Australian Government

MURRAY–DARLING BASIN AUTHORITY

River Murray System annual operating plan

2015–16 water year
1 June 2015–31 May 2016

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Cover image: The River Murray at Caloote, South Australia. Photo: Arthur Mostead 2008.

Acknowledgement of the Traditional Owners of the Murray–Darling Basin

The Murray–Darling Basin Authority acknowledges and pays respect to the Traditional Owners, and their Nations, of the Murray–Darling Basin, who have a deep cultural, social, environmental, spiritual and economic connection to their lands and waters. The MDBA understands the need for recognition of Traditional Owner knowledge and cultural values in natural resource management associated with the Basin.

The approach of Traditional Owners to caring for the natural landscape, including water, can be expressed in the words of Darren Perry (Chair of the Murray Lower Darling Rivers Indigenous Nations) —

> *'the environment that Aboriginal people know as Country has not been allowed to have a voice in contemporary Australia. Aboriginal First Nations have been listening to Country for many thousands of years and can speak for Country so that others can know what Country needs. Through the Murray Lower Darling Rivers Indigenous Nations and the Northern Basin Aboriginal Nations the voice of Country can be heard by all'.*

This report may contain photographs or quotes by Aboriginal people who have passed away. The use of terms 'Aboriginal' and 'Indigenous' reflects usage in different communities within the Murray–Darling Basin.

Accessibility

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1. Introduction

The River Murray System annual operating plan for the 2015–16 water year (1 June 2015 to 31 May 2016) provides context and describes how the River Murray System (the system) may be operated under a number of inflow scenarios in the coming year.

The scenarios have been prepared by the Murray–Darling Basin Authority (MDBA) with input from the Australian Government and the states of New South Wales, Victoria and South Australia through MDBA's Water Liaison Working Group.

This plan contains:

- Chapter 1 – A brief description of the legislative framework relevant to the operation of the River Murray System
- Chapter 2 – Key objectives and constraints in operations
- Chapter 3 – System status at 1 June 2015 and potential water availability in 2015–16
- Chapter 4 – Summary of water sharing and significant river operations during the 2015–16 water year under a range of scenarios
- Chapter 5 – River Murray System operations during 2015–16 under a range of scenarios (individual structures, reaches and issues)
- Chapter 6 – A calendar of events
- Chapter 7 – Advice on where to find further information on the River Murray System.

The actual conditions that occur in the 2015–16 water year will inevitably be different to the scenarios presented in this plan, and therefore actual river operations will also be different to any projection presented. In particular, the patterns of environmental water delivery and use during 2015–16 are uncertain; and with the possibility of large volumes of environmental water to be delivered, the impacts on the scenarios in this operational plan may be significant. Nevertheless, these scenarios provide a useful indication of potential river operations in the 2015–16 water year.

This document will be formally reviewed by MDBA and the Water Liaison Working Group in October. The jurisdictions will also receive updates on a regular basis, through the Water Liaison Working Group, to account for actual conditions as the season progresses in order to fine-tune system operations. This plan will be updated if there are significant changes.

If this plan has not been adopted by MDBA prior to the start of the 2015–16 water year (1 June 2015), river operations will be undertaken upon the advice of the Water Liaison Working Group.

LEGISLATIVE FRAMEWORK

MDBA coordinates the operation of the River Murray System to provide water to the states of New South Wales, Victoria and South Australia in accordance with the Water Act 2007 (Cth.), and the Murray–Darling Basin Agreement ('the Agreement') which is a schedule to the Act.

State water entitlements are determined in accordance with Part XII of the Agreement – Distribution of Waters, and operations are undertaken in accordance with decisions of the Murray–Darling Basin Ministerial Council and the Basin Officials Committee. In this respect MDBA acts on behalf of the joint governments in operating the River Murray System to meet their requirements.

This Annual operating plan is consistent with the:

- Water Act 2007 including the Murray–Darling Basin Agreement
- Relevant decisions of Ministerial Council and Basin Officials Committee
- Objectives and Outcomes for River Operations in the River Murray System as determined by Basin Officials Committee
- The Basin Plan 2012 (in particular Chapters 9 and 11)
- MDBA corporate plan
- MDBA asset management plan
- MDBA asset agreement
- Memoranda of understanding with Constructing Authorities.

The Annual operating plan has regard to:

- Basin annual environmental watering priorities
- Priorities of the Southern Connected Basin Environmental Watering Committee
- The Living Murray operational scenarios
- Commonwealth Environmental Water Holder environmental watering plans
- Southern Basin state watering plans (where provided).

In the event of any conflict between these documents or between the Annual operating plan and these documents, MDBA will seek the advice of jurisdictions as appropriate.

2. Objectives and constraints

2.1. Key objectives

The governments of the Commonwealth, NSW, Victoria and South Australia, via the Basin Officials Committee (BOC), have responsibility for the high-level decision-making in relation to river operations. They perform this by setting objectives and outcomes for MDBA to achieve. These objectives and outcomes can be found on the MDBA website.

In many instances, river operations require the balancing of competing needs on a day-to-day basis. The following broad objectives have been set by the BOC when carrying out river operations:

Water storage and delivery and accounting — To operate the River Murray System efficiently and effectively in order to deliver state water entitlements, while conserving water and minimising undesirable losses; and to maximise the water available to the Southern Basin states, after providing for operating commitments in the River Murray System.

River Murray Operations (RMO) assets — To ensure that RMO assets allow MDBA to manage and deliver water that is fit for the purpose for which it is to be used, efficiently, effectively and safely.

People and communities — To contribute to the safety of communities along the River Murray as well as the economic, social, environmental and cultural activities of people using the River Murray System.

Environment — To contribute to the protection and, where possible, restoration of priority environmental assets and ecosystem functions within the River Murray System.

Communication and information management — To ensure that MDBA, in operating the River Murray System: uses the best available data, tools and systems; keeps all stakeholders with an interest in the MDBA's river operations well informed of its plans and activities; acts transparently; and is accountable for its actions in accordance with the Agreement.

If, on any occasion, MDBA is unable to achieve one or more of the objectives above, in whole or in part, because of a conflict between those objectives and one or more other objectives, MDBA shall consult with the jurisdictions. MDBA will aim to achieve an appropriate balance between conflicting objectives, taking into consideration the prevailing circumstances, in accordance with the advice or decision of the jurisdictions.

2.2. System attributes

Some key considerations in River Murray System operations are: the considerable variability of both inflows and usage; weir pool operations; the long travel times; and system constraints such as the Barmah Choke. Each is briefly discussed below.

Considerable variability of both inflows and usage. Operations of the River Murray System occur in the context of considerable variability, including:

- There is extreme variability in the weather of the Murray–Darling Basin, and consequently the inflows to the River Murray System are amongst the most variable in the world. Short-term rainfall forecasts have improved substantially over recent years and are used to support operational decisions. Medium-term rainfall forecasts and run-off forecasts are also improving and serve as a useful guide to what might happen in the future.
- The climate is changing and the River Murray System has experienced record-breaking droughts, summer floods, and extreme temperatures in the last decade. The Bureau of Meteorology reports that southeast Australia has experienced a decline in late autumn and early winter rainfall since the mid-1990s. The traditional river system planning methods (adopted in this document) use observed historical inflow and demand patterns as a foundation. Such observations may no longer represent the variability of future seasons and MDBA is therefore working closely with the Bureau of Meteorology to ensure the latest information on trends and outlooks are factored into the operation of the River Murray System.
- The water market has become increasingly active during recent years, and this growth is expected to continue into the future. The impacts of trade on the timing and location of water demand will become clearer with time.
- The amount and location of water carried-over from year to year is changing as entitlement holders adapt to new and evolving carryover policies.
- The amount of water available for environmental purposes is increasing and its timing and location of use is expected to vary greatly between years. This is difficult to encapsulate in the operational plans.
- There may also be short-term issues along the river, which are difficult to foresee, that can require a rapid response. Some issues affecting river operations develop within weeks (e.g. blue–green algal blooms), or within days (e.g. a sudden increases in salinity, or a fish kill due to poor water quality). Some of these issues can potentially be mitigated by river operations, particularly in years when water is relatively abundant.
- Very rarely, there are emergency river operations carried out that require an immediate response.

System flow constraints and considerations. At various locations in the River Murray System there are flow constraints, which may apply during periods of regulated release and which, if breached, may have significant social and environmental impacts depending on timing. Some of these constraints include:

- Mitta Mitta River downstream of Dartmouth Reservoir: approximately 10,000 ML/day at Tallandoon
- Hume Reservoir to Yarrawonga Weir: 25,000 ML/day at Doctors Point
- release from Yarrawonga Weir (due to ‘Barmah Choke’): approximately 10,000 ML/day (currently, when watering of the Barmah–Millewa Forest is desirable, regulated releases of 15,000 ML/day, and possibly up to 18,000 ML/day, may be targeted in 2015–16 to meet environmental watering objectives subject to further consideration by NSW and Victoria)
- inlet to Lake Victoria (Frenchmans Creek): up to 10,000 ML/day depending on the water level in Lake Victoria

- outlet from Lake Victoria (Rufus River): up to 10,000 ML/day depending on river and lake levels (although at rates above 7–8,000 ML/day, erosion along the Rufus River needs to be taken into consideration). Further constraints may apply—see Section 5.14
- Edward River downstream of Stevens Weir: 2,700 ML/day (not applicable when watering of Werai Forest is desirable)
- Lower Darling River downstream of Menindee Lakes: 9,000 ML/day (although rates may be reduced to improve NSW water supply reliability)
- outlet to lower Darling River from Lake Menindee: less than 4,000 ML/day depending on level in Lake Menindee.

The constraints above are limits which are not targeted to be exceeded by normal river operations. These flows are not, however, automatic targets and lower flow rates will often be appropriate given the circumstances at the time.

The coordination of inflows. The operation of the River Murray System occurs in coordination with:

- the Snowy Mountains Scheme (operated by Snowy Hydro Limited) – the Snowy Water Licence allows Snowy Hydro substantial flexibility over its day-to-day release pattern whilst fulfilling water supply targets on an annual basis
- regulated tributaries, particularly the Goulburn River in Victoria (operated by Goulburn-Murray Water) and the Murrumbidgee River and Billabong Creek in NSW (operated by Water NSW), including the delivery of water held in inter-valley trade accounts (known as IVT or Valley Accounts) as a result of permanent and temporary water trade to the Murray
- tributaries that are primarily unregulated, such as the Kiewa and Ovens Rivers
- the Darling River in NSW, including any operations of the Menindee Lakes when directed by NSW (see Section 5.11).

This coordination is important, as water released from storages within MDBA's control needs to be managed in conjunction with other regulated and unregulated inflows to the system in order to optimise outcomes.

Weir pool operations. Drawing on or raising weir pools has become a more common practice at an increasing number of weirs in recent years to assist in meeting environmental and water delivery objectives. These operations may not always match the expectations of local communities that may have previously experienced near constant weir pool levels for a long period of time. Changing weir pool levels will increase in frequency in the future for a range of purposes, including to achieve improved ecological outcomes. River operations may lead to changes in weir pool levels, after consideration is given to balancing objectives in Section 2.1.

Long travel times. In the reach from Hume Reservoir to Lake Victoria, there is limited capacity for re-regulation or release of flows into the River Murray. The typical flow time between Hume Dam and Lake Victoria under regulated flow conditions is 25 days, and it is likely that weather conditions will change over this time period and there will be variability in river transmission losses and demand for water. This limited re-regulation capacity affects the level of control that MDBA has over the flow regime in much of the River Murray, particularly in years of average and high inflows, or during extended hot spells when the available water in the river may be less than consumptive orders for short periods of time. A 'rain rejection' can result if water orders are cancelled, due to significant rainfall along the river, after the water has already been released.

Subsequent out-of-bank flows are possible, particularly in the Barmah–Millewa Forest (discussed further in Section 5.8.2).

3. Potential water availability

3.1. System status on 1 June 2015

In 2014–15, most of the Murray–Darling Basin received rainfall that was close to average or drier (Figure 1). In particular, rainfall across large areas of the headwater catchments of the Darling River remained below average. Relatively low rainfall was also experienced across northern and north-western Victoria.

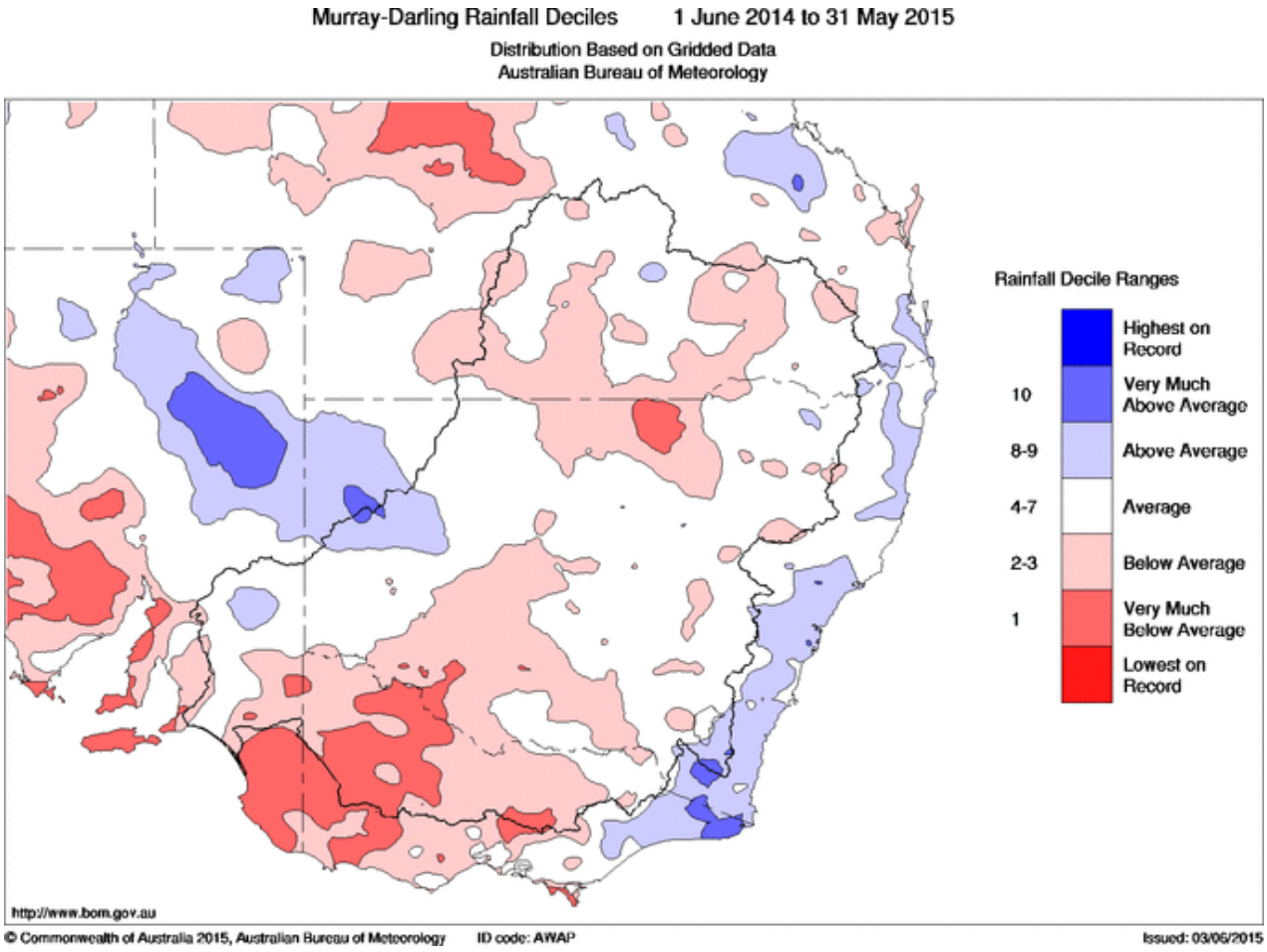

Figure 1: Rainfall deciles — 12 months 1 June 2014 to 31 May 2015

Inflows to the River Murray System in 2014–15 were 4,350 GL (excluding Menindee, Snowy Mountains Scheme, IVT and environmental water delivered via tributary inflows), which has an annual exceedance probability of 86%. The median inflow is about 8,050 GL. Inflows were markedly below the long-term average for all months except July (Figure 2). Inflows in spring (September to November) were particularly low, being just 25% of the long-term average (AEP 92%).

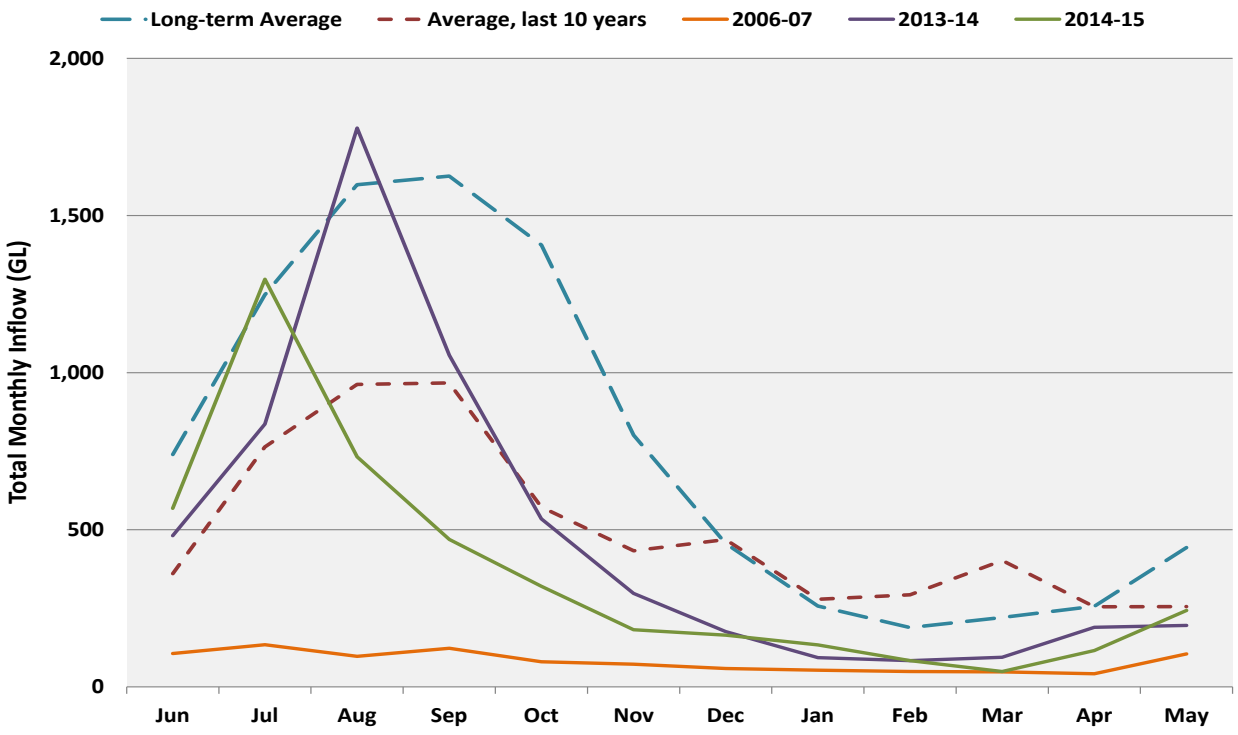

Figure 2: River Murray System inflows—recent years and long-term averages

Note: Inflows exclude Menindee inflows, Snowy Mountains Scheme releases, and inter-valley transfers of consumptive and environmental allocations.

