dependent ecosystems that meet one or more of five criteria. In the absence of a pre-existing comprehensive list of environmental assets for the Basin KEA were identified using a collation of existing government geographic datasets. This takes a solely site-based view of what constitutes an asset. The approach is scientifically defensible and appropriate given currently available environmental data sets, and as noted in Section 4.1, the approach has used best available science.

In the longer term it is recommended that an ecosystem or landscape perspective on defining KEA be considered. This would support consideration of the role of interactions between sites in maintaining biodiversity and as well as

consideration of ecological processes operating at a valley or Basin-scale. For example, migratory waterbird populations rely on different sites at different times given the mosaic of wetland wetting and drying across the Basin, and Basin-scale protection of these populations is difficult using a site-based approach.

The initial peer review of the methods for identifying KEA noted that the protection of biodiversity at the ecosystem level requires a classification of ecosystems to ensure that selected assets are representative of the diversity of ecosystems found in the Basin. A classification would facilitate identification of rare or unique ecosystems. Currently there is no single broadly accepted classification of riverine and floodplain ecosystems available and the information required to classify assets was neither readily available nor could be generated within the required timeframe. However, the consequence of this is that some ecosystem types may not be represented in the planning process.

Having identified KEA, indicator sites (iKEA) were identified and this step is discussed in Section 5.3. Ecological targets have only been set for these iKEA, and the clarity and scientific appropriateness of these targets are discussed in Section 4.1 and so are not repeated here. The appropriateness of these targets in a managed water resource system is considered in Section 7.1.

MDBA (2011a) describes in detail how the specific criteria were interpreted and applied to identify KEA, and describes limitations of data availability and quality and how these were addressed. It is not clear how many potential KEA were culled by not meeting any of the criteria. It appears that none may have been culled, in which case it is unclear how the criteria were useful. Earlier reviews noted problems with the consistency and currency of information extracted from the various databases and jurisdictions, however, the list of KEA has subsequently been reviewed and revised. It is important that the KEA database is maintained and updated with new information as it becomes available, to provide an important tool to help evaluate the longer term outcomes from Basin Plan implementation.

Conceptually there is a strong scientific basis for consideration of KEF in the environmentally sustainable level of take (ESLT) method, and arguably, protection of KEA is not possible without also protecting KEF. However, there are two significant weaknesses with the KEF component of the method. The first weakness is that while KEF were identified using a “systematic analysis of the functions occurring in rivers in the Basin”, both the KEF classification and the assessment of where in the Basin specific KEF are relevant are poor. These aspects are overly dependent on a crude geomorphic view without reference to

the large body of published scientific literature describing the links between flow variability and ecological functions, and how these vary along climate and physiographic gradients.

While the practical implementation of the conclusions of MDBA (2011a) is defensible, the specific conclusion “that all components of the flow regime are important in all river types” is an ambiguous interpretation of a more general idea, and the methods used to arrive at the conclusion are clumsy. In essence, this conclusion is similar to the ‘natural flow paradigm’ (Lytle and Poff, 2004), which hypothesises that the functions that drive and underpin the ecological character of a river are intimately tied to the natural patterns of flow variability and that deviations away from that natural flow regime will alter the rate and extent to which those processes occur. In time, this will lead to an altered ecological character.

This links to the second weakness of the KEF method, which is that the hydrologic targets set for the various flow metrics are largely arbitrary, with no ecological targets specified and no real sense given of the ecological improvements that meeting KEF flow targets will deliver. To support the KEF method a river classification that considers hydrology should be developed, which, combined with some relatively simple models, might allow a more sophisticated approach to be used in setting the hydrologic targets for different river types. More important will be the development of appropriate monitoring programs to refine these targets in the long term.

A limitation of the reporting of KEF hydrologic metrics is that only proportional changes in have been considered. MDBA (2011a) refers to this as an issue of ‘low numbers’. For example, an increase in the frequency of a specific event from one to two events while proportionally the same as an increase from 50 to 100 events is likely to have very different ecological consequences. This is not an issue of ‘low numbers’ but simply a limitation of only using proportions for assessing change. To aid interpretation of ecological outcomes, absolute as well as proportional changes in KEF flow metrics should be assessed.

## 5.3 Is the concept of indicator sites sound?

### Summary assessment

The use of indicator sites to assess overall environmental water requirements is an appropriately pragmatic approach, as is using sites with high water requirements rather than using random (or stratified-random) approach to site selection. It has not been demonstrated that the indicator KEA are ecologically representative of the range of water-dependent ecosystems across the Basin.

MDBA has assumed that the water requirements of iKEA encompass the water requirements of the full set of KEA yet this assumption is untested. This assumption is unlikely to be an important source of uncertainty at the Basin-scale but may be an important source of uncertainty for individual water resource plan areas.

### Detailed assessment

The ESLT method uses a set of ‘hydrologic indicator sites’ for KEA and KEF, although the selection rationale for KEA indicator sites is quite different to that for KEF indicator sites. The concept of indicator sites is sound, however, there are important untested assumptions in the process of site selection.

