The New South Wales Government is a leader in environmental water management, with allocation of water to the environment dating as far back as the early 1980s.

In 1998, environmental flow rules were introduced for the state’s regulated inland rivers and the unregulated Barwon–Darling River. In 2004 water sharing plans provided the first legislated recognition of environmental water. Building on these reforms, in 2005–06 the Government established NSW RiverBank, the first program in Australia dedicated to the purchase of water for the environment.

In addition to the above initiatives, the NSW Government with the support of the Australian Government has established programs such as the NSW Wetland Recovery Program and the Rivers Environmental Restoration Program. These have increased our efforts to recover environmental water and rehabilitate some of Australia’s most stressed and valued wetlands, such as the Macquarie Marshes and Gwydir Wetlands.

This annual report focuses on the environmental outcomes achieved through the effective use of environmental water held for release at the discretion of an environmental water manager, including licensed environmental water recovered through programs such as RiverBank and the Rivers Environmental Restoration Program.

In 2009–10, the Department of Environment, Climate Change and Water (DECCW) delivered 122,977 megalitres of environmental water with 57,418 ML of this coming from the Commonwealth Environmental Water Holder. Examination of these environmental watering events demonstrates how the successful planning of water releases has achieved targeted ecological outcomes, such as a boost to waterbird breeding and improvement in the condition of wetland and floodplain vegetation and habitat.

DECCW will continue to build on its success as a leader in environmental water management through a range of water recovery programs in the coming year.

Our rivers and wetlands provide water, support biological diversity, play important roles in our cultural and social experience, and support industry and investment: they are our past and present and must be part of our future.

Lisa Corbyn
Director General
Department of Environment, Climate Change and Water
## Contents

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The Department of Environment, Climate Change and Water (DECCW) is the environmental water holder in New South Wales. In conjunction with the NSW Office of Water, DECCW leads efforts to secure water for the environment through planning mechanisms, the purchase of water, and more efficient water delivery and management infrastructure, all to ensure our wetlands and rivers are here for future generations.

In NSW, water sharing plans allocate a share of water to users for various purposes, including town water supply, irrigation, industry and environmental needs. Environmental water is provided for in the plans as ‘planned’ environmental water and ‘adaptive’ environmental water.

‘Planned’ environmental water is allocated for fundamental ecosystem health via rules set out in water sharing plans. These rules typically:

- establish seasonal flow targets at specific points
- protect a proportion of specific flow events from being diverted
- provide for minimum flows below storages or at the end of systems
- protect the variability of instream flow.

In many regulated rivers, rules establish environmental water allocations to be released at the discretion of an environmental water manager.

‘Adaptive’ environmental water is committed for specified environmental purposes through a water access licence arising from either the purchase of entitlements from willing sellers or the recovery of water savings by infrastructure projects.

Planned environmental water is provided before water is allocated to other water users or town water supplies. Adaptive environmental water licences receive allocations on the same terms as other licences of the same category: for example, if a general security licence is purchased and committed as adaptive environmental water, the same allocations as any other general security licence will apply.

DECCW is responsible for managing all environmental water allocations and the adaptive environmental water licences held by the NSW Government. The NSW Office of Water, which is part of DECCW, is responsible for implementing water sharing plans, including rules-based planned environmental water that is released automatically under the provisions of these plans.

The Australian Government also uses its environmental water holdings in NSW to protect and restore nationally significant environmental assets, such as the Macquarie Marshes and Gwydir Wetlands. DECCW has a Memorandum of Understanding with the Commonwealth Environmental Water Holder (CEWH) to cooperate on the management of state and federal environmental water holdings. In 2009–10, DECCW delivered 122,977 megalitres of NSW and CEWH environmental water in the Gwydir, Macquarie, Murrumbidgee and Murray valleys. No planned environmental water was delivered to the Lachlan as a result of the low level of water availability and the suspension of the water sharing plan. However, good summer rainfall produced tributary flows that delivered environmental benefits to the lower reaches of the river.

Non-statutory environmental watering plans, known as ‘annual watering plans’ and ‘adaptive environmental management plans’, are used to help define the water requirements of assets and prioritise the use of environmental water within an area on both an annual and strategic basis.

This annual report focuses primarily on the NSW Government’s investment in recovering water for the environment and the active management of environmental water held by or available to DECCW, including adaptive environmental water, environmental water allocations under water sharing plans, and water provided by the CEWH. It does not report in detail on rules-based planned environmental water that is released or protected automatically under water sharing plans.

The delivery of water recovered under The Living Murray Initiative is not covered in this report. Information on these watering events can be found in the latest implementation report available on the Murray–Darling Basin Authority’s website at www.mdba.gov.au/services/publications/more-information?publicationid=67.
In NSW a number of programs have supported the recovery of water for the environment through the purchase of water access licences or investment in efficient water delivery and management infrastructure.

**NSW RiverBank** commenced in 2005–06 and was the first program in Australia dedicated to the purchase of water entitlements for the environment. The $105-million program funded by the NSW Environmental Trust had purchased 72,575 megalitres of water entitlement by 30 June 2010 with funding to continue purchasing water up till June 2012.

The **Rivers Environmental Restoration Program** (RERP) is a $181.12-million program which aims to arrest the decline of some of the most important and threatened wetland habitats in NSW through water recovery and effective management of environmental water. RERP is funded by the NSW Government (with a $101.5-million contribution from NSW RiverBank) and the Australian Government ($79.62 million from the Water for the Future–Water Smart Australia Program). At 30 June 2010, RERP had recovered 28,954 ML of water entitlement (in addition to the 72,575 ML recovered by NSW RiverBank) through the purchase of water licences and water savings from infrastructure projects.

In support of this investment in water recovery, RERP is also investing approximately $35 million in science, infrastructure, community engagement and the purchase of land to maximise the benefits of the water purchased. Outcomes to date include the development of Digital Elevation Models and associated water flow models that will assist environmental water managers in testing various watering scenarios. Infrastructure projects, including a $1.6-million investment in Yanga National Park’s Lowbidgee area, are proving instrumental in delivering water to areas that have not been inundated for decades. Engagement activities with landholders and Aboriginal communities are building understanding and support for wetland values and the reconnection of Aboriginal communities to culturally significant wetlands.


