



Office of
Environment
& Heritage

Lachlan Valley

Annual environmental watering plan 2013–14



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Cover photo: Lachlan River at Oxley, 2013 (P Packard/OEH)

The *Lachlan Valley Annual Environmental Watering Plan 2012–13* has been prepared with the assistance of the Lachlan Riverine Working Group and the Lachlan Catchment Management Authority.

Summary

The *Lachlan Valley Annual Environmental Watering Plan 2013–14* outlines the objectives and potential actions for environmental water delivery in the Lachlan valley for the coming water year. This watering plan was developed by the NSW Office of Environment and Heritage incorporating input from the Lachlan Riverine Working Group.

It is estimated that up to 160,000 ML may be available for environmental purposes during 2013–14. This volume will be made up of NSW Environmental Water Holdings, Commonwealth environmental water and water provided for by the water sharing plan. The water use limit for general security water users for 2013–14 is 100%. This means that even with full use in 2013–14 and no further allocations, approximately 42,000 ML of general security water would remain in NSW and Commonwealth accounts to be accessed in the following water year.

Early-season predictions by the Bureau of Meteorology suggest median to above average rainfall conditions may persist for the start of the 2013–14 water year. Long-range predictions indicate that rainfall is likely to be close to median values during most of the year, which would be reflected in reduced storage volumes when compared to the previous year. Environmental water management for 2013–14 should reflect the possible drier conditions in the catchment and seek to maintain the positive ecological responses seen in the last three years.

A primary focus is to maintain the condition of a diversity of wetland types in the Lachlan valley, in particular river red gum, black box and lignum communities and continue to provide habitat for wetland-dependent fauna, including threatened species such as the freckled duck, southern bell frog and Sloane's froglet. Watering will be undertaken to ensure the protection of refuge habitats.

To achieve this, water will be allocated to wetlands that support vulnerable water-dependent species and to wetlands in critical phases of recovery. These include wetlands of the effluent creek systems such as the Booligal Wetlands, Murrumbidgee Swamp and Lake Merrimajeele, wetlands on the floodplain such as the Lachlan Swamp, and the terminal wetlands of the Great Cumbung Swamp. Should the opportunity arise, water will be allocated to support fish habitat and to reduce the impact of river regulation on native fish.

Plans for the management and use of environmental water in 2013–14 are linked to the significant environmental flow released into the lower Lachlan River and wetlands systems in June 2013. While the bulk of this flow was released in the 2012–13 water year some releases may continue into July of 2013. The extended travel times for the water over the 625 km of the river and its spread into the lower Lachlan Swamp and the Great Cumbung Swamp means the flow straddles the two water years with flows passing down the river and spreading into the lower Lachlan wetlands through July and August 2013.

Some water will be held in accounts to maintain waterbird rookeries in the lower Lachlan wetlands, should the need arise. Rookeries have previously established in the Booligal wetlands in 2010–12.

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Abbreviations

AEWP	Annual Environmental Watering Plan
AWD	available water determination
CEW	Commonwealth environmental water
CEWO	Commonwealth Environmental Water Office
LRWG	Lachlan Riverine Working Group
ML	megalitres (1,000,000 litres)
OEH	NSW Office of Environment and Heritage
NOW	NSW Office of Water
NSW EWH	NSW Environmental Water Holdings
RAS	resource availability scenario
SWC	State Water Corporation
WSP	<i>Water Sharing Plan for the Lachlan Regulated River Water Source 2003</i>

1 Introduction

The Office of Environment and Heritage (OEH) is the manager of environmental water in New South Wales. OEH works collaboratively with partner agencies and the community to deliver water to protect and improve the environmental values of our rivers and wetlands. At the same time, OEH recognises the economic value of floodplain agriculture and works with its delivery partners to minimise adverse impacts of environmental water delivery on land access and agricultural activities.

The Lachlan catchment consists of a 1,200 km-long regulated river system, with a range of ecological assets within or near the main river that are able to be watered by within-channel flows. The Lachlan's riverine and wetland assets are described in detail in the Lachlan Environmental Water Management Plan, developed by the Lachlan Riverine Working Group (LRWG). Many of the key ecological assets in the Lachlan are in the lower end of the catchment, located on the extensive unregulated effluent creek system or on the floodplain, with relatively high channel flows or even overbank flows required before they commence to fill.

Environmental water maintains the ecological function and condition of these important assets in the Lachlan Valley by supporting permanent and semi-permanent wetland vegetation, colonial nesting waterbirds and migratory bird species listed under international agreements. Environmental flows also support a range of threatened and endangered native fish species through both in-stream flows and wetlands replenishment.

