Integrated catchment management in the Murray–Darling Basin

A process through which people can develop a vision, agree on shared values and behaviours, make informed decisions and act together to manage the natural resources of their catchment: their decisions on the use of land, water and other environmental resources are made by considering the effect of that use on all those resources and on all people within the catchment.

Our values
We agree to work together, and ensure that our behaviour reflects the following values.

**Courage**
- We will take a visionary approach, provide leadership and be prepared to make difficult decisions.

**Inclusiveness**
- We will build relationships based on trust and sharing, considering the needs of future generations, and working together in a true partnership.
- We will engage all partners, including Indigenous communities, and ensure that partners have the capacity to be fully engaged.

**Commitment**
- We will act with passion and decisiveness, taking the long-term view and aiming for stability in decision-making.
- We will take a Basin perspective and a non-partisan approach to Basin management.

**Respect and honesty**
- We will respect different views, respect each other and acknowledge the reality of each other’s situation.
- We will act with integrity, openness and honesty, be fair and credible, and share knowledge and information.
- We will use resources equitably and respect the environment.

**Flexibility**
- We will accept reform where it is needed, be willing to change, and continuously improve our actions through a learning approach.

**Practicability**
- We will choose practicable, long-term outcomes and select viable solutions to achieve these outcomes.

**Mutual obligation**
- We will share responsibility and accountability, and act responsibly, with fairness and justice.
- We will support each other through necessary change.

Our principles
We agree, in a spirit of partnership, to use the following principles to guide our actions.

**Integration**
- We will manage catchments holistically; that is, decisions on the use of land, water and other environmental resources are made by considering the effect of that use on all those resources and on all people within the catchment.

**Accountability**
- We will assign responsibilities and accountabilities.
- We will manage resources wisely, being accountable and reporting to our partners.

**Transparency**
- We will clarify the outcomes sought.
- We will be open about how to achieve outcomes and what is expected from each partner.

**Effectiveness**
- We will act to achieve agreed outcomes.
- We will learn from our successes and failures and continuously improve our actions.

**Efficiency**
- We will maximise the benefits and minimise the costs of actions.

**Full accounting**
- We will take account of the full range of costs and benefits, including economic, environmental, social and off-site costs and benefits.

**Informed decision-making**
- We will make decisions at the most appropriate scale.
- We will make decisions on the best available information, and continuously improve knowledge.
- We will support the involvement of Indigenous people in decision-making, understanding the value of this involvement, and respecting the living knowledge of Indigenous people.

**Learning approach**
- We will learn from our failures and successes.
- We will learn from each other.
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Foreword

Floodplains are an important feature of our landscape. They are the home of some of our most productive agricultural land, they are a critical element in the ecological health of our rivers and they are essential in managing the impact of floods.

This document was originally prepared in 2002; its release has been delayed to ensure consultation and support for the Strategy. Whilst we are currently experiencing some of the driest weather sequences on record, I am confident that co-ordinated management of high river flows across floodplains will become an issue in the near future.

Getting the balance right on how we use floodplains remains a major challenge for all State Governments. The Murray-Darling Basin Floodplain Management Strategy sets out principles for floodplain management that are supported by all Governments within the Basin. These principles recognise the importance of an integrated catchment management approach to floodplain management where we must consider that actions across the catchment can impact on the floodplain.

The Strategy proposes actions that can be undertaken by the Murray-Darling Basin Commission (MDBC) to support State floodplain management programs. This is particularly important along the River Murray where a coordinated effort between States is necessary to ensure that flood mitigation works are appropriately located and that the upstream and downstream impact of works are considered.

This Strategy sets out the Council’s expectations that State Governments and regional communities will recognise the need to ensure floodplain management takes into account the social, environment and economic outcomes from investment on floodplains.

Rt Hon. Ian Sinclair AC
President, Murray-Darling Basin Commission

All States in the Basin are committed to the floodplain management principles set out in this Strategy.
Summary

Flooding is a natural part of our catchment processes. We are aware of the economic and social damage that floods can bring. But they also bring water to floodplains, wetlands and billabongs; and in doing this, trigger an important cycle of ecological events that eventually result in improved water quality and river health. Without floods the long-term productive capacity of the Murray-Darling Basin’s natural resources will diminish.

Within the Basin we need to place floodplain management within both an integrated catchment management and a risk management framework. Flood management programs must balance competing objectives and seek to maximise social, economic and environmental outcomes. But despite investment in flood management programs, a level of risk will remain for people that live and farm on the floodplain. It is critical that communities in flood prone areas understand the related risks and manage their activities accordingly.

Floodplain management is constitutionally a State responsibility. The States have powers to control new activities on floodplains. Historic settlement practices have, however, in many areas substantially modified flood behaviour and generated adverse effects at the local, catchment and Basin scale. These works involve both private protection works (levees) and public infrastructure (for example, causeways, bridges, railways and roads). They are often many years old and in many instances redundant. Their modification or removal is expensive.

This Strategy sets out a series of principles that will guide the floodplain management activities of participating Governments across the Basin. It identifies research and development and community education activities that could provide Basin-wide benefits and pays particular attention to the need for coordinated effort along the River Murray where floodplain activities in one State can directly impact upon other States.

The Strategy also defines the floodplain management role of the MDBC. It recognises that floodplain management is a State responsibility and that the States have well-developed programs. However, floodwaters move across State boundaries and coordinated efforts by all States in the Basin together with facilitation by the Commission are required if we are to manage flood impacts for the benefit of the whole community.
Introduction

In June 2001, the Murray-Darling Basin Ministerial Council adopted and published an Integrated Catchment Management Policy for the Basin. The policy mapped out the values, goals, principles, and approaches to be pursued by the Ministerial Council to achieve ecologically sustainable resource use in the Basin. Integrated catchment management requires that decisions regarding natural resources (land, water and other environmental resources) are integrated at a catchment scale and that decisions about the environment of the catchment, its economic productivity and its people are also considered collectively.

