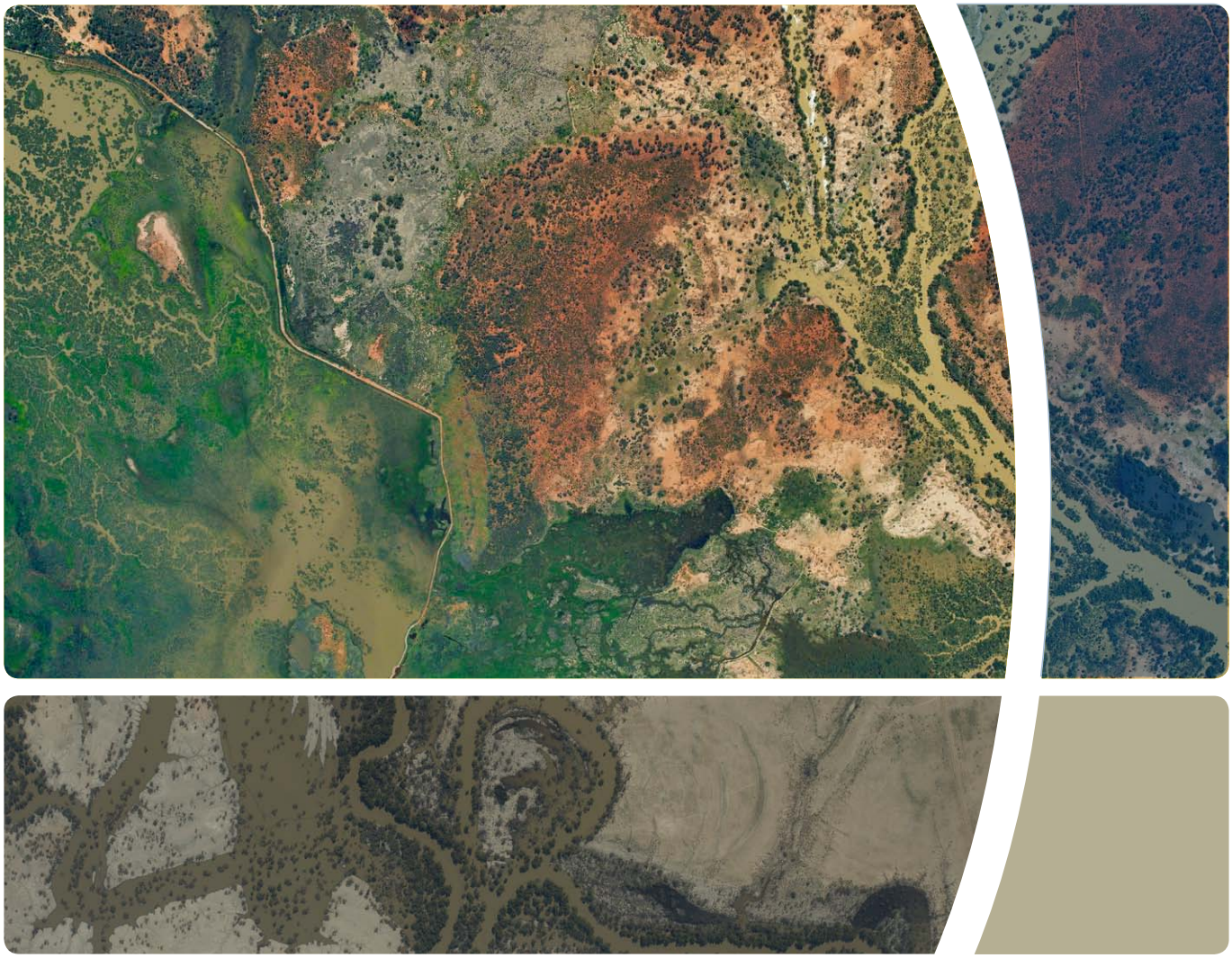
Department of Primary Industries
Office of Water

Accounting for the third Toorale water shepherding trial

August–September 2010



Leading policy and reform in sustainable water management

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The NSW Office of Water manages the policy and regulatory frameworks for the state's surface water and groundwater resources, to provide a secure and sustainable water supply for all users. It also supports water utilities in the provision of water and sewerage services throughout New South Wales.
The Office of Water is a division of the NSW Department of Primary Industries.