OEH, in addition to managing environmental water in the Lachlan valley on behalf of NSW, may also manage delivery of environmental water held by the Commonwealth. Environmental water is made available through three sources:

- *Water Sharing Plan for the Lachlan Regulated River Water Source 2003 (WSP)* (NSW Government 2003), which makes provision for environmental flows which accumulate water based on dam inflow rates or announced allocation levels
- NSW Government-held licensed environmental water – NSW Environmental Water Holdings (EWH)
- Commonwealth government holdings of water entitlements – Commonwealth Environmental Water (CEW).

The *Lachlan Valley Annual Environmental Watering Plan 2013–14 (AEWP)* presents the objectives for environmental water use and describes the range of possible watering actions that may be undertaken during the upcoming water year. It considers previous environmental water use, the current condition of assets and the current and predicted water availability for 2013–14. The plan also outlines the monitoring strategy for the coming year, identifies risks and strategies to address these risks.

The AEWP was developed by OEH based on advice from the LRWG. The LRWG is a multi-stakeholder reference group which provides a unique forum for drawing on expert knowledge, including local knowledge and experience. The LRWG also advises OEH on the implementation and adaptive management of watering actions throughout the watering year.

It is important for environmental water holdings to be managed alongside other flows and demands within the system to maximise the likelihood of water reaching its target, to minimise adverse consequences of water delivery, and to maximise the benefits of applying environmental water. As the management of environmental water needs to adapt to changing water availability, in-stream flows and the specific ecological response to flows, the AEWP is used as a tool to provide guidance and flexibility. This allows land and water managers to respond to changes in water resource conditions, opportunities and environmental priorities as the season progresses.

The AEWP is consistent with the WSP, *RiverBank Water Use Plan for the Lachlan Water Management Area* (NSW Government 2007) and the water management responsibilities of the NSW Government. The implementation of the AEWP is reported in *Environmental water use in New South Wales: Annual report*.

The Commonwealth Environmental Water Office (CEWO) also produces plans and reports in relation to its water holdings.¹

Watering priorities for 2013–14 are outlined in section 5 and identify a number of potential environmental watering sites.

Lachlan valley environmental watering sites 2013–14

The map identifies some of the potential watering sites; numbering shows the location of sites and does not indicate the priority or sequence of watering.

Number	Site	Number	Site
1	Burrawang West Lagoon	11	Murrumbidgee Swamp and Lake Merrimajeele
2	Yarnel Lagoon	12	Cuba Dam
3	Lachlan River Channel – Euabalong	13	Lake Waljeers
4	Booberoi Creek	14	Peppermint Swamp
5	Brewster Weir Pool	15	Lake Bullogal
6	Bensons Drop Weir - Mountain Creek	16	Lachlan Swamp
7	Morrisons Lake	17	Ita lake
8	Moon Moon Swamp	18	Baconian Swamp
9	Upper Merrowie Creek	19	Great Cumbung Swamp
10	Booligal Wetlands		