**Pipeline NSW** is being implemented by the NSW Office of Water to improve the efficiency of delivering water for rural stock and domestic use by replacing open channels and dams with piped systems, tanks and troughs. The program will recover up to 5000 ML of water entitlement by achieving water savings from reduced system and operational losses. The program is jointly funded with $3.5 million from RiverBank and $3.5 million from the Australian Government’s Water for the Future–Water Smart Australia Program and will conclude in 2012.
The **Hawkesbury–Nepean River Recovery Program** is a $77.4-million program funded by the Australian Government’s Water for the Future fund that aims to improve river health below the system’s major water supply dams. It is doing this by increasing the amount of water retained in the river for the environment and reducing nutrient loads. The project commenced in 2009 and includes $5.35 million for DECCW to purchase water licences held within the Hawkesbury–Nepean, securing water for the environment into the future. The water licence purchase project will gauge the market value of water in a system with little history of water trading.

The **NSW Wetland Recovery Program** is a $26.8-million program jointly funded by NSW and the Australian Government’s Water for the Future–Water Smart Australia Program. During the course of the program from 2005 till June 2010, a total of 9383 ML of environmental water was purchased. The program also invested in wetland research, management tools, wetland management plans, grazing projects, weed control and infrastructure projects to recover water and improve environmental water flow in the Gwydir Wetlands and Macquarie Marshes. Further information on the achievements of the program is available at www.wetlandrecovery.nsw.gov.au.

The **Living Murray Initiative** was established in 2003 by the Murray–Darling Basin Ministerial Council, in partnership with the Australian, NSW, Victorian, South Australian and Australian Capital Territory governments to return up to 500,000 ML of water to improve the environmental health of six ‘icon’ sites along the Murray River. In NSW water was recovered from the southern Murray–Darling Basin, including the regulated water sources of the Murrumbidgee, Murray and Lower Darling rivers. The NSW Government has contributed $115 million to this program, along with investments from its partners. Over 222,000 ML has been recovered from within NSW for The Living Murray, more than 45% of the total water recovered under the program.

**Water for Rivers** was established by the NSW, Victorian and Australian governments in 2003 to recover 282,000 ML of water for the Snowy and Murray Rivers by 2012. Water savings are being achieved through investment in more efficient water infrastructure, innovation and technology and the purchase of water access licences. By January 2010, approximately 215,000 ML of water entitlement had been recovered under the program.

All other water recovered through the above programs is managed by DECCW for the benefit of NSW rivers and wetlands, with the exception of The Living Murray and Water for Rivers where recovered water entitlement is recognised as being jointly held by partner jurisdictions and inter-jurisdictional planning and management arrangements have been established.
### Cumulative environmental water holdings recovered to 30 June 2010 by program and valley (ML)

<table>
<thead>
<tr>
<th>Regulated water source</th>
<th>NSW RiverBank</th>
<th>Rivers Environmental Restoration Program</th>
<th>NSW Wetland Recovery Program</th>
<th>The Living Murray</th>
<th>Water for Rivers</th>
<th>Subtotal per source</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GS*</td>
<td>SA**</td>
<td>GS</td>
<td>SA</td>
<td>LTCE***</td>
<td>LTCE</td>
</tr>
<tr>
<td>Gwydir</td>
<td>7,798</td>
<td>–</td>
<td>7,104</td>
<td>441</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Macquarie</td>
<td>19,366</td>
<td>12</td>
<td>20,809</td>
<td>128</td>
<td>5,891</td>
<td>1,302</td>
</tr>
<tr>
<td>Lachlan</td>
<td>24,103</td>
<td>–</td>
<td>472</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Murrumbidgee</td>
<td>15,617</td>
<td>5,679</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>NSW southern Murray–Darling Basin****</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>221,487</td>
<td>215,000</td>
</tr>
</tbody>
</table>

| Subtotal per program   | 66,884       | 5,691                                    | 28,385                      | 569              | 8,081          | 1,302              |
| Total licensed environmental water holdings | 547,399 |
| Unregulated water sources | 8,252 |

### Environmental water recovered between 1 July 2009 and 30 June 2010 by program and valley (ML)

<table>
<thead>
<tr>
<th>Regulated water source</th>
<th>NSW RiverBank</th>
<th>Rivers Environmental Restoration Program</th>
<th>NSW Wetland Recovery Program</th>
<th>The Living Murray Market Purchase Measure</th>
<th>The Living Murray Water Recovery Programs</th>
<th>Subtotal per source</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GS*</td>
<td>SA**</td>
<td>GS</td>
<td>SA</td>
<td>LTCE***</td>
<td>LTCE</td>
</tr>
<tr>
<td>Gwydir</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Macquarie</td>
<td>6,192</td>
<td>–</td>
<td>5,646</td>
<td>54</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Lachlan</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Murrumbidgee/Murray</td>
<td>8,983</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>19,247</td>
<td>19,780</td>
</tr>
</tbody>
</table>

| Subtotal per program   | 15,175       | –                                        | 5,646                       | 54                                       | –                                        | 19,247              |
| Total environmental water recovered (40,122 ML environmental water purchased in the market + 19,780 ML recovered through water infrastructure efficiency programs) | 59,902 |

* GS = General security access entitlement: allocation varies depending on inflows and storage levels
** SA = Supplementary access entitlement: access is subject to event-based announcements
*** LTCE = Long-term cap equivalent: a unit of measure under The Living Murray equating to long-term average water availability of specific water entitlements
**** Includes water recovered from the Murray, Murrumbidgee and Lower Darling valleys for the benefit of the Murray River (The Living Murray) and Snowy River (Water for Rivers). Entitlement recovered under Water for Rivers is a mix of NSW and Victorian entitlement of various reliabilities.
The Gwydir Valley encompasses a catchment of 26,596 square kilometres and contains a mosaic of wetland types from semi-permanent marshes and waterholes to floodplain woodlands which are only inundated during large floods. The Gwydir River branches into the Gingham (north) and Lower Gwydir (central) watercourses and the Mehi, Mallowa and Moomin systems (south).