KEA indicator sites were identified as those that met one or more of the following criteria:

- ♦ the additional flows required are at the high end of the flow spectrum
- ♦ the site is located in a valley with significant water resource development
- ♦ the additional environmental water demand is large in a regional context
- ♦ the site contributes to a geographic spread of indicator sites across the Basin
- ♦ selection of the site avoids overlap and repetition in potential water requirements.

The 18 iKEA sites were thus selected primarily on a hydrologic basis to help determine SDLs. As most of the iKEA are floodplain sites the collective water requirements of these sites have a big influence on the estimation of the ESLT. However, as previously noted, the assumption that these iKEA represent the diversity of the full list of KEAs identified has not been tested.

A further untested assumption is that the volumes of water recovered to meet the requirements of the iKEA will be sufficient to also meet the water requirements of all identified KEA. This assumption should be tested and if shown to be reasonable it will be important during the implementation phase of the Basin Plan to assess whether any environmental works and measures used to increase the efficiency of environmental watering undermine achieving these broader outcomes.

A number of KEA (e.g. Barmah Forest, Gunbower-Koondrook-Perricoota Forests, Hattah Lakes, Chowilla Floodplain and the Edward-Wakool system) do not meet the last two of the above criteria of creating a geographic spread and having non-overlapping water requirements. However, recent improvements to the methods for setting environmental water demands in the models in a way that recognises the interdependencies between these sites means that 'repetition' between water requirements for these sites is avoided.

Indicator sites for KEF were selected where reliable modelled data were available with a focus on rivers most influenced by diversions and potentially influenced by the Basin Plan. Where possible these coincided with sites used in the Sustainable Rivers Audit (SRA) hydrologic assessments. This is robust approach. The only shortcoming, as noted earlier, is the absence of a demonstrated coverage of the range of river ecosystem types. This shortcoming should be addressed but is unlikely to be a major source of uncertainty in the initial determination of a Basin-wide ESLT.

## 5.4 Are the expressions of environmental water requirements to meet specified objectives and targets scientifically sound?

### Summary assessment

The expressions of environmental water requirements are scientifically sound. The expressions of water requirements are primarily – although not solely – based on the robust information available on the water requirements of floodplain vegetation. Incorporating into the analysis information available on the water requirements of other species associated with iKEA would increase the confidence in the specification of iKEA water requirements.

### Detailed assessment

iKEA water requirements have been expressed in terms of the frequency of events of a particular magnitude, duration and seasonal timing. This approach is scientifically sound as these are well recognised as environmentally important characteristics of river flow regimes. However, there are other flow characteristics that are important for many floodplain species, in particular the maximum period between flood events. While targets have not been specified for the maximum period between flood events for iKEA, it is recommended that this flow metric is reported and compared to without-development and baseline modelling results.

Because the specified objectives for iKEA are focussed on floodplain vegetation, the method may overlook flows required by other species that are directly or indirectly dependent on the floodplain vegetation of iKEA. Fuller analysis of the water requirements of other species associated with iKEA may demonstrate these are sufficiently captured in the vegetation requirements, and thus help strengthen the case for the vegetation-focussed approach.

The target watering frequencies for iKEA are expressed as a range between a 'low risk' frequency and a 'high risk' frequency. In several cases it is not clear that 'high risk' and 'low risk' are appropriate labels for the actual watering frequencies being considered and this confounds interpretation of the modelling results. It is recommended that either the target watering frequencies or the risk nomenclature be reviewed to ensure consistent use of risk nomenclature and thus aid interpretation of modelling results.

KEF water requirements are very uncertain. There are no ecological targets specified for KEF. The specified hydrological targets are expressed as either a proportion of the without-development flow regime (base flows) or the restoration of specific in-channel events (freshes). This makes it difficult to identify the desired ecological outcomes. KEF should be clearly defined, the scale at which they operate identified and their flow requirements described in generic terms. Once this has been completed KEF could be regionalised and ecological outcomes and performance indicators defined. This is only possible for a limited number of KEF, but would enable better articulation of in-stream flow requirements and greater transparency of trade-offs.

# 6 Modelling, analyses and results interpretation

## 6.1 Are the hydrologic and environmental modelling and associated analyses transparent, appropriate and defensible?

### Summary assessment

The hydrological and environmental modelling and analyses undertaken to guide environmentally sustainable level of take (ESLT) and sustainable diversion limit (SDL) determination were not fully documented by the conclusion of this review (October 2011) making it difficult to assess the appropriateness and defensibility of this work.

The draft documentation and verbal descriptions provided suggest that the hydrologic and environmental modelling and analyses are appropriate. Undocumented assumptions and modelling choices are a source of uncertainty in SDL determination. The modelling of environmental flow regimes for the unregulated rivers of the Basin appears to have been problematic with lower confidence in the modelling results for these rivers.