An integrated catchment management approach should also apply to floodplain management. How we manage land use on the floodplains directly affects the extent and severity of floods. How we manage floodwaters directly impacts on our economic development, environmental water and wetland management goals.

Floods are also closely related to environmental flows. In the highly regulated River Murray system the incidence of minimal and minor flooding has decreased over the past two decades, resulting in less floodwaters reaching important wetlands and some floodplain wetlands being permanently inundated with water.

In the northern parts of the Basin, floodwaters are an important source of water for irrigation development. Harvesting water from floods, particularly the smaller floods, must be carefully managed to ensure the health of wetlands and other water dependent ecosystems throughout the riverine system are not jeopardised.

Natural flooding patterns have also been significantly altered over the years by human activity. This primarily involves the impacts of public infrastructure (roads and bridges) and public or private floodworks (levees) for the protection of urban areas or agriculture production.

While each State and the MDBC are addressing these issues it is important that the cumulative efforts are coordinated and that, in particular, flood management policies address environmental flow needs. This Strategy seeks to establish a framework within which the strategies of the States are coherent, consistent, effective and sustainable.
Macquarie Marshes - A Ramsar listed wetland that requires an integrated catchment management approach.
Strategy Recommendations

Basin-Wide

Basin-wide principles for floodplain management will be used to guide the development of floodplain management activities within all jurisdictions. These principles recognise the need for an integrated catchment management approach to floodplain management to ensure that floodplain management does not adversely impact on other values such as downstream water quality and quantity.

The Strategy is based on clearly defining the roles of all tiers of Government, the MDBC, regional catchment and river management organisations, and the local communities in floodplain management. The Strategy recognises that the primary responsibility for developing and implementing floodplain management plans rests with State Governments.

A long-term communication strategy will be developed to keep the community informed about the risks associated with floodplain land use and the roles and responsibilities of Governments, communities, and individuals in floodplain management.

The Cooperative Research Centre for Catchment Hydrology, in consultation with Local Government and the Commission, will develop a series of technical floodplain planning workshops for Local Government and catchment and river management organisations.

Coordination of Murray-Darling Basin Floodplain Management

Developing and implementing floodplain management plans is a State responsibility. The Commission will assist States by adopting a strategic approach to coordinating floodplain management across the Basin. This involves:

• defining priority catchments and regions for the development of new or review of existing floodplain management plans
• developing model criteria to guide the development of floodplain management plans
• assessing floodplain management plans for priority areas against those criteria
• assessing the impact of significant floodplain development proposals that are referred by States in general and NSW in particular under the NSW Murray Regional Environmental Plan Number 2
• advising and assisting on further knowledge required for effective planning.

The construction and maintenance of levees or other works designed to provide protection for urban or agriculture purposes is primarily a State responsibility and should be funded privately or through appropriate programs.

Commission funding for floodplain works may be considered if the primary outcome of these works is to achieve ICM outcomes.

River Murray Floodplain Management Programs

The Commission will establish a River Murray Floodplain Management Committee to work with States to assess impacts of floodplain management strategies and of existing and proposed significant floodplain developments and to advise the Commission of appropriate investments.

The River Murray Floodplain Management Committee will work with Victoria and NSW in ensuring that agreed protocols for River Murray floodplain levees are incorporated into relevant regional floodplain management plans.
Working with States the River Murray Floodplain Management Committee will consider and recommend standards for levee maintenance. States may incorporate these standards and appropriate monitoring strategies into relevant regional floodplain management plans.

The River Murray Floodplain Management Committee will develop procedures for assessing the impact of levee removal on surface flow volumes.

The River Murray Floodplain Management Committee will develop a communication strategy that promotes the roles and responsibilities of Governments, their agencies and the community in floodplain management, particularly in relation to the River Murray.

The River Murray Floodplain Management Committee will explore and recommend to the Commission options for minimising the social and economic impacts arising from managed releases for environmental flows.

The Commission will extend its knowledge base about developments on the River Murray floodplain including floodplain mapping programs, support for River Murray water modelling and monitoring the cumulative impact of developments on the floodplain.

The Commission, in consultation with the Bureau of Meteorology, will sponsor a series of technical workshops for State Emergency Service coordinators on the flood patterns of the River Murray and its major tributaries.

The Commission will develop a Flood Emergency Manual for the River Murray in consultation with relevant agencies and will be updated every five years.
The Murray-Darling Basin

The Basin is Australia’s largest and most developed river system. Nearly 4000 km long, the river system is among the world’s 10 longest rivers. The catchment area covers over one million square kilometres of land from southern Queensland through to the Murray mouth in South Australia. Over 2 million people live within its borders.

The mean annual run-off is approximately 24,300 GL, with the average outflows from the Basin of 4700 GL. Some 86% of the Basin contributes virtually no run-off to the river systems except during floods.

Approximately 75% of Australia’s irrigation and over 41% of Australia’s gross value of agricultural production occur within the Basin. It provides drinking water for over three million people, more than one third of whom live outside its borders. There are some 30,000 wetlands within the Basin; 11 of which have been listed under the Ramsar Convention on Wetlands of International Importance.

Lock 15 - Euston

©Michael Bell
Flooding: an Overview

Flood damage is conservatively estimated to cost $350 million per year across Australia. These costs result from water damage to housing and infrastructure and loss of agriculture and other economic production.