Gwydir Valley environmental watering event sites 2009–10

The Gingham system supports river red gum forests, coolibah woodlands and extensive grasslands of water couch, lignum, river cooba, cumbungi and spike rush. It provides critical breeding habitat for waterbirds which nest in colonies, such as egrets, herons, cormorants, spoonbills, ibis and darters, as well as such other waterbirds as ducks, swans, grebes, coots and swamphens. Similarly, the Lower Gwydir Watercourse supports river red gum forests, river cooba, water couch marsh, marsh club rush and common reeds. It contains open water lagoons and provides feeding habitat for nesting colonies, especially of ibis and spoonbills.

The Mehi, Mallowa and Moomin systems support coolibah and river red gum forests which act as a riverine corridor, together with river cooba and lignum vegetation communities.

Noteworthy in all these areas are species listed under international agreements including the barn swallow, black tern, Caspian tern, cattle egret and common tern.
Areas of the Gwydir Wetlands support the largest stand of marsh club rush in NSW, which is listed as a critically endangered ecological community under the *NSW Threatened Species Conservation Act 1995* (TSC Act). Native fish and aquatic invertebrate habitats in the Gwydir are listed as an endangered ecological community under the state’s *Fisheries Management Act 2004*. This Act also lists several threatened native fish species including silver perch, olive perchlet, purple-spotted gudgeon and the river snail while the Murray–Darling population of eel tail catfish is listed as vulnerable under the TSC Act.

Parts of the Gwydir Wetlands are listed under the Ramsar Convention on Wetlands of International Importance (the ‘Ramsar Convention’). The listing covers parts of three private properties – ‘Windella’, ‘Crinolyn’ and ‘Goddard’s Lease’ – and part of a fourth property ‘Old Dromana’, which was purchased by DECCW during 2009–10 with funding from RERP. These wetlands are found in the Gingham and Lower Gwydir watercourses. Traditionally the Gwydir Wetlands is the country of the Gamilaroi people with over 160 cultural heritage sites recorded, including burial sites, scarred trees and stone artefacts.

The Gwydir Valley has supported cattle and sheep grazing since the late 1830s while dryland cropping and irrigation has developed since the 1970s. Regulation of the Gwydir River since the construction of Copeton Dam in the 1970s has dramatically affected the flooding regime for the Gwydir Wetlands and, along with land management activities and channel modifications, has caused a decline in water quality, the health of wetland vegetation and the diversity and numbers of native waterbirds and fish species. Weirs and other barriers also restrict the movement of fish and other aquatic species as well as having an impact on critical processes, such as fish spawning.
Water delivery

Water delivered in the Gwydir Valley during the 2009–10 environmental watering year

<table>
<thead>
<tr>
<th>Location</th>
<th>Start date</th>
<th>Finish date</th>
<th>NSW</th>
<th>CEWH*</th>
<th>EWA**</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whittakers Lagoon (1)</td>
<td>January 2010</td>
<td>January 2010</td>
<td>70</td>
<td>–</td>
<td>–</td>
<td>70</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>70</td>
</tr>
</tbody>
</table>

The numbers in the table relate to the watering event sites marked on the map.

* CEWH = Water sourced from the Commonwealth Environmental Water Holder
** EWA = Environmental water allocation accrued under the Water Sharing Plan for the Gwydir Regulated River Water Source 2002

In addition to adaptive environmental water delivered to Whittakers Lagoon there were also good tributary flows in early January as a result of the heavy rainfall. A proportion of these were protected as planned environmental water and provided flows of 2928 ML to the Gingham system and 1732 ML to the Lower Gwydir system.

Catchment condition in 2009–10

From July to December 2009, the Gwydir Valley suffered an extended dry period and, with many days exceeding 40°C in summer, drought conditions were experienced throughout. In early January, cyclonic activity resulted in heavy rainfall with 70 millimetres received across the lower wetland areas and significant falls (140 mm) in the upper tributaries. However the valley's major storage, Copeton Dam, received minimal inflows, meaning general security licences received no allocation during the year. Supplementary access licences receive 100% allocation at the commencement of each year along with access during specific declared periods in unregulated flow events.

Watering aims

The prevailing drought during the year and the likely prospect of little water available in environmental accounts meant that watering objectives in 2009–10 were modest in scope. Priorities were to:

- maintain and, where possible, restore core habitat and vegetation communities in the Lower Gwydir and Gingham watercourses, ensuring refuge sites were adequately watered and waterholes remained during extended droughts
- maintain native fish populations by providing low flows which protect water quality in priority reaches and allow for recovery when more water becomes available
- rewater Whittakers Lagoon to encourage waterbird breeding and the recovery of aquatic plants and continue the restoration of this isolated floodplain wetland.

Ecological outcomes

Fifteen waterbird species were attracted to Whittakers Lagoon after watering, with five of them – the Pacific black duck, yellow-billed spoonbill, Australasian grebe, Pacific heron and grey teal – breeding successfully. The watering continued the lagoon’s restoration which began in 2008 with benefits for native aquatic and riparian vegetation, especially the river red gum and coolibah communities, and reduced weed infestation and compaction of soil.

Due to hot conditions, the 4660 ML of tributary flows to the Gingham and Lower Gwydir wetlands wetted just 1370 hectares of wetland. Consequently, only the lowest parts of the wetland held water long enough to benefit native aquatic plants, including water couch. The critically endangered ecological community marsh club rush did not complete its seed set.

Water plans

The following plans determine or inform how environmental water is allocated and managed in the Gwydir Valley:

- Water Sharing Plan for the Gwydir Regulated River Water Source 2002
- RiverBank Water Use Plan for the Gwydir Water Management Area
- Environmental Watering Plan for the Gwydir Valley 2009–10
The Macquarie River, with a catchment of about 75,000 square kilometres, spreads out into a number of distributary streams and extensive floodplain wetlands as it flows onto the Darling Riverine Plain. The main Macquarie River channel forms the Macquarie Marshes north of Warren which extend through the Barwon River and include a range of wetlands from semi-permanent marshes and lagoons to ephemeral wetlands.

