Managing Wetlands Workshop
6 September 2011
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Optimising environmental water protocols to maximise benefits to native fish populations

Murray–Darling Freshwater Research Centre (MDFRC) and Arthur Rylah Institute (ARI) for Environmental Research (Vic) as research providers with input from environmental mangers from a number of organisations including:

- Murray Catchment Management Authority (NSW)
- Murray Wetlands Working Group (NSW)
- Goulburn Broken Catchment Management Authority (Vic)
- North East Catchment Management Authority (Vic)
- Murray–Darling Basin Authority (MDBA).
Fish are an important component of water dependent ecosystems and their biodiversity. Murray–Darling floodplain wetlands provide habitat for many threatened and significant fish species and yet investigation of artificial riverine–floodplain–wetland by environmental watering has mainly focussed on the needs of waterbirds and forests, leaving gaps in our understanding of the flooding requirements for native fish.

Australia’s floodplain river systems support thousands of wetlands, including many of international significance. A large number of these have suffered marked degradation as a consequence of altered hydrology associated with river regulation. Water is now being set aside specifically for environmental purposes. This ‘environmental water’ is being used to reinstate a more natural flow regime within rivers and to inundate wetlands for specific environmental gains, particularly the maintenance of riparian forests and enhancing bird breeding events.

While the use of environmental watering has been progressing at a rapid rate, especially within the Murray–Darling Basin, the knowledge and management procedures required to develop suitable protocols for wetland watering designed to benefit other biotic groups is lagging behind. For example, there is a relatively poor understanding of how flow interacts with underlying ecological processes that would enhance native fish populations. Improving our knowledge of fish water requirements will help ensure that we balance the water requirements of fish communities with those of other biota.

About the project

This three-year project is one of only a few studies that has investigated the fine-scale relationships between the application of environmental water (i.e. timing, magnitude, duration, method of delivery, and frequency of delivery), wetland habitat characteristics, and the fish community. This project examined the water needs of fish in off-river wetlands for four typical fish species, (three native species—golden perch, Australian smelt and carp gudgeon—and one alien fish, common carp) and how to deliver the water to maximise species management.

The early and on-going collaboration with stakeholders to help shape and inform the design of science and the project outputs was critical to the success of this project.

This work addressed the requirement under the National Water Initiative for best available science that allows for informed judgement on the trade-offs between competing outcomes for water systems, and the need for knowledge that demonstrates ecological outcomes from environmental flow management.

Key findings

- **Wetlands are productive hotspots in floodplain riverine landscapes**
  This is the first time that the importance of floodplain wetlands to the overall productivity of fish populations has been quantified in Australia.

- **The method of delivery of environmental water is critical to boosting fish numbers in wetlands**
  Delivery through natural flow or regulators provides greater fish recruitment than delivery methods that limit fish passage into the wetland, such as pumping, siphoning, or passing water through small pipes/culverts.

- **Timing of water delivery is important**
  Short-term fish recruitment can be maximised if water delivery coincides with, or is just prior to, the spawning season of the target fish species.

- **The source of water is important**
  Sourcing water from either the river or large permanent creeks rather than from depauperate sources such as irrigation channels will maximise benefits to short-term fish abundance.
• Semi-permanent floodplain wetlands have higher concentrations of nutrients and primary productivity when compared to the main river channel. This higher productivity supports a more abundant zooplankton community that is important food for native fish.

• Fish body condition is improved in semi-permanent wetlands compared to the main river channel during spring and summer.

• Longer watering events in the semi-permanent wetlands of the mid-Murray promote greater recruitment of fish and improve fish body condition.

• Environmental watering increases the abundance of the total fish community (all species considered together) within wetlands by increasing the abundance of fish in their first year of life.

Key messages

One of the goals of the project was to work with managers to deliver products to better facilitate adaptive management strategies. A number of key messages to assist managers in decision making and adoption has been identified:

• Watering ‘attributes’ are critical to optimising fish abundance in wetlands because they affect the colonising potential of fish (method of water delivery, source water) and their ability to successfully spawn and recruit (timing of watering).

• The delivery of environmental water should be a key focus of restoration efforts aimed at improving native fish outcomes in floodplain wetlands. The role of habitat in influencing fish community response assumes more importance when wetlands are watered naturally (i.e. not through artificial management infrastructure).

• Fish-related targets for wetland watering need however to be carefully defined since the importance of watering and habitat attributes to fish abundance varies among species. If the target is specifically aimed at an individual species, managers will need an awareness of its species biology and ecological requirements.

• The inherent variability of wetlands and watering events means that fish-related targets for wetland watering should be reviewed, and adapted if required, before each artificial watering event to ensure that the target is achievable.

