MURRAY-DARLING BASIN COMMISSION

The Barmah-Millewa Forests
WATER MANAGEMENT STRATEGY

June 2000
Any individuals have exerted themselves to improve the ecological health of the Barmah-Millewa Forests, on which this Water Management Strategy is focused. A great debt is owed to many people who during the past century have diligently recorded river flows and seasonal and Forest conditions, providing the historic base on which to evaluate change. For at least half a century, many individuals and organisations expressed concern about the effects of river regulation on the red gum forests. Remedial actions, by the Victorian Forests Commission, commenced in 1939 but did not keep pace with increased demands on the system. A little later, in the late 1940s and early 1950s, the first water management study of the red gum forests was carried out by the Forests Commission of New South Wales, driven in part by a concern for the impacts of changing patterns of river flows and the proposed Snowy Mountains Scheme. Neville Davies had an involvement in this study and a continued role, later representing the Forests Commission with Barrie Dexter, from the Victorian Forests Commission, on a River Murray Commission water management committee in the 1980s.

In the 1940s, 1950s and 1960s, interest centred on prevention of unseasonal flooding of the forest and an understanding of river, creek and effluent hydraulics. Over this time, the River Murray Commission’s Executive Engineer, Geoff Harrison, and staff from the Deniliquin office of the Water Conservation and Irrigation Commission — Ian Bolton, John Duchatel and John Moorehouse, among others — carried out the groundwork for design of the present forest regulator system. In the early 1970s, the focus moved from providing and managing flow control structures to a wider interest in better water management of Forest ecosystems. Intrastate Forest and water agencies investigations commenced in 1976 — an intrastate perspective being developed through the River Murray Commission’s Water Resources and Management Committee. The first requirement was to define the water requirements of the Forests as a prerequisite to developing strategies for efficient Forest water management. At this time, the Victorian State Rivers and Water Supply Commission — David Dole, Ian Meacham, and Clark Ballard, among others — began an involvement in the Forest water management issues. In New South Wales, the Forestry Commission began a series of innovative works to improve Forest watering using the insight of Peter Paunovic and Joe Murphy.

In 1983, the River Murray Commission released a public information statement, River Murray-Tocumwal to Echuca — River Regulation and Associated Forest Management Problems. This work, a joint State Agency/Commission effort driven by Warren Martin and Ian Meacham, drew on studies of the relationship between forest ecology/forest management and water regimes undertaken by the forestry schools at the Australian National University, the University of Melbourne and Victorian and New South Wales land and water agencies. It also drew on river management modelling carried out by the River Murray Commission. At this time, Leon Bren, from the School of Forestry at the University of Melbourne, began a series of studies of water management in the Forest that stretched over some ten years. This work was extended by Peter Bacon, of New South Wales State Forests, in the early 1990s.

In response to a change in community attitudes towards a greater sensitivity to environmental issues in the 1970s and
1980s, senior management at State and Commonwealth levels provided support for comprehensive multi-disciplinary studies. Over the next decade, various studies — of Forest ecology, hydrology, geomorphology and further river management modelling under various demand strategies and historical seasonal sequences — added significantly to the data base.

This strategy’s immediate antecedents were Maunsell Pty Ltd’s 1992 Barmah-Millewa Forests Water Management Plan. Maunsell’s Don MacLeod was ably assisted by John Tilleard (floodplain hydraulics), Drew Bewsher (river and effluent hydraulics and other modelling), Scott Keyworth (economics) and Judy Frankenberg (forest and riparian vegetation), among others. Peter Crowe (New South Wales State Forests), Barrie Dexter and Colin Leitch (both from Victorian Department of Conservation, Forests and Lands — subsequently Conservation and Environment) and Clark Ballard assisted with supervision of the consultancy.

When the Maunsell study was completed, the Murray-Darling Basin Commission (MDBC) began an extensive community consultation exercise involving individuals, communities and local government from the local region, which culminated in the 1994 report of the Community Reference Group. The Murray-Darling Basin Ministerial Council sought this involvement in recognition of the need for community endorsement if actions are to be effective in the long term.

More recently, both the New South Wales State Forests (Mike Thomson and David Leslie) and the Victorian Department of Natural Resources and Environment (Kevin Ritchie and Keith Ward) have begun a series of works within the Forest to improve watering. The Barmah-Millewa Forum — a joint community/agency group — has given valuable advice on the Forest’s water management.

The valuable assistance and support of the following people throughout the operation of the Community Reference Group and the subsequent Barmah-Millewa Forum is especially acknowledged: Gordon Ball, Jack Bright, Stan Brown, Mac Carling, Alan Corry, Barrie Dexter, Russell Douglas, Neil Eagle, Stewart Ellis, Janet Field, Laurie Fitzsimmons, Richard Francis, Rhys Glenn, Les Gordon, Jim Grant, Maurice Holland, John Hosford, Len Hubbard, Ron Marks, Max Moor, Joe Murphy, Rod Power, Enoch Trickey, Stan Vale, Brian Vial, Colin Walker and Rick Webster.