The following information on the ecological values and assets of the Macquarie Marshes has been summarised from the Macquarie Marshes Adaptive Environmental Management Plan (AEMP), available at www.wetlandrecovery.nsw.gov.au/download/10224MacquarieMarshAEMP.pdf.

The Macquarie AEMP describes the Macquarie Marshes in geographic units of the North, South and East Marsh. The North Marsh typically contains open water lagoons and extensive areas of reed bed and river red gum and cooba woodland and incorporates the Northern Nature Reserve, Pillicawarrina, Bora Channel, Loudens Lagoon and Monkeygar Creek. The South Marsh has suffered a reduction in reedbed vegetation and a reduction in the frequency of inundation to open water lagoons. The South Marsh includes the Southern Nature Reserve, Mole Marsh, Monkey Swamp, Buckinguy Swamp and Marebone area. Both the North and South Marsh sustain important habitat for waterbird breeding, especially for species that nest in colonies: the egret, heron, cormorant, spoonbill, ibis and darter.
The Eastern Marsh includes Wilgara, Dusty Swamp and the Gum Cowal–Terrigal Creek systems. It is characterised by deep and protected open lagoons, river red gum and cooba woodland on riparian floodplain areas, which support colonially nesting species, such as egret, heron, cormorant, spoonbill, ibis and darter.

The North, South and East Marsh all provide habitat for several bird species listed as endangered or vulnerable under the NSW Threatened Species Conservation Act 1995 (TSC Act): the brolga, magpie goose, Australian painted snipe, Australasian bittern and blue-billed duck. Also listed under the TSC Act are two local endangered ecological communities: the coolibah–black box woodland and the Myall woodlands. The marshes host two endangered fish species, the Murray cod (under Commonwealth legislation) and the silver perch (NSW legislation). Numerous mammals, amphibians and plants listed under the TSC Act are also found in the area.

The Macquarie Marshes Nature Reserve and part of the privately owned ‘Wilgara’ are listed under the Convention on Wetlands of International Importance (the ‘Ramsar Convention’). These areas are of particular importance as they have historically supported some of the largest waterbird breeding events in Australia’s recorded history and provide essential breeding and feeding habitat for hundreds of species of animals and plants.

There are over 500 cultural heritage sites recorded in the Macquarie–Cudgegong Valley, which lies within the traditional country of the Wailwan people. They include carved trees, ceremonial and burial sites, oven mounds, scar trees and stone artefacts.

Agricultural use of the Macquarie Marshes began in the early to mid-1800s, with large-scale irrigation developing in the area since the 1970s following construction of Burrendong Dam in 1967. The regulation of flows through the construction of dams and weirs has altered the water regime of the marshes.

**Catchment condition in 2009–10**

The catchment remained dry for the first half of the water year but excellent rain fell below Burrendong Dam from late December through to February. The water sharing plan remained suspended and there were no allocations of water to general security licences.

**Watering aims**

Due to the dry conditions and deteriorating condition of core wetland areas, the primary aim for watering was to avoid further damage to the Macquarie Marshes by relieving the effects of severe unnaturally prolonged drought by wetting semi-permanent wetlands and refuge habitats in the South and North Marsh. If conditions improved, the aims also sought to extend the watering to the East Marsh to promote small-scale opportunities for recruitment of native fish and waterbirds and allow dispersal opportunities for native fish.

A spotted marsh frog metamorph at Buckinguy Swamp in the Macquarie Marshes, an indicator of successful frog breeding after environmental watering.
Environmental water use in New South Wales

Water delivery

Water delivered in the Macquarie Valley during the 2009–10 environmental watering year

<table>
<thead>
<tr>
<th>Location</th>
<th>Start date</th>
<th>Finish date</th>
<th>NSW</th>
<th>CEWH*</th>
<th>EWA**</th>
<th>Total for event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southern and northern Macquarie Marshes (Bukinginguy Swamp, Monkeygar Wetland and Mole Marsh and northern reedbeds) (1) (2)</td>
<td>August 2009</td>
<td>November 2009</td>
<td>3,196</td>
<td>87</td>
<td>16,000</td>
<td>19,283</td>
</tr>
<tr>
<td>East Macquarie Marshes (Gum Cowal–Terrigal Creek systems) (3)</td>
<td>January 2010</td>
<td>February 2010</td>
<td>654.4</td>
<td>845.6</td>
<td>–</td>
<td>1,500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>20,783</strong></td>
</tr>
</tbody>
</table>

The numbers in the table relate to the watering event sites marked on the map.

* CEWH = Water sourced from the Commonwealth Environmental Water Holder
** EWA = Environmental water allocation accrued under the Water Sharing Plan for the Macquarie and Cudgegong Regulated Rivers Water Source 2003

Water available for use during the 2009–10 water year included that held in the environmental water allowance under the water sharing plan, small volumes of adaptive environmental water carried over from the 2008–09 water year and water available on an event-specific basis under supplementary access licences. The extensive rainfall from late December to March provided good flows in tributaries and triggered supplementary access in early January and mid-February. These tributary inflows, protected as planned environmental water under the water sharing plan, provided in the order of 80,000 ML to the Macquarie Marshes.

Ecological outcomes

The watering objectives for 2009–10 were achieved. Watered areas in the South and North Marshes responded positively. Semi-permanent wetland vegetation (common reed, water couch and spike rush) increased in cover and abundance and, with the follow-up rain, were able to add significantly to the seed bank. River red gums showed improved canopy density. Many species of frogs (Peron’s tree frog, the spotted marsh frog, banjo frog and barking marsh frog) and a number of waterbird species (the brolga, yellow-billed spoonbill, Pacific heron, Pacific black duck and grey teal) were able to breed successfully as a direct result of watering. In the North Marsh, a nesting colony of intermediate, great and cattle egrets of between 800 and 1000 nests successfully established as a result of tributary flows and local rainfall.

Watering in the East Marsh provided some much-needed water to the Wilgara Ramsar site. This water benefited instream systems by wetting riparian vegetation thus providing refuge aquatic habitat along an extended length of the Gum Cowal–Terrigal Creek and also enabling fish passage throughout the system. The flows alleviated the effects of prolonged drought in the area and arrested the decline in ecological character of the Wilgara Ramsar site for the immediate future. The water specifically benefited river red gum, lignum and river cooba communities which provide a nesting habitat for colonial waterbirds (egret, heron and ibis).