Flooding provides both water and sediment to floodplains, which makes them amongst Australia’s most productive agricultural land. This has influenced the pattern of agricultural development in Australia and has led to significant modifications to floodplains to protect urban and agricultural investment.

Causes of Floods

Floods are defined as relatively high water levels caused by excessive rainfall or storm surge that cause flow to overtop the natural or artificial banks of a stream, creek, river, estuary, lake or dam.

Almost all of the flooding within the Murray-Darling Basin is attributed to rainfall. In 1993, for example, 120 mm of rain fell in the 1450 square kilometre catchment area of north-east Victoria leading to major floods that resulted in $320 million damage to urban and agriculture resources.

While the intensity of the rainfall is critical, so too is the extent of the area that the rainfall covers and factors (soil type, wetness etc.) that affect the run-off from catchments.

What are Floodplains?

Floodplains are areas that are roughly horizontal across the valley floor and that are flooded regularly or infrequently (Figure 1). Within floodplains there are a number of natural features that contribute to flood behaviour and the riverine environment.

Floodplains are dynamic natural systems. They evolve as a consequence of either streams meandering back and forth across floodplains (horizontal accretion) or as a result of depositing fine sediment on the floodplain during floods (vertical accretion).

Within Australia, vertical accretion is believed to be the major influence on floodplain development. The low stream power and the high clay content of the riverbanks restrict the meander (horizontal movement) rates of streams across the floodplain. Consequently the areas adjacent to streams tend to build up and there is a greater frequency of anabranching of streams.

Understanding Technical Terms:

AEP – Annual Exceedence Probability is the probability of a given size or larger flood occurring in any one year.

ARI – Average Recurrence Interval is the average period in years between a flood of a particular size or larger.

PMF – Probable Maximum Flood is the extent of flood prone land. This area is commonly assumed to have an AEP of the order of 1:10 000 to 1:10 000 000.

DFE – Defined Flood Events are the particular flood events selected for the management of flood hazard. For example a local flood study may select a flood event with an ARI of 1:50 years as the focus of the study.

Figure 1: Understanding Floodplains and Probable Maximum Floods
Floodplain Ecology
Healthy and well-functioning floodplains are critical for maintaining river health. Flooding releases nutrients from the floodplain and triggers life cycles in a vast range of riverine plants and animals. Floodplains and in particular, floodplain wetlands are vital areas for fish and waterbird breeding. Wetlands, (billabongs, backwaters, lakes, swamps and floodplain depressions) are ecologically significant parts of the floodplain, supporting higher biodiversity of species and greater ecological production. As well as providing significant flora and fauna habitat as breeding sites, they are important feeding sites for native fish and waterbirds. Floodplain wetlands provide flood storage and by filtering sediments and reusing nutrients found in floodwaters, they help to maintain water quality and the productive capacity of catchments.

Floodplain Land Use
Human activity has significantly altered the pattern of flooding on many floodplains throughout the Murray-Darling Basin. The extent of our modification to floodplains can be seen by changes in wetland types within the Basin. Many wetlands have been isolated from their rivers and creeks by agricultural development, others have had their watering regimes radically altered by river management activities. The majority of wetland types now occupy less than 50% of their original area. For example on the Central Murray floodplain between Deniliquin and the Murray-Wakool Junction, there are an estimated 6000 hectares of wetlands isolated from flooding.

Agricultural development in the Basin has seen the widespread construction of works that have modified the pattern of flooding on floodplains. These include public works such as roads and railway lines and substantial public and private levee systems. Many of these works were constructed before environmental controls were in place and have blocked flood flows to wetlands. Basin-wide, the impact of alienating wetlands from the floodplain has been significant. It is a major threat to biodiversity, as many species of aquatic plants and invertebrates, frogs, waterbirds and fish depend on wetland habitat during their life cycles. Nutrient cycling functions that are vital in sustaining riverine biota have been substantially reduced, with associated impacts on the health of floodplain ecological systems. Without the flushing and leaching effects of flood flows, isolated wetlands have accumulated salt on their soil surfaces. The potential exists, should watertables rise substantially, for isolated wetlands to receive groundwater discharge and effectively act as evaporation basins further accumulating salt deposits.

While some of the impacts on floodplain wetlands may be addressed through environmental flow management, many wetlands, particularly those higher on the floodplain require structural changes to restore flood flows. A major difficulty in carrying out these changes is the high level of social and economic impact involved. In addition to the works required to connect a wetland to its river or creek, works are often required to maintain flood protection to other property under production, to maintain farm access routes, or to maintain on-farm irrigation supply routes. These restoration costs are usually well beyond the reach of individual landholders and need to be considered in the development of catchment natural resource management plans.

Case Studies of Floodplain Land Use

• Coonamit Bridge Approaches – the Coonamit Bridge crosses a naturally constricted floodplain area of the lower Wakool River. The road is a major link between Swan Hill and Moulamein and its approaches were built to a level providing good access during floods. The Edward-Wakool Floodplain Management Strategy identified the approaches as having high hydraulic impacts and proposed 300 metres of additional waterway area to address this impact. Some of this waterway has been provided by two bridge openings constructed in 1997. These openings help to reduce flood levels locally and alleviate the flood risk to nearby landholders. They also allow improved flood watering for river red gum woodland and wetlands downstream of the bridge approaches.