The modelling has used current carry-over rules designed for irrigation water use. These are likely to be sub-optimal for environmental water management given the need to reinstate small-medium overbank flow events. This is likely to have influenced which hydrological targets have been met in the modelling.

### Detailed assessment

The determination of SDLs has focussed on the use of the complex Basin-wide hydrologic modelling suite (IRSMF) and associated pre- and post-processing tools. This has been a challenging and time-consuming effort.

Prior to the publication of the Guide, the intended hydrologic modelling methods were formally documented (Podger et al., 2010) and independently peer reviewed (MDBA, 2010). These peer reviews recognised the complexity of the modelling task, noted limitations of the proposed approach, but endorsed the proposed approach as appropriate to the task given the available time. The reviews noted that the complexity and magnitude of the modelling effort was of a scale not attempted previously anywhere in the world. Importantly however, the SDL scenarios presented in the Guide were not derived using these modelling methods but using a simpler and less robust 'end-of-system' flow analysis.

While IRSMF was deemed fit for purpose by the peer reviews, early application of these methods revealed significant limitations and uncertainties:

- ♦ water requirements for key ecosystem functions (KEF) were not represented in the modelling
- ♦ the methods used to recover water in upstream models as contributions to environmental water demands in downstream models were undefined
- ♦ treating environmental water demands at different locations along connected systems (particularly the connected southern system) as independent was unrealistic.

The first of these uncertainties has been partly overcome by identifying key sites at which to include environmental water demands for 'freshes' and base flows to drive improvements in hydrologic metrics for KEF.

The second of these uncertainties arose because the modelling suite does not enable a downstream model to 'order' environmental water from an upstream model. Thus the distribution across tributary models of the additional environmental water (over and above within valley needs) to meet environmental water needs in downstream models, and the mechanisms to recover this water, need to be determined prior to running the models. Different mechanisms to recover the additional water in the model (for example, 'purchasing' entitlements, reducing allocations or reducing irrigation demand by reducing planted areas) have different efficiencies in terms of the reduction in use required to recover a given volume of water for the environment. The more recent modelling has assumed all new environmental water will be entitlement-based. Entitlement-based water may not always be well suited to meeting high flow environmental water demands as discussed below. The more recent modelling has also adopted a single method for determining the distribution across tributary models of additional water, although the resulting distribution will not necessarily match what occurs in reality.

The third of the above uncertainties is especially significant in the southern connected system, where Barmah Forest and Gunbower-Koondrook-Perricoota, for example, are typically watered by the same flood events as they pass downstream. The early use of eFlow Predictor (Marsh, 2009) to derive the environmental water demand for each site independently meant it was difficult to optimise environmental ordering and watering across sites. It was expected that better temporal alignment of environmental water demands across the southern connected system could significantly reduce the total adjustment volume.

Subsequent to the publication of the Guide, the Murray–Darling Basin Authority (MDBA) developed a new spreadsheet tool (Pick-a-Box) to assist with the preparation of environmental water demand time series and to help overcome this third limitation of the early modelling. At the time of writing there was no documentation describing the development, assumptions and use of Pick-a-Box in the Basin Plan modelling work. However, the tool and its use were described to the panel. Pick-a-Box takes a time series of flows including all the possible high flow events from eFlow Predictor, and a time series of allocations to assumed new environmental water entitlements from the baseline run of the detailed hydrologic modelling. This of course requires specification of the proposed SDLs (new environmental water entitlements – number and type) prior to determination of the environmental water demand time series. The modelling with the demands included then enables testing that the proposed SDLs will in fact be able to deliver the necessary environmental watering regime.

Pick-a-Box is used to manually identify which high flow events to include in an environmental water demand time series for use in the detailed hydrologic modelling of SDL scenarios. It is essentially used to filter the time series from eFlow Predictor to overcome limitations in the version of eFlow Predictor used by MDBA – in particular the inability to precisely set target average watering frequencies (more recent versions of eFlow Predictor offer greatly flexibility in setting target watering frequencies). Pick-a-Box is used iteratively across indicator key ecosystem asset (iKEA) sites in the connected southern system enabling the development of environmental water demand time series that are synchronised between sites.

Although the use of Pick-a-Box represents a marked improvement over the use of eFlow Predictor alone for preparing environmental water demand time series, the method has several manual steps requiring judgments by individual modellers that have been not been documented and hence the process is not entirely repeatable. It is important that the use of eFlow Predictor and Pick-a-Box to derive environmental water demands is clearly documented.

As noted above, the SDL modelling has represented all new environmental water as entitlement-based water and used existing carry-over rules. In many locations it is likely to be difficult to meet environmental water demands efficiently using entitlement-based water under existing carry-over arrangements and these arrangements may be preventing some of the hydrologic targets being

met in the modelling. While it is technically difficult and time-consuming to comprehensively investigate alternative carry-over arrangements, these implicit assumptions in the modelling are likely to be a significant source of uncertainty in some of the proposed SDLs.

