November 2008

Submission to the Senate Inquiry into the *Water Amendment Bill 2008*

Introduction

ACF welcomes the opportunity to comment on the *Water Amendment Bill 2008* which is intended to give effect to the Intergovernmental Agreement on Murray-Darling Basin Reform (the IGA) signed by First Ministers at the 3 July 2008 COAG meeting. The proposed changes seek to improve the prospects of achieving environmentally sustainable water reform across the Basin by streamlining leadership, governance and investment in the reform process, improving ecological outcomes through better implementing international commitments including the Ramsar Convention and related agreements and introducing scientifically credible extraction limits and environmental flow regime plans.

ACF considers that the amendments to the *Water Act 2007* should, however, go much further than set out in the current *Water Amendment Bill 2008* and the IGA on reform. There remain outstanding areas of concern, some of which were the subject of our submission to the earlier Inquiry that preceded the *Water Bill 2007* last year. The following key areas require further attention before the *Water Amendment Bill 2008* is passed.

Independence of the Murray-Darling Basin Authority (MDBA) and governance arrangements

ACF supports bringing the MDBC and the MDBA together as a single institution but remains concerned about the extent to which the Authority might be subject to Ministerial interference in relation to the Basin Plan – as per section 44(3)(ii) for example where the Commonwealth Minister can direct the MDBA to make changes to the Basin Plan – and to governance issues that prevent it from adopting sufficiently strong measures of the scale and timeframe required to match the magnitude of the problems facing the MDB. We have very similar concerns about the Basin Officials Committee (BOC) which will replace the existing Commission and smaller Ministerial Council.

ACF has previously referred to the analysis and recommendations put forward by a previous MDB Commissioner, John Scanlon, *inter alia* in his publication '*A hundred years of negotiations with*

no end in sight: Where is the Murray Darling Basin Initiative leading us?'[1] His experience over two terms as a MDB Commissioner led him to conclude that meaningful reform was not possible under existing governance arrangements, not least because Ministers and Commissioners would inevitably advocate parochial standpoints and because their pursuit of immediate, jurisdictional interests render them unable to make and implement decisions in the long-term interests of the Basin as a whole. He observed that unanimous voting arrangements at both Ministerial Council and Commission level resulted in lowest common denominator advice and decision-making and consequently, the comprehensive failure to deal adequately with the challenges facing the MDB that has resulted in the current crisis. His recommendations for governance reform include:

- Establish an independent, skills-based Commission with voting powers supported by heads of government agencies from each jurisdiction with ex officio, non-voting member status; and
- Abolish unanimous voting requirements at Ministerial Council and Commission level and replacing it with majority or qualified majority voting.

Whilst the new members of the MDA Authority will comprise skills-based individuals, the Basin Officials Committee, which effectively replaces the existing MDB Commission and advises the Ministerial Council, will continue to comprise heads of department with unanimous voting arrangements, as will the new Ministerial Council. The major governance change to these bodies is the reduction in jurisdictional representation from 2 or 3 to 1 only. This arrangement will fail to deliver frank and fearless advice and decisions by these bodies, which remain responsible for many parts of the MDB outside developing the Basin Plan.

Also, the Ministerial Council retains an "advisory role in relation to the Basin Plan"[2] and although neither the MDBA nor the Commonwealth Minister are obliged to act on the advice it is likely to be influential and efforts will be made to accommodate their advice in the Basin Plan.

Whilst the proposed governance arrangements for the Basin Plan whereby the MDBA is not obliged to accept the Commonwealth Minister's recommendations and if the Minister does not adopt the Basin Plan as put forward by the MDBA the reasons for doing so must be tabled in Parliament, are a vast improvement over current arrangements, they would be greatly improved by providing the Authority with freedom from all political interference in making the Plan, perhaps establishing the Authority along the same lines as the Reserve Bank of Australia. The Authority should develop the Basin Plan on the basis of best-available science and not the Minster's view. Clauses 38 and 62 that create exceptions to the Basin plan and confer the ability of the Minister to direct the MDBA to make changes to the Basin plan should be deleted from the *Water Amendment Bill 2008*.

Further amendment to the *Bill* is also required to explicitly set out how the new Ministerial Council, BOC and the MDBA will work together to ensure that existing statutory water shares will be integrated into the Basin Plan to meet the sustainable diversion limits and e-watering plans.

[1] Scanlon, J. (2006). A hundred years of negotiations with no end in sight: Where is the Murray Darling Basin Initiative leading us? 23 EPLJ 1. Lawbook Co.
[2] COAG Agreement on Murray-Darling Basin Reform, 03.07.08

The passage of this Bill through parliament provides an opportunity to clarify ambiguity around whether or not the states retain a veto on the use of water obtained by the Commonwealth Government for environmental flow. If this is the case any such provisions should be abolished.

Definition of critical human needs

ACF welcomes the hitherto absent definition of critical human needs (section 86A[2]) but it needs to go further and provide criteria that would need to be met – both scientific and economic – before providing a non-human consumption allocation of water under the banner of critical human needs. Would it be possible, for example, under the current wording in the *Bill* to successfully argue that spray irrigation of a golf course that contributes to the socio-economic fabric of a regional area meets the definition of critical human needs?

Water that keeps the entire river system functioning should be the first priority need and arguably therefore, the estuary through which salt and other pollutants are flushed from the system, contributes towards critical human needs and therefore an environmental allocation that sustains the Lower Lakes, the Coorong and the integrity of the estuary should be a first priority need.

Also, the amendments essentially ignore the aspirations of Indigenous Australians to access and use cultural water.

This entire section requires further discussion and thought before the *Amendment Bill 2008* is passed.

Increased role for the ACCC

ACF welcomes the increased role of the ACCC in improving water markets *inter alia,* not least because water markets and market based instruments (MBIs) for water reallocation are key tools in addressing overextraction. We are worried however that political nervousness has already caused the ACCC to miss opportunities to contribute expert analysis to the debate in a meaningful way. Specifically, in their July 2008 publication '*Water Market Rules, Position Paper'* the ACCC failed to present any analysis of the impact of the controversial 4% annual cap on trading water out of irrigation districts, commenting only that *"At its meeting on 3 July 2008 COAG stated its ambition to increase the cap on the trade of water entitlements out of districts from four to six per cent. The water market rules should accommodate the outcomes of this agreement"* and recommending therefore that *"operators should be permitted to impose a cap on permanent trade out of an irrigation district in accordance with any agreement between the federal government and state governments as reflected in state legislation"* (section 6.8, pg 48).

The 4% annual cap on trade out of an irrigation district is a barrier to trade that will impede the Commonwealth Government's $3.1 billion for water entitlement purchase being rolled out as currently budgeted, delaying the reallocation of water to the environment and preventing drought stressed irrigators accessing options to sell water and manage risk as effectively as possible.

The ACCC failed to provide frank and fearless analysis and advice on this matter. It is one thing for an agency like the ACCC to say that market rules should accommodate current government policy but quite another to fail to publish the analysis of the implications such a decision or policy might have. The *Water Amendment Bill 2008* should require that the ACCC is immune from political censure and obliged to provide the full analysis on issues that are at the core of making water markets work, in particular barriers to trade and anti-competitive behaviour.

Risk assignment framework
The allocation of risk and the circumstances under which water licence holders might be entitled to compensation if the sustainable diversion limit is reduced remains unclear and ambiguous. The distinction between changes to the sustainable diversion limit on the grounds of changes in 'policy' or 'improved knowledge', is particularly unclear, given that new policies are generally driven by improved knowledge and a consequent acknowledgement of a need for change. The lack of clarity will lead to uncertainty amongst entitlement holders and governments and is likely to be a touchstone in the future for further conflict, delaying the implementation of further reductions in the sustainable diversion limit if required. The *Amendment Bill 2008* should clarify this to reduce future uncertainty.

Basin Community Committee (BCC)
The BCC will replace the existing Community Advisory Committee (CAC) and has the potential to be influential in advising the Ministerial Council and the Authority. It is worrying that as it currently stands in the *Bill*[3] the BCC does not require mandatory representation by environmental or Indigenous interests or from floodplain graziers who rely upon overland flows and therefore have a strong interest in the Basin Plan. This should be addressed in the *Bill*. Furthermore, the term 'water user', which at least eight of the sixteen members of the BCC must be, should be given a broad interpretation.

Third party rights and public accountability
We reiterate our earlier recommendation to the Senate Inquiry into the *Water Bill 2007* that the *Act* should contain public standing provisions and these should be set out in the current *Water Amendment Bill 2008*. Currently the lack of an open standing provision greatly restricts the accountability of the *Act*.

The *Bill* should be amended so that it contains public standing provisions equivalent to those in the EPBC Act so the Authority and the Minister can be held accountable in exercising their public interest functions under the legislation and also assist in the enforcement of the legislation.

The Environmental Water Holder needs to be free from inappropriate limitations
The Commonwealth Environmental Water Holder should be free to acquire, hold and use water to most effectively achieve the *Water for the Future* objectives and restore the environment. It should not be subject to limitations such as the 4 per cent limit on moving water out of a designated irrigation area or the 10 per cent limit Victoria has placed on water ownership by an entity that is not a landholder. The *Water Amendment Bill 2008* should clarify this exemption from arbitrary limitations.

Further comments
The *Water Act 2007*, the *Water Amendment Bill 2008* and the *Water for the Future* plan are collectively intended to put water allocation and management in the MDB onto an ecologically sustainable footing for the future and optimise sectoral outcomes from the reform process. A key pathway to achieving this outcome is to accelerate water acquisition and re-allocation to the environment under the *Water for the Future* plan and to introduce a new investment vehicle for integrated

[3] Water Amendment Bill 2008, section 16.

investment of existing funding commitments at a district level as set out in ACF's recent paper '*Land and water reform in the Murray-Darling Basin*', attached as Appendix 1[4].

This paper describes how regional communities, businesses and land managers that want to participate in targeted land and water reform can work together with Murray-Darling Basin state and federal governments on the buyback of water entitlements, structural adjustment and infrastructure investment. The paper has received widespread cross-sectoral support and demonstrates how governments can secure benefits for industry, communities and the environment by integrating investment in water acquisition, infrastructure improvement and structural adjustment in geographically targeted zones. The desired outcomes of the *Water Act 2007*, the *Water Amendment Bill 2008* and the *Water for the Future* plan would be much more achievable if such an approach to investment in land and water reform were adopted.

Secondly, given that much of the Commonwealth Government's authority for the referral of powers under section 52 of the Constitution is based on Australia responsibilities under the Ramsar Convention and related bilateral agreements to which Australia is a signatory, it is important that policy reform across the MDB gives full effect to our national and international wetland commitments in the MDB and secures the future for the flora and fauna that rely on them. Recommendations for how this could be achieved within the current Commonwealth Government framework for biodiversity conservation and water reform are published in the recent paper '*Wetlands for our Future*' by ACF and the Inland Rivers Network (IRN), attached as Appendix 2[5].

This paper makes specific recommendations for improving Australia's performance under the Ramsar Convention via a proposal for a *National Wetlands Initiative*, which would include a set of integrated actions in three areas: (1) recovering water for wetlands; (2) improving Ramsar and protected areas designation and management; and (3) integrating wetlands protection within broader environmental legislation including the *Water Act 2007* and the *Environmental Protection and Biodiversity Conservation (EPBC) Act*. The Commonwealth Government should give effect to the international and national commitments to wetlands protection invoked as the constitutional basis for the *Water Act 2007* by adopting these recommendations through further amendments to the current *Bill*.

Finally, various amendments should be made to the Objects of the Act and the responsibilities of the MDBA to explicitly state that restoring and maintaining river and wetland health are a key objective of this important piece of legislation and responsibility of the new Authority.

The authors

The Australian Conservation Foundation (ACF) is committed to inspiring people to achieve a healthy environment for all Australians. For more than 40 years it has been a strong voice for the environment, promoting solutions through research, consultation, education and partnerships. It works with the community, business and government to protect, restore and sustain our environment.

---

[4] ACF (2008). Land and Water Reform in the Murray-Darling Basin.
http://www.acfonline.org.au/uploads/res/Targeted_land__water_reform_paper_16-10-08.pdf

[5] ACF and IRN (2008). Wetlands for our Future: Meeting national and international wetland commitments in the MDB. See:
http://www.acfonline.org.au/uploads/res/Ramsar_paper_final_201008.pdf

Australian Conservation Foundation
Floor 1, 60 Leicester Street
CARLTON, Vic 3053
Ph: (03) 9345 1111
Fax: (03) 9345 1166
Email: a.buchan@acfonline.org.au
www.acfonline.org.au

If you have any questions or comments in relation to this submission please contact: ACF's Healthy Rivers Program Coordinator**:**

Dr Arlene Buchan: Phone (03) 9345 1124, mobile 0407 883 907

AUSTRALIAN CONSERVATION FOUNDATION

Land and water reform in the Murray-Darling Basin

How governments can secure benefits for industry, communities and the environment by integrating investment in water acquisition, infrastructure improvement and structural adjustment in geographically targeted zones

16 October 2008

This paper describes how regional communities, businesses and land managers that want to participate in targeted land and water reform can work together with Murray-Darling Basin state and federal governments on the buyback of water entitlements, structural adjustment and infrastructure investment.