• If a target of wetland watering is to increase long-term native fish abundance, fish need a secondary watering event (e.g. top-up watering) to move into the river. Severe wetland shrinkage post-watering should be avoided.

• The fish communities inhabiting floodplain wetlands are spatially and temporally diverse – with this in mind managers may want to minimise reliance on a limited number of iconic wetlands to achieve conservation goals.

• Scientist/water manager collaboration is important to maximise native fish benefits from environmental watering.

To maximise the success of wetland watering for native fish the following key points for monitoring have been identified:

• Wet weight, Fultons condition factor and percent dry weight seem suited to assessing changes in fish condition over short-term periods (i.e. weeks to months); physiological measures such as lipid content seem more useful in reflecting changes over medium to long-term periods (i.e. greater than several months).

• Monitoring programs should seek to collect data along gradients of watering attributes (timing of watering, method of delivery, source water, event frequency, carp screens) and wetland characteristics, to describe the relationship between attributes, characteristics and ecological outcomes.

• An agreed, coordinated monitoring program should be developed amongst stakeholders and scientists to optimise watering strategies and maximise knowledge generation.

• Ideally the monitoring of individual watering events should be treated as part of a larger monitoring program seeking to describe the relationship between watering attributes and desired outcomes.

• Appropriate collaborative institutional arrangements should be developed to allow synthesis of monitoring data from a variety of institutions and research projects.
Project products

**Decision support tool**

During drought periods the ability of water managers to deliver an optimal water regime (timing, volume, rate or frequency) to facilitate native fish breeding, is limited. Therefore the project team focussed on the development of a predictive tool that would allow managers to compare and contrast a range of sub-optimal wetland inundation scenarios and determine which is most likely to achieve their objectives. The Fish-in-Wetlands Decision Support Tool (FWDST) was developed using Bayesian network models for three native species—golden perch, Australian smelt and carp gudgeon—and one alien fish, common carp.

By considering a range of native and alien fish species, the Fish-in-Wetlands Decision Support Tool (FWDST) aims to provide managers with a probabilistic assessment of fish population responses to a number of different wetland watering strategies so that they may be compared. The tool could also be used to help prioritise or determine which wetlands might receive water by comparing the expected fish response in a number of wetlands.

The FWDST and accompanying user manual can be found at: www.mdfrc.org.au

**Wetland demonstration site**

The MDFRC and ARI have worked with all relevant stakeholders including the NSW Office of Environment and Heritage, the NSW Department of Industry and Investment (Fisheries), NSW State Water, the Murrumbidgee CMA, and the Wiradjuri people to develop Coonancoocabil lagoon on the lower Murrumbidgee River, NSW as a demonstration site. This demonstration site will facilitate the ongoing development and refinement of the decision support tool.

**Waterlines report**

*Watering floodplain wetlands in the Murray–Darling Basin for native fish* (Beesley L, Price A, King A, Gawne B, Nielsen D, Koehn J, Meredith S, Vilizzi L, Ning N, Hladyz S) presents a summary of key findings, key messages, recommendations and science from the project work. It also includes monitoring protocols that could be used by those undertaking environmental watering. It is available from the Commission’s website www.nwc.gov.au

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**Further information**

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The National Water Commission is responsible for driving progress towards the sustainable management and use of Australia’s water resources under our blueprint for water reform – the National Water Initiative.
Water regime for wetland and floodplain plants: a source book for the Murray–Darling Basin
Understanding and better managing wetland plants is vital to boosting the health of the catchments in which they are located. Wetland plants oxygenate and purify water and can directly improve other ecosystems.

About this project

The National Water Commission funded this book to update and extend the authors’ original publication produced in 2000. This volume, Water regime for wetland and floodplain plants: A source book for the Murray–Darling Basin, captures the wealth of research knowledge generated over the past decade about effective vegetation management as part of the ecology of our inland wetland and floodplain systems. The new publication is an invaluable resource for everyone involved in wetland and floodplain management in the Murray–Darling Basin. Planners and practitioners can now access the most up-to-date, evidence-based knowledge and practice methods for managing ecologically important wetland plants.

This work addresses the requirement under the National Water Initiative for best available science that allows for informed judgement on the trade-offs between competing outcomes for water systems, and the need for knowledge that demonstrates ecological outcomes from environmental flow management.

The updated edition covers 19 species and information is provided at several levels to meet the requirements of a range of stakeholders. A synthesis of what is known about each species is organised under simple headings such as ‘Life cycle’ and ‘Water regime’.

