



Office of
Environment
& Heritage

Macquarie–Castlereagh Water Resource Plan Area

**Statement of annual environmental watering
priorities 2016–17**

© 2016 State of NSW and Office of Environment and Heritage

With the exception of photographs, the State of NSW and Office of Environment and Heritage are pleased to allow this material to be reproduced in whole or in part for educational and non-commercial use, provided the meaning is unchanged and its source, publisher and authorship are acknowledged. Specific permission is required for the reproduction of photographs.

The Office of Environment and Heritage (OEH) has compiled this statement in good faith, exercising all due care and attention. No representation is made about the accuracy, completeness or suitability of the information in this publication for any particular purpose. OEH shall not be liable for any damage which may occur to any person or organisation taking action or not on the basis of this publication. Readers should seek appropriate advice when applying the information to their specific needs. This document may be subject to revision without notice and readers should ensure they are using the latest version.

All content in this publication is owned by OEH and is protected by Crown Copyright, unless credited otherwise. It is licensed under the [Creative Commons Attribution 4.0 International \(CC BY 4.0\)](#), subject to the exemptions contained in the licence. The legal code for the licence is available at [Creative Commons](#).

OEH asserts the right to be attributed as author of the original material in the following manner:
© State of New South Wales and Office of Environment and Heritage 2016.

Published by:

Office of Environment and Heritage

59 Goulburn Street, Sydney NSW 2000

PO Box A290, Sydney South NSW 1232

Phone: (02) 9995 5000 (switchboard)

Phone: 131 555 (environmental information and publications requests)

Phone: 1300 361 967 (national parks, general environmental inquiries and publications requests)

Fax: (02) 9995 5999

TTY users: phone 133 677, then ask for 131 555

Speak and listen users: phone 1300 555 727, then ask for 131 555

Email: info@environment.nsw.gov.au

Website: www.environment.nsw.gov.au

Report pollution and environmental incidents

Environment Line: 131 555 (NSW only) or info@environment.nsw.gov.au

See also www.environment.nsw.gov.au

ISBN 978-1-76039-439-4

OEH 2016/0461

August 2016

Contents

Purpose of this statement	1
Macquarie–Castlereagh Water Resource Plan Area description	1
Consultation.....	1
Antecedent conditions: previous watering and condition of assets	3
Forecast available water	4
Resource availability scenario and water management outcomes	5
Annual environmental watering priorities.....	5
Cooperative arrangements for water delivery	9
Further documentation	10
References	10
Appendix A	11

Purpose of this statement

This statement meets the New South Wales Government's obligations to outline the annual environmental watering priorities for the Macquarie–Castlereagh Water Resource Plan Area (WRP area) as set out in Part 4, Division 4 of Chapter 8: Environmental watering plan of the Murray–Darling *Basin Plan 2012* (MDBA 2012a).

Guidelines for how to determine priorities for applying environmental water (MDBA 2012b) have been used to identify the environmental watering priorities for 2016–17 for the Macquarie–Castlereagh WRP area.

The priorities reported here are derived from the Macquarie–Castlereagh Water Resource Plan Area Annual Environmental Watering Plan 2016–17.

Macquarie–Castlereagh Water Resource Plan Area description

The Macquarie–Castlereagh WRP area covers all surface water resources in the area, including those of the Bogan catchment (Map 1). The area includes the regulated Macquarie–Cudgegong water source, which is governed by the [Water Sharing Plan for the Macquarie and Cudgegong Regulated Rivers Water Source 2004](#), and unregulated streams, which are governed by three separate water sharing plans for:

- the Castlereagh River above Binnaway Water Source 2003
- the Castlereagh (below Binnaway) Unregulated and Alluvial Water Sources 2011
- the Macquarie Bogan Unregulated and Alluvial Water Sources 2012.