Proposal

A targeted land and water reform package would help reverse the decline in the condition of rivers and wetlands, improve the profitability of agriculture and boost the confidence of rural communities of the Murray-Darling Basin.

ACF proposes a geographically targeted land and water reform package under the *Water for the Future* program that would accelerate and integrate investment of the $3.1 billion *Restoring the Balance* water buyback money with the $5.8 billion *Sustainable Rural Water Use and Infrastructure* efficiency and structural adjustment funds.

Coordinated and targeted government investment should aim to secure multiple benefits for Murray-Darling Basin communities and the environment across short, medium and long-term timescales.

Other government and non-government funding options, like emerging carbon sequestration opportunities and stewardship and ecosystem services payments, can be integrated into the package as appropriate.

A targeted approach to land and water reform would benefit the Murray-Darling Basin by securing water entitlements with a reliability that will provide secure environmental flows to restore system health. Identifying and improving the management of high conservation value freshwater assets could follow on from targeted water and land reform.[1]

Irrigators and irrigation dependent communities will benefit from debt retirement, structural adjustment, local investment and increased certainty about their future in light of the ongoing drought, the growing impacts of climate change and governments' water reform agendas.

Such an approach would make a valuable contribution to reversing the decline in the condition of rivers and wetlands, improve the profitability of agriculture and boost the confidence of rural communities in the Murray-Darling Basin. It would capitalise on a once in a lifetime opportunity to redesign irrigation systems for the future.

What does a targeted investment in water and land reform package involve?

The package involves locally driven land and water capability assessments of irrigation districts, incorporating the CSIRO *Sustainable Yields* predicted impacts of climate change on water availability over the next 30 years, along with all existing local and regional natural resource management (NRM) and environmental data. The analysis results in an NRM 'traffic light' rating across the irrigation district that divides areas into three categories.

Districts in the first category ('green') have good prospects of remaining viable for irrigation in the future. They are close to the river or to 'backbone' channels of the irrigation system, they have good soils, have no salinity issues, or have other beneficial characteristics.

Districts in the second category (red') are classified as unlikely to be viable in the future.

Districts in the third category ('amber') are districts where conclusions about future viability cannot currently be drawn from rigorous scrutiny of available data.

The traffic light mapping enables reconfiguration and land use plans to be developed and funded appropriately. Specifically:

- 'green' areas: good prospects for sustainable irrigation in the future. They should be prioritised for infrastructure investment that optimises their water use and production efficiency;

[1] Substantial work has been completed since 2003 to identify and quantify the flow regimes needed to restore iconic Murray environments as part of The Living Murray Initiative. In addition, the Victorian Environmental Assessment Council recently completed its River Red Gum Forests Investigation that has mapped and documented the flood dependent natural values along the Murray and its Victorian tributaries in detail.

- 'red' areas: not suitable now or will not be suitable in the future for irrigated agriculture. They should be prioritised for water buyback, structural adjustment, decommissioning of irrigation components and other transitional assistance to dryland farming, grazing or other suitable land use including participation in novel or emerging markets for carbon or other ecosystem services; and
- 'amber' areas: require further analysis to determine what their optimal, future land use might be before any future major public / private investment takes place there.

The analysis behind the traffic light mapping should consider the natural resource condition, ecological assets, socio-economic pressures and access to markets and other matters of significance, particularly the anticipated impact of climate change on the Murray-Darling Basin. The analysis focuses on irrigation areas at a district level and funnels an appropriate mix of investment vehicles towards them that reflects their optimum, future land and water use.

In 'red' areas targeted for water buyback, water entitlements should be purchased with funds from the Commonwealth Government's $3.1 billion *Restoring the Balance in the Murray Darling Basin* program. Once water has been purchased from a 'red zone' it cannot be traded back in. Water traded out of these zones through this package should not be included in the current 4 per cent limit on the trading of water out of an irrigation area.

Funds from the Commonwealth's $5.8 billion *Sustainable Rural Water Use and Infrastructure* program should be used to support the decommissioning, rationalisation, reconfiguration and modernisation of irrigation infrastructure as appropriate depending on whether the area is red, amber or green, and provide structural adjustment and transitional assistance where required. Water savings made from public investment in decommissioning irrigation channels and other infrastructure should become environmental water entitlements. Governments should explore opportunities to work in partnership with private landholders and investors to reconfigure irrigation systems in ways that maximise regional and basin-wide benefits.

Other existing Commonwealth and state government policy commitments and funding streams should be integrated on a case by case basis, including those for stewardship payment programs and carbon and ecosystem service markets.

Private enterprise can also play a critical role in the renewal of regional landscapes and communities through the reconfiguration of unsustainable or unsuitable irrigation systems. Partnerships between irrigators, conservation interests and companies seeking to invest in sustainable agricultural industries in rural Australia are emerging throughout the Murray-Darling Basin. For example, VicSuper is investing $40 million to improve farming practices on the River Murray floodplains of northern Victoria. The venture, called *Future Farming Landscapes*, may expand to

$250 million and is aimed at generating economic returns while preserving the environment.[2]

A targeted package of water and land reform should also enable the strategic purchase of land and water entitlements when multiple environmental and irrigation reconfiguration benefits are provided. These benefits would include:

- re-establishing lateral and longitudinal connectivity between a river and its floodplain;
- increased protection for high-conservation value wetlands and other natural assets;
- improved salinity and nutrient management and the development of ecosystem markets for these and other services, such as carbon sequestration;
- extension of the National Reserve System; and
- the application of conservation tools including covenants and land stewardship payments suited to local conditions.

Case study

Across the Murray-Darling Basin irrigation communities are examining their future prospects in the context of the ongoing drought, the anticipated impacts of climate change and the risks and opportunities that might arise from government water reform agendas and funding packages. At least one such community is developing an adaptation strategy consistent with this proposal for integrated water buyback, structural adjustment and irrigation infrastructure decommissioning and investment. This represents a good example of how such a proposal might work in practice.

Torrumbarry Irrigation Area, Victoria

Through the Torrumbarry Reconfiguration & Asset Modernisation Strategy (TRAMS), Goulburn-Murray Water has developed a strategy for redesigning the Torrumbarry Irrigation Area (TIA) with a view to retaining irrigation in the future but in a more targeted way than at present. The TIA is located in northern Victoria and includes the Cohuna, Kerang and Swan Hill Regions from the Torrumbarry Weir to Nyah. The irrigation area utilises man-made and natural carriers, including RAMSAR listed wetlands, to deliver irrigation water. Goulburn-Murray Water seeks to ensure 'a more sustainable irrigation system that enables profitable and diverse agriculture, environmental respect and community strength'.

The strategy envisages a future that involves a 30 per cent reduction in Goulburn-Murray Water assets, 50 per cent of the delivery system modernised, fewer assets and hence less costs, improved customer service, improved outcomes for local

[2] http://www.theage.com.au/news/businessinnovations/a-happy-marriage-of-green-and-gold/2007/11/30/1196530637867.html

ecological assets and increased irrigator and community confidence in the future. Goulburn-Murray Water is in the process of adopting the 'traffic light' model and will use it as the basis for planning the reconfiguration of their irrigation infrastructure and land use change, and community consultation on the need for change. The water authority is developing zones for targeted water purchase and other initiatives with a view to moving water away from the 30 per cent of irrigation infrastructure scheduled for decommissioning.

TRAMS shows how communities can plan for large scale change from the bottom up if given the appropriate information and the opportunity to do so.

A key characteristic of the TIA is the use of natural carriers and lakes for water storage and transfer, which results in significant evaporation and other water losses. Goulburn-Murray Water is working with other agencies to better manage these issues to improve water use efficiency, environmental, economic and social outcomes. This includes recognition of the value of water to the community wellbeing including aesthetic, recreation and tourism benefits.

Further information about TRAMS can be found by calling: 1800 013 357 (toll free).

How can the geographically targeted, integrated package improve on opportunistic buyback or isolated infrastructure investments?

A targeted water and land reform package could allow local communities to understand, own and drive the process of change that will affect all regions of the Murray-Darling Basin. Planning with a 30-year time horizon and incorporating the risks of climate change and consequent reductions in water availability will reduce the uncertainty many irrigators and irrigation dependent communities feel about the future and will increase investment certainty.

Assessing long term land and water capability first and allowing the traffic light assessment to drive the investment of funds, mitigates the risk of investing public money in creating world-class irrigation infrastructure which will become world-class stranded assets if it occurs in areas unsuitable for long-term irrigation. There is no sense concreting in the mistakes of the past.

How can the package fit into existing Commonwealth water reform policy and funding commitments?

The Commonwealth *Water for the Future* program comprises two key investment strategies including $3.1 billion for buying back water from willing sellers and $5.8 billion for structural adjustment and infrastructure improvement, which the Government has expressed an intention to roll out simultaneously.

On 3 July 2008 the Commonwealth, Victorian, NSW, South Australian, Queensland and Australian Capital Territory governments signed an agreement on Murray-

Darling Basin reform. This agreement set out the priorities and principles for Commonwealth investment in water reform projects.

The objectives of the Commonwealth's investments in priority projects are to:

- implement water saving infrastructure projects;
- return water to the environment and restore river health; and
- adapt to climate change in an environment of reduced water availability.

The Commonwealth has established the following investment priorities:

- projects must be able to secure a long-term sustainable future for irrigation communities, in the context of climate change and reduced water availability in the future;
- projects must deliver substantial and lasting returns of water to the environment to secure real improvements in river health; and
- projects must be value for money in the context of the first two tests.[3]

The package ACF is proposing meets these objectives and enables simultaneous investment of both the $3.1 billion and $5.8 billion programs. This package also avoids the risk of creating world-class irrigation infrastructure that will quickly become world-class stranded assets in areas that will be unable to sustain irrigation in the future as a result of climate change and other pressures.

Who would prepare the traffic light ratings and develop the package?

In conducting the land and water capability assessments and developing the traffic light ratings, catchment management authorities, departments of primary industries, water, natural resources, environment and related disciplines, water authorities and irrigation infrastructure owners or operators should collaborate in working groups with irrigators, land holders and local environmental organisations to establish blueprints that set out a vision for their areas. An expression of interest in accessing an appropriate investment packages would then be provided to the Commonwealth under the *Water for the Future* program.

What criteria should be applied by the Commonwealth in identifying and investing in such a package?

Appropriate criteria for identifying and investing in targeted water buyback zones have already been established by the Commonwealth Government (see 'Due Diligence Criteria for Basin State Priority Projects' in Appendix 1 as attached).[4]

[3] MDB IGA p.22.
[4] For further information: http://www.environment.gov.au/water/programs/off farm/pubs/guidelines.pdf

Conclusion

Australia has a historic opportunity to prepare irrigation industries for the impacts of climate change and restore the Murray-Darling Basin to health. Australians have made it clear they want to be able to enjoy a healthy Murray-Darling Basin. To bequeath to future generations an ecological disaster would be a symbol of national failure.

A targeted water and land reform package would create renewed hope in the Basin and help revive Australia's greatest river system. Achieving this goal will require the combined energy of governments and communities. The Australians who established irrigation settlements 50, 70 or 100 years ago applied courage, perseverance and vision to their task. Our nation needs those same qualities applied again to the challenges of the Murray-Darling Basin.

The authors

The Australian Conservation Foundation (ACF) is committed to inspiring people to achieve a healthy environment for all Australians. For more than 40 years it has been a strong voice for the environment, promoting solutions through research, consultation, education and partnerships. It works with the community, business and government to protect, restore and sustain our environment.

Australian Conservation Foundation
Floor 1, 60 Leicester Street
CARLTON, Vic 3053
Ph: (03) 9345 1111
Fax: (03) 9345 1166
Email: a.buchan@acfonline.org.au
www.acfonline.org.au

If you have any questions or comments in relation to this submission please contact: ACF's Healthy Rivers Program Coordinator**:**

Dr Arlene Buchan: Phone (03) 9345 1124, mobile 0407 883 907

Appendix 1[5]

In undertaking the due diligence assessment of priority projects the Commonwealth will consider the social, economic, environmental, financial and technical aspects of the project.

1. Economic and social criteria
Projects must be able to secure a long-term sustainable future for irrigation communities, in the context of climate change and reduced water availability into the future:

- projects must contribute towards regional investment and development, secure regional economies and support the local community; and
- projects must demonstrate a long-term economic and environmental benefit that can be sustained over a 20 year horizon, preferably supported by an irrigation modernisation plan consistent with the Commonwealth's guidelines for irrigation modernisation planning assistance.

