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Macquarie Marshes Ramsar site

Article 3.2 response strategy

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Cover photo: View over the southern section of Macquarie Marshes Nature Reserve (Tim Hosking/OEH)

Summary

A notification of likely change in ecological character of the Macquarie Marshes Ramsar site was submitted to the Ramsar Secretary General on 17 July 2009 under Article 3.2 of the Ramsar Convention. This change can best be described as a 'likely change' from a semi-permanent wetland system to an ephemeral wetland system in parts of the Ramsar site. Water availability and management were found to be the primary drivers of change.

The Macquarie Marshes are located in the lower reaches of the Macquarie River in central west New South Wales, and stretch north of the township of Warren. The extent of the greater Macquarie Marshes (approximately 200,000 hectares) is defined by flood patterns and vegetation types. The Marshes include areas inundated by flows from the Macquarie River and its distributary streams and anabranches, including Marebone Break, Bulgeraga Creek, Buckiinguy Creek, Monkeygar Creek, Old Macquarie River, Bora Channel, the Ginghet, Mullins Swamp, Gum Cowal–Terrigal Creek to its confluence with Marthaguy Creek, Long Plain Cowal and Dusty Swamp.

The Macquarie Marshes Ramsar site was designated in 1986 and covers about 10% of the area of the Marshes. The Ramsar site contains core areas of semi-permanent wetland vegetation, sites of great importance for waterbird breeding, and habitat for a large number of wetland-dependent faunal species. Sections of the site are on private properties used for sustainable cattle grazing on native pastures.

Alterations to the natural flow regime of the Macquarie River have resulted in significant reductions in the frequency and duration of wetland and floodplain inundation across high, medium and low flow events. The site is considered to have been in decline since 1944 when the first alterations to the flow regime for farming in the catchment were undertaken. It is likely that the millennium drought (2000–10) has increased the rate of decline of the Macquarie Marshes Ramsar site as large areas of wetland were not flooded for several years.

The critical components and processes of the Macquarie Marshes Ramsar site that have been most impacted are:

- native and migratory waterbird numbers and diversity
- breeding of waterbirds
- the distribution, extent and health of wetland vegetation.

A draft strategy was prepared in 2009. The draft strategy set restoration objectives for the critical components and processes, some of which had exceeded their limits of acceptable change at the time. It proposed short-, medium- and long-term actions to achieve the objectives. Much has been achieved since 2009 in restoring the ecological character of the Macquarie Marshes and some actions have been completed. All actions outlined in this final strategy are contingent on resources being available and stakeholders being in agreement.

Large floods in 2010–11 and 2011–12 have resulted in good responses from waterbirds and wetland vegetation. However, it is too early to judge whether the ecological character of the Ramsar site has been restored to an acceptable level. A monitoring, evaluation and reporting framework has been developed to enable a timely decision to be made on rescinding the Article 3.2 notification.

Contents

Abbreviations

AEMP	adaptive environmental management plan
Basin	Murray–Darling Basin
CEWH	Commonwealth Environmental Water Holder (established by the Commonwealth *Water Act 2007*)
CEWO	Commonwealth Environmental Water Office
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CW CMA	Central West Catchment Management Authority
DPI	Department of Primary Industries NSW
ECD	ecological character description
EFRG	Macquarie and Cudgegong Environmental Flows Reference Group
LAC	limits of acceptable change
MDBA	Murray–Darling Basin Authority
ML	megalitres (1,000,000 litres)
NOW	NSW Office of Water
NPWS	National Parks and Wildlife Service
NSW	New South Wales
OEH	Office of Environment and Heritage
RERP	Rivers Environmental Restoration Program
SEWPaC	Department of Sustainability, Environment, Water, Population and Communities
WRP	Wetland Recovery Program
WSP	water sharing plan

1 Purpose

This strategy outlines actions that respond to the notification, made under Article 3.2 of the Ramsar Convention (1987), of likely adverse (human-induced) change in ecological character of the Macquarie Marshes Ramsar site, and sets timeframes for those actions.

Submission of the Article 3.2 notification followed an assessment of the available evidence of change in ecological character at the site. As of November 2009, the assessment of evidence of change in ecological character of a Ramsar site, submission of an Article 3.2 notification and development of a response strategy is guided by the National guidance on notifying change in ecological character of Australian Ramsar wetlands (Article 3.2) as endorsed by the Natural Resources Management Ministerial Council (DEWHA 2009).

In the context of meeting Australia's obligations under the Ramsar Convention, this response strategy is a key step in providing advice to the Ramsar Secretariat about actions undertaken to address the factors causing change in ecological character as notified under Article 3.2 (Figure 1).

The response strategy is not intended to replace existing management plans or other arrangements in place for the site. It is intended to be a concise overview of:

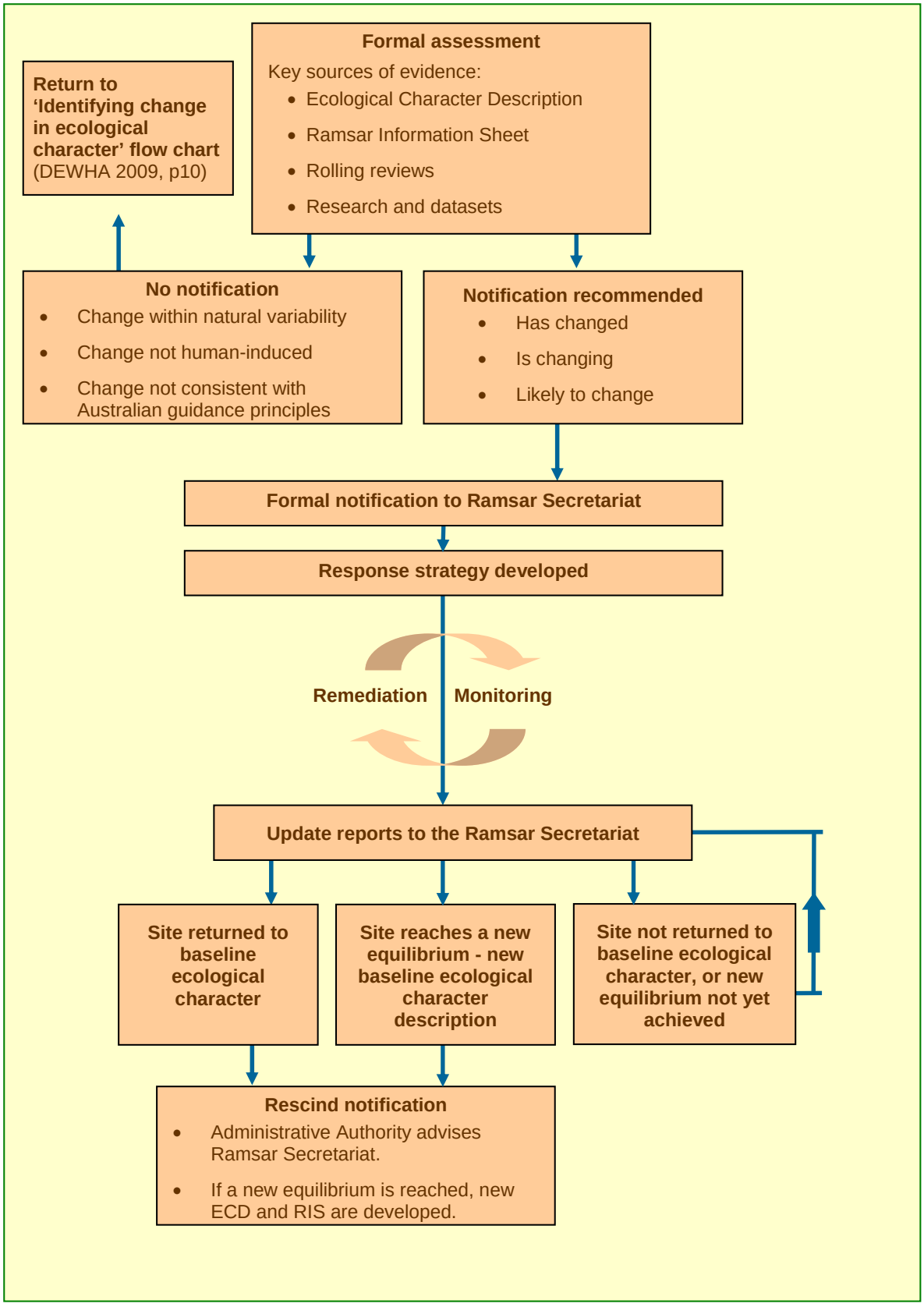
- the management goals and restoration objectives agreed by governments and land managers for the site following the notification
- the suite of activities underway to meet these objectives within an adaptive management framework
- roles and responsibilities of the respective parties
- arrangements for the measurement and monitoring of progress
- key points at which collective review of progress is warranted
- the timing and nature of subsequent updates to the Ramsar Secretariat.

The response strategy must also inform the prioritisation of management actions and investment decisions.