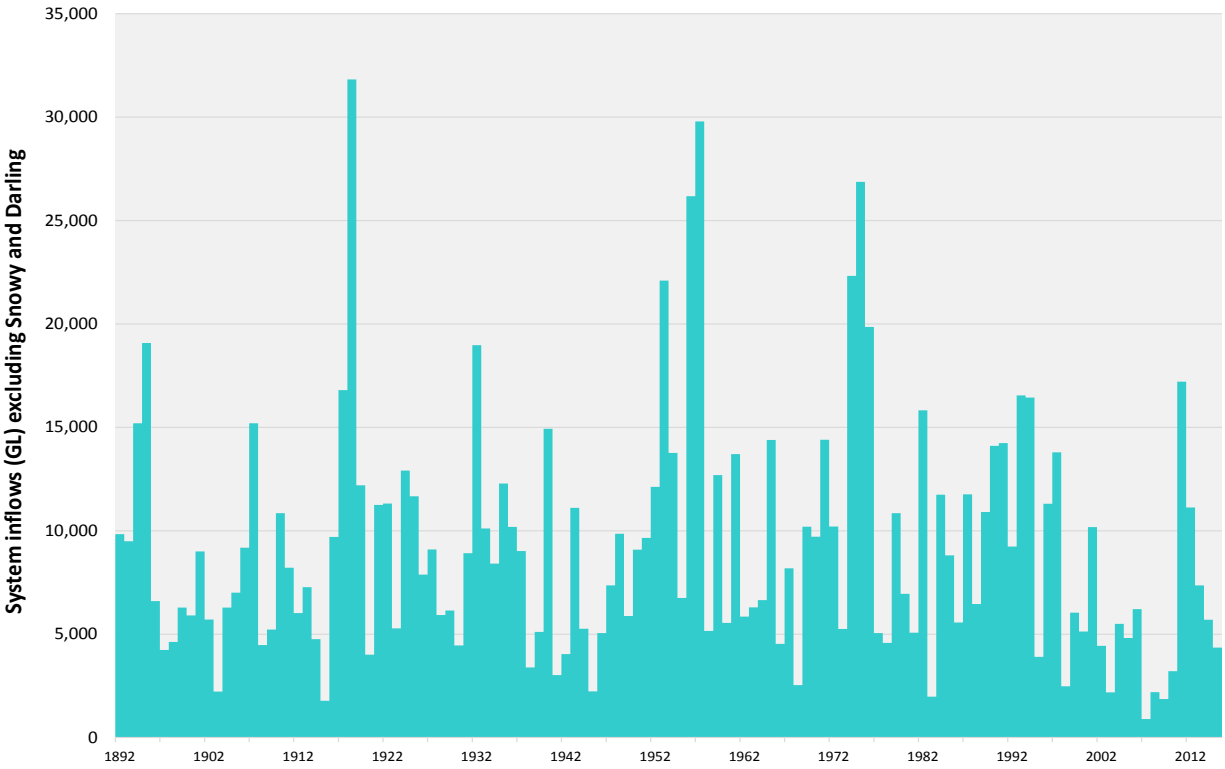

Figure 3: River Murray System inflows—water year totals (to end May) since 1982

Note: inflows exclude Menindee inflows, Snowy Mountains Scheme releases, and inter-valley transfers of consumptive and environmental allocations and are based on modelled current conditions

For the second year in a row, there was very little inflow to the Menindee Lakes system. Total inflows to the Menindee Lakes during 2014–15 were about 40 GL (Figure 4), which has an AEP of 98%**.** For the two years since June 2013, the inflow has totalled less than 200 GL (98% AEP).

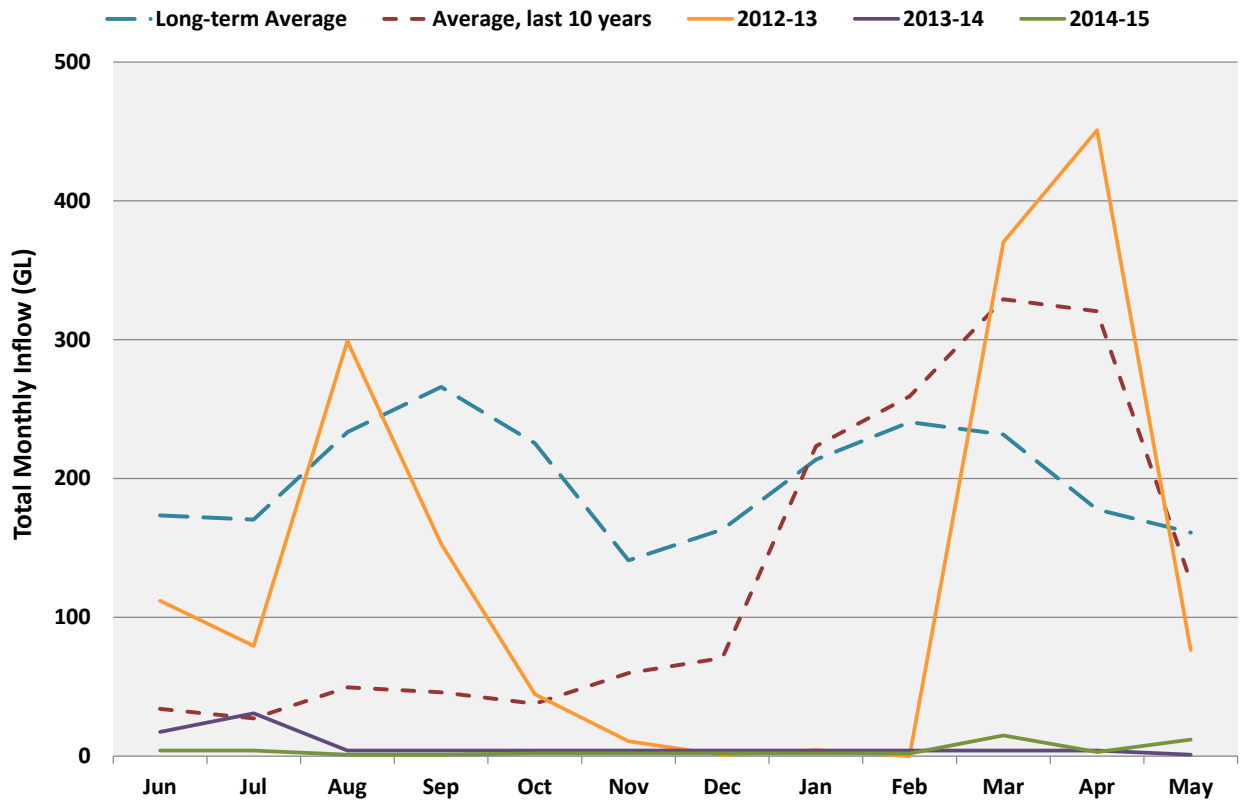

Figure 4: Inflows to Menindee Lakes—recent years and long-term averages

At the beginning of the water year, MDBA's total active storage was close to the long-term average (Figure 5). However, after July 2014, the storage volume dropped below the long-term average and was 3,769 GL on 31 May 2015, which is about 1,320 GL less than the long-term average for the end of the water year.

The storage in MDBA major reservoirs on 1 June 2015 is shown in Table 1. The water stored in the Menindee Lakes was less than 640 GL and therefore not available to the MDBA. On 1 June 2015, there was also approximately 17 GL of water available to the Murray held in storages in the Murrumbidgee and Goulburn Valleys as a result of earlier net trade out of these valleys and into the Murray, with this volume expected to increase to approximately 90 GL on 1 July 2015.

Total storage in the Snowy Mountains reservoirs (managed by Snowy Hydro) remains modest, although Lake Eucumbene storage has risen in the past year from around 43 to 54% capacity.

Storage in Dartmouth Reservoir increased from 3,452 GL (90% capacity) on 1 June 2014 to 3,689 GL (96% capacity) in mid-September. Bulk transfers to Hume Reservoir commenced in mid-September and continued throughout the remainder of the year. High downstream demands, combined with low inflows, had drawn the storage level down to 2,880 GL (75% capacity) by the end of May 2015.

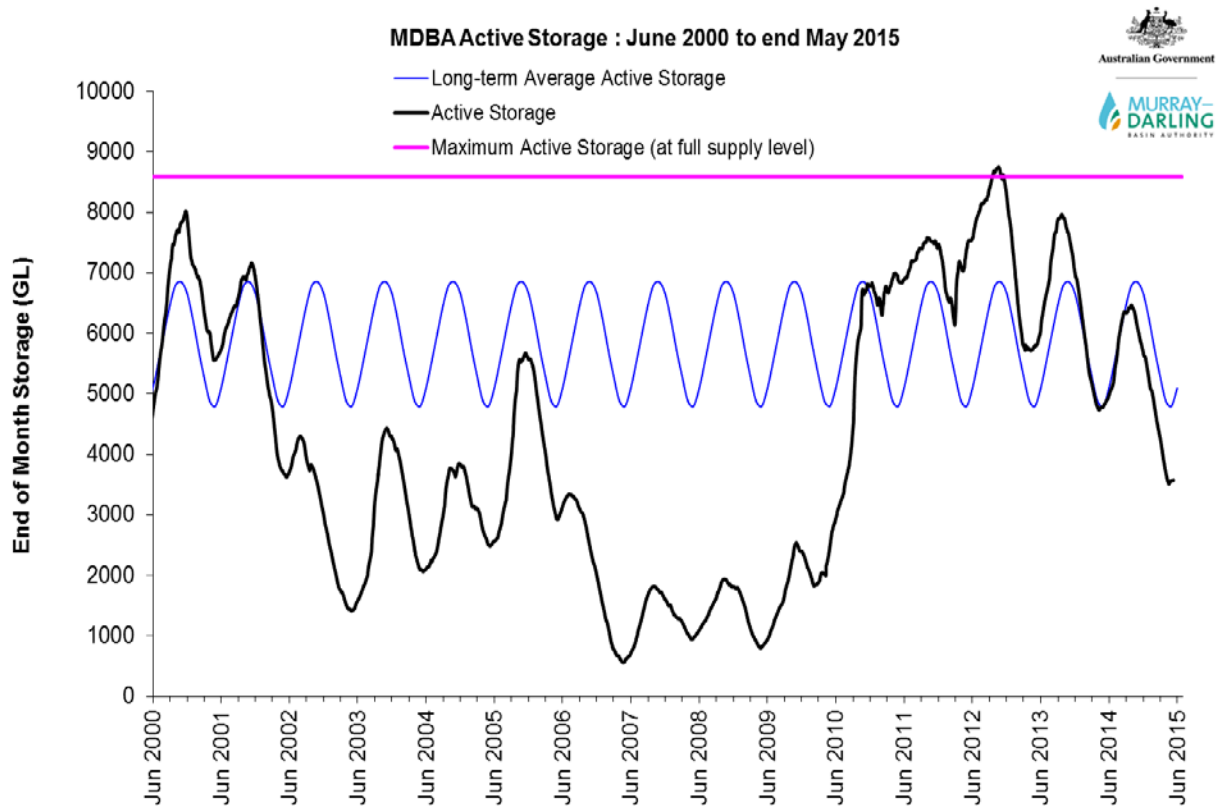

Figure 5: MDBA active storage June 2000 to May 2015.

This graph shows the sum of active storage in Dartmouth and Hume Reservoirs, Lake Victoria and the Menindee Lakes.

Table 1: Storage in MDBA major reservoirs on 1 June 2015

Major storage	Total capacity (GL)	Active capacity (GL)	Total water in storage (GL)	Percentage of total capacity	Active water in storage (GL)
Dartmouth Reservoir	3,856	3,785	2,879	75%	2,808
Hume Reservoir	3,005	2,982	764	25%	741
Lake Victoria	677	577	332	49%	232
Menindee Lakes*	1,731	1,251	73	4%	0
River Murray System total	**9,269**	**8,595**	**4,048**	**44%**	**3,781**

*Menindee Lakes may be surcharged to 2,050 GL under certain circumstances. Water will not be available to the MDBA until the volume next exceeds 640 GL

There was 1,276 GL of water stored in Hume Reservoir on 1 June 2014, which was 42% capacity. The storage rose quickly during late winter, but with the dry conditions from August onwards, demand was high during spring. Boosted by bulk transfers from Dartmouth, the storage volume in Hume peaked in late September to early October at 2,343 GL (78% capacity). The storage was then steadily drawn down, reaching a low of approximately 640 GL (21% capacity) during April 2015. The storage volume at the end of May 2015 was 755 GL (25% capacity).

Lake Victoria at the end of May 2015 held 328 GL (48% capacity) and Menindee Lakes held 73 GL (4% capacity).

3.1.1. Critical human water needs and conveyance reserve

MDBA has declared that the River Murray System is under 'Tier 1' conditions. This means that 'normal' water sharing arrangements are in place at the start of 2015–16 water year. Tier 1 arrangements occur in very wet to dry conditions, when enough water is available to meet critical human water needs (*NSW 61 GL, Victoria 77 GL and South Australia 204 GL*) and enough water (*1,596 GL conveyance water*) is available to operate the river system to deliver critical human water needs.

In Tier 1, a conveyance reserve of 225 GL is also set aside for the next year to ensure critical human water needs can be delivered into the future. The full conveyance reserve for 2016–17 has been set aside at the start of 2015–16 by the states; and each state has sufficient water to meet its critical human water needs in 2015–16.

Tier 1 water sharing arrangements are likely to continue for 2015–16. If inflows are extremely low in 2015–16, then critical human water needs would only be expected to be in jeopardy if such dry conditions continue into 2016–17. The probability of this occurring is low but nonetheless a possibility. MDBA will closely monitor conditions and liaise with partner governments to monitor risks and adjust plans accordingly in the knowledge that drought security is reliant on forward planning and the management of reserves.

3.2. Hydrological assumptions for 2015–16

The annual water availability for each state is determined by MDBA at the start of each water year (1 June) and then updated at least monthly throughout the year. The annual water availability for each state is calculated using data, models and assumptions agreed to by each of the jurisdictions. In some instances, water availability assessments are prepared twice monthly to assist allocation announcements by the states.

Each determination of water availability takes into account the available water that is in storage at the time, the water in transit, the amount of water used in that water year so far, assumptions of future inflows (both regulated and unregulated) and the losses that may be experienced in delivering water along the length of the River Murray System for the remainder of the year.

3.2.1. River Murray System scenarios for 2015–16

Since the inflows to the River Murray System cannot be known in advance, this plan addresses the operations that may be undertaken under six different scenarios that cover, in broad terms, the likely range of conditions that may be experienced. Each scenario has in-built assumptions for inflows from the Snowy Scheme, unregulated inflows into Dartmouth and Hume Reservoirs and inflows from the tributaries; including the Kiewa, Ovens, Goulburn, Murrumbidgee, and lower Darling Rivers, conveyance (river losses), storage losses and usage patterns.

The supply of water to the environment is now a major feature of River Murray System operations and, due to the nature of environmental water delivery, significant uncertainties exist on how this water will be delivered in the 2015–16 water year. These scenarios include

assumptions on both consumptive and environmental use and any differences between actual and assumed use may change operations.

Generally, it is only the volume of water available under the 'extreme dry scenario' (and updates thereof) that is progressively allocated by the states to their water users. The other scenarios provide indicative quantities of water availability to the states to assist planning and risk management by water managers and customers, should those wetter scenarios eventuate. The assumptions in each scenario could change in future years as data and models are updated.

The scenarios in this plan are based on information available at 1 June 2015. The scenarios include the impacts of rain up to this date and allow for a recession of inflows into late June 2015. The relative difference between the inflows of each of the six scenarios can be compared in Figure 6.