2. Environmental criteria
Projects must deliver substantial and lasting returns of water to the environment to secure real improvements in river health:

- projects must be based on a technically valid calculations of net water savings, with
- projections to take into account the impacts of climate change;
- projects must be able to deliver water in the form of a secure and transferable water entitlement to the Commonwealth Environmental Water Holder; and
- the Commonwealth's share of water saved must be capable of being used for purposes that reflect the Commonwealth's environmental priorities

3. Value for money criteria
Projects must deliver value for money in the context of the first two criterion:

- projects must have a suitable dollar per megalitre benchmark against local/regional water, including multiple benefit values, eg, reduced River Murray salinity, and flood plain restoration.
- market prices and represent cost- and time-effective strategies for achieving water savings;
- projects must demonstrate a positive cost-benefit outcome for a range of investment scenarios, compared with a no change option; and
- there must be clearly defined, and agreed, cost sharing arrangements.

4. Water reform criteria

[5] Inter Governmental Agreement of Murray-Darling Basin Reform, COAG, 2008.

All activities associated with the funding of projects must be in accordance with Council of Australian Governments and National Water Initiative agreements. Jurisdictions or other parties must make progress towards key water reforms, including those previously agreed to by jurisdictions under the National Water Initiative, including, but not limited to:

- competitively neutral and independently regulated water market and trading arrangements across the southern connected Basin;
- water charging regimes that reflect the full cost of supply to end users, including environmental externalities where feasible and practical;
- publicly accessible and compatible water register arrangements across all Basin jurisdictions (including a national water register information database);
- strategic investment to accelerate development of a best practice and consistent Basin water modelling platform, noting that the Murray-Darling Basin Authority will be developing such a platform in consultation with Basin States;
- compliance with any other COAG water and National Water Initiative reforms.

5. Other due diligence criteria

Projects must be consistent with best practice and other national approaches and standards being adopted for planning and implementation of *Water for the Future*. Projects will need to integrate with Basin State water planning documents and processes. Projects involving irrigation systems will require independently-conducted water loss hotspot assessment and modernisation plans. Funding will be provided for on-ground works related expenditure only and not for financial restructuring or other purposes. Suitable project management capability and capacity must be demonstrated. Project specifications must include:

- appropriate governance arrangements for the project to ensure it delivers on time, within budget and against all key objectives;
- compliance with relevant state environmental legislation and the *Environment Protection and Biodiversity Conservation Act 1999*;
- compliance with other relevant jurisdictional legislation;
- indemnification of the Commonwealth against any environmental or other third party damage caused by the project;
- no responsibility to the Commonwealth for any past, present or future taxation liabilities arising from investments;
- warranties on investments; and
- no allocation of responsibility to the Commonwealth for any legal contracts already entered into, except where explicitly agreed.

The Commonwealth will take into account other relevant matters where necessary in undertaking its due diligence.

WETLANDS FOR OUR FUTURE



Meeting national and international wetland commitments in the Murray-Darling Basin

AUSTRALIAN CONSERVATION FOUNDATION

INLAND RIVERS NETWORK

Wetlands for our Future: Meeting national and international wetland commitments in the Murray-Darling Basin
Sarah Moles, Brendan Fletcher and Amy Hankinson
Australian Conservation Foundation and Inland Rivers Network

Authorised by Don Henry, Executive Director, Australian Conservation Foundation
60 Leicester St, Carlton VIC 3051; Ph: (03) 9345 1111; Fax: (03) 9345 1166; www.acfonline.org.au

For more information and contact details for ACF and IRN please see:
www.acfonline.org.au/rivers
www.irnnsw.org.au

The Australian Conservation Foundation (ACF) is committed to inspiring people to achieve a healthy environment for all Australians. We work with the community, business and government to protect, restore and sustain our environment.

The Inland Rivers Network (IRN) is a coalition of environment groups and individuals concerned about the degradation of the rivers, wetlands and groundwater of the Murray-Darling Basin. Since 1991 IRN has advocated for the conservation and restoration of these ecosystems.

About the authors

Sarah Moles has been involved in Murray-Darling Basin management and policy issues for a number of years and currently sits on several consultative committees within the Murray-Darling Basin. She has previously worked for WWF, and recently published a book entitled *The Dying Darling*.

Brendan Fletcher is a former IRN Coordinator, and was previously a highly experienced US attorney.

Amy Hankinson is the current IRN Coordinator, and has worked for IRN for over 3 years. She has a background in Science and Law.

Photo credits

Main picture: Straw-necked ibis in flight, Narran Lakes, Kate Brandis
Bottom row L-R: Straw-necked ibis nests, Narran Lakes, David Heap; Wyara Lake, Paroo, Dr John Porter; Macquarie Marshes, Amy Hankinson

INLAND RIVERS NETWORK

AUSTRALIAN CONSERVATION FOUNDATION

Wetlands for our Future

Meeting national and international wetland commitments in the Murray-Darling Basin

October 2008

Sarah Moles, Brendan Fletcher and Amy Hankinson

EXECUTIVE SUMMARY

Australia signed the Ramsar Convention on Wetlands of International Importance more than 30 years ago. However, over the years the Commonwealth Government, as signatory to the Convention, and state governments, which manage many Ramsar wetlands, have failed to fulfil many of their significant obligations under the Ramsar Convention.

In the years since the Ramsar Convention came into effect, the condition of Australia's wetlands has declined precipitously. Ninety percent of the wetlands in the Murray-Darling Basin have vanished (Beeton *et al*. 2006). The condition of the remnants is poor in most cases, critical in some. Despite good intentions, Australia's Ramsar program has failed to stem the decline of Murray-Darling Basin wetlands, including many wetlands designated as Ramsar sites.

There are several reasons for this. Firstly, merely designating a wetland as a Ramsar site does not, and cannot be expected to preserve a wetland. Follow-up is needed, in the form of management planning, management activity and investment in rehabilitation. Too often, the needed follow-up has been lacking. Secondly, even top-flight management activity of a Ramsar site cannot address all impacts originating off-site, and often off-site activities are the most threatening. Thirdly, Ramsar designation and management planning have not been well integrated with other natural resource management processes at the national and state levels.

The Water for the Future framework and associated processes present an important opportunity for the Australian Government to renew Australia's Ramsar commitments and give them full effect. By invoking international Ramsar commitments as a constitutional basis for the *Water Act 2007*, the Australian Government has recognised that more must be done at a national level to stem wetlands decline. It has also recognised that the *Water Act* and Water for the Future are appropriate vehicles for renewing Australia's wetlands commitment. Now the Government must bring substance to that recognition.

This paper makes specific recommendations for improving Australia's Ramsar programs via a proposal for a National Wetlands Initiative, which would include a set of integrated actions in three areas: (1) recovering water for wetlands; (2) improving Ramsar and protected areas designation and management; and (3) integrating wetlands protection within broader environmental legislation including the *Water Act 2007* and the *Environmental Protection and Biodiversity Conservation (EPBC) Act*.

- In the area of *recovering water for wetlands,* a National Wetlands Initiative would:

    - Immediately finance recovery of environmental water by accelerating the roll out of the Water for the Future[1] expenditures; and

    - Set targets *and* timelines for returning water to parched wetlands.

- In the area of *improving Ramsar and protected areas designation and management,* a National Wetlands Initiative would:

    - Incorporate Ramsar management plans into the Murray-Darling Basin Plan to be prepared under the Water Act 2007;

    - Establish a procedure for preparing and accrediting Ramsar Management Plans under the Water Act, similar to the Water Act's procedure for Water Resource Plans;

    - Establish a Commonwealth Fund for Private Ramsar Managers, so that private individuals who assist Australia in meeting its international wetlands commitments by agreeing to Ramsar listing for wetlands on their lands would be eligible for the funding they deserve;

    - Undertake a review of imperilled Murray-Darling Basin Ramsar sites – including the Coorong, Chowilla Floodplain, Macquarie Marshes and Gwydir Wetlands - to determine whether they warrant inclusion on the Montreux Register of sites in ecological danger;

    - Begin the process of establishing a national system of High Conservation Value freshwater assets, including a component for community groups to develop and participate in nominations.

- In the area of *incorporating wetlands protection into broader environmental legislation,* a National Wetlands Initiative would amend the Water Act 2007 to:

    - Include an explicit requirement that investment in water recovery through the Water for the Future be directed by the Murray-Darling Basin Plan;

    - Include a requirement that the Basin Plan ensures that enough water is set aside to mitigate the impacts of climate change on wetlands; and

[1] Water for the Future is the Commonwealth Government's framework to secure water supply, and has a particular focus on the Murray-Darling Basin. $12.9 billion will be invested over ten years to address four key priorities: using water wisely; supporting healthy rivers; taking action on climate change; and securing water supplies

- Ensure that there is explicit jurisdiction under the Water Act to protect environmental flows from diversion and theft.

The National Wetlands Initiative would amend the EPBC Act to:

- Enable the listing of nationally significant high conservation value freshwater areas,

- Provide that any action likely to have a significant impact on these nationally important freshwater areas or on national water resources be subject to EPBC Act assessment and approval;

- Trigger the development of management plans and implementation strategies for listed areas; and

- Improve cumulative impact assessments in water resource management, including those of water extractions.

1. INTRODUCTION

This paper is intended as a resource for conservationists, resource users, policy makers and anyone concerned with Australia's Ramsar program and the future of Murray-Darling Basin wetlands. The paper assesses Australia's progress in meeting its Ramsar commitments, particularly with respect to key Murray-Darling Basin wetlands, and finds that progress wanting. It examines the effectiveness of current national approaches to protecting, conserving and sustainably managing wetlands listed under the Convention, as well as their ability to give effect to the commitments to Ramsar 'wise use' principles.

The paper then describes the key threats to Murray-Darling Basin wetlands that have gone either unaddressed or been insufficiently addressed by Ramsar processes to date. Case studies of key Ramsar wetlands in the Murray-Darling Basin have been included and summarise ecological and conservation values, the extent of hydrologic change due to over-allocation, other threatening processes and some results of environmental watering activities.

Finally, the paper makes specific and detailed recommendations for improving Australia's Ramsar performance through a National Wetlands Initiative.

2. AUSTRALIA'S PROGRESS IN MEETING RAMSAR COMMITMENTS

The objective of the Ramsar Convention is 'the conservation and wise use of all wetlands through local, regional and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world' (Ramsar Convention Secretariat 2006). Put more simply, the Ramsar Convention is intended to conserve wetlands around the world.

As a Contracting Party to the Ramsar Convention, the Australian Government is required to meet four core obligations:

1. To designate at least one site that meets Ramsar criteria to the Convention and promote the conservation of listed Ramsar sites (Article 2);

2. To promote the wise use of all wetlands within Australia through national land use planning, conservation and management (Article 3);

3. To establish nature reserves in wetlands, whether or not they are included in the Ramsar List, and promote training in the fields of wetland research, management and wardening (Article 4); and

4. To consult with other Contracting Parties about the implementation of the Convention (Article 5).

One other important aspect of the Ramsar Convention is the Montreux Record, which is a register of Ramsar sites where changes in the ecological character of the sites have occurred since listing.

This section of the paper assesses Australia's progress in meeting these four obligations in relation to the Ramsar Convention's overall objective of 'the conservation and wise use of all wetlands,' and also briefly considers whether some Murray-Darling Basin Ramsar sites may warrant consideration for listing on the Montreux Record.

2.1 Designation and conservation of listed wetlands

Article 2 of the Ramsar Convention requires member countries to name at least one wetland of international importance as a Ramsar and maintain the ecological character of all wetlands so named (Ramsar Convention Secretariat 2006).

Australia has listed 65 wetlands of international importance (Department of the Environment and Water Resources 2007). Many of Australia's Ramsar sites are in National Parks such as Myall Lakes and Paroo River in New South Wales, Currawinya and Bowling Green Bay in Queensland, the Coorong and Coongie Lakes in South Australia, and Hattah-Kulkyne Lakes in Victoria. Where sites designated are in national parks or on private land, or are not on Commonwealth-owned land, responsibility for on-ground management of the Ramsar sites generally rests with state environment and conservation agencies or private land managers.

Within the Murray Darling Basin, (MDB), there are 16 Ramsar sites covering more than 500,000 hectares. Five of these wetlands are also designated as icon sites under The Living Murray (TLM), and six are described in detail as case studies later in this report.

Although Australia has listed numerous Ramsar wetlands, it has not had great success in maintaining the ecological character of wetlands listed. Recent assessments indicate that 22 of Australia's 65 Ramsar sites – over one third of listed sites – have changed in ecological character or have the potential to change (Beeton *et al*. 2006). Ramsar sites within the Murray-Darling Basin, particularly those that have been impacted by irrigation, have fared especially poorly, as the case studies in Part 4 of the report demonstrate. There is an urgent need to focus on maintaining the ecological character of wetlands once listed.

2.2 Promoting the wise use of all wetlands within Australia

Article 3 of the Ramsar Convention requires member countries to promote the wise use of all wetlands within their jurisdictions, not merely those that have been listed.

