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The Secretary
Senate Rural and Regional Affairs and Transport
Parliament House
Canberra ACT 2600

SUBMISSION TO SENATE INQUIRY INTO WATER POLICY INITIATIVES

Rural and Regional Affairs and Transport Committee

Introduction

Recent water reforms at both a National and State level are leading to improved water use and management in Australia and raising national consciousness about the need to adequately value and protect our waterways. There remain areas in need of substantial reform, however, and other areas where slow or partial uptake of the reform agenda means that river and aquatic ecosystem health continues to decline. This decline, in turn, threatens the ongoing viability of the diverse livelihoods, businesses and communities that rely on a healthy environment.

In this submission, the Inland Rivers Network and Australian Conservation Foundation draw the Committee's attention to the impacts of some recent water policy initiatives and key issues yet to be addressed. These issues are addressed under the five subheadings given in the Terms of Reference.

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 the Network has advocated for the conservation of biological diversity in these environments, the maintenance of essential ecosystem functions and the restoration of degraded habitats.

Australian Conservation Foundation (ACF) is committed to inspiring people to achieve a healthy environment for all Australians. For 40 years we have been a strong voice for the environment, promoting solutions through research, consultation, education and partnerships. We work with the community, business and government to protect, restore and sustain our environment.

Contact: Please call Arlene Buchan of ACF on 0407 883 907 or Amy Hankinson of IRN on 0432 053 449 if there are any questions arising from this submission.

(a) The development of water property titles

Addressing overallocation and overuse

Recent water policy initiatives, including those being developed under the framework of the National Water Initiative, increase the property right or security of water access entitlements. The *quid pro quo* is that action will be taken to:

> "return all overallocated or overused systems to environmentally sustainable levels of extraction". (NWI, s.23 iv).

These two fundamental tenets of the NWI have broad stakeholder support, as evidenced in the joint ACF, National Farmers Federation (NFF) and Australian Bankers Association (ABA) statement (attached).

The NWI does not, however, include any targets or timetable for returning extraction levels to sustainable limits and only requires

> "substantial progress towards adjusting all overallocated and / or overused systems" by the end of 2010 (NWI Schedule A: Draft Timetable for Implementation of Key Actions).

Whilst we understand that the pathways for addressing overallocation and overuse are to be set out in state based implementation plans, and that the National Water Commission (NWC) will only accredit implementation plans once satisfied that the above requirements will be met, various state based developments are cause for concern in this regard. Moreover, some states are pre-empting the Commission's sign-off by claiming their plans are consistent with the NWI.

In Victoria, for example, Sustainable Water Strategies are the planning mechanisms through which the state government intends to vary or enhance the environmental water reserves of river systems to address overuse and overallocation. The Victorian Central Region Sustainable Water Strategy is currently in development and includes the Yarra, Werribee, Maribyrnong, Tarago, Latrobe, Thomson, Macalister, Barwon, Leigh, Moorabool and Gellibrand Rivers and Creeks.

We understand that modelling for projected future consumptive demand is based on:

> "full utilisation of existing rights to consume water, in systems where current use is well below the maximum allowable" (Discussion Paper Central Region Sustainable Water Strategy, October 2005, p.9).

This could result in a significant increase in water extracted from these rivers because water authorities may currently use less water than they are allocated. For example, in the highly stressed Moorabool River increasing extraction from current use levels to the volume allocated under Bulk Water Entitlements could result in a 20% increase in water extraction.

In the Thompson River, scientific studies indicate that the river requires 40GL/year of environmental flow to be returned to it but the government's 10-year plan is only to return 18GL/year.

Whilst public consultation on the Central Region Sustainable Water Strategy has commenced it does not include accurate assessments of the environmental flow requirements of the regions' river systems. The results of environmental flow studies currently underway will not be collated until the 15 December 2005. The draft Sustainable Water Strategy will be prepared by the Department of Sustainability and Environment (DSE) between 15 December 2005 and 15 January 2006. While detailed projections of consumptive water demand is presented in the Central Sustainable Water Strategy Discussion Paper, there is no data quantifying the specific environmental flow requirements of the region's river systems.

This is inconsistent with obligations under the NWI to "return all overallocated or overused systems to environmentally sustainable levels of extraction". Consumptive use in rivers that are already stressed or at risk of flow stress should be capped at current use and water recovered for environmental flows to redress overallocation. These rivers should not be subject to further increases in extraction. Unless overallocation and overextraction are fully addressed, water licence holders will benefit greatly from the transfer of a public good to a private good through increased water licence security without the public getting the benefit of healthy rivers. Such an outcome would be inequitable and unacceptable.

Matching Environmental Water to the Needs of the Environment

The characteristics of environmental water allocations should reflect the ecological needs of the river, wetland etc for which they are allocated. The specific needs of freshwater assets will vary greatly depending on many factors and the frequency, duration, magnitude and seasonality of different flow components including overbank flows, low flows, summer freshes etc is crucial for maintaining or restoring the ecological values that characterise the assets.

We are concerned that some water recovery processes are proceeding without any understanding or consideration of what the ecological needs of the asset in question are and they are failing therefore to recover water with the right sort of characteristics, in terms of level of security, capacity for carry-over in dams etc.

In the 'First Step' of the Living Murray Initiative for example, around 240GL of water has been identified for recovery through efficiency and infrastructure projects. We are unaware of any discussion about the extent to which the characteristics of this recovered water will meet the needs of the six 'Significant Ecological Assets' or 'icon sites' that are to benefit from the recovered water.

We support all the current Living Murray water recovery measures but see an immediate need for the Environmental Watering Group of the MDBC to prepare an indicative portfolio of the optimum mix of water products that could best meet the ecological objectives of the First Step decision in both wet and dry years. Further water recovery efforts should then focus on ensuring that the recovered

water reflects the characteristics of the indicative portfolio rather than just target the easiest water to recover.

Market Mechanisms for Returning Water to the Environment

The development of property rights and water markets to allow trading in water extraction licences provides a new and important opportunity for governments to enter the market and purchase water which can then be returned to the environment to address overextraction. This opportunity to adopt market mechanisms for water recovery is recognised in the NWI, s79ii:

> ii) where it is necessary to recover water to achieve modified *environmental and other public benefit outcomes*, to adopt the following principles for determining the most effective and efficient mix of water recovery measures:
>
> a) consideration of all available options for water recovery, including:
>
> – investment in more efficient water infrastructure;
>
> – purchase of water on the market, by tender or other market based mechanisms;
>
> – investment in more efficient water management practices, including measurement; or
>
> – investment in behavioural change to reduce urban water consumption;
>
> b) assessment of the socio-economic costs and benefits of the most prospective options, including on downstream users, and the implications for wider natural resource management outcomes (eg. impacts on water quality or salinity); and
>
> c) selection of measures primarily on the basis of cost-effectiveness, and with a view to managing socio-economic impacts.

We are concerned by the resistance that parties to the NWI and the Living Murray Initiative are expressing about the use of market mechanisms to address overextraction. We see no grounds for adopting such an ongoing position. Market mechanisms can and should be used as one element in a portfolio of water recovery mechanisms to address overextraction.

For example, the MDBC estimates that the intergovernmental agreement to return an average 500GL/year of environmental flow to the River Murray under the 'First Step' of the Living Murray Initiative will not be achieved within the 2009 timeframe if only infrastructure and efficiency based water recovery methods are used.

Despite this, the MDB Ministerial Council rejected calls from the South Australian Government, the Australian Floodplain Association, environmental NGOs, leading scientists - including Professor Peter Cullen amongst others - to adopt the use of market mechanisms for water recovery and instead only requested the MDB Commission to provide advice on market based options at the next Ministerial Council meeting in April 2006.

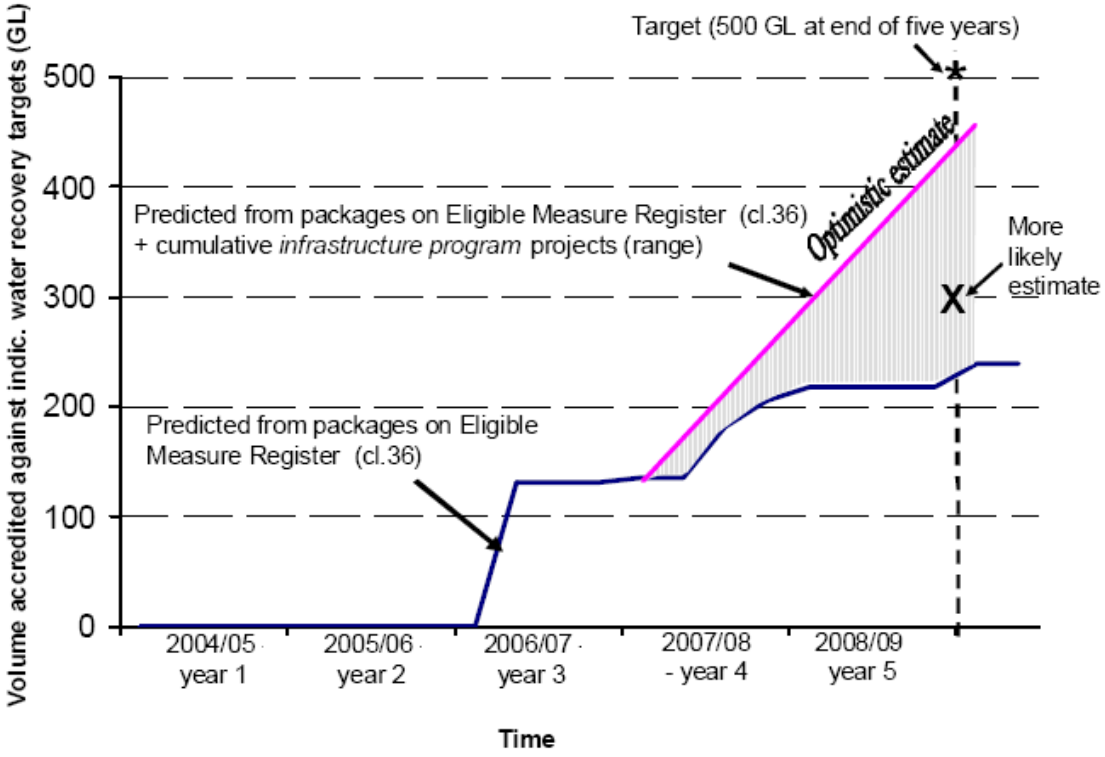

Figure showing the predicted volume of water capable of being recovered from infrastructure and efficiency measures currently identified by the parties to the 'First Step' (Graph from Attachment 3 to the MDB Ministerial Council 38 Communique).

Structural adjustment methods outlined in the recent paper by Young and McColl - "*Managing Change: Australian structural adjustment lessons for water*" - discusses the need to change water resource allocation so that it more accurately reflects resource constraints and scarcity, and will enhance the longevity of rural communities through more sustainable practices. Their paper also discusses methods for acquiring environmental water with positive repercussions for rural areas. These adjustment methods include the use of market mechanisms.

Recent work by ABARE Economics[1] discusses water 'options' contracts as a particular market mechanism for returning water to the environment as part of a portfolio of environmental water entitlements with tangible benefits for irrigation licence holders as well as the environment.

Market mechanisms should be actively embraced by all parties to the NWI as a mechanism for water recovery for the environment. This is especially so where market mechanisms provide substantially more cost effective opportunities for water recovery and therefore maximise return for the taxpayers' investment. The current restriction on the Australian Water Fund - i.e that it should be used

[1] Hafi, A., Beare, S., Heaney, A. and Page, S. (2005). Water Options for Environmental Flows. www.abareconomics.com/publications/nat_res_managment/2005/e-reports/eReport_WaterOptions.pdf

for infrastructure and efficiency measures only - is uncalled for and should be removed.

We acknowledge and support the recent 'Riverbank' announcement by NSW Premier Iemma to invest $105 million to buy water entitlements in inland NSW; prioritising the Macquarie Marshes, Gwydir Wetlands, Lowbidgee Floodplain and the Narran Lakes. This substantial investment should make a significant difference to the long-term future of these stressed river and wetland systems, especially if matching funding is forthcoming from the Australian Water Fund.

We also note that South Australia is advocating for the direct purchase of water for the environment and particularly to return 500 GL of environmental flow to the River Murray by 2009 as part of the intergovernmental 'Living Murray Initiative'.

We call on the Australian Government to match NSW's Riverbank commitment, and to work with all governments to embrace large-scale licence buy-back as a means to returning water to the environment and in particular with all Living Murray states to use market mechanisms as part of the 'First Step'.

Floodplain Harvesting

In NSW and Queensland the development of private property rights in water has occurred without addressing the issue of floodplain harvesting and works on floodplains. This is of great concern to environmentalists and downstream water users including floodplain graziers.

Overland flow is linked to downstream river flow. It makes an important contribution to natural flow variability and the connectivity of floodplains with river channels. Harvesting overland flow for storage and subsequent irrigation use has huge implications for downstream river and wetland health, as well as on downstream users, and must be addressed immediately. Immediate resolution of this conflict is needed to provide greater certainty and fairness to non-irrigation water users and the environment.

Poor measurement and metering mean that the total amount of water diverted under this practice is not known and the low to zero cost of harvesting such water has driven its uncontrolled development over a very short period of time. In the Gwydir River catchment for example, storage capacity has increased from a practically negligible amount at the beginning of the 1970's to in excess of 400 GL today.

Excessive floodplain harvesting is responsible, amongst other things, for the reduction in river flow to the Gwydir wetlands causing a decline in the quantity and quality of native vegetation, reduction in native fish, frogs, reptiles and waterbird breeding events. The decline in the environmental values of aquatic ecosystems like The Gwydir Wetlands is contrary to Australia's obligations under the Ramsar Convention. Similar effects are seen in other wetlands downstream of areas where floodplain harvesting occurs including the Narran Lakes, the Lowbidgee floodplain and the Macquarie Marshes.

Policies must be developed that refer to all flood-works so that their implications for catchment management can be assessed. It is also essential to ensure that floodplain harvesting is accountable and adequately managed. As with river flows, overland flow extraction must be capped. Where the initial cap is ecologically unsustainable, water should be recovered and returned to the environment using the full suite of water recovery mechanisms set out in the NWI.

Condamine Balonne Water Planning Process

A large number of off-stream storages have been built in recent years and the infrequency and small magnitude of flows within the Lower Balonne is of great concern to NSW. Criticism has also arisen following the recent water reform process in Queensland, with issues of process and inadequate consultation raised, as well as strong concerns regarding the levels of extraction permitted or at least acquiesced to. The negative impacts of this development and the reform process have been felt acutely by graziers in the Lower Balonne and the environment. The submission on the draft water resource plan made by the 'Environment Groups' to the QLD government is attached[2].

The Murray-Darling Basin Cap

General: Cap implementation in 1995 has driven water use efficiency resulting in decreased returns to rivers from irrigation districts[3]. The Cap for irrigation districts is defined as the net diversion, which is the gross diversion from the off-takes less the return flows. A reduction in drainage returns increases the effective net diversion to irrigation districts and decreases the downstream flow regime, but the increase is not reflected in the accounts kept for monitoring Cap compliance.

The drainage from NSW has reduced by a step-change in the order of 26.5 GL/year post -1993/94 and the drainage from Victoria is reducing by 9.7 GL/year since 1990/91 corresponding to a total reduction of around 68 GL/year since 1993/94[3]. The Cap should be adjusted to reflect this effective increase in water use for irrigation and loss of water to the environment to prevent the ongoing erosion of environmental water.

New South Wales: The Murray-Darling Basin Cap has not been fully implemented in NSW, despite being established over a decade ago. The NSW Government agreed on a Barwon-Darling Cap in July of this year but has not yet implemented it and we understand that water extractions in the system remain well above the Cap level. It is unreasonable to further delay implementing the Cap in light of ongoing environmental decline and water users' need for investment certainty.

The Cap strategy as agreed, however, is flawed because:

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[2] Accessed via: http://www.irnnsw.org.au/pdf/CondamineBalonneWRP.pdf

[3] MDBC Technical Report 2002/2003. Prepared by Prasad, A & Close, A. Analysis of Irrigation Returns from Irrigation Districts in New South Wales and Victoria.

- The 173 GL up-front credit is a blatant Cap violation and provides an unjustified privilege to this valley that no other valley in the southern MDB has benefited from;
- Continuous accounting potentially allows irrigators to extract very large volumes of water in a single year. If any single year were to be a dry(ish) year, there could be serious environmental consequences;
- Allowing a 173GL/year credit provides insurance against climate change for irrigators and irrigators alone. Assuming that the next 100 years are climatically much like 1891-1997, then having a 173GL/year credit works as an average. However, if the next 100 years are drier than 1891-1997, as predicted by climate change studies the 173GL/year average is too high and would erode the security of the environment's water.

Queensland: Several systems remain excluded from the MDB Cap including the Border Rivers, Condamine-Balonne, Moonie and Warrego systems. This is unreasonable given that the southern states have been subject to the Cap for a decade and further, given the impact that overextraction in the Condamine-Balonne, for example, is having on the environment and downstream users, and the inadequacy with which this is being addressed through the 'resource operations plan' (see above for details).

(b) Methods of protection for rivers and aquifers

River and aquifer protection requires a range of tools reflecting the complexity of the issues facing riverine ecosystems. Many are catchment-wide issues that need to be dealt with through broader scale planning and regulation of water management. Developing a system of protected, high-conservation value areas is an essential plank in a good planning framework and would provide in-situ protection of areas from externally driven problems. A system which recognises and incorporates a range of values, from cultural to environmental also encourages local stewardship and attracts investment into regional communities for example through tourism, co-management by government and communities, regional development and new jobs.

Also, the National Water Initiative requires the Parties to:

> "identify and acknowledge surface and groundwater systems of high conservation values, and manage these systems to protect and enhance those values; (NWI s. 25 x).

However, it does not provide a mechanism for doing so.

Please find attached the IRN and ACF "*Vision for a Framework under the NWI for the Protection of High Conservation Value Freshwater Areas in Australia*" which we submit as our proposal of a mechanism to implement NWI s. 25 x) and also fulfil Australia's international and national commitments related to aquatic biodiversity conservation and water reform.

Please also find attached the draft proceedings of the "*Freshwater Protected Areas in Australia*" Conference, held in September 2004 by World-Wide Fund

for Nature (Australia) and the Inland Rivers Network. We hope these documents provide a useful reference for the Committee.

Environmental Flows
The water reforms have attempted to improve the quality and quantity of river flows to more closely mimic natural flow variability. However, the problem of high summer flows is an unresolved problem which may well be exacerbated by trading. High and/or constant flows can have a number of negative impacts, as commented on by Jones in "*Managing the Ecological Risks of Water Trading*"[4]. There is a need for these impacts to be mitigated, for example by setting a maximum summer channel capacity limit.

(c) Farming innovation

Please see comments about dealing with floodplain works generally under heading (a).

There is ample opportunity for ongoing investment in improved water use efficiency measures, by reducing loss through seepage and evaporation from water storages or during irrigation water transmission, for example as described in 'The Business of Saving Water'[5].

We welcome such investment provided the measures do not erode existing environmental flow, for example, by preventing seepage that would otherwise be returned to the river flow via ground water connectivity or have any other environmentally detrimental effect.

There are clearly opportunities for partnerships between business and government in jointly investing in efficiency projects and using public money to leverage private investment in adopting farm-based innovation. All investment of public money should result in commensurate public benefit, and water recovered as a result of public investment must be returned to the environment rather than the consumptive pool.

More broadly, there is an urgent need for a national policy framework that drives large-scale private investment in a wide variety of commercial-environmental ventures. Such a framework should aim to take account of the three broad layers in the investment chain: capital, natural resource, and technical expertise. It could do so by providing a mixture of measures concentrating on closing information gaps, funding high-priority activities, and providing incentives for commercial investments that deliver environmental gains. It should serve to build the capacity of private land and water managers and investors to explore and identify new commercial opportunities that demonstrate multiple environmental benefits. Governments should provide incentives for private land and water managers to disclose detailed information about

[4] *Watershed*, CRC for Freshwater Ecology Newsletter, April 2005.
[5] The Pratt Water Murrumbidgee Project: www.napswq.gov.au/publications/pubs/pratt-water-main.pdf

environmental conditions on their property and their plans for managing emerging threats.

Ideally, the framework should employ policy instruments and investment vehicles that governments and investors are familiar with and have been tried and tested in other policy areas. Such instruments and vehicles have already been put to good use augmenting public investments in the business innovation, health care, built infrastructure and other spheres.

To be strategic, the framework would have to ensure that only those private ventures investments that were aligned with national priorities, and regional NRM targets and standards would receive concessions and incentives. In this way only ventures that successfully aligned private interests with the public good would receive public assistance to enable them to become self-sustaining.

Importantly, these schemes would add a powerful new tool to the kit of regional communities, and enable regional NRM groups to steer private land and water management in sustainable directions..

In 2001, ACF, CSIRO Land & Water and a group of companies with a large stake in rural Australia commissioned the Allen Consulting Group to explore options for leveraging private investment in sustainable land and water use. ACG proposed five key elements to catalyse and guide such investment[6]:

- Statutory investment companies, as tax-preferred investment vehicles, to raise access to private capital for accredited commercial-environmental ventures;
- An integrated package of taxation offsets and concessions tailored to make environmental investments more attractive, with the aim of revenue neutrality;
- Nationally agreed accreditation criteria of plans for commercial-environmental ventures to ensure consistency with national and regional NRM priorities;
- Seed funding to be made available for innovative commercial ventures that yield verifiable environmental benefits;
- A national statutory Fund to administer these programmes and concessions.

The NWI and the Australian Water Fund is an example of progress towards these elements, although clear gaps remain in the framework.

(d) Monitoring drought and predicting farm water demand

The implications of drought for the environment and producers that depend upon a healthy environment are becoming more acute as reduced flows in regulated systems mean the lower reaches and floodplains of many rivers are receiving very little water. Areas that have been severely adversely impacted by

[6] Allen Consulting Group (2001) *Repairing the Country: Leveraging Private Investment*, A report to the Business Leaders' Roundtable. ACG, Canberra & Sydney. Available online at www.acfonline.org.au/uploads/res_private_investment.pdf

the current drought such as Chowilla Floodplain, the Coorong and the.Murray Mouth have seen many droughts worse than the current one and been less impacted. This is because even during severe droughts, occasional freshes and floods are sufficient to maintain the viability of the environment. However, under the current level of regulation such intermittent flows are captured, stored and used for irrigation, exacerbating greatly the impact of the drought on the environment.

Monitoring drought and predicting farm water demand is also difficult when water is still not fully accounted for. In particular, with floodplain harvesting still being largely unregulated it is difficult to make any accurate plans for equitable water sharing and demand management.

(e) The implications for agriculture of predicted changes in patterns of precipitation and temperature.

Much uncertainty remains about the precise scale, timing, impacts and implications of anthropogenic climate change on patterns of precipitation and temperature in Australia but it is likely to have major impacts on agriculture.

Some scientists predict , for example, that climate change is likely to cause a 5% or 1,100GL/year reduction in system inflows to the River Murray by 2023 (see table below). Given that the Living Murray Initiative currently only seeks to return 500 GL of water to the grossly overextracted and stressed River Murray by 2009, further steps are crucial just to keep one step ahead of the momentum of climate change!

Given that scientists[7] recommended at least 1,500 GL of water should be returned to the River Murray to provide it with just a “moderate chance” of being restored to health, without considering the above mentioned predicted climate change impacts, it emphasises the need for action beyond the ‘First Step’. Given the critical condition of the River Murray, we strongly suggest that work on what the second and subsequent steps could look like should begin straight away and not be delayed until post-implementaton of the ‘First Step’.

More generally, the risk of climate change-induced reduction in river inflows means it is imperative that water is fully accounted for so that any risk assignment framework is meaningful, the impacts of climate change clear, and necessary resilience-building strategies undertaken in good time.

We would welcome further debate on around managing the impacts of drought on people, businesses and landscapes in this, the driest inhabited continent with a notoriously unpredictable and variable climate.

[7] Ecological Assessment of Environmental Flow Reference Points for the River Murray System. Interim Report prepared by the Scientific Reference Panel for the MDBC, Living Murray Initiative. 2003.

Impact of Climate Change on the River Murray in terms of:	Most Likely Change in System Inflows by 2023	Most Likely Change in System Inflows by 2053
Percentage reduction in inflow	**-5%**	**-15%**
GL/year	**-1100**	**-3300**

Source: CSIRO (2004).

The effects of climate variability will be, however, be compounded by climate change. Irrigated agriculture must adapt so as to co-exist with a healthy environment and other water users such as floodplain graziers of inland NSW or the increasingly rare commercial fishers of the Lower Lakes and Coorong of the River Murray.

The voice of Australian farmers for 25 years

Australian Conservation Foundation

National Farmers' Federation

AUSTRALIAN BANKERS' ASSOCIATION

News Release

23 June 2004 Joint Release

FARMERS, ENVIRONMENTALISTS AND BANKERS UNITE ON HOW TO ADDRESS OVERALLOCATION OF WATER AND RESTORE RIVERS TO HEALTHY WORKING CONDITION

The Australian Bankers' Association (ABA), Australian Conservation Foundation (ACF) and National Farmers' Federation (NFF) joined today to offer Australia's political leaders a set of six principles that should be addressed before committing to a National Water Initiative at the Council of Australian Governments meeting this Friday.

The principles, agreed by farmers, environmentalists and bankers, would guide Governments in dealing with over-allocated systems and restoring rivers to healthy working condition.

The ABA, ACF and NFF urged politicians to take a bipartisan approach on these critical water reform issues and use this unique opportunity to deliver a comprehensive and fair long-term framework for managing Australia's water resources.

NFF President, Mr Peter Corish said, "COAG leaders have the opportunity to get it right and in doing so give security to farmers over their water entitlements and provide certainty for the environment and regional communities."

ACF Executive Director, Mr Don Henry said, "Reconciling the needs of both water users and the environment is an essential task and it needs clear targets and a significant national funding commitment to achieve these goals within ten years."

ABA Chief Executive, Mr David Bell said, "To ensure continuity and certainty of access to finance for agribusinesses it is important that water users and their bankers are able to assess the future impact that water reforms will have on businesses so that they can minimise uncertainty."

The six principles are:

1. Within six to 12 months, Governments to identify over-allocation and river health status. Following this, within 10 years, Governments to address over-allocation and restore Australia's rivers to healthy working condition. This will require a significant funding commitment from the Commonwealth and State / Territory Governments for structural adjustment.

2. All processes are transparent, consultative and informed by science. …2

3. Assignment of future risk:

   - Changes due to bona fide improvements in science/ knowledge - water users, State / Territory Governments, and the Australian Government share the risks equally.

   - Changes in government policy - governments pays.

   - If climate change reduces the size of the total resource, then impacts will be shared proportionally between the environment and water users. Beyond this, governments will pay for further changes required to maintain river health.

4. Where water has to be acquired for the environment it should come from water efficiency savings, improved infrastructure and purchase from willing sellers.

5. Within 10 years, governments to complete a national heritage rivers reserve system to protect rivers of agreed high conservation values.

6. State / Territory Governments to commit to give water entitlement holders an equivalent status to land, for the purposes of accessing finance.

Contact:

Heather Wellard, ABA Public Relations, (02) 8298 0411 or 0409 830 439

Rebecca Fredericks, ACF Media Co-ordinator, (03) 9345 1109 or 0407 040 085

Mairi Barton, NFF General Manager Public Relations, (02) 6273 3855 or 0408 448 250

Ends

Mr. Steve Goudie,
DNR&M
PO Box 318
Toowoomba,
Qld 4350

2nd February 2004

Dear Steve,

Re: Submission on the Draft Water Resource Plan for the Condamine – Balonne catchment of the Queensland Murray Darling Basin.

The Australian Conservation Foundation (ACF), Inland Rivers Network (IRN), Nature Conservation Council of NSW (NCC), Queensland Conservation Council (QCC), Toowoomba & Region Environment Council Inc. (TREC), and the World Wide Fund for Nature (WWF) [hereafter the 'Environment Groups'] would like to thank you for the opportunity to comment on the Draft Water Resource Plan for the Condamine – Balonne catchment.

Our submission has been prepared with legal advice from the Environmental Defenders Office (Qld) Inc. and approximately follows the format of the draft Water Resource Plan. It includes recommendations and comments on issues that we believe require further consideration and development. They are dealt with under the following headings:

- Underlying principles for the Environment Groups' submission
- Adaptive management
- General comments on the Overview Report for the Draft Condamine – Balonne Water Resource Plan
- Part 3: Outcomes for sustainable management of water
- Part 4: Performance indicators and objectives
- Part 5: Strategies for achieving outcomes
- Part 6: Monitoring and reporting requirements
- Part 7: Implementing the Plan
- Part 8: Minister's report and amending plan

These issues are expanded upon in the following pages. Please contact Ms Sarah Moles, WWF's Wetlands Conservation Officer on 07 4666 6125 or smoles@wwf.org.au should you have any questions regarding this submission.

Yours sincerely,

Phillipa Walsh
Director of Conservation
For The Environment Groups.

Underlying principles for this submission

The Environment Groups believe that the Water Resource Plan must be consistent with the purpose and objectives of the Water Act 2000, as well as agreements made by the Council of Australian Governments (CoAG) under the National Competition Council (NCC), including the Water Reform Policy process.

The NCC CoAG Water Reform Policy states: *"In relation to water allocations or entitlements, where they have not already done so, States would give priority to formally determining allocations or entitlements to water, including allocations for the environment as a legitimate user of water."* ((4)(b) p105, Part 2, Agreements on Related Reforms, Compendium of Competition Policy Agreements, 2nd edition, 1998)

The 1994 Council of Australian Governments (CoAG) Water Reforms Framework states that *"...the environmental requirements, wherever possible, will be determined on the best scientific information available... In cases where river systems have been over-allocated, or are deemed to be stressed, arrangements will be instituted and substantial progress made... to provide a better balance in water resource use including appropriate allocations to the environment in order to enhance/restore the health of river systems."* (Attachment A (4)(d)).

The Environment Groups understand that the nature of Queensland's legislation makes it difficult to specify an environmental allocation. We therefore suggest that the Draft WRP strengthens the security of environmental flow provisions and provides specific links back to the ecological outcomes specified in s8(h)(i-ix). We believe these need to be statutory requirements in the WRP. See recommendations at Part 4.

Smart Targets

The Environment Groups believe the application of the SMART principle is essential in developing an effective WRP. This means clauses are:

Specific
within the sphere of influence.
expressed in biophysical terms.

Measurable
clearly defined. For example, targets with percentages. Where qualitative words are used a definition should accompany them.
relative to an existing baseline or trend.

Achievable
within the bounds of realistic resourcing, ensuring that monitoring, capability and commitment are available.

Relevant
consistent with relevant legislation and strategies.

Timebound
defined within a delivery date

We believe these will enhance the scope of the clauses and their ability to achieve the 'SMART' objectives.

Adaptive Management

The Environment Groups believe that water management needs to be sufficiently adaptive to natural and human induced changes, in order to maintain our water resources in an acceptable state for current and future generations. The development of adaptive management systems and research to improve understanding of riverine, floodplain and wetland ecosystems is essential to their management.

Basing environmental requirements on the best available scientific information and regular review of environmental flow provisions is essential for ensuring that the *Water Act 2000* objectives of protecting and restoring aquatic ecosystems are implemented. (s10 (2)(c) (iv)) The Environment Groups support the proposed links between the Condamine – Balonne WRP and the CRC Northern Laboratory's Narran Lakes research project.

The CoAG Water Reforms Frameworks also states that *"... jurisdictions would consider establishing environmental contingency allocations which provide for a review of the allocations five years after they have been determined"*. (Attachment A (4)(e)). The Environment Groups strongly support the provision to review the WRP after 5 years as a significant improvement over the 10 year review specified in previous WRPs. We believe such flexibility is essential in the face of possible reductions in available water, likely to arise from climate change or other catchment/landuse practices that may increase water use.

The Environment Groups note that the Draft WRP does not contain provisions for specified amendments relating to environmental water or the impact of a significant water quality incident. It is imperative that the WRP is sufficiently adaptive to anticipate and prevent over-extraction and contamination and adequately deal with contingencies should they occur.

General comments on the Overview Report for the Draft Condamine – Balonne Water Resource Plan

Section 1.2. Ecological Condition.

The Environment Groups note that the Scientific Review Panel *"found that the rivers and wetlands of the Lower Balonne system are presently in a reasonable ecological condition, but this condition is expected to deteriorate if the present capacity to extract water from the system should actually be exercised."* (p10, Draft WRP, emphasis added.)

The Environment Groups also note that the Draft WRP proposes no net increase in the volume of water to be extracted from the Condamine-Balonne system. Given that Cullen *et al* expect the condition of the rivers and wetlands to deteriorate if the present extraction capacity is exercised, the Environment Groups contend that 'no net increase' is insufficient to protect ecological values and is therefore inconsistent with the purpose and objectives of the Water Act 2000.

The Environment Groups understand that the current storage capacity on the Lower Balonne Flood Plain is approximately equal to (within 100,000 ML) the annual average discharge as measured at the NSW / Qld border.

Whilst we acknowledge the Draft WRP for the Condamine-Balonne is moving away from the mean annual flows approach to river management, we are nevertheless concerned that operationalizing the existing levels of extraction and storage capacity will institutionalize the degrading effects of current levels of development. We advocate taking the opportunity to work towards immediate improvement of the ecological condition of the floodplain by making 'across the board' reductions to entitlements prior to the completion of the WRP process.

Section 2.1. Community Consultation.

The Environment Groups understand that Ministerial Advisory Councils were established for the upper and middle reaches of the system, while a Community Reference Group was appointed for the Lower Balonne Floodplain.

We further understand that with respect to the Lower Floodplain, working groups comprising members of the CRG were established to:

- build stakeholder understanding of floodplain values and functioning;
- contribute advice and ideas to DNR&M regarding the draft WRP; and
- ensure co-operation and information exchange between the CRG, DNR&M staff and scientific experts and researchers providing the best available and most up-to-date data for planning purposes.

The Environment Groups congratulate the Department of Natural Resources and Mines for the thorough consultation and receipt of community ideas and advice that took place within the Condamine-Balonne catchment during the process of WRP development.

Section 2.3 Implementation through the ROP

The Environment Groups support the opportunity for all interested parties to make submissions on the draft ROP. We look forward to putting forward our ideas on water sharing and trading rules, as well as environmental flow arrangements.

Section 2.5. Establishment of MDBC Cap.

The Environment Groups are strongly in favour of metering all extractions in the Condamine-Balonne catchment, including the harvesting of overland flow water. This data is essential to monitoring of the MDB Cap as well as the implementation and auditing of the WRP.

The Environment Groups support the application of penalties for non-compliance with water license terms and conditions. We believe that reductions in access entitlements provide a far greater incentive to comply with license conditions than financial penalties.

The Environment Groups also support review and / or revision of water sharing or water management rules in the event of actual extractions exceeding predictions. We understand that this could mean a review or revision could be triggered prior to the planned five year review.

Section 3.1. Event-based Environmental Flow Management and Water Sharing Rules.

The Environment Groups are concerned that large flow events are deemed to be 'less environmentally important' than low flow events. (p 18, Draft WRP)

The Environment Groups believe that ALL flow levels are important, with different flows being important to different parts of the system. (e.g. low flows - in-stream biota and channel

maintenance; medium flows – benches and floodplain billabongs; high flows – floodplain vegetation communities).

We support the use of water diversions and storage works to maximize the efficiency of environmental water, but believe the floodplain itself should also be a recipient of environmental flows.

We note the concerns of floodplain graziers that the loss of high flow events over the past decade has caused pasture and productivity declines and a trend towards thickening of the woody shrub layer.

The most recent event (January 2004) highlights the concerns we share with graziers on the Lower Balonne Floodplain. We understand that in 1994, a peak discharge of approximately 65,000ML at Jack Taylor Weir resulted in a river height of 5.76 metres at the Brenda gauge and the inundation of some 24,000 hectares of Culgoa floodplain at Brenda Station on the Qld/NSW border. (P. Petersen, pers.comm) The peak discharge for the most recent event (January 2004) was 75,000 ML, yet no water broke out of the river and no floodplain inundation occurred on Brenda Station, nor in downstream areas. We believe this is almost entirely due to the extent of water harvesting along the Culgoa River.

The Environment Groups believe this provides graphic evidence of the impact of water harvesting on the Lower Balonne Floodplain, as well as the urgent need for reductions in all water harvesting entitlements to ensure continued ecosystem functioning and to prevent irreversible damage. Such action would be consistent with the Precautionary Principle and the purpose of the Water Act 2000. It is also economically sound: it is considerably cheaper to prevent damage to natural infrastructure than it is to repair it.

Section 3.2. Cap on total Level of Water Extractions.

With the exception of the specific exemptions listed, the Environment Groups do not believe the WRP should allow for <u>any</u> increase in the amount of water authorised to be taken in the plan area. In particular, we strongly oppose any increase in the taking of overland flow water and believe it essential that a rigorous and transparent process links the WRP and requirements under the *Integrated Planning Act 1997*.

Section 3.3. Conversion of Licenses to Water Allocations.

The Environment Groups note that the Condamine-Balonne community has made a concerted effort to allow sleeper licenses to come on-line with no increase in overall extractions. We support the notion of a sunset clause for development of these licenses, but believe that if the timeline expires before a license is activated, then the license should be cancelled outright and not re-allocated anywhere in the system. Rather, this water should be returned to the environment.

Section 3.4. Development of Water Trading Rules.

The Environment Groups note that tradable allocations may result in water being directed to higher value uses. We believe there is an underlying – and false – assumption inherent in this point. Higher value uses of water are more economically efficient, but not necessarily environmentally beneficial. (Isaacs 2002)

The Environment Groups note that conditions may be imposed on traded water for social or economic reasons. We believe such conditions should apply for environmental reasons. We therefore support the establishment of rules that ensure consistency with Environmental Flow Objectives and conditions such as restricted access to protect natural features such as waterholes or lakes.

The Environment Groups strongly support the requirement for approved land and water management plans for use of traded water

Section 3.5. Integration of Overland Flow Management.

The Environment Groups find the distinction between Type A (no downstream impact) and Type B water (downstream impact) difficult to reconcile and unnecessarily complex. We are concerned by the sheer volume of overland flow water that is extracted from the Condamine-Balonne system. This water is essential for floodplain functioning, including maintaining floodplain pastures, bushland communities, wetlands and downstream users. We strongly believe that substantial cuts should be made to all overland flow entitlements, to secure the long-term health of the floodplain before irreversible damage is done. This should be done prior to the completion of the WRP so that compensation is not required.

The Environment Groups strongly support the regulation of overland flow water for irrigation purposes in the draft WRP.

We strongly support the measurement (metering) of overland flow water.

The Environment Groups also support the non-tradability of overland flow water.

Section 3.6. Monitoring, Assessment and Reporting Systems.

The Environment Groups believe there is a need for a clear understanding of the probable (or desirable) ecological consequences of the plan. These should be statutory requirements and detailed in Part 3 'ecological outcomes' of the WRP. As presented in the Draft Plan, the ecological outcomes are poorly defined. The Environment Groups are concerned that this will make it difficult to accurately assess whether the WRP is achieving its objectives.

The Environment Groups recognise that the Draft WRP is breaking new ground in river management and that rigorous monitoring will be required to evaluate the new approach. We are concerned that the resources required to adequately monitor the efficacy of the plan will be significant and beyond the budget available to the Department of Natural Resources & Mines.

Environment Groups support the proposed 5-year report on:

- the accuracy of stream flow gauging;
- implementation of the WRP;
- appropriateness of Performance Indicators;
- effectiveness of event management rules; and
- progress in research activities into Narran Lakes and the Culgoa Floodplains National Parks' vegetation communities.

We particularly support monitoring of the condition of natural ecosystems and the development of real time monitoring systems to underpin proposed event management arrangements.

The Environment Groups strongly support metering of all volumes taken by all water licenses and water allocations, including overland flow extractions. This is essential for demonstrating compliance with the MDB Cap

Section 3.7. Formation of Water Advisory Councils.

The Environment Groups support the proposed establishment of Water Advisory Councils, particularly with respect to the Lower Balonne for the implementation of event management rules.

We believe it will be essential for this body to have broad geographic representation as well as access to a comprehensive set of skills. Experts in ecology and water management from both Queensland and NSW should be involved. Equitable representation by community stakeholders will be essential to countering perceptions of bias.

Finally, the Environment Groups believe that the process by which it was agreed to allow sleeper licenses in the Lower Balonne to develop up to the 30th percentile should be covered in the Overview report. We regard transparency as an essential requirement.

Comments on Supporting Documents – Upper and Middle Condamine MAC Proposals.

The Environment Groups do not support a new allocation of 40,000 ML in the middle reach of the Condamine-Balonne. Further allocations would come at the expense of the reliability of existing users, including the environment, which is not acceptable.

We believe a 2 year timeframe for the development of sleeper licenses (on a 'no net increase in extractions' basis) is generous and reasonable. We strongly recommend that undeveloped licenses be cancelled and not re-issued after this time has elapsed.

The Environment Groups vigorously oppose any development of new in-stream structures in the Condamine-Balonne system.

COMMENTS ON THE DRAFT WRP

Part 3: Outcomes for sustainable management of water

'Ecological outcomes' means a consequence for an ecosystem in its component parts specified for aquifers, drainage basins, catchments, sub catchments and water courses. All water resource plans must state outcomes, including *ecological outcomes* for the sustainable management of water.(definition, Water Act 2000)

Thus the consequence for an ecosystem must be in accordance with the concept *sustainable management*, the key part of the purpose of Chapter 2 of the Water Act 2000.

Sustainable management is management that-

1. allows for the allocation and use of water for the physical, economic and social wellbeing of the people of Queensland within limits that can be sustained indefinitely; and

2. protects the biological diversity and health of natural ecosystems; and

3. contributes to-(*a list of 9 actions*).

Thus sustainable management means that protection of biological diversity and health of ecosystems must occur, AND indefinitely sustainable use of water AND some contribution (which may fall short of full achievement) is made to each of the nine listed actions.

The definition of sustainable development excludes water use that cannot be sustained indefinitely and excludes economic development that is not within the principles of ecologically sustainable development.

The Environment Groups are concerned with the approach taken in the draft WRP for the Condamine - Balonne for several reasons:

Part 3 s 8 states that "*Water is to be allocated and managed in such a way that seeks to achieve a balance in the following outcomes.*"

The term 'balance' is not quantified, making it impossible to understand what the ecological consequences of the plan might be.

Part 3 s8 then goes on to list outcomes (a) to (p) of which (h) mentions ecological outcomes and contains 9 examples of those. Other outcomes include

to make water available to sustain current levels of and to support future growth in , economic activity in the plan area while recognizing the social and cultural values of communities in the basin.

The Environment Groups believe that the outcomes should not be balanced against each other. This is contrary to a proper interpretation of the purpose statement of Chapter 2, Water Act 2000, which clearly gives priority to the protection of biological diversity and ecosystem health over other outcomes. Sustainable management is not the same as ecologically sustainable development as that term is loosely described.

The environmental flow objectives do seek to protect the health of natural ecosystems and achieve the Plan's ecological outcomes for the catchment. There is however no attempt to suggest means or strategies of going beyond those outcomes to achieve improved ecological sustainability.

The Environment Groups believe that there should be reasonable grounds to believe that the strategies in the WRP will deliver the desired ecological outcomes for the Plan. We are concerned that the outcomes stated in s8(h) (i) – (ix) and s8(l) and s8(m) of the draft WRP are too general to achieve the purpose of the Water Act 2000. The majority of these outcomes refer to 'maintaining" or 'improving' particular habitats or 'reducing' the adverse impacts of degrading processes. While the outcomes are clear in their objective, there is no defined meaning within the Plan for 'maintain', 'improve' or 'reduce'. The current draft could permit the degradation or destruction of eg. some pool habitats, on the grounds that the use of the water contained therein would not impact on the health of the total river or the total riverine environment. The Environment Groups are concerned that DNR&M would find such an argument difficult to defend.

The environmental flow objectives are based on a 5-year period following the commencement of this plan. It is reasonably foreseeable that some outcomes may not be able to be attained within a 5-year period. In the event that some outcomes are not met within the 5-year period, provisions should ideally be made for appropriate actions to be taken to ensure that those outcomes are achieved.

The Environment Groups believe that the ecological outcomes must be made more specific and relate expressly and directly to features in the plan area. We suggest that ecological outcomes be defined as trajectories of continuous improvement – an approach consistent with recommendations by the CRCFE at the River Health Forum in Dalby, May 2001. The Environment Groups suggest consideration of the following examples as desirable ecological outcomes for the Condamine - Balonne catchments:

- that the condition and extent of all wetland types in the Plan area is maintained or improved.
- Riverine waterholes and permanent/mostly permanent waterholes are maintained as permanent/mostly permanent.

- Frequency and extent of connectivity between the river and floodplain wetlands is maintained.
- Abundance, diversity and opportunities for recruitment of native fish are maintained.
- Hydrological variability is maintained, including flood duration, frequency, amplitude, seasonal timing, rate of rise and fall, and extent of floodplain inundation.

We would welcome the opportunity to be involved in the development more specific ecological outcomes for the Plan area.

Recommendation:

That s8 be amended to read: 'The outcomes for the plan area are:'

That a list of ecological outcomes, related to specific features in the WRP area be developed in consultation with appropriate ecological experts and listed under s8 as worded above.

That the terms 'maintain', 'improve' and 'reduce' be defined in Schedule 5.

Part 4: Performance indicators and objectives

The Water Act 2000 defines "performance indicator" as: "a measure that can be calculated and is stated in a water resource plan to assess the impact of an allocation and management decision or proposal on water entitlements and natural ecosystems." (p386 Water Act 2000, Reprint No 2)

The Environment Groups believe that the performance indicators ('low flow', summer flow', etc) have little or no ecological relevance. We understand they are derived from preliminary statistical associations with no firm conceptual basis in ecology. We are concerned with the underlying assumption that improvement in flows will deliver better ecological outcomes, when there are no related ecological indicators against which to measure this.

Performance indicators for EFOs need to relate to specific features in the Plan area. We recognise that the event management rules for the Lower Balonne are moving in this direction, but specific features in the Plan area are needed for the Middle and Upper catchments. We suggest that the riparian forest from Pratten to Macalister, and floodplain wetlands and billabongs along the middle reach are appropriate ecological assets and specific features which could be included in monitoring and assessment frameworks.

The Environment Groups are also concerned that the relationship between performance indicators and environmental flow objectives is extremely and unnecessarily complicated. We understand that a performance indicator is usually a meaningful number. The performance indicators presented in s9 (a)-(e) appear to be elements of an equation, the workings of which will define the environmental flow objectives. We believe that the reverse should be the case (i.e. that a formula that includes the environmental flow objectives should determine the performance indicators, which should be presented as meaningful numbers).

Even with reference to the Dictionary provided at the end of the Water Act 2000, it is difficult to calculate the EFOs. The Ecosystem Principles developed by ARMCANZ states that accountability is an important factor. We suggest that performance indicators and EFOs should be defined in the WRP and given with details that make the information more accessible to the public and which therefore encourage accountability. A table format could be useful in this regard.

The EFOs and WASOs as set out in Part 4 do appear to have regard to recent scientific information. The critical indicators that are referred to have been adapted from W*atershed, CRCFE, February 2002.*

The Environment Groups understand that for some key hydrological indicators, 66% natural flow is inadequate. The Cooperative Research Centre for Freshwater Ecology's Expert Reference Panel for the Murray River system note that analyses carried out by the Technical Advisory Panel for the Condamine-Balonne and Fitzroy Basin WAMP "clearly identify that for a range of key hydrological indicators, assessed across several Australian river systems, the limit for an increased risk of unacceptable environmental degradation (environmental flow limit) generally lies within the range of 65 - 75% natural"[1].

To permit flows to fall below 66% would therefore be inconsistent with the purpose of Chapter 2 of the Water Act 2000.We further understand that there is no basis for an upper limit of 133%. We would welcome an opportunity to discuss this issue.

The Environment Groups understand that in the neighbouring Border Rivers Catchment, one of the performance indicators is an end of system flow of at least 61% of the pre-development flow pattern. . While this indicator will benefit mostly NSW, it would also be of benefit to the catchment generally. This is more specific than the EFOs in the Condamine – Balonne. The Environment Groups suggest that a percentage should also be set for the Condamine-Balonne.

The Environment Groups are concerned that s10 (Environmental Flow Objectives) and s11 (EFOs (assessing impact of decisions)) will not implement strategies for progressive improvements. Environment Groups believe that the WRP should contain obligations for progressive improvement in EFOs. This would be consistent with the policy intent and purpose of Chapter 2, Water Act 2000. We suggest that trend information could be useful in this regard, making it possible to assess the predicted effects of the Plan against those actually resulting from its implementation, and whether the environment is actually a recipient of more water.

The Environment Groups believe that s10, (Environmental flow objectives) is poorly worded and the meaning uncertain. We are concerned that use of the term 'not less than the lesser of' is inconsistent with the Precautionary Principle; and that he words 'be minimised' will be interpreted subjectively. These weaknesses could institutionalise current levels of development when legitimate opportunities to restore environmental flows exist and should be taken to protect riverine health. .Furthermore, these weaknesses make the assessment process uncertain and subject to challenge by consumptive users.

The Environment Groups believe that s11, Environmental flow objectives (assessing impact of decisions) is complicated, poorly worded and the meaning vague and uncertain. We believe the current phrasing will make it difficult to determine

- clear cut entitlements and access conditions for irrigators;
- whether environmental flow objectives are being met; and
- whether operating rules are adhered to.

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[1] *Independent Report of the Expert Reference Panel on Environmental Flows and Water Quality Requirements for the River Murray System*
Prepared for the Environmental Flows and Water Quality Objectives for the River Murray Project Board, Cooperative Research Centre for Freshwater Ecology, February 2002, accessed at
http://www.mdbc.gov.au/naturalresources/e-flows/pdf/ERPreport.pdf

The Environment Groups believe that the WRP must clearly state environmental flow objectives so that there is no room for misinterpretation. A list of proposed habitat, biological, physical and chemical performance indicators is included in Appendix 1.

Recommendation:

That the words "be minimised" be deleted from s 10(a) and (b).

That s11 be reworded to clarify its meaning and strengthen the security of environmental flow objectives.

Part 5: Strategies for achieving outcomes

s16 (1) of the Draft WRP states that "the chief executive must not make a decision that would increase the average total volume of water that may be taken annually in the plan area." No timeframe is provided to indicate how the 'average' is determined. The Environment Groups believe this must be specified for clarity.

The Environment Groups advocate consistent legislative and policy frameworks, co-ordinated across all aspects of government business. We believe that it is unacceptable to increase the total volume of water that may be taken if environmental flow objectives will be compromised.

The Environment Groups believe that all decisions must be consistent with the objectives of the WRP. We fail to understand why decisions relating to event-management in the Lower Balonne should be an exception and recommend that s17(3) be deleted.

S19(2) appears to contain drafting errors. The Environment Groups propose rewording this clause as recommended below

The Environment Groups note that the catchment community has made efforts to allow sleeper and dozer licenses to develop without increasing total extractions. We believe s23(2)(e) is too broadly defined and needs to relate back to the specific ecological outcomes specified at s8(h)(i-ix) in order to strengthen those purposes. This is consistent with the finding in the case Friends of Springbrook Vs Gold Coast City Council and Stone, which found broad outcomes to be insufficient to ensure ecological outcomes are achieved.

Furthermore, while we support the 'sunset' clause on the development of sleeper licenses, we believe those licenses that are not developed within the timeframe should be cancelled. We recommend the addition of a clause 23(3) to facilitate such action.

The Environment Groups believe s25 should be linked back to the ecological outcomes stated at s8(h)(i-ix) in order to strengthen the achievement of those outcomes.

S25(3) reduces by 5% the maximum rate for taking unsupplemented in the Lower Balonne. We understand that this reduction facilitates the development of sleeper and dozer licenses in the Lower Balonne up to the 30th percentile with no net increase in overall extractions.

S33(1) then allows entitlement holders in the Lower Balonne to take 5% more than the maximum rate for taking water stated on their entitlement for the first 5 years of this Plan. S33(2) states that s33(1) expires 5 years after the commencement of this Plan. We question the need – and indeed the wisdom – of such temporary, transitional arrangements. All stakeholders in the Lower Balonne (and indeed the whole Condamine-Balonne) are well aware of the water planning process and those new arrangements, including adjustment to entitlements, are likely. We believe the effect of s33(1) will be to delay the implementation of adjusted entitlements. Furthermore, we are deeply concerned that such temporary arrangements will undermine the usefulness of monitoring programs established to assess the efficacy of the WRP.

S27 should define the volumetric limit for unsupplemented water in the upper and middle reaches of the catchment. S27(a) and (b) cover the social and economic outcomes, but not the ecological outcomes stated in s8. We believe that requiring the chief executive to have regard to the matters identified in s8(h)(i-ix) will improve the capacity of the WRP to achieve its ecological outcomes and the purpose of the of the Water Act 2000..

S28(4) does not limit the matters the chief executive may consider. We believe this is another clause that is too general and needs to be specifically linked back to the ecological outcomes stated in s8(h)(i-ix).

The Environment Groups oppose the construction of further in-stream structures in the Condamine-Balonne catchment. We accept that modifications may be required to existing infrastructure, and recommend that consideration be given to removing existing works to improve environmental flows.

The Environment Groups welcome the inclusion of clauses that specify purposes for the management of low and medium flows and the filling of Narran Lakes to support bird-breeding events.

As noted elsewhere in this submission, the Environment Groups share the concerns of graziers on the floodplain regarding the total volume of water extractions in the Condamine-Balonne catchment. We acknowledge that the Draft WRP attempts to move towards more sustainable use and management of water, but are concerned that the Draft provisions may be too little, too late. For this reason we believe more specific reductions in water harvesting must be made, and advocate the deletion of terms such as 'up to' and 'up to a maximum period of'. We believe such terms are weak, discretionary and may be subject to individual interpretation by water harvesters. This may hinder the achievement of the purposes of sections 37 – 39.

The purpose of s38 does not make it clear that the rule is intended to reduce the impacts of water harvesting on country naturally flooded under pre-development flow patterns. See recommendation for re-wording below.

The Environment Groups understand that irrigators on the Lower Balonne floodplain agreed that the flow event management rules for filling Narran Lakes would apply to all water harvesters on all distributary streams, not just those on the Narran River. (S. Moles, pers comm.) We commend this agreement and co-operation. We understand the rationale was one of equity as well as addressing protection of the ecological asset identified by Cullen et al – ie. 'the biota of rivers and distributary channels of the Lower Balonne and their associated wetlands.' The Environment Groups believe that s 39 should be amended to make it quite clear that all distributary streams are subject to this rule.

The Environment Groups note that Cullen et al identified the National Parks of the Culgoa Floodplains as critical ecological assets on the Lower Balonne floodplain. We believe that the event management rules should also address the management of high flow events, with the purpose of a high flow rule being to maintain the floodplain vegetation communities of the Culgoa Floodplain National Parks. Whilst acknowledging that high flows provide compensation for allocations foregone under s37-39, we believe maintaining these ecological assets may require specific management intervention for some high flow events. We believe specific provision must be made targeting this need. Therefore, a new clause must be inserted, linked to the reporting requirements in s 55(2)(d), to address high flow management and the vegetation communities of the Culgoa Floodplain National Parks.

The Environment Groups welcome the inclusion and regulation of overland flow water in the Draft WRP and support the assessment process with a clear cut-off date, for the notification of existing works. Without such a timeframe, there is no motivation for landholders to notify the Department of their works. Furthermore, there should be provision for the Department to place conditions on these works to meet environmental objectives. We support the assessment of overland flow works as assessable development under IPA 1997, so that impacts on eg. wetlands and riparian zones, are properly assessed.

S45 is designed to allow DNR&M to license the harvesting of overland flow water "if the chief executive is satisfied there has been, or may be, an increase in the average annual volume of overland flow water taken using the works, above the average annual volume that could have been taken under the operating arrangements in place immediately before the commencement of this plan."

We believe this section is open to challenge and uncertain in its operations. No starting point in time is indicated in the Draft WRP, from which to judge any increase. Without a clear starting point, we fail to understand how the chief executive would determine whether more overland flow water is actually being taken.

The Environment Groups therefore suggest that some presumptions need to be written into the WRP to make it easier for the chief executive to license overland flows. The chief executive might have absolute discretion to license overland flow water up to the average annual volume taken before commencement of the WRP. It could then be the water user's responsibility to prove how much was taken at the commencement of the WRP, not up to the chief executive to prove that amount was taken. For new works, the user could provide evidence of eg date of construction of works, or be presumed to have initiated such works after the commencement of the WRP.

The Environment Groups support the provision in the Draft WRP for the ROP to reduce the volume of overland flow water taken to meet the objectives and outcomes of the Plan. However, we believe s46(1)(d) is discretionary and needs amending to strengthen the Plan.

s 45 (2)(b The Environment Groups are concerned that average annual volumes are not useful as conditions on overland flows, as these flows are not annual events. We believe the conditions should be referenced around some other more relevant criterion and would welcome an opportunity to discuss this further.

Sections 46 and 47 – are confusing and may be mutually exclusive. Ie. if s 46 applies then s 47 does not and vice versa. s 46 has general application and s 47 applies to the Lower Balonne. All the criteria in 46(1) (d) which refer to the volume of water available for sharing should also apply to s 47.

Recommendation:

That s16(1) be amended to clarify the term 'average volume' by including the word/s (e.g.) 'annual' or 'over the life of this Plan' as appropriate.