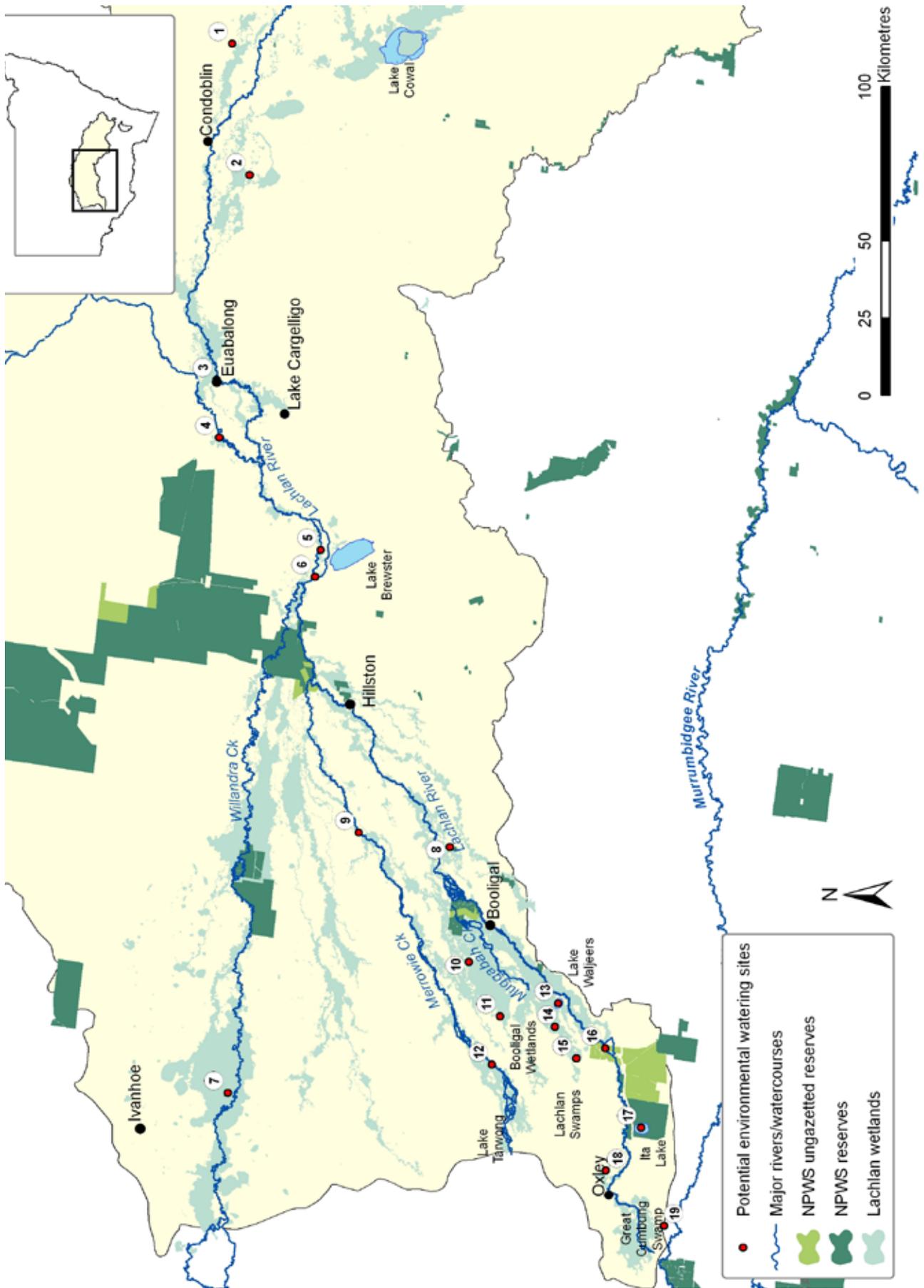


P Packard/OEH

Brewster outflow wetland

¹ www.environment.nsw.gov.au/environmentalwater

Lachlan Valley environmental watering sites 2013–14



2 Environmental water releases 2012–13

During March 2012, significant rainfall occurred across the Lachlan catchment. There was local flooding across much of the mid and lower Lachlan with the river, creeks and deflation basin wetlands inundated in advance of the flood front that travelled down the river. While the flood front itself was moderated by the time it reached the lower Lachlan and was not of the height or duration required to reach many higher level wetlands, the rain that preceded its arrival, combined with inflows from Mirrool Creek, meant that some wetlands received their first inundation since the early 1990s.

The substantial inflows to Wyangala and Belubula dams resulted in full storage levels and general security accounts withdrawn and re-allocated to 136%. Inflows were sufficient to trigger the release of translucent flows as a series of high flow pulses to the mid and lower Lachlan from June until early October, when the release limit of 350,000 ML was reached (Table 1). The translucent flows arrived in the lower Lachlan as the flood flow was beginning to recede, providing river levels of sufficient height to run many of the flood runners and high flow creeks throughout the winter and spring of 2012.

Table 1 Lachlan environmental water releases, 2012–13

Asset	Timing	Total volume (ML)	Water source(s)	Outcomes
Booligal Block bank ibis colony	24 October – 3 November 2012	446	NSW EWH, CEW	Drop boards at the block bank were installed to maintain water levels until environmental flow arrived. In spite of stabilised water levels nesting was abandoned by the birds. The environmental flow was terminated due to abandonment of breeding.
Mid and lower Lachlan	June – early November 2012	350,000	Translucent releases under WSP	Many wetlands in the lower Lachlan floodplain and effluent creeks system received their first inundation since the early 1990s. End of system flows increased the extent and duration of inundation of the Great Cumbung Swamp.
Lower Lachlan River and Swamp, and Great Cumbung Swamp	May – July 2013	66,060	NSW EWH, CEW	Water release to continue into 2013–14. Anticipated outcome is to provide inundation to areas that are in the early stages of recovery following the millennium drought and changes to river flows. Provision of the flow in winter serves to address the seasonal flow reversal caused by river regulation.
Burrawang West Lagoon	May 2013	150	NSW EWH	

For further details of environmental releases refer to the report *Environmental water use in NSW 2012–13*.

3 Current condition of assets

Though the ecological condition of Lachlan wetlands varies considerably across the catchment, it is generally accepted that the lower Lachlan floodplain has improved significantly since the millennium drought. Since 2010 wet conditions have resulted in good responses by wetland vegetation, waterbirds and frogs.