As the Macquarie Marshes Ramsar site is a small component (approximately 10%) of the greater Macquarie Marshes, this response strategy is informed by the *Macquarie Marshes Adaptive Environmental Management Plan* (AEMP) (DECCW 2010) for the greater Marshes and will operate within the framework of the AEMP.

This response strategy will also need to inform and be delivered alongside the framework of the Murray–Darling Basin Plan which has been signed into law (Commonwealth of Australia 2012). The goals identified in this response strategy (section 7), where appropriate, will be linked to the ecological performance indictors developed for the Macquarie Marshes under the Basin Plan framework (long-term environmental watering plans).

This approach is consistent with Ramsar Convention guidance on managing for the maintenance of the ecological character of listed sites and restoration of wetlands, where the components, processes, and benefits/services of wetlands are a function of broader catchment and landscape scale ecosystems (Ramsar Convention Secretariat 2010).



Source: DEWHA (2009, p11)

Figure 1 Formal assessment and notification of change in ecological character

2 What is at stake?

The Macquarie Marshes are one of the largest freshwater wetlands in the Murray–Darling Basin. The ecological system contains a variety of wetland types, ranging from semi-permanent wetlands that require frequent inundation to ephemeral wetlands inundated by only the largest floods.

The Macquarie Marshes are particularly renowned for large colonial waterbird breeding events. In order to support these events in the future, waterbird habitat in both the Ramsar site and other important wetlands of the Macquarie Marshes will need to be maintained and restored.

A wetland of international importance

The Macquarie Marshes Ramsar site covers 19,850 ha and includes the southern and northern sections of the Macquarie Marshes Nature Reserve (19,078 ha),[1] U-block (189 ha), which was part of the nature reserve in 1986 but is now private property, and part of the private property Wilgara (583 ha) (Figure 2). The Ramsar site comprises approximately 10% of the greater Macquarie Marshes.

Macquarie Marshes Nature Reserve was listed in 1986 as a Ramsar site because it:

- was one of the best representative examples of an inland floodplain wetland in the Murray–Darling Basin (Ramsar criterion 1)
- supported nationally threatened species – Australian painted snipe, superb parrot and aromatic peppercress (Ramsar criterion 2)
- supported regionally significant areas of river red gum woodland, water couch marsh and common reed reed bed, which provided habitat for 77 waterbird species and 15 frog species (Ramsar criterion 3)
- supported a wide diversity (Ramsar criterion 3) and large numbers (over 20,000) of waterbirds (Ramsar criterion 5), including migratory species (Ramsar criterion 4)
- regularly supported large-scale colonial nesting waterbird breeding events (Ramsar criterion 4)
- protected core wetland and refuge areas in the Marshes (Ramsar criterion 4) (OEH 2011).

The Wilgara wetland was added to the Macquarie Marshes Ramsar site in 2000 because of its waterbird values. In particular, it supported an important intermediate egret rookery (Ramsar criterion 4) and the endangered Australasian bittern and Australian painted snipe (Ramsar criterion 2). U-block was added in March 2012.

In 2012 the site was also recognised as meeting the recently defined criterion 8 for fish. It supports 11 of the 35 native fish species found in the Murray–Darling Basin and is an important site for native fish feeding and breeding, and for providing longitudinal and lateral connectivity for fish populations.

1 The *Macquarie Marshes Nature Reserve Plan of Management* guides management of the nature reserve (NPWS 1993).

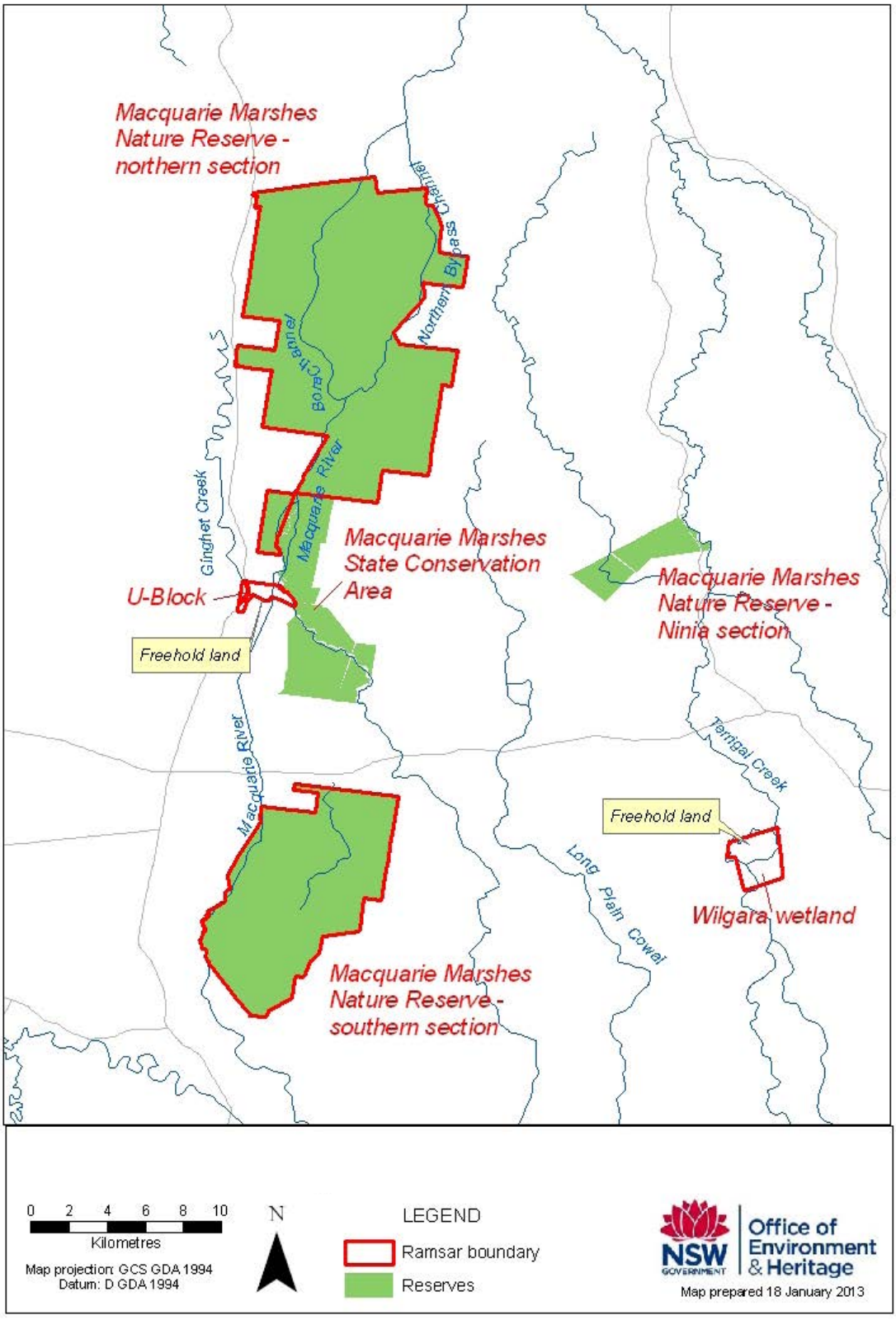


Figure 2 Macquarie Marshes Ramsar site

3 Status

The notification of likely change in ecological character was made in 2009 because there had been substantial changes in the area and health of wetland vegetation communities and because there had been a substantial decline in waterbird abundance and breeding opportunities.

The Office of Environment and Heritage (OEH) has prepared an ecological character description (ECD) for the Macquarie Marshes Nature Reserve component of the Ramsar site (OEH 2012a). The ECD describes limits of acceptable change (LAC) for the critical components, processes and benefits/services that characterise this part of the Ramsar site. LAC are defined by Phillips (2006) as:

> … the variation that is considered acceptable in a particular measure or feature of the ecological character of the wetland … The inference is that if the particular measure or parameter moves outside the 'limits of acceptable change' this may indicate a change in ecological character that could lead to a reduction or loss of the values for which the site was Ramsar listed.

Based on the evidence presented in the ECD, LAC defined for the nature reserve and U-block components of the Ramsar site were exceeded for:

- the health and extent of wetland vegetation communities, including the loss of cumbungi, significant declines in the areas of water couch and common reed, the death of large numbers of river red gums and an increase in invasive species
- waterbird species diversity and abundance, which have declined significantly
- waterbird breeding events – there were no large colonial waterbird breeding events and only two small events between 2000 and 2009; however, in spring–summer 2010–11 a large breeding event occurred following substantial inundation of the Marshes and a colonial nesting waterbird breeding event occurred in 2011–12
- use of waterbird breeding sites – only two of eight sites historically used for colonial waterbird breeding within the Ramsar site have been used for breeding since 2000 (including the recent events).