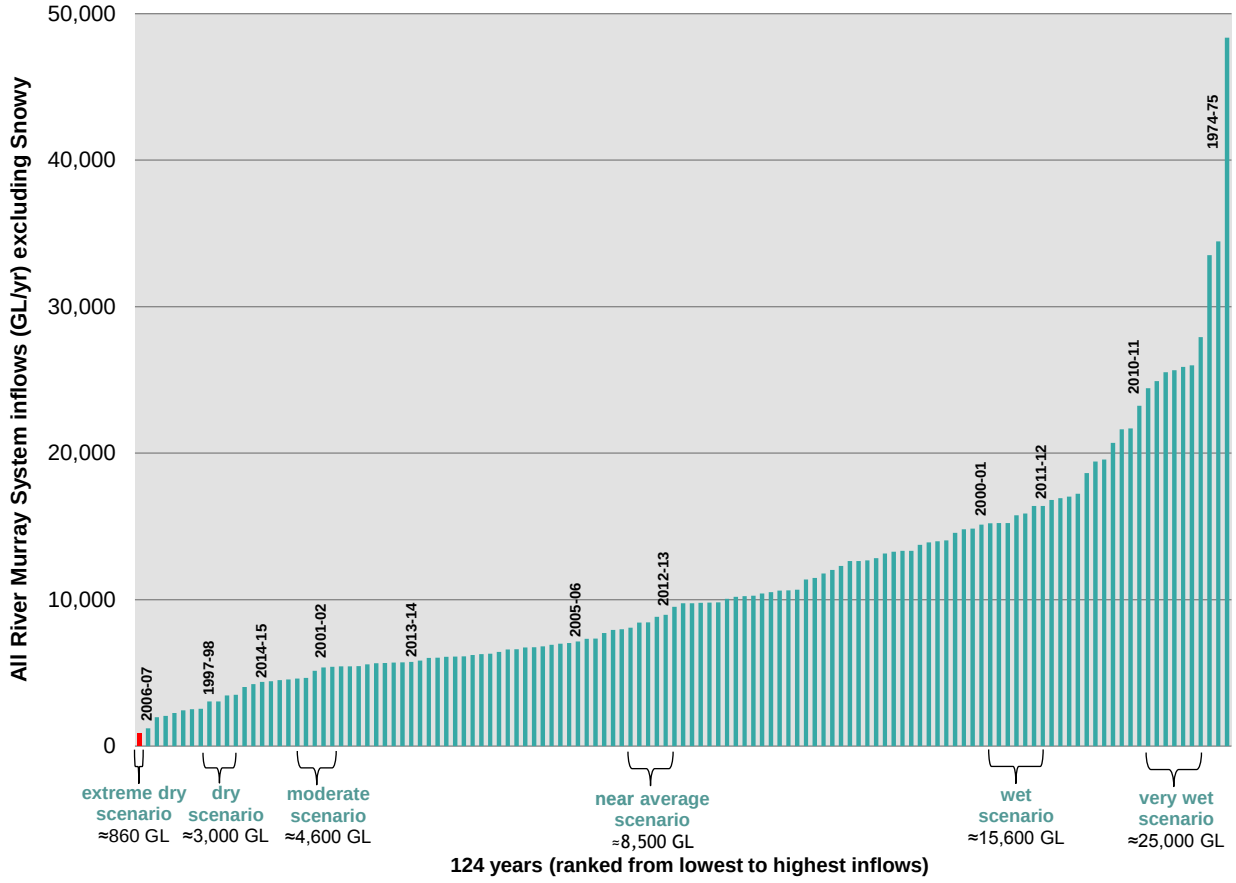

Figure 6: River Murray System inflows – ranked water year totals since 1892

Note: The extreme dry scenario, highlighted in red, is lower than the lowest inflow on record. Inflows include Menindee inflows but exclude Snowy Mountains Scheme releases, inter-valley transfers and environmental water; and are based on modelled current conditions.

The details of the six scenarios are provided in Table 2 and they are labelled according to the assumed River Murray System inflow as follows:

- a current 'extreme dry' scenario which assumes about 860 GL of River Murray System inflows. The 'worst case' scenario determined under the Basin Plan totals 650 GL, however inflows could not reasonably be expected to fall to such low levels in 2015–16 as

it would require extreme dry conditions to persist over two years. For comparison the lowest inflows on record (2006–07) totalled about 914 GL, including Menindee inflows. It is conceivable that if very dry conditions are observed in 2015–16, MDBA may adopt the 'worst case' scenario for operational planning in 2016–17

- a 'dry' scenario, assumes River Murray System inflows of about 3,000 GL, which is comparable to inflows in 1997–98
- a 'moderate' scenario, assumes River Murray System inflows of about 4,600 GL which is comparable to inflows in 2001–02
- a 'near average' scenario, assumes River Murray System inflows of about 8,500 GL which is comparable to inflows in 2012–13
- a 'wet' scenario, assumes River Murray System inflows of about 15,600 GL which is comparable to inflows in 2000–01 and 2011–12
- a 'very wet' scenario, assumes River Murray System inflows of about 25,000 GL which is comparable to inflows in 2010–11.

3.2.2. Conveyance water (river losses)

The volume of water set aside for conveyance, which includes losses due to evaporation and seepage along the river system, varies between scenarios. The 'extreme dry' and 'dry' scenarios assume 850 GL for conveyance between Dartmouth Reservoir and the South Australian border. The 850 GL conveyance along the River Murray takes a conservative approach and is higher than losses experienced in recent dry years, i.e. about 750 GL in 2006-07.

In the drier scenarios, the pattern of losses is skewed towards summer when evaporation is expected to be higher. The volume and pattern of water set aside for conveyance will be regularly reviewed by MDBA and altered to suit the actual conditions as they develop.

The 850 GL assumes that:

- river flows are at channel capacity through the 'Barmah choke', for at least a short period during the year
- all major wetlands affected by regulated flows are connected at some stage of the year
- any additional net losses caused by varying weir pool levels for environmental benefit are debited to environmental entitlement holders.

If conditions are wetter, then conveyance losses will be higher due to increased overbank flow and flooding and consequential evaporation and seepage on the floodplain. Consequently, the wetter scenarios assume higher conveyance losses, with about 1,050 GL assumed in the 'wet' scenario (Table 2) and 1,660 GL assumed for the 'very wet' scenario. The pattern of actual losses can be very different to those assumed in this operational plan.

The conveyance loss, under regulated conditions, along the River Murray in South Australia upstream of Wellington is included as part of the South Australian 696 GL Dilution and Loss entitlement. The proportion of evaporation and other losses between the SA border and Wellington (just upstream of Lake Alexandrina) compared with flows to the Lower Lakes will vary from year to year depending on evaporation, extent of inundation and local rainfall. For 'extreme dry' planning purposes, it is assumed that about 50% of the 696 GL is lost and the other 50% flows to the Lower Lakes.

Table 2: Detail of assumptions in each scenario for 2015–16

Item	Type	Extreme dry (GL)	Dry (GL)	Moderate (GL)	Near average (GL)	Wet (GL)	Very wet (GL)
Active MDBA storage on 1 June 2015	Input	3,780	3,780	3,780	3,780	3,780	3,780
Water available from Valley Accounts	Input	70	90	90	90	90	90
Change in water in transit between 1 June 2015 and 31 May 2016	Input	40	-20	-60	-30	0	-220
Inflows from upstream of Albury (including Snowy Scheme)	Input	750	2,250	3,150	4,450	6,600	8,900
Inflows from upstream of Menindee	Input	0	0	0	800	2,900	7,300
Inflows from Victorian tributaries	Input	230	900	1,400	2,600	4,400	6,500
Inflows from NSW tributaries	Input	210	210	420	1,000	2,000	3,000
Conveyance losses upstream of SA Border	Commitment	-850	-850	-880	-880	-1,050	-1,660
Conveyance losses along lower Darling River	Commitment	0	0	0	-10	-140	-780
Conveyance Reserve for 2016–17	Commitment	-225	-225	-225	-225	-225	-225
Storage losses upstream of the SA Border	Commitment	-260	-300	-310	-450	-800	-950
Supply of South Australian Dilution and Loss Entitlement	Commitment	-696	-696	-696	-696	-696	-696
Supply of Additional Dilution Flow to South Australia	Commitment	0	0	0	0	-60	-750
Supply of unregulated flow to South Australia	Commitment	0	0	0	-2,400	-5,900	-13,000
Minimum reserve for 2016–17	Commitment	0	-170	-500	-835	-835	-835
Approximate water allocated to NSW, Victoria and South Australia (rounded) *	Total	3,000	5,000	6,200	7,200	10,100	10,500

*Includes carryover water in each state

3.2.3. South Australia's storage right

In response to the extreme drought conditions in 2006 and 2007, the *Water Act (2007)* includes provisions to improve security of supplies under a repeat, or even worse drought conditions. Two schedules to the Murray–Darling Basin Agreement have been enacted in this regard.

Ministerial Council approved the Schedule to Account for South Australia's storage right (Schedule G), the Schedule for Water Sharing (Schedule H) and associated consequential amendments to the Agreement on 15 June 2011. These Schedules allow South Australia to store water, without risk to Victorian and NSW water security, in order to safeguard the delivery of critical human water needs to South Australia during periods of severe drought. They also oblige all three states to set aside critical human water needs.

During 2013–14, South Australia set aside 50 GL for critical human water needs and private carryover. After deductions for evaporation and a small spill at Lake Victoria of 5 GL from the storage right, approximately 43 GL resided in Dartmouth Reservoir at end May 2014. In April and May 2015, South Australia set aside a further 11 GL (of which 5 GL remains in Lake Victoria) while the total stored in Dartmouth Reservoir has increased to approximately 49 GL. Water held in South Australia's storage right is the first to spill, should physical spills or pre-release occur at the relevant storage.

South Australia will seek to increase the volume in the storage right in 2015–16 by around 50 GL, based on the current weather outlook and requirements to meet flow and water level requirements below Lock 1. South Australia will advise MDBA of their monthly deferred water storage plans throughout the year.

3.2.4. Storage losses

Assumptions of evaporative losses from storages vary for each scenario, being about 260 GL in the 'extreme dry' scenario and then increasing in the wetter scenarios (960 GL in 'very wet' scenario) due to the much larger wetted surface area, particularly over summer, with increased water in storage. The majority of the assumed evaporative loss in these wetter scenarios is at Menindee Lakes (420-600 GL). High summer rainfall, as occurred in 2011–12, can significantly reduce evaporative losses, but this has not been assumed in the scenarios.

4. Summary of water sharing and significant operations

State water entitlements and significant decisions on river operations are primarily driven by the timing and location of inflow events and usage patterns. For the six scenarios outlined in Section 3.2.1 of this plan, Table 3 provides a summary of water availability; Table 4 provides a summary of important operational decisions that may need to be made while Table 5 provides outlooks to assist environmental management.

The water sharing arrangements (Tier 1) between states, which are in effect at the start of 2015–16, are outlined in Part XII of the Murray–Darling Basin Agreement.

Table 3: Summary of water availability under each scenario

Water availability	Extreme dry (GL)	Dry (GL)	Moderate (GL)	Near average (GL)	Wet (GL)	Very wet (GL)
Sharing rules at end of May 2015	Tier 1	Tier 1	Tier 1	Tier 1	Tier 1	Tier 1
Indicative water availability: NSW	680	1,200	2,040	2,610	3,960	4,280
Indicative water availability: VIC	1,570	2,660	3,000	3,420	4,970	5,100
Indicative water availability: SA	940	1,154	1,154	1,154	1,154	1,154
SA Dilution & Loss	696	696	696	696	696	696
Conveyance Reserve for 2016–17	225	225	225	225	225	225
Forecast Minimum Reserve at end May 2016	0	170	500	835	835	835
Trade Adjustment to South Australia at 1 June **	~-30	~-30	~-30	~-30	~-30	~-30
Special Accounting	NSW and Vic likely to commence special accounting in August and continue throughout year	NSW and Vic likely to commence special accounting in August. NSW may continue throughout year but Vic may cease	NSW only, likely to commence special accounting in August and may continue	NSW only, likely to commence special accounting in August and may continue	Both states unlikely to be in special accounting	Both states unlikely to be in special accounting
Net internal spill at all MDBA storages (Vic to NSW) ***	0#	50#	150#	270#	520#	430#
Additional Dilution Flow (see Section 5.11.1)	≈ 0#	≈ 0#	≈ 0#	≈ 0#	≈ 60#	≈ 750#
Unregulated Flows ##	≈ 0	≈ 0	≈ 0	≈ 2,400	≈ 5,900	≈ 13,000
Assumed usage: NSW #	680	1,200	1,950	1,950	2,100	2,100
Assumed usage: VIC (incl. carryover)	1,400	1,800	1,900	1,900	1,900	1,900
Assumed usage: SA ent. delivered	1,640	1,850	1,850	1,850	1,850	1,850
End of season active storage (highly dependent on water use during 2015–16)	≈560#	≈1,160#	≈1,760#	≈3,400#	≈6,200#	≈7,500#

Highly dependent on the timing of improvements in water availability and usage patterns

* As at end May 2015, an additional 53.6 GL was available in South Australia's storage right. South Australia may defer some of its entitlement flow during 2015–16 to increase its storage right (Clause 91).

** Trade Adjustment figure will decrease South Australia's Entitlement in 2015–16. Figure given is the volume forecast at 1 July and may change during the year.

*** NSW and Victoria each have access to half the capacity of each MDBA storage. When a state 'fills' its half, any additional inflow 'internally spills' to the other state.

When the flow or prospective flow of the River Murray at the South Australian border is unable to be regulated, South Australia will receive these additional flows above its entitlement flow as 'unregulated flow'.

Table 4: Summary of significant river operations under each scenario

River operations	Extreme dry	Dry	Moderate	Near average	Wet	Very wet
Expected Dartmouth release above minimum	~ 2,800 GL, transfer commencing in June, up to 10,000 ML/day.	~ 2,600 GL, transfer commencing in June, up to 9,500 ML/day. Includes <70 GL release for power generation, water quality or if Snowy Creek flow is very low.	~ 2,200 GL, transfer commencing in June up to 8,500 ML/day. Includes <70 GL release for power generation, water quality or if Snowy Creek flow is very low.	~ 1,300 GL, transfer commencing in July up to 8,000 ML/day. Includes <70 GL release for power generation, water quality or if Snowy Creek flow is very low.	Potential pre-releases and spill in winter/spring. Harmony transfers over summer / autumn. Includes <58 GL release for power generation, water quality or if Snowy Creek flow is very low.	Potential pre-releases and spill Oct to Dec. Harmony transfers over summer / autumn. Includes <58 GL release for power generation, water quality or if Snowy Creek flow is very low.
Dartmouth storage end May 2015	~140 GL	~630 GL	~1,200GL	~2,300 GL	~3,600 GL	~ 3,700 GL
Hume storage	Low levels (<10% capacity) in autumn, increased chance of algal bloom	Low levels (<10 % capacity) in autumn, increased chance of algal bloom	Low levels (~10 % capacity) in autumn, increased chance of algal bloom	Low levels (~20 % capacity) in autumn, some chance of algal bloom	Possible spill during spring/early summer, higher levels (>40% capacity) over summer/autumn	Spill during spring/early summer, higher levels (>60% capacity) over summer/autumn
Use of Goulburn Valley Account	At the start of July 2015, it is expected that there will be around 90 GL in the Goulburn Valley Account (from net trade out of the valley). If required, the Goulburn Valley Account water will be called by MDBA between December 2015 and April 2016. MDBA will liaise closely with the Goulburn-Broken CMA and Goulburn-Murray Water during the 2015–16 water year to adaptively manage MDBA requests for the delivery of water from the Goulburn to meet irrigation and environmental water demands along the River Murray, alleviate duration of high flows through the Barmah 'choke' and also, where possible, to meet the environmental aims along the Goulburn, Broken and Campaspe Rivers (see Section 5.4.2).					
Use of Murrumbidgee Valley Account	At the start of July 2015, it is expected that there will be around 10 GL in the Murrumbidgee Valley Account (from net trade out of the valley). If this volume increases substantially, the Murrumbidgee Valley Account water will be called by MDBA between December 2015 and April 2016, if required. If there are significant volumes of trade to the Murray then MDBA will liaise closely with NSW in regard to delivery rates and timing. It is possible that environmental water may be traded through the Murrumbidgee account and delivered at Balranald. In this event, the environmental trade volume would be called immediately upon the water being traded in and so would have a zero net effect on total volumes held within the Murrumbidgee account.					

River operations	Extreme dry	Dry	Moderate	Near average	Wet	Very wet
Operation of Weir pools (see Section 5.3 for details)	Lake Mulwala drawdown continuing in winter 2015. Mildura Weir pool to be reinstated in late July on completion of maintenance. Possible operational manipulations at all weirs.	Lake Mulwala drawdown continuing in winter 2015. Mildura Weir pool to be reinstated in late July on completion of maintenance. Possible operational manipulations at all weirs.	Some flood operations. Lake Mulwala drawdown continuing in winter 2015. Mildura Weir pool to be reinstated in late July on completion of maintenance. Possible operational manipulations at all weirs.	Some flood operations. Lake Mulwala drawdown continuing in winter 2015. Mildura Weir pool to be reinstated in late July on completion of maintenance. Possible operational manipulations at all weirs.	Flood operations. Lake Mulwala drawdown continuing in winter 2015. Mildura Weir pool to be reinstated in late July on completion of maintenance. Possible operational manipulations at all weirs.	Flood operations. Lake Mulwala drawdown continuing in winter 2015. Mildura Weir pool to be reinstated in late July on completion of maintenance. Possible operational manipulations at all weirs.
Lake Victoria Operating Strategy Cultural Heritage	Normal levels but may not fill	Normal levels but may not fill	Normal levels and likely to fill	Spilling between August and November	Spilling between July and November	Spilling for majority of year
	All scenarios: Operations will need to minimise the length of time that the Lake Victoria level is high. Lake levels will need to be consistent with the LVOS. Under wetter scenarios it may be possible to hold Lake Victoria at lower levels, if unregulated flows to South Australia are persisting.					
Lake Victoria 250 GL reserve at end May 2015 (Section 5.10)	Expected to require additional release from upper storages. May not be able to be met.	Expected to require additional release from upper storages. May not be able to be met.	May require additional release from upper storages. Likely to be able to be met.	Able to be met	Able to be met	Able to be met

Table 5: Summary of significant environmental operations under each scenario

Environmental operations	Extreme dry	Dry	Moderate	Near average	Wet	Very wet
Assumed environmental water release from Hume	200–300 GL	300–500 GL	600–700 GL	300–500 GL	300–500 GL	50–200 GL
River Murray Increased Flows held in Snowy Storages in 2015–16	~440 GL	~440 GL	~440 GL	~440 GL	~440 GL	~440 GL
Assumed environmental water release from tributaries	Goulburn River ~250 GL Murrumbidgee River ~0 GL	Goulburn River ~400 GL Murrumbidgee River ~0 GL	Goulburn River ~400 GL Murrumbidgee River ~0 GL	Goulburn River ~350 GL Murrumbidgee River ~0 GL	Goulburn River ~350 GL Murrumbidgee River ~200 GL	Goulburn River ~250 GL Murrumbidgee River ~200 GL
Barmah–Millewa Environmental Water Allocation In all scenarios the water may not need to be used and some may be carried over to the following year.	~360 GL in EWA. May be borrowed and partially not available.	~440 GL in EWA. May be partially borrowed. NSW and Victorian shares become partially available. Flow triggers are not met.	~460 GL in EWA. Both NSW and Victorian shares become available but triggers for release not met due to insufficient 'useable component' in B-M EWA. However amendments for trigger may occur.	~460 GL in EWA. Both NSW and Victorian shares become available but triggers for release not met due to insufficient 'useable component' in B-M EWA. However amendments for trigger may occur.	~460 GL in EWA. Possible spill of B-M EWA. Both NSW and Victorian shares become available and triggers for release not met due to insufficient 'useable component' in B-M EWA, however amendments for trigger may occur.	~510 GL in EWA. Possible spill of EWA. Both NSW and Victorian shares become available. Triggers for release not met due to insufficient 'useable component' in B-M EWA, however amendments for trigger may occur.
Below minimum flow/height levels	Not expected to be required	Not expected to be required	Not expected to be required	Not expected to be required	Not expected to be required	Not expected to be required
Lower Lakes	Water levels will be managed, where possible, to remain above 0.5 m AHD, consistent with the CEWO watering schedule for 2015–16.	Operations, where possible, will vary lake levels between 0.50 and 0.85 m AHD to assist reducing salinity at Lake Albert, however wind and tidal affects may result in water levels outside of this range. Release to the sea through Barrages should target at least 2,000 ML/day for as many days as possible to manage salinity levels in the Coorong and to assist with maintaining an open Murray Mouth.				