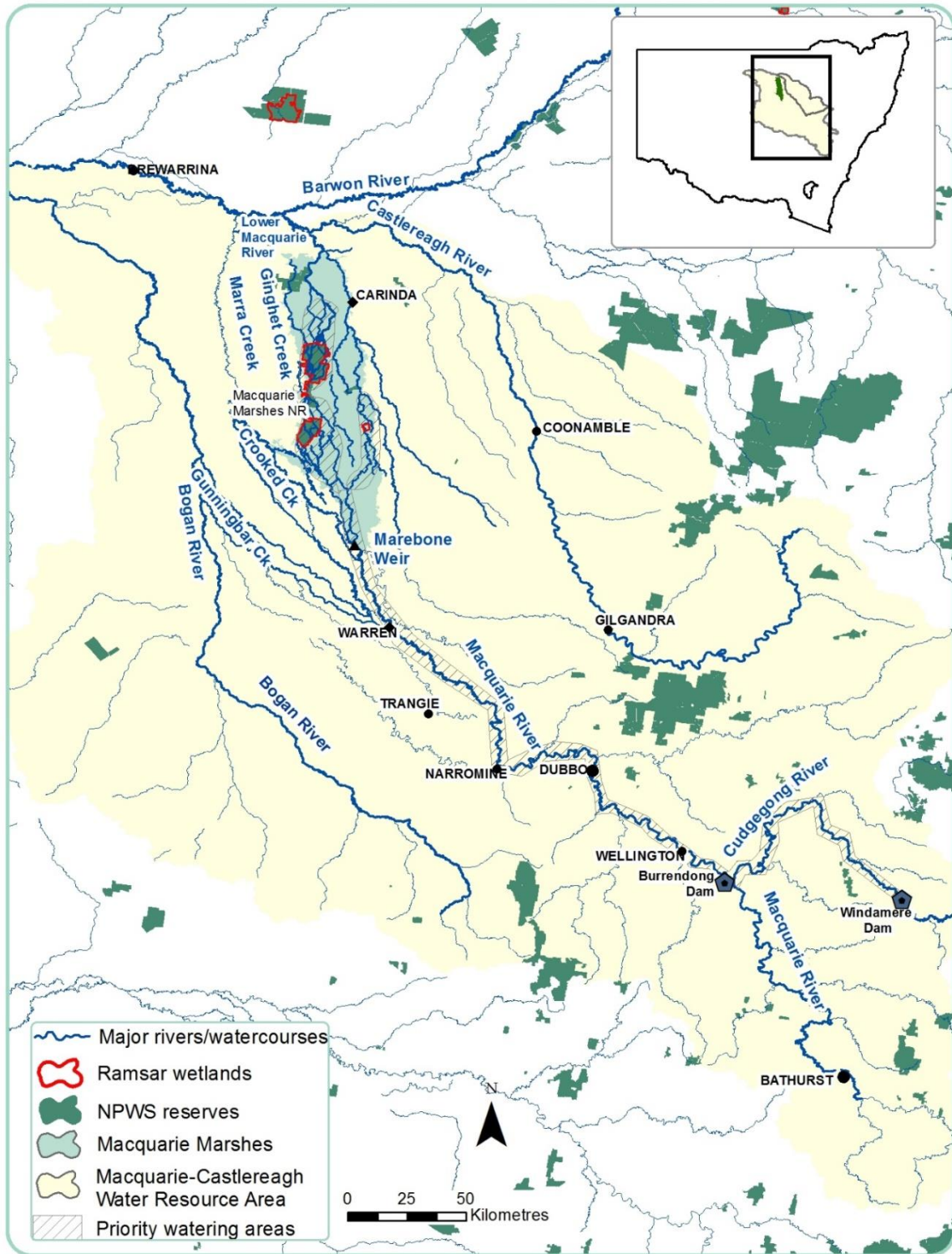
The Macquarie Marshes are the Macquarie–Castlereagh WRP area's largest wetland system and the main focus of managed environmental water. The Marshes include a range of wetlands, such as reedbeds, water couch meadows, river red gum woodlands and floodplains that are inundated only by large floods. The Macquarie Marshes Nature Reserve and parts of the privately owned properties 'Wilgara' and 'U-Block' are listed under the [Convention on Wetlands of International Importance](#) (the 'Ramsar' Convention).

Other environmental assets within the WRP area include significant fish and aquatic ecosystem values, river-fed cowals (small wooded swampy depressions often found in red-soil country) and billabongs, and streams that provide aquatic connectivity.

Consultation

In NSW, environmental water advisory groups are the primary vehicles for stakeholder consultation on environmental water planning for a particular WRP area. The Macquarie Cudgegong Environmental Flows Reference Group (EFRG) provides advice on the development of the Macquarie–Cudgegong Annual Environmental Watering Plan.