Each section provides details on the water regime for the subject species, presenting what is known about its ecological dependency on water regime and the effect on growth, survival and capacity to reproduce. This focus on the flow ecology relationship will enable managers to use the technical life-cycle details to inform their practical options for regulating and controlling water regimes in wetland and floodplain systems. This detail is followed by a one-page summary of the flow and water regime the species requires for vigorous health. Further scientific and management references are provided for those who need more detail.
The featured species were selected for their ecological importance and relevance to flows and flow management of Basin wetlands, floodplains and rivers. Some are invasive, including introduced plants such as willow and lippia, and native species such as giant rush. These are included for their functional impact on wetland and floodplain systems and the need for managers to develop specific strategies for their control.

The authors’ species selection was based on their own experience and knowledge of the vegetation with which most wetland and floodplain managers deal from day to day.

The sections are titled as follows:

- Forests and woodlands (black box)
- Shrublands ( lignum )
- Grasslands ( cane grass )
- Sedgelands and rushlands ( common spikerush )
- Herblands ( lippia )
- Benthic herblands ( ribbon weed ).
Further information

The publication, *Water regime for wetland and floodplain plants: a source book for the Murray-Darling Basin* (Roberts J & Marston F) is free and can be downloaded electronically from the Commission’s website www.nwc.gov.au

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The National Water Commission is responsible for driving progress towards the sustainable management and use of Australia’s water resources under our blueprint for water reform – the National Water Initiative.
Minimising environmental damage for inland wetland recovery

Dr Deborah Nias – Murray Wetlands Working Group
Dr Darren Baldwin – Murray Darling Freshwater Resource Centre
Sulfidic sediments in Australia’s inland waterways have recently emerged as a potentially serious environmental problem depending on the specific local conditions. They can cause considerable ecological damage and have the potential to significantly detract from aesthetic values and impact on human health.

About sulfidic sediments

Sulfidic sediments, also known as acid sulfate soils, contain high levels of reduced inorganic sulfur. This occurs when large amounts of sulfate in the soil are converted into sulfide (reduced sulfur) by bacteria that use sulfate instead of oxygen for respiration. The sulfide then reacts with metal ions to form metal sulfides such as iron pyrite.

If they are disturbed or exposed to oxygen, when a water body dries out, a range of biogeochemical processes can be triggered. Acidification, deoxygenation of the water column, and the mobilisation of toxic heavy metals and metalloids are the major processes that can occur. These toxins can affect human health and cause ecological damage.

Sulfidic sediments are very common in coastal regions around the world and were not thought to be a problem in inland areas. However, they are now emerging as a major threat to inland waterways and wetlands. One of the most dramatic examples of the oxidation of sulfidic sediments is Bottle Bend Lagoon in south-western New South Wales. Following a partial drying of the lagoon in 2002, the pH fell from 8 to less than 3 in about four months, resulting in a substantial fish kill. The wetland has remained acidic since then. To put this in context, the Australian water quality guidelines for aquatic ecosystems recommend a pH of greater than 6.5.

There are a number of visual cues which may indicate the presence of sulfidic sediments in an inland water body, including:

- discoloured and reddish bank and bed sediments from bank seepage
- banks and organic debris covered in copper coloured scum
- appearance of an oil slick and reddish deposits
- sediments beneath any scum resembling black ‘ooze’;
- unhealthy looking, murky water with an orange to brown tinge
- a distinctive salty odour.

About this project

This project, funded by the National Water Commission, was designed to determine appropriate wetting and drying strategies in inland wetlands to minimise formation of sulfidic sediments. It provides environmental water managers with tools and guidelines on how to best manage inland wetlands to prevent the formation of sulfidic sediment, and how to remediate affected systems.

This work addresses the requirement under the National Water Initiative for best available science that allows for informed judgement on the trade-offs between competing outcomes for water systems, and the need for knowledge that demonstrates ecological outcomes from environmental flow management.
Key findings

Saline groundwater is the principal source of sulfate to inland water bodies.

Through bore surveys along the Murray River, the research team established that much of the shallow groundwater was saline and contained high sulphate concentrations. The amount of sulfate in groundwater was found to correlate strongly with salinity levels. As a consequence, groundwater salinity can be used as an indicator of the potential formation of sulfidic sediments.

Once formed, sulfidic sediments are both difficult and costly to effectively manage. Environmental flows have the greatest potential to be used as a proactive tool for preventing the accumulation of harmful levels of sulfidic sediments in inland waterways.

Remediation is costly and time-consuming. A field experiment at Bottle Bend Lagoon, involving the application of 20 treatments aimed at neutralising oxidised sulfidic sediments in a severely degraded wetland, revealed that very few were successful in reducing acidity levels after six months, particularly at sediment depths greater than 5cm. The research also demonstrated that implementation at a wetland scale of any effective treatments, e.g. application of calcium carbonate (aglime), is likely to be prohibitively expensive and logistically challenging.

It is much more effective to minimise the potential for oxidation of sulfidic sediments in the first place.