Environmental operations	Extreme dry	Dry	Moderate	Near average	Wet	Very wet
River salinity	Environmental entitlement holders will assess salinity risks of watering activities and, if required, use additional environmental water to boost dilution in the few months after any significant overbank flow event in the lower River Murray.					
Overbank flows and flooding	In channel flows	Chance of overbank flow into central Murray forests, otherwise in channel	Increased chance of overbank flows into central Murray forests	Extensive overbank flows into central Murray forests and some other parts of the River Murray System	Extensive and prolonged overbank flows along large sections of River Murray System	Extensive and prolonged flooding along large sections of the River Murray System
South Australian Lower Murray Irrigation Area (LMRIA) Acid Drainage	Potential for water quality problems from acid drainage during summer and autumn if flow to SA is close to or less than the entitlement flow and when the flow over Lock 1 is less than 2,500 ML/day (target based on current SA modelling).			Sufficient dilution from Additional Dilution Flow and unregulated flow is likely to prevent most water quality issues associated with acid drainage. However potential water quality problems from acid drainage during summer and autumn remain due to increased chances of lower flow conditions.		
Blackwater	Potential for localised blackwater event.			Potential for significant blackwater event with very low dissolved oxygen levels. MDBA may call on Murray Irrigation escapes and co-ordinate environmental water releases where possible to provide dilution		
Chance of blue-green algal blooms along river	There is always a chance of blue-green algal blooms forming somewhere along the River Murray System. Algal blooms generally form during the summer and persist into autumn and have been observed in both high flow and low flow years, however the more extensive blooms have been observed more often during dry years. River Murray Operations may be able to assist in dispersing algal blooms in some weir pools with 'pulsed' flows on some occasions. However, this is not always feasible, particularly when water is scarce.					

5. System operations

5.1. Introduction

Water availability at the start of the season will be limited in Victoria and very limited in NSW, although carryover water will be available to many entitlement holders. Lower Darling water availability is expected to be very limited due to the low storage levels in the Menindee Lakes. South Australian entitlement holders have 100% water availability although full entitlement flow is not assured under the extreme dry scenario. It is expected that there will be limited irrigation demand in NSW unless there is significant winter and spring rainfall. In Victoria, irrigation demand could potentially be high, especially if conditions are dry. It is also expected that there will be significant use of environmental water and this is discussed further in Section 5.4.

MDBA storage levels were 25% below the long-term average for June. This, in combination with El Niño conditions, increases the likelihood of water availability being suppressed in 2015–16. Further information on the influence of El Niño can be found on the Bureau of Meteorology website. Despite the increased chance of drier conditions it is still possible that wetter conditions can occur and under these conditions it is possible that some parts of the River Murray System will experience overbank flows or flooding in 2015–16. This will be greatly influenced by the timing, location and intensity of rainfall events that cannot be forecast this far in advance. Further information on the potential for high flows and flooding is provided for each structure/reach in this section of the plan. However, as rain events unfold, the Bureau of Meteorology is responsible for issuing flood warnings for the River Murray System in NSW and Victoria, while the South Australian Department for Environment, Water and Natural Resources has the lead responsibility in South Australia.

5.2. No changes to minimum flow rates expected

As part of drought operations between 2006 and 2010, the minimum flows or river levels were temporarily reduced at some locations to conserve water (Table 6). During 2015–16 it is *not* expected that flows will need to be reduced below normal minimum targets unless there are unforeseen or emergency circumstances. However, depending on patterns of rainfall, irrigation demand, environmental watering and other circumstances, it is possible that flows close to minimum rates may occur for extended periods in the River Murray System upstream of the South Australian border.

Table 6: Minimum flow rates at key locations

Standing procedure	Normal minimum	Temporary minimum between 2006–2010
Minimum release from Dartmouth Reservoir	200 ML/day	200 ML/day
Minimum release from Hume Reservoir	600 ML/day	400 ML/day
Minimum target flow at Doctors Point	1,200 ML/day	800 ML/day
Minimum release from Yarrawonga Weir	1,800 ML/day	1,500 ML/day
Minimum flow at Edward River off take	100 ML/day	80 ML/day
Minimum flow at Gulpa River off take	80 ML/day	30 ML/day
Minimum release from Stevens Weir	150 ML/day	130 ML/day
Minimum river height at Swan Hill	0.6 m local gauge height	0.5 m local gauge height
Minimum River Murray contribution to release from Wentworth Weir	700 ML/day	700 ML/day

5.3. Weir pool level manipulation

Manipulation of water levels in weir pools may be implemented for a number of reasons including:

- the need to supply downstream water requirements when there are very hot conditions and demands are high
- to minimise evaporation rates
- to temporarily store water rather than allow it to pass downstream
- for construction and maintenance program
- to provide variation in water levels to minimise bank erosion
- for environmental benefit including the wetting and drying of adjacent wetlands.

In 2015–16, a number of weir pool level manipulations are planned and these plans are detailed below. Operational variations in weir pools that have occurred since 2005 (not including flood operations or major drawdowns) are outlined in Table 7. This table also provides indicative levels (in brackets) that have the potential to impact on water quality and access. If a weir pool needs to be raised or lowered outside its normal operating range then state agencies would be notified via the Water Liaison Working Group. The public would be notified through the River Murray Weekly Report and via media releases where appropriate.

Table 7: Operational variations in weir pool levels since 2005

Weir	FSL	Weir pool lowering	Weir pool raising
Lake Mulwala	124.9 m	30 cm (20 cm)	25 cm
Torrumbarry Weir (Lock 26)	86.05 m	40 cm (25 cm)	no surcharge
Euston Weir (Lock 15)	47.6 m	30 cm (25 cm)	40 cm
Mildura Weir (Lock 11)	34.4 m	10 cm (10 cm)	5 cm
Wentworth Weir (Lock 10)	30.8 m	10 cm (10 cm)	10 cm
Kulnine (Lock 9)	27.4 m	20 cm (25 cm)	25 cm (15 cm)
Wangumma (Lock 8)	24.6 m	80 cm (50 cm)	85 cm (40 cm)
Rufus River (Lock 7)	22.1 m	15 cm (15 cm)	25 cm
Murtho (Lock 6)	19.25 m	10 cm (8 cm)	40 cm (40 cm)
Paringa (Lock 5)	16.3 m	10 cm (8 cm)	50 cm (50 cm)^
Bookpurnong (Lock 4)	13.2 m	10 cm (4 cm)	30 cm
Overland Corner (Lock 3)	9.8 m	10 cm (3 cm)	20 cm*
Waikerie (Lock 2)	6.1 m	10 cm (8 cm)	50 cm (~50 cm)*
Blanchetown (Lock 1)[#]	3.2 m	10 cm (10 cm)	50 cm (~50 cm)*

Notes:
Values in brackets refer to weir pool level variations that may have significant impacts on river management such as water quality and water access.
^ Normal operating range up to 13 cm
* Normal operating range up to 30 cm
[#] Levels at Lock 1 are currently being managed around 10 cm below normal pool due to leakage issues.

Under high flow or flood events, such as those observed during 2010–12, many structures may be inundated or removed and, in such circumstances, the ability to undertake pool manipulations would be limited.

At end June 2015, Lake Mulwala was drawn down to about 121.2 m AHD, which is 3.5 m below its normal operating level. This drawdown has multiple aims including maintenance and remedial works at Yarrawonga Weir and along the foreshore, and also control of the exotic aquatic weed, *Egeria densa*. The lake is expected to be raised back to its normal operation range of 124.6–124.9 m AHD by late July. It is unlikely that another drawdown of Lake Mulwala will be required in 2015–16.

At Mildura Weir (Lock 11), the weir pool was drawn down in late May 2015 and the weir trestles removed for major maintenance and repairs. This work includes installing another five mechanised trestles and repairs to the steel tracks of the trestleway. In addition, the lock will be dewatered to allow inspection and repairs, including painting and seal replacement on the lock gates. The weir pool is expected to be returned to full supply level in late July and the lock is expected to re-open in September. MDBA, in consultation with the local community and industry groups, have timed this drawdown to coincide with lower irrigation and recreational demands during winter.

Torrumbarry Weir may be drawn down by up to 40 cm during winter 2015 and winter 2016, and possibly at other times of the year, to assist with meeting downstream demand if river flows are low.

Beginning in June 2015 and continuing throughout the year, the level of Euston (Lock 15) weir pool is planned to be raised during winter and spring, and lowered in autumn. It is expected that pool levels will increase by up to 60 cm above full supply level, with the highest levels planned for September and October. Over summer, the weir pool is expected to be close to full supply level. Commencing in March, the weir pool will be gradually lowered and reach about 30 cm below FSL in May–June 2016.

The environmental benefits of this weir pool level manipulation at Euston are expected to derive from the temporary inundation of Dry Lake and Lake Benanee: wetting and drying of fringing riparian vegetation, and faster-flowing water when the pool is lowered.

Manipulation of the weir pools at Locks 7, 8 and 9 in 2015–16 will focus on both weir pool raising and lowering. Weir pool raising benefits riparian vegetation and species such as frogs that rely on inundation, while weir pool lowering can benefit native fish by increasing the water velocity in the river channel to provide flow cues for spawning.

At Lock 9, it is proposed to increase the weir pool up to 25 cm above FSL in late winter but lower the weir pool to 10 cm below FSL during spring and summer. The weir pool is expected to be maintained close to FSL after March 2016.

At Lock 8, there is scope to have much greater variation in weir pool levels. Therefore, it is proposed to gradually raise Lock 8 weir pool up to 80 cm above FSL in late winter, followed by a gradual lowering to 80 cm below FSL by the end of the year. The weir pool level is expected to remain below FSL until May 2016.

Water levels in the weir pool upstream of Lock 7 are expected to be up to 50 cm above FSL by late winter, then lowered to 25–50 cm below FSL during summer. The weir pool at Lock 7 may also need to be raised at some times when the Lock 6 pool level is above full supply level. This raising of the weir pool at Lock 7 is to ensure an adequate flow velocity through the Lindsay River and Mullaroo Creek for maintenance of habitat for Murray cod.

These weir pool level manipulations at Euston and Locks 7, 8 and 9 are being coordinated by NSW Office of Water in consultation with MDBA, other state water authorities, Mallee CMA, environmental water holders and other government authorities. Weir pool levels will be closely monitored to ensure that these operations are not hindering other environmental water actions in the region. If necessary, these weir pools will be utilised to mitigate salinity spikes should any occur as a result of the Mildura weir pool drawdown. Further information on these weir pool manipulations will be provided in media releases and the MDBA Weekly Report.

The Chowilla floodplain works may be tested again in 2015–16. If so, the weir pools at Locks 6 and 7, and possibly also Lock 5, may need to be raised depending on the magnitude of flow to SA and the desired environmental watering scenario. As an example, “low floodplain inundation” on the Chowilla floodplain is possible when the flow to SA is 5,000–10,000 ML/day and, in this scenario, the weir pool at Lock 6 may be raised to about 40 cm above full supply level. In higher flow scenarios, the weir pool may be raised up to 62 cm.

At Lock 5, the weir pool may need to be raised during the potential testing of the Chowilla Floodplain infrastructure to ensure an adequate depth of water at the downstream entrance to the fishway at the Chowilla Regulator. Raising the Lock 5 weir pool is expected to be required

when the flow to SA is less than 15,000 ML/day. In these circumstances, the weir pool at Lock 5 is expected to be raised up to 15 cm above its full supply level.

The South Australian Department of Environment, Water and Natural Resources (DEWNR) and SA Water are planning to raise the weir pool levels at Locks 5 and 2 as part of the Riverine Recovery Project weir pool manipulation program. Water levels are planned to be raised from spring following a period of community consultation. This weir pool raising trial is being coordinated by DEWNR and is subject to ongoing reviews, impact assessment and community consultation.

The level of the weir pool at Lock 5 is planned to be raised by up to 50 cm above FSL during spring 2015 (noting this is 37 cm above the normal operating range of 16.3–16.43 m AHD). The raising is planned to commence in September with a gradual raising of the water level to 30 cm above FSL of 16.3 m AHD. The level would then be held steady for 1–2 weeks before gradually raising again up to 50 cm above FSL. The pool would be held steady at this level for 2–3 weeks before gradually lowering back to FSL by the end of November 2015. The event at Lock 5 will be monitored closely for rail beam vibration and this may limit the height of the manipulation.

The level of the weir pool at Lock 2 is planned to be raised by up to 50 cm above FSL during spring 2015. The raising is planned to commence in September with a gradual raising of the water level to 30 cm above FSL of 6.1m. The level would then be held steady for 1–2 weeks before gradually raising again up to 50 cm above FSL. These higher levels would occur during late September to mid-October. After 2–3 weeks at 50 cm above FSL, the weir pool would be gradually lowered to return to FSL by early December. Regular reviews, impact assessment and community consultation would be undertaken prior to, during and after the event.

The weir pool manipulation trials at Locks 2 and 5 are aimed at a broad spectrum of ecological outcomes, including improved lateral connectivity between the River Murray and the floodplain fringe, seedling recruitment of red gums and lignum, native fish breeding and temporary inundation of river red gum woodlands, black box woodland and ephemeral wetlands. More information on these trials is available on the SA Department of Environment, Water and Natural Resources website.

Weir pool water level variations along the River Murray are becoming an increasingly common feature of routine river operations. These trials enable greater hydrological variability to improve ecological outcomes along the River Murray.

5.4. Delivering environmental water

The scenarios in this plan rely on assumptions on the location and timing of water use along the river system. For irrigation and urban water supplies, there is a long history of use that can be analysed to develop forecasts under the different scenarios. However, at this stage, there is a limited history to assist in forecasting the use of recently acquired environmental water. As well, use will change as environmental works are completed, and in the longer term as constraints to the delivery of environmental water are reviewed and lifted. Environmental works are designed to make best use of water available for environmental use (both unregulated flows and regulated delivery of environmental allocations).

The scenarios in this plan are based on assumptions, after preliminary consultation with the Commonwealth and states, of how the environmental water may be used. Actual use will most

likely differ from the assumed use although the scenarios should give an indication of what may occur.

In 2015–16, most bulk environmental water delivery in the Murray is expected to be as a release of environmental water from Hume Reservoir. These releases would, where possible, follow a similar pattern to natural inflows (otherwise known as translucency flows). The releases are targeted at a broad-scale, low-level environmental watering event along the entire River Murray System all the way to the Coorong and Murray Mouth in South Australia. In the wetter scenarios, overbank flow into the Barmah–Millewa Forest will naturally occur which may then be supplemented by environmental water releases from Hume Reservoir.

Environmental water released from Hume Reservoir is expected to be used at multiple sites as it flows down the river system. For example, water released from Hume may be used to increase the flow through Gunbower Creek. Accounted return flows might then be pumped into the Hattah Lakes, with the remainder then contributing to higher flows into South Australia.

In the ‘wet’ and ‘very wet’ scenarios there may, at times, be limited opportunity to release environmental water due to very high flow rates and the risk of flooding. However, as in recent years, environmental water may be released at low flow rates to fill in gaps between high flow events, to ensure appropriate recession rates, to promote successful waterbird breeding and to provide flow variability to assist fish migration and spawning. Some environmental water may also be used to dilute blackwater (where low oxygen levels affect in-stream biota), if it occurs. In June 2015, the Basin Officials Committee approved the water accounting and delivery arrangements for such a broad scale environmental watering in 2015–16.

For all but the ‘extreme dry’ and ‘very wet’ scenarios in this Operating Plan, it is assumed that 300–700 GL of environmental water would be released from Hume Reservoir to support environmental watering actions at a range of sites. The environmental water has been assumed to be released, in the ‘near average’ and wetter scenarios, at relatively low flow rates following flood peaks, to primarily target low-lying floodplain wetland systems and also to provide water for The Living Murray projects which are planned to be, or have recently been, tested or commissioned.

Additionally, a second type of bulk environmental water delivery is possible. In this case, ‘normal’ trade will be used as the mechanism to supply South Australia with environmental water. This trade was a large component of environmental water delivery in 2012–13, 2013–14 and 2014–15. However, in 2015–16, this volume of trade is expected to be relatively small.

Environmental water reaching the River Murray from the Goulburn River system is expected to total about 250 GL in the ‘extreme dry’, and up to 400 GL in the ‘dry’ to ‘wet’ scenarios.

The flow to South Australia is expected to be boosted by environmental water volumes of approximately 200–850 GL. Most of this water is expected to cross the border in spring, with smaller volumes possible in autumn.