• Lake Talbetts – this large wetland (170 hectares) is filled under natural conditions during Edward River floods. The lake last filled in 1956 when it held about three metres of water. It has an extensive tree-lined inflow creek that has been progressively blocked by road crossings (including the Kyallite Road) and an irrigation supply channel. Some cropping has been undertaken in the...
Nature of Flooding in the Murray-Darling Basin

Floods vary considerably in terms of their peaks, shape (duration of high flows and rate of rise and fall from the peak), volume and flow velocities. Flood regimes can be characterised as:

- flashy, that is short duration occurring in catchments up to 25 sq. km following thunderstorms
- medium response times where flood duration is in the order of days and occurs in catchments of between 25 to 1000 sq. km
- slow response where duration is in the order of days to weeks and the catchment is usually greater than 1000 sq. km in area with wide floodplains.

Within the Murray-Darling Basin all of these flood characteristics can be observed.

Flooding in the Southern Areas of the Basin

The River Murray drains over 420 000 km² of the South-Eastern Highlands of Australia. Over 40% of the water comes from catchments in NSW and Victoria above Albury. The river below Albury is characterised by its low gradients and hence slow moving flows.

The Cadell Fault is the most important geological influence on the River Murray. Its origins can be traced to geological activity some 25 000 years ago, that resulted in the tilting of the Cadell lakebed, however this was abandoned because of increasing salt near the soil surface. The lake is an example of a wetland type that is not common on the floodplain. The return of flooding to the lake would realise significant ecological benefits as a fish and waterbird habitat. Flooding would also be beneficial in flushing and leaching salts from the lakebed. To restore flooding, a substantially increased waterway area is required beneath the Kyalite Road, as well as the removal of blockages caused by private works (irrigation channels, road crossings) in a number of locations along the inflow creek, and the removal of silt build-up in reaches of the creek channel.

- Watercourse joining Mulligans Creek and the Wakool River – this five kilometre runner and its adjacent 60 hectares of floodplain woodland represent important riparian habitat. The watercourse, which once connected two major flood flow carriers (Mulligans Creek and the Wakool River), has been blocked from flooding for many years to protect adjacent agricultural development. If reopened to flooding, the watercourse would provide significant fish habitat because of its high value for fish passage between Mulligans Creek and the Wakool River. This would also have benefits for landholders in the area by providing additional waterway area for flood passage and helping to alleviate local flood risk. However, extensive works will be required to restore flooding and to maintain flood protection to adjacent cropped areas. The cost of these works is beyond the means of the individual landowner and cannot be met without external funding assistance.

- Chawilla Floodplain – The Chawilla floodplain is recognised as one of the major floodplain elements of the Murray-Darling system and is a Ramsar site. Increased regulation and diversions from the upstream rivers have led to a significant decrease in frequency and extent of flooding, causing increased salinisation, loss of key vegetation communities and reduced accessions of fish and other aquatic species to the mainstream of the river. In October 2000, a trial was undertaken to enhance flow in the River Murray in South Australia. Water was saved in Lake Victoria from above entitlement flows and released on top of a natural peak flow, enhancing flow from 32 000 ML/d to 42 050 ML/d (over-bank flow begins at about 35 000 ML/d). At the same time, the weir pool at Lock 5 was raised by 50 cm for 11 days. The increased pool level augmented the enhanced flow to the equivalent of 70 000 ML/d for approximately 30% of the weir pool of the Lock 5–Lock 6 reach. An additional 6% of the floodplain was flooded as a result of this trial. Monitoring has shown that floodplain vegetation responded to the increased flooding and there was no significant adverse salinity impacts of the manipulation. The duration and extent of flooding was not sufficient to stimulate significant native fish or bird breeding. The trial demonstrated that a minor improvement in environmental outcomes can be achieved by better use of existing flows, but significantly increased flows are required to meet even modest environmental goals in this important area.

The Basin’s floods vary from flashy short duration floods affecting a relatively small area to floods that can last weeks and affect hundreds of kilometres.
basement block, lifting the eastern side some 8 to 12 metres. The area today is known as the Barmah Choke. Channel capacity of this section of the river is restricted to 10 600 ML per day. These geological features as well as the large catchment areas of the river’s major tributaries, can result in quite different flood behaviour for different reaches of the river for a specific flood event.

Major Floods on the River Murray

The first recorded major flood on the Murray was in 1867. The 1870 flood is regarded as the largest flood to have occurred on the River Murray. Other major floods occurred in 1916, 1917, 1931, 1956, 1974, 1975, 1986 and 1993. Depending upon which tributaries are in flood and whether those tributaries enter the river before or after the Barmah Choke, determines whether the floodwaters escape from the River Murray into the Edward River system and into NSW. The key points are that flows are constricted at the Barmah Choke, forcing floodwaters into the Edward-Wakool River system and into the Barmah forest. If River Murray flooding from the upper catchment coincides with significant flooding on the Goulburn and Campaspe Rivers, the Murray may actually flow backwards at Barmah, a phenomena that has been observed twice this century.
Flooding in the Lower Reaches of the River Murray

In addition to sharing of floodwaters between NSW and Victoria, the other major issue for the southern part of the Basin is ensuring sufficient flood flows pass through the length of the river. Floodplain management works in NSW and Victoria such as restoration of floodplain storages and reconnection of isolated wetlands could reduce the total volume of flows downstream into South Australia. The environmental benefits of reconnecting the floodplain and wetlands in the upper part of the river must be considered against the environmental requirements of the lower reaches.

Flooding in the Central Areas of the Basin (Namoi, Barwon, Darling, Lachlan, Macquarie, Murrumbidgee and Castlereagh Rivers)

All but the Castlereagh River have substantial irrigation development and extensive floodplain structures (new and proposed) which require careful coordination through management plans. The plans are needed to ensure environmental benefits of flooding are not lost to local habitats and Basin scale impacts on flora, fauna and downstream water quality from interference to natural flood flows are minimised and/or restored.

