

Introduction

This is a summary guide to the current water allocation method for the Macquarie-Cudgegong regulated river water source. It is a concise document aiming to provide public information on the priorities for water sharing and how water is allocated to competing interests.

The Department of Planning, Industry and Environment periodically assesses available water resources. The resource assessment identifies the volumes of water for allocation to the different rights and categories of water access licenses (WAL). The process of allocating water to WAL holders is formally known as an Available Water Determination (AWD)¹. The results of the resource assessment and allocation process are advised through water allocation statements published on the department's website.

The water allocation statement sets out the percentage of entitlement each category of WAL has been allocated and therefore the volume of water credited to respective accounts. The water allocation statements are normally published monthly until full allocation for the water year has been made to all WAL categories.

This summary guide presents the key components behind the water allocation process, followed by an example of a past allocation and statement.

Water users

There are various types of water users including the environment, basic rights, as well as WAL holders. The principles and hierarchy of allocating available water to the different rights and categories of licences are prescribed in the *Water Management Act 2000* and the Water Sharing Plan for the Macquarie-Cudgegong Regulated River Water Source 2016. The Act states² that sharing of water from a water source must protect the water source, its dependent ecosystems, and basic landholder rights.

The maximum annual volumes assigned to rights and licence categories in megalitres (ML) per water year in this regulated river water source are listed below:

- Domestic and stock³ WAL 14,265 ML
- Local water utility⁴ WAL 22,681 ML
- High security⁵ WAL 19,419 ML
- General security (GS)⁶ WAL 632,428 ML
- Environmental water allowance (EWA)⁷ 160,000 ML

There is also Supplementary WAL⁸ with a full entitlement of 50,000 ML. Supplementary water users can only access water in periods of announced supplementary flow events, which occur when surplus flows, typically from tributaries and/or storages spills, are identified. Supplementary water is not supplied from storages (regulated water), therefore does not compete for allocations

¹ *Water Management Act (2000)*, Clause 59

² *Water Management Act (2000)*, Section 5(3)

³ Water Sharing Plan, Clause 21

⁴ Water Sharing Plan, Clause 22

⁵ Water Sharing Plan, Clause 23

⁶ Water Sharing Plan, Clause 24

⁷ Water Sharing Plan, Clause 14 (12)

⁸ Water Sharing Plan, Clause 25

with other licence categories. A supplementary WAL usually receives a full 100% allocation⁹ at the start of each water year, subject to the long-term limits, regardless of regulated water availability.

Planned environmental water

In this system, the planned environmental water is managed through an Environmental Water Allowance (EWA)¹⁰, which accrues water at the same time and rate as the general security WALs. For example, if general security WALs receive a 10% allocation increase, then EWA also receives a 10% allocation, which amounts to 16 GL.

The EWA balance is divided into translucent and active sub-accounts. The translucent sub-account water is used based on natural flow triggers, whereas the active sub-account volume is 'called' when required by environmental water managers. Any translucent release is subject to inflows to Burrendong Dam and operates between 15 March and 30 November. The active sub-account is intended to service targeted environmental assets downstream of Marebone Weir, such as the Macquarie Marshes.

The default position distributes 60% of EWA allocation to the translucent sub-account¹¹ and the balance (40%) to the active sub-account. However, this can be altered at the start of each water year¹² to allow the active component to increase up to 60%. This gives e-water holders greater operational flexibility. The translucent sub-account is intended to maintain instream ecological values in the Macquarie River between Burrendong Dam and Marebone Weir.

Opening allocation

New allocations are made at the beginning of each water year for the following licence categories; domestic and stock, local water utility and high security, as the remaining account balance cannot carry forward and is forfeited.

At the beginning of each water year, the full 100% allocation is required by the water sharing plan¹³ whenever possible for high priority entitlements, including domestic and stock, water utilities and high security WALs. On occasions when it is very dry and the allocation starts less than 100% for high security WALs, then high security WALs must be topped up to full allocation from the next available water before allocating to general security WALs¹⁴.