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Background

In early September 2010, with continuing high flows in both the Murray and Barwon-Darling Rivers, regional conservation interests including the Murray-Darling Wetlands Inc. and Darling River Action Group recommended that a significant volume of water be released into the Great Darling Anabranch for environmental flows.

Following consultation between the NSW Office of Water, the Department of Environment Climate Change and Water, the Murray Darling Basin Authority, and the Commonwealth Environmental Water Holder, an initial target release of 47,000 megalitres (ML) into the Great Anabranch was agreed to.

The initial volume was made up of 30,000 ML from water accounts managed under The Living Murray (TLM) program, an estimated 6,000 ML of water provided by the Commonwealth Environmental Water Holder from (shepherded) water that was available subsequent to the purchase of Toorale, and the remainder from NSW environmental water accounts.

Water that would otherwise have been diverted at Toorale

As a result of management action determined by the NSW Office of Water for 2010-2011, each Barwon-Darling licence subject to the 173 gigalitre (GL) Cap policy has only been permitted access up to its Cap share in 2010-11. This made 7,672 ML available to the Darling River licences at Toorale.

This available volume was then considered to have otherwise been diverted from the Darling River prior to the purchase of Toorale Station by the NSW and Commonwealth Governments, and as a consequence remained in-stream.

Flow in the Darling River at Louth reached the commence-to-pump condition for the Toorale licence, of 1,130 ML/day on 17 August 2010. Consistent with the *Memorandum of Understanding In Relation To Shepherding Water For The Environment*, the Commonwealth Environmental Water Holder, through the Department of Sustainability, Environment, Water, Population and Communities, and in consultation with the NSW Office of Water, requested that all water available to the Toorale Darling River licence account be shepherded to the Menindee Lakes and then released into the Great Darling Anabranch.

Flows continued above the commence-to-pump flow condition. At the authorised pumping rate of 370 ML/day it was calculated that the entire volume available in the Toorale Darling River account would have been accessed by 6 September 2010.

At the time, it was estimated that at least 6 GL (7,672 ML at Toorale minus transmission and evaporation losses) could be released into the Great Anabranch that could be attributed to water shepherded from Toorale.

Use of Toorale water

Environmental flow releases commenced into the Great Darling Anabranch from Lake Cawndilla in the Menindee Lakes Scheme on 13 September 2010.

Subsequent rain and inflows resulted in a pre-release from the lakes and replacement of the regulated flow with unregulated pre-release flows.

It had previously been agreed that the water shepherded from Toorale was the first to be released into the Anabranch. The entire volume of water attributed to Toorale was released from Lake Cawndilla prior to the commencement of the unregulated pre-release flows.

As the bed of the Anabranch was dry at the time, having not had flows since 2002, it was agreed that the initial releases, including water attributed to Toorale, would have been fully used to provide flows within the Anabranch channel.

Calculation of river losses from Toorale to the Menindee Lakes

The accurate assessment of losses in the reach between Toorale and Menindee is difficult at any time given the inherent inaccuracies in hydrometric data and the influence of unmeasured local effects.