The Macquarie Cudgegong EFRG has recommended a suite of watering strategies for the 2016–2017 water year that are reflected in these annual environmental watering priorities. The Office of Environment and Heritage (OEH) website has details of the [objectives and membership of the Macquarie Cudgegong EFRG](#).



Map 1: Annual environmental watering priority areas, Macquarie–Castlereagh WRP area, 2016–17

Antecedent conditions: previous watering and condition of assets

Macquarie Marshes

Total gauged inflows to Marebone Weir during the 2015–16 water year (to May 2016) were about 122,923 megalitres (Figure 1), including:

- 52,555 megalitres of discretionary environmental flows targeted at the Macquarie Marshes and mid-Macquarie River (Commonwealth Environmental Water Office and NSW licences, and discretionary allowances under the [Water Sharing Plan for the Macquarie and Cudgegong Regulated Rivers Water Source](#))
- 26,069 megalitres of regulated irrigation orders below Marebone Weir
- 10,000 megalitres of stock and domestic replenishment flows for Gum Cowal/Terrigal Creek and the Lower Macquarie River
- 34,299 megalitres of ‘operational surplus’ flows (primarily tributary flows)
- 3050 megalitres of regulated river-system base flows down the Macquarie River (10 megalitres per day at Marebone).

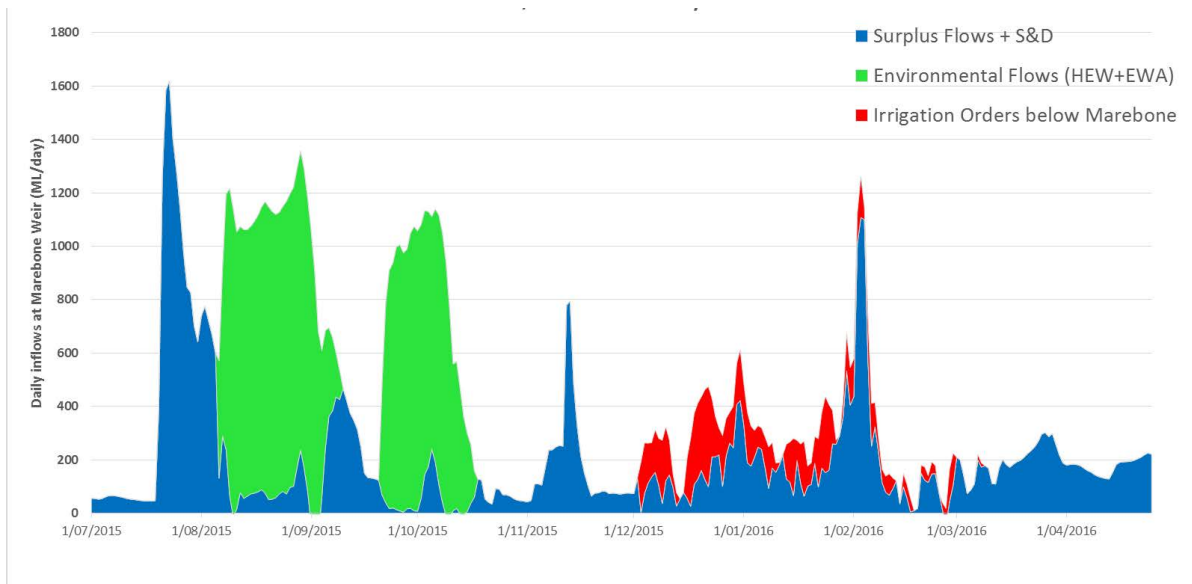


Figure 1: Total daily inflows to the Macquarie Marshes at Marebone, 2015–16 (until May 2016). S&D, stock and domestic; HEW, held environmental water; EWA, environmental water allocation

Since July 2012, rainfall in the catchment has been well below average, with Burrendong Dam inflows below the 80th percentile. Rainfall during July 2015 provided a beneficial tributary flow into the Marshes; this flow was used to prime the system for the discretionary environmental water flow over winter–spring 2015.

Initial field observations indicate that the ground cover in areas that did not receive water during 2013–2016 now contains a substantial percentage of terrestrial plants. Total grazing pressure and lack of rainfall have resulted in most areas having low-biomass ground cover, although the proportions of bare ground and exotic plants are still relatively low. Tree condition in most areas was found to be generally good but declining in some areas, such as the Northern Marshes woodlands. The North Marsh reedbed was subject to a large-scale fire in March 2016 that burned most of the reedbed area.