Major floods have included those in the 50s and 70s and more recently July/August 1998 and November 2000.

Flooding in the Northern Areas of the Basin

Floodwaters are a major source of water for agriculture development in southern Queensland and northern NSW. In the Waggamba Shire for example over $7 million in building approvals associated with cotton crops were issued in 1998/99.

Harvesting of flood flows through the construction of levees and farm storages has led to increase pressure on water dependent ecosystems and has changed the pattern of flooding in the region.

**Current Floodplain Management Programs**

State Governments are responsible for floodplain management and all States have extensive flood management programs (see Table 1). Commonwealth funding programs support State programs. Figure 3 illustrates the major elements of Australia’s floodplain management processes.

Local communities, including Local Government, are central to this process. They have responsibility for determining the level of risk exposure from flooding by balancing the economic, social and environmental costs and benefits of flood prevention.

However, planning by local communities must be in the context of regional, State and Basin strategies if they are to meet the challenges of enhancing floodplain ecosystems and minimising flood impacts on upstream and downstream communities.

Local community preferences are expressed through local floodplain management plans. These are guided by regional floodplain management objectives. State agencies, Local Governments and other experts support local communities in developing local floodplain management plans (see Box 2).

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Figure 3: Floodplain Management in Australia
Regional Strategies
These set the vision, objectives and priorities for the floodplain management within the region. They are developed in consultation with regional communities and draw on data about regional flood patterns and current floodplain use. The strategies provide information to assist Local Governments with their land use planning function. They assign priorities for detailed local floodplain management plans and establish cost sharing arrangements. Depending upon the State where the regional plans are developed they may also address the operation and maintenance requirements of public levees.

Local Floodplain Management Plans
These plans assess the existing flood risk faced by the community and identify particular structural works and recommend amendments to land use and Local Government planning and development guidelines to minimise flood risk. They take account of local environmental features.

Table 1: State Floodplain Management Programs

<table>
<thead>
<tr>
<th>Elements of the Process</th>
<th>South Australia</th>
<th>Victoria</th>
<th>New South Wales</th>
<th>Queensland</th>
</tr>
</thead>
<tbody>
<tr>
<td>State has a floodplain management policy?</td>
<td>To be developed as part of the State Water Plan</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Can activities on the floodplain be controlled by Local Government statutory planning and development schemes?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Are local floodplain management studies being prepared?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Are the local studies coordinated at a regional level?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Are flood studies integrated with other resource management and environment protection plans?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

The Murray-Darling Basin Riverine Issues Working Group has invested substantial financial resources, through the Strategic Investigation and Education program, in understanding floodplain ecological processes and understanding the relationships between flow and floodplain inundation.


In 2000, the Commission established a Floodplain Management Project Board to develop this floodplain Strategy for the Murray-Darling Basin.

As part of the implementation of the recommendations from the Environmental Flows Project Board, the Ministerial Council agreed in March 2001, to explore options for minimising the economic impact of minor flooding along the River Murray associated with releases for environmental flows.

In May 2001, the Commission coordinated the capture of high-resolution digital elevation data using laser scanning technology in the upper and mid-River Murray area. This information will greatly assist in assessing the impact of upstream floodplain management programs on the extent of downstream flooding and will enable the trade-off between upstream and downstream environmental benefits of flood events to be considered.

Since the early 1990s, the MDBC has assisted State and local activities by facilitating cooperation and providing advice, research, sponsorship and funding.
Basin-Wide Floodplain Management Issues and Policies

Murray-Darling Basin Floodplain Management Strategy Objectives

This Strategy has the following objectives:

- to ensure that all Governments, floodplain users and stakeholders understand the importance of floodwaters to the environment, the risk associated with floods and the trade-off required between development of floodplains, local protection, and upstream and downstream flood impacts
- to encourage appropriate steps to manage risk, taking into account the social, economic and environmental cost and benefits.

Murray-Darling Basin Floodplain Management Strategy Outcomes

The Strategy aims to achieve the following outcomes:

- agreed Basin-wide floodplain management principles that are supported by the Commonwealth and State Governments within the Murray-Darling Basin
- a framework for coordination of State Government floodplain management programs, particularly for rivers that constitute State borders
- improved integration of floodplain management with other natural resource management programs to enhance integrated catchment management objectives
- clearly defined roles of the MDBC, partners, State and Local Governments and other stakeholders in Murray-Darling Basin floodplain management.

Principles for Floodplain Management

Successful floodplain management requires the balancing of a range of competing values. The competition between values occurs within regions and between regions. For example, modification to existing floodplain management works may result in either increased or decreased flood flows downstream and can have both positive and negative impacts on the community and the environment.

 Establishment of Basin-wide principles, supported by all jurisdictions, will ensure that the capacity to examine these trade-offs is considered by each region and by the Commission. The proposed principles are:

- **Integrated Catchment Management Approach**
  Floodplain management in the Murray-Darling Basin will be based on a shared understanding of the environmental, social and economic aspects of floodplain management and on understanding the dynamics of the river/floodplain interaction both across the full range of flood events and across the Basin as a whole.

- **Protection of Social and Economic Infrastructure**
  Floodplain management programs are necessary to reduce the social and economic risks from flooding, but these programs will not eliminate all flood risk.

  Construction of uncontrolled flood mitigation works, before and during a flood event can lead to significant flood impacts elsewhere on the floodplain. Individuals undertaking works that are not licensed by the appropriate State authority or Local Government (in some States) are likely to be liable for subsequent damage.