The Basin Officials Committee (BOC) has again approved the regulated release of water from Menindee Lakes (if available) during unregulated flows in the River Murray — to target higher environmental flow rates at the South Australian border.

The environmental water holders have also provided an indication of how some smaller parcels of water are expected to be used; however, these do not have a big impact on overall river operations. Further information can be found in the Victorian Environmental Water Holder's Seasonal Watering Plan 2015–16, on the Commonwealth Environmental Water Office website and in the Basin Environmental Watering Priorities 2015–16.

5.4.1. Release of environmental water from Hume Reservoir

Commencing in June 2015, and continuing through winter, spring and early summer, environmental water will be released from Hume Reservoir as part of a multi-site watering event. Up to 634 GL has been committed by the Commonwealth Environmental Water Holder to support environmental watering at specific sites along the river as well as boosting flows to better reflect natural flow regimes. Delivery of this water will be coordinated with other river operations. More information is available from the Commonwealth Environmental Water Office.

5.4.2. Environmental inflows from the Goulburn River

MDBA will, where possible, assist with the implementation of the Goulburn River Seasonal Watering Proposal for 2015–16 developed by the Goulburn-Broken Catchment Management Authority. This watering proposal aims *'to continue to pursue the vegetation and fish objectives by implementing minimum and fresh flows, particularly in winter and spring'.*

A minimum flow of 540 ML/day is being targeted at McCoys Bridge year-round, as well as 'freshes' (short periods of within-channel higher flows), especially during spring, to stimulate fish breeding and promote the establishment of vegetation prior to summer. A winter fresh to encourage bank vegetation and improve macroinvertebrate habitat is also desirable and planned for June 2015. Plans for an autumn and winter fresh in 2016 are also being considered.

Estimated environmental water volumes needed to support the watering proposal range from 250 to 400 GL (depending on rainfall and runoff). Additional water may also be used to achieve the proposal's objectives during 2015–16.

The environmental inflows to the River Murray from the Goulburn River during winter and spring (as described above) are also expected to provide ecological outcomes along the River Murray downstream of the confluence of the two rivers.

This plan also acknowledges and will, where possible, assist in the implementation of the lower Broken Creek Seasonal Watering Proposal for 2015–16 developed by the Goulburn-Broken Catchment Management Authority.

MDBA River Operations staff will liaise closely with the Goulburn Broken CMA and Goulburn-Murray Water during the 2015–16 water year to adaptively manage the delivery of inter-valley trade water from the Goulburn River to assist, where possible, meeting environmental objectives along the Goulburn and Campaspe Rivers and the lower Broken Creek.

5.4.3. Environmental inflows from the Murrumbidgee River

This plan acknowledges the potential for a significant inflow of environmental water from the Murrumbidgee River of up to 200 GL, if natural inflow triggers are met. Most of this environmental water is expected to enter the Murray in winter–spring with the primary objective of the event

being low level wetland inundation along the Murrumbidgee River. Where practical, this inflow would be coordinated with environmental releases from upstream as part of a possible broad-scale watering to provide a flow pulse to South Australia in spring.

MDBA River Operations staff will also liaise closely with Water NSW, the NSW Office of Water and the NSW Office of Environment and Heritage during the 2015–16 water year to adaptively manage the delivery of inter-valley trade and environmental water from the Murrumbidgee River.

5.4.4. Gunbower Forest watering

The Gunbower Forest, on the River Murray floodplain downstream of Echuca, is an internationally important river red gum wetland complex. Gunbower Forest works aim to increase the frequency of flooding of the river red gums in the mid-section of the forest. Water can be diverted from Gunbower Creek, through a channel into Spur Creek, to be ultimately dispersed through the forest. Water returns back to Gunbower Creek before re-joining the River Murray near Koondrook township.

Following natural flooding of the Gunbower Forest during 2010, 2011 and 2012, the forest was able to remain dry during 2013. Commissioning of the Gunbower Forest works commenced in late May 2014, and was successfully completed by December 2014.

Flows through Gunbower Creek recommenced in May 2015 and are expected to continue throughout the year. Of the total flow through the creek, the net use is expected to be about 19 GL, with the remaining volume returning to the River Murray for downstream users. For Gunbower Forest, about 20–25 GL of water will be delivered in spring, with a small volume returning to the River Murray.

Operation of the Gunbower Forest works are managed to ensure that irrigators are not impacted.

For more information see North Central CMA's Gunbower Forest page.

5.4.5. Further commissioning of Koondrook–Perricoota works

The Koondrook–Perricoota Forest in southern New South Wales is a large mosaic of river red gum, black box and grey box communities, interspersed by wetland ecosystems. The forest has many environmental, social, cultural and economic values. The environmental works at Koondrook provide an opportunity for water to be diverted into the upstream end of the Koondrook–Perricoota State Forest where it flows through the forest into the Wakool system. Structures located within the forest allow for some water to be returned directly to the River Murray, but only during very large watering events.

In 2014–15, there was a small-scale commissioning of works at Koondrook–Perricoota which tested the inlet structures, fishways, the inlet channel and two regulators using 26 GL of environmental water. This event inundated approximately 4,500 ha of creeks and wetlands.

In 2015–16, a similar scale commissioning of the works may be undertaken. The water will enhance last year's ecosystem outcomes with the inundation of large areas (up to 4,500 ha) of wetlands, creeks and fringing vegetation. These flows will assist the recovery of semi-permanent wetland communities and support healthy populations of resident native fish in the wetlands.

This Annual Operating Plan assumes that up to 25 GL of environmental water will enter the forest in the 'dry' to 'wet' scenarios, with no water returning to the Wakool River. In the 'very wet' scenario, the forest is likely to be flooded naturally; while in the 'extreme dry' scenario other sites are likely to have higher priority for limited environmental water.

5.4.6. Watering of Hattah Lakes

Hattah Lakes is a large floodplain and wetland system set within the Mallee landscape, consisting of shallow lakes, creeks and temporary swamps bordered by riverine woodlands. In 2013–14, 67 GL of environmental water was delivered to Hattah Lakes for the initial commissioning of structures and providing water to large areas of the lake system. Last year, approximately 100 GL of environmental water was delivered to facilitate the commissioning of all structures within the lakes, including the outlet regulators (Messengers and Oateys Regulators). Approximately 39 GL of environmental water was returned to the River Murray for downstream use.

The proposed environmental watering at Hattah Lakes in 2015–16 will build on the watering actions of the previous two years; by topping up water levels in semipermanent and temporary wetlands to support waterbird and fish breeding. Red gum forest and woodlands will be allowed to dry to encourage development of the understory.

In all scenarios in this Annual Operating Plan, except if the River Murray is naturally flooding, it is expected that up to 20 GL of water will be pumped into the Hattah Lakes. These inflows are expected to commence in September 2015 and continue until October. No water is expected to return to the River Murray from the Hattah Lakes system this year.

For more information see Mallee CMA's Hattah Lakes page.

5.4.7. Watering via Mulcra works

Lindsay–Wallpolla Islands are comprised of three adjacent anabranch systems in north-west Victoria: Lindsay (15,000 ha), Mulcra (2,000 ha) and Wallpolla (9,000 ha). The floodplain is relatively flat and dissected by a network of rivers, small creeks and permanent and ephemeral wetlands.

In 2014–15, there was a large-scale commissioning of the works at Mulcra Island, commissioning of three regulators at Lindsay Island and a number of discrete wetland watering actions. Between August and December 2014, water was diverted from the River Murray upstream of Lock 8 into the Potterwalkagee Creek anabranch. Using the newly-constructed regulators, this water was used to fill Horseshoe Lagoon and inundate the Mulcra floodplain. The watering improved the condition of wetland and fringing vegetation, including river red gums and lignum shrublands.

Further watering is planned for Mulcra and Lindsay Islands in 2015–16. Under dry scenarios, watering will focus on maintaining baseflows through Mullaroo Creek, the northern Lindsay River and Potterwalkagee Creek. Wetter conditions will enable freshes to be delivered through these waterways and more extensive wetland watering.

Commencing in August 2015, environmental water will be pumped to Lake Walla Walla. This pumping is expected to continue for 4–5 months and deliver up to 10 GL to the lake. This water is aimed to benefit the vegetation of the lakebed and provide breeding opportunities for frogs and waterbirds.

The volumes of environmental water use for other parts of the Mulcra works are expected to be up to 5 GL in all planning scenarios. For more information see Mallee CMA's Lindsay Island page.

5.4.8. Testing Chowilla floodplain works

The Chowilla floodplain is an environmentally significant area containing the largest stand of river red gum forest remaining in the lower River Murray. As well as diverse floodplain vegetation, the area includes temporary wetlands, lakes and billabongs that are connected by anabranch creeks during high river flows. These habitats support many waterbirds, frogs, fish and invertebrates, including rare and endangered species.

MDBA's The Living Murray program provided funds to construct a suite of works to enable large areas of the Chowilla Floodplain to be inundated when the flows in the River Murray would otherwise be insufficient. These works were completed early in 2014 and initial testing was undertaken during September–December 2014.

Further testing of the Chowilla infrastructure may be undertaken during spring 2015. This will involve using the Chowilla regulator to create an in-channel rise within Chowilla Creek. Pulsing flows down Slaney and Pipeclay Creeks would also be targeted to manage valuable flowing habitats and to enable the operation of new fishways to be optimised.

For more information see SA Department of Environment, Water and Natural Resources Chowilla page.

5.5. Snowy Mountains Scheme

Each year the Murray and Murrumbidgee Rivers receive water from the Snowy Mountains Scheme from releases for power generation. The annual volume of water to be released from the Scheme is outlined in Schedule F of the Murray–Darling Basin Agreement.

Assumptions have been made for inflows from the Snowy Mountains Scheme in each of the six scenarios but for commercial reasons relating to electricity markets it is not appropriate to disclose these in this document.

5.6. Dartmouth Reservoir

Key considerations when operating Dartmouth Reservoir are the holding of reserves for later years and the transfer of water to Hume Reservoir within the channel capacity of the Mitta Mitta River. Based on the storage level on 1 June 2015, indicative storage volume and releases for Dartmouth Reservoir under the six scenarios are shown in Figure 7 and Figure 8.

During 2014–15, the storage in Dartmouth Reservoir reached 96% capacity in mid-September. After this date, Dartmouth storage volume gradually decreased as bulk transfers of water to Hume Reservoir continued for much of the water year. Bulk transfers of water from Dartmouth aim to ensure there is sufficient water in Lake Hume during summer and autumn to meet

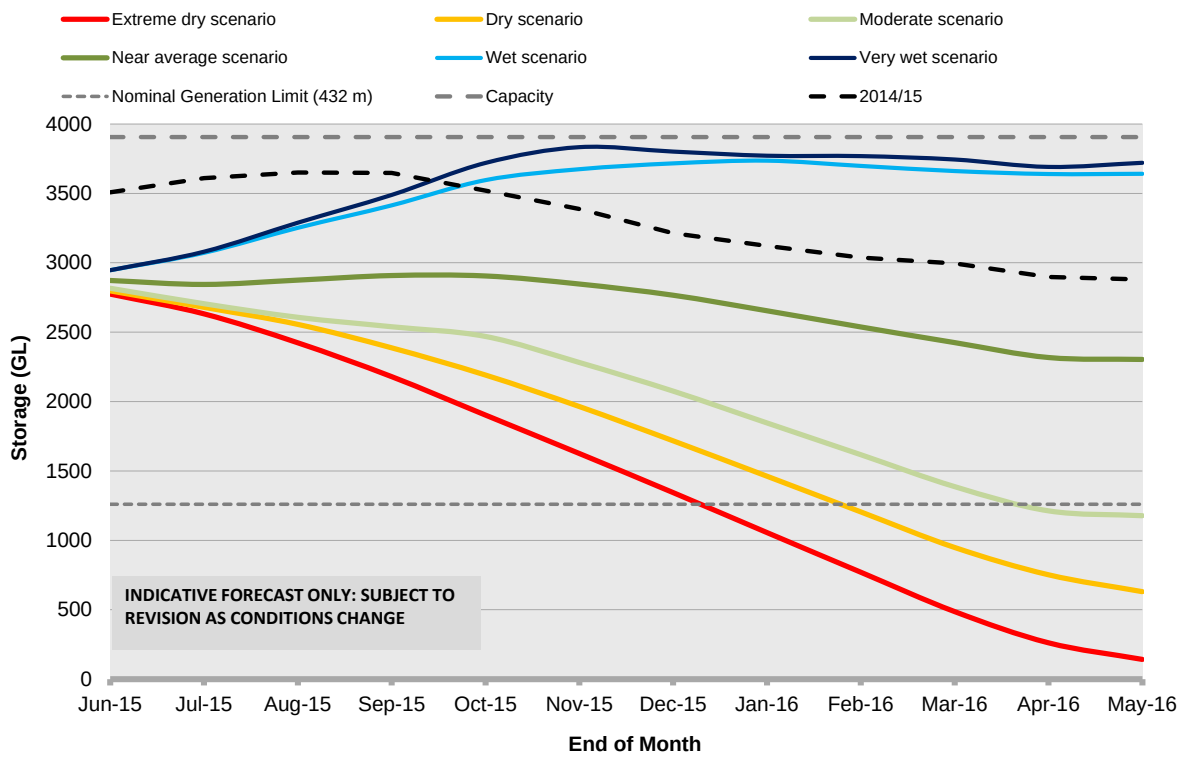

Figure 7: Dartmouth Reservoir storage outlook

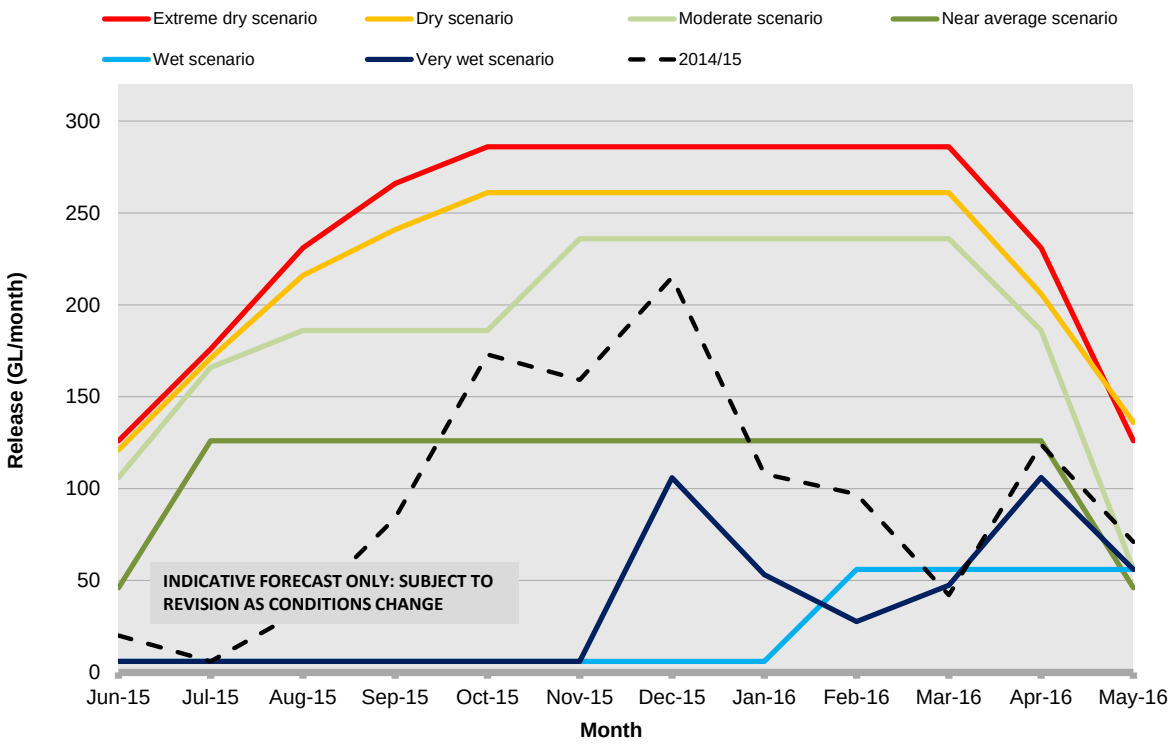

Figure 8: Dartmouth Reservoir release outlook

downstream demands. Where operationally possible, these transfers are managed for environmental and community benefit. The total volume released from Dartmouth Reservoir during 2014–15 was around 1,130 GL. There were limited periods during 2014–15, all prior to mid-August, when releases from Dartmouth were at the minimum flow rate of 200 ML/day.

When storage in Dartmouth is high, 'harmony' transfers to Hume Reservoir may be made to provide the Mitta Mitta Valley with higher in-channel flows and increased flood protection for the following year. Harmony transfers can also benefit the operations of the Dartmouth power station and the recreation and tourism at Lake Hume through raised lake levels over summer and autumn. Transfers are calculated to give the two storages about the same chance of filling in the future.

Pre-releases from Dartmouth Reservoir are considered in conjunction with the operation of Hume in its spilling or flood phase and may be required in 2015–16 if conditions are wet. Pre-releases at Dartmouth should not unnecessarily reduce Hume's share of the total available airspace, or aggravate flooding if it is already occurring downstream of Hume.

In 2015–16, if required, priority will be given to providing airspace in Hume Reservoir in view of the large flood mitigation capacity afforded by the free overflow spillway of Dartmouth Dam (note that much less flood mitigation is possible at Hume as storage levels approach full supply level). For more information on flood management at Dartmouth Dam see MDBA's Flood management at Dartmouth Dam page.

Under the 'very wet' scenario, the storage is expected to effectively fill (99% capacity, 3,817 GL), and this may result in 20–200 GL of spill before January 2016. Beyond this date, the 'wet' and 'very wet' scenarios assume harmony transfers to Hume Dam for the remainder of the water year.

Under the 'near average' and drier scenarios, inflows will not be sufficient to fill Dartmouth Reservoir. Under these scenarios, it is expected that 'bulk' releases (where transfers from Dartmouth to Hume Reservoirs are needed to meet demand downstream of Hume) would be required in 2015–16.

Under the 'extreme dry' scenario, there may need to be up to 2,800 GL released from Dartmouth and the storage volume could reduce to about 5% capacity by the end of the year. In this 'extreme dry' scenario, inflows are set low and the demand has been set high.