There is also evidence that the LAC for the Wilgara component of the Ramsar site, as defined in the Wilgara ECD (Biosis Research 2006), may have been exceeded. The site manager has reported that:

- Australasian bittern and Australian painted snipe were not observed in the Ramsar site between 2000 and 2011, but painted snipe have been seen in 2012; however, it is noted that there has been no regular or targeted monitoring for these species
- waterbird species abundance and diversity have declined to below acceptable levels
- there has been one waterbird breeding event since 2000 (in 2011 sacred ibis nested in lignum)
- livestock fodder was reduced during the drought due to insufficient flooding of the wetland and stock were removed to maintain groundcover; there has been a good growth response of wetland plants from flooding in spring–summer 2010–11 and 2011–12.

4 The problems

The key threats to the ecological character of the Macquarie Marshes Ramsar site that have contributed to this likely change in ecological character are:

- water resource development, which has altered the volume, timing and duration of floods in the Marshes (CSIRO 2008)
- drought conditions in the catchment and consequent low environmental allocations for the Marshes between 2000 and 2010 which amplified the impacts of ongoing water extraction, causing unnatural drying of wetland vegetation communities
- enlargement of channels, especially in the southern section of the nature reserve, which have increased the flood volumes needed to achieve overbank flows
- in-channel barriers to river flows and floodplain structures, which have altered the flow regime and impacted on fish passage and connectivity.

There are other risk factors.

- The capacity of the Burrendong Dam outlet is not large enough to release significant quantities of both environmental and irrigation water if required simultaneously.
- The vegetation is dependent on fresh water in the upper soil layers that is only adequately recharged by regular floods, and much of the shallow groundwater in the Marshes is too saline to support plant growth.
- Weeds and pests such as lippia, Noogoora burr, pigs and carp compete with native species and may be advantaged by the altered hydrological conditions that have resulted from water resource development.
- Under some conditions, dense regrowth of native species such as river red gum, river cooba and black roly-poly may occur, which can affect biodiversity values.
- Private Ramsar site lands are used for livestock production.
- There is an increased chance of wildfire events under a drier climate.

The Wilgara wetland, which is part of a productive grazing property, experienced economic loss due to reduced grazing capacity as a result of the changes to wetland vegetation during 2000–10. It has been observed that wetland vegetation responded well to the flooding in 2010–11 and 2011–12, but this response has not yet been quantified.

In addition, during the drought a stock and domestic channel to Gilgarney (Fulton's channel) was constructed adjacent to the Wilgara wetland. Its potential to drain the wetland was assessed through the In-stream Infrastructure Compliance project under the Wetland Recovery Program (WRP) in 2009, and it was demonstrated that it is not having a significant impact on the wetland.

CSIRO (2008) predicted that by 2030 the climate will be generally drier in the Macquarie catchment and the Marshes. Under the best estimate climate scenario the average period between floods is predicted to increase by 10%, the number of floods will reduce by 5% and the average annual flood volume will reduce by 16%. It is also predicted that the seasonality of rainfall will change from a winter system to a summer system. This is likely to impact on plant communities and cues for waterbird breeding. A drier climate may also increase competition for water resources and increase the risk of fire which can have catastrophic effects on wetland vegetation (river red gums do not tolerate wildfire).

More detailed information on threats to the Macquarie Marshes Ramsar site is contained in the Macquarie Marshes AEMP (DECCW 2010), the Wilgara ECD (Biosis Research 2006) and the Macquarie Marshes ECD (Nature Reserve and U-block components) (OEH 2012a).

5 Management of the current problems

The New South Wales (NSW) and Australian governments are taking action to improve the ecological health of the Macquarie Marshes Ramsar site and the greater Macquarie Marshes through a series of investment programs (Appendix A) and statutory mechanisms.

The ecological character of the Ramsar site is protected under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the NSW *National Parks and Wildlife Act 1974*. The Basin Plan, prepared by the Murray–Darling Basin Authority (MDBA) under the Commonwealth *Water Act 2007*, promotes the wise use of all Basin water resources, promotes the conservation of declared Ramsar wetlands in the Basin and takes account of the ecological character of declared Ramsar wetlands as well as the ecological values of all other key environmental sites in the Basin (Commonwealth of Australia 2012).

The Basin Plan sets long-term sustainable and enforceable diversion limits on surface water and groundwater in the Murray–Darling Basin. Future water sharing plans (WSPs) will need to be consistent with the sustainable diversion limits set in the Basin Plan. The Basin Plan also addresses the use of environmental water, management of salinity and water quality, and trading rules. The long-term environmental watering plans, to be prepared under the Basin Plan, will set ecological performance indicators (ecological objectives and targets) for the broader Macquarie Marshes. The Australian Government Minister for Sustainability, Environment, Water, Population and Communities (SEWPaC) has signed the Basin Plan into law (Commonwealth of Australia 2012).

The Water Act also establishes the Commonwealth Environmental Water Holder (CEWH) to manage the Commonwealth's environmental water holdings. The Commonwealth Environmental Water Office (CEWO) has been established to support the CEWH. The independent CEWH is required to use its holdings to protect or restore environmental assets to give effect to relevant international agreements. Water that is held in the Murray–Darling Basin is required to be managed in accordance with the environmental watering plan that will be developed by the MDBA.[2]

Recovery of water for the Marshes

Establishing a more 'natural' flow regime is a key strategy for maintaining refuges and restoring the Macquarie Marshes Ramsar site. Determining how much water is needed to do this in the long term is complex and is being considered in the Basin Plan process; however, section 3.5 of the AEMP identified that most of the ecosystems of the Marshes need more water, more regularly, than they received between 2001 and 2010 (DECCW 2010).

The Water Sharing Plan (WSP) for the Macquarie and Cudgegong Regulated Rivers Water Source was made under the NSW *Water Management Act 2000* and is due to be revised in 2014. The new WSP will need to be consistent with the Basin Plan. Improving the WSP's capacity to deal with dry climatic sequences, such as those experienced during the millennium drought, will be important for reducing the impacts of water resource development in the longer term.

Under the current WSP, the environment has an annual water allowance of up to 160,000 ML held in Burrendong Dam. The volume of allocations which accrue to this allowance each year is determined by the available water determination, which is dependent on water availability in the catchment. The WSP also has rules that limit extraction from supplementary flows and total annual extraction from the river system in order to protect a proportion of river flows for the environment.

To address the inadequacy of allocation to the environment, the NSW Government has purchased 48,419 ML of general security entitlement, 1451 ML of supplementary access entitlement and 2980 ML of unregulated entitlement in the Macquarie Valley (as at 6 November 2012). The Commonwealth Government contributed funding toward the NSW purchases and in addition

2 Further information is available at www.environment.gov.au/water/policy-programs/cewh/index.html.

holds a further 98,004 ML of general security entitlement and 1888 ML supplementary access entitlements (as at 30 November 2012) which it is using to meet the environmental needs of the Macquarie Marshes. Allocations to general security entitlements purchased by governments are made in accordance with the available water determination and are used to deliver water to the Marshes. The purchase and holding of supplementary access entitlements by governments also increase the volume of unregulated flows to the Marshes when supplementary access is available.[3]

In developing the Basin Plan the MDBA has determined that adequate environmental water has been recovered to meet the environmental water needs of the Macquarie and Castlereagh catchment and that no further water needs to be recovered to meet local water requirements.

Management of environmental water

OEH is responsible for managing environmental water allocations established under WSPs and water access licences held by the NSW Government for an environmental purpose.[4] The Macquarie and Cudgegong WSP establishes the Macquarie and Cudgegong Environmental Flow Reference Group (EFRG) which advises OEH about managing environmental water and helps OEH prepare an annual watering plan (OEH 2012b). Environmental water management is critical during dry times as it is the main tool used to sustain critical refuges and values in the greater Macquarie Marshes.

The volume required to inundate a particular area of the Marshes varies depending on the antecedent conditions. Critical factors include season, recent inundation history, recent rainfall and soil moisture. The soils of the Marshes are estimated to hold up to 10–15 ML per hectare (DECCW 2010, p47). According to CSIRO forecasts (CSIRO 2008), it is likely that the Marshes will experience longer periods without water, which is likely to result in a higher average ratio of water volume to soil area for specific floods.

The EFRG has had significant experience in managing environmental water since 2001. Digital elevation and inundation history mapping are used to further assist in determining accurate information about volumes of water required to provide suitable flow regimes in the Marshes. A hydrodynamic model has been developed and is being used to inform environmental watering decisions and restoration initiatives. The outcomes of environmental watering events are reported annually by OEH.

The CEWO manages Commonwealth water from a Basin-wide perspective in coordination with other environmental water holders and sits as an observer on the EFRG. The CEWO evaluates and prioritises environmental watering actions in accordance with its published long-term framework, which has been developed in consultation with the Environmental Water Scientific Advisory Panel, interested stakeholders and delivery partners, including the NSW Government. Watering options proposed by NSW in the Macquarie catchment are assessed against published criteria, using the best available information and advice from the Environmental Water Scientific Advisory Panel.[5]

Improvements to water management infrastructure

In an effort to reduce the barriers or constraints to water and fish movement in the river and across the floodplain throughout the catchment, a number of improvements have been made.

