

Water recovery and ‘over recovery’ in the Macquarie valley

Project

The Inland Rivers Network engaged Slattery & Johnson to prepare a paper on environmental water recovery targets, and the concept of ‘over-recovery’ of environmental water, in the Macquarie Valley.

Terms of Reference

1. The basis for changing the water recovery targets for the Macquarie valley, including the Northern Basin Review,
2. The effect of the reduction in the Macquarie’s contribution to the Barwon-Darling on Macquarie water recovery targets,
3. The Cap Factors used as the basis of the water recovery targets, and
4. Floodplain water-harvesting in the Macquarie Valley.

Introduction

The NSW and Commonwealth Governments own 174.6 gigalitres¹ of general security water access licences and 9.7 gigalitres² of supplementary water access licences in the Macquarie valley.^{3, 4} The two governments have agreed that this equals a long term annual average amount of 95.8 gigalitres.^{5, 6}

The NSW Department of Planning, Industry and Environment presented a paper, *2021 Technical paper 2 – Basin Recovery Targets*, to the Macquarie-Cudgegong Environmental Water Advisory Group.⁷ The paper outlines the background to the water recovery in the Macquarie valley. It points out that, using 2018 Cap factors, 74.03 gigalitres of General Security shares have been ‘over-recovered’ in the Macquarie Valley, equal to 38.2 gigalitres of environmental water.

¹ 126.4 gigalitres is held by the Commonwealth and 48.4 gigalitres is held by NSW.

² 8.3 gigalitres is held by the Commonwealth and 1.4 gigalitres is held by NSW.

³ DAWE. (2021). *Environmental water holdings*. <http://www.environment.gov.au/water/cewo/about/water-holdings>

⁴ DPIE. (2019). *Current water holdings*. <https://www.environment.nsw.gov.au/topics/water/water-for-the-environment/about-water-for-the-environment/current-water-holdings>

⁵ DAWR. (2021). *Surface water recovery required under the Basin Plan including the Sustainable Diversion Limit Adjustment Mechanism as at 31 March 2021*. <https://www.agriculture.gov.au/sites/default/files/documents/surface-water-recoveries-including-sdlam.pdf>

⁶ NSW DPI. (2018). *Water reform technical report: Derivation of LTDLE factors in NSW*. Sydney: DPI. https://www.industry.nsw.gov.au/_data/assets/pdf_file/0019/162181/technical-paper-derivation-technical-factors-nsw.pdf

⁷ NSW DPIE (2021). *Macquarie-Cudgegong Environmental Water Advisory Group 2021 Technical Paper 2 – Basin Recovery Targets*. NSW DPIE, Dubbo.

The Commonwealth Environmental Water Holder has experienced pressure to sell water back to irrigation to ‘correct’ this ‘over-recovery.’

The claim of ‘over recovery’ results from the following processes:

1. Changing the water recovery targets, and
2. Changing the Cap factors.

Changing the water recovery target

Water recovery in the valleys of the Northern Basin has two components. Local (or in-valley) recovery for the source valley and shared (or downstream) recovery (or contribution), for the Barwon-Darling/Baaka.

The water recovery targets for the Macquarie valley have been changed twice since they were set under the Basin Plan in 2012.

The first change was an amendment to the Basin Plan in 2018 that reduced the local recovery target. At the same time a commitment was made to reduce the downstream recovery target. These changes were recommended by the *Northern Basin Review*.⁸

The second change was an agreement for an additional reduction in the downstream recovery target for the Barwon-Darling between the NSW Department of Primary Industry and the Murray-Darling Basin Authority (MDBA) in 2019. These three water recovery targets are shown in Table 1.

Table 1: Water recovery target in the Macquarie valley

	Basin Plan ⁹ GL	Amendment to the Basin Plan 2018 ¹⁰ GL	Agreement in 2019 ¹¹ (GL)
Water recovery target (local)	65.0	55.0	55.0
Water recovery target (shared)	18.0	16.0	2.6
Total Water recovery target	83.0	71.0	57.6

⁸ MDBA. (2016). *The Northern Basin Review*. MDBA. Canberra.