During 2012–13 the antecedent condition of the catchment using five categories – very dry, dry, median, wet and very wet – was considered wet, with high allocations of environmental water. Since the rain of March 2012 which triggered the flood, the mid and lower Lachlan catchment has had well below average rainfall. Despite the recent floods and the release of planned environmental water, at the start of 2013–14 the mid and lower Lachlan floodplains and wetlands were very dry with only the deeper or more reliably watered areas still holding surface water. This rapid drying means that the early stages of recovery and regeneration are beginning to falter in some areas.

4 Estimates of environmental water availability

The seasonal outlook provided by the Bureau of Meteorology for June to August 2013 indicates near-normal rainfall for the catchment of the dams and the upper Lachlan.²

The Bureau of Meteorology has confirmed neutral conditions (neither El Niño nor La Niña) at the start of the water year. Climate models surveyed by the Bureau of Meteorology indicate that the tropical Pacific is likely to remain neutral throughout the winter, while the development of La Niña later in 2013 cannot be ruled out.³ With median antecedent conditions and a likely median year, 2013–14 can be considered a moderate year in terms of environmental water delivery.

The 2013–14 water year will see a large volume of environmental water available early in the season – around 113,756 ML at the start of July 2013 (Table 2).

The figures given in this section have not been adjusted for possible future trade. OEH trades allocation periodically to cover a proportion of water use charges associated with NSW EWH. The volume of environmental water to be traded in the valley will be determined by the price in the local market and the targeted level of cost recovery. OEH manages trade of NSW EWH based on state-wide trading opportunities and equity between valleys.

The figures given in this section are adjusted to take into account the volumes likely to be used in the watering planned to occur in the lower Lachlan in June 2013. At time of preparation of this plan, lower Lachlan watering is expected to use up to 15,000 ML of NSW held environmental water and up 75,000 ML of Commonwealth held environmental water.

The NSW Office of Water (NOW) has announced that the annual use limit for general security water users will remain at 100% of entitlement for the 2013–14 water year. NOW advises that under dry conditions no general security allocations would be anticipated before the end of January 2014, whereas under median conditions general security allocations could reach 13% by the end of October 2013, rising to a total of 22% by the end of January 2014. Under wet conditions it is likely that Wyangala Dam will fill and spill by the end of October 2013 causing a reset of general security accounts to 136% of entitlement.

Table 2 Lachlan Valley environmental water availability

Account	Account available (ML)	Volume available at 1 July 2013 (ML)
Planned environmental water allowances		
Environmental contingency allowance (ECA)	10,000	10,000
Water quality allowance	20,000	20,000
Lake Brewster ECA	10,000	10,000
Translucent releases	350,000	Dependent on inflow triggers being met
Account	Share component (ML)	Volume available at 1 July 2013* (ML)
NSW Environmental Water Holdings		
High security	1,000	1,000
General security	24,569	16,039
Lake Brewster general security Adaptive Environmental Water Licence (AEWL)	12,000	12,000
Unregulated	184	
Commonwealth environmental water		
High security	733	733
General security	86,923	43,984

* Assuming no available water determination for general security

2 www.bom.gov.au/watl/rainfall/exceedance.shtml

3 www.bom.gov.au/climate/enso/

5 Objectives for the water year

A combination of high carried-over general security account balances, 100% commencing allocation for high security accounts, and allocations against ECA and water quality allowance accounts means that even with no starting available water determination (AWD) for general security accounts and dry to neutral conditions, 2013–14 can be best described as a moderate year.

