

Application and assumptions used for deriving the BDL-based 2024 LTDLE factors for the Intersecting Streams

Introduction

The NSW Government is responsible for updating the 2018 Long-Term Diversion Limit Equivalence (LTDLE) factors when a water resource plan (WRP) is accredited in a river valley or the BDL model is revised with agreed-upon corrections and refinements. This report details how NSW has updated the LTDLE factors for the Intersecting Streams.

LTDLE factors reference:

- *Consultation paper: NSW updated factors for water recovery (June 2018)*
- *Water reform technical report: Derivation of LTDLE factors in NSW (May 2018)* (refer to this document for all inputs related to calculating the LTDLE factors including the reference files)

Supporting files for the updates:

- Confluence Reference (with working notes)
- *Alluvium, Water Balance modelling and hydrologic assessment report: Toorale water infrastructure project – Survey and design (April 2020).*

Background

Origins of past Cap usage figures

The intersecting streams are multiple rivers originating in Queensland that flow across the border into western NSW and continue south until they join the Barwon–Darling. These rivers are ephemeral and generally have not experienced irrigation development on the NSW side of the border due to the general remoteness and inconsistent flow regimes, making large scale irrigation uneconomical.

Most development takes the form of small block banks to enhance existing natural pools that provide water for stock and domestic purposes.

Historically, no metering of diversion was undertaken on this system. More recently (post BDL conditions) meters were installed at several properties under the NSW non-urban metering policy for a few farms deemed to be capable of irrigation take, however no diversions have been recorded since.

NSW has undertaken extensive remote sensing assessments and failed to identify consistent irrigation occurring historically, although a few ad-hoc developments were identified as having been used sporadically in the past. These developments focussed on fodder and grain production and were opportunistic rather than being a regular business activity.

The remote sensing assessment was backed up by a series of targeted entitlement holder interviews undertaken in support of a risk assessment for the protection of held environmental water owned by the Commonwealth in QLD that the Commonwealth Environmental Water Holder (CEWH) would like protected through the NSW Intersecting Streams, through the Barwon–Darling and into the Lower Darling and Murray systems. We spoke to all major entitlement holders or their friends/neighbours and nobody had current irrigation activities, although a number said they had the capability and would do so in the future if the returns justified the exercise.

NSW has historically supplied a figure of 3 GL/y for Cap compliance on the Intersecting Streams. We were unable to definitively trace the origins of this number or reproduce it, however after talking to retired NSW officers from that era it seems most likely that the number originated in the volumetric conversion process that NSW undertook to change area-based water usage permits to volumetric permits. Typically, in western NSW these “area” permits had a lower focus on the area which could be irrigated, and instead restricted the equipment that could be used and the purposes that were allowed for the water taken.

Present day expert opinion from Andrew Brown, A/Manager Water Modelling is that this 3 GL/y figure is generally plausible as a representation of widely distributed stock and domestic water use and small, infrequent irrigation that may occur from time to time. No better estimates are presently available, and it is not anticipated that, given the known priorities for the department, this situation would alter in the future.

The exception to the fit of this assessment is the former operations at the Toorale property near the junction of the Warrego and Darling rivers. This property was able to take water from both the Warrego and Darling rivers but was treated as a Barwon–Darling water user for most water management purposes, because that was the primary focus of the farm and the major source of irrigation water taken. Consistent verbal feedback from retired NSW Government employees was that there was no chance that Toorale was included in the 3 GL/y estimate. This personal feedback is consistent with earlier Barwon–Darling IQQM model configurations that accounted for Warrego pumping at Toorale as a Darling River take.

NSW and the Murray–Darling Basin Authority (MDBA) previously worked in collaboration to prepare a first estimate of LTDLE factors and the outcomes were published in [*Intersecting Streams – 2022 updated estimate of the BDL, LTDLE factors and the held environmental water recovered*](#) available on the [department’s website](#).

This first estimate was based on a full utilisation assumption for the Toorale entitlements and a 3 GL/y assumption for all other entitlements. Information available at the time suggested that take by the western floodplain exceeded the issued licences significantly and it was thought that new licences might be issued to better represent the past operational practices. This report will apply much of the same approach developed with the MDBA, but instead apply the best available information on the BDL condition usage attributable to the Toorale entitlements.