Major steps in the water allocation process

The major steps in the resource assessment resulting in water allocations include:

- 1) Identifying the water in storages.
- 2) Budgeting for a future inflow.
- 3) Deducting all existing commitments, inclusive of future higher priority commitments.
- 4) Setting aside water for system overheads to 'run' the river and deliver allocated water.

⁹ Water Sharing Plan, Clause 38

¹⁰ Water Sharing Plan, Clause 14

¹¹ Water Sharing Plan, Clause 14(12c) -translucent sub allowance to receive 60%.

¹² Clause 14(13)

¹³ Water Sharing Plan, Clauses 34-36

¹⁴ Water Sharing Plan, Clause 37(1)

This can be further illustrated using Equation (1) below.

$$\text{Water for Allocation} = \text{Available Resource} + \text{Future Inflow} - \text{Commitments} - \text{System Overheads} \quad (1)$$

General security water users and EWA receive their allocation increments only when additional 'Water for Allocation' is found through the resource assessment process and higher priority licences have already reached their required allocation.

Every river system has its own way of arranging the line items of its balance sheet (see Table). However, in broad terms, the balance sheet conforms with Equation (1). Accordingly, the four items shown on the right hand side of Equation (1) are explained next.

Available resource

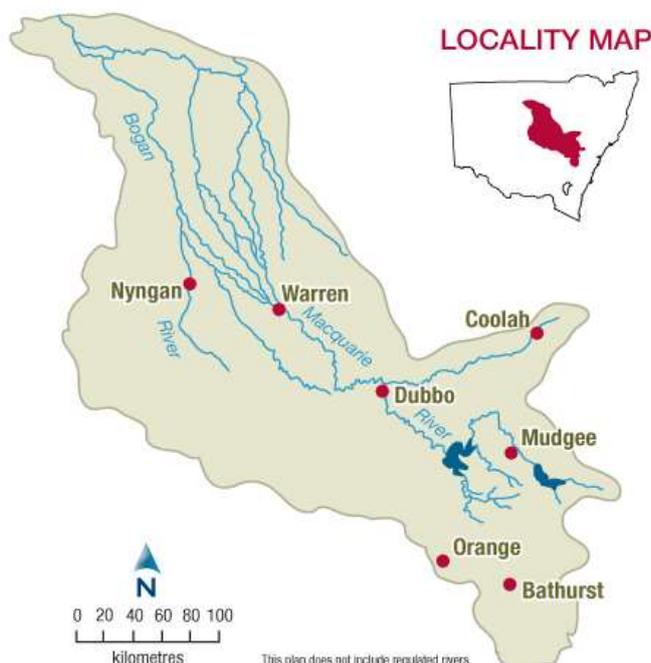
This river system has two headwater reservoirs in series – releases from the upstream storage can be captured by the downstream storage. Burrendong Dam has a capacity of 1,189,000 ML and the much smaller upstream storage, Windamere Dam, can hold 368,000 ML.

Burrendong Dam lies on the Macquarie River, while Windamere Dam is situated on the Cudgegong River. Available resource considers the total accessible volume in Burrendong Dam, plus periodic bulk water transfers from Windamere Dam.

The department does not assess Windamere volume while allocating to the users on the Cudgegong River. Instead, the practice is to reserve 70,000 ML in Windamere Dam to meet full allocation to all high priority entitlements, totalling 8,585 ML per year.

General security WALs on the Cudgegong River, with entitlement totalling 18,760 ML, receive the same allocation as those on the Macquarie River below Burrendong Dam.

Storage behind smaller in-stream weirs, useful in re-regulating and managing flows, is generally considered too small for inclusion in the resource assessment.



Future inflow

The resource assessment aims to secure water through a repeat of the driest observed inflow period¹⁵ to 1st July 2004 (the commencement of the inaugural water sharing plan). This is the design level of risk in the water sharing plan, balancing water allocation for productive use, with saving water in storage for security through drought. The two objectives are mutually exclusive.

A minimum inflow volume over a period of about two years in the flow sequence between 1892 to 2004 is included in