<https://www.mdba.gov.au/sites/default/files/pubs/Northern-basin-review-report-FINAL.pdf>

⁹ MDBA. (2016). *The Northern Basin Review*. MDBA. Canberra.

<https://www.mdba.gov.au/sites/default/files/pubs/Northern-basin-review-report-FINAL.pdf>

¹⁰ MDBA. (2016). *The Northern Basin Review*. MDBA. Canberra.

<https://www.mdba.gov.au/sites/default/files/pubs/Northern-basin-review-report-FINAL.pdf>

¹¹ DAWR. (2021). *Surface water recovery required under the Basin Plan including the Sustainable Diversion Limit Adjustment Mechanism as at 31 March 2021*. <https://www.agriculture.gov.au/sites/default/files/documents/surface-water-recoveries-including-sdlam.pdf>

The first change in 2018 reduced the Basin Plan water recovery target for the Macquarie Valley from 83 to 71 gigalitres.¹² This consisted of a 10 gigalitre reduction in the local recovery target from 65 to 55 gigalitres and a two gigalitre reduction in the downstream recovery target from 18 to 16 gigalitres.

The second change in 2019 reduced the downstream recovery target by an additional 13.4 gigalitres, from 16 to 2.6 gigalitres.

The Northern Basin Review was required by the *Water Act 2007* and the Basin Plan to use the best available science and consider climate change.^{13, 14} However, no new scientific information was used to justify reducing water recovery in the Macquarie.

There is a provision in the Basin Plan for the shared recovery to be redistributed between valleys, but it had to be determined by the 31st December 2016.¹⁵ The reduction to the shared recovery was agreed between the NSW and Commonwealth Governments in March 2019, after the date allowed by the Basin Plan.¹⁶

The Basin Plan states that in the absence of an agreement on the shared target by the 31st December 2016, the shared portion should be distributed on a pro rata basis between the target zone, based on each valley's baseline diversion limit.¹⁷ The Macquarie valley is in the Northern Basin zone, with a total shared reduction of 143 gigalitres. Using this method the shared reduction for the Macquarie valley is 23.9 gigalitres.

Applying the requirement in the Basin Plan, that the shared is based on the pro rata baseline diversion limit for the northern Basin zone, the water recovery target for the Macquarie valley should be 78.9 gigalitres, as shown in Table 2.

Table 2: Water recovery target in the Macquarie valley using the shared reduction method in the Basin Plan

Water recovery targets	Water recovery target (GL)
Local	55.0
Shared	23.9
Total Water recovery target	78.9

¹² MDBA. (2016) *The Northern Basin Review*. MDBA. Canberra

<https://www.mdba.gov.au/sites/default/files/pubs/Northern-basin-review-report-FINAL.pdf>

¹³ Commonwealth. (2007). *Water Act, Subdivision F*. <https://www.legislation.gov.au/Details/C2017C00151>

¹⁴ Commonwealth. (2012). *Basin Plan, Section 6.06*. <https://www.legislation.gov.au/Details/F2012L02240>

¹⁵ Commonwealth. (2012). *Basin Plan, Section 6.05 (4)*. <https://www.legislation.gov.au/Details/F2012L02240>

¹⁶ Krebs, I. (2019). *Email: FW: NSW WRPs - ensuring use of correct Local and shared reduction amount volumes*. Sydney: NSW Parliament. Obtained under Standing Order 52.

¹⁷ Commonwealth. (2012). *Basin Plan, Section 6.05*. <https://www.legislation.gov.au/Details/F2012L02240>

Changing the Cap factors

Cap factors are not scientific or objective. An exchange between the Commonwealth Water Minister's Office and the CEO of the National Irrigators Council demonstrates there was an expectation from the Minister's Office, that the Minister would approve the Cap factors:

Obviously it is the wish of the Deputy Prime Minister and also the NSW Minister that no one is disadvantaged by this process.