That s 17(3) be deleted.

That s19(2) be amended to read: "In assessing a change in allocation and calculating the decision's consistency with the water allocation security objectives, the performance indicators are calculated on the basis that the water allocation is not part of the allocation group to which it is being added, or from which it has come."

That s23(2)(e) be amended to include each outcome contained in s8(h)(i-ix).

That an additional clause 23(3)be added stating that "Sleeper licenses that are not developed within 2 years of the commencement of this Plan will be cancelled and not re-allocated."

That s25(4) be amended to read "The chief executive must have regard to the outcomes stated at s8(h)(i-ix) of this Plan.

That s27 be amended to define the absolute volumetric limit to taking water in a given year.

That a new sub-clause (c) be added to s27 stating "the ecological outcomes stated in s8(h)(i-ix)."

That s28(4) be amended to specifically include the ecological outcomes stated in s8(h)(i-ix).

That s30 be amended to read "modifying or removing works for improving the passage through the watercourse system of environmentally significant flows."

That s33(1) and s33(2) be deleted.

That the words "up to a maximum period of 5 days" be deleted from s37(3)(b)(i)(A).

That the words "up to" be deleted from s 37(3)(b)(i)(B).

That the words "up to" be deleted from s37(3)(c).

That s 38(1) be amended to read "The purpose of the rules for the management of medium flow events is to reduce the impact of water hater harvesting on the area naturally flooded by medium flow events under pre-development flow patterns.

That the words "up to a maximum period of 5 days" be deleted from s38(2).

That the words "and to protect the biota of the rivers and distributary channels of the Lower Balonne and their associated wetlands" be added to s 39(1).

That the words "up to a maximum period of 10 days" be deleted from s 39(2 and s 39(3)

That a new s40 be inserted to manage high flows, with the specific purpose of maintaining the vegetation communities of Culgoa Floodplains National Park.

That s45(1)(b) be rewritten to reflect the words used in s38(4) of the Water Act 2000..Ie: "The Chief Executive is satisfied that there is a risk that the taking or interfering with overland flow water in the Plan area may significantly affect ... " (add all facts in s38(4)(b) (i) to (iii) of the Water Act 2000.

That the word "may" be replaced with the word "must" in s 46(1)(d).

That s 47 be amended to include the criteria listed in s 46(1)(d)

That s51(3) be deleted.

Part 6: Monitoring and reporting requirements

Water monitoring requirements are quite extensive and include programs that relate to both water quality and quantity. It is acknowledged (s.53(3) of the Plan) that the monitoring programs must assist in enabling the chief executive to assess the effectiveness of the strategies in Part 5 of the Plan.

The Environment Groups note that the draft WRP mentions hydrological performance indicators, as well as biological, chemical, physical or habitat indicators of ecosystem health.

The Environment Groups believe this suite of monitoring requirements is a significant improvement over those specified for other WRPs and are likely to give a more comprehensive

and accurate picture of aquatic health. We acknowledge that current data sets are limited, but believe that on-going monitoring will provide further information for these sets, which will prove useful for adaptive management in the future.

The Environment Groups support the inclusion of monitoring for the condition of riverine habitats, and the involvement of community groups in monitoring programs (s52). However, we are concerned by recent reductions in staffing within this area of the Department. Adequate resources must be provided for appropriate monitoring.

The Environment Groups support transparent and accountable processes and advocate Quadruple Bottom Line accounting in the interests of good governance. We recommend the independent auditing of water infrastructure operators' reports as well as the data on which they are based (s54).

The Environment Groups believe this Part of the WRP should contain provisions for adaptive management and triggers for a review of the WRP should it fail to achieve performance indicators, ecological outcomes and / or environmental flow objectives.

Recommendation:

That a new clause s 52(3) be inserted to trigger a review of the WRP if monitoring indicates strategies under Part 5 are not being achieved.

That s54 (1) be amended to read "Each water infrastructure operator must provide the chief executive with all water monitoring data collected under s 53(2) for independent auditing, as well as a written report containing the following - ...".

Part7: Implementing and Amending the Plan

The Environment Groups look forward to having input to the Resource Operations Plan.

The Environment Groups support the establishment of advisory councils. However, we believe that the reference to stakeholders in s 59 is weak and not sufficiently inclusive and should be amended to ensure representation by cultural, economic and environmental interests. This would then be consistent with s 41 of the Water Act 2000.

We welcome the inclusion of sections to amend the WRP under s57 Water Act 2000. However, the Environment Groups believe that s57 should allow for amendments to the WRP during its 10-year life in the event that performance indicators, ecological outcomes and environmental flow objectives are not being achieved.

Recommendation:

That s57(b)(ii) be deleted.

That s 59 be amended to read "An advisory council is to consist of the members, appointed by the Minister, representing cultural, economic and environmental interests in the part of the plan area for which the council is established."

Conclusion

The Environment Groups are concerned that the Draft Plan does not give effect to the Purpose of the Water Act 2000 and is potentially invalid and open to legal challenge.

Like the Integrated Planning Act 1997, the Draft WRP is pro-development. Although it contains environmental purpose statements, these are not adequately reflected elsewhere in the document. We urge adoption of the stated recommendations to strengthen the environmental purposes of the WRP and to remove vague and uncertain meanings.

REFERENCES

National Competition Council, COAG Water Reform Framework

Isaacs, M 2002. *The Political Economy of Water Reform Feasibility in Australia* University of Queensland.

Water Act 2000

Cooperative Research Centre for Freshwater Ecology, Feb 2002. *Independent Report of the Expert Reference Panel on Environmental Flows and Water Quality Requirements for the River Murray System.* Prepared for the Environmental Flows and Water Quality Objectives for the River Murray Project Board, accessed at

http://www.mdbc.gov.au/naturalresources/e-flows/pdf/ERPreport.pdf

Appendix.
Table 1. Proposed Environmental Performance Indicators

Biological Performance Indicators	Chemical Performance Indicators	Physical Performance Indicators	Habitat Performance Indicators
• Invertebrates - DNRM and community role - require seasonal monitoring (spring/autumn) - AusRivas western model may be appropriate. - Need to monitor: - hyporrheic - sediment - water column - surface - vegetative - shellfish, crustaceans etc • Fish - DPI/DNRM Fisheries and Universities role - need to monitor fish species and abundance - need to monitor seasonally (i.e. 4 times a year) • Birds • CAMBA and JAMBA requirements - QPWS and community role - Need to monitor species and abundance (including breeding events) • Mammals/vertebrates - QPWS and community role - need to include threatened species and species of local significance • E.coli, bacteria, viruses, algae • Vegetation – species and abundance	• Water quality (ANZECC guideline "trigger values") Need to monitor: - pH - BOD - Turbidity - TDS - Temperature - Total Nitrogen - Total Phosphorus - Pesticides - Herbicides	• DNRM , universities & community role • Erosion • Siltation • Bank stability • Flows • velocity • quantity • seasonality • Depth to water table • Bench wetting • Floodplain inundation • Duration & frequency of cease to flow • Subsidence • Riffle/pool connection • Water usage	• Riparian veg extent and health • Aquatic veg extent and health • Weeds • Snags • GDE's condition & extent • Wetlands – condition, frequency of filling, fish/frog breeding

Freshwater Protected Areas: New and existing tools for conserving freshwater ecosystems in Australia

A national conference
27-28 September 2004
University of Sydney

STATEMENT, RECOMMENDATIONS
AND SUPPORTING PAPERS

Acknowledgments

The *Freshwater Protected Areas* conference would not have been possible without the financial support of the Murray-Darling Basin Commission, New South Wales Department of Environment and Conservation and the Myer Foundation. The Inland Rivers Network (IRN) and WWF-Australia gratefully acknowledge this support.

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In addition, many individuals gave their time, energy and expertise to the conference. The IRN Steering Committee – Anne Reeves, Deb Stevenson, Dietrich Willing, Judy Messer and Tim Fisher – guided the planning. Angela Baker and Sam Newton at the Nature Conservation Council of New South Wales (NCC) gave us the benefit of their experience in organising conferences. Matthew Sparks at NCC kept track of the registration forms and generally created order from chaos. Pip Walsh provided direction at a critical moment late in the process. Sue Lennox from OzGreen skillfully facilitated and took great photos. Rachael Young from NCC was the timekeeper no loquacious speaker dared to cross. Lana Assaf, Lesley Killen and Rosemary Varley welcomed the participants, maintained the literature tables, and shepherded poor lost conference-goers from session to session.

Thank you to each one of these volunteers for helping to make the conference a success, and most importantly, a big thanks to everyone who attended.

Brendan Fletcher
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About IRN

Inland Rivers Network is a coalition of environment groups and individuals concerned about the degradation of the rivers, wetlands and groundwaters of the Murray-Darling Basin. Since 1991 the Network has advocated for the conservation of biological diversity in these environments, the maintenance of essential ecosystem functions and the restoration of degraded habitats.

The story of water resources management in Australia's Murray-Darling Basin in the twentieth century has largely been one of gross over extraction, excessive flow regulation and a dismissal of environmental concerns. While many rivers are still beautiful and support prosperous industries and communities, the health of the Basin's rivers and wetlands is generally poor – and declining. The Inland Rivers Network exists to advocate for these threatened environments.

Inland Rivers Network steering committee member organisations include the Australian Conservation Foundation, the Nature Conservation Council of New South Wales, National Parks Association of New South Wales, Coast and Wetlands Society, Friends of the Earth and Central West Environment Council.

www.irnnsw.org.au

About WWF-Australia

WWF-Australia, formerly known as World Wildlife Fund and World Wide Fund For Nature, is part of the WWF International Network – the world's largest independent conservation organisation, at work in over 100 countries and supported by more than 5 million people.

We are a not-for-profit, supporter-based organisation committed to conserving the unique wildlife of Australia and the Asia-Pacific. Our primary aim is to find solutions to the key challenges facing our natural environment today.

With the help of more than 70 000 supporters across Australia, we are currently working on 180 projects across the region, directly employing more than 100 people, and raising and investing more than $14 million annually in conservation programs.

www.wwf.org.au

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Table of contents

Foreword

The idea of place-based protection for ecosystems of high conservation value has been central to the modern conservation movement for its entire history. In the 125-plus years since the gazetting of the Royal National Park, Australia has been a global leader in establishing terrestrial national parks, marine parks and systematic conservation planning through the National Reserve System. However, Australia does not have any comparable national system for protecting high conservation value freshwater ecosystems.

While there are a range of programs and policies that address the issue, including the new National Water Initiative, the National Reserve System and state laws to protect high conservation value river systems, there appears to be little coordination or cooperative planning between them.

National policies and objectives exist for protecting terrestrial and marine ecosystems, but no comprehensive and coordinated approach exists for aquatic ecosystems.

The $500 million Living Murray Initiative illustrates the need to not only protect significant ecological assets from on-site impacts – indeed, several are protected within conservation reserves and are also designated as internationally important Ramsar wetlands – but to also deliver adequate river flows to maintain ecological processes and aquatic biodiversity.

At the time of printing, many areas of Australia are in drought. Water restrictions are in place – and likely to tighten as climate change impacts strengthen and El Nino cycles return – in all the southern capital cities in an arc stretching from Brisbane through Adelaide to Perth. Hence pressure on rivers, wetlands and estuaries in the agricultural and grazing zones and near urban centres will grow as secure water supplies are sought.

IRN and WWF-Australia convened *Freshwater Protected Areas: New and existing tools for conserving freshwater ecosystems in Australia* in the belief that Australia can and should become an innovator in protecting freshwater ecosystems of high conservation value. In organising the conference, we strove to involve a range of speakers and participants that would demonstrate the need for an integrating policy framework for identifying and protecting high conservation value aquatic ecosystems, the basis for building such a framework from the existing aquatic conservation programs around Australia, and some of the elements we believe such a framework should include.

First, we organised a truly national conference, with speakers from every state and territory, on the principle that the over-arching framework should be national in scope. Even more than terrestrial ecosystems, aquatic ecosystems stretch across state boundaries, and effective protection often requires interstate cooperation. In addition, systematic aquatic conservation planning can most effectively take place within a nationally consistent river classification approach.

In building a national framework, however, Australia will not be starting from scratch. A national framework should be sufficiently flexible to incorporate existing tools for protection and to promote the development of new tools where needed. In that spirit, the conference featured presentations on existing programs for protecting HCV aquatic ecosystems from states and territories around Australia, case studies across tenures from public to private land, and land in which Indigenous people have legal rights and interests.

Finally, a national framework should promote landholder and community involvement in conserving freshwater ecosystems. The conference featured presentations on existing partnerships between irrigators and conservation groups, a cooperative management agreement between an Indigenous group and a state, and a community-based program to restore an urban creek system.

These and other essential elements of a national framework are noted in the conference statement and recommendations developed and endorsed by conference participants.

This book captures the diversity of presentations from the conference in written form. We hope it also captures the spirit of the conference, from the confidence that there is a strong existing research and practical basis for a national framework, to the conviction that without a national coordinating mechanism existing programs cannot reach their potential.

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SECTION 1

Conference statement and recommendations

Statement

We, the participants of the first national conference on Freshwater Protected Areas, find that:

1. Australia's freshwater ecosystems are priceless and unique natural, social, economic and cultural assets.

2. Urgent action is needed to protect and rehabilitate freshwater ecosystems across Australia.

3. Australians are concerned about river health and the security of freshwater ecosystems.

4. All Australians have a duty of care towards our freshwater ecosystems to ensure their long-term security.

5. Freshwater ecosystems are defined for the purposes of this document to include rivers, wetlands, floodplains, lakes, inland saline ecosystems, estuaries, karst and other subterranean ecosystems, springs and groundwater dependent ecosystems.

6. Protected areas are a cornerstone of biodiversity conservation in terrestrial and marine ecosystems, and should also be a foundation for conserving freshwater ecosystems.

7. Development of a comprehensive, adequate and representative (CAR) system of freshwater protected areas should form a core component of a nationally coordinated approach to protecting freshwater ecosystems.

8. Significant opportunities exist to develop and effectively manage a network of freshwater protected areas across less impacted areas of Australia, notably in tropical and arid- and semi-arid-zone river systems. In these landscapes, the management of whole river systems to maintain and enhance freshwater ecosystems is not only possible, but is a national imperative.

9. There is a pressing need for formal protection and rehabilitation of aquatic ecosystems of high conservation value in more developed parts of southern and eastern Australia, using both new and existing tools such as Ramsar-listed wetlands or conservation reserves.

10. Traditional Owners have lived along rivers, wetlands and estuaries across Australia for tens of thousands of years and have an inherent right and vital role to play in their management. Non-Indigenous Australians have much to learn from Indigenous communities about how to care for freshwater ecosystems.

11. Protecting less impacted freshwater ecosystems is significantly more cost effective than rehabilitating degraded freshwater ecosystems.

12. Comprehensive efforts for freshwater ecosystems usually entail both protection and rehabilitation.

13. Many useful tools exist for protecting freshwater ecosystems, including site-specific tools (such as protected areas, property management planning, Ramsar designation, heritage rivers and covenants) and catchment management tools (such as natural resources and fisheries management, land-use planning

and providing environmental water for river health). However, there has been a lack of both political will and resources to use these tools effectively.

14. Emerging river protection tools provide innovative mechanisms for river protection, notably Wild Rivers listing by state and territories, Heritage River listing under the federal *Environment Protection and Biodiversity Conservation Act*, the proposed Australian Heritage River Systems, aquatic or fisheries reserve establishment under state and territory fisheries laws, and formal environmental water provisions.

15. While much is already being done by governments, landholders and communities to protect and rehabilitate some freshwater systems, efforts need to be dramatically improved if future generations are to inherit an ecologically healthy Australia.

Recommendations for action

The conference participants agree that a nationally coordinated approach to protecting freshwater ecosystems should be based upon the following recommendations:

1. The Council of Australian Governments should negotiate an Agreement, as a matter of priority, to drive the development of a national strategy and programs for identifying, classifying, and protecting freshwater ecosystems of high conservation value across Australia.

2. A national inter-jurisdictional program should be established to work towards a nationally-consistent approach to the classification and inventory of freshwater ecosystems.

3. A nationally applicable decision support system to drive the appropriate use of existing and emerging freshwater protection tools should be developed.

4. The vast majority of freshwater ecosystems of high conservation value occur outside the formal reserve system. A nationally coordinated approach to protecting freshwater ecosystems must be applied across all land tenures throughout Australia, using new and existing freshwater protection tools.

5. In northern and central Australia, which retain many of Australia's less impacted freshwater ecosystems, development of a comprehensive, adequate and representative protected area system should occur in tandem with comprehensive protection of freshwater ecosystems and native vegetation through whole-of-catchment mechanisms.

6. In more developed systems, such as in parts of southern Australia, development of a comprehensive, adequate and representative protected area system should occur in tandem with targeted rehabilitation.

7. Traditional Owners and non-Indigenous landholders manage vast areas of high conservation value freshwater ecosystems across Australia; they should be supported and encouraged in their efforts through management planning that specifically addresses freshwater ecosystem protection, and by the provision of incentives and information.

8. Partnerships with Indigenous peoples need to be formed to protect freshwater ecosystems. Traditional Knowledge Systems should form a key basis for the management of freshwater protected areas.

9. Where landholders have voluntarily established freshwater protected areas on their land, governments should provide greater support to ensure that the values of those areas are protected from off-site impacts, such as from reduced river flows.

10. Obstacles to the full use of existing, but to date under-utilised, tools for protecting freshwater ecosystems should be reviewed and addressed.

11. The establishment of an Australian Heritage River System should be investigated, as proposed by Kingsford et al. in a report commissioned by Land and Water Australia (in press).

12. Levels of 'adequacy' of protection of freshwater ecosystems, in relation to a comprehensive, adequate and representative approach to protection, should be investigated.

13. Secure, long term funding mechanisms for the establishment and management of freshwater protected areas should be established.

14. Inter-agency and inter-jurisdictional coordination to achieve a stable framework for managing freshwater protected areas should be enhanced.

15. Precautionary policies and protection mechanisms should explicitly address the cumulative impacts on freshwater ecosystems at the catchment scale.

16. Governments should make full use of existing legal provisions to protect existing freshwater protected areas.

17. Legal and policy frameworks for catchment and water management planning should explicitly provide for the identification, maintenance and enhancement of the conservation values of freshwater protected areas.

18. The capacity of communities to lead the establishment and management of freshwater protected areas across land tenures, both public and otherwise, should be enhanced.

19. New and innovative partnerships for establishing and managing freshwater protected areas should be developed through building bridges and meaningful community engagement across all communities in a catchment.

Keynote addresses

2.1

Protecting Australia's high conservation rivers, wetlands and estuaries - a blueprint

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Australia's rivers meander across our continent, forming a network of 'landscape arteries'. They sustain floodplains, lakes, swamps, estuaries and other wetlands, and provide the water and nutrients for biodiversity, the floodplain eucalypts, native fish, waterbirds, frogs and many more plants and animals. Australians have strong connections to our rivers, whether through Indigenous or non-Indigenous cultures. Despite the ecological and cultural importance of Australia's rivers, we have generally failed to adequately protect their unique values. Unless we change this, future generations will have to pay increasing costs of rehabilitation (e.g. River Murray, priority catchments for salinity management).

This paper briefly summarises what could be done to protect our rivers, including their wetlands and estuaries. Together with a longer discussion paper, this summary resulted from a series of workshops and a national forum with people from state and territory governments. The paper focuses on ecological conservation values, but recognises that rivers have considerable cultural, economic and ecosystem service values that could relatively easily be incorporated within this framework.

Water issues and their management have never been more prominent in Australia's history. Cities are running out of drinking water and major rivers are losing many of their ecological values. Individuals, catchment management groups and governments universally recognise the importance of water and rivers. The National Water Initiative (NWI) formally charts collective responsibilities for future sustainable management. While all governments are protecting our rivers, wetlands and estuaries, there is little consistency in approaches. A common framework for the identification and protection of high conservation value rivers, a subset of all rivers, is needed.

This paper concentrates on protecting high conservation value rivers, wetlands (including floodplains) and estuaries. However, it must be acknowledged that protecting high conservation value rivers will not, by itself, be sufficient. Many plants and animals rely on different parts of rivers or even different rivers – sometimes even highly impacted rivers. A waterbird may depend on many rivers, estuaries and wetlands in its lifetime, while a fish may migrate from the ocean up to a river's headwaters. So even with protection of high conservation value rivers, there is a need to restore or protect the values of *all* rivers wherever possible.

To develop an effective system for protecting high conservation value rivers, there are two key questions:

1. What rivers, wetlands or estuaries are important?
2. How can these rivers, wetlands or estuaries be effectively protected?

SECTION 2

CONTENTS

What rivers, wetlands and estuaries are important?

Measures of importance are nearly always relative. So for rivers, a comparison of all rivers is required to find out which have the highest conservation value. Similarly, all wetlands or estuaries need to be compared. Without knowing this information, a strategic focus for protection will fail. With such comprehensive information, it is also possible to determine importance at different spatial scales. This approach can answer questions such as: 'What are the most important rivers (wetlands, estuaries) in Australia, in a particular state, territory or catchment?' To answer this, three things are required: consistent information, an agreed spatial network and mechanisms for classification and evaluation.

CONSISTENT INFORMATION

Agreement about consistent information for comparing Australia's rivers, wetlands or estuaries is essential. This paper proposes six conservation criteria for collecting this information.

The river, wetland or estuary:

1. is largely unaffected by the direct influence of land and water resource development
2. is a good representative example of its type or class
3. is the habitat of rare or threatened species or communities, or location of rare or threatened geomorphic or geological feature(s)
4. demonstrates unusual diversity and/or abundance of features, habitats, communities or species
5. provides evidence of the course or pattern of the evolution of Australia's landscape or biota

   or
6. performs important functions within the landscape.

SPATIAL FRAMEWORK

Rivers should always be managed from a catchment perspective, the essential element of any spatial framework. Australia can be divided into drainage divisions, river basins (*see Figure 1*) or river segments. The first two categories are widely used, although some of their boundaries do not adequately represent catchments and require future adjustment. River segments provide the finest scale of resolution.

FIGURE 1: AUSTRALIA'S (A) MAJOR RIVERS, (B) 245 LARGE RIVER BASINS AND (C) 12 MAJOR DRAINAGE DIVISIONS

Each river segment has an associated catchment for which data related to the six conservation criteria could be collected. Using the river segment scale as the finest scale of information, this information can be aggregated to the whole catchment, drainage division or continent to begin the national comparison to find out what is most important. Hierarchical labelling and mapping tools can automate such a comparison.

CLASSIFICATION AND EVALUATION

With all river segments identified in a catchment, available data sets or expert panels may be used to come up with scores and thresholds for the six proposed conservation criteria. A classification of rivers is essential, using the data collected for river segments and probably initially aggregated to the catchment scale. This is because rivers, wetlands and estuaries vary so much across the continent that we have to avoid comparing apples with oranges. Armed with information about the relative conservation importance of an area, protection can be targeted to comprehensively represent Australia's rivers, wetlands and estuaries.

Many states and territories have begun to use national conservation criteria and significance thresholds. This process can gather momentum, beginning with identification of all nationally important rivers, wetlands (>200 ha) and large estuaries. Evaluation could then be extended to all rivers, wetlands and estuaries within five years. With increasing information in the future, an automated process could be repeated.

How can a river, wetland or estuary be effectively protected?

There are three major catchment-level threats to Australia's rivers, wetlands and estuaries: river regulation and diversions, catchment disturbance and pest species. A fourth significant threat, climate change, transcends catchment boundaries and is best dealt with through wide-ranging policies. The major deficiency in nearly all of Australia's systems of river and wetland protection has been the absence of a catchment focus. This is the only way to protect Australia's rivers.

Currently every state and territory government and the Australian Government has a range of legislative and policy tools that could effectively protect rivers if implemented properly at a catchment scale. Australia and its river communities could also establish an Australian Heritage Rivers System.

EFFECTIVE POLICY AND LEGISLATION

There are four major ways to protect important rivers, wetlands and estuaries in most states and territories: environmental flow management; protected areas; natural resource management and planning; and incentives. These can be used singly or together to effectively protect the rivers, wetlands and estuaries identified as nationally important. There are specific measures that could be taken in each of these areas.

Environmental flows

Increasingly, the amount of water in a river is becoming identified for regulated and unregulated rivers (with dams and substantial diversions), and groundwater systems as shared between the environment (environmental flow) and extraction for

irrigation, industry or drinking water. The environmental flow is set aside for the river's, wetland's or estuary's ecological health. The management of environmental flows for high conservation areas in rivers and groundwater dependent ecosystems is particularly important.

1. Knowledge of the amount of environmental flow needed for ecological sustainability of a river, wetland or estuary is important.
2. Management of environmental flows should be within an adaptive management framework. This means setting goals and objectives, and developing models that predict outcomes and testing these with monitoring so progress can be measured.
3. Flow restoration targets may be necessary, including better management of environmental flows or additional environmental flows through improved water use efficiency, purchase of water or policy decisions.

Protected areas

Conservation around the world hinges primarily on the proclamation and management of protected areas: national parks, nature reserves, world heritage and aquatic reserves. Many of these areas include parts of rivers, wetlands or estuaries. Use of protected areas for high conservation rivers, wetlands and estuaries could be considerably more effective with the introduction of the following measures:

1. Identified important wetlands, estuaries and rivers could be the focus for protected areas or nominations as wetlands of international importance (e.g. Ramsar sites).
2. All protected areas could have management plans. Those with high conservation aquatic areas can explicitly set out how the plans address key issues of sustainability for the protected area at a catchment scale (e.g. upstream environmental flows, pest control strategies, impacts of catchment disturbance). A 'fortress' approach of only addressing issues inside the boundary fence is unlikely to achieve effective protection.
3. Identified important wetlands, estuaries and rivers may involve voluntary conservation agreements with private landholders.
4. Some identified important wetlands, estuaries and rivers may be candidates as threatened communities under relevant legislation.

Natural resource management and planning

The most effective way to protect high conservation rivers, wetlands or estuaries is to make this objective a key part of any natural resource management and planning that may affect the area.

1. Statutory resource and land use plans, including river management plans, may assess and control potential impacts at catchment scales to these ecosystems.
2. Water plans may include environmental objectives that adequately acknowledge high conservation value rivers, wetlands and estuaries and provide water regimes that maintain their ecological values.
3. River management planning can explicitly incorporate rivers, their wetlands (including floodplains) and estuaries in single management plans that recognise catchment processes and hydrology.
4. Similarly, single river plans could be developed for rivers, wetlands or estuaries that extend between state or territory borders.
5. Planning for important wetlands, estuaries or rivers within a catchment can be culturally sensitive and acknowledge traditional ownership.
6. Developments on rivers, wetlands or estuaries listed on the National Heritage List may trigger the *Environment Protection and Biodiversity Conservation Act 1999*, as do matters of national environmental significance (Ramsar sites, World Heritage areas, nationally threatened ecological communities, nationally threatened species, and migratory species).
7. Water trading between or within catchments could only be sanctioned if it does not affect the ecological sustainability of an important wetland, estuary or river.
8. Water quality policies and management can focus on important wetlands, estuaries or rivers within a catchment.
9. Exotic species (plant or animal) that may be detrimental to important wetlands, estuaries or rivers within a catchment should be prevented.
10. River management planning for important wetlands, estuaries or rivers should have early involvement of communities in planning, with sufficient funding.
11. Research and development should focus on threats that affect conservation values of high conservation rivers, reaches and dependent ecosystems for improved management.

Incentives

There is increasing realisation around the world that effective protection and conservation of ecological heritage will not occur without cooperation and assistance of communities directly affected. Many of the high conservation value wetlands, estuaries and rivers will be on private land. Involvement of communities will be critical, particularly through consultation but also through incentive programs.

1. High conservation value wetlands, estuaries or rivers may be identified and given priority in Australian Government, state and regional investment frameworks.
2. High conservation value wetlands, estuaries or rivers may receive priority in monitoring and assessment of ecological values (e.g. Rivercare, Water Watch, auditing).
3. High conservation value wetlands, estuaries or rivers could be the focus for tax and rate-relief programs and new incentive schemes for landholders committed to protection of these areas.

AUSTRALIAN HERITAGE RIVERS SYSTEM

Protection of ecological and cultural values of high conservation rivers is most effective within a whole of catchment context. This is particularly difficult because Australian rivers extend over hundreds and even more than a thousand kilometres. Currently much of the funding for rivers is spent on rehabilitation in the southeast of the continent. Given that prevention is better than cure, there is a need for more funding to be directed towards river catchments of high conservation value.

A new way of protecting rivers at this scale could be implemented and run primarily by the communities involved. This could be done through the establishment of an Australian Heritage River System by the governments of Australia, led by the Australian Government. This system would include the essential steps of nomination, designation, consultation and administration.

Potential candidate rivers would need to be of high conservation value, at a large scale (i.e. river basin, tributary river). The nomination of a river as an Australian Heritage River would be a 'bottom-up' process by the community to foster engagement and ownership, with seed funding from government. Designation as an Australian Heritage River would not imply a moratorium on development but encompass sustainable use. There could be parallel development of a process that identifies and assesses cultural values.

1. An Australian Heritage Rivers System would require support from the Australian Government and establishment of a small coordination group with the states and territories.
2. There could be identification of potential candidate river basins as Australian Heritage Rivers, using current data.
3. Seed funding may be provided for communities to do background studies if interested in designation as an Australian Heritage River. Nomination and designation would not occur without demonstrated community support.

Making it happen

This paper and its full version provide a national framework that could be developed for protection of Australia's high conservation value rivers, wetlands and estuaries. It has taken account of much of the excellent work underway in all states and territories. A national program would progress the work, leading ultimately to national assessments. An inter-jurisdictional group, with relevant expertise from within and outside government, could develop the different elements of this program under the aegis of the Natural Resources Management Ministerial Council.

Acknowledgments

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2.2

Freshwater protected areas: gaps in the Australian protected area system and priorities for action

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Introduction

According to the *Convention on Biological Diversity 1992* (CBD), the conservation of biodiversity, including aquatic biodiversity, requires the protection of representative examples of all major ecosystem types, coupled with the sympathetic management of ecosystems outside those protected areas. Although the Australian Commonwealth Government and all eight Australian state and territory governments are committed to this principle, only Victoria, Tasmania and the Australian Capital Territory have funded specific programs aimed at establishing fully representative systems of inland aquatic protected areas. In Victoria and Tasmania these systems remain incomplete. Although all jurisdictions have established some terrestrial reserves (Ramsar sites, for example) which protect aquatic ecosystems, the degree to which such reserves protect representative aquatic ecosystems has not been systematically assessed in any Australian state.

Rivers and subterranean ecosystems appear neglected by the current terrestrial reserve network, although the fact that comprehensive inventories of freshwater ecosystems are incomplete in all Australian states makes this conclusion anecdotal rather than quantitative.

This paper recommends the accelerated development of comprehensive inventories of inland aquatic ecosystems in all Australian jurisdictions, partly to provide platforms for the identification and selection of protected areas. A second key recommendation is the development of a national framework for the establishment of comprehensive, adequate and representative aquatic protected areas. The protection of high conservation value rivers is also the subject of discussion and recommendations.

The paper concludes that Australia has no major gaps in policy; however, there are major gaps in action. The commitments have been established but not implemented. Promises have simply not been funded. In general, the necessary legislation is in place; in some cases, statutory provisions for the establishment of freshwater protected areas were developed many years ago, but have never been used. Action, not words, is needed now.

Background

Representative protected areas are an important component of terrestrial and marine biodiversity conservation programs. In addition, these protected areas have key roles in conserving ecosystems of special importance and in providing ecologically based benchmarks vital for assessing the long-term sustainability of resource management programs. However, in spite of explicit international and national commitments, Australian state governments have been slow to establish systems of representative protected areas in inland aquatic environments.

The term 'protected area' means - paraphrasing the International Union for the Conservation of Nature (IUCN) definition - an area of either public or private land where at least some major threats to the values contained within the area can be managed in an effective and long-lasting fashion. Criteria for defining protected areas are provided by the six-part IUCN categorisation (Nevill and Phillips 2004 Appendix 1).

Calls for the establishment of representative freshwater protected areas date back to at least 1971. From the late 1980s to 2003, all Australian states developed policy commitments to establish freshwater protected area systems. During the early 1990s Victoria (alone) established (at least in theory) protected 'representative rivers', together with statutory 'heritage rivers'. Meanwhile other states took little or no action to implement their commitments.

The last five years have seen renewed concern in the face of increasing degradation of freshwater ecosystems. Tasmania embarked on a program to establish representative freshwater protected areas in 2001.

Dunn (2000), Nevill (2001) and Georges & Cottingham (2001) called for the establishment of systems of representative reserves for freshwater ecosystems, in line with Australia's international commitments under the CBD, and commitments made by states in the *InterGovernmental Agreement on the Environment 1992*. Morton et al. (2002) and the Wentworth Group (2002) called for special protection for Australia's major rivers where ecosystems remain substantially intact. Cullen (2002) recommended the establishment of a four-tiered river classification, including 'heritage rivers' and 'conservation rivers' which would both receive special protection. These views were taken up by the Wentworth Group (2003). Nevill and Phillips (2004) made a series of detailed recommendations to governments regarding freshwater inventory and protected area development, pointing out that, at the policy level, all Australian states were committed to establishing comprehensive, adequate and representative (CAR) freshwater protected areas. Early in 2004, the Conference of Parties to the CBD emphasised the need for signatories to develop freshwater protected areas (pers. comm. Bill Phillips July 2004).

At the government level, both Queensland and New South Wales are actively examining the development of wild river policy. Victoria is examining policy related to the protection of representative rivers, and Tasmania is progressing the Conservation of Freshwater Ecosystem Value project. Western Australia is also considering methods of protecting high value rivers. The Commonwealth, through the NRM Ministerial Council, is encouraging the development of regional NRM planning: the success of such planning (as far as freshwater ecosystems are concerned) hinges substantially on the availability of freshwater inventories containing data on value,

condition and threat. The CoAG National Water Initiative (NWI) draft discussion paper (2004) foreshadowed increasing emphasis on protecting high value rivers. The National Reserves System (NRS) Directions Statement (2004) elevated the protection of freshwater ecosystems to a high priority within Australia's protected area system.

Special values of inland aquatic ecosystems

A systematic approach to selecting protected areas is important and the identification of the value of a particular site or ecosystem is a fundamental part of such an approach.

A variety of methods have been developed to assess the value of sites. For example, based on the approach developed by the ANZECC Wetlands Network in 1994[1], an aquatic ecosystem could be listed as 'nationally significant' if:

- it is a good example of a type occurring within a biogeographical region in Australia
- it plays an important ecological or hydrological role in the natural functioning of a major aquatic ecosystem or complex
- it is important as the habitat for animal taxa at a vulnerable stage in their life-cycles, or provides a refuge when adverse conditions such as drought prevail;
- it supports 1% or more of the national population of any native plant or animal taxa
- it supports native plant or animal taxa or communities which are considered endangered or vulnerable at the national level
- it is of outstanding historical or cultural significance.

Victoria's heritage rivers provide another example of the determination of value. The *Heritage Rivers Act 1992* proclaimed 18 heritage rivers and 25 natural catchments. The Act protects these areas, which were identified for their values characterised under three headings:

- nature conservation - (a1) highly natural catchments, (a2) native fish rarity or diversity, (a3) botanical significance, (a4) geological or geomorphological significance
- landscape - (b1) high scenic value, (b2) waterfalls
- recreation - (c1) whitewater canoeing, (c2) car-based camping, (c3) recreational fishing for exotics, (c4) recreational fishing for natives.

Values relating to aquatic environments which might be conserved include biodiversity, geodiversity, recreation, landscape (scenic), historic, cultural and spiritual. Nevill and Phillips (2004, table 1.1) compare the focus of different protective mechanisms on different values, while Appendix 7 contains a more detailed discussion of values.

Value, importance (or significance), condition and threat are related concepts. Importance is usually seen as a level of value (Nevill and Phillips 2004, app. 7). The pressure-state-response model has been used in various ways to connect the concepts in assessment exercises, although (in the Australian context) more often in estuarine rather than freshwater environments (National Land and Water Resources Audit, 2001d, 2002a).

Value is related to condition, but is not the same thing. Value is often defined to include relative disturbance, but can extend far beyond that. For example, a wetland may have high value as the last remaining habitat of the endangered pig-nosed turtle; yet, if it is infested with weeds, the wetland's condition may be poor, and the long term prognosis for the turtle uncertain.

In a world of limited resources, it is desirable to try to obtain the most effective and efficient outcome (in this case ecosystem protection) for money spent. If a site has high value, good condition, and is not likely to be under threat, there are arguments for spending money elsewhere. On the other hand, if a site has high value, deteriorating condition, and increasing threat, this may be an important location to direct funds, provided that threats can be managed with reasonable economy. The problem with this philosophy is that it directs funds towards crisis situations, ignoring locations where the most economical long term protective measures might be put into place. Over a long period of time, such an approach may see catchment after catchment pushed towards over-exploitation, with pervasive loss of values. High-value low-threat sites are thus good candidates for protected area establishment where this can be effected economically.

Comprehensive inventories of aquatic ecosystems are needed to prioritise funding programs. Ideally, it is important to have information about:

- where different types of values exist
- where such values are highest (where significant or important sites exist)
- where values are under threat (where condition is, or is likely to deteriorate)
- where the most effective and efficient opportunities exist to protect values.

The ability of Australian regional NRM planning frameworks to obtain and integrate this information is critical, and is likely to be the Achilles heel of current NRM programs.

Theoretically, such programs need to identify (a) concordance of high conservation values with high condition as the most effective areas for proactive conservation management, and (b) concordance of high value with low ecological condition as potentially priority rehabilitation areas (subject to availability of funds). The form of threatening processes, and their manageability, need to be considered in detail in this equation.

Existing frameworks for the conservation of natural river values generally include recreational and scenic values (e.g. Victoria[2], the USA[3], and Canada[4]). Victoria's heritage rivers were also selected partly on the basis of geomorphic values (Nevill & Phillips 2004, app. 4).

Threats to inland aquatic ecosystems

Threats are described in Nevill & Phillips (2004, sec 4.2). Over much of the Australian continent inland aquatic ecosystems are either already in crisis, or are rapidly approaching a crisis situation. Introduced plants and animals present huge and intractable problems. The spread of agriculture has been accompanied by wetland drainage and water diversion and extraction. The complex morphology of pristine streams, including deep holes, submerged timber, and gravel and rock beds has disappeared under sediment loads from eroding catchments. Grazing of wetlands and

riparian areas has destroyed both terrestrial and dependent aquatic ecosystems. Unsustainable levels of water extraction from aquifers has seen the disappearance of springs, wetlands and ephemeral streams. Poorly designed irrigation schemes, and the clearance of deep-rooted vegetation has seen salinity levels rise in streams over large and increasing areas of Australia. Sand mining has destroyed coastal wetlands.

Many terrestrial, aquatic and subterranean ecosystems are groundwater-dependent. Ecosystems most heavily dependent on groundwater include the ecosystems of groundwater-fed rivers, lakes, springs and wetlands, and their immediate terrestrial environments. Groundwater-based ecosystems include aquifers of various kinds, as well as ecosystems in the immediate layers underlying streams, lakes and estuaries.

Meanwhile, state water management agencies have, until very recently:

- issued excessive extraction licences without adequate consideration of environmental flows
- failed to adopt a strategic approach to the management of the cumulative effects of small to medium-sized water infrastructure developments
- adopted a cavalier attitude to the enforcement and auditing of statutory controls[5] (Nevill 2001, 2003; Nevill and Phillips 2004).

Importance of protected areas for the conservation of biodiversity

In essence, protected areas involve establishing management boundaries within which at least some threatening processes can be effectively controlled. Given the highly connected nature of inland aquatic ecosystems, the application of a second tier of controls within a buffer zone or wider catchment must be an important feature of the management of inland aquatic protected areas.

A cornerstone of biodiversity protection (first articulated in the international context in the *World Charter for Nature 1982*) is the tenet that, where ecosystems are subject to significant modification by humans (through harvesting, pollution, resource extraction, or the introduction of exotic species, for example) it is necessary *to set aside representative examples of these ecosystems to provide biodiversity 'banks', and benchmarks against which human management of the ecosystems can be measured in the long term*.

The 'mirror' of this tenet states that *actions should also be taken in managed ecosystems to minimise impact by protecting natural values* (including biodiversity) as far as practicable. Threatening processes need to be identified and managed over the entire landscape.

The above cornerstone is one of the key foundations of the International Convention on Biological Diversity 1992, and has been broadly adopted by all national biodiversity strategies developed by signatory-nations to the Convention, including Australia's national strategy. The Australian biodiversity program was established by the *National Strategy for the Conservation of Biological Diversity 1996*, to which all Australian states are signatories.

The role of representative inland aquatic protected areas

As is the case in terrestrial and marine environments, there are a number of roles that inland aquatic protected areas can play. These include:

- at a national level, protection of biodiversity against threatening processes through the establishment of a comprehensive, adequate and representative system of protected areas containing examples of all major inland aquatic ecosystems in relatively undisturbed condition
- the facilitation - through a process of the identification of natural values, ecosystem condition, and threats - of broad strategic planning processes aimed at the protection biodiversity within the entire landscape
- provision for the conservation of special groups of organisms - for example, species with complex habitat requirements, or mobile or migratory species, or species vulnerable to disturbance and which may depend on reservation for their conservation, or species heavily dependent on particular (possibly threatened) habitats during certain life history stages
- provision for the special needs of rare, threatened or depleted species, and threatened or unique ecological communities
- provision of biodiversity 'banks' to recolonise damaged or degraded environments, whether such degradation has occurred by natural disaster, bad long-term management practices, or by accident (such as a major pollutant spill)
- provision of scientific reference sites, either for research, or to provide benchmark indicators by which sustainable management may be judged
- protection of areas of high conservation value including those containing unusual diversity of habitats, communities or species; rare or threatened geological or geomorphological features; natural refugia for flora and fauna; and centres of species endemism
- protection of areas sufficiently large to allow extremely long term processes to take place, such as the evolution of species or landscapes
- within the constraints of the above, provision for the recreational, aesthetic and cultural need of Indigenous and non-Indigenous people.

Difficulties in managing aquatic protected areas

LINEAR CONNECTED PROTECTED AREAS - SPECIAL ISSUES

The following issues must be considered when managing aquatic reserves:

- Rivers are linear, so that management needs to consider issues in relation to upstream, downstream and lateral elements of the river.
- Water is essential to life and thus has multiple interest groups competing for its use.
- There may be conflict between state and national perspectives.
- There is a plethora of state legislation with potential conflicting approaches to river management. This may also be reflected by multiple management responsibilities. Where more than one agency has responsibility, no-one takes responsibility.

- Implementation of river management strategies may be recommended at a national or state level, but require action at a local or even property level.
- Interstate boundary issues exist, with different management priorities and strategies potentially being applied to each bank of the river, or to the aquifer which feeds the river.
- Where freehold land abuts a watercourse, many landowners are firmly committed to their riparian rights to water.
- The general community may have unrealistic expectations for river management.
- It is often claimed that there is insufficient communication between researchers and river ecologists with those who manage rivers.
- Rivers are conceptually difficult systems to understand and describe in the necessary complexity.
- Funding issues are likely to restrict the effectiveness of river management.
- Economic pressures on river systems may result in conflicting demands for a limited resource.

All protected areas are affected to some extent by activities outside their boundaries. The management of representative inland aquatic protected areas is difficult, but it is not impossible. The bottom line is a commitment to the protection of our inland aquatic biodiversity, as well as the wider values which representative protected areas can protect.

Protected area identification and selection

In terms of general principles and approaches, the six stages identified by Margules and Pressey (2000) are largely transportable between terrestrial, freshwater and marine habitats.

STAGES IN SYSTEMATIC CONSERVATION PLANNING

Systematic conservation planning can be separated into six stages, and some examples of tasks and decisions in each are presented below. Note that the process is not unidirectional; there will be much feedback and many reasons for altering decisions.

1. **Compile data on the biodiversity of the planning region**

   Review existing data and decide on which data sets are sufficiently consistent to serve as surrogates for biodiversity across the planning region. If time allows, collect new data to augment or replace some existing data sets. Collect information on the localities of species considered to be rare and/or threatened in the region (these are likely to be missed or under-represented in conservation areas selected only on the basis of land classes such as vegetation types).

2. **Identify conservation goals for the planning region**

   Set quantitative conservation targets for species, vegetation types or other features (for example, at least three occurrences of each species, 1500 ha of each vegetation type, or specific targets tailored to the conservation needs of individual features). Despite inevitable subjectivity in their formulation, the value of such goals is their explicitness. Set quantitative targets for minimum size, connectivity or other design criteria. Identify qualitative targets or preferences (for example, as far as possible, new conservation areas should have minimal previous disturbance from grazing or logging).

3. **Review existing conservation areas**

   Measure the extent to which quantitative targets for representation and design have been achieved by existing conservation areas. Identify the imminence of threat to under-represented features such as species or vegetation types, and the threats posed to areas that will be important in securing satisfactory design targets.

4. **Select additional conservation areas**

   Regard established conservation areas as 'constraints' or focal points for the design of an expanded system. Identify preliminary sets of new conservation areas for consideration as additions to established areas. Options for doing this include reserve selection algorithms or decision-support software to allow stakeholders to design expanded systems that achieve regional conservation goals subject to constraints such as existing reserves, acquisition budgets, or limits on feasible opportunity costs for other land uses.

5. **Implement conservation actions**

   Decide on the most appropriate or feasible form of management to be applied to individual areas (some management approaches will be fallbacks from the preferred option). If one or more selected areas prove to be unexpectedly degraded or difficult to protect, return to stage 4 and look for alternatives. Decide on the relative timing of conservation management when resources are insufficient to implement the whole system in the short term (usually).

6. **Maintain the required values of conservation areas**

   Set conservation goals at the level of individual conservation areas (for example, maintain seral habitats for one or more species for which the area is important). Ideally, these goals will acknowledge the particular values of the area in the context of the whole system. Implement management actions and zonings in and around each area to achieve the goals. Monitor key indicators that will reflect the success of management actions or zonings in achieving goals. Modify management as required.

These same steps could, broadly, form the basis of a national strategy aimed at establishing systems of representative inland aquatic protected areas. However, in a continent with large arid regions subject to unreliable and widely fluctuating rainfall, a number of points are of particular interest.

At locations where permanent water has been a feature of the landscape over long periods of time, habitats often display a narrow-range of locally endemic aquatic invertebrates (snails, crustaceans, flatworms etc.) that are poor dispersers and lack the capacity for active dispersal and desiccation resistant stages in their life cycles. Typical habitats are springs or spring-fed streams.

Species (such as those above) can have very small distributions and most may not be catered for in systems of protected areas, unless each critical site and its water supply can be fully protected. However, in many cases such ecosystems can be protected to a considerable extent outside reserves by maintaining water flow, riparian vegetation and exclusion of invasive exotics. This can be an issue of particular concern in forestry

areas, and in pastoral and other rural areas, as well as some urban environments.

By far the largest amount of information regarding the distributions of aquatic animals is in museum collections. For most invertebrate groups this information is not yet databased. Undertaking this task to enable the accessing of this information as part of a national virtual aquatic biodiversity information system would be a cost effective way to generate a large amount of point data that is currently unavailable for many taxa. These data can then be subjected to spatial analysis, and used as biodiversity surrogates for mapping and protected area identification.

Current freshwater protected area programs

Table 1 lists specific state commitments to the development of systems of representative freshwater protected areas, and the programs developed to put these commitments in place. More detail on state programs is contained in the discussion below, and in Nevill & Phillips (2004), particularly Chapter 6 and Appendix 4.

All states have programs in place designed to meet commitments under the Ramsar convention 1971 – these commitments include the development of freshwater ecosystem inventories, and the protection of outstanding examples of wetlands covering the full range of types included in the Ramsar definition of the term. In no state are these programs complete, although work, particularly on ecosystem inventories, continues.

The only jurisdiction to establish a reasonably comprehensive (although now somewhat out of date) freshwater ecosystems inventory is the Australian Capital Territory, and the ACT is the only jurisdiction to establish a reasonably comprehensive system of representative freshwater protected areas including both still and flowing ecosystems. The ACT has had the advantage of being the smallest Australian jurisdiction, as well as having, historically, the most favourable funding. The ACT, Victoria, and Tasmania are in fact the only jurisdictions to attempt to directly action their 'representative freshwater protected area' commitments. The Victorian program, while ambitious, has not been completed, and is currently under review as part of the Healthy Rivers Program. The Tasmanian system is under development.

TABLE 1: STATE REPRESENTATIVE FRESHWATER RESERVE COMMITMENTS AND PROGRAMS

	COMMITMENT CONTAINED IN:	SPECIFIC IMPLEMENTATION PROGRAM
WA	Wetlands Conservation Policy 1997 *This commitment was not reinforced by the draft Waterways WA Policy 2002 (Nevill & Phillips 2004)*	None *The Waterways WA Policy, due for release initially in 2003, has not yet been completed*
NT	A Strategy for Conservation of the Biological Diversity of Wetlands 2000	None
QLD	Wetlands Strategy 1999	None
NSW	Rivers and Estuaries Policy 1993 Wetlands Management Policy 1996 Biodiversity Strategy 1999	None *The State Aquatic Biodiversity Strategy, due for release in 1999, has not yet been completed*
ACT	Nature Conservation Strategy 1998	Nature Conservation Program
VIC	State Conservation Strategy (SCS)1987 Biodiversity strategy 1997 Healthy Rivers Strategy 2002-2003	Heritage Rivers Program *Wetlands component of the SCS incomplete* Healthy Rivers Program
TAS	Nature Conservation Strategy (2000) *State Water Development Plan, Conservation of Freshwater Ecosystem Values (CFEV) Project (design phase 2002-2004)*	State budget 2002 funded the CFEV project (Nevill & Phillips 2004, app. 10). No funds allocated for project implementation in the current state budget
SA	Wetlands Strategy for SA 2003 *The policy has an explicit commitment to representative wetland reserves, set against a wide interpretation of the meaning of 'wetland'*	None

Of the remaining five jurisdictions, Queensland and New South Wales have commenced the construction of state-wide freshwater ecosystem inventories, and South Australia is committed to do so (regional wetland inventories are available). In Western Australia and the Northern Territory, action has not been taken to put in place either comprehensive ecosystem inventories or systems of representative freshwater protected areas. Instead, these states have concentrated on the broader bioregional framework of the Commonwealth's National Reserves System Program (NRSP), which itself has only recently highlighted the freshwater reserve issue. Action is now being taken within the NRSP which may see the establishment of a nationally agreed approach to the classification of freshwater ecosystems into categories or types which could provide a framework for the long-term development of a national system of representative freshwater reserves.

Future directions

KEY ISSUES

Assuming that each state and territory government could make funds available to implement existing commitments in relation to inland aquatic protected areas, a number of important questions need to be addressed in the implementation of such a program:

- What approaches are most suitable for classifying a full range of inland aquatic ecosystems? - including river, wetland, lake, estuarine and aquifer ecosystems?
- What are the data requirements of such approaches, and to what extent is the necessary data available in each state? To what extent can it be made available using existing survey programs?
- Should a consistent approach to classification be adopted across all eight jurisdictions, given the different size and resource base of the jurisdictions? Should a tiered or staged approach be developed which could be applied to delineate finer detail as more comprehensive supporting data becomes available?
- What is the magnitude of the problem? To what extent do existing terrestrial protected areas protect representative examples of inland aquatic ecosystems?
- What principles should be used in protected area identification and selection? To what extent can those developed for terrestrial and marine ecosystems (see above) be applied to the inland aquatic scene?
- What management approaches and guidelines are already available (for example the Wild Rivers Project run by the Commonwealth has produced a management guideline document in 1999 which is widely applicable to the management of connected linear protected areas)
- How should unique ecosystems be protected? For example a representative approach appears unsuited to the protection of subterranean or mound spring ecosystems where discrete habitats contains endemic species, or crater lakes which may have unique geological and ecosystem attributes
- What kinds of protected areas are needed? How many are needed? How large should protected areas be? How can issues of scales and connectivity be addressed in selecting and managing protected areas and their catchments? How are ecosystems framed, and how do terrestrial links (landscapes) tie to aquatic concerns? Ecosystem fragmentation raises a whole set of issues, as does the integration of biophysical processes within management regimes
- Are new legislative approaches useful? Can the Victorian *Heritage Rivers Act* provide a useful model?
- In terms of management approaches outside protected areas, why is there so little effective action being taken to address basic problems? (For example, grazing damage to riparian zones, and the management of the cumulative effects of incremental developments?)

Mechanisms need to be found as a matter of urgency to address these issues. The most obvious approach appears to be a Commonwealth-supported interstate working group, supported by a wide-ranging stakeholder reference group.

THE EXISTING RAMSAR FRAMEWORK

Australia endorsed the Ramsar convention in 1971 (Nevill and Phillips 2004, sec. A2.6.2). Under the convention, parties are required to:

- nominate suitable sites as *Wetlands of International Importance* and to manage those sites (and all wetlands in their jurisdiction) to maintain their ecological values
- formulate and implement land-use planning procedures to include wetland conservation considerations
- develop national systems of wetland reserves
- tcooperate with other nations in promoting the wise use of wetlands, where wetlands and their resources, such as migratory birds, are shared.

After 30 years, these obligations have not yet been fully met, partly as Australia's actions to implement the convention have been coloured by the Australian use of the word 'wetland'. Generally speaking, Australians describe an area of still or very slow-moving water as a wetland. However, the Ramsar convention uses the term to describe 'wetland' *which includes rivers and streams.*

As discussed above, a national framework for the protection of high conservation value (HCV) rivers must consist of three essential elements:

- agreement by Australia governments on how HCV rivers[6] should be identified and selected
- a list of HCV rivers developed from that agreement
- ways of linking that list with environmental assessment, control and planning mechanisms, as well as protected area reservation programs[7].

Taking the first point, all states have agreed to implement the Ramsar convention (and in fact all have made considerable progress in so doing). This convention contains agreed criteria for identifying and selecting Ramsar areas. These criteria are set out in Nevill and Phillips (2004, app.7) and are directly relevant to rivers and streams – defined to include associated floodplains and estuaries.

Taking the second point, Ramsar sites effectively comprise a sub-section of a well-accepted national list: the *Directory of Important Wetlands of Australia* (Environment Australia 2001). International frameworks for allocating heritage value use three value levels: international importance, national importance, and state importance. Ramsar sites, listed within the directory, are explicitly allocated internationally important. The remaining sites within the directory are important at the national level. Victoria, for example, lists 11 Ramsar sites and 159 nationally important sites within a wetland inventory containing 13 114 sites (Victoria is thought to contain around 17 000 wetlands over 1 ha in size).

Taking the third point, Ramsar sites provide a head of action within the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (Nevill & Phillips 2004, version 1.005, sec. 6.1.2). Australian states have also implemented legislation, policy and programs specifically focused on protecting Ramsar sites. Victoria provides an example, where their statutory *Environment Protection Policy (Waters of Victoria) 2003* specifically seeks to provide additional protection to Ramsar sites. The Victorian Government is at present considering review or replacement of the *Water Act 1989.* It seems likely that this re-examination of the

Act may result in Ramsar sites being added to the heads of consideration listed under section 40 of the existing Act, which would provide additional protection for environmental flows affecting Ramsar sites.

In summary, Australia's endorsement of the Ramsar convention on the protection of wetlands has provided a national framework for the protection of high conservation value rivers. An advantage of expanding this framework (rather than developing a new one) is that it is already accepted by all Australian states, and to some extent protective mechanisms already exist in both Commonwealth and state legislation. There are, of course, many other management strategies which need to be applied in tandem with the Ramsar framework (see below).

INTERNATIONAL CONTEXT

Many nations have developed freshwater protected area programs, partly in response to commitments under the Ramsar Convention 1971 and the World Charter for Nature 1982 (Nevill and Phillips 2004, app. 2). The United States of America was the first nation to develop a program for protecting rivers of high conservation value, under their Wild and Scenic Rivers Program (based on the US federal Wild and Scenic Rivers Act 1968). Canada initiated a Canadian Heritage Rivers System (www.chrs.ca) in 1984, and now has around 40 designated rivers. Given similarities of broad government structures and responsibilities between Canada and Australia, the Canadian system may be the most interesting international model.

The Canadian Heritage Rivers System (CHRS) was created by an agreement between the federal and state and territory governments. The purpose (in essence) of the agreement was to create an administrative structure, based on jurisdictional cooperation rather than legal or funding arrangements, which would protect Canada's outstanding rivers. The CHRS aims to use and strengthen existing legislation and management arrangements.

There is only a single category: 'heritage river'. Listing as a heritage river is achieved by a two-step process: nomination and designation.

While the first heritage rivers were nominated by provincial governments or their river management agencies, nominations now come from mainly from the community. Nomination submissions must demonstrate that the river in question meets criteria for 'outstanding value'. Nominations must demonstrate strong community support, and must have the support of the provincial government. A nominated river will not be designated until a management plan has been developed which seeks to protect the values for which the river has been nominated.

Provincial governments monitor heritage river condition and value at one year (short report) and ten year (long report) intervals. A river can be de-listed if the values for which it was listed degrade.