Overall, the post-Guide approach to setting the environmental water demands in the hydrologic models has overcome significant limitations inherent in the pre-Guide modelling. However, at the time of writing there was no coherent documentation of the new modelling methods as applied, meaning this review relied on verbal descriptions from the MDBA modelling team. A shortcoming of the current methods is the adherence to existing carry-over arrangements, which is likely, in some valleys, to represent a significant constraint to efficiently achieving desired environmental outcomes using environmental water entitlements. Additionally, MDBA indicated verbally that the modelling of environmental flow regimes for the unregulated rivers of the Basin has been problematic with lower confidence in the modelling results for these rivers.

In analysing the more recent modelling results MDBA has categorised the hydrologic targets according to the degree to which current operational constraints prevent targets being met. There will of course always be uncertainty about which current system constraints could be reasonably overcome through, for example, new outlet structures on dams, buying of easements to allow flooding or relaxing operating constraints related to channel capacity. However, the approach is appropriate and defensible and an improvement on the earlier methods.

At present there is insufficient transparency around the modelling and analysis in support of the determination of SDLs, primarily because the final modelling methods and results are not documented. The Panel strongly encourages MDBA to provide clear documentation of the modelling methods as used, stating the assumptions and uncertainties, and the results of the modelling and their interpretation. The results should demonstrate the extent of any shortfalls in meeting the environmental water targets for stated environmental objectives under proposed SDLs, and the likely ecological consequences of such shortfalls.

## 6.2 Have model outputs been synthesised and reported in appropriate ways that are simple to comprehend and explicitly link to stated objectives and targets?

### Summary assessment

Modelling results for iKEA – indicating the expected frequency of watering events for floodplain and wetland iKEA and various flow metrics for the Coorong-Lower Lakes-Murray Mouth region compared to targets – were provided during the review. During the review the panel provided feedback to MDBA on how to improve the presentation of these results including clearer linking back to the ecological targets. The most recent summary of model outputs seen by the panel (dated 10 August 2011) provided a simple to comprehend synthesis of iKEA results, but did not explicitly link back to ecological targets.

Few modelling results were provided for KEF hydrologic metrics. The hydrologic targets developed for KEF have not been linked to specific ecological targets. This is largely because of an inadequate knowledge base to specify robust and meaningful ecological targets but has been confounded by inadequate work on KEF classification and attribution to flow. These shortcomings mean that even when results for KEF hydrologic metrics become available, they will not be able to be linked directly back to environmental objectives.

A coherent synthesis of the all modelling results and their interpretation against ecological targets in the context of a robust Basin-scale conceptual ecological model has not yet been produced.

### Detailed assessment

The panel was provided with various iterations of modelling results during the review period. The approaches to the synthesis and reporting of results continue to improve reflecting early feedback from the panel. The assessments herein are based on modelling results that are compilation dated 10 August 2011 based on run #836 for the Lachlan and run #832 for the other rivers of the Basin. This tabulation of results compares the frequencies of key watering events to target and baseline values for the 18 iKEA and a small number of sites where demands were included in the models for KEF. KEF metric reporting for the majority of the hydrologic indicator sites was not provided.

To date there has been no comprehensive, structured synthesis and reporting of the modelling results, and no ecological interpretation of the results at the Basin-scale. Basin-scale interpretation is challenging because of the absence of a robust conceptual model linking asset-scale to Basin-scale ecological outcomes. In the absence of such a conceptual model, the logic trail from “*protect and restore the environmental values*” (through the criteria used for selection of assets and functions) to the species used to estimate water requirements, is complex and difficult. In particular, it will be difficult for stakeholders to gain an understanding of the likely environmental character of the Basin under the Basin Plan compared to alternate scenarios, or to understand how outcomes for a particular asset or river reach are linked to basin-scale outcomes and vice versa.

For iKEA, it is recommended that model outputs be synthesised and reported against the outcomes being sought. Currently model outputs are synthesised and reported for iKEA in terms of average frequencies or a percentage of years. These are critical but where hydrological targets are not met the ecological consequences have not been described. It is recommended that when formally documenting the modelling results, any shortfalls against hydrologic targets and the likely environmental consequences of these shortfalls be described. It is also recommended that a Basin-scale synthesis of the expected environmental benefits from the proposed SDLs be prepared.

The panel was not provided with summary reporting of KEF metrics for the SDL scenario. KEF reporting against targets should include absolute changes as well as relative changes, otherwise the magnitude of the pre- and post-SDL metric values are unknown. As there is no clear link at present between KEF targets and underlying ecological targets, synthesising and reporting against ecological targets is not possible. The lack of KEF objectives and ecologically based targets undermines the MDBA’s capacity to report the predicted outcomes of the Basin Plan or to articulate the trade-offs.

The high level of uncertainty associated with KEF flow requirements should be considered when comparing modelling results to KEF targets as it’s not appropriate to treat these targets as precise in assessing SDL performance.