An upgrade to Gradgery Lane downstream of Warren has increased the flow capacity of the Macquarie River at this point from 4000 ML per day to 12,000 ML per day without impeding road

3 For holdings of environmental water see www.environment.nsw.gov.au/environmentalwater/waterpurchase.htm and www.environment.gov.au/ewater/northern/macquarie-castlereagh/index.html.

4 For information on OEH management of environmental water see www.environment.nsw.gov.au/environmentalwater/envwatermacquarie.htm.

5 For information on CEWO activities in the Macquarie catchment see www.environment.gov.au/ewater/northern/macquarie-castlereagh/index.html.

access; the upgrade was funded by the NSW and Australian governments under the WRP at a cost of approximately $3.5 million and will improve the capacity to deliver environmental water to the Marshes.

Floodplain structures downstream of Marebone Weir that divert or constrict flows on the floodplain have also been audited under the WRP and actions undertaken to modify or remove works where appropriate.

The construction of a fishway at Marebone Weir funded under the Rivers Environmental Restoration Program (RERP) has been completed. This will improve fish community connectivity between the Macquarie River and the Marshes (DECCW 2011, section 4.2).

Fishways have been constructed at Bulgeraga channel crossings 1 and 2.

OEH has breached levees on the Macquarie Marshes State Conservation Area (previously known as Pillicawarrina) to reinstate floodplain flow to the northern section of the nature reserve. Under WRP and RERP the stock and domestic supply requirements of landholdings supplied by the North Marsh Bypass channel and the lower Macquarie River were documented and a scoping study undertaken to identify potential alternative supply schemes and water savings. RERP also funded work to examine the potential hydrological and ecological impacts of developing an alternative source of stock and domestic water supply (DECCW 2011). A Commonwealth funded ($0.15 million) feasibility study is now underway to investigate water efficiency gains that could be made from piping stock and domestic water supplies from the Macquarie River as well as from other priority river systems in NSW. This study will include an assessment of the likely impacts on the Ramsar site.

The Macquarie River (Narromine to Oxley Station) Floodplain Management Plan (DECCW 2008) should assist with regulation of structures on the floodplain upstream of the Marshes. Structures that currently lie within the defined floodway and alter wetland connectivity may need to be modified or removed. When it is finalised, the NSW Floodplain Harvesting Policy is expected to restrict future development of floodplain structures that are intended to harvest floodplain flows.[6] Valley-wide floodplain management plans, to be prepared under the Water Management Act, should identify ecological assets in floodways to be protected and restored.

Improvements to land management practices

Part of the property Pillicawarrina was purchased in 2008–09 by the NSW Government with funding from the Australian Government under RERP to reduce pressure from intensive irrigation and cropping adjacent to the nature reserve, and to help restore the floodplain (DECCW 2011, p11).

Best management practice grazing guidelines were prepared through the WRP to assist private land managers to manage grazing in the Macquarie Marshes.

Incentives have been provided to landholders in the Macquarie Marshes through RERP to improve management of wetlands on private land. Extension activities have also recently been undertaken to provide information to landholders about soils and new grazing practices.

Additionally, the Warren to Barwon Project, which is the flagship Central West Catchment Management Authority (CW CMA) project for the Marshes area, is undertaken in collaboration with a range of partners including OEH, NSW National Parks and Wildlife Service (NPWS), Department of Primary Industries (DPI) Fisheries, North West and Central West Livestock Health and Pest Authorities, the Invasive Animals Cooperative Research Centre and the University of New England. The Warren to Barwon Project seeks to trial improved land management practices in wetlands and floodplains of the lower Macquarie, including the Marshes. This includes addressing pest and weed management, native seed harvesting and grazing management.

6 www.water.nsw.gov.au/Water-management/Law-and-policy/Key-policies/Floodplain-harvesting/Floodplain-harvesting/default.aspx

Proactive management of the Wilgara site by the land manager has been increased to include extended grazing rest periods when appropriate and increased monitoring and control of feral animals and weeds. In addition, the Australian Government's Biodiversity Fund has provided $700,000 over six years to enhance restoration and regeneration of the Wilgara wetlands. The funding will support continued best practice in the management of the wetlands, in the context of a holistic primary production business, the introduction of invasive species management programs and the introduction of a comprehensive monitoring program which will feed back into the overall adaptive management of this site.

Under the 2012 Biodiversity Fund, the not-for-profit RiverSmart received $1.8 million to address land management and river health issues in the lower Macquarie River. CW CMA is partnering in the delivery of the program.

Controlling pests and weeds

The Macquarie Marshes Ramsar site was identified as a priority under the 2010–11 Caring for Our Country Business Plan for on-ground management activities that address key threats to the ecological character of the site. Funding was granted for specified activities including feral pig control, weed control and vegetation restoration where pigs had caused damage to waterbird habitat. A sum of $700,000 was received by CW CMA in 2010 to assist in this regard. CW CMA and the community are also addressing lippia and Noogoora and Bathurst burrs though RiverSmart. Willows have been removed from the riverbank along 70 kilometres up to Gradegy Lane.

Lippia

Bare ground caused by inundation patterns appears to be the primary factor favouring the spread of lippia. Biological control methods have been investigated by the Lippia Working Group but research has stalled due to lack of available funding. Through the Warren to Barwon Project, managed by the CW CMA with assistance from OEH and DPI, there will be further investments made in lippia trials in the floodplains in and around the Marshes over 2010–13. There is also a targeted research program into lippia control methods being undertaken by the University of New England in the Macquarie Marshes and immediately upstream of the Marshes.

Carp

A carp reduction and native fish enhancement strategy has been developed for the Macquarie Marshes by DPI (I&I 2010). The strategy identifies a range of activities to reduce the impact of carp on the Macquarie Marshes and enhance native fish habitat. RERP funded the construction of a carp management structure at Marebone. Further assistance through a Caring for Our Country grant has enabled the installation of an additional carp management structure at Pillicawarrina and its operation for a minimum of two years.

Pigs

Feral pigs are routinely controlled by OEH as part of its management in the Macquarie Marshes Nature Reserve, and by the Livestock Health and Pest Authorities and landholders on adjacent private lands. Assistance through a Caring for Our Country grant has enabled additional pig shoots and investment in trials of new pig baiting technology to work in coordination with such methods. Feral pig control, coordinated by CW CMA through the Warren to Barwon Project, is being undertaken collaboratively with the Livestock Health and Pest Authorities, NPWS and the Invasive Species Cooperative Research Centre.

Invasive native plants

Some native species have invasive characteristics and this is recognised as a significant issue for landholders and the environment. These species include the chenopod black roly-poly and woody species such as river red gum and river cooba which tend to form monocultures in dense cohorts when inundation patterns favour their development. Under the Warren to the Barwon Project, CW CMA is investing in trials to treat invasive native species and exotic species to restore groundcover biodiversity and productivity for affected grazing on private lands within and adjacent to the Macquarie Marshes.

Fire management in Macquarie Marshes Nature Reserve

The objectives for managing fire in Macquarie Marshes Nature Reserve are to protect life and property while at the same time aiming to meet the ecological requirements of the wetlands. The strategies for managing fire in the nature reserve, including the operational and management guidelines, are detailed in the *Macquarie Marshes Nature Reserve Fire Management Strategy 2012–2017* (NPWS 2012).

Part of the threat from fire to the ecological integrity of the Marshes is large, high intensity wildfires that could occur after prolonged dry periods and under adverse weather conditions. Such fires may threaten river red gum, reed bed and woodland vegetation communities. Important management actions are to conduct mosaic prescribed burns when there is adequate soil moisture and to maintain an adequate fire trail network to respond to wildfires. As flooding frequency and antecedent conditions are a major determinant of the extent and health of wetland vegetation communities, any prescribed burning in the nature reserve needs to take those factors into account.

Restoring geomorphic, hydrologic and vegetative structure and function

Ecological processes in the Macquarie Marshes are dependent on intermittent hydrologic connectivity between channels and floodplains, reflecting the natural boom and bust cycle of inland Australian rivers. Wetland vegetation response and resilience is dependent on these functions.

Restoring eroded channels in the southern section of the Macquarie Marshes Nature Reserve was documented as critical to the ecological functioning of the Marshes by the NSW Department of Land and Water Conservation in the 1990s (Brereton 1994; Brereton et al. 2000; Kidson et al. 2000). As a result, some six to seven structures were put in place in the Breakaway under an Environmental Trust Grant obtained in 1995. However, channel erosion has continued and options that reinstate overbank flooding and restore a more natural flooding regime within the constraints of river regulation in the southern section of the nature reserve are being reevaluated through the Southern Marshes Stream Restoration Scoping study which has been funded by the Australian Government's Water for the Future program.

In the Macquarie Marshes, the vegetation associations closely reflect the frequency and duration of inundation. Protecting areas of semi-permanent wetland in good condition is a priority. Retaining and/or restoring key waterbird breeding habitat throughout the Macquarie Marshes is also essential for maintaining the values of the Ramsar site. Restoring and maintaining adequate inundation to water couch meadows on Wilgara wetland and U-block are essential for providing pasture for sustainable grazing and forage habitat for colonial nesting waterbirds.