The advantages to the community of heritage river listing are the strengthening of existing river protection frameworks, as well as providing a 'benchmark' which enhances tourism and recreation activities related to the river. Limited special federal funding is provided for the management of heritage rivers (see below). According to Don Gibson (CEO CHRS):

- CHRS is a model of increased intergovernmental cooperation in conservation. Intergovernmental charters among all jurisdictions are a rare achievement in Canada, especially in heritage conservation, and this charter was a major step forward. The program fosters close cooperation and consensus building between federal and provincial governments which, like Australia, are sometimes conflicting jurisdictions.
- One of the greatest strengths of the system is the community support it receives from local citizens who want to be proactive in protecting and promoting the heritage values of their community rivers. Significant and diverse support for the system has come from every level of government; national and grassroots non-governmental organisations; Aboriginal organisations; rural and urban communities; and industry, including tourism, agriculture, forestry and local businesses.
- CHRS is a tool of community revitalisation and increased quality of life for residents. It is a designation which communities can use to market their river as tourism destinations. Communities such as St. Stephen, New Brunswick and Cambridge, Ontario have used the designation as an important component of their long term economic development strategies. Economic impact studies on the CHRS have been very positive and demonstrate that the program is an excellent investment for governments.

The Canadian Heritage Rivers System is discussed in more detail in Appendix 14 in Nevill and Phillips 2004.

AUSTRALIAN MODELS FOR A NATIONAL FRAMEWORK

The ACT has created river reserves by establishing a string of terrestrial reserves under their *Land (Planning & Environment) Act 1991*, and Tasmania is presently developing protective mechanisms under its Conservation of Freshwater Ecosystem Values project. However, the most important current model is provided by Victoria.

Victoria passed its Heritage Rivers Act in 1992. While NSW and WA's attempts to develop similar legislation failed, in both cases existing legislation was modified to enhance the protective mechanisms available to government. For example, NSW modified its National Parks and Wildlife Service Act to allow the designation of 'wild rivers'. In practice, this has done little to protect undamaged rivers.

Victoria's 18 heritage rivers were selected after an extensive public investigation by the Land Conservation Council (LCC). The LCC examined and mapped rivers according to a variety of attributes, one of which was value. Values considered were:

- nature conservation - (a1) highly natural catchments, (a2) native fish rarity or diversity, (a3) botanical significance, (a4) geological or geomorphological significance
- landscape - (b1) high scenic value, (b2) waterfalls
- recreation - (c1) whitewater canoeing, (c2) car-based camping, (c3) recreational fishing for exotics, (c4) recreational fishing for natives. (Refer to maps 11, 12 and 13 of the LCC report.)

The Act sought to protect heritage rivers by preventing further dam construction or water diversion, and by controlling certain activities, like timber harvesting, in the river's catchment. Sections 9 and 10 of the Act state:

Section 9. ***Contents of management plans***
A management plan for a heritage river area or natural catchment area must state the way in which the managing authority is to undertake its duties and exercise its powers under this Act and the management plan must be consistent with the purpose of this Act, the authority's duties and powers and any Land Conservation Council recommendations in respect of which notice has been given under section 10(3) of the *Land Conservation Act 1970*.

Section 10. ***Land and water uses which are not permitted in heritage river areas***

1) An impoundment, artificial barrier or structure that impedes the passage of water fauna must not be constructed in a heritage river area specified in Column 1 of Schedule 3 unless the Governor in Council by notice published in the Government Gazette, approves its construction in that area.
2) There must not be a new water diversion in a heritage river area specified in Column 2 of Schedule 3 unless it is approved by the Governor in Council by notice published in the Government Gazette.
3) Any new water diversion from a waterway upstream from the lowest point of a heritage river area specified in Column 3 of Schedule 3 must not significantly impair the nature conservation, recreation, scenic or cultural heritage attributes of the area.
4) Sub-section (3) does not apply to a water diversion approved by the Governor in Council by notice published in the Government Gazette.
5) Timber harvesting is not to be carried out in any heritage river area specified in Column 4 of Schedule 3.

If the general principles of Victoria's approach were applied elsewhere, the management plan could be expanded to encompass two distinct levels: (a) strict controls over the area of public land under the direct influence of the managing authority, and (b) a wider plan covering both public and private land in the river's catchment, developed after consultation with landowners and other stakeholders, and implemented through controls and incentives available to:

- the State Government through water legislation
- the relevant local government(s) through land use planning provisions
- regional catchment or natural resource management plans through incentive funding.

Cumulative impacts

The protection of biodiversity rests on two cornerstones: (a) the protection of representative and viable examples of all major ecosystems in reserves, and (b) the sympathetic management of the broader landscape in which the reserves lie. Managing the cumulative effects of incremental development is one of the most important and intractable problems facing the water resource industry today.

All Australian states have put in place statutory impact assessment procedures for assessing the likely effects of *large* ('state significance') development proposals. All states also have strategic landuse planning procedures specifically designed to control the cumulative effects of *small* developments, such as housing. The cumulative effects of fishing effort on fisheries resources are also specifically recognised and controlled by all state governments.

However, water developments generally 'slip through' such procedures, and their cumulative effects are poorly controlled in all states. Although most developments affecting water resources take place through small and medium sized projects (farm dams, levee banks, weirs etc.) the need to manage the cumulative effects of these projects is generally not specifically recognised in state water resource legislation. Moreover, in those states which have developed statutory catchment planning frameworks, these frameworks have not implemented effective mechanisms for managing cumulative effects, even though these effects are seriously degrading the catchment resource.

Under the general guidance of the Natural Resource Management Ministerial Council's *National Action Plan for Salinity and Water Quality* (NAP) and the Council of Australian Governments (CoAG) water reform agenda, regional natural resource management plans are now being developed and implemented in all Australian states. CoAG has also initiated the development of the National Water Initiative. However, without a rigorous approach to the management of cumulative effects, and without the necessary information on the value and condition of freshwater ecosystems, I argue that these approaches will fail to effectively control the degrading affects of the cumulative impacts of water resource development on aquatic ecosystems.

As a matter of urgency, cumulative effects within the water resource industry must be taken much more seriously, and that controls must have five critical elements (Nevill 2003):

- The need to establish strategic development caps on a catchment basis must be *formally recognised in water resource legislation*, and appropriate procedures must be established to set and implement the caps in consultation with stakeholders.
- *Caps must be comprehensive and inclusive.* Stakeholder consultation programs must establish caps covering: water extraction from both surface and groundwaters; the construction of farm dams (number and volume), agricultural drains, impediments to fish passage, and levee banks; the development of irrigated pasture; the clearance of deep-rooted vegetation, and activities (e.g. stock access) capable of degrading riparian vegetation.
- *Adaptive management* principles must be rigorously incorporated within catchment planning processes.
- Comprehensive caps on development *must be set well ahead of the point where the catchment enters a stressed or crisis situation*.
- Last but not least, the caps must be set in a *precautionary* way.

To what extent are these five principles evident in current water management processes, or regional NRM planning? A state-by-state review suggests that the first three of the five are usually (although not always) explicit or implicit within both areas. The major difficulties relate to the last two principles. At the time of writing, although

(in theory) several states have policy endorsing such an approach, only Victoria is making an attempt to implement caps well ahead of catchments entering crisis. In relation to the final point, thoughtful and committed implementation of the precautionary principle is both urgent and overdue across all Australian states.

Plans to protect catchment ecosystems cannot be effective without adequate knowledge of the relative value and the current condition of these ecosystems. There is an urgent need to develop comprehensive state inventories of inland aquatic ecosystems, incorporating both value and condition data. Such inventories are slowly developing across Australia, but could benefit greatly by the development of a national framework attached to Commonwealth funding.

Conclusions

It is clear that inland aquatic ecosystems are under increasing threat. Many of the threats are pervasive and intractable. Systems of terrestrial protected areas have been established, and the largest of these, and those specifically targeted at wetland areas (such as Ramsar sites), undoubtedly protect *some* representative samples of major inland aquatic ecosystems.

However, in spite of international, national and state-level commitments to the establishment of representative systems of inland aquatic protected areas, only Victoria and the Australian Capital Territory have made serious attempts to establish such protected areas. Tasmania initiated a program in 2001 designed to protect comprehensive, adequate and representative examples of freshwater ecosystems, both by reservation and by alternative approaches.

The Australian Capital Territory has inherent advantages due to its small size and the large amount of public land within its jurisdiction, and here some relatively impressive protected areas have been created. Victoria led the nation with its 1987 Nature Conservation Strategy, the subsequent Rivers and Streams Investigation by the Land Conservation Council, and the eventual passage of the *Heritage Rivers Act 1992*. However, the initial vision of the Victorian program has not been fully realised.

Australia's remaining five jurisdictions have not moved to implement their commitments. This delay should be seen within the perspective of the need to establish the broader bioregional National Reserve System, which has occupied most Australian nature conservation agencies over the last decade. This has, by necessity, focused attention at the bioregional and landscape level. Most inland aquatic ecosystems exist at a finer level of detail, and have so far escaped priority attention within the National Reserve System.

It is time for this approach to change. Sufficient progress has been made at broad planning levels now to justify turning attention to ecosystems of finer detail - in particular, rivers, lakes, wetlands and aquifers. Inland aquatic ecosystems should now be highlighted within the National Reserve System framework, and the latest NRS directions statement (2004) indicates that such action is being planned.

No Australian state has met its full Ramsar Convention obligations in relation to the preparation of comprehensive wetland inventories, using the Ramsar definition of 'wetlands'. Partial inventories have been established, and these are valuable. They should now be expanded, using nationally agreed classification methods, to encompass all major inland aquatic ecosystems. These inventories can then be used to identify gaps in the existing protected area system. It is to be expected that the most significant gaps, and those which will be most difficult to fill, will relate to large midland and lowland rivers, some types of floodplain wetlands, and aquifers.

There will be obvious difficulties involved in management issues due to the dependence of inland aquatic ecosystems on the condition and management of the wider catchment; however, just because something is difficult does not mean that it can't be done.

Successful implementation of national and state commitments to inland aquatic protected area systems rests on two fundamental premises. First, Australia needs to supplement its bioregional planning and management framework with more detailed information applicable to specific small-scale habitats, such as those found in inland aquatic ecosystems. Second, in implementing NRM strategic catchment management processes designed to protect inland aquatic values, it is essential to involve the wider community and all stakeholders early in the process of identifying and selecting areas for reservation.

While there is widespread support for extending the reach of voluntary conservation agreements to complement on-protected area conservation management, there is a clear need to strengthen the role which regional planning instruments can play in the conservation of biodiversity. For this to be of greater use for biodiversity protection, it will be necessary to review and revise the current legislative and administrative arrangements that give effect to regional planning.

In regard to assessing the adequacy of existing protected areas, and identifying and selecting additional protected areas, basic requirements are:

- a classification of inland aquatic ecosystem types that can be supported with data which is either available, or foreseeable within existing survey program budgets
- targets for the protection of biodiversity pattern and process. This will involve the selection and use of biodiversity measurement surrogates.

These are basic requirements. The development of protected area identification, selection and management approaches should begin with the template of the 'six stages' set out above.

Recommendations

To recapitulate, there are a small number of urgent issues. Firstly, although some representative examples of freshwater ecosystems are contained within existing protected areas, no systematic national review has been conducted to identify gaps in the reserve network. It is likely that many freshwater ecosystem types are not adequately protected - particularly those of riverine or subterranean nature. Secondly, although all jurisdictions are developing inventories of freshwater ecosystems, these remain incomplete. Nowhere are they comprehensive in the sense of containing up-to-date data on value, condition and threat over wetlands, rivers and subterranean ecosystems. The acceleration of work on inventories is urgent to underpin both protected area gap analysis studies and developing regional NRM strategies. Thirdly, river degradation is ubiquitous and increasing over much of temperate Australia; the identification and

protection of remaining rivers of high conservation value is urgent. In all three areas, the Commonwealth needs to play a leading role, particularly with respect to promoting and funding interstate working groups to address these issues in a coordinated way. Fourthly, the sympathetic management of biodiversity outside protected area frameworks is essential, and urgent action needs to be taken to encourage and support biodiversity conservation measures on freehold and agricultural land.

DEVELOPMENT OF A NATIONAL FRESHWATER PROTECTED AREA FRAMEWORK

I believe that Australian nature conservation programs are now at the point where effort needs to be focused toward programs protecting existing high value freshwater ecosystems. Given the continuing decline of inland aquatic ecosystems over much of the Australian continent, it is now urgent that the development of comprehensive, adequate and representative inland aquatic protected areas be elevated, nationwide, as a high priority. In addition to the protection of representative ecosystems, unique and vulnerable aquatic ecosystems need to be identified and protected. *A national freshwater protected area framework needs to be developed*.

My three central recommendations on this issue are that:

1) **National protocols be established for the collection and storage of freshwater ecosystem attribute data to support the development of nationally compatible ecosystem classifications and inventories.**

   States are currently using different classification approaches of varying sophistication. Different approaches to classification can be useful, and no ideal classification exists to suit all purposes. Collecting and storing attribute data free of classification not only allows states to continue using existing classifications, but such an approach also opens an opportunity to use such data to develop separate national classifications and inventories. Such inventories would utilise nested hierarchies of ecosystem classifications, allowing the allocation of freshwater ecosystems into ('representative') categories. Using nested hierarchies allows a staged approach, with initial work confined to the simpler categories supported by existing data. As more data becomes available, more sophisticated analysis can be under-taken. This approach to classification could underpin the development of a national inventory of freshwater ecosystems, including rivers, wetlands and aquifers (see section 5.9 above). The development of an *'interim freshwater bioregionalisation of Australia'* would complement and extend the utility of such an approach

2) **A national approach be developed to enable the identification of gaps in the existing protected area system relating specifically to freshwater ecosystems.** Such an approach would incorporate methods for identifying and selecting potential inland aquatic protected areas

3) **Programs be funded to establish and manage a comprehensive, adequate and representative network of inland aquatic protected areas** (which would be developed as an outcome of the implementation of the first two recommendations). This network would sit within a national framework, most probably as part of an expanded National Reserves System, and would utilise both state and Commonwealth funding.

These actions, I believe, should be initiated within the cooperative frameworks of the National Reserve System (NRS) and the NRM Ministerial Council, assisted by agencies such as the Commonwealth Department of Fisheries, Forests and Agriculture, and the Department of the Environment and Heritage (wetlands program). The National Audit, and Land and Water Australia (including the National Rivers Consortium) have much to contribute and need to be involved. The principles used in terrestrial and marine reserve identification and selection (see section 3.3) should provide a base for the development of national approaches.

As concerns developed three decades ago that the terrestrial reserves network should protect representative examples of terrestrial ecosystems, Specht (1975) recommended that *at least one large sample of each major terrestrial ecosystem in each biogeographic division of each state should be incorporated into an ecological reserve*, either by designating the whole or part of existing national parks and other nature conservation reserves as *ecological reserves* or, where necessary, by acquisition of land. The same logic can be applied today in relation to freshwater ecosystems, bearing in mind comments made above about the development of regionalisations applicable to freshwater ecosystems. All we need to do is replace the word 'terrestrial' in Specht's recommendation with the word 'freshwater'.

It is instructive to note that various freshwater protection tools exist under state water, catchment and fisheries legislation, but that these provisions have generally not been used (to date) by jurisdictions with any enthusiasm (Nevill & Phillips 2004, table 1.1 and app. 4). This is apparently due to the reluctance of the relevant management authorities to accept environmental responsibilities which they now have within their mandate, but have historically been the province of nature conservation agencies. Such agencies have generally not seen nature conservation, particularly relating to site reservation or protection, as part of their core business. As a consequence, these legislative protection tools lie largely unused at this point in time.

PROTECTION OF RIVERS OF HIGH CONSERVATION VALUE

Given the development of national databases containing information on freshwater ecosystems, it is now feasible to develop a national framework for the protection of high conservation value (HCV) rivers.

Four measures are recommended for immediate action:

1) The Commonwealth should fund, under an interstate steering committee, **the identification of where the highest river values exist, where they are most at threat, and where such values might be most effectively and efficiently protected.** Refer to the discussion of values in Nevill & Phillips (2004, app. 7).

2) The Commonwealth should initiate, fund and convene an inter-state working group to discuss and **develop mechanisms to protect high conservation value rivers, with particular focus on the possibility of adapting the Canadian Heritage Rivers System to the Australian**

situation. Refer to Nevill & Phillips (2004): Chapter 7 on mechanisms and Appendix 14 on the Canadian system.

3) Bearing in mind the wide definition of 'wetland' contained within the Ramsar Convention and national directory frameworks, immediate steps (coordinated and partly funded by the Commonwealth) should be taken to **accelerate the use of the existing Ramsar framework to identify, select and protect rivers of high conservation value** (rivers of international importance). Until more rigorous quantitative criteria are developed for identifying and selecting rivers of HCV than are provided for by the Ramsar criteria and the Ramsar strategic framework guidelines[8], these criteria provide a useful interim approach.

4) Commonwealth funds should be provided to the states to **accelerate the assessment of rivers against the importance criteria which underpin listing in the *Directory of Important Wetlands in Australia*** (rivers of national importance), and states should be encouraged to add important rivers to the directory.

Additional information on the protection of high conservation value rivers is provided in Nevill & Phillips (2004, ch. 7), which outlines a variety of measures which might be taken in the medium or long term. These need to be considered by all three levels of government, as well as by regional natural resource management agencies.

SYMPATHETIC MANAGEMENT OF UTILISED ECOSYSTEMS

Australian governments, at all three levels, need to do much more to encourage the sympathetic management of land outside networks of protected areas (Nevill & Phillips 2004, s.6.1.4.2). Key strategies which need urgent attention, especially by Commonwealth and state governments, relate to:

1) **developing *effective* strategic approaches within regional NRM planning frameworks to address the impacts of cumulative water-related development within individual catchments.** Comprehensive inventories of freshwater ecosystems are essential to support NRM planning processes (see above); in addition, the precautionary principle (Nevill & Phillips 2004, app. 15) needs much stronger emphasis

2) **adequate financial compensation to landholders for the provision of ecosystem services**

3) together with the above, **a gradual phasing in of natural resource accounting requirements targeted at large corporate landholders** (Nevill & Phillips 2004, sec. 7.13.4).

Bearing in mind the importance of the CoAG water reform framework in encouraging more effective management of the water resource by state governments (Nevill & Phillips 2004, apps. 3, 4), and bearing in mind the recommendations of the Wentworth Group (Nevill & Phillips 2004, app. 12) it is essential that the 2004 revision of the CoAG framework, including the National Water Initiative, incorporate:

1) **mechanisms to encourage states to identify and protect rivers of special importance** (see discussion above and Nevill & Phillips 2004, ch. 7)

2) **mechanisms to encourage the states to implement effective procedures for the strategic management of the cumulative effects of incremental water developments** (referred to in the Wentworth report as the need for 'comprehensive water accounts').

Acknowledgments

This paper owes a debt to all those who contributed to *The Australian Freshwater Protected Area Resourcebook* (see section 2.3 of that report). I would particularly like to thank Andrew Boulton, Mary Maher, Peter Cullen, Stuart Blanch, Jim Tait, Janet Stein, Tony Ladson, Gary Brierley and Richard Kingsford.

Notes

1. Environment Australia 2001, *A directory of important wetlands in Australia*, 3rd edn, Environment Australia, Canberra, p. 11.

2. The Heritage Rivers Programs (see *Heritage Rivers Act 1992*).

3. The Wild and Scenic Rivers Program (see Wild and Scenic Rivers Act 1968).

4. The Heritage Rivers Program.

5. State government water agencies in all states tend to turn a blind eye to illegal dams. An exception is provided by a recent campaign by the Victorian Government, including an advertising campaign and a moratorium from prosecution. This campaign (see *Weekly Times,* 13 August 2003) resulted in farmers applying to license thousands of illegal dams. A similar situation exists regarding the illegal clearing of native vegetation. The Australian Broadcasting Commission's Background Briefing of 14 September 2003 details the almost complete failure of the NSW Government to enforce its legislation controlling land clearing.

6. In other words, a nationally consistent means of identifying and selecting rivers and estuaries of high conservation value (see the six-stage planning process described by Margules and Pressey 2000, sec. 4.3).

7. This would be the first step in achieving nationally consistent means of protecting these rivers and estuaries. New tools, like special-purpose legislation (modelled perhaps on Victoria's *Heritage Rivers Act 1992*) will take time to develop.

8. Available from the Ramsar website: www.ramsar.org (accessed November 2003).

References

Nevill, J 2003, 'Managing the cumulative effects of incremental development in freshwater resources', *Environmental and Planning Law Journal*, 20 (2) 85-94.

Nevill, J & Phillips, N (eds.) 2004, *The Australian freshwater protected area resourcebook*, OnlyOnePlanet Australia, Hampton, Melbourne. Available from http://www.ids.org.au/~cnevill/FW_ProtectedArea_SourceBook.doc, or from www.onlyoneplanet.com.au.

Citations for remaining references can be located in the Australian Society for Limnology Representative Reserves Working Group Bibliography 2004, which is located at http://www.ids.org.au/~cnevill/ASL_bibliography.htm or www.onlyoneplanet.com.au.

2.3

Towards a national policy for the protection of high conservation value aquatic ecosystems

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Australia has no integrating policy framework for identifying and protecting aquatic ecosystems of high conservation value. Various policies, laws and programs exist to conserve freshwater and estuarine ecosystems, such as the National Water Initiative, National Reserve System, National Action Plan on Salinity and Water Quality, Natural Heritage Trust, Ramsar wetlands, state wild and heritage rivers programs, and Matters of National Environmental Significance protected under the *Environment Protection and Biodiversity Conservation (EDBC) Act*. However, over-arching policy, funding and institutional arrangements to coordinate and direct these and other efforts by governments and communities are lacking.

River protection tools that are either well known, or which require further development and implementation, include conservation reserves, Ramsar wetlands, heritage or wild rivers under state law, heritage river listing under the EPBC Act, aquatic reserves under state fisheries laws, Indigenous Protected Areas, catchment and water management planning, land use planning and development assessment, and conservation and property agreements over freehold and leasehold land,

Legal jurisdiction for aquatic biodiversity conservation and water management resides in a range of government agencies, as well as in catchment management authorities, across Australia.

In contrast to endeavours in terrestrial and marine conservation, no national target-driven approach exists for driving systematic conservation planning in aquatic ecosystems. The accepted reserve design principles that underpin terrestrial reserve planning (i.e. comprehensiveness, adequacy, representativeness) are yet to be applied explicitly to aquatic ecosystems. Such efforts are hamstrung by the absence of a nationally-consistent river classification approach. The *National Objectives and Targets for Biodiversity Conservation* do not explicitly require states and territories to provide minimum protection levels for aquatic ecosystems, which would be a useful basis for guiding conservation efforts, particularly in fragmented landscapes in southern Australia.

Significant opportunities exist for protecting whole catchments and major sub-catchments across northern and central Australia. In *Securing the North: Australia's Tropical Rivers*, the Australian Tropical Rivers Group states that approximately 80% of Australia's tropical rivers are free-flowing and drain largely uncleared landscapes. The group states that all tropical rivers require active management to protect and recover their ecosystem values, and also identify the need for targeted protective management for high conservation value aquatic assets.

A key policy challenge for less-impacted northern and central Australian landscapes is to conserve and rehabilitate river systems that retain ecological integrity (the vast majority), rather than adopting a CAR reserve approach from southern Australia as a basis for rationalising broad scale land clearing and inappropriate development outside reserves.

Policy commitments during the 2004 federal election campaign by major parties identified the need to conserve high conservation value river systems, particularly in northern Australia.

WWF-Australia is developing a proposal for a national policy framework for identifying and protecting high conservation value aquatic ecosystems in Australia. The proposal will be finalised and released in the near future, and will be available at the WWF website www.wwf.org.au.

THEME ONE

Freshwater protected areas: reports from the states

SECTION 3

CONTENTS

3.1

Protecting wild rivers in NSW

MARK CONLON
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New South Wales' *National Parks and Wildlife Act 1974* (NPW Act) provides for the declaration of wild rivers within reserves. While no rivers have yet been declared, the Parks and Wildlife Division of the Department of Environment and Conservation (DEC) is currently assessing ten wild rivers for declaration.

What is a wild river?

The concept of designating wild rivers originated in North America, and the wild and heritage rivers of Canada and the United States are now important conservation icons and tourist attractions.

The *National Parks and Wildlife Act 1974* defines wild rivers as those exhibiting *substantially natural flow and containing remaining examples in a condition substantially undisturbed since European occupation of New South Wales, of:*

(a) the biological, hydrological and geomorphological processes associated with river flow

(b) the biological, hydrological and geomorphological processes in those parts of the catchment with which the river is intrinsically linked. (Section 61).

NSW's formal commitment to freshwater conservation is limited. Many high conservation value streams and riparian areas have been reserved as one of principal aims of terrestrial reservation (Oxley Wild Rivers National Park, Kosciuszko National Park); however, no management framework for the river systems on parks exists. Wild river declarations provide an opportunity to designate and manage pristine freshwater ecosystems on DEC estate at the high conservation end of the spectrum. As one component of a natural resource framework, wild river protection demonstrates the state's commitment to the conservation of streams. It also highlights the reserve system's role in providing significant waterway recreational opportunities and ecosystem services. Although wild rivers are only declared within reserves, there are opportunities to use wild rivers declarations as the basis of off-reserve partnerships in areas of high conservation value. Wild river declaration also provides iconic recognition for some much-loved rivers in NSW.

Wild river management

The NPW Act stipulates the following management principles for wild rivers:

- the restoration (wherever possible) and maintenance of the natural, hydrological and geomorphological processes associated with wild rivers and their catchments, including natural flow variability; and
- the identification, conservation and appropriate management of Aboriginal objects and Aboriginal places.

The DEC is currently preparing a wild rivers policy. The objectives of the policy are to provide guidance on the management of declared wild rivers within areas reserved under the *National Parks and Wildlife Act 1974*. For example, the DEC policy will set out the types of activities permitted on wild rivers.

What will wild river declaration achieve?

Within DEC reserves, wild river declaration has the capacity to ensure sensitive management of rivers of highest conservation value in NSW. Additional resources may be directed towards restoring sections of these rivers where necessary.

Outside reserve estate, wild river declaration may encourage sensitive development upstream of wild rivers by:

- requiring consultation by statutory authorities for actions in relation to wild rivers
- raising awareness amongst other land managers by providing data on wild rivers
- raising the profile of icon rivers amongst the broader community.

NSW Government election commitment

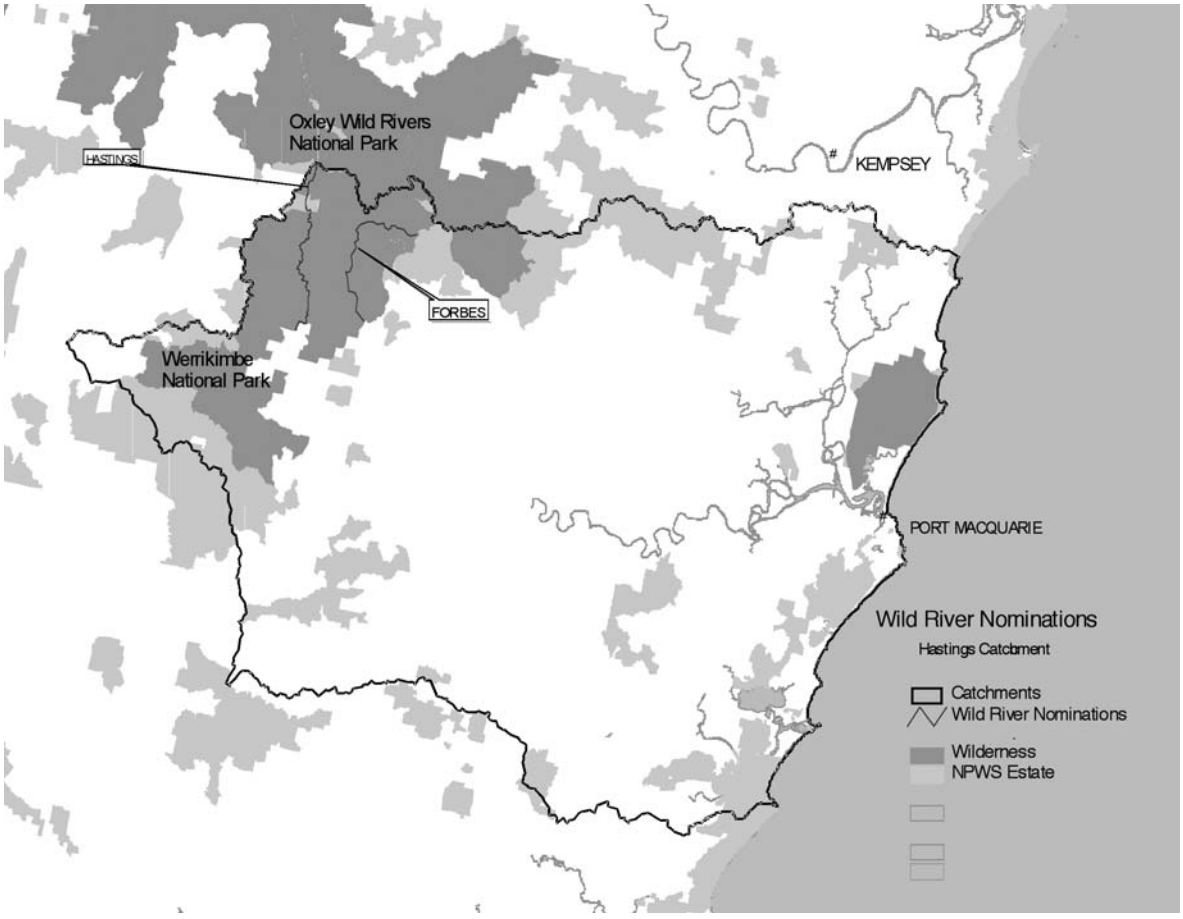
The NSW Government has committed to the gazettal of nine rivers as wild rivers in this term. The nine to be gazetted are:

- *Hawkesbury Nepean Catchment* – Colo, Kowmung, Grose and Macdonald Rivers
- *Northeast NSW* – Upper Hastings and Forbes Rivers and Washpool Creek
- *Southeast NSW* – Brogo River
- *Western NSW* – Paroo River.

A tenth river, the Maria River north of Port Macquarie, has been nominated by the National Parks Association and is also being assessed.

The condition of the ten rivers and their catchments under assessment is varied (see Figures 1-3), with the upper catchments of some rivers falling wholly within reserve and

FIGURE 1: UPPER CATCHMENT IN RESERVE – HASTINGS CATCHMENT



declared wilderness, some with limited parts of their upper catchment off-park and others flowing from numerous sub-catchments with a variety of land uses. While it may be possible to make assumptions about the condition of rivers in the more pristine landscapes, others will require a more detailed assessment to ensure they meet the condition of wild rivers required by the Act.

Wild river assessment

There are existing, established techniques to assess biological and geomorphological condition of freshwater rivers. These techniques are currently being used by the NSW Government for a range of projects and are highly suitable for wild river assessment.

- For assessment of *biological* health, AUSRIVAS analysis is used by DEC which samples and analyses freshwater invertebrates.
- For assessment of *geomorphic* condition the River Styles® is used by DIPNR; it measures a range of physical features of rivers.

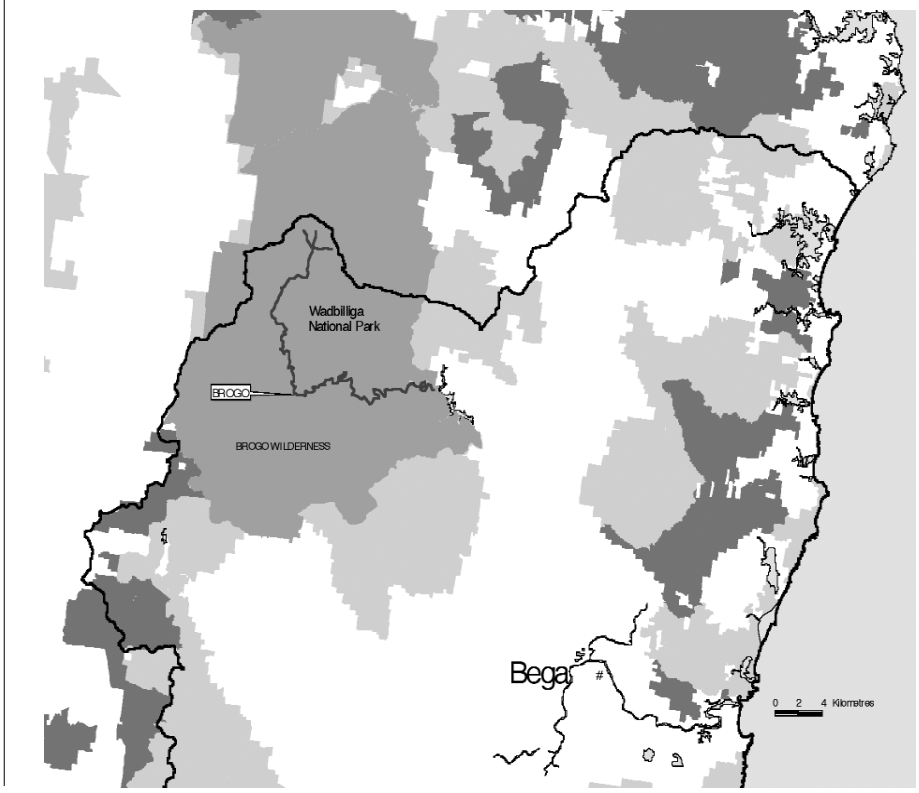
One of the benefits of adopting these techniques is that there is already a large body of data for NSW rivers.

There is no widely available means of estimating a river's natural flow and the degree of hydrological alteration since European occupation. However, gauging stations which measure river flow have been established along many NSW rivers and from this data it is often possible to detect any artificial modifications to a river's flow regime.

The advantages of adopting the above assessment methods include the following:

- They measure river condition against an estimated pre-European condition, thereby addressing the NPW Act
- The methods are repeatable and could be used by the DEC to monitor the condition of wild rivers over time
- These methods are being used to collect data as part of other projects and are therefore cost effective.

FIGURE 2: UPPER CATCHMENT IN RESERVE – BEGA CATCHMENT

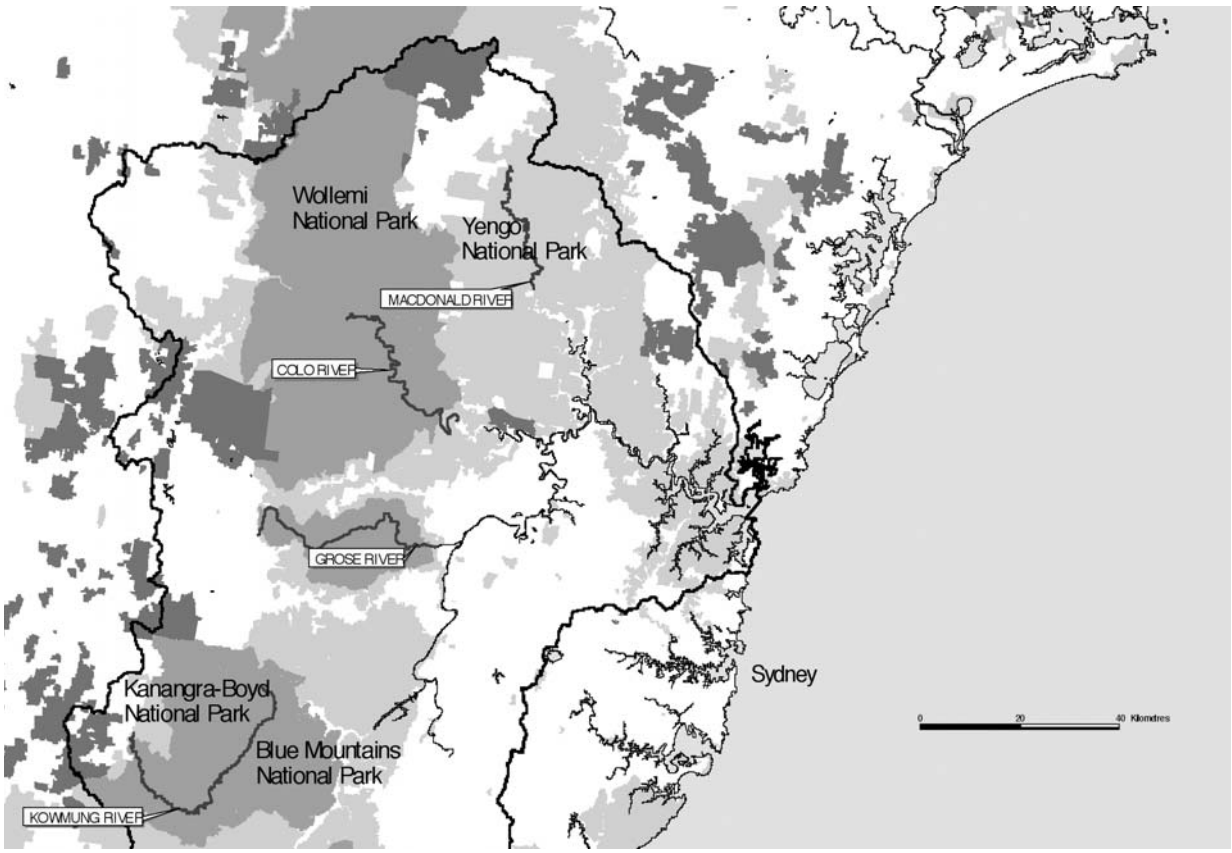


Challenges and opportunities

For the DEC, the major challenges in wild river protection will be to:

- protect wild rivers across land tenures
- link with natural resource management initiatives such as Catchment Management Authorities and Catchment Management Plans.

FIGURE 3: UPPER CATCHMENTS WITH MULTIPLE LAND USE – HAWKESBURY NEPEAN



3.2

Victoria's approach to managing high value rivers

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Victoria's efforts to develop a system of freshwater protected areas commenced in the late 1980s through the Heritage Rivers Program. In June 1987, the Victorian Government directed the Land Conservation Council to conduct a special investigation of Victoria's rivers and streams. The purpose was to investigate the scenic, recreational, cultural and ecological values of rivers and streams and to make recommendations on the use of rivers and how identified values could be protected. The *Heritage Rivers Act 1992* lists 18 heritage rivers and 26 natural catchment areas for protection.

In addition to establishing heritage rivers, Victoria has a program of identifying and protecting rivers of high value. The Victorian River Health Strategy was released in 2002 and outlines a comprehensive river health protection and restoration framework within an integrated catchment management context. It is based on strong information-based, decision-making processes, involvement of the community and developing partnerships for investment.

Building on the Victorian River Health Strategy, the recently released Victorian Government's white paper *Securing our Water Future Together* (DSE 2004) has identified specific actions to protect and restore Victoria's priority rivers.

This paper briefly discusses freshwater reserves in Victoria and highlights several recent initiatives to protect and restore Victoria's freshwater areas.

THE OVENS RIVER – MEASURES ARE BEING UNDERTAKEN TO REDUCE THE THREATS TO THIS HIGH VALUE RIVER

Introduction - Freshwater reserves in Victoria

There has been considerable discussion regarding the need for freshwater reserves as a key tool for protecting aquatic environments. The concept of freshwater reserves is not new in Victoria. In June 1987, the Victorian Government directed the Land Conservation Council to conduct a special investigation of Victoria's rivers and streams. The purpose was to investigate the scenic, recreational, cultural and ecological values of rivers and streams and to make recommendations on the use of rivers and how identified values could be protected. The investigation concluded with the passing of the *Heritage Rivers Act* in 1992. The Act lists 18 heritage rivers and 26 natural catchment areas for protection. In regard to heritage rivers, a managing authority is specifically required to:

'…take all reasonable steps to ensure that the significant nature conservation, recreation, scenic or cultural heritage attributes of the area are protected…'

While the Act clearly specifies activities that can and can't occur within a Heritage River, the Act is silent on threatening activities (e.g. new water diversions, timber-harvesting impacts on flow, water quality) outside of the heritage river 'corridors'.

Other mechanisms to protect aquatic systems include the declaration of 'fisheries reserves' under the *Fisheries Act 1995* and the determination and protection of 'critical habitat' through the *Flora and Fauna Guarantee Act 1988.*

Considerations that need to be taken into account when using these tools include:

- acceptance by community as existing activities need significant change or to be ceased altogether
- limited ability to achieve their goal including managing threats outside of immediate area that requires protection
- ability to access funding to successfully implement over the long term.

Victorian Government initiatives to manage threats to river health

TABLE 1: ASSETS CONSIDERED IN MANAGING VICTORIAN RIVERS

ENVIRONMENTAL	SOCIAL	ECONOMIC
RARITY • Significant flora/fauna • Significant EVC • Wetland/estuary significance • Wetland rarity • Sites of significance • Heritage river REPRESENTATIVENESS • Representative river NATURALNESS • Natural macroinvertebrate communities • Natural riparian vegetation - Width - Longitudinal continuity - Structural intactness • Natural fish populations - Observed/expected - Fish proportion introduced • Fish migration • Ecologically healthy river	RECREATION • Fishing • Non-motor boats • Motor boats • Camping • Swimming • Passive recreation CULTURAL • Sites of cultural significance • Land claim • European heritage • Listed landscape FLAGSHIP SPECIES • e.g. Murray cod • Irrigation water supply	• Proclaimed water supply catchments • Public infrastructure • Agricultural land • Tourism • Power generation • Ecosystem services

VICTORIAN RIVER HEALTH STRATEGY

The Victorian Government has made significant inroads in protecting and restoring river health. The first initiative towards systematically identifying and addressing threats to river health was the development and subsequent implementation of the Victorian River Health Strategy (2002). The Strategy provides the framework in which government in partnership with the community makes decisions on the management, protection and restoration of Victoria's rivers.

The development and implementation of ten regional river health strategies based on the Victorian framework provides each catchment management authority with the principles to undertake significant improvements to river health, including:

- protecting the rivers that are of the highest community value from the decline in condition
- maintaining the condition of rivers that are currently ecologically healthy
- achieving an overall improvement in the environmental condition of the remaining rivers
- preventing damage from future management activities.

Victoria's management of rivers is shifting from an issues-based management to an asset-based approach that enables integration of environmental, economic and social considerations across the range of interrelated threats facing rivers (refer to Table 1). This paradigm shift recognises that protection is a sound investment compared with restoration and will see investment being transferred from treating areas in the worst condition to protecting those areas in best condition as a priority.

Importantly the development of regional river health strategies builds on the work that has been undertaken through the Heritage Rivers Program. The extent to which the present approach in managing Victoria's rivers meets the intent of the Heritage Rivers Act needs to be assessed.

The asset-based approach has a strong focus on risk management decision making. Victoria has invested heavily in benchmarking the health of Victorian streams. The Index of Stream Condition (ISC) was developed to assist in assessing river condition. The ISC is an integrated tool for catchment management that can assist Catchment Management Authorities together with their regional communities to set management objectives and measure the effectiveness of long term programs for the rivers in their catchment. The ISC is an indicator of environmental condition that integrates information of the major components of our river systems that are important from an ecological perspective. It brings together information on the current river flow regime, water quality, condition of the channel and riparian zone and the invertebrate communities living in the stream.

VICTORIA'S 'OUR WATER OUR FUTURE': AN ACTION PLAN

The Victorian Government's white paper *Securing our Water Future Together* (DSE, 2004) commits to achieving significant improvements in the ecological health of Victorian rivers, floodplains and estuaries by 2010. This will be achieved through the implementation of the integrated policy framework provided by the Victorian River Health Strategy. Key river health initiatives include:

- recognition that the Ovens and Mitchell rivers are high value and require special levels of protection as 'Icon Rivers'
- establishment of caps on water allocation in all Victorian river basins
- major intervention to improve environmental flows in unregulated and regulated river basins including the River Murray and Snowy River

- legal recognition of environmental water through the creation of the Environmental Water Reserve in all rivers
- establishment of an environmental levy on water use to support the implementation of the Victorian River Health Strategy.

Conclusion

Victoria has adopted a river protection and restoration process looking at whole-of-catchment, and importantly involving the community. This partly addresses the issues relating to the establishment of freshwater reserves including community acceptance and managing threats to aquatic systems on a catchment scale.

Victoria looks forward to being part of the future discussions on freshwater reserves and their role in achieving river health.

References

DNRE 2002, *Healthy Rivers, Healthy Communities and Regional Growth: Victorian River Health Strategy*, State of Victoria, Department Natural Resources and Environment.

DSE 2004, *Victorian Government White Paper: Securing Our Water Future Together,* State of Victoria, Department of Sustainability and Environment, Melbourne.

3.3

Freshwater protected area arrangements in Queensland

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There are a number of legislative and voluntary mechanisms available in Queensland to protect freshwater ecosystems. This paper outlines the main mechanisms and the extent to which they are presently used. All mechanisms, except local government planning schemes, are implemented by the State Government. Some 4.1% (over 7 million hectares) of Queensland is within the protected areas estate (covering national parks, world heritage areas, conservation parks, wilderness areas, and refuges), many of which are managed for specific riverine and floodplain habitats. Over 60% of the state area is covered by water resource plans, which provide environmental flows to maintain riverine and wetland health of those 11 river systems. To identify and classify wetlands of state significance, a significant mapping program is presently underway across the state and is linked to the state's regional ecosystem mapping to support rigorous assessments. Each local government in the state is required to develop and implement a planning scheme that specifies environmental outcomes to be achieved through development approval processes, which may include water quality targets and freshwater ecosystem values. Powers exist to protect identified fish habitats from development activities, but to date no specific fish habitat areas have been established in freshwaters. The State Government is presently developing legislation to protect the state's remaining wild rivers (those having all or almost all of their natural values intact) by limiting future land and water-based developments in those catchments.

Protected areas

The State Government, under the *Nature Conservation Act 1992* (NCA), can establish protected areas to protect relevant conservation values. The management of each protected area is to be in accordance with prescribed management principles. The following types of protected areas may be declared:

- National parks (scientific)
- Resources reserves
- National parks
- Nature refuges
- National parks (Aboriginal land)
- Coordinated conservation area
- National parks (Torres Strait Islander land)
- Wilderness areas
- National parks (recovery)
- World Heritage Areas
- Conservation parks
- International agreement areas

These areas are largely state lands. Mining is specifically prohibited in the first six categories of protected areas under the NCA. In almost all cases, parks include riverine and floodplain habitats.

Several national parks were primarily established to protect freshwater habitats. Examples include Currawinya NP in far south-west of Queensland, which has extensive semi-arid wetland systems including two large lakes, one saline; Fraser Island NP, which has perched dune lakes and tannin-stained lakes inland; Bowling Green Bay NP in north Queensland, which has the extensive near-coastal and estuarine wetland systems; Lawn Hill Gorge NP in tropical Gulf savannah country, which has spectacular gorge formations through unusual limestone geology, including intersecting sub-surface limestone aquifers; and Lake Broadwater NP, which is the only natural lake on the Darling Downs.

The *Marine Parks Act 1982* provides for Marine Parks to include all land up to the highest astronomical tide. This may include freshwater streams rarely inundated.

The *Recreation Areas Management Act 1988* provides for the state to establish recreation areas that can include both land and water. The Act applies to both state and private land. Areas such as Moreton Island, Fraser Island and Brisbane Forest Park have been declared under this Act.

The *Queensland Heritage Act 1992* could provide an opportunity for freshwaters of particular cultural value to be recognised.

The *Land Title Act 1994* and the *Land Act 1994* provide for the registration of covenants that could include freshwater. The government is currently undertaking a project in the north of the state that will result in the establishment of covenants to protect environmental values and reduce impacts of poor water quality on the Great Barrier Reef inshore waters.

Some 4.1% (7 125 303 ha as at June 2002) of Queensland is within the national park and other protected areas estate.

For more details contact David Campin of the Environmental Protection Agency (phone (07) 3227 7836 or email David.Campin@epa.qld.gov.au).

Water resource plans

The State Government, under the *Water Act 2000*, can establish a water resource plan (WRP) for a basin. A WRP formally establishes the strategic balance between consumptive and environmental water allocations across the basin.

The plans consider the flow requirements at a set of key points through an entire basin and across the flow regime. A numerical simulation model of daily flow within the basin is utilised in the development of each plan. This assists in the development of appropriate environmental flow strategies and the assessment of their relative benefits. Modelling flows over a long period is particularly important in river systems

exhibiting high flow variability. Typically, the maximum extent of available rainfall and stream flow records is used in the modelling.

A key outcome of a WRP is the Environmental Flow Objectives that ensure that the flow-related health of a catchment's streams and rivers is maintained through environmental flows. These flows are a means of managing water to mimic natural flow patterns. They are not a volume of water that is expressly reserved for the environment – more a case of how a particular type of flow, or part of a flow, should be managed or protected to support natural processes. In some streams, flows might not occur at all at certain times of the year, and an environmental flow strategy would strive to replicate this characteristic. WRPs propose strategies to cater for a number of flow attributes important for the river system's ecological health.

Environmental Flow Objectives define how far flows are allowed to deviate from their pre-development levels. In simple terms, the more flows change, the greater the risk of impact on river health. The Environmental Flow Objectives specified in a plan, therefore, define the acceptable level of risk and impact associated with a given level of water development and use.

To assess the environmental implications under different levels of water resource development, a Technical Advisory Panel (an independent group of experts in flow-related disciplines) is engaged to develop a set of performance measures that form the basis of performance indicators specified in each water resource plan. This work involves drawing on general scientific principles, panel members' experience, and benchmarking (comparison between a specific river reach and a set of reference reaches subject to varying degrees of flow regime change). This technical assessment and the panel's advice are important considerations in developing a plan's performance indicators, which are used as the basis for describing environmental flow requirements.

WRPs exist for 11 basins in the state and another 6 are presently under development, including extensive community consultation and socio-economic assessments. A more detailed resource operations plan (ROP) is developed for each WRP to outline the 'rules' for the taking of water, providing environmental flows, trading of water entitlements, and for assessing the performance of the WRP in achieving its objectives. The completed WRPs represent 60% of the state area and the plans under development represent another 30%.

For more details contact Mr Lyall Hinrichsen of the Department of Natural Resources and Mines – phone (07) 3247 4582 or email Lyall.Hinrichsen@nrm.qld.gov.au.

Wetlands of state significance

Under the *State Coastal Management Plan – Queensland's Coastal Policy August 2001* the State Government recognises areas of state significance that include coastal wetlands, coastal dune systems and endangered regional ecosystems. The Queensland Government also has obligations under the Intergovernmental Agreement on the Environment, including the management and protection of world heritage areas, Ramsar sites and areas listed under JAMBA[2] and CAMBA[3].

No wetlands are yet listed as having state significance, but a significant mapping program is presently underway across the state to provide the necessary rigorous information for such status to be established. The aim is to have a single official wetland map for Queensland for regulatory and conservation management purposes that also provides technically sound classification of wetlands and other aquatic ecosystems. The project is quite complex because the base waterbody mapping is undertaken mostly by multi-temporal satellite imagery analysis, which is then classified to recognise different aquatic ecosystem types. Finally, the result is reconciled and incorporated into existing Regional Ecosystem mapping. In practice, wetland elements down to about 2 ha for coastal catchments and about 5 ha inland are captured. Wetlands smaller than that may also be on the maps but not individually reconciled with Regional Ecosystems or truthed.

For more details contact Peter Macdonald of the Environmental Protection Agency – phone (07) 3225 1638 or email Peter.Macdonald@epa.qld.gov.au.

Local government planning schemes

All local governments in Queensland are required under the *Integrated Planning Act 1997* to develop and implement a planning scheme for their area. Each scheme is to specify environmental outcomes that are to be achieved, which may include water quality targets and freshwater ecosystem values. The State Government may require an individual planning scheme to include a number of state interests, such as protection of acid sulphate soils, in these values.

Development applications need to demonstrate how the environmental values will not be adversely affected by the proposed development. Decisions by local government and state agencies regarding the application are appealable by the applicant and third parties.

Only a small number of local governments have specifically identified freshwater habitats in their environmental objectives to date. These local governments are mostly within high population coastal regions. The State Government assesses the performance of a planning scheme in achieving its environmental outcomes from time to time during a scheme's 7-year life.

Fish habitat areas

The State Government, under the *Fisheries Act 1996*, can establish specific fish habitat areas (FHAs) to protect marine or freshwater fish habitats. Within an FHA, development works and related activities (including building or maintaining a structure; excavation and filling; stabilisation; disturbing and planting vegetation; dumping matter and application of pesticides) can be directly managed through a permitting system. Permits will only be issued for prescribed types of works and acceptable levels of impact. There are two classes of FHA: management level A and management level B, with the latter allowing for a higher level of development and impact.

The declaration process involves extensive consultation with stakeholders and the community, requiring a consensus before an FHA will be declared. Recent declarations have taken between two and five years to complete. To date, FHAs are wholly on

unallocated state land or within National Parks, unless agreement is reached with a landholder to include their freehold land (only one instance of this). FHAs are defined using cadastral boundaries to provide a clear 'legal' boundary for compliance monitoring.

Incompatible development cannot occur within a FHA. If the government decides to allow an incompatible development to occur (i.e. a development not of the type prescribed in the *Fisheries Regulation 1995*) in an FHA, it must revoke all or part of the FHA. However, revocations require significant justification and community support.

Despite strong stakeholder interest, no freshwater FHAs have been declared to date. The main shortcomings with the FHA approach for freshwaters are:

- the significant resources required to declare an FHA, including extensive consultation, and to then process future development permit applications within the FHA
- the long time taken to declare an FHA, preventing any urgent management intervention
- the relatively small size of FHAs compared to the scale of freshwater habitat
- the severe limitations of FHAs to address off-stream and upstream impacts.

To address these shortcomings, the Government is examining the role of FHAs and all other freshwater management options, within the context of all management and development controls currently available in Queensland. The planned *Framework for Habitat Management* will outline:

- key biotic and abiotic components of freshwater fish habitat
- key works and activities in freshwater and their impact on habitat components
- Queensland fish species habitat requirements and sensitivities
- the impacts of activities in the different regions of the state on freshwater habitat components
- an overview of legislative and non-legislative freshwater habitat management bodies and tools.

To date, work has started on defining habitat requirements, identifying key threatening activities and assessing the current management 'gaps'. A range of legislative and management tools will be examined, including FHAs, to determine the most effective means of protecting fish habitat in future. It is expected the framework will be completed in 2004. For more details, contact Ms Claire Peterken of the Department of Primary Industries and Fisheries – phone (07) 3225 2239, or email Claire.Peterken@dpi.qld.gov.au.

Proposed wild rivers

The Queensland Government has adopted a policy to protect the state's remaining wild rivers. A wild river is one that still has all or almost all of its natural values intact. The key criteria for 'naturalness' are hydrologic processes, geomorphic processes, water quality, riparian function and wildlife corridor function. These values underpin ecological, aesthetic, recreational, scientific and cultural attributes.

This is a very comprehensive river protection policy as it will apply to whole river systems, including the river, its estuary (or terminal wetland), its main tributaries, any identified special features (e.g. significant wetlands) and all lands in the catchment. These elements will be detailed in a statutory declaration for each river to allow the policy to be applied with certainty.

To implement this policy, the government is developing legislation to control future development in such rivers and their catchments. Some activities will be prohibited, some permitted subject to full impact assessment, and some permitted subject to use of approved codes.

However, the policy does recognise existing rights and permits. It does not seek to ‘turn back the clock’ on existing authorised developments or to require restoration of these rivers and their catchments. It is not trying to create catchment scale national parks, i.e. it is permitting further development provided it is consistent with the policy. In effect the policy is limiting further development with the intent of maintaining existing natural values.

The policy has simple criteria for selecting wild rivers, recognising the paucity of scientific information available and the relative importance of social and economic considerations in current natural resource management decision-making processes. With time, it is expected the scientific rigor underpinning the criteria will improve.

Simplicity is a major strength of the policy, increasing its chances of successful implementation and acceptance by catchment communities. Each declaration will involve extensive consultation of the catchment's communities to ensure their aspirations, concerns and values are considered.

The performance of each wild river declaration will be assessed every five years by the State Government to determine if the controls are effective in achieving the policy's purpose.

For more details contact Mr John Amprimo of the Department of Natural Resources and Mines – phone (07) 3224 7668 or email: John.Amprimo@nrm.qld.gov.au.

Notes

1. Director (Water Monitoring and Information), Water Planning. Leads the department's development of policies and legislation for riverine management across Queensland including Wild Rivers, riverine management planning, water quality, water resource plan performance monitoring, and sustainable extraction of quarry materials.

2. Japan Australia Migratory Birds Agreement.

3. China Australia Migratory Birds Agreement.

3.4

NT parks and freshwater ecosystems

STUART GOLD
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This paper focuses on two projects currently being undertaken by the Northern Territory Government concerning the planning and management of biodiversity (and water resources) in the Northern Territory. The two projects are:

- Natural Resource Management Planning in the Daly River Area
- development of a Parks and Conservation Masterplan for the NT.

Both of these projects will have a bearing on the future management of freshwater ecosystems in the NT, one at physical/site level (i.e. the Daly Basin); the other in developing future NT conservation policy with the prospect of enhancing the freshwater component of the NT conservation estate.

The Northern Territory covers some 1.34 million square kilometres, approximately one-sixth of the Australian landmass. Dominant topographical features are the 200 km sandstone escarpment in the Top End and the desert ranges of central Australia.

Vegetation and wildlife patterns reflect landscape feature and a rainfall gradient, which falls sharply from north to south. The north has a tropical monsoon climate, with mean annual rainfall for Darwin of 1600 mm. Most of the rain falls from late October to early April. The southern part of the NT is arid with mean annual rainfall of 300 mm (Australian Bureau of Meteorology).

Waterbodies make up approximately 47 000 square kilometres of the Northern Territory, or about 3.5% of the land surface. Approximately 11% of NT waterbodies are within the existing reserve system. Of the 33 NT wetlands listed in the 'Directory of Important Wetlands in Australia', 10 are currently within or partially within the protected area system. Figure 1 shows the overlay of NT waterbodies and the NT protected area system.

