SENATE RURAL & REGIONAL AFFAIRS & TRANSPORT REFERENCES COMMITTEE

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Inquiry into the management of the Murray Darling Basin

Canberra, 24 April 2012

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From: Michael Young
Sent: Monday, 23 April 2012 6:17 PM
To:
Cc: RRAT, Committee (SEN)
Subject: Reply to Question from Senator Xenophon

Dear Committee

During my appearance before the Committee today Senator Xenophon asked me to provide additional information on the impacts of biodiversity and my interpretation that biodiversity plantings are excluded from the interception arrangements in the Proposed Plan.

The relevant sections of the Proposed Plan read as follows

Part 5 Interception activities

9.28 Without limiting subsection (2), if there are any of the following activities in the water resource plan area, the water resource plan must list them as classes of interception activity which have, or have the potential to have, a significant impact on the water resources of the water resource plan area:

(a) interception by a runoff dam;
(b) interception by a commercial plantation;
(c) interception by a mining activity, including coal seam gas mining;
(d) interception by floodplain harvesting.

In the definitions section of the Proposed Plan it is stated that

commercial plantation means an area of land on which perennial woody plants are planted primarily for commercial purposes (other than the production of food).

Note: Some examples of commercial purposes are the production of timber, woodchip, oil or biofuel, or the commercial exploitation of the carbon sequestration capacity of the plants.

Note that establishment of a plantation for biodiversity conservation is not included in the above list. Moreover, the word "primarily" means that if the prime purpose was for biodiversity conservation then carbon credits could sneak through as a secondary purpose.

One way of solving this problem would be to amend the Proposed Plan along the following lines

Part 5 Interception activities

9.28 Without limiting subsection (2), if there are any of the following activities in the water resource plan area, the water resource plan must list them as classes of interception activity which have, or have the potential to have, a significant impact on the water resources of the water resource plan area:

(a) interception by a runoff dam;
(b) interception by a ~~commercial~~ plantation;
(c) interception by a mining activity, including coal seam gas mining;
(d) interception by floodplain harvesting.

In the definitions section of the Proposed Plan

~~commercial plantation~~ means an area of land on which perennial woody plants are planted ~~primarily for commercial purposes (other than the production of food).~~

~~Note: Some examples of commercial purposes are the production of timber, woodchip, oil or biofuel, or the commercial exploitation of the carbon sequestration capacity of the plants.~~

I trust that this answers the Senator's question.

Mike Young
Professor, Water and Environmental Policy
The University of Adelaide
Honorary Professor, University College London

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INLAND RIVERS NETWORK

Submission to the Murray-Darling Basin Authority in response to the *Proposed Basin Plan*

16th April 2012

Inland Rivers Network Incorporated

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About Inland Rivers Network

The Inland Rivers Network (IRN)[1] is a coalition of environment groups and individuals concerned about the degradation of the rivers, wetlands and groundwaters of the Murray-Darling Basin. Member groups of IRN include the Australian Conservation Foundation; the Nature Conservation Council of NSW; the National Parks Association of NSW; the Central West Environment Council; Friends of the Earth; The Wilderness Society, Sydney Branch and the Coast and Wetlands Society.

IRN has been advocating for the conservation of rivers, wetlands and groundwater within the Murray-Darling Basin since 1991. Accordingly, IRN welcomed bipartisan moves to improve water management, specifically the development of an overarching Basin wide approach to the management of interconnected water sources.

Introduction

As indicated in various prior submissions and correspondence with the Murray-Darling Basin Authority (MDBA), IRN is strongly supportive of the Basin Plan concept. IRN believes that the Basin Plan exists as the best opportunity available to restore health to the highly degraded inland river and wetland systems of the Murray-Darling Basin (the Basin).

IRN is of the opinion that the objectives and requirements of the Commonwealth's *Water Act 2007*[2] provide a strong framework for the development of a Basin Plan that is scientifically robust and environmentally sound.

IRN has been highly involved in the Basin Plan process to date. IRN made a submission to the *Sustainable Diversion Limits Discussion Paper* in March 2010. Representatives of IRN have attended all of the major stages of the MDBA engagement program to date, including the consultation process and submission to the *Guide to the proposed Basin Plan* (the *Guide*) in December 2010 and a number of key stakeholder information meetings relating to the current *Proposed Basin Plan* held throughout 2011 and into 2012.

IRN has also played an important role in introducing NSW inland regional communities to the Basin Plan concept and communicating the opportunities of this historic water reform process. As part of the IRN 'Water for Wetlands is Water for Life' workshop series (held between March and June 2010), and at the request of IRN, MDBA representatives attended and presented a conceptual overview of the *Basin Plan* process. In some communities these workshops enabled the first community engagement opportunity they had received regarding the Basin Plan.

IRN also ran two specific workshops on the *Proposed Basin Plan,* funded by MDBA engagement assistance. The *Basin Plan Talks* were held in Sydney in April 2011 and Orange in May 2011. IRN

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[1] For more information see website at www.irnnsw.org.au

[2] *Water Act 2007* (Cwlth)

has also conducted additional workshops in Broken Hill in September 2011 and recently in Dubbo in March 2012.

In summary, IRN welcomes the opportunity to provide feedback on the *Proposed Basin Plan* and to express disappointment in the major step backwards from the original intent as outlined in the *Guide.* This important opportunity to advance the management of the ecological health and integrity of the Murray-Darling Basin water sources must not be compromised and needs to be undertaken with the utmost scientific rigour.

Summary of key points

IRN believes that the *Water Act 2007* provides for the delivery of a Basin Plan that is environmentally sound and scientifically rigorous. However, IRN is of the opinion that the *Proposed Basin Plan* fails to meet both the key objects of the *Water Act 2007* and its own objectives for the following reasons:

- The proposed reduction of only 2,750 GL from consumptive use will not protect and restore the key environmental assets or ecosystem functions of the Basin to a level of health and resilience as identified in Chapter 7 Part 2
- The hydrological modelling conducted to justify this poor outcome for environmental water allocations is compromised and inadequate
- The Environmental Watering Requirements assessments demonstrate that inadequate water is proposed to be returned to the environment
- That 'current extent' for Ramsar listed wetlands is based on mapping undertaken during 2008 towards the end of the driest period on record
- More attention needs to be paid to opportunities for more environmental water from the Northern Basin
- The proposed increase of groundwater allocation to 2600 GL fails to recognise the implications to surface water connectivity and is likely to counteract any benefit that might be derived from the proposed return of 2750 GL surface water
- The groundwater water resource plan areas should not be influenced by state borders
- The risk to environmental water allocations from reduced inflows caused by climate change up to 2039 has not been considered
- The water quality targets as set out in Schedule 9 are inconsistent
- The proposed 20% compliance buffer for the long-term annual diversion limit must be removed
- Water Resource Plans should consider a large range of environmental flow sources and not only concentrate on release opportunities from storages

Key Recommendations

IRN recommends that the *Proposed Basin Plan* is improved in the following ways:

1. That 4,000 GL be returned to the environment to ensure that the objects of the *Water Act 2007* and the management objectives and outcomes to be achieved by the Basin Plan as outlined in Chapter 5 of the *Proposed Basin Plan* are met
2. That more water be returned from the Northern Basin
3. That Water Resource Plans identify policy and physical constraints that can be modified to enable better delivery of environmental water so that management objectives and outcomes of the *Proposed Basin Plan* are achieved
4. That the proposed increase in groundwater allocation to 2,600 GL be removed from the *Proposed Basin Plan*
5. That section 6.13 (1) be altered so that non-compliance with a long-term annual diversion limit be a debit amount equal to or greater than 2%.
6. That section 6.14 provide a share of allocation of risks in relation to reduction in water availability of 50%
7. That section 9.09 *Change in reliability* be removed from the *Proposed Basin Plan*

Positive aspects

IRN supports the Management objectives and outcomes in relation to environmental outcomes as described in section 5.03 and extended in Chapter 7 of the *Proposed Basin Plan.*

While Note 1 under section 5.03 identifies the challenges of water management with water storages and property including floodplains under the control of various persons, IRN believes it is the role of the Water Resource Plans to inform the type of active management required to achieve environmental outcomes.

IRN supports section 6.08 that there is no allowance for temporary diversions for each SDL resource unit.

IRN particularly supports the following principles to be applied to environmental watering as identified in Part 7 Division 1:

- Principle 6 – Apply the precautionary principle
- Principle 8 – Adaptive management
- Principle 9 – Relevant international agreements
- Principle 10 – Other management and operational practices

IRN supports section 7.53 (1), (2), (3) – Planning for the recovery of additional environment water.

IRN supports section 9.22 that a water resource plan can include rules which ensure that environmental watering requirements are not compromised

IRN is also pleased to see the recognition of groundwater and surface water connections in section 9.24

General concerns

IRN was originally encouraged by the significant progress that seemed to have been achieved towards the prescribed goals of the *Water Act 2007* leading up to the release of the *Guide*. In particular, the body of scientific knowledge that has been amassed for the catchments of the Murray-Darling Basin deserves broad acclaim.

IRN believes that the volume of this scientific data, produced by the CSIRO Water for a Healthy Country Flagship program,[3] and by other programs, has placed the MDBA in a unique position. In the past many poor decisions have been made with respect to Australia's water resources stemming from lack of scientific knowledge, with devastating consequences for the nation's ecological resources. There is broad consensus that the knowledge that the MDBA now has is of the highest available quality, and IRN requests that the impetus will be maintained in promoting such research in all areas.

Lack of scientific rigor

IRN is disappointed that the *Proposed Basin Plan* has not made the best use of that knowledge and that the CSIRO review of the proposed 2750 GL reduction in diversions across the Basin identifies that this volume was not arrived at through the use of best available science or scientific opinion.[4]

On this basis alone, the *Proposed Basin Plan* must be improved to comply with the *Water Act 2007.*

Limitations of KEA HIS approach

IRN remains cautious about the fundamental assumption of the Basin Plan relating to the identification of environmental assets. That is, the hypothesis that environmental outcomes for the whole Basin will be achieved by identifying the hydrological requirements of only 18 Key Environmental Asset Hydrological Indicator Sites (KEA HIS) and 88 Key Environmental Function Sites (KEF) throughout the entire Basin (in which there are approximately 30,000 wetlands and multiple river reaches of differing character).

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[3] http://www.csiro.au/org/WfHC.html

[4] CSIRO 2011 *Science Review of the Estimation of an Environmentally Sustainable Level of Take for the Murray – Darling Basin*

IRN acknowledges the complexities involved in gathering data and conducting modelling around such an extensive network of inland freshwater systems and appreciates that critical progress is being made in this area as part of the Basin Plan process.

Despite the progress, IRN believes that insufficient data, monitoring projects and gauging points suggest limitations in the KEA HIS approach.

Flaws of long-term averaging

There is a failure of the capacity for long-term averages of water availability to be able to reflect the high variability of the hydrological systems within the Basin. However, the *Water Act 2007*, and hence the *Proposed Basin Plan*, work on the basis of long-term averages. IRN believes that there are serious problems with this approach, for it does not reflect either the high variability of the system or the impacts of climate change.

Large flood events weight the long-term average of water availability. Conversely, during long dry periods a 'double drought' effect applies where natural shortages are compounded by greater human demand for water. In particular, in northern parts of the Basin, the use of annual averaging is particularly problematic as the boom and bust cycles are an intrinsic part of these systems.

Natural high flow events may also be curtailed in regulated systems by the need to protect social and infrastructure investment that has developed in recent time.

There is a particular need to recognise the impacts on medium to low flows in the current rules for water extraction across the Basin. The loss of environmental resilience has been caused through a reduction in the range of flow regimes. Long term averages remove the consideration of the flow variability that fresh water dependent ecosystems require.

By determining the Sustainable Diversion Limit (SDL) as a particular quantity of water per year, the MDBA has missed the opportunity of setting diversion limits which reflect the water availability in the basin. Section 23(2) of the Act[5] provides for the long-term average sustainable diversion limit to be specified

a) as a particular quantity of water per year or
b) as a formula or other method that may be used to calculate a quantity of water per year or
c) *in any other way that the Authority determines to be appropriate* (emphasis added)

IRN believes that the MDBA must use a more accurate basis for its modeling, for example drawing on the best science data available from the CSIRO.

[5] http://www.csiro.au/org/WfHC.html

Climate change scenarios

IRN is concerned at the way in which the likely impacts of climate change are taken into account have changed between the *Guide* [6] and the *Proposed Basin Plan.* The *Guide* communicated the CSIRO modelling which shows that impacts under a median 2030 scenario may cause the Basin to be 10% drier than the current conditions. The *Guide* made an allowance for at least a 3% reduction in the current water extraction limit.[7]

The MDBA has since made a policy decision that there will be no reduction in SDLs to accommodate the predicted reduction in runoff from climate change.

The consideration that the 114 years of historic records used in hydrological modelling is sufficient to incorporate any climate change that may occur has shifted all the risk to environmental water.

This also includes a risk to the highly connected groundwater sources.

The projections from the Intergovernmental Panel on Climate Change, and the CSIRO's Climate Change in Australia 2007 technical report[8] indicate that the likely impacts of climate change by the end of the *Proposed Basin Plan* in 2029 will have caused a deterioration in available water for environmental outcomes.

Groundwater connectivity and Groundwater Dependent Ecosystems (GDEs)

While the *Proposed Basin Plan* recognises the importance of hydrological connections between groundwater and surface water (eg provision of baseflows) to be considered in groundwater water resource plans[9], there is no equivalent recognition in surface water water resource plans to consider the recharge of groundwater in highly connected systems.

The destruction of irreplaceable groundwater systems has a major impact on ecosystem health and ecological function. The disruption of the natural capacity to store water in the landscape, and the subsequent loss of base flows needs to be closely considered. The connectivity between surface water and groundwater, particularly with alluvial aquifers, needs to be clearly understood when defining take. This connectivity is important for both aquatic and terrestrial biodiversity reasons.

IRN does not support separate SDLs for surface and groundwater systems where there is a high level of connectivity. This management arrangement has been achieved in the Wybong

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[6] *Guide to the proposed Basin Plan – Technical Background*, Volume 2, Part 1, pp.118-124.
[7] *Guide to the proposed Basin Plan – Technical Background*, Volume 2, Part 1, pp.118-124.
[8] CSIRO 2007; www.csiro.au/resources/Climate-Change-Technical-Report-2007.html
[9] MDBA 2011 *Proposed Basin Plan* section 9.24 p71

unregulated water sharing plan in the Hunter Valley, and could easily be repeated in Water Resources Plans in the Basin.

Connectivity with the Great Artesian Basin (GAB) has not been identified or accounted for in the *Proposed Basin Plan*. While IRN acknowledges that this is not specified as within the bounds of the Basin Plan under the *Water Act,* IRN believes that work to further understand the relationship between Basin and GAB water sources needs to be undertaken, in order for potentially vital connectivity not to be overlooked. It is essential that additional research into surface water and groundwater connectivity in the MDB be undertaken to prevent entrenching commitments in surface and groundwater plans that would compromise the objectives of the *Water Act 2007*.

IRN is not alone in acknowledging that there remains many gaps remain in our understanding of connectivity arrangements.[10] This continues despite the significant further work in this area undertaken recently by the CSIRO and others. The lack of adequate, well funded research into ecological function and hydrology of the Basin is one of the reasons for its current poor state.

Application of the precautionary principle, as required by the *Water Act 2007*, should ensure that uncertainty around groundwater knowledge does not justify poor planning.

For this reason, IRN does not support the proposed increase in groundwater allocation up to 2,600 GL which is almost equivalent to the proposed reduction in surface water consumption. The identification of potential new groundwater allocations in over half of the groundwater SDL areas is unacceptable in a Basin Plan that aims to addressing large-scale over-allocation and overuse of highly connected water sources. IRN is of the conviction that flagging these groundwater sources for further allocation will ensure a continuation of unsustainable water use practices.

IRN is also concerned that the groundwater water resource plans are not required to identify the needs of GDEs across the Basin. The focus on priority environmental assets dependent on groundwater in *Proposed Basin Plan* is likely to cause ongoing deterioration of a range of important GDEs in the Basin that have not yet been clearly identified.

Specific analysis of Key Issues:

Proposed reduction of only 2,750 GL

IRN has major concerns that the MDBA has proposed a reduction in current diversions of only 2,750 GL, based on a political decision. The attempts to justify this volume through the release of a number of reports half way through the public exhibition period of the *Proposed Basin Plan* confirms the lack of best scientific knowledge used to arrive at this outcome.

[10] The Impact of Groundwater Use on Australia's Rivers; Rick Evans www.lwa.gov.au

IRN believes that the original approach adopted in the *Guide* was a much better approach to calculating the environmental requirements of the Basin. By identifying the end of system flow needs, then working back up stream through the individual catchments, taking into account the requirements of the key environmental assets, the MDBA had arrived at a more scientifically robust conclusion on the volume of water needed to return the Basin, and its water dependent species, to ecological health and resilience.

IRN believes that the *Proposed Basin Plan* starts with an unsustainable volume to be returned to system and the MDBA has worked backwards to justify its ecological outcomes.

The report on *Hydrological Modelling to inform the proposed Basin Plan: Methods and results* released in February 2012, outlines that:

"Environmental water requirements can be modelled using two fundamental approaches. That is, the models can be run to either:

1. Estimate the reduction in diversions required to achieve the specified environmental objectives; or,

2. Estimate the environmental flow outcomes that can be achieved from a specified reduction in diversions (i.e. test ESLT options against environmental objectives)."[11]

The *Hydrological Modelling* report outlines that while the development of the *Guide* used the first approach, the development of the *Proposed Basin Plan* used the second approach.

The reason given for the use of the second approach ie identify a volume then test the outcomes against environmental objectives is that:

*"Over the last three years the MDBA has predominantly focussed on the development and application of the second approach.....**This second approach is also simpler to represent in the models and provides greatest confidence in output as it is more closely aligned with current river operations and management.**"*[12] (IRN bold)

IRN is very concerned that current river operations and management have informed the environmental outcomes of the *Proposed Basin Plan.* It is these very operations and management that have caused the ecological demise of the Basin. The change in process from the *Guide* has created a major problem with the outcome of the *Proposed Basin Plan*. This proposed outcome severely limits the very positive opportunities that a Basin Plan had offered to the Australian community.

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[11] MDBA 2012 *Hydrological Modelling to inform the proposed Basin Plan: Methods and results* p15

[12] MDBA 2012 *Hydrological Modelling to inform the proposed Basin Plan: Methods and results* pp15 - 16

The method of the second approach to test the Environmentally Sustainable Level of Take (ESLT) against environmental objectives has demonstrated quite clearly that a 2,750 GL reduction in diversions does not meet those objectives.

The report released by the MDBA in November 2011: *The proposed 'environmentally sustainable level of take' for surface water of the Murray-Darling Basin: Methods and Outcomes* (ESLT Report) lists the following set of **'adapted'** targets:

For the purposes of determining environmental water requirements and an ESLT, MDBA has adapted the Environmental Watering Plan targets to recognise that it is not practically possible to return the rivers to a pristine or pre-development condition. The Basin-wide ecological targets are:

Within the constraint of being deliverable in a working river system that contains public and private storages and developed floodplains, the Basin-wide ecological targets are that there are improvements in:
o flow regimes including the following flow components; cease-to-flow events, low-flow season base flows, high-flow-season base flows, low-flow-season freshes, high-flow season freshes, bank-full flows, over-bank flows;
o hydrologic connectivity between the river and floodplain and between hydrologically connected valleys;
o floodplain and wetland types including the condition of priority environmental assets and priority ecosystem functions;
o condition of the Coorong and Lower Lakes ecosystems and Murray Mouth opening regime;
o condition and diversity of native water-dependent vegetation;
o recruitment and populations of native water-dependent species, including vegetation,
o the community structure of water-dependent ecosystems.

Note: Priority environmental assets and priority ecosystem functions are environmental assets and ecosystem functions that can be managed with environmental water.[13]

There has never been an expectation or in fact, a call, to have the Basin returned to a *'pristine or pre-development condition'*. The key concern is to halt the ongoing trend of decline and restore some balance from past poor management and excessive extractions that have caused a great deal of ecological damage.

The proposed ESTL of 10, 873 GL per year will not adequately address the decline of many of the key environmental assets within the Basin. This is demonstrated in the undated MDBA reports released in 2012 assessing the environmental watering requirements (EWR) of the hydrological indicator sites.

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[13] MDBA 2011 *The proposed 'environmentally sustainable level of take' for surface water of the Murray-Darling Basin: Methods and Outcomes* p201

A more detailed analysis of the EWR will follow later in this submission.

Figure E.1: *Outline of method used to determine ESLT* [14] demonstrates that the consideration of socio-economic objectives and constraints (both physical and policy) have determined the steps used for assessing environmental requirements and outcomes.

This method of determining the ESLT reveals that the EWR targets for many of the key hydrological indicator sites are severely compromised and can only be met with a high level of uncertainty.

This does not give any confidence that the *Proposed Basin Plan* will deliver on its environmental objectives. IRN does not believe that any of the Basin-wide targets as identified in the ESLT Report will be met with the necessary frequency or volume of water required to achieve improvement.

Hydrological modelling

IRN has major concerns about the limitations of the modelling used to justify the SDL in the *Proposed Basin Plan.* More emphasis has been placed on maintaining storage volumes and consumptive diversions than on identifying the necessary environmental outcomes.

'The modelling has sought to limit, as much as possible within the limitations of the modelling systems, the use of environmental water use to that expected to be available to the environmental account. The MDBA has used water balance data to check that this has occurred, by ensuring that storage volumes were similar to the baseline conditions and consumptive diversions were not adversely affected.'[15]

The various graphs demonstrating the hydrological modelling for the BP2800 series in each key water source indicates that very little is gained in the medium and low flow scenarios from the current diversion levels.

The importance of variety of flow regime and seasonality of flows for ecological outcomes has not been adequately addressed in the modelling justification of a reduction of only 2750 GL from current diversion rates.

Natural flow patterns have been altered dramatically in both regulated and unregulated water sources. To deliver environmental outcomes in a sustainable Basin Plan, timing of flow deliveries and variety of flow patterns must be taken into consideration.

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[14] MDBA 2011 *The proposed 'environmentally sustainable level of take' for surface water of the Murray-Darling Basin: Methods and Outcomes* pvii

[15] MDBA 2012 *Hydrological modelling to inform the proposed Basin Plan. Methods and Results*, p 37

The interpretation of the scenarios modelled for the Condamine-Balonne water source has lead to the conclusion that the return of an additional 50GL/y back for consumptive purposes from 2800 GL will not have a significant impact on the environment:

'The results for 100 GL/y to 150 GL/y reduction scenarios did not differ significantly in environmental outcomes. Hence, a further 50 GL/y increase in the Condamine-Balonne SDL was agreed, reducing the Basin-wide proposed water recovery to 2750 GL/y'.[16]

However, the *Hydrological Modelling* report indicates that for the targets for the Narran Lakes key environmental asset in this water source: ***'The results suggest that a recovered volume of 203 GL/y is required to achieve a maximum period between events'***[17] (IRN bold)

The assumption to allow an additional 50 GL/yr diversion in the Condamine-Balonne water source did not take into account the needs of the downstream Barwon-Darling water source.

Major limitations to the modelling used for the Condamine-Balonne and other water sources have been identified: *'The reasons for not including demand series in these models include a lack of flow regulating capacity, or technical limitations within the model, time constraints or a combination of them.'*[18]

IRN has many concerns about the modelling outcomes and assumptions that have informed the decision on total reduction to diversions for the *Proposed Basin Plan.* This is particularly because it was based on current water sharing and management rules.

'The Basin Plan scenario modelling was carried out by simulating a reduction in consumptive water use, and making an equivalent volume of water available for environmental use within the water sharing and water management rules and constraints as prescribed under baseline conditions.'[19]

Some significant limitations with the modelling are identified including system operating constraints and water sharing arrangements. These 'limitations' are precisely what IRN had expected the Basin Plan to resolve. It is entirely inappropriate that the current problems with the system management are used to identify or verify inappropriate environmental flows for the achievement of the objectives a sustainable Basin Plan.

'The modelling carried out shows that a 2800 GL/y reduction in consumptive use achieved significant targeted environmental outcomes, within the uncertainty levels of current hydrological and ecological science and within the limitation of current modelling tools

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[16] MDBA 2012 *Hydrological modelling to inform the proposed Basin Plan. Methods and Results*, p vi
[17] MDBA 2012 *Hydrological modelling to inform the proposed Basin Plan. Methods and Results*, p 51
[18] MDBA (2012) *Hydrological modeling to inform the proposed Basin Plan. Methods and Results* p 25

[19] MDBA 2012 *Hydrological modelling to inform the proposed Basin Plan. Methods and Results*, p v

available. Some flow indicators, especially those requiring large, infrequent flows to inundate higher parts of the floodplain were not met under any of the scenarios modelled. In regulated systems this is primarily due to system operating constraints. In unregulated streams, sharing of events between environmental use and consumptive use would need to be addressed to improve the environmental outcomes.'[20]

IRN is very concerned that the modelling conducted to review the environmental outcomes of a 3,200 GL reduction of diversions has not been made available during the exhibition period of the *Proposed Basin Plan.*

IRN is also concerned that the changed approach to modelling, as conducted by the MDBA to move from the *Guide* to the *Proposed Basin Plan* did not include modelling for a 3,500 GL or a 4,000 GL reduction, as had been conducted under the previous approach.

There has been nothing provided by the MDBA to compare the outcomes of both modelling approaches. The only information provided has been presented as a justification for the lower figure of 2800 GL which was then further lowered on very questionable assumptions to 2750GL.

The CSIRO review has identified that the MDBA has made limited use of available floodplain inundation models and there is an absence of a clear over-arching conceptual model linking site based key environmental asset and key ecological function assessment to regional and Basin-wide ecological condition and flow regime change.[21]

Environmental Water Requirement assessments (EWR)

IRN believes that there has been no genuine consideration of environmental flow requirements for either the key environmental assets or key ecological functions in the Basin to develop the *Proposed Basin Plan.*

The hydrological modelling has been limited to maintaining baseline conditions and existing management rules, the ESLT development has been limited by consideration of socio-economic impacts and constraints, both physical and policy, and the EWR reports for each key environment asset is restricted entirely to the water available under the 2750 GL scenario.

In most cases, the EWR indicates that site-specific indicator targets will not be met with a high degree of certainty.

Instead of the *Proposed Basin Plan* clearly identifying policy and system constraints that need to be addressed to enable improved environmental outcomes, these have been factored in as restrictions on environmental flow availability.

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[20] MDBA 2012 *Hydrological modelling to inform the proposed Basin Plan. Methods and Results*, p ix

[21] CSIRO 2011 *Science Review of the Estimation of an Environmentally Sustainable Level of Take for the Murray – Darling Basin* p 3

The EWR have demonstrated that the *Proposed Basin Plan* will not successfully achieve its environmental objectives. Some examples of the assessment outcomes for key environmental assets:

Macquarie Marshes

IRN has had a close association with water management in the Macquarie region since the development of the first water management plan in the 1980's. IRN currently has member groups represented on the Environmental Flows Reference Group (EFRG) established under the Macquarie-Cudgegong Regulated River Water Sharing Plan.

The EFRG has been advising the NSW and Commonwealth Governments on the delivery of environmental water, both planned and held, to the Macquarie Marshes for a number of years. In the decision-making processes developed by the EFRG, it is obvious that there is not enough environmental water available to achieve key outcomes to improve the resilience and health of this significant wetland area.

IRN is very concerned that the *Proposed Basin Plan* is based on maintaining the Macquarie Marshes at their 2008 mapped extent. This is an appalling abrogation of responsibility under the international agreements that protect this site.

The EWR for Macquarie Marshes is based on a reduction of 65 GL/y which has already been achieved in the catchment. The combined recovery of water for the environment in the Macquarie-Castlereagh is 84 GL/y. The *Proposed Basin Plan* has modelled that 19 GL/yr be available for downstream.