Water plans

The following plans determine how environmental water is allocated and managed in the Macquarie and Cudgegong Valley:

- RiverBank Water Use Plan for the Macquarie River
- Environmental Watering Plan for the Macquarie Valley 2009–10
The Lachlan is one of the most variable river systems in Australia with a catchment of 90,649 square kilometres and three areas of particularly high ecological value.

### Lachlan Valley ecological assets 2009–10

The Booligal Wetlands complex is made up of numerous small wetlands and swamps. Booligal, Merrimajeel and Murrumbidgi lakes in this area are listed as nationally significant wetlands on the Directory of Important Wetlands in Australia. The Booligal Wetlands supports lignum, river red gum, black box and river cooba vegetation communities and are also known for the large number of colonial waterbirds that breed and forage in the area, mostly ibis species and royal spoonbill. Breeding by the Australasian bittern, blue-billed duck and freckled duck, which are all listed as vulnerable under the NSW Threatened Species Conservation Act 1995 (TSC Act), also occurs in the area. The wetlands also provide habitat for species such as the great egret, glossy ibis and sharp-tailed sandpiper which are listed under various international migratory bird agreements.

The Great Cumbung Swamp is a good example of a terminal NSW reed swamp. It also acts as a drought refuge during dry conditions and is listed in the Directory of Important Wetlands in Australia. The swamp contains common reed and river red gum communities interspersed with patches of black box and lignum. The swamp and its floodplain support one of the largest stands of river red gums in NSW. The Australasian bittern, blue-billed duck and freckled duck are found within the swamps and are listed as vulnerable under the TSC Act. Several other waterbirds listed under international agreements are also found within the swamp including the eastern great egret, glossy ibis, common greenshank, Latham’s snipe, white-bellied sea-eagle, and sharp-tailed sandpiper.
Lachlan Swamps encompasses Lake Ita, Lake Waljeers, Lake Bullogal and Peppermint Swamp. The area is also listed in the Directory of Important Wetlands in Australia and supports stands of black box, river cooba, river red gum, lignum and nitre goosefoot. When Lachlan Swamps is flooded, it is known to support a large number of waterbirds including great egret colonies. Lachlan Swamps contains many vulnerable TSC Act species: waterbirds including the blue-billed duck, brown treecreeper, grey-crowned babbler, magpie goose and freckled duck and two listed plant species: the Mossgiel daisy and Menindee nightshade.

The lowland section of the Booligal Wetlands complex, the Great Cumbung Swamp and Lachlan Swamps are listed as endangered ecological communities under the NSW Fisheries Management Act 2004.

In addition to these nationally significant wetlands, DECCW has prioritised several smaller wetlands for delivery of environmental water. These are located in the mid-Lachlan anabranches near Condobolin and further downstream near Booligal. These lagoons are representative of many hundreds along the river and are vital for maintaining river health. When flooded they provide important habitats for waterbirds, fish and aquatic plants. During extended periods of low water availability, such as those the Lachlan has experienced over the past decade, targeted watering of these smaller wetlands provides an opportunity for broader recovery of the river system when wetter conditions return.

The particular sites chosen for watering have strategic importance and are also highly valued by the landholders. One supports a population of the endangered purple-spotted gudgeon, another hosts a breeding pair of the vulnerable brolga, while others support diverse aquatic plant communities which supply seed sources for riparian and wetland areas further downstream.
The Lachlan Valley has many dams, weirs and other regulating features which have changed the hydrology and ecology of the area. These changes have decreased the inundation of wetlands and floodplains, resulting in increased fragmentation of aquatic habitats.

**Catchment condition in 2009–10**

The Lachlan water sharing plan remained suspended during the 2009–10 watering year because of the ongoing period of record low inflows which began in 2002. Emergency measures were implemented for town supply with water trucked to many communities downstream of Lake Cargelligo to meet stock and domestic needs. High security licences received 10% of their allocation but there were no allocations to general security licences.

With these persistently dry conditions, many wetlands in the Lachlan are under considerable stress. For example, the core reed beds of the Great Cumbung Swamp have contracted significantly in area and the surrounding red gum woodlands are in very poor condition, with the widespread death of trees across a range of age classes.

**Watering aims**

Due to the absence of any significant rainfall and the prevailing drought conditions there was no environmental water available for discretionary use by DECCW.

**Water delivery**

As a result of the low level of water availability and the suspension of the Lachlan water sharing plan, no planned environmental water was released from Wyangala Dam to the Lachlan River. However, good summer rainfall below the dam provided tributary flows that delivered environmental benefit to the lower Lachlan River.

**Ecological outcomes**

Tributary flows in the Lachlan River re-connected small isolated pools, improved linkages between wetlands and allowed fish movement within the system. The flows temporarily benefited some small lagoons on the properties of ‘Yarnel’, ‘Burrawang West’ and ‘Lilydale’ and enabled riparian vegetation to persist for the immediate future period. Many other areas of regional significance such as Murrumbidgill Swamp have not received water since 1998 and are exhibiting loss of ecological character with flood-dependent vegetation such as river red gum increasingly stressed or dying.

**Water plans**

The following plans determine or inform how environmental water is allocated and managed in the Lachlan Valley:

- Water Sharing Plan for the Lachlan Regulated River Water Source 2003
- RiverBank Water Use Plan for the Lachlan Water Management Area
The Murrumbidgee catchment covers 81,527 square kilometres including a 1690-km stretch of river and its surrounding wetlands and a number of national parks, nature reserves and conservation areas with important wetland values. The catchment has one of the most diverse terrains in NSW, ranging from the alpine areas of Kosciuszko National Park and the Monaro Plains through to the grazing and grain belts of the south-west slopes and the shrublands and grasslands of the semi-arid western Riverina.

Murrumbidgee Valley environmental watering event sites 2009–10

For DECCW’s environmental water planning purposes, the Murrumbidgee is split into two broad areas: the mid-Murrumbidgee and the lower Murrumbidgee floodplain, known as the ‘Lowbidgee’.