Adaptive environmental management plan

An adaptive environmental management plan (AEMP) for the Macquarie Marshes was developed under WRP (DECCW 2010). The Macquarie Marshes AEMP set out the key ecological, social and economic values and functions of the greater Marshes and identified the various wetland assets across the Marshes that have traditionally supported those values and functions. The AEMP also set out the actions necessary to restore and maintain those values and functions in the future.

The AEMP recognised the need for long-term commitment from landholders, government and the community. This commitment encompasses engagement of stakeholders, the establishment of governance and reporting frameworks, resourcing for targeted restoration actions and implementation of best management practice land use in the Macquarie Marshes.

The AEMP is intended to inform the management of the greater Macquarie Marshes and to guide strategies, projects and tasks for restoring and maintaining critical ecological functions and habitats in the Macquarie Marshes.

Monitoring and reporting

Programs to inform monitoring and reporting of the ecological character of the Macquarie Marshes include:

- the Ramsar Rolling Review which will provide regular reporting on threats to the ecological character of the Ramsar site
- monitoring of the ecological outcomes of environmental watering events
- monitoring of the delivery and ecological outcomes of the WSP through the NSW Integrated Monitoring of Environmental Flows program.

The MDBA will develop a monitoring and evaluation program to review the performance of the Basin Plan including performance of the environmental watering plan for the Murray–Darling Basin. The program is likely to provide useful information, but it is unclear whether it will be sufficiently detailed to permit comprehensive reporting on the ecological character of the Macquarie Marshes.

OEH will report every six months to the Commonwealth Department of Sustainability, Water, Population and Communities (SEWPaC) on actions that are underway in response to the Article 3.2 notification. This reporting will assist in determining when the Article 3.2 notification can be rescinded (see Figure 1). SEWPaC will report at least triennially to the meetings of Contracting Parties to the Ramsar Convention on the condition of the Ramsar site.

6 Restoration objectives

The restoration objectives for the Macquarie Marshes Ramsar site are set out in Table 1. The restoration objectives have been established from the LAC for the character of critical components, processes and benefits/services of the Ramsar site, as described in the ECDs (Biosis 2006; OEH 2012a) (see section 3 for a discussion of LAC).

The primary focus of the restoration objectives is to restore wetland vegetation communities to greater than 80% of both their extent and condition classes as existed at the time of listing. The 80% restoration target for wetland vegetation is consistent with the LAC in the ECDs (Biosis 2006; OEH 2012a). Full ecosystem restoration is a long-term objective, as it depends on the establishment and growth of new trees in some areas.

Vegetation classes are the main focus of the objectives because good information is available on trends in their extent and condition since the early 1990s, they support other assets by providing

habitat and they can act as surrogate indicators until better information is available. The objectives recognise that only a small proportion of each vegetation community was in good condition in 2008 (the basis of this assessment), that vegetation that is in good condition needs to be maintained, and that those areas that can most easily be restored should be prioritised. Figures 3, 4 and 5 show the extent of wetland vegetation communities across the components of the Ramsar site in 1991 and 2008. New vegetation maps showing the vegetation response to flooding in 2010–11 and 2011–12 have not yet been produced.

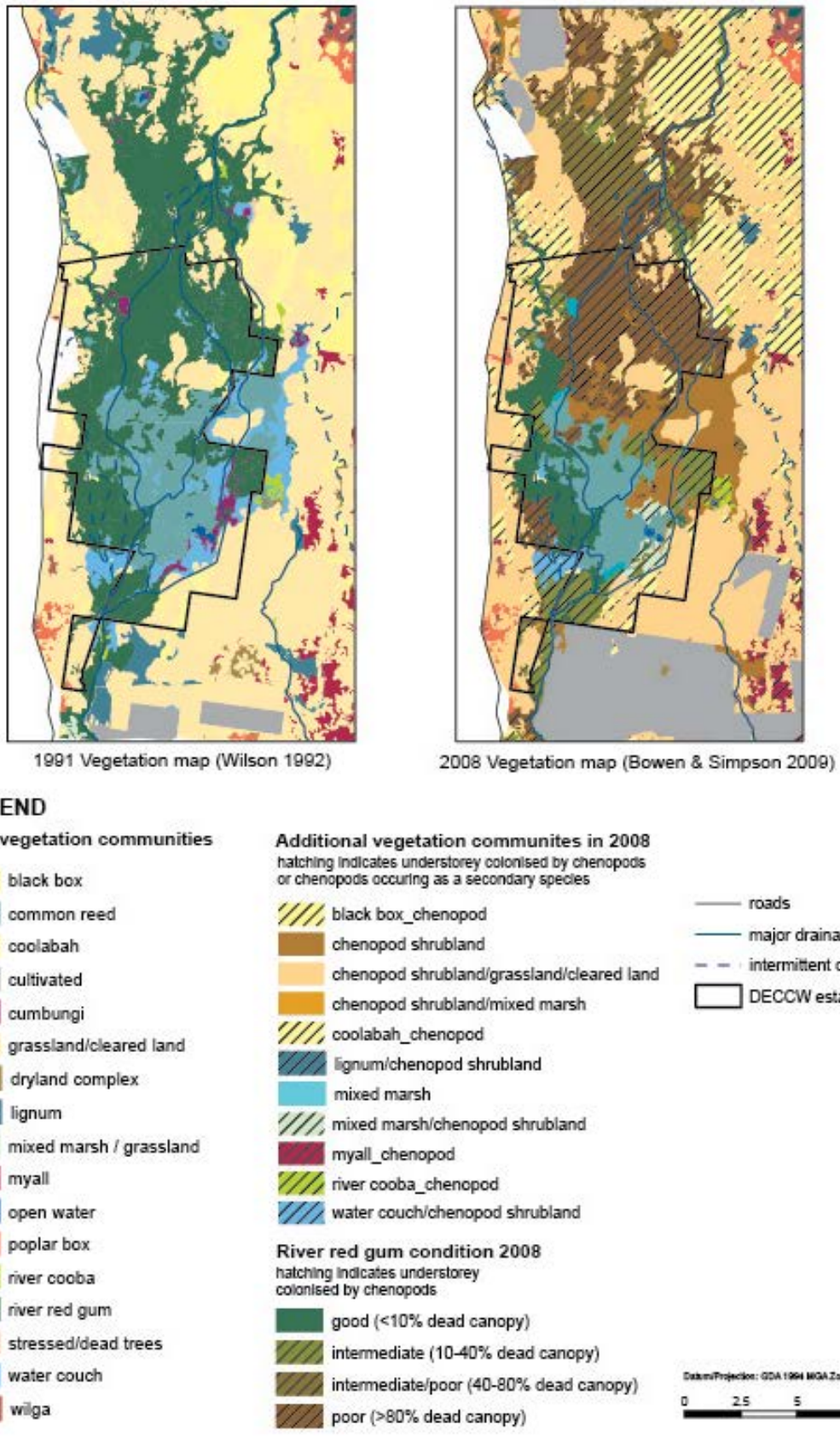
Restoration objectives for waterbird diversity and breeding have also been established from their LAC as there is reasonable data since the early 1980s. A restoration objective for native fish to restore fish passage has also been included.

Table 1 Restoration objectives and restoration targets for the Macquarie Marshes Ramsar site

Restoration objectives for critical components, processes and benefits/ services	Critical components, processes and benefits/services (approx. 1991 area)	Restoration targets	Notes
Restore the extent and condition of semi-permanent wetland vegetation communities to more than 80% of their 1991* level.	River red gum in the northern section of the nature reserve and Wilgara (6000 ha)	Maintain 1400 ha in good condition, and restore 3500 ha of intermediate and poor condition river red gum in the northern section of the nature reserve. Maintain/restore at least 230 ha in Wilgara.	Restoration objective requires the establishment of new trees which may take up to100 years to provide some habitat functions. Inundation patterns to create appropriate densities of trees are required.
	Common reed (3000 ha)	Maintain 1800 ha of reed beds in the northern section of the nature reserve and restore a further 600 ha in the southern section.	Channel erosion in Monkeygar Creek and Breakaway has resulted in more water being needed to overbank and water the reed beds in the southern section of the nature reserve. It has been observed that in response to the 2010–11 and 2011–12 floods, reed beds have expanded from the extent recorded in 2008; however, the amount of recovery has not yet been measured.
	Water couch (1300 ha)	Maintain 170 ha of water couch in Wilgara, and restore 870 ha of water couch in the nature reserve and U-block components of the Ramsar site.	Local knowledge suggests that water couch needs to be grazed. Grazing is not currently a management strategy in the nature reserve component of the Ramsar site. It has been observed that water couch has responded to the 2010–11 and 2011–12 floods; however, the extent of this response has not yet been measured.
	Mixed marsh (>280 ha)	Maintain 280 ha of mixed marsh in the Wilgara component of the Ramsar site. Maintain all existing areas of mixed marsh in the nature reserve component of the Ramsar site.	The methods used to map the extent of mixed marsh in 1991 and 2008 were different and cannot be compared. Mixed marsh is an ecotonal community and its extent and composition is more variable than other semi-permanent wetland communities. Response to the 2010–11 and 2011–12 floods is as for water couch and common reed.
	Open water lagoons (90 ha)	Maintain and restore at least 70 ha of open water lagoons.	Some sites are currently disconnected from flow paths.