Other WRP area assets

Pulses of environmental water were released into the Cudgegong River in November 2015 and January 2016 in response to inflow triggers; the event durations were 6, 6 and 3 days, with a maximum flow rate of 896 megalitres and a total volume across the three events of 4167 megalitres.

In-stream flows in the regulated Macquarie River between Burrendong and Marebone Weir were relatively low over 2015–16 owing to the limited catchment rainfall and low carryover volumes of general-security water available for irrigation use.

Forecast available water

The Bureau of Meteorology prediction for the 2016–17 season is for greater-than-average rainfall. Indications are that the prevailing El Niño is declining. The climate outlook can be viewed at the [Bureau of Meteorology website](#).

Discretionary environmental water holdings in the Macquarie–Castlereagh are available from two sources:

- an environmental water allowance under the current Water Sharing Plan
- licensed entitlements held by the NSW and Commonwealth governments.

On the basis of the 2015–16 carryover, as well as the predicted adjustments for evaporation and ongoing very dry conditions, relatively limited volumes of discretionary environmental water will be available for use at the start of the 2016–17 water year (Table 1).

Table 1: Discretionary environmental water availability, Macquarie–Castlereagh WRP area

Source	Maximum volume	Volume expected to be available at 1 July 2016 ¹
<i>Planned environmental water allowance²</i>		
Active general security	96,000ML	0ML
Translucent general security	64,000ML	0ML
<i>NSW licenced adaptive environmental water holdings</i>		
General security	48,420ML	0ML
Supplementary	1451ML	1451ML ³
<i>Commonwealth licenced adaptive environmental water holdings</i>		
General security	126,224ML	7886ML
Supplementary	8292ML	8292ML ³

¹ Volumes based on an available water determination of 0%

² As set in the Macquarie–Cudgegong Water Sharing Plan – refers to planned environmental allocated to the Environmental Water Allowance under the water sharing plan to provide for the Macquarie Marshes and the riverine environment. Excludes ‘licence-based’ environmental water.

³ Supplementary water use depends on declaration of a supplementary event.

The volumes in Table 1 have not been adjusted for possible future trade. OEH periodically trades water allocations to cover a proportion of water-use charges associated with NSW adaptive environmental water holdings. The volume of environmental water traded in a WRP area is determined by the price in the local market and the targeted level of cost recovery. OEH manages the trade of NSW adaptive environmental water in accordance with environmental water demand and trading opportunities across the Murray–Darling Basin, taking into consideration equity among WRP areas over time.

A typically high proportion of flows to the Marshes is the result of ‘operational surplus flows’ from the regulated Macquarie River; these surplus flows are over and above base flows and stock and domestic replenishment flows. Some are from dam deliveries and others from tributary flows.

There are a range of potential scenarios for water availability in the coming water year. In order to plan ahead, the EFRG uses the most conservative scenario, which assumes that very dry conditions recommence at the start of a water year. This approach reflects the standard resource allocation processes used by WaterNSW and improves the likelihood of water being available to meet environmental water requirements through a period of dry conditions. If conditions prove to be wetter, environmental water is typically used to enhance the opportunities triggered by other inflows to achieve substantial ecological outcomes.

About 7800 megalitres will be available in 2016–17 as a result of carryover provisions. This is regarded as the minimum volume available at the start of the year under ‘very dry’ conditions.

The surface water availability scenario for the Macquarie–Castlereagh has been determined by comparing the forecast surface water availability with long-term historic data, in accordance with the *Guidelines for the method to determine priorities for applying environmental water* (MDBA 2012b) (see Appendix A: Table A1). According to the analysis, the surface water availability under the most likely weather scenario (very dry) is ‘very low’.

Resource availability scenario and water management outcomes

The resource availability scenario is based on the surface water availability and antecedent conditions (Appendix A: Table A1). The surface water availability is determined to be ‘very low’ and the antecedent conditions are ‘very dry’, so the overall resource availability scenario for 2016–17 is ‘very dry’.

Given this result, the management outcomes (Appendix A: Table A2) are focused on avoiding irretrievable loss of, or damage to, environmental assets.