The Lowbidgee incorporates the Nimmie–Caira and Redbank systems, including Yanga National Park. Vegetation communities typically found in the Lowbidgee include river red gum, black box, common reed, cumbungi, river cooba, nitre goosefoot, cane grassland and Chenopod shrublands. The area supports numerous species listed under the Environmental Protection and Biodiversity Conservation Act 1999 (Cwlth): Murray cod, painted snipe, red-necked stint, regent honeyeater, regent parrot, superb parrot, austral pipewort, chariot wheel, slender darling pea, Menindee nightshade, southern bell frog and eastern long-eared bat. The Lowbidgee has several birds, fish, reptiles, mammals and plants listed under the NSW Fisheries Management Act 2004 (FM Act) and Threatened Species Conservation Act 1995.
(TSC Act), and various international agreements. The Murrumbidgee River is also part of the endangered ecological community of the lower Murray River Catchment declared under the FM Act.

The mid-Murrumbidgee includes Fivebough and Tuckerbil swamps listed under the Convention on Wetlands of International Importance (the ‘Ramsar Convention’) and in the Directory of Important Wetlands. Dominant vegetation communities in the area include river red gum, black box, spike rush, garland lily and blanket fern. The site supports five species listed under the Environmental Protection and Biodiversity Conservation Act 1999: trout cod, plains wanderer, superb parrot, southern bell frog and floating swamp wallaby-grass. Several species of birds, fish, reptiles, mammals and plants found in the mid-Murrumbidgee are also listed under the FM Act, TSC Act and various international agreements.

There are numerous cultural heritage sites within the Murrumbidgee Valley. Tuckerbil Swamp, which contains an ancestral burial ground, is of significance to the Wiradjuri people. Many indigenous families, who belong to the Narrungadera Wiradjuri community, still live within the Riverina and maintain a strong connection to the land and wetlands such as Fivebough and Tuckerbil swamps.

The catchment contains 26 storage or diversion structures under NSW operation, making the Murrumbidgee one of Australia’s most regulated rivers with substantial impacts on the water regime and water availability to floodplains and wetlands.

During 2009–10, NSW RiverBank completed the purchase of 5272 ML of unregulated extraction rights from Tala Lake on the Lowbidgee floodplain. Importantly, this purchase will facilitate the efficient delivery of environmental water across the Lowbidgee floodplain through Tala Lake and into the southern area of Yanga National Park and also improve the lake’s environmental values.

Catchment condition in 2009–10

Conditions were extremely dry between July and December before good rainfall commenced across much of the catchment around Christmas and continued through to March. The water sharing plan remained suspended but there was sufficient water in Burrinjuck and Blowering Dams to allow allocations of 27% in total to general security licences from October 2009 to April 2010. High security licences received 95% of their allocations. When general security allocation exceeded 20% in early March 2010, a substantial volume of environmental water allowance, which had been loaned to support critical human and industry needs since 2006, was paid back. Supplementary access licences receive 100% allocation at the commencement of each year, along with access during specific declared periods in unregulated flow events.

Watering aims

Due to the dry conditions at the start of the water year and the limited availability of water, watering aims were modest. The emphasis was on supporting wetland habitat in the Lowbidgee, particularly to produce conditions suitable for breeding by the endangered southern bell frog. Sites in the Nimmie–Caira system and Yanga National Park where the frogs were expected to occur were targeted.

As water availability increased, watering aims were extended to improving the condition of red gum woodland in several locations, much of which had not been watered for more than five years and some of which have historically supported waterbird breeding.
Water delivery

Water delivered in the Murrumbidgee Valley during the 2009–10 environmental watering year

<table>
<thead>
<tr>
<th>Location</th>
<th>Start date</th>
<th>Finish date</th>
<th>NSW</th>
<th>CEWH*</th>
<th>EWA**</th>
<th>Total for event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lowbidgee wetlands (including Yanga National Park) (1)</td>
<td>October 2009</td>
<td>March 2010</td>
<td>1,525</td>
<td>7,140</td>
<td>1,744</td>
<td>10,409</td>
</tr>
<tr>
<td>Lowbidgee Torry Plains (2)</td>
<td>November 2009</td>
<td>November 2009</td>
<td>–</td>
<td>–</td>
<td>761</td>
<td>761</td>
</tr>
<tr>
<td>Maude Lagoon (3)</td>
<td>December 2009</td>
<td>May 2010</td>
<td>36</td>
<td>–</td>
<td>–</td>
<td>36</td>
</tr>
<tr>
<td>Private properties in North Redbank (4)</td>
<td>March 2010</td>
<td>April 2010</td>
<td>400</td>
<td>1,600</td>
<td>6,200</td>
<td>8,200</td>
</tr>
<tr>
<td>Yanga National Park (5)</td>
<td>April 2010</td>
<td>June 2010</td>
<td>–</td>
<td>40,000</td>
<td>15,483</td>
<td>55,483</td>
</tr>
<tr>
<td>Fivebough Swamp (7)</td>
<td>May 2010</td>
<td>May 2010</td>
<td>–</td>
<td>–</td>
<td>1,003</td>
<td>1,003</td>
</tr>
<tr>
<td>Coonanocobil Swamps (9)</td>
<td>May 2010</td>
<td>June 2010</td>
<td>180</td>
<td>–</td>
<td>–</td>
<td>180</td>
</tr>
<tr>
<td>Campbells and Nericon swamps (10)</td>
<td>June 2010</td>
<td>June 2010</td>
<td>465</td>
<td>–</td>
<td>–</td>
<td>465</td>
</tr>
<tr>
<td>Tiger and Woolshed swamps (11)</td>
<td>June 2010</td>
<td>June 2010</td>
<td>1,000</td>
<td>–</td>
<td>–</td>
<td>1,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>86,518</td>
</tr>
</tbody>
</table>

The numbers in the table relate to the watering event sites marked on the map.