...So ultimately it will be a Ministerial decision.¹⁸

We have previously raised the following points in relation to Cap Conversion Factors/Planning assumptions/Long Term Diversion Limit Equivalent (LTDLE) factors:

- Current reliability factors adopted by the Dept of Agriculture and Water and the MDBA for reporting the yield of entitlement recovered in Macquarie and Gwydir Valleys are inconsistent, to an extent of up to 25%, with reliability measures derived from the hydrological modelling underpinning the MDBA's determination of Sustainable Diversion Limits (SDLs).*
- This anomaly must be corrected as it impacts on future water recovery in the north because...*
- **Any attempt to fiddle with the LTDLE factors elsewhere in the Basin will totally unhinge any remaining level of support for the Plan amongst irrigators.***

We remain totally opposed to any revision of Cap Factors, planning assumptions, conversion factors, LTDLE or whatever else they are now being called except in the two northern Valleys (Macquarie/Gwydir) were [sic] the cap factors are demonstrably wrong.¹⁹

DPIE claims that Cap factors are determined by multiplying the reliability of a water share with its level of use (called 'utilisation').²⁰ A Cap factor is meant to represent the percentage of the face value of the water share received in real water in the long term. For example, a cap factor of 0.42 means that for every megalitre of water share 42 percent will be allocated and used in the long term.

Long-term average annual extractions expressed in hydrological models should equal the sum the water shares multiplied by their Cap factor. That is, every change in a hydrological model's long-term average annual extractions will be based on a change to the Cap factors.

¹⁸ Coulton, M. (2016). *Email to Perin Davey, CC Tom Chesson, Phillip Glyde, Darcy Moar, Subject: Cap Factors.*

¹⁹ Chesson, T. (2016). *Email to Matthew Coulton, Perin Davey, CC: Phillip Glyde, Darcy Moar, Gavin McMahon, Subject: RE: Cap Factors*

²⁰ NSW DPI. (2018). *Water reform technical report: Derivation of LTDLE factors in NSW. Sydney: DPI.*
https://www.industry.nsw.gov.au/data/assets/pdf_file/0019/162181/technical-paper-derivation-technical-factors-nsw.pdf

There have been two officially agreed Cap Factors (2011 Cap Factors and the 2018 Cap Factors). There has also been a new hydrological model for the Macquarie valley with new unofficial Cap Factors (2021 Cap Factors).

2011 Cap factors

The Macquarie Valley modelling used to develop the Basin Plan assumed Cap factors of 0.42 (42 percent) for General Security shares and 0.21 (21 percent) for Supplementary shares. These are known as the 2011 Cap factors.²¹ The long-term annual average volume of held environmental water using the 2011 Cap factors is shown in Table 3.

Table 3: Held environmental water in the Macquarie valley using the 2011 Cap Factors

	Held environmental water (GL)	Cap factors (2011)	Long term annual average volume (GL)
General Security	174.6	0.42	73.3
Supplementary	9.7	0.21	2.0
Total			75.3

Table 3 shows that, using the 2011 Cap factors, the long-term annual average volume of held environmental water in the Macquarie Valley is 75.3 gigalitres.

Using the 2011 Cap factors against the different water recovery targets, there is

- an 'under-recovery' of 7.64 gigalitres compared to the Basin Plan 2012 target (83.0 gigalitres),
- an 'over-recovery' of 4.36 gigalitres compared to the 2018 target (71.0 gigalitres),
- an 'over-recovery' of 17.7 gigalitres compared to the 2019 amended target (57.6 gigalitres), or
- an 'under recovery' of 3.6 gigalitres compared to the water recovery target using the shared reduction method in the Basin Plan (78.9 gigalitres).

2018 Cap factors

In 2018, NSW increased the Cap factors for Macquarie General Security shares from 0.42 to 0.516 (51.6 percent) and for Macquarie Supplementary shares from 0.21 to 0.588 (58.8 percent).²² These are known as the 2018 Cap factors.