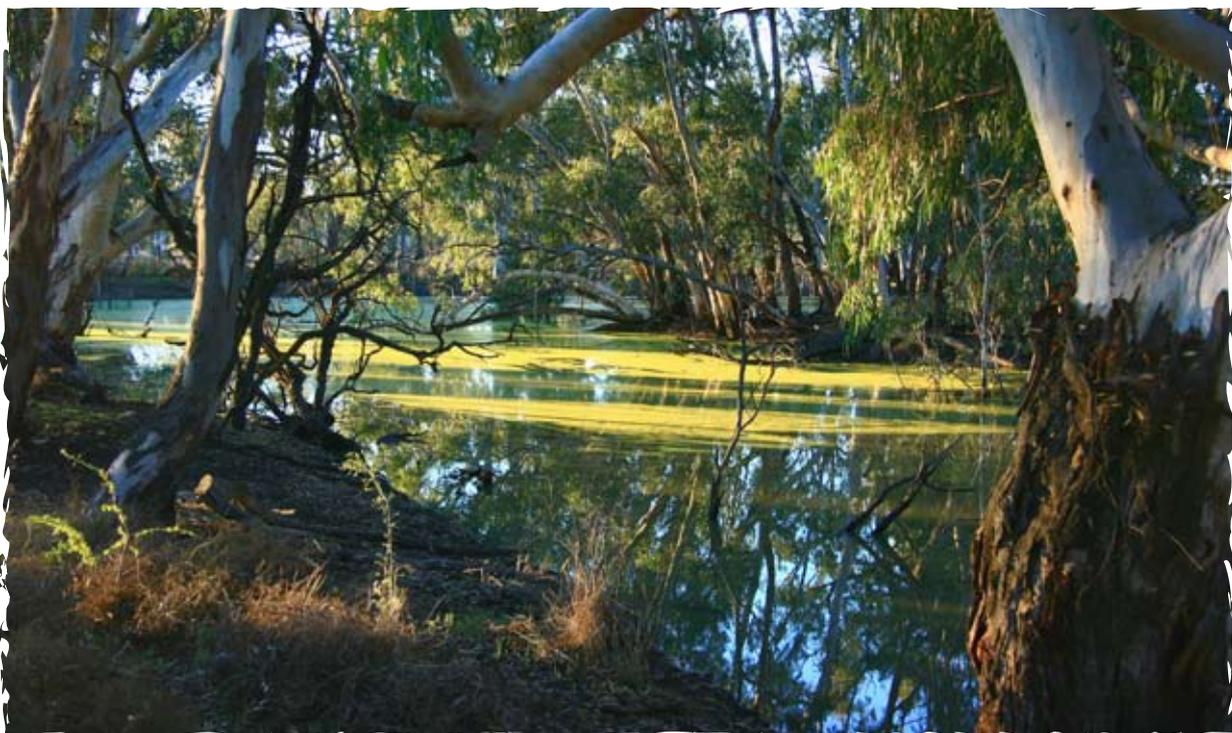
The moderate conditions objectives described below will be the focus of this watering year, and the bulk of the planned water use will be allocated to meet these objectives.

If the lower Lachlan flow planned for June 2013 has not ended before the start of the 2013–14 water year, OEH will work with CEWO to complete delivery of water to the lower Lachlan River and wetlands.

There is also the intent to use piggy-backing environmental flows to supplement small naturally occurring freshes or translucent flows in the mid to lower Lachlan. These flows will facilitate fish breeding and fish passage and inundate low commence-to-flow lower Lachlan wetlands. There is also the opportunity to piggy-back environmental water onto the replenishment flows to be provided into the unregulated Willandra Creek from the high river levels at the Willandra weir arising from the lower Lachlan flow in June 2013. During the peak irrigation season (November–April) opportunities may arise to top up flows, but care will be needed to avoid unintended impacts on agricultural activities and assets.

The current conditions – median to high dam levels, drying catchment and forecasted high starting account balances, but no anticipated starting AWD for general security – mean that, while there is a high volume of adaptive environmental water available, some caution is needed to ensure sufficient environmental water will be available the following watering year to maintain critical habitats.

If an El Niño weather pattern develops and 2013–14 becomes very dry, environmental water managers will consider carrying over some licensed water into the 2014–15 water year. This decision will be made later in the water year and does not preclude watering in 2013–14. Ongoing discussion with the LRWG will be necessary under an El Niño scenario to advise on water use objectives and balance between use and carryover.



P.Packard/OEH

Lachlan River at Waljeers

5.1 Determining the resource availability scenario

Five resource availability scenarios (RASs) are used to assist with planning and prioritisation: very dry, dry, median, wet and very wet. Resource availability is based on water availability (account balances and any AWD at 1 July 2013) and the antecedent conditions (Table 3).

AWD for general security accounts at 1 July 2013 is 0%, with a median surface water availability. A combination of below average rainfall (dry) with the persistence of water in the landscape from the March 2012 floods (wet) means the antecedent conditions can be best described as median, so the RAS for 2013–14 is moderate, with the possibility of becoming dry if the catchment enters a dry phase later in the water year.

Table 3 Resource availability scenario

Surface water availability	Antecedent conditions				
	Very dry	Dry	Median	Wet	Very wet
Very low	Very dry	Very dry	Dry	Dry	N/A
Low	Very dry	Dry	Dry	Moderate	Wet
Median	Dry	Dry	Moderate	Wet	Wet
High	Dry	Moderate	Wet	Wet	Very wet
Very high	N/A	Moderate	Wet	Very wet	Very wet

5.2 Objectives for environmental water management

The objectives for delivery of environmental water to sites in the Lachlan are to:

- 1 improve and/or maintain the condition of a diversity of wetland types in the Lachlan Valley
- 2 prevent further decline in stressed wetland vegetation communities, in particular river red gum, black box and lignum communities
- 3 increase and/or maintain the abundance and diversity of wetland and riparian aquatic vegetation
- 4 provide habitat for wetland-dependent fauna
- 5 ensure no catastrophic losses of local populations of threatened, water-dependent species as a result of drying or water quality decline in refuge habitats
- 6 support and/or maintain colonial waterbird breeding primarily in the lower Lachlan wetlands
- 7 complement naturally occurring high river flows or, if necessary, create high flows that provide a benefit to wetland and floodplain-dependent fauna and flora communities by increasing duration and/or extent of inundation
- 8 minimise the adverse impacts that altered flow regimes may have on in-stream fauna, in particular native fish populations
- 9 provide suitable in-stream conditions for native fish breeding and recruitment
- 10 reinstate a wetting–drying cycle for natural ephemeral floodplain wetlands that have been negatively impacted by river regulation and/or severe droughts
- 11 minimise the adverse impacts that altered flow regimes may have on in-stream fauna, in particular the endangered aquatic ecological community of the Lachlan River
- 12 minimise the adverse impacts that altered flow regimes may have on in-stream processes, including productivity.

Under moderate resource availability conditions actions to meet these objectives are feasible. However, the mix or emphasis of actions will be dependent on site-specific conditions and flow opportunities within the river. While releases for the lower Lachlan flow planned for June 2013 may have concluded by the commencement of the current water year, the flows will continue to pass down the target reach of the river and spread into the lower end wetland systems into late August 2013. This flow principally addresses objectives 1, 2, 3, 4 and 7. These objectives relate to supporting basic ecosystem functions in the river, wetlands and floodplain, and to supporting continued improvement in the condition of wetland vegetation communities and habitats.

The Basin-wide management outcomes reflect priorities under different RAS (Table 4). The moderate scenario focuses on basic functions such as growth, reproduction and recruitment through connectivity between the river and low-lying floodplain areas.

Table 4 Basin-wide management outcomes for each resource availability scenario

	Resource availability scenario				
	Very dry	Dry	Moderate	Wet	Very wet
Management outcome	<p>Avoid irretrievable loss of, or damage to, environmental assets:</p> <ul style="list-style-type: none"> – 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. 	<p>Ensure environmental assets maintain their basic functions and resilience:</p> <ul style="list-style-type: none"> – Support the survival and viability of threatened species and communities. – Maintain environmental assets and ecosystem functions, including by allowing drying to occur consistent with natural wetting–drying cycles. – Maintain refuges. 	<p>Maintain ecological health and resilience:</p> <ul style="list-style-type: none"> – Enable growth, reproduction and small-scale recruitment for a diverse range of flora and fauna. – Promote low-lying floodplain–river connectivity. – Support medium-flow river and floodplain functions. 	<p>Improve the health and resilience of water-dependent ecosystems:</p> <ul style="list-style-type: none"> – Enable growth, reproduction and large-scale recruitment for a diverse range of flora and fauna. – Support high-flow river and floodplain functions.* – Promote higher floodplain–river connectivity.* 	<p>Improve the health and resilience of water-dependent ecosystems:</p> <ul style="list-style-type: none"> – Enable growth, reproduction and large-scale recruitment for a diverse range of flora and fauna. – Support high-flow river and floodplain functions.* – Promote higher floodplain–river connectivity.*

* After due consideration of impacts to private lands.

5.3 Environmental watering priorities

The focus for management and use of environmental water in the 2013–14 year is reflective of the ecological responses from increased flows over the past three years within the context of significant drying over the past year. The 2012–13 watering plan anticipated carrying water over to allow for a post-flood drying phase to be followed by flows to wet targets in the lower Lachlan and effluent creek systems.

Plans for the management and use of environmental water in 2013–14 are linked to the significant environmental flow released into the lower Lachlan River and wetlands systems in June 2013. While the bulk of this flow has been released in the 2012–13 water year some releases may continue into July 2013. The extended travel times for the water over the 625 km length of the river and its spread into the lower Lachlan Swamp and the Great Cumbung Swamp means the flow straddles the two water years, with the flow passing down the river and spreading into the lower Lachlan wetlands through July and August 2013.

Other than completing the lower Lachlan flow, environmental water would be used during 2013–14 to support specific events such as colonial bird breeding, supplement very low flows to maintain fish refugia, supplement translucent flows or significant tributary inflows to support fish movement and breeding, and supplement significant translucent flows, significant tributary inflow or replenishment flows to inundate priority and good condition semi-permanent wetlands and refugia.

Table 5 outlines the watering requirements for the lower Lachlan River channel and wetlands, and Table 6 lists additional watering options arising from lower Lachlan watering.