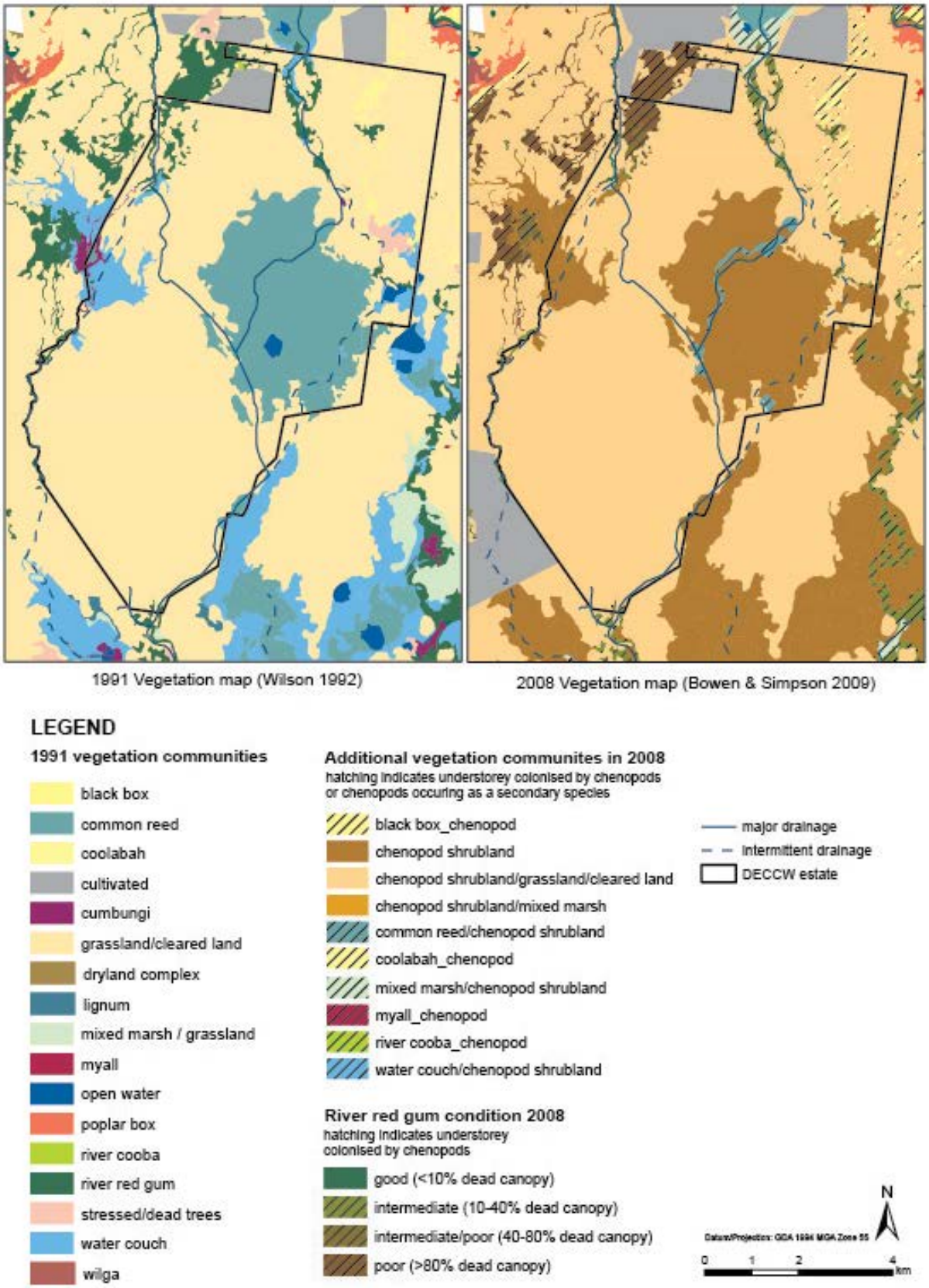
* The 1991 vegetation mapping provides the best available information on extent of wetland vegetation communities in 1986 (the year the area was designated as a Ramsar site).

Restoration objectives for critical components, processes and benefits/ services	Critical components, processes and benefits/services (approx. 1991 area)	Restoration targets	Notes
Maintain and restore river cooba as an important habitat component for nesting waterbirds.	River cooba (unknown)	Maintain in association with other vegetation communities such as lignum and river red gum or as small monocultures. Maintain river cooba on Wilgara for egret nesting.	Not mapped in 1991 or 2008. River cooba can behave as an invasive species under some circumstances.
Maintain coolibah and black box woodlands in good condition.	Coolibah and black box (700 ha)	Maintain current area of coolibah and black box, and improve the understorey composition to include semi-permanent wetland communities, grassland and chenopods.	Much of the coolibah and black box community was in poor condition in 2008. Its condition has not been assessed in 2011 or 2012.
Maintain and restore lignum shrublands.	Lignum (<200 ha)	Maintain and restore lignum shrubland in Salt paddock, Q-block, Halls block and Wilgara.	Lignum is not well mapped.There is limited knowledge of conditions favouring its re-establishment. It is important for colonial waterbird nesting, especially straw-necked and glossy ibis and royal spoonbill.
Maintain and restore wetland habitats to support waterbird diversity so that at least 14 species are observed every two years.	Waterbird diversity	Maintain and restore the range of wetland communities to support a diverse waterbird community.	Waterbird data is derived from the annual eastern Australian aerial waterbird surveys of the northern third of the northern section of the nature reserve.
Maintain and restore colonial waterbird breeding localities in event ready condition.	Waterbird breeding	Support breeding by at least 500 pairs every two years. Support large scale waterbird breeding events (>40,000 nests) at least once every eight years.	There was no breeding between 2001 and 2008. There was nesting by approximately 500 pairs of colonial waterbirds in the Ramsar site in P-block in 2008 and 2010. There was a large-scale breeding event in the Marshes in 2010–11, including two colonies (P-block and Bora North) of approximately 25,000 pairs in the nature reserve component and a small colony of ibis at Wilgara. The largest colony (approximately 70,000 nests) was outside the Ramsar site in the Monkeygar reed beds. There was smaller scale colonial waterbird breeding in response to flooding in 2011–12. There has been no colonial waterbird breeding on Wilgara in either 2010–11 or 2011–12.
Maintain and restore open water lagoons and exposed muddy margins as habitat for migratory shorebirds and waterfowl.	Shorebirds	Maintain and restore seasonal drawdown of lagoons to coincide with late summer–autumn to coincide with shorebirds in 15 out of every 20 years.	Some lagoons are currently disconnected from flow paths.



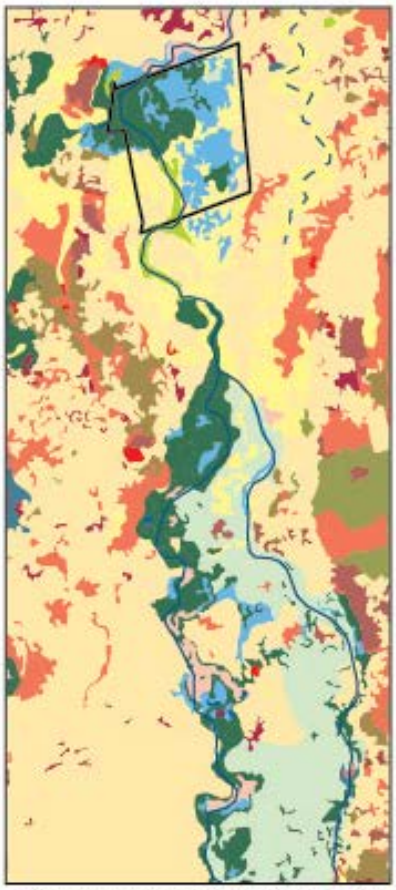
Source: Wilson (1992); Bowen and Simpson (2009, 2010)

Figure 3 Changes in vegetation communities in the northern nature reserve and surrounding areas 1991–2008