Finally, this publication, based on a comprehensive draft by Richard Francis, was developed collaboratively between Clive and Matthew Huggan, of Pacific Project Management Pty Ltd, and Brian Lawrence, of the MDBC, with valuable advice from members of the Barmah-Millewa Forum. The MDBC, and ultimately the Australian community, are indebted to the many individuals and organisations — including those not named here — whose contributions over the years have made possible the integrated management reflected in this Strategy.
The Barmah-Millewa Forest is a particularly valuable natural resource, with high ecological, scientific, economic, cultural and recreational values. As in many areas along the River Murray, management of water flows and other matters affecting the Forest have been complicated by its location on the border between two States. When the Hume Dam came into operation, in 1936, flooding patterns within the Forest were changed. In the ensuing years, many individuals, community groups and government agencies have been collecting information on water management in the Forests. Many people have expressed concern about the detrimental effects of river regulation on the Barmah-Millewa Forests. In 1990, it was decided to draw the available information together into a comprehensive water management plan for the Forest. A technical study was commissioned to determine Forest water requirements and to develop water management strategies to meet them. The Murray-Darling Basin Commission then prepared an issues paper to encourage the community and State agencies to make comments.

In June 1993, the Murray-Darling Basin Ministerial Council authorised a Forest environmental water entitlement of 100 gigalitres per year equally down from the States of New South Wales and Victoria. At the next meeting of the MDBC, Commissioners decided that, in relation to water supply to the Barmah-Millewa Forest, the Forest would be managed as a single unit using a single annual water allocation. A Community Reference Group, set up to ensure that stakeholders were widely represented, published a Water Management Plan in 1994. The Ministerial Council subsequently convened an “interim Barmah-Millewa Annual Forum” — a joint community/agency group, now called the Barmah-Millewa Forum — to advise the Commission on the water management in the Forest.

The Commission, having coordinated these activities in collaboration with the community and government agencies, has now prepared this Water Management Strategy. It is to be a dynamic document: it will be modified as our knowledge advances to improve our management of the Forest. Finding the best balance of all the factors involved in management of the Forest has not been easy. In striving to achieve that balance, many valuable lessons have been learnt.

The Strategy now gives us the advantage of a much clearer focus on the tasks ahead. Managing agencies of the New South Wales and Victorian governments will continue to develop and implement programs for land, water and wildlife management under the Strategy’s umbrella. However, we will all need to exercise a strong, long-term, collective will if the words in the Strategy are to be brought to life. The hard work, cooperation and goodwill extended so far is a good sign that we will rise to the many challenges involved in looking after this important Forest.

Dr Roy Green
President
Murray-Darling Basin Commission
April 2000
This Water Management Strategy reflects the aspirations of the community and government agencies for sustainable water management of the Barmah-Millewa Forests. Essentially it involves managing the forest/water environment in accord with complex ecological, economic, and social factors inside and outside the Forest. Acceptable trade-offs have been derived following consultation with the community and agencies. The Strategy’s focus on maintaining or enhancing the ecological health will be achieved by managing the water regime in a manner that recognises the Forest as a single ecosystem; by recognising appropriate economic, environmental and social factors; and by adapting to advances in knowledge.

To do that, the Strategy needs to provide specifically for:

• managing the Forest as a single ecosystem;
• optimising the use of river flows to enhance water management of the Forest environment;
• facilitating effective water management by dividing the Forest into areas that can be managed independently or semi-independently;
• providing, operating and maintaining water management works or structures required for economic and effective operation of the Strategy;
• recording and evaluating information on the Forest’s history and past and on-going management practices, and applying that information to water management and to assessment of the Strategy’s performance;
• monitoring, recording and evaluating scientific information required to manage water flow operations efficiently, and using that information in assessing the Strategy’s performance and in managing adaptively;
• monitoring, recording and evaluating socio-economic information to assist in managing water flow operations, and using that information in assessing the Strategy’s performance and in managing adaptively;
• increasing knowledge of the needs of environmental watering regimes and of water management practices, and applying that knowledge in assessing the Strategy’s performance and in managing adaptively; and
• developing plans to implement the Strategy with maximum effectiveness.

It is expected that component habitats at greatest risk will receive highest priority under the Annual Operating Plans prepared by the State managing agencies, which come under the umbrella of the Water Management Strategy. The Strategy does not include time-frames and responsibilities — they will be in the Business Plan.
The Strategy’s BACKGROUND

Significant aspects of the Barmah-Millewa Forests

Various habitats within the Barmah-Millewa Forests depend on regular, extensive flooding along the River Murray — at specific times of the year and for an adequate duration. The pattern of flows within the Forest has changed as utilisation of the water resources of the Murray, including regulation of the river, has increased. As a result, flooding events are now less effective in watering the Forest, and high summer flows keep wetland habitats inundated for longer periods.