Extensive surveys have been undertaken over a ten year period to identify:

- the distribution and status of shorebirds around the coast and coastal wetlands of the NT
- the distribution and status of colonial seabirds and waterbird breeding colonies in the Top End.

These surveys have shown that the NT has abundant nationally and internationally significant coastal wetlands and colonial waterbird, seabird and shorebird sites.

Condition surveys have been undertaken for several of the NT's major river systems, including the Roper, Daly, Katherine, Flora and Victoria rivers.

These condition reports indicate that NT rivers are generally in good condition with only patchy weed infestations in the riparian zone of some rivers and relatively low levels of erosion along some unfenced river corridors as a result of cattle intrusion.

The NT has good historical flow data for most of the major rivers dating back some thirty years. Of the 29 river basins in the NT current levels of water use (extraction) have been estimated at no more than 0.5% (National Land & Water Resources Audit).

Current water management policies are focused around the development of water allocation plans for all basins under development pressures. Water allocations for the environment are set at a minimum of 80% in the 'Top End' and a minimum of 95% in the arid zone. Management controls include clearing restrictions and vegetation buffers for rivers, wetlands and rainforest areas. Bioregional conservation plans are being prepared for areas under development pressure, including the Daly Basin.

There are few man-made structures or barriers in place to divert or capture the flow of natural waters in the NT. A number of barrages have been established on the Mary River floodplain to mitigate the effects of saltwater intrusion. Currently there are only three dams in the Territory. These have been developed for the provision of urban water supply. They include the Manton Dam, built in 1942, Darwin River Dam constructed in 1970, and Donkey Camp which is a weir across the Katherine River constructed in 1983.

Natural resource management planning in the Daly River area

The NT has a very low level of intensive horticulture with only 8000 ha under production (out of a land mass of 134 781 602 ha). Because of its good soils and abundant fresh water supplies, the Daly Basin has been chosen as an area with high potential for future horticultural development. The Daly Basin comprises approximately 20 000 km^2 within the broader Daly River Catchment, which occupies some 53 000 km^2 (see Figure 2). The Daly Basin provides a unique opportunity to establish a framework for sustainable development before development takes place.

To this end the Northern Territory Government is:

- preparing a Region Water Resource Strategy for the Daly Region
- introducing specific land clearing controls
- preparing a Conservation Plan.

The NT Government has already established a Community Reference Group (CRG) tasked with preparing an ecologically and socially sustainable development framework for the Daly Region. An Expert Reference Group (ERG) has also been established to assist the CRG with developing the framework.

In addition to the above a number of studies have been undertaken with funding from the National River Health Environmental Flow Initiative to provide recommendations on environmental flows consistent with maintaining the biota and wider ecosystem values of the Daly River. The studies include:

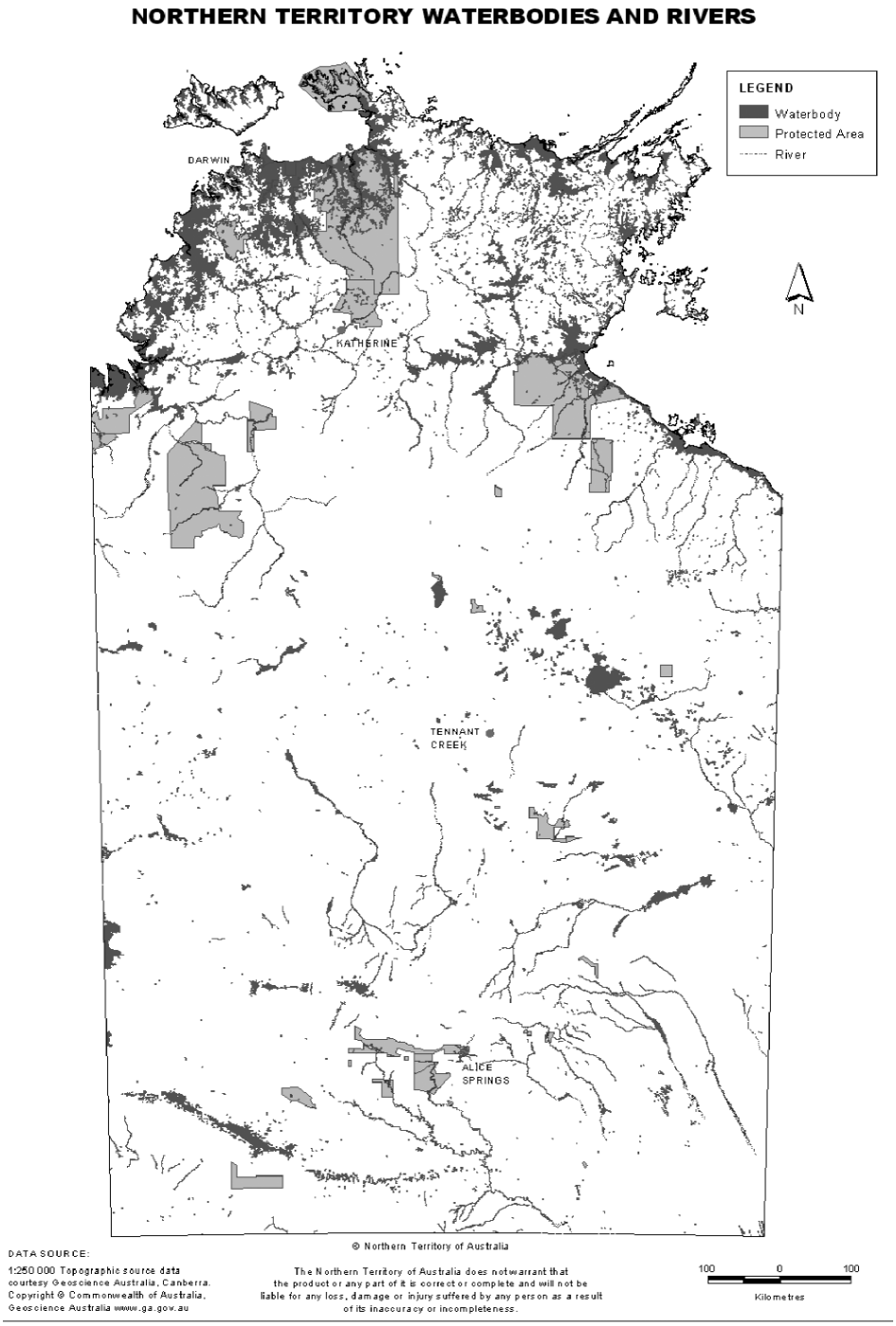
- inventory and risk assessment of water dependent ecosystems in the Daly River

- modelling dry season flows and predicting the impact of water extraction on a flagship species (pig-nosed turtle)
- periphyton and phytoplankton response to dry season flows in the Daly River
- environmental flow requirements of *Vallisneria nana* (ribbon weed) in the Daly River
- tree water use and sources of transpired water in riparian vegetation along the Daly River.

Erskine et al. (2003) provides a summary of the survey results and recommendations for environmental water requirements for the Daly River. In summary, the report recommends the following:

- institution of an integrated natural resource management approach to managing the Daly River catchment
- maintenance of estuarine biophysical processes and aquatic habitats
- identification and protection of groundwater dependent ecosystems
- design and implementation of a benchmarking and monitoring program and institution of an adaptive approach to ecosystem management
- maintenance of turtle and fish passage
- maintenance of groundwater levels for use by riparian vegetation
- maintenance of existing levels of water quality
- maintenance of existing structure and function of wetlands
- assessment of adequacy of imposed licence conditions and discharge thresholds with revision based on monitoring results.

FIGURE 1: OVERLAY OF WATERBODIES AND PROTECTED AREAS IN THE NT



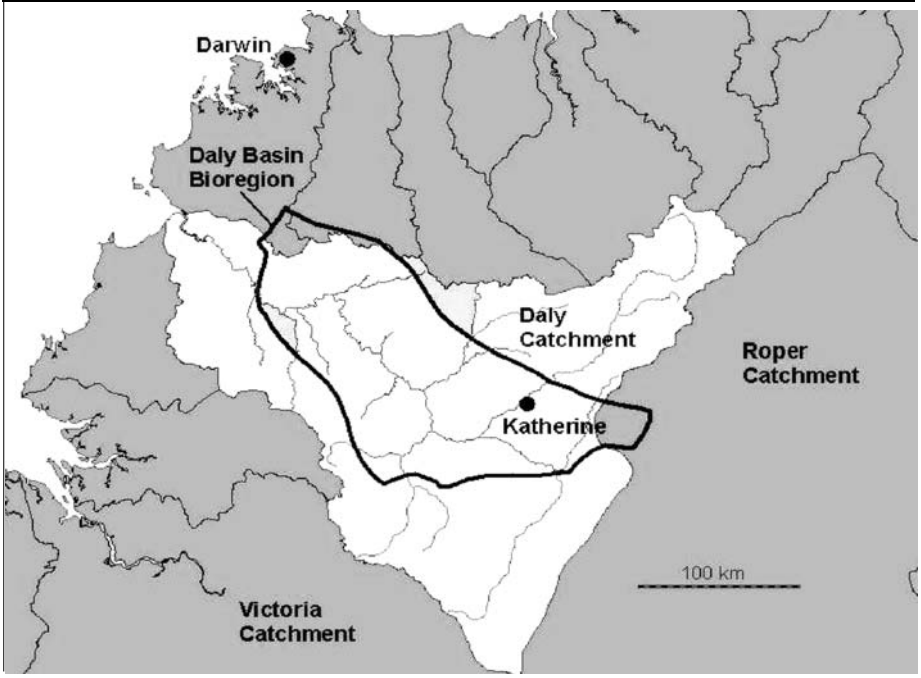
Development of a Parks and Conservation Masterplan for the NT

The Conservation Policy Group within the Department of Infrastructure Planning and Environment is currently preparing a Parks and Conservation Masterplan for the NT. The main goal of the masterplan is to provide a vision and blueprint for the conservation of the Northern Territory's biodiversity and for the development of the NT's park system over a 15-20 year period.

The preparation of the masterplan is being guided by the following set of principles:

1. The Territory, with most of its natural vegetation intact and largely pristine freshwater ecosystems, is presented with a unique opportunity to pursue social and economic development within a conservation framework.
2. The conservation of biodiversity is the responsibility of all Territorians and can only be achieved through community partnerships.
3. The close traditional association of Aboriginal people with land and wildlife has been important for the maintenance of the Northern Territory's biological diversity, and traditional knowledge and management practices continue to have relevance to current management programs.
4. The effectiveness of conservation in the NT is dependent on a strong and integrated suite of legislation.
5. An essential ingredient of conservation is the establishment of a comprehensive, adequate and representative park system.
6. In general, the most effective and cost efficient conservation management across the vastness of the NT will be achieved by using the skills and expertise of the landholders and by providing appropriate incentives and capacity building.
7. Negative incremental effects of development on biodiversity can be managed though integrated regional natural resource management planning.
8. Better knowledge of biodiversity is essential for environmental planning and effective conservation.
9. The conservation of biodiversity across the Northern Territory and the management of parks and reserves can be allied with the further development of nature-based tourism opportunities and the socioeconomic development of Aboriginal communities.

FIGURE 2: DALY BASIN CATCHMENT AND BIOREGION



The Parks and Conservation Masterplan is being developed by the Northern Territory Government in partnership with the Northern and Central Land Councils, Parks Australia North and other key stakeholder and industry groups.

Information concerning the masterplan project, including newsletters and a set of issues papers prepared to stimulate discussion can be found at www.parksmasterplan.nt.gov.au. It is intended a draft masterplan will be prepared by December 2004, and finalised by April 2005.

It should be noted that the masterplan deals with far more than the park system. It will chart a course towards the protection of the Territory's biodiversity across all land tenures including Aboriginal and pastoral lands. It represents a tremendous opportunity for the Territory Government to learn from the mistakes of the past and to undertake development within a sustainable framework.

Reference

Erskine WD, Begg GW, Jolly P, Georges A, O'Grady A, Eamus D, Rea N, Dostine P, Townsend S & Padovan A 2003, 'Recommended environmental water requirements for the Daly River, Northern Territory, based on ecological, hydrological and biological principles', *Supervising Scientist Report 175 (National River Health Program, Environmental Flows Initiative, Technical Report 4)*, Supervising Scientist, Darwin, NT.

3.5

Freshwater protected areas in South Australia - can present legislation in South Australia cut the mustard?

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Introduction and outline

Within South Australia, there are many significant and unique 'freshwater' environments including Great Artesian Basin springs, permanent and ephemeral rivers, marshes, floodplains, billabongs and estuaries. These 'freshwater' (and brackish) environments are vital natural resources, providing recreation and pleasure, as well as being essential to our economy and fishing industry. These environments are important to the maintenance of fish stocks and endangered flora, while our wetlands are a vital habitat for birds and other species.

The International Union for Conservation of Nature and Natural Resources (IUCN) defines a protected area as:

An area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means (IUCN, 2004).

In order to be an effectual Freshwater Protected Area (FPA), the declared site should seek to protect the flora, fauna, habitat and environmental water requirements of the area. Without all of these components protected, a declared FPA would be unlikely to protect the biological diversity or natural and associated cultural resources; instead it could be expected that the condition of the site would continue to decline from that when the area was declared.

In South Australia, legislation and strategies exist that could provide a framework for the establishment of FPAs when combined or used in a complementary way. No individual Act can be used in isolation to effectively protect all of the components required to create a functioning FPA. The *River Murray Act 2003* is the one exception; however, this legislation specifically relates only to the River Murray in SA and cannot be applied across the entire state.

This manuscript seeks to outline the relevant legislation in SA, describing some of the deficiencies regarding Freshwater Protected Areas and how the legislation could be used or integrated to effectively protect freshwater ecosystems in this state. How the River Murray Act could be used in the declaration of FPAs for the River Murray and its tributaries is also explored.

The Fisheries Act 1982

The *Fisheries Act 1982*[1], administered by PIRSA Fisheries, is focused around ensuring sustainable fisheries management in South Australia. Within the legislation, there exist some provisions for the protection of aquatic habitat and selected flora and fauna.

Section 47 of the Fisheries Act provides that the Governor may, by proclamation, declare an aquatic reserve. A reserve may consist of waters, or land and waters, but land can only form part of a reserve if it is placed under the care, control and management of the Minister for Agriculture, Food and Fisheries.

The effect of declaring an aquatic reserve is that a person must not enter or remain in the area of the reserve, unless authorised by regulations or by permit. The types of access that are authorised in each aquatic reserve are set out in the *Fisheries (Aquatic Reserve) Regulations 2004* (which replaced the 1989 Regulations). Furthermore, the Fisheries Act makes it an offence to disturb the bed of any waters of an aquatic reserve and makes it an offence to remove or interfere with aquatic or benthic flora or fauna of an aquatic reserve. (However, a person may apply to the Director of Fisheries for a permit to undertake activities or operations that may have this effect: section 48G.)

The existing aquatic reserves have different access regimes, as prescribed in the regulations. The different levels of access range from the total banning of fishing activities to no restrictions on fishing activities. Typically, commercial fishing is prohibited in a reserve and limited recreational fishing is permitted.

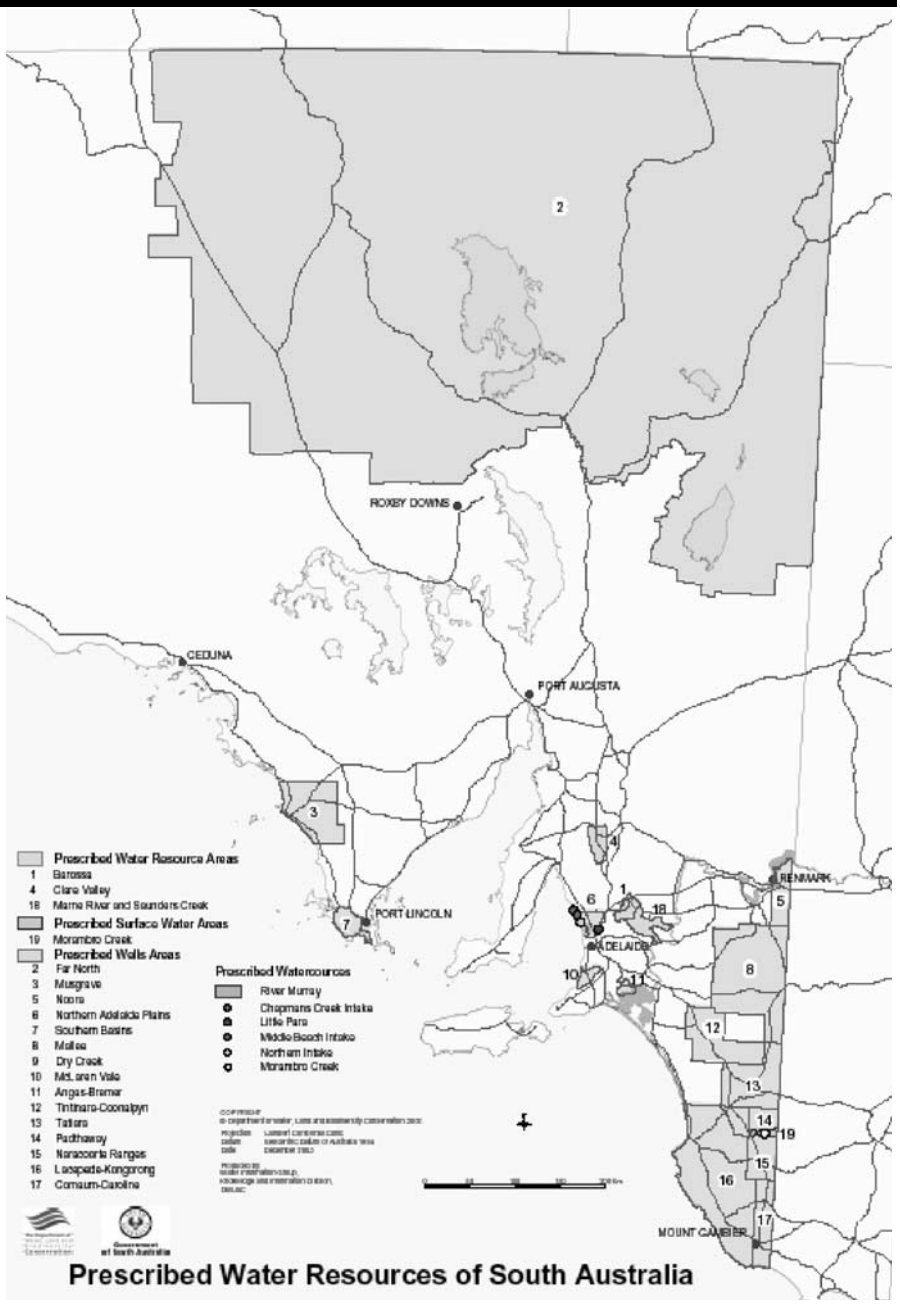
Native freshwater fish are protected under section 42 of the Fisheries Act, which provides that it is an offence to take species listed as 'protected species'. The list of protected species is prescribed in Regulation 6 of the *Fisheries (General) Regulations 2000* and includes the following freshwater fish:

- fish of the genus *Ambassis, Mogurnda or Nannoperca*
- Freshwater catfish *(Tandanus tandanus)*
- River blackfish *(Gadopsis marmoratus)*
- Silver perch *(Bidyanus bidyanus)*
- Trout cod *(Maccullochella macquariensis)*
- Murray River crayfish *(Euastacus armatus)*
- female Yabbies (*Cherax destructor* carrying external eggs).

Furthermore, clause 145 of Schedule 1 of the *Fisheries (General) Regulations 2000*, prohibits licensed commercial fishers from taking native fish from the backwaters of the River Murray.

Despite the fact that the Fisheries Act provides for the limited protection of aquatic flora and fauna, through listing of protected species, or the protection of benthic aquatic habitat, it does not provide for the protection of water levels or water quality required to maintain the health of the habitat or fish populations. The tools available under the Fisheries Act are fisheries management tools. As a result, this Act would need to be used in

FIGURE 1: LOCATION OF THE PRESCRIBED AND RESTRICTED AREAS ACROSS SOUTH AUSTRALIA



conjunction with other Acts that do relate to the management of waters such as the *Water Resources Act 1997* or the *River Murray Act 2003*.

The Water Resources Act 1997

The *Water Resources Act 1997* (South Australia) established a system for the use and management of the state's water resources so as to provide for ecologically sustainable development.

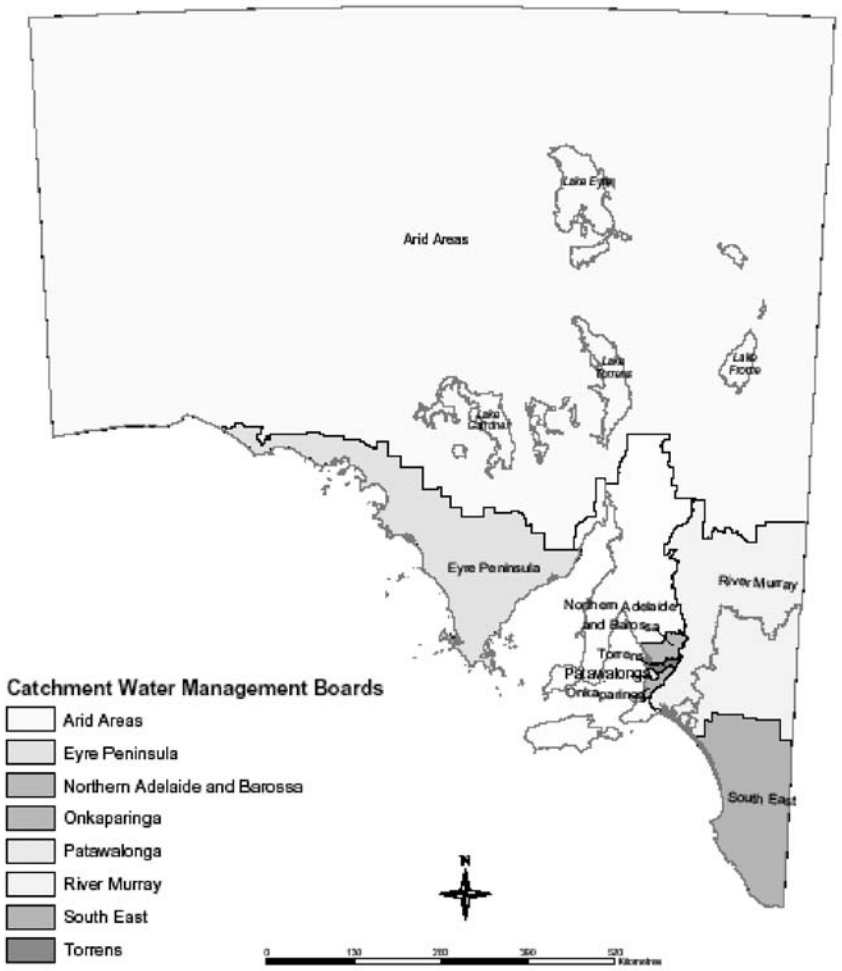
The Water Resources Act has the following key provisions that underpin this system. It established a hierarchy of water plans to address policy and management issues at different scales. The State Water Plan sets the state-wide strategic direction for water resources management and includes resource assessment and state-level policy. Catchment water management plans address catchment scale issues such as water quality, stormwater management and pollution, water reuse, riparian zone and wetlands management.

Water allocation plans set out how 'prescribed' water resources in a defined area must be allocated in the form of transferable personal property rights. These plans must assess and provide for ecosystem water needs both within and downstream of the 'prescribed' area. This includes surface and groundwater dependent ecosystems. To date there have been 16 water allocation plans completed and four are in preparation.

There is also a provision in the Act for local water management plans, which would address local issues on a local government scale.

The Act allows for 'prescription' of water resources, which are then only accessible via a licensed allocation as set out in a water allocation plan. Once a resource is 'prescribed' a water allocation plan must be developed for that resource. There are also emergency and short term powers ('notice of restriction') to deal with water resources under stress or at risk of stress. This includes for reasons of ecosystem protection. Figure 1 shows the location of the prescribed and restricted areas across the state.

FIGURE 2: LOCATION & BOUNDARIES OF SA'S CATCHMENT WATER MANAGEMENT BOARDS



The Act provides for the establishment of catchment water management boards that are skills-based and community based bodies. The boards must prepare catchment water management plans and can raise their own funds via levies to implement these plans. There are eight catchment water management boards covering most of the state (see Figure 2). The boards are also responsible for preparing water allocation plans for any prescribed resources within the board's area.

The Act includes many provisions to protect ecosystems including their biodiversity. The object of the Act includes specific reference to '*(a) protecting the ecosystems (including their biological diversity) that depend on those resources*'. There is some focus on environmental water provisions primarily delivered through water allocation plans. Catchment water management plans can and do include programs for riparian, wetland and in-stream habitat management and rehabilitation. These plans can also establish a system of permits for 'water affecting activities' such as levees, dams, weirs, vegetation destruction and discharging water.

The Act has many provisions that can assist in protecting, managing and rehabilitating freshwater ecosystems, and the roll-out of water plans under the Act has provided great improvements in these areas. However the Act does not provide for 'protection' in the sense of a reserve system but provides the mechanisms to protect environmental water needs and manage habitats in the context of catchment management.

The Water Resources Act is one of three Acts that will be replaced in full by the *Natural Resources Management Act 2004*. When this Act becomes fully operational in mid-2005, the catchment water management boards will cease to operate and their responsibilities and powers will pass over to new regional NRM boards.

The Natural Resources Management Act 2004 (South Australia)

The Natural Resources Management Act 2004 is Australia's most comprehensive natural resources management legislation, establishing a new institutional framework for delivering ecologically sustainable development in South Australia.

South Australia has had three separate Acts covering key elements of natural resources management. Now the Natural Resources Management Act unites the three in a way that is more effective and efficient. The new Act replaces the *Animal and Plant Control (Agriculture and Other Purposes) Act 1986, Soil Conservation and Land Care Act 1989* and *Water Resources Act 1997*. The operational parts of the former Acts have been updated and moved into the new Act so there is a large degree of consistency and minimum change, except where it was needed.

The Natural Resources Management Act has as its objective the ecologically sustainable development of the state's natural resources including protection of biodiversity and ecological processes and ecosystems.

The Act creates a simplified planning and administrative structure compared to that under the previous three pieces of legislation.

It provides for a state-level NRM Council that will, amongst other things, develop the State NRM Plan that will set the strategic direction for natural resource management across the state. Below that it provides for the creation of eight regional NRM Boards that will be skills-based. These boards must develop and implement statutory natural resource management plans that address a wide range of natural resources management issues, and be consistent with the State NRM Plan. Boards will also be responsible for developing water allocation plans for 'prescribed' water resources.

NRM Boards will be able to raise funds through a natural resource management levy to implement their regional plans. Regional NRM Boards will also be responsible for the

implementation of Natural Heritage Trust (NHT), National Action Plan for Salinity and Water Quality (NAP) and the National LandCare Program (NLP) funding programs.

At both the state and regional level the Act provides for greater integration with the development control and planning system under the *Development Act 1993*.

The Natural Resources Management Act will provide an increased range of options to address protection of aquatic ecosystems, compared to the Water Resources Act. All the provisions from the Water Resources Act that can assist in aquatic ecosystem protection have carried over to the new Natural Resources Management Act. However there are additional opportunities contained within the Natural Resources Management Act:

- The Act defines 'natural resources' as among other things including natural biota and ecosystems, which extends its scope.
- The Act applies to the entire state including state waters, which provides scope for dealing with coastal and estuarine ecosystems.
- There is provision for regional NRM plans to specifically address conservation as well as use and management of natural resources.
- There is provision for regional NRM plans to specifically include arrangements to manage wetlands, estuaries and marine resources including the linkages between these systems.
- There is scope for regional NRM plans to provide investment for a broader range of actions that contribute to aquatic ecosystem management, rehabilitation and monitoring.
- There are stronger arrangements in relation to working with local government.
- There is a requirement under the general duty of care provisions to consider cumulative impacts on natural resources.

Although the Natural Resources Management Act does have many provisions that can assist in managing and rehabilitating freshwater ecosystems, the Natural Resources Management Act, in the same way as the Water Resources Act, does not provide for 'protection' in the sense of a reserve system. Instead it provides the mechanisms to manage natural resources and habitats in a sustainable manner.

The Wilderness Protection Act 1992 (South Australia)

The *Wilderness Protection Act 1992* allows for the establishment and management of areas with high wilderness values. The applicability of this legislation to FPAs is limited because many of South Australia's freshwater areas are quite variable spatially and temporally; few, if any, would fit the criteria established under the Act. Of course, freshwater areas may fall within a Wilderness Protection Area that has been established primarily to protect the wilderness values of surrounding land.

The Native Vegetation Act 1991 (South Australia)

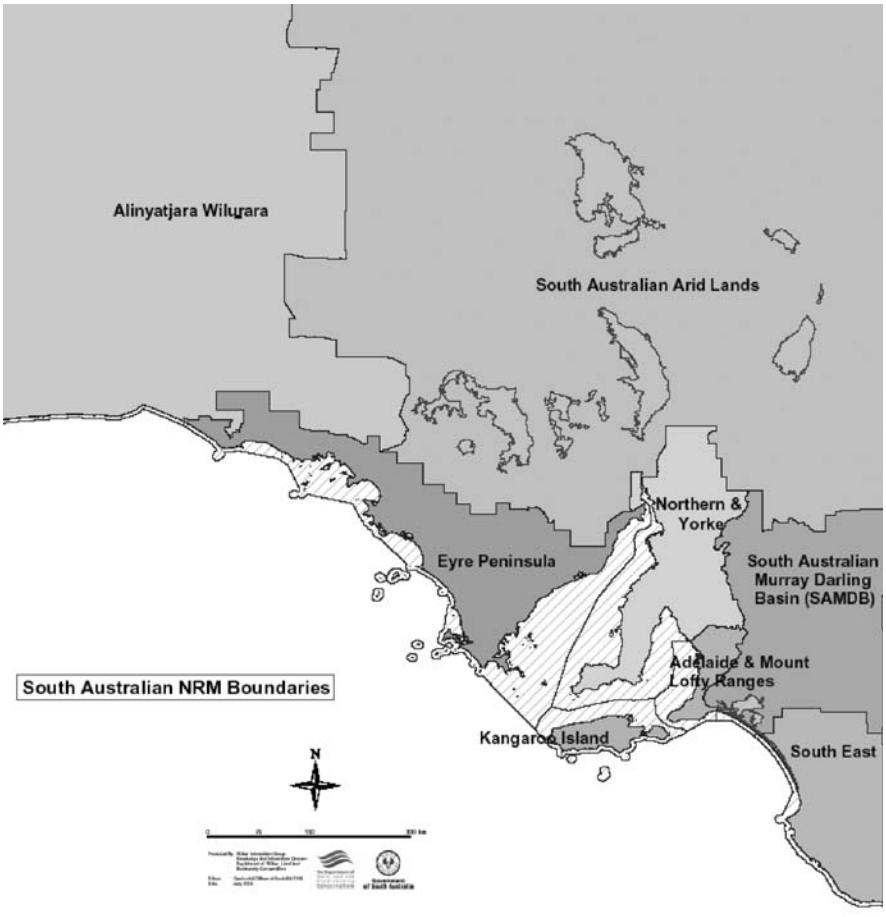
The *Native Vegetation Act 1991* provides for the protection and management of native vegetation on private land through Heritage Agreements, amongst other instruments. Many small wetlands are included in Heritage Agreements and are afforded a degree of protection but no protection is provided to guarantee access to water resources.

The National Parks and Wildlife Act 1972 (South Australia)

The *National Parks and Wildlife Act 1972* allows the establishment of a variety of protected areas to conserve wildlife and natural features of the land and specifies management objectives and provides for the preparation and adoption of a management plan.

It provides for the protection of all native plants and animals, which includes the protection of fish and other aquatic flora and fauna. It allows plants and animals to have a conservation rating that affords extra protection. No fish have been rated yet.

FIGURE 3: LOCATION & BOUNDARIES OF SA'S NATURAL RESOURCE MANAGEMENT REGIONS



This Act does not address the issue of guaranteeing the supply of water to ensure the long-term health of wetlands or water dependent ecosystems.

The Wilderness Protection Act, Native Vegetation Act, and National Parks and Wildlife Act all provide some level of protection to areas of land or associated aquatic systems, but as they operate now, are unable to offer protection to water required to maintain these habitats.

Present level of protection for freshwater environments in SA

Presently in South Australia, freshwater environments are protected using the *National Parks and Wildlife Act 1972* administered by the Department for Environment and Heritage (SA). South Australia has five categories of parks administered through this Act:

- Game Reserves (GR)
- Regional Reserves (RR)
- Recreation Parks (RP)
- National Parks (NP)
- Conservation Parks (CP)

Fifty-eight of the 69 wetlands in the directory of Important Wetlands in Australia are within, or partly within, government managed land. Eleven are on private land and two of these are subject to Heritage Agreements. A large number of the wetlands in this directory are on Crown land and require further investigation and establishment of protected areas where appropriate.

Many of the parks in SA include some aquatic habitats but the legislation provides no protection for the majority of the water resources required to maintain function of these systems. Therefore, although the site might be protected, the water that keeps it functioning as an aquatic system may not be protected.

The South Australian Comprehensive and Representative Reserve System (CARRS)

The Department for Environment and Heritage is still developing a state CARRS strategy to be consistent with the national 'Directions for the National Reserve System - A Partnership Approach'.

The South Australian CARRS program places priority on wetlands, wetland ecosystems and the requirements of migratory birds when assessing and selecting new protected areas. There is a provisional list of threatened ecosystems in South Australia. There are 14 threatened ecosystems in the non-agricultural areas of the state, of which 7 are wetland ecosystems. In the agricultural regions of the state there are 33 threatened ecosystems of which 11 are wetland ecosystems and another three ecosystems are dependent on periodic waterlogging. Under the CARRS program, there is a strong bias towards acquiring land with wetland values.

The Department for Environment and Heritage Corporate Plan 2004 contains an aspiration to conserve desert wetlands. This is an indication of the focus of conservation programs in the semi-arid and arid parts of the state.

The River Murray Act 2003 (South Australia)

The *River Murray Act 2003* aims to ensure that the River Murray is properly protected from activities occurring within the state, and also to increase the legal status of the Murray-Darling Basin Agreement, raising the bar for other states on the extent of commitment to the Agreement and the decisions made under it (Dyson 2003).

The object of the Act is to protect, restore and enhance the River Murray in accordance with principles of Ecological Sustainable Development. The Act establishes four objectives for a healthy River Murray that relate to river health, environmental flows, water quality, and human dimensions.

The intention of the River Murray Act is to protect a complex set of characteristics and features. The River Murray is more than a watercourse, and more than the water that flows in that watercourse (Dyson 2003). The definition of the River Murray includes the:

- main stem of the river
- River Murray system: stem, anabranches, tributaries, wetlands, flood plains
- natural resources of the river, being
  - soil, water, air, vegetation, animals and ecosystems
  - natural and cultural heritage, amenity, geological values
  - minerals and other substances.

The Act can assist in freshwater ecosystem conservation through various measures that allow the Minister for the River Murray to control activities undertaken in the River Murray regions, as defined in the Act. The measures include:

- ministerial powers (e.g. works and measures)
- referrals – directed conditions of activities
- management agreements
- duty of care
- Protection Orders
- Regulations.

The most direct way to create and manage an FPA under the River Murray Act would be through the making of Regulations (see below).

MINISTERIAL POWERS - WORKS AND MEASURES

Under section 17 of the River Murray Act, the minister is able to undertake activities to perform the minister's functions under the Act. The minister's functions include instituting and supervising programs to protect, maintain or improve the River Murray. These could include works such as, the construction, maintenance or removal of infrastructure or other devices for altering or managing the flow of water, water levels or water quality. m Such works may include, for example:

- regulating structures on wetlands adjacent to the River Murray to provide for localised wetting and drying
- banks, culverts, pumps, pipelines and channels to divert water from the river to rejuvenate floodplains and wetlands

- small weirs, or the raising of existing weirs, varying water levels to mimic natural conditions
- groundwater pumps and pipelines and disposal basins to lower groundwater levels below the root zones of native vegetation (getting into the realms of works to be dealt with under the Murray-Darling Basin Act and Agreement).

REFERRALS

The River Murray Act creates a 'referral' mechanism that requires the referral of activities for determination by the minister for the River Murray, to ensure that the activities are consistent with the objectives of the Act. Activities to be referred include certain applications for statutory authorisations made under other Acts. (Examples include development applications and mining leases; further referrals will be introduced, including fishing licences and native vegetation clearance consents.) The minister can direct refusal or impose approval conditions on referred applications.

Certain statutory instruments are also referred to the Minister for the River Murray. Examples include: Plan Amendment Reports, district soil plans and aquaculture policies.

MANAGEMENT AGREEMENTS

The minister may enter into management agreements with landowners in the SA Murray-Darling Basin. The potential scope for management agreements is very wide. Management agreements could be established to assist in conserving freshwater areas, for example wetlands on private land.

Management agreements can:

- require or restrict specific work
- provide for care, control or management of infrastructure
- implement environmental improvement programs
- provide for payment of an incentive, or remissions of taxes
- be registered against the land title and run with the land, enforceable against future owners and occupiers of the land.

Management agreements may be enforced according to the terms of the management agreement (such as sanctions that might be identified in the agreement itself), via a Protection Order, or via a Reparation Order where harm has occurred due to the breach.

DUTY OF CARE AND ENFORCEMENT OF ACT

The Act establishes a 'duty of care' to not harm the river through one's actions. The duty may be enforced through the issue of an Order under the Act, such as:

- Interim Restraining Orders – prevent current or future action that may harm the river
- Protection Orders – secure compliance with the general duty of care, a condition of an authorisation, or an exemption
- Reparation Orders – enforce actions or payment to make good existing damage to the river
- Reparation Authorisations – allow an officer to make good damage to the River Murray. The minister may recover costs of reparation from the wrongdoer.

REGULATIONS

The most direct way to create and manage an FPA under the River Murray Act would be through the making of Regulations identifying the particular area to be protected, and setting out the types of activities that would be allowed, prohibited or otherwise regulated within the designated area.

The Governor may make regulations that further the purposes of the River Murray Act, including regulations to create River Murray Protected Areas and to prohibit or restrict or otherwise regulate activities within such an area, or prohibit or restrict access to such an Area.

Without limiting the regulation-making power, Regulations may prohibit or restrict, in any RMPA or part of an RMPA, either comprehensively or subject to conditions. Conditions may include that a person:

- enter a bond or other prescribed financial arrangement
- take other steps to offset adverse impacts on the river
- develop and comply with an environment improvement program
- comply with a code of practice, standard, policy or other document prepared by a prescribed body.

Regulations may be enforced by the issue of a Protection Order or other Order (see above) and also, where the regulation provides that breach is an offence, by commencement of proceedings for an offence under the Act.

Conclusion: can SA legislation be used to create freshwater protected areas?

Historically, the focus of reserve systems to protect natural resources has been on terrestrial systems, hence the present make-up of reserves and parks. The renewed focus within government on ecological sustainable development has seen greater emphasis placed on sustainable development of our natural resources, including water, with many significant changes undertaken in the recent past. Defining environmental water requirements and using them in water allocation planning have been part of this change.

From this examination of South Australian legislation, it is clear that South Australia has the legislative tools to protect the four components that make up a functioning Freshwater Protected Area (FPA) but only by using multiple pieces of legislation.

The reserve system could provide the basis for protecting freshwater environments in conjunction with other legislation, but equally provisions under the Fisheries Act could be used. Preferably the two Acts working in conjunction could declare the geographic location of the FPA. In conjunction with the declaration of an FPA using the above Acts, an allocation of water could be secured through the water allocation plans under the Water Resources Act, to maintain the health of that protected area.

The challenge will be to work collaboratively to secure compliance and enforce the protection of Freshwater Protected Areas to ensure that inappropriate activities do not occur.

Notes

1. The *Fisheries Act 1982* is presently under review, with a new Act to be completed by 2006.

References

Dyson, M 2003, 'The South Australian River Murray Act – demanding priority for the river within South Australia and raising the bar on intergovernmental commitments', *Paper given at the 5th Australasian Water Law & Policy Conference*, Melbourne, 27-28 November 2003.

IUCN (International Union for Conservation of Nature and Natural Resources) 2004, *About Protected Areas,* [http://www.iucn.org/themes/wcpa/wcpa/protectedareas.htm]

3.6

The Tasmanian Conservation of Freshwater Ecosystem Values (CFEV) framework: developing a conservation and management system for rivers

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Introduction

The Tasmanian Government initiated the development of a State Water Development Plan (WDP) in 1999, which has been active since 2000/01. The plan had two main arms: exploring and initiating opportunities for further development of water resources through expansion and intensification of infrastructure, water use and trading; and evaluation of environmental aspects of water management. A scoping review of environmental aspects pertaining to the WDP by Davies (1999) made two sets of recommendations: changes to existing water management and planning processes, and the development of a conservation system for freshwater dependent ecosystems. Davies (1999) recommended the development of a conservation system based on the 'CAR' principles (comprehensive, adequate and representative), locally familiar through such processes as the Tasmanian Regional Forest Agreement. The emphasis of the recommendation was on developing a 'reserve system' for freshwater dependent ecosystems involving a suite of formal and informal 'reserves', which were to be coupled with improved water management and planning processes.

Subsequently, during 2000/01, the Tasmanian Government approved the development of a CAR-based freshwater conservation system, and allocated funding. This has now become the CFEV (Conservation of Freshwater Ecosystem Values) framework project, and has expanded on the initial remit of the Davies (1999) review to include:

- all freshwater dependent ecosystems (rivers, estuaries, wetlands, other waterbodies, groundwater dependent ecosystems, and saltmarshes)
- a standardised assessment of conservation values
- a standardised assessment of conservation management priority.

The CFEV framework project is not aimed at establishing 'reserves'. Instead, it is focused on establishing a system in which all examples of each ecosystem type (mapped at 1:25 000 scale) are assigned a relative conservation value (accompanied by a wide range of biophysical condition and classification data underpinning its development) and management priority, so that water, catchment and natural resource management and planning at state and regional levels could work from a consistent basis with regard to conservation and management of freshwater ecosystem values.

This paper provides a brief introduction to the framework project, which is a 'work in progress'. An overview of the framework is followed by some detail on the conduct of an audit of river condition and biophysical classes. The project is progressing rapidly and is scheduled for completion in mid-2005.

The CFEV framework

The framework is being developed as shown in Figure 1, and has several key elements:

1. Audit: an audit of the biophysical types (classes) of all freshwater dependent ecosystems and of their biophysical condition. This required the collection/collation of consistent data at a statewide level on key biological (e.g. faunal and floral species and assemblages etc.) and physical (e.g. geomorphological, flow regime etc.) components of the mapped ecosystems (e.g. river reaches, mapped wetlands etc.). Consistent data on these components were frequently lacking, and this component therefore required a process of collation of internally consistent 'real' sample-based data, expert evaluation, mapping rules, GIS-scripting, attribution and mapping, and validation. A separate classification was conducted for each component, and no attempt was made to develop an integrated 'meta classification'. Each component class was treated as a separate attribute of the mapped ecosystem units in further analyses.

The condition assessment required the development of a data-set describing the biological and physical condition of the mapped units. Condition was equated to 'naturalness' and was evaluated in terms of the degree of departure from pre-European reference condition. Again, consistent data on condition was required and was generally lacking, except for a few components (e.g. riparian vegetation, stream macroinvertebrates). A major emphasis was placed on evaluating observed and published relationships between condition and various mappable features of human development, as surrogates for anthropogenic change. These relationships were 'encoded' by the use of expert rule sets (aka fuzzy logic), developed in a workshop setting with a variety of people with relevant technical expertise. A series of indices of condition were developed and aggregated using expert rules (encoded into the Matlab® package) into a final condition or naturalness score, representing the degree of departure from natural reference condition and encoded.

For each ecosystem type, a set of features (e.g. biological assemblages etc.) were selected which could be used in the classification and condition analyses, based on considerations of data availability, quality and comprehensiveness, and on the need to have features representing a variety of functional components within the ecosystem (e.g. fish, plants, invertebrates, geomorphology, flow etc).

FIGURE 1 A: GENERAL FLOW CHART FOR THE CFEV FRAMEWORK PROJECT

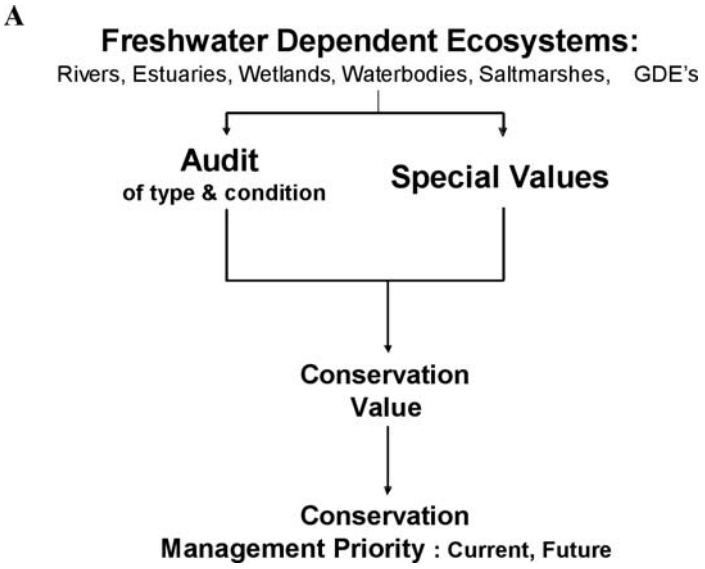
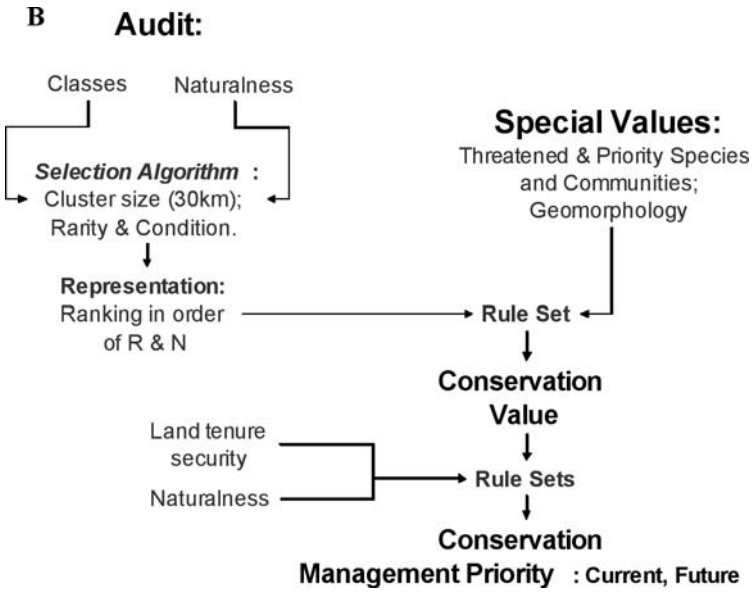


FIGURE 1 B: SUMMARY OF DATA ANALYSES



The results were applied to the mapped units, which required development of GIS layers for stream drainage, wetlands etc. linked to a digital elevation model. As various aspects of existing (cartographically) mapped GIS layers for these components were unsatisfactory, much work was done to develop new/revised drainage, wetland etc. layers for this analysis, and indeed for the entire project. Details of this work are not reported here.

The principle output of the audit was a set of mappable GIS layers and database files with all component features attributed with measures of biophysical condition.

2. Special values: a component was required which incorporated a range of 'special values' which could not be included within the formal standardised audit. Considerable effort was expended in defining the classes of special values for inclusion in the framework. These included threatened species, priority species and communities, significant freshwater geomorphological features etc. These data were by their nature noisy and inconsistent and biased in spatial coverage. Criteria were developed to assess their inclusion/exclusion. Special value data were sourced from a variety of locations and experts, screened for their relationship to freshwater dependent ecosystems, classified by their ecosystem type (e.g. rivers, estuaries etc.), and collated into a single, GIS-based data set. The special value data types were classified into high and moderate value depending on whether an attribute was listed under legislation (e.g. formally listed species), and on relative confidence in the data records.

3. Conservation value: relative conservation value was derived for all mapped ecosystem features (GIS polygons or lines) by a two-stage process, first using audit data only, then incorporating special value data. Firstly, a spatial algorithm (scripted in ArcView) was applied to the audit data set which selected examples in order of rarity and condition. Details of this algorithm and the selection process will be published elsewhere. Initially, all mapped features were attributed with their various biological and physical classes and their size (drainage length, wetland area etc.). Each feature was assigned a unique numerical string consisting of its naturalness score and the set of biophysical classes attributed to it. This

defined both its condition and its biophysical 'type'. To this string was appended a 'rarity' score which represented the cumulative length (for rivers) or number of features of a particular type. The selection algorithm then proceeded by selecting features in the order of the best condition example of the rarest type (e.g. the highest condition scoring example of the smallest unique biophysical type). After selecting and 'removing' a feature, it then re-assessed the overall rarity of the biophysical types and re-ran the selection process after recalculating the rarity score.

The main output of the selection process was a ranking of all the mapped features for that ecosystem type (e.g. all stream drainage sections) in order of declining naturalness and representation. These ranks were then 'banded' into very high, high, medium and low bands based on consideration of the number of selected units. This was called the interim conservation value.

The second step involved combining the interim conservation value outputs with special value data to derive a conservation value. A rule set was developed to change the interim conservation value depending on whether a special value was associated with the feature. The rule set was initially designed to reduce the potential for the special value data (with its inherent errors and biases) to dominate the assignment of conservation value.

The output was an assignment of relative conservation value, banded as very high, high, medium and lower, to every example (feature) of each ecosystem type.

4. Conservation management priority: the relative priority for management was derived by considering three attributes: conservation value, condition and land tenure security. It was considered that priority for management would be defined by whether a feature had higher or lower conservation value; whether it was in good or poor condition; and whether the land tenure was secure or not. Ideally, some indicator of water management 'security' should be included here, but no such measure or context currently exists.

A rule set was developed which considered these three aspects in the light of the need for:

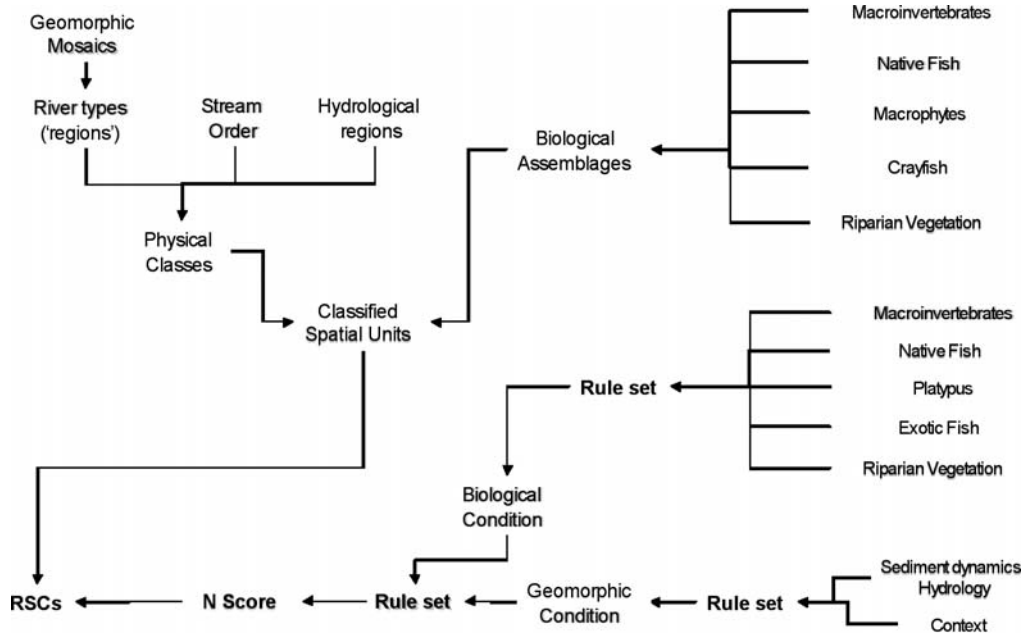
- improved management of ecosystem values under current conditions ('Current Conservation Management Priority')
- protection/maintenance of existing ecosystem values during future development/management ('Future Conservation Management Priority').

This rule set was applied to the attributed features in GIS in order to produce a mappable set of attributes for each feature which assigned a level of Conservation Management Priority under Current and Future conditions, assigned as very high, high, moderate or low.

The rivers audit

The audit analyses differed between ecosystem types, depending on their key ecosystem components and data availability. The analyses conducted for rivers are shown in Figure 2.

FIGURE 2: THE CFEV TASMANIAN RIVER AUDIT



Flow chart showing attribution of river drainage sections and river section catchments (RSCs) with biophysical classes derived from a number of biological and physical classification data sets (upper section) and with an index of naturalness ('N Score') derived from a number of biological and physical indicators of departure from reference condition.

RIVERS – BIOPHYSICAL CLASSES

Five ecosystem components were included for the biological classification - fish assemblages, benthic macroinvertebrates, aquatic macrophyte assemblages, riparian tree assemblages, and crayfish species. Three components were included in the physical classification - fluvial geomorphology, hydrological regime, stream order. A separate classification was conducted for each component. These were developed as follows:

Fish assemblages: a fish distributional database prepared during the Regional Forest Agreement in 1997 was updated with new records. A workshop was attended by five freshwater fish biologists and a set of mapping rules developed for each of 15 fish species. These rules were used to generate fish species range maps in GIS. These range maps (as attributed polygons) were overlayed to generate a state wide map of potential fish assemblages. These were reviewed and small unlikely overlaps removed ('slivers') resulting in 55 fish assemblages. Additional mapping rules were then used to convert this fish assemblage range map (Figure 3) to a stream drainage layer attributed with fish assemblages.

Benthic macroinvertebrates: benthic macroinvertebrate samples from some 290 sites, collected by kick sampling of riffle and edge habitats during the 1997–1999 National River Health Program autumn sampling seasons were collated. These samples were re-assessed by genus/species identification and counting of ephemeroptera, plecoptera, trichoptera, coleoptera and odonata. These data from the two habitats were pooled to provide a composite taxon list for each site. Cluster analysis (by unweighted paired group mean averaging of a Bray Curtis Similarity matrix on presence/absence data) was conducted, and site groups defined. Some additional site groups were also identified following inclusion of data from an additional 60 sites for which only riffle habitat data was available, by conducting the UPGMA classification for all riffle samples including the new ones. The classification was confirmed by conducting an analysis using Kohonen Self Organising Map neural networks (X). The classes were then related to environmental variables using both discriminant function analysis and neural network (multi-layer perceptron) analyses. However, these techniques could not account for more than 45-50% of the variance in group membership. Modelling of the macro-invertebrate assemblage distributions was then abandoned.

The benthic macroinvertebrate assemblages defined from the UPGMA analysis were instead assigned to the stream drainage using regional boundaries defined by eye, and attributed by overlaying regional boundary polygons over the drainage in GIS. First order and alpine (> 800 m) streams were assigned to a separate sub-classes of each regional assemblage.

Aquatic macrophyte assemblages: macrophyte assemblages were identified during a workshop, building on the classes defined by Hughes (1987). Mapping rules were developed, based on elevation, stream size, climatic region and geomorphology and used to assign classes to the drainage layer.

Riparian tree assemblages: a reconstruction of pre-European tree assemblages had been developed as a catena in GIS at a 1 km2 grid scale (M Brown, D Peters unpub. data). This was intersected with the drainage in ArcView and stream sections attributed with their mid-point assemblage classes.

Crayfish species: distributional range maps for Astacopsis gouldi were provided by Forestry Tasmania, and combined as GIS polygons with polygons describing the known historical distribution of A. franklinii and A. tricornis.

Fluvial geomorphology: Landscape areas of similar fluvial geomorphological character were identified using a domain analysis conducted by Jerie et al. (2003) on variables describing key geomorphological controls (geology, runoff, process history etc). This analysis was subsequently completed for the entire Tasmanian drainage, and mosaics attributed to all drainage sections. Specific attributes describing the geomorphological character of the drainage were also tabulated. A typology of river geomorphological character at sub-catchment level was developed by inspection of mosaic distributions and by multivariate classification and ordination (UPGMA and multi dimensional scaling) of river-length-mosaic sequences derived fro all major sub-catchments. These river types were also attributed to the drainage.

Hydrological regime: Results of the hydrological characterisation conducted by Hughes (1987) were re-evaluated and used to develop GIS polygons for broad regions describing areas with similar natural (pre-development) flow regimes. This analysis was based on hydrological variables of high ecological relevance.

Stream order: Strahler stream order was assigned to all stream drainage sections.

FIGURE 3: NATIVE FISH ASSEMBLAGE RANGE MAP

BIOPHYSICAL CONDITION

The assessment of biophysical condition was conducted by combining data on geomorphological and biological condition into a single index of naturalness using expert rules (see Figure 2). The biological condition assessment was conducted by combining data on the status of benthic macroinvertebrates, native and exotic fish, riparian vegetation, willows and platypus. All of these data were attributed to the entire stream drainage by a variety of modelling and mapping rules, derived from field data. A number of derived variables were applied to the drainage by accumulation downstream through the stream drainage network in GIS using either a catchment area or runoff weighting, using dedicated GIS scripts. Individual components of the assessments were combined by the use of expert rules, developed through workshops and coded into Matlab® scripts for analysis. The geomorphological condition assessment incorporated measures of the effects of land clearance, flow regulation, and dam sediment storage on stream sediment budgets. Ideally, the recent version of SedNet would have been used as part of this assessment, but at the time of conducting this analysis, confidence in SedNet's ability to model sediment budgets at reach scale were low.