The concept of 'wise use' as used within the Ramsar Convention has developed over time to encompass sustainable management of individual sites that is integrated with whole-of-catchment approaches. The most official recent guidance on the term states that '[w]ise use of wetlands is the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development' (Ramsar Convention Secretariat 2007). While this definition recognises that human activity may have an impact on wetlands, it requires member countries to ensure that human activities are compatible with the continued maintenance of the ecological character of all wetlands, listed or unlisted, to the greatest extent possible.

Unfortunately, the evidence indicates that Australia's performance on this obligation has been lacking. The 2006 Australia State of the Environment Report states that while many nationally important wetlands in northern Australia are in good condition, those in southern Australia 'need significant management actions for their recovery'. The state of wetlands within the Murray-Darling Basin is alarming, with 90 percent of floodplain wetlands in the Basin lost. As many as 231 nationally important wetlands are under pressure from changes to the water regime (Beeton *et al*. 2006).

Plainly, those wetlands that have disappeared and the many that remain, but are threatened by excessive water use, cannot be said to be under sustainable management. When the overwhelming majority of the Basin's wetlands are lost forever and many that remain are barely hanging on for life, it is cannot be said that Australia has made adequate progress toward its Ramsar obligation to promote the wise use of all wetlands.

2.3 Establishing nature reserves and promoting training in wetland research, management and wise use

Article 4 of the Convention requires member countries to establish nature reserves in wetlands, whether or not they are included in the Ramsar List. Member countries are also expected to promote training in the fields of wetland research, management and wardening.

To the extent wetlands are included within Australia's reserve system, it is within the national parks system, which is primarily oriented toward terrestrial reserves, and the

marine parks system, which does not include freshwater wetlands. Australia has no comprehensive, adequate and representative reserve system for the conservation of freshwater areas. Although there is recognition of this omission from Australia's biodiversity conservation efforts, and documents such as the 2006 *State of the Environment Report* and 2005 *Directions for the National Reserve System: A Partnership Approach* acknowledge the increasing interest in such a system and seek to ensure that this gap be addressed, at present there are no active plans to develop a national reserve system to conserve freshwater areas.

Regarding the Ramsar obligation to promote wetlands research and management, Australia has some of the best trained and most knowledgeable wetlands researchers and managers in the world. Most of the information in this report is based on the work of Australian wetlands researchers and managers. That we know as much as we do about the dramatic decline in wetlands health is due to their work.

Australia's record in acting on this knowledge, however, is poor. As the case studies below make clear, more than enough is known about the threats to Murray-Darling Basin wetlands to support the immediate actions required to address those threats. But for now, much of the good work done on Australian and Murray-Darling Basin wetlands seems destined to take no more concrete form than recommendations for action in reports sitting on bookshelves.

2.4 International cooperation

Australia's progress toward implementing Article 5 of the Ramsar Convention, which requires all Ramsar member nations to work to strengthen international wetlands conservation, is largely beyond the purview of this report, which focuses on Australia's Ramsar record in the Murray-Darling Basin.

It is worth noting, however, that to the extent Australia can point to a strong domestic record in wetlands conservation, it will have a stronger position from which to negotiate and consult in international forums. It will be better able to argue for strong conservation measures abroad when discussing or amending the CAMBA (China – Australia Migratory Bird Agreement) and JAMBA (Japan – Australia Migratory Bird Agreement) treaties.

2.5 The Montreux Record

The Montreux Record is a register of wetland sites on the List of Wetlands of International Importance where changes in ecological character have occurred, are occurring, or are likely to occur as a result of technological developments, pollution or

other human interference. The Montreux Record is
maintained as part of the Ramsar List (Ramsar Convention Secretariat 2006).

The purpose of Montreux listing is to highlight changes in the condition of a listed wetland for the purpose of mobilising resources and public concern in order to better conserve the wetlands. It is important to note that Montreux listing is not intended to be used as a badge of shame, but rather as a positive tool to advance the conservation purposes of the Ramsar Convention. It is also a tool that enhances transparency in reporting and, when used, reinforces the integrity of the Ramsar listing system through the disclosure of endangered sites. To this extent it relates quite closely to Australia's commitments regarding international cooperation above, as the Montreux Record is an important way to inform other countries of issues being faced and courses of action being taken to address such threats. The Ramsar Secretariat has suggested that Montreux listing may be useful where:

- demonstrating national commitment to resolve the adverse changes in a Ramsar site would assist in resolving the changes;

- highlighting particularly serious cases of changes in ecological character would be beneficial at national and/or international level;

- positive national and international conservation attention would benefit the site; and/or

- inclusion on the Record would provide guidance in the allocation of resources available under financial mechanisms (Ramsar Convention Secretariat 2006).

As the case studies below make clear, several Murray-Darling Basin Ramsar sites, including, the Coorong, Barmah-Millewa Forests, Macquarie Marshes, Gwydir Wetlands, and Narran Lakes, have seen changes in their ecological character since listing. Given the dramatic nature of these changes, it is recommended that the Australian Government should consider whether listing these sites on the Montreux Record would benefit these sites.

3. THE THREATS TO MURRAY-DARLING BASIN WETLANDS

The thing wetlands need most to flourish is water. The water needs of individual wetlands vary greatly: some wetlands are permanent, some are intermittent; some wetlands vegetation needs annual flooding, some can be flooded less often. But while the water requirements of any given wetland are not necessarily simple and require expert analysis, there is no debating the general truth: wetlands need water in the amounts, timing, frequency and duration specific to their ecological requirements. Without that, wetlands will die.

The key threats to Murray-Darling Basin wetlands are those things that prevent wetlands from receiving the water they need. The key issue facing most of the wetlands in the Murray-Darling Basin is over-extraction of water and associated river regulation. Not only have Murray-Darling wetlands faced a wholesale loss of water volume, the frequency of flows has reduced dramatically, replaced by either no water, a constant low flow and/or unseasonal flows.

Floodplain development severs wetlands and floodplains from main river channels, altering the timing and manner of delivery of water to floodplain wetlands in less severe cases, and cutting off wetlands entirely from sources of water and other ecological inputs in the worst cases.

Climate change will worsen these impacts, further reducing the volume of water to reach floodplain wetlands, changing the seasonal cycles of wetting and drying, and exaggerating the already devastating impacts of floodplain development.

In these degraded conditions, invasive species, which often thrive on ecological disturbance, will push aside more and more of Australia's native plants and animals.

As will be seen in this section and, in more detail, in the case studies on Murray-Darling Basin Ramsar wetlands, Australia's Ramsar program has been able to do little to counter these threats. The key challenge for reinvigorating Australia's Ramsar programs is to develop mechanisms so that the Ramsar program can in fact address the most significant threats to wetlands health.

3.1 River regulation and over-extraction

River flow is the key driver of river and floodplain wetland ecosystems (Bunn and Arthington 2002). The scientific literature makes it clear that overuse and regulation of rivers have severe implications for the health of entire river systems (wetlands, floodplains) and their wildlife. The statistics for major Murray-Darling Basin wetlands make for grim reading:

- More than 50% of floodplain wetlands on developed rivers may no longer flood (Kingsford 2000);

- Many key wetlands have been affected by a reduction in both flood frequency and overall flows (Kingsford 2000);

- Flooding of the Barmah- Millewa Forest, on the main stem of the Murray, has declined from 80% of years to 35% years (Kingsford 2000);

- Flows of the Murray River to the sea have been reduced to only 27% of natural median flow (Goss 2003), resulting in an 80% reduction in colonially-nesting waterbird breeding (Leslie 2001); and

- When median annual flows are considered (more indicative given the high variability within the system), the losses in volume are even higher. Most MDB systems have lost over 50% of their water and some almost 70% (MDBC 2006a).

There is no serious argument among wetlands researchers over whether over-extraction is a critical problem. However, a lack of political will and efforts to stymie water recovery programs have hampered progress in addressing the problem. Difficulties in making 'trade-offs' with consumptive users exist, despite the fact that many irrigators suffer economic losses due to over-allocation and over-extraction.

Australia's approach to wetlands protection to date has failed to tackle this issue.

3.2 Floodplain development

Floodplain development presents threats to Murray-Darling Basin wetlands that are related to but also distinct from problems cause by over-extraction and regulation of main channel flows with dams and locks. Floodplain development can deny wetlands their water as surely as over-extraction, but often the loss is indirect.

For example, floodplain development includes roads and other infrastructure, flood control works and works associated with irrigation developments, all of which may divert water out of natural floodways and away from wetlands. Sometimes these diversions are unintentional, as in the case of some roads and railways, but they are no less ecologically damaging for that.

Some floodplain development reduces the water available to wetlands more directly. Floodplain harvesting involves capturing or harvesting local runoff or water that has overflowed from a river channel towards a defined channel. Many natural depressions, billabongs and small distributary or effluent creeks have also been modified for use as private on-farm storages. A 2005 report published by the Murray-Darling Basin Commission estimates that farm dams could reduce stream flows within the Murray Darling Basin from 1000-3000 GL over the next 20 years (MDBC 2005b). When seen in this light, floodplain harvesting can be considered as another form of over-extraction, but because it is either poorly regulated or in some cases entirely unregulated, it is often considered together with other types of floodplain development.

The problems caused by floodplain development are not limited to the volume of water wetlands receive. The health of river channels depends on connectivity with floodplains for nutrient and organic carbon cycling and production of invertebrates (an

important food source for fish and colonial-nesting waterbirds) (Thoms 2003). Levees and other floodplain structures sever the connection between rivers, floodplains and wetlands (Arthington 2002). Without connectivity, food webs deteriorate and eventually collapse.

3.3 Climate change

Climate change represents the single largest future threat to the water resources and wetlands of the Murray-Darling Basin. Since 1950 rainfall decreases of up to 50 mm per decade have occurred in the eastern and southern parts of the Basin, decreases that are among the largest observed in any part of Australia (Van Dijk *et al*. 2006).

The projections indicate that things will get worse. Overall temperatures in the Basin are projected to rise up to 2°C by 2030 and 5.5°C by 2070, with rainfall also predicted to decrease by around –13% by 2030 (Van Dijk *et al.* 2006).

Such decreases in rainfall could have very severe to catastrophic impacts on the Basin's water resources. Recent work by CSIRO indicates that the median impact of climate change across the Murray-Darling Basin is an 11 percent reduction in available water by 2030, equivalent to about 2500 GL/year on average (Young *et al* 2008; see www.csiro.gov.au/partnerships/MDBSY.html). This work has also found that climate change is set to have an additional impact on average period between floods to important wetlands and also on the maximum period between floods. For example, in Barmah-Millewa the average period between floods is expected to increased by a further 13 percent, and maximum period between floods will increased by a further 95% percent (CSIRO 2008). At the end of the system, where the Coorong and Lower Lakes Ramsar site is located, CSIRO predicts that total flow will be reduced by 61 percent, and flow will cease 40 percent of the time, compared to 1 percent of the time in the absence of consumptive use (Young *et al* 2008).

If these scenarios come to pass, the impacts on Murray-Darling Basin wetlands will be dramatic. Wetlands will decrease in extent, and the remnants will be less healthy than today. Floodplain connectivity will decrease, water quality may decrease, and wetlands may be more vulnerable to invasions from invasive species (Van Dijk *et al.* 2006).

3.4 Invasive species

Another key threat to wetland health, particularly in the Murray-Darling Basin, is invasive species. A recent World Wildlife Fund publication entitled *World's top 10 rivers at risk,* dealing with risks to freshwater ecosystems worldwide, states that 'Invasive species threaten the biological fabric of river basins.'

Over the last century, there has been a significant increase in the distribution and abundance of invasive fish species within the Basin, while native fish species have seriously declined to around 10% of their original levels (Wong *et al*. 2007). Carp are viewed by many anglers as the scourge of the river. In many locations carp account for around 60-90% of the total fish biomass (Wong *et al.* 2007).

Invasive plants wreak ecological havoc as well. Lippia, a species used as a 'no mow' lawn, can smother a floodplain (Earl 2003). Aquarium species such as water hyacinth and ornamental riparian trees such as willows have negative impacts on the productivity of the riverine environment and floodplain, which in turn impacts wildlife.

The WWF report states that this swing to abundant invasive species is the 'result of significant changes in water flow, thermal pollution, in-stream habitat degradation, and barriers to fish passage' (Wong *et al.* 2007). Accordingly, it is clear that the impacts of regulation and extraction, as well as general habitat degradation, have had broad reaching indirect impacts in terms of providing favourable conditions for invasive species as well as directly affecting native species.

An improved Ramsar program would address prevention and control of invasive species themselves as well as direct habitat rehabilitation, including better management of exacerbating and often underlying issues – specifically a lack of flooding and environmental flows from over-extraction and river regulation.

4. CASE STUDIES OF MURRAY-DARLING BASIN WETLANDS

This section presents seven case studies of Ramsar-listed wetlands in the Murray-Darling Basin, plus a single case study of a nationally important wetland that is not Ramsar listed, in order to illustrate the type and scale of threats facing Ramsar wetlands in the Murray-Darling Basin.