The effect of river operations

The Barmah-Millewa Forest’s unique range of wetland habitats includes:

- swamps and marshes;
- rushlands;
- grasslands;
- lakes;
- billabongs;
- streams; and
- red gum forest.

These habitats — home to a large number of species of fish, amphibians, reptiles, birds and mammals — are of enormous environmental value. Under the current flow regime, many are deteriorating. To sustain these habitats and the ecosystems they support, an appropriate water regime is required.
The Hume Reservoir is operated to meet irrigation demand; as a consequence unregulated creeks in the Forest that would normally run dry in summer now carry water into low-lying areas throughout the year. The result has been a decline in the Forest’s health. Some regulators and earthen embankments have been built to exclude this water from the Forest, reducing its impacts.

Another major effect of current river regulation is the considerable variation in the height of the River Murray between November and May. During this period, localised rainfall often causes irrigators to reject water released from storages to meet their orders. Consequently, river levels run higher than expected—often in sharp peaks. Because these flows occur suddenly, regulators are less able to manage them. Moreover, because of their unseasonality and short duration, the flows are less useful to the Forest than natural floods. They also limit access when people’s use of the Forest would be at a peak. Refinements to the process of ordering irrigation water can help to minimise these events. This Strategy includes provisions to overcome those problems.

The flow regime is similarly altered by the capture or mitigation of natural winter and spring flows, reducing the frequency, duration and height of flood events that are important for the health of the Forest.

The need for formal water management
Since the completion of Hume Dam in 1936, many individuals and organisations have sounded warnings about deterioration of the Forest’s ecosystems. Now, public and political support for addressing the Forest’s water problems is high.

For many years, the MDBC has attempted to provide water for environmentally sensitive Forest areas on an ad hoc basis, accounting for this water as a loss. However, it has become apparent that a more formal approach is needed for ecologically sustainable management of the Barmah-Millewa Forest’s ecosystems. This Strategy embodies that approach, based on extensive consultation between the Forest’s Stakeholders.

A major consequence of current patterns of river regulation is the unseasonally high level of the River Murray throughout summer and autumn. During this period, the Murray-Darling Basin Agreement requires the MDBC to supply sufficient water to meet downstream irrigation demands and provide entitlement flows to South Australia.

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Schematic of red gum forest flooding requirements
Parameters governing the allocation of water

The Murray-Darling Basin Commissioners, in keeping with the decisions of the Murray-Darling Basin Ministerial Council, have directed that water allocations must be made within the following parameters:

- the Forest’s water use is to be accounted as diversions from New South Wales and Victoria;
- system modelling is to be used to define property rights and treatment in assessment procedures;
- use of the Forest’s environmental water allocation is to be measured at Hume Dam, and is to be called on through the usual water ordering procedures;
- when the Forest receives rain rejection water, its environmental water allocation is not to be debited;
- when the river is in flood and an off-allocation is declared, the Forest’s use of that water use is not to result in a debit;
- in any water year, use of the Forest’s environmental water allocation is to be cancelled if Hume Reservoir spills;
- the need for overdraws and underdraws is to be tested using system modelling; and
- procedures for sales of water are to be derived and tested using system modelling.

These parameters are expected to be developed further as our knowledge improves and the States agree on more effective means of utilising the environmental water allocation.

The Stakeholders

The following are Stakeholders in this Water Management Strategy:

- the Murray-Darling Basin Ministerial Council;
- commonwealth and State government agencies with natural resource and water resource management responsibilities within the Barmah-Millewa Forests and the Murray catchment, including the MDBC;
- local government agencies;
- joint community-government resource management entities in the region — such as the Murray Catchment Management Committee, Cadell Land and Water Management Board, and Goulburn-Broken Catchment Management Authority;
- community groups with interests in natural resource management and the regional and local economy;
- communities in the region, including Aboriginal communities, with strong cultural ties to the forest environment;
- industries and users supported (directly and indirectly) by commercial, tourist and recreational activities pursued within the forest; and
- downstream users of River Murray water.

These Stakeholders are represented through membership of the Barmah-Millewa Forum.

Developing the Strategy

For many years, Forest agencies and people whose livelihoods depended on the Forest had been expressing concern about the impact of water management on the Forest’s ecosystems. In 1990, responding to these concerns, the MDBC commissioned a consultant technical study of water management, published in 1992 as the Barmah-Millewa Forests Water Management Plan — Final Report.
The MDBC then prepared an issues paper to encourage the community and state agencies to make comments. A public meeting was held at which representatives were nominated for a Community Reference Group to help develop a water management plan.