Annual environmental watering priorities

Annual planning was done at the EFRG planning meeting held in May. The group recommended the following actions under ‘very dry’ to ‘dry’ (worst case) or ‘moderate (and above)’ resource availability scenarios.

Very dry to dry weather scenario: drought contingencies to minimise damage

Under an ongoing ‘very dry’ to (slightly improved) ‘dry’ scenario, with no increase in water availability, a number of environmental watering priorities have been identified for the WRP area for 2016–17 (Table 2).

Table 2: Macquarie–Castlereagh watering site priorities under a ‘very dry’ or ‘dry’ resource availability scenario 2015–16

Component	Objectives	Volume
Vegetation	Should the opportunity arise (i.e. if a sufficiently sized and timed tributary flow reaches the Macquarie Marshes), support a watering event of approximately 4000ha to 10,000ha of semi-permanent wetland vegetation communities in the Northern and Southern Macquarie Marshes.	Up to 7.8GL in conjunction with tributary flows or other water to create an event of around 30,000ML
Shallow groundwater and soil moisture	Should the opportunity arise (i.e. if a sufficiently sized and timed tributary flow reaches the Macquarie Marshes), provide a flow event that will: <ul style="list-style-type: none"> • support the shallow-groundwater system that is critical for river red gum vegetation health • support soil moisture in about 4000ha to 10,000ha of the Northern and Southern Macquarie Marshes. 	No additional volume to above
Frogs	Should the opportunity arise (i.e. if a sufficiently sized and timed tributary flow reaches the Macquarie Marshes), support a watering event of about 4000ha to 10,000ha of flow-dependent frog species habitat in the Northern and Southern Macquarie Marshes.	No additional volume to above
Migratory waterbirds	Should the opportunity arise (i.e. if a sufficiently sized and timed tributary flow reaches the Macquarie Marshes), support a watering event of about 4000ha to 10,000ha; this will provide mudflat habitat in the Northern and Southern Macquarie Marshes.	No additional volume to above
Colonial nesters	No colonial nesting waterbird species breeding likely to occur.	N/A
Native fish	It is assumed that drought refugia in the mid-Macquarie will be supported by normal WaterNSW operations (irrigation supply, stock and domestic supply, base flows). Should the opportunity arise (i.e. if a sufficiently sized and timed tributary flow reaches the Macquarie Marshes), support a ‘fresh’ flow event that will pulse through the mid-Macquarie River and create fish habitat opportunities of about 4000ha in the Northern and Southern Macquarie Marshes.	No additional volume to above
Flow-dependent Aboriginal cultural assets	Should the opportunity arise (i.e. if a sufficiently sized and timed tributary flow reaches the Macquarie Marshes), support a watering event of about 4000ha to 10,000ha in the Northern and Southern Macquarie Marshes; this will support some known values.	No additional volume to above

Component	Objectives	Volume
Geomorphic processes	Support a relatively stable geomorphology in the Marshes. Undertake the flow event with consideration for geomorphic hot-spots, including areas of flow variability, and surveillance of any obvious changes to streams and flow paths.	No additional volume to above
Future years	Should a suitably sized tributary flow event not occur, the 7.8GL will be carried over for use in future years, to: <ul style="list-style-type: none"> (if deep drought occurs) support drought refugia and riparian vegetation in the mid-Macquarie River augment natural flows to support the core vegetation communities and processes in the Macquarie Marshes. 	Up to 7.8GL, if the trigger flow event does not occur

Under a dry to very dry scenario, the primary aims of environmental watering in the Macquarie–Castlereagh WRP area in 2015–16 will be to:

- (if conditions are suitable) use the remaining carryover water to augment tributary flows and thus support core semi-permanent wetland vegetation in some parts of the Macquarie Marshes
- (during the same action above) support a ‘fresh’ (i.e. moderate increase in flow) in the mid-Macquarie River to support the breeding of in-stream generalists.