Where possible, any significant releases or transfers from Dartmouth to Hume Reservoir will be made as a series of pulsed releases following the environmental guidelines developed by MDBA and Charles Sturt University, to enhance the ecological values of the Mitta Mitta River.

The pulsed releases, where required, will aim to be less than 7,000 ML/day; but higher releases of up to 10,000 ML/day at Tallandoon cannot be ruled out, particularly under very dry scenarios. Both the timing and release rates from Dartmouth will be greatly dependent on inflow and usage patterns and the storage volume in Hume Reservoir.

5.7. Hume Reservoir and flow at Doctors Point

Hume Reservoir is the primary regulating structure in the River Murray System. Hume is used to store inflows from the upper Murray catchment as well as water released from the Snowy Mountains Scheme and Dartmouth Reservoir. This water is then released as needed, supplemented by downstream tributary inflows, to meet the consumptive and environmental needs of NSW, Victoria and South Australia.

At the end of May 2015, Lake Hume was around 25% full and catchments of the upper Murray were relatively dry. Therefore, above average inflows will be needed for Hume to spill in 2015–16. However, the timing and duration of flood events cannot be predicted this far in advance. The flow rates presented in this plan (for example at Doctors Point in Figure 10) are daily average flows over the month and therefore do not reflect what may occur on a day to day basis with flood peaks.

Based on the storage level on 31 May 2015, indicative storage volumes for Hume Reservoir under the six scenarios are shown in Figure 9. Under the 'wet' and 'very wet' scenarios, Hume Reservoir will be effectively full (99% capacity) before high demand for water begins (irrigation and/or environmental requirements) at the start of the 2015–16 irrigation season.

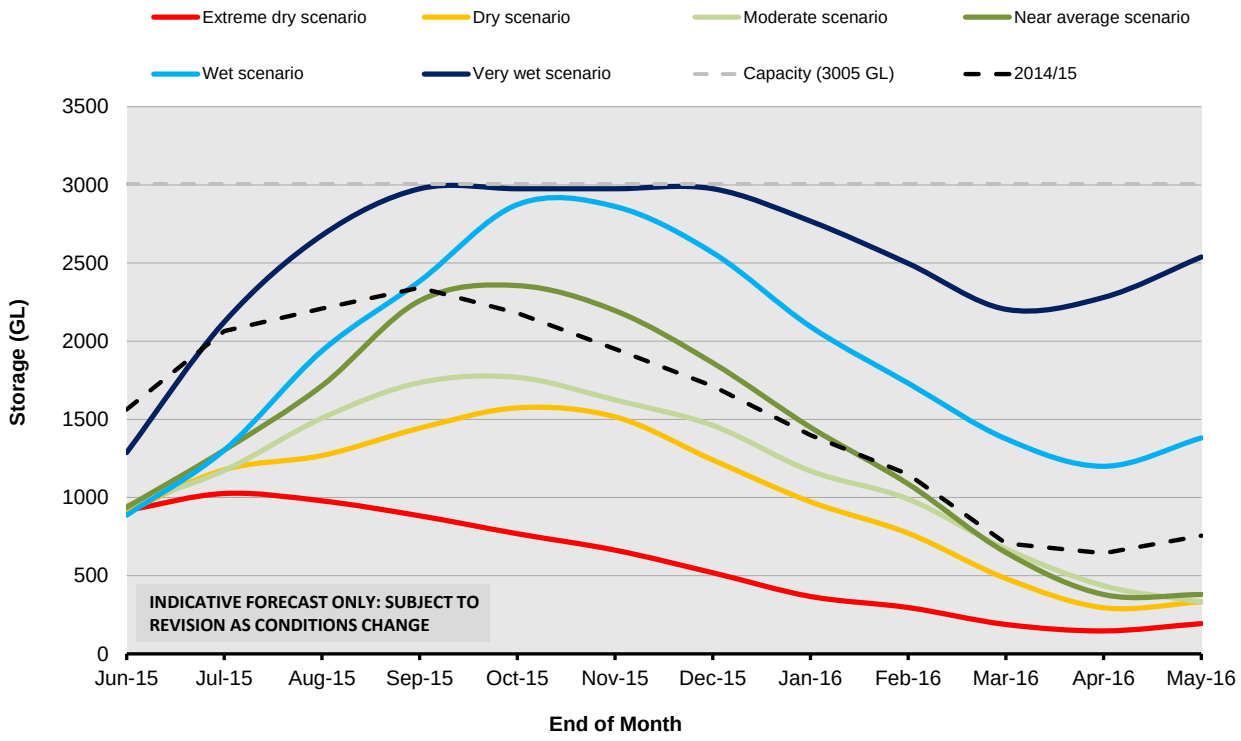

Figure 9: Hume Reservoir storage outlook

There is almost no ability to surcharge the storage under normal flood operations and therefore, under wetter scenarios, a small volume of airspace will be maintained to assist in protecting downstream communities from damage caused by moderate to major floods. This will be achieved by passing smaller flow events though Lake Hume, with possibly little or no attenuation, if rainfall and streamflow conditions show this to be prudent. Such an operation aims to provide improved flood mitigation outcomes in any subsequent larger flood event. For the rare but very large floods, there is virtually no flood mitigation as flow in is very nearly the same as flow out. More information on flood management at Hume Dam can be found on the MDBA website.

In the 'moderate' and drier scenarios, Hume is not expected to fill and may be at or below 10% capacity by May 2016.

The flow at Doctors Point, in the Murray downstream of Hume Reservoir and the Kiewa River, is expected to be, on **average**, below channel capacity downstream of the dam (25,000 ML/day) in all cases except the 'very wet' scenario (Figure 10). An average release of 15,000–

20,000 ML/day is expected over summer in most cases. However, with no water available from the Menindee Lakes, flows near channel capacity rates may be required for short periods if demand is unusually high.

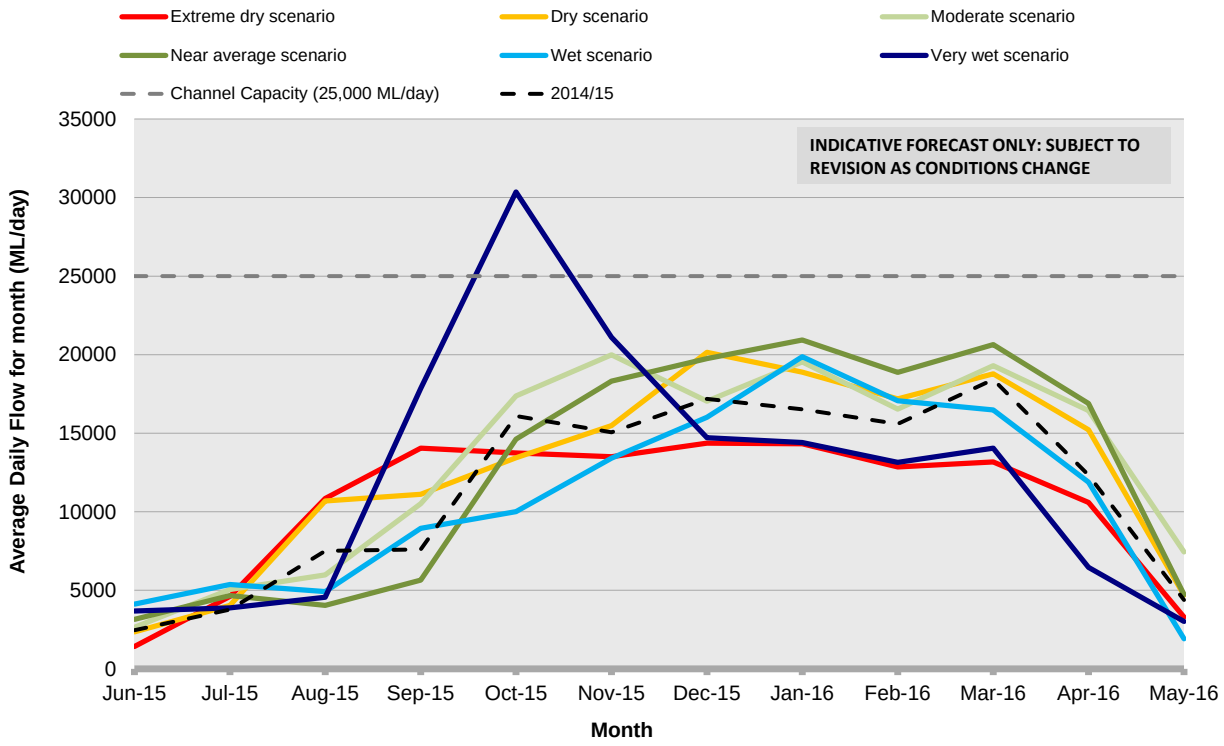

Figure 10: Hume reservoir release outlook—flow at Doctors Point

Note: flow rates are an average daily flow within the month and do not represent peak flow rates.

Commencing in June 2015, and possibly continuing until January 2016, there will be releases of up to 650 GL of environmental water from Hume Reservoir. Some of this water may be used to support watering of the Barmah–Millewa Forest (see Section 5.8.1 below); however a large proportion will be released from Hume at modest rates of up to an additional 10,000 ML/day, following natural inflow cues where operationally possible. These 'translucent' releases of environmental water will be managed to ensure that the flow at Doctors Point does not exceed 25,000 ML/day and the flow downstream of Yarrawonga does not exceed 15,000 ML/day.

5.8. Lake Mulwala and the Barmah Choke

The 'Barmah Choke' is a section of the River Murray (between Yarrawonga and Torrumbarry Weirs) that has the lowest capacity of any section of the river downstream of Hume Dam. The Barmah Choke is within an area of high ecological value: the Barmah–Millewa Forest.

Releases from Lake Mulwala, through Yarrawonga Weir, in excess of about 10,000 ML/day are sufficient to cause over-bank flooding within the forest. When 'in channel' flows are occurring, about 2,000 ML/day of the 10,000 ML/day is directed to the north via the Edward River and Gulpa Creek; with the remainder (about 8,000 ML/day) flowing south along the Murray past Picnic Point and towards Echuca.

5.8.1. Winter and spring

The level in Lake Mulwala at the end of May 2015 was 3.2 m below full supply level with the lake level expected to be held at about 3.7 m below FSL for most of June and July. This lowering was undertaken to facilitate maintenance works at Yarrawonga Weir and along the foreshore of Lake Mulwala, as well as to assist with control of the aquatic water weed *Egeria densa*. Gradual refilling of Lake Mulwala is expected to commence in July, to enable filling of irrigation channels as required. The lake will be close to its normal operating level of 124.7 m AHD in time for the irrigation season in August.

In most scenarios, the additional 'translucent' release of environmental water from Hume Reservoir may increase the flow through the Barmah Choke above channel capacity throughout much of late winter, spring and early summer, but these managed flows are planned to remain less than 15,000 ML/day release from Yarrawonga Weir.

If there is a significant unregulated overbank event in the Barmah–Millewa Forest at some stage during winter/spring, these high flows may be followed up with environmental water from Hume Reservoir to provide a gradual recession during spring and early summer. As such, the storage volume in Lake Mulwala and the release from Yarrawonga Weir during spring and early summer will be managed, where possible, to assist in achieving these environmental outcomes whilst meeting other diversion commitments. This managed watering of Barmah–Millewa Forest is most likely to occur in the 'wet' and 'very wet' scenarios, but is also possible under drier conditions (Figure 11).

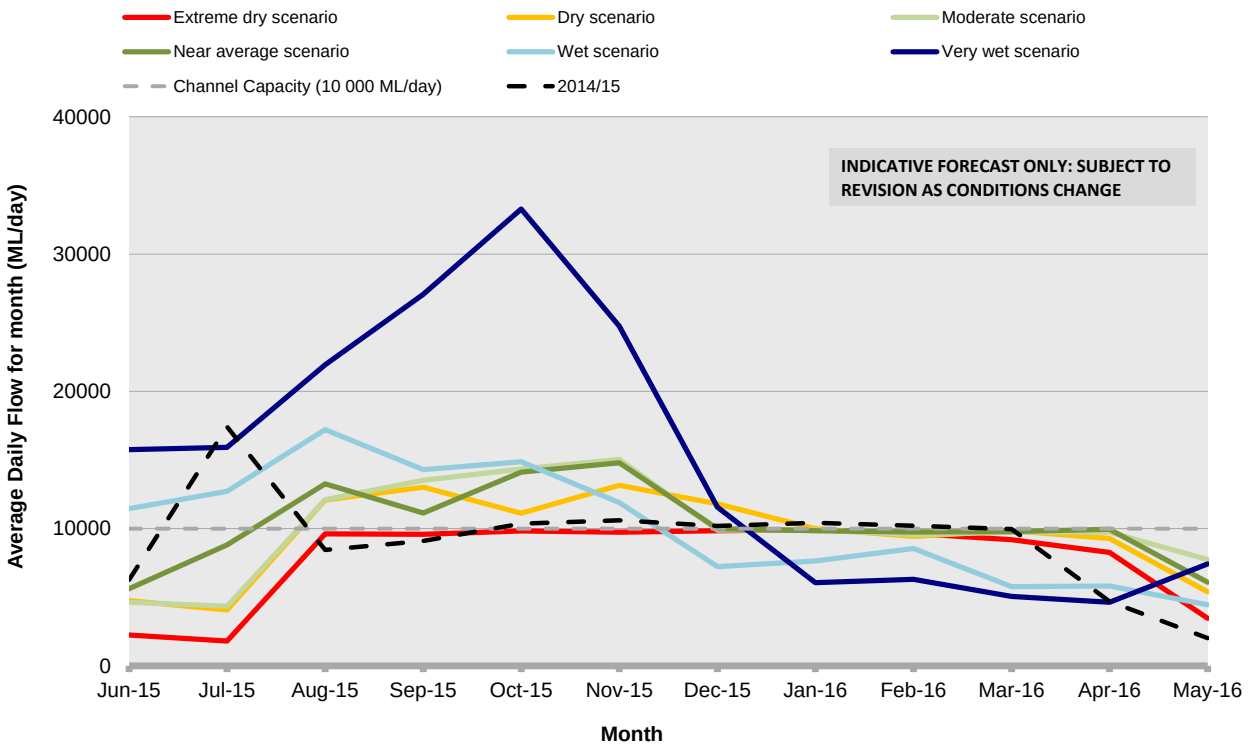

Figure 11: Yarrawonga Weir release outlook

Note: flow rates are an average daily flow within the month and do not represent peak flow rates.

As in other years, it is expected that the environmental flows will mainly focus on maintaining critical flows after flood peaks, providing flow pulses to assist fish spawning and migration, implementing a gradual recession of flows to minimise bank slumping and allowing waterbirds to complete breeding cycles.

During larger overbank flow events, the level of Lake Mulwala and releases from Yarrawonga Weir will be managed in accordance with flood operating procedures, again being mindful of the environmental water proposals and the potential release of the Barmah–Millewa Environmental Water Allocation. Generally speaking, large inflow events can be expected to be passed 'straight through' Lake Mulwala in winter/spring with little mitigation as is the normal practice.

5.8.2. Summer and autumn

In summer and autumn 2015–16, it is expected that Lake Mulwala will be operated within its normal operating range (124.6 to 124.9 m AHD) during the irrigation season. A drawdown of Lake Mulwala is not planned for 2015–16. If, however, drawdown becomes necessary, MDBA will advise the community of any pool lowering via media releases and through our River Murray Operations Weekly Report.

The restricted channel capacity through the Barmah Choke limits the amount of water that can be delivered downstream (e.g. to the Torrumbarry Irrigation Area, Sunraysia, and South Australia). Choke capacity could be an issue during 2015–16 if demands are high and tributary inflows (excluding environmental water) downstream of the Barmah Choke (e.g. from the Goulburn and Murrumbidgee Rivers) remain low. The risk of a shortfall in supply is increased when there is little water available in the downstream storages (Lake Victoria and the Menindee Lakes).

In all scenarios, it is expected that the release from Yarrawonga Weir will generally be at or near channel capacity at the Barmah Choke for extended periods from January 2016 onwards, when flooding of the forest is undesirable. These high flow rates increase the chances of summer flooding in the forest if there is a rainfall event that leads to a 'rain rejection' of ordered water. If there are summer inflow peaks or rain rejection events they will be mitigated, as per past practice, when flooding of the forest is not desirable (i.e. there is a potential to increase the lake level to 125.15 m AHD for short periods, a potential to draw down lake levels to 124.5 m AHD prior to rain events and also to utilise irrigation canals where possible).

Under all scenarios, flows downstream of Lake Mulwala will fall to 8,000 ML/day or less when inflows downstream of the lake are sufficient to meet all demands. This may also happen for short periods due to increased demand at Lake Mulwala or for longer periods if there is sufficient inflow to Menindee Lakes to satisfy demand downstream of Wentworth Weir and hence reduce the need for release from the upper Murray storages.

The lower target flow rates downstream of Yarrawonga Weir have the potential to affect some recreational users further downstream as river levels would be lower. MDBA will have regard to the requirements of recreational users and will aim to meet those requirements where they align with meeting other objectives but cannot guarantee river levels for recreational use. Recreational water users are encouraged to check flow forecasts on the MDBA website when planning their activities. Further information on recreation is also available on the MDBA website.

In all cases over summer and autumn, flows less than channel capacity will be targeted, if possible, to mitigate against rainfall rejection.

MDBA will continue to undertake monthly reviews of the relaxation of the rule preventing trade of allocations from above to below the Choke. With no water currently available to MDBA in Menindee Lakes, the normal restrictions to trade across the Choke will remain in place until seasonal conditions and demands allow.

5.9. Euston Weir flow

At Euston Weir, below the confluence of the Murray and Murrumbidgee, flows are not expected to exceed a monthly average of 17,000 ML/day in the 'moderate' and drier scenarios in 2015–16 (Figure 12). In the 'near average' and wetter scenarios, natural freshes and flood events occur upstream in the Murray, Goulburn and/or Murrumbidgee which then flow through Euston Weir. In all scenarios except the 'very wet', the monthly average flow at Euston is expected to be 10,000 ML/day or less from January to May 2016.