* CEWH = Water sourced from the Commonwealth Environmental Water Holder

** EWA = Environmental water allocation accrued under the Water Sharing Plan for the Murrumbidgee Regulated River Water Source 2003

Ecological outcomes

Watering in the Murrumbidgee during 2009–10 was successful, particularly in improving the health of river red gum habitats. Watering of the Lowbidgee wetlands provided some suitable breeding conditions for the southern bell frog and also enabled a small number of great egrets, little pied and little black cormorants, darters, royal spoonbills and white ibis to successfully breed and fledge their young.

Maude Lagoon was watered to provide a suitable nursery habitat for stocked native fish prior to their release to the river system in spring 2011. At North Redbank, approximately 8000 hectares of river red gum forest and associated wetlands were inundated as far downstream as the Balranald Common, temporarily halting the decline in condition of these vegetation communities.
Watering in Yanga National Park inundated approximately 15,000 ha of river red gum forest and woodland and black box woodland, including severely stressed areas of woodland vegetation not watered in a decade or more.

‘Nap Nap’ and ‘Waugorah Creek’ stations received water to connect isolated pools and wetlands. Connection of these areas enabled native fish movement and provided water to culturally significant sites. Fivebough Swamp was watered to ensure the continued health of the Ramsar-listed site, with many waterbirds, including 23 brolgas, taking advantage of the available water. Campbells and Nericon swamps were watered to support refuge habitat for migratory water birds.

Landholders within the Lowbidgee wetlands were instrumental in the success of environmental water delivery. Much of the infrastructure for delivery of water within the Lowbidgee district is privately owned and therefore the cooperation of land owners is essential. In addition, local knowledge of how water moves through this large and complex region has contributed significantly to the successful outcomes achieved in 2009–10, and will continue to be invaluable for future water deliveries.

**Water plans**

The following plans determine or inform how environmental water is allocated and managed in the Murrumbidgee Valley:

- Water Sharing Plan for the Murrumbidgee Regulated River Water Source 2003
The Murray River makes up part of the border between NSW and Victoria. The river stretches 1700 kilometres and includes a large anabranch system, the Edward–Wakool system, which collectively creates an intricate network of waterways. The NSW portion of the Murray and Lower Darling valleys has an area of 14,490 square kilometres containing a mosaic of wetland types from ephemeral wetlands to permanently wet lagoons and rivers.

Murray and Lower Darling valleys environmental watering event sites 2009–10

NSW Central Murray State Forests and the Barmah–Millewa State Forest are listed under the Convention on Wetlands of International Importance (the ‘Ramsar Convention’). Within NSW, the Millewa Forest, Koondrook–Pericoota Forest, Chowilla Floodplain and the River Murray Channel are icon sites under The Living Murray Initiative. Watering of these sites is coordinated by the Murray–Darling Basin Authority and undertaken in conjunction with the states. Information on these watering events is available from the Murray–Darling Basin Authority’s website at www.mdba.gov.au/services/publications/more-information?publicationid=74.

The Murray and Lower Darling valleys support one of Australia’s largest stands of river red gum forest, as well as river cooba, black box, lignum, common reed, Moira grass, spike rush and giant rush communities. The following species found in the valleys are listed under the Environmental Protection and Biodiversity Conservation Act 1999 (Cwlth): Macquarie perch, Murray cod, trout cod, painted snipe, regent honey eater, superb parrot, small scurf-pea, mountain Swainson-pea,
floating swamp wallaby-grass and southern bell frog. There are also numerous fish, birds, mammals, reptiles and plants listed under the NSW Fisheries Management Act 2004 (FM Act) and Threatened Species Conservation Act 1995, and various international agreements. The Lowland Murray River has also been declared an endangered ecological community under the FM Act.

A large proportion of wetlands that exist on the NSW River Murray floodplain are located on private property. Within the Murray catchment and surrounding areas more than 968 cultural heritage sites are recorded. The majority of these occur within the Milawa Forest (Cummergunja people), Werai Forest (Deniliquin people) and the eastern portion of Koondrook Forest (Cummergunja and Moama people). Cultural heritage sites include scar trees, burials, shell middens and oven mounds.

Many activities have had an impact on the ecological values of the Murray catchment, including river regulation, livestock grazing, fishing, water diversions and timber harvesting. River regulation and the historic over-allocation of the water resource in particular have reduced the extent and condition of floodplain wetlands.

**Catchment condition in 2009–10**

The River Murray system continued to experience dry conditions throughout 2009–10, with inflows well below the long-term average. Despite this, there was an improvement in inflows compared with recent years which resulted in some allocations being made to adaptive environmental water licences.

While the water sharing plan remained suspended, general security allocations started on 1 October and continued through to 1 April, totalling 27%. High security allocations started on 15 July and continued through to 1 April, totalling 97%.

**Watering aims**

Due to the ongoing drought, the aim of environmental watering during 2009–10 was to prevent irreversible environmental damage and provide refuges to avoid critical loss of threatened species.

This included:

- reinstating a more naturally wetting–drying cycle that improves the condition of stressed and culturally significant wetlands, hosting river red gums, black box, river cooba, lignum, common reed and spike rush, while maintaining the abundance and diversity of understorey vegetation
- maintaining habitat for the endangered southern bell frog and other wetland-dependent fauna and flora, such as the endangered regent parrot.

Vegetation in Brechin Wetland responds to environmental watering.
### Water delivery

Water delivered in the Murray and Lower Darling valleys during the 2009–10 environmental watering year