Additional information on the case study wetlands is provided in the Appendix.

4.1 Coorong and Lower Lakes

4.1.1 Location and condition

The Coorong and Lower Lakes wetlands are located at and just above the mouth of the Murray River in South Australia. The Coorong is a long, shallow estuarine ecosystem made up of lagoons and wetlands and separated from the Southern Ocean by a long peninsula of sand. The Lower Lakes are freshwater lakes separated from the Coorong by a set of barrages. The Coorong and Lower Lakes were Ramsar-listed in 1985 (MDBC 2005a).

Together, the Coorong and Lower Lakes wetlands make up an ecosystem of tremendous diversity, with 23 different wetland types included within the Ramsar site. Within the Coorong, there are estuarine areas, saline marshes, freshwater soaks and open water, a hypersaline area at the southern end, and a number of ephemeral salt lakes (MDBC 2005a).

The area is vital for waterbirds, with 85 species recorded in the area. The Coorong is an important breeding area for the Australian pelican, Crested tern and Fairy tern, and Lake Alexandrina is important for egrets, ibises, cormorants and the Rufus night heron. The Coorong and Lower Lakes site ranks within the top six waterbird sites in Australia (MDBC 2005a).

4.1.2 Condition and threats

A recent expert report, commissioned by the South Australian Government, concluded that a comprehensive shift in the ecological character of the Coorong was underway, that the Coorong portion of the Ramsar site is critically endangered, and that there are strong signals that the Lower Lakes will become critically endangered without significant intervention (Phillips & Muller 2006).

The conclusions of this report have since been demonstrated in a dramatic way: the decades of regulation and over-extraction of water from the River Murray, which have recently been exacerbated by drought, has diminished freshwater flows to the Lakes and Coorong to such an extent that the Lakes are now 0.5m below sea level – for the first time in the 7,500 years since they formed (despite frequent and intense natural droughts throughout that period). As declining water levels expose acid sulphate soils, scientists worry that a "tipping-point" could be reached beyond which the buffering capacity of the environment is exceeded and the reversal of progressive acidification becomes impossible. All but one indicator of ecosystem health is negative and getting worse, including those for native plants, turtles, fish, frogs, birds and everything else that relies on this unique ecosystem for its feeding and breeding habitat.

The Coorong and Lower Lakes Ramsar site is now experiencing unprecedented stress and potentially irreversible change in ecological character across the whole system.

Scientists say "the situation in the Lakes will worsen without intervention" and that "without sufficient water, ecosystem recovery from the current impacts may take years to decades depending on an individual species' ability to recolonise. Some species will not be recoverable. Many of the unique ecological attributes that make this area significant internationally will be irreversibly lost" (SA MDB NRM Board, April 2008).

As the end of the entire Murray-Darling system, the cumulative impacts of all activities taking place upstream affect the Coorong and Lower Lakes. When there is over-extraction in the farthest reaches of the Darling Basin in Queensland, the impact falls on the Coorong. When climate change reduces the snowmelt from the Australian Alps, the impact falls on the Coorong. When saline groundwater enters the Murray River near the Murray-Darling confluence, the impact falls on the Coorong.

As elsewhere, the most critical impacts are from lack of water. Median flows from the Murray were estimated at 27% of the historical average in 2001, and have been less than 5% of natural levels since 2001, turning the Coorong and Lower Lakes into a sink for salt and silt from the entire Murray system (MDBC 2005a; Phillips & Muller 2006).

As a result, vast areas of the Coorong have become saltier than seawater, creating a virtual Dead Sea. The estuarine zone where freshwater and saltwater mix, one of the Coorong's most vital ecosystems, has shrunk to 25% of its former area. The mouth of the Murray, Australia's greatest river, remains open only due to mechanical dredging (MDBC 2005a; Phillips & Muller 2006).

These changes have had an adverse impact on the region's flora and fauna. Pelican numbers in the Coorong have declined almost 80% over the past 40 years, with almost no breeding activity in some years. Populations of other waterbirds have also collapsed – the 1960s, more than 250,000 small migratory waders were recorded in one section of the estuary, by the 1990s and 2000s only 3,000-13,000 were recorded over the

entire estuarine system. An aquatic plant called *Rupia tuberosa,* a vital part of many waterbirds' diets, has disappeared over huge areas, foreshadowing further waterbird declines (MDBC 2005a; Phillips & Muller 2006).

As a result, the authors of *Ecological Character of the Coorong, Lakes Alexandrina and Albert Wetland of International Importance* have recommended that the Coorong portion of the site be listed as an endangered ecological community under the EPBC Act. They have also recommended that consideration be given to listing the Coorong on the Ramsar Montreux Record of sites in ecological danger (Phillips & Muller 2006).

4.2 Narran Lakes

4.2.1 Location and features

Narran Lakes Ramsar site encompasses a portion of a 30,000 hectare terminal wetlands complex of the Narran River, which is itself part of the Condamine-Balonne River system. The wetlands are located in northeastern New South Wales and include four major lakes as well as numerous floodplain wetlands and river channels (eWater CRC 2006).

Narran Lakes is one of the Murray-Darling Basin's hotspots for waterbird breeding, and was designated a Ramsar site in part for its importance to waterbirds. Forty-six species have been recorded as breeding in the Lakes ecosystem (eWater CRC 2006).

4.2.2 Condition and threats

Unlike Currawinya Lakes, Narran Lakes does not receive anything like the flows it did under natural conditions, and wetland health has declined as a result.

Inflows to Narran Lakes have been dramatically reduced in the past 20 years by rapid intensive irrigation development in the Queensland Condamine-Balonne catchment. Water harvesting from rivers and floodplains is a significant proportion of the total take, with off-stream storage capacity in excess of 1.5 million ML (MDBC 2005b).

Under pre-development conditions, Narran Lakes filled once every two years. Under current levels of infrastructure and development the Lakes may now be expected to fill on average one year in seven. Projected median annual flows in the Narran River at the state border are now 32% of simulated natural conditions (Cullen *et al.* 2003).

The Lower Balonne Floodplain has been undergoing a change in vegetation for many years, with pasture species supported by periodic inundation being replaced by woody, unpalatable shrubs. The effect is not due to drought but to the extension of drought by large scale water harvesting.

Of the main tree species present on the Narran Lakes floodplain, river red gum *E. camaldulensis*, river cooba *Acacia stenophylla* and coolabah *E. coolabah* are showing signs of stress. Of 4,000 trees surveyed as part of the Narran Lakes Ecosystem Project, 35% were dead, 12% stressed and only 15% considered healthy (i.e. with intact crowns) Very few healthy seedlings were recorded – 70% of river red gum saplings surveyed were dead. Until the summer of 2008 almost a decade had passed since there had been a waterbird breeding event at Narran Lakes (eWater CRC 2006). The 2008 event in Narran Lakes provided a long-awaited and critical opportunity for colonially-nesting waterbirds to breed in the Murray-Darling Basin. The event also highlighted the importance of Ramsar wetlands and their protection.

4.3 Gwydir Wetlands

4.3.1 Location and features

The Gwydir Wetlands Ramsar site covers 823 hectares within the much larger Gwydir Wetlands complex. The site is located west of Moree in northwestern New South Wales, at the terminus of the Gwydir River. It is a good example of a Darling River terminal river delta.

Like other Murray-Darling Basin Ramsar sites, Gwydir Wetlands is an important spot for waterbird breeding. Because major wetlands within the Basin rarely flood simultaneously, it takes on special importance as a refuge for waterbirds when other wetlands are dry. Approximately 500,000 birds were recorded in Gwydir Wetlands in 1998 (Taylor-Woods & Jaensch 2006).

4.3.2 Condition and threats

Gwydir wetlands suffer from both over-extraction and particularly high levels of floodplain development.

The core wetland area of 70,000 ha (of a much larger total) has been reduced to less than 5% of its pre-development area since the construction of Copeton Dam and the development of the Gwydir irrigation industry. Natural flows have been reduced by 60% and large flows have been reduced by 70% (McCosker & Duggan 1993).

As is the case in the Macquarie and Narran catchments, over-extraction of floodplain flows has extended periods of drought and reduced natural variability. Large floods are smaller and less frequent and periods of low flow are increasing. A 1 in 5 natural flood event below Copeton Dam is now expected once every 25 years.

Lippia invasion, inextricably linked to river regulation and shorter, shallower periods of inundation has altered the ecological character of the Gwydir Ramsar site and driven a land use change (from grazing to cropping) in much of the core wetland area as well as the wider catchment (Rae 1994). In addition, the (often illegal) construction of levee banks to divert floodwaters or protect cropped areas has alienated large areas of floodplain from the watercourses.

The *Ecological Character of the Gwydir Wetlands* (Taylor-Woods & Jaensch 2006) summarises the water requirements of the Gwydir Wetlands as follows:

1. During substantial inundation events, Old Dromana and Goddards Lease are each inundated for periods of 3-6 months, occasionally longer, and Crinolyn for shorter duration.;

2. On average, extensive inundation occurs at Old Dromana and at Goddards Lease in 5 of every 10 years, and at Crinolyn, in 4 of every 10 years;

3. A number of artificial impediments to free flow of water along the Gingham and Lower Gwydir watercourses exist (mainly for irrigated agriculture) and these should be removed or reduced in capacity, with no further impediments introduced;

4. Occasional, extensive winter-spring inundation is beneficial to maintenance of Marsh club-rush communities but the more usual summer-autumn inundation is more desirable for lippia control and pasture quality;

5. As a broad indicator based on best available information, inflow of 4ML/ha/year to each Ramsar property (or 10-15ML/ha/year after prolonged dry spells) is expected to contribute substantially to sustaining key vegetation/habitat in the Gwydir Wetlands Ramsar site; and

6. As a broad indicator based on best available information, inflow of 35,000ML/year to the (entire) core wetland system of the lower Gwydir, following substantial natural inflows, is expected to contribute substantially to sustaining breeding of colonially nesting waterbirds in the greater Gwydir Wetlands, *if stimulated to breed by natural flows*.

The Gwydir Water Sharing Plan includes an environmental water account of 45,000ML annually with provision for carryover to 90,000ML. This is inadequate to meet all environmental objectives for the Gwydir floodplain (including the Mehi and Mallewa-Moomin distributaries) that are described in the Water Sharing Plan.

4.4 Macquarie Marshes

4.4.1 Location and features

The Macquarie Marshes Ramsar site covers 18,726 hectares within the 200,000 Macquarie Marshes wetlands complex west of Dubbo. The site includes the Macquarie Marshes Nature Reserve, which is managed by the New South Wales National Parks and Wildlife Service, and the 583-acre Wilgara Wetlands, which is privately owned and managed (NSW WFTF 2000).

Macquarie Marshes is one of the largest inland wetlands in southeastern Australia. The Marshes host the largest reedbeds in southeastern Australia and one of the most significant red gum forests (NSW WFTF 2000).

The Macquarie Marshes is famous for its birdlife. In large floods more than 500,000 waterbirds congregate at the Marshes to nest, forage and breed. The Marshes are one of the few sites where Magpie Geese and Pied Heron breed, and it contains some of the largest egret rookeries in New South Wales (NSW WFTF 2000).

4.4.2 Condition and threats

The Macquarie Marshes are barely hanging on, and the biggest reason for their problems is a lack of water. Prior to large scale river regulation for irrigation, 51% of the water in the Macquarie River passing Dubbo ultimately reached the Marshes. By the early 1990s, this figure had fallen to 21%, reducing the Marshes in size by at least 40-50%. The large floods so important for waterbird breeding and overall wetland health are much rarer, and low, drought-like flows are more common (Kingsford & Thomas 1995).

Reduced volumes, smaller flows and floodplain harvesting are driving a change in plant community composition in the Marshes, with terrestrial species replacing water-dependent aquatic vegetation. River red gums are dying and being replaced by drought-tolerant vegetation (Kingsford & Thomas 1995; Summerell 2004, cited in Johnson 2005).

Waterbird numbers are collapsing. From the 1970s through the late 1990s number of colonially nesting waterbirds at the Marshes fell by 100,000 every 11 years (Kingsford & Johnson 1998).

In the last seven years things have become much, much worse. There has been no successful colonially nesting bird breeding event since 2000 - the longest recorded period without breeding- because of insufficient water and the short duration of flood events (Johnson 2005). In October 2005, the NSW Department of Environment and

Conservation's annual aerial survey of wetland birds in October 2005 found that 'for the second year in a row, record low numbers of waterbirds were counted on the Macquarie Marshes.

4.5 Lowbidgee Floodplain and the Great Cumbung Swamp

4.5.1 Location and values

The Great Cumbung Swamp and Lowbidgee wetlands are large wetlands (50,000ha and 200,000ha respectively) located at the confluence of the Lachlan and Murrumbidgee rivers.[2] They are among the 35 major wetlands in the Murray-Darling Basin (MDBC 2006a) and are on the list of important wetlands in Australia (Environment Australia 2001). Although they are not Ramsar listed, these wetlands are included among these case studies for two reasons: (1) because they are among the largest and most important wetlands in the Murray-Darling Basin not listed under Ramsar, and (2) because the Ramsar Convention places an obligation on Australia to provide sustainable management for all wetlands, not just those designated as Ramsar sites.