The EWR for Macquarie Marshes incorrectly indicates a 4,000 ML /day flow constraint at Marebone Weir to prevent flooding at Gradgery Lane. This constraint has been removed through the investment in an upgrade that has raised the access road so that higher flows can be delivered to the Marshes.

The model runs are therefore incorrect by containing this constraint.

IRN believes for the long-term health and resilience of the Macquarie Marshes the full use of existing recovered environmental water is needed within the water source and that additional recovery is required to include in the shared Basin reduction.

The EWR indicates that the specific site flow indicators for the Macquarie Marshes under 65GL/y are:

- Provide a flow to ensure the current extent of vegetation communities are sustained ie an inflow of 100 GL during June to April will be achieved in 80% years which has a high uncertainty of achieving the target
- Provide a flow regime that supports colonial nesting waterbird breeding events

ie an inflow of 250 GL between June and April for 40% years which has a high uncertainty of achieving the target

- Provide a flow regime which supports a range of aquatic species
  Ie an inflow of 400 GL between June and April for 30% years which has a high uncertainty of achieving the target
- Provide a flow regime which supports floodplain connectivity
  Ie an inflow of 700 GL between June and May for 17% years which has a high uncertainty of achieving the target

This outcome for the Macquarie Marshes in the *Proposed Basin Plan* is unacceptable and demonstrates that conditions in this important wetland will not improve to the extent needed to ensure resilience for future climate change stresses.

Gwydir Wetlands

Most of the site specific indicators for the Lower Gwydir and Mallowa Creek wetlands are only met with a high level of uncertainty. The target to provide a flow regime which supports key ecological function particularly floodplain connectivity is not met at all for the Lower Gwydir.

The identified constraint in Mallowa Creek for delivery of adequate environmental flows is the current access rule for pumping at a flow of 50ML/day.

Only 15% of the original extent of the Gwydir wetlands remains. The *Proposed Basin Plan* will not even protect this small area of significant Ramsar listed wetland.

The proposed target flows that will not be met with any certainty will only provide water to 75% of the current extent of semi-permanent wetlands, to between 50% - 70% of floodplain wetlands (river cooba – lignum, and coolibah/river red gum communities) and that higher floodplain vegetation communities (coolibah and black box woodlands) may be inundated between 10% - 20% of years.

The MDBA needs to take into account the high level of floodplain harvesting that occurs in the Gwydir water source and recognise that this needs to be addressed in the water resource plan.

The current level of environmental water recovery of 42 GL/y is entirely inadequate to maintain the current extent of the Gwydir wetlands system. The *Proposed Basin Plan* fails to meet any of the environmental objectives in the Gwydir water source.

The failure has been acknowledged to the extent that under the current modelled scenario the Gwydir has been disconnected from the rest of the Basin.[22]

[22] MDBA (2012) *Hydrological modeling to inform the proposed Basin Plan. Methods and Results* p 69

Lachlan Wetlands

The modelling for the wetlands in the Lachlan water source is based on the current recovered volume for environmental flows of 48 GL/y. This volume is entirely inadequate to maintain and improve the large areas of wetland in the lower Lachlan.

In this water source the EWR demonstrates that site specific flow indicators for riparian, wetland and floodplain vegetation; habitat requirements for water birds; recruitment opportunities for a range of aquatic species and key ecosystem function will not be met with a high level of certainty.

Barwon-Darling

The *Proposed Basin Plan* completely fails to meet any of the flow targets needed to achieve the site specific indicators in the Barwon-Darling water source.

This is a key exposure of the inadequacy of the decisions made by the MDBA and the failure of the *Proposed Basin Plan* to meet its environmental objectives.

This failure indicates that decisions such as the return of 50GL/y for diversion in the Condamine-Balonne water source are unjustifiable. The decision to disconnect the Gwydir water source from the Basin has deliberately ignored the fact that more water must be recovered from the Gwydir to both meet in-valley targets and to provide downstream flows to the Barwon-Darling.

The decisions that water recovered in key tributaries to the Barwon-Darling are adequate fails to provide the identified flows needed to meet the environmental flow targets in that water source.

The identified contribution of 143 Gl/yr from the Northern Basin is inadequate and a key failure of the *Proposed Basin Plan.*

Current Extent of Ramsar listed Wetlands

IRN believes that another key failure of the *Proposed Basin Plan* is the decision to limit the Ramsar listed wetlands in the Basin to their 2008 mapped extent. This is a total abrogation of responsibilities agreed to under the Ramsar Treaty and must be addressed.

In 2008 the wetlands had received some of their lowest inflows on record over an extended period of time. This was on top of reductions of flows during medium and wet years preceding the 'Millenium Drought'. To propose to maintain these internationally significant wetlands at their lowest mapped extent prevents any future capacity to withstand longer dry periods caused by climate change.

CSIRO has predicted a likely increase in drought severity during the life of the Basin Plan. The wetlands of the Basin require flows that will cause an improvement in extent so that they can survive future stress.

More water to be recovered from the Northern Basin

IRN believes that the more sustainable reduction target of 4,000GL/y could be contributed through an increase in environmental water from the North Basin.

The *Proposed Basin Plan* has demonstrated that both in-valley targets and downstream targets in the Northern Basin require a larger volume of environment water to be achieved.

The issue of the constraints at Menindee Lakes for delivering additional water to the lower Murray system is a policy constraint that can be easily improved. The MDBA has avoided all required decisions to deliver a sustainable outcome for the Basin.

This has been verified in the *Hydrological Modelling* report which states:

'the reductions in diversions in key tributaries in the northern connected Basin have been specified to meet the local environmental water requirements and those of the Barwon-Darling system. However they do not include any specific water recovery to meet environmental water requirements for the River Murray and Lower Darling (downstream of the Menindee Lakes)'[23]

The *Hydrological Modelling* report also continues to explain the how the modelling attempted to identify a shared reduction for downstream needs:

'For Basin Plan scenarios, contribution of connected tributaries to the respective downstream targets in the north and south (referred to as "Shared reduction"), has been calculated using approximately a pro-rata approach (in terms of percentage of total diversions) to split the shared component across the relevant tributaries. This is one of the possible ways in which the shared reduction could be sourced from various valleys. In practice, the actual contribution by individual valleys to the shared reduction will be dependent on the outcomes of water recovery programs'[24]

This statement again reveals the flaws in the MDBA decision making process. The outcomes of the modelled scenarios should inform the water recovery programs how to achieve the necessary environmental targets. The process of developing the *Proposed Basin Plan* for the Northern Basin contributions was largely based on water already recovered.

The disconnection of the Gwydir from the Basin was an outcome of this approach rather than considering the level of water recovery needed to provide a sustainable " Shared reduction".

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[23] MDBA (2012) *Hydrological modeling to inform the proposed Basin Plan. Methods and Results* p 10
[24] MDBA (2012) *Hydrological modeling to inform the proposed Basin Plan. Methods and Results* p 11

In discussing the modelling for downstream requirements *Hydrological Modelling* report states that:
'Due to a variety of reasons, downstream demand time series were not included in the Warrego, Condamine-Balonne, Moonie, Border Rivers and Namoi in the northern connected Basin, or the Ovens, Loddon and Campaspe Rivers in the southern connected Basin. Regardless of there not being a specific demand, the in-valley environmental flows included in these models contributed to the desired flows in the Barwon-Darling and in the River Murray System. The reasons for not including demand series in these models include a lack of flow regulating capacity, or technical limitations within the model, time constraints or a combination of them.'[25]

This statement incorrectly assumes that the desired flows have been contributed to the Barwon-Darling when it has already been demonstrated in this submission that none of the key site specific flow indicators have been met in this significant water source.

The *Proposed Basin Plan* completely fails to deliver the necessary environmental flows in the Northern Basin and the "Shared reduction" needed for downstream contributions to the Murray Mouth.

Groundwater SDL resource Units

IRN has already identified in this submission major concern with the increased groundwater SDL of 2600 GL in the *Proposed Basin Plan.*

There is also concern that the groundwater resource units are based on state borders or social boundaries rather than on the boundaries of the groundwater systems.

This indicates that the MDBA is not prepared to achieve one of the key opportunities presented by the Basin Plan to manage the Basin as a wholistic system for the benefit of the environment.

Water quality and salinity

IRN is concerned that the modelling conducted to justify the proposed reduction of 2750 GL to the SDL for the Basin has not taken into consideration the possible flow needs for maintaining suitable water quality for ecological function and river health.

The Target values for target application zones[26] that have been developed to inform the Water quality and salinity management plan[27] are inconsistent with very little information about salinity levels.

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[25] MDBA (2012) *Hydrological modeling to inform the proposed Basin Plan. Methods and Results* p 25
[26] MDBA (2011) *Proposed Basin Plan – a draft for consultation* Schedule 9 p 195
[27] MDBA (2011) *Proposed Basin Plan – a draft for consultation* Chapter 8 p 54

The very high Total Nitrogen targets for the Condamine and Warrego systems, both upland and lowland, Border Rivers, Gwydir and Namoi lowland and Lower Murray are inconsistent with the targets for other parts of the Basin and reflect an accommodation of poor industry practices rather than a target to cause them to improve.

There is no consistency or apparent justification for the range of Total Phosphorous targets across the Basin.

Schedule 9 has no salinity targets identified.

Managing non compliance of SDL

IRN is very concerned with the intention in the *Proposed Basin Plan* to allow a 20% buffer on over extraction of environmental water allocations[28]. This sets the poor outcome of delivering only 2750 GL back by a further 550 GL.

In fact, with this rule the *Proposed Basin Plan* guarantees a reduction in diversions of only 2200 GL. This further erodes any likely environmental outcomes to be achieved.

IRN strongly recommends that section 6.13: *Determine whether there is non-compliance* should be minimised to *'a debit amount equal to or greater than 2% of the long-term annual diversion limit for the SDL resource unit.*

Water resource plans

IRN believes that the Basin Plan under the Act has the ability to inform the development of the water resource plans so that they do contribute to both in-valley improvements to key environmental assets and key ecological functions, as well as providing environmental flows for downstream targets.

The modelling for the *Proposed Basin Plan* and the decision-making of the MDBA has placed too much emphasis on the ability to meet indicator targets through environmental water releases from major storages. These are mostly a long way upstream of the key sites that need to be watered because of the regular impoundment of all flow heights; low, medium and high; in the storages.

If the MDBA had conducted its decision-making in a way that genuinely identified the environmental flow needs of each water source, then it would have baseline information to inform an adaptive approach towards delivering important flows at the right time.

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[28] MDBA (2011) *Proposed Basin Plan – a draft for consultation* Chapter 6 p 29

Many of the constraints built into the modelling for the *Proposed Basin Plan* are current inappropriate and inflexible rules in state water sharing plans that could be adaptively managed.

In fact, some of this adaptive management has been achieved at a local level in times of crisis. In the Lachlan a bird breeding event was allowed to succeed because local stock and domestic users agreed to hold off their access rights to a weir pool under the fledglings were ready to leave.

The opportunistic use of natural inflows from tributaries should be factored into water resource plans so that key environmental targets can be met without large releases from major storages.

This requires the water resource plans to have more flexible rules on commence-to –pump levels in unregulated water sources and on the contributions of unregulated flows into regulated systems.

For example, the supplementary access rule in the Macquarie regulated river is that pumping can commence once the flow is at 5,000 ML/day at Marebone Weir. On some occasions, with a major colonial waterbird breeding event occurring, there may be a better environmental outcome if access to a particularly timed tributary inflow was held off.

The same issue occurs with weir drown outs for fish passage. A more adaptable set of rules, particularly around opportunistic access to natural flows would achieve much better environmental outcomes in the Basin as a whole.

Further challenges and opportunities

IRN would like to make the following observations towards creating a more robust Plan and on the further challenges for the delivery of such a Plan.

Adaptive environmental management

IRN stresses the importance of *adaptive* environmental management. With the significant increase in relevant scientific data in the last few years, it is imperative to develop management systems and capabilities that build on this knowledge to apply the delivery of environmental water to give best results. Fully developed watering protocols must be used to achieve clearly defined environmental objectives.

Security of environmental water

The low security of environmental water is of the gravest concern and IRN urges the Authority to address this issue urgently particularly in relation to climate change risk.

Environmental water managers

Consequent to these points, the role of environmental water managers will be an essential key to the success of a return to sustainable water resources. IRN strongly supports the general proposal that there be coordinated management of environmental water with input from local catchment groups. We stress that coordinated central management must draw on the biological and hydrological expertise within locally based environmental agencies, and the environmental water managers must be empowered to make use of that expertise to best effect. This will require clear definition of role and authority and adequate resourcing.

IRN also strongly emphasizes that in the consultation requirements for the development of long-term water plans[29] that consultation must also be held with scientific researchers and other sources of environmental knowledge.

Recognising improved water efficiency

It should be recognized that those farmers and irrigators who have already improved the efficiency of their systems will not receive any beneficial treatment in recognition of their efforts. This is counter-productive, and actually discourages innovation. We call upon the Authority to rectify this imbalance and recognize the very significant improvements that have been made by some innovative people.

Recent rain events

IRN recognizes that it will be easy for the recent rain events and consequent vegetation and fauna responses to mask the damage of the excessive long dry. However we believe that the current high water levels provide a magnificent opportunity for transition to sustainable diversion limits, since water will be plentiful for many months to support communities moving to reduced water consumption when water is again scarce. We exhort the Authority and Federal Government to proceed to a truly sustainable Murray-Darling Basin without any further delays.

New opportunities for regional renewal

IRN supports the whole of government approach to structural adjustment, regional renewal, new opportunities and diversification for Basin communities. Regional economies are already changing as a result of a range of both local and global impacts. The long term outcomes of a robust Basin Plan will support resilient regional communities.

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[29] MDBA (2011) *Proposed Basin Plan – a draft for consultation* Chapter 7 p 38

Ratio of buyback and infrastructure investment

Buy backs are the most cost effective and immediate solution to addressing the overallocation of water. IRN believes that the ratio of expenditure between infrastructure improvements and buy backs, in relation to environmental benefits, needs to be maintained at the original announced level. The immediacy of the water buy backs will also help provide certainty both for regional economies and environmental outcomes, because of the time delays associated with implementing infrastructure improvements.

Conclusion

IRN would like to conclude by reiterating its support for the Basin Plan concept. IRN believes that the Basin Plan is the best opportunity to address overallocation and overextraction of water resources and restore balance to the Basin. However, as detailed in this submission, IRN sees the *Proposed Basin Plan* will not deliver this important outcome. A Basin Plan that is scientifically rigorous and environmentally sound is desperately needed in order to return important rivers and wetlands throughout the Basin to health.

IRN trusts that the MDBA will take into account the issues raised in the submission when deliberating on the final outcome to be delivered to the Federal Government

NSW Murray Wetlands Working Group

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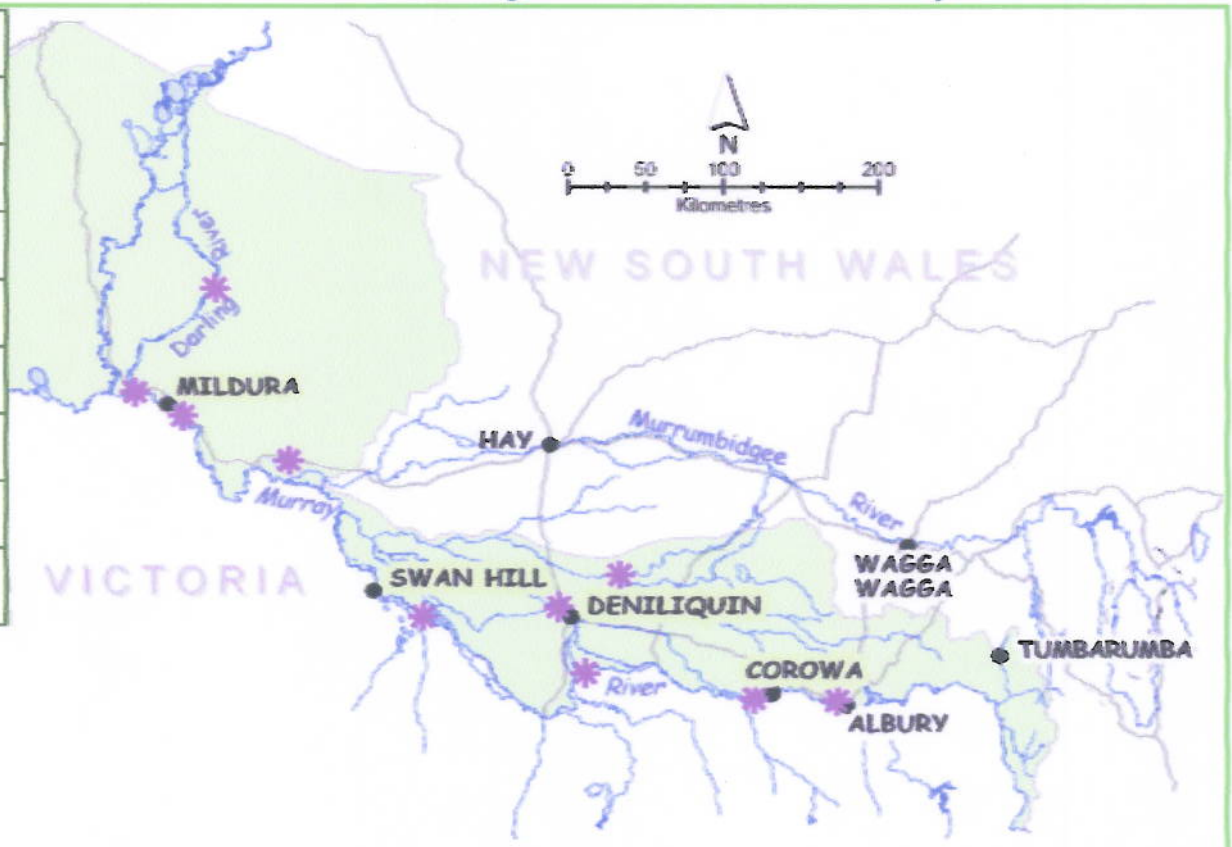

Click on each * on above map for further information on these Projects:

1. River Murray Wetland Database
2. Croppers Lagoon Corowa
3. Watering of Private Property Wetlands
4. Rehabilitation of Lake Moira part of Barmah Millewa Forest
5. Mapping of Billabong Creek Wetlands
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Watering Private Wetlands

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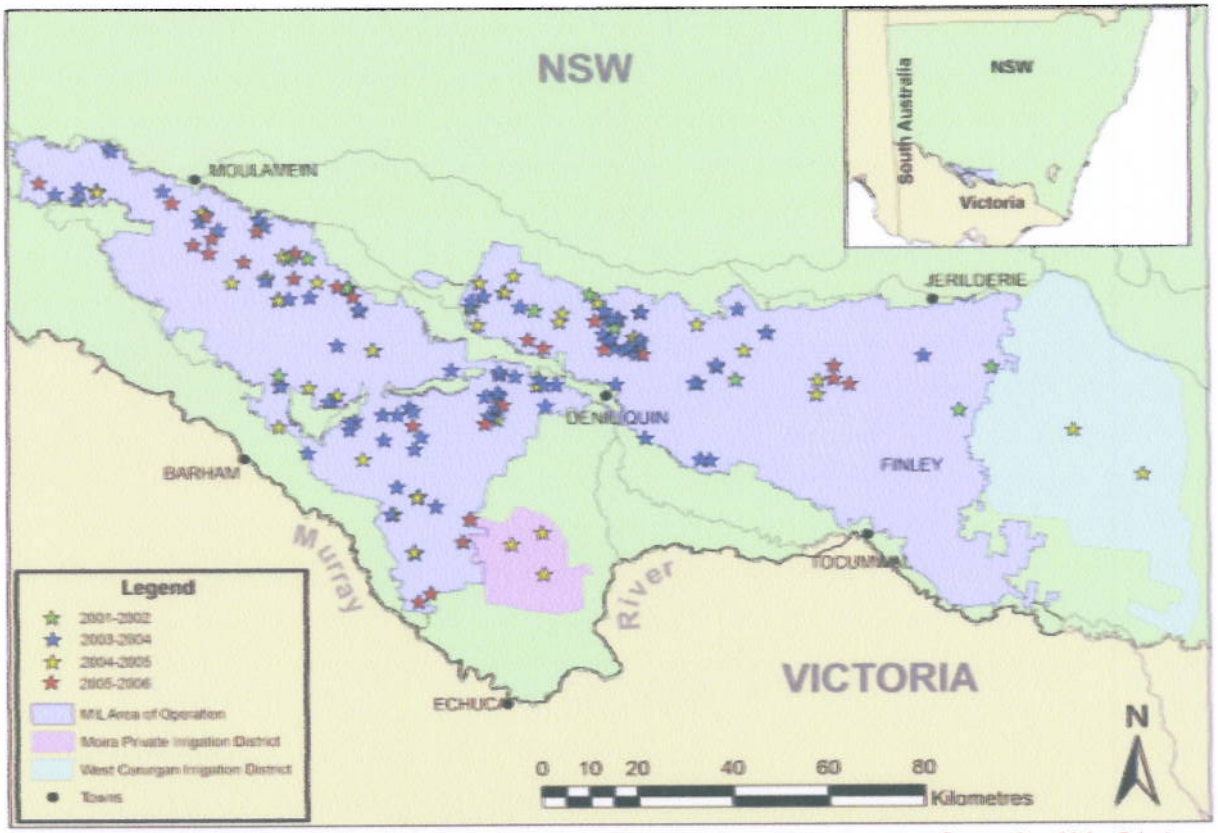
Background:

In late 2001, the NSW Murray Wetlands Working Group (MWWG) initiated a pilot project to increase wetland diversity within the area of operation of Murray Irrigation Limited (MIL). The pilot was part of the MWWG's objectives to develop and implement well-researched, technically sound and community-endorsed management programs for wetlands whilst developing a strategic approach to the management and rehabilitation of wetlands throughout the Murray and Lower Darling catchments within NSW.

The MWWG identified a need to address wetland degradation in the MIL Area of Operations. This region was once one large floodplain that would only have been connected with the rivers in times of high flows, sometimes not for many years. Due to changes in land-use, draining of wetlands, building of levee banks and irrigation supply channels, these floodplain areas are now rarely flooded even in times of high rainfall events or high river flows.



Map of the sites that have received water over the past 6 years in the Murray Irrigation area of operation, Moira Private Irrigation District and the West Corurgan Irrigation District.

Why water these sites:

River regulation along with other obstructions such as roads, levee banks and irrigation infrastructure have dramatically altered the natural flow regime and reduced the frequency of inundation of many inland wetlands. To maintain biodiversity in ephemeral (temporary) wetlands, both the wet and dry periods are significant. Under natural conditions, a majority of inland wetlands are filled at irregular intervals by flooding, then drying out between the next inundation. Many of the species of plants and animals, including frogs, fish, waterbirds, river red gum, black box and aquatic plants that can be found in or surrounding wetland area have adapted to this irregular cycle of wet and dry and depend on this cycle for breeding and survival.

Selection of Sites:

To undertake the project, the MWWG sought the co-operation of MIL to set up a process to provide water to wetlands on private property. MIL advertises an Expression of Interest (EOI) for the Environmental Water in their various newsletters. Landholder respond to the EOI, and the returned surveys are then assessed by MIL staff for groundwater suitability (ie ensuring if the site was watered no impacts occurred

to groundwater level via leakage or draining). The sites that are approved by MIL are forwarded to MWWG so that on-ground site assessments can take place. Discussion are held with the landholder's and MWWG project officers for their motivation for applying for the environmental water, the duration since the wetland last received water along with surveying the condition of existing vegetation. If the site and landholder's motivation for applying for water fit the criteria then the application is approved.

Delivery of Environmental Water:

Once on-ground assessments have been completed, the area of each wetland is calculated and the megalitres needed at 6 ML per hectare. A bulk temporary transfer of the environmental water needed to fill the wetlands and allowing for contingency measures (such as bird breeding events), is completed to the MIL licence on behalf of the NSW Water Administration Ministerial Corporation. Landholders can then access the water for their individual wetlands and begin filling them, for up to a period of 3 months.

This is the most critical part of the project, getting water to the wetland sites and could not be done without the full support of MIL staff and management to use irrigation infrastructure and resources and the landholders to manage the water once it has been allocated to their holdings.

Where the Environmental Water came from:

The NSW Water Administration Ministerial Corporation (WAMC) has a collective 32,027 megalitres (ML) of water savings or Adaptive Environmental Water (AEW) allocations. Since 1999 to present, the MWWG has been providing advice to the WAMC on how best to manage the allocations for environmental purposes. The actual management of the AEW allocations is also conducted by the MWWG on behalf of the WAMC, on a trial basis.

The AEW allocations have been generated through two different sources:

- 30,000 ML was generated through seepage control works within Murray Irrigation Limited that were funded by the NSW Government; and
- 2,027 ML was generated through hydrologic rehabilitation works on Moira Lake, Moira State Forest, NSW. See the Moira Lake Rehabilitation Project webpage for more information.

The primary objective for managing the AEW allocations is to achieve the optimum environmental benefit. Each year this is achieved by either:

1. diverting water to target wetlands requiring increased inundations; or
2. temporarily trading up to 50% of the water savings to fund further wetland rehabilitation work, and diverting the remaining water into wetlands.

The proportions of the AEW allocations diverted to wetlands and/or traded varies from year to year and is dependent on river flow conditions and specific conditions at possible target wetlands.

Monitoring Conducted:

During the wetting and drying phases of these wetlands, various methods are used to monitor changes in vegetation and bird communities. These include photopoints to monitor broad changes in the wetland over time, stratified random sampling using quadrats and cover abundance, along with 20 minute bird surveys and measurement of salinity levels in surface water. The monitoring is carried out once every three weeks while the sites are wet, and a final monitoring session after a period of nine weeks was completed, after each individual site had dried.

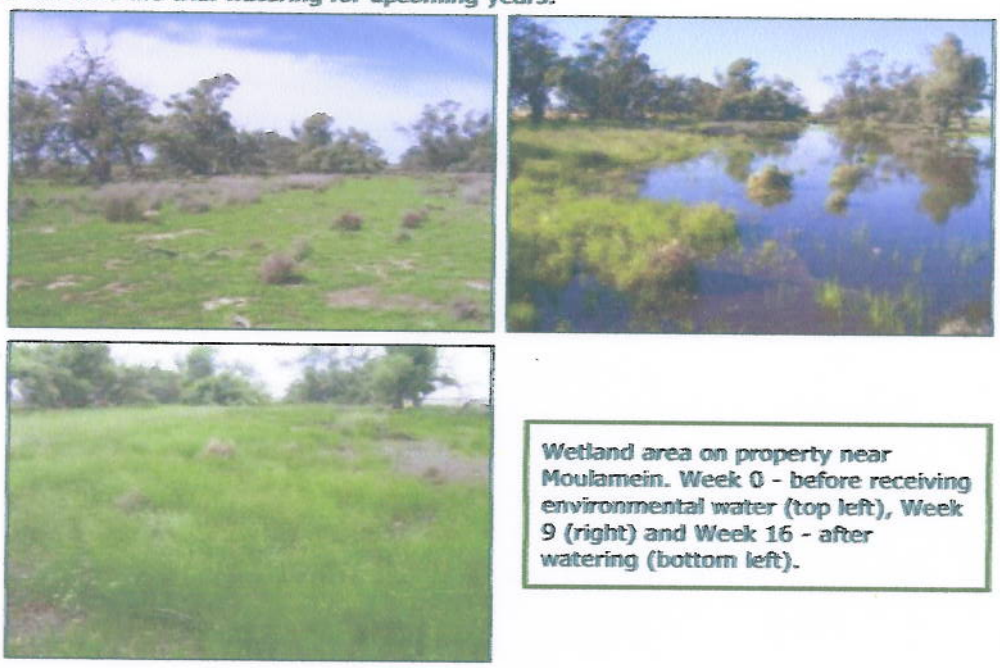
Project Expansion:

In 2004 due to the success of the private property watering project within the MIL area, the project was expanded into the Moira Private Irrigation District (MPID) and West Corurgan Irrigation District on a trial basis. A total of 2 sites were watered in West Corurgan area and 3 sites in MPID using 631 ML of environmental water.