Key messages

• Management of sulfidic sediments should be included as a key objective when determining use of environmental water in Australia’s inland river catchments.
• Rehabilitation of waterways affected by sulfidic sediments is not simple and there is no single approach. Each system should be considered on a case-by-case approach, utilising the Action Support Tool developed in this project.
• Use of agriculture chemicals containing sulfate, e.g. gypsum, should be limited as far as possible.
• Monitoring of shallow groundwater composition, especially salinity levels, should be incorporated into wetland and river assessments as an indicator of the potential for the presence or formation of sulfidic sediments.

Project products

Support tool

An Action support tool for managing sulfidic sediments in inland aquatic ecosystems has been developed to provide guidance on the identification and management of sulfidic sediments in inland aquatic ecosystems. This tool is available on the MDFRC website: www.mdfrc.org.au.

Waterlines report

The Waterlines report, Sulfidic sediments in inland waterways (Baldwin DS, and Capon SJ 2011) presents a summary of key findings and management recommendations from the project work. It is available from the Commission’s website: www.nwc.gov.au

Guidance document for the management of acid sulfate soils

The scientific knowledge generated not only supported the project recommendations and products, but underpinned the development of the National guidance on the management of acid sulfate soils in inland aquatic ecosystems produced by the Department of Sustainability, Environment, Water, Population and Communities. This document can be found at: http://www.environment.gov.au/water/publications/quality/guidance-for-management-of-acid-sulfate-soils.html
The National Water Commission is responsible for driving progress towards the sustainable management and use of Australia’s water resources under our blueprint for water reform – the National Water Initiative.
Adaptive management of wetlands and rivers – the role of waterbirds as indicators

Professor Richard Kingsford
University of New South Wales
Waterbirds are known to be extremely sensitive to changes in wetlands, especially to filling and drying patterns—making the status of bird populations an invaluable indicator of wetland condition. Waterbird numbers are also an important contributory criterion to the significance of a wetland, for example under the Ramsar Convention.

About this project

The National water resource assessment using waterbirds: Ecosystem health and conservation importance of water-dependent ecosystems and rivers project is funded by the National Water Commission (the Commission) through their Raising National Water Standards (RNWS) Program. The project focuses on the potential use of waterbirds as a group of indicators for water resource management and planning and the project report will be released in late 2011. The project addressed three major objectives:

1. Design and completion of a national survey of waterbirds in all major wetlands of Australia holding water in 2008
2. Assessment of long-term changes in waterbird numbers in relation to flow in key wetlands of eastern Australia using data from the Eastern Australia Aerial Waterbird Survey
3. Design and establishment of a National Waterbird Database for storing and accessing waterbird survey data.

Key findings

The project revealed a substantial decline in waterbird numbers across the survey region of eastern Australia based on surveys of the region generated from 1983 through to 2009. This is due partly to drought and loss of habitat but also to the long-term effects of river regulation on some wetland systems.

The survey found that few wetlands supported large numbers of waterbirds (more than 10,000), with most supporting fewer than 1000. Those with high or extremely high concentrations (25,001 – 300,000) were in northern Australia, Western Australia, central Queensland and western New South Wales.

The largest numbers of waterbirds were in northern and western Australia; the Timor Sea division had 41 per cent of all the birds counted. The top 20 ranked wetlands, rated in terms of waterbird abundance, supported 40 per cent of the waterbirds counted. More than 50 per cent of the birds were found in 41 wetlands.

The 10 most abundant species, or species groups, were the magpie goose (accounting for 19.5 per cent of all waterbirds), followed by small waders, plumed whistling-duck, grey teal, large waders, egrets, banded stilt, wandering whistling-duck, pink-eared duck and tern. This ‘top 10’ accounted for more than 72 per cent of total waterbird abundance surveyed.

The national aerial survey has produced an unprecedented amount of information on the distribution and abundance of waterbirds across the country. This information will assist water resources managers to fulfil Commonwealth and jurisdictional reporting responsibilities and to plan the timing and duration of environmental flows to key wetlands.
Key recommendations

A summary of recommendations arising from the project for policy and management are highlighted below.

1. The importance of northern Australia to waterbirds must be recognised at a national (and international) level. This should include use of the data from the 2008 National Waterbird Survey to inform a critical assessment of the current reserve network in tropical regions and wetlands listed under Ramsar.

2. The significance of ephemeral wetlands of inland Australia to waterbirds, especially duck species, even during a dry year such as 2008 should be recognised at national and jurisdictional levels.

3. Much of the value of the National Waterbird Survey will come from repeating this survey over time and supplementing the survey with longitudinal studies of targeted wetlands that respectively explore long-term temporal trends and finer seasonal and event-based fluctuations.