- **Regional Planning Approaches**
  The Murray-Darling Basin Floodplain Management Strategy, supporting regional and catchment strategies and local floodplain management plans will build upon existing knowledge of floodplain management and:
  - take a risk management approach to floodplain management
  - as far as practical not impede natural flood patterns
  - develop a shared knowledge by stakeholders of flooding issues and factors that influence flood outcomes
  - ensure community participation in developing floodplain management strategies and community ownership of outcomes
  - facilitate understanding of current and future land uses and acknowledge the impact of landscape change on the floodplain
  - develop options that seek to enhance environmental benefits of flooding
  - consider emergency response and other contingencies necessary to deal with large floods.

This Strategy aims to build awareness of flood risk and the need to manage that risk through agreed floodplain management principles and a framework for coordinating activities across the Basin.
Coordination of Floodplain Management Activity
Institutional arrangements for implementing the Basin Floodplain Management Strategy should:

a) ensure the involvement of appropriate levels of Government and the full range of stakeholders
b) have a statutory basis, and have clear lines of accountability.

Basin-wide principles for floodplain management will be used to guide the development of floodplain management activities within all jurisdictions. These principles recognise the need for an integrated catchment management approach to floodplain management to ensure that floodplain management does not adversely impact on other values such as downstream water quality and quantity.

Roles and Responsibilities for Floodplain Management
A major concern expressed by the Basin community, particularly within the River Murray area, is the lack of clarity about the role of different agencies in Murray-Darling Basin floodplain management. This is in part due to:

- administrative changes within State Governments
- Local Government amalgamations in some States and the subsequent changes in staff and responsibilities
- the creation, in some States, of catchment management organisations with responsibility for regional floodplain management.

As a consequence of these changes, old structures such as the River Murray Interstate Levees Committee no longer operate.

The community through various forums has expressed concern about the need to clearly define and communicate floodplain management responsibilities of the Commonwealth, States, Local Government and the MDBC.

This section defines the floodplain management roles. It recognises that State legislation provides the basis for developing and implementing floodplain management plans. State legislation also offers a level of protection to the respective State agencies from liability arising from flood impacts.

Commonwealth Government Role
To develop policies that:
- facilitate the development of effective long-term strategies for the sustainable management of floodplains
- ensure the conservation of environmental and cultural values of national significance
- provide flood warning service through the Bureau of Meteorology
- provide financial support for the development and implementation of priority floodplain management strategies through various Commonwealth programs.

Murray-Darling Basin Commission Role
To develop policies and programs for floodplain management in the Murray-Darling Basin that:
- ensure flood management programs are effectively coordinated where their impacts affect other States and that cross-river regional flood strategy development occurs where appropriate
- enable floodplain management activities to be appropriately integrated with other natural resource management programs; be consistent with the Ministerial Council’s Integrated Catchment Management Policy framework and recognise the benefit of flooding for the environment
- provide technical advice and support to States on the impact of flood mitigation works, and modifications to these works, on River Murray flood patterns
- develop appropriate computer models to enable the implications of current and future levee activity on River Murray flows to be assessed
- support floodplain management activities of States through the Murray-Darling Basin 2003 and Riverine Issues Strategic Investigation and Education programs
- undertake public communication and knowledge generation activities in support of these functions.

State Government Roles
State Governments are primarily responsible for floodplain management. Their role includes:
- development of floodplain management policies, programs and plans supported by appropriate Statutory Instruments and institutions to license works on floodplains
- while States have primary responsibility for developing and implementing floodplain management plans, all other government sectors and the community have important roles to play.
• ensuring that Government investment in floodplain management activities is appropriately targeted and are integrated with State development and planning programs to ensure that outcomes for the community reflect the economic, environmental and social values of floodplains
• support and assist communities to develop and implement cost effective flood mitigation works to reduce the risk of significant flood damage and enable flooding to support the natural functions of the floodplain environment
• coordinate floodplain management activities with neighbouring States where appropriate.

Regional Catchment Management Organisations

Within the Murray-Darling Basin, States have supported the development of regional catchment and river management organisations to assist with preparing and implementing natural resource management programs. Floodplain management is one of these programs and regional groups are responsible for ensuring:

• decisions regarding floodplain management, particularly its relationship to land, water, vegetation and other environmental resources are integrated at catchment scale
• strategies and action plans for floodplain management are developed and implemented in partnership between communities and Governments
• support for regional land use planning that reduces the future growth of flood risk and flood damage
• support the activities of Local Government in delivering floodplain planning activities
• within Victoria, that public levees are maintained at an appropriate standard.

Local Government

Local Governments through planning and development schemes, control changes in land use and have a major role in floodplain management, particularly in urban areas. They are responsible for ensuring that local development is consistent with sustainable development principles. Local Governments are responsible for:

• developing and implementing local planning schemes that recognise flood risk and seeks to minimise the economic, social and environmental cost of floods
• identifying and implementing appropriate urban flood protection works
• maintaining urban flood protection measures
• assisting local communities recover from the impact of floods.

Community Role

Communities of flood prone areas are key to the successful management of flood risk and both the upstream and downstream impact of their floodplain management plans. Within the flood management framework provided by catchment organisations and Local Governments, communities and individuals are responsible for:

• understanding the current level of flood risk and taking appropriate actions
• accepting the needs of flood dependent ecosystems
• participating in local and regional floodplain planning to determine acceptable levels of flood risk, the level of investment in flood mitigation works and the needs of the environment for floodwaters
• maintaining privately owned levees at an appropriate standard
• the damage caused by unapproved flood mitigation works during a flood event
• managing the recovery from floods.