Table 5 Watering requirements for the lower Lachlan River channel and wetlands system

Site/ action name	Location	Size (ha)	Volume estimate (ML)	Justification	Recommendation, timing and comments
Complete lower Lachlan River channel and wetlands watering	Lake Brewster to Great Cumbung Swamp	Approx 10,000 ha of river corridor habitat, 1–5,000 ha lower Lachlan Swamp, 4–6,000 ha Great Cumbung Swamp	1–10,000 (out of a total planned release of 90,000 ML commencing on 1 June 2013)	Completion of major lower system flow designed to reach commence-to-flow for major wetland assets from Lake Brewster to Great Cumbung Swamp, including Moon Moon Swamp, lower Lachlan Swamp, Lake Ita and Baconian Swamp. Flow will deliver an estimated 25,000–30,000 ML as end of system flows to the Cumbung.	Provide flows as required to complete watering. Flow in winter is cost-effective and serves to address the seasonal flow reversal caused by river regulation.

Table 6 Watering requirements for additional actions

Site/ action name	Location	Size (ha)	Volume estimate (ML)	Justification	Recommendation, timing and comments
Lower Willandra Creek	Willandra Creek from Morrisons Lake Nature Reserve to Ivanhoe-Balranald Road		6,000	Willandra Creek and associated wetlands below Morrisons Lake Nature Reserve are in variable condition with some wetlands in early recovery phase following last year's flood.	Piggy-back on replenishment flow in winter–early spring only. Once Morrisons Lake has received water consideration will be given to directing flows further down creek.
Lower Gum Swamp	Muggabah Creek	100 ha	1,000	Highly stressed river red gum and lignum community in early phases of recovery following recent flood. Swamp does not receive water from creek flows.	Piggy-back on replenishment flow as a pulse to reach commence-to-flow (approximately 150 ML/d). Option for 2013–14 if replenishment flow continues, otherwise action potentially to commence in 2012–13.



Azolla and Ludwigia, Lower Lachlan

P Packard/OEH

5.4 Actions to be considered for flows if ecological need or opportunity arises

These actions will be considered for environmental watering if an ecological need arises, such as bird breeding, drought refuge requirements or continued wetland vegetation recovery, or opportunity arises to supplement flows for fish breeding or passage (Table 7). The LRWG will be consulted on a case by case basis for significant releases of environmental water where the opportunity or need occurs.

Table 7 Asset or action for watering consideration

Site/ action name	Location	Size	Volume estimate (ML)	Justification	Recommendation, timing and comments
Booligal Wetlands ibis colony	Merrimajeel Creek	~200 ha	2,500–5,000	Support colonial bird breeding if other flows are insufficient to maintain water levels.	Only actioned if breeding commences. Likely timing October–February. Block bank regulator is to be operated as additional means of maintaining water levels.
Cuba Dam ibis colony	Merrowie Creek	~50–150 ha	5–25	Support colonial bird breeding if other flows are insufficient to maintain water levels.	Only actioned if breeding event commences. Likely timing October – February.
Southern bell frog at Lake Bullogal	Lake Bullogal, Noonamah Water Scheme		500	Southern bell frog was recently rediscovered at Lake Bullogal. Noonamah Water Scheme has been the only source of permanent water in the vicinity. The scheme has been superseded by a piped water scheme such that the shallow water habitats of the channels and the deeper permanent water refuges of the ground tanks are no longer annually inundated. If a resident and viable frog population is to be maintained in the area it may be necessary to use environmental water to inundate the old channel and tanks in the Lake Bullogal area.	If dry conditions prevail throughout winter – early spring, and the channel and tanks are drying down, consideration should be given to pumping water into the scheme from the Lachlan River as far as the tanks nearest to Lake Bullogal. Spring flow for approximately 4–6 weeks. The scheme and pump have been superseded by the pipe scheme but they have not been decommissioned.
Lake Brewster pelican breeding	Lake Brewster channel banks		1–5,000 Dependent on storage operations and evaporation	Maintain water levels in the outflow wetland and outflow channel if required to avoid abandonment of nests and young.	Levels managed adaptively to align where possible with storage operations and to allow drying cycle for outflow wetland plants. Support most likely to be needed in late summer–autumn. Can use Lake Brewster ECA and/or Brewster AEWL.
Lake Brewster wetlands	Lake Brewster inflow and outflow wetlands	1,000 ha	Up to 10,000	Provide appropriate wetting and drying regimes to support continued establishment and growth of wetland plants in the constructed wetlands.	Levels managed adaptively to align where possible with storage operations to avoid rapid fluctuations during peak growing season and at end of season to allow drying cycle for outflow wetland plants. Support most likely to be needed in summer–autumn. Can use Brewster AEWL.
In-channel targets under dry to very dry conditions	Booligal to Oxley	300 km of river channel	Up to 3,000	Maintain visible flow in river to prevent fragmentation and stratification of pools.	50 ML/d at Booligal for up to 60 days.
In-channel targets for fish breeding or passage	River channel from Forbes to Hillston, including anabranck creeks	600 km of river channel	Dependent on flows and base flow levels in river.	Supplement significant translucent flows or significant tributary inflow to achieve or extend weir draw-out for fish passage and/or to extend duration of freshes to support fish breeding.	Target flows during late spring early summer. Care required to reduce risk of carp recruitment.