It should be noted that the current project has only included a preliminary analysis of the extensive data set produced by the 2008 National Waterbird Survey. Many recommendations of relevance to policy and management require further analyses and consideration in the context of specific management questions, including:

1. identification of wetlands of national importance to waterbirds, both overall and to particular species, to ensure these are adequately protected by the reserve network and conservation agreements such as Ramsar

2. identification of wetlands of regional importance to waterbirds, both overall and to particular species to ensure these are adequately protected by the reserve network or off-reserve conservation measures such as environmental flow planning

3. identification of wetlands of local importance to waterbirds using data on species and functional compositions to inform appropriate on-ground management actions

4. identification of waterbird species of potential concern such as grey teal, for development of targeted species management plans.

A number of recommendations on directions for future research have been identified.

The extensive dataset produced by the 2008 National Waterbird Survey has considerable potential for generating new knowledge about the ecological structure, function and condition of Australian rivers and wetlands. Some of the key questions that might be addressed using the existing dataset include:

1. How do patterns of waterbird diversity and abundance at a national scale relate to patterns of diversity and abundance of other aquatic organisms?

2. What spatial patterns exist in the distribution of waterbird species at a national scale and how do these relate to wetland area, wetland type, climate, hydrology, land use and landscape factors?

3. How vulnerable, in terms of projected exposure, are wetlands of importance to waterbirds to climate change in different regions of Australia?

Project products

Waterlines report

The Waterlines report from this project will present a summary of key findings, messages, recommendations and science and will be available in late 2011.

National waterbird database

The prototype national waterbird database was developed as a product of this project. The database is designed as a rigorous platform that when fully scoped, seeks to establish the foundation for a central repository for Australia’s waterbird data. It will include the results of ground, boat and aerial surveys of populations that will be flexible, enabling the incorporation of a range of datasets. The National Water Commission and the Department of Sustainability, Environment, Water, Population and Communities are working together to ensure this database is accessible on line.
Further information

Further information on the *National water resource assessment using waterbirds* project can be found on the Commission’s website: www.nwc.gov.au

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The National Water Commission is responsible for driving progress towards the sustainable management and use of Australia’s water resources under our blueprint for water reform — the National Water Initiative.
National framework for the assessment of river and wetland health (FARWH)

Western Australia – Department of Water
Rivers of northern Australia, Northern Territory & Western Australia – Tropical Rivers and Coastal Knowledge (TRaCK), Queensland – Department of Environment and Resource Management, New South Wales – Office of Environment and Heritage, Department of Premier and Cabinet
Significant gaps in available data and understanding of Australia’s river and wetland health were found during the National Water Initiatives Baseline Assessment of Water Resources 2005 (AWR 05). The assessment also identified the need to develop an approach that enables locally relevant, comprehensive assessments of river and wetland health to be comparable across jurisdictions so that condition at a national scale could be assessed.

About these projects

To address the need for a nationally consistent report on river and wetland health, the framework for the assessment of river and wetland health (FARWH) was developed and initially tested in Victoria and Tasmania as part of the AWR 05. The National Water Commission funded four additional trials to further test the robustness of the framework in different jurisdictional contexts and ecosystem types. Three riverine trials were undertaken in Queensland, Northern Australia and south west Western Australia. One trial was undertaken in New South Wales to test the applicability of the framework for wetlands.

The trials were overseen by the FARWH national high level technical steering committee, made up of jurisdictional and Australian Government representatives. This group has ensured that FARWH is useful for managers, and is able to complement other tools or approaches being used in different parts of Australia. The framework has been found to be robust and is near ready to be adopted at a national scale.

The FARWH trial outcomes have demonstrated that a national approach to river and wetland assessments is technically feasible under the broad framework proposed. Important lessons have been learned, particularly on the need to incorporate wetland extent as an index, the value of using remote sensing technologies, and the need for FARWH to be developed in a flexible manner so that it can be used at a variety of scales. Measuring the environmental response of rivers and wetlands will provide indicators of success for our significant investments in water buybacks, water efficiency programs, and improvements to the delivery of environmental water.

About FARWH

The FARWH builds on lessons learned from two decades of Australian river and wetland health assessment programs. It draws on existing jurisdictional river and wetland assessment programs (such as the Monitoring River Health Initiative, Tasmanian Conservation of Freshwater Ecosystem Values and the Victorian Index of Stream Condition).

The FARWH uses a hierarchical model (Figure 1) of river and wetland indices found to be relatively consistent across the country: catchment disturbance; hydrological disturbance; water quality and soils; physical form; fringing zone, and; aquatic biota.

A key outcome of the FARWH development is the addition of another index, wetland extent (Figure 2). This index aims to measure wetland reduction over time as wetland area is often altered or destroyed as a result of land-use change. The wetland extent index needs to be considered as a first step and in addition to other indices of wetland health to provide a complete assessment of wetland ecosystem health.