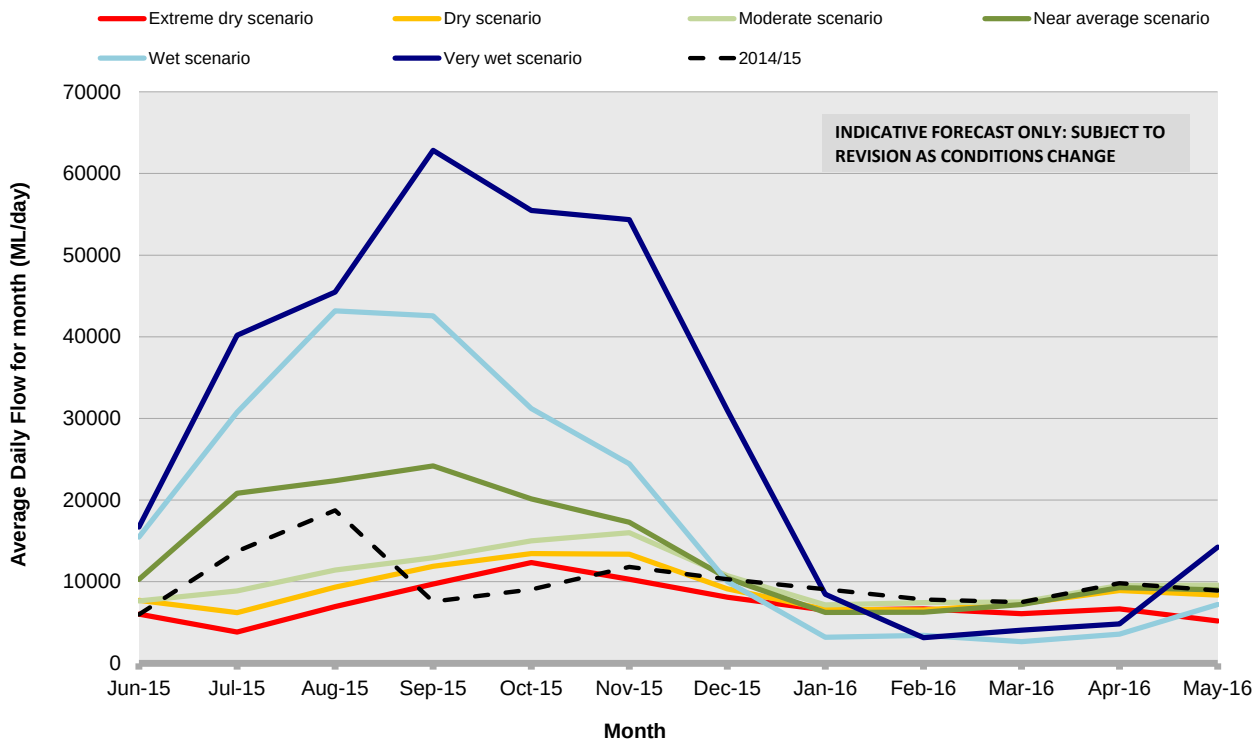

Figure 12: Euston Weir flow outlook

Note: flow rates are an average daily flow within the month and do not represent peak flow rates.

5.10. Lake Victoria

A critical consideration that influences the use of Lake Victoria is that it must be operated and managed to minimise disturbance to Aboriginal cultural heritage material and any burials that may be exposed by erosion of the foreshore must be protected. MDBA will aim to fulfil the intent of the Lake Victoria Operating Strategy (LVOS) (MDBC, 2002) and the Lake Victoria Cultural Landscape Plan of Management (revised 2007) that are required by the Aboriginal Heritage Impact Permit issued by the NSW Office of Environment and Heritage.

The LVOS requires the period of time that the water level in Lake Victoria is held high to be minimised. The LVOS aims to minimise erosion at high lake levels and allow for revegetation to

protect important cultural heritage. However, in some circumstances such as when MDBA cannot call on water from the Menindee Lakes, water security assumes a higher priority and the levels in Lake Victoria may exceed the storage values recommended in the LVOS.

Lake Victoria is expected to effectively fill (if not by tributary inflows then by bulk transfers from Hume) at some stage during the spring/early summer under most scenarios (Figure 13). The storage is expected to be in excess of 24.5 m AHD (≈400 GL) by mid-June 2015 and then be filled as late as possible as recommended by the LVOS. In the 'very wet' and 'extreme dry' scenarios the lake may not be filled. The lake is expected to be gradually drawn down during autumn in a manner that is consistent with the LVOS.

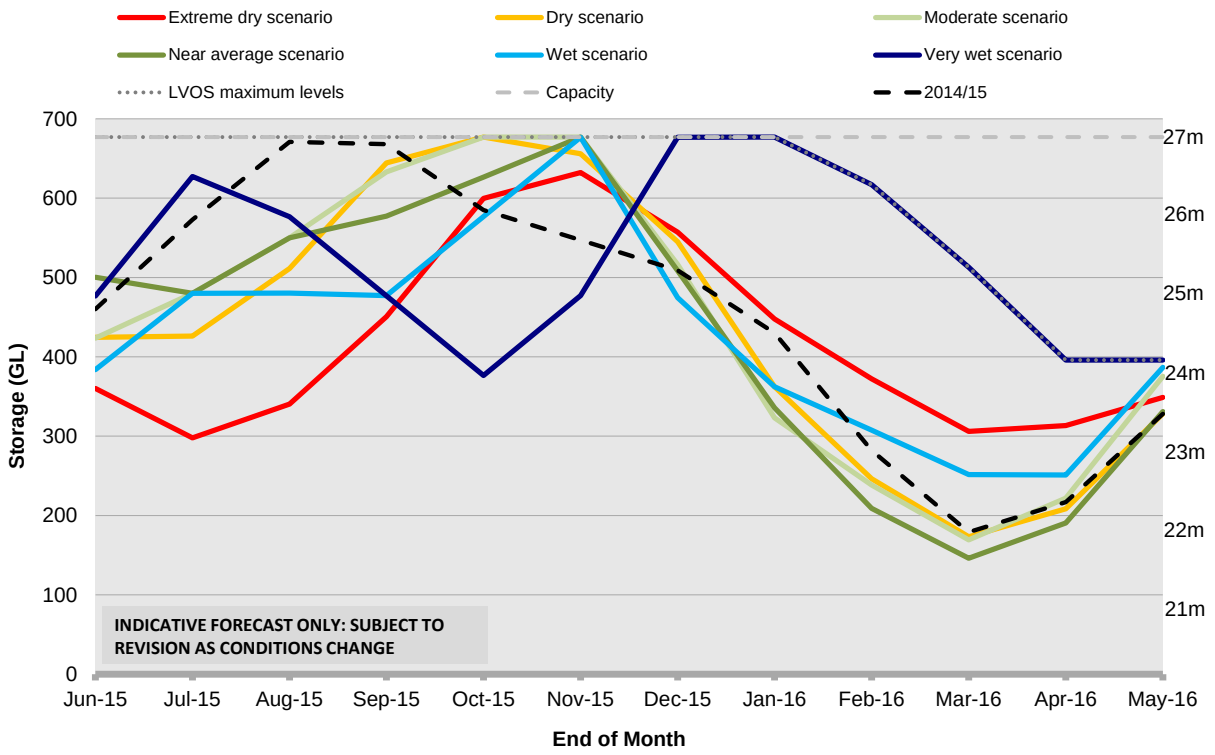

Figure 13: Lake Victoria storage outlook

Clause 103 of the M-DB Agreement requires that the first 250 GL of minimum reserve be held in Lake Victoria at the end of each May. Current planning indicates that this could be implemented under all scenarios, however, to save water under an 'extreme dry' scenario or for other operational reasons, MDBA may seek Ministerial Council approval to store some of this reserve in upstream storages.

5.11. Menindee Lakes

At 1 June 2015 the Menindee Lakes had a stored volume of 73 GL. Under the 'moderate' and drier scenarios, the plan assumes no inflows throughout 2015–16. Higher inflows are assumed in the wetter cases from July onwards (Figure 14).

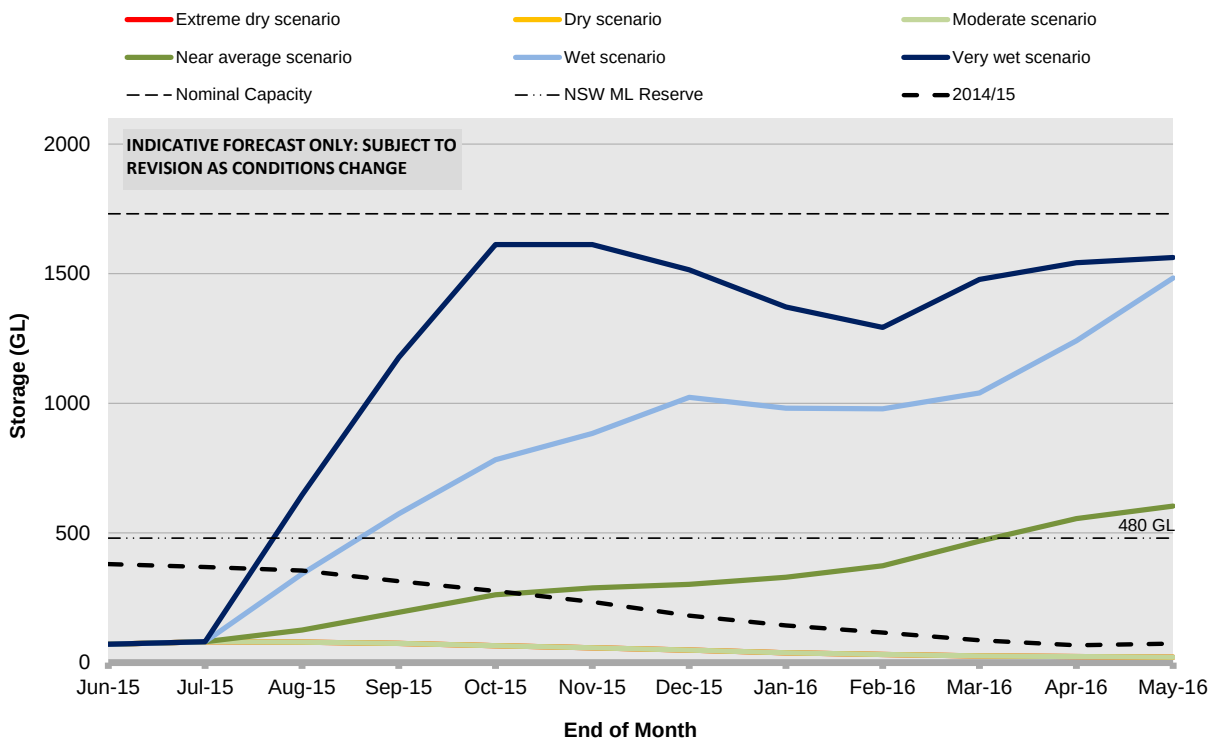

Figure 14: Menindee Lakes' storage outlook

Note: No inflow has been assumed in the three driest scenarios and therefore the red and yellow lines are hidden by the light green moderate scenario.

Under the 'wet' and 'very wet' scenarios, Menindee Lakes may be in flood operations and be surcharged for considerable periods of time over the coming year, noting that the lakes should not be surcharged (due to flood risk) between 1 January and 1 March unless the flow at Weir 32 would otherwise exceed the downstream channel capacity of 20,000 ML/d. Under the 'wet' and 'very wet' scenarios it may be necessary to draw the lakes down to FSL by the end of December, even though such releases would spill at Lake Victoria.

As a general practice, further inflows to Menindee Lakes can be expected to be stored preferentially in Lakes Wetherell and Pamamaroo (up to their surcharge level) then in Lakes Menindee and Cawndilla. Under the 'near average' and drier scenarios, the lakes will remain below 640 GL such that no water would be able to be accessed by MDBA for the River Murray System. Under these conditions the storage in Menindee Lakes would be managed solely by Water NSW to safeguard local water supplies.

It should be noted that inflows to Menindee Lakes are often not 'aligned' to conditions across the headwaters of the Murray. It is therefore quite conceivable that one system can have wet conditions whilst the other is dry. Operations will be adjusted accordingly noting that priority is generally given to first draw water from Menindee Lakes before other headwater storages.

5.11.1. Releases from Menindee Lakes

Releases, if any, from Menindee Lakes (Figure 15) to the lower Darling River, will be attributed to the respective allocations of NSW and Victoria according to Clause 120 of M-DB Agreement. If the volume stored in the Menindee Lakes exceeds 640 GL at some time during 2015–16, MDBA

will be able to use water to supply the River Murray System until the storage volume next falls to 480 GL. In accordance with the provision of the M-DB Agreement that have been endorsed by all Basin jurisdictions, the agreed operation of Menindee Lakes is to use the water in this storage in preference to the storages upstream, such as Hume and Dartmouth, due to higher evaporation and loss rates at Menindee.

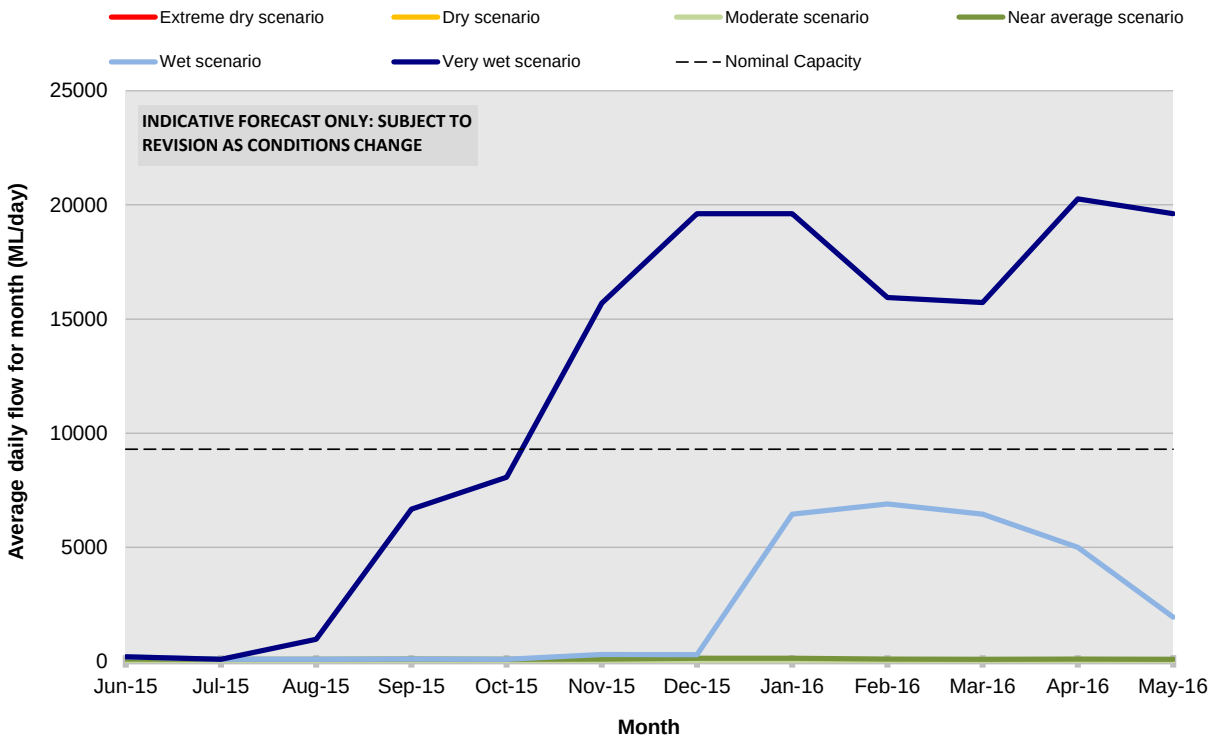

Figure 15: Menindee Lakes' release outlook

Note: flow rates are an average daily flow within the month and do not represent peak flow rates. No inflow has been assumed in the three driest scenarios and therefore the red and yellow lines are hidden by the light green moderate scenario

If the volume stored does not exceed 640 GL, the water in Menindee Lakes will remain under the sole management of NSW and will be used to supply urban water to Broken Hill and Menindee and, potentially, to supply Lower Darling irrigators. Local water availability for Lower Darling entitlement holders will continue to be determined by NSW Office of Water in accordance with NSW policy.

If accessible to MDBA, Menindee Lakes will be operated in conjunction with Lake Victoria, aiming to reduce evaporative losses whilst minimising the chance of spill from Lake Victoria. Further considerations affecting the operation include the need to protect cultural heritage at Lake Victoria as well as longer-term security of water supply in the Lower Darling and for Broken Hill should there be a return to extreme dry conditions. Releases may be capped at rates where only releases from Lakes Menindee and Cawndilla are made. Harmony transfers may be released in a variable pattern in order to benefit the ecology of the Lower Darling River.

If Menindee Lakes are surcharged, the average minimum release of 500 ML/day (compared with 200–350 ML/day when Menindee is not surcharged) will be targeted until higher releases are needed for demand or triggered by the 'harmony' procedures between Menindee Lakes and Lake Victoria. These procedures set out 'trigger' storage volumes in Lake Victoria for the end of each

month (Table 8). If Lake Victoria storage is forecast to be below these volumes, then water may be released from Menindee Lakes to transfer to Lake Victoria.

Table 8: End of month 'trigger' storage volumes (GL) in Lake Victoria

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
660	500	140	180	180	180	180	340	500	680	680	680

The actual releases made from Menindee Lakes, and the subsequent levels in Lake Victoria, will consider demands for water in South Australia and also the needs of the Lake Victoria Operating Strategy (LVOS).

Additional Dilution Flow (ADF) may also influence the operation of Menindee Lakes and Lake Victoria. ADF aims to reduce river salinities in South Australia without significantly impacting on water availability. The intent of the rules is a ‘use it or lose it’ principle whereby additional water is delivered to South Australia rather than be lost as evaporation from Menindee Lakes. The ADF procedures have a set of triggers described below:

South Australia will receive 3,000 ML/day above the daily equivalent of the monthly entitlement flow, whenever both of the following conditions are satisfied:

a. the storage in Menindee Lakes exceeds the volumes within the given month as listed under trigger storage below (Table 9); and
b. the combined storage in Hume and Dartmouth Reservoirs exceeds 2000 GL.