With some of the most extensive lignum swamps and reed beds in NSW, surveys have consistently identified the Lowbidgee Floodplain and the Great Cumbung Swamp as amongst the most important waterbird breeding areas in southeastern Australia with large breeding events occurring in most years (Driver *et al.* 2002). Sixty bird species have been identified at the two sites, 68% of which bred in the area (Kingsford and Thomas 2001). The third largest breeding colony of Glossy Ibis and the seventh largest breeding colony of Straw-necked Ibis ever recorded in Australia took place at this site. (Marchant and Higgins 1990, cited in Kingsford and Thomas 2001). Great Cumbung Swamp is one of the most important breeding areas in SE Australia for the rare freckled duck.

These wetlands are also important breeding grounds for fish including Murray cod (NSW DNR 2007).

In the early 1990s, it was determined that the Lower Murrumbidgee floodplain satisfied four criteria for listing as a wetland of international importance under the Ramsar Convention. However, no part of the area was listed (Davis 1994 cited in Kingsford and Thomas 2001). The four qualifying criteria were:

[2] There are some small creeks that transfer water between the wetlands but the rivers and wetlands generally only join in large flood events, which occur in 15-20 percent of years (Pressey *et al.* 1984 in Kingsford and Thomas 1991). However due to their geographical proximity and importance they are being covered together here.

- particularly good examples of two wetland types (Lignum swamps, fringing River Red Gum forests);

- habitat for plants and animals at a critical stage of their biological cycles (breeding areas);

- 20,000 individual waterbirds; and

- 1% of the population of Straw-necked Ibis (DWR 1994 cited in Kingsford and Thomas 2001).

4.5.2 Condition and threats

The story of the Lowbidgee Floodplain and Great Cumbung Swamp is much the same as for Ramsar-listed wetlands to the north: over-extraction and floodplain development have led to vegetation change and declines in waterbird numbers.

Historical accounts of the Lowbidgee in 1902 described an extensive wetland that was frequently flooded, but today, the Murrumbidgee River that flows to the wetlands is one of Australia's most developed rivers, with diversions accounting for about 22% of all annual flows diverted in the Murray-Darling Basin (Kingsford and Thomas 2001). As a result of diversions from the Murrumbidgee, the amount of water reaching the Lower Murrumbidgee floodplain has been reduced by 60% (Kingsford and Thomas 2001). Diversions from the Lachlan have caused inflows to the Great Cumbung Swamp to decline by 53 percent (Driver *et al.* 2002).

Floodplain development has only worsened the problems cause by diversions. In the Lowbidgee there are approximately 394 km of channels and 2,145 km of levee banks, which either sever parts of wetlands from flows or cause excess flooding in other areas (Kingsford & Thomas 2001). Such development was the primary cause of a 60% reduction in the wetland area, including the main waterbird habitats, between 1975 and 1998 (Kingsford & Thomas 2001).

Similarly, floodplain flows in the Great Cumbung Swamp are significantly affected by an extensive levee and channel network and many areas now receive far more or far less water than they did previously. Some areas are unnaturally flooded to enhance plant growth for cattle feed (Driver *et al.* 2002).

Negative impacts have been dramatic. At least 75% of the wetlands of the lower Murrumbidgee floodplain have been lost and approximately half of what remains is degraded (Kingsford 2003; Kingsford & Thomas 2001). Only one area on the Lower Murrumbidgee floodplain, the Redbank stratum, remained in reasonably good condition as a wetland (Kingsford &Thomas 2001). Trees that once received water

every 7-10 years have not had water for 20-25 years, and in the Lowbidgee most Lignum communities have been lost or are in poor health (Kingsford & Thomas 2001).

Since the early 1980s waterbird abundance in the area has declined by more than 80% – a collapse directly attributable to loss of habitat caused by over-development of water resources. Native fish have also been severely affected: five fish extinct/probably extinct, two extremely rare, six others populations extremely reduced (Kingsford &Thomas 2001).

The decision to exclude the Lowbidgee from the Murrumbidgee Water Sharing Plan, the key statutory plan in the catchment that determines the level of water extraction and provides the basis for water delivery and management, has done nothing to manage or mitigate these threats.

4.6 Barmah-Millewa Forest

4.6.1 Location and features

Barmah-Millewa Forest is the largest red gum forest in Australia, and the largest tree-dominated floodplain wetlands in southern Australia. The forest is located on the main stem of the Murray River downstream from Yarrawonga Weir and upstream of Echuca (MDBC 2005a).

The Barmah Forest, on the south side of the Murray in Victoria, was Ramsar-listed in 1982. The Millewa Forest, on the NSW side, was Ramsar-listed as part of the NSW Central Murray State Forests Ramsar site in 2003 (MDBC 2005a).

As Australia's largest red gum forest, Barmah-Millewa has long been considered a wetlands complex of the highest conservation value. Linked through an unbroken riparian corridor along the Murray and Edward Rivers, the forests are in relatively good ecological condition. In addition to red gum forest, the Barmah-Millewa forest contains important black box woodlands, couch grassland, lignum shrubland, Giant rushland, and Australia's most extensive Moira grassland (MDBC 2005a).

Barmah-Millewa is particularly important for native birds and fish. Approximately 54 waterbird species have been recorded in the area. Barmah-Millewa's habitats provide for at least eight species listed in the IUCN Red Book: the Australasian Bittern, Superb Parrot, Silver Perch, Flat-headed Galaxias, Regent Honeyeater, Swift Parrot, Murray Hardyhead, and Trout Cod, as well as eight species listed under CAMBA and JAMBA treaties (MDBC 2005a).

4.6.2 Condition and threats

River regulation has had a significant, adverse impact on the health of the Barmah-Millewa Forest. The spring flooding that was common under natural conditions has been reduced in both extent and duration. Conversely, the river now runs higher in summer than under natural conditions due to irrigation requirements and rainfall rejection events (MDBC 2005a).

This change in flow conditions has had a dramatic impact on Barmah-Millewa vegetation. Some areas of river red gum forest and woodland on higher ground are now stressed because they do not receive water at the frequency and duration needed; conversely, some low-lying red gums are waterlogged by unnatural, shallow summer flooding. Moira grasslands are being encroached upon from two sides – on higher ground, by red gums that can tolerate less frequent spring flooding; on lower ground by rushes that can survive frequent summer floods (MDBC 2005a).

Regulation has also affected colonially nesting waterbirds. The abundance and diversity of waterbirds has declined since the mid-1970s, with some bird numbers declining tenfold. Successful breeding episodes are down by 80%, and in 1989 it was reported that egrets had not bred in Barmah-Millewa for 20 years (MDBC 2005a).

Unsustainable industrial logging and associated activities are also threatening the ecological character of Barmah-Millewa and associated River Red Gum Ramsar sites. A recent report by National Parks Association of NSW has shown that on average, an estimated 3,965 hectares of the NSW Central Murray State Forests Ramsar site, of which the Millewa forest is a part, is approved for logging each year (4.8% of the site) and of this some 1,353 ha per year is approved for total vegetation removal (through patch-clearfelling) (NPA NSW, 2008). This is leading to negative impacts on numerous native species that are dependent on these wetlands for survival.

Recent deliveries of large quantities of environmental water, however, have given hope that some of these trends could be arrested, perhaps reversed. An Environmental Water Allocation (EWA) of 100 GL per year was set aside in 1993, and the first large-scale trial of the EWA under the 'Living Murray' initiative (TLM) was undertaken between October 2005 and March 2006. It was the largest environmental water delivery ever undertaken in Australia, providing medium level flooding (equivalent to a 1in 5 year event) and resulting in 57% of the floodplain being inundated. The release achieved multiple objectives, including the following:

- Successful breeding of approximately 50,000 colonial waterbirds. Multiple colonies were established throughout the forest wetland system, including a mixed colony of over a thousand nests of the listed Nankeen Night Herons and 3 species of Egret. It was the first time in 40 years that these species have bred in Barmah. Sacred Ibis, Straw-necked Ibis and Royal Spoonbills also bred in numbers exceeding the 2000 event (MDBC 2006b);

- Fish research and monitoring projects being undertaken throughout the forest at the time of the release established an unequivocal link between flooding and the spawning of native fish species. Golden and Silver perch spawned in unprecedented numbers. Murray Cod also spawned but the link to flooding is less clear. For the first time, Trout Cod were observed to have spawned as a result of this managed flood event and there was also significant spawning and recruitment of many of the smaller native fish species (MDBC 2006b);

- Frog breeding occurred in most water management areas of forest wetland system including: Peron's Tree Frog, Pobblebonk Frog, Barking Marsh Frog, Spotted Marsh Frog, Plain's Froglet and Common Froglet (MDBC 2006b);

- Floodplain vegetation including much of the River Red Gum forest and some of the River Red Gum woodland responded with new growth and vigour, as did many of the flood-dependant and flood-tolerant understorey species. Wavy marshwort and Moira grass were among the aquatic plants and terrestrial grasses that completed their lifecycles and set seed (MDBC 2006b);

- The EWA volume diverted into the Barmah-Millewa Forest wetlands equated to 515 GL, though an estimated 92-95% returned in through-flows to the River Murray. These return flows were reallocated to other Icon Sites down-stream for River Red Gum rescue projects in Victoria and for consumptive use in NSW (MDBC 2006b); and

- The flows through the Forest resulted in the drop out of significant loads of nutrient-rich sediment and returned carbon, vital to the ecology of the river, to the river system (MDBC 2006b).

The success of this environmental watering event across a broad spectrum of outcomes demonstrates the potential for environmental gains at other case study sites described in this report, should adequate environmental water be recovered. It also demonstrates the potential for other parts of the Central Murray State Forests Ramsar site that have received very little water and are also undergoing major ecological change and decline.

4.7 Paroo River wetlands and Currawinya Lakes

4.7.1 Location and features

There are two Ramsar sites in the Paroo River Basin: Curranwinya Lakes in southwestern Queensland, and Australia's most recently designated Ramsar site, the Paroo River wetlands in northwestern New South Wales.

Currawinya Lakes Ramsar site is wholly contained within Currawinya Lakes National Park, and is an important site for birds. About 180 species of birds have been observed at Currawinya, and more than 100,000 waterbirds were seen at Currawinya during a

1987-89 survey. No other wetland in arid or southern Australia is thought to support such a high number of waterbirds consistently.

Paroo River Wetlands Ramsar site comprises the 71,133 ha Nocoleche Nature Reserve and the 67,171 ha Peery component, which is located within the Paroo-Darling National Park. During large floods that can cover as much as 800,000 hectares, the Paroo catchment is a magnet for waterbirds, with as many as 250,000 birds from 63 species thought to aggregate there at peak times (Timms 2001). This includes the highest concentration of rare freckled ducks (*Stictonetta naevosa*) in Australia. This species, recognised as threatened at both national and global scales has been observed in flocks in excess of 10,000 birds (Scott 1997).

The Paroo River is the last remaining free-flowing river in the northern Murray Darling Basin.

4.7.2 Condition and threats

The Paroo River Wetlands and Currawinya Lakes Ramsar sites maintain many of their original ecological values because the flow regime of the Paroo River has been altered comparatively little compared to other Murray-Darling Basin Ramsar sites. The Paroo River Basin is in significantly better condition than those systems where intensive irrigation is established.

As a result, the Paroo can be considered a 'reference river.' It provides a benchmark against which changes in other northern Murray-Darling Basin rivers can be compared, and gives some indication of what northern Murray-Darling Basin rivers would be like in the absence of intensive irrigation, as well as what they could be like if a more natural flow regime were re-established. It illustrates that the condition of the other Ramsar wetlands in the Darling Basin, along with vast areas of floodplain, is not merely due to drought.

That is not to say that there have been no adverse impacts to the Paroo River Basin and the Paroo River Wetlands and Currawinya Lakes Ramsar sites. Much of the catchment has been degraded by the clearing of native vegetation and over-grazing. Soils in this catchment are generally susceptible to sheet and gully erosion. Runoff time following high intensity rainfall events has decreased while flood heights have increased significantly.

In addition, the western boundary of Currawinya Lakes national park, which is co-extensive with the Ramsar site, is unfenced and control of feral animals, especially pigs and cats is an on-going concern.

The Paroo River Agreement provides a degree of security for the Paroo River Wetlands and Currawinya Lakes that does not apply to other Ramsar sites in the Murray-Darling Basin. The agreement provides that Paroo River flows at the Qld – NSW border will be

capped at 99% of pre-development levels under Queensland's Water Resource Plan, which should maintain inflows to Currawinya Lakes as well. Future iterations of the Queensland Water Resource Plan need to ensure that extractions are not increased and that the End of System Flow remains at 99% of pre-development levels at the state border.