History of Development at Toorale

The original development at Toorale occurred in the late 1800s and was based on small block banks constructed on the Warrego River to supply stock and domestic pools, and one key structure at Boera Dam, which was designed to stand up the flow sufficiently so that it would move more regularly onto the western floodplain through existing natural flow paths. Water was “held” out on the floodplain with small banks (training walls) across low sections along the western side of the Warrego River and eventually, if a large volume was pushed westwards, some water could eventually rejoin the Darling River. This unique setup is made even more remarkable in that it was constructed before heavy earthmoving machinery was commonplace and according to anecdotal reports, was done by hand and with horse drawn scoops.

This water harvesting activity was for the purpose of enhancing the growth of natural pastures to provide better grazing for sheep. For a very long time (>100 years) this activity was not considered to be irrigation and the water management focus was on a requirement for passing flows at Boera Dam, which meant that unlimited volumes could be sent on to the floodplain as long as two pipes, with a licensed size and sill height, were kept open in Boera Dam to pass a share of any flow downstream to the Darling.

Later, NSW issued Toorale with nominal entitlements for the activity at Boera Dam. The method used to assess the entitlement volumes is unclear and verbal advice from past NSW Government employees suggests that they had no concrete information to go on, so they simply applied a standard rate and moved on. No attempts were made to require a meter for the diversions to the western floodplain or undertaking any other management responses beyond ensuring that the passing flow requirements were being followed because this ensured that, irrespective of the actual level of diversion that was occurring in practice, the level of diversions was not increasing. The lack of measurement meant that the licence sizes were immaterial.

Toorale was purchased by Clyde Agriculture (pre-BDL) who ultimately changed the focus of the business from sheep grazing to cotton growing.

The cotton growing development was based on the conversion of Ross Billabong into a large on farm storage. Ross Billabong could be filled with metered diversions from the Darling River,

floodplain harvesting (natural overbank flows) from the Darling into the top of Ross Billabong, and the construction of a block bank called Peebles Dam near the end of the Warrego River that would push water laterally to the east into Ross Billabong. Similar to Boera Dam, Peebles Dam had a passing flow requirement as its primary licensing control.

A private report commissioned from a consulting hydrologist by Clyde Agriculture indicated that during the cotton era at Toorale, the business preferentially allowed water to bypass Boera Dam to be captured further downstream into Ross Billabong and thence via second lift pumps into the cotton development. Neither the second lift pumps nor the lateral diversion from the Warrego River into Ross Billabong was ever metered or otherwise measured, even after the volumetric conversion of licences. It is understood that the quantum of “diverted” water was similar irrespective of whether it went to the western floodplain exclusively or to a combination of the western floodplain and the cotton development via Ross Billabong, as the diversion was driven in the main by the infrequent flow regimes and the passing flow licence conditions.

In the early 2000s, the NSW Government built the first hydrological planning model for the Barwon–Darling River in response to concerns that substantial growth in use had occurred since the imposition of Cap in 1993/94, as evidenced by an apparent spurt in infrastructure and area developed largely for cotton growing purposes. This model determined that growth in use had occurred, and the NSW Government implemented a novel treatment which saw the nominal ~540 GL of Barwon–Darling unregulated water entitlements reissued as an individual share of the assessed Cap of 173 GL/y for the entire valley. After further extensive model development work, this figure was revised upwards to 189 GL/y and it was eventually determined that the Barwon–Darling was not actually in breach of Cap conditions, however NSW elected to continue the management response of individual shares of Cap as a long term solution that was expected to ensure that a usage compliance based limit was highly unlikely to be breached at any time in the future.

Clyde Agriculture’s cotton business at Toorale was already somewhat marginal in terms of profitability and the consulting hydrologists report suggested that the success of the business was dependent on low-cost water with few practical limits on diversion being applied. The effective reduction in water that could be pumped from the Barwon–Darling, which was the primary water supply for the farm, in combination with inefficient storage in Ross Billabong led Clyde Agriculture to decide to sell up and the Commonwealth jointly purchased the property in 2008 with the NSW government with the idea that the NSW government would turn the farm into a national park, and the Commonwealth would use the entitlements for environmental purposes.