Research and Development Priorities

Through the Riverine Issues program, research and development efforts are being directed towards understanding location, causes and threats to floodplain flora and fauna and steps that could be taken to address these issues. It is critical that this work continues, so that regional and local floodplain management plans rest with State Governments.

R&D will continue to improve our understanding of the threats to floodplain plants and animals and the steps that can be taken to manage such threats.
Rehabilitating Floodplain Wetlands

There are several projects being implemented that map wetlands and identify management requirements. To assist with the development of regional floodplain management plans a Basin-wide map that assigns priority to wetlands is required. Of particular importance is the identification of those wetlands that may require alteration to existing levees if the wetlands are to be maintained or enhanced.

Managing Floodplains for Environmental Outcomes

Healthy floodplains are essential to maintaining water quality. While the Environmental Flows Project Board will deal with the issue of water requirements for wetlands and river ‘benches’, there is an emerging issue about land use on the floodplain and the impact this use has on the ecological processes the floodplain provides. Many organisms within floodplain soils are thought to remain dormant until they are extensively saturated by floodwaters. The extent to which heavy grazing and cultivation damage these organisms and the limit of their subsequent ability to respond to saturation, requires further investigation.

Maximising the Environmental Benefits of Flooding

Removal of existing levees or other structures might improve the management of floodwaters and restore flows to water dependent ecosystems. But this may result in the loss of flows downstream. We need to understand whether allowing some of the flood back into wetland areas will significantly affect downstream volumes. Similarly, harvesting of floodwaters for consumptive use can reduce the environmental benefits arising from flooding for downstream ecosystems. In both cases the environmental impact is likely to be greatest for small to medium floods.

Community Education

A major challenge for floodplain managers is ensuring that the community and individuals understand the risk and responsibilities associated with living on the floodplain, are appropriately prepared for the next flood and are willing to invest in coordinated actions that can reduce flood impact.

Community awareness and understanding of impacts, risks and responsibilities is an ongoing process that requires detailed mapping of the floodplain and level of risk associated with different areas on the floodplain.

Actions required of the local community, particularly landholders include the maintenance of private levees. For example, removal of trees and other woody vegetation where the root system can affect the integrity of the levee.

A long-term communication strategy will be developed to keep the community informed about the risks associated with floodplain land use and the roles and responsibilities of Government, communities and individuals in floodplain management.

Local Governments and catchment management organisations are key players in planning and managing activities on the floodplain. A targeted education campaign focusing on these groups will ensure that ‘best practice standards’ can be maintained.

The Cooperative Research Centre for Catchment Hydrology, in consultation with Local Government and the Commission, will develop a series of technical floodplain planning workshops for Local Government and catchment and river management organisations.

This Strategy’s success will rely on high awareness of the impacts and risks of flooding and a commitment to floodplain management at government, community and individual level.
Coordination of Murray-Darling Basin Floodplain Management

The Commission will assist its member States by establishing a planning framework that enables a systematic approach to floodplain management across the Basin.

A Regional Floodplain Management Planning Approach

Consistent with national best practice floodplain management principles, the Commission will promote the need for each regional catchment within the Basin to have a regional floodplain management strategy.

In general, a floodplain management plan would be expected to:

- be overseen by a community-based steering committee that draws its membership from catchment management organisations, Local Government, landholders and community groups
- comprise three broad stages:
  - review of existing flood data and floodplain land use
  - gathering of additional information
  - assessment of flood management options
- recommend actions that may include:
  - priority areas for local floodplain management planning
  - modifications to existing levees affecting flood behaviour
  - identify areas of environmental and cultural significance that require special attention by planning schemes and mitigation works
  - identification of existing levees restricting/blocking flood flows into degraded wetland areas
  - establishing general guidelines for private and public levee maintenance standards
  - establishment of general guidelines for private levee construction standards

Sponsoring the Development of Regional Floodplain Management Plans

The Swan Hill Regional Flood Strategy has illustrated the benefits of interstate cooperation in dealing with River Murray floods where floodwaters are shared between Victoria and NSW.

The Commission can assist States by identifying priority areas for the development of management plans. The priority areas may include those areas of significant flood risk and have major environmental assets not adequately catered for by existing floodplain management plans. For example, the MDBC through the MD2001 program is jointly funding with NSW the development of floodplain management for key NSW floodplains (Lachlan, Macquarie, Billabong Creek, Namoi, Gwydir, Barwon/Darling Rivers and the Liverpool Plains).

Setting Priorities and Funding Floodplain Planning and Works

The Commission has supported State floodplain planning efforts through funding programs such as the MD2001. The Commission programs do not generally fund construction of, or modification to, flood mitigation works. State and Commonwealth floodplain management programs provide funds for these activities.

The Commission may consider supporting floodplain management works through the natural resource management funding programs, only if the primary outcome of those works is to achieve improved Integrated Catchment Management outcomes.

Developing and implementing floodplain management plans is a State responsibility. The Commission will assist States by adopting a strategic approach to coordinating floodplain management across the Basin. This involves:

- defining priority catchments and regions for the development of new or review of existing floodplain management plans
- developing model criteria to guide the development of floodplain management plans
- assessing floodplain management plans for priority areas against those criteria
- assessing the impact of significant floodplain development proposals that are referred by States in general and NSW in particular under the NSW Murray Regional Environmental Plan Number 2
- advising and assisting on further knowledge required for effective planning.

The construction and maintenance of levees or other works designed to provide protection for urban or agricultural purposes is primarily a State responsibility and should be funded privately or through appropriate programs.