# 7 Policy integrity

## 7.1 Are the final expressions of an environmentally sustainable level of take (ESLT) evidence-based and consistent with stated environmental objectives and targets?

### Summary assessment

The panel's assessments are based on modelling results (date 10 August 2011) provided by the Murray–Darling Basin Authority (MDBA) for a 2800 GL/yr reduction scenario. The modelling results for this scenario provide a sound evidence base for the expected degree of flow regime change and the extent to which this would meet specified hydrologic and thus ecological targets.

The results indicate that for this level of change in consumptive water use, and assuming appropriate management of new environmental water, valuable ecological benefits could be delivered across the Basin including meeting several of the specified ecological targets. As modelled, the proposed sustainable diversion limits (SDLs) deliver environmental benefits on the areas of the floodplain that can be watered more easily but some dis-benefits for areas of the floodplain that are more difficult to water. This highlights that there are trade-offs to be made between environmental outcomes when managing environmental water.

The modelled 2800 GL/yr reduction scenario considered by the panel does not meet several of the specified hydrologic and ecological targets. In some cases operational constraints prevent delivery of environmental water to meet targets implying that some of the current ecological targets are not consistent with unavoidable operational constraints. In other cases, the shortfalls against targets appear to be a result of insufficient environmental water, shortcomings in modelling environmental flow regimes in the unregulated rivers of the Basin or a combination of these factors.

Further analyses, including modelling of water use reduction scenarios above the 2800 GL/yr scenario, are required to more fully assess the reasons for the modelled shortfalls. Given the current evidence base, the level of take represented by the 2800 GL/yr reduction scenario is not consistent with the hydrologic and ecological targets provided in the review.

### Detailed assessment

This final question of the original terms of reference is intended to provide an overarching assessment of policy integrity, given the available knowledge base and the body of hydrologic and environmental technical work undertaken in support of the proposed ESLT. The assessment of policy integrity here is limited to the components of the process within the scope of this review as indicated by the red box on Figure 1. Thus we have limited this final question to a consideration of the specified ecological targets (Step 3 in Figure 2) as described in the appendices to the Guide, which MDBA has indicated are the targets being used for the proposed Basin Plan.

A caveat on these assessments is that at the time of writing MDBA had not finalised its view on an ESLT, or on the final magnitude of proposed SDLs. MDBA provided a verbal description from MDBA on how SDLs will be set out in the proposed Basin Plan including a description of a 'shared component' that will be prescribed for the southern Basin and for the northern Basin.

In addressing this final question the panel has used the modelling results provided by MDBA dated 10 August 2011 and labelled "draft – work in progress". These results are a compilation from run #836 for the Lachlan and run #832 for the other rivers of the Basin. The results are for a scenario representing a 2800 GL/yr average reduction in surface water diversions. These results indicate performance against the specified hydrologic targets for the 18 indicator key ecosystem asset (iKEA) sites as well as for five other locations in the northern Basin where demands for 'freshes' to improve key ecosystem functions (KEF) have been included in the modelling. The results compilation provided did not include hydrologic metrics for KEF at the other 83 hydrologic indicator sites.

Although the modelling results provided do not directly indicate the proposed SDLs for each SDL area, the proposed Basin-wide SDL is clearly implicit and the panel understands that the proposed SDLs have been fully represented in the hydrologic modelling. The results provided are clearly evidence-based. The hydrologic modelling results appear to be robust, however, MDBA has indicated they believe some of the models (e.g. the Gwydir Integrated Quantity Quality Model (IQQM)) are not able to adequately represent iKEA flow regimes and that modelling of environmental flow regimes for the unregulated rivers of the Basin appears has been problematic with lower confidence in the modelling results for these rivers.

It is beyond the scope of this review to critique the performance of individual models, however, MDBA should ensure any such concerns with model performance for Basin planning purposes are documented and subject to expert review prior to discounting counter-intuitive or unexpected modelling results.

The modelling and analyses undertaken by MDBA indicate that under the proposed SDLs (a 2800 GL/yr average annual reduction in Basin-wide surface water diversions) significant increases in the frequencies of watering of major floodplain wetland systems across the Basin could be achieved as well as improvements to within channel environmental flow regimes. The modelling suggests that for this level of change in consumptive water use, and with appropriate management of new environmental water, valuable ecological benefits could be delivered across the Basin.

The modelling indicates that in some cases operational constraints prevent delivery of environmental water to meet targets, and in presenting the modelling results MDBA has categorised the hydrologic targets into:

- ♦ achievable under current operating conditions (91 targets)
- ♦ achievable under some conditions (constraints limit delivery at some times) (16 targets)
- ♦ difficult to influence achievement under most conditions (constraints limit delivery at most times) (13 targets).

Given the 13 targets in the last category, it is currently unclear whether all the proposed ecological targets and high-level environmental objectives are fully consistent with a managed water resource system.