Some of the project's key outcomes include:

- Increased abundance in wetland plants such as reeds, rushes and nardoo, as well as regeneration of several species of wetland plants from the existing seed bank;
- Black Box and River Red Gum trees at all sites exhibited signs of new growth, flowering and some recruitment
- Establishing or restocking seed banks for next time wetland is flooded,
- Surface salinity remained quite fresh, usually below 400 EC;
- Over 150 bird species recorded during monitoring including endangered and vulnerable species in New South Wales and National and migratory species from the northern hemisphere, and
- An improved landholder and community knowledge and understanding of wetlands and the benefits of delivering water to these formerly dry sites.

Due to the positive outcomes and feedback that was received from within the irrigation community, it was decided to continue the trial watering for upcoming years.



Wetland area on property near Moulamein. Week 0 - before receiving environmental water (top left), Week 9 (right) and Week 16 - after watering (bottom left).

From 2001 to 2008 a total of 136 private landholders have been involved in the project, 162 private wetlands have received approximately 20,044 ML of water and a total of 3,368 Ha of ephemeral wetlands and the wildlife and vegetation associated with them have received a rejuvenating lifeblood which has been missed for many years.

In **2007/08** all private property wetland watering projects were suspended due to a zero allocation as a result of the on-going drought.

In **2006/07** the Watering of Private Wetlands Projects was postponed in most areas due to limited volumes of environmental water available. No MIL sites were able to be conducted and will be carried over to the 2007/08 season (water availability permitting). In the LMD region only 2 sites were watered. A total of 288 ML was used to inundate 23 ha.

In **2005/06**, a total of 25 landholders participated, despite the continuing dry conditions. For the first time the program was expanded to incorporate private property wetlands in the Lower Murray Darling (LMD) area. Within the MIL Area of Operation a total of 22 landholders participated. Twenty-two sites, totalling 597 ha was watered using 2,921 ML. In the LMD region 3 landholders participated. All sites had water pumped into them. In total 260 ML was used to inundate 27 ha.

In **2004/05**, 32 landholders participated. In total 32 wetlands were inundated, covering a total area of 997 ha and used 4,520 ML of water.

In **2003/04**, 40 landholders participated, quite a growth compared to 2001/02! A total of 49 sites received water, a total area of 902 ha, using 7,510 ML of water.

In **2002/03**, 27 landholders were involved compared with only 10 in 2001/02. A total of 43 sites received water, and nine of these sites were monitored for vegetation changes and bird diversity. All other sites had photo points established and photographs taken at regular intervals during the project.

In the first year, 2001/02, eleven wetland sites, totalling an area of 250 hectares (Ha), on private land received 600ML of water.

Wetland vistas at Sunset (top left). Wetlands provide excellent habitat for many native animals, Bearded Dragon (top right).





Wetland area on the property near Deniliquin receiving water week 1(top left). 4 weeks into the project (top right). After the water has receded Week 14 (bottom right).

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Moira Lake Wetland System - Rehabilitation Project

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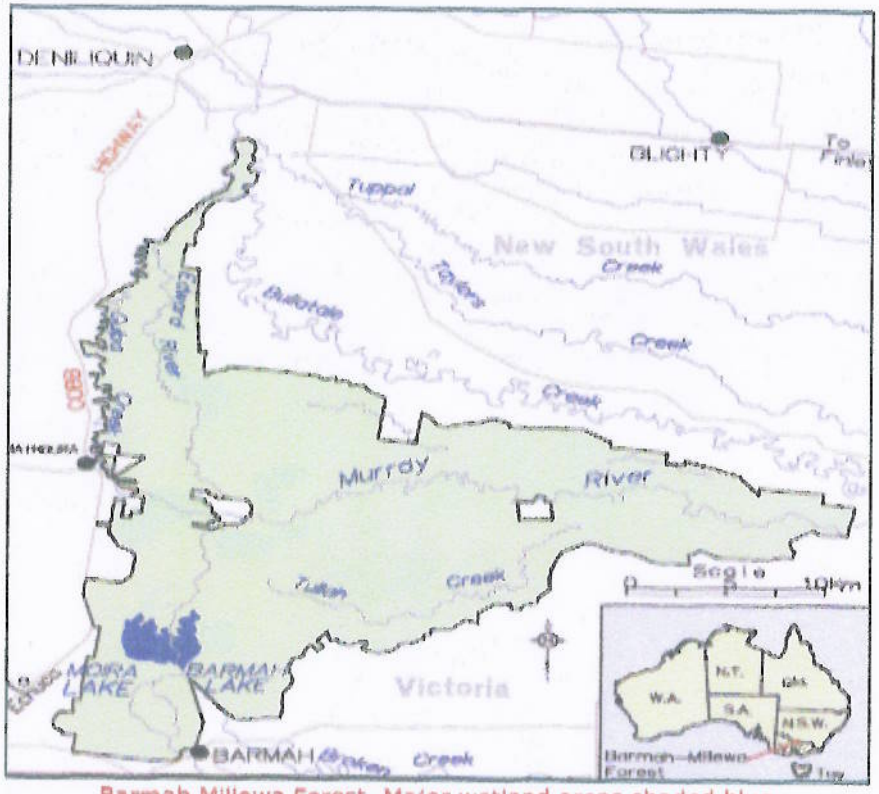
Background:

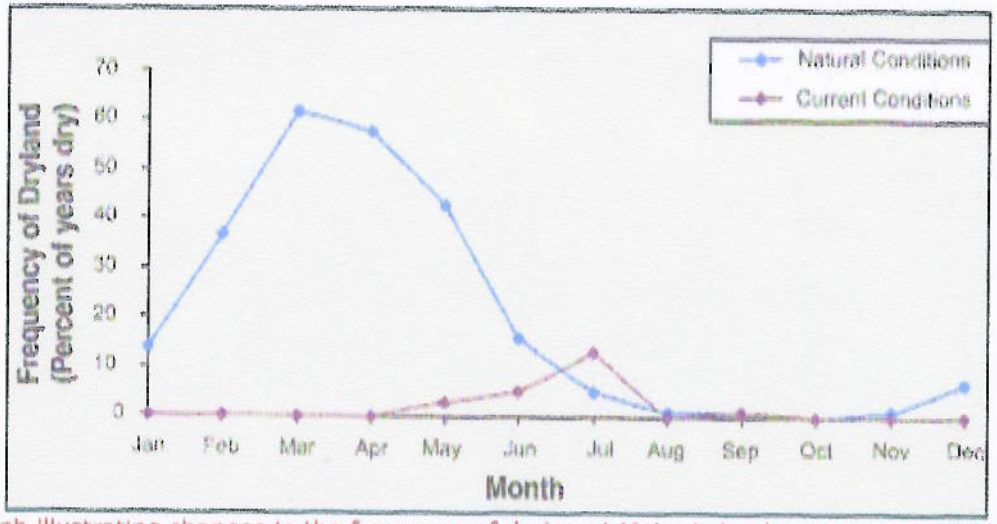
The Moira Lake wetland system is one of the most significant and largest wetlands in southern NSW. The Lake system is situated on the NSW-side of the Ramsar-listed Barmah-Millewa Forest. It consists of two shallow, open freshwater lakes, totalling an area of 1,500 hectares (ha), fringed by rushes and reeds, and surrounded by large areas of marshland and River Red Gum forest



Barmah Millewa Forest. Major wetland areas shaded blue

The Moira Lake system provides a range of vegetation and wetland types due to slight variations in elevation across the floodplain and resulting in differences in the frequency and depth of inundation. These include areas consist of reedbeds, open rush and grass plains and River Red Gum forest.

Prior to the construction of Hume Dam, Moira Lake supported large waterbird breeding colonies and was a major native fish breeding site for the central Murray region, particularly for Murray Cod. However, following the completion of the Hume Dam in 1936 the frequency, extent and duration of winter and spring flood events declined, and regular periodic drying in summer and autumn no longer occurred. These changes altered the ecology of the lake, reducing its ability to support many native plants and animal species whose lifestyles depended on flooding and drying, which in turn created ideal conditions for pest species such as carp and native opportunist species such as Giant Rush (Juncus ingens).



Graph illustrating changes in the frequency of drying at Moira Lake due to river regulation.
(Graph sourced from the Wetlands of the Barmah-Millewa Forests)

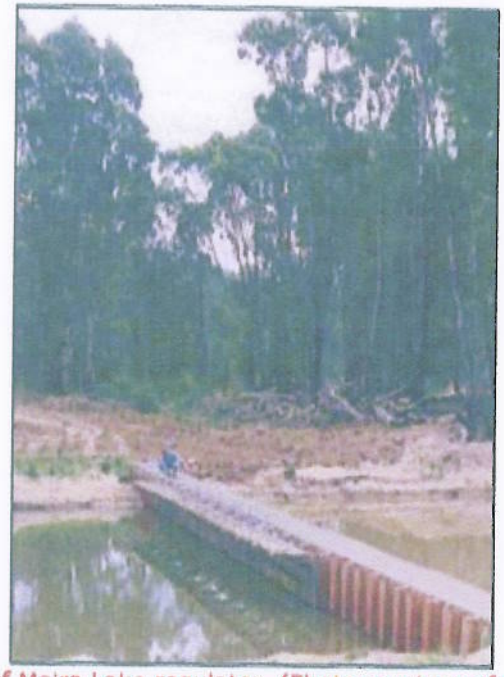
Rehabilitation Project:

The NSW Murray Wetlands Working Group, in conjunction with NSW State Forests and the Department of Infrastructure Planning and Natural Resources (former Dept. of Land and Water Conservation) have developed a rehabilitation plan for the wetland system aimed at counter-acting the impacts of river regulation.

The first two stages of the plan have been completed. This included the engineering works of constructing and installing a regulator, which excludes regulated river flows from Moira Lake during summer. These works have allowed the Lake to dry over the summer of 1997/98 the first time in 60 years, as well as in 1998/99 and 1999/00. .

Re-establishment of the natural cycle of drying and re-flooding will gradually restore native fish and waterbird habitats

throughout the wetlands. The exclusions of summer flows has the additional benefits of improving the efficiency of water supply down the river by reducing the evaporative losses from the Lake, estimated to be 2,027 megalitres (ML).



Installation of Moira Lake regulator. (Photo courtesy of David Leslie)

Stage 3 of the rehabilitation plan has been designed to:

- Allow the Moira Lake to drain back to the Murray River during periods of regulated flow;
- Improve the movement of native fish between the Murray River and the wetlands by providing fish passage; and
- Maintain the productivity of nearby swamp meadows.

Royal Spoonbills nesting in Reed Beds Swamp, Moira State Forest. (Photo courtesy of David Leslie).

Environmental Flows:

Provision of environmental flows, piggy-backed onto natural floodwaters, to the Barmah-Millewa Forest in 2000/01 saw the return of large waterbird breeding colonies along the shores of the Moira Lake. Up to 30,000 birds successfully bred in the wetlands including species such as the threatened brown bittern, great and intermediate egrets, black swans, nankeen night herons, comorants and ibis. Some of the bird species recorded during the breeding event had not been seen in the area for more than 30 years.

Carp Harvesting:

After flooding the wetlands, carp harvests are conducted as water drains back from the wetlands into the Murray River. A specially designed net has been used to catch the carp. The net's mesh size is large enough for smaller native fish such as Australian smelt to pass through freely and there has been no evidence of the net injuring larger native species such as Murray cod. A commercial fisher is employed to conduct the harvest, and convert the carp into a popular garden fertiliser.

In 2001 approximately 80 tonne of Common Carp (Cyprinus carpio) was captured before returning into the Murray River. In 2004 up to 40 tonne of carp was harvested from the wetlands.

Through point-source control of carp such as is in Moira Lake, can help keep in check and even reduce carp numbers. This will help lead to good environmental outcomes for wetlands, rivers, and native fish.

Future Management and Research:

A range of management actions including engineering works, environmental flows, fencing to exclude stock from the Lake and carp harvesting will continue to improve Moira Lake and its wetlands. The latest management tool to be trialed is the use of fire to manage the beds of Giant Rush.

A range of research projects are being undertaken to monitor and assess changes to fish, vegetation, waterbirds and micro-invertebrate assemblages within the wetlands. Organisations involved include NSW Fisheries, Monash University, the CRC for Freshwater Ecology and the Barmah-Millewa Forum.

Moira Lake - Full (winter/spring)

Draw Down (Late Spring)

Moira Lake - Dry (Summer/Autumn)

Carp Harvesting (during draw down)

NSW Murray Wetlands Working Group Inc.

Program Manager Deborah Nias

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Inland Sulfidic Sediments

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For many years the impact of sulfidic sediments (potential acid sulfate soils) has thought to be confined to coastal areas. However more recent findings have shown that it is a significant emerging threat to the long-term ecological sustainability of Australia's inland wetlands.

The formation of sulfidic sediments has resulted from significant changes to wetland hydrological regimes, as well as from increased salinity from sulphur-rich groundwater. When sulfidic sediments dry out (oxidised) and are then re-wetted (reduced) the chemical processes that occur can result in the production of acid which is released into the water column. The high levels of acid, in combination with high levels of salinity and the liberation of heavy metals can result in a lethal cocktail for freshwater aquatic fauna and flora.

The NSW Murray Wetlands Working Group is one of the leading organisations in Australia which is focussing on the impact of sulfidic sediments and trying to develop management options for effected inland wetland systems.

Background - Bottle Bend Lagoon

The NSW Murray Wetlands Working Group (MWWG) and the Murray Darling Freshwater Research Centre (MDFRC) were first alerted to the detrimental impacts of sulfidic sediments following a drying and wetting cycle that occurred at Bottle Bend Lagoon, NSW, during 2001/2002.

Bottle Bend Lagoon is a natural ephemeral wetland that is located within the Gol Gol State Forest on the NSW-side of

Click each thumbnail for enlargement

- Coppery coloured scum on banks and debris (photo above)

- Iron bacteria residue which has an oil slick look and rust coloured deposits (photo above)

the Murray River, approximately 30 km SE of Mildura, Victoria (Figure 1). For many years the wetland was semi-permanently inundated due to the influence of the Lock 11 weir pool at Mildura.

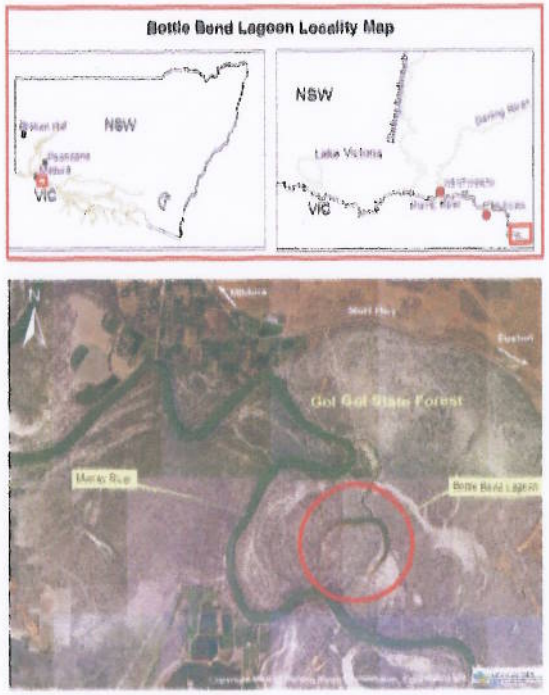


Figure 1: Bottle Bend Lagoon locality map

With the on-set of the current drought, low river flows (<3,500 ML/d) resulted in Bottle Bend Lagoon partially drying out over the summer months of 2001/2002 (Figure 2).

- Just under the surface of the scum, the soil resembles black 'ooze' (photo above)

- Waters look 'unhealthy' and are murky with an orange-brown tinge (photo above)
- A distinct 'salty' odour.

Wetlands which are most at risk are those that have:

- Been inundated for extended periods of time
- Elevated groundwater levels and/or disposal basins

Figure 2: Partial drying of Bottle Bend Lagoon, Gol Gol State Forest, NSW, 2001-2002

Monitoring of the wetland showed the following results:

- pH level decreased from 7.24 (April 2002) to 3.69 (June 2002)
- intrusion of highly saline groundwater (>30,000 mScm-1)
- groundwater is influenced by the operation of the Mildura weir pool
- liberation of heavy metals, such as aluminium and manganese, in lethal concentrations
- massive fish kill - decrease in diversity (7 genera reduced to 1 genus) and decrease in abundance (3,524 individuals sampled in May 2002, 48 individuals sampled October 2002)

Water quality recordings at Bottle Bend Lagoon in 2007 shows pH levels fluctuating between 3 - 1.8, and conductivity exceeding 140,000 mScm-1. Bottle Bend Lagoon is now a severely degraded freshwater wetland, and is a shadow of its former self (Figures 3 & 4).

in the surrounding area

- Been identified as definitely containing sulfidic sediments or most probably contain them
- Water with an electrical conductivity of >1,750 mScm-1 and/ or
- Sediment salinities of > 400 mScm-1

What To Do?

If you suspect a wetland has sulfidic sediments, you will need to undertake a full assessment for the presence of sulfidic sediments before initiating a drying cycle. It may be necessary to keep water in the wetland in the short term. The Murray Darling Freshwater Research Centre has developed a Rapid Screening Tool to assist in identifying wetlands that are at risk.
More information can be sourced via the MDFRC website.

What is in the Future?

The Australian Government's Raising National Water Standards Programme and the NSW Murray Wetlands Working Group are funding a large research programme being conducted by the Murray Darling Freshwater Research Centre and managed by the MWWG.

The project is entitled "Minimising Environmental Damage from Water Recovery from Inland Wetlands: determining water regimes to minimise the impact of sulfidic sediments (potential acid sulfate soils)". The objective of the project is to provide tools and guidelines on how best to manage inland wetlands. The project aims to:

- Determine appropriate watering strategies in inland wetlands to minimise the formation of sulfidic sediments;
- Identify changes to hydrologic regime that minimise

Figures 3 & 4: Bottle Bend Lagoon in October 2001 (top) and in May 2007 (bottom) — impacts of sulfidic sediments and saline groundwater.

Unfortunately Bottle Bend Lagoon is not an isolated case. In 2004 the MDFRC conducted a major project looking at the prevalence of sulfidic sediments in wetlands within the NSW section of the Murray-Darling Basin. The project was funded by the NSW Environmental Trust and the MWWG. Of the 81 wetlands surveyed, 20% of wetlands showed some evidence of sulfidic sediments, which if mismanaged, can potentially lead to ecological damage.

What are Sulfidic Sediments?

ecological harm in wetlands where sulfidic sediments are already present, particularly where a drying regime is being used as part of a water recovery strategy.

The NSW Environmental Trust (www.environment.nsw.gov.au) is providing additional funding to promote and educate wetland managers across NSW.

Through these collaborations, significant progress will be made within two years to help wetland managers and improve wetland condition.

NSW Murray Wetlands Working Group

Australian Government
National Water Commission

NSW Environmental TRUST

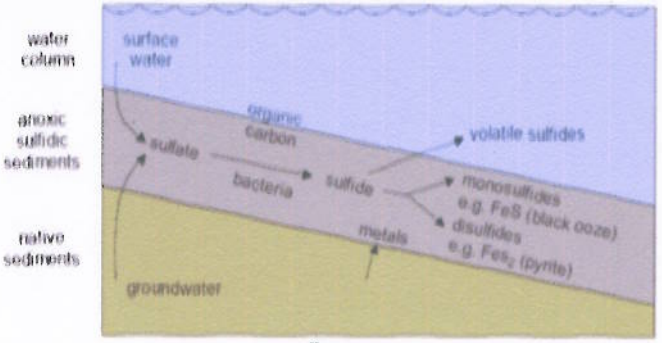
The Murray-Darling Freshwater Research Centre

Summary Brochures:

Download the following brochures for a summary on sulfidic sediments and their impacts on inland Australian wetlands. The production of the brochures was funded by the Australian Government's National Water Commission and the NSW Environmental Trust.

Sulfidic sediments form naturally when soils are inundated for extended periods by sulfate-rich water.

- Sulfate is reduced to sulfide by anoxic bacteria in the presence of organic carbon
- Sulfides react with metals in the soil to form sulfidic minerals such as iron pyrite
- Sulfidic sediments cause no harm if left undisturbed and submerged
- If exposed to air (as in a natural or manipulated drying event), sulfidic sediments oxidise to produce sulfuric acid and other toxins
- When the sediments are re-wetted, excess acid may be flushed into the water and cause harm to fish, water bugs and vegetation.



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A diagrammatic representation of chemical processes that occur to form sulfidic sediments

Identifying Sulfidic Sediments — What to Look For:

Sulfidic Sediments (1) - PDF 330 Kb
Sulfidic Sediments (2) - PDF 576 Kb

Media Coverage:

- ABC Bush Telegraph interview and slides show
- The Weekend Australian (2008-01-12) www.theaustralian.news.com.au
- Catalyst — ABC1 - www.abc.net.au/catalyst/murraydarling

References:

- Baldwin, S, Hall, K., Rees, G. and Richardson, A. (2007). Development of a protocol for recognizing sulfidic sediments (potential acid sulfate soils) in freshwater wetlands. Ecological Management & Restoration 8:1, 56–60
- Hall. K., Baldwin, S., Rees, G.N. and Richardson, A. (2006). Extent of sulfidic sediments in NSW inland wetlands. Report to the NSW Environmental Trust.
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- McCarthy, B., Conallin, A., D'Santos, P. and Baldwin, D. (2006). Acidification, salinization and fish kills at an inland wetland in south-eastern Australia following partial drying. Ecological Management & Restoration 7(3):221 - 223.
- McCarthy, B., Conallin, A., and Walsh, R. (2003). Aquatic survey of Bottle Bend Lagoon, near Buronga NSW: Salinisation and acidification impacts. Report to the NSW Murray Wetlands Working Group.

- Red discolouration from bank seepage which indicates groundwater intrusions high in iron content (photo above)

Click each thumbnail for enlargement

Murray-Darling Freshwater Research Centre, Mildura.

16 April 2012

Proposed Basin Plan
Murray–Darling Basin Authority
GPO Box 3001
CANBERRA CITY ACT 2601

Dear Mr Knowles

Re: Conservation Councils of Australia Joint Submission on the Proposed Basin Plan

The Murray-Darling Basin Plan is one of the most significant and vital reforms facing Australia today. The Murray-Darling Basin, while physically located in the Eastern States is a resource for all of Australia. Its environmental assets, including Ramsar listed wetlands and ecosystems, are of national and international significance. This reform is important for all Australians.

The Conservation Councils of Australia collectively represent 450 member groups and the environmental interests of Australians from all states and territories. We play our part by championing the environment and the people who care about it. We give a voice to the growing environmental challenges that face us and the emerging solutions showing the way to the future. We educate and engage people about what they can do to help.

The following organisations have signed on to this submission in recognition that the Basin Plan is a national issue and that the environmental health of the system should not be compromised for short-term economic and political gain:

- Conservation Council of SA
- Conservation Council ACT (ConsACT),
- Conservation Council of Western Australia (CCWA),
- Environment Centre Northern Territory (Environment Centre NT),
- Environment Tasmania (ET),
- Environment Victoria (EV),
- Nature Conservation Council NSW (NCC),
- Queensland Conservation Council (QCC).

The proposed Basin Plan released by the Murray-Darling Basin Authority in November 2011 is a deeply flawed document that will not deliver many of the identified hydrologic and environmental targets. It fails scientific rigour and analysis of the volumes that would achieve these outcomes and is in our view non-compliant with the Water Act (2007).

We do know that the proposed return of 2750 GL of water to the Basin is not scientifically defensible because it will not deliver key ecological outcomes across the Basin. The CSIRO review of the methodology confirmed that an Environmentally Sustainable Level of Take (ESLT) of 2800 GL 'does not achieve the majority of the hydrologic targets' and 'is not consistent with the currently stated environmental goals.'[1]

We recommend that the following improvements be made to the proposed Basin Plan to protect the environment, to build resilience in the Basin to better cope with climate variability and drought, and provide long term certainty and fairness for the communities dependent on a healthy basin:

1. Acknowledge that healthy ecosystems are the foundation that supports the economic and social success of the entire Basin.
2. The plan must be based on rigorous and defensible science, returning sufficient water restore the health of the basin and fix overallocation as required by the Water Act. Additional modelling is now required on higher flows to determine how much water is needed to achieve the hydrologic and environmental outcomes needed for a healthy Basin.
3. Keep the Murray Mouth naturally open ensuring that the two million tonnes of salt mobilised from the Basin in an average year is exported to the sea annually.
4. Include an ESLT that is not compromised by social or economic considerations
5. The SDLs must be based on achieving a healthy basin and not lowered to match current constraints.

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[1] Young, WJ, Bond, N, Brookes, J, Gawne, B and Jones, GJ (2011) Science Review of the Estimation of an Environmentally Sustainable Level of Take for the Murray-Darling Basin. A report to the Murray-Darling Basin Authority from the CSIRO Water for a Healthy Country Flagship. http://download.mdba.gov.au/proposed/CSIRO_ESLT_Science_Review.pdf

    a. Include in this plan a strategy to remove or manage around operational constraints
    b. Ensure that infrastructure funding provided to states is conditional on the progressive removal and management of constraints
    c. Ensure that as constraints are removed SDLs are amended to ensure the full range of environmental objectives can be met
6. Deliver key environmental outcomes and protect all key ecological assets and functions
7. Remove the proposal to allocate a further 2600 GL of groundwater and assume that by default, groundwater systems are linked to surface water systems until proven otherwise. Groundwater extraction should be capped at current levels of entitlement.
8. Take into account the effect climate change and increased climate variability will have on future water availability in the Basin
9. Recognise indigenous interests and rights to cultural flows and differentiate between environmental and cultural water rights.
10. Comply with the letter and intent of the Water Act 2007

We understand that the reduction in water available for industry and agriculture will have short-term effects for communities in the Basin, but note that if we do not take steps to secure the health of the environment then these communities will suffer in the long-term. We also note that the ecosystem services provided by a healthy Basin are valued in the range of $3-8 billion, while the cost to irrigation of returning 2750 GL to the environment is $542 million, a fraction of what a healthy environment provides.[2]

Failing to restore the Basin to health or protect the ecosystems and the services they provide will cause devastation to communities in the Basin when the next drought arrives. The plan must secure the long-term health of the Murray-Darling Basin if these communities are to have a secure future. The $9 billion set aside to fund the Basin Plan should incorporate how communities can adapt, transform and innovate with change. Efforts to diversify and build more resilient basin economies should be accelerated.

The Basin Plan must secure the health of the Murray-Darling Basin far into the future; sustainable use of water is the only way to guarantee the health of the Basin and the communities that depend on it. The Conservation Councils of Australia welcome and advocate for the introduction of a Basin Plan but stipulate that it must be a strong plan, based on rigorous and defensible science that guarantees ecological outcomes will be delivered.

The proposed plan in its current iteration does not provide these outcomes.

[2] CSIRO (2012) Assessment of the ecological and economic benefits of environmental water in the Murray–Darling Basin. CSIRO Water for a Healthy Country National Research Flagship, Australia. http://www.mdba.gov.au/files/bp-kid/2017-Assessment_Ecological_Economic_Benefits.pdf

The plan that gets implemented must restore the health of the system and take the long-term perspective for the whole of Australia. It must transcend state territorialism over water and recognise that it is a resource for all Australians, not just those who have first access thanks to geography.

Succumbing to short-term economic and political gains instead of providing a secure future for the Murray-Darling Basin will condemn the environment and the communities that rely on it to ruin. We call on our leaders and the Murray-Darling Basin Authority to drive true reform on this issue that has plagued Australia since the Commonwealth was formed.