The Murray-Darling Basin Ministerial Council comprises Ministers of the Commonwealth, New South Wales, Victorian, South Australian and Queensland Governments who set policies and define broad directions for the management of the Basin’s natural resources. One of the specific goals of the Ministerial Council is to seek to conserve the Basin’s sensitive ecosystems.

In 1993 the Ministerial Council directed the MDBC to “develop water management strategies for the Barmah-Millewa Forest which would enhance forest, fish and wildlife values while not creating undue adverse effects in other areas”. Subsequently the Ministerial Council directed that 100 GL per year was to be allocated to meet the Forest’s environmental water needs.

The Community Reference Group prepared a draft plan and referred it to state agencies for review and comment. After considering the agencies’ views, in 1994 the Group published Community Consultation — Final Report on Barmah-Millewa Forest Water Management Plan from a Local Community Reference Group.

In 1994 the MDBC formed an interim Annual Forum and Advisory Committee (re-named in 1998 as the Barmah-Millewa Forum; discussed to monitor and advise on the Forest’s management.

The MDBC, having coordinated these activities in collaboration with the community and government agencies, has concluded the processes by preparing this Strategy.

Implementing the Objectives

Functions and relationships involved in managing the Barmah-Millewa Forest are shown in appendix 1.

Management Agencies

New South Wales

State Forests of New South Wales and the New South Wales Department of Land and Water Conservation are the primary agencies responsible for managing the land and water resources in the Millewa Forest. New South Wales Fisheries and the New South Wales National Parks and Wildlife Service also have specific statutory responsibilities for native fish, wildlife, flora and cultural heritage.

In 1996, two NSW Government agencies — State Forests and the Department of Land and Water Conservation — developed a Water Management Plan for the Millewa Forests in cooperation with the community and other agencies (including Victorian Government agencies). The plan was prepared in accordance with the consultation and planning processes established by Murray Regional Environmental Plan No. 2 — Riverine Land (REP No. 2). It aims to maintain, and where possible improve, the ecological and productive sustainability of the Millewa Forests. It provides a statutory framework for planning and coordinating water management tasks between the various agencies with responsibilities for land, water and wildlife in New South Wales. It also provides an essential link between this Strategy and the operational plans for managing the Forest.
Victoria

The Department of Natural Resources and Environment and Goulburn-Murray Water are the primary agencies responsible for managing the land and water resources of the Barmah State Forest and State Park. Specific responsibilities relate to various pieces of legislation, including management of the Forest and Forest produce under the *Forests Act 1958*, management of the State Park portion of the Forest under the *National Parks Act 1975*, the provision of rural water services and bulk water supplies under the *Water Act 1989*, and the protection of native flora and fauna under the *Flora and Fauna Guarantee Act 1988*.

The Department of Natural Resources and Environment has prepared an *Interim Water Management Strategy for Barmah Forest* that aims to maintain and improve the ecological health of the Barmah Forest. A particular goal is to reduce the rate of decline in moira grass plains and to provide more suitable watering of other open wetland systems and red gum forests.

The management of Forest watering is undertaken within a broader forest management framework specified in the Mid-Murray Forest Management Plan and the Barmah State Park and Barmah State Forest Management Plan.

Commonwealth

The Commonwealth’s role relates to legislation regarding environmental and heritage aspects of the Forest — in particular as they affect interstate matters or Commonwealth decisions. The national and international significance of the forest is also addressed by the Commonwealth through the migratory bird agreements with Japan and China, and through the Convention on Wetlands of International Importance (widely known as the “Ramsar Convention”).

MDBC

On behalf of the Murray-Darling Basin Ministerial Council, the MDBC seeks to promote and coordinate planning and management for the effective, efficient and sustainable use of water, land and other environmental resources of the Murray-Darling Basin. The MDBC works in partnership with the five governments involved in the Murray-Darling Basin Initiative.

The Barmah-Millewa Forests is bisected by the River Murray, which is also the border between New South Wales and Victoria. The MDBC coordinates activities that enhance and integrate water management, treating the Forest as a single ecosystem. It does so because of its responsibilities for operating the River Murray and because of the impacts of that operation on the Forest.

Management advice: THE BARMAH-MILLEWA FORUM AND ADVISORY COMMITTEE

The two Forest water management advisory groups — the Barmah-Millewa Forum and Advisory Committee — advise on and monitor the management processes. Members of the groups are drawn from the community, and from State agencies with responsibilities for land and water resource management within the Forest, to ensure that decisions reflect community and agency views.