During this particular flow event there was extensive rainfall throughout the region downstream of Toorale that would have generated small local inflows. Similarly, flows from the Paroo River from the February-March 2010 flood were still contributing to the volume of flow in the Darling River at Wilcannia. Table 1 shows an assessment of the flows at Bourke, Louth, Tilpa and Wilcannia, for three periods:

Table 1: Assessment of the flows at Bourke, Louth, Tilpa and Wilcannia

Flows since start of December 2009				
	Flow (ML)	As % of Bourke	As % of Louth	As % of Tilpa
Bourke	3,138,145	100		
Louth	3,127,980	99.7	100	
Tilpa	3,111,743	99.2	99.5	100
Wilcannia	3,047,257	97.1	97.4	97.9
Event December 2009 to February 2010				
	Flow (ML)	As % of Bourke	As % of Louth	As % of Tilpa
Bourke	1,352,380	100		
Louth	1,344,235	99.4	100	
Tilpa	1,257,966	93	93.6	100
Wilcannia	1,085,464	80.3	80.7	86.3
Event August 2010 to September 2010				
	Flow (ML)	As % of Bourke	As % of Louth	As % of Tilpa
Bourke	162,909	100		
Louth	138,774	85.2	100	
Tilpa	151,035	92.7	108.8	100
Wilcannia	171,091	105	123.3	113.3

1. Losses between Bourke and Wilcannia since flows in the Darling River recommenced in December 2009 to the end of the shepherding period in September 2010 were 2.9 per cent Between Louth and Wilcannia, the losses were 2.6 per cent.
2. Losses in the initial flows between Bourke and Wilcannia between December 2009 and February 2010, were 19.7 per cent.
3. During August and September 2010, for the 21 days when the Toorale water was deemed to be shepherded from Toorale to the upstream reaches of the Menindee Lakes, there was a significant gain of 5.0 per cent between Bourke and Wilcannia, with a gain of 23.3 per cent between Louth and Wilcannia).

This assessment demonstrates potentially at least three aspects of volume assessment:

- Small errors in hydrometric data
- The unquantified impacts of local rainfall and runoff
- The impact of Paroo inflows

The conclusion to be drawn is that the volumetric loss assessment using only recorded hydrometric data is inconclusive and consequently unreliable to the point of not being useful. This situation is not unusual for any natural unregulated flow, and particularly relevant for the Darling River.

There does not appear to be a simple process to resolve this problem. It is appropriate to draw the same conclusion reached in the first trial in March 2009 that the recorded data alone could not support the calculation of the real river flow losses occurring during the event.

An alternative methodology is to assume that the losses are predominately due to evaporation, as there had been continuous flow prior to the event and seepage would be small.

The river distance between Toorale and the upstream extent of Lake Wetherell is 570 kilometres.

Assuming an average river width of 50 metres, and applying the pan evaporation at Cobar for the period of 54.4 mm, and applying an evaporation pan factor of 0.7 provides an evaporative volume of 1,085 ML.

To provide an indication of the sensitivity of these assumptions to the calculated loss, reducing the pan factor to 0.5 calculates a volume of 775 ML, while an average width of 80 metres and pan factor of 0.7 provides an evaporative volume of 1,736 ML. An average width of 80 metres and pan factor of 0.5 provides 1,085 ML.

All things considered, a reasonable estimate of the evaporation losses in the Darling River between Toorale and Wetherell is about 1,000 ML.

Evaporation losses within Menindee Lakes

The shepherded Toorale water 6,672 ML (7,672-1,000) flowed into the Menindee Lakes at a rate of 318 ML/day (6,672 ML over 21 days), in the period 29 August to 18 September.

The water was released from Lake Cawndilla to the Great Anabranch from 13 September to 3 October.

In calculating evaporation for the period 13 September to 3 October, the storage volume increased from 1,684 GL to 1,824 GL, while the surface area reduced from 43,800 to 43,500 hectares due to less water stored in the shallow Lake Wetherell and more water stored in the deeper and less evaporative Lakes Menindee and Cawndilla.

Using average surface area during the period and applying evaporation rates at Cobar (Menindee not available) of 79.6 mm and a pan factor of 0.7, provided a total evaporation of 24,300 ML.