Yours sincerely,

The Conservation Councils of Australia

Tim Kelly
Chief Executive
Conservation Council SA

Stuart Blanch
Director
Environment Centre NT

Toby Hutcheon
Executive Director
Queensland Conservation Council

Kelly O'Shanassy
Chief Executive
Environment Victoria

Clare Henderson
Executive Director
The Conservation Council ACT region

Piers Verstegen
Director
Conservation Council of WA

Pepe Clarke
Chief Executive Officer
Nature Conservation Council of NSW

Phill Pullinger
Director
Environment Tasmania – The Conservation Council

Conservation Council SA

Submission on the Proposed Murray-Darling Basin Plan

16 April 2012

Conservation Council of SA Inc
CCSA
1/157 Franklin St
Adelaide
SA 5000

www.conservationsa.org.au

The **Conservation Council of South Australia Inc (Conservation Council SA)** is the peak conservation body for South Australia, representing around 50 of the state's environment and conservation organisations.

Conservation Council SA is an independent non-profit, non party-political, community based organisation which provides resources, advice and representation for the SA environment movement, and which leads many of the key conservation campaigns in SA.

Conservation Council SA is known for its success in developing long term community development, education, and on-ground environmental restoration programs.

Conservation Council SA regularly liaises with local, state and federal governments, media, educational institutions, NGOs, unions, industry, business and other groups on matters relating to the environment and social justice.

As a community organisation, much of what Conservation Council SA achieves is through a large network of skilled volunteers from all walks of life – for its office, on-ground, governance and campaign activities.

Conservation Council SA is committed to a healthy environment for South Australia.

Contents

1. List of recommendations

1. In order to ensure sufficient export of salt, a Murray Mouth that is open all of the time and functional connectivity across the Lakes, Coorong and Mouth, science tells us the Basin Plan must include the following targets, and deliver sufficient flow regimes to achieve them:
    - flush 2 million tonnes of salt and other accumulated pollutants/sediment out to sea every year
    - keep the Murray Mouth open naturally at all times
    - maintain salinity at less than 1000 EC units in Lake Alexandrina 95% of time and never over 1500 EC
    - maintain salinity in Lake Albert less than 2500 EC units at all times (and should be closer to 2000 most of the time)
    - enable the management of variation in the lakes between +0.35 mAHD as an absolute lowest level with regular (at least every 3 years), short (2-4 weeks) periods of +0.9 mAHD to inundate the samphire
    - safeguard the health of the Coorong, its key food plants and all species that depend on this ecosystem.
2. There needs to be a program of further improvements to the system of barrages to ensure it is adequate, can be operated rapidly, is reliable and does not allow the ingress of salt water through leakage. The management of the barrage system must be reviewed and well documented to be integrated with environmental watering plans.
3. An environmental watering plan dedicated to Lakes Alexandrina and Albert, the Coorong and Murray Mouth must be prepared. The Basin Plan must include safeguards and trigger points to ensure that if the SDLs are not adequate to protect these sites, changes are made and water is found to protect these critical Ramsar ecosystems. Real time open and transparent monitoring will be essential.
4. The Basin Plan is legally required to be based on the best available science: this means science that is robust, transparent and fully utilised to guide decision-making. The Plan should not contain patchy or misleading data that undermines the confidence of the people it seeks to engage.
5. The Plan should abandon the proposed new 2600 GL allocation of groundwater for consumptive use. By default, surface and groundwater systems should be considered as connected. Use from connected groundwater water systems should be covered by the SDLs. Any ground water systems found to be disconnected from surface water should only be allocated when a system groundwater allocation plan has been completed.
6. The Basin Plan must base its assessment of future water availability on the most likely climate change scenarios (ie, those that accord with the higher emissions scenarios) and indicate how both the likely reductions in water availability and the increasingly frequent flooding events would be managed.
7. Water returned for the river should be protected as an entitlement for the river at the highest level of security, both up to 2019 and thereafter.

8. The Basin Plan must contain an assessment of ESLT that is not compromised by social or economic considerations. This would need to deliver all of the environmental targets allowing for likely climate change. Optimisation of environmental, social and economic factors to determine SDLs can be carried out subsequently, but SDLs still need to be environmentally sustainable.
9. Modelling for SDLs should be based on overcoming identified delivery constraints where feasible, recognising that the more frequent flooding events expected from climate change will not respect constraints at all.
10. Water buyback should continue without delay. The vast majority of the $9 billion available funding should be dedicated to buying back water allocations first whilst helping communities to transition to a more diverse and resilient economy in the Basin.
11. Any infrastructure improvements should be required to demonstrate a high return of water to the river and be conditional on states working to remove delivery constraints.
12. Some infrastructure improvements are best undertaken during drier periods. The Plan must be prepared to take best advantage of the next dry period.
13. No individual or state should be financially disadvantaged for being an early adopter of water efficiency measures. The $9 billion investment should prioritise water returns to restore the river system, but where significant efficiencies have been achieved, it should be available to help communities diversify their economies or fund measures to improve environmental outcomes (such as those for the Coorong, Lower Lakes and Murray Mouth recommended above).
14. Water buybacks and infrastructure investment should be based on assessments of what regions will be viable for agriculture in the future.
15. The Basin Plan needs to be vocal about the value of ecosystem services: that they underpin economic activity in the Basin and that investing in them will bring far higher economic returns than allowing their continued decline. The Basin Plan should identify and support the notion that ecosystem service provision is a worthy way to diversify the Basin economy into the future.
16. The Basin Plan must be based on an understanding of the cultural requirements of aboriginal nations along the River, informed by meaningful consultation.
17. We do not support buffers to states to exceed their SDLs; these should be removed from the Basin Plan.
18. Data regarding environmental targets and water quality must be made publicly available in an accessible and timely fashion.
19. Standards for continuous improvement should be incorporated into the adaptive management process (e.g. AS/NZS 4360: 2011).

2. Introduction

The Basin Plan is a statutory instrument, created under the Water Act 2007 (the Act). As such, it has no scope to deviate from the requirements specified in this Act. Failure to comply with the Act would render the Basin Plan illegal.

It is evident that the Basin Plan fails to comply with the Act in a number of areas, some of which will be detailed in this submission.

This conclusion has been verified by the legal analysis[1] undertaken by the Victorian Environmental Defenders Office.

3. Purpose of the Basin Plan

As reported by *The Advertiser*, at the public forum held in Adelaide on 3 April 2012, MDBA Chair Craig Knowles 'told the meeting the plan would be a compromise of "diametrically opposed" views between the states and between various irrigators and environmentalists.[2]' He is reported as saying:

"We have tried to strike a balance ... recognising that there is no magical compromise number here."

Yet there is no mandate for the Basin Plan to be a compromise between opposing views. If it does not meet the requirements of the Water Act 2007, it is not legal.

As stated in section 20 of the Act, requirements of the Basin Plan include:

a) giving effect to relevant international agreements (to the extent to which those agreements are relevant to the use and management of the Basin water resources); and
b) 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); and
c) Basin-wide environmental objectives for water-dependent ecosystems of the Murray-Darling Basin and water quality and salinity objectives;

The Plan is required to achieve certain environmental outcomes (s22), which include (s4):

a) ecosystem function; and
b) biodiversity; and
c) water quality; and
d) water resource health.

Contrary to statements by some and apparent interpretation by the MDBA, the Act (s3) does *not* require the Basin Plan to optimise economic, social and environmental outcomes. It requires the Basin Plan to "promote the use and management of the Basin water resources in a way that" optimises those outcomes. This sort of qualifier is

[1] Environment Defenders Office (Victoria) (2012) Legal analysis of the Proposed Murray-Darling Basin Plan http://www.edovic.org.au/downloads/law%20reform/EDO_legal_analysis_of_draft_MD_Basin_Plan.pdf
[2] Jean, D (2012) I'll change Murray-Darling basin Plan if it's a dud: Burke, *The Advertiser* 3rd April 2012 http://www.adelaidenow.com.au/ill-change-river-plan-if-its-a-dud-burke/story-e6frea6u-1226318039008

not found in the wording of objects such as:

> (b) to give effect to relevant international agreements
>
> (d) (i) to ensure the return to environmentally sustainable levels of extraction for water resources that are overallocated or overused; and
>
> (ii) to protect, restore and provide for the ecological values and ecosystem services of the Murray-Darling Basin (taking into account, in particular, the impact that the taking of water has on the watercourses, lakes, wetlands, ground water and water-dependent ecosystems that are part of the Basin water resources and on associated biodiversity).

Nevertheless it is clear that in its processes, the MDBA has allowed consideration of socio-economic impacts to compromise its assessment of the key question for the Basin Plan: the environmentally sustainable level of take. This will be discussed further below.

4. Does the proposed Basin Plan achieve its statutory requirements?

As discussed above, the Basin Plan must achieve certain environmental outcomes under the Water Act. So does the proposed Basin Plan meet its statutory obligation to achieve these outcomes?

According to the best scientific information available, it does not. This conclusion has been repeated consistently by at least four separate scientific analyses[3] [4] [5] [6], including that commissioned by the MDBA itself. Problems with the methodology fall into a number of categories:

1. Environmental targets developed by the MDBA do not adequately represent the full range of ecosystems in the Basin.
2. The use and presentation of scientific information have been patchy and inconsistent, creating doubt that the Basin Plan has been developed on the basis of the best available science.
3. CSIRO's independent review of the methodology was conducted without consideration of the massive increase to groundwater extraction, and hence its findings do not reflect what is now being proposed.
4. A massive threat to the future availability of water resources, climate change, has not been accounted for.
5. In spite of all of the flaws and omissions, the proposed reduction scenario of 2750 GL still fails to meet a significant number of the MDBA's environmental targets.
6. The MDBA has failed to identify the environmentally sustainable level of take – the reduction scenario that would achieve all environmental targets - because

[3] Young, WJ, Bond, N, Brookes, J, Gawne, B and Jones, GJ (2011) Science Review of the Estimation of an Environmentally Sustainable Level of Take for the Murray-Darling Basin. A report to the Murray-Darling Basin Authority from the CSIRO Water for a Healthy Country Flagship.
http://download.mdba.gov.au/proposed/CSIRO_ESLT_Science_Review.pdf

[4] Wentworth Group of Concerned Scientists (2012) Statement on the 2011 Draft Murray-Darling Basin Plan
http://www.wentworthgroup.org/uploads/Wentworth%20Group%20Statement%20on%20the%202011%20Draft%20Murray-Darling%20Basin%20Plan.pdf

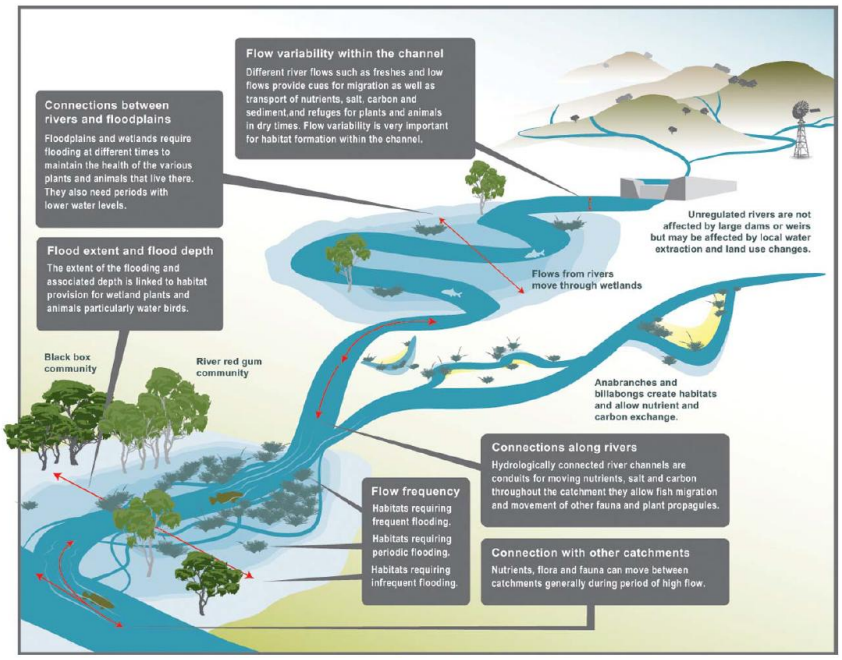
[5] Lamontagne S, Aldridge KT, Holland KL, Jolly ID, Nicol J, Oliver RL, Paton DC, Walker KF, Wallace TA, Ye Q (2012) Expert panel assessment of the likely ecological consequences in South Australia of the proposed Murray-Darling Basin Plan. Goyder Institute for Water Research Technical Report Series No. 12/2
http://www.goyderinstitute.org/uploads/Expert%20Panel%20Final_020412.pdf

[6] Kingsford, R et al (2012) The Proposed Murray-Darling Basin Plan: Scientific Statement – April 2012
http://www.wetrivers.unsw.edu.au/wp-content/uploads/2012/04/Science-Statement-on-Proposed-Basin-plan_April-2012.pdf

its assessments of this have been compromised by consideration of socio-economic factors and so called operating constraints.

4.1 Environmental targets do not represent all Basin ecosystems and their functions

The MDBA's diagram[7] below is telling, in that it is labelled a 'conceptualisation of the processes that drive Basin health', and what is shown is a river system without a mouth.



The flushing function provided by the Murray Mouth is absolutely critical, for without it the river system will fill up with a backlog of salt and toxins; currently two million tonnes are generated every year, and this could increase with future climate change.

South Australia is not responsible for all of this toxic load; 70% originates from upstream states[8].

Yet as the state at the end of the system, South Australia bears the brunt of this salt not being flushed to sea. Sky-high salinity levels during the recent drought period saw the collapse of the species that underpins the food chain in the Coorong *Ruppia tuberosa*, South Australian drinking water supplies put at risk and water for stock and irrigation being rendered unusable. If the Basin Plan allowed this to situation to arise again in the future, it would be a failing on environmental, social and economic grounds.

However the absence of salinity targets for the lower lakes indicates that the logic displayed in the MDBA's diagram is not coincidental.

The MDBA's modelling[9] shows that 2800 GL would only achieve four out of the seven salinity targets for the Coorong – hardly an outstanding result. 3200 GL would achieve six out of seven, but we do not know what number would be needed for all seven to be achieved.

The Basin Plan needs to restore the health of the key ecosystems and functions of the whole river system. This requires targets for environmental outcomes in the Lower Lakes, Coorong and Murray Mouth and sufficient return of water to achieve them.

---

[7] Murray-Darling Basin Authority (2011) The proposed "environmentally sustainable level of take" for surface water of the Murray-Darling Basin: Methods and outcomes, Canberra.
http://download.mdba.gov.au/proposed/ESLT_MDBA_report.pdf

[8] Murray-Darling Basin Commission (1999) The Salinity Audit of the Murray-Darling Basin, Canberra.
http://www2.mdbc.gov.au/__data/page/303/Final_Salt_Audit2.pdf

[9] Murray-Darling Basin Authority (2012) Hydrologic modelling to inform the proposed Basin Plan - methods and results, MDBA publication no: 17/12, Murray-Darling Basin Authority, Canberra.
http://download.mdba.gov.au/proposed/Hydro_Modelling_Report.pdf

To protect these key ecosystems and functions at the end of the river system, a range of measures also needs to be undertaken. A detailed description of these is provided in Appendix A. The best science should underpin any options to increase local flows to the lower Coorong as there are risks to the effectiveness of this option and other environmental impacts.

If the final Basin Plan fails in its obligations to protect all Basin ecosystems and their functions (including those at the end of the system), the Conservation Council SA supports the position of the Government of South Australia, that legal action must be considered.

Recommendations

1. **In order to ensure sufficient export of salt, a Murray Mouth that is open all of the time and functional connectivity across the Lakes, Coorong and Mouth, science tells us[10,11,12] the Basin Plan must include the following targets, and deliver sufficient flow regimes to achieve them:**
   - **flush 2 million tonnes of salt and other accumulated pollutants/sediment out to sea every year**
   - **keep the Murray Mouth open naturally at all times**
   - **maintain salinity at less than 1000 EC units in Lake Alexandrina 95% of time and never over 1500 EC**
   - **maintain salinity in Lake Albert less than 2500 EC units at all times (and should be closer to 2000 most of the time)**
   - **enable the management of variation in the lakes between +0.35 mAHD as an absolute lowest level with regular (at least every 3 years), short (2-4 weeks) periods of +0.9 mAHD to inundate the samphire**
   - **safeguard the health of the Coorong, its key food plants and all species that depend on this ecosystem.**
2. **There needs to be a program of further improvements to the system of barrages to ensure it is adequate, can be operated rapidly, is reliable and does not allow the ingress of salt water through leakage. The management of the barrage system must be reviewed and well documented to be integrated with environmental watering plans.**
3. **An environmental watering plan dedicated to Lakes Alexandrina and Albert, the Coorong and Murray Mouth must be prepared. The Basin Plan must include safeguards and trigger points to ensure that if the SDLs are not adequate to protect these sites, changes are made and water is found to protect these critical Ramsar ecosystems. Real time open and transparent monitoring will be essential.**

[10] Phillips, W, and Muller, K (2006) Ecological character of the Coorong, Lakes Alexandrina and Albert wetland of international importance. South Australia Department for Environment and Heritage, Adelaide.
[11] Lester, RE, Webster, IT, Fairweather, PG, and Young, WJ (2011) Linking water resource models to ecosystem response models to guide water resource planning – an example from the Murray–Darling Basin, Australia. *Marine and Freshwater Research* 62, 279–289.
[12] Muller, K (2010) Target water level envelopes for the Lower Lakes derived from biological and ecological process indicators, including implications of compliance and non-compliance.

4.2 Patchy use and presentation of best available science

The Water Act (s 21) requires the MDBA to develop the Basin Plan on the basis of the 'best available scientific knowledge'. The CSIRO was commissioned by the Authority to review its methodology and raised[13] a number of areas where the use of science was inconsistent or not optimal. For example (emphasis added):

> The panel considers environmental flows to be a relatively new scientific discipline and thus a significant fraction of what can reasonably be considered as the 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** (p 14).

Why did MDBA not make greater use of expert opinion in a field where this is still considered to be the best available science?

CSIRO also noted:

> 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 per cent of the existing area of the particular ecological community, while in other cases the target is for a lesser area... **no justification is given for targets set at less than 100 per cent of the current area** (p 15).
>
> ..the use of scientific information is not fully consistent because of the absence of a clear over-arching conceptual 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** (p 19).

This lack of transparency is also identified by the Wentworth Group of Concerned Scientists[14]. The Group provides an alarming comparison between information presented in the Guide and the proposed Basin Plan on one of the key indicator sites, the Hattah Lakes. What is revealed is that of the six ecological targets listed in the Guide, outcomes are presented for only four in the Basin Plan. The two that have been omitted both receive no environmental benefit from 2800 GL, and presentation of all six targets would have shown that only three of them were met under this scenario.

This deliberate exclusion of two of the three unmet targets reflects very poorly on the MDBA, which has repeatedly promised that the Basin Plan would be developed with complete transparency. Instead, the Authority appears to be engaging in deliberate obfuscation regarding the poor outcomes of its proposed reduction scenario.

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[13] Young, WJ, Bond, N, Brookes, J, Gawne, B and Jones, GJ (2011) Science Review of the Estimation of an Environmentally Sustainable Level of Take for the Murray-Darling Basin. A report to the Murray-Darling Basin Authority from the CSIRO Water for a Healthy Country Flagship.
http://download.mdba.gov.au/proposed/CSIRO_ESLT_Science_Review.pdf

[14] Wentworth Group of Concerned Scientists (2012) Statement on the 2011 Draft Murray-Darling Basin Plan
http://www.wentworthgroup.org/uploads/Wentworth%20Group%20Statement%20on%20the%202011%20Draft%20Murray-Darling%20Basin%20Plan.pdf

Recommendation:

4. **The Basin Plan is legally required to be based on the best available science: this means science that is robust, transparent and fully utilised to guide decision-making. The Plan should not contain patchy or misleading data that undermines the confidence of the people it seeks to engage.**

4.3 CSIRO findings did not consider massive increases to groundwater extraction

It must be noted that the CSIRO review was based on modelling of a 2800 GL reduction scenario, slightly higher than the proposal of 2750 GL in the proposed Basin Plan. We therefore do not know what number of targets would be met under the slightly lower reduction scenario.

However a far greater concern is that the CSIRO panellists were not informed of the MDBA's intention to increase groundwater extraction by 2600 GL – in dramatic contrast to the small reduction that was proposed in the Guide.

It is not clear why the CSIRO scientists were not given the opportunity to assess the impact of the proposed massive increase in groundwater extraction, and this significant omission undermines confidence in the MDBA's processes.

The Wentworth Group of Concerned Scientists examined[15] the MDBA's reasoning for increasing groundwater and identified four key flaws in it:

> 1. The groundwater environmentally sustainable levels of take (ESLTs) in the draft Basin Plan have been derived using unjustified assumptions.
>
> 2. The assumptions adopted to calculate the ESLTs ignore much of the long-term connectivity of surface and groundwater
>
> 3. There has been a steady increase in the Baseline Diversion Limit - the current level of usage of groundwater – which is then used to justify increased groundwater use
>
> 4. The draft Basin Plan fails to identify impacts on groundwater dependent ecosystems

What effect this may have on the targets can only be guessed, but given the connection between groundwater and surface water systems, the Wentworth Group's assessment is:

> Ultimately the failure of the draft Basin Plan to include the impacts of the increase in groundwater extractions in the surface water modelling means that the surface water Sustainable Diversion Limits are unlikely to deliver the claimed outcomes and water users who rely on extractions from the Basins rivers will see their water asset eroded as the upstream groundwater users extract the water first.

[15] Wentworth Group of Concerned Scientists (2012) Analysis of Groundwater in the 2011 Draft Murray-Darling Basin Plan
http://www.wentworthgroup.org/uploads/Wentworth%20Group%20analysis%20of%20groundwater%20in%20the%202011%20draft%20Basin%20Plan.pdf

> The failure to adequately analyse the impacts of increasing groundwater extractions on surface water means the draft Basin Plan will not adequately protect environmental assets, particularly those dependent on low flows.

Once again, this would be a failing of the Basin Plan on environmental, economic and social grounds.

Given the entire premise of the Basin Plan is to correct decades of over-allocation of surface water resources, it is indefensible for it to repeat the same mistake with groundwater.

Recommendation

5. **The Plan should abandon the proposed new 2600 GL allocation of groundwater for consumptive use. By default, surface and groundwater systems should be considered as connected. Use from connected groundwater water systems should be covered by the SDLs. Any ground water systems found to be disconnected from surface water should only be allocated when a system groundwater allocation plan has been completed.**

4.4 Climate change has not been accounted for

In section 22, the Water Act calls for 'an identification of the risks to the condition, or continued availability, of the Basin water resources' and specifically cites climate change as one of these risks (item 3). It also calls for strategies to 'manage, or address, the risks identified' (item 5). So it is clear that climate change must not only be identified in the Basin Plan, but there must be strategies to manage how it may affect water availability.

In its 2009 advice[16] to the MDBA on defining climate scenarios for use in Basin Plan modelling, CSIRO not only assumed that climate change *would* be considered, but suggested the recent extreme dry period should be treated as a likely scenario, and a management plan developed to cope with it:

> **Short and medium-term operational planning (next 10–15 years) should also consider the recent climate (past 10–20 years) as a likely scenario**. This is because (i) much longer dry periods have been observed in the palaeo-climate data, (ii) the dry conditions may continue for some time yet because of initial conditions in the atmosphere-ocean system, and (iii) there is evidence partly attributing the current drought to global warming. This is particularly so for hydrologic systems, where because of low storage levels and very dry antecedent catchment conditions, significant amounts of rainfall are now required before there is an increase in streamflow and storage inflow (p 14).
>
> Planning decisions will need to consider the planning horizon and the balance between risks and rewards and whether the system can adapt to climate change and other development drivers on water. For example, planning decisions need not be based on the worse-case scenario, **but a management plan is needed to deal with it if it does eventuate** (p 13).

[16] Chiew FHS, Cai W and Smith IN, 2009. Advice on defining climate scenarios for use in Murray-Darling Basin Authority Basin Plan modelling, CSIRO report for the Murray-Darling Basin Authority. http://www.mdba.gov.au/files/publications/Defining-climate-scenarios-report-from-CSIRO.pdf

However only two years later in its science review, CSIRO noted[17]:

> 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 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** (p 19).

> 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** (p 20).

The MDBA justified its decision to base its estimates for future water availability on the historical 1895-2009 period because 'the median projected climate change impacts on streamflow are currently within the range of natural variability'[18].

However the median climate change scenario referred to is not the one that is most likely to occur, it is simply the model that has the middle ranking. Also, it assumes a medium level of global warming, when as far back as 2007, CSIRO[19] pointed out that:

> It is worth noting that observed carbon dioxide concentrations, global mean temperatures and sea level rise have been **tracking the upper end of the IPCC scenario range** from 1990 to 2006 (Rahmstorf et al. 2007). Although this 17-year period is very short, it suggests that the **mid and low projections may be less likely than the high projections, with significant implications for risk management**.

Also, since 2007 climate change projections have worsened, such that in 2011, climate scientists warned us that:

> There is now little to no chance of maintaining the rise in global mean surface temperature at below 2◦C, despite repeated high-level statements to the contrary. Moreover, the impacts associated with 2◦C have been revised upwards.. sufficiently so that 2◦C now more appropriately represents the threshold between dangerous and extremely dangerous climate change[20]

and

> ..our best estimate is that the A1FI emissions scenario would lead to a warming of 4°C relative to pre-industrial during the 2070s. If carbon-cycle feedbacks are stronger,

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[17] Young, WJ, Bond, N, Brookes, J, Gawne, B and Jones, GJ (2011) Science Review of the Estimation of an Environmentally Sustainable Level of Take for the Murray-Darling Basin. A report to the Murray-Darling Basin Authority from the CSIRO Water for a Healthy Country Flagship.
http://download.mdba.gov.au/proposed/CSIRO_ESLT_Science_Review.pdf

[18] http://www.mdba.gov.au/draft-basin-plan/draft-basin-plan-chapter-summary/appendix-a

[19] CSIRO (2007) Climate Change in Australia – Technical Report 2007
http://www.climatechangeinaustralia.gov.au/documents/resources/TR_Web_Ch4.pdf

[20] Anderson, K and Bows, A Beyond 'dangerous' climate change: emission scenarios for a new world *Phil. Trans. R. Soc. A* January 13, 2011 369 (1934) 20-44 http://rsta.royalsocietypublishing.org/content/369/1934/20.full

> which appears less likely but still credible, then 4°C warming could be reached by the early 2060s in projections that are consistent with the IPCC's 'likely range'[21].

Given the acknowledged reality that we are tracking towards the highest IPCC scenarios (A1FI), we need to recognise that 4 degrees of warming is possible even within the next 50 years, creating an adaptation task for which the median scenario used by the MDBA cannot possibly prepare us. This wishful thinking that the median scenario is a scientifically defensible one to be using must be abandoned.

CSIRO also expressed concern that:

> ..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 per cent) 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 that 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** (p 20).

This issue of environmental water not being secure has also been identified by Professor Mike Young[22], whose concern is specifically for the period post-2019:

> Under the original Murray Darling Basin Agreement, almost all the downside risks of climate change were assigned to the environment. Recognising the folly of this approach, the National Water Initiative requires governments to give the environment the same degree of security as all other entitlement holders.
>
> Under the Proposed Plan, however, all "held" environmental water is defined as being outside the sustainable diversion limit. Irrigators are once again to be protected at the expense of the environment – a short-term strategy with seriously adverse long-term risks associated with it. The pro-rata sharing arrangement that Australian Governments have been building over most of the last decade is replaced with a return to the old arrangement that caused many of the Basin's problems to emerge!

The MDBA's policy decision not to address the projected impacts of climate change directly contravenes the Water Act, ignores the advice of its own scientific advisors and poses a significant risk to the environment – and therefore to the health of the whole Basin and the communities that depend on it - in the likely dry periods.