The terms of reference of the Barmah-Millewa Forum are to provide advice on the annual water operating plans to ensure that they are:
- coordinated between the states;
- consistent with this Strategy; and
- effectively and efficiently using the Forest’s environmental water allocation of 100 GL per year.
The Forum is also to monitor and report on the effectiveness of the annual operating plans and to provide information to the community and facilitate community/agency input. The Advisory Committee is a sub-committee of the Barmah-Millewa Forum, which advises the Forum and has additional responsibilities for liaising on implementation of the Annual Operating Plans and reviewing and advising on the development of a Business Plan, priorities for research, monitoring and investigation, and planning, project design and scheduling. It also evaluates performance and plans future investigations. Full terms of reference for the two groups are available from the MDBC.

**Monitoring, review and evaluation**

The Strategy is intended to be a dynamic document that will be amended, as a result of collecting and analysing information, to ensure that it continues to address its Mission and Objectives in the best possible way. Actions needed for the process of continuous improvement are incorporated in the objectives and subordinate strategies appearing in Section 3: The Strategic Focus. The MDBC will review the Strategy at intervals of not more than three years in consultation with the Barmah-Millewa Forum. Changes will be as authorised by the MDBC.

Monitoring, review and evaluation processes will be incorporated into projects conducted to support the Strategy and is also included in the Barmah-Millewa Annual Report. They will include appropriate checks against Key Performance Indicators to control, evaluate and modify Subordinate Strategies and Activities. In this way, activities will be continually focused on objectives to ensure the best use of resources, including the allocation and re-allocation of funding.

Water Management Plans, which are developed and implemented by the State managing agencies, provide the framework for planning and coordinating water management tasks between the various agencies and divisions with responsibility for land, water and wildlife. Some may be developed to address specific flora and fauna requirements, consistently with the intentions of the MDBC’s water management policies and other strategies.

The agencies, in conjunction with the Barmah-Millewa Forum, also produce an Annual Operating Plan that contains the yearly works program.
A Glossary is on page 17.

The following statements of the Mission, Objectives and Subordinate Strategies derive from the Murray-Darling Basin Ministerial Council’s directive to the MDBC to “develop water management strategies for the Barmah-Millewa Forest which would enhance forest, fish and wildlife values while not creating undue adverse effects in other areas”.

MISSION

The mission of the Barmah-Millewa Forest Water Management Strategy is to maintain or enhance the ecological health of the Barmah-Millewa Forest by managing its water regime in a manner that:

- recognises the Forest as a single ecosystem;
- recognises appropriate economic, environmental and social factors; and
- adapts to advances in knowledge.
To meet the requirements of strategies 1.1 and 1.2, water management actions should aim, where practicable, to:

- mimic natural flooding characteristics, including recession, duration, and seasonality;
- increase low-level flooding (at appropriate times and for appropriate durations for maximum effect) to assist in maintaining the moira grass plains;
- initiate actions to alleviate drought-stressed forest and wetlands; and
- initiate and sustain the breeding of native fauna.

Community information, education and consultation activities come within the purview of Objective 1.

The parameters governing the allocation of water listed on pages 3, 9 and 10 are to be applied to actions carried out under Strategies 1.1 and 1.2.

At the time this Strategy was published, 100 GL of water per year (50 GL each from New South Wales and Victoria) was the environmental water entitlement for sustaining the Barmah-Millewa Forest. Detailed use of that allocation was to be developed through the Business Plan for the Forum.

Issues relating to property rights, overdraws, underdraws and possible trading in the water market are currently under discussion and the definition of security of supply and licence conditions for the entitlement is still to be finalised.
Objective 2: To optimise use of river flows to enhance water management of the environment.

Strategies

2.1 Ameliorate, as far as is practicable, the impacts of river regulation exerted through high summer flows and rain rejection flows.

2.2 When possible, and taking into account the needs of Forest users, reinstate a more natural wetting and drying cycle by managing water flows within the river and within the Forest to benefit ecosystem requirements.

2.3 When possible, manage unseasonal Forest flooding to minimise damage to environmental, commercial and recreational values, in that order.

2.4 When possible, manage summer and autumn Forest flooding to protect sensitive environmental areas.

2.5 Manage forest flooding during the summer and autumn peak irrigation period to protect, as far as is practicable, access by fire control, commercial and recreational vehicles.

2.6 Refine procedures for ordering irrigation water from Hume Dam and Yarrawonga Weir.
Elaboration of the Strategies

The following parameters governing the allocation of water listed are to be applied to actions carried out under Strategies 2.1 to 2.6. In meeting the requirements of objective 2, maximum use of river flows from floods, minor flushes and rain rejections should be made to enhance environmental watering of the forest, usually from July to December. A proviso is that there are to be no significant adverse impacts within the forest, or upstream or downstream, that have not been accepted by the community in earlier consultation.