Unfortunately recent development in the Paroo River catchment appears to have breached this agreement, and will result in reduced flows to the highly significant Paroo River and wetlands. A recent report has found that since the moratorium was introduced a new 21 hectare water storage structure has been established along with five other new storages; 57 hectares of land has been cleared of vegetation, and a new channel system with a combined length in excess of 10 km had been constructed (Kingsford and Roff 2008). It is unclear what action will be taken to remedy this situation.

The Paroo River Wetlands' and Currawinya Lakes' status as national parks and nature reserves helps to protect the sites from further degradation from grazing, but this protection is not complete. Fencing the site and otherwise controlling feral animals requires funding, and the funding for national parks, particularly those in sparsely populated western Queensland and New South Wales, is limited.

5. CONCLUSION AND RECOMMENDATIONS

Australia is failing to meet its obligations under the Ramsar Convention, especially its obligations to maintain the ecological character of Ramsar-listed wetlands and promote the wise use and sustainable management of all wetlands. Among the reasons for this failure are the following: (1) Ramsar designation often does not address off-site activities, such as over-extraction and floodplain development, that result in a lack of water for wetlands, (2) Ramsar designation is sometimes not followed by needed management planning and activity, or investment in rehabilitation, and (3) Ramsar designation and management have not always been well integrated with other natural resource management processes at the national and state levels.

As the case studies in this report demonstrate, Australia's wetlands are in crisis, particularly in the Murray-Darling Basin. The situation demands a coordinated and comprehensive response – a response that is equal to the Basin-wide nature of the crisis. Every year we delay action, more wetlands are lost and the cost of rehabilitation goes up.

As dire as the situation is, it also presents a unique opportunity. A decisive intervention has the potential to yield dramatic benefits. Because the Commonwealth Government is undertaking more comprehensive Basin planning and management under the *Water Act* 2007, new mechanisms for protecting wetlands can be integrated seamlessly and effectively into the new Basin planning arrangements. Because the Commonwealth has committed to substantial expenditures to reduce over-allocation, mechanisms for prioritising wetlands recovery actions can assist managers in directing expenditures for acquisitions. A National Wetlands Initiative can accomplish more now than at any time in recent history.

For these reasons, IRN and ACF propose that the Commonwealth undertake a National Wetlands Initiative to protect our wetlands, integrate wetlands management with Basin-wide water management processes, and renew Australia's commitment to the Ramsar Convention.

A comprehensive National Wetlands Initiative would include a set of integrated actions in three areas: (1) recovering water for wetlands, (2) improving Ramsar and protected areas designation and management, and (3) integrating wetlands protection within broader environmental legislation including the *Water Act* 2007 and the *Environmental Protection and Biodiversity Conservation* (EPBC) *Act 1999*.

- *Water for wetlands.* The single most important reason for wetlands decline in Australia is lack of water, and the single most important thing Australian governments can do to improve wetlands health is to expedite dramatically the acquisition of water for the environment.

Recently both the Commonwealth and the Murray-Darling Basin states have made substantial financial commitments to return water from over-allocated river systems to wetlands – through The Living Murray Initiative in 2003, the NSW Riverbank Program, and recently the Commonwealth pledged $3.1 billion toward addressing over-allocation in the Murray-Darling Basin. An additional $5.6 billion, earmarked for modernising irrigation, is also intended to return water to the rivers and wetlands.

However, progress toward actually returning water to stressed river systems has been painfully slow – to date, only 133 GL of the roughly 500 GL anticipated to be acquired has been approved for purchase via the Living Murray process, and much of this water may not be realised under climate change scenarios. The current $3.1 billion commitment to address over-allocation under the Water for the Future is weighted toward future expenditure; with only $226.1 million of $3.1 billion budgeted to address over-allocation in the 2007-08 and 2008-09 financial years. However it should be noted that this is over $50 million more that was allocated in the previous year's budget.

A National Wetlands Initiative would:

- Immediately finance recovery of environmental water by accelerating the roll out of the Water for the Future expenditures, in particular the purchase of water entitlements; and

- Set targets *and* timelines for returning water to parched wetlands.

- *Improving Ramsar and protected areas designation and management.* Too often, designation of Ramsar sites is not followed up by adequate management planning, management activity, and investment in rehabilitation. In addition, Australia still has not begun the effort to establish a comprehensive, adequate and representative system of high conservation value freshwater areas equivalent to the terrestrial national parks and marine parks systems. A National Wetlands Initiative would:

  - Incorporate Ramsar management plans into Murray-Darling Basin Plan prepared under the Water Act 2007;

  - Establish a procedure for preparing and accrediting Ramsar management Plans under the Water Act, similar to the Water Act's procedure for Water Resource Plans;

- Establish a Commonwealth Fund for Private Ramsar Managers, so that private individuals who assist Australia in meeting its international wetlands commitments by agreeing to Ramsar listing and appropriate management for wetlands on their lands would be eligible for the funding they deserve;

- Undertake a review of imperilled Murray-Darling Basin Ramsar sites – including the Coorong, Lower Lakes, Chowilla Floodplain, Macquarie Marshes and Gwydir Wetlands - to determine whether they warrant inclusion on the Montreux Register of sites in ecological danger; and

- Begin the process of establishing a national system of High Conservation Value freshwater assets, including a component for community groups to develop and participate in nominations.

- *Incorporating wetlands protection into broader environmental legislation.* The Water Act 2007 is based on the Commonwealth's constitutional powers to implement international environmental agreements, and Section 3 of the Act specifically states that it is intended to give effect to those agreements, which include the Ramsar Convention on Wetlands of International Importance, the Convention on Biological Diversity, and migratory bird treaties with China and Japan.

  However, this recognition of the need for a national approach to wetlands protection is not always reflected in the substance of the Water for the Future or the Water Act 2007. There is no provision for a national system of protected wetlands within the Water Act, nor does the Water Act require planning for Ramsar-listed wetlands to be fully integrated with water management planning.

  A National Wetlands Initiative would elevate the importance of wetlands protection within the Water Act 2007, so that the Act truly lives up to its constitutional justification. It would also include amendments to the EPBC Act that reflect the national significance of wetlands and water management.

  The National Wetlands Initiative would amend the Water Act to:

  - Include an explicit requirement that investment in water recovery through the Water for the Future be directed by the Murray-Darling Basin Plan;

  - Include a requirement that the Basin Plan ensures that enough water is set aside to mitigate the impacts of climate change on wetlands; and

- Ensure that there is explicit jurisdiction under the Water Act to protect environmental flows from diversion and theft.

The National Wetlands Initiative would amend the EPBC Act to:

- Enable the listing of nationally significant freshwater areas,

- Provide that any action likely to have a significant impact on these nationally important freshwater areas or on national water resources be subject to EPBC Act assessment and approval;

- Trigger the development of management plans and implementation strategies for listed areas; and

- Improve cumulative impact assessments in water resource management, including those of water extractions.

APPENDIX A

This appendix provides summary information on the wetlands described in the body of the report and is based upon the information in the Australian Wetlands Database. For more detailed information, you can access the Database at http://www.environment.gov.au/cgi-bin/wetlands/search.pl.

Currawinya Lakes

Description: Currawinya Lakes Ramsar site is within Currawinya Lakes National Park in southwestern Queensland. Lake Numalla (almost 3000ha) is a freshwater lake while Lake Wyara (3800ha), less than three kilometres away, is saline.

Total area (*Ramsar area in parentheses):* 151,300 (151,300)

Date Ramsar listed: 11/03/96

Number of Ramsar criteria met: 6

Number of Directory of Important Wetlands criteria met: 6

Wetland types represented: 6

General significance: Unlike many lakes in inland Australia, which are temporary, the Currawinya lakes are semi-permanent. Lake Numalla has been dry only three times this century; Lake Wyara dries out more frequently and becomes a vast glaring saltpan.

Waterbird significance: Lakes Wyara and Numalla are very important sites for waterbirds in Australia. No other wetlands in arid or southern Australia are thought to consistently support such high numbers of waterbirds. Estimates of over 100,000 waterbirds from 41 species have been recorded at particular times.

Disturbances and threats: Soil erosion, which may lead to sedimentation of the lakes, and feral animals.

Paroo River Wetlands

Description: The Paroo River wetlands comprise a reticulate system of broad, shallow, flat bottomed distributary channels of the Paroo River, Cuttaburra Creek and Kulkyne Creek draining into shallow lateral and sub-terminal overflow swamps and level floored, terminal playa lakes. The wetlands are located in northwestern New South Wales and southwestern Queensland.

Total area in ha (*Ramsar area in ha in parentheses):* 750,000 (138,304)

Date Ramsar listed: 20/09/07

Number of Ramsar criteria met: 6

Number of Directory of Important Wetlands criteria met: 3

Wetland types represented: 8

General significance: The Paroo River is the last remaining free-flowing river in the northern Murray-Darling Basin. It is altered comparatively little compared to other Murray Darling Basin wetlands and can be used as a reference site or benchmark for comparison to other Basin wetlands.

Waterbird significance: The Paroo catchment is a magnet for waterbirds, with as many as 250,000 birds from 63 species thought to aggregate there at peak times. This includes the highest concentration of rare freckled ducks in Australia.

Disturbances and threats: Grazing and burning of Lignum may decrease localised areas of waterbird habitat for up to five years. Sedimentation and erosion are threats in some areas. Feral animals including pigs, foxes and cats are responsible for predation on waterbirds in some areas.

Narran Lakes

Description: The Narran Lakes wetlands are a series of interconnecting terminal lakes of the Narran River. They are located in northwestern New South Wales near Brewarrina.

Total area (*Ramsar area in parentheses):* 30,000 (5,531)

Date Ramsar listed: 14/06/99

Number of Ramsar criteria met: 6

Number of Directory of Important Wetlands criteria met: 5

Wetland types represented: 6

General significance: Narran Lakes and associated wetlands are representative of large terminal wetlands occurring in semi-arid NSW. They provide waterbird drought refuge when wetlands in other areas of the state are dry, and with the Macquarie Marshes and Gwydir Wetlands, form an important, interconnected wetlands resource.

Waterbird significance: Among the highest-ranked sites in the Murray-Darling Basin for species richness, number of breeding species and total number of birds. Fourteen species with restricted breeding distribution in western NSW have been observed breeding.

Disturbances and threats: Water extraction, invasive species including lippia, pigs and foxes.

Gwydir Wetlands

Description: The Gwydir wetlands are a series of terminal wetlands of the Gwydir River and contain one of the largest stands of water couch (*Paspalum distichum*) and marsh club-rush (*Bolboschoenus fluviatilis*) remaining in New South Wales. They are located in northwestern New South Wales 60 kilometres west of Moree.

Total area in ha (*Ramsar area in ha in parentheses):* 102 (832)

Date Ramsar listed: 14/06/99

Number of Ramsar criteria met: 3

Number of Directory of Important Wetlands criteria met: 5

Wetland types represented: 6

General significance: The Gwydir Wetlands are a particularly good example of an inland terminal delta in the Darling Riverine Plains bioregion. The wetlands play a substantial role in the biological and ecological functioning of the Murray-Darling Basin, as the major wetlands in the Basin are rarely inundated simultaneously, and are not always suitable for bird breeding at the same time.

Waterbird significance: Up to 500,000 waterbirds have been observed breeding at Gwydir. 238 bird species have been recorded, including 165 species that have been observed breeding.

Disturbances and threats: Irrigation pressures on Gwydir River, clearing/cropping irrigation operations, weed invasion (especially Lippia Phyla *canescens*), channel erosion, pesticides, feral animals.

Macquarie Marshes

Description: The Macquarie Marshes comprise a complex of braided swamps, lagoons, channels and floodplain inundated by flooding from the lower Macquarie and its distributary streams. The Marshes incorporate extensive areas of reed swamp, river red gum woodland, and water couch grasslands. The Macquarie Marshes are located in central northern New South Wales approximately 100 kilometres north of Warren.

Total area in ha (*Ramsar area in ha in parentheses):* 220,000 (18,726)

Date Ramsar listed: 01/08/86

Number of Ramsar criteria met: 5

Number of Directory of Important Wetlands criteria met: 2

Wetland types represented: 7

*General significance: T*he Macquarie Marshes represent an outstanding example of inland reed swamps and floodplain woodland. As with other large wetlands in semi-arid NSW, the Macquarie Marshes provide drought refuge when wetlands in other parts of the state, especially more inland areas, are dry. Because of their size, the Macquarie Marshes provide habitat for large numbers of waterbirds.

Waterbird significance: There are permanent populations of threatened species including the Australasian bittern and brolga. The Marshes are highly significant for colonially nesting waterbirds including straw-necked ibis, intermediate egret, rufous night heron and royal spoonbill.

Disturbances and threats: River regulation causing problems including salinity, erosion, death of floodplain dependent species and reduction in reedbed size. Waterbird numbers have declined Water quality, pesticides, weeds e.g. Lippia (*Phyla nodiflora*), and feral animals (including pigs and foxes) are also problems.