To meet these objectives, the EFRG has recommended:

- Default position: carryover.** Under the dry to very dry scenario (no additional available water determinations in the water year) we should retain the remaining 7.8-gigalitre carryover for use in future years unless the flow trigger in (2.) below is met or available water determinations are announced (see medium resource availability scenario below).
 - In response to future demands for use, we should augment tributary flows to support the core areas of the Marshes, or support drought refugia in the mid-Macquarie.
- Response to flow event trigger for release.** If this trigger occurs, the remaining 7.8 gigalitres of water should be delivered to achieve:
 - a flow of at least 23 gigalitres over 30 days at Marebone Weir in spring (August to October) or autumn (March to May) by adding to environmental water to the flow event trigger
 - a total flow event of approximately 30 gigalitres from all water sources
 - delivery to the Southern and Northern Marshes, prioritising Bulgeraga Creek and then the Macquarie River (so as to maximise inundation of the Northern Marshes)
 - (for managed portions) a total flow of about 900 to 1000 megalitres per day.

Medium resource availability scenario for wetland maintenance

The NSW Department of Primary Industries – Water predicts that an additional allocation of 24%, equivalent to about 80,000 megalitres, will be available under the ‘medium’ weather/inflow scenario in October 2016. The EFRG has recommended the following approach for the 2016–2017 water year (Table 3).

Table 3: Macquarie–Castlereagh watering site priorities under a medium resource-availability scenario, 2016–17

Component	Objectives	Volume
Vegetation	Should the opportunity arise (i.e. if a sufficiently sized and timed tributary flow reaches the Macquarie Marshes), support a watering event of about 8000ha to 12,000ha of semi-permanent wetland vegetation communities in the Northern and Southern Macquarie Marshes.	Between 30GL and 60GL
Shallow groundwater and soil moisture	Should the opportunity arise (i.e. if a sufficiently sized and timed tributary flow reaches the Macquarie Marshes), provide a flow event that will: <ul style="list-style-type: none"> • support the shallow-groundwater system that is critical for river red gum vegetation health • support soil moisture in about 8000ha to 12,000ha of the Northern and Southern Macquarie Marshes. 	No additional volume to above
Frogs	Should the opportunity arise (i.e. if a sufficiently sized and timed tributary flow reaches the Macquarie Marshes), support a watering event of about 8000ha to 12,000ha of flow-dependent frog species habitat in the Northern and Southern Macquarie Marshes.	No additional volume to above
Migratory waterbirds	Should the opportunity arise (i.e. if a sufficiently sized and timed tributary flow reaches the Macquarie Marshes), support a watering event of about 4000ha to 10,000ha, which will provide mudflat habitat in the Northern and Southern Macquarie Marshes.	No additional volume to above
Colonial nesters	No colonial nesting waterbird species breeding likely to occur.	N/A
Native fish	Should the opportunity arise (i.e. if a sufficiently sized and timed tributary flow reaches the Macquarie Marshes), support a ‘fresh’ flow event. This will pulse through the mid-Macquarie River and create fish habitat opportunities over about 8000ha to 12,000ha of the Northern and Southern Macquarie Marshes.	No additional volume to above
Flow-dependent Aboriginal cultural assets	Should the opportunity arise (i.e. if a sufficiently sized and timed tributary flow reaches the Macquarie Marshes), support a watering event of about 8000ha to 12000ha in the Northern and Southern Macquarie Marshes, which will support some known values.	No additional volume to above
Geomorphic processes	Support a relatively stable geomorphology in the Marshes. Undertake the flow event with consideration for geomorphic hot-spots, including those with flow variability, and surveillance of any obvious changes to streams and flow paths.	No additional volume to above
Future years	Should there be water balances remaining in accounts this water year because: <ul style="list-style-type: none"> • no flow has been delivered (because of the timing of available water determinations or because trigger flows have not been met), or • there are available water determinations in excess of 60GL, then that balance should be carried over for use in future years.	All additional water volumes allocated.

Under the medium condition scenario, the primary aims of environmental watering in the Macquarie–Castlereagh WRP area in 2016–17 will be to:

- (if conditions are suitable) use up to 60 gigalitres of discretionary environmental water from all sources to create a flow event that supports core semi-permanent wetland vegetation in some parts of the Macquarie Marshes
- (during the same action above) support a ‘fresh’ in the mid-Macquarie River to support the breeding of in-stream generalists.

To meet these objectives, the EFRG has recommended:

1. **Default position: 30-gigalitre event.** Under the medium scenario (additional available water determinations), we should deliver a 30- to 60-gigalitre flow event to achieve:
 - a minimum total volume of 30 gigalitres (with additional water if available water determinations allow), up to 60 gigalitres total event size
 - delivery to the Southern and Northern Marshes, prioritising Bulgeraga Creek and then the Macquarie River in order to maximise inundation of the Northern Marshes
 - (for managed portions) a total flow of about 900 to 1000 megalitres per day
 - optimal utilisation of surplus flows wherever possible.
2. **Retention of the remaining allocation as carryover for use in future years.**
 - In future years, augment tributary flows to support the core areas of the Marshes, or support drought refugia in the mid-Macquarie should dry conditions return.