Unseasonal flooding by appropriate operations at Hume Dam and Yarrawonga Weir, and by control of flows to Mulwala Canal and the Edward Escape, should be minimised as far as practicable. Relevant hydraulic operations at Hume Dam and Yarrawonga Weir, and use of Mulwala Canal to bypass flows around the Forest, are to be reviewed periodically.

According to the MDBC’s current Operating Rules, floods of less than 60,000 ML/day (measured at Yarrawonga) are not to be mitigated during May and June. The exception is that when flows are below channel capacity, regulators may be closed to allow commercial activities in the Forest to continue.

Similarly, the rules provide that during July to December, floods are not to be mitigated below 60,000 ML/day downstream of Yarrawonga Weir and that available flows in the River Murray should be used, where practicable, to enhance water regimes. Water use from storage as part of the environmental allocation for the Forest is to be recorded.

Water Flow Contingency Plans, to be developed in autumn each year, should determine priorities for water allocation so that available water can be allocated appropriately — particularly in the event of drought.

As a matter of the highest priority, in accordance with Strategies 1.1 and 1.2 but subject to water resource constraints, water management operations are to:

- minimise riverbank slumping — by setting operational procedures for Yarrawonga Weir and other regulators to control rates of fall in water levels downstream of the Weir;
- minimise disruption of waterbird breeding and nesting activities at the end of a period of flooding caused by rapid drainage of wetlands and grass plains — by setting operational procedures for Yarrawonga Weir and other regulators that take into account waterbird requirements, or by using temporary water-holding structures identified in management plans; and
- alleviate stresses on the forest and wetlands after a period of drought — by managing river flows, regulators and other works.

Towards the end of a period of flood, State agencies should determine desirable water levels for any waterbird activities that occur and advise the MDBC accordingly.

State agencies, in consultation with the Barmah-Millewa Forum, are to review — within the river and within the forest — the condition of the Murray, Edward and Gulpa riverbanks and effluent channels. They are to advise the MDBC accordingly.

Erosion of the banks of the River Murray has been identified as a particular risk for the longer-term management of water in the Forest, requiring water operations to minimise the problem and development of management actions to prevent further erosion.
Objective 3: To facilitate effective water management by refining the division of the Forest into areas that can be managed independently or semi-independently.

Strategies

3.1 Identify vegetation and habitat associations, hydrologic boundaries (as formed by barriers to the movement of water), sources of water, areas of water deficit, and areas with similar water regime patterns or requirements.

3.2 Refine the division of the Forest into water management areas based on that information.

Elaboration of the Strategies

Information relating to Strategies 3.1 and 3.2 is contained in the Water Management Plans and Annual Operating Plans of the State agencies.

Objective 4: To provide, operate and maintain water management works or structures required for economic and effective operation of the Water Management Strategy.

Strategies

4.1 Continually review requirements for water management works, design of new works, and modification or retirement of existing works within the river and the forest.

4.2 Operate and maintain existing water management works and structures in a cost-effective and efficient manner.

4.3 Ensure that construction of new works is cost-effective.

4.4 In constructing and operating works, ensure that environmental protection principles, and appropriate public consultation and planning principles and procedures (including REP No. 2), are adhered to.

4.5 Develop, maintain and implement plans for installation of new water control works necessary to enhance forest water regimes.

4.6 Conduct trials of works to enhance water management, including spreading of water in the Barmah Forest and the Millewa Forest.

4.7 Conduct an Operation and Maintenance Program for water management works within the Forest.
Elaboration of the strategies

The parameters governing the allocation of water listed on pages 9 and 10 are to be applied to actions carried out under Strategies 4.1 to 4.7.

Objective 5: To record and evaluate information on the Forest's history and past and on-going management practices, and apply that information to water management and to assessment of the Water Management Strategy's performance.

Strategies
5.1 Document present and past water management practices.
5.2 Record, collate and document Forest experience and knowledge from all sources: Aboriginal and non-Aboriginal people, agency records, government archives, historical societies, anecdotal information etc.
5.3 Establish and maintain an information system for this information.

Elaboration of the Strategies

Much valuable information on the Forest's history and past management practices is available from the personal recollection of people who have a long association with the area. It is important to secure such information while these people are still alive.

Objective 6: To monitor, record and evaluate scientific information required to manage water flow operations efficiently, and to use that information in assessing the Water Management Strategy's performance and in managing adaptively.

Strategies
6.1 Develop ecosystem indicators, and inventory and monitoring systems for flora, fauna and ecological processes.
6.2 Measure, record and evaluate information required to effectively manage the Barmah-Millewa Forest ecosystem, and report it against specified performance criteria.
6.3 Evaluate remote sensing of Forest flooding and vegetation health to complement field observations.
6.4 Develop a database containing a Geographic Information System and other information.
6.5 Specify performance criteria and develop optimum water management options for each water management area, based on information collected.