Recommendation

6. **The Basin Plan must base its assessment of future water availability on the most likely climate change scenarios (ie, those that accord with the higher emissions scenarios) and indicate how both the likely reductions in water availability and the increasingly frequent flooding events would be managed.**
7. **Water returned for the river should be protected as an entitlement for the river at the highest level of security, both up to 2019 and thereafter.**

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[21] Richard A. Betts, Matthew Collins, Deborah L. Hemming, Chris D. Jones, Jason A. Lowe, and Michael G. Sanderson When could global warming reach 4°C? *Phil. Trans. R. Soc. A* January 13, 2011 369 (1934) 67-84 http://rsta.royalsocietypublishing.org/content/369/1934/67.full

[22] Young, M and McColl, J Which is better – The Existing or Proposed Administrative Arrangements for the MDB Basin? Droplet no. 20 http://www.myoung.net.au/water/droplets/Droplet_20_Basin_Plan.pdf

4.5 2750 GL fails to meet a significant number of environmental targets

Being scientists rather than lawyers, the CSIRO panel did not question the MDBA's inclusion of 'operational constraints' in the modelling of SDLs, even though as will be discussed below, this approach contravenes the Water Act.

Nevertheless, CSIRO points out (p30): '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 are also not met in the modelling'.

South Australian Government scientists conducted their own analysis of how the proposed 2750 GL scenario would affect key South Australian environmental assets. Their findings were verified[23] by the Goyder Institute for Water Research, and were summarised thus:

> It is clear that the return of 2750 GL of water does not meet many of the environmental water requirements for key assets in South Australia.
>
> Environmental water requirements of key vegetation communities, such as red gum, lignum and black box, are not met for significant areas of the floodplain including the Riverland-Chowilla Ramsar site. These assets remain at risk of continued decline.
>
> The Coorong, Lower Lakes and Murray Mouth Ramsar site remains at risk from low water levels and high salinities during dry periods, which will adversely affect the health of plants and animals, particularly in the South Lagoon and Lake Albert.
>
> The MDBA's salt export target of 2 million tonnes per year is not met, especially during dry periods.
>
> Under the draft Basin Plan, periods of constriction of the Murray Mouth would still occur and may require dredging to ensure it is kept open during periods of low barrage flows, such as during drought.
>
> The delivery of overbank flows required to water floodplain environments is limited by constraints on water delivery, such as limits on channel capacities and operating rules.
>
> Removal or relaxation of these constraints will be necessary to deliver flow regimes that would significantly improve ecological benefits for floodplain environments in South Australia.

4.6 The MDBA has failed to identify the environmentally sustainable level of take

If it is so clear that the MDBA's proposed SDLs will not meet specified environmental targets, why hasn't the Authority modelled other scenarios to determine what level of water returns will? It is certainly not for lack of repeated requests to do so by environmental organisations across the Basin.

It seems that, instead of carrying out an unbiased assessment of the environmental watering requirements of a healthy river system, the MDBA decided to take into account unrelated social and economic considerations.

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[23] Lamontagne S, Aldridge KT, Holland KL, Jolly ID, Nicol J, Oliver RL, Paton DC, Walker KF, Wallace TA, Ye Q (2012) Expert panel assessment of the likely ecological consequences in South Australia of the proposed Murray-Darling Basin Plan. Goyder Institute for Water Research Technical Report Series No. 12/2 http://www.goyderinstitute.org/uploads/Expert%20Panel%20Final_020412.pdf

The MDBA gives some examples of how it has taken into account economic, social and environmental outcomes in its framework for determining an environmentally sustainable level of take (ESLT). These include[24]:

- Selecting a *healthy working basin* as an overarching objective for the Basin (rather than the restoration of rivers to a pristine state);
- Selecting ESLT options for testing that give consideration to economic, social and environmental outcomes;
- The process has been bounded by current water delivery constraints, a key social and economic consideration

The language of a 'healthy working basin' does not come from the Water Act and the development of this overarching objective was not a requirement of the Act. However, having unnecessarily developed it, the MDBA then uses it to justify a compromised approach to environmental objectives, saying that these are 'to be understood in the context of a working basin'[25].

The Act (s4) defines ESLT as 'the level at which water can be taken from that water resource which, if exceeded, would compromise key environmental assets, key ecosystem functions, the productive base of the water resource or key environmental outcomes for the water resource'.

There is nothing in this to indicate that social or economic considerations should be taken into account.

Regarding the delivery constraints mentioned in the third dot point above, at the 'No future on a dead river' community meeting held in Adelaide on 10 April 2012, Minister Tony Burke denied that the proposed water reduction was decreased from the optimal amount for environmental outcomes as a result of social and economic considerations. He said, 'The principal thing that drives the numbers down are the capacity constraints'. However as shown above, the MDBA sees delivery constraints as being 'a key social and economic consideration'.

Minister Burke also said that the constraints were one of his key concerns with the current draft Plan, and that 'I don't want the current limits on delivery of water to end up being a permanent cap on how far we can go on fixing the health of the system'.

Whilst the MDBA cannot demand that states remove delivery constraints, this does not prevent the modelling of water reduction scenarios with the vast majority of constraints managed and therefore removed. Not all constraints are equal; some are easily overcome. Some will need to be addressed anyway due to the risk of increased extreme wet events that are plausible in a changing climate.

At this point we have no information about what would actually be a truly sustainable diversion limit for the Basin, and this is a tremendous failing for a Plan that has had so much political will and capital investment behind it.

Recommendation

8. **The Basin Plan must contain an assessment of ESLT that is not compromised by social or economic considerations. This would need to deliver all of the environmental targets allowing for likely climate change. Optimisation of**

[24] Murray-Darling Basin Authority (2011) The proposed "environmentally sustainable level of take" for surface water of the Murray-Darling Basin: Methods and outcomes, Canberra. http://download.mdba.gov.au/proposed/ESLT_MDBA_report.pdf

[25] http://www.mdba.gov.au/draft-basin-plan/draft-basin-plan-chapter-summary/ch05

environmental, social and economic factors to determine SDLs can be carried out subsequently, but SDLs still need to be environmentally sustainable.

9. **Modelling for SDLs should be based on overcoming identified delivery constraints where feasible, recognising that the more frequent flooding events expected from climate change will not respect constraints at all.**

5. Matters of process/implementation

5.1 Prioritise buybacks without delay

The plan must not cause delays in progress already being made. The river and communities cannot wait until 2019 for most of this water to be returned. Buybacks deliver water more efficiently than engineering solutions and should be prioritised accordingly.

Recommendations

10. **Water buyback should continue without delay. The vast majority of the $9 billion available funding should be dedicated to buying back water allocations first whilst helping communities to transition to a more diverse and resilient economy in the Basin.**
11. **Any infrastructure improvements should be required to demonstrate a high return of water to the river and be conditional on states working to remove delivery constraints.**
12. **Some infrastructure improvements are best undertaken during drier periods. The Plan must be prepared to take best advantage of the next dry period.**

5.2 Rewarding efficient water users

The establishment of the Murray Darling Basin Authority and the development of the Basin Plan are part of an effort to overcome the competing interests of the separate Basin jurisdictions. However we think it is important that it is acknowledged that South Australia voluntarily capped its diversions decades ago, and as a result, South Australian irrigators have been far ahead of other states in their highly efficient water use.

Those who take early action should not be economically disadvantaged for doing so. Also, there are valid queries about equity when allocation reductions are borne equally across states, but the capacity to achieve further efficiencies is far from equal.

South Australia and early adopters elsewhere must not miss out on their fair share of investment for being extremely efficient users of water. Investment should not be tied to irrigation infrastructure improvements that are not needed equally everywhere.

In South Australia, investment to improve the environment of the Coorong, Lower Lakes and Murray Mouth is needed. Infrastructure proposals should facilitate the delivery of environmental watering plans whilst ensuring the protection of Ramsar listed ecosystem against further harm.

South Australia would also welcome support for communities to transition to less water-intensive livelihoods and diversify their economies (discussed further below).

But as the state that suffers the cumulative effect of delivery constraints, the best way to ensure equity for South Australia would be tying infrastructure investment in upstream states to the removal of delivery constraints, as recommended above.

Recommendation

13. **No individual or state should be financially disadvantaged for being an early adopter of water efficiency measures. The $9 billion investment should prioritise water returns to restore the river system, but where significant efficiencies have been achieved, it should be available to help communities diversify their economies or fund measures to improve environmental outcomes (such as those for the Coorong, Lower Lakes and Murray Mouth recommended above).**

5.3 Diversifying the Basin economy: value-adding and ecosystem services

Whether it is planned or not, change is a natural part of life. Whatever the cause of change, we know that the businesses, economies and societies that can adapt quickly are the most resilient. Throughout our history, the challenges of change have driven creative solutions, often resulting in technological leaps with permanent benefits.

During the millennium drought, Basin communities demonstrated their resilience, with Australia's irrigated agriculture reducing its water use by 23% (nearly 3000 GL), while its value fell by only 5%[26]. These figures demonstrate a significant increase in the efficiency of production, an undeniably positive achievement.

If the Basin economy could increase its efficiency to such an extent when the change was unplanned, then surely we can expect an even better result when there is an unprecedented level of government support for a less water-intensive economy.

In our very dry continent that is at risk of becoming even dryer with future climate change, we need to be thinking about how we can reduce our reliance on irrigated primary production, and the Basin Plan and associated government support programs provide a perfect opportunity to do so.

One obvious avenue is to add value to our primary produce and build up our manufacturing industry once more. Another is to start recognising and valuing ecosystem services.

While this is a relatively new area in Australia, there is increasing recognition globally of the need for economies to recognise ecosystems services. In Australia, farmers will soon be able to derive income from carbon farming, and various grants exist for environmental stewardship, however there is enormous scope for this to grow.

Ecologist Dr Kerri Muller describes some of the services provided by ecosystems in the Murray Darling Basin[27]:

- breaking down sewage and exporting tonnes of salt out through the mouth
- regulation of groundwater levels and quality as appropriate rates of recharge reduce secondary salinisation of productive lands and waters

[26] Australian Bureau of Statistics (2006) Drought drives down water consumption media release http://www.abs.gov.au/AUSSTATS/abs@.nsf/Previousproducts/4610.0Media%20Release12004-05?opendocument&tabname=Summary&prodno=4610.0&issue=2004-05&num=&view=

[27] Muller, Kerri (2010) Personal Communication, 15 October 2010

- nutrient transformations, reducing algal blooms and making waste into useable nutrients
- transport of agrichemicals, which improves the efficacy of chemicals because less resistance builds up in the ecosystem
- carbon sequestration as new forests, reeds, and functioning ecosystems sequester more carbon
- flood mitigation and controlled deposition of sediments
- genetic resources, which provide adaptability to a changing future climate
- provision of shade and shelter for livestock, which improves farm productivity
- erosion control as good tree/reed growth can reduce or prevent bank slumping and erosion of waterways.

If ecosystem services are recognised appropriately, benefits can flow to the environment, society and the economy, rather than our rather dated model where trade-offs are considered inevitable.

We appreciate that the MDBA's cost benefit analyses are now starting to acknowledge and attempting to value ecosystem services[28]. In spite of the difficulties quantifying some ecosystem services, CSIRO nevertheless found that the value of ecosystem services provided by a healthy Basin is many times higher than the costs: $3-8 billion versus the $542 million reduction in the value of irrigated agriculture. It is vital that this work continues and grows, and it needs to be highlighted front and centre in the Basin Plan.

The Economics of Ecosystems and Biodiversity (TEEB) approach (upon which CSIRO's analysis was based) requires that ecosystem services are ascribed a monetary value, and it also engages affected stakeholders from the start, in defining the issue and being part of the solution. However it does not do this to the extent of allowing commercial demands to override the requirements of biological systems, as seems to be occurring with the Basin Plan. It allows science to determine the response required, and then has procedures to address the human impacts associated with this.

Instead of the current approach to infrastructure investment and buyback, there should be a process to first identify the areas that will be viable for irrigated agriculture in the long-term, determined using land capability data and climate change projections. These regions can then be targeted for modernisation and efficiency measures, while other areas transition to either dryland agriculture or the provision of vital ecosystem services.

Environmental watering programs should also be strategic, prioritising sites that contribute to the health of the river system as a whole and where water can be reused at downstream sites. As with irrigated agriculture, there should be investment in infrastructure works to achieve maximum benefit from the available environmental water.

Farmers in non-viable regions would be paid compensation for real water and benefit from an exit package. Under these circumstances, the water buyback would be exempted from all restrictions on water trade. However this does not mean that communities in these regions should cease to exist.

Where possible, communities must be empowered to diversify their economies. A range of programs and support from all levels of government are needed to provide

[28] CSIRO (2012) Assessment of the ecological and economic benefits of environmental water in the Murray–Darling Basin. CSIRO Water for a Healthy Country National Research Flagship, Australia. http://www.mdba.gov.au/files/bp-kid/2017-Assessment_Ecological_Economic_Benefits.pdf

fresh opportunities. But a vital part of this is to recognise and reward ways of relating to the land other than agricultural ones.

Irrigation communities that move to ecosystem service provision such as revegetation for salt and sediment mitigation, water quality control, biodiversity provision and carbon sequestration should receive an income that reflects the real value of the services they provide.

These new sources of income would allow communities to remain viable, with people staying on the land and becoming land stewards. Landscapes would remain productive, biodiversity would benefit and problems of weed and pest infestation would be reduced.

Recommendation

14. **Water buybacks and infrastructure investment should be based on assessments of what regions will be viable for agriculture in the future.**
15. **The Basin Plan needs to be vocal about the value of ecosystem services: that they underpin economic activity in the Basin and that investing in them will bring far higher economic returns than allowing their continued decline. The Basin Plan should identify and support the notion that ecosystem service provision is a worthy way to diversify the Basin economy into the future.**

5.4 Cultural flows differ from environmental flows

The Water Act (s 21) says that the Authority and the Minister must have regard to Indigenous issues and that the Basin Plan must describe the uses of Basin water resources - including by Indigenous people (s 22).

In 2006, the Ngarrindjeri nation developed a plan for their *Yarluwar-Ruwe* (Sea Country), which includes the lower Murray River, Lakes, Coorong and adjacent marine and land areas. In it they describe[29] their many layers of connection with their environment:

> Ngarrindjeri people hold cultural and spiritual connections to particular places, to particular species of animals and plants, and all elements of the environment are part of our kinship system. Particular animal and plant species are the *Ngartji* (totem or special friend) of Ngarrindjeri people, who have special responsibility to care for their *Ngartji*. To care for *Ngartji* is to care for country.
>
> The land and waters is a living body. We the Ngarrindjeri people are a part of its existence. The land and waters must be healthy for the Ngarrindjeri people to be healthy. We say that if *Yarluwar-Ruwe* dies, the waters die, our *Ngartjis* die, then the Ngarrindjeri will surely die.
>
> We ask non-Indigenous people to respect and understand our traditions, our rights and our responsibilities according to Ngarrindjeri laws and to realise that what affects us, will eventually affect them.

To ensure that this culture is maintained, water is required at certain times to ensure that the various species can flourish, and defined events can happen and customs take place. For example, water of certain volumes and heights is required at certain

[29] Ngarrindjeri Tendi, Ngarrindjeri Heritage Committee, Ngarrindjeri Native Title Management Committee (2006) Ngarrindjeri Nation Yarluwar-Ruwe Plan Caring for Ngarrindjeri Sea Country and Culture http://www.environment.gov.au/indigenous/publications/pubs/ngarrindjeri-scp-2006-1.pdf

times to ensure that swans lay eggs in sufficient numbers so that some eggs can hatch (and continue the species) and some can be harvested for food by the Ngarrindjeri.

The provision of water to ensure that this happens could be labelled a cultural flow. Without flows of this kind, the various manipulations of water flows through locks, and barrages by the MDBA might achieve other objectives (such as delivery of certain volumes of water to irrigators, or flushing of salt) but might mean that the swans are left without the water at the quantity and timing they need to ensure that they breed.

In terms of the Basin Plan, for cultural flows to have any meaning, the MDBA needs to work with the aboriginal nations along the Rivers to understand events such as the example above and provide sufficient flows at the right times to ensure that the events take place.

Indigenous rights to cultural flows must be respected and acknowledged as being integral to the Basin Plan.

Recommendation

16. The Basin Plan must be based on an understanding of the cultural requirements of aboriginal nations along the River, informed by meaningful consultation.

5.5 Adaptive management

A true adaptive management process would be quite objective in its assessment of whether water reductions need to go up or down. However as pointed out by the Environmental Defenders Office[30], the MDBA reveals a bias in its thinking by talking about the possibility of SDLs going up, rather than up or down. This is disappointing, especially as the failure to account for the likely impact of climate change would seem to increase the chances that SDLs would need to go down.

Adaptive management will not be possible unless the process is conducted with complete transparency. Local communities must be empowered by having access to all data regarding environmental targets and water quality.

It is most concerning that the Basin Plan proposes states be allowed to exceed their SDLs - by up to 19% with no reasonable excuse, and even higher with a reasonable excuse. We do not even know what constitutes 'reasonable' as it has not been defined.

Furthermore, as it is proposed that states be allowed to carry over a credit for an unspecified time period if they do not use all of their SDL entitlement each year, the draft Plan sets up a situation where these entitlements could be claimed back, without warning and presumably at a time of water scarcity, which could have serious implications for downstream users and environmental assets.

If an SDL is defined for a river, then allocations should not be allowed for more than that amount. If they are allowed, it means that in bad years, states can take much more than is available and make a drought much worse than it should have been. We do not support buffers for states.

[30] Environment Defenders Office (Victoria) (2012) Legal analysis of the Proposed Murray-Darling Basin Plan http://www.edovic.org.au/downloads/law%20reform/EDO_legal_analysis_of_draft_MD_Basin_Plan.pdf

Recommendation

17. **We do not support buffers to states to exceed their SDLs; these should be removed from the Basin Plan.**
18. **Data regarding environmental targets and water quality must be made publicly available in an accessible and timely fashion.**
19. **Standards for continuous improvement should be incorporated into the adaptive management process (e.g. AS/NZS 4360: 2011).**

6. Appendix A – Measures to restore the Coorong, Lower Lakes and Murray Mouth

Improvements to the barrages

- Further infrastructure improvements are required for the barrages to enable complete rapid operation and greater flow-through at the right times.
    - Manually operated gates are not sufficient to manage the system on a daily basis in regard to tidal changes, storms and wind variation.
    - A greater number of reliable automated gates are required in certain areas eg boundary creek
    - Based on local comments, a proportion of automated gates may either not work or suffer from poor reliability. If this is the case then these gates should be upgraded and maintained to a minimum standard of performance and availability.
- The barrages must be upgraded to stop salt water ingress. Leakage through concrete stop log portions of the barrage is significant, particularly during periods of high tide and low levels in Lake Alexandrina and the Goolwa Channel (compounded by the frequent southerly winds).
- Additional fish passages are required in certain areas of the barrages.
- A review of the operational plan of the barrages is needed, to better integrate the environmental needs of the Lakes and Coorong, provide variation of Lake levels that supports changeover of water and environmental outcomes. When environmental watering plans are completed, the operation of the barrages should be directed towards delivery of these plans in addition to maintaining a division between salt and fresh water.
- There should be stronger linkages with biodiversity experts in planning the operation of the barrages and timing of openings and closures.

Improving the water changeover into Lake Albert

- Optimise the timing of lake height variation to enhance water changeover (for example, lower lake head in advance of inflow pulses).
- Fully remove remnants of the temporary bund and return the Narrung narrows to the original bathymetry.
- Further infrastructure measures and improvements should only be undertaken where detailed environmental impact assessment confirms that these measures do not cause further significant environmental harm:
    - Investigate the dredging of the Narrung narrows to increase flows and turnover, ensuring safeguards against further environmental harm
    - Investigate the removal of the causeway that is restricting water flows through the Narrung narrows and determine if this can be achieved in a way that prevents further environmental harm from silt mobilisation
    - A proposal to open Lake Albert to the Coorong is not supported due to significant environmental issues.

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Murray-Darling Basin Authority
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Monday, 16 April 2012

Submission to Proposed Basin Plan

The Nature Conservation Council of NSW (NCC), founded in 1955, represents more than 100 local and regional member societies from across New South Wales.

NCC participated actively in the state water reform process commenced in the mid 1990's by the NSW Government. This included engaging in the development of the *Water Management Act 2000* (WMA), nominating environmental representatives to River Management Committees formed under the WMA and assisting in the development of the major regulated river Water Sharing Plans (WSPs) and the first tranche of groundwater WSPs and unregulated streams WSPs.

NCC welcomed the adoption of the *Commonwealth Water Act 2007* (the Act) as a significant step forward in the management of the Murray-Darling Basin as a whole. The requirement to establish a Basin Plan that is binding on the states was welcomed as a positive and necessary approach to mitigate the long-term degradation of this important inland river system caused by over extraction.

NCC is concerned that this important opportunity has been seriously compromised to the extent that the proposed Basin Plan is not compliant with the Act. NCC wishes to submit the following recommendations to rectify this problem and to ensure that the objects of the Act are met:

Recommendations:

1. **That the environmentally sustainable level of take (ESLT) is based on the volume of water required by the key environmental assets in the Basin to ensure their long-term resilience.**

2. **That the sustainable diversion limit (SDL) be reduced by 4,000 GL as identified by the best available scientific knowledge, pursuant to the requirements of the Act.**

3. **That the proposed increased available extraction of groundwater to 2,600 GL be removed.**

4. **That the Environmental Watering Plan include the protection of groundwater dependent ecosystems.**

5. **That the 20% compliance buffer for SDLs be removed.**

6. **That the water quality targets are robust and enforceable.**

CASE STUDY – GWYDIR WETLANDS ASSESSMENT

NCC wishes to use the case study of the Gwydir water resource unit to demonstrate how the proposed Basin Plan fails to protect key environmental assets that are listed under international conventions and agreements and fails to meet the objectives of the Act.

Poor assumptions and ecological targets

The internationally significant Gwydir wetlands are known to have shrunk to 15% of their original extent. The proposed Basin Plan will not improve or even maintain that current extent. It has based all assessment of environmental requirements (EWR) on the area of semi-permanent wetland, floodplain wetland and floodplain vegetation mapped in 2008 towards the end of the millennium drought.

The proposed frequency of environmental flows will only water a percentage of those remaining vegetation types. The ecological targets and water requirements identified for the Gwydir wetlands in the proposed Basin Plan will continue the ongoing decline of this internationally significant wetland.

The EWR for the Gwydir wetlands has indicated that under current environmental water availability all identified site-specific ecological targets will only be met with high uncertainty or not met at all. The fact that this information has been used to determine the ESLT highlights the inadequacy of the proposed Basin Plan.

This information is incorrectly reported in the document released by the MDBA in February 2012 *Hydrological modeling to inform the proposed Basin Plan. Methods and Results* which states:

*"**Gwydir:** Environmental water requirements were determined for the Lower Gwydir and Gingham channel and the Mallowa watercourse management units. The modelling carried out shows that water already recovered (42 GL/y average long term use) is adequate for meeting the in-valley environmental water requirements".*[1]

The Gwydir EWR indicates that the identified site-specific targets will not be adequately met. They will only be met with high uncertainty. This means that there is a low likelihood that the targets will be achieved.

High uncertainty is described in the EWR as *"the best estimate of the threshold, based on current scientific understanding, which, if not met, may lead to the loss of health or resilience of ecological communities, or the inability of species to reproduce frequently enough to sustain populations. The high–uncertainty frequencies attempt to define critical ecological thresholds."*[2]

Poor environmental flow outcomes

The EWR has identified the following unsustainable decisions for protecting wetland vegetation in the Gwydir wetlands:

Semi-permanent wetlands

Only 6,829 ha were mapped in 2008. The EWR has indicated that extensive grasslands of club rush and water couch and stands of cumbungi require regular, frequent and prolonged flooding. Species such as water couch requires flooding every 1 – 2 years for between 5 and 8 months duration.

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[1] MDBA (2012) Hydrological modeling to inform the proposed Basin Plan, Methods and Results. Executive Summary p vi
[2] MDBA (2012) Assessment of Environmental Requirements of the proposed Basin Plan: Gwydir Wetlands p 21

The proposed frequencies for flooding this important wetland vegetation aim to ensure that *"at least 75 % or around 5,000 ha of the remaining semi-permanent wetland vegetation communities are inundated in 80-90% of years (based on a long-term average)."*[3]

1. *Floodplain wetlands*

Only 6,719 ha were mapped in 2008. The EWR has indicated that the proposed frequency of environmental flows *"aim to ensure that between 50% and 70% (approx. 3,200 – 4,500 ha) of the remaining river cooba – lignum, and coolibah/river red gum communities are inundated between 20 - 50% of years (based on a long term average). Remaining parts of this functional group are likely to be inundated in around 10% of years (based on a long term average)."*[4]

2. *Floodplain Vegetation*

In 2008, 77,949 ha of floodplain vegetation was mapped. The EWR indicates that the proposed flow frequencies *"aim to ensure that the majority of the remaining coolibah and black box woodlands are inundated between 10 -20% of years (based on a long term average)."*[5]

However, the EWR determines that with the 42 GL/yr (average long term use) recovered for environmental flows the site-specific indicators are not achieved with certainty:

> Lower Gwydir/Gingham Wetlands vegetation, water birds, aquatic fauna and ecosystem function targets will only be met with high uncertainty and in case of the high flow of 250 GL, not at all.
>
> Mallowa Wetlands there is no change from current conditions for the vegetation target and high uncertainty that the ecosystem function target will be met

Poor modelling and policy

There is additional concern over the effectiveness of the modelling and delivery of environmental water to the wetland areas in the Gwydir catchment.

Much of this decision making has been influenced by current water policy and constraints within the Gwydir River system. The nearest upstream gauge, at Yarraman Bridge, used for environmental flow modeling, is in excess of 55km of river length away from the wetlands. Combined with multiple channels and associated high flow losses, there is a high level of uncertainty about the representativeness of this gauge for flows entering the wetlands.[6]

The EWA identifies that for the Mallowa wetland system:

*"The **considerable level of irrigation development** in the Mallowa system limits the potential of regulating larger flows down the channel to inundate the wetland vegetation, **because when flow rates exceed around 50 ML/d, much of this water is harvested.**"*[7] (bold type added)

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[3] MDBA (2012) Assessment of Environmental Requirements of the proposed Basin Plan: Gwydir Wetlands p 13
[4] MDBA (2012) Assessment of Environmental Requirements of the proposed Basin Plan: Gwydir Wetlands p 16
[5] MDBA (2012) Assessment of Environmental Requirements of the proposed Basin Plan: Gwydir Wetlands p 16
[6] MDBA (2012) Assessment of Environmental Requirements of the proposed Basin Plan: Gwydir Wetlands p 22
[7] MDBA (2012) Assessment of Environmental Requirements of the proposed Basin Plan: Gwydir Wetlands p 18

It is stated that the aim is to enhance conditions as they exist under current arrangements due to the regulated nature of the system and delivery constraints provided by agricultural land development.

However, it has been demonstrated that current environmental conditions in the Gwydir wetlands system will not be enhanced by the proposed flow targets.

The EWR does concede: " ***although it is acknowledged that there may be some opportunities for change to increase the ability to deliver environmental flows.***"[8] (bold type added)

The proposed Basin Plan should identify the opportunities for policy and constraints changes that will allow improved environmental management and outcomes across the Basin.

Connectivity to Basin

The hydrological model has indicated that the available environmental water in the Gwydir (42 GL/yr average long term use) is not adequate to supply any downstream flows without impacting on the in-valley environmental requirements.

'The sourcing of environmental water requirements of Barwon-Darling from Gwydir in the BP-2800 scenario resulted in a negative impact on the in-valley indicators specified for the Gwydir Wetlands. Therefore, the Gwydir-ECA scenario did not include the downstream environmental demands and the proposed Basin Plan considers Gwydir to be a disconnected system.[9]

The proposed Basin Plan needs to identify an adequate volume of environmental water from the Gwydir to satisfy the needs of the important wetlands with certainty and to provide important downstream contributions to the Barwon – Darling system.

The diversions from the Gwydir Regulated, Unregulated and Groundwater Water Sources for flood irrigation purposes are too high for long-term environmental health of the river system and its dependent wetland species.