The degree to which the 2800 GL/yr reduction scenario meets the hydrologic targets across these categories is summarised in Table 2. The SDLs modelled in this scenario do not achieve the majority of the hydrologic targets. They meet 55 percent of the 'achievable' targets at either the 'high risk' or 'low risk' frequency. The 2800 GL/yr reduction scenario is thus not consistent with the currently stated environmental targets.

While operational constraints preclude the meeting of some hydrologic and ecological targets, in other cases the shortfalls against targets appear to be a result of insufficient environmental water, the shortcomings in modelling environmental flow regimes in unregulated rivers or a combination of these factors. Modelling and analysis of water use reduction scenarios above the 2800 GL/yr scenario are required to more fully assess the reasons for the modelled shortfalls. The level of take represented by the 2800 GL/yr reduction scenario is not consistent with the currently stated hydrologic and ecological targets given the available evidence base.

Table 2 Number and percent of hydrologic targets met by category under in the 2800 GL/yr reduction scenario modelled by MDBA as indicated by results summary of 10 August 2011

CATEGORY	NO. TARGETS REPORTED AGAINST	MET AT 'LOW RISK' FREQUENCY		MET AT 'HIGH RISK' FREQUENCY		NOT MET BUT IMPROVEMENT LIKELY		NO IMPROVEMENT		WORSE THAN BASELINE	
		NO	%	NO	%	NO	%	NO	%	NO	%
Achievable under current operating conditions	83	22	27	23	28	27	33	10	12	1	1
Achievable under some conditions	16	1	6	4	25	7	44	3	19	1	6
Difficult to influence achievement under most conditions	13	0	0	0	0	2	15	7	54	4	31
<b>Total</b>	<b>112</b>	<b>23</b>	<b>21</b>	<b>27</b>	<b>24</b>	<b>36</b>	<b>32</b>	<b>20</b>	<b>18</b>	<b>6</b>	<b>5</b>

The panel understands that other reduction scenarios have been modelled, but the panel has not seen modelling results for these other scenarios, and thus it is not clear how the 2800 GL/yr reduction proposal was arrived at. The panel assumes this proposal was arrived at as a result of socio-economic considerations by MDBA (as per the logic in Figure 1), but a consideration of socio-economic analyses is beyond the terms of reference for this review. As indicated in the logic of Figure 1 the feedbacks following socio-economic considerations require a revision to the environmental targets, or to key environmental asset (KEA) and key ecosystem functions (KEF), in order for the proposed ESLT to be consistent with the stated objectives and targets.

The panel accepts that the modelling results provided do not necessarily represent the optimal environmental outcomes that could be achieved under a 2800 GL/yr reduction scenario. Limitations in the modelling and assumptions about how environmental water would be used mean that the modelled outcomes from the proposed ESLT are likely to be less than what could be achieved in practice. Further work is required to explore more optimal environmental watering under the proposed Basin Plan. Nonetheless, the modelling results are currently the best available evidence base for the expected environmental performance of the proposed ESLT.

It appears that MDBA has not yet followed the feedback loops in Figure 2 to interpret the likely ecological consequences of this level of hydrologic performance and to assess if the proposed high-level environmental objectives are likely to be met under the proposed SDLs.

The modelling indicates that if environmental water were to be managed as modelled, the proposed SDLs would increase the frequency of smaller beneficial floods but reduce the frequency of reservoir spills thus decreasing the frequency of larger beneficial floods. As modelled, the proposed SDLs would thus deliver environmental benefits on the areas of the floodplain that can be watered more easily, but would deliver some dis-benefits for areas of the floodplain that are difficult to water (for example, parts of the Riverland-Chowilla Floodplain). This highlights that there are trade-offs to be made between different environmental outcomes in managing environmental water.

In summary, the modelling indicates that the proposed SDLs would be highly unlikely to meet the specified ecological targets even in the absence of future climate change. Operational constraints are a key reason for this, but a large number of achievable targets are also not met in the modelling. MDBA has undertaken a robust assessment of which hydrologic targets are currently achievable and which would be difficult to achieve. This assessment however, does not seem to have led to revision of the ecological targets to remove those unachievable given unavoidable constraints. An interpretation of what, ecologically, can be realistically achieved with the Basin Plan under the proposed SDLs has not yet been clearly articulated, either at a site level or at a Basin level.

With respect to climate change, it is recommended that MDBA indicate whether, if the drying projections for the Basin come to pass, the MDBA's intention would be to revise the environmental objectives for the Basin Plan, enforce more stringent SDLs to ensure environmental protection, or adopt some compromise between the two.

# 8 Environmentally sustainable level of take uncertainty

The five-step process for environmentally sustainable level of take (ESLT) and sustainable diversion limit (SDL) determination (Figure 2) provides a framework for summarising the relative uncertainties and sources of uncertainty Table 3 provides preliminary qualitative assessments of uncertainty based on the expert opinion of the panel in the context of the material reviewed. This emphasises that the largest source of material uncertainty in the ESLT and SDLs is the policy choices involved in defining environmental objectives.