²¹ NSW DPI. (2018). *Water reform technical report: Derivation of LTDLE factors in NSW*. Sydney: DPI. https://www.industry.nsw.gov.au/_data/assets/pdf_file/0019/162181/technical-paper-derivation-technical-factors-nsw.pdf

²² NSW DPI. (2018). *Water reform technical report: Derivation of LTDLE factors in NSW*. Sydney: DPI. https://www.industry.nsw.gov.au/_data/assets/pdf_file/0019/162181/technical-paper-derivation-technical-factors-nsw.pdf

This inflates the book value of the environmental portfolio to achieve water recovery targets.

The long-term annual average volume of held environmental water using the 2018 Cap factors is shown in Table 4.

Table 4: Held Environmental water in the Macquarie valley using the 2018 Cap factors

	Held environmental water (GL)	Cap factors (2018)	Long term annual average volume (GL)
General Security	174.6	0.516	90.1
Supplementary	9.7	0.588	5.7
Total			95.8

Table 4 shows that, using the 2018 Cap factors, the long-term annual average volume of held environmental water in the Macquarie Valley is 95.79 gigalitres.

Using the 2018 Cap factors against the different water recovery targets, there is:

- an ‘over-recovery’ of 12.8 gigalitres compared to the Basin Plan 2012 target (83.0 gigalitres),
- an ‘over-recovery’ of 24.8 gigalitres compared to the 2018 target (71.0 gigalitres),
- an ‘over-recovery’ of 38.2 gigalitres compared to the 2019 target (57.6 gigalitres), or
- an ‘over recovery’ of 16.9 gigalitres compared to the water recovery target using the shared reduction method in the Basin Plan (78.9 gigalitres).

2021 Cap factors

The NSW Government has recently updated its modelling for the Macquarie valley as part of licensing floodplain harvesting. The NSW Water Minister, Melinda Pavey, explains:

The NSW Government has spent six years and over \$17 million collecting and analysing data from field inspections, remote sensing, metering and river flow records, and having improved modelling independently reviewed.

We are using the best available expertise and information to create a world-leading licensing regime for floodplain harvesting that should be the envy of every other Basin State.²³

²³ Pavey. (2021). *New data supports historic floodplain harvesting reform in NSW*. Mackay: Melinda Pavey MP. <https://melindapavey.com.au/new-data-supports-historic-floodplain-harvesting-reform-in-nsw/>

The Murray-Darling Basin Authority (MDBA) agreed to change the sustainable diversion limits in the Basin Plan based on this ‘best available information.’²⁴ The MDBA accepted that the updated model used to determine floodplain harvesting in the Macquarie valley is ‘best available information,’ and used that model to determine compliance with the sustainable diversion limit for 2019-20.^{25, 26}

The NSW government has said that floodplain harvesting in the Macquarie is under the legal long term annual average extraction limit. DPIE has attempted to demonstrate this using new hydrological models. The outputs are reported in *Floodplain harvesting entitlements for the Macquarie Valley regulated river system*.²⁷ The report shows a long term annual average extraction limit of high security, general security, and supplementary shares of 317.6 gigalitres, shown in Table 5.

Table 5: Long term annual average extractions for high, general security and supplementary shares under the latest DPIE modelling

Share type	Long-term annual average (GL)
High and general security shares	304.0
Supplementary shares	13.6
Total long-term annual average of high, general security and supplementary shares	317.6

This modelling necessarily contains new assumptions for each type of water share’s reliability and use. In other words, it uses new, different Cap Factors. For the purposes of this report we refer to these the 2021 Cap factors.

Using the 2011 Cap factor for High Security shares,²⁸ the new Cap factors used in the modelling are 0.4566 (45.66 percent) for General Security shares and 0.272 (27.2 percent) for Supplementary shares.