All indices are reported against separately so that the variable influence of an individual index on system typology is not lost in an aggregation process. An aggregated overall score is also available.

Wetland and river scores in a specific region are also assessed and reported separately, due to the fundamental differences in function between the two types of system.
Figure 1: The initial FARWH assessment approach

A two-tiered approach

Currently, the application of FARWH is limited by data availability and the resources needed to collect new data. With this in mind, the FARWH has been adapted to include the option of a two-tiered approach (Figure 2).

The first tier of the approach involves a broad scale assessment using existing datasets and desktop methods to assess an entire region of interest. This tier uses indices that are threat based, and enables efficient use of resources to gain a broad threat or risk based assessment in data poor areas.

The second tier involves a more detailed assessment at the reach-scale or site scale. This allows resources to be applied to data-rich areas, or those identified as at high risk or of particularly high conservation value. Most or all indices can be fully analysed and explored in the second tier assessment.
Figure 2: The proposed two-tiered FARWH assessment approach

Phase 1: Broad-scale desktop assessment
- Modelling, remote sensing and/or GIS analyses (or analysis of detailed data if available) (requires mapping of system)
- Wetland extent
- Catchment disturbance
- Hydrological disturbance
- Fringing zone

Low risk of declining condition (based on understanding of system) or
High risk of declining condition (based on understanding of system)

No obligation for detailed condition assessments
Can be undertaken if specific reason(s) identified (e.g. Ramsar site, HCV/HC, jurisdictional drivers)

Phase 2: Detailed condition assessment
- Select indices (based on conceptual understanding of system)
- Catchment disturbance
- Hydrological disturbance
- Fringing zone
- Wetland extent
- Water quality and soils
- Physical form
- Aquatic biota

Assessment using selected indices

Phase 3: Output and validation
- Outputs
  - FARWH scores: indices/sub-indices
  - Prioritisation of actions
  - Jurisdictional reporting

If detailed condition data is available, skip straight to Phase 2

Research to test and validate underlying conceptual understanding

Catchment disturbance
Hydrological disturbance
Fringing zone
Low risk of declining condition
High risk of declining condition
Wetland extent
Research to test and validate underlying conceptual understanding
Wetland extent

Water quality and soils
Physical form
Aquatic biota
Assessment using selected indices

Outputs
- FARWH scores: indices/sub-indices
- Prioritisation of actions
- Jurisdictional reporting

Catchment disturbance
Hydrological disturbance
Fringing zone
Low risk of declining condition
High risk of declining condition
Additional outcomes of the FARWH trials

- **Development of products to support the use of FARWH**
  As part of the tropics and south-west Western Australia trials, a demonstration online tool was developed by the Institute of Ecology, University of Canberra and Catchment Simulation Solutions. The online tool demonstrates how jurisdictions could manage data, mapping and present multiple scales of results. The tool also provides an example of interactive training on how to use the FARWH.

- **Alignment of assessment methods**
  The FARWH program has provided a forum for jurisdictions to share lessons about using different river and wetland assessment programs. Sharing knowledge in this way has meant that FARWH has incorporated the ‘best’ features of existing assessment programs. Recent FARWH trials have used remote sensing technologies such as light detection and ranging. These methods may enable remote areas of Australia with little existing data to be assessed for future application of the FARWH.

- **Stimulating and assisting jurisdictional programs**
  The funding of the trials has provided the skills and experience to align any future assessments across and within jurisdictions. For example, in Western Australia, many of the methods developed during the FARWH trials have been adopted for existing programs such as water allocation plans and the determination of environmental flow requirements. This approach will be used in other states and territories, which will result in nationally comparable datasets and the sharing of knowledge between jurisdictions. If implemented at a national level it will also assist with prioritisation of funding and resources.

Project products

The FARWH trials have resulted in the following technical reports to be published at the end of September 2011:

- **Field trial of the framework for the assessment of river and wetland health (FARWH) in the wet/dry tropics: Daly River and Fitzroy River catchments** Tropical Rivers and Coastal Knowledge research hub (TRaCK)
- **Alignment of state and national river and wetland health assessment needs (Queensland FARWH trial)** Queensland, Department of Environment and Resource Management
- **The Framework for the assessment of river and wetland health (FARWH) for flowing rivers of south-west Western Australia (parts I & II)** Western Australia, Department of Water
- **Testing the framework for the assessment of river and wetland health (FARWH) in New South Wales wetlands** New South Wales, Office of Environment and Heritage

The outcomes of the trials are synthesised in a Waterlines report to be published at the end of September 2011, *The Framework for the assessment of river and wetland health: findings from the trials and options for uptake* (Alluvium Consulting). The Waterlines synthesis report presents the refined FARWH model and outlines estimated costs and recommendations for future uptake.