The irrigation infrastructure was progressively removed or disabled other than some historically significant structures and the then NSW Department of Planning and Environment – Biodiversity, Conservation and Science (BCS, now Conservations Programs, Heritage and Regulation in the NSW

Department of Climate Change, Energy, the Environment and Water) built a new weir at Boera Dam that included a fishway and a set of lay flat gates with an increased capacity of 1,650 ML/day

Licensing Issues at Toorale

As discussed above, water licensing and measurement at Toorale had always been quite laissez-faire, consistent with the general perceptions of no actual growth occurring and the difficulties in finding practical measurement solutions. However, after the Commonwealth led buy-out, community concerns grew from downstream water users in the Darling, Lower Darling and Murray that the Commonwealth and NSW governments would attempt to double dip on the entitlements by continuing or even increasing the volumes diverted onto the western floodplain while simultaneously attempting to recognise volumes acquitted against the unregulated Warrego entitlements downstream and into the Murray.

At a similar time, the NSW non-urban metering policy was released and ultimately the independent Natural Resources Access Regulator (NRAR) issued a breach notice to BCS for failing to meter diversions onto the western floodplain.

The NSW Department of Industry – Water (now the Water Group in the NSW Department of Climate Change, Energy, the Environment and Water) and BCS worked collaboratively to have the Minister formally declare that physical metering was impractical, and a model could be used as a substitute.

BCS commissioned the consultancy Catchment Simulation Solutions to prepare a source based hydrologic model that covered the Warrego from Fords Bridge down to the Darling and included a representation of the western floodplain for the first time. The western floodplain hydrologic representation was informed by a small-scale hydraulic model that produced the first meaningful description of how water left the river at Boera Dam and moved across the floodplain. The model was calibrated to satellite images of the wetting front.

Andrew Brown peer reviewed the model for the department, and it was accepted as an alternative metering method.

The availability of this alternative metering method was a major advance in our capacity to estimate diversions under BDL conditions, compared to the previous LTDLE factor assessment in 2018, and the metering model has been integrated into the new Barwon–Darling Source model that is currently under construction.

What counts as a diversion?

As discussed above, water pushed onto the western floodplain was not typically considered as a diversion and even the limited representation that was built into the original Barwon–Darling IQQM

model was never considered as something that should be reported into processes such as Cap compliance.

The *Water Act 2007* (Cth) (the Water Act) includes a broader definition of take as being water taken for a private benefit. Applying that definition to the activities at Boera Dam finds that the artificial structures of the dam and training walls do abstract water from the river at an artificially high rate and that a private benefit was being obtained through enhanced sheep grazing outcomes.

One possible interpretation then becomes that all extra water going onto the western floodplain that was there due to the presence of Boera Dam (with gates open or closed) and the training walls further downstream should be considered as take, net of any flows that ultimately returned to the Darling River. Under that interpretation an estimate of the take would be the difference between a “natural” or without development conditions model run and some kind of current conditions arrangement.

An alternative interpretation offered was that all water going onto the western floodplain was planned environmental water (PEW), so none of it should be acquitted to any of the purchased entitlements and those entitlements would instead be fully available to the CEWH to protect water flowing downstream to Menindee Lakes. This interpretation was not consistent the Water Act (that is, that take is in fact occurring), and even though environmental outcomes were also happening on the western floodplain alongside better sheep grazing, prior determinations by MDBA at Lowbidgee in the Murrumbidgee meant that incidental environmental outcomes of this type are not a protected entity.

A further review of past decisions around bywash dams led to the department making a formal policy decision that take by the fully licensed structure at Boera Dam was deemed to be occurring whenever the gates were closed. If the gates are open, no take is occurring even if additional water is leaving the river due to the presence of the block bank. All bywash dams cause some degree of additional lateral water movement and all are similarly managed through licence conditions that stipulate maximum wall heights and maximum sill levels in the bywash. Take is only considered to be occurring by actions taken on the pool created by the dam, not by the dam itself. Typical actions might include pumping from the pool or the operation of other diversion structures, in this case, passing flow pipes.

More recently, there has been a debate occurring about if gates closed means 900 ML/day (original passing flow capacity) or 1,650 ML/day as the new passing flow capacity of the upgraded Boera Dam. For LTDLE factor purposes, because we want BDL conditions, this pre-dates the new structure and the current operating regime, so under BDL conditions water would be passed until Peebles Dam is full (priority being given to the cotton side of the business), then pushed onto the western

floodplain, aka the management regime while Toorale was being operated by Clyde Agriculture immediately prior to the Commonwealth purchase of the property.

Dan Connor (Director Metering and Licensing) and Allan Raine (Director Water Planning Implementation) confirmed to Andrew Brown by email on 19 February 2025 that gate closed was metered diversion and gate open was PEW.