Modeled stream flow was a significant input to the condition analyses for geomorphology (e.g. in weighting various input variables for sediment inputs), and for a number of biological and physical condition indicators (e.g. as in input into a flow regulation or abstraction indices). Stream flow was modeled as mean annual runoff (MAR) by applying long-term modeled estimates of 'effective precipitation' (rainfall minus evapotranspiration) to the catchment and drainage layers, using a catchment area-weighted downstream accumulation script. The resulting natural MAR data was validated against long term MAR figures from 32 gauging stations across a wide range of catchment areas and locations (with an r2 = 0.998 for log-log linear regression over three orders of magnitude of catchment area).

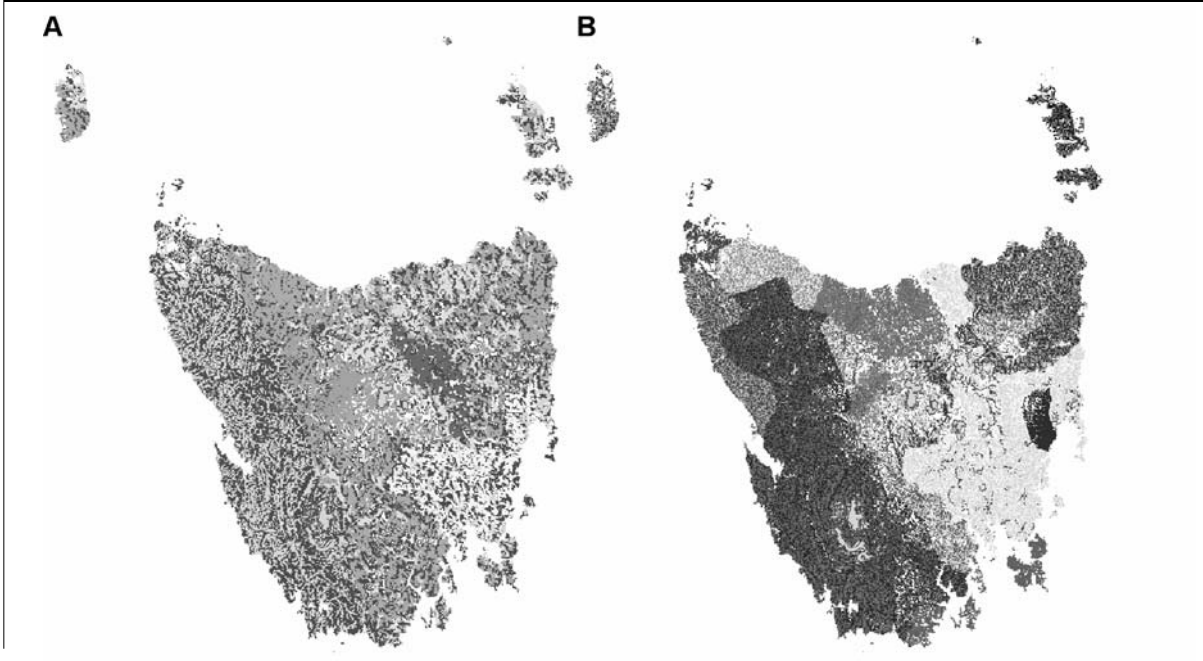
Three indices of change to flow regime were derived representing:

- net flow abstraction = the net proportion of long term MAR abstracted under current conditions (estimated from accumulated licensed abstraction and inter-basin transfers)
- flow regulation = the sum of all upstream storage divided by MAR (storage being derived by accumulating the sum of licensed storage volumes – including 'active' hydroelectric storage – and all unlicensed mapped farm dams, estimated from an area-volume relationship)
- change in flow variability - attributed as an index to drainage sections immediately downstream of specific water regulating infrastructure and 'diluted' downstream in proportion to relative MAR.

All of the condition analysis input data were attributed to the entire stream drainage by a variety of modelling and mapping rules, starting where possible with data derived from field or aerial-photo sources and input onto GIS.

Groups of condition indicators were combined when necessary by the use of expert rules, developed through workshops and coded into Matlab® scripts for analysis. Expert rules also allowed for adjustment of outputs within specific contexts (e.g. different geomorphological mosaics were associated with differing levels of stream response to flow change). The primary output of the condition analysis was an index (ranging from 0 to 1) of biophysical condition of the stream reach.

FIGURE 4: DERIVED MAPS OF MACROPHYTE (A) AND BENTHIC MACROINVERTEBRATE (B) ASSEMBLAGES ASSOCIATED WITH STREAM DRAINAGE IN TASMANIA. EACH SHADE REPRESENTS A DISTINCTIVE ASSEMBLAGE



Results

THE AUDIT

The project is very much a work in progress. Maps of the distributions of benthic macroinvertebrate and macrophyte assemblages are shown in Figure 4. A map of the river condition (naturalness) rating is shown in Figure 5. Overall, river condition was lowest in the midlands, south east, north and north west of the state, including King Island. Condition was highest in the south west and World Heritage Area of Tasmania, with some rivers (e.g. the Gordon and King rivers) being shown as in poor condition.

CONSERVATION VALUE AND MANAGEMENT PRIORITY

Rule sets for developing an assessment of conservation value and management priority were under development at the time of this conference, and will be completed in early 2005.

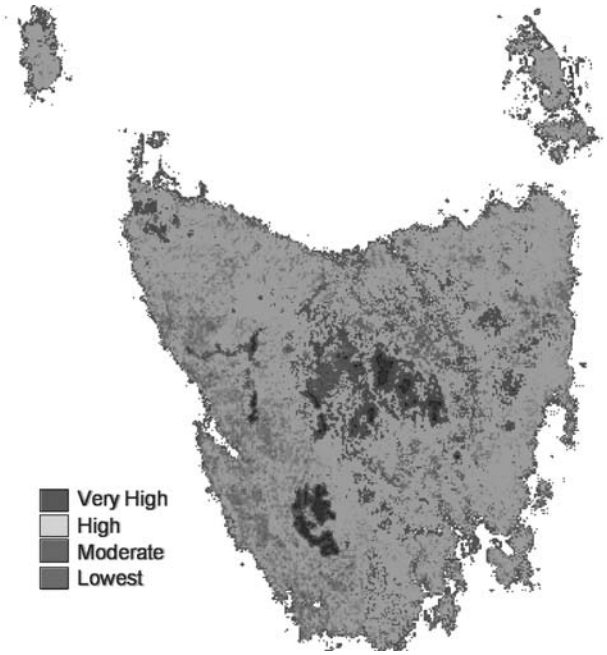
Summary & conclusions

The audit analyses for Tasmanian rivers have demonstrated that the application of expert knowledge, standardised environmental data on stream biota and physical character, multivariate analysis with a marked reliability on GIS analysis and spatial data manipulation can result in a comprehensive state-wide audit of biophysical typology and condition. Our desire to conduct these analyses at a small scale (1:25 000), due to the need to develop conservation and management prescriptions at sub-catchment scale by aggregation of data at a higher spatial resolution, resulted in large data sets, occasionally long computational times and the need for a well organised GIS support.

The assignment of conservation value and management priority to the stream drainage is a key deliverable of the CFEV project. It should result in a consistent approach to water management, development application assessments, licensing and to the environmental aspects of water management planning.

There is considerable government interest in developing the CFEV framework as the basis for a number of regulatory, policy and management and planning decisions, and to integrate it within the NRM and catchment planning context.

FIGURE 5: BIOPHYSICAL CONDITION RATING (N SCORE) FOR TASMANIAN RIVERS



The N score is a continuous variable, but has here been divided into bands for presentation.

References

Davies, PE 1999, 'Water Development Plan', *Environmental Scoping Report*, DPIWE, Hobart, Tasmania.

Hughes, JMR 1987, *A study of riverine plant communities in Tasmania, with especial reference to central East Coast rivers*, Ph.D. Thesis, University of Tasmania, Hobart.

Jerie, K, Houshold, I & Peters, D 2003, 'Tasmania's river geomorphology: stream character and regional analysis', *Nature Conservation Report 03/5*, Nature Conservation Branch, Department of Primary Industries, Water and Environment, Hobart, Tasmania, vols 1 and 2.

SECTION 4

THEME TWO

Challenges in establishing and managing FPAs

CONTENTS

4.1

Managing for Indigenous cultural values of water in freshwater protected areas

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Indigenous customary property rights and other cultural values have challenged land managers and conservation organisations to address social and cultural concerns in their efforts to enhance the terrestrial protected area system. Inclusion of Indigenous environmental philosophy and customary systems of resource management are now more widely accepted as being essential to pluralistic protected area policies and programs and the development of cross-cultural conservation ethics. This paper argues that the Indigenous cultural landscape and social catchments within which rivers flow require close attention as protected area concepts derived from terrestrial systems are applied to aquatic systems in northern Australia. These two important facets of the social geography of freshwater protected area policy are examined with specific reference to the socio-ecological systems of northern Australian rivers.

Introduction

With increasing growth in the Indigenous estate, now estimated to be 18% nationally, and a concomitant increase in Aboriginal land management initiatives (Baker et al. 2001; Altman & Whitehead 2003), Indigenous people's views on protected area concepts and conservation policies continue to grow in significance.

Indigenous people are particularly important conservation stakeholders in northern Australia. In the Northern Territory, for example, Aboriginal people own and manage about half of the landmass, including 84% of its coastal areas. Of the 23 NT bioregions classified under the Interim Biogeographic Regionalisation of Australia approximately one-third occur predominantly on Aboriginal land (Northern Territory Government 2004a). As the NT implements its commitment to a comprehensive, adequate and representative reserve system, this will necessitate the engagement of Aboriginal traditional owners in negotiation and agreement-making.

Rivers and riparian habitats are key areas of contemporary Aboriginal interest and there is increasing Aboriginal awareness of existing or emerging threats to rivers and wetlands, such as sedimentation from erosion, weed infestations, deteriorating water quality, feral animal impacts, saltwater intrusion and other degrading processes (Jackson, Storrs & Morrison in press; Cooke 1999). In the Daly and Katherine regions, for example, Aboriginal people have observed changes to the large rivers, the Daly and the Katherine, which appear to be consistent with sedimentation, although the cause(s) of the stated change is not known (Jackson 2004a). Aboriginal traditional owners in the northern regions mentioned throughout this paper are also conscious of the physical and biological linkages between rivers and wetlands, and are concerned to see them taken into account in land and water management practices. Unless protected areas encompass an entire river system, their value will be limited. As Cooke has said in relation to wetland conservation in north Australia:

> *Because natural systems are relatively intact at the landscape scale over much coastal Aboriginal land in northern Australia, there remains a chance to challenge the historical paradigm in which small but 'representative' proportions of lands are isolated into 'nature' reserves, while other areas are regarded as comparatively expendable for cropping or commercial developments which heavily impact biodiversity (1999: xiii).*

This paper argues that the Indigenous cultural landscape and social catchments within which rivers flow require close attention as protected area concepts and natural resource management models derived from terrestrial systems are applied to aquatic systems in northern Australia. Following an introductory section on the significance of water in Indigenous environmental philosophies, I briefly outline the nature of Indigenous rights and interests in northern waters and then turn to a discussion of Indigenous cultural landscapes and protected area policy. The final section places the cultural landscape concept within the context of social catchments; the scale at which much contemporary resource management practice is conducted.

Indigenous cultural values of water

There are growing indications that the natural resource management sector is keenly interested in learning more about Indigenous water values and how to better protect them in large-scale landscape planning exercises (Morgan et al. 2004; Jackson 2004a; Toussaint et al. 2001). An extremely close affinity between Aboriginal societies and northern riparian environments has resulted in the markedly different cultural values of water and rivers held by Aboriginal people to those of other Australians (see Langton 2002; Jackson, Storrs & Morrison in press). Aboriginal people hold distinct cultural perspectives on water relating to identity and attachment to place, environmental knowledge, resource security, and the exercise of custodial responsibilities to manage inter-related parts of customary estates.

According to a national discussion paper on onshore Indigenous water rights prepared to stimulate debate in Indigenous communities,

> *Aboriginal peoples have never drawn a distinction between the land and the waters that flow over, rest upon or flow beneath it. The land and waters are equal components of 'country', all that require care and nurturing, and for which there are ongoing responsibilities (Lingiari Foundation 2002: 6).*

Water plays a central role in Aboriginal cultures and societies: 'their lives and various religious, legal, social and economic beliefs and practices' (Barber & Rumley 2003: 3). Aboriginal groups conceptualise water sources and rivers, as with the land, as having derived from the Dreaming, the time when the world attained its present shape. Recent north Australian studies emphasise the importance of mythic beings as significant to the origin and maintenance of all water sources (Barber & Rumley 2003; Langton 2002; Toussaint et al. 2001; Yu 2000). Miriam-Rose Ungunmerr describes the cultural topography of a place called Malfiyin on the NT's Moil River, which begins from a spring in the Wingate ranges:

> *As the Moil makes it way down the mountain and runs into the flood plain below, there are many special places. We call them Creation places. It is where things begin or where they come from. Our Dreamings have special places on the River. We believe that there is a place where an animal or a bird has a Creation place. They are responsible for creating that particular area… The animals and plants that have formed at Malfiyin are part of the landscape and we belong to them. We believe we are the Pelican, Water, King Brown, Magpie Geese and others. They are our Dreamings. Other birds and animals live there. We only claim the ones that come from Malfiyin (2003: 5).*

Cultural institutions governing peoples' systems of rights and interests were also created by the Dreamings. Rights and responsibilities in relation to places under Aboriginal law arise from what Langton refers to as 'wide mytho-geographical bodies of knowledge' (2002: 45). Knowledge of the environment, the natural features and vitally, its spiritual dimensions, is a prerequisite to exercising rights to land, including water bodies.

Cultural etiquette such as the 'baptism' or welcoming ritual is a practice shared by many Indigenous land-holding groups referred to in the literature (e.g. Langton 2002, Lingiari Foundation 2002). Strangers are required to be welcomed to country, especially to a water body. Water is typically placed on the head. Custodians in the Kimberley have a responsibility not only to introduce visitors to country, but to also inform a water source if a change in social relations, such as a death, has occurred (Toussaint et al. 2001: 63).

An affiliation with a dominant environmental feature, such as a river or spring, may play a key role in the formation of group and individual identity (Langton 2002). For one group, whose country is found between the Fish and Moyle rivers west of the Daly River in the Northern Territory, their very name refers to the riparian world where language relates people to place. *Ngan'gikurunggurr'* means Deep Water Sounds (Ungunmerr 2003: vii). It is described as the language of the swamp people who live in the lower reaches of the Moil River. Cultural affiliations to water are expressed in other ways too: through social etiquette, place-based knowledge, narratives, beliefs and daily practices (Toussaint et al. 2001: 39). Mythological accounts of poor water management serve as ecological parables in the catchments which have been studied;

pointing to a strong awareness of the need to cautiously manage and share water resources within Aboriginal cultures (Jackson 2004a; Toussaint et al. 2001).

Aboriginal people frequently describe water as an element that lives or embodies a life force (Yu 2000; Jackson 2004a). Yu describes how water is understood as a living entity in Kimberley Aboriginal cultures:

> *'Living water' is an Aboriginal English expression that requires translation as it refers both to the physical properties of water sources and their cultural significance. Living water sources …. are permanent water sources … characterised as **kunangkul** – everlasting – and are a defining element of an individual's country (2000: 20)*

Aboriginal environmental knowledge is conscious of cycles and seasons and the interactions between the metaphysical and human realms. For instance, rainmaking rituals are critical to maintaining water supplies in many Aboriginal traditional societies, regenerating the country and ensuring the health of the ecosystem, including people (Toussaint et al. 2001: 58). In the Daly region of the Northern Territory, hydrological processes are recognised as important to the health of an ecosystem by Aboriginal people consulted (Jackson 2004a). This is consistent with reports from the Fitzroy region of the Kimberley, where:

> *… the importance of hydrology 'driving' ecology is not lost on the Aboriginal people. They are fully aware of the importance of flood flows and much of their hunting culture seems to associate a large flood with environmental 'health' of the river, particularly of the permanent pools (Storey, Davies & Froend 2001: np).*

In two large northern rivers, the Daly (NT) and Fitzroy (WA), river flow is considered vital to its character and dependent wildlife (Toussaint et al. 2001). The impacts of river regulation, especially impoundment for dams, is likely to damage a valued cultural principle: the unimpeded flow of a river body. Research conducted for the Water and Rivers Commission in the Kimberley found that:

> *Significant in the context of possibilities related to damming the river, and relevant to the distress which emerged over Dimond Gorge, is that the rivers must run free. Indigenous responsibilities and aspirations are embedded within a belief that the spiritual force of the river should never be blocked so that the increase of all species, including humans, is ensured.' (Toussaint et al. 2001: 65).*

Activities that might stop river flow and disturb movement of fish and turtle were seen in a negative light, for instance, in a study of the Indigenous cultural values in the Daly River region (Jackson 2004a). In the Daly (Jackson 2004a) and other Kimberley studies (e.g. Yu 2000), groundwater is of considerable significance to Aboriginal societies and interactions between ground and surface waters are topical in discussions about the environmental and cultural impacts of water abstraction for agricultural use, for example. Yu's study of Karajarri hydrological knowledge from the Canning Basin south of Broome, WA, observes a 'taxonomy' of water sources, with many distinctions drawn between the general classification of 'on-top' water and 'bottom' water (2000).

Aboriginal rights and interests in northern rivers

Freshwater resources and river systems are key areas of traditional and contemporary interest to Aboriginal people and, until recently, Aboriginal people's rights and interests in water resource development have been largely overlooked (Langton 2002). Langton describes this historical legacy of appropriation and marginalisation:

> *The cultural traditions associated with Aboriginal waterscapes have been vulnerable to the colonial appropriation of water sources throughout Australian postcolonial history. This vulnerability is now exacerbated by a new hydrological frontier: several water capture projects, proposed and ongoing, represent the new frontier of settler population expansion from the old frontier of the temperate and semi-arid zones to the new frontier of the wet-dry tropical savanna of northern Australia (2002:43).*

Early settler mining and settlement activity in northern Australia had an extremely disruptive effect on Aboriginal societies. In what has been termed 'the battle for the waterholes", introduced animals: buffalo, cattle and horses, all had a widespread negative effect on Aboriginal traditional lifeways (McGrath 1987). Enormous ecological pressure was created as waterholes became watering points and the resulting social impact included severe anxiety from disturbance to sacred sites, and conflict over hunting of introduced animals which had often displaced native game. McGrath writes:

> *The waterhole was a prime focus of land-use in the Aboriginal economy. Besides the resource of water itself for drinking and bathing, waterholes were the centres of many forms of edible life… They served as settings for big ceremonies. The waterhole was a focus, representing for respective individuals a birthplace, a symbol of creation and reproduction, of plants, and animals and people. Its religious and economic symbolism and social significance as camp and meeting place made loss or damage hurtful to the traditional owners (1987:5).*

Defending the waterholes from non-Aboriginal intruders was, according to McGrath, one of the shorter-lived phases of the conflict that lasted many years (1987). Violence was employed over a number of decades to ensure that Aboriginal people did not impede colonisation, including stocking the pastures and struggling with agricultural schemes along various river systems such as the Adelaide, Daly, Ord and Fitzroy. The comprehensive marginalisation of Aboriginal interests can be seen clearly in the damming of the Ord River and utilisation of water for irrigation and hydro-electric power in the East Kimberley (Coombs et al. 1989). Construction of two dams and lakes altered the landscape and put lands flooded by those waters beyond the reach of native title holders (Barber & Rumley 2003).

Following the introduction of statutory land rights in the 1970s, and more recently, common law recognition of native title, Aboriginal people in many areas of northern Australia have a significant legal stake in the activities relating to use, protection and management of rivers. There is, however, variability across the three northern jurisdictions in the degree of control traditional owners can exert over their estates as a result of differing land rights regimes (Cooke 1999). Those rights are strongest in the Northern Territory, where the *Aboriginal Land Rights (Northern Territory) Act 1976* applies. There are many NT rivers that are wholly within land held under inalienable

Aboriginal freehold title (e.g. the Liverpool river in Arnhem Land), and there are many others that form a boundary between land that is available for claim and that which is not (e.g. the Roper River in the Gulf of Carpentaria).

A key contemporary concern of many Aboriginal groups in regions where pastoral tenure dominates is the lack of access to rivers and wetlands. Access to the natural resources and sites of significance within a riparian zone or wetland is essential for local livelihood, health, well-being and cultural heritage. In 1998, there were 22 outstanding land claims to banks and beds of NT rivers (Jackson 2004b). Contention over the control of water resources has been a feature of many land claims heard to date. For example, claims to land in the Daly region in the 1980s, including the bed and banks of the river itself, considered whether there would be a detrimental impact on the public interest should traditional owners be granted land with bores for town water supplies (Tan 1997). Government proposals for a hydro-electricity dam, extensive flood mitigation and large-scale irrigation works over the claimed land were submitted as evidence of significant public detriment. Other claims have heard similar detriment arguments relating to the requirement for groundwater under Aboriginal land for mining operations and for stock route watering points (ibid).

In the NT a grant of land to an Aboriginal Land Trust does not include water, which is reserved to the Crown (Reeves 1998:219). Two Land Commissioners have held that the beds and banks of a watercourse can be claimed by Aboriginal traditional owners; yet, an opposing view by another Land Commissioner argued that the land was unavailable for claim (ibid). The Land Councils have argued that 'there is no doubt that traditional interests exist in beds and banks of rivers and no evidence that granting of such land gives rise to any problems' (cited in Reeves 1998:221).

The legal status of Indigenous water rights across Australia under native title law remains unclear and unresolved. Although there was no specific reference in *Mabo (No. 2)* to water rights, the reasoning of the case could be applied to water resources (Tan 1997). Native title is described as:

> *the interests and rights of indigenous inhabitants in land, whether communal, group or individual, possessed under the traditional laws acknowledged by and the traditional customs observed by the indigenous inhabitants (Olney 2000: 10).*

The *Native Title Act 1993* (Cth), (s.2.11), gives native title holders rights in land and waters, rights of access to those lands and waters for hunting, gathering, fishing and cultural, including spiritual activities. Waters are defined in s. 253 of the Native Title Act and include rivers, lakes or subterranean waters. Native title rights to a number of rivers have recently been recognised in a large native title claim called St Vidgeon in the Gulf of Carpentaria, where protected areas are under-represented. According to this determination native title has been found to exist regarding all of St Vidgeon station, and the Roper, Cox and Limmen Bight rivers. The native title has been described as non-exclusive rights of possession, use and enjoyment of the land and water, including the right to reside on the land (Northern Land Council 2001). The nature and extent of native title rights includes the right to speak for and make decisions about the use and enjoyment of the determination area and a right to use and enjoy the natural resources therein (Olney 2000). In this claim exclusive rights in relation to the waters of the rivers of the area were not claimed.

A native title right to take water for domestic purposes is likely to be non-controversial, unlike commercial resource rights that traditional owners might wish to

BILLABONG ON WAGIMAN LAND, DALY RIVER, NORTHERN TERRITORY

claim. Experience gained through the Croker Island sea native title claim suggests that it may be some time until there is widespread recognition of a right of commercial participation by Indigenous people in the trade in resources, including water. There will also be many questions raised about the impact of various water resource decisions on native title should it prove to exist in relation to a water body. The NSW Aboriginal Land Council has argued that protection of native title rights may not be restricted to only those acts that physically impair the enjoyment of native title rights and interests. Impacts on the spiritual connections with the waters concerned may require consideration (19 April 2004). However, numerous doubts remain about the ability of contemporary native title law to protect native title. Lane contends that not only are there significant problems in defining the extent of common law recognition of native title, there are other pressures as well:

> *Native title over water is complex because of the huge range of interests that already clamour for attention from government, and the environmental imperative of immediate action to stabilise the decline in quality of inland water systems (2000: 13).*

Sacred sites in rivers and wetlands are vital features of the Aboriginal cultural landscape and are protected by heritage legislation in all northern jurisdictions. Sacred sites are landscape features 'created either by the metamorphosis of Dreamtime figures into rocks, boulders, trees, etc. or by the action of such an ancestor, or ancestors, sometimes when interacting with each other' (Northern Land Council 2004: 25). According to provisions of the NT's sacred site legislation and the *Aboriginal Land Rights (Northern Territory) Act*, custodians are guaranteed access to such sites. Rivers such as the Katherine and Daly show a great density of sacred sites alongside and within their banks (Toohey 1982; Kearney 1988). Evidence provided to land claim hearings for Jawoyn customary estates near Katherine, for example, reveals that:

> *The sites are dispersed over and outside the claim area … it is clear that the densest concentration of sites by far is along the rivers in the southern part of the claim… The difference in the density of distribution of the sites may well be associated with ecological factors: they are more numerous in the fertile riverine areas and less so on the high black soil plain which is dry and more inaccessible (Kearney 1988: 33).*

Native title rights to water, riparian zones and aquatic resources require that conservation planners and managers give attention to Indigenous interests and aspirations in all jurisdictions. In coming years, native title claims, customary resource rights and negotiated agreements may contribute to strengthening Aboriginal control of land, water and biological resources across the country. Indigenous people across northern Australia, however, hold interests in land, water and conservation management that extend beyond the range of interests protected under the statutory land rights regimes of Queensland and the Northern Territory. Irrespective of current legal entitlements to land and aquatic resources and environments, the customary rights, interests and cultural values of Aboriginal people should be acknowledged in biodiversity conservation research and management across all tenures and jurisdictions. There are many Aboriginal groups that continue to observe their law and customs but through accidents of legal history, such as the imposition of incompatible land uses and tenures, have been distanced from their land and rivers.

Indigenous cultural landscapes and protected area policy

For more than a decade, Indigenous groups in Australia have communicated their strong interest in the cultural aspects of environmental management, particularly the priority they wish to give to cultural heritage management of protected areas (Woenne-Greene et al. 1994). The predominance of the Western cultural construction of landscape has been subjected to critique from Indigenous peoples and others (see Langton 1996; Dodson 1996; Bird-Rose 1996). Dodson, for example, refers to Aboriginal notions of 'country' in preference to the term landscape:

> *There is another dimension that invests the land with meanings and significance - that transforms land and environment into landscape, and into 'country'. That other dimension is culture. Culture is what enables us to conceive of land and environment in terms that are different to conventional European notions. To us indigenous peoples all landscapes are cultural (1996: 25).*

The desirability of including Indigenous lands in the terrestrial protected area system and improving rates of Aboriginal participation in protected area management has for some years underpinned government approaches to biodiversity conservation (e.g. Thackway et al. 1996). However, advancing Indigenous interests in terrestrial protected area declaration and management was not an initial consideration in the development of the national reserve system.

Until the Indigenous Protected Area (IPA) Program, initiated by the then Australian Nature Conservation Agency, there was no established mechanism to include Indigenous freehold and leasehold lands in the national reserve system. Thackway et al. (1996) observe that prior to a geographic analysis of gaps in the system, the importance of Indigenous estates was not apparent to conservation planners. Much of the Indigenous estate occurred in northern and central Australia where communities might run their own land management programs, often with the assistance of a representative organisation, such as Land Councils. Traditional owners, while very interested in joint management of conservation areas, also expressed a reluctance to relinquish control and allow the diminution of customary rights to their lands. In response to sensitive consultation with Indigenous groups by the Commonwealth's environment department (see Smyth 1995), the IPA program was developed to establish partnerships between Indigenous land owners and nature conservation agencies.

The IPA program encourages Indigenous groups to include biologically significant areas of Indigenous land in the national reserve system in exchange for management resources to support conservation outcomes. Indigenous land owners were attracted to the IPA program, which was consistent with IUCN Guidelines, because they saw a means

to retain local control through self-declaration and attract high status to their management effort with formal IPA declaration (Thackway et al. 1996). The Commonwealth Government in turn was responding to a number of national and international developments in biodiversity conservation and native title which affirmed the 'the fundamental premise that traditional knowledge plays an important role in the conservation of biodiversity' (Thackway & Brunckhorst 1998:175). As a result of the establishment of protected areas on Aboriginal land there has been a shift in conservation policy away from the absolute priority given to conservation goals to accommodating native title rights and cultural heritage priorities.

The traditional protected area paradigm has tended to separate natural and cultural values, so that Indigenous peoples' relationship with country is 'conceived as divisible into separate and severable portion' (Godden 2002:258). In the Ord River region of WA, for example, a multitude of agencies are responsible for different parts of the environment and the 'environment' itself is split into the cultural and natural realms. The cultural realm is the province of heritage agencies concerned primarily with archaeological heritage and sacred sites, not inter-related socialised landscapes. Barber and Rumley contrast this to the non-Aboriginal management structures, embedded in traditional law and custom, and ones that

> *theoretically enable claimants to manage all the cultural and physical resources within the Ord Valley…it is clear that there is a significant disjunction between the rights accorded to traditional owners by their tradition and the way in which traditional owners are engaged by European agencies (2002:27-28).*

Providing for adequate regard of social values, including cultural values, in river protected areas will require recognition of Indigenous people's desire for control over their customary estates and efforts to cross the traditionally dichotomous categories of nature and culture. An important first step will involve a change to the scale of inquiry and action to that of the socially constructed landscape, away from material views of heritage which narrowly delimit sacred sites (Byrne et al. 2003:3; Jackson 1998).

Reflection on the use of particular terms or language will also be important to improving our understanding of socialised landscapes. For instance, there is currently considerable interest in the notion of 'wild rivers' (e.g. Wentworth Group 2003), yet in the NT there has been negligible public debate on the concept. Aquatic resource managers and conservation groups may be comfortable with the term 'wild' river, which denotes a river that has been relatively unchanged since European settlement, particularly one that is unregulated by engineering structures. Many Aboriginal people, however, are likely to be more sensitive towards the term, given its use in public debates about wilderness and association with the concept of *terra nullius* (see Langton 1996). A wild river might suggest that there has been no human intervention and there is now little or negligible human interaction with its features. The intervention and effects of Aboriginal and settler groups may be masked by this term and the importance of these socio-ecological river systems to contemporary Aboriginal people overlooked.

Social catchments

When considering how best to conserve the values of dynamic river systems flowing through large tracts of land and behaving differently from year to year there is need to take into account the social relations operating within the catchment. Catchments in north Australia, and indeed in other parts of Australia, are unlikely to be culturally, linguistically or politically homogenous. In any given catchment there may be numerous Aboriginal groups with rights and interests in particular river locales, hence the intra-Aboriginal socio-political relations will require consideration when decisions are made that affect a catchment.

Seeking the involvement of all groups will give rise to considerable logistical and political difficulties relating to equity of Aboriginal representation. The Kimberley's Fitzroy Valley, an area of some 95 000 square kilometres, is home to at least 30 Indigenous communities and crosses seven ethnolinguistic areas with a consequent complex array of cultural and political affiliations (Toussaint et al. 2001:14). As a result of social change brought about by colonisation of Indigenous lands, 'river' and 'desert' groups share cultural responsibility for river management through marriage alliances and totemic relationships with conceptions sites (Toussaint et al. 2001:54). Langton describes the Aboriginal land tenure system as it typically occurs in Arnhem Land in the NT:

> *The territories of these groups are not simply the length of river systems but wedges of differential ecological resource locales, including specific stretches of river systems, combined in a patchwork effect (2002:51).*

The impact of a particular water management activity or policy might be felt on downstream groups, or on neighbouring groups outside the catchment, depending on the system of regional social organisation and the rules for using and managing resources. Langton makes the important point that it is not only the physical impact of a water use decision which must be considered, but also the social impact 'on all the groups who draw from water sources their identity and traditional relational patterns' (2002: 53). These relational patterns of social organisation may take different forms, as observed by Cooke in Arnhem land (cited in Langton 2002). In Central Arnhem Land, where the river is not spoken of in its entirety, there is no one name for a river, rather many locality names. Yet in Western Arnhem Land there is a classificatory title which applies to all people of a catchment, whether or not they are the same clan or language group (cited in Langton 2002:50).

In the dry tropics of north Australia freshwater sources such as lagoons, billabongs, creeks, rivers and other wetlands are very often productive places, highly valued by other groups as well as Aboriginal people. Recreational fishers, tourists, and conservationists are placing increasing emphasis on the new amenity and lifestyle values associated with these locations and resources (Holmes 1996). Some coexisting values are complementary and do not necessarily require exclusive occupancy rights to satisfy or protect, although conflict has been generated, usually over access to fishing locations or development impacts on water quality and flow. Current property regimes, such as the pastoral lease system, do not adequately cater for these varied multiple uses, and management of popular water holes and fishing spots has been a source of tension between pastoralists and other user groups as well as Aboriginal traditional owners. For

example, the NT's Pastoral Land Board is currently dissatisfied with legislative provisions for access to waterways and features of public interest through pastoral land (Northern Territory Government 2004d). The Board has reported that the provisions do not address responsibility for construction and maintenance of roads, boat ramps, public facilities, garbage collection etc. (ibid:6).

The issue of competition among users is an important one for Indigenous people who have historically been marginalised from resource governance and environmental management processes. Efforts to establish river protected areas will need to be mindful of socio-political processes operating within a catchment and the traditional modes of decision-making of Indigenous peoples. This will be a challenge for catchment management institutions operating in complex cross-cultural environments. Attempts are being made by the Northern Land Council, a body representing Aboriginal interests in land matters, to develop catchment management approaches to their wetland projects which recognise the inter-related nature of wetlands and the particular forms of social organisation where 'Aboriginal land ownership and kinship can extend across catchments' (Thurtell et al. 1999: 1; see also Jackson, Storrs & Morrison in press).

Conclusion

Indigenous people have been critical of protected area policy and in recent years have called for greater recognition of their cultural values and desire to share in the management of customary estates. Indigenous-led forms of natural resource management are attracting increasing attention for the significant social, cultural and economic benefits they can bring for Aboriginal people, as well as environmental benefits for the nation (Altman & Whitehead 2003). Buttressed by developments in native title law, the case for collaborative management with Indigenous people has been strengthened. There is now considerable interest in improving the incentive structures currently available to Aboriginal land management initiatives and in responding to the need for increased community participation, capability and resources to undertake collaborative land management (Northern Territory Government 2004c). Unless due consideration is given to the social impact of the establishment of protected areas on Aboriginal communities, they are unlikely to be viewed as a universally popular mechanism for biodiversity conservation. Aboriginal people's experience of Ramsar is instructive. A number of north Australian representative Aboriginal organisations have been disinclined to pursue Ramsar listing of wetlands because of the perception that such a procedure will result in loss of management control by Indigenous land-owners for little gain (Michael Storrs pers comm.: Cooke 1999)

The environmental condition of Australia's tropical rivers is comparatively good, with NT river reaches, along with those of Tasmania, suffering the least impact from catchment disturbance of all Australian jurisdictions. Perhaps because of this good condition, the NT has no policy relating specifically to river conservation or freshwater reserves. There is incidental protection of some tropical rivers as they flow through National Parks, such as the South Alligator and Keep Rivers in Kakadu National Park and Keep River National Park respectively. However, flowing water does not observe cadastral boundaries and so the protection afforded by a National Park will only apply to the area within the park, not the values of the entire length of the river if upstream activities such as mining, pastoralism or land-clearing affect the river ecosystem.

The spatial and temporal scale of river behaviour draws attention to the inadequacy of relying on protected areas for aquatic conservation. Conservation of river systems will require that we develop a tool box of off-reserve instruments and institutions with the objective of conserving the aquatic ecosystems that fall outside the reserve system which will need to be enhanced to better protect aquatic environments. Regional planning at a catchment scale may be one such mechanism, but at present does not appear to be sufficiently cognisant of social relations and cultural landscape valuations, nor the full costing of orthodox development paths, such as continued pastoral activity in marginal areas.

Furthermore, rivers and water hold many qualities in the cultural life of Aboriginal people which are likely to be difficult to embrace under a traditional protected area model which has a bias towards natural values. A vibrant conservation mandate may emerge from the intersection of multiple interests in river environments and a growing awareness that the health of the resource is fundamental to continued use and appreciation. Perhaps the notion of 'heritage rivers', for example, if developed in concert with Aboriginal custodians, could well reflect the special significance of water to Indigenous communities and to more recently arrived communities that now attach great significance to the places where they fish, camp, enjoy quiet times and a sense of belonging.

References

Altman, J & Whitehead, P 2003, *Caring for country and sustainable Indigenous development: opportunities, constraints and innovation*, Working Paper No. 20, Centre for Aboriginal Economic Policy Research, Canberra.

Baker, R, Davies, J & Young, E 2001, *Working on Country: Contemporary Indigenous Management of Australia's Lands and Coastal Regions*, Oxford University Press, South Melbourne.

Barber, K & Rumley, R 2003, *Gunanurang: (Kununurra) Big River, Aboriginal Cultural Values of the Ord River and Wetlands*, study and report prepared for the Water and Rivers Commission, Perth.

Bird-Rose, D 1996, *Nourishing Terrains: Australian Aboriginal Views of Landscape and Wilderness*, Australian Heritage Commission, Canberra.

Byrne, D, Brayshaw, H & Ireland, T 2003, *Social Significance: A Discussion Paper*, NSW Parks and Wildlife Service, Sydney.

Centre for Tropical Wetlands Management and Centre for Indigenous Natural and Cultural Resource Management 1999, *Wise Use of Wetlands in Northern Australia Indigenous Use*, Northern Territory University, Darwin. Preface by P Cooke, pp. vi-xiii.

Coombs, HC et al. (eds) 1989 *Land of Promises*, Centre for Resource and Environmental Studies and Aboriginal Studies Press, Canberra.

Dodson, M 1996, 'Indigenous Peoples, Social Justice and Rights to the Environment', *Ecopolitics IX, Perspectives on Indigenous peoples Management of Environment and Resources, Conference Papers and Resolutions*, Northern Territory University, Darwin, 1-3 September 1995, pp. 25-29.

Farrelly, E 2003, *Dadirri – The Spring Within: the Spiritual Art of the Aboriginal People of Australia's Daly River Region*, Terry Knight and Associates, Darwin. Preface by M Ungunmerr, pp. vii-ix.

Godden, L 2002, 'Indigenous Heritage and the Environment: Legal Categories Are Only One Way of Imagining the Real', *Environmental and Planning Law Journal*, 19(4), pp 258-266.

Holmes, J 1996, 'Diversity and Change in Australia's Rangeland Regions: Translating Resource Values into Regional Benefits', *Rangeland Journal* 19(1), pp. 3-25.

Jackson, S 1998, 'Land Use Planning and Cultural Difference', *Tracking Knowledge in North Australian Landscapes: Studies in Indigenous and Settler Ecological Knowledge Systems,* eds. D Rose & A Clarke, North Australia Research Unit, Darwin, pp. 87-104.

Jackson, S 2004a, *Preliminary Report on Aboriginal Perspectives on Land-Use and Water Management in the Daly River Region, Northern Territory*, report to the Northern Land Council, CSIRO, Darwin.

Jackson, S 2004b, 'Maritime Agreements and the Recognition of Customary Marine Tenure in the Northern Territory', *Honour Among Nations? Treaties and Agreements with Indigenous People*, eds. M Langton, M Teehan, L Palmer, & K Shain, Melbourne University Press, Melbourne, pp. 220-236

Kearney, J 1998, *Jawoyn (Katherine Area) Land Claim – Report by the Aboriginal Land Commissioner to the Minister for Aboriginal Affairs and to the Administrator of the Northern Territory*, Australian Government Publishing Service, Canberra.

Lane, 2000, 'Native Title and Inland Waters', *Indigenous Law Bulletin*, 4(29), pp. 11-13.

Langton, M 1996, 'Art, Wilderness and Terra Nullius', *Conference Papers and Resolutions from Ecopolitics IX – Perspectives on Indigenous peoples Management of Environment and Resources*, Northern Territory University, Darwin, 1-3 September 1995, pp. 11-24.

Langton, M 2002, 'Freshwater', *Background Briefing Papers: Indigenous Rights to Water*, Lingiara Foundation, Broome, WA, pp. 43-64.

Lingiari Foundation 2002, *Background Briefing Papers: Indigenous Rights to Water*, Broome, Western Australia.

McGrath, A 1987, *Born in the Cattle*, Allen and Unwin, Sydney.

Morgan, M, Strelein, L & Weir, J 2004, *Indigenous Rights to Water in the Murray Darling Basin*, Research Discussion Paper Number 14, AIATSIS, Canberra.

Northern Land Council 2001, *Northern Land Council Annual Report 2000-2001*, Darwin.

Northern Land Council and Aboriginal Areas Protection Authority 2004, *An Introduction to the Aboriginal People of the Daly River Region: Their History, Land and Sites, Report to the Daly River Expert Reference Group*, NT Department of Infrastructure, Planning and Environment.

Northern Territory Government 2004a, *Issue Paper – Biodiversity Conservation on Aboriginal Land in the NT*, Parks and Wildlife Commission, Darwin, http://www.nt.gov.au/ipe.

Northern Territory Government 2004b, *Issue Paper – Biodiversity Conservation in the NT – Does It Matter?*, Parks and Wildlife Commission, Darwin, http://www.nt.gov.au/ipe.

Northern Territory Government 2004c, *Issue Paper – Off-Reserve Conservation and Sustainable Use*, Parks and Wildlife Commission, Darwin, http://www.nt.gov.au/ipe.

Northern Territory Government 2004d, *Discussion Paper: Review of the NT Pastoral Act 1992*, NT Department of Infrastructure, Planning and Environment, Darwin, http://www.nt.gov.au/ipe.

Olney, J 2000, *Wandarang, Alawa, Marra and Ngalakan Peoples V Northern Territory of Australia* [2000] FCA 923, http://www.austlii.edu.au/.

Reeves, J 1998, *Building on Land Rights for the Next Generation: The review of the Aboriginal Land Rights (Northern Territory) Act 1976*, Commonwealth of Australia, Canberra.

Smyth, D 1995, *Protecting Country – Indigenous Protected Areas*, Phase Two Report, Consultancy Report, prepared for the Australian Nature Conservation Agency, Canberra.

Storey, A, Davies, S & Froend, R 2001, *Fitzroy River System: Environmental Values*, report prepared for Water and Rivers Commission, University of Western Australia & Edith Cowan University, Perth.

Tan, PL 1997, 'Native Title and Freshwater Resources', *Commercial Implications of Native Title*, eds. B Horrigan & S Young, Federation Press, pp. 157-199.

Thackway, R, Szabo, S & Smyth, D 1996, 'Indigenous Protected Areas: A New Concept in Biodiversity Conservation', *Biodiversity: Broadening the Debate 4; The Beat Goes On…*, Australian Nature Conservation Agency, Canberra.

Thackway, R & Brunckhorst, D 1998, 'Alternative Futures for Indigenous Cultural and Natural Areas in Australia's Rangelands', *Journal of Environmental Management* 5(3), pp. 169-181.

Toohey, J 1982, *Daly River (Malak Malak) Land Claim*, report by the Aboriginal Land Commissioner to the Minister for Aboriginal Affairs and to the Administrator of the Northern Territory, Australian Government Publishing Service, Canberra.

Toussaint, S, Sullivan, P, Yu, S & Mularty Jnr, M 2001, *Fitzroy Valley Indigenous Cultural Values Study*, report for the Water and Rivers Commission, Centre for Anthropological Research, University of Western Australia, Perth.

Woenne-Greene, S, Johnston, R, Sultan, R & Wallis, A 1994, *Competing Interests: Aboriginal Participation in National Parks and Reserves in Australia (A Review)*, Department of Employment, Education and Training, Canberra.

Woinarski, J 2002, *Biodiversity Audit - Bioregional Summaries: Compilation of Individual Summaries for the National Land and Water Resources Audit*, NT Parks and Wildlife Service, http://www.nt.gov.au/ipe.

Yu, S 2000, *Ngapa Kunangkul: Living Water*, report on the Aboriginal Cultural Values of Groundwater in the La Grange Sub-Basin, prepared by the Centre for Anthropological Research, University of Western Australia, for the Water and Rivers Commission of Western Australia, 2nd edn.

4.2

The need and role for freshwater bioregions in the selection of representative freshwater protected areas in Australia

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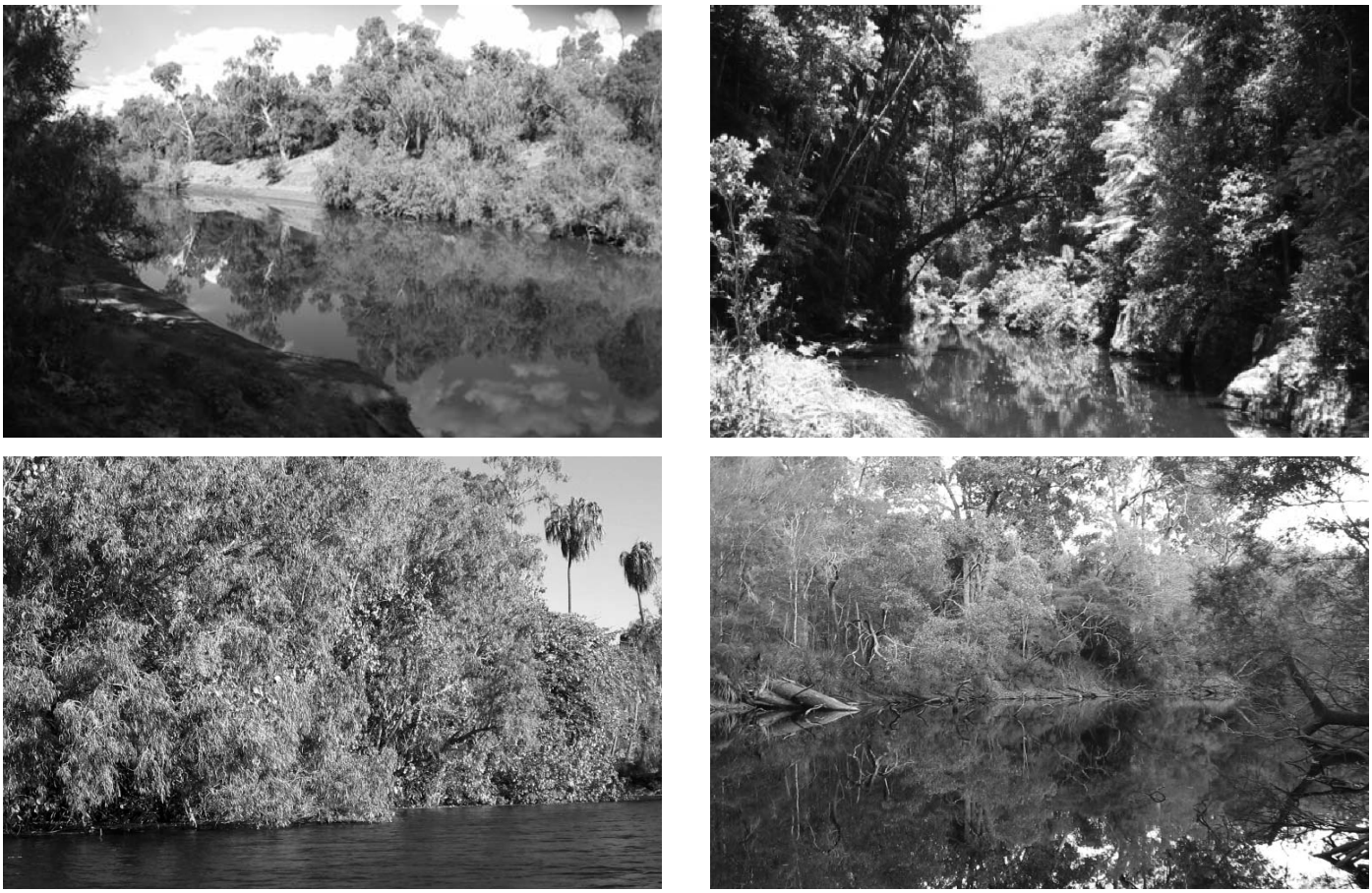
Australia is a large continent that has a diverse array of freshwater ecosystems and associated biodiversity. To provide comprehensive, adequate and representative (CAR) protection of this biodiversity, freshwater protected areas need to be stratified across the full suite of Australian freshwater ecosystems. In terrestrial and marine protected area planning hierarchical biogeographic frameworks including terrestrial bioregions (Interim Biogeographic Regionalisation of Australia - IBRA), marine bioregions (Interim Marine and Coastal Biogeographic Regionalisations of Australia - IMCRA) and smaller scale regional ecosystems are used to help deliver representative conservation outcomes. The lack of a freshwater biogeographic regionalisation for Australia currently limits our ability to define representative protected area candidates Australia-wide. Freshwater biota has unique biogeographic constraints that are not reflected by existing bioregional frameworks. In this paper the potential role of freshwater biogeographic regionalisations for serving representative protected area planning is examined by the application of



PHOTOS OF AUSTRALIAN RIVERS (CLOCKWISE FROM ABOVE LEFT, FLINDERS, RICHMOND, BURDEKIN AND MARY RIVER BASINS) FROM ONLY TWO OF AUSTRALIA'S DRAINAGE DIVISIONS HIGHLIGHT SOME OF THE DIVERSITY THAT NEEDS TO BE CAPTURED BY A REPRESENTATIVE AQUATIC PROTECTED AREA NETWORK

Australian freshwater fish regions (Unmack 2001) to examine the representativeness of the exiting protected area coverage of Australian river systems. Ways forward toward the development of an Interim Freshwater Biogeographic Regionalisation of Australia (IFBRA) are also recommended.

Introduction

Australian rivers and their associated freshwater ecosystems are diverse. They span tropical to temperate climatic zones, include perennial, highly seasonal and intermittent flow regimes and drain a diverse array of geological settings ranging from ancient weathered landscapes with low relief to mountainous basins with more recent geological origins. The varied biophysical settings and evolutionary histories of Australian river systems are reflected in the rich biodiversity of its freshwater ecosystems.

All Australian jurisdictions have made commitments to the conservation of Australia's biodiversity heritage, including the establishment of representative protected area networks for freshwater ecosystems (ANZECC 1996, Neville 2002). In recent years there has been a groundswell of support and associated policy development toward the establishment of freshwater protected areas (Cullen 2002, NRS Taskforce 2004, Kingsford et al. 2004). To conserve representative examples of Australia's freshwater biodiversity, a protected area planning framework is needed to stratify conservation efforts across the full suite of Australian freshwater ecosystems.

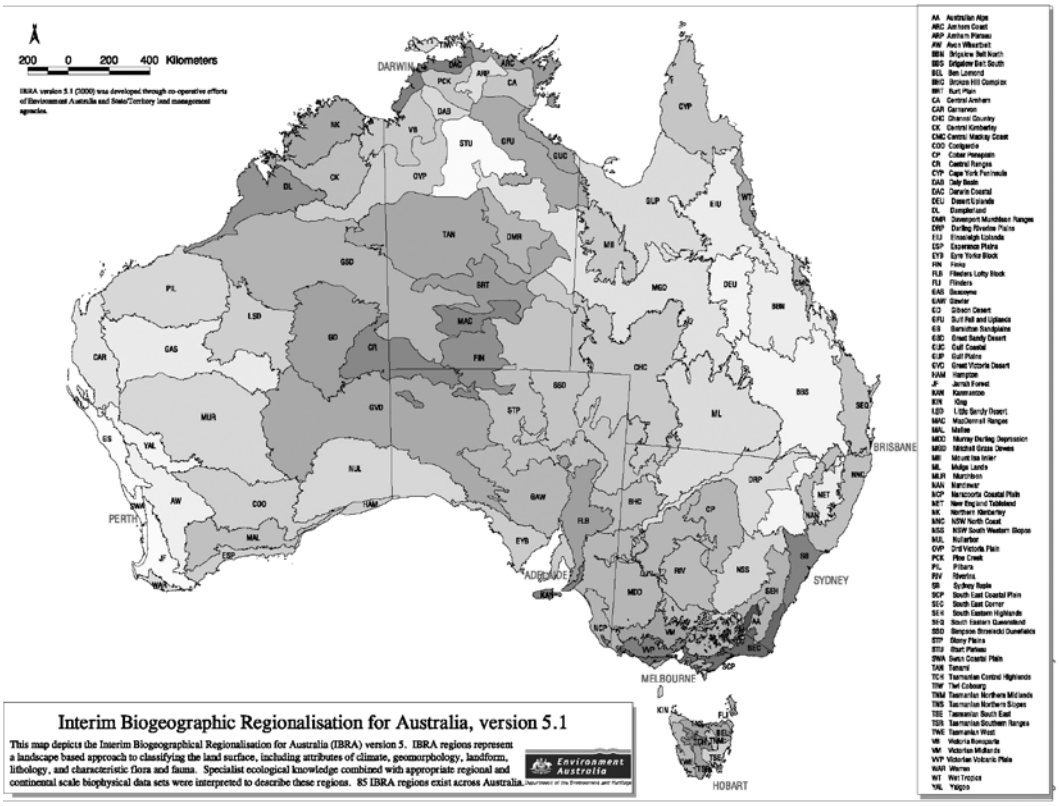
EXISTING BIOREGIONAL FRAMEWORKS

Systematic terrestrial and marine biodiversity conservation planning in Australia is served by national bioregional frameworks that define terrestrial (IBRA) (Thackway & Cresswell 1995; Environment Australia 2001) and marine (IMCRA) 'bioregions' (Thackway & Cresswell 1998). (See Figure 1.) Bioregions are units of homogeneity in ecological systems and in relationships between organisms and environments (Omernik 1987). In effect bioregions provide surrogate representations of the 'grain of biodiversity' at broad continental scales.

Terrestrial and marine bioregions now form part of a hierarchical framework that include finer scale biogeographic regionalisations including sub-bioregions or sub-regions (IBRA 5.1) which in most jurisdictions are further divided by regional ecosystems, ecological vegetation communities or substrate community types or equivalent in the case of marine ecosystems (GBRMPA 2001) (see Figure 2). Despite some inconsistencies identified during the application of these finer scale frameworks for national biodiversity assessments (NLWRA 2002), they have had a relatively convergent development across Australian jurisdictions.

Despite national advances in terrestrial and marine biogeographic conservation planning frameworks there has not been equivalent development of freshwater bioregional frameworks. Nationally there has been limited documentation of freshwater biodiversity at the ecosystem scale (Neville 2002) and there are currently no accepted freshwater bioregions (Tait et al. 2003).

FIGURE 1: INTERIM BIOGEOGRAPHIC REGIONALISATION OF AUSTRALIA (IBRA), VERSION 5.1 BIOREGIONS



APPLICATION OF BIOREGIONALISATION IN CONSERVATION PLANNING

Bioregionalisation provides the foundation for systematic biodiversity assessment and conservation planning including the design of comprehensive, adequate and representative (CAR) protected area networks. In broad terms the two key applications of bioregional frameworks for biodiversity conservation planning include:

1. biogeographically stratified or *representative* assessments of resource condition e.g. National Assessment of Landscape Health (Morgan 2001) (see Figure 3)
2. assessments of protected area network progress or representativeness e.g. National Reserve Consolidation Priorities (NLWRA 2002) (see Figure 4).

Both of these applications help define CAR conservation priorities. CAR principles have long underpinned Australian Government investment in the development of the National Reserve System and recent indications are that they shall also be pursued in the further development of freshwater protected areas (NRS Task Force 2004). Without bioregional frameworks to target protected area initiatives there is an inherent risk that conservationists and policy makers will primarily focus protection efforts on least disturbed areas or biodiversity 'hotspots'.

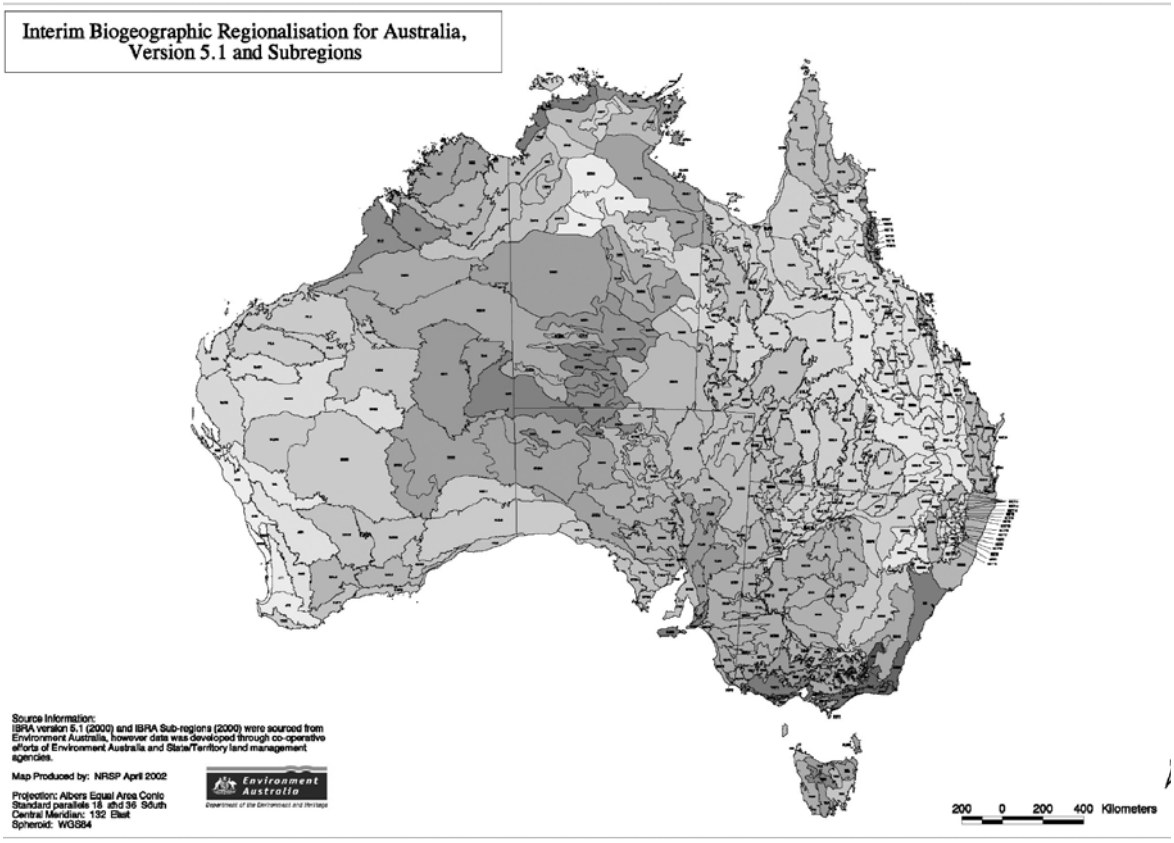
While there are legitimate rationales for such foci they alone will not deliver a representative protected area network. Impacts to Australian biodiversity have not been evenly distributed across the continent or regional landscapes. Regions or landscape more suited to development have borne the greatest brunt in terms of biodiversity loss. By targeting aquatic protected area initiatives such as heritage rivers (Cullen 2002) and wild rivers (QDNRM 2004) solely toward undisturbed rivers there is a risk that more developed river basins will not be considered for protected areas despite the effective role that they may be able to play in safeguarding biodiversity within Australia's 'workhorse' river basins. Bioregionally-based assessments of conservation priorities identify protection needs and opportunities within representative suites of ecosystems and river basins including many that may be considered 'challenged' in terms of conservation opportunities.