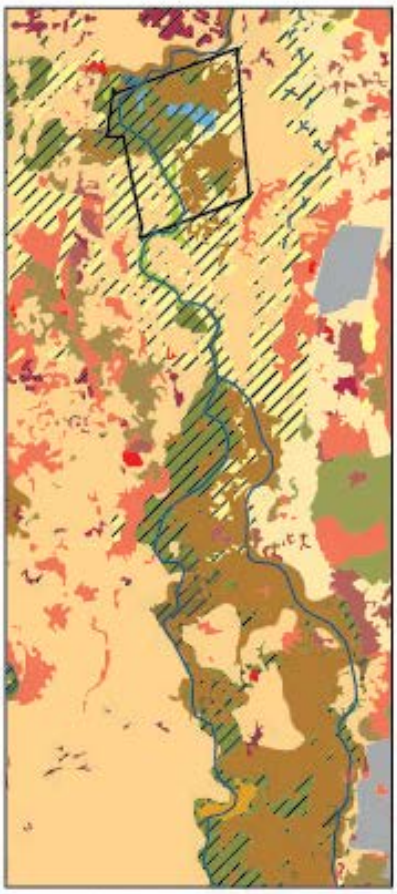


Source: Wilson (1992); Bowen and Simpson (2009, 2010)

Figure 4 Changes in vegetation communities in the southern section of the nature reserve1991–2008



1991 Vegetation map (Wilson 1992)



2008 Vegetation map (Bowen & Simpson 2009)

LEGEND

1991 vegetation communities

- black box
- common reed
- coolabah
- cultivated
- cypress
- grassland/cleared land
- dryland complex
- lignum
- mixed marsh / grassland
- myall
- open water
- poplar box
- river cooba
- river red gum
- stressed/dead trees
- water couch
- wilga

Additional vegetation communites in 2008

hatching indicates understorey colonised by chenopods or chenopods occuring as a secondary species

- black box_chenopod
- chenopod shrubland
- chenopod shrubland/grassland/cleared land
- chenopod shrubland/mixed marsh
- coolabah_chenopod
- lignum/chenopod shrubland
- myall_chenopod
- river cooba_chenopod
- water couch/chenopod shrubland

- major drainage
- intermittent
- Wilgara Ramsar site

River red gum condition 2008

hatching indicates understorey colonised by chenopods

- good (<10% dead canopy)
- intermediate (10-40% dead canopy)
- intermediate/poor (40-80% dead canopy)
- poor (>80% dead canopy)

N

Datum/Projection: GDA 1994 MGA Zone 55

0 1 2 4 km

Source: Wilson (1992); Bowen and Simpson (2009, 2010)

Figure 5 Changes in vegetation communities in Wilgara and surrounding areas 1991–2008

7 Goals and actions

The overall purpose of this response strategy is to halt the decline and improve the condition of the Macquarie Marshes Ramsar site to a point where the Article 3.2 notification for the site submitted on 17 July 2009 can be rescinded.

In order to achieve this outcome, short-term (one-year), medium-term (five-year) and long-term (10-year) goals, objectives and actions were developed. The objectives are to:

- optimise water recovery and management
- improve geomorphic, hydrologic and vegetative structure and function
- implement best management practices for pests and weeds
- achieve commitment from government and stakeholders
- conduct appropriate monitoring, evaluation and reporting.

The actions to achieve these objectives have been implemented since the response strategy was drafted in 2009. As a result, most of the short-term actions and some of the medium-term actions have been completed. These are documented in Appendix B. All ongoing actions and incomplete actions are listed in Tables 2–4 below.

Actions taken under this response strategy aim to achieve maximum environmental benefits for the Ramsar site, but also for the greater Macquarie Marshes, without which the Ramsar site values would be diminished. The actions are contingent on the availability of resources and the agreement of stakeholders to any action. Implementation of the response strategy is being regularly monitored by OEH and SEWPaC. However, OEH is the lead agency for the implementation of the strategy.

Ramsar Convention guidance on management planning recognises the need to manage wetlands in the context of their broader catchment and landscape settings. The concept of zonation, where the ecological character of a wetland is managed for conservation and wise use by applying management zones such as core, buffer and transition zones, reflects the fact that actions and conditions outside of a site's immediate boundary need to be considered when responding to adverse change in ecological character at a site (Ramsar Convention Secretariat 2010, p19–21, 30–32).

Table 2 Short-term goal and ongoing actions (one year)

Goal: Avoid damage to and maintain the resilience of areas of the Macquarie Marshes that are in good condition and establish restoration objectives for key components, processes and benefits/services of the Ramsar site.

Objective	Action	Responsibility
Optimise water recovery and management	Target environmental water to maintain areas in good condition as appropriate, particularly semi-permanent wetland vegetation, waterbird breeding habitat and refugia for native fish. If adequate water is available, target water to also restore areas in intermediate and poor condition as appropriate.	OEH, EFRG, CEWH – ongoing
	Ensure sufficient environmental water is available for the Ramsar site through relevant NSW and Australian government water recovery and management programs.	OEH, EFRG, SEWPaC – ongoing
Implement best management practices for pests and weeds	Undertake land management trials for weeds and invasive native species.	DPI, CW CMA, site managers – ongoing
	Undertake feral pig control.	OEH, CW CMA, community – ongoing

Objective	Action	Responsibility
Achieve commitment from government and stakeholders	Update the ECD for the Wilgara component to comply with the national framework.	OEH, Wilgara manager, SEWPaC
Conduct appropriate monitoring, evaluation and reporting	Undertake coordinated monitoring.	OEH, Wilgara and U block managers, SEWPaC – ongoing
	Report every six months in March and October to SEWPaC on implementation of this response strategy.	OEH, Wilgara and U-block managers, SEWPaC – ongoing

Table 3 Medium term goal and actions (5 years)

Goal: Establish by 2015 suitable water management and infrastructure to sustain the restoration objectives for the Ramsar site under a drier climate scenario.

Objective	Action	Responsibility
Optimise water recovery and management	Establish incentives and agreements with private land managers who receive environmental water to protect the values of the Ramsar site.	OEH
	Ensure sufficient environmental water is available for the Ramsar site, through relevant NSW and Australian government water recovery and management programs.	OEH, SEWPaC
	Target environmental water to priority assets having regard to the Murray–Darling Basin Environmental Watering Plan, EFRG recommendations, operational constraints, statutory and policy requirements including, as appropriate, areas in good condition, waterbird breeding habitat, refugia for fish, and long-lived species such as river red gum.	EFRG, OEH, CEWH
	Finalise planning and implement the construction of a cold water pollution curtain at Burrendong Dam.	State Water Corporation
Improve geomorphic, hydrologic and vegetative structure and function	Clarify the role, effect and status of existing structures for managing water in the Macquarie Marshes Ramsar site, including examining the geomorphology.	NSW Office of Water (NOW)
	Investigate the hydrological and ecological impacts of developing an alternative to the North Marsh Bypass Channel and implement if appropriate.	OEH, State Water Corporation
	Assess the feasibility of installing in-stream works and/or channel and piping infrastructure to key ecological assets in the Ramsar site.	OEH, SEWPaC
	Protect and restore vegetation at waterbird breeding sites and waterbird foraging habitats.	CW CMA, landholders, OEH
	Assess whether new erosion control structures are feasible in the Ramsar site and construct if appropriate.	OEH, DPI
Implement best management practices for pests and weeds	Implement actions identified in the carp reduction strategy for the Macquarie Marshes.	DPI, CW CMA, landholders, community
	Undertake feral pig control as specified in the NPWS regional pest management strategy.	OEH
	Trial and utilise best practice to minimise the effects of weeds such as lippia, Noogoora burr and Bathurst burr on wetland values through the Warren to Barwon Project and RiverSmart.	CW CMA, land holders and OEH
Achieve commitment from government and stakeholders	Review and undertake priority actions identified in the AEMP for the Macquarie Marshes.	OEH, CW CMA, SEWPaC, stakeholders
	Ensure the water requirements of the Ramsar site informs the review of the WSP for the Macquarie and Cudgegong Rivers, the WSP for the Macquarie Bogan Unregulated and Alluvial Water Sources, and the development of the Basin Plan.	NOW, OEH, MDBA, SEWPaC

Objective	Action	Responsibility
Conduct appropriate monitoring, evaluation and reporting	Report at least triennially to the meetings of Contracting Parties to the Ramsar Convention on the condition of the Ramsar site.	OEH, SEWPaC
	Assess five-year progress towards restoration objectives to determine whether the Article 3.2 notification can be rescinded.	OEH, SEWPaC

Table 4 Long-term goal and actions (10 years)

Goal: By 2020 manage the Ramsar site's values within acceptable variability, recognising that wetlands are connected, complex and dynamic systems and rescind the Article 3.2 notification.