The proposed environmental allocation of 42 GL/y average long term use is not adequate and needs to be raised to at least 80 GL/y to begin to achieve the objectives of the Act and contribute to the Basin SDL.

... ...

In it's current form, the Proposed Basin Plan will not prevent the long-term decline of wetlands, native fish, water birds and River Red Gums. We strongly urge the Murray Darling Basin Authority to adopt the recommendations outlined above, to ensure that the Basin Plan achieves its statutory purpose and delivers long overdue reform in the Basin.

Yours sincerely,

Pepe Clarke
Chief Executive Officer

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[8] MDBA (2012) Assessment of Environmental Requirements of the proposed Basin Plan: Gwydir Wetlands p 18
[9] MDBA (2012) Hydrological modeling to inform the proposed Basin Plan. Methods and Results p 69

Environment Victoria submission to the Murray-Darling Basin Authority's *Proposed Basin Plan*

April 2012

'*Unless action is taken now, the basin and its communities do not have a long-term future and consequently face irreversible decline in the environmental health and, in turn, the economic strength of the Basin. It is vital to change the balance between water for the environment and water for economic benefit in order to restore the environmental health of the Basin and preserve and enhance its long term productivity.*'[1]

Introduction

Environment Victoria is the state's peak non-government, not-for-profit environment organisation. Our Healthy Rivers Campaign is dedicated to working with government, business and communities for the restoration and protection of our state's great river systems. Our vision is for a future where healthy rivers sustain abundant life and prosperous communities, providing us with good food, clean water and places to love and enjoy.

The Murray-Darling Basin Plan is a watershed document in Australian water planning. As the MDBA has said, ' For the first time, the surface water, groundwater and environmental water resources of the national heartland, the Murray-Darling Basin, will be managed as a whole, according to a legally enforceable plan – the Basin Plan'[1]. The Plan is set up by the Commonwealth *Water Act (2007)*, which was passed by both Houses of Parliament with bi-partisan support – twice. The *Water Act* requires the Plan to do certain things, including:

- Set Basin wide environmental objectives, and water quality and salinity objectives;
- Set and enforce environmentally sustainable limits on the quantities of surface water and ground water that can be taken from Basin water resources;
- Be based on best available science and socio-economic data; and
- Optimise social, environmental and economic outcomes[2].

This submission examines how well the draft Plan meets these objectives and explores ways in which it could be improved.

We are deeply concerned that the Proposed Basin Plan is fundamentally flawed as it fails to adequately protect and restore the environmental health of the basin or preserve and enhance its long term productivity. These two elements are inextricably linked and long term productivity cannot be maintained with out protecting environmental health. The sustainable diversion limits (SDLs) set for Victorian rivers in the proposed Plan are not adequate to ensure their long term health and will not result in a return to good condition for these rivers. They do not appear to be based on the best available science as required by the Commonwealth Water Act[3]. There is no evidence provided in the draft Plan or its supporting documentation that the approach to groundwater management is sustainable in the long term and the failure to plan for a drier climate remains a serious concern. The use of operational constraints to justify failure to meet ecological objectives, while it has some basis in reality, is unacceptable if there is no process to remedy the constraints.

[1] MDBA (2009) The Basin Plan – a concept statement, p 2
[2] Water Act 2007 s 20,21,22
[3] Act, s21 (4b)

Summary of recommendations

Recommendation 1.1. *SDL reductions need to be increased throughout the Basin, sufficient to meet all ecological and hydrologic targets at a low level of risk. An overall reduction of 4,000 GL should be modelled as a matter of urgency, not withstanding operational constraints and the uncertainties in the model. Running the model on a valley by valley basis may assist, especially in the northern Basin, which is relatively free from delivery constraints.*

Recommendation 1.2. *Surface water SDLs should be set as a number (ie a volume of water that can be taken,) not as a reduction amount from a variable and as yet unfinalised baseline diversion limit.*

Recommendation 2.1*. The MDBA should return to the precautionary approach taken in the Guide. We support the introduction of a cap on groundwater use but it should not be based on the RRAM methodology. All groundwater use should be immediately capped at the current level of entitlements, as occurred when the Murray-Darling Basin Cap was introduced.*

Recommendation 2.2. *In areas where there is no adequate resource appraisal or a current management plan, appropriate and scientifically robust studies of aquifer characteristics, surface ground water connectivity, groundwater dependent ecosystems and resource sustainability should occur before any change to the current arrangements is proposed. This could occur before the 2015 review or before the next iteration of the Basin Plan, potentially in conjunction with the Independent Expert Scientific Committee which is overseeing bio-regional assessments and research into ground water related impacts of coal-seam gas and coal mining in the MDB.*

Recommendation 3.1.1. *The MDBA should adopt the language of the Act and ensure that its objectives fully align with the Act's objectives. The objective for a 'healthy working basin' should be abandoned as it has not been defined and it is open to interpretation as to its meaning.*

Recommendation 3.2.1. *The language used in the Plain English Summary and other explanatory materials which evidences bias towards increasing SDLs must be removed, as this may affect interpretation and implementation of the Bsain Plan. In addition the Basin Plan should set out in more detail the factors that must be considered in the review including the latest climate modeling and data, the status of constraints and the latest science on the environmental requirements of the Basin.*

Recommendation 3.2.2. *The MDBA should continue to invest to improve the science base of the Basin Plan and its modeling platform, so that the 2015 review and subsequent iterations of the plan can be based on up to date and accurate information.*

Recommendation 3.3. *Clause 9.09 (2) should be deleted from the final Basin Plan to remove uncertainty about implementing SDLs and potential weakening of water resource plan obligations.*

Recommendation 4.1. *The Basin Plan should be amended to guarantee the security of planned and other categories of environmental water and transfer the risk of changes in water*

availability due to climate change to held water, consistent with clause 48 of National Water Initiative.

Recommendation 4.2. *There needs to be a suite of climate adaptation measures to accompany the Basin Plan such as protecting remaining free-flowing rivers, replanting riverside forests, removing redundant dams, and adding fish ladders and cold water pollution control devices to dams.*

Recommendation 5.1. *The MDBA should conduct a systematic assessment of the feasibility, costs and benefits of redesigning river management operations and infrastructure to deliver ecological outcomes, followed by a prioritisation of works & measures.*

Recommendation 5.2. *Once an impediment to delivery of environmental water has been removed, the MDBA should review the ability to achieve improved environmental objectives and adjust the SDL accordingly.*

Recommendation 5.3. *The MDBA should seek to create opportunities for flood mitigation through the removal of constraints and promote these to state and federal governments*

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Recommendation 5.4. *Funding for removal of constraints should be sought from the federal government's SRWUI initiative.*

Recommendation 6.1.1. *The MDBA should incorporate the economic benefits of environmental watering identified by CSIRO in their optimization of economic outcomes of the Basin Plan. These benefits far outweigh the economic costs of implementing the Plan.*

Recommendation 6.1.2. *The MDBA should continue to invest in developing methodology to measure the economic benefits of ecosystem services and other benefits of environmental watering.*

Recommendation 7.1. *The MDBA should provide enough water to Ramsar listed wetlands in the MDB to ensure that all ecological targets are met and that the targets are adequate to maintain and enhance the characteristics for which the sites were listed.*

Recommendation 8.1.1. *The MDBA increases the site-specific flow indicators for the lower Goulburn to their optimal values (25,000ML/day for 5+ days at least 8 years out of 10 with a maximal period between events of 3 years and a mean number of at least 2 events per year; and 40,000 ML/day for 4+ days at least 5 years out of 10 for 4+ days with a maximal period between events of 5 years) and includes a flow indicator of at least 55,000 ML/day at a frequency to complete ecosystem processes, possibly 2 years in 10. The Goulburn model should be re-run to work out how much water is required to meet these targets.*

Recommendation 8.1.2. *The status of physical constraints at Shepparton should be assessed immediately and any necessary action to deliver flows of up to 40,000ML/day taken. The actions identified to allow delivery of up to 40,000 ML/day to the lower Goulburn floodplain should also be urgently prioritised.*

Recommendation 8.2. *The MDBA should abandon its reliance on the NRSWS for environmental objectives for the Campaspe. It should instead use the FLOWS study as a guide and set overbank objectives for reaches 2 and 3, and recalculate the in-valley SDL to accommodate these. The MDBA should treat the Goulburn, Campaspe and Loddon as separate SDL units for compliance purposes.*

Recommendation 8.3. ***T****he MDBA should abandon its reliance on the NRSWS for environmental objectives for the Loddon. It should instead use the Loddon FLOWS study as a guide and set overbank objectives for reach 3. It should also take into account connection between ground and surface water and the needs of the Kerang Lakes, and then recalculate the in-valley SDL to accommodate these.*

Recommendation 8.4. *The MDBA establishes objectives for the Ovens River based on the FLOWS study and calculates the ESLT required to meet them.*

Recommendation 8.5. *The MDBA establishes objectives for the Kiewa based on the FLOWS study and calculates the ESLT required to meet them.*

Recommendation 8.6. *The MDBA should evaluate and prioritise constraints to the delivery of environmental water to the lower Murray floodplain, especially the Ramsar sites, and insist that the appropriate authorities deal with them to allow the Ramsar condition of the sites to be maintained. Once the constraints have been unlocked, the SDLs should be adjusted to allow all the ecological objectives to be met.*

Recommendation 8.7*. The MDBA should set an SDL for the Wimmera River sufficient to meet its ecological objectives and maintain the Ramsar character of Lake Albacutya.*

Recommendation 9.1 *The Basin Plan must provide enough water to keep the Murray Mouth open without the need for dredging and maintain salinity levels below critical thresholds in all years, including those of severe drought.*

Areas of concern

1. Surface water SDLs

The proposed Basin Plan recommends an environmentally sustainable level of take from the rivers of the Basin of 10,873 gigalitres (GL)/year. 'This is the amount of water that can be used for irrigation, agriculture, drinking and so forth (known as 'consumptive use') on average' says the MDBA[4], and it has determined that to get to that level of take, consumptive use needs to be reduced by 2,750 GL/year across the Basin. This reduction is to happen over a seven year period (to 2019), with targets set for each of the catchments in the Basin and a further shared downstream target which is likely to be implemented from 2015.

The MDBA also says '*The environmentally sustainable level of take will ensure that there is enough water left in the river system to meet environmental needs*'[5]. The question that must

[4] Plain English summary of the proposed Basin Plan (MDBA) 2011, p vii
[5] Plain English Summary of the proposed Basin Plan (MDBA) 2011, p vii

be answered is will the proposed SDLs for the rivers of the Basin ensure that the Basin's rivers will be healthy in the long-term?

Scientific reviews of the draft Plan do not inspire confidence. The MDBA commissioned CSIRO review of the science behind the draft Basin Plan says that 'The SDLs modeled in this scenario do not meet the majority of the hydrologic targets, they meet 55% of the achievable targets…. The 2,800 GL/yr reduction scenario is thus not consistent with the currently stated environmental targets'.[6] This view is reiterated in the CSIRO assessment of the ecological and economic benefits of the draft plan which says that:

> *'The outputs from the models … show small but ecologically significant improvements in ecological response variables under the 2800 scenario relative to the baseline scenario. Ecologically significant here means a likely halt in decline or an improvement relative to the baseline scenario. The magnitude of improvements is relatively consistent across groups of response variables (floodplain vegetation; waterbirds; the Coorong) except native fish. But this does not mean that ecological consequences under the 2800 scenario are the same or similar for all flow-dependent ecosystems. There are some clear differences between ecosystems in the northern Basin and southern Basin, between different hydrologic indicator sites, and between different parts of those sites.*
>
> *Vegetation communities on higher parts of the floodplain are likely to remain vulnerable under the BP-2800 scenario, particularly river red gum woodland and black box woodland. These communities are likely to become more dependent upon high natural flow events, the occurrence of which is likely to be increasingly uncertain. Black box woodland is quite hardy under dry conditions but requires flooding for regeneration. Lack of regeneration has been apparent in many black box woodlands in the southern Basin for some time. The long-term ecological consequences are likely to be an excess of mortality over recruitment, a reduction in extent of river red gum and black box woodland on the higher floodplain, and a transition from flood-dependent vegetation communities to fully terrestrial ones'.*[7]

The Goyder Institute also notes the threats to the upper floodplain and possible salt accumulation in the Lower Lakes and Coorong. It concludes 'the Basin Plan is unlikely in the longer-term to maintain the ecological character of the Riverland-Chowilla and CLLMM Ramsar sites (and the other non-Ramsar environmental assets)'.[8]

The Wentworth Group of Concerned Scientists goes a step further and says that the MDBA 'shows us the good news, and they hide the bad news. It does not explicitly outline which environmental assets can and cannot be protected or restored by the draft Plan'. In their opinion, 'The Draft Murray-Darling Basin Plan should be withdrawn because it does not

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[6] Young WJ, Bond N, Brooke J, Gawne B & Jones GJ (2011); *Science review of the estimation of an environmentally sustainable level of take for the Murray-Darling Basin.*

[7] CSIRO (2012) *'Assessment of the ecologic and economic benefits of environmental watering in the Murray-Darling Basin'* p89

[8] Goyder Institute for Water Research (2012) *Expert Panel Assessment of the Likely Ecological Consequences in South Australia of the Proposed Murray-Darling Basin Plan* A report to the South Australian Government

provide the information required to make an informed decision on the future of the river system'[9].

Environment Victoria has conducted its own analysis of what the proposed SDLs mean for the health of Victoria's rivers[10]. We have assessed the ability of the prescriptions of the draft Basin Plan to meet the environmental objectives set by the MDBA, using data from *The proposed 'environmentally sustainable level of take' for surface water of the Murray-Darling Basin* (the ESLT report). We found that the draft Plan will provide reasonably good environmental outcomes for instream habitats in northern Victorian rivers and conditions will improve. Further away from the river channel it's a different story and outcomes for floodplains are at best uncertain and at worst disastrous. There will be some improvements in mid-level floodplain condition in some locations, but conditions in the upper levels of the floodplains will not improve anywhere in Victoria. Lake Albacutya in the Wimmera system is likely to lose its status as a Ramsar Wetland of International Importance. We detail our analysis in later sections of this submission.

All the evidence is pointed in the same direction – that the SDL reduction targets proposed in the draft Plan are not high enough to protect ecosystems and meet the requirements of the Water Act. Risks to surface water dependent ecosystems are likely to be remain severe, particularly for higher-lying floodplain ecosystem components in the Lower Murray regions and the Goulburn floodplain, and in the northern Basin. The BP-3200 scenario does not significantly mitigate these risks, and further modelling is required to show the volumes of water needed to meet the ecological objectives.

In the proposed Basin Plan, surface water SDLs are expressed as Baseline Diversion Limits (BDLs) minus a specified volumetric reduction[11]. However BDL calculations are complex[12] and have not yet been finalised. There have also been significant changes between publication of the *Guide to the proposed Basin Plan* and the draft Plan itself. BDLs could potentially increase, which would result in the SDLs increasing and therefore reduced environmental flows. In some cases the increase could be sizeable, particularly in the northern Basin where floodplain harvesting has never yet been accurately quantified.

Recommendations

1.1. *SDL reductions need to be increased throughout the Basin, sufficient to meet all ecological and hydrologic targets at a low level of risk. An overall reduction of 4,000 GL should be modelled as a matter of urgency, not withstanding operational constraints and the uncertainties in the model. Running the model on a valley by valley basis may assist, especially in the northern Basin, which is relatively free from delivery constraints.*

1.2. *Surface water SDLs should be set as a number (ie a volume of water that can be taken,) not as a reduction amount from a variable and as yet unfinalised baseline diversion limit.*

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[9] Wentworth Group of Concerned Scientists (2012): *Statement on the 2011 Draft Murray-Darling Basin Plan*

[10] *What does the draft Basin Plan mean for northern Victoria's rivers?* An analysis by Environment Victoria (2012)

[11] Proposed Basin Plan schedule 2

[12] Proposed Basin Plan schedule 3

2. Groundwater

There has been a major change in the approach to groundwater allocation between the *Guide to the proposed basin Plan* and the draft Plan. The Guide took a conservative approach, recommending an overall decrease in groundwater use of 174 GL, all of it in NSW. Other groundwater areas were to be capped either at current level of use or at current level of entitlement.[13]

All this has changed in the draft Plan. While we acknowledge that some of the change (especially in BDLs) is due to better information, the differences are still radical. Many BDLs have changed in the 13 months since the Guide was released, with a few decreasing but most increasing, with a cumulative increase of 565 GL across the Basin. As the BDL is the starting point of SDL calculation, this is a pretty significant change. The MDBA has provided the basis for calculating the BDL but gives no indication of why the results are so different in the draft Plan to the Guide[14].

The BDL includes an estimate of groundwater extraction for stock and domestic use – since this use is not registered or metered, it is notoriously difficult to measure. For example in Victoria, stock and domestic use is estimated to have increased from 11% of all groundwater use in 2008/9 to 18% in 2009/10, largely as a result of the way the estimates are made[15]. Stock and domestic use can be a significant impact in some catchments, and there is no way of assessing whether MDBA estimates are accurate.

The MDBA has divided the Basin into 79 groundwater SDL units[16]. Of these, 14 have a groundwater management plan either in action or under development. These areas cover about 25% of the basin and are the areas where most groundwater use occurs. They are also the areas in which most is known about aquifer characteristics, interconnection between ground and surface water and where resource assessments have been carried out. In addition they are the areas where monitoring of groundwater levels is most comprehensive. For the rest of the Basin, demand has historically been low and there has been little need to investigate the resource. The MDBA has estimated that a full resource assessment would cost around $1 million per SDL area[17].

The MDBA has attempted to estimate resource availability and a sustainable level of take by using a recharge risk assessment method (RRAM). This method has not been scientifically reviewed and assigns levels of risk based on wholly inadequate information. It moves away from a precautionary approach and has come up with some very significant increases in potential groundwater use, mostly in the SDL areas in the eastern part of the Basin.

In Victoria, the SDL area for which the biggest increase is proposed is the Wimmera-Mallee Sedimentary Plain (area GS9d), where the water is saline and there is little demand. There is no

[13] Guide p141
[14] MDBA (2012c) The proposed Groundwater Baseline and Sustainable Diversion Limits. Methods report.
[15] Victorian Water Accounts 2009-10, p46
[16] Proposed Basin Plan; schedule 4.
[17] MDBA briefing to ENGOs, 29/3/12

rational reason to recommend a 200GL increase in the permissible take of groundwater. Similar instances occur in NSW, SA and Queensland. Given that the Victorian Auditor General has said that so little is known about the groundwater resource it is impossible to know if current ground water use is sustainable[18], the approach taken by the MDBA appears foolhardy.

Recommendations

2.1*. The MDBA should return to the precautionary approach taken in the Guide. We support the introduction of a cap on groundwater use but it should not be based on the RRAM methodology. All groundwater use should be immediately capped at the current level of entitlements, as occurred when the Murray-Darling Basin Cap was introduced.*

2.2. *In areas where there is no adequate resource appraisal or a current management plan, appropriate and scientifically robust studies of aquifer characteristics, surface ground water connectivity, groundwater dependent ecosystems and resource sustainability should occur before any change to the current arrangements is proposed. This could occur before the 2015 review or before the next iteration of the Basin Plan, potentially in conjunction with the Independent Expert Scientific Committee which is overseeing bio-regional assessments and research into ground water related impacts of coal-seam gas and coal mining in the MDB .*[19]

3. Problems with the legal instrument

3.1. Objectives of the Basin Plan

The Water Act requires the Basin Plan to contain 'management objectives and outcomes to be achieved by the Basin Plan'[20] that set the scope and tone for the document The Water Act states that the management objectives and outcomes must be consistent with the purposes in s20 of the Act, and must address environmental outcomes, water quality and salinity, sustainable diversion limits and trading in water access rights. Chapter 5 of the draft Plan contains the management objectives and outcomes.

Rather than take management objectives directly from the Act, the MDBA has chosen to develop its own objectives that align with its approach to Basin planning. The language focuses on the concept of a healthy working basin (without defining what that means) and has economic considerations as a primary concern. Two objectives in particular don't wholly accord with the Act - the objectives for the Basin Plan as a whole in clause 5.02 and the objectives for the SDLs in clause 5.05.

The management objectives for the Basin Plan as a whole in 5.02 focus on achieving a 'healthy working basin' and the optimisation of economic, social and environmental outcomes. It also mentions the international agreements and water security. This is a very selective choice of objectives and in fact leaves out the main objective of the Act and Basin Plan which is establishing environmentally sustainable limits on the water that can be taken from the Basin. The management objectives for the SDLs in 5.05 similarly focus disproportionately on economic

[18] VAGO (2010) *Sustainable management of Victoria's groundwater resources* http://www.audit.vic.gov.au/reports_and_publications/reports_by_year/2010-11/20100510_groundwater.aspx

[19] http://www.environment.gov.au/coal-seam-gas-mining/index.html; viewed 12/4/12

[20] *Water Act 2007* s22 item, 4

considerations such as recovering water through water use efficiency, improving certainty for water users and providing time for entitlement holders to adjust to the SDLs. These are all valid objectives for the SDL, but the SDL is primarily required to protect and restore ecosystems and maintain ecosystem function and the productive base of the system, none of which are mentioned in the SDL objectives. A limited reference to protection of ecosystems in light of climate change only appears in the management outcomes[21].

This deliberate shift from the language and focus of the Water Act is indicative of the MDBA's approach throughout the draft Plan. As intended, the MDBA has used those objectives to guide its focus for other parts of the draft Plan. The move away from the objectives of the Act has therefore influenced the whole draft Plan[22].

Recommendation

3.1.1. *The MDBA should adopt the language of the Act and ensure that its objectives fully align with the Act's objectives. The objective for a 'healthy working basin' should be abandoned as it has not been defined and it is open to interpretation as to its meaning.*

3.2. 2015 review of SDLs

The MDBA has included a provision in the Draft Plan for a 2015 review of the SDLs[23]. The review may result in a recommendation to amend the SDLs up or down in the light of new knowledge or other considerations listed in clause 6.06.

The plain English summary of the Draft Plan has some very explicit statements about what may occur at the 2015 review. It states "Between now and 2015 we can expect to learn more about the river system…this may mean the 1468GL proposed for recovery could be reduced significantly – perhaps in the order of hundreds of gigalitres'.[24] This view is echoed in regards to the constraints issue – the MDBA states that if constraints are removed and environmental outcomes can be achieved with less water the 2015 review would allow the SDLs to increase (i.e. more water for consumption).[25]

There is no acknowledgement in the MDBA documentation that the 2015 review could also result in the SDLs being decreased, for example due to factors such as new knowledge about the needs of the system or better understanding of climate impacts, removal of constraints to delivery of environmental water or advances in irrigation and farming water efficiency. The language suggests that the MDBA has a bias towards the review resulting in an increase in the amount of water for consumptive use. Nothing in the Water Act or elsewhere supports such a bias[26].

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[21] In clause 5.05(2)(a)

[22] This discussion is based on Environment Defender Office 's *Legal analysis of the proposed Murray-Darling Basin Plan* http://www.edovic.org.au/downloads/law%20reform/EDO_legal_analysis_of_draft_MD_Basin_Plan.pdf; viewed 12/4/12

[23] Proposed Basin Plan cl 6.07

[24] Plain English Summary pviii

[25] MDBA (2011), *River management – challenges and opportunities*, p4

[26] See EDO Legal analysis of the draft Basin Plan for more details

A key requirement for the 2015 review, and for future iterations of the Basin Plan, is the generation and incorporation of new knowledge based on the best available science. Environmental watering is an infant discipline which is developing rapidly as more environmental water becomes available and watering is tried out under different circumstances. Modeling is an essential input to the planning process and the MDBA needs to invest in continual improvement to the modeling platform. What is considered state of the art now will not be in 5 or 10 years time. The MDBA needs to continue to invest in its own modeling platform and work with experts such as CSIRO and eWater to improve its knowledge base.

Recommendations

3.2.1. *The language used in the Plain English Summary and other explanatory materials which evidences bias towards increasing SDLs must be removed, as this may affect interpretation and implementation of the Basin Plan. In addition the Basin Plan should set out in more detail the factors that must be considered in the review including the latest climate modeling and data, the status of constraints and the latest science on the environmental requirements of the Basin.*

3.2.2. *The MDBA should continue to invest to improve the science base of the Basin Plan and its modeling platform, so that the 2015 review and subsequent iterations of the plan can be based on up to date and accurate information.*

3.3. Reliability of entitlements

Chapter 9 of the Draft Plan sets out what States must include in water resource plans to comply with the Basin Plan. Section 9.09 has an exemption clause that could undermine many of the provisions of the Basin Plan. The clause states that:

> **9.09 Change in reliability**
> (1) A water resource plan must, to the extent possible, meet each requirement of this Chapter in a way that will not result in a change in the reliability of water allocations in relation to the water resources of a water resource plan area.
> (2) However, if it is not possible to meet a requirement in such a way, the requirement has effect only to the extent that it does not result in such a change[27].

The MDBA has said that this clause was intended to mean that the Basin Plan should not do anything to change the reliability of entitlements[28], but clause 9. 09(2) goes further than that. It reads as if reliability of entitlements has priority over the provisions of the Basin Plan, and that if its implementation affects reliability then the states are not bound to implement it.

Recommendation

3.3.1. *Clause 9.09 (2) should be deleted from the final Basin Plan to remove uncertainty about implementing SDLs and potential weakening of water resource plan obligations.*

[27] Proposed Basin Plan s9.09
[28] MDBA briefing to ENGOS, 29/3/12

4. Climate Change

> *'Freshwater environments and their fishes are particularly vulnerable to climate change because the persistence and quality of aquatic habitat depend heavily on climatic and hydrologic regimes…. Many Australian freshwater fish species are adapted to variable or unpredictable flow conditions and, in some cases, this evolutionary history may confer resistance or resilience to the impacts of climate change. However, the rate and magnitude of projected change will outpace the adaptive capacities of many species. Climate change therefore seriously threatens the persistence of many of Australia's freshwater fish species, especially of those with limited ranges or specific habitat requirements, or of those that are already occurring close to physiological tolerance limits'*[29].

Despite the susceptibility of freshwater environments to rising global temperatures, the MDBA has not considered predicted climate change and associated changes in run-off in determining SDL reductions. They have instead assumed that future climate will fall within the range of historic variability.

The evidence of the Millennium drought demonstrates that environmental water carries a disproportionate impact when inflows decline as compared with the impact on consumptive users. This impact was clearly demonstrated in the Victorian Northern Region Sustainable Water Strategy, and explained as follows:

> *'Climate change means environmental flows will be reduced significantly more than water for users. This is because the majority of environmental flows are not provided by entitlements; they come from unregulated flows or 'above cap' water that cannot be harvested or spills from storages. Spills from storages are particularly reduced under climate change because storages on average hold less water in them and can therefore capture a greater proportion of inflows. The environment does have some entitlements. While these are less impacted by climate change they represent less than six per cent of the total water available for the environment'.* [30]

Even after the Basin Plan comes into effect, that majority of environmental water will still not be provided by entitlements, but will be variously described in different states as 'unregulated', 'rules-based', 'planned' or 'above cap', all of which are much less secure categories of water than entitlements. The reliability of all these types of environmental water is eroded by climate change, and the burden of decreased water availability is not shared equally between all users with the environment carrying a disproportionate share.

The National Water Initiative, agreed by all Basin states and the federal government in 2004, intended that the risk of climate change should be born by entitlement holders (clause 48).

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[29] Morongiella et al (2011) *Climate change and its implications for Australia's freshwater fish*. Marine and Freshwater Research **62**, 1082-98

[30] DSE (2009) *Northern Region Sustainable Water Strategy* p 24

However the 2011 Biennial Assessment of implementation reports that there has been limited progress in adopting the risk assignment provisions, and many stakeholders remain confused.[31] The Basin Plan is an ideal opportunity to fix this and resolve the issues around planned environmental water.