6.6 Continue to model flows through regulators, Forest runners and the River Murray, to provide hydraulic knowledge for operating Forest regulators.

6.7 In response to information acquired, assess the Water Management Strategy’s performance and modify actions progressively in accordance with adaptive management principles.

Elaboration of the Strategies

Ecological processes in Strategy 6.1 include sediment deposition and erosion. Information collected in pursuit of Strategy 6.2 is to encompass wetlands, grasslands, billabongs, effluent channels, trees and grasses, and is to include details of:

- flood mapping;
- water sources;
- water quality;
- groundwater levels;
- flow path and drainage, including riverbank stability;
- hydrology and flows in the Forest;
- watering history, including flood levels and durations, and water use from storage facilities used for environmental flows;
- operation of water management works;
- vegetation and wildlife status; and
- other information as required.

Information collected in pursuit of Strategy 6.3 will thus enable greater coverage of the Forest and will reduce the requirement for expensive field inspections. It is to include data on:

- change in flora and fauna;
- water use;
- water deficits; and
- geomorphic change.

The parameters governing the allocation of water listed on pages 9 and 10 are to be applied to actions carried out under Strategies 6.5 to 6.7.
Objective 7: To monitor, record and evaluate socio-economic information to assist in managing water flow operations, and to use that information in assessing the Water Management Strategy’s performance and in managing adaptively.

Strategies

7.1 Collect and evaluate statistics on Forest visitors to assess the value which the community places on the Forest.

7.2 Collect and evaluate data on the commercial value of Forest industries to regional and national economies.

7.3 Collect and evaluate data on commercial usage on the local, regional and national economies, and visitor usage on the regional economy.

7.4 Support tourist and recreational activities by providing a public information service to advise of areas of safe access during Forest flooding.

7.5 In response to information acquired, assess the Water Management Strategy’s performance and modify actions progressively in accordance with adaptive management principles.

Elaboration of the Strategies

Information compiled in pursuit of Strategy 7.1 is to include origin, destination, length of stay, activities pursued, expenditure etc. Activities under this Strategy will record existing knowledge of the areas (within the framework set by the water management area system) affected by each of the regulators and the potential to manage other water-stressed areas by:

- new structures;
- the behaviour of flow within these areas;
- the ways in which these flows are managed, or might be better managed, to enhance Forest environmental watering and commercial and recreational activities; and
- adverse impacts of water regime management such as flooding of adjacent landholders, damage to heritage sites, enhancement of one forest habitat at the expense of another; etc.

Objective 8: To increase knowledge of the needs of environmental watering regimes and of water management practices, and to apply that knowledge in assessing the Water Management Strategy’s performance and in managing adaptively.
Strategies

8.1 Investigate the relationships between water management and environmental factors.

8.2 Investigate and trial managed floods using releases of water from storages and/or in conjunction with trigger flows from tributaries upstream of the Forests.

8.3 Further investigate benefits and costs of managed floods with the aim of integrating salinity management (salt export), managed flooding, enhanced downstream environmental water management and dilution of river salinities.

8.4 Develop and report Managed Flooding Operational and Monitoring Procedures that are integrated with other management plans.

8.5 In response to advances in knowledge, assess the Water Management Strategy’s performance and modify actions progressively in accordance with adaptive management principles.

Elaboration of the Strategies

Factors encompassed by Strategy 8.1 are to include soil moisture, aquifer recharge and groundwater levels, water quality, environmental water requirements and use, water use by flora and fauna and associated flora and fauna health factors.

Trial managed floods (Strategy 8.2) should:

- occur at appropriate times from July to December inclusive;
- be controlled so that there are no significant adverse impacts, other than to vehicular access within the Forest;
- be optimised, with respect to size, Ovens-trigger flows, storage contents and channel capacity, and statutory reserve, using computer simulation and field experience to fine tune criteria;
- be trialled, when a means to effectively monitor their value is in place;
- utilise water stored in Lake Mulwala to minimise Hume Dam releases;
- take into account impacts on flooding in the River Murray outside of the Forest.

The parameters governing the allocation of water listed on pages 9 and 10 are to be applied to actions carried out under Strategies 8.2, 8.4 and 8.5.

A coordinated Research Program should be prepared each year, commensurate with available funding, and research and investigations activities conducted should be reported annually.
Objective 9: Develop plans to implement the Water Management Strategy with maximum effectiveness.

Strategies

9.1 Monitor, review and refine water management policies and actions.

9.2 Develop a Capital Works Program and funding application framework

9.3 Develop an Operations, Maintenance and Management Program for assets needed.

9.4 Develop a Business Plan for the long-term financial and ecological viability.

Elaboration of the Strategies

The parameters governing the allocation of water listed on pages 9 and 10 are to be applied to actions carried out under Strategies 9.1 to 9.4.