Objective	Action	Responsibility
Optimise water recovery and management	Apply environmental water to achieve maximum environmental benefit consistent with statutory requirements and the Murray–Darling Basin Environmental Watering Plan.	EFRG, OEH, CEWH
Improve geomorphic, hydrologic and vegetative structure and function	Map and understand the connectivity between important colonial waterbird breeding areas throughout the Murray–Darling Basin.	OEH, universities
	Assess feasibility and, if appropriate, construct piping for delivering stock and domestic water in the Macquarie Marshes.	NOW, State Water Corporation, OEH
	Investigate the feasibility of increasing the outlet valve capacity at Burrendong Dam outlet and quantify the potential environmental benefits of this action.	State Water Corporation, NOW, OEH
	Restore fish passage at 100% of State Water Corporation managed structures obstructing fish movement.	DPI
Implement best management practices for pests and weeds	Implement actions within the carp reduction and native fish enhancement strategy.	DPI, CW CMA, landholders
	Trial and utilise best practise to minimise the effects of weeds such as lippia, Noogoora burr and Bathurst burr on wetland values.	CW CMA, landholders, OEH, DPI
Achieve commitment from government and stakeholders	Implement actions identified and agreed to in the AEMP.	OEH, SEWPaC, Wilgara manager, community
Conduct appropriate monitoring, evaluation and reporting	Report at least triennially to the meetings of Contracting Parties to the Ramsar Convention on the condition of the Ramsar site.	OEH, SEWPaC
	Assess ten-year progress towards restoration objectives to determine whether the Article 3.2 notification can be rescinded.	OEH, SEWPaC

8 Rescinding the Article 3.2 notification

A key measure of the success of this response strategy will be notification by Australia to the Ramsar Secretariat that the Article 3.2 notification of likely change in ecological character of the Macquarie Marshes Ramsar site can be rescinded. In order to rescind the Article 3.2 notification, one of two possible outcomes will need to have been achieved (DEWHA 2009, p13):

1 that the site's ecological character has been restored, or
2 where the remediation to the ecological character of the site at the time of listing was neither possible nor feasible, that revised objectives for the site have been met.

The steps necessary to determine whether either of the two possible outcomes has been achieved will include:

- implementation of the monitoring framework
- determining whether restoration objectives have been achieved
- ensuring a management regime is in place that will provide for maintenance, as far as possible within the context of a drying climate, of ecological character (whether that at time of listing or at a new benchmark).

Appendix A Australian and NSW government programs

Water for the Future

Water for the Future is the Australian Government's long-term initiative to better balance the water needs of communities, farmers and the environment. It contains a suite of urban and rural policies and programs, including significant funding for water purchasing, irrigation modernisation, desalination, recycling, and stormwater capture. The initiative helps provide farmers and communities with more confidence to plan for a future with less water, to put water use on a sustainable footing, to enhance irrigation productivity, and to improve river and wetland health.[7]

Water for the Future is built on four key priorities:

- taking action on climate change
- using water wisely
- securing water supplies
- supporting healthy rivers and wetlands.

Through the Sustainable Rural Water Use and Infrastructure Program, a component of Water for the Future, the Australian Government is providing $4.8 billion for infrastructure, improved rural water use and water management activities in the Basin, such as:

- improving infrastructure planning so irrigation network operators and local governments can prioritise and plan potential asset upgrades
- improving distribution networks to fix old systems and reconfigure channel delivery systems
- investing in more efficient on-farm irrigation technology, such as converting flood irrigation to sprinklers and drip systems
- environmental works and measures, such as new regulators that deliver environmental watering outcomes more efficiently.[8]

Infrastructure projects are modernising farm technology, making irrigation more efficient and supporting long-term sustainable food production. They are also supporting local businesses and helping to place communities on a better footing to deal with reduced water availability into the future. Many of these investments improve the health of our rivers and wetlands by returning a share of the water savings to the environment.

Under Water for the Future, the Australian Government has committed $3.1 billion through the Restoring the Balance in the Murray–Darling Basin program to purchase water entitlements for the environment. This water is being managed by the CEWH to protect and restore the environmental assets of the Murray–Darling Basin.[9]

NSW RiverBank

NSW RiverBank was a $105 million environmental fund set up by the NSW Government to buy water for the most stressed and valued inland rivers and wetlands. The program was part of the broader City and Country Environment Restoration Program, announced by the NSW Premier in November 2005. In 2007 the Australian Government also announced that it would support investment in environmental water purchases through RiverBank, funded by the Water Smart Australia program. The program was completed in 2011.

7 www.environment.gov.au/water/australia/index.html
8 www.environment.gov.au/water/policy-programs/srwui/index.html
9 www.environment.gov.au/water/policy-programs/entitlement-purchasing/index.html

Rivers Environmental Restoration Program

The NSW and Australian governments set up RERP to address the urgent need to improve the health of some of the most significant and threatened wetlands in the Murray–Darling Basin. RERP focused on five areas, one of which was the Macquarie Marshes. This program incorporated the $101.5 million NSW RiverBank program and was supported by a $79.62 million grant from the Australian Government's Water Smart Australia program. The program was completed in June 2011 (DECCW 2011).

NSW Wetland Recovery Program

The $26.8 million WRP, which was completed in 2010, was jointly funded by the NSW Government and the Australian Government's Water Smart Australia program. WRP aimed to improve the ecological health of the Macquarie Marshes and the Gwydir wetlands, two of Australia's most iconic inland wetlands, through the development of better land and water infrastructure and management practices. The program involved local landholders, key stakeholders and government organisations. By focusing on these two wetlands, which include areas of international importance, the program aimed to develop a blueprint for recovery procedures for inland wetlands and river systems across Australia. WRP included a water entitlements purchasing component which secured 7200 ML of general and supplementary entitlements for the environment.

Caring for Our Country

Caring for Our Country is the Australian Government's current natural resource management initiative. It is designed as an integrated package with one clear goal, a business approach to investment, clearly articulated outcomes and priorities and improved accountability. It commenced on 1 July 2008 and aims to integrate delivery of the Commonwealth's previous natural resource management programs, the Natural Heritage Trust, the National Action Plan for Salinity and Water Quality, the National Landcare Program, the Environmental Stewardship program and the Working on Country Indigenous land and environmental program.

The goal of Caring for Our Country is a healthy, better protected, well-managed, resilient environment, and one which provides ecosystem services in a changing climate. Essential ecosystem services include protected biodiversity, clean air and water, and healthy soils which support sustainable food and fibre industries.

Caring for Our Country will support activities which contribute to the following priorities:

- a national reserve system
- biodiversity and natural icons
- coastal environments and critical aquatic habitats (including the Great Barrier Reef Rescue Plan)
- sustainable farm practices (to build on the success of Landcare)
- natural resource management in remote and northern Australia
- community skills, knowledge and engagement.

Funding is available from the Government's $2.25 billion Caring for Our Country initiative for the six priority areas.[10]

10 www.nrm.gov.au

Biodiversity Fund

The Australian Government's Biodiversity Fund, which began in 2012, is investing around $946 million to 2018 to help land managers store carbon, enhance biodiversity and build greater environmental resilience across the Australian landscape. The fund is providing support to eligible land managers for activities which restore, manage and better protect biodiversity on public and private land. It will also provide support to land managers who wish to take advantage of emerging opportunities in the new carbon market. The main areas of investment are:

- **biodiverse plantings**, providing funding to help land managers expand native habitat through planting mixed vegetation species appropriate to the region
- **protecting and enhancing existing native vegetation**, through funding to support land managers to protect, manage and enhance existing native vegetation in high conservation areas for carbon storage and biodiversity benefits.[11]

11 www.environment.gov.au/cleanenergyfuture/biodiversity-fund/index.html

Appendix B Completed actions

Short-term goal and actions (one year)

Goal: Avoid damage to and maintain the resilience of areas of the Macquarie Marshes that are in good condition and establish ecological management targets for key components, processes and benefits/services of the Ramsar site.

Objective	Action	Comments
Optimise water recovery and management	Identify priorities for environmental water use within the Ramsar site.	This has been addressed by the AEMP, ECD, and the Guide to the Basin Plan. It is also included in annual environmental water planning and will be incorporated in the long-term environmental water plan when it is developed.
	Purchase water from willing sellers to increase the environment's share of water (where value for money opportunities arise and subject to other demands on purchase program budgets).	The Basin Plan (Commonwealth of Australia 2012) has determined that adequate water has been recovered in the Macquarie and Cudgegong rivers to meet local environmental needs.
Improve geomorphic, hydrologic and vegetative structure and function	Complete the fishway for Marebone Weir to enhance connectivity between the Macquarie River and Marshes for native fish.	Completed by DPI under NSW WRP and RERP.
Implement best management practices for pests and weeds	Develop a carp reduction and native fish enhancement strategy for the Marshes.	See I&I (2010).
Conduct appropriate monitoring, evaluation and reporting	Develop an agreed monitoring framework.	Draft monitoring framework developed, which is guiding ongoing monitoring activities. To be refined/agreed in light of monitoring framework being developed for wider Marshes.
Achieve commitment from government and stakeholders	Complete the ECD for the nature reserve and U-block components of the Macquarie Marshes Ramsar site.	The ECD was published in July 2012 (OEH 2012a).

Medium-term goal and actions (five years)

Goal: By 2015 establish suitable water management and infrastructure to sustain the desired ecological objectives for the Ramsar site under a drier climate scenario.

Objective	Action	Comments
Improve geomorphic, hydrologic and vegetative structure and function	Review State Water Corporation structures in Bulgeraga Creek to reduce their effects on fish passage and to reduce erosion.	Fish passage has been provided at channel crossings 1 and 2.
	Reduce the effects of Pillicawarrina weir on fish passage.	Works have been completed and include additional upgrade of weir and culvert.

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