Following publication, the above reports will be available on the Commissions website, www.nwc.gov.au. The anticipated date for publication is 26 September 2011.
Further information

The Waterlines report and four supporting technical reports will be available from the Commission’s website from 26 September 2011.

www.nwc.gov.au/publications

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The National Water Commission is responsible for driving progress towards the sustainable management and use of Australia’s water resources under our blueprint for water reform – the National Water Initiative.
Aboriginal engagement in water planning
The development and application of Water Sharing Plans is rolling out across Australia. Engaging Aboriginal communities in this process is vital, with social and legal obligations requiring that water is allocated to social, spiritual and customary objectives.

Water Sharing Plans provide two forms of water for cultural purposes, namely:

1. Aboriginal cultural water – up to 10ML for traditional cultural purposes
2. Aboriginal commercial water – restricted to a limited number of water sources, up to 500ML can be used for commercial purposes (usually high flow access only).

Some Aboriginal communities already hold a water licence, but many of these are inactive. Although Aboriginal needs are to be considered in the development of Water Sharing Plans in New South Wales (NSW), the level of consultation is very limited and the needs of Aboriginal communities are generally not adequately addressed. During the development of environmental water provisions for Water Sharing Plans there is a need to consider those issues that are significant to Aboriginal communities.

About this project

This project, to be completed in March 2012, will develop and use Water Sharing Plan Aboriginal Profiles to establish baseline indicators to assess whether NSW is progressively meeting its obligations under the NSW Water Management Act 2000 and the National Water Initiative. It will also establish an evidence base that can be maintained and updated for ongoing work in this area. In addition, it will build capacity and knowledge in government organisations and Aboriginal communities about the best way to work together so that Aboriginal inclusion in water planning is meaningful and secures useful outcomes for all involved.

The project will primarily focus on priority inland areas and extend into coastal water planning areas, if resources permit.

Both the National Water Initiative and the NSW Water Management Act 2000, require Water Sharing Plans to consider the provision of water for cultural purposes, or to protect areas of cultural significance.

Understanding the assets valued by Aboriginals in areas where Water Sharing Plans are being developed and implemented is the starting point for this project. State-wide baseline metrics for each Water Sharing Plan area across NSW will be developed and populated including:

- providing an overall state-wide (statistical and spatial) picture of Aboriginal environmental issues within Water Sharing Plan areas using standard Aboriginal organisational and environmental profiles
- identifying existing water licences held by Aboriginal land owners and other Aboriginal entities
- establishing existing Aboriginal landowners adjacent to water courses, together with their existing or required water assets, who may wish to secure cultural or commercial entitlement
- identifying other generic environmental and cultural landscapes of importance to Aboriginal people that provide opportunities for accessing cultural flows
- targeted assessment with Aboriginal community organisations.

Local baseline metrics will also be developed in consultation with local communities and are likely to include:

- Aboriginal owned land, water licenses and unit shares
- Aboriginal community organisations
- extent of recognition of spiritual, social and customary values of water.
This information will provide the basis for training and education activities that will build capacity and knowledge within government and Aboriginal communities about how to engage and measure the success of Aboriginal inclusion in the development and application of Water Sharing Plans. Two-day community training workshops in the Macquarie catchment of NSW will help disseminate these findings and test ideas about how to improve existing processes to include Aboriginal needs in Water Sharing Plans.

**Expected outcomes**

The expected outcomes from this project are two-fold:

*For the NSW Office of Water*

- to enhance Aboriginal engagement in water planning
- to capture baseline information on Aboriginal performance indicators to inform the evaluation of water sharing plans
- to identify water dependent cultural assets to include in water sharing plans
- to establish networks between staff and Aboriginal communities to communicate water issues
- to improve the coordination of water management activities/information relevant to Aboriginal communities.

*For Aboriginal communities*

- to provide improved confidence in water reform processes and the ability of the NSW Office of Water to deliver the reforms
- to provide the knowledge, skills and ability to participate in the water sharing planning process
- to provide an informed understanding of the opportunities and benefits in the water sharing process
- to increase skills and expertise in the sustainable use of water for their cultural and economic benefit
- to gather information on assets to better inform water sharing plans
- to provide an enhanced capacity to make successful submissions to NOW and have aboriginal issues and values incorporated into water sharing plans
- to have an increase in the number of Aboriginal people successfully securing licences and other available water allocations.
Further information

For further information on this project visit the Commission's website:

www.nwc.gov.au/projects

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The National Water Commission is responsible for driving progress towards the sustainable management and use of Australia's water resources under our blueprint for water reform – the National Water Initiative.
Australian environmental water management report 2010
About this project

The National Water Commission produced the *Australian environmental water management report 2010* to assist governments to deliver the National Water Initiative’s (NWI) water resource accounting outcome: to ensure that adequate measurement, monitoring and reporting systems are in place in all jurisdictions and to support public and investor confidence in the amount of water being traded, extracted for consumptive use, and recovered and managed for environmental and other public benefit outcomes.