This more clearly expressed policy decision represents a significant advance since the prior estimation of LTDLE factors that occurred in 2018. No equivalent decision had been made prior to 2009 for BDL conditions which was instead characterised by the absence of any conscious choices. The MDBA established a precedent for the Barwon–Darling Cap regarding embargoes on diversions that NSW imposed on Barwon–Darling water users for the purpose of improving supplies available to Broken Hill further downstream. Although no embargoes had been applied prior to 1993/94, the MDBA determined that NSW would have applied those restrictions prior to 1993/94 if the right circumstances had eventuated for consistency with the priorities expressed in the NSW water management acts and that consequently embargoes should be applied as a feature for the full period of the Barwon–Darling Cap model scenario. NSW asserts that an application of the same principle be made in this case to the effect that if circumstances had compelled a determination prior to 2009, we would have arrived at the same conclusion as we have in 2024 and hence the gate closed equals diversion is also a BDL condition.

For BDL conditions in the intersecting streams, the governing limit on water extractions is Cap as the first water sharing plan was created in 2011. In essence, this report is asserting that the usage under BDL conditions becomes the old Cap figure of 3 GL/y plus any amounts assessed as being used from the Warrego at Toorale which was not previously considered.

Prior estimates of Warrego diversions at Toorale had been previously removed from the estimation of Cap diversions in the Barwon–Darling to prevent double counting.

Data Sources

Source Model

Catchment Simulation Solutions created an eWater Source based, water balance model (see *Toorale Water Balance Project – Boera Dam Hydraulic Modelling and Application development March 2021*), as part of the metering exemption application building on prior work by Alluvium for the Toorale Water Infrastructure Project (see Alluvium, *Water Balance modelling and hydrologic assessment report: Toorale water infrastructure project – Survey and design (April 2020)*).

The final report is archived at INW21/32084.

An existing “Scenario 2” of this Source model was adapted to represent BDL conditions. “Scenario 2 was intended to describe the operations of Toorale immediately prior to the Commonwealth purchase where the farm was operated as a cotton and sheep business by Clyde Agriculture. This scenario is the most representative of Cap conditions available.

Modifications were made to this scenario to impose the licence conditions alongside the gate closed equals take policy decision that was made after the model scenario was developed. A detailed description of the modifications made can be found in supporting file report (Warrego LTDLE Scenario Modelling for Toorale Station Western Floodplain Water Use.docx).

A summary of key changes to represent BDL conditions:

- Any water diverted onto the western floodplain when the gates are closed, is to be accounted for against a water access licence (WAL) (that is, considered held environmental water).
- Any water that goes onto the western floodplain (when the gates are fully opened), will be regarded as PEW.
- *Fully opened* is defined as when 900 ML/d passing through the Boera Dam main gates.
- Priority is given to the Unregulated River (Special Additional High Flow) licence with no carry over as per the water sharing plan.
- A bespoke accounting system was created to apply the 3-year debiting rule of the unregulated river licence as per the water sharing plan.

Entitlements

The entitlements under BDL conditions (generally 30 Jun 2009) and Current Conditions were reviewed, considering data from *Water reform technical report: Derivation of LTDLE factors in NSW (May 2018)*, the Water Licensing System, and *Water Sharing Plan for the Intersecting Streams*

Unregulated River Water Sources 2024, and used in the calculation of updated LTDLE factors in the Intersecting Streams, (Table 1)

Table 1. Intersecting Streams entitlements (BDL and Current Conditions)

Entitlement type	2018 Shares	2024 Shares
Unregulated River (Warrego at Toorale)	8,106	8,106
Unregulated River (Special Additional High Flow for Warrego at Toorale)	9,720	9,720
All other consumptive use *	17,924	17,924
Total	35,750	35,750

* The BDL is an estimate that is described in Schedule 3 of the Basin Plan for surface water and Schedule 4 for groundwater. The way the Basin Plan BDLs have been derived is set out in the water resource assessments for without-development and baseline conditions, Murray–Darling Basin Authority technical report 2010/20 Version 2 (MDBA 2011) for surface water and The proposed Groundwater Baseline and Sustainable Diversion Limits: Methods report (MDBA 2012) for groundwater. The BDL can change through the assessment of improved information about the limit of diversions as at 30 June 2009.

BDL Diversions

The new model was developed in the eWater Source package. The BDL model was adopted as the primary data source to describe long-term (1895–2009) diversions in the Intersecting Streams (Table 2).