The Panel recommends that MDBA adopt this or similar frameworks to both assess and communicate the types and sources of uncertainty and to direct future technical effort and research endeavours. Ideally this could be refined to indicate quantitative levels of uncertainty. Given the uncertainties involved the Panel strongly recommends MDBA commit to an adaptive approach to implementation of the Basin Plan informed by a well-designed ongoing environmental monitoring and evaluation program that supports longer-term knowledge generation in order to iteratively refine the ESLT and SDLs.

**Table 3 Summary of relative uncertainty for each step of the ESLT and SDL determination process, sources of uncertainty and their materiality to the ESLT and SDLs**

STEP	RELATIVE UNCERTAINTY		SOURCES OF UNCERTAINTY	MATERIALITY OF UNCERTAINTY TO MAGNITUDE OF ESLT AND SDLs
Define environmental objectives	--		Primary: policy choice	high
Identify KEA and KEF	KEA	low	Primary: MDBA methods Secondary: scientific knowledge	low
	KEF	high	Primary: scientific knowledge Secondary: MDBA methods	low
Specify ecological targets	KEA	moderate	Primary: scientific knowledge Secondary: MDBA methods	moderate
	KEF	--	<i>No targets specified</i>	low
Specify EWR & hydrologic targets	KEA	moderate	Primary: scientific knowledge Secondary: MDBA methods	moderate
	KEF	high	Primary: scientific knowledge Secondary: MDBA methods	low
Determine SDLs that meet targets		moderate	Primary: MDBA methods Secondary: scientific knowledge	moderate

# 9 Recommendations for future work

Ongoing improvements can be made over the coming months and years in the application of best available science to the determination and management of an environmentally sustainable level of take (ESLT) for the Basin. Future investments in ecological research and monitoring are critical to guide an adaptive approach to implementation of the Basin Plan, and to ensure that the ecological outcomes gained from every megalitre of applied environmental water continue to improve.

In the assessments presented in Sections 3–7 numerous recommendations are made for future work that relate directly to the terms of reference of the review. These are consolidated in Table 4 work recommended for the short term, Table 5 work recommended for the medium term and Table 6 work recommended for the long term, against the five steps in the sustainable diversion limit (SDL) determination process (Figure 2).

These time frames are defined as follows:

- ♦ short term – prior to the finalisation of the Basin Plan in 2012
- ♦ medium term – in the period prior to the 2015 (when SDLs are expected to be reviewed)
- ♦ long term – ongoing beyond 2015.

Some of the work recommended for the short term is considered critical for supporting consultation on the proposed Basin Plan – these tasks are indicated in italics in Table 4. The remaining work recommended for the short term is not considered critical but represents a relatively small effort that would usefully strengthen the body of work.

In addition to the recommendations in Table 4 through to Table 6, several general recommendations were also made in the preceding sections:

1. The key environmental asset (KEA) database should be maintained and expanded to support adaptive implementation of the Basin Plan.
2. All modelling input and output data should be archived as an audit trail of the modelling and to enable future analysis.
3. In developing and applying the ‘body of science’ to the Basin Plan a more open and inclusive engagement with the water science community is recommended.
4. The development of new river models for the Basin using the eWater Source modelling platform should continue to be supported.

The most important additional work in the short term is completing and publishing coherent and comprehensive documentation of the ESLT analyses. This will greatly increase the transparency and defensibility of the work. We recommend that the documentation include:

5. A coherent conceptual ecological model linking flow regimes to ecological responses, across multiple spatial scales and biogeographic zones, both as a means for guiding the compilation of scientific data and evidence underpinning an ESLT and to support effective communications of the science and analyses.
6. Description of the final modelling methods stating the key assumptions and sources of uncertainty.
7. A summary of the modelling results that support the proposed ESLT and SDLs indicating which hydrologic targets can be met under current constraints, the likely overall ecological consequences and the extent to which these are consistent with the higher-level environmental objectives of the Basin Plan.
8. A Basin-scale synthesis of expected environmental benefits from the proposed ESLT and SDLs.

The recommendations for future work in Table 4 through to Table 6 that have been identified in the course of this review only relate to the basin-scale water resource planning process. Other research and technical work would be expected to assist in regional scale water resources planning. Additionally, implementation of the Basin Plan represents a major challenge that would be sensibly supported by targeted research, especially to guide the

effective and efficient management of environmental water. It is beyond the scope of this review to present a strategic research plan to guide adaptive water planning and adaptive water management in the Basin. However, a number of the panel members have separately prepared such a document and provided this to MDBA to the Commonwealth Department for Sustainability, Environment, Water, Population and Communities.