6 Risks and strategies to manage risk

Table 8 summarises likely risks relating to environmental water use planning and delivery as well as the associated mitigation responses.

Table 8 Risks and strategies to manage risk

Risk	Rating	Response
Unexpectedly high irrigation demand for water during the period of environmental releases reduces flow.	Medium (possible and moderate)	OEH will consult closely with SWC river operators to anticipate flow forecasts.
Asset manager declines previously endorsed environmental flow delivery at short notice.	Medium (possible and moderate)	OEH will communicate regularly with asset managers and seek agreement for environmental flows and confirmation of preferred timing.
Gauging station failure or inaccuracy results in overuse of NSW EWH.	Medium (possible and moderate)	NOW and SWC given prior notice so that relevant gauging stations can be appropriately calibrated and maintained.
Unpredictable weather – turns drier than expected.	High (likely and major)	Review asset condition and future priorities for watering.
Unpredictable weather – turns wetter than expected.	Medium (unlikely and minor)	Releases adjusted to avoid unintended flooding. Additional watering options possible – continually assess volumes available.
Flow management is uncoordinated.	Medium (possible and moderate)	Contact LRWG; undertake early communication with SWC, Lachlan landholders and other stakeholders.
Water use and works approvals not linked to licences.	High (possible and major)	Confirm status with NOW and seek discretionary one-off approval if necessary.
Estimated flow target volumes are substantially wrong.	Medium (unlikely and moderate)	Monitor flow delivery daily and seek adjustments; revise targets for future attempts.
Unforeseen physical impediments to flow delivery.	Medium (rare and major)	Early communication with Lachlan landholders and SWC; alert NOW if illegal or unapproved obstructions are identified.
Water use plan not amended in time to take advantage of other unplanned or unforeseen opportunities.	Medium (possible and moderate)	Seek urgent approval from NOW.
Insufficient water available to complete colonial waterbird breeding, if initiated.	Medium (unlikely and severe)	Maintain contingency of water in account. Use Wyangala ECA and/or Lake Brewster ECA. Purchase general security allocation.

7 Monitoring and reporting

The planned or likely monitoring over 2013–14 in relation to environmental watering or known wetland and river assets includes:

- environmental flow response monitoring (including Integrated Monitoring of Environmental Flows program), flow and water quality assessments, and ongoing WSP assessment work undertaken by NOW
- field hydrography, water gauging, and modelling undertaken by SWC and NOW
- selected satellite imagery analysis to measure extent of inundation
- analysis of available hydrographic data from key gauging sites
- airborne surveillance to check water delivery and spread, broad-scale vegetation responses and activity at any colonial bird breeding sites
- regular, case-specific on-ground inspection of wetland areas to ground-truth inundation areas, duration and effect of inundation, faunal response and photographic evidence of response
- automated frog call recording at target sites
- repeat photo-points at target sites
- additional monitoring tailored to the specific objectives of releases which may be required, for example inspection of the progress of bird breeding, and evidence of aquatic macrophyte responses
- repeat condition assessment of Murrumbidgee Swamp, Lake Tarwong and Lake Bullogal
- baseline condition assessments of Moon Moon Swamp and key elements of lower Lachlan Swamp
- vegetation response assessment of Lake Ita.

The following reporting will be undertaken in relation to activities in the water year:

- Regional Manager, Regional Operations, OEH, for regular updates on conditions (climate, available environmental water) during flow delivery (LRWG and local landholders)
- OEH will provide the record of seasonal flows, inundation extent and ecological monitoring in *Environmental water use in New South Wales: Annual report*
- regular updates to CEWO.

References

Bowen S and Simpson S 2010, Report to the NSW Rivers Environmental Restoration Program, NSW Department of Environment Climate Change and Water, Sydney.

NSW Government 2003, Water Sharing Plan for the Lachlan Regulated River Water Source 2003, NSW Government, Sydney.

NSW Government 2007, RiverBank Water Use Plan for the Lachlan Water Management Area, NSW Government, Sydney.

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