Table 2. Intersecting Streams BDL diversions 1895–2009

Entitlement type	Estimated diversions 1895-2009 (ML/y)	Source of water usage data used for LTDLE calculation
Unregulated River and Unregulated River (Special Additional High Flow) Western Floodplain for the Warrego at Toorale	15,801	Modelled estimate from the Source model
Previous BDL for Intersecting Streams excluding Western Floodplain take	3,000	The BDL is an estimate that is described in Schedule 3 of the Basin Plan for surface water and Schedule 4 for groundwater.

No metered diversions are available for the Intersecting Streams, so the historical utilisation rates are unknown.

Results

2018 factors

The Intersecting Streams are largely undeveloped, with nearly all consumptive water use occurring at the Toorale property that was purchased by the Commonwealth in 2008. There are no available records of historical usages, or an existing BDL model scenario as used in the other systems. Previously, full recovery was assumed from this purchase. An estimate of the Basin Plan BDL as at May 2018 for the Intersecting Streams was 3,000 ML/y. Table 3 presents the 2018 and 2024 LTDLE factors.

2024 factors

Table 4 sets out the basis for how the updated factors were determined in 2025. The primary change is that an Intersecting Streams LTDLE factor for the western floodplain unregulated take has been revised. An estimate of the Basin Plan BDL as at May 2018 for the Intersecting Streams was 3,000 ML/y, this is still assumed for take other than the newly defined western floodplain unregulated take.

Key differences between 2018 and 2024 factors

A new model developed as an authorised alternative to physical metering has been modified and used to estimate take for the western floodplain that would have been occurring under Cap conditions, which defines the BDL

Steps have been taken to establish a methodology to define what is considered western floodplain unregulated take, rather than the assumption of full utilisation made in the 2018 assessment. Table 5 outlines the volumetric differences between the 2018 and 2025 assessments.

Table 3. Summary of 2018 and 2024 LTDLE Factors

Entitlement type	2018 LTDLE Factors	2024 LTDLE Factors
Unregulated River entitlements at Toorale (WAL 27558, 27555, 27552)	0.817	0.886
Unregulated River (Special Additional High Flow) (WAL 31152)	1.000	0.886
All other Intersecting Streams entitlements	0.167	0.167

Table 4. Intersecting Streams entitlements, 2018 factors, 2024 factors derivation and BDL shares by entitlement class

Entitlement type	2018			2024		
	Entitlement shares	Factors	BDL share (ML y)	Entitlement shares	Factors	BDL share (ML y)
Unregulated River (Toorale)	8,106	0.817	6,623	8,106	0.886	7,182
Unregulated River (Special Additional High Flow) (Toorale)	9,720	1.000	9,720	9,720	0.886	8,612
All other Intersecting Streams entitlements	17,924	0.167	3,000	17,924	0.167	3,000
Total	35,750	-	19,343	35,750	-	18,794

Table 5. Summary of Intersecting Streams environmental entitlements, the LTDLE volumes under the 2024 and 2018 factors, and the difference between the 2024 and 2018 factor volumes by entitlement class

Entitlement type	Total environmental entitlements	2018 factor	Recovery under 2018 factors (ML/a)	2024 factor	Recovery under 2024 factors (ML/a)	Change in recovery amount (ML/a)
Unregulated River	8,106	0.817	6,623 ¹	0.886	7,182	+559
Unregulated River (Special Additional High Flow)	9,720	1.000	9,720	0.886	8,612	-1,108

Entitlement type	Total environmental entitlements	2018 factor	Recovery under 2018 factors (ML/a)	2024 factor	Recovery under 2024 factors (ML/a)	Change in recovery amount (ML/a)
All other Intersecting Streams entitlements	16	0.167	0 ²	0.167	3	+3
Total	17,842	-	16,343	-	15,797	-546

¹ A Transcription error previously listed this as 6,626 (6,622.6)

² 16 ML of stock & domestic at Toorale was not considered previously

The 16 ML of stock and domestic entitlements present at Toorale are associated with the station house and workers cottages generally. Verbal advice from former NSW Government employees was that only the Unregulated River and Special Additional High Flow licences could be associated with the operation of Boera Dam and the distribution of flows onto the western floodplains. Against that description of purpose, the 16 ML entitlement is conceptually incorporated into the existing estimate of 3 GL/y of usage for the wider system because only the irrigation business at Toorale was not considered to be a part of the 3 GL/y estimate.