The flows described above would have multiple benefits, including inundating key wetland areas of the Southern and Northern Marshes, with resulting benefits to semi-permanent and woodland vegetation there, plus potential benefits to the lower and mid-Macquarie Rivers and connectivity to the Barwon River. They would also help fill the shallow groundwater profile, which is critical for the ongoing condition of the wetlands.

Flows will be adaptively managed to integrate with other demands in the system to avoid inconvenience for landholders where possible. Where inconvenience is a risk, potentially affected landholders will be consulted and agreement sought on acceptable ways to manage events.

Cooperative arrangements for water delivery

OEH is the environmental manager for NSW and coordinates environmental watering, with advice from the relevant environmental water advisory group in each WRP area. OEH has negotiated cooperative arrangements with the Commonwealth Environmental Water Office and WaterNSW to maximise the benefits of environmental water use in NSW.

OEH has developed strong partnerships with local water and wetland stakeholders across the catchment to promote efficient and effective delivery of environmental outcomes for the key assets in the catchment.

Further documentation

Reporting on water used throughout the 2016–17 watering season will be included in OEH's *Environmental Water Use in NSW: Outcomes 2016–17* and also in the *Annual Report of the Commonwealth Environmental Water Holder 2016–17*, both of which will be available in late 2017.

References

MDBA 2012a, *Basin Plan*, Murray–Darling Basin Authority, Canberra,
<http://www.mdba.gov.au/basin-plan>

MDBA 2012b, *Guidelines for the method to determine priorities for applying environmental water*: Murray–Darling Basin Authority, Canberra,
<http://www.mdba.gov.au/sites/default/files/archived/alterred-PBP/APBP-Ch7-Guideline.pdf>

Appendix A

Table A1: Determining the resource availability scenario

Surface water availability	Antecedent conditions				
	Very dry	Dry	Medium	Wet	Very wet
Very low	Very dry	Very dry	Dry	Dry	n/a
Low	Very dry	Dry	Dry	Moderate	Wet
Medium	Dry	Dry	Moderate	Wet	Wet
High	Dry	Moderate	Wet	Wet	Very wet
Very high	n/a	Moderate	Wet	Very wet	Very wet

Source: Modification of table in ‘Guidelines for the method to determine priorities for applying environmental water’ in the Murray–Darling *Basin Plan* (MDBA 2012b), using ranges for water availability and antecedent conditions rather than the percentile ranges (15 points in each band) used in the plan

Table A2: Management outcomes for each resource availability scenario

	Resource availability scenario				
	Very dry	Dry	Moderate	Wet	Very wet
Management outcome	Avoid irretrievable loss of, or damage to, environmental assets	Ensure environmental assets maintain their basic functions and resilience	Maintain ecological health and resilience	Improve the health and resilience of water-dependent ecosystems	Improve the health and resilience of water-dependent ecosystems
	Avoid critical loss of species, communities and ecosystems. Maintain critical refuges. Avoid irretrievable damage or catastrophic events. Allow drying to occur, where appropriate, but relieve severe, unnaturally prolonged dry periods.	Support the survival and viability of threatened species and communities. Maintain environmental assets and ecosystem functions, including allowing drying to occur, consistent with natural wetting-drying cycles. Maintain refuges.	Enable growth, reproduction and small-scale recruitment for a diverse range of flora and fauna. Promote connectivity of low-lying floodplains and rivers. Support medium-flow river and floodplain functions.	Enable growth, reproduction and large-scale recruitment of a diverse range of flora and fauna. Support high-flow river and floodplain functions.	Enable growth, reproduction and large-scale recruitment of a diverse range of flora and fauna. Support high-flow river and floodplain functions.

Source: Modification of table in ‘Guidelines for the method to determine priorities for applying environmental water’ in the Murray–Darling *Basin Plan* (MDBA 2012b), with the objective ‘Promote higher floodplain–river connectivity’ removed from the wet and very wet scenarios