Table 9: Volume (GL) in Menindee Lakes required to trigger Additional Dilution Flow

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1300	1300	1300	1300	1300	1650	1650	1500	1300	1300	1300	1300

The duration of ADF over the coming year will be driven by a number of factors, including:

- inflows from the entire River Murray System
- diversions by the upper states
- the flow to South Australia
- environmental water demand in South Australia
- inflows to, and releases from, Menindee Lakes
- the impact of these factors on storage volumes at Lake Victoria and Menindee Lakes.

Generally, regulated release rates from Menindee Lakes will aim to be below about 5,000 ML/day at Weir 32 to minimise river losses and to preferentially draw from Lakes Menindee and Cawndilla. However, regulated releases of up to 9,000 ML/day at Weir 32 may be implemented if required. In the ‘wet’ scenario, releases may exceed 9,000 ML/day due to inflows causing the lakes to spill. Flood releases are directed by NSW Office of Water and in general will pass inflows, whilst the lakes are close to full.

It is expected that water will be callable by MDBA from the Menindee Lakes only if significant flooding occurs in the upper Darling River. For planning purposes, these high inflows to the Menindee Lakes have been assumed in the 'near average' to 'very wet' scenarios.

5.12. Flow to South Australia

South Australia will have access to full entitlement flows for all of 2015–16 in all scenarios except the 'extreme dry' (Figure 16). Any water traded to South Australia will also be supplied. The flow to South Australia may also be boosted by Additional Dilution Flow (ADF) and unregulated flow in the wetter scenarios. In all cases, significant volumes of environmental water (300–850 GL) are also expected to be delivered to South Australia.

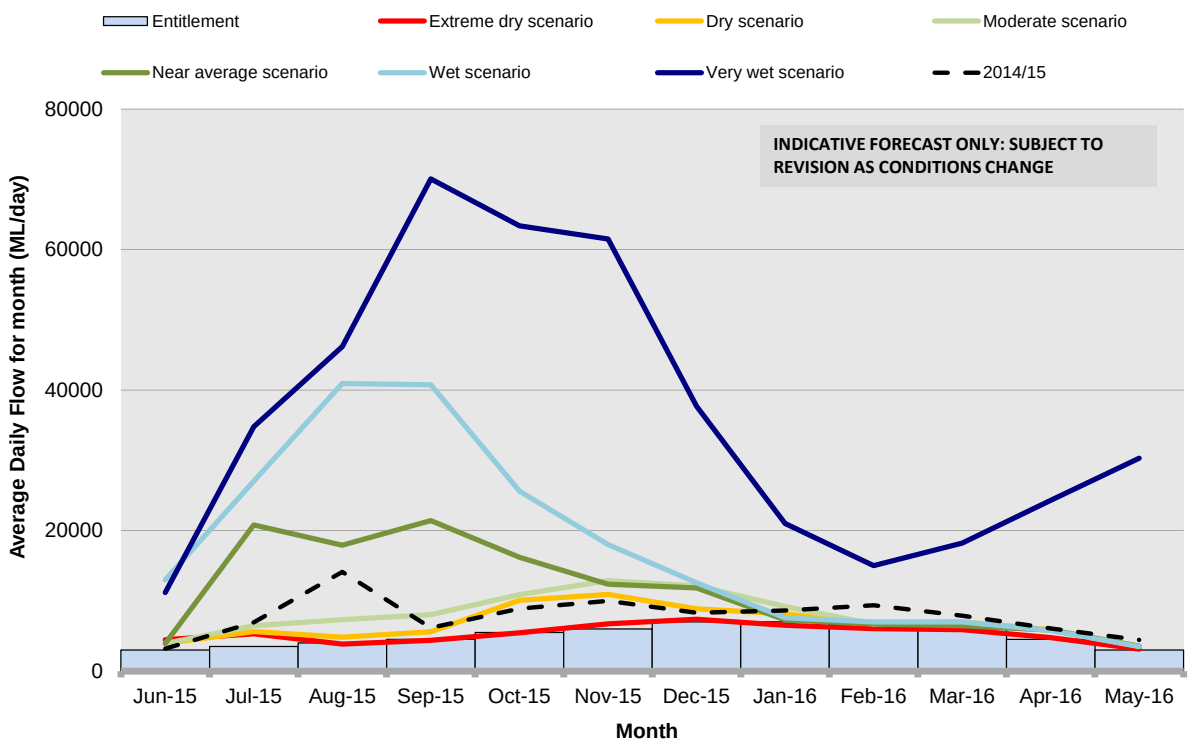

Figure 16: Flow to South Australia outlook

Under the 'extreme dry' scenario, unregulated flows are not expected to occur. In the 'dry' and 'moderate' scenarios, modest volumes of unregulated flow may ensue through small inflow events from upstream. In the 'near average' to 'very wet' scenarios, large upstream inflow events may result in prolonged unregulated flows. Under the wetter scenarios, there could be a significant flood along the River Murray in South Australia.

South Australia may choose to manage monthly flows in order to build a reserve for critical human water needs and private carryover for 2016–17. To build this reserve, particularly in light of El Niño conditions, South Australia is expected to defer some of its entitlement flow in accordance with South Australia's Storage Right (Schedule G of the Murray–Darling Basin Agreement) and formal carryover arrangements in South Australia. This water would spill before NSW and Victorian entitlements – see the text on South Australia's Storage Right in Section 3.2.3.

Water quality monitoring previously undertaken in the Lower Murray Reclaimed irrigation Area (LMRIA) has highlighted the presence of acid water in 14 of the 27 drainage discharge points that may potentially pose a health risk under low flow conditions. Modelling undertaken by SA Water indicates that the minimum flow target for dilution is 2,500 ML/day, and higher flows will provide greater dilution. The LMRIA Acid Drainage Working Group will be reconvened in 2015–16 due to the El Niño conditions and implications of reduced, or constrained flow to South Australia post December 2015 under a dry scenario.

This modelling is being refined and heavy metal concentrations may potentially increase under the extreme dry to moderate scenarios, which will require increased treatment by SA Water to protect public water supply. Under the near average to very wet scenarios, there should be sufficient dilution from ADF, unregulated flows and the provision of environmental water.

5.13. Lower Lakes and Barrage operation

Lakes Alexandrina and Albert (Lower Lakes) are upstream of five barrages located at Goolwa, Tauwitchere, Boundary Creek, Ewe Island and Mundoo Island.

With full entitlement flow, it is expected that the water level of the Lower Lakes will be managed between 0.50 and 0.85 m AHD, however wind and tidal influences may result in lake levels temporarily outside this range. In an extreme dry scenario, the water levels may fall below 0.5 m AHD.

Since late 2011, there have been managed variations to the release of water through the barrages in such a way as to vary the level of the Lower Lakes between 0.50 and 0.85 m AHD. These actions aimed to improve salinity levels in Lake Albert; however, at times it has been very difficult to implement due to water availability and high water levels in the Coorong as a result of extremely high tides.

In 2015–16, operation of water levels and releases will be consistent with the watering schedule agreed between the Commonwealth Environmental Water Office and DEWNR. The schedule outlines a number of objectives, including operational strategies to achieve the priority ecological outcomes for the Coorong, Lower Lakes and Murray Mouth region. The objectives include managing environmental water to avoid the level of the Lower Lakes falling below 0.50 m AHD and, between January to March 2016, discharging 1,000 ML/day where practicable and with the objective of consistency of barrage flows. This action is seeking to manage salinity levels in the Coorong.

Barrage fishways will be operated as the first priority for releases throughout 2015–16, with adjacent bays operated to provide attractant flow. When larger volumes are available, releases will be prioritised through Tauwitchere barrage, to influence salinity and water levels in the Coorong. During winter, priority may be given to releases through Goolwa barrage to enable fish passage, flow along the Goolwa Channel and the continued opening of the Murray Mouth. Barrage releases will aim to minimise sand ingress through the Murray Mouth, where possible.

In October 2002, a dredging operation commenced at the Murray Mouth to endeavour to maintain connectivity between the Goolwa Channel, the Coorong and the sea. With severe drought it was necessary to continue dredging until late 2010. A relatively large flood in early 2011 scoured out a significant volume of sand and increased the channel size through the mouth. Even with additional flows available through progressive implementation of the Basin

Plan, there has been ongoing accumulation of sand inside the Murray Mouth as shown in Figure 18. Dredging at the Murray Mouth recommenced in January 2015 and will remain in place for the foreseeable future.

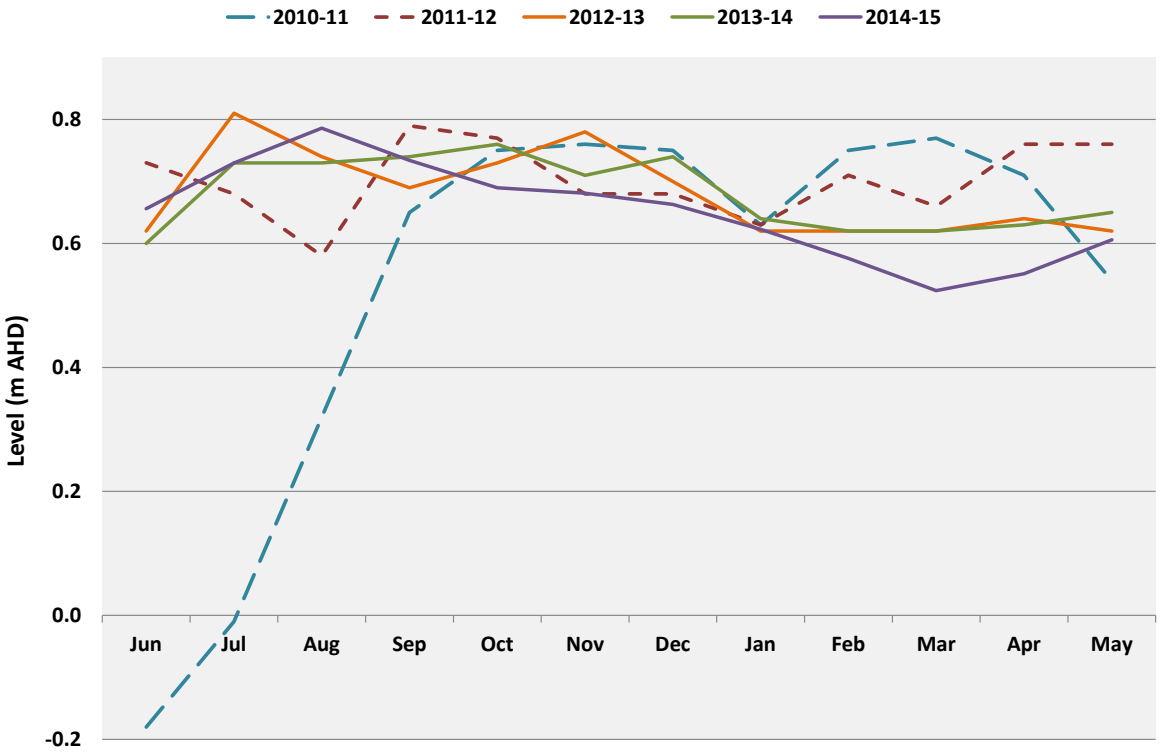

Figure 17: Lower Lakes Level 2010–11 to 2014–15

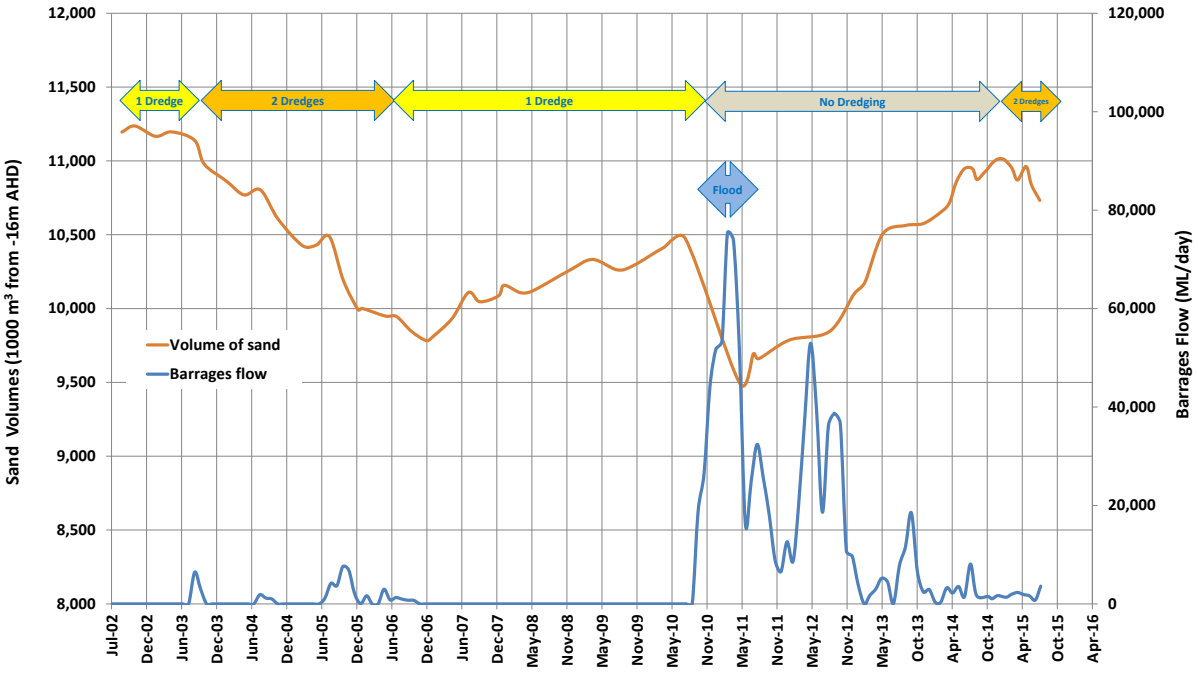

Figure 18: Murray Mouth sand volume and flow to sea

5.14. Maintenance and construction in 2015–16

A summary of the major works along the River Murray System are provided in Table 10 and Table 11. Some of the works may impede navigation and they may be an influencing factor on the target flows for environmental releases (see Section 5.4). The critical flow rates mentioned in the Tables below will be reviewed as works progress at each of the sites.

Table 10: Works on new structures to improve environmental outcomes

Site	Status as at 1 June 2015	Period of construction	Critical flow (ML/day) that may prevent or delay works
Lindsay Island (Mullaroo regulator)	Construction ongoing	October 2013 – July 2015	23,000 ML/day @ Lock 7 (during periods of active construction)
Hattah Lakes	Works expected to begin in May 2016	May 2016	Flow of 5,000–10,000 ML/day at Euston

Table 11: Works to improve current structures

Site	Status as at 1 June 2015	Period of construction	Critical Flow (ML/day) that may prevent or delay works
Lock 11 (Mildura) trestleway repairs and trestle upgrade	Commence late May 2015	May – August 2015	~15,000 ML/day
Lock 11 (Mildura) refurbishment	Commence late May 2015	May – September 2015	N/A
Lock 15 (Euston) refurbishment	Commence February 2016	February – May 2016	~ 40,000 ML/day

6. Calendar of Events in 2015–16

These dates were presumed correct at the time of publishing. However, readers are advised to check the most recent information with the event organisers for community events, or on the MDBA website for information on major works.

Month	Major works or actions	Community events
June	Mullaroo works - located just upstream of Lock 7. The restriction here is to keep the flows below about 23,000 ML/day at Lock 7. Expected to be completed in July. Mildura Weir drawdown for works. Mildura Lock closed for works.	N/A
July	Mildura Weir expected to be reinstated in late July and refilling will commence. Lock at Mildura Weir closed for works.	N/A
August	Lock at Mildura Weir closed for works.	8–9 August 2015 – Lake Mulwala ski race
September	Lock at Mildura Weir expected to be reinstated. Potential Dartmouth winch commissioning.	N/A
October	N/A	17–18 October 2015 – Multi-Sport Festival Triathlon – Lake Mulwala. Visit their web page (www.ymmf.com.au). 17–18 October 2015 – Ted Hurley Memorial Classic ski race – Mildura. Visit their web page (http://www.milduraskiclub.org/index.html)

Month	Major works or actions	Community events
November	N/A	14 November 2015 – Barrie Beehag ski race, Echuca. Visit their web page (http://www.southern80.com.au/index.html) 25– 29 November 2015 – YMCA Massive Murray Paddle Yarrawonga to Swan Hill. Visit their web page (http://www.massivemurraypaddle.org.au/)
December	N/A	5–6 December 2015 – Yamaha Cod Classic Fishing Tournament – Lake Mulwala 5–6 December 2015 – Renmark Rowing Regatta
January	N/A	N/A
February	Lock 15 (Euston) - lock refurbishment - tentative start date 1 February 2016. Duration - allow 4 months. Lock will be out of operation during that period.	12–14 February 2016 – Southern 80 water ski race at Echuca. Visit their web page (http://www.southern80.com.au/)
March	N/A	11–13 March 2016 – Robinvale Classic water ski race. Visit their web page (http://www.waterskiracing.com/) 25–27 March 2016 – Mildura 100 water ski race. Visit their web page (http://www.milduraskiclub.org/)
April	N/A	16–17 April 2016 – Lake Mulwala ski Race.
May	Hattah Lakes works – 2 to 3 weeks requiring a flow of 5,000– 10,000 ML/day at Euston.	N/A

7. Further information

This Annual operating plan will be reissued only if a significant amendment is required due to unforeseen circumstances.

MDBA will update a routine monthly operational plan, which contains outlooks of potential storage behaviours and release rates, regularly throughout 2015–16. These updates will be shared with the jurisdictions via Water Liaison Working Group.

Updates on river operations within the water year will be provided in a number of forms, which can be accessed via the MDBA website (www.mdba.gov.au) including:

- the MDBA Weekly Report on river operations
- live river data
- water in storage
- forecasts in relation to flows and salinity levels
- media releases in relation to river operations
- special circumstances reports.

Further information relating to River Operations can also be found on the MDBA website.