Commission funding for floodplain works may be considered if the primary outcome of these works is to achieve Integrated Catchment Management outcomes.

The River Murray in flood
River Murray Floodplain Management Programs

The management of River Murray floodplains, and particularly its system of levees, requires special attention by the Commission. Because of the extent of development along the River Murray and regulated nature of River Murray flows, levees and other impediments to the passage of floodwaters can have a significant impact on the River Murray communities and the operation of the River Murray Water business.

Natural flow paths along the River Murray have been modified by the construction of Government and private levees. Levees have been constructed by landholders to provide local protection, by Local Governments to protect urban areas and, in Victoria, by public works agencies to provide flood protection over larger regional areas.

Modifications have also resulted from other infrastructure (private and public) such as railway embankment, raised ‘flood free’ roads, irrigation channels, etc. These have affected flows into and out of wetlands, obstructed fish passage, as well as directing flows elsewhere.

Managing Developments on the River Murray Floodplain

Historically, the Interstate Leveses Committee (see text box) has been responsible for coordinating River Murray floodplain development between Victoria and NSW.

The Interstate Levees Agreement provided an overarching framework for sharing flood storage capacity between the States. However over time it became clear that the Agreement provided limited guidance for floodplain developments of specific reaches of the River.

The nature of floodplain development has also changed over the years. Large public funded levees are no longer being constructed and most floodplain development activities relate to construction of small private levees and other localised developments on the floodplain.

Because of the increased awareness of the needs of the environment, much of the current floodplain management activity is being directed towards restoration of natural flow paths.

Regional floodplain management strategies and Local Government planning and development schemes guide these activities. In addition the NSW Murray Regional Environmental Plan No. 2, requires all River Murray floodplain developments in NSW to be referred to the Commission for comment. In Victoria, catchment development activities relate to construction of small private levees and other localised developments on the floodplain.

Because of the increased awareness of the needs of the environment, much of the current floodplain management activity is being directed towards restoration of natural flow paths.

Establishing the River Murray Floodplain Management Committee

It is proposed that a new River Murray Floodplain Management Committee be established with the following terms of reference:

- to promote the integration of floodplain management with other Integrated Catchment Management programs and to set priorities for investment in flood mitigation works that will improve Integrated Catchment Management outcomes
- to develop model criteria for the development of floodplain management plans and to assist States by providing advice on how individual plans meet those criteria
- to develop a framework for the performance management of the floodplain management activity.
• to advise the Commission on priorities for investment in floodplain management plans, and research and development on further knowledge required to support effective planning
• at the request of State agencies to assess proposals for levee construction and management programs as they affect the River Murray
• to make recommendations to the Commission as to the impact of regional catchment floodplain management strategies on the surface water flows of the Basin and the consistency of these strategies with MDB floodplain management principles
• to provide technical advice to States and the Commission on the impact of proposed works that may have a significant impact on flood flows
• any other terms of reference determined by the Commission.

The Commission will establish a River Murray Floodplain Management Committee to work with States to assess impacts of floodplain management strategies and of existing and proposed significant floodplain developments and to advise the Commission of appropriate investments.

The River Murray Floodplain Management Committee will develop procedures for assessing the impact of levee removal on surface flow volumes.

Environmental Flows and Flooding
Managing the River Murray system requires the Commission to achieve a balance between a range of objectives. For example releasing additional water from storages for environmental flows can increase the frequency of minor flooding.

The River Murray Floodplain Management Committee will explore and recommend to the Commission, options for minimising the social and economic impacts arising from managed releases for environmental flows.

Role of the Murray-Darling Basin Commission
The Murray-Darling Basin Agreement 1992 requires the MDBC to be notified of activities that might affect the flow and quality of the River Murray. Although floodplain management responsibilities rest with States, the Commission’s role in managing River Murray flood flows has led to a need for the Commission’s River Murray floodplain responsibilities to be clearly articulated.

The River Murray Floodplain Management Committee will develop a communication strategy that promotes the roles and responsibilities of Governments, their agencies and the community in floodplain management, particularly in relation to the River Murray.

Providing Technical Information
The River Murray Mapping program illustrates how the Commission can support States with regional and local floodplain planning by providing information about the extent of flooding on the River Murray.

There are other areas where the Commission can provide benefits to States through investment in mapping technology. Existing topographic maps of the Basin produce coarse information about elevation and are therefore of limited value in mapping flood flows.

Airborne Laser Scanning provides high-resolution digital elevation information. The technology has been used successfully to map...
flow paths in areas of the Barmah-Millewa forest. Because of its ability to both map and penetrate vegetation cover, laser scanning provides a possible tool for auditing the condition of existing levees.

The Commission will extend its knowledge base about developments on the River Murray floodplain through floodplain mapping programs, supporting River Murray water modelling and monitoring the cumulative impact of developments on the floodplain.

**Emergency Flood Response**

State water agencies, State Emergency Services and the Bureau of Meteorology are responsible for flood response.

The Commission, because of its role in operating River Murray structures and the need to manage environmental and other water releases in a way that is consistent with managing flood waters, has a close working relationship with the Bureau of Meteorology with respect to advising the Bureau on flooding.

However, in the case of 'border rivers' where flood response activities from two of three States require coordination, there is need for a clear and unambiguous statement of the roles and responsibilities of agencies involved with planning and coordination of emergency response.

The Commission, in consultation with the Bureau of Meteorology, will sponsor a series of technical workshops for SES coordinators on the flood patterns of the River Murray and its major tributaries.

The Commission will develop a Flood Emergency Manual for the River Murray in consultation with relevant agencies and will be updated every five years.