**Table 4 Recommended future work for the short term, with critical tasks indicated in italics**

STEP	KEY ADDITIONAL WORK TO REDUCE ESLT AND SDL UNCERTAINTY
Define environmental objectives	- <i>Review the proposed ecological targets and high-level environmental objectives to ensure they are consistent with unavoidable system constraints (such as the presence of major dams).</i>
Identify KEA & KEF	- Clarify and clearly document the conceptual basis for the inclusion of KEF in the ESLT method. - Specify more clearly the sources of scientific information on which the articulation of KEF values has been based.
Specify ecological targets	- Clarify where necessary the basis for the areal extent of iKEA ecological targets.
Specify EWR & hydrologic targets	- More fully document the links between KEF and flow metrics based on the peer-reviewed scientific literature. - Review either the target watering frequencies or the associated risk nomenclature to ensure consistent use of risk nomenclature.
Determine SDLs that meet targets	- <i>Report both absolute and proportional changes in KEF flow metrics relative to the modelled baseline, as well as the maximum period between iKEA watering under the proposed SDLs.</i> - <i>Clearly communicate to stakeholders the policy choices around climate change implicit in the proposed Basin Plan, and demonstrate how the Basin Plan would perform during the worst extended drought sequence in the historic record, and ideally, the worst drought sequence from one or more future climate scenarios.</i> - <i>Improve the consistency between proposed SDLs, specified ecological targets and high-level environmental objectives. This could be via revision to targets or SDLs or both, and/or commitment to a program of works and measures.</i>

Table 5 Recommended future work for the medium term

STEP	KEY ADDITIONAL WORK TO REDUCE ESLT AND SDL UNCERTAINTY
Define environmental objectives	
Identify KEA & KEF	<ul style="list-style-type: none"> <li>- Develop a biophysical classification of KEA in the Basin to support both the existing methodology and to guide future research and monitoring programs, as well as to test the representativeness of iKEA.</li> <li>- Strengthen the approach to including KEF in the methods, including an improved classification, a regionalisation of KEF and a 'mapping' of KEF importance across the Basin. Use the classification to test the representativeness of KEF indicator sites.</li> </ul>
Specify ecological targets	<ul style="list-style-type: none"> <li>- Specify more clearly the ecological outcomes associated with KEF flow targets.</li> </ul>
Specify EWR & hydrologic targets	<ul style="list-style-type: none"> <li>- Undertake a fuller analysis of the water requirements of species associated with iKEA to demonstrate whether these are sufficiently captured in the vegetation requirements that have been assessed.</li> <li>- Explore the scope for location-specific hydrological targets for KEF.</li> <li>- Test that KEA and KEF indicator sites are sufficient to represent the full set of environmental water requirements and their redistribution across the Basin. It is recommended that this is approached by assessing the sensitivity to the Basin-wide environmental water requirement to the number and distribution of indicator sites – incrementally increasing the number of indicator sites used in the analysis to determine whether the Basin-wide environmental water requirements change.</li> </ul>
Determine SDLs that meet targets	<ul style="list-style-type: none"> <li>- Undertake floodplain inundation modelling for a few key sites such as the Riverland-Chowilla to test the sensitivity of ecological outcomes in higher floodplain areas to variations in the Basin-wide SDL.</li> <li>- Undertake basin-wide inundation modelling to determine how many KEA, and of what types, will be watered under the target flow regimes described for iKEA.</li> <li>- Undertake modelling of floodplain wetland inundation and ecological responses to guide determination of efficient and effective environmental water regimes.</li> <li>- Explore the sensitivity of SDLs to carry-over rules to ensure the most efficient use can be made of recovered environmental water. Initially, simplified modelling approaches could be explored. This should be explored in the context of assessing how operational constraints could be overcome as these aspects of water management strongly interact.</li> <li>- Undertake modelling to assess the extent to which works and measures could enable existing constraints to be overcome and thus improve ecological outcomes.</li> <li>- Consider development of a simpler Basin-wide hydrologic model explicitly linked to ecological and economic outcomes in order to rapidly explore multiple SDL options and the implications of model parameter uncertainty.</li> <li>- Determine the magnitude of future adjustments to SDLs that would be required under a range of future climate change scenarios to maintain the level of environmental protection offered by the currently proposed SDLs.</li> <li>- Communicate the approach to sharing the longer-term risks associated with climate change between water users and the environment.</li> </ul>

Table 6 Recommended future work for the long term

STEP	KEY ADDITIONAL WORK TO REDUCE ESLT AND SDL UNCERTAINTY
Define environmental objectives	
Identify KEA & KEF	<ul style="list-style-type: none"> <li>- Broaden the perspective on KEA from a site-focus to encompass an ecosystem or landscape view (within the framework of a KEA classification).</li> </ul>
Specify ecological targets	<ul style="list-style-type: none"> <li>- Explore opportunities to broaden ecological targets to incorporate consideration of ecosystem services and other ecological values beyond biodiversity.</li> </ul>
Specify EWR & hydrologic targets	<ul style="list-style-type: none"> <li>- Strengthen the linkages between hydrologic targets and ecological outcomes for KEA and KEF based on evaluation of long-term monitoring data supported where appropriate by targeted research.</li> </ul>
Determine SDLs that meet targets	

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# Appendix A: Material provided for the review

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