²⁴ MDBA. (2015). *Basin Plan Water Resource Plan Requirements Position Statement 3C: Method for determining take*. Canberra: DBA. https://www.mdba.gov.au/sites/default/files/pubs/WRP-Position-Statement-3C-method-for-determining-take_0.PDF

²⁵ Moroka Pty Ltd. (2019). *Independent review for of interim baseline diversion limits for NSW floodplain harvesting*. Canberra: MDBA. Obtained under FOI 115. <https://www.mdba.gov.au/about-us/accountability-reporting/freedom-information/foi-disclosure-log>

²⁶ MDBA. (2021). *Murray-Darling Basin sustainable diversion limit compliance outcomes 2019-20*. Canberra: MDBA. <https://www.mdba.gov.au/sites/default/files/pubs/murray-darling-basin-sustainable-diversion-limit-compliance-outcomes-2019-20-report.pdf>

²⁷ DPIE. (2021). *Floodplain harvesting entitlements for the Macquarie Valley regulated river system*. Sydney: DPIE. https://www.industry.nsw.gov.au/_data/assets/pdf_file/0003/356097/fph-entitlements-macquarie-regulated-river-system-model-scenarios-report.PDF

²⁸ The plan limit in floodplain harvesting report for high & general security is 304 gigalitres. To determine the long-term average limit for each share type we used the 2011 Cap factor for High Security of 85% and derived the general security cap factors from the difference between 304 GL and HS Shares @ 85%. This was because the Cap factor DPIE used for the 2020/21 model is not clear. The High Security Cap factor used in 2011 is 85 percent is the high security, 2018 it is 68.8 percent and we used the higher of the two.

The long-term annual average of held environmental water using the 2021 Cap factors is shown in Table 6.

Table 6: Held environmental water in the Macquarie valley using the 2021 Cap Factors

	Held environmental water (GL)	Cap factors (2021)	Long term average (GL)
General Security	174.6	0.4566	79.7
Supplementary	9.7	0.2720	2.6
Total			82.3

Table 6 shows that, using the 2021 Cap factors, the long-term annual average volume of held environmental water in the Macquarie Valley is 82.3 gigalitres.

Using the 2021 Cap factors against the different water recovery targets, there is:

- an ‘under-recovery’ of 0.6 gigalitres compared to the Basin Plan 2012 target (83.0 gigalitres),
- an ‘over-recovery’ of 11.4 gigalitres compared to the 2018 target (71.0 gigalitres),
- an ‘over-recovery’ of 24.7 gigalitres compared to the 2019 amended target (57.6 gigalitres), or
- an ‘over recovery’ of 3.4 gigalitres compared to the water recovery target using the shared reduction method in the Basin Plan (78.9 gigalitres).

Cap factors and water recovery

The water recovery targets have changed three times since they were set. Those changes were not based in science, but rather were intended to ‘minimise water recovery.’

This is demonstrated by the following extracts from email exchanges between DPIE officers:

Under our advice, our overarching principle is to minimise future buyback.

MO (Minister’s Office) was happy with the approach.²⁹

Remind me again: who decides where the shared component of the SDL reduction goes? I’ve noticed in the Border River and Macquarie reports that there is a foot note that says it is up to the states to decide. Is this correct?³⁰

Our view was that MDBA should decide in a way that minimises recovery.³¹

²⁹ Isaacs, M. (2019). *Email: Unnamed Attachment*. Sydney: NSW Parliament. Obtained under Standing Order 52.

³⁰ Davidson, A. (2019). *Email*. Sydney: NSW Parliament. Obtained under Standing Order 52.

³¹ Brown, A (2019). *Email: Unnamed attachment*. Sydney: NSW Parliament. Obtained under Standing Order 52

The water recovery amounts are arbitrary. They have been changed by changing Cap factors, which was based on considerations such as the Minister's discretion, National Irrigators Council support for the Basin Plan, 'no disadvantage' to irrigators, but are not based on any science.

Therefore, the difference between water recovery targets and water recovery amounts, so called 'over-recovery,' can also only be arbitrary.

Model performance

The model used for the 2011 and 2018 Cap factors has a standard error of 132 gegalitres and a mean error of 75 gegalitres.³² The model used for the 2021 Cap factors does not have a published standard or mean error, but is based on the earlier model.