WHY A NEED FOR FRESHWATER BIOREGIONS?

Given the advanced development of national terrestrial and marine bioregional frameworks within Australia, it is legitimate to ask why there is a need to develop freshwater bioregions. Is aquatic biota that different from terrestrial biota in terms of their biogeographic affinities to warrant the need for separate bioregionalisation?

Freshwater biota distribution patterns are governed by environmental tolerances and preferences, their distributional ability, stochastic events and the history of river basin connectivity (Tait et al. 2003). While all the preceding influences are also important to the biogeography of terrestrial biota, it is the effect of river basin connectivity history that distinguishes the biogeographic patterns of freshwater biota from terrestrial biota. Obligate freshwater biotas particularly 'suffer unique biogeographic constraints' (Unmack

FIGURE 2: INTERIM BIOGEOGRAPHIC REGIONALISATION OF AUSTRALIA, VERSION 5.1 SUBREGIONS



2001). For freshwater biota unable to disperse across land, freshwater biota distribution patterns are catchment constrained except for rare events of inter-basin connectivity which naturally include floods, pulses of sea water into oceans, drainage rearrangements and lower sea levels (Unmack 2001) (see Figure 5). River basin boundaries and the history of connectivity between them is an appropriate primary consideration in the definition of bioregional frameworks for freshwater biota.

Progress toward freshwater bioregions

In recent decades advances in the biogeographic understanding of Australian freshwater biota and the development of various classification systems for biotic communities and/or their physical environments have paved the way for the development of an IFBRA counterpart to the existing IBRA and IMCRA bioregions (Tait et al. 2003).

'A PRIORI' REGIONALISATIONS

The first attempts to define aquatic ecoregions within Australia occurred relatively recently, reflecting the early stage of development of freshwater bioregionalisation in Australia. Wells & Newall (1997) followed the example of North American workers (Omernik 1987) in developing *a priori* regionalisations using largely terrestrial attributes (e.g. climatic surfaces, physiography and pre-European vegetation). Defined regions were then tested; they performed poorly against elements of freshwater ecosystems including observed water quality characteristics, macro invertebrate assemblages and other biophysical attributes. One of the key limitations of this early work was that the natural boundaries provided by watersheds were not considered in the definition of regions despite the recognition that 'drainage network and positioning were likely to explain much of the observed subregional variation' (Wells & Newall 1997). Whiting et al. (2000), provide another more recent example of the application and limitations of *a priori* regionalisations in the use of terrestrial bioregions to define freshwater crayfish biodiversity conservation values Australia-wide. The ultimate resolution of

FIGURE 3: NATIONAL ASSESSMENT OF LANDSCAPE HEALTH OF 'SUBREGIONS' (MORGAN 2001)

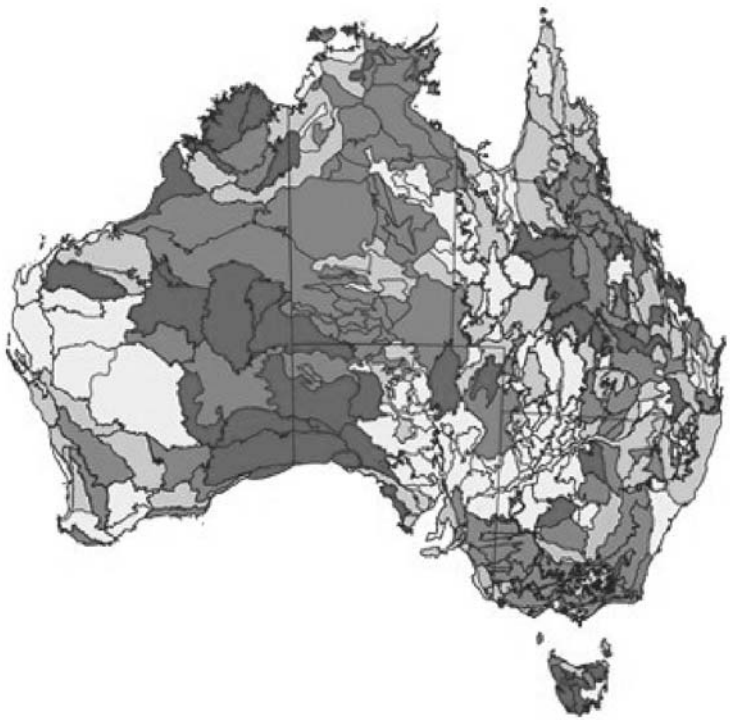
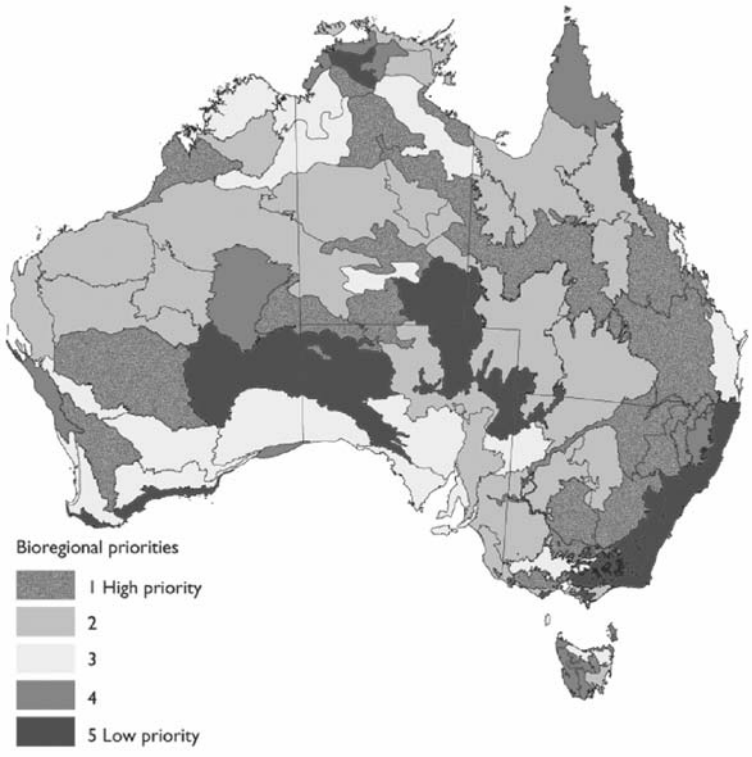


FIGURE 4: ASSESSMENT OF NATIONAL RESERVE SYSTEM CONSOLIDATION PRIORITIES WITHIN BIOREGIONS (NLWRA 2002)



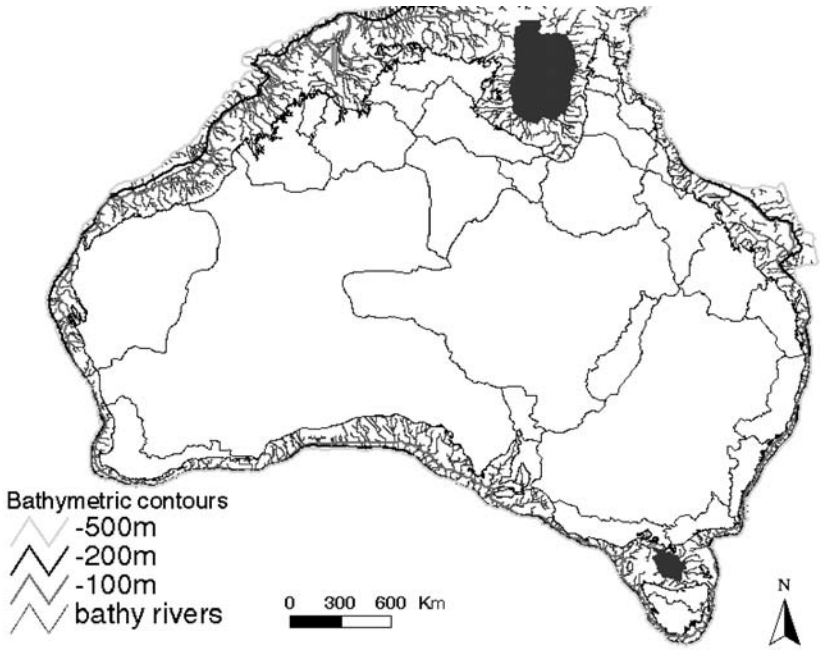
defined regional conservation values is relatively poor and the terrestrial region framework has little relationship to the distributional boundaries of the target taxa.

INTRINSIC BIOTA REGIONALISATION

In the early work of Wells & Newall (1997), intrinsic regionalisations evident in macro invertebrate data were acknowledged as an appropriate means of defining the scale of regions but were not proposed as a primary protocol for the definition of aquatic ecoregions. The definition of intrinsic regional patterns in aquatic biota primarily macro invertebrates has since been progressed significantly by the many workers involved Australia-wide in the National River Health Program (Davies 2000). For this program defined regional patterns of aquatic macro invertebrates are used to predict regional and reach scale macro invertebrate assemblages and observed versus expected values used as an assessment of riverine ecological condition. Although much of the data is only resolved to family level, it represents the first national data set for Australian freshwater biota and its potential application for regionally based biodiversity assessment and protected area planning has been recognised (Wells et al. 2002). One of the limitations of poor taxonomic resolution is that defined regions are broad and often do not recognise distinct biogeographic boundaries such as drainage divides (Well & Newall 1997, Turak et al. 1999). In some jurisdictions where macro invertebrate data has been more finely defined to a species level their greater potential for defining bioregions has been recognised (Doeg 2001, Wells et al. 2002).

Victorian initiatives to protect representative rivers have provided the impetus for one of the better examples of intrinsic biota regionalisations being applied to freshwater conservation planning in Australia (Doeg 2001). Even with the use of species level data a limitation of macro invertebrate data demonstrated by this study is the lack of definition of catchment boundaries that results from the combination of both obligate and non-obligate freshwater taxa in the data set. Resulting broad regionalisations cross major drainage division divides which represent significant biogeographic boundaries to more obligate freshwater biota such as freshwater fish (see Figure 6).

FIGURE 5: RIVER COURSES DURING LOWER SEA LEVEL (UNMACK 2001), HIGHLIGHTING PAST CONNECTIVITY OF NOW ISOLATED RIVER BASINS



Where intrinsic regionalisations are defined by freshwater fish distribution, catchment boundaries form an important delineation between units although some uppermost catchment units span catchment divides reflecting the exceptional distributional abilities of some fish species that live in high energy low order streams (see Figure 7). Another intrinsic regional feature that emerges in freshwater fish data and is reflected in macro invertebrate data is the distinction between upper, mid and lower catchment biota. Increases in fish species diversity with increasing catchment area and distinctions in upper, mid and lower catchment fish communities have long been recognised (Welcome 1985, Pusey et al. 1995, Gehrke 1997). The bioregional importance of inter-catchment position is discussed further below.

The only attempt to define intrinsic biota regions nationally for obligate freshwater taxa has been the definition of freshwater fish provinces by Unmack (2001) (see Figure 8). Unmack's (2001) work on the biogeography of freshwater fish provides the most substantial progress toward the development of national freshwater bioregions in Australia.

RIVER BIOPHYSICAL CLASSIFICATION FRAMEWORKS

One of the reasons that intrinsic biota regionalisation has not been more fully explored for freshwater biodiversity in Australia has been the general paucity and incomplete coverage of distributional data for most freshwater taxa. In the absence of biota survey data biophysical classification approaches that attempt to capture the drivers of ecosystem function and composition are pursued as surrogates. Environmental domain analysis has been one of the more robust approaches applied in the definition of terrestrial bioregions in Australia and has more recently been applied as a conservation assessment framework for streams in Tasmania (Jerie et al. 2003). Other developments in this field including a proposed national approach for river classification (Calvert et al. 2001) and the definition of river process zones (Thoms et al. 2001, Thoms & Parsons 2003) which reflect key physical and ecological drivers of aquatic ecosystems and associated biotic communities, provide a biophysical framework foundation for progressing freshwater biogeographic understanding toward the definition of bioregions.

BIOGEOGRAPHIC SURVEY AND REVIEWS OF TAXA

While surrogate biophysical classification approaches are likely to always have a role in identifying target areas for a representative freshwater protected area network, systematic survey of freshwater taxa distribution remains essential to serve freshwater biodiversity conservation objectives. In the past decade national taxonomic reviews of freshwater biota and improvement in data sets for invertebrates (Davies 2000), molluscs (Ponder and Walker 2001), fish (Unmack 2001) and turtles (Georges and Thomson 2002) all provide a basis for examining cross-taxa congruity in distributional patterns that may help define freshwater bioregional boundaries.

DEVELOPMENT OF MOLECULAR PHYLOGENETIC TOOLS

Another emerging method that is providing an objective basis for defining freshwater bioregions is the development of molecular tools for mapping phylogeographic regions (Hughes et al. 1996, Avise 2001, Hurwood et al. 2001, Georges et al 2001, Ponder & Walker 2001). The identification of genetic differentiation in widely distributed freshwater species is a quantitative method for identifying barriers to population intermixing which may represent biogeographic boundaries for less vagile and less widely distributed taxa. This tool can be used to confirm bioregional boundaries identified on the basis of discontinuities in species distributions which alone cannot unambiguously be distinguished from the impact of stochastic effects.

FURTHER DEFINITION OF TERRESTRIAL REGIONALISATIONS

The application of terrestrial bioregions to freshwater biodiversity conservation planning have in the past been dismissed on the basis that they were unsuitable for explaining patterns in freshwater biota (Georges & Cottingham 2002) and too broad for the scale of patterns observed in freshwater biota (Marchant et al. 1999, Turak et al. 1999). However, finer scale terrestrial regionalisation such as subregions (Environment Australia 2001) and regional ecosystems (Sattler & Williams 1999) have not been explicitly tested for this role. Given that these finer scale

FIGURE 6: VICTORIAN RIVER REGIONALISATIONS DERIVED FROM A MIXTURE OF OBLIGATE AND NON-OBLIGATE FRESHWATER MACRO INVERTEBRATES ARE BROAD AND CROSS MAJOR CATCHMENT DIVIDES (FROM DOEG 2001)

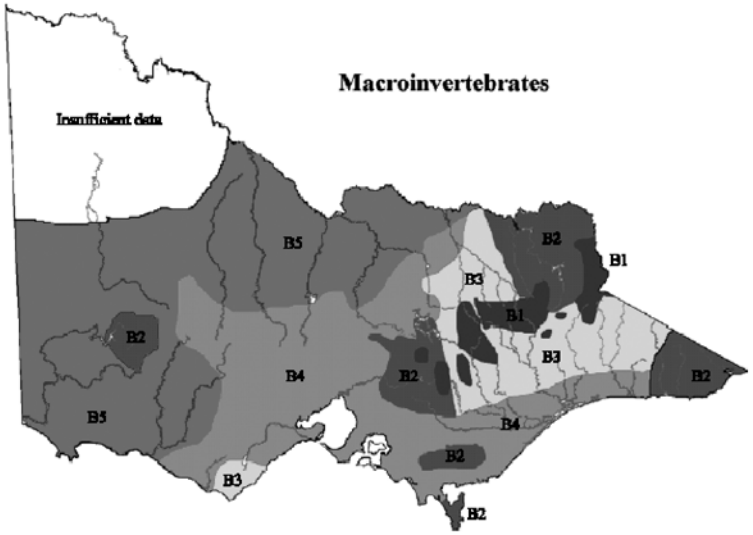
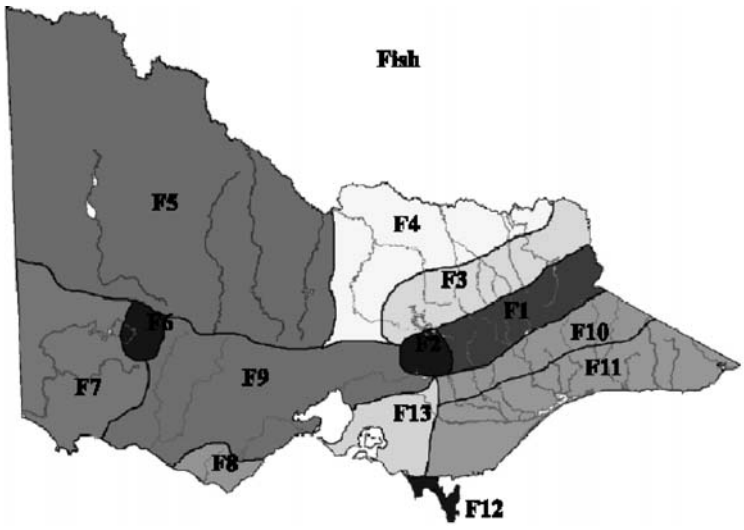


FIGURE 7: VICTORIAN RIVER REGIONALISATIONS USING OBLIGATE FRESHWATER FISH DEFINED MAJOR CATCHMENT BOUNDARIES (FROM DOEG 2001)

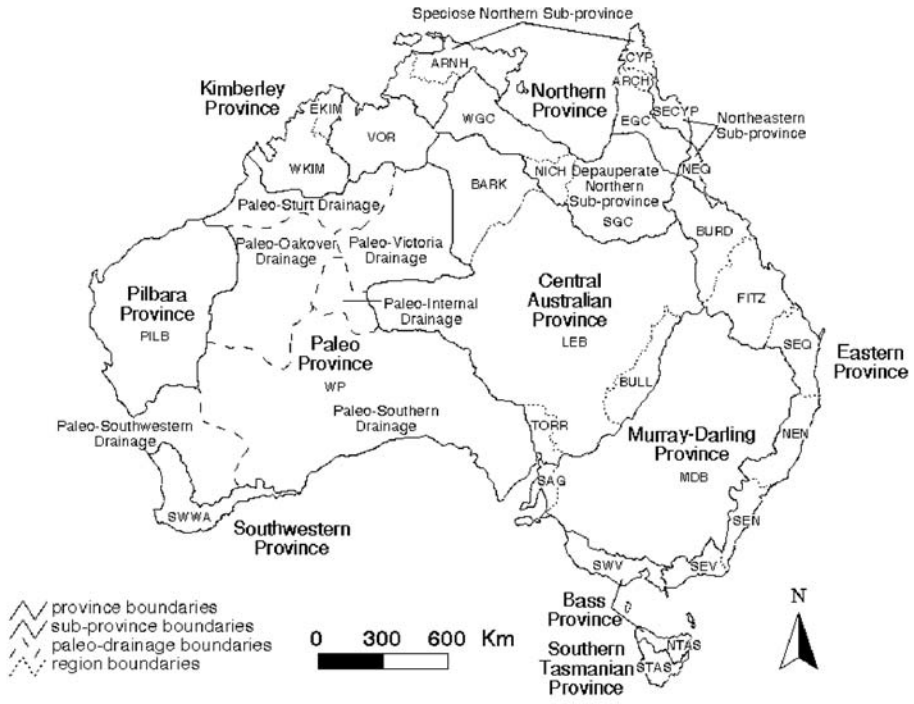


terrestrial regionalisation capture some of the key geomorphic drivers of freshwater ecosystems it might be expected that they could provide a useful conservation planning framework for some elements of freshwater biodiversity, particularly more vagile and non-obligate freshwater taxa that show distributional associations with terrestrial ecosystem elements and which disperse readily across catchment boundaries (e.g. aquatic macro invertebrates with strong flying adult life stages, amphibians, reptiles). Cursory examination suggests that distributional patterns of riparian vegetation communities and associated biota may be 'captured' by this type of terrestrial based regionalisation (Tait et al. 2003). The application of finer scale terrestrial regionalisations has considerable potential that needs to be assessed in the development of freshwater bioregional boundaries.

Time for an interim freshwater bioregionalisation of Australia?

Given the advances in freshwater biogeographic understanding that have occurred in the last decade (discussed above) it is timely to consider whether an interim freshwater bioregionalisation of Australia can now be developed to meet the need for a national aquatic protected area planning framework. The timeliness and need for such a development is based on the common discussions and policy commitments concerning aquatic protected areas currently occurring across Australian jurisdictions. Past experience in terrestrial and marine conservation planning has shown that biodiversity does not recognise jurisdictional boundaries. There needs to be operational consistency across jurisdictional boundaries if the conservation priorities underpinning the establishment of a truly representative National Reserve System (NRS) as articulated in the recent NRS directions discussion paper, are to be identified (NRS Taskforce 2004). Ultimately Federal Government funding support for the NRS also provides a pragmatic impetus for the development of a national freshwater bioregional framework and IBRA and IMCRA represent national precedents.

FIGURE 8: AUSTRALIAN FRESHWATER FISH PROVINCES DEFINED BY UNMACK (2001).AND NON-OBLIGATE FRESHWATER MACRO INVERTEBRATES ARE BROAD AND CROSS MAJOR CATCHMENT DIVIDES (FROM DOEG 2001)



PROPOSED PRINCIPLES AND APPROACHES FOR AN IFBRA

Proposed approaches and principles for the development of an IFBRA have been previously discussed by Tait et al. (2003). The following presents an abbreviated summary.

1. Distribution of biota should have precedence over physical attributes in defining regions.

One of the ultimate goals of a fully representative aquatic protected area network is to conserve Australia's aquatic biodiversity. To this end it is recommended that intrinsic biota regionalisations should be used as the primary basis for defining bioregional boundaries (and associated conservation targets) c/f surrogate physical attribute based classifications that may or may not capture biogeographic features. It is recommended that the primary role of physical attribute classification is to provide a basis for proposing (and subsequently testing) sub regionalisation of bioregions where finer resolution biota data is not initially available, and for facilitating unit mapping once robust biogeographic associations are demonstrated.

2. A freshwater bioregional framework needs to be hierarchical for application at multiple scales.

As for terrestrial conservation planning, freshwater bioregional frameworks need to be able to support conservation assessments at national, regional and property scales. It is recommended that a nested hierarchical framework that includes at least three tiers including macro scale bioregions, medium scale subregions, provinces or equivalent and smaller scale regional aquatic ecosystems and/or riverine reach types provides an ideal developmental target that replicates the operability of existing terrestrial and marine bioregional frameworks.

3. Aggregated River basins be adopted as the macro units (bioregions) in the interim freshwater bioregionalisation of Australia.

The importance of river basin boundaries and connectivity history for describing broad freshwater biogeographic patterns is undisputed and drainage basins have been described as the most meaningful regionalisations for inland waters because

surface waters are 'arranged spatially as a network throughout the landscape effectively controlled by topography' (Georges and Cottingham 2002). Broad regional aquatic biotas that span more than one river basins can be defined in most parts of the continent and the aggregation of river basins on the basis of shared aquatic biota would seem an intuitive basis for defining freshwater bioregions. The drainage basin based freshwater fish provinces proposed by Unmack (2001) are proposed as a robust starting point for further cross taxa validation (see Figure 8).

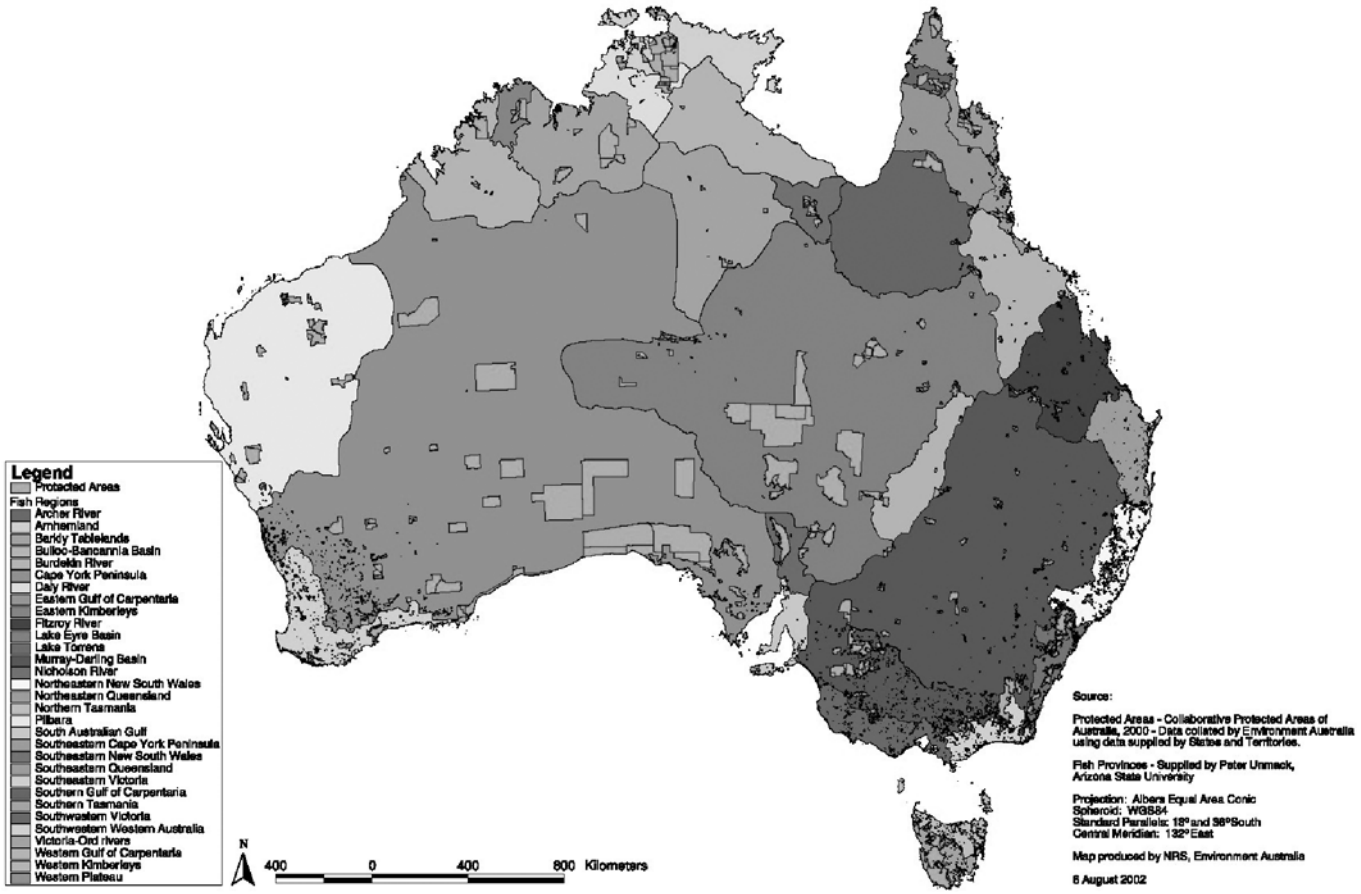
4. *Catchment position stratifications provide the second level of hierarchy (subregions) in the interim freshwater bioregionalisation of Australia.*

Upper, mid and lower catchment biotic associations are recognised in most river basins within Australia, often reflecting natural biogeographic boundaries such as waterfalls or major changes in hydraulic power and associated valley scale changes in ecosystem processes and habitat settings. Recognised associations include both vertebrate and invertebrate aquatic taxa (Pusey et al. 1993, 1995, Gehrke 1997, Doeg 2001, Choy et al. 2002). Such intra-basin associations occur spatially and at scales that present a viable means of subdividing broader inter-basin biogeographic associations and are recommended as the obvious second level of hierarchy for a freshwater bioregionalisation of Australia. In the absence of sufficient biota data it is recommended that valley scale physical and 'river process zone' classifications (Calvert et al. 2001, Thoms et al. 2001, Thoms & Parsons 2003) could be utilised for the first interim bioregionalisation with subsequent research effort to be directed toward identifying the existence and scale of concordance with within-basin biogeographic patterns.

5. *Terrestrial biogeography and physical attributes have a legitimate stratification role for 'freshwater' bioregional frameworks and vice versa.*

While the use of intrinsic biota regionalisation is preferred as the primary basis for defining bioregional assessment frameworks, physical attribute classification still has an important role to play in proposing and testing the subdivision of broader biogeographic associations as alluded to in points 1 and 4 (above). Most existing terrestrial bioregional frameworks have a predominantly physical basis defined by geology or geomorphology. In the absence of catchment biogeographic boundaries, physical environment classification usually provides a robust surrogate and predictor of terrestrial biogeographic patterns. Importantly much 'freshwater biodiversity' includes non-obligate freshwater species and/or more vagile semi-terrestrial taxa with inter-basin distributional and recruitment abilities. For freshwater ecosystem elements such as riparian vegetation, aquatic macrophytes and more vagile fauna such as reptiles, amphibians and macro-invertebrates with terrestrial adult life stages, existing,

FIGURE 9: AUSTRALIA'S PROTECTED AREAS OVERLYING FRESHWATER FISH REGIONS OF UNMACK (2001)



particularly finer scale terrestrial-based regionalisations i.e. land types and regional ecosystems, may provide an appropriate spatial framework for conservation assessments or for subdividing freshwater regionalisations. Such secondary classification or stratifications could provide the means for developing a fully comprehensive framework for identifying conservation targets for a representative aquatic protected areas network.

EXAMPLE APPLICATION OF FRESHWATER BIOREGIONALISATION 1: ASSESSING 'ADEQUACY' AND 'REPRESENTATIVENESS' OF EXISTING PROTECTED AREAS

For many Australian freshwater conservation biologists, the potential of bioregional frameworks for biodiversity conservation planning is not well recognised because such approaches have largely been the preserve of terrestrial workers. To illustrate such an application, a GIS was used to intersect the freshwater fish regions of Unmack (2001), with the Australian protected area database (Hardy 2001) (see Figure 9). As these protected areas largely contain terrestrial ecosystems, the AUSLIG 250K Australian Drainage Coverage was also intersected to assess the percentage of defined drainage network within each fish region that is contained or 'represented' in existing protected areas. It should be noted that this analysis includes the fallible assumption that riverine systems within terrestrial reserves are 'protected' which is known not to be the case for many Australian protected areas where the hydrology of river systems or other catchment based drivers of ecosystem condition are impacted by development external to or even within the protected area boundary (Kingsford et al. 2004).

Summary results of this analysis are presented in Table 1 and Table 2 and discussed further below.

FINDINGS RE: EXISTING PROTECTED AREA COVERAGE AND 'REPRESENTATIVENESS' OF FRESHWATER FISH REGIONS

One of the most readily notable features of the protected area coverage of Australian freshwater fish regions is that few protected areas are large enough to encompass entire river basins with the notable exceptions occurring in Arnhem Land (Kakadu National Park) in the Northern Territory and in South West Tasmania. This has obvious ramifications in terms of the level of effective protection provided to the overall assemblage of aquatic ecosystems within river basins and for organisms such as fish within existing protected areas that often move between upper and lower catchment areas within a river basin.

Although no intra-basin regionalisations were used in this assessment, it is also apparent from assessing the distribution of existing protected areas that there is a general bias in protected area coverage toward upper basin areas and an under representation of mid and lower basin areas. This bias is most apparent in two of the five most highly represented fish regions in existing protected areas (South Eastern NSW and South Eastern Victoria). This highlights the propensity within more highly populated areas to protect significant areas of upper catchment while committing much of the mid and lower basin areas to development (see Table 1).

The 1st, 2nd and 5th most highly represented fish regions in protected areas occur within prominent 'wilderness' areas of South Western Tasmania, Cape York (Archer River) and the Wet Tropics of North Queensland (North Eastern Qld). Protected areas within these more remote and lower populated regions have an apparently greater capacity for including mid and lower basin areas although in the case of South West Tasmania it needs to be recognised that protection does not apply to the hydrological processes of the included river systems (see Table 2.)

The most poorly represented fish regions in protected areas include those that belong to Australia's intensively developed workhorse rivers and or rangeland regions, particularly the Gulf of Carpentaria. In the case of the former, competition for land and water resources for development and existing resource degradation would provide a constraint to the implementation of protected areas but also underpins their potentially important role in safeguarding remaining aquatic biodiversity values. In the case of the rangeland regions low levels of representation in protected areas is indicative of low levels of investment in conservation management generally within these regions. Importantly less intensive patterns of development within these regions mean that opportunities for cost-effective protective management initiatives may be greater.

TABLE 1: FIVE FRESHWATER FISH REGIONS WITH HIGHEST LEVEL OF REPRESENTATION IN EXISTING PROTECTED AREAS

FRESHWATER FISH REGION NAME	% OF FISH REGION AUSLIG 250K DRAINAGE NETWORK WITHIN PROTECTED AREAS
Southern Tasmania	45%
Archer River	29%
South Eastern NSW	26%
South Eastern VIC	24%
North Eastern Qld	16%

TABLE 2: EIGHT FRESHWATER FISH REGIONS WITH LOWEST LEVEL OF REPRESENTATION IN EXISTING PROTECTED AREAS

FRESHWATER FISH REGION NAME	% OF FISH REGION AUSLIG 250K DRAINAGE NETWORK WITHIN PROTECTED AREAS
Fitzroy River	3.7%
Murray-Darling Basin	3.6%
South Eastern QLD	3.0%
Lake Torrens	2.9%
Southern Gulf of Carpentaria	2.0%
Burdekin River	1.6%
Eastern Gulf of Carpentaria	1.0%
Western Gulf of Carpentaria	0.1%

EXAMPLE APPLICATION OF FRESHWATER BIOREGIONALISATION 2: ASSESSING RESOURCE CONDITION BASED CONSTRAINTS / OPPORTUNITIES (= PRIORITIES) FOR REPRESENTATIVE PROTECTED AREAS

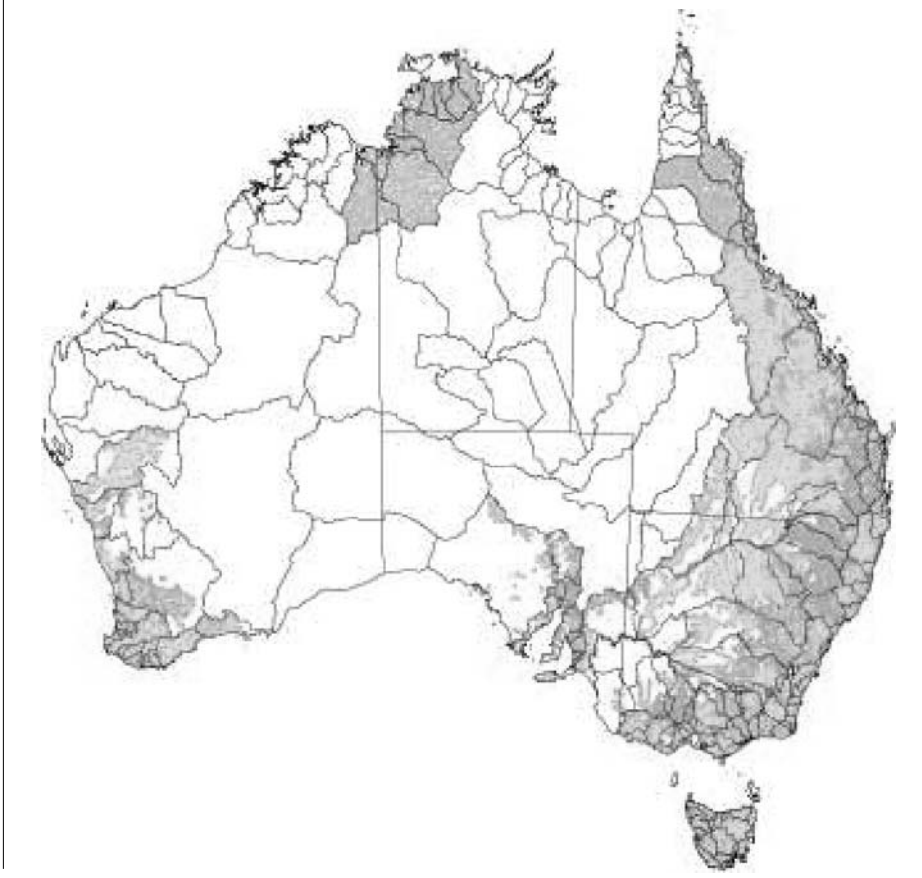
As noted in the introductory section of this paper, identifying representative conservation priorities and opportunities requires an assessment of not only existing representation of regions in protected areas but also of the existing condition status of representative regions.

One of the challenges involved in assessing conservation priorities for riverine and other aquatic ecosystems is that they can continue to exist in the landscape in a range of condition states following resource development impacts. In comparison, terrestrial ecosystems that have been subjected to intensive development such as broad scale clearing are generally considered to be extinguished. Modified land cover therefore provides a ready means of assessing the areal post-development representation and remaining conservation opportunities of terrestrial ecosystems not withstanding more cryptic condition impacts associated with extensive threats such as fire, grazing and weeds.

National integrated assessments of river condition (NLWRA 2002) now provide a means of conducting equivalent analyses of condition status and conservation opportunities for freshwater bioregional entities (see Figure 10).

Although a GIS analysis was not conducted to demonstrate this application, the conservation planning merits of intersecting bioregional frameworks such as freshwater fish regions with the assessment of river condition data layer are apparent. Such an analysis identifies where opportunities in terms of better condition areas remain to address the poor representation of entire fish regions (i.e. Murray Darling Basin) or alternatively sub-regional areas (i.e. mid and lower basins areas of the South Eastern NSW fish region) within protected areas. The relatively good condition and associated opportunity for protective (c/f remedial) management approaches in northern and inland Australia fish regions including those with low levels of existing representation in protected areas is also elucidated by such an analysis.

FIGURE 10: REACH SCALE ASSESSMENT OF RIVER CONDITION WITHIN THE INTENSIVE LAND USE ZONE (NLWRA 2002)



Toward an IFBRA – conclusion and ways forward

CONCLUSION

Based on a cursory examination of the potential of freshwater bioregional frameworks for defining conservation priorities and opportunities for a representative network of Australian freshwater protected areas, the case for the development of a national freshwater bioregionaliation of Australia appears conclusive. While efforts to develop freshwater bioregions in Australia are recent in comparison to advances made for terrestrial and marine ecosystems, improved understanding of freshwater biogeography now puts us in a position to establish an Interim Freshwater Biogeographic Regionalisation of Australia. Although some conservationists see the development of such a framework as diversionary from the main game of getting on with the delivery of aquatic protected areas, it is argued that the strategic benefits of such a framework warrant its development and that an IFBRA could be delivered cost-effectively in the shorter rather than longer term by working with the foundational framework provided by existing biogeographic knowledge and developed biophysical classification methods.

This framework would logically be based on the natural aquatic biogeographic units provided by river basins. River basins aggregated on the basis of shared aquatic biota are proposed as being the logical macro-regions of a necessarily hierarchical framework. Existing national river basin based biota regionalisations i.e. the freshwater fish regions of Unmack (2001) are proposed as a foundation framework for further development. Observed patterns in freshwater biogeography suggest that the second tier of a hierarchical framework would be defined by upper, mid and lower drainage basin stratifications of the primary basin aggregations.

Intrinsic biota regionalisations and phylogeographic regions defined using molecular techniques define the real 'grain' of aquatic biodiversity that forms the target for representative protected areas. These should form the primary tools for defining bioregional boundaries across and within drainage basins. Recognising the limited coverage of data for many aquatic taxa and aquatic ecosystems within Australia, physical environment classification will also remain important for proposing and testing bioregional associations and for mapping efined associations. Considering the variable distributional abilities and mixture of obligate versus non-obligate freshwater biota within 'freshwater biodiversity' terrestrial based bioregionalisations and physical environment classification are also likely to have a valuable role in defining and stratifying freshwater bioregional frameworks.

The timeliness and need for a national aquatic protected area planning framework is demonstrated by the common discussions and policy commitments concerning aquatic protected areas currently occurring across Australian jurisdictions. Past experience in terrestrial and marine conservation planning has shown that there needs to be operational consistency across jurisdictional boundaries if the conservation priorities underpinning the establishment of a truly representative National Reserve System are to be identified. Ultimately Federal Government funding support for the NRS provides a pragmatic impetus for the national development of a freshwater bioregionalisation of Australia and IBRA and IMCRA provide national precedents.

IFBRA – SOME WAYS FORWARD

To progress an IFBRA some of the key needs that need to be progressed as a priority are considered to be:

1. more detailed analysis of intrinsic regionalisations in existing national macro invertebrate data sets
2. collection, compilation and analysis of distributional data for more aquatic taxa to identify intrinsic biota regionalisations and to examine cross taxa concordance in biogeographic boundaries
3. examining biogeographic concordance and associated surrogacy value of biophysical classification frameworks and existing terrestrial based bioregionalisations
4. greater investment in phylogenetic molecular tools to provide a more quantitative method for defining freshwater bioregional boundaries
5. establishment of a national program including an inter-jurisdictional working group to progress all of the above.

Acknowledgments

This paper presents an abbreviated version of a larger publication Tait, Choy and Lawson (2003) and was developed with the assistance of these two co-authors. Analyses presented in this paper were made possible by the provision of GIS coverages of Australian freshwater fish regions and provinces by Peter Unmack and through GIS support provided by Damien Woolcombe and Bruce Cumming of the National Reserve Section of Environment Australia. Thanks are extended to all these individuals for their generous support and efforts.

References

Australian and New Zealand Environment and Conservation Council 1996, *National Strategy for the Conservation of Australia's Biological Diversity*, Department of the Environment, Sports and Territories, Canberra, ACT.

Avise, JC 2001, *Phylogeography and conservation of freshwater vertebrates: a comparative regional perspective,* paper presented to the Fenner Conference on the Environment 2001, Biodiversity Conservation in Freshwaters, 5-7 July 2001, Canberra.

Calvert, S, Erskine, W, & Junor, B 2001, *Development of a National River Classification System - Final Report*, Consultancy report prepared for the Murray-Darling Basin Commission, Environment Australia and the Land and Water Resources, Research and Development Corporation by PPK Environment and Infrastructure Sydney, Australia.

Choy, SC, Thomson, CB & Marshall, JC 2002, 'Ecological condition of central Australian arid-zone rivers', *Water Science and Technology* 45(11), pp. 217-224.

Cullen, P 2002, 'The Heritage River Proposal', *Proceedings of the International Congress on Aquatic Protected Areas*, hosted by the Australian Society for Fish Biology, Cairns, Australia, August 2002.

Davies, P 2000, 'Development of a National River Bioassessment System (AUSRIVAS) in Australia', *Assessing the biological quality of freshwaters – RIVPACS and other techniques,* JF Wright, DW Sutcliffe & MT Furse (eds.), Freshwater Biological Association, Ambleside, UK, pp. 113-124.

Doeg, T 2001, *Representative Rivers of Victoria: Selection of Regions – a Discussion Paper,* report prepared for the Victorian Department of Natural Resources and Environment, August 2001.

Environment Australia 2001, *Revision of the Interim Biogeographic Regionalisation of Australia (IBRA) and the Development of Version 5.1 – Summary Report*, National Reserves Section, Environment Australia, Department of Environment and Heritage, Canberra.

GBRMPA 2001, *Bioregions of the Great Barrier Reef World Heritage Area*, Map Number C03051, Great Barrier Reef Marine Park Authority, Townsville, Queensland.

Gehrke, PC 1997, 'Species richness and composition of freshwater fish communities in New South Wales rivers', *Fish and Rivers in Stress, The NSW Rivers Survey*, NSW Fisheries Office of Conservation and the CRC for Freshwater Ecology in association with the NSW Resource and Conservation Assessment Council.

Georges, A, Shaffer, HB, Adams, M, Thomson, S & Storz, B 2001, *Phylogeography of Australian freshwater turtles*, paper presented to the Fenner Conference on the Environment 2001, Biodiversity Conservation in Freshwaters, 5-7 July 2001, Canberra.

Georges, A & Cottingham, P 2002, *Biodiversity in Inland Waters – Priorities for its Protection and Management,* recommendations from the Fenner Conference on the Environment 2001, Technical Report 1/2002, Cooperative Research Centre for Freshwater Ecology.

Georges, A & Thomson, S 2002, *Evolution and Zoogeography of the Australian Freshwater Turtles.*

Hardy, AM (ed.) 2001, *Terrestrial Protected Areas in Australia: 2000 Summary Statistics for the Collaborative Australian Protected Areas Database (CAPAD)*, Environment Australia, Canberra.

Houng, H, Recknagel, F, Marshall, J & Choy, S 2001, 'Predictive modelling of macroinvertebrate assemblages for stream habitat assessment in Queensland (Australia)', *Ecological Modelling,* 195, pp. 195-206.

Hughes, J, Bunn, SE, Choy, SC & Pearson, R 1996, 'Genetic differentiation among populations of Caridina zebra (Decapoda, Atyidae) in the tropical rainforest stream, northern Australia', *Freshwater Biology*, 36, pp. 289-296.

Hurwood, D, Huges, J & McGlashan, D 2001, *The role of comparitive phylogeography in identifying areas of high conservation values in freshwater systems*, paper presented to the Fenner Conference on the Environment 2001, Biodiversity Conservation in Freshwaters, 5–7 July 2001, Canberra.

Jerie K, Household I & Peters D 2003, *Tasmania's river geomorphology: stream character and regional analysis, vol. 1,* Nature Conservation Branch, Department of Primary Industries, Water and Environment, 03/5.

Marchant, R, Hirst, A, Norris, R & Metzeling, L 1999, 'Classification of macroinvertebrate communities across drainage basins in Victoria; consequences of sampling on a broad spatial scale for predictive modelling', *Freshwater Biology*, 41, pp. 253-268.

Nevill, J 2002, *Freshwater Aquatic Protected Areas: State by State overview,* World Congress on Aquatic Protected Areas, 14–17 August 2002, Cairns, Australia.

NLWRA 2001, *Landscape health in Australia – a rapid assessment of the relative condition of Australia's bioregions and subregions*, National Land and Water Resources Audit, Canberra.

NLWRA 2002, *Australian Catchment, River and Estuary Assessment 2002,* National Land and Water Resources Audit, Canberra.

NRS Taskforce 2004, *Directions for the National Reserve System – a Partnership Approach*, prepared by the National Reserve System Taskforce of the Natural Resource Management Ministerial Council's Land, Water and Biodiversity Committee, Canberra 2004.

Omernik, JM 1987, 'Ecoregions of the conterminous United States', *Annals of the Association of American Geographers,* 77(1), pp. 118-125.

Ponder, W & Walker, K 2001, *From mound springs to mighty rivers – freshwater molluscs and their discovery and conservation in Australia*, paper presented to the Fenner Conference on the Environment 2001, Biodiversity Conservation in Freshwaters, 5-7 July 2001, Canberra.

Pusey, BJ, Arthington, AH & Read MG, 1993, 'Spatial and temporal variation in fish assemblage structure in the Mary River, south-eastern Queensland: the influence of habitat structure', *Environ. Biol. Fish.*, 37, 355-80.

Pusey, BJ, Arthington, AH & Read, MG 1995, 'Spatial and temporal variation in fish assemblage structure in two rivers of the wet tropics of Northern Queensland, Australia, *Environ. Biol. Fish*., 42, pp.181-99.

Sattler, PS & Williams, RD (eds.) 1999, *The Conservation Status of Queensland's Bioregional Ecosystems*, Environmental Protection Agency, Queensland Government, Brisbane.

Tait, J, Choy, S & Lawson, R 2003, 'Bioregional Frameworks for the Assessment of Freshwater Biodiversity in Australia', *Proceedings of the International Congress on Aquatic Protected Areas,* hosted by the Australian Society for Fish Biology, Cairns, Australia, August 2002.

Thackway, R & Creswell, ID (eds) 1995, *An interim biogeographic regionalisation for Australia; a framework for establishing the national system of reserves,* Australian Nature Conservation Agency, Canberra.

Thackway, R & Creswell, ID (eds) 1998, *Interim Marine and Coastal Regionalisation for Australia: an ecosystem-based classification for marine and coastal environments, version 3.3,* Environment Australia, Commonwealth Department of the Environment, Canberra.

Thoms, MC & Parsons, M 2003, 'Identifying spatial and temporal patterns in the hydrological character of the Condamine-Balonne River, Australia, using multivariate statistics', *River Research and Applications*, Vol 19, pp 443-457.

Thoms, MC, Hill, SM, Spry, MJ, Chen, XY, Mount, TJ & Sheldon, F 2001, *The Geomorphology of the Barwon-Darling Basin In The Darling Book*.

Turak, E, Flack, LK, Norris, RH, Simpson, J & Waddell, J 1999, 'Assessment of river condition at a large spatial scale using predictive models', *Freshwater Biology*, 41, 283-298.

Unmack, PJ 2001, 'Biogeography of Australian freshwater fishes', *Journal of Biogeography*, 28, pp.1053-1089.

Welcomme, RL 1985, *River Fisheries,* FAO Fisheries Technical Paper, 262, p. 330.

Wells, F & Newall, P 1997, *An examination of an aquatic ecoregion protocol for Australia,* Australian and New Zealand Environment and Conservation Council.

Wells, F, Metzeling, L & Newall, P 2002, 'Macroinvertebrate regionalisation for use in the management of aquatic ecosystems in Victoria, Australia', *Environmental Monitoring and Assessment,* 74, pp. 271-294.

Whittington, J, Coysh, J, Davies, P, Dyer, F, Gawne, B, Lawrence, I, Liston, P, Norris, R, Robinson, W & Thoms, M 2001, *Development of a Framework for the Sustainable Rivers Audit – a report to the Murray Darling Basin Commission*, August 2001 Technical Report no. 8/2001, Cooperative Research Centre for Freshwater Ecology, Canberra.

Whiting, AS, Lawler, SH, Horwitz, P & Crandall, KA 2000, 'Biogeographic regionalisation of Australia: assigning conservation priorities based on endemic freshwater crayfish phylogenetics', *Animal Conservation 3*, pp. 155-163.

SECTION 5

THEME THREE

Case Studies: innovations in protecting freshwater habitats

CONTENTS

5.1

Protected Areas in the Murray-Darling Basin: The Role of 'The Living Murray' and the Native Fish Strategy

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Murray-Darling Basin Commission

Introduction

Evidence continues to grow of the declining condition of the Murray-Darling Basin's (MDB) natural resources: native fish species are in severe decline, in both distribution and abundance, wetlands are contracting and water quality is degrading. A snapshot study undertaken recently found that 70% of the length of the river habitat in the Murray Darling Basin has been modified in some way (Norris et al. 2001).

The realisation that Australia's freshwater biodiversity is declining has seen the introduction of federal legislation and strategic tools aimed at the conservation and protection of these resources. In 1996 a National Reserve System was established to fulfil the need for terrestrial protected ecosystems, and the National Representative System of Marine Areas was established to fulfil the need for marine protected ecosystems (Barrett and Ansell 2003).

Protected areas are 'an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means' (International Union for the Conservation of Nature [IUCN] 1994). Categories of protected areas are based on management objectives (defined by IUCN) and range in intensity of human use from strictly protected nature reserves through to areas managed for multiple use (e.g. community forests) (Department of the Environment and Heritage 2004).

Traditionally, biodiversity conservation in Australia has focused on terrestrial, and to a lesser extent marine, systems. Although terrestrially-focused protected areas (e.g. National Parks and reserves) provide some incidental protection to freshwater aquatic systems, management is predominantly focused on terrestrial biodiversity values, with conservation of aquatic biodiversity

given lower priority (Mancini 2005). Currently there is no long term protection for freshwater aquatic areas. In many states there is legislation which could be used to further the protection given to freshwater areas, however, in most cases this is yet to be acted upon (Cullen 2003).

In response to the declining health of the Basin's freshwater ecosystems, the Murray Darling Basin Ministerial Council (MDBMC) has established a number of initiatives, which have the capacity to afford greater protection to freshwater habitats and biodiversity. These include 'The Living Murray' initiative (TLM) and the Native Fish Strategy (NFS).

The Native Fish Strategy

The NFS was established to provide measures in the Murray-Darling Basin to sustain viable fish populations and communities throughout its rivers. The goal of this strategy is to rehabilitate native fish communities in the Basin back to 60% of their estimated pre-European settlement levels over a period of 50 years. In order to achieve this goal, six driving actions have been identified. The second of these – protecting fish habitat – recognises the need for establishing freshwater protected areas in the Basin. The NFS is proposing to establish a number of protected areas in the MDB called habitat management areas (HMAs). At this stage HMAs are only conceptual and are still being developed (MDBC 2003).

HABITAT MANAGEMENT AREAS

Habitat management areas (HMAs) are areas of land which will be protected by state legislation to ensure their condition is maintained or enhanced. An HMA might be a:

- habitat which supports a unique fish community
- habitat in pristine condition that supports a healthy community
- location where existing management practices have already contributed to the enhanced values of the area (MDBC 2003).

Once in place HMAs should protect important habitat for aquatic and riparian biota, subsequently helping to preserve biodiversity and prevent the loss of many species that rely on these areas to complete their life cycles such as reproduction, recruitment and growth (Barrett and Ansell 2003). HMAs will also improve the overall health of the Basin's rivers and floodplains and enable threatening processes such as the impacts of reduced water quality to be more closely managed (MDBC 2003).

Once an HMA is established it can be protected permanently by legislative power, focusing on conserving habitat and biodiversity for the long-term through integrated management plans (MDBC 2003).

HMAs will integrate a 'multiple-use management' framework and thus would not normally exclude popular recreational pursuits such as fishing and camping, which are important to many local communities along the Basin's inland waterways. State fisheries and catchment management legislation already contain provisions for closed seasons, closed areas and protection of critical habitats. A system of habitat management areas may simply formalise and coordinate the protective measures already in place, and identify areas where additional measures will enhance and secure the viability of native fish and freshwater ecosystems (MDBC 2003).

The use of habitat management areas for recreational or commercial pursuits should be appropriate to the individual site and follow a hierarchical structure such as that adopted by the International Union for the Conservation of Nature. IUCN sites are categorised and range from areas of almost complete public exclusion to those that afford a 'sustainable flow of natural products and services to meet community needs' (IUCN 1994). Though strongly dependent on size, resource use may also vary within a management area, so that in some areas certain activities may be excluded while in others there may be multiple-use of resources.

The lower reaches of the MDB are in relatively poor condition but due to the type and rarity of habitat which occurs there, they warrant establishment of HMAs. Conversely there are a greater number of upland areas in relatively good habitat condition which would be suitable for HMAs; however, they are generally depauperate of native fish species (Barrett and Ansell 2003).

The establishment of habitat management areas will improve the connectivity of protected areas in the Basin and provide ecologically important areas with protection to ensure they are not further degraded.

The Living Murray

In mid-2002, the Murray-Darling Basin Ministerial Council established 'The Living Murray' (TLM) in response to substantial evidence that the health of the River Murray system was in decline. The council's concern was that the decline would threaten the Basin's industries, communities, and natural and cultural values (MDBC 2004a).

The goal of the TLM initiative is to achieve a *healthy working River Murray system sustaining communities and preserving unique values*. A 'First Step'[1] towards achieving this goal focuses on maximising the environmental benefits for six Significant Ecological Assets (SEAs) (MDBC 2004b):

- Barmah–Millewa Forest
- Gunbower and Koondrook–Perricoota Forests
- Hattah Lakes
- Chowilla Floodplain (including Lindsay–Wallpolla)
- Murray Mouth, Coorong and Lower Lakes
- River Murray Channel.

These six sites were chosen because of their ecological values, the range of habitats they encompass, their position on the river and the fact that their ecological health was in decline.

In order to ensure the ecological objectives of the First Step Decision are met, a number of environmental management plans are currently being developed to guide water application and delivery. These plans are habitat specific and will thus identify the specific watering regimes needed at each of the assets to maximise environmental benefits.