Recommendations

4.1. *The Basin Plan should be amended to guarantee the security of planned and other categories of environmental water and transfer the risk of changes in water availability due to climate change to held water, consistent with clause 48 of National Water Initiative.*

4.2. *There needs to be a suite of climate adaptation measures to accompany the Basin Plan such as protecting remaining free-flowing rivers, replanting riverside forests, removing redundant dams, and adding fish ladders and cold water pollution control devices to dams.*

5. Constraints

The MDBA has stated that system constraints were a very important limiting factor in setting SDLs.[32] They have said that it would be very difficult to return more than 2750GL to the system because physical and operating constraints would prevent that water from being delivered, particularly to the upper levels of the floodplain. It is clear that this has had a strong influence in the decision making process when setting the SDLs, and has been cited as a key reason for selecting the 2750 GL figure.[33]

The types of constraint cited by the MDBA are many and various, from river operational rules to 'nuisance flooding' of private land to dam outlet capacity to major inundation of towns such as Shepparton or Wagga Wagga. To date there has been no systematic attempt to neither categorise these constraints nor prioritise them for ease or effectiveness of remediation. The MDBA is consulting with the states and river managers, but sees its role as a 'catalyst' for change rather than as a decision maker[34]. Indeed, many of the issues fall under state jurisdiction and their attitude will be key to resolution. However the relation of unlocking constraints to the achievement of environmental objectives is clearly the role of the Authority.

The categorisation of constraints is a key first step. Some may be illusory – for example, recent flood pre-releases from Eildon dam did not cause the flooding expected by some landholders[35]. Other potential flooding of private land may be beneficial and sought after by the landholders. The Australian Floodplain Association has recently negotiated voluntary easements over millions of hectares to allow the flooding of their land with environmental water, in recognition of the economic benefit it provides

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[31] National Water Commission (2011) *The National Water Initiative - securing Australia's water future: 2011 assessment;* Finding 1.6, p48

[32] See for example Craig Knowles, *Murray Murmurings:The MDBA explains where the 2750GL figure comes from*, published in Crikey http://blogs.crikey.com.au/rooted/2011/12/16/murray-murmurings-the-mdba-explains-where-the-2750-figure-comes-from/

[33] See for example Murray-Darling Basin Authority, *The proposed 'environmentally sustainable level of take' for surface water of the Murray-Darling Basin: methods and outcomes,* November 2011 p 3

[34] MDBA briefing for ENGOs 29/3/12

[35] Geoff Earl, pers comm

them[36]. This approach could be extended to other areas of the Basin. Purchase of low lying land to allow for flooding is another much discussed option. Key constraints such as the Mondarlo bridge near Gundagai should be early targets for remediation.

Once a constraint has been removed, it should be possible to water parts of the floodplain that were previously inaccessible. It is really important that at this stage the MDBA should review the appropriate SDL to make sure that there is adequate water available to achieve the full range of environmental objectives that removal of the constraint allows.

An area well worth further exploration is the increased options for flood mitigation that resolving delivery constraints on environmental water would provide. For example, one location where physical constraints limit the delivery of environmental water is the lower Goulburn floodplain. In March 2012 unprecedented local rainfall caused extensive flooding in the nearby Broken Creek. Had the Goulburn floodplain been able to accommodate more water, flows for Broken Creek could have been diverted through a natural depression to the Goulburn floodplain and flooding in Nathalia and other towns would have been much reduced. Similarly, flooding in Shepparton is a major impediment to the delivery of water to the Lower Goulburn and Murray sites downstream. If Shepparton could be protected to allow the delivery of environmental water, it would also be protected from natural flooding. In January 2011 over 500 homes were flooded in the town and the damage bill for the 1993 floods was over $40 million[37].

The Commonwealth government has committed $5.8 billion to the Sustainable Rural Water Use and Infrastructure (SRWUI) initiative. So far most investment from this initiative has been in irrigation infrastructure projects. Removing constraints is highly compatible with the initiative's primary objective of delivering 'substantial and lasting returns of water for the environment'[38] and funding should be directed to this end.

Recommendations

5.1. *The MDBA should conduct a systematic assessment of the feasibility, costs and benefits of redesigning river management operations and infrastructure to deliver ecological outcomes, followed by a prioritisation of works & measures.*

5.2. *Once an impediment to delivery of environmental water has been removed, the MDBA should review the ability to achieve improved environmental objectives and adjust the SDL accordingly.*

5.3. *The MDBA should seek to create opportunities for flood mitigation through the removal of constraints and promote these to state and federal governments.*

5.4. *Funding for removal of constraints should be sought from the federal government's SRWUI initiative.*

6. Socio-economic impacts

The MDBA has carried out extensive social and economic research to assess the consequences of returning water to the environment. It has estimated that 'the level of total production in the

[36] http://www.theage.com.au/national/murraydarling-graziers-open-floodgates-to-inundation-20111222-1p798.html

[37] DSE (2010) *Priority works to increase the effectiveness and efficiency of environmental water delivery in northern Victoria*

[38] http://www.environment.gov.au/water/programs/srwui/index.html

Basin (gross regional product) will be reduced by less than 1 per cent and that this is expected to be more than offset by broader economic growth over the transition period to 2019–20'[39]. The impacts will occur primarily in small communities that are heavily dependent on irrigation, and where life is pretty difficult anyway. These communities are in need of support to adjust and should be the beneficiaries of a whole of government approach to structural adjustment. However even the MDBA admits that overall the benefits of a healthy Basin exceed the costs.[40]

These benefits are spelt out by CSIRO in their recently released report *'Assessment of the ecologic and economic benefits of environmental watering in the Murray-Darling Basin'.* While there has been insufficient time for Environment Victoria to fully digest this report it is clear that the benefits of a healthy Basin are significant.

> *'The economic value of benefits under the 2800 scenario relative to the baseline scenario is dominated by habitat ecosystem services. The additional Basin-wide value of enhanced habitat ecosystem services – arising from floodplain vegetation, waterbird breeding, native fish and the Coorong, Lower Lakes, and Murray Mouth – is worth between AU$3 billion and AU$8 billion under the 2800 scenario relative to the baseline scenario'[41].*

In addition, carbon sequestration by healthy red gum and black box floodplain vegetation could be worth up to $1 billon and avoided cost for water treatment up to $30 million. Tourism benefits could be up to AU$160 million annually. While the CSIRO is cautious about the interpretation of the results, it is obvious that the benefits are of a different order of magnitude to the costs which have been estimated by ABARES as an annual AU$542 million reduction in the gross value of irrigated agricultural production across the Basin in the long term.

The CSIRO has only assessed the BP-2800 scenario and has not attempted to quantify the additional benefits of returning larger volumes of water to the environment. These could be significant and should be modeled.

The CSIRO points out that the valuation of ecological benefits and ecosystem services is an evolving discipline and further work is needed[42]. The discipline is attracting international attention and approaches are being developed by the United Nations Environment Program through its Economics of Ecosystems and Biodiversity (TEEB) project. Among TEEB's conclusions and recommendations are the following:

> *'Ecosystem conservation and restoration should be regarded as a viable investment option in support of a range of policy goals including food security, urban development, water purification and wastewater treatment, regional development, as well as climate change mitigation and adaptation'; and further that*

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[39] MDBA (2011) Socio-economic analysis and the draft Basin Plan Part A, p vii,
[40] Plain English Summary to the proposed Basin Plan, p123
[41] CSIRO (2012) *'Assessment of the ecologic and economic benefits of environmental watering in the Murray-Darling Basin' p vi*
[42] Ibid p 200

'[f]ailure to incorporate the values of ecosystem services and biodiversity into economic decision making has resulted in the perpetuation of investments and activities that degrade natural capital. Including the full value of biodiversity and ecosystem services in decision making can be achieved if their sustainable management is recognized as an economic opportunity rather than as a constraint on development'.[43]

It is essential that the MDBA continue to invest in developing the methodology and incorporating the results into its social and economic optimization process.

Recommendations

6.1.1. *The MDBA should incorporate the economic benefits of environmental watering identified by CSIRO in their optimization of economic outcomes of the Basin Plan. These benefits far outweigh the economic costs of implementing the Plan.*

6.1.2. *The MDBA should continue to invest in developing methodology to measure the economic benefits of ecosystem services and other benefits of environmental watering*

7. The importance of and threats to freshwater biodiversity – conservation of Ramsar sites

It is appropriate that the Basin Plan is being formulated during the International Decade for Action – 'Water for Life' - 2005-15. The primary goal of this Decade is to promote efforts to fulfill international commitments made on water and water-related issues by 2015[44]. Since one of the key obligations in the Water Act is for the Basin Plan to 'give effect to' international agreements such as the Ramsar and Biodiversity Conventions, it is important to note the global context. A group of international authors supported by the UNESCO sponsored Diversitas[45] have put it this way:

'Fresh water makes up only 0.01% of the World's water and approximately 0.8% of the Earth's surface, yet this tiny fraction of global water supports at least 100 000 species out of a total of approximately 1.8 million – almost 6% of all described species. Inland waters and freshwater biodiversity constitute a valuable natural resource, in economic, cultural, aesthetic, scientific and educational terms. Their conservation and management are critical to the interests of all humans, nations and governments.

Yet this precious heritage is in crisis. Fresh waters are experiencing declines in biodiversity far greater than those in the most affected terrestrial ecosystems, and if trends in human demands for water remain unaltered and species losses continue at current rates, the opportunity to conserve much of the remaining biodiversity in fresh water will vanish before the 'Water for Life ' decade ends in 2015'.[46]

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[43] TEEB (2010) T*he Economics of Ecosystems and Biodiversity - Mainstreaming the economics of nature- A synthesis of the approach, recommendations and conclusions of TEEB.*

[44] http://www.un.org/waterforlifedecade/background.shtml, viewed 2/4/12

[45] http://www.diversitas-international.org/about/mission-and-history viewed 2/4/12

[46] Dudgeon et al (2006) *Freshwater biodiversity: importance, threats, status and conservation challenges*. Biol Rev 81, p163-182

There are five key threats to freshwater biodiversity: overexploitation ; water pollution ; flow modification ; destruction or degradation of habitat ; and invasion by exotic species.[47] All these threats are well established in the MDB, and their combined and interacting influences have resulted in population declines and range reduction of freshwater biodiversity in the Basin as well as worldwide. While no native freshwater species are known to have become extinct, some (for example the Murray Hardyhead[48]) have come perilously close. To be successful the Basin Plan needs to address these key threatening processes.

The MDB is home to 16 Ramsar sites, 11 of which are Key Environmental Assets for the Basin Plan. Based on data provided by the MDBA, only one of the eleven (the Curranwinya Lakes on the Paroo) will retain its full Ramsar character under the BP-2800 scenario. A further two (Macquarie Marshes and Gwydir wetlands) will meet the targets set for them, but these targets allow for significant decline in condition. The other eight will suffer a clear decline in condition, some (for example Lake Albacutya) to the extent that their Ramsar status is seriously threatened. This situation is unacceptable and in b reach of Australia's international agreements.

Table 1. Changes to Ramsar status of MDB wetlands[49]

Name	State	BP Region	KEA	Ecological Targets met?
Naran Lakes	NSW	Condamine-Balonne	Y	NO
Gwydir wetlands	NSW	Gwydir	Y	YES but targets allow for decline
Macquarie Marshes	NSW	Macquarie-Castlereagh	Y	YES but targets allow for decline
Barmah	NSW - Vic	Murray	Y	NO
Gunbower	Vic-NSW	Murray	Y	NO
Hattah-Kulkyne	Vic	Murray	Y	NO
NSW Central Murray State Forests	NSW	Murray	Y	NO
Riverland (Chowilla)	SA	Murray	Y	NO
The Coorong & Lower Lakes	SA	Murray	Y	NO
Curranwinya Lakes	Qld	Paroo	Y	YES
Lake Albacutya	Vic	Wimmera-Avoca	Y	NO
Banrock Station Wetland Complex	SA	Murray	N	
Kerang Lakes	Vic	Murray	N	
Fivebough and Tuckerbil Swamps	NSW	Murrumbidgee	N	
Ginini Flats	ACT	Murrumbidgee	N	
Paroo wetlands	NSW	Paroo	N	

[47] Dudgeon et al (op cit), Ben Gawne MDFRC
[48] http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=56791, viewed 2/4/12
[49] Based on data in MDBA's ESLT and Hydrologic modeling reports

Recommendation

7.1. *The MDBA should provide enough water to Ramsar listed wetlands in the MDB to ensure that all ecological targets are met and that the targets are adequate to maintain and enhance the characteristics for which the sites were listed.*

8. Surface water SDLs for Victorian catchments

Since Environment Victoria conducted its original analysis of what the proposed SDLs would mean for Victoria's rivers, the MDBA has made more information available in its hydrologic modeling report[50] and its revised assessment of environmental water requirements[51]. The following comments draw on all these sources of information.

8.1. Goulburn River

The MDBA has set the following site specific flow indicators for the Lower Goulburn floodplain, using Shepparton as the compliance point[52]

Site-specific ecological targets	Site-specific flow indicators
Provide a flow regime which ensures the current extent of native vegetation of the riparian, floodplain and wetland communities is sustained in a healthy, dynamic and resilient condition	25,000 ML/d for a median duration of 5 days between June & November for 70% of years
Provide a flow regime which supports the habitat requirements of waterbirds and is conducive to successful breeding of waterbirds Provide a flow regime which supports recruitment opportunities for a range of native aquatic species (e.g. fish, frogs, turtles, invertebrates) Provide a flow regime which supports key ecosystem functions, particularly those related to connectivity between the river and the floodplain	40,000 ML/d for a median duration of 4 days between June & November for 40% of years

These objectives are at the lowest end of the range provided in their source document from the Victorian Department of Sustainability and Environment[53], which in turn contained significant reductions form the original FLOWS study conducted in 2003.

[50] MDBA (2012a) Hydrologic modelling to inform the proposed Basin Plan: methods and results
[51] MDBA (2012b) Assessment of environmental water requirements for the proposed Basin Plan
[52] MDBA (2012) Assessment of environmental watering requirements for the proposed Basin Plan: Lower Goulburn Floodplain
[53] DSE (2011) Overbank flow recommendations for the Lower Goulburn River

Table 6: Primary overbank flow recommendations

Period	Component	Magnitude	Frequency (mean number of event years per 10 years)			Median duration	Maximum period between events
			Lower	Optimal	Upper		
Jun - Nov	Overbank	25,000 ML/d	7	8	10	5+ days	3 years
Jun - Nov	Overbank	40,000 ML/d	4	5	6	4+ days	5 years
Rates of rise and fall to follow both 2003 and 2007 recommendations. The 2003 recommendations are for the maximum rate of rise to be 135% and maximum rate of fall to be 85%, expressed as change in discharge (p50). The 2007 recommendations are for the maximum rate of rise to be limited to 2.70-3.60 metres in winter/spring, and maximum rate of fall to be limited to 1.75-2.70 metres in winter/spring (p88). Spell independence of 5 days as per 2007 recommendations (p86). The compliance point for the recommendations is the Shepparton gauge (number 405204).							

Table 7: Secondary overbank flow temporal distribution recommendations

Magnitude	Mean number of event years per 10 years			Mean number of events in an event year		Mean number of events per 10 years	
	Lower	Optimal	Upper	Lower	Upper	Optimal	Natural
25,000 ML/d	7	8	10	2	3	16 - 24	24
40,000 ML/d	4	5	6	1	2	5 - 10	16

It can be seen that the MDBA has selected not only the lower limit of frequency (rated as high uncertainty in the MDBA's estimation) but also of duration for both flow indicators. Nor does the MDBA meet the secondary overbank temporal characteristics identified by DSE. The maximum interval between 40,000 ML/day events remains obstinately stuck at 12.7 years instead of the desired 5 years for reasons that the MDBA can not explain[54]. An inadequate water recovery target may be the problem.

In addition, the MDBA has not adopted the requirement for 60,000 ML/day identified by Cottingham et al in their 2003 environmental flows study[55] and reiterated as 55,000 ML/day in their 2007 review[56]. The MDBA's justification is that the increased flows provide only incremental benefits for floodplain vegetation, based on data provided by DSE. In their 2011 report, DSE identifies 10 wetland Ecological Vegetation Classes (EVCs) and 11 floodplain EVCs on the Lower Goulburn floodplain. They state that a 40,000 ML/day event inundates 89% of the EVCs that would be inundated by a 60,000ML/day event, and that a 40,000 ML/day event is therefore adequate[57]. This view is adopted by the MDBA.

However this calculation fails to take into account the conservation status of the EVCs. All of the 21 listed EVCs are threatened, with 11 classified as vulnerable and 4 as endangered. Given this

[54] MDBA (2012a) Hydrologic modelling report p 167
[55] Cottingham et al (2003) Environmental flow recommendations for the Goulburn River below Lake Eildon
[56] Cottingham et al (2007) Evaluation of summer inter-valley water transfers from the Goulburn River
[57] DSE (2011) p 23

status the conservation of the entire area of EVCs should be a priority of the MDBA and not just 89% of it. In addition the original recommendation made by Cottingham et al was to maintain floodplain connectivity and 'supply of terrestrial organic carbon suitable to support foodwebs along with sediments and nutrients to drive biogeochemical cycles comparable with unregulated conditions'[58]. In other words 60,000 ML/day were designed to protect the ecosystem processes described in the Water Act.

Recommendation

8.1.1. *The MDBA increases the site-specific flow indicators for the lower Goulburn to their optimal values (25,000ML/day for 5+ days at least 8 years out of 10 with a maximal period between events of 3 years and a mean number of at least 2 events per year; and 40,000 ML/day for 4+ days at least 5 years out of 10 for 4+ days with a maximal period between events of 5 years) and includes a flow indicator of at least 55,000 ML/day at a frequency to complete ecosystem processes, possibly 2 years in 10. The Goulburn model should be re-run to work out how much water is required to meet these targets.*

Constraints in the Goulburn

There has been much discussion of the effect of constraints on the delivery of environmental flows and the example most frequently given in Victoria is that delivery of flows for the Lower Goulburn floodplain will result in the flooding of Shepparton. However the MDBA states that 'Analysis undertaken by the Victorian Department of Sustainability and Environment (2011) found that flows up to 40,000 ML/d at Shepparton are achievable within existing physical constraints'[59]. If this is the case all the targets set by MDBA could be met without flooding the town and the problem is illusory. The situation requires immediate clarification.

DSE has come up with a detailed set of proposals with a business plan for ameliorating constraints in the lower Goulburn floodplain to allow the delivery of up to 40,000ML/day.[60] These proposals should be prioritised for implementation.

Recommendation

8.1.2. *The status of physical constraints at Shepparton should be assessed immediately and any necessary action to deliver flows of up to 40,000ML/day taken. The actions identified to allow delivery of up to 40,000 ML/day to the lower Goulburn floodplain should also be urgently prioritised.*

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[58] Cottingham et al (2007) op cit

[59] ESLT report p50

[60] DSE (2010) *Priority works to increase the effectiveness and efficiency of environmental water delivery in northern Victoria*

8.2. Campaspe River

The MDBA has not undertaken any independent modelling to verify and validate that the proposed in-valley SDL is sufficient to restore ecologically significant components of the flow regime[61]. Instead it has relied on water recovery targets set through the Victorian government's Northern Region Sustainable Water Strategy (NRSWS).

The approach to environmental water requirements taken in the NRSWS has some fundamental flaws[62]. It was based on a category of environmental outcome approach and moved away from the FLOWS methodology previously employed in Victorian river health planning. For the Campaspe, the NRSWS selected a category 4 outcome under baseline conditions which became a category 2 outcome under a severe climate change scenario[63]. Category 4 is described as a 'working river' (not a healthy working river) and includes some bankfull components but no overbank, whereas category 2 is described as 'survival' and 'this type of flow is insufficient in the long term and would lead to a rapid and continued deterioration of river health and likely loss of many species at a local and regional level'[64].

To import these targets into the draft Plan without further assessment is unconscionable. The environmental flow study for the Campaspe recommends bankfull (up to 12,000 ML/day) and overbank (up to 14,000 ML/day) for reaches 2 and 3.[65] The overbank flows are to connect flood runners, aid River Red Gum regeneration, deliver organic material to the river and cue fish migration. They will not impact on nearby roads or farmland.

The FLOWS study does not recommend overbank flows for reach 4 downstream of the Campaspe siphon, as nearly all native vegetation has been cleared from this area. Ironically this is the reach through which extra water from the Goulburn can be routed via the Western Waranga Channel (WWC) which crosses the Campaspe at the siphon. It is this connection through the WWC which allows the MDBA to consider the Goulburn, Campaspe and Loddon as a single system in the implementation and reporting of SDLs. It makes no sense when the environmental objectives for reach 4 are so limited.

Recommendation

8.2. *The MDBA should abandon its reliance on the NRSWS for environmental objectives for the Campaspe. It should instead use the FLOWS study as a guide and set overbank objectives for reaches 2 and 3, and recalculate the in-valley SDL to accommodate these.*
The MDBA should treat the Goulburn, Campaspe and Loddon as separate SDL units for compliance purposes.

Constraints in the Campaspe: One of the capacity constraints identified by the MDBA is the need to deliver peak irrigation demand in summer downstream of Lake Eppalock. The closure of the Campaspe Irrigation District has removed this constraint, yet it is still included by the MDBA.

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[61] Hydrologic modelling report p 174
[62] Environment Victoria submission to the draft NRSWS (2008) http://environmentvictoria.org.au/sites/default/files/useruploads/EV_Draft_NRSWS_submission_dec08.pdf?phpMyAdmin=8%2CSW0pHXD5tewKNvRRFVgHetb%2Ca
[63] DSE (2009) *Northern Region Sustainable Water Strategy* p133
[64] NRSWS p 131.
[65] SKM (2006) *Campaspe River environmental FLOWS assessment*

8.3. Loddon River

The MDBA has treated the Loddon in a similar way to the Campaspe, again adopting inadequate water recovery targets from the NRSWS. The Loddon FLOWS study[66] identifies bankfull and overbank flow components for the mid reaches of the Loddon (eg 13,000 ML/day once every 3 years for reach 3b - Serpentine to Loddon weir) which are not implemented through the NRSWS or examined by MDBA.

The lower Loddon floodplain is much modified and with extensive levee banks. High rainfall in January 2011 caused extensive flooding and water was trapped in low lying areas for months. This has lead to a Victorian government land purchase program to create an active floodplain and mitigate future flood impacts. This program is not currently seen as a river restoration project but could be designed that way to create environmental benefits, especially if the restored floodplain is used for carbon sequestration. It's in danger of being another opportunity let slip by the MDBA.

The Kerang Lakes are a Ramsar listed wetland of international importance. Over 150 species of native plants have been recorded from at the site, including the threatened Chariot Wheels, River Swamp Wallaby-grass, and the Slender Darling-pea. In addition, over 100 species of native fauna have been recorded, of which 31 are protected under international migratory bird agreements and treaties. Six nationally threatened species, the Australian Painted Snipe, Plains-wanderer, Regent Parrot, Murray Cod, Murray Hardyhead, and Macquarie Perch, are also recorded at the site[67]. It is a really important refuge site for waterbirds.

Yet there is no discussion anywhere that Environment Victoria can find in the extensive MDBA documentation of the water needs of the Lakes. While they have been heavily modified to meet the water storage requirements of downstream irrigators, there is no assessment of whether current arrangements are sustainable or what the long term consequences are for waterbirds or the condition of the Ramsar site. This points to another failure of the MDBA to meet the requirements of the Water Act to 'give effect to international agreements' – the Kerang lakes seem to be the forgotten Ramsar site.

The Loddon River has been much abused and is subject to many operational constraints. Key constraints are the low outlet capacity at Cairn Curran and Tullaroop reservoirs, and 'the Chute' (a concrete pipe that controls flow through an embankment built across the River which restricts flows in the lower Loddon to 250 ML/day). The MDBA does not provide any discussion of how these might be dealt with to allow improvements in environmental condition.

One further complication is the connection between ground and surface water in the Loddon catchment. The CSIRO Sustainable Yields project expects groundwater use to double in the Loddon catchment to 59 GL/year by 2030, and that this will create an average reduction in stream flows of 17GL /year[68]. This exceeds the water recovery target of 12 GL/year for the Loddon so all benefit from the in-valley SDL will be lost to increased ground water extraction.

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[66] Loddon River Environmental Flows Scientific Panel (2002) *Environmental Flow Determination of the Loddon River catchment*

[67] ESLT report p140

[68] Water Availability in the Loddon-Avoca. A report to the Australian Government from the CSIRO Murray-Darling Sustainable Yields Project. (2008).

Overall, the outlook for the Loddon is very poor if the proposed in-valley SDL is adopted. The MDBA suggests that delivery efficiency is low if more water is recovered in the Loddon to meet downstream needs, and that most of the extra recovered water would remain in the catchment[69]. This suggests to Environment Victoria that in-catchment needs are not being met and that the in-valley SDL target is not high enough.

Recommendation

8.3. T*he MDBA should abandon its reliance on the NRSWS for environmental objectives for the Loddon. It should instead use the Loddon FLOWS study as a guide and set overbank objectives for reach 3. It should also take into account connection between ground and surface water and the needs of the Kerang Lakes, and then recalculate the in-valley SDL to accommodate these.*

8.4. Ovens River

The MDBA has not set an in-valley SDL for the Ovens River, suggesting only that it may make a contribution to the downstream component. This is despite the fact that the Ovens is listed as a Heritage River and that the lower Ovens floodplain has recently been declared a national park. The scientific panel that carried out the FLOWS study recommended that 'the natural frequency and duration of bankfull and overbank flows be maintained in the future'[70].

The Ovens River supports significant, healthy populations of Murray cod, golden perch and Murray crayfish. These are likely to be important at a regional scale as source populations for other locations in the region, including Lake Mulwala, and the Murray River between Lake Hume and Lake Mulwala. If this is the case, then the loss of species from the Ovens River may have implications for regional diversity. The availability of diverse, high quality river-floodplain habitat in the lower Ovens provides opportunities for conservation or recovery of endangered or threatened species (e.g. trout cod). Once established, Ovens River based populations may provide a basis for more widespread recovery of threatened or endangered species.

The Ovens River also provides a unique combination of a flooding flow regime and a forested floodplain. As a consequence, floods down the Ovens River export a large amount of organic carbon and nutrients downstream, to Lake Mulwala and eventually into the main channel of the Murray River. There is mounting evidence to suggest that the Murray River is carbon limited and that the addition of floodplain derived organic matter will stimulate productivity downstream. This would imply that the health and productivity of Lake Mulwala and the Murray River downstream are strongly influenced by both flow and catchment management in the Ovens valley[71].

The MDBA does not take any of this into account and it has not set any objectives for the Ovens. The river hardly rates a mention in the ESLT report.

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[69] Modelling report p 175

[70] Cottingham P. Gawne B. Gigney H., Koehn J., Roberts J. Stewardson M. and Vietz G. (2008). Lower Ovens Environmental Flows Project: Environmental flow recommendations. Report prepared for the North Eastern Catchment Management Authority

[71] Cottingham et al (2008) op cit p22

The Upper Ovens is highly connected to groundwater and is the site of the Victorian government's first integrated water management plan. This plan treats the water resource in the area as a single entity and is a model for future management plans for areas of high connectivity. It is not perfect – for example, the low flow trigger points are inadequate to properly protect the river- but it makes a real attempt to manage the resource as a whole.

The National Water Commission is supporting work in the Lower Ovens to establish the degree of connectivity between ground and surface water there and if an increase in groundwater use would have any impact on stream flows and GDEs[72]. This is the kind of detailed assessment that is required before any increase in ground water extraction can be contemplated.

Recommendation

8.4. *The MDBA establishes objectives for the Ovens River based on the FLOWS study and calculates the ESLT required to meet them.*

8.5. Kiewa River

Like the Ovens, the Kiewa River is largely ignored by the MDBA and no in-valley SDL has been set. The Kiewa FLOWS study states that 'Overall the preliminary compliance calculations for the flow recommendations indicate that the current flow regime on the main stem of the Kiewa River may already provide for the environmental assets that are dependent on low flows, high flows and the smaller fresh events. However, the environmental assets dependent on the occurrence of larger freshes, bankfull and overbank events may, particularly in the upstream reaches, be impacted under the current flow regime'.[73]

Recommendation

8.5. *The MDBA establishes objectives for the Kiewa based on the FLOWS study and calculates the ESLT required to meet them.*

8.6. Victorian Murray

Current diversions from the Murray in Victoria are 1,707 GL/yr, which the MDBA proposes reducing by 253 GL/yr to meet in-catchment environmental needs. Further reduction is likely after 2015 when downstream needs are taken into account.