Lowbidgee Floodplain, including Great Cumbung Swamp

Description: The wetland comprises the floodplain of the lower Murrumbidgee River, including Pollen and Caira Creeks, and Tala and Yanga Lakes. Significant flooding of the area traditionally occurred in about four in five years, mainly in spring due to rain in the headwater catchments of the Murrumbidgee River.

Total area in ha (*Ramsar area in ha in parentheses):* 200,000 (not applicable)

Date Ramsar listed: (not applicable)

Number of Ramsar criteria met: 4

Number of Directory of Important Wetlands criteria met: 5

Wetland types represented: 10

General significance: Great Cumbung Swamp together with the surrounding floodplain supports one of the largest stands of River Red Gum in NSW. The wetlands complex also supports some of the most extensive lignum swamps and reed beds in NSW, and contains important breeding grounds for fish including Murray cod.

Waterbird significance: Lowbidgee Floodplain and the Great Cumbung Swamp are among the most important waterbird breeding areas in southeastern Australia. Sixty

bird species have been identified at the two sites, and the third largest breeding colony of Glossy Ibis and the seventh largest breeding colony of Straw-necked Ibis ever recorded in Australia took place at this site.

Disturbances and threats: Clearing of Lignum and other wetland vegetation for cropping, water regulation, water channelling and water diversion, and feral animals.

Barmah-Millewa

Description: The Barmah-Willewa Forest is a large River Red Gum open forest and woodland. The forest features a variety of permanent and temporary wetlands, including lakes, swamps, billabongs, grassland plains and flooded forest. Smaller areas support Black Box, Yellow Box and Grey Box woodland on higher ground. The forest is located on the main stem of the Murray River downstream from Yarrawonga Weir and upstream of Echuca.

Total area in ha (*Ramsar area in ha in parentheses):* 66,000 (Barmah 28,515; Millewa 33,636)

Date Ramsar listed: 15/12/82

Number of Ramsar criteria met: 4

Number of Directory of Important Wetlands criteria met: 4

Wetland types represented: 4

General significance: The Barmah-Millewa forest is the largest River Red Gum forest in Australia. It is of special value for its genetic and ecological diversity because of its size, variety of communities and its high productivity (given maintenance of flooding). Given an appropriate flooding regime Barmah Forest has supported significant colonies of Ibis and nesting waterfowl, and provides significant breeding habitat for fish and amphibians.

Waterbird significance: The forest is an important breeding area for ibis in some years. Other colonially nesting species (e.g. cormorants, egrets, spoonbills also nest in years of flood. A fter flood periods, the forest is a significant waterfowl breeding areas, supporting ducks, Great Cormorants, Little Black Cormorants, Little Pied Cormorants, White-Faced Herons, Pacific Herons and Rufous Night Herons, crakes and rails.

Disturbances and threats: Changed water regimes, timber harvesting, cattle grazing, and rising saline groundwater levels.

Coorong and Lower Lakes

Description: The Coorong is a shallow, saline to hypersaline, coastal lagoon system more than 100 kilometres in length at the mouth of the River Murray. It is divided by two long peninsulas into a Northern and Southern Lagoon. The Northern Lagoon's north western end is connected with Lake Alexandrina and Lake Albert, with associated shoreline marshes at the Murray mouth. These lakes contain fresh to brackish/saline waters. South of the Southern Lagoon lies a chain of shallow, ephemeral salt lakes and swampy mud flats.

Total area in ha (*Ramsar area in ha in parentheses):* 140,500 (140,500)

Date Ramsar listed: 01/11/85

Number of Ramsar criteria met: 8

Number of Directory of Important Wetlands criteria met: 6

Wetland types represented: 23

General significance: The Coorong is one of the most important and diverse collections of coastal wetlands in Australia, including a wide range of habitats from freshwater to hypersaline, mostly in a natural state. Contains a representative sample of coastal and salt-influenced terrestrial habitats as well as an unusual set of aquatic habitats in the Coorong lagoons and ephemeral lakes, and its waters include important nurseries for fisheries. The Coorong is one of the most significant Aboriginal archaeological sites in Australia.

Waterbird significance: The Coorong supports important nesting colonies of cormorants, herons, egrets, ibises and terns. One of southern Australia's biodiversity hotspots for waterbirds, with 238 species recorded.

Disturbances and threats: Increased salinity due to lack of freshwater flows from the River Murray as a result of water controls, weed invasion, presence of feral animals and degradation of sand dune plant communities by off road vehicles and campers, boating and waterskiing.

REFERENCES

Arthington, A., 2002, 'Environmental flows: ecological importance, methods and lessons from Australia', paper presented at Mekong Dialogue Workshop on International Transfer of River Basin Development Experience: Australia and the Mekong Region, 2 September 2002, Sydney, online at www.mekong.es.usyd.edu.au/events/past/Conference2002/index.htm.

Beeton, R.J,S., Buckley, Kristal I., Jones, Gary J., Morgan, Denise, Reichelt, Russell E. & Trewin, Denis, 2006, *Australia State of the Environment 2006*, Independent report to the Australian Government Minister for the Environment and Heritage, Department of the Environment and Heritage, Canberra.

Bunn, S.E. & Arthington, A.H., 2002, 'Basic Principles and Ecological Consequences of Altered Flow Regimes for Aquatic Biodiversity', *Environmental Management,* Vol. 30, No. 4, pp. 492–507.

Convention on Wetlands of International Importance especially as Waterfowl Habitat. Ramsar (Iran), 2 February 1971, UN Treaty Series No. 14583, as amended by the Paris Protocol, 3 December 1982, and Regina Amendments, 28 May 1987, online at www.ramsar.org/key_conv_e.htm.

CSIRO, 2008, *Water Availability in the Murray - Summary of a report to the Australian Government from the CSIRO Murray-Darling Basin Sustainable Yields Project*, CSIRO Canberra.

Cullen,P, Marchant, R., and Mein, R., 2003, *Review of Science underpinning the Assessment of the Ecological Condition of Lower Balonne System*, Queensland Government.

Department of the Environment Water Resources, 2007, Ramsar Convention on Wetlands webpage, online at www.environment.gov.au/water/environmental/wetlands/ramsar/index.html

Driver, P.D., Hameed. T, Smith, T, Wettin, P & Raisin, G, 2002, 'Rehabilitation of wetland inundation regimes in the Lachlan River, NSW, Australia: achievements and ongoing challenges', from Driver et al. (in prep), *Modelling wetland flows in the Lachlan Valley, for Water Science and Technology*, online at www.riversymposium.com/index.php?element=17

Earl, J., 2003, *The distribution and impacts of lippia (Phyla canescens) in the Murray Darling system*, Final report to the Lippia Working Group, Australian Cotton CRC, NSW, online at http://cotton.crc.org.au/Assets/PDFFiles/Reports/Lippia/LipiaMDS.pdf

Environment Australia, 2001, *A Directory of Important Wetlands in Australia, Third Edition,* Environment Australia, Canberra.

eWater CRC, 2006, *Narran Ecosystem Project,* online at www.canberra.edu.au/centres/narran/

Goss, K.F., 2003, 'Environmental flows, river salinity and biodiversity conservation: managing trade-offs in the Murray–Darling Basin', *Australian Journal of Botany*, vol.51, pp. 619–25.

Johnson, W, 2005, 'Adaptive management of a complex social-ecological system: the regulated Macquarie River in south-eastern Australia, University of New England thesis.

Kingsford, R.T., 2000, 'Ecological impacts of dams, water diversions and river management on floodplain wetlands in Australia', *Austral Ecology* (2000) 25, 109–127.

Kingsford, R.T. & Johnson, W., 1998, 'Impact of water diversions on colonially nesting waterbirds in the Macquarie Marshes in arid Australia', *Colonial Waterbirds* 21: 159-170.

Kingsford, R.T. & Roff A. 2008, *A case study: floodplain development on the Paroo River, the last free flowing river in the Murray-Darling Basin*, Wetlands and Rivers Research Group, School of Biological, Earth and Environmental Sciences, University of NSW, Sydney

Kingsford, R.T., & Thomas, R.F., 1995, 'The Macquarie Marshes and its waterbirds in arid Australia: A 50-year history of decline', *Environmental Management* 19: 867-878.

Kingsford, R.T. & Thomas, R.F., 2001, *Changing water regimes and wetland habitat on the Lower Murrumbidgee floodplain of the Murrumbidgee River in arid Australia,* Report to Environment Australia, April 2001.

Leslie, D.J., 2001, 'Effect of river management on colonially-nesting waterbirds in the Barmah-Millewa forest, southeastern Australia', *Regulated Rivers: Research & Management* 17:21-36.

McCosker, R.O; and Duggin, JA., 1993, Gingham Watercourse Management Plan: Final Report. University of New England, Armidale, NSW.

MDBC, 2005a, *The Living Murray Foundation Report on the significant ecological assets targeted in the First Step Decision*, online at www.mdbc.gov.au/subs/dynamic_reports/foundation_report/pubdetails.html. Murray-Darling Basin Commission, Canberra.

MDBC, 2005b, *Preliminary review of selected factors that may change future flow*

patterns in the River Murray System, online at http://www.mdbc.gov.au/__data/page/1503/Earthech_report_for_web.pdf. Murray-Darling Basin Commission, Canberra.

MDBC, 2005c, *State of the Darling Interim Hydrology Report,* online at http://www.mdbc.gov.au/__data/page/1551/State_of_the_Darling_-_Interim_Hydrology_Report.pdf. Murray-Darling Basin Commission, Canberra.

MDBC, 2006a, *Natural Resource Management – Wetlands*, online at http://www.mdbc.gov.au/nrm/water_issues/wetlands. Murray-Darling Basin Commission, Canberra.

MDBC, 2006b, *Water application across the River Murray system and Icon Sites - Status Report.* Murray-Darling Basin Commission, Canberra.

National Parks Association of NSW, 2008, *The Impacts of River Red Gum logging and associated activities in NSW on matters of National Environmental Significance*, Sydney

Natural Resource Management Ministerial Council, 2005, *Directions for the National Reserve System: A Partnership Approach,* NRMMC

NSW DNR, 2007, *Information page on Murrumbidgee wetlands*, online at http://naturalresources.nsw.gov.au/water/wetlands_area_murrum.shtml. New South Wales Department of Natural Resources, Sydney.

NSW WFTF, 2000, *Information Sheet on Ramsar Wetlands – Macquarie Marshes,* online at http://www.wetlands.org/RSIS/_COP9Directory/Directory/ris/5AU027en.pdf.

Phillips, W., & Muller, K., 2006, *Ecological Character of the Coorong,Lakes Alexandrina and Albert Wetland of International Importance,* South Australian Dept Environment & Heritage, Adelaide.

Rae, N., 1994, *Water Requirements of the Gwydir Valley Wetlands – an Assessment and Consolidation of Prior Studies*, Sydney, NSW Department of Natural Resources.

Ramsar Convention Secretariat, 2006, *The Ramsar Convention Manual: a guide to the Convention on Wetlands (Ramsar, Iran, 1971)*, 4th ed. Ramsar Convention Secretariat, Gland, Switzerland.

Ramsar Convention Secretariat, 2007, *Wise use of wetlands: A Conceptual Framework for the wise use of wetlands,* Ramsar handbooks for the wise use of wetlands, 3rd edition, vol. 1. Ramsar Convention Secretariat, Gland, Switzerland.

Scott A., 1997, *Relationships between waterbird ecology and river flows in the Murray-Darling Basin,* CSIRO Land and Water Technical Report No. 5/97, CSIRO Land and Water, Canberra.

South Australian Murray-Darling Basin Natural Resource Management Board (April 2008) *Report to the Murray-Darling Basin Ministerial Council on the condition of the Coorong and Lower Lakes*, South Australia

Taylor-Woods, E. and Jaensch, R., 2006, *The Ecological Character of the Gwydir Wetlands Private Ramsar Site in NSW.* New South Wales Department of Environment and Conservation, Sydney.

Thoms, M.C., 2003, 'Floodplain–river ecosystems: lateral connections and the implications of human interference', *Geomorphology* 56 (2003) 335–349.

Timms B.V., 2001, 'Large freshwater lakes in arid Australia: A review of their limnology and threats to their future', *Lakes & Reservoirs: Research and Management* 6, 183-196.

Van Dijk, A. et al., 2006, *Risks to the Shared Water Resources of the Murray-Darling Basin*, Murray-Darling Basin Commission, Canberra.

Wong, C.M., Williams, C.E., Pittock, J., Collier, U. and P. Schelle 2007, *World's top 10 rivers at risk*, WWF International, Gland, Switzerland.

Young, W.J., Podger, G. and Marsh, N., 2008, *Water resource development & climate change in the MD Basin: impacts on river hydrology & implications for environmental sustainability*, CSIRO, 11th International Riversymposium, August 2008