HELPING TO MEET THE OBJECTIVES OF EXISTING PROTECTED AREAS

Areas within the six SEAs are protected by international, national and state legislation. This ranges from international treaties for migratory bird species with China (China–Australia Migratory Bird Agreement [CAMBA]) and Japan (Japan–Australia Migratory Bird Agreement [JAMBA]), Ramsar, and international biosphere reserves, to national parks and reserves and state

TABLE 1. DESCRIPTION OF THE CURRENT PROTECTION OF THE SIX SEAS

Significant Ecological Assets	Level of Protection	
	International	National and State
Barmah-Millewa Forest (New South Wales, Victoria)	Ramsar CAMBA JAMBA	National Forest State Forest
Gunbower and Koodrook-Pericoota Forests (New South Wales, Victoria)	Ramsar JAMBA CAMBA	State Forest
Hattah Lakes (Victoria)	Ramsar JAMBA CAMBA Biosphere Reserve	National Park
Chowilla Floodplain (including the Lindsay-Wallpolla System) (South Australia, Victoria, New South Wales)	Ramsar JAMBA CAMBA Biosphere Reserve	National Park State Forest
Murray Mouth, Coorong and Lower Lakes (South Australia)	Ramsar JAMBA CAMBA	National Park
River Murray Channel (New South Wales, Victoria, South Australia)		

forests. The differing levels of protection afforded to each of the SEAs is summarised in Table 1.

TLM will provide protected areas within the SEAs with improved water regimes, that more closely match what is required to meet the ecological objectives for each site. This will be achieved through water recovery and changed management of existing water resource infrastructure. Maintaining more natural flow regimes while still meeting requirements for regulated supply may be among the most important strategies for freshwater biodiversity conservation (Poff et al. 1997). In some cases re-operating flow structures to achieve ecologically sustainable water management may be equally if not more important than protected area designation (Poff et al. 1997). In addition to providing environmental flows to the six SEAs, TLM will also develop works and measures to improve habitat condition within these assets, optimise the benefits of water recovered for the SEAs and improve management of water currently available.

Each state has management plans currently in place for protected areas within the SEAs which promote an integrated approach to management, involving a range of agencies and the community (Parks Victoria 2004). Victoria, for example, has in place strategic management plans for each Ramsar-listed site (with the exception of Edithvale-Seaford Wetlands) (NRE 2002). Some of these Ramsar-listed wetlands lie within national parks such as the Hattah-Kulkyne Lakes and thus require management in accordance with the objectives set out by the *National Parks Act 1975* (Vic) (NRE 2003a). Other Ramsar-listed areas such as Gunbower Forest lie within state parks and are thus reserved and managed in accordance with the *Forests Act 1958* (NRE 2003b). The objectives of the protected areas vary in accordance with their IUCN category. Areas in pristine condition generally have strict regulations to ensure the habitat condition is maintained. Other areas, in less pristine condition have regulations which allow the protected area to be used for recreational purposes and natural resource uses such as timber harvesting.

The main objectives of protected area management plans are to 'facilitate conservation and wise use, and in some cases, restore' the site so as to maintain biodiversity and/or cultural values (NRE 2002).

Although the objectives of TLM are specifically focused on achieving ecological outcomes for the six SEAs they complement those identified by MDB jurisdictions, National Parks and State Forests management plans. For example, a main objective of the *National Parks Act 1975* (Vic) is to 'maintain, protect and preserve indigenous fauna and flora' (Parks Victoria 2004). TLM will help achieve this objective by providing environmental flows to those SEAs within Victoria.

A major objective of most of the protected areas within the MDB is to preserve and protect the natural environment. Many of the fauna and flora in these protected areas rely on specific watering regimes to survive. The River Murray Channel, which is an SEA, connects protected areas along its length, often a problem encountered when establishing freshwater protected areas. The River Murray Channel also provides a passageway for fish and other biota to access other areas within the MDB. TLM Environmental Works and Measures Program has undertaken works and measures in the River Murray Channel such as fishways, which improve fish passage along the length of the Channel and provide greater opportunities for fish to move between SEAs and hence protected areas.

Summary

The NFS and TLM are working together to protect the integrity of aquatic habitats and biodiversity within the MDB. The NFS is working to establish habitat management areas for the purpose of conservation of native fish populations within the Basin. This will involve designation under state legislation which is largely in place, providing a mechanism for the protection of riparian and instream habitats, combined with the provision of environmental flows under TLM.

Furthermore, TLM initiative provides existing protected areas within the SEAs with an integrated approach to catchment management, the chance to improve water regimes, and contribute to meeting objectives for protected sites.

A major problem faced in the establishment of protected areas across river systems is the lack of longitudinal connectivity between sites. The River Murray Channel Asset within TLM will partly address this, given its longitudinal boundary extends from Hume Dam in the Upper Murray to Wellington at the head of the Lower Lakes. Activities along this asset, such as fishway construction at locks and weirs, are already starting to address issues of connectivity, by providing greater opportunities for fish to move between sites.

References

Barrett, J & Ansell, D 2002, 'The Practicality and Feasibility of Establishing a System of Freshwater Protected Areas in the Murray-Darling Basin', *Aquatic Protected Areas: What Works Best and Why? – Proceedings of the World Congress on Aquatic Protected Areas, Cairns, Australia, August 2002*, (Eds.) JP Buemer, A Grant & DC Smith, Australian Society for Fish Biology, Brisbane, pp. 601-613.

Cullen, P 2003, 'The Heritage River Proposal – Conserving Australia's Undamaged Rivers', *Proceedings of the World Congress on Aquatic Protected Areas, Cairns, Australia, August 2002*, (Eds.) JP Beumer, A Grant & DC Smith, pp. 513-520.

DEH 2004, *Six IUCN Protected Area Categories,* Department of the Environment and Heritage, Australian Government, Canberra, available at <http://www.deh.gov.au/parks/iucn.html> [accessed 10th February 2005].

IUCN 1994, *Guidelines for Protected Areas Management Categories*, IUCN, Cambridge, UK and Gland, Switzerland, p. 261.

Mancini, L, Formichetti, P, Anselmo, A, Tancioni, L, Marchini, S & Sorace, A 2005, 'Biological quality of running waters in protected areas: the influence of size and land use', *Biodiversity and Conservation*, 14, 351-364.

MDBC 2003, *Native Fish Strategy for the Murray Darling Basin Commission 2003-2013*, Canberra, ACT.

MDBC 2004a, *The Living Murray Business Plan*, Murray Darling Basin Commission, Canberra, ACT.

MDBC 2004b, *The Living Murray Environmental Works and Measures Program*, The Murray Darling Basin Commission, Canberra, ACT.

Norris, RH, Liston, P, Davies, N, Coysh, J, Dyer, F, Linke, S, Prosser, I & Young, B 2001, *Snapshot of the Murray-Darling Basin River Condition*, report to the Murray-Darling Basin Commission, Canberra, ACT.

NRE 2002, *Management of Victoria's Ramsar Wetlands: Strategic Directions Statement*, Department of Natural Resources and Environment. Melbourne, Victoria.

NRE 2003a, *Hattah-Kulkyne Lakes Ramsar Site: Strategic Management Plan*, Department of Natural Resources and Environment, Melbourne, Victoria.

NRE 2003b, *Gunbower Forest Ramsar Site: Strategic Management Plan*, Department of Sustainability and Environment, Melbourne, Victoria.

Parks Victoria 2004, *Ramsar Wetlands*, Melbourne, Victoria, available at <http://www.parkweb.vic.gov.au/1process_content.cfm?section=41&page=25> [accessed 18th February 2005].

Poff, N, Allan, J, Bain, M, Karr, J, Prestegaard, K, Richter, B, Sparks, R & Stromberg, J 1997, 'The Natural Flow Regime: a paradigm for river conservation and restoration', *Bioscience*, 47, pp. 769-784.

5.2

Wilgara Wetland: a private Ramsar listing

ERIC FISHER

Environmental values of the Wilgara Wetland Ramsar site

The Wilgara Wetland is part of the Macquarie Marshes, which is situated two-thirds of the way along the Macquarie River in central west NSW. The Marshes are a flow-through marsh that is currently under threat from upstream extractive water use.

The site at Wilgara is very representative of healthy functioning wetlands. It supports a range of wetland vegetation including river red gums, coolabahs, lignum, water couch and some phragmities reed. At times of flood a number of waterbirds, including colonial nesters, breed at this site. It has one of the most diverse colonies within the Macquarie Marshes. Species include four species of egrets, three of ibis, spoonbill, heron, ducks etc.

Being a Ramsar site the Wilgara Wetland also supports a viable and sustainable beef cattle enterprise. This is considered a 'wise use' of wetlands under the Ramsar Convention.

What Ramsar listing our private land means to us

My family and I decided to Ramsar-list our land in 2000 because we wanted to ensure its environmental value were given as much protection as we felt we could possibly give. From our point of view this involved entering into a management agreement that would enable the 'wise use' of the land, that being beef cattle production, while still maintaining its environmental values. We feel very strongly that environmental outcomes and agriculture do not have to be mutually exclusive. Parts of the Macquarie Marshes have suffered a great deal of decline and we did not want to see that happen to our land.

We were led to believe at the time of signing the agreement that Ramsar listing actually protected wetlands of international importance - a fact we have sadly come to realise is not true in this state or country.

Since listing in 2000

Since we listed our Ramsar site it has degraded to a state that is quite distressing. While it is not as bad as many parts of the Marshes it can not be regarded as a healthy functioning wetland. This is due primarily to the water management within the Macquarie Valley by the water agencies. The number and detail of management decisions that have been detrimental to the Marshes almost beggars belief. While my family and I stay faithful to the management agreement we signed to protect the Wilgara Wetland it seems other signatories have not taken their commitment nearly as seriously.

The other point to mention is the involvement of non-government organisations (NGOs) in this process. During the listing procedure we had enormous support from NGOs and we could not have completed the listing without their help. However since then they have had very little contact with us at all. At a time when many NGOs could and should be sounding alarm bells to the powers that be about wetland decline they seem to be very quiet, almost silent. We feel they put the Marsh issues in the 'too hard basket'.

They tend to use the Marsh and Private Ramsar Managers as publicity tools. It sometimes appears there is an endless stream of visitors to the area, but as soon as they leave the issues and problems facing this wetland are quickly forgotten.

Ramsar listing of private land by landholders is used to make various governments and NGOs look as if they are actively protecting wetlands. This is wrong – Ramsar listing or a convenant of any type does not automatically ensure the protection of any wetland. There are a suite of excuses to defend why this is not the case and 'buck passing' is the one used most of all. The fact is that while landholders are required to agree to very stringent management practices, governments' responsibilities are not so prescriptive. Perhaps this is the area of protection that needs to be more examined.

NSW Ramsar Managers Network

In February 2003 a meeting of all Ramsar stakeholders was held in Canberra to look at ways of ensuring a greater level of support for Ramsar managers. This meeting resulted in the formation of the NSW Ramsar Managers Network (RMN) thanks to the support of the NSW Minister for Environment and Conservation. This group is still in its infancy but hopefully will begin to address the areas which currently see our listed wetlands still degrading.

The aims of the RMN are to:

- get ministerial acknowledgement of the Ramsar Managers Network by both state and federal ministers
- to reverse wetland degradation and establish more sustainable management of river systems.

Conclusion

It is naive to think that a simple conservation covenant will automatically protect a piece of land or waterway. It needs a very high level of commitment and will by those entering into the agreement. Governments and NGOs have neglected to understand that a great deal of responsibility goes with signing such agreements. It is not a matter of signing and all will happen automatically. Active and hands-on management is also part of the responsibility, as well as making hard and sometimes unpopular decisions. Until all players are willing to accept this view and responsibility, our rivers, floodplains and wetlands will continue to pay the price.

5.3

Murray Wetland Watering – a partnership between conservation and irrigation

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Murray Irrigation Limited (MIL), the NSW Murray Wetland Working Group (WWG) and irrigators have forged an innovative partnership to restore the health of wetlands on irrigation farms. The partnership is innovative given that WWG is a conservation group and MIL is Australia's largest private irrigation company. The project emerged as irrigation infrastructure has significantly affected the natural flow of flood waters across the landscape resulting in many wetlands having not been flooded for up to 40 years. Ironically, the answer to restoring the wetland ecology lay within the very cause of the problem – delivering water through irrigation infrastructure. The wetland watering project has succeeded in terms of irrigator participation. In the last three years the number of sites involved has grown from 11 to 68 sites. There have been significant biological responses in existing vegetation, an emergence of wetland plants and an increase in bird life. The trial has had its minor difficulties caused by cultural differences in the groups involved and animosity over the environmental allocation. However the project has delivered many benefits in terms of changing attitudes to improve environmental outcomes in the medium to long term. This success means MIL is keen to see the continuation and growth of the wetland watering program.

The players

NSW MURRAY WETLAND WORKING GROUP

The NSW Murray Wetland Working Group is an independent, incorporated community-based group. It was established in 1992 by the Murray and Lower-Murray Darling Catchment Management Committees to address degradation of wetlands along the Murray River, and to develop and implement management programs for wetlands. The group's objectives are to develop a strategic approach to the management and rehabilitation of wetlands throughout the Murray and Lower-Darling Catchments in NSW and implement management programs at selected wetlands.

WWG projects include:

- trial watering of wetlands on private property
- development of the Murray River wetlands database
- Steven's Weir fishway on the Edward River near Deniliquin
- development of a wetland monitoring kit
- development and implementation of a management plan for Thegoa Lagoon.

Working group members include independent landholders, representatives of community groups, local councils, non-government and government agencies. Participating organisations include:

- Murray and Lower-Murray Darling Catchment Management Boards
- Australian Conservation Foundation
- NSW Department of Infrastructure, Planning and Natural Resources
- NSW Environment Protection Authority
- NSW Fisheries
- NSW National Parks and Wildlife Service
- NSW State Forests
- Murray Darling Basin Commission
- Murray Darling Association
- Murray Darling Freshwater Research Centre
- Wetland Care Australia
- Yorta Yorta Nation
- Wentworth and Hume Shires / Albury City Council.

MURRAY IRRIGATION LTD

Murray Irrigation Limited, a private irrigation company based in Deniliquin NSW, was established on 3 March 1995 when the NSW Government Murray Irrigation Area and Districts were privatised. Each irrigator is a shareholder in the company. There are ten elected company directors; eight are irrigator member directors and two are directors with special skills in engineering and finance. Murray Irrigation is the largest privately owned irrigation supply and drainage company in Australia, with an entitlement of 1.445 million megalitres, which is 67% of the NSW share of Murray River irrigation entitlements. Murray Irrigation's infrastructure is valued at $470 million and with an annual turnover of $35 million. All operation, maintenance and refurbishment costs are covered by shareholder water charges.

Setting the scene

THE NEED IDENTIFIED

Murray Irrigation's area of operation and the surrounding landscape is some of the flattest land in the world. Much of it is floodplain, traversed by a network of creeks, depressions and flood runners. The expansion of irrigation and development of infrastructure such as drains, channels, levees and access tracks significantly affected the natural flow of flood waters to the network of creeks, depressions and flood runners, leaving many ephemeral wetlands permanently dry. It is estimated that some wetlands in the area have not been flooded for up to 40 years, causing significant change to their ecology and the region's biodiversity.

THE IDEA

Given the level of development of the irrigation district, it seemed an impossible task to restore natural flows to isolated wetlands, particularly on farms. Ironically, the answer lay within the very cause of the problem – irrigation infrastructure. It was David Leslie, from NSW State Forests, who first suggested using the irrigation system to deliver water to these wetlands, an idea which was developed into a three-year trial to water wetlands on private property.

WATER AVAILABLE

The allocation was part of the dowry package negotiated when Murray Irrigation was privatised, and represented a return to the environment from government investment in upgrading the company's irrigation supply system to create savings. The state government entrusted 30 000 ML to the WWG for a three year trial to support environmental improvements of wetlands in May 2001.

THE UNKNOWNS

The environmental science in this area was almost non-existent, so this project represents almost entirely new research. Conservationists and native vegetation specialists were uncertain what ecological benefits could be gained from the artificial watering of ephemeral wetlands. Seasonal wetlands had once been flooded every seven years or so. Experts were unsure that these wetlands could recover after 40 years in a radically changed environment, or that any viable seed would remain to kick start regeneration. Some believed the watering could, in fact, cause further strain to an already stressed ecological system. Others, like David Leslie, believed there could be at least a short term reprieve, or possibly a turnaround in the gradual decline of the vegetation in these areas over the past 15 to 20 years. These uncertainties would have made it easy to reject the project.

ATTITUDES

Landholder uncertainty was another significant issue in getting the project off the ground. For some landholders the idea of watering wetlands was and is total anathema. For years they had been told, and coerced through legislation and fines, to clear land for production and to keep their properties free of 'scrub' and understorey plants in order to reduce fire risk and vermin harbour. They have also been told to prevent watering ponding on their properties, as it represented waste and inefficient water use and may accelerate rising water tables and cause salinity.

Many members of the irrigation community also believe environmental initiatives threaten their businesses and it was initially quite difficult to convince landholders about the potential value of the project. The Living Murray process threatens to take away up to 1,500 gigalitres from the Murray-Darling Basin over and above recent reforms which have reduced average irrigation yield in the district from 111% to 87% of entitlement. Changes to vegetation clearing laws and emergence of species recovery plans have further contributed to an anti-environment culture amongst the irrigator community.

Even irrigators who expressed an interest in the project were anxious about the possible consequences that might see them effectively penalised for supporting an environmental initiative. These concerns relate to possible land use restrictions which might be imposed by legislation should endangered flora or fauna be discovered. Landholders were uncomfortable about the presence of environmental experts on their properties, in case these experts should discover something the landholder hadn't realised was there, or didn't want publicised, again because of potential restrictions or changes that could be forced on their operations. In addition, they were concerned about reactions from neighbours if they used environmental water when the whole industry faced reduced allocations as a result of environmental initiatives.

Fortunately there were enough landholders willing to brave the uncertainties and take part in that first year. There were positive answers to many of the questions, and the project provided initial evidence that ephemeral wetlands could respond, even after decades without significant watering.

THE POLITICS

Landholders and town communities within Murray Irrigation's area of operations are heavily dependent on irrigated agriculture. Any initiative that may, potentially, threaten the region's access to water, or undermine irrigators' allocations is strongly resisted. A program using environmental allocation, resumed from irrigators, for environmental and biodiversity outcomes was always going to prove controversial.

The initial local reaction was largely influenced by a front page newspaper article 'Water Furore – environmental flows sold to irrigators', *Deniliquin Pastoral Times*, October 2001. The article was driven by concerns within some sectors of the community that the Wetland Working Group was 'profiteering' from the sale of environmental water – water that had been taken from irrigators. It was the first time that water earmarked for the environment had actually been sold in the district. Previously, environmental allocations had been 'lent' to irrigators and became part of the available resource for the year. This occurred during the first year of the trial, before there were any results to counter the negative messages which were picked up by a reasonable cross-section of the community. The sale of environmental water was used in opposing environmental flows debate for some time.

The story so far

THE SITES

Wetlands that were watered spanned a cross-section of wetland and vegetation types. Dominant communities included:

- black box depressions
- riparian transitional area
- red gum swamps
- tangled lignum swamps
- flood runners
- cumbungi swamps.

Sites span across MIL's area of operations and as shown in Figure 1.

As shown in Table 1 the growth in the watering program is a testimony to its success.

The amount of water used at each site was estimated by staff visiting the site or arbitrarily allocated six megalitres per hectare. In the first year of the trial, landholders began filling their wetlands towards the end of October 2001. In 2002 watering began at the start of October and this year watering will commence at the beginning of September.

FIGURE 1: WETLAND WATERING SITES 2001/2003

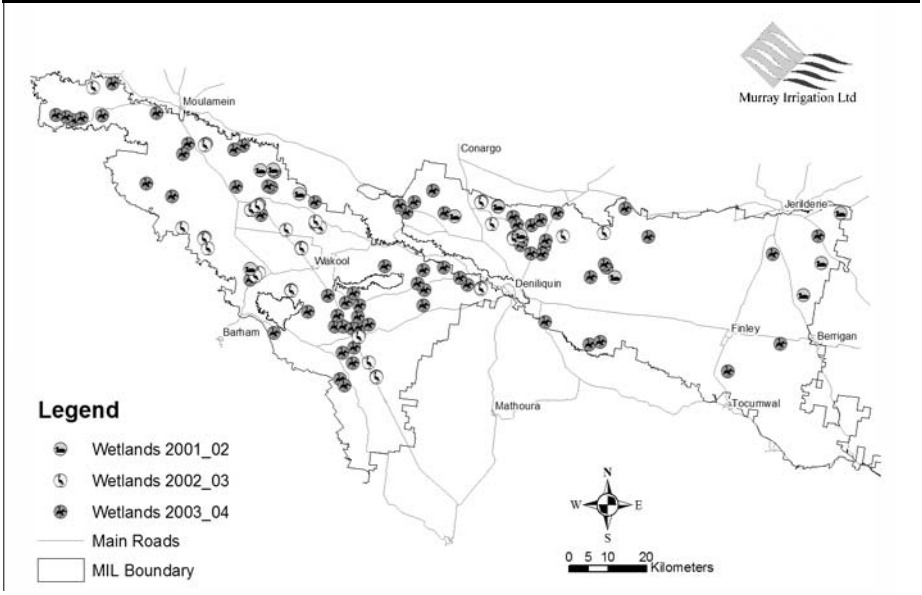

TABLE 1

YEAR	SITES	VOLUME (ML)	AREA (HA)
2001	11	569	232
2002	28	3085	561
2003	68	7016	1151

THE CONTRIBUTIONS

Landholder contributions to the project have been substantial, with agreement to eliminate grazing, manage site preparation, schedule watering and monitor wetland responses. Landholders participating in the program have committed to:

- using the water for designated purposes only, not consumptive use
- eliminate grazing by removing stock for an agreed period of time
- allow the site to be used for education / promotional purposes if required
- share costs relating to earthworks and fencing where applicable, and operational management of the site.

THE BIOLOGICAL RESPONSE

Flooding farm wetlands has created an immediate biological response. Early monitoring indicates improved health in existing vegetation and the emergence of various wetland plants. Bird response has also been encouraging with local and some less frequently seen migratory birds inhabiting the sites.

The Wetland Working Group monitoring program used vegetation and birds as response attributes to monitor the success of the trial. Changes to the vegetation community and bird composition were assessed along with the change in health of trees within the wetlands.

After watering, all sites displayed a positive growth in wetland plants with many previously unobserved wetland species recorded. Other changes observed after inundation included new growth on black box and tangled lignum, with both species starting to flower (Nias, Alexandera & Herring 2003). In the first year of the trial prior to watering there were 57 plant taxa; after watering, a total of 83 taxa were recorded from the quadrants in all 11 wetland sites for the 6 month monitoring period (Nias et al.). Average hourly counts of bird species increased at most sites after inundation. However, because the monitoring program was not a controlled experiment it cannot be stated with any certainty that the presence of the birds was a direct result of the watering (Nias et al.). Nine bird species were recorded that are listed under the NSW Threatened Species Conservation Act, and of these, four are also considered threatened species under federal legislation (Nias et al.). Eight migratory shore bird species were also recorded (Nias et al.).

THE COMMUNITY RESPONSE

Participating landholders were generally very pleased with the improvements in their wetland and in almost all cases they saw an improvement in the wetland beyond their expectations. Some comments made in support of the program included the following:

'On our side of the Box Creek tree health is not good. It was just fantastic to be able to water those trees. Between 25% and 30% of the mature trees on our property have been saved by the flooding process. We're just rapt.

There are so many sick and suffering trees. If the this project can help those trees it could be the difference between them living and dying. We need a healthy environment in among the irrigation, not just for tangible reasons, but also for the image of irrigation.'

Neil Bull, Union Plains, Deniliquin

'The growth was phenomenal. We were very surprised by all the things that came back. It was absolutely amazing the way the watering created new life – a whole new ecosystem. It's a pretty easy way to look after the environment. The trees are already there. All you have to do is water them.'

Lyndall Horne, Shady Park, Berrigan

'The wetland watering can be extremely worthwhile. We need to preserve what we have so our children, and our children's children can see what this region was originally like.'

Lorrine Hopper, Grassmere, Wakool

'The regeneration was spectacular. We never expected to see so much growth from a drink of water. It was awe-inspiring to see the number of different plants – aquatic and bush plants – that were actually there.'

Chris Lahy, Uambi, Wakool

These comments show a great deal of landholder interest and enthusiasm in the project. At the end of the first year of the project a survey of participants was also undertaken with all involved indicating they would be involved again.

TABLE 2

TASK	MIL	NSW MWWG
Promotion material	MIL has produced and distributed to potential participants a colour four-page brochure in years two and three of the program	WWG promotes the project in the broader community with an article in the Ecological Management and Restoration Journal along with articles in their quarterly newsletter
Advertising	MIL advertises the program in our weekly fax newsletter, quarterly newsletters and through the print media	WWG has contributed to the cost of newspaper advertising
Fielding enquiries	MIL handles enquires about the program – sending out information and application forms	N/A
Site selection	MIL organises to meet landholders on site and guides WWG staff during site selection	WWG selects sites and notifies landholders as to the success of their application
Water delivery	MIL takes orders and delivers water through the supply system similar to other crop types	N/A
Water accounting	MIL transfers wetland allocations onto approved landholdings and accounts for its use transfering unused water back to the WWG	N/A
Water charges	MIL contributes half the delivery cost, around $4/ML, for first year of participation. Landholder pays in subsequent years	WWG pays half the delivery charge which is around $4 /ML and provides the bulk allocation free of charge
Compliance	MIL ensures that water is being used for wetland watering	N/A
Monitoring	In the first year of the program MIL funded the bird survey component of the monitoring along with an opinion poll of participants. In year two MIL monitored 19 sites taking photos on two occasions as a minimum	In the first year of the program WWG monitored all 11 sites. In year two, nine sites were monitored intensively. Intensive mirorring requires two full-time staff visiting sites every three weeks for six months assessing changes in vegetation, birdlife and water salinity

Summing up the relationship

The wetland watering initiative provides an opportunity for MIL shareholders to become participants in conservation work which will benefit the biodiversity of the region, improve the vegetation and bird life on their farm and enable us to showcase that MIL shareholders are undertaking positive environmental initiatives.

THE BENEFITS

There are no direct benefits for the company, however indirectly the project has delivered many benefits in terms of changing attitudes to improving environmental outcomes in future. This investment is anticipated to return significant company and community benefits in the medium to long term.

Turning around the vegetation attitude

The most significant community gain has come from people witnessing the rapid improvements in vegetation health which has triggered an interest in vegetation protection. The MIL area of operations, like many irrigation areas, has a relatively low level of interest in vegetation protection or rehabilitation initiatives. This project has sparked the enthusiasm of the participants in vegetation works. The project has proven to be a very valuable education and engagement tool to move landholders into vegetation protection and enhancement works. The timing has also been fortunate, as the Murray catchment board has set some ambitious vegetation targets for the area. This program will undoubtedly play a positive role in achieving these targets.

Regional value from environmental water

One of the key values of this project has been to return benefit to the region where the environmental allocation of 30,000 megalitres was sourced. In the past the community in the region has seen the environment flow debate in a very negative light because water is likely to be taken from this region to benefit another. However, this project allows a growing portion of the community to appreciate that environmental allocation can return some value to our region.

Develop an understanding between production and conservation

This project has been a major success in developing a positive partnership between groups which are often seen at odds with each other. This partnership is bringing together two groups that in terms of the water debate are traditional adversaries. The partnership is resulting in a better understanding of each others' issues and priorities and it is expected this will lead to more balanced and common sense outcomes in resolving future environmental issues.

Irrigation company partnership in an environmental project

MIL believes environmental partnerships will improve our business credibility as we display our awareness and willingness to resolve environmental issues. We are also demonstrating our environmental credentials by contributing resources into environmental outcomes that have little direct benefit to the business.

Broadening the focus of environmental flows

MIL believes the environmental flow debate in the Murray focuses too much on volumes rather than ecological health. Many other important issues impact on the riverine ecology other than volumes of water. Hopefully the use of environmental allocation on things other than delivering volumes to the lower Murray system will help secure river health as the key issue rather than megalitres of water. We would like to see MIL's leadership in providing environmental benefits through using environmental allocation away from the lower end of the Murray help broaden the river health options up for debate.

THE DIFFICULTIES

Cultural differences

As with any relationship where parties have significant differences there have been some difficulties in implementing this project. The key difference between parties is that the WWG is a water conservation group and MIL is a water resource user. There are also key differences in how these types of groups operate. We have people from different professional backgrounds working for our organisations and in terms of operations, our core businesses are vastly different. Minor disagreements have arisen on issues relating to cost shares, water sales and acknowledgement of contributions from each party. None of these differences have compromised the project or been large enough to jeopardise its continuation.

Conclusion

MIL is keen to see the continuation of the wetland watering program, given that the three-year trial was due to finish at the end of 2003 and a decision on its future is pending. The program has succeeded in terms of irrigator participation, biological response and developing a better understanding between conservation and irrigation groups. Importantly for the irrigators it has shown that environmental benefits do not have to come at the cost of irrigator's business viability. The trial has helped improve the level of acceptance of vegetation initiatives in the community; however, government needs to develop a more consultative approach before broad scale change is realised. Further improvements in the relationship between irrigation and conservation could be achieved by MIL or a participant from the irrigation region being represented on the WWG.

Notes

1. The First Step marks the start of the council's collective action to return the River Murray to a healthy working river. http://www.thelivingmurray.mdbc.gov.au/

Reference

Nias DJ, Alexandera P & Herring M 2003, 'Watering private property wetlands in the Murray Valley, New South Wales', *Ecological Management & Restoration*, Vol 4, 1.

SECTION 6

THEME FOUR

Involving the community

CONTENTS

6.1

On the historical signing of the Yorta Yorta Co-operative Land Management Agreement between the Victorian Government and the Yorta Yorta Nation

HENRY ATKINSON
Yorta Yorta Nation

I have been asked to comment on the historical Yorta Yorta Cooperative Land Management Agreement between the Yorta Yorta Nation and the Victorian Government, but before I do I want to touch on the Murray Darling Basin and MLDRIN, the Murray Lower Darling Rivers Indigenous Nations.

It is slightly ironic that this year, 2004, I am asked as the spokesperson of the Yorta Yorta Nation to speak to a conference on freshwater protected areas.

In the past, the Indigenous people of this land were not considered by the bodies appointed by governments to know anything at all about the rivers, plants, and creatures of a land we have lived on for 40 000 to 60 000 years.

It was way back that my people were so concerned about the disruption to the river system and that was mainly the Dhungala, which you know as the Murray River, that they asked the government to charge a tax on the river boats. The money was to be directed to the Indigenous people to supplement the loss of one of their main sources of traditional food, that being the fish of the river.

It had been noted by the Indigenous people that this food source was being depleted and the main cause was pinpointed as being due to the vast number of river boats churning up and down the river and disrupting the breeding of fish. And along with this loss of fish was the invasion of their natural hunting grounds by settlers and farmers adding to the distress to my people.

My people were not only concerned for their wellbeing but that of the whole river system. The danger pointed to a greater concern radiating to all living creatures within the system and the surrounding land, and when expressed to the authorities no one bothered to listen. Now we are in extreme danger of allowing this mighty river system to die and where will we all be then?

This conference is a good thing and will, with any luck at all, place great emphasis on the river system of the Murray Darling Basin, from the tiniest feeder creeks in Queensland,

New South Wales and Victoria all the way down to the mouth in South Australia. My hope is that it will awaken more and more people to the fact that this situation which is in the hands of governments and official bodies needs all Australians to 'do their bit' with less pollution and less water wastage for anything to work effectively.

I would like to see all governments acting stronger for the wellbeing of the waterways and the environment and less concerned about what they will lose in revenue. It is a sad fact of life that governments are money driven and in this instance the waterways are more important than all the money the governments may or may not get from revenue in relation to water.

Governments come and go but we, the people, are here for all time, and we must have our waterways protected for all by the elected bodies. Governments must be accountable for nonaction and I look forward to the day when governments of this prosperous country are fair dinkum and deliver what they say they will and not take forever in doing it. This sensitive river system cannot wait forever.

MLDRIN

The Murray Lower Darling Rivers Indigenous Nations was initiated by the traditional owners of the Lower Murray Darling Basin so we could have a collective voice for the Murray and Lower Darling River system.

In 1998 the Yorta Yorta met with traditional owner groups of the Murray Darling Basin, from the top of the mountains to the mouth of the Murray and from inland to the Minnidee Lakes and beyond. The then CEO of the Murray Darling Basin Commission met with our group, and with their help we formed MLDRIN.

The Murray Darling Basin Commission supports our organisation in relation to resources and employment, thus enabling the Indigenous voice to have a say in caring for country and the waterways and for the protection of sacred sites etc.

The agreement

The agreement, The Yorta Yorta Cooperative Land Management Agreement, although not the first with a government department (as we have agreements with Vic Roads) is one of an historical nature due to it being the first time the State Government of Victoria has come to any agreement with the Indigenous people of this country.

It took some three years of work by the Yorta Yorta Nation, our solicitors Arnold Bloch Leibler and Partners, and the representatives of the Victorian State Government to reach a binding agreement. While this agreement gives the Yorta Yorta Nation a much welcomed say, it is not legislation and this is what we will be striving for.

Clause 13 of the agreement identifies its objects, which are to facilitate: The active and resourced involvement of the Yorta Yorta people in decisions about the management of the Designated Areas, including the integration of Yorta Yorta knowledge, internal decision-making processes and perspectives into management planning and works programming; the development of mutual recognition and trust between the Yorta Yorta people and the state; and the identification and promotion of employment, training and economic development opportunities for the Yorta Yorta people.

This agreement gives hope to a people who have had their life structure dramatically altered due to the invasion in 1788.

Not that this agreement will undo the past for it will not, nothing can undo the suffering, the loss of identity, religion and the destructive breakup of families. Nothing can take the sorrow away from the hearts of my people and all our descendants, but with this agreement it gives us hope.

We at last have been identified as the people of this land and acknowledgment of the fact that we are here and will always be here.

The Indigenous life was self-sustaining before 1788, where family groups lived in relative harmony with others and all the land entails. Invasion took away the land, the food and the whole being of my people.

We have not been able to sustain a decent living with declining health and reliance on the welfare system to just survive.

With this Cooperative Land Management Agreement we will not only derive funding but knowledge and employment. This will go to the education, employment, and improved health for my people and eventually see us off the welfare merry-go-round.

The Indigenous people have a lot to give and want to be self-sustaining and be in control of their own destiny. This agreement will enable the Yorta Yorta people to voice their opinion and play a part in the Living Murray Initiative, especially with the icon sites which are within Yorta Yorta country.

Our cultural sites are protected by the Cultural Heritage Acts but now with the Yorta Yorta Cooperative Land Management Agreement they are protected by their rightful people, enabling the Yorta Yorta Nation to have a greater say in protection of the sites and others which may be discovered in the future.

As I mentioned the Yorta Yorta are looking to the future with the Cooperative Land Management Agreement being the stepping stone to legislation and bringing on board the Government of New South Wales in negotiating an agreement with them in regards to the Millewa Forest. It is important for the wellbeing of the whole forest area, the Barmah Forest on the Victorian side of the river and the Millewa Forest on the New South Wales side, to be covered by an agreement enabling the Yorta Yorta to care for this part of their traditional land.

The New South Wales Government has declined to enter into any similar dialogue with the Yorta Yorta Nations in trying to protect this environmentally sensitive area on their side of the river system.

The Yorta Yorta are working towards the whole area of the Barmah and the Millewa forests in becoming a national park.

This first agreement is a stepping stone for the next agreement, which is already on the table: the Aspirations Agreement. Not only will these agreements put my people on the path to self-determination with the funds they provide, but they show the greater community the respect the state has for the Indigenous population.

Respect and acknowledgement by a government body will enable my people to re-gain their rightful place on this land and so in someway enabling us to live a life more in keeping with the wider population of a very prosperous country and not, as we have now, one of being a second class citizen in our own land. It is with these aspirations of bringing my people to this standard of living that makes the Yorta Yorta work so hard in obtaining a level playing field for all Indigenous Australians.

I commend the members of this conference and thank them for their continued diligence and care for this land and the waterways which I hold dear. I hope that their recommendations are well received by participating bodies and by the government on a whole and are acted upon in a hasty manner to keep one of the mightiest river systems in the world alive and well for all our children and grandchildren.

To not take heed will see the once proud, swift flowing Dhungala of my childhood die ,and from that there will be no return. What will we then say to the children of Australia, non-Indigenous and Indigenous?

Thank you.

6.2

Sustaining community involvement in the rehabilitation of an urban creek corridor: the Merri Creek example

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Introduction

'The Merri Creek Management Committee respects and honours the spirit of the land and its peoples, indigenous plants and animals, and works with the community to preserve, restore and promote the Merri Creek, its catchment and neighbouring region as a vital living system', (MCMC mission statement 1999).

The Merri Creek catchment forms part of the original lands of the Wurundjeri people (Ellender & Christiansen 2001). It rises north of Melbourne, Victoria, in the foothills of the Great Dividing Range near the town of Wallan, and flows south through the basalt plains of the Victorian Volcanic Plains Bioregion. The upper third of the creek flows through predominantly rural land, before meeting the rapidly developing rural-urban interface and flowing through the culturally and linguistically diverse northern suburbs of Melbourne before joining the Yarra River at inner-suburban Clifton Hill (see Figure 1). Although parts of the creek corridor are severely degraded and the in-stream ecology is in largely poor condition, significant patches of the original vegetation remain. The creek and its adjoining lands still provide habitat for indigenous flora, fauna and ecological communities, including some that are rare or threatened. The creek corridor also provides important parkland – 'breathing space' – for local residents, particularly in its densely populated urban reaches.

Biologically, the Merri Creek corridor is considered a habitat corridor of regional to state significance (McMahon & Schulz 1993; NRE 2002a). It contains a number of endangered ecological vegetation classes (NRE 2000b) including escarpment shrubland, streambank shrubland and plains grassland, the latter of which less than 0.1% remains (Craigie 1998, Muir 1999). The native grasslands of the creek corridor are also home to significant populations of the 'critically endangered' Golden Sun Moth[1] (rediscovered south of the Great Divide after 90 years absence by an MCMC staff member and a community member in December 2003) MCMC 2004) and to key populations of the 'vulnerable' Growling Grass Frog[2].

The creek lands were important and productive for the Wurundjeri Willam, the area's traditional custodians (Ellender & Christiansen op.cit.). With European settlement, the native grasslands became prime locations for sheep grazing. Urban expansion, both residential and industrial, came to Merri Creek's lower reaches in the late 19th century and with it, a loss of recognition of the creek's natural values. By the 1970s, mirroring widespread changes elsewhere in Australia, local communities had begun to appreciate the values and potential of the creek corridor. Successful community action was taken to restrict further development and ecological, aesthetic and recreational values were promoted.

Merri Creek Management Committee was formed in 1989, beginning a 15-year program of cooperation between agencies and the community in both the coordination of management and the delivery of on-ground works in the Merri Creek corridor. During this time MCMC has gained considerable experience in involving the local community in ecological rehabilitation and in developing a more healthy relationship between people and their local waterway. It is this 15-year experience of involving the local community which is reflected on in this paper.

The key factors in sustaining involvement include:

- community origins of the Merri Creek project
- proper resourcing
- continuity of staffing
- appropriate structures and processes to facilitate formal involvement
- organisational commitment to regular, frequent informal opportunities for involvement
- shared vision and goals.

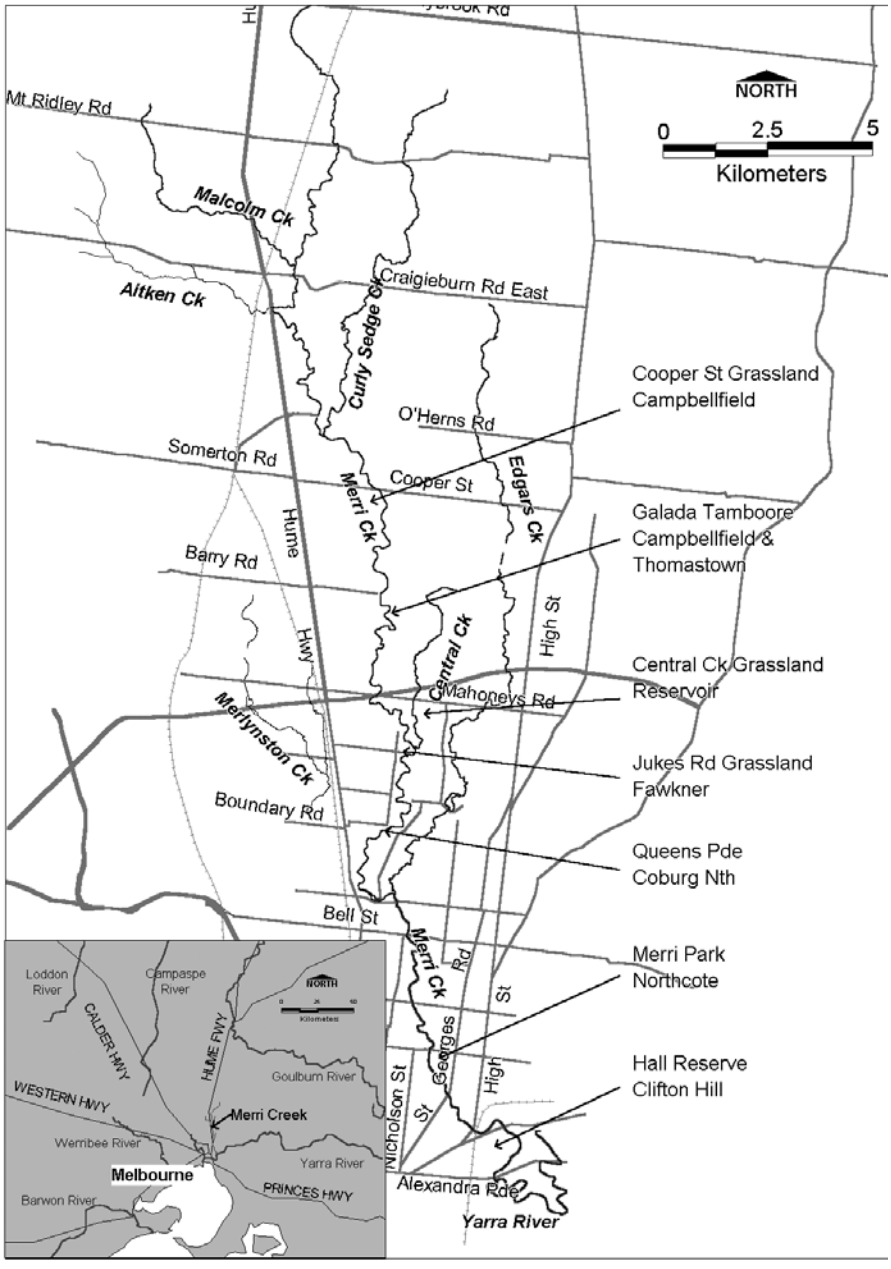
Background to community involvement

During the early 1970's a number of community groups dedicated to conserving Merri Creek in its 'natural' form were established in response to major development proposals for the creek corridor (Bishop, 1975). These proposals included a plan for the creek to be barrel-drained, in response to a major flood in 1974 (Earl 1974), a planned freeway (the F2) down the creek valley, and the proposed installation of high voltage overhead powerlines downstream of Brunswick (Brunswick – Richmond Powerline). In 1976 these groups, with the support of surrounding local councils, promoted the formation of the Merri Creek Coordinating Committee (MCCC), a voluntary advisory group made up of representatives from local government and community groups, intended to encourage a coordinated and cooperative approach to the protection and restoration of the Merri Creek, its environs and tributaries. The key vision was of a public open space corridor, revegetated with indigenous species, a familiar enough concept in 2004 but a radical view 30 years ago. The initial focus of this group was to prevent the construction of the Merri Creek Freeway and associated development, and to secure the creek corridor as public open space corridor (Radford 2002). The freeway reservation within the creek valley downstream of the Western Ring Road

was eventually revoked and with it, the rationale for barrel-draining dissipated. Following a prolonged campaign against the overhead powerlines, community groups again had success in the decision to locate the high voltage Brunswick-Richmond Powerline underground.

Merri Creek provides a meeting place for local communities, contributing to individuals' and communities' sense of belonging, both to place and to community. Bush et al. (op. cit.) argue that this sense is likely to have been deepened by the community's active involvement in the conservation, restoration and management of the area, particularly as it has involved a struggle to protect areas from alternative uses.

FIGURE 1: MAP OF THE URBAN AND URBAN-RURAL FRINGE OF MERRI CREEK'S CATCHMENT. THE SHADED AREAS INDICATED AREAS OF OPEN SPACE. THE INSET SHOWS MERRI CREEK'S LOCATION IN RELATION TO PORT PHILLIP BAY AND MAJOR WATERWAYS OF THE AREA



Merri Creek Management Committee formation

By the early 1980s it was clear that the task of coordinating activities along the creek required more than a voluntary committee. Management consultants were hired to advise on appropriate structure and funding arrangements for a new body. As consequence of this study's recommendations (Ernst & Whinney 1988) the Merri Creek Management Committee (MCMC), an incorporated association with paid staff[3], including a dedicated revegetation crew, was established in 1989. The original MCMC membership included relevant local governments (the cities of Broadmeadows, Brunswick, Coburg, Collingwood, Fitzroy, Northcote, Preston and Whittlesea), state government agencies (the Victorian Department of Conservation & Environment and Melbourne Water) and the community group Friends of Merri Creek (itself formed through a recommendation of the Ernst and Whinney study that a number of separate community groups amalgamate). The original funding arrangements for MCMC were proposed as a 50:50 contribution from state and local government, with revegetation works being undertaken on a fee for service basis.

Current MCMC structure and funding

As a result of council amalgamations, MCMC's local government representation has changed. More significantly, the state agencies have withdrawn from formal membership, due to a stated lack of ability to resource the group, and the state no longer contributes direct funding to MCMC. Nevertheless there continues to be a close working relationship with these agencies. Current MCMC membership includes the cities of Darebin, Hume, Moreland, Whittlesea and Yarra, and a relatively new member, the rural shire of Mitchell, which covers Merri Creek's headwaters and upper catchment. The Friends of Merri Creek remain a key member.

MCMC receives direct core funding from its member municipalities, and is successful in obtaining grants from state and federal programs as well as philanthropic trusts and industry programs. MCMC also tenders for

contracts, mainly from local or state government agencies. Total operating income 2003–04 was close to $900 000. Of this, $381 188 was provided directly from councils, the majority for MCMC's Planning and Coordination functions ($117 450) and its Parkland Management works ($187 855). Council grants also funded a number of catchment-wide education programs ($75 883), the largest of which was the community-based water quality monitoring and stormwater education program, Waterwatch[4] (see www.mcmc.org.au for further details). Continuity of funding from local government has allowed for organisational stability and staff continuity (a number of staff have been with MCMC since its inception), key factors in maximising community involvement.

Community involvement in MCMC's governance

MCMC's structure and decision-making processes reflect its commitment to genuine community involvement. MCMC's policies and priorities are set at quarterly meetings of its Committee of Management, the membership of which is made up of two representatives from local councils, (usually one council officer and one Councillor) and six representatives from Friends of Merri Creek. Sub-committees, including a Planning and Issues sub-committee, Merri Creek and Environs Strategy Implementation sub-committee, a finance sub-committee (all of which meet quarterly) and an executive sub-committee (meets monthly) are crucial to the good governance of MCMC. All sub-committees include representation from Friends of Merri Creek and, historically, representatives from Friends of Merri Creek have comprised the majority of MCMC's office bearers.

The ongoing commitment by MCMC's council members to maintaining a professional organisation, the very structure of which incorporates community representation, has been vital to MCMC's success and its ability to sustain community involvement.

MCMC's programs

One of the first integrated programs undertaken by the new MCMC was to commission the compilation of information on Merri Creek's flora, fauna, cultural heritage, geological and recreational values, and the statutory planning measures required to protect them. This eventually resulted in the production of the 'Merri Creek and Environs Strategy' (Merri Creek and Environs Strategy Steering Committee, 1999). The strategy sets out the strategic priorities, objectives and actions for the conservation and restoration of Merri Creek, to be undertaken by local government and other agencies, with MCMC in many instances in a support and coordinaton role. The vision of Merri Creek in the strategy is of *'a healthy living stream flowing through an attractive environment which provides habitat for native animals and is valued by the community as a peaceful, passive open-space haven'*. Aspects of this vision have already become a reality.

Currently MCMC has a staff of 14 people involved in a range of projects including restoration and revegetation works, strategic and statutory planning, and community education and water quality monitoring (see www.mcmc.org.au for more details). The ongoing program of vegetation management works along Merri Creek and its tributaries was commenced immediately MCMC was formed in 1989 and currently constitutes MCMC's largest program. The following discussion on community involvement will focus primarily on this work of MCMC's Parkland Management program. A high level of community participation has also been achieved in MCMC's Waterwatch and stormwater/litter community programs (see MCMC's Annual Reports). Important to involvement in specific programs has been MCMC's ability to achieve a frequent profile in local media and to produce numerous and regular publications, including a newsletter, brochures, reports and books.

Community involvement in parkland management works

MCMC's parkland management works fall into two categories: riparian and wetland sites, and grassland sites. Technical aspects of Merri Creek's restoration works, and the challenges of working in narrow, linear reserves subject to multiple uses, are described in detail by Bush et al. (2003). MCMC works at over 80 sites along Merri Creek between its confluence with the Yarra River and Kalkallo, beyond the northern outskirts of Melbourne. Sites with remnant vegetation, existing revegetation or strong local community interest are given priority. The ultimate aim is to revegetate the weedy 'sea' between the existing 'islands' of indigenous vegetation, whether remnant or revegetated.

Critical to success has been the emphasis on undertaking these works in such a way as to involve and inspire local communities. Bush et al. (op. cit.) attribute this to the community origins of MCMC's restoration projects, and to an organisational culture committed to optimising the creative potential for community interaction with the natural areas, for the benefit of both.

Community participation in restoration, revegetation and monitoring work has involved Friends of Merri Creek, other localised environmental groups, educational institutions (primary, secondary and tertiary), industry groups, local residents, neighbourhood houses and other community groups. In addition to assisting restoration work it has also led to a growing sense of custodianship of and pride in Merri Creek.

Friends of Merri Creek, a wholly voluntary group, is active in advocating for the creek and in promoting and motivating community involvement in the restoration works. MCMC meets annually with a sub-committee of 'the Friends' to plan the calendar for the year's community activity days. The two groups aim to work closely together to complement each others' strengths. Publicity for community activity days describes them as joint activities with Friends of Merri Creek and MCMC. Community activities are also conducted with other 'Friends of' groups at specific localities and with council bush crews. Anyone is welcome to join these days.

At times, activities are also organised to cater for specific groups, including those reflecting MCMC's commitment to seek opportunities for a multicultural involvement in Merri Creek's restoration. A recent example described by Bush et al. (op. cit.) involved an Islamic women's group who approached MCMC requesting a women-only planting day. At the group's request the activity was held on a weekday during school holidays so that women could bring their children. MCMC provided halal food for a BBQ and

female staff to assist with the planting. After the eating, the activity ended in spontaneous singing and dancing, a process which Bush et al. (op. cit.) describe as '...transforming the 'natural' environment of Merri Creek to a dual natural *and* cultural space'.

Each year a significant number of community activities are held involving many hours of community and student work as detailed in Table 1 below.

The bulk of MCMC's community activities are held during the planting season in May to October. During the busiest period activities can be as frequent as every weekend; sometimes two or even three activities have been held simultaneously on different parts of the creek. There are obvious practical limitations to this, not the least being the availability of staff and the means to pay them. Despite this full program, there appears to be unmet demand from communities wanting more opportunities for involvement.

In addition to these 'formal' activities, for which MCMC collects data on numbers participating and hours volunteered, there are innumerable informal activities organised and undertaken by individuals and small groups at various points along the creek. Some groups actively hand weeds their 'patch', others vigorously collect litter. Where possible, and where known, these groups are given support by MCMC, even if the support is as simple as acknowledging their efforts. Council bush crews also organise some community activity days along the creek.

Type of community activities

MCMC community activities are diverse. In additional to 'traditional' plantings, community activities include weeding, mulching, jute mat removal, litter removal, mapping of weeds and remnants, bird-observation, Kangaroo Grass seed harvesting, plant identification, monitoring of rare species, surveys and habitat walks and talks. Information displays are mounted at most activity days and staff make a particular effort to connect with volunteers by talking with them about issues that concern them. Activities such as basket-making and boomerang making have expanded participants' appreciation and understanding of the Aboriginal history of the area and Aboriginal people's association with the land.

Particular attention is paid to organising community activities to maximise the productive involvement and enjoyment of the community. For example MCMC puts considerable effort into preparing for planting days, usually digging most of the holes before the day and laying out plants on the day into specific spots. The morning's work usually finishes with a BBQ; halal and vegetarian food are always available.

All MCMC sites are actively maintained and worked on from year to year, an important factor in sustaining involvement and connection. Reid (2004) describes the implicit role MCMC plays in '…assisting others to make a deeper connection with the landscape'. She emphasises that MCMC does this '...by creating a setting where volunteers' experience of the place is positive. Volunteers go home with its dirt on their hands and having left evidence of their presence in the form of what they have planted; they have had a tangible and observable interaction with the landscape'. Reid concludes that this leads to a community notion of itself as a '...community caring for the nature they themselves have restored'.

Community activities have contributed to a raised awareness amongst local residents and park users of the conservation status of the Merri and its corridor, as well as fostering a sense of custodianship and personal responsibility for the creek. They have also allowed community members to develop practical skills and knowledge in revegetation and restoration.

TABLE 1: MCMC COMMUNITY ACTIVITIES

	2001-02	2002-03	2003-04
Community activity days	45 days	36 days	31 days
Community volunteer hours	2114 hrs	2466 hrs	4012 hrs
Student hours	1471 hrs	1277 hrs	1466 hrs

Signage at specific sites along the creek plays an important role in providing community information and understanding. With specific funding, MCMC has been able to commission a number of interpretative signs in community languages, Italian, Greek and Arabic.

Revegetation works along Merri Creek have clearly improved habitat values for a number of faunal species. Species of birds not recorded in a 1993 fauna survey of Merri Creek (McMahon & Schulz 1993, have since been sighted in a number of sites, some utilising habitat in revegetation plantings. Other species appear to have expanded their habitat, being sighted in areas from which they were previously absent (Bush et al., op. cit.). The proliferation of birdlife is a factor commented on by many who have know the creek over the years and is another tangible expression of the achievements of revegetation.

Merri Park: an example of sustained community involvement

Almost all of the original wetlands, swamps and billabongs of the Merri Creek have been filled or drained over the past 200 years. To replace previously drained habitat for some species of flora and fauna, MCMC, in collaboration with Melbourne Water and Darebin Council, constructed a wetland system in 1999 at Merri Park, Northcote (Bush et al., op. cit.). The floor of an existing retarding basin (Figure 2) provided a site in which to recreate an off-creek wetland system that captures stormwater formerly flowing directly into the creek. The series of marshes and ponds have been progressively revegetated, through numerous community planting days (Figures 3, 4 & 5) and a high level of community ownership has been engendered. Since its creation, two species of frogs uncommon in the adjacent stretches of Merri Creek – Pobblebonk (Limnodynastes dumerili) and Common Froglet (Ranidella signifera) – have been heard calling from the wetland.

Other specific examples of MCMC's revegetation and restoration projects are described in Bush et al. (op. cit.), many of which have involved comparable levels of community input.

FIGURE 2: MERRI PARK RETARDING BASIN, NORTHCOTE, PRIOR TO CONSTRUCTION OF WETLAND SYSTEM, APPROX 1998. THE BATTERS AND FLOOR OF THE RETARDING BASIN WERE SMOOTH AND COVERED IN GRASS AT THIS TIME

FIGURE 3: MERRI PARK WETLAND, NORTHCOTE, COMMUNITY PLANTING DAY MAY 2004. NOTE THE TRANSFORMATION AFTER FIVE YEARS OF ACTIVE REVEGETATION

FIGURE 4: DETAIL OF COMMUNITY PLANTING DAY, MERRI PARK WETLAND, NORTHCOTE, MAY 2004. A MARQUE WITH DISPLAY INFORMATION AND BBQ CAN BE SEEN IN THE BACKGROUND

An ongoing partnership

As summarised by Bush et al. (op. cit.) MCMC's Merri Creek restoration project has sought an integration of technical, ecological and social aspects in the belief that the interactions between these three are crucial to landscape and community health.

The ongoing challenge for MCMC is to continue to build and maintain a shared vision for the creek corridor with communities, local government and other agencies. New communities in the rapidly expanding residential sub-divisions of the middle reaches of Merri Creek provide a particular challenge as do the 'communities' of the industrial areas abutting substantial sections of the Merri corridor. Being neither an agency nor a community group, but containing attributes and elements of both, MCMC aims to provide a bridge between the two. It is in this role that MCMC, working with the management agencies and the broader community, has been able to achieve what it has to date.

Acknowledgments

Thanks to the MCMC staff – Judy Bush, Brian Bainbridge and Barb Miles – who wrote the article on which much of this paper is based, and more generally to the MCMC staff and committee members who make up the organisation. Special thanks are due to members of Friends of Merri Creek and other community members who have volunteered so many hours towards Merri Creek's restoration.

FIGURE 5: STUDENTS FROM KING KHALID COLLEGE, COBURG, ASSISTING WITH REVEGETATION OF THE MERRI PARK WETLAND, NORTHCOTE

Notes

1. *Synemon plana* – EPBC listed species.

2. *Litoria raniformis,* also known as Southern Bellfrog, EPBC-listed.

3. A key commitment in MCMC's establishment was the agreement that staff work under the same terms and conditions as council staff. MCMC now has its own EBA which ensures good working conditions and pay, vital ingredients for ensuring staff continuity and commitment.

4. MCMC is host organisation for the Merri and Moonee Ponds Waterwatch program, part of the Melbourne Waterwatch program, itself part of the National Waterwatch program.