Assuming that the entire shepherded volume (6,672 ML) is in the storage over this period of time (conservative assumption), the shepherded volume is about 0.38 percent of the average total storage volume (1,754,000 ML). 0.38 percent of the total evaporation is 92.3 ML.

A total of 92 ML is therefore considered an appropriate estimation of evaporative losses while the shepherded water was stored in the Menindee Lakes.

Total loss of water prior to release to the Great Darling Anabranch

The total loss between Toorale and the Cawndilla outlet regulator totals 1,092 ML.

Therefore, the volume of water released to the Great Darling Anabranch for environmental purposes that can be attributed to water that would have otherwise have been diverted at Toorale and now shepherded downstream is 6,580 ML. (7,672 ML (Toorale) – 1,000 ML (river loss) – 92 ML (storage loss).

Anabranch accounting

Releases to the Great Darling Anabranch via the Cawndilla outlet regulator in the Menindee Lakes Scheme, where these have been for stock and domestic purposes, have generally been accounted as a debit on the NSW Murray water account, without debit to a specific water access licence.

Releases to the Great Anabranch for environmental purposes during the past 20 years have typically been made as part of flood management or released when total volumes in the Menindee Lakes have exceeded nominal full supply capacity and have been part of 'normal' operations to reduce surcharge levels in the lakes. These volumes have not be debited as a consumptive use.

For environmental releases to the Great Anabranch as a whole, there is no requirement to credit a water access licence linked to a work. However, specific releases from regulated flows should be debited against the appropriate water account. For example, the volumes released at the direction of the MDBA are accounted against licences issued for The Living Murray and volumes released at the direction of DECCW are accounted against appropriate NSW environmental water licences.

Of the total volume of water released to the Anabranch from regulated flows, a portion can be accredited as being made available from the volume of Toorale water shepherded to the Menindee Lakes.

Interstate accounting

At the time of the shepherding proposal, the Menindee lakes were not spilling and were subject to normal inflow accounting rules. At the time there was a period of special accounting existing for both NSW and Victoria. In this instance effectively one third of the inflows are available to each of the three states.

Victoria indicated its agreement to the shepherding process by "foregoing" its share of the inflow and allowing it to be delivered to the Anabranch. Within the Murray-Darling Basin Agreement there is no ability to adjust or modify accounts for situations such as this. To overcome this, it was informally agreed that at the next instance when an account reconciliation between the states required NSW to 'trade' water to Victoria, then the trade volume would be reduced by the volume of the account adjustment. In this instance it would be one third of the "shepherded" releases as the evaporation in the storage would also be shared.

In the original proposal to provide flows to the Anabranch, one of the conditions of the use of 30 GL from the TLM Anabranch licence was that the residual of that released Anabranch volume that flowed out of the Anabranch would be made available to South Australia to benefit icon sites. It was estimated that 20 GL would flow out of the Anabranch to the Murray River. There is no accounting mechanism in the Murray-Darling Basin Agreement that enables this contribution of TLM inflow into South Australia to be recognised without impacting on the water available to South Australia during periods of regulated flow.

To address this issue, it was agreed that NSW would trade the TLM outflows from the Anabranch to negate any account impacts on South Australia and make the TLM water available for environmental assets. To reconcile the accounts with South Australia as result of these actions, it was proposed to reduce the trade to South Australia by one third of the additional inflow volume attributed to the Toorale licence, similar to the Victorian solution.

With the subsequent pre-release (notional spill) of Menindee Lakes continuing into November, it is suggested that this accounting is now redundant. The accounts for each State at Menindee and Lake Victoria are now full and consequently it is not necessary to reconcile the sharing of inflows by trading of two thirds of the shepherded volume.

Further, the outflows from the Great Darling Anabranch to the River Murray occurred during an unregulated flow period at Lake Victoria and could not be re-regulated and contribute to future regulated flow into South Australia. Therefore, there has been no impact on water availability and a trade will not be required to offset the South Australia account impacts.