The MDBA has developed a series of water requirements for the Ramsar wetlands and a number of ecological targets including

- 'protect flood-dependent vegetation considered essential to support crucial habitat for identified flora and fauna;
- sustain in-channel and wetland process that ensure reproduction, regeneration, dispersal, immigration and emigration of identified flora and fauna;

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[72] http://nwc.gov.au/rnws/groundwater-projects/strategic-aquifer-characterisation-to-quantify-sustainable-yields/lower-ovens-river-catchment-water-resource-assessment viewed 13/4/12

[73] EarthTech (2008) Environmental Flow Determination for the Kiewa

- protect key in-stream drought refuges; and
- maintain appropriate wetting/drying cycles in floodplain billabongs and wetlands'[74]

The volume of water should meet the targets for instream and near channel habitats, but by the MDBA's own admission 'Outcomes for floodplain vegetation communities, wetlands and habitats are mixed depending on their location on the floodplain and spatial location within the Murray region'[75] Many parts of the mid and upper floodplain will not receive environmental water, particularly in the lower Murray downstream of Euston, which includes the Ramsar listed Hattah Lakes[76] and Lindsay Walpolla. The main reason given is the operational constraints, in particular flow restrictions between Hume Dam and Yarrawonga. Flows in this section of the river are limited to 25,000 ML/day specifically to prevent overbank flooding. Since overbank flooding is essential to maintain the condition of the Ramsar sites, as required by the Water Act, citing this constraint as a reason for not providing it is particularly invidious.

AS discussed in section 5, resolving constraints is the key to environmental water delivery to floodplain assets in the lower Murray. Failure to deal with them will result in the loss of most of the black box forests (and much of the red gum) on the upper floodplain and all the benefits they bring as identified in the CSIRO benefits report. It will also disrupt the ecosystem processes that are essential to a healthy functioning river, or even a healthy working river.

Recommendation

8.6. *The MDBA should evaluate and prioritise constraints to the delivery of environmental water to the lower Murray floodplain, especially the Ramsar sites, and insist that the appropriate authorities deal with them to allow the Ramsar condition of the sites to be maintained. Once the constraints have been unlocked, the SDLs should be adjusted to allow all the ecological objectives to be met.*

8.7. Wimmera River

The MDBA has set a number of objectives for the Wimmera system, including filling and maintaining Lake Hindmarsh (378 GL) for 3 consecutive years duration at an average recurrence interval of 20 years, and filling and maintaining Lake Albacutya (230 GL) for 2 years at an average recurrence interval of 20 years. While the water recovery proposed will reduce the maximum intervals between filling events, it will not be enough to maintain the characteristics for which Lake Albacutya was listed under the Ramsar convention. The lakefull events will be too infrequent 'to support significant populations of waterbirds and significant waterbird breeding events which are fundamental to the ecological character of Lake Albacutya and its Ramsar listing as a wetland of international importance'[77] This abandonment of Ramsar condition is totally unacceptable.

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[74] ESLT report p 149
[75] ESLT report p150
[76] The Wentworth Group of Concerned Scientists give a full analysis of the consequences of the draft Plan for Hattah Lakes, see http://www.wentworthgroup.org/uploads/Wentworth%20Group%20Statement%20on%20the%202011%20Draft%20Murray-Darling%20Basin%20Plan.pdf
[77] MDBA (2011) ESLT report p144

The MDBA is proposing to recover 23 GL for in-catchment needs in the Wimmera. The principal source of this water would be through closure of the Wimmera Irrigation Area near Horsham and Murtoa. The MDBA makes an assumption that this is the only source of water available in the catchment and seems to be basing the proposed SDL on that. The irrigators are in fact offering to sell 28 GL which includes a loss entitlement.[78]

In fact there are other opportunities to acquire water in the catchment. The recently completed Wimmera-Mallee Pipeline Project has resulted in very significant water savings including an 18 GL environmental entitlement for the Wimmera and Glenelg Rivers held by the Victorian Environmental Water Holder. However this is not the end of the story for environmental water recovery through the WMPP project.

Since the business case was developed for the WMPP, many parameters have changed. Farming practices in the region are changing in response to drier conditions and many farmers are shifting from grazing to cropping. Thus stock watering requirements are reducing along with the declining sheep numbers and the original assumptions about stock and domestic demand may no longer be appropriate.[79] This means that the water previously set aside for future growth may not be needed as future developments will have the opportunity to meet their water needs by purchasing water form existing users. Opportunities for trade among users then opens up, including the possibility of water purchase for the environment by the Commonwealth and state governments. They may also be able to purchase water from the growth reserve for environmental purposes[80].

Recommendation

8.7*. The MDBA should set an SDL for the Wimmera River sufficient to meet its ecological objectives and maintain the Ramsar character of Lake Albacutya.*

9. Flushing salt from the system

The MDBA has estimated that on average 2 million tonnes of salt needs to be exported from the system to maintain water quality across the MDB. Given 70 per cent of this salt comes from Basin states upstream of South Australia[81], it is clearly a Basin-wide responsibility to provide enough water to facilitate this important ecosystem service and the shared reduction target or downstream component of the draft Plan[82] is essential to meet this need. The MDBA's own sensitivity testing and the Goyder Institute have both established that even the BP-3200 scenario does not provide enough water to achieve the salt flushing objective and will condemn the Coorong as a salt dumping ground for the system.

Recommendation

9.1 *The Basin Plan must provide enough water to keep the Murray Mouth open without the need for dredging and maintain salinity levels below critical thresholds in all years, including those of severe drought.*

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[78] DSE (2011) Western Region Sustainable Water Strategy p159
[79] DSE (2010) Draft Western Region Sustainable Water Strategy p 237
[80] DSE (2011) Western Region Sustainable Water Strategy p154
[81] MDBC (1999). The Salinity Audit of the Murray-Darling Basin. A 100 year perspective.
[82] Proposed Basin Plan cl6.05

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Modelled Ecological Outcomes of the Proposed Basin Plan Surface Water Sustainable Diversion Limits

Key

Target not achieved
Target achieved at high level of risk
Target achieved at low level of risk

Site	Flow Indicator and Ecological Target						
Lower Balonne Floodplain	(1) native fish	(2) riparian forest	(3) lignum shrublands & coolibah woodlands	(4) lignum shrublands & coolibah woodlands; river-floodplain connectivity	(5) native floodplain grasslands; river-floodplain connectivity		
Narran Lakes (Ramsar site)	(1) red gum, coolibah and lignum in Northern lakes	(2) lignum & river cooba at Clear Lake	(3) lignum, coolibah and grassland communities on broader floodplain	(4) colonial nesting waterbirds	(5) lignum stands on broader floodplain		
Lower Macintyre river	(1) native fish, in-stream habitat	(2) native fish, in-stream habitat	(3) native fish, in-stream habitat				
Gwydir Wetlands - Lower Gwydir & Gingham channel (Ramsar Site)	(1) native fish, frogs & turtles	(2) native fish, frogs & turtles	(3) wetlands; floodplain lignum, woodlands & grasslands	(4) wetlands; floodplain lignum, woodlands & grasslands	(5) wetlands; floodplain lignum, woodlands & grasslands	(6) wetlands, floodplain vegetation & colonial nesting waterbirds	(7) wetlands, floodplain vegetation & colonial nesting waterbirds
Gwydir Wetlands - Mallowa	(1) lignum; red gum & coolibah woodlands	(2) lignum; red gum & coolibah woodlands					
Namoi River	(1) anabranch vegetation, fish, in-stream habitat	(2) anabranch vegetation, native fish, in-stream habitat	(3) anabranch vegetation, native fish, in-stream habitat				
Macquarie Marshes (Ramsar Site)	(1) semi-permanent wetlands and red gum forest	(2) wetlands & red gum forest; colonial nesting waterbirds	(3) woodland communities; colonial nesting waterbirds	(4) woodland communities; colonial nesting waterbirds			
Barwon-Darling River	(1) Nutrient cycling	(2) Nutrient cycling	(3) Nutrient cycling	(4) In-stream habitat	(5) In-stream habitat	(6) In-stream habitat	
Talyawalka Anabranch (Darling River)	(1) billabongs & wetlands; red gum & black box woodlands; colonial nesting waterbirds	(2) billabongs & wetlands; red gum & black box woodlands; colonial nesting waterbirds	(3) billabongs & wetlands; red gum & black box woodlands; colonial nesting waterbirds				

Site	Flow Indicator and Ecological Target						
Booligal Wetlands	(1) semi-permanent & permanent wetlands	(2) red gum and lignum communities	(3) colonial nesting waterbirds				
Lachlan Swamp	(1) semi-permanent & permanent wetlands	(2) red gum and lignum communities	(3) black box woodlands	(4) colonial nesting waterbirds			
Great Cumbung Swamp	(1) semi-permanent & permanent wetlands	(2) red gum; floodplain wetlands; colonial nesting waterbirds	(3) red gum; floodplain wetlands; colonial nesting waterbirds				
Mid-Murrumbidgee Wetlands	(1) Colonial nesting waterbirds	(2) riparian, floodplain & wetland communities; fish, frogs & turtles	(3) riparian, floodplain & wetland communities; fish, frogs & turtles	(4) riparian, floodplain & wetland communities; fish, frogs & turtles	(5) riparian, floodplain & wetland communities; fish, frogs & turtles		
Lowbidgee Floodplain	(1) floodplain & wetland communities; colonial nesting waterbirds; fish, frogs & turtles	(2) floodplain & wetland communities; colonial nesting waterbirds; fish, frogs & turtles	(3) floodplain & wetland communities; colonial nesting waterbirds; fish, frogs & turtles	(4) floodplain & wetland communities; colonial nesting waterbirds; fish, frogs & turtles	(5) floodplain & wetland communities; colonial nesting waterbirds; fish, frogs & turtles	(6) floodplain & wetland communities; colonial nesting waterbirds; fish, frogs & turtles	
Lower Goulburn Floodplain	(1) fish, frogs & turtles	(2) fish, frogs & turtles	(3) riparian, floodplain & wetland communities; colonial nesting waterbirds; fish, frogs & turtles	(4) riparian, floodplain & wetland communities; colonial nesting waterbirds; fish, frogs & turtles			
Lake Hindmarsh	(1) red gum woodland & aquatic fauna	(2) red gum woodland; native fish; colonial nesting waterbirds	(3) red gum woodland; native fish; colonial nesting waterbirds				
Lake Albacutya (Ramsar Site)	(1) red gum & black box woodlands; waterbird foraging; aquatic herblands	(2) red gum & black box woodlands; waterbird breeding; aquatic herblands					
Barmah-Millewa (Ramsar Site)	(1) freshwater meadows & marshes; moira grass plains; red gum forest	(2) freshwater meadows & marshes; moira grass plains; red gum forest	(3) freshwater meadows & marshes; moira grass plains; red gum forest	(4) red gum forest & woodland; black box woodland	(5) red gum forest & woodland; black box woodland	(6) red gum forest & woodland; black box woodland	(7) colonial nesting waterbirds
Gunbower-Koondrook-Pericoota (Ramsar Site)	(1) permanent & semi-permanent wetlands	(2) permanent & semi-permanent wetlands	(3) red gum forest & woodland; black box woodland	(4) red gum forest & woodland; black box woodland	(5) colonial nesting waterbirds		

Site	Flow Indicator and Ecological Target						
Hattah Lakes (Ramsar Site)	(1) permanent, persistent & semi-permanent wetlands	(2) permanent, persistent & semi-permanent wetlands	(3) permanent, persistent & semi-permanent wetlands	(4) red gum forest	(5) red gum woodland	(6) episodic wetlands & black box woodland	
Riverland-Chowilla (Ramsar Site)	(1) native fish	(2) wetlands & red gum forest	(3) wetlands & red gum forest	(4) wetlands & red gum forest	(5) red gum forest & woodland	(6) black box woodland	(7) black box woodland
Edward-Wakool (inc. Werai Ramsar Site)	(1) native fish	(2) reed beds & low-lying wetlands in Werai Forest	(3) colonial nesting waterbirds in Werai Forest	(4) ephemeral wetlands & watercourses; red gum forest & woodland	(5) ephemeral wetlands & watercourses; black box woodland		
Lower Darling River	(1) threatened ecological communities in Darling Anabranch	(2) Darling Anabranch floodplains & lakes; Lower Darling wetlands & waterbirds	(3) Darling Anabranch floodplains & lakes; Lower Darling wetlands & waterbirds	(4) in-stream habitat, native fish & riparian wetlands in Lower Darling	(5) red gum & higher level wetlands in Lower Darling		
Coorong, Lower Lakes & Murray Mouth (Ramsar Site)	(1) Southern Coorong average salinity	(2) Southern Coorong maximum salinity	(3) Southern Coorong maximum salinity	(4) Southern Coorong maximum salinity	(5) Northern Coorong average salinity	(6) Northern Coorong maximum salinity	(7) Northern Coorong maximum salinity
	(8) Barrage flow	(9) Barrage flow					

Basin Plan Groundwater Diversion Limits: Comparing the "Guide" and the Proposed Basin Plan

		Guide					Proposed Basin Plan				Change: Guide to PBP			
Guide category	SDL unit name	BDL	use	SDL	change from BDL (GL)	change from BDL (%)	BDL_	SDL_	change from BDL (GL)_	change from BDL (%)_	BDL (GL)	BDL (%)	SDL (GL)	SDL (%)
1	Angas Bremer	6.5	6.7	4	-2.5	-38%	6.57	8.75	2.18	33%	0.07	1%	4.75	119%
1	Lake George Alluvium	1.1	1.1	0.75	-0.35	-32%	1.3	1.3	0	0%	0.2	18%	0.55	73%
1	Lower Lachlan Alluvium	108	117.9	64.8	-43.2	-40%	123.4	117	-6.4	-5%	15.4	14%	52.2	81%
1	Lower Namoi Alluvium	86	99.4	75	-11	-13%	88.3	88.3	0	0%	2.3	3%	13.3	18%
1	Upper Lachlan Alluvium	77.1	77.1	63	-14.1	-18%	94.1	94.1	0	0%	17	22%	31.1	49%
1	Upper Condamine Alluvium	117.1	117.1	76.8	-40.3	-34%	126.9	86.5	-40.4	-32%	9.8	8%	9.7	13%
1	Upper Condamine Basalts	76.1	76.1	61.1	-15	-20%	79	79	0	0%	2.9	4%	17.9	29%
2	Lower Macquarie Alluvium	69.3	41.9	41.9	-27.4	-40%	70.7	70.7	0	0%	1.4	2%	28.8	69%
2	Peel Valley Alluvium	9.3	7.3	7.3	-2	-22%	9.34	9.34	0	0%	0.04	0%	2.04	28%
2	Upper Namoi Alluvium	122.1	95	95	-27.1	-22%	123.4	123.4	0	0%	1.3	1%	28.4	30%
2	Australian Capital Territory (Groundwater)	7.25	0.5	4.4	-2.85	-39%	1.7	7.25	5.55	326%	-5.55	-77%	2.85	65%
3	Lower Gwydir Alluvium	32.3	32.3	32.3	0	0%	32.9	32.9	0	0%	0.6	2%	0.6	2%
3	Mallee	63.4	40.8	63.4	0	0%	65.7	150.5	84.8	129%	2.3	4%	87.1	137%
3	Lower Murray Alluvium (Shallow; Shepparton formati	40	40	40	0	0%	81.9	81.9	0	0%	41.9	105%	41.9	105%
3	Lower Murray Alluvium (Deep; Renmark Group and (	83.7	86.3	83.7	0	0%	88.8	88.8	0	0%	5.1	6%	5.1	6%
3	Lower Murrumbidgee Alluvium	280	303.7	280	0	0%	300.5	300.5	0	0%	20.5	7%	20.5	7%
3	Marne Saunders	4.7	2.5	4.7	0	0%	4.97	4.97	0	0%	0.27	6%	0.27	6%
3	Peake-Roby-Sherlock	5.2	1.7	5.2	0	0%	5.99	5.99	0	0%	0.79	15%	0.79	15%
4	Bell Valley Alluvium	2.2	2.2	2.2	0	0%	2.21	2.21	0	0%	0.01	0%	0.01	0%
4	Belubula Alluvium	1.9	1.9	1.9	0	0%	2.9	2.9	0	0%	1	53%	1	53%
4	Castlereagh Alluvium	0.4	0.4	0.4	0	0%	0.63	0.63	0	0%	0.23	58%	0.23	58%
4	Collaburragundry-Talbragar Alluvium	3.7	3.7	3.7	0	0%	2.76	2.76	0	0%	-0.94	-25%	-0.94	-25%
4	Cudgegong Alluvium	1.6	1.6	1.6	0	0%	2.54	2.54	0	0%	0.94	59%	0.94	59%
4	Eastern Porous Rock: Namoi-Gwydir	10.3	10.3	10.3	0	0%	15.5	15.5	0	0%	5.2	50%	5.2	50%
4	Manilla Alluvium	1.9	1.9	1.9	0	0%	0.42	0.42	0	0%	-1.48	-78%	-1.48	-78%
4	Mid-Murrumbidgee Alluvium	44	44	44	0	0%	48.1	48.1	0	0%	4.1	9%	4.1	9%
4	NSW Border Rivers Alluvium	6.6	6.6	6.6	0	0%	8.39	8.39	0	0%	1.79	27%	1.79	27%
4	NSW Border Rivers Tributary Alluvium	0.5	0.5	0.5	0	0%	1.73	1.73	0	0%	1.23	246%	1.23	246%
4	Upper Gwydir Alluvium	0.8	0.8	0.8	0	0%	0.72	0.72	0	0%	-0.08	-10%	-0.08	-10%
4	Upper Macquarie Alluvium	13.7	13.7	13.7	0	0%	18	18	0	0%	4.3	31%	4.3	31%
4	Upper Murray Alluvium	11	11	11	0	0%	14.1	14.1	0	0%	3.1	28%	3.1	28%
4	Upper Namoi Tributary Alluvium	2	2	2	0	0%	0.37	0.37	0	0%	-1.63	-82%	-1.63	-82%
4	Young Granite	4.3	4.3	4.3	0	0%	7.09	7.09	0	0%	2.79	65%	2.79	65%
4	Queensland Border Rivers Alluvium	13.4	13.4	13.4	0	0%	13.8	13.8	0	0%	0.4	3%	0.4	3%

Basin Plan Groundwater Diversion Limits: Comparing the "Guide" and the Proposed Basin Plan

		Guide					Proposed Basin Plan				Change: Guide to PBP			
Guide category	SDL unit name	BDL	use	SDL	change from BDL (GL)	change from BDL (%)	BDL_	SDL_	change from BDL (GL)_	change from BDL (%)_	BDL (GL)	BDL (%)	SDL (GL)	SDL (%)
4	Loddon-Campaspe Highlands	9.4	9.4	9.4	0	0%	13	16.8	3.8	29%	3.6	38%	7.4	79%
4	Ovens-Kiewa Sedimentary Plains	14.7	14.7	14.7	0	0%	28.5	30.5	2	7%	13.8	94%	15.8	107%
5	Lachlan Fold Belt: Lachlan	23.1	23.1	23.1	0	0%	36.9	123.6	86.7	235%	13.8	60%	100.5	435%
5	Lachlan Fold Belt: Murray	5.1	5.1	5.1	0	0%	14.3	31.9	17.6	123%	9.2	180%	26.8	525%
5	Lachlan Fold Belt: Murrumbidgee	30.9	30.9	30.9	0	0%	26.3	133.4	107.1	407%	-4.6	-15%	102.5	332%
5	Eastern Porous Rock: Macquarie Castlereagh	5.2	5.2	5.2	0	0%	6.2	13.4	7.2	116%	1	19%	8.2	158%
5	Inverell Basalt	2.9	2.9	2.9	0	0%	4.15	4.15	0	0%	1.25	43%	1.25	43%
5	Lachlan Fold Belt: Macquarie-Castlereagh	47.7	47.7	47.7	0	0%	51.2	89.3	38.1	74%	3.5	7%	41.6	87%
5	Liverpool Ranges Basalt	2.7	2.7	2.7	0	0%	2.16	2.16	0	0%	-0.54	-20%	-0.54	-20%
5	New England Fold Belt: Border Rivers	3.4	3.4	3.4	0	0%	6.31	15.3	8.99	142%	2.91	86%	11.9	350%
5	New England Fold Belt: Gwydir	4.1	4.1	4.1	0	0%	6.45	22.2	15.75	244%	2.35	57%	18.1	441%
5	New England Fold Belt: Namoi	15.6	15.6	15.6	0	0%	18.3	39.4	21.1	115%	2.7	17%	23.8	153%
5	Condamine Fractured Rock	2.1	2.1	2.1	0	0%	0.81	2.14	1.33	164%	-1.29	-61%	0.04	2%
5	Queensland Border Rivers Fractured Rock	6.8	6.8	6.8	0	0%	10.1	11	0.9	9%	3.3	49%	4.2	62%
5	Goulburn-Broken Highlands	9.8	9.8	9.8	0	0%	15.2	35.8	20.6	136%	5.4	55%	26	265%
5	Murray Highlands	4.4	4.4	4.4	0	0%	5.44	5.44	0	0%	1.04	24%	1.04	24%
5	Ovens Highlands	3.2	3.2	3.2	0	0%	4.67	4.67	0	0%	1.47	46%	1.47	46%
5	Wimmera-Avoca Highlands	0.2	0.2	0.2	0	0%	1.26	3.02	1.76	140%	1.06	530%	2.82	1410%
6	Adelaide Fold Belt	3	3	3.3	0.3	10%	3.61	5.25	1.64	45%	0.61	20%	1.95	59%
6	Billabong Creek Alluvium	2	2	6.1	4.1	205%	7.5	7.5	0	0%	5.5	275%	1.4	23%
6	Eastern Mount Lofty Ranges	19.3	19.3	33.5	14.2	74%	34.7	38.5	3.8	11%	15.4	80%	5	15%
6	Kanmantoo Fold Belt	8.2	8.2	27.5	19.3	235%	8.91	28.5	19.59	220%	0.71	9%	1	4%
6	Lachlan Fold Belt: Western	1.2	1.2	13	11.8	983%	13.7	230.6	216.9	1583%	12.5	1042%	217.6	1674%
6	Lower Darling Alluvium	1.4	1.4	1.9	0.5	36%	1.78	1.78	0	0%	0.38	27%	-0.12	-6%
6	NSW Alluvium above the GAB	1.2	1.2	29	27.8	2317%	1.28	22.5	21.22	1658%	0.08	7%	-6.5	-22%
6	NSW Sediments above the GAB	1	1	46	45	4500%	0.92	80	79.08	8596%	-0.08	-8%	34	74%
6	Orange Basalt	6.9	6.9	24	17.1	248%	10.7	10.7	0	0%	3.8	55%	-13.3	-55%
6	Upper Darling Alluvium	2.4	2.4	4.8	2.4	100%	6.72	7.1	0.38	6%	4.32	180%	2.3	48%
6	Warrumbungle Basalt	0.5	0.5	0.6	0.1	20%	0.55	0.55	0	0%	0.05	10%	-0.05	-8%
6	Western Porous Rock	29.3	29.3	71	41.7	142%	48.7	225.9	177.2	364%	19.4	66%	154.9	218%
6	SA Murray (Groundwater)	1.8	1.8	19	17.2	956%	1.8	127.8	126	7000%	0	0%	108.8	573%
6	Sediments above GAB: Border Rivers	0.1	0.1	42	41.9	41900%	0.04	28.7	28.66	71650%	-0.06	-60%	-13.3	-32%
6	Sediments above GAB: Condamine-Balonne	0.3	0.3	5	4.7	1567%	0.66	35.6	34.94	5294%	0.36	120%	30.6	612%
6	Sediments above GAB: Moonie	0.5	0.5	9	8.5	1700%	0.1	64.9	64.8	64800%	-0.4	-80%	55.9	621%

Basin Plan Groundwater Diversion Limits: Comparing the "Guide" and the Proposed Basin Plan

		Guide					Proposed Basin Plan				Change: Guide to PBP			
Guide category	SDL unit name	BDL	use	SDL	change from BDL (GL)	change from BDL (%)	BDL_	SDL_	change from BDL (GL)_	change from BDL (%)_	BDL (GL)	BDL (%)	SDL (GL)	SDL (%)
6	Sediments above GAB: Warrego, Paroo, Nebine	1.1	1.1	25.4	24.3	2209%	1.21	197.1	195.89	16189%	0.11	10%	171.7	676%
6	St George Alluvium: Condamine-Balonne (shallow)	2.5	2.5	40	37.5	1500%	0.77	54.6	53.83	6991%	-1.73	-69%	14.6	37%
6	St George Alluvium: Condamine-Balonne (deep)	7.5	7.5	12.6	5.1	68%	12.6	12.6	0	0%	5.1	68%	0	0%
6	St George Alluvium: Moonie	0.5	0.5	1.7	1.2	240%	0.01	1.37	1.36	13600%	-0.49	-98%	-0.33	-19%
6	St George Alluvium: Warrego, Paroo, Nebine	0.3	0.3	6.5	6.2	2067%	0.12	49.1	48.98	40817%	-0.18	-60%	42.6	655%
6	Warrego Alluvium	0.7	0.7	26.6	25.9	3700%	0.7	19.8	19.1	2729%	0	0%	-6.8	-26%
6	SA Murray Salt Interception Schemes	11.1	11.1	28	16.9	152%	11.1	28.6	17.5	158%	0	0%	0.6	2%
6	GM: Victorian Riverine Sedimentary Plains (shallow;	83.3	83.3	85	1.7	2%	244.1	244.1	0	0%	160.8	193%	159.1	187%
6	GM: Victorian Riverine Sedimentary Plains (deep; Ca	89.6	89.6	127	37.4	42%	175	127	-48	-27%	85.4	95%	0	0%
6	WM:West Wimmera (Loxton Parilla Sands)	0	0	12	12	absolute i	0	22.1	22.1	absolute i	0	absolute	10.1	84%
6	WM:West Wimmera (Murray Group Limestone)	1.9	1.9	25.5	23.6	1242%	25.5	25.5	0	0%	23.6	1242%	0	0%
6	WM:West Wimmera (Tertiary Confined Sands Aquife	0.8	0.8	4	3.2	400%	4	4	0	0%	3.2	400%	0	0%
6	WMBZ (Loxton Parilla Sands)	0	0	9.7	9.7	absolute i	0	9.37	9.37	absolute i	0	absolute	-0.33	-3%
6	WMBZ (Murray Group Limestone & Tertiary Confined	8.8	8.8	15.2	6.4	73%	15.2	15.2	0	0%	6.4	73%	0	0%
6	WM: Wimmera-Mallee Sedimentary Plain	0.6	0.6	27	26.4	4400%	24.2	236.2	212	876%	23.6	3933%	209.2	775%
na	Gunnedah Oxley Basin	na	na	na	na	na	0	300	300	absolute i	na	na	300	absolute
na	Oaklands Basin	na	na	na	na	na	0	2.5	2.5	absolute i	na	na	2.5	absolute
	Total	**1786.6**	**1744.8**	**2095**	**308.3**		**2352.16**	**4339.7**	**1987.5**		**565.6**		**2244.8**	

Guide categories

1 Reduction in current diversion limit and use

2 Reduction in current diversion limits, but not in use "provided that additional surface-water losses are accounted for"

3 Cap at current diversion limit

4 Cap at current use (no current limit). "considered to be highly connected to surface water...additional groundwater take would further reduce surface-water streamflow"

5 Cap at current use with trade offset (no current limit). "also highly connected to surface water."

6 Growth allowed - unassigned water

(see Guide Technical Background pp167-171)