The report presents a comprehensive picture of Australia’s current environmental water management arrangements at 30 June 2010. It was not intended to assess the arrangements in place or to make recommendations. Instead, it was intended to promote better understanding of environmental water management and to provide a clear, agreed baseline for future reference.

The establishment of water requirements for the environment and the subsequent provision of water through water plans, does not lend itself easily to volumes and ‘water balances’. Environmental water requirements necessarily involve issues of timing, water quality and dynamic flows. This complexity means that at an overall regime level it is difficult to represent environmental water allocations numerically – posing a significant challenge in water resource accounting.

Given the necessity for jurisdictions to report on environmental water management practices and allocations, this project sought to establish a 2010 baseline of activity in the area. For the purposes of the study, the following definition was used:

*Environmental water is the water regime provided to achieve environmental objectives*

Using this definition, the report focused on environmental objectives and values, not ‘other public benefit outcomes’ (e.g. recreational and aesthetic outcomes) within water plans that state and territory governments are delivering under their relevant water legislation.

Key findings

Over a twelve month period, researchers systematically worked their way through water plans in each jurisdiction across Australia. Following this extensive analysis the following key findings were reported.

- Environmental water management is a complex task that has developed in response to vastly different water resources around the country and a range of historical demands on those resources.
- While the ‘delivery’ of water through water access entitlements for environmental purposes in the Murray-Darling Basin has received widespread public attention, environmental water management around Australia is primarily based on ‘restrictions on extraction’ from water resources, through water plans and conditions on water access entitlements.
- Although the determination and commitment of environmental water is improving, the detail, frequency and geographic coverage of monitoring, reporting and review of environmental water varies around Australia. Often this is a reflection of the different water resources and the different levels of pressure on those resources.
An environmental water management framework

A consistent environmental water management framework was used in the report to allow a comparison the various approaches around Australia. The framework consists of four elements, shown in Figure 1 and described in Table 1.

**Figure 1: The environmental water management framework used in the Australian environmental water management report 2010**

![Environmental Water Management Framework Diagram]

**Table 1: Description of the elements of the environmental water management framework**

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determination</td>
<td>Determine environmental objectives and water requirements for a range of risk levels.</td>
</tr>
<tr>
<td>Commitment</td>
<td>Decide the environmental water provisions, (allocation limits, access rules and delivery of entitlements) and commit to them through the development and implementation of water plans.</td>
</tr>
<tr>
<td>Compliance</td>
<td>Monitor and report to assess if the actual extraction (and delivery of entitlements) and the water regime provided comply with the commitments.</td>
</tr>
<tr>
<td>Review</td>
<td>Monitor and report on environmental response and condition so as to evaluate and review the environmental water objectives and provisions.</td>
</tr>
</tbody>
</table>

The report argues that applying this framework consistently across all jurisdictions will enable a more thorough and comparable assessment to be made of progress in environmental water management. While the report did not include recommendations, the Commission encourages the recent (and ongoing) developments in water accounting standards, that will assist in delivering consistency and rigour to environmental water reporting, which will in turn promote the ‘public and investor confidence’ that the NWI seeks to achieve.
The *Australian environmental water management report 2010* delivered a consolidated report on environmental water management in Australia. This has:

- transparently reported environmental water rules and entitlements, their management and the reporting arrangements in place to monitor environmental water management outcomes
- promoted improved environmental water management practices by allowing jurisdictions to compare approaches and share knowledge
- collected national data on environmental water management to promote NWI outcomes
- provided an authoritative basis to identify gaps and support improvement in environmental water management.

This report is the first stage in a three year project, *Development of an Australian environmental water report*, funded through the Raising National Water Standards program. The project was developed to promote improved environmental water reporting and to produce an annual report on:

- environmental water objectives and expected outcomes
- environmental water management and implementation arrangements
- statutory recognition of environmental water
- achievement of environmental water objectives and outcomes (outcome monitoring and reporting).

Stages 2 and 3 of the project are currently underway and the National Water Commission aims to complete the project by February 2012.

**Further information**

The publication *Australian environmental water management report 2010* is free and can be downloaded electronically from the Commission’s website [www.nwc.gov.au](http://www.nwc.gov.au) or a hard copy can be ordered through the Commission’s bookshop.

For further information on the next stages of the project contact Emily Slatter on emily.slatter@nwc.gov.au or (02) 6102 6083

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