<table>
<thead>
<tr>
<th>Location</th>
<th>Start date</th>
<th>Finish date</th>
<th>NSW</th>
<th>CEWH*</th>
<th>EWA**</th>
<th>Total for event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brechin Wetland (~25 km east of Swan Hill) (1)</td>
<td>September 2009</td>
<td>December 2009</td>
<td>150</td>
<td>–</td>
<td></td>
<td>150</td>
</tr>
<tr>
<td>Pollack Swamp (2) and Wee Wee Creek (3)</td>
<td>October 2009</td>
<td>December 2009</td>
<td>1,343</td>
<td>1,000</td>
<td></td>
<td>2,343</td>
</tr>
<tr>
<td>Andruco Lagoon (Lower Darling River) (4)</td>
<td>October 2009</td>
<td>June 2010</td>
<td>145</td>
<td>129</td>
<td></td>
<td>274</td>
</tr>
<tr>
<td>Toupana Creek (5) and St Helena Swamp (6)</td>
<td>November 2009</td>
<td>December 2009</td>
<td>750</td>
<td>1,500</td>
<td></td>
<td>2,250</td>
</tr>
<tr>
<td>Boomanoomana Swamp (7)</td>
<td>November 2009</td>
<td>February 2010</td>
<td>504</td>
<td>–</td>
<td></td>
<td>504</td>
</tr>
<tr>
<td>‘Kennaugh’ (8), ‘Nampoo’ (9), Boeill Creek Floodplain (10) and ‘Cliffhouse’ (11)</td>
<td>November 2009</td>
<td>April 2010</td>
<td>341</td>
<td>259</td>
<td></td>
<td>600</td>
</tr>
<tr>
<td>Werai State Forest (12)</td>
<td>November 2009</td>
<td>January 2010</td>
<td>–</td>
<td></td>
<td>4,500</td>
<td>4,500</td>
</tr>
<tr>
<td>Normans Lagoon (13) and Picanniny Lake (14)</td>
<td>Early January 2010</td>
<td>Mid January 2010</td>
<td>167</td>
<td>–</td>
<td></td>
<td>167</td>
</tr>
<tr>
<td>Murray Irrigation Ltd wetlands (near Deniliquin, Moulamein, Wakool and Finley) (15)***</td>
<td>April 2010</td>
<td>May 2010</td>
<td>1,517</td>
<td>–</td>
<td></td>
<td>1,517</td>
</tr>
<tr>
<td>Thegoa Lagoon (17)</td>
<td>April 2010</td>
<td>June 2010</td>
<td>2,045</td>
<td>–</td>
<td></td>
<td>2,045</td>
</tr>
<tr>
<td>Grand Junction (18) and Lucerne Day (19)</td>
<td>April 2010</td>
<td>June 2010</td>
<td>558.5</td>
<td>357.5</td>
<td></td>
<td>916</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>April 2010</strong></td>
<td><strong>June 2010</strong></td>
<td><strong>15,606</strong></td>
<td><strong>Total for event</strong></td>
<td><strong>15,606</strong></td>
<td></td>
</tr>
</tbody>
</table>

The numbers in the table relate to the watering event sites marked on the map.

* CEWH = Water sourced from the Commonwealth Environmental Water Holder

** EWA = Environmental water allocation accrued under the Water Sharing Plan for the New South Wales Murray and Lower Darling Regulated Rivers Water Sources 2003

*** The Murray Irrigation Limited (MIL) Private Wetlands Project was suspended from 2005 to 2009 due to insufficient conveyance water in the MIL area of operation to conduct the project. In the 2009–10 water season, 1,517 ML of adaptive environmental water was used to inundate 19 private property wetlands within the MIL area. The project is a collaborative effort between government, private landholders and the irrigation industry. It has been listed as one of Top 25 Australasian Ecological Restoration Projects by the Global Restoration Network.
Ecological outcomes
Watering in the Murray delivered over 15,500 ML of environmental water, enabling many sites to exhibit improved vegetation condition, especially in river red gum, lignum and black box communities. The watering also enabled the emergence of native understorey species. Before watering, many sites lacked an understorey altogether.

Specifically, watering Picanniny Lake revived the breeding and foraging habitat of many wetland bird species. Watering within Werai State Forest enabled the recruitment of numerous bird, fish and frog species.

Watering at ‘Nampoo’ and ‘Cliffhouse’ stations enabled the recruitment of many frog species, including the southern bell frog, which is listed as vulnerable under Commonwealth legislation. Andruco Lagoon watering events saw the recruitment of many frog species including Peron’s tree frog. Watering acted as a drought refuge at Toupna Creek for the southern pygmy perch, a protected species in NSW, and at ‘Kennaugh’ for the brolga, which is listed as vulnerable in NSW.

Water plans
The following plans determine and inform how environmental water is allocated and managed in the Murray Valley:

- Water Sharing Plan for the NSW Murray and Lower Darling Regulated Rivers Water Sources 2003
The management and delivery of environmental water by DECCW relies on the cooperation of a number of NSW agencies, the Australian Government and other partners. DECCW would like to acknowledge the contribution of the following partners.

The Department of Sustainability, Environment, Water, Population and Communities leads implementation of national water reforms and administers the Australian Government’s Water for the Future—Water Smart Australia Program.

The Commonwealth Environmental Water Holder manages environmental water holdings purchased by the Australian Government and contributes environmental water to events undertaken by DECCW and its partners.

The NSW Office of Water is responsible for implementing the Water Act 1912 and Water Management Act 2000, determines water availability, manages flow events in unregulated and regulated rivers, monitors water use, and implements and monitors the outcomes of rules-based planned environmental water under water sharing plans.

State Water manages river operations and water delivery in regulated river systems across NSW.

Industry & Investment NSW remediates weirs, levees, banks and other water infrastructure, and provides special technical and policy advice to water recovery and environmental water use projects and plans, particularly in areas of on-farm water use efficiency, floodplain forest and wetland management.

Other partners with significant roles in environmental water management in NSW include:

- the 13 catchment management authorities who work with regional communities to respond to key natural resource management issues facing their catchments
- environmental water advisory groups who provide expert knowledge, including local knowledge and experience advising DECCW how to manage environmental water
- Murray Wetlands Working Group, an independent community organisation which aims to rehabilitate and improve wetlands within the River Murray and Lower Darling catchments
- Murray–Darling Basin Authority, which is the Australian Government agency responsible for managing the water resources within the basin, including responsibility for preparing a Basin Plan by 2011 and coordinating the management of water recovered for The Living Murray icon sites
- Natural Resources Commission of NSW which provides independent advice to NSW Government agencies on managing the state’s natural resources, including progress towards meeting the statewide natural resource targets set out in the NSW State Plan
- private landholders many of whom provide access to their properties, advice and on-ground support to DECCW during watering events.
Tala Lake bordering Yanga National Park

Front cover: River red gum at sunset at Tala Lake on the border with Yanga National Park, after inundation by environmental flows released between April and July 2010 Paul Childs DECCW

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