References

Bishop, I (ed.) 1975, *The Merri Creek Study. A Review of Urban Creek Management – Past, Present, Future*, Victorian Public Interest Research Group, Parkville.

Bush, J, Miles, B & Bainbridge, B 2003, 'Merri Creek: Managing an urban waterway for people and nature', *Ecological Management & Restoration,* 4, pp. 170-179.

Craigie, V 1998, 'Status of grassy ecosystems in Victoria – the Grassy Ecosystem Reference Group', *Down to Grass Roots – Proceedings of a conference on the management of grassy ecosystems,* (eds.) V Craigie & C Hocking, Victoria University, St Albans, pp. 1-4.

Earl, C 1974, *The Merri Creek Flood,* Water Supply, Sewerage and Drainage Branch, Melbourne and Metropolitan Board of Works, Melbourne.

Ellender, I & Christiansen, P 2001, *People of the Merri Merri – The Wurundjeri in Colonial Days*, Merri Creek Management Committee, East Brunswick.

Ernst and Whinney Services 1988, *Merri Creek Management Stud,* Final report and recommendations.

McMahon, ARG & Schulz, M 1993, *Merri Creek Concept Plan Flora and Fauna – report prepared for Merri Creek Management Committee and Melbourne Water,* Ecological Horticulture, Clifton Hill.

MCMC 2004, *Merri News,* February 2004 Newsletter of Merri Creek Management Committee.

Steering Committee 1999, *Merri Creek and Environs Strategy*, Merri Creek and Environs Strategy, Melbourne Water, Melbourne.

Muir, A (rev.) 1999, 'Western (Basalt) Plains Grassland Community Action Statement No. 53', *Flora and Fauna Guarantee Act,* Department of Conservation and Natural Resources, Victoria.

NRE 2002a, 'Biosites: Sites of Biodiversity Significance in Port Phillip and Westernport Region Victoria', *Flora and Fauna,* Port Phillip Region Regional Services Division, Department of Natural Resources and Environment.

NRE 2002b, *Victoria's Native Vegetation Management – a framework for action*, Department of Natural Resources and Environment, Victoria.

Radford, R 2002, 'Friends life members: Ann & Bruce McGregor', *Friends of Merri Creek Newsletter*, May-July, p. 7.

Reid, K 2004, 'Merri Creek Case Study', unpublished essay, p. 17.

Victoria Department of Conservation and Environment 1990, *Remnant Native Grasslands and Grassy Woodlands of the Melbourne Area – an Action Plan for Conservation Based on Biological Values,* Department of Conservation and Environment, East Melbourne.

SECTION 7

Dinner speaker

The protection of Cooper's Creek

R.B. MORRISH
Cooper's Creek Protection Group

A brief history

A proposal to develop a large cotton irrigation project on the property Currareva at Windorah was introduced to the community of Windorah and district at a public meeting in September 1995. The proposal involved 3000 hectares of cotton to be irrigated by an annual extraction of 42 000 megalitres drawn from Cooper's Creek by large water harvesting pumps and stored in very large shallow earth tank storages. The proponents of this scheme were cotton farmers from the Macquarie River area of NSW who had recently purchased Currareva and doubtless saw the potential for large profits in the cheap land and 'free' water.

The reaction of the local community was one of both incredulity and horror. A lifetime of experience with the Cooper and its highly variable seasons and flows, from extreme droughts through to the ephemeral times-of-plenty after the big floods, had given the local community an intuitive understanding of the river and its central role in the arid landscape of the inland. Local people knew how critical the natural flows of the Cooper were to life in a very dry region, and could sense its potential vulnerability to large scale interference with natural flow patterns. The Cooper Channel Country after flooding produces superb natural cattle fattening pasture of immense value to extensive pastoralism, and it was immediately apparent that interference with the natural flows of the Cooper and the introduction of cotton pesticides on a large scale would jeopardise this opportunistic fattening operation.

The Cooper's Creek community immediately held an emergency meeting, formed the Cooper's Creek Protection Group (CCPG), and began planning the campaign strategy to protect the river. Meg Strang, then Rural Reporter with ABC Longreach, introduced the story to western Queensland and through the ABC network to the Australian public generally, setting a precedent for the sustained media interest which kept awareness of the issue before a wider public. Throughout the Cooper irrigation debate, the media played an important role informing public opinion and demanding accountability from the Government's water management processes.

Many people and organisations offered their support. People who had once worked or lived on the Cooper – ringers, drovers, fencers, horsebreakers, cooks, housemaids, managers – rallied to the cause. Managers and staff of the larger pastoral stations as well as

smaller private pastoralists and outback town and community members formed the core of the CCPG. We received invaluable assistance from the largest pastoral companies such as Stanbroke, Kidmans, Australian Agricultural, Consolidated, Colonial, Napco and Heytesbury. Tourism operators such as Broken Hill and Port Augusta Caravan Parks sponsored our distinctive sticker carrying the well-known slogan 'Get your cotton pickin' hands off Cooper's Creek'. 4WD and recreational fishing clubs offered support and solidarity. A group of graziers from the Macquarie Marshes invited us to visit them and view at first hand the wetland degradation caused by excessive irrigation demand and river regulation. Simultaneously we were able to attend a meeting in Narromine, the home of the Currareva developers, where many concerned people from the town and district protested against the effect of toxic cotton pesticides and herbicides on public health in the region.

Thousands of people from all over Australia wrote or phoned to offer support; many of these people also contacted politicians to register their protest against the proposed irrigation scheme. The huge support from all these people not only influenced the political process, but also provided a significant boost to the morale of the local community and strengthened our resolve in the fight. Early in the campaign, we also realised that we had allies in the conservation movement and in the Australian ecological science community, and strong working relationships developed. The media in particular were most interested in the hitherto unlikely combination of graziers and conservationists standing side by side against a common threat. The CCPG, the Australian Conservation Foundation and the Queensland Conservation Council often issued joint media releases concerning the Cooper irrigation issue.

The eventual success of the campaign to protect the Cooper was due to the combined efforts of these many people and organisations, and a significant portion of the CCPG's work was in facilitating alliances and providing a local community focus for these efforts. The nexus which developed between the local community, conservation organisations and the ecological science community proved very effective in engaging government and public attention.

As a parallel process to the public protest campaign, some members of the local community and the CCPG also took part in the Department of Natural Resources' Water Management Planning Process. For over two years the department gathered submissions, set up an extensive hydrological modelling study for the Cooper, and heard arguments and discussion from the community advisory panel, whose membership also included various Queensland and South Australian government agencies, conservation organisations, local government, the Currareva cotton proponents and a formal pro-irrigation lobby. The department's hydrology section produced modelling and statistical analysis which proved useful in examining hydrological issues despite inherent deficiencies imposed by the relative scarcity of stream gauge data. However, many members of the community reference panel – particularly the CCPG and the conservation organisations – expressed frustration because a bias towards irrigation options seemed to guide the process at a policy level. We could only assume that this direction had been imposed by a pro-development culture at some senior levels in the department, ultimately supported by government and ministerial policy.

The CCPG, the conservation groups, and indeed many of the agencies represented on the community advisory panel repeatedly called upon the government to fund a scientific reference panel to address issues of ecology of the Cooper's aquatic, riparian, and terrestrial systems, and to advise on likely consequences of large-scale water extraction for these ecosystems. These requests were met with repeated and emphatic refusals by the department and minister. The CCPG decided to redress this lack of consideration of ecological issues by holding a scientific workshop in Windorah. The workshop was jointly organised and convened by the chairman of the CCPG and Dr Jim Puckridge, a freshwater ecologist from the University of Adelaide with over 15 years' research experience in the wetlands of the lower Cooper.

The Windorah Scientific Workshop, held 3-6 September 1996, was a resounding success and attracted over 100 participants, including a core group of scientists from Australian universities and other scientific organisations, as well as members of conservation organisations, government agencies from a number of different states and Canberra, graziers and pastoral station managers, and interested members of the public. The workshop attracted no government funding whatsoever, and the valuable efforts of all participants in travel and attendance costs were self-funded. Local pastoralists including the major pastoral companies readily donated travel assistance by collecting some scientific participants in Bourke and Innamincka and flying them to and from Windorah in station aircraft. The 15 scientific papers delivered at the workshop conclusively established the critical dependence of the Cooper's ecosystems upon the highly variable natural water flows that drive the system. In an open letter to Natural Resources Minister Howard Hobbs the scientists called on the Queensland government to reject the Currareva application to take water from the Cooper and to reject all future applications for intensive agriculture projects involving cultivation and/or irrigation in the Lake Eyre Basin rivers. A summary of ecological considerations supporting these recommendations was added.

Mr Hobbs' initial reaction to the workshop was dismissive. However, within a short space of time, the workshop recommendations were endorsed by a number of important scientific bodies, including the Institute for Wildlife Research at the University of Sydney and a group of 36 Australian wetland scientists at the Australian Society for Limnology Annual Conference in September 1996. Even more powerful scientific support was soon forthcoming at the INTECOL 5th International Wetlands Conference in Perth (23-27 September 1996) where 430 wetland scientists and managers from all over the world unanimously passed a resolution calling on relevant state governments and the Federal Government to reject irrigation proposals for the Lake Eyre Basin and to set up a framework for the sustainable management of the Basin. The resolution had been introduced to the conference by two of the Windorah Workshop participants, Professor Richard Kingsford and Professor Peter Davies.

Faced with this overwhelming weight of scientific opinion, which was widely reported in the Australian media, Mr Hobbs publicly stated that there would be 'no cotton

irrigation on the Cooper'. However, there was uncertainty whether this undertaking extended to irrigation for other crops or to the Thomson and Barcoo subcatchments of the Cooper. It appeared that the department and the minister, while attempting to appease the Cooper community from Windorah downstream, were simultaneously preparing to make concessions to an irrigation lobby in the upstream subcatchments.

In response to these political uncertainties, the CCPG organised a large protest rally to coincide with the Windorah races for the last weekend of September 1996. Stations on the Cooper from Windorah to Innamincka trucked in their working horse plants and the protest culminated in a mounted parade through the main street of Windorah. Media interests – TV, radio and print – was high. Politicians and relevant ministers were invited. Those politicians who attended the rally had already given valuable support, including the local member Vaughan Johnson (then Transport Minister) and Labor Members of Parliament Henry Palaszczuk, Clem Campbell and Tim Mulherin (then in Opposition). This demonstration of bipartisan support was politically effective and greatly appreciated by the local community. Federal Environment Minister Senator Robert Hill arrived too late for the rally but made himself available to hear some informal deputations.

After the conclusion of the water management planning process in 1997, an uneasy but relatively quiet period followed while the department prepared its draft water management plan for the Cooper. It was uneasy because advisory party members were allowed no further input and the whole process from then on was shrouded in secrecy. Ambivalent ministerial and departmental statements at the time seemed like those which haunted Macbeth:

That palter with us in a double sense,
That keep the word of promise to our ear
And break it to our hope.

When a new minister, Lawrence Springborg, publicly unveiled the Draft Water Management Plan in April 1998, these misgivings proved well-founded. The draft plan announced by Mr Springborg proposed to make available 22 500 megalitres of new water harvesting entitlements in the tributary subcatchments of the Thomson and Barcoo, and to force use of the substantial 'sleeper' licences in the system. The two largest such licences, allowing a combined total of 1000 hectares of irrigation and unrestricted in total volume entitlement, were at Currareva and Hammond Downs, both properties now owned by the cotton developers.

The hydrological modelling work which the department had done was a major positive feature of the draft plan, and it clearly indicated a substantial effect of these proposed irrigation demands on downstream flows in the Cooper. The effects modelled were particularly pronounced for low flow events because of the plan's low thresholds for water extraction. This would have had severe consequences for flows into downstream drought refuge waterholes and for the periodic maintenance of aquatic ecological connectivity of these refuges. Another round of submissions to the process began, with scientists, conservationists, the CCPG and many members of the general public providing detailed written criticisms of the shortcomings of the draft plan as well as taking part in a vigorous media campaign to inform the Australian public about the failure of the plan to protect the ecological integrity and pastoral sustainability of the Cooper.

A few months later, a state election resulted in a change of government. In September 1999 Minister Rod Welford (now QLD's Attorney General) announced the new Water Management Plan on the banks of the main channel of Cooper's Creek near Windorah. The plan expressly ruled out commercial irrigation development or any other forms of large-scale water extraction within the whole Cooper's Creek catchment, having particular regard to the vital ecological functions of natural flows in the system and to the existing sustainable industries in the catchment. The plan allowed for modest increases in stock and domestic water use and for future needs of towns in the catchment.

The final decision represented a victory for the local community of Cooper's Creek and for the many people of the scientific and conservation communities and the wider Australian public who did so much to protect this part of the Australian natural heritage. Rod Welford and the Beattie Government deserve approbation for their decision. Unfortunately two serious limitations of the plan exist: (1) it contains no provisions to regulate the taking of overland flow (water on floodplains); and (2) it has only a ten-year lifetime. The first limitation may be dealt with after another round of planning processes, but the second is potentially more serious as it allows the possibility that governments reviewing the plan may re-introduce irrigation development. Irrigation development is currently promoted for the outback river catchments of northern Australia (including the northern subcatchments of the Cooper) and at least one high-profile federal politician lends support and leadership to these promotions.

It is prudent to identify and learn from those factors which contributed to the success of the Cooper campaign, to be vigilant, and to be prepared to deal with future threats. It would appear that the success of the campaign was attributable to a number of important and essential factors:

1. very strong and outspoken local community protest
2. strategic alliances with scientific and conservation communities
3. widespread support of the general Australian public
4. vigorous political engagement by the local community and by conservation organisations
5. strong media interest and coverage of issues
6. strong scientific interest and the use of good science to support the campaign

Future protection of the Cooper and indeed other relatively hydrologically and ecologically intact rivers of outback northern Australia will probably require most or all of these factors for success. It is certain that good scientific information will be essential. A short outline follows of the scientific information used to present the case for preservation of the natural water flows of Cooper's Creek.

Physiography and Geomorphology

Cooper's Creek is one of the world's large rivers, spanning over 1500 km from the most north-eastern upstream subcatchment of Torrens Creek through to the Cooper's terminus at the entrance to Lake Eyre. That portion of the total system actually bearing the name Cooper's Creek begins about 20 km upstream of Windorah where the two major

tributaries, the Barcoo and Thomson Rivers, converge. From this point of convergence to the point of entry into Lake Eyre is a distance of 800 km.

The catchment area is large, approximately 3 000 000 km^2, an outstanding feature being the exceptionally large proportion, approximately 1 000 000 km^2, of floodplain (Graetz 1980). The extensive floodplain and its associated wetlands characterise the distinctive landform of the Cooper from Windorah to Lake Eyre. Very low gradients (< 1 in 5000) along this floodplain give rise to low flow velocity and ensure that the infrequent large flood events, when they occur, are quite prolonged.

The Queensland section of the Cooper floodplain forms an extensive and intricately patterned network of braided and anastomosing channels distributing floodwater through a large portion of the Queensland Channel Country and supplying very large ephemeral swamps and other wetland areas almost too numerous to count. A short distance south of Windorah the channel floodplain attains a width of 90 km. The major channels contain, at intervals, some large waterholes which act as important refuges for biodiversity during drought. Among the larges is Eulbertie, a serpentine waterhole on Tanbar Station 26 km long and up to 20 m deep. One very large (800 km^2) terminal ephemeral freshwater lake, Yamma Yamma, also on Tanbar, is situated at the western edge of the Cooper floodplain about 160 km south-west of Windorah.

The Queensland channel floodplain terminates at a narrow constriction west of Nappa Merrie at the border with South Australia where the Cooper is confined within a deep channel cutting through a range of stony mesas and plateaux. A very large and deep waterhole, Cullymurra, lies within this section of channel on the South Australian side between the border and Innamincka. Immediately west of Innamincka the floodplain spreads out again into a large distributary system with three main branches. The (central) main branch continues towards Lake Eyre after inundation of the Tirrawarra Swamp, diverging along the way into a number of subsidiary lakes such as Lake Hope. The north-west branch takes water to an extensive mosaic of over 100 shallow lakes forming the Coongie Lakes wetland system, the largest Ramsar listed wetland in Australia covering an area of 20 000 km^2. The third branch is the Strzelecki Creek distributary system which during its relatively infrequent inundations carries water south-west across floodplains to Lakes Blanche, Callabonna, From and Gregory, rarely, if ever, rejoining the main branch after this circuitous route.

The diversity and complexity of this floodplain geomorphology influences the hydrological patterns of the river and its wetlands.

TABLE 1: COOPER FLOW SUMMARY STATISTICS

STATISTIC	CURRAREVA	NAPPA MERRIE
Annual flows		
Mean (km^3)	3.12	1.35
Standard deviation (km^3)	4.26	3.03
Coefficient of variation	1.35	2.24
Coefficient of skewness	3.08	3.66
(Number of values)	(42)	(20)
All monthly flows		
Mean (km^3)	0.27	0.13
Standard deviation (km^3)	1.03	0.64
Coefficient of variation	3.78	4.96
Coefficient of skewness	8.57	9.93
(Number of values)	(556)	(285)
Peak annual discharge		
Mean (cumecs)	2409	615
Standard deviation (cumecs)	4209	1357
Coefficient of variation	1.74	2.20
Coefficient of skewness	4.40	3.76
(Number of values)	(42)	(20)

Source: DNR Resources Management: Currareva records 1939-1988 (incomplete)
Nappa Merrie records 1949-1969 (incomplete)

Notes: 1 km^3 = 1 million megalitres
1 cumec = 1 cubic metre per second

Hydrology

While research and planning objectives usually require the calculation of a number of detailed measures based on aspects of the hydrograph, a broad picture of the behaviour of rivers on a large scale can be obtained from a few statistics relating to total annual flow and its variability.

Gauging stations operated for a number of years at three locations on the Cooper: at Currareva near Windorah, at Nappa Merrie 420 km downstream, and at Innamincka 70 km downstream from Nappa Merrie. Unfortunately no gauges exist on any of the distributary systems further downstream from Innamincka or on the significant tributary systems of Kyabra Creek and the Wilson River in the Queensland Channel Country. The Currareva and Nappa Merrie gauges were discontinued in 1988 and 1969 respectively.

Fundamental summary statistics for the flow data are presented in Table 1. Mean flow at Currareva, 3.12 million megalitres, is on a scale comparable to that of some larger Gulf rivers. Variability is very high e.g. coefficient of variation (CV) 1.35 at Currareva and increasing downstream. The CV is calculated as the standard deviation divided by the mean and any coefficient > 1 indicates exceptionally high variability. The data comparing all monthly flows and peak annual discharge yield even higher indices of variability. Variability is clearly a defining hydrological characteristic of the system and is known to have a major role in determining the ecology of the Cooper (Puckridge et al. 1998).

Flow volumes at the downstream (Nappa Merrie) site are much lower than at the upstream site, reflecting high transmission losses, a general feature of arid rivers and a particular feature of the Lake Eyre Basin rivers where widely distributed floodplain and channel geomorphology disperses flow into extensive ephemeral wetland systems.

Variability is higher at the downstream site, another common feature of arid rivers. The high coefficients of skewness indicate remarkably skewed flow distributions, meaning in this case the means are heavily weighted or biased by extremely infrequent, uncharacteristically large flows such as that of the year 1974. It should be noted that the Nappa Merrie records do not include the 1974 flood event and therefore the means, variability and skewness measures are understated for this recording station in comparison with the Currareva records. Even so, extremely high variability and skewness are reflected for this arid site.

A more appropriate measure of central tendency is the median flow, defined as the 50th percentile or the flow exactly halfway along the distribution, where 50% of years have higher flow and 50% lower flow. Median annual flows for the Cooper for the period of gauging are 1.419 million megalitres at Currareva and 0.365 million megalitres at Nappa Merrie. Median statistics present a more useful picture of the central tendency of arid river flow regimes than means, and draw attention to the relative scarcity of the total water resource by the simple implication that in 50% of years, flow will be less than the median.

Ecology: the Windorah Workshop

Existing work on ecology of arid rivers and new studies on the Cooper present a body of scientific information that emphasizes the roles of flow and flow variability as major determinants of ecosystem processes in the Lake Eyre Basin rivers. This research indicates that natural flow regimes are necessary for the maintenance of ecosystem integrity. Some early work up to 1995 is summarised in two reports by Dr Steve Morton and colleagues from CSIRO Wildlife and Ecology Unit, assessing natural values of the Lake Eyre Basin aquatic ecosystems according to World Heritage criteria, and reporting on the vital role of the more permanent waterbodies as refugia for biodiversity in the arid landscapes of inland Australia (Morton et al. 1995a, 1995b).

Many scientists who have studied the ecology of Cooper's Creek or similar arid zone systems presented outlines of their work at the Windorah Workshop. Summary proceedings were published by the Australian Conservation Foundation (Noonan (ed.) 1996). An abbreviated account of the workshop papers and subsequent research on the ecology of Cooper's Creek follows.

The Cooper's magnificent wetlands have, quite appropriately, been a focus for investigation. They play an important and internationally recognised role in waterbird ecology and conservation. Professor Richard Kingsford and his colleagues have extensively documented the large waterbird populations that boom after filling of the Cooper wetlands and Lake Eyre (e.g. Kingsford & Porter 1993, Kingsford 1995) as well as the few remaining hydrologically intact wetlands of the Murray Darling system, situated on the Paroo River (Kingsford & Porter 1999). Professor Kingsford's work on the Macquarie Marshes within the upper Darling system clearly established the decline in waterbirds consequent upon regulation by damming of the Macquarie River, diversion of flow to cotton irrigation and loss of wetland habitat through impoverished water regimes (Kingsford & Thomas 1995). The work outlined in Professor Kingsford's workshop paper provided an ominous warning for the future of Australian waterbirds and wildlife generally if irrigation and other water diversion schemes were allowed to proliferate in Australian inland rivers which have so far escaped development.

The Coongie Lakes system of the lower Cooper is an area of great natural beauty and high conservation significance, listed under the Ramsar Convention. Julian Reid's paper on the waterbird dynamics of Coongie Lakes, including high abundance, high breeding richness, enormous reproductive output under ecological 'boom' conditions, complex adaptations to highly variable and unpredictable rainfall and hydrological conditions, and the importance of drought refuge values within the Coongie Lakes system and adjacent portions of the lower Cooper. The paper argued that the internationally recognised wetland values of the Coongie Lakes system would be significantly degraded and perhaps irreparably impaired as a consequence of large irrigation schemes upstream, such as the proposed Currareva cotton development.

The Coongie Lakes wetlands are the focus of a major long-term body of work on the ecology of fish and macroinvertebrate faunas of Cooper's Creek by Dr Jim Puckridge of the University of Adelaide. This work established relationships between hydrology and biology of the aquatic faunas and explored the richness and complexity of these relationships in considerable detail (e.g. Puckridge 1999). Dr Puckridge presented a workshop paper summarising this work relating hydrology to aquatic ecology. Reviews of the role of hydrology in the ecology of dryland rivers (Walker et al. 1995) and large rivers generally (Puckridge et al. 1998) established the dependence of ecological integrity upon hydrological integrity in arid rivers such as the Cooper.

Fish and waterbirds depend on the food source provided by invertebrates. Professor Brian Timms' extensive studies of invertebrates of the temporary wetlands of the Paroo indicated that moderate droughts reduce invertebrate diversity. By extrapolation, severe droughts or water deprivation caused by upstream water diversion would entail significant losses of production and biodiversity with consequent losses of invertebrate predators such as fish and waterbirds.

Dr Martin Denny investigated responses of arid zone terrestrial and avian fauna to the large flooding event of 1974 in Cooper's Creek, Strzelecki Creek and the Bulloo Overflow systems. Species abundance and diversity increased during and after the period of flooding. Dr Denny's paper explored the dynamics of this response in some detail, and described increases both in small mammals and lizards with consequent increases in larger predatory animals such as snakes and raptors. Responses to flooding were described as forming an integral part of the natural history of the native fauna. Dr Denny pointed out that changes to such a unique phenomenon as a consequence of diminished flow regimes would impact not only upon the immediate survival of animals totally dependent upon the Cooper ecosystem but also upon those, such as nomadic and migratory birds, which use this area as part of a larger suite of habitats.

Dr Jerry Maroulis presented a summary of the Wollongong University geomorphological research on Cooper's Creek led by Professor Gerald Nanson. His paper outlined physiographic attributes such as unpredictability and variability of flooding, high transmission losses, low gradients,

floodplain clay soil characteristics, the complex anastomosing channel network and co-existing mud braids, highly variable floodplain widths, decreasing discharge and increasing aridity downstream. Both contemporary and paleochannel processes were described, including waterhole and channel development and the Quaternary evolution and paleoclimate of the floodplain environment. The importance of sediment transport characteristics of mud aggregates in the geomorphology of the Channel Country was identified.

The productive value and dynamics of native pastures of the Cooper were addressed by Professor Brian Roberts. Professor Roberts' studies indicated that on the heavy, cracking self-mulching clays of the Cooper floodplain, intermittent grazing did not adversely affect either basal cover percentage or botanical composition. Professor Roberts emphasised the compatibility of grazing and conservation values if 'best practice' was implemented. His paper suggested that all of the Cooper flow was necessary for vital ecological functions, and that the precautionary principle be applied to reject irrigation development because of the potential damage associated with water extraction and the associated risk of chemical pollution of the Cooper and its wetlands.

Dr Mike Olsen presented a broad picture of the mosaic of vegetation diversity within the Channel Country and its surrounding environment of south-west Queensland. He suggested that the recent evolution of arid zone flora resulted in closer and more sensitive relationships to climate and natural hydrological patterns than in the older rainforest remnant in more mesic environments. As a consequence of the interaction between hydrology and biotic patterning, he considered any alteration to the natural hydrological regime, on the scale of the proposed cotton irrigation scheme, as totally unacceptable.

Dr Stuart Blanch's and Professor Keith Walker's paper investigated the adaptations of floodplain plants in semi-arid rivers for survival in the extremes of flooding and drought typical of semi-arid floodplain ecosystems. Their paper indicated that major alterations of flow patterns as a result of irrigation have dramatically altered vegetation patterns in many rivers around the world. Australian examples include the lower Murray River where flow regulation has dramatically shrunk the area of floodplain vegetation, and the Gwydir Valley in northern NSW where cotton irrigation has led to the loss of 95% of core wetland area. Decline in the extent and abundance of floodplain plants was associated with loss of plant diversity and invasion of weeds. These effects could be predicted for rivers such as Cooper's Creek following changes to flow regime as a result of irrigation development.

Professor Grant McTainsh and colleagues Alan Lynch and Craig Strong presented the results of a programme of wind erosion studies in the Channel Country, a region of very high naturally occurring wind erosion typified by dust storms. Within the broad biogeographic region, different land zones yielded different contributions to erosion, the area proposed for cotton growing at Windorah being situated within the most highly erodible land zone (contributing 87% of total wind eroded sediments). Cultivation of this area would accelerate soil erosion rates. Wind-eroded dusts could be expected to transport pesticides such as endosulfan to the river environment immediately adjacent to the cultivated area.

Professor Peter Davies presented results of studies of the influence of flow conditions on aquatic fauna in arid zone streams of the Pilbara region of Western Australia, a region comparable in dryness to the middle reaches of the Cooper tributary system upstream from Windorah. In the Pilbara, size of refugia pools was found to be related to community structure of both macroinvertebrates and fish, the larger pools supporting higher biodiversity while the smaller pools became almost anoxic at night due to elevated water temperatures and high rates of biological respiration of the algal biomass. A long term sampling programme has shown the importance of flow in structuring the composition of aquatic faunal communities. This data provided a model for assessment of the impacts of water abstraction, predicted for arid areas to be greater than for other regions because after abstraction water volumes would be insufficient to buffer effects of high water temperatures and biological respiration, leading to localised losses of biodiversity.

Professor Angela Arthington's paper on holistic assessment of environmental flow requirements elucidated the complex relationship between many flow parameters and the ecology of aquatic systems, and outlined some of the difficulties of the task of restoring environmental flows to rivers degraded by regulation and abstraction of flow. Professor Arthington had recently described detrimental effects of agricultural land use and cotton production on the aquatic ecosystems and natural environment of tributaries of the Darling River in northern NSW (Arthington 1995, 1996). Subsequent to the workshop, Professor Arthington and colleagues from Griffith University have carried out an extensive research programme on the fish assemblage structure of waterholes of Cooper's Creek and its tributaries, Kyabra Creek and the Thomson River (Arthington et al. 2005). Their findings indicate temporal variations in this structure, and abundance of five species in April 2001 was related to the extent of floodplain inundation 14 months previously (the flood event of February 2000). The authors conclude that magnitude, timing, frequency and duration of floodplain inundation and natural variations in waterhole volume must be maintained in order to sustain the distinctive habitats and fish assemblages of this dryland river system.

Professor Stuart Bunn and Professor Peter Davies presented a paper suggesting research to elucidate the role of river-riparian linkages for arid zone streams. They indicated that most of the current knowledge of such linkages comes from temperate forest ecosystems, and little is known of the role of basic ecological processes such as the source of energy and nutrients in arid and semi-arid streams, and the importance of aquatic plant and animal production to adjacent terrestrial food webs. Subsequent to the workshop, they carried out a research programme investigating waterholes of Kyabra and Cooper's Creeks to answer these questions. Current theoretical models suggest the importance of terrestrial organic matter as sources of organic carbon for aquatic consumers. In contrast, this research, based on stable carbon isotope analysis, indicates that a narrow band of filamentous algae along the shallow littoral zone of the waterholes contributes the major source of energy for aquatic consumers, ultimately supporting large populations of crustaceans and fish (Bunn et al. 2003). Despite the presence of large amounts of terrestrial carbon, there was no evidence of it being a significant contributor to the aquatic food web. These

findings are not consistent with existing models of ecosystem processes in large rivers such as the river continuum concept or the flood pulse concept, both of which emphasise terrestrial sources of organic carbon as the basis of the aquatic food web. The findings contribute important new directions to the understanding of fundamental ecosystem processes in large rivers and lend strong support to a riverine productivity model. There are clear implications that factors influencing the production, distribution and composition of micro-algae (such as flow regulation, water abstraction, nutrients, toxic chemicals, stock trampling) are likely to disturb the food webs of large river ecosystems.

The workshop concluded, appropriately, with a paper by Professor Walker and Dr Puckridge describing the 'boom and bust' ecology of the Cooper and contrasting this with the notion of a regulated economy represented by a proposal for irrigated agriculture. They likened the irrigation proposal, in the language of economics, to the imposition of a fixed demand (irrigation requirement) on a fluctuating and highly variable supply (natural hydrology). They suggested that the irrigation proposal could be rationalised only in the sophistry of short term economics. 'Just as regulation is the antithesis of a free-market economy, it is alien to a boom-and-bust ecology – the ecosystem could not accommodate a competitor for water that is vital for its own maintenance.' (Walker & Puckridge 1995, Walker et al. 1997.)

The success of the Windorah Workshop established a precedent for a second such workshop on the ecology of the Paroo River, held at Hungerford in July 1997 (Kingsford (ed.) 1999). Both of these workshops are recognised as models for community-driven, publicly accessible and transparent collaborative resource management partnerships between landholders, scientists, conservationists and the wider community (Kingsford et al. 1998). A valuable scientific legacy of the water management debate is the collective ecological wisdom which may now be focused on evaluation of future proposals for interference with natural flow regimes of rivers and wetlands. General scientific principles have been established (e.g. Bunn & Arthington 2002, Kingsford 1998, Puckridge et al. 1998, Walker et al. 1995) identifying flow as the driving force of river and wetland ecology, and alteration of natural flow regimes as a major cause of ecosystem degradation.

Concluding observations

The rise of the modern industrial state has been associated with the colonisation of 'wild' nature and the over-exploitation, exhaustion and degradation of natural resources. Nowhere is this more evident than in the relentless push to extend agricultural and irrigation development of our rivers. Within the last 60 years Australia has so enthusiastically pursued such development that many rivers of the eastern coast, together with the Snowy and the once might inland system, the Murray-Darling of semi-arid Australia, have suffered severe degradation as a result of regulation and excessive irrigation demand on the water resource. As a result of the culpable failure of governments, both state and federal, to protect these rivers from over-exploitation, Australia now faces huge environmental costs as recent political debate on the future of the Murray-Darling system indicates. But even while this debate intensifies, there is a push to extend development to rivers as yet free from irrigation and intensive agriculture. The focus of new development interest has shifted within the last ten years to the Channel Country and the Gulf Country of Queensland and the Kimberley region of northern WA. Proponents of development ignore accumulating evidence of degradation of Australia's regulated and irrigated rivers, evidence indicating that high-volume water demand is incompatible with the requirements of ecosystem integrity.

Sixty years ago issues concerning wise use and conservation of our natural resources received little attention in a world misinformed by a prevailing myth of untamed frontiers and unlimited natural resources available for exploitation. But in the past 60 years – less than an average human lifetime in the industrialised world – the once magnificent natural landscapes and wildlife of many parts of the earth have been reduced to mere remnants. As Professor David Suzuki (1993) has outlined, we face the sad fact that our children and our children's children will inherit a world bereft of much of the former natural beauty, biodiversity and wonder that older generations took for granted.

The rivers and wetlands of any region are its lifeblood, particularly in a country as dry as Australia. In the Gulf of Carpentaria, in the Channel Country and across north Australia generally, we are fortunate in having quite large and magnificent rivers and wetlands still relatively intact in their flow regimes and ecologically healthy. They exist as precious natural heritage in a world where natural landscapes and ecosystems are increasingly diminished by population and development pressures. The challenge for Australians is to ensure their preservation and to continue and to generalise the efforts that protected Cooper's Creek.

References

Arthington, AH 1995, *State of the rivers in cotton growing areas: Northern NSW and the border rivers with Queensland*, Land and Water Resources and Development Corporation, Canberra.

Arthington, AH 1996, 'The effects of agricultural land use and cotton production on tributaries of the Darling River, Australia', *GeoJournal*, 40: 115-125.

Arthington, AH, Balcombe, SR, Wilson, GA, Thoms, MC and Marshall, J 2005, 'Spatial and temporal variation in fish-assemblage structure in isolated waterholes during the 2001 dry season of an arid-zone floodplain river, Cooper Creek, Australia', *Marine and Freshwater Research*, 56: 25-35.

Bunn, SE & Arthington, AH 2002, 'Basic principles and ecological consequences of altered flow regimes for aquatic biodiversity', *Environmental Management*, 30: 492-507.

Graetz, RD 1980, 'The potential applications of LANDSAT imagery to land resource management in the Channel Country', *CSIRO Rangelands Research Centre (Deniliquin) Technical Memo 80/2*, CSIRO Division of Land Resources Management, Perth.

Kingsford, RT 1995, 'Occurrence of high concentrations of waterbirds in arid Australia', *Journal of Arid Environments*, 29: 421-425.

Kingsford, RT 1998, 'Management of wetlands for waterbirds', in Williams, WD (ed.), *Wetlands in a dry land: Understanding for managemen*t, Environment Australia, Biodiversity Group, Canberra.

Kingsford, RT (ed.) 1999, *A free-flowing river: the ecology of the Paroo River*, NSW National Parks and Wildlife Service.

Kingsford, RT & Porter, JL 1993, 'Waterbirds of Lake Eyre, Australia', *Biological Conservation*, 65: 141-151.

Kingsford, RT & Porter, JL 1999, 'Wetlands and waterbirds of the Paroo and Warrego Rivers', in Kingsford, RT (ed.), *A free-flowing river, the ecology of the Paroo River*, NSW National Parks and Wildlife Service.

Kingsford, RT & Thomas, RF 1995, 'The Macquarie Marshes in arid Australia and their waterbirds: A 50-year history of decline', *Environmental Management*, 19: 867-878.

Morton, SR, Doherty, MD & Barker, RD 1995a, 'Natural heritage values of the Lake Eyre Basin in South Australia: World Heritage Assessment', *Report to the World Heritage Unit*, Department of the Environment, Sport and Territories, Canberra: CSIRO Division of Wildlife and Ecology.

Morton, SR, Short, J & Barker, RD 1995b, 'Refugia for biological diversity in arid and semi-arid Australia', *Biodiversity Series, Paper No. 4, Report to the Department of the Environment*, Sport and Territories, Biodiversity Unit, Canberra: CSIRO Division of Wildlife and Ecology.

Noonan, D (ed.) 1996, 'An Ecological Perspective on Cooper's Creek', *Summary Proceedings, Windorah Scientific Workshop*, Australian Conservation Foundation, Adelaide.

Puckridge, JT 1999, 'The role of hydrology in the biology of dryland rivers', in Kingsford, R.T. (ed.), *A free-flowing river: the ecology of the Paroo River*, NSW National Parks and Wildlife Service.

Puckridge, JT, Sheldon, F, Walker, KF & Boulton AJ, n.d, 'Flow variability and the ecology of large rivers', *Marine and Freshwater Research*, 49: 55-72.

Suzuki, D 1993, *Time to change*, Allen and Unwin, St Leonards, NSW.

Walker, KF & Puckridge, JT 1996, 'Irrigation development on Cooper Creek, central Australia – prospects for a regulated economy in a boom-and-bust ecology', in Noonan, D (ed.) 1996, 'An Ecological Perspective on Cooper's Creek', *Summary Proceedings, Windorah Scientific Workshop*, Australian Conservation Foundation, Adelaide.

Walker, KF, Puckridge, JT & Blanch, SJ 1997, 'Irrigation development on Cooper Creek, central Australia – prospects for a regulated economy in a boom-and-bust ecology', *Aquatic Conservation: Marine and Freshwater Ecosystems*, 7: 63-63.

Walker, KF, Sheldon, F & Puckridge, JT 1995, 'A perspective on dryland river ecosystems', *Regulated Rivers: Research and Management*, 11: 85-104.

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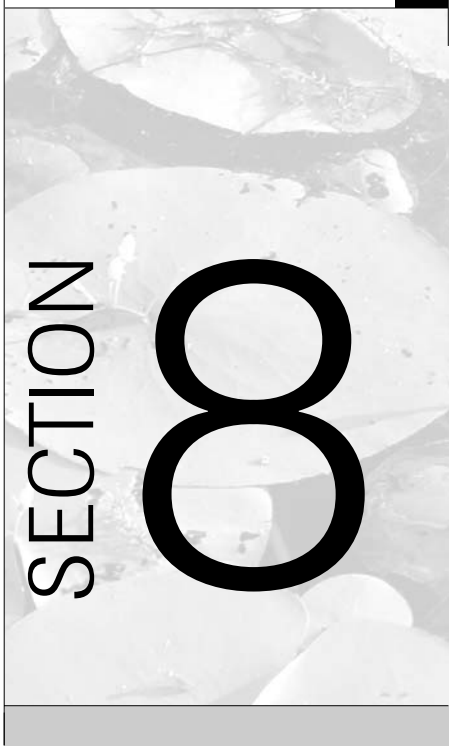

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Vision for a Framework under the NWI for Protecting High Conservation Value Freshwater Areas in Australia

EXECUTIVE SUMMARY

Conservation organisations have proposed establishing a national system for protecting high conservation value freshwater areas for several years**.** More recently government and international bodies have proposed high conservation value area networks. Despite the level of interest and commitment evident from the number of proposals, there is no agreed framework for an Australian high conservation value system or even any widespread common understanding of what such a system would consist of. This paper outlines the necessary components of a system for protecting high conservation value areas while responding to some common questions regarding the definition of high conservation value areas, the objective of a high conservation value areas system, and the need for and benefits of protecting high conservation value areas.

What is a high conservation value area?

A high conservation value area would be an area recognised for its particular value that was specifically managed to maintain, protect or improve those particular values. The area can take many forms and be designated according to a range of values including environmental, scientific, cultural (indigenous and non-indigenous), heritage, and social values. Such an area would be managed in a variety of ways, depending on the values present, and management could occur on site or throughout the catchment.

Particular types of high conservation value freshwater area could be based on the IUCN definition of "protected area" - "An area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means" (IUCN 1994) – to freshwater aquatic ecosystems. Depending on how the management regime was designed, such designation would be more or less formal and involve a combination of government and local management.

Why do we need to identify and protect high conservation value areas?

- To fill a gap in Australia's approach to freshwater biodiversity conservation
- To fulfil national commitments, in particular a mechanism for implementing the requirement in the National Water Initiative to 'identify and acknowledge surface and groundwater systems of high conservation values, and manage these systems to protect and enhance those values' (s25 x)
- To fulfil international commitments under the Convention on Biological Diversity and Ramsar Convention

- To recognise local stewardship and foster opportunities for community involvement in rivers conservation
- To provide tangible illustrations of the value of rivers to Australian communities and attract investment in valuable areas

What are the components of a national high conservation value areas framework?

- A framework for identifying, classifying and prioritising areas to protect in a comprehensive, adequate and representative system
- A system for assigning appropriate levels of protection at appropriate scales
- A mechanism for involving the public in nominating and managing sites

What difference can high conservation value areas make on the ground?

- See below for examples from the Paroo River and the Gwydir River.

Introduction

Conservation organisations have proposed establishing a system for identifying and protecting high conservation value areas for several years. In 2002 the Australian Conservation Foundation and the Inland Rivers Network published a paper entitled "Establishing Freshwater Aquatic Reserves in New South Wales." In 2003 the Wentworth Group of Concerned Scientists proposed a national river classification system comparable to the national reserve system. In 2004 a conference convened by IRN and WWF Australia recommended that the Council of Australian Governments negotiate an agreement to develop a national framework for protecting freshwater ecosystems of high conservation value.

More recently government and international bodies have proposed high conservation value area networks. The Queensland Government announced a Wild Rivers Policy in 2004 and is currently translating that policy commitment into legislation. The National Reserve System Taskforce has recommended that freshwater ecosystems be incorporated within the National Reserve System.

The National Water Initiative includes a commitment to identify freshwater ecosystems of high conservation values and manage these systems to protect those values (NWI s 25x)). The 3rd World Conservation Congress held by the International Union for the Conservation of Nature (IUCN) passed a resolution recommending that all member states establish high conservation value area networks.

Despite the level of interest and commitment evident from the number of proposals, there is no agreed framework for an Australian high conservation value areas system or even any widespread common understanding of what such a system would consist of. In our view, the proliferation of proposals, each using slightly different terminology and applying to a slightly different scale, is indicative of both widespread support for the concept of a high conservation value areas network and the need for a central institution, or a collective such as CoAG, to promote the development of a flexible *national* framework.

We believe that the final form of such a framework should be the result of wide-ranging discussions including a variety of stakeholders. However, it is currently possible to identify the necessary components of a protected areas framework using proposals for freshwater protected ares, existing examples of such areas, and comparisons to terrestrial and marine protected areas. This paper outlines these components while responding to some common questions regarding the definition of high conservation value areas, the objective of a national system for protecting high conservation value areas, the need for and benefits of identifying and protecting high conservation value areas.

What is a high conservation value area?

The concept of a high conservation value area is simply the application of the well-known definition of "protected area" to freshwater aquatic ecosystems.

Australia's National Reserve System uses the IUCN definition of protected area: "An area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means."

Although this definition does not explicitly apply to freshwater ecosystems ("land and/or sea"), it is easily adapted to freshwater ecosystems ranging from rivers to mound springs to

wetlands to lakes. In fact, as a result of the resolution on high conservation value areas just passed by the World Conservation Congress, IUCN is committed to adapting its guidance on protected areas to freshwater ecosystems.

Why do we need a national system for identifying and protecting high conservation value areas?

- *To fill a gap in Australia's approach to freshwater biodiversity conservation*

  There are several basic approaches to biodiversity conservation. One can focus on protection of individual species, for example by developing and implementing recovery plans for a threatened fish species. One can focus on regulating activities that have an impact on biodiversity, for example by restricting water use to preserve terminal wetlands. One can focus on habitat rehabilitation, for example by resnagging streams.

  Or one can focus on protecting reasonably intact areas and rehabilitating degraded areas that retain significant conservation value. Protected areas have been the core of terrestrial biodiversity conservation efforts for over one hundred years, serving as refuges for threatened species, biodiversity banks to recolonise degraded environments, reference sites for scientific studies, and sites for low-impact recreation and natural history education. More recently protected areas have become an important part of marine biodiversity conservation.

  However, protected areas networks have not been widely established for freshwater ecosystems. Freshwater conservation efforts in Australia have focussed on species protection, regulatory processes, and habitat rehabilitation, as in the examples above. Protected areas can supplement those approaches and integrate them with heightened effectiveness through focus on a discrete place. Australia's freshwater conservation programs and its protected areas systems are incomplete without a high conservation value areas network.

- *To fulfil national commitments*

  National Water Initiative
  In June 2004, the Intergovernmental Agreement on a National Water Initiative was signed by the Commonwealth of Australia and the Governments of New South Wales, Victoria, Queensland, South Australia, the Australian Capittal Territory and Northern Territory. The Government of Tasmania has since also signed the NWI.

  As part of the NWI, the Parties agree that their water access entitlements and planning frameworks will:

  > "identify and acknowledge surface and groundwater systems of high conservation values, and manage these systems to protect and enhance those values" (s25x))

  Other Commitments
  The Australian Government and State and Territory Governments have endorsed the goal of a comprehensive, adequate and representative system of reserves in Australia. This goal does not distinguish between terrestrial, marine or freshwater reserves, but currently Australia's progress toward this goal is made via the National Reserve System, the Regional Forest Agreement and the National Representative System of Marine Protected Areas. There is no component for high conservation value freshwater areas.

However, in the draft paper "Directions for the National Reserve System – A Partnership Approach," the National Reserve System Taskforce recognised this gap and recommended that an approach to ensure freshwater ecosystems are appropriately incorporated within the NRS be finalised in 2004.

Although no such approach has been finalised, we agree with the Taskforce that a system for protecting high conservation value areas must be developed for Australia to continue its progress toward the goal of a genuinely comprehensive, adequate and representative system of reserves.

- *Why a National Framework?*

  From a biophysical perspective, ecosystems do not respect state or territory borders. Rather, aquatic systems are linear so management in one state should be consistent with management in another. Many of our most iconic systems are interstate (Eyre Basin, Murray River, Paroo River, Darling River etc) and a national framework could simplify the *ad hoc* arrangements that currently govern these although biophysical inventories can of course be done on a state by state basis..

  Consistency across the whole nation can better be assured under a national framework – avoiding a rail gauges problem so to speak – which could easily occur when looking at place-based protection of aquatic ecosystems. The National Reserve System provides an example of a broadly established national framework that serves a precedent and from which useful lessons could be learned.

  Experience in other areas of NRM management in Australia suggest that the ability to coordinate and leverage financial resources is increased a national framework.

- *To fulfil international commitments*

  Australia is a signatory to the Convention on Biological Diversity (CBD) which requires countries to establish a system of protected areas to conserve biodiversity; develop guidelines for the selection, establishment and management of protected areas; and promote the protection of ecosystems, natural habitats and the maintenance of viable population of species. Australia's National Reserve System is designed to fulfil this commitment.

  Decision VII/2 of the 7th Meeting of the Conference of the Parties to the Convention on Biological Diversity (Kuala Lumpur 2004) extends the CBD by adopting a goal of establishing and maintaining comprehensive, adequate and representative systems of protected inland water ecosystems.

  Resolution CGR3.RES039 of the 3rd IUCN World Conservation Congress (Bangkok 2004) recommends that all States establish protected areas representative of all freshwater ecosystems.

  Developing and implementing a national framework for high conservation value areas would place Australia on the cutting edge of the developing international commitment to establish high conservation value areas systems.

- *To recognise local stewardship and foster opportunities for community involvement in rivers conservation*

  Freshwater conservation can be difficult for the public to understand and participate in for a variety of reasons. Water management is notoriously technical and even when stakeholder committees are involved, only a handful of community representatives can be involved directly. When conservation gains are achieved, as in the recovery of native fish populations or the replication of temporal flow variations, the results are often difficult for the trained eye to see and impossible to see for the average person interested in aquatic conservation, in part because the important changes take place underwater.

  Processes for nominating, designating and managing protected areas can be designed to attract broad community involvement. In Australia there are currently public nomination processes for National Heritage listing and Wilderness listing, models that could be extended to a heritage rivers system. The national parks system in New South Wales relies on volunteer help and groups like the "Friends of the Colo" in Wollemi National Park to help with weed eradication, biodiversity surveys, and staffing visitors centres. The Canadian Heritage Rivers System rests on public involvement from start to finish. Community organisations often take a leading role in assembling nominations and continue their involvement through management planning and implementing projects to enhance the conservation values of Canadian Heritage Rivers. In sum, high conservation value areas offer unparalleled opportunities for community involvement in aquatic conservation.

  The designation of high conservation value areas can recognise local stewardship that has occurred and the official recognition of a local asset can highlight its importance to the wider community. The range of management options available for these areas also provides opportunities for further local involvement in protecting the area and its values.

- *To provide tangible illustrations of the value of rivers to Australian communities and attract investment in valuable areas*

  Protected areas have long been one of the most tangible illustrations of how we as a society value our terrestrial and marine ecosystems, and they have the potential to serve the same purpose for freshwater ecosystems. The mere fact of designation can draw additional attention to the values of an iconic place, as with Uluru-Kata Tjuta National Park or the Great Barrier Reef Marine Park. Education has always been an important aspect of protected areas management, and educational signage, ranger-led nature discovery tours and visitor information displays fit easily within a protected areas concept in a way they do not with species-based management or water use regulation. Protected areas can also be managed to provide low-impact recreational opportunities, involving the very broadest sector of the public in the benefits of conservation.

  The designation of a high conservation value, protected area not only provides an incentive for the investment of local resources, but it can also assist communities gain funding for better protection of their areas. Investment in regional and rural areas can have a range of positive impacts within communities as well as within the high conservation value area.

What are the components of a national high conservation value freshwater areas framework?

- *A framework for identifying, classifying and prioritising areas for protection in a comprehensive, adequate and representative system*
  The first step in developing a CAR system is to build an inventory of the freshwater areas that could be candidates for protection and a system for prioritising candidates.

  This is done for the National Reserve System through the Interim Biogeographic Regionalisation for Australia (IBRA), which provides a broad-level break up of the Australian landmass into eighty biogeographic regions. Priorities for protection within the system are established by assessing gaps in the system with reference to IBRA and developing strategies for filling those gaps.

  IBRA is not directly applicable to a potential high conservation value areas network, as many aquatic systems cut across biogeographic regions developed according to terrestrial criteria. However, one expert who was involved in developing IBRA has suggested that appropriate bioregional criteria could be developed for Australian freshwater ecosystems, perhaps using native fish assemblages as a starting point (Tait *in press*).

  Another potential model for the system is Tasmania's Conservation of Freshwater Ecosystem Values (CFEV) Project. This project is an audit of the naturalness (N), representativeness (R) and distinctiveness (D) (NRD) of each freshwater ecosystem type in Tasmania. A NRD assessment is conducted on all rivers, lakes, wetlands, estuaries, saltmarshes, and karst systems. The N, R and D scores are used, via expert rules, to derive assessments of conservation value, and assess state conservation management priorities for freshwater dependent ecosystems.

  Canada has developed a system that includes both natural and cultural heritage values. "A Framework for the Natural Values of Canadian Heritage Rivers" is a planning document for the system that establishes hydrological, physiographical, morphological and biotic criteria for assessment. "A Cultural Framework for Canadian Heritage Rivers" does much the same thing for cultural values including water transport, riparian settlement history, and European and indigenous spiritual values.

- *A system for assigning appropriate levels of protection at appropriate scales*

  A comprehensive freshwater areas network will also include different levels of protection and different spatial scales. For example, the Wentworth Group has suggested a level of protection at the Commonwealth level, e.g. an Australian Heritage Rivers System that could be complemented by protection of streams of statewide significance at the state level.

  In addition, there are several proposed and existing classification schemes that could be adapted to a national freshwater framework that is flexible and recognises that different values will result in the use of different management tools and levels of protection.

  The IUCN protected area management categories are well-known. IRN and ACF have previously suggested a system that would include classifications based on IUCN Category II (National Park: Protected area managed mainly for ecosystem conservation and recreation), Category IV (Habitat/Species Management Area: Protected Area managed mainly for conservation through management intervention), and Category VI (Managed Resource Protected Areas: Protected Area managed mainly for the sustainable use of natural ecosystems) (IRN and ACF 2002).

Within this classification scheme, the strictest classification (Category II) would be reserved for relatively intact ecosystems, at catchment scale where possible. Management actions would largely be designed to maintain existing ecological values, e.g. prohibitions on new diversions or impoundments, restrictions on vegetation management affecting the aquatic ecosystem, restrictions on use such as angling or boating restrictions. A next tier would apply to rivers with important conservation values that are in need of some rehabilitation. Management actions within this classification could include prohibitions or restrictions, for example on boating, but many management activities would focus on rehabilitation: resnagging, thermal pollution mitigation, riparian revegetation, erosion control. The final classification would apply to significantly altered waterways where the goal is to prioritise nature conservation, conservation of cultural heritage, and provision of compatible recreational opportunities. Within this category, both the prohibitions and rehabilitation actions may apply, and may be supplemented with projects with a special emphasis on sustainable recreation and conserving cultural heritage.

The Queensland Conservation Council (QCC) has proposed a slightly different classification for Queensland's Wild Rivers Policy: Wild and Natural Rivers, which have almost all of their natural and or cultural values intact and demonstrate high ecological integrity at a catchment scale; Rivers of Regional Significance, which are rivers that present significant conservation or cultural values at a regional scale; and Heritage Rivers, which are rivers that retain rich social heritage value despite having suffered from degrading pressures over time. In QCC's proposal, a set of prohibited activities, including new water extractions, prohibitions on new dams, and restrictions on floodplain developments, apply to all three categories.

The existing Victorian Heritage Rivers program has two categories, Heritage River and Natural Catchment Areas. Neither category is defined in the Victorian Heritage Rivers Act except by reference to the areas included in the category, but it appears that Heritage Rivers are restricted to the river channel itself plus riparian land immediately adjacent, whereas Natural Catchment Areas can include land throughout the catchment. New impoundments and water diversions are prohibited in Heritage Rivers unless the Governor in Council approves its construction. New water diversions, new impoundments, and a variety of land and water management activities are strictly prohibited in Natural Catchment Areas.

- *A mechanism for involving the public in nominating and managing sites*

As discussed above, protected areas offer a tremendous opportunity for involving communities in conservation. Nowhere is this more so than in nominating sites for protection, where communities can define what they value about a place, work with technical experts to devise plans for maintaining and enhancing those values, and articulate the ongoing value of protection for this and future generations.

The Canadian Heritage Rivers System rests on extensive public involvement at every stage of the process. Extensive guidance is available to community groups to help structure their involvement. At the earliest stage, a proponent of designation is encouraged to evaluate their river against national and provincial guidelines and involve other stakeholders in the nomination. Once it's been determined that the river may qualify, the proponent can get financial assistance from the Canadian Heritage Rivers Board for conducting the research needed to prepare a nomination. After the river has been nominated, community involvement continues through management planning and monitoring, with some financial assistance available through the Board.

There are analogous, though perhaps less detailed examples of community nomination processes in Australia. Community groups can nominate sites for inclusion on the National Heritage List. The New South Wales Wilderness Act authorises any person to submit a wilderness proposal to the Director of National Parks and Wildlife for assessment.

- ***What difference can high conservation value areas make on the ground?***

High conservation value areas can perform the same functions as terrestrial or marine protected areas. They can provide the responsible management agency with authority to control activities within the bounds of the area: managing access, recreational activities ranging from angling to boating and consumptive uses. They can provide the management agency with additional authority, whether formal (statutory) or informal, to influence off-site impacts through involvement in off-site planning and resource allocation processes. They can act as a locus for rehabilitation activities of different types and a magnet for effective investment of rehabilitation funds.

Management actions will differ considerably between different protective classifications. In general, management for relatively intact systems will focus on protection and the prevention of damaging acts; management for degraded systems will focus on rehabilitation. The two examples below, both based on actual proposals for protection, illustrate the difference.

1. The Queensland Conservation Council has proposed that the Queensland section of the Paroo River be given the most stringent protection available under their Wild Rivers proposal: Wild and Natural Rivers. Under this classification, additional water extractions, new dams and weirs, flow control activities such as desnagging, exotic fish stocking, and intensive agriculture are prohibited within the catchment. Floodplain developments, vegetation clearing, mining and forestry are restricted.

   This protective classification will strengthen and formalise a level of existing protection through the Intergovernment Agreement for the Paroo River between New South Wales and Queensland. That agreement establishes a process for the two states to consider water and catchment issues cross-border but does not provide the specific restrictions in the QCC proposal. In addition, formal designation as a protected area also would boost the potential for signage and other educational material.

2. The Murray-Darling Basin Commission Native Fish Strategy, in its Investment Plan 2003-2006, has proposed a set of "demonstration reaches," which are integrated habitat rehabilitation projects designed to show the benefits for native fish when all the necessary river-rehabilitation works are integrated and focussed in one place. The objectives of the demonstration reach program are similar to those discussed in this paper for high conservation value areas: to show by example the need for river rehabilitation to address the full range of issues, to show the extent of benefits that can be achieved by integrated programs, to enhance community awareness and support, and to focus the attention of funding agencies and boost scientific knowledge of rivers and fish.

   The Investment Plan includes costed proposals for ten demonstration reaches throughout the Murray-Darling Basin. For example, the $10 million proposal for the Gwydir River and Gingham Watercourse includes projects to resnag habitat; improve regulator operation; provide fish passage; control willow, water hyacinth, and carp;

and a communications program. Expected benefits include increase in number and diversity of native fish, improved wetland and floodplain habitat values, and greater control over environmental flow releases to inundate wetlands.