The Business Plan (Strategy 9.4) should address the following:

• determination of funding needs, both capital and operational;
• identification of likely funding requirements from the MDBC on a three-year rolling basis;
• identification of other potential funding sources both government and non-government, including options for water trading; and
• financial management of water management projects — including planning, design and construction of works and measures, operations and maintenance, research, monitoring and investigations.

The Business Plan is also intended to provide detailed practical operational rules and guidelines for the application and delivery of the Forest's environmental water allocation. These guidelines will be developed through a two-stage process involving the consideration of the environmental health of each water management area, and consideration of the wider economic, social, hydrologic and hydraulic issues.
adaptive management Management based on the best scientific and technical knowledge currently available — recognising that many “knowledge gaps” exist and that management may need to be modified, adapted or otherwise refined in response to further information and experience gained by progressive implementation of elements of management.

annual operating plans Plans produced by state managing agencies containing the yearly works program for their part of the Barmah-Millewa Forests.

aquifer A rock, gravel or sand layer that holds water and through which water can move.

Commission, the See Murray-Darling Basin Commission.

ecologically sustainable management Managing resources so that ecological processes, on which life depends, are maintained and the total quality of life — now and in the future — can be increased.

forest environmental water allocation The allocation of water from the Hume Dam for the environmental needs of the Barmah-Millewa Forests. Currently approved by the Murray-Darling Basin Ministerial Council as 100 GL per year.

GL Gigalitre: one thousand million or 10^9 litres.

groundwater The water in the saturated pores of soil or rock below the watertable.

irrigation period, peak See summer and autumn peak irrigation period.

managing adaptively See adaptive management.

MDBC See Murray-Darling Basin Commission.

Ministerial Council The Murray-Darling Basin Ministerial Council, comprising Ministers of the Commonwealth, New South Wales, Victorian, South Australian and Queensland Governments who set policies and define broad directions for the management of the Basin’s natural resources. A minister of the ACT.
Government also participates under the terms of a memorandum of understanding. Further information is in section 1 of the MDBC’s annual report.

ML
Megalitre: one million or 10^6 litres.

Murray-Darling Basin Agreement
The agreement between the Commonwealth, New South Wales, Victorian, South Australian and Queensland Governments that governs natural resource management in the Murray-Darling Basin. Further information is in section 1 of the MDBC’s Annual Report.

Murray-Darling Basin Commission
The executive arm of the Ministerial Council. The Commission comprises an independent President and two Commissioners from each of the Contracting Governments: normally chief executives and senior executives of the agencies responsible for stewardship of land, water and the environment. The Commission is supported by about 50 staff. Further information is in section 1 of the MDBC’s Annual Report.

off-allocation water
Flows occurring in an off-allocation period, when unregulated tributary flows or spills are sufficient to supply irrigation needs and downstream obligations. On such occasions, water used by irrigators is not counted against an irrigator’s allocation.

overdraws
Borrowing next season’s water from reserves, for use during the current season.

peak irrigation period
See summer and autumn peak irrigation period.

rain rejection water
Water ordered by irrigators that is unused due to local rainfall and which adds to flows in the river.

recharge
Replenishment of an aquifer from rainfall or irrigation water.

regulators
Structures, including earth banks and various types of gates, that control the movement of water into and out of the Forest.

REP No. 2
Murray Regional Environmental Plan No. 2 – Riverine Land. A landmark environmental planning strategy for the Murray and its floodplain, applying from Hume Dam to the South Australian Border. It provides a democratic mechanism for coordinating planning on a cross-river basis between NSW and Victoria.

Strategy, the
The Barmah-Millewa Forests Water Management Strategy. See also subordinate strategies.
subordinate strategies  Strategies flowing from the objectives of the Barmah-Millewa Forests Water Management Strategy, as distinct from the Water Management Strategy itself.

summer and autumn peak irrigation period  The period of peak regulated flows normally occurring in the months of January to April inclusive.

underdraws  Unused water allocation carried over into a subsequent year.

water management plans  Plans produced by state managing agencies for management of water in their part of the Barmah-Millewa Forests.

water year  In the instances mentioned in this report, the 12-month period from 1 May to 30 April.
References


Murray-Darling Basin Commission 1993, minutes of Commission meeting No. 26 of 22 October 1993 [containing decision that in relation to water supply the Barmah-Millewa Forest is to be managed as a single unit using a single annual allocation].

Murray-Darling Basin Commission 1993, minutes of Ministerial Council meeting No. 12 of 25 June 1993 [containing decision to allocate 100 gigalitres to the Barmah-Millewa Forest].

Appendix 1:
FUNCTIONS AND RELATIONSHIPS
involved in managing the Barmah-Millewa forest