Notwithstanding government claims about the improvement in the modelling, all the numbers are well within the model's margin of error.

Discussions between NSW Departmental officers demonstrate that the new model does not address many of the previous model's issues, despite being upgraded with 'best available information'. Concerns include not having historical data, that data inputs are 'magic numbers' without documented justifications, an inability to explain model outputs, the way that modelling held environmental water distorts the model outputs, and the model not replicating observed data.

A consultant engaged to fix the model said:

Please bear in mind the values used in the older model did not reproduce the observed allocations which is the problem we were aiming to address...

There are lots of magic numbers that may have some physical basis but without any clear explanation are not possible to include in a model...

There was a loss assessment done but does not relate to the resource assessment sheets as many things are lumped together...

To confuse things more the allocations in some of their sheets did not agree with the announced allocations i.e. you would not want to reproduce these...

It really is quite a mess and I warned Daniel if they were challenged in court they would have difficulty in proving a consistent approach. Indeed if they had a consistent approach they could provide it and we could put it in the model...

Maybe it is worth spending some time getting an agreed approach to solve this problem. This may take some time but really comes down to agreement on minimum inflow sequences, forecast periods, carry over reserves in storages and TOL as a function of allocation and month. It may well be that we don't need to match history.

³² Bewsher, D. (2013). *Barwon-Darling Valley Independent Audit of Cap Model*. Canberra: MDBA. Obtained via FOI 90. <https://www.mdba.gov.au/about-us/accountability-reporting/freedom-information/foi-disclosure-log>

In the absence of not being able to unravel the mystery I just aimed at reproducing observed as best as I could within the time frame. I think there is further compromise to make these values more accepted at the expense of reproducing observed results.³³

The errors in the current models are systemic. The models and their results are open to manipulation and are the justification for ‘over-recovery.’

Other matters

These matters have implications for:

- Water recovery in the Intersecting streams,
- The Cap and sustainable diversion limit in the Barwon-Darling,
- The veracity of the Macquarie model in relation to floodplain harvesting, and
- Best available information and water recovery in all other valleys.

Conclusion

Nothing in legislation requires an ‘over recovery’ to be sold back to the consumptive pool, as explained by a Senior DPIE official:

NSW has been quite clear that how much water CEWO holds in the northern basin is absolutely and solely a question for the Commonwealth so there is not actually a thing called over recovery in any legal sense, they have just succeeded more than was expected, so well done to them.

Their entire approach makes no sense to me anyway, if I was them I would be thrilled....I now had increased opportunities to manage my portfolio in other northern valleys while maintaining the expected overall recovery levels. I would be literally telling everyone about how clever and farsighted the Commonwealth had been.³⁴

The local recovery target in the Macquarie valley was not based on ‘best available science’ and appears to be inconsistent with the *Water Act 2007* and the Basin Plan 2012.

The shared water recovery target in the Macquarie valley was changed after 31 December 2016 and may be inconsistent with the Basin Plan 2012.

There are three different water recovery targets (2011, 2018 and 2019) that governments have announced, and a fourth that might be a requirement according to the Basin Plan, that hasn’t been announced. The overall targets consist of local and shared reductions, which have also been changed.

There are three different sets of Cap factors; 2011, 2018 and 2021. These have been used to create a scenario that says there is over ‘over-recovery’ in the Macquarie and the Gwydir

³³ Podger, G. (2019). *Email: Re: I’m back*. Sydney: NSW Parliament. Obtained under Standing Order 52

³⁴ Brown, A. (2020). *Email: RE: Toorale and BDL calc*. Sydney: NSW Parliament. Obtained under Standing Order 52.

Valleys. If the same approach was used in the Murrumbidgee there would be a significant 'under-recovery.'

Regardless of which Cap Factors or water recovery targets are used, the error band in the models is significantly higher than the water recovery volumes being debated. The model is not a credible way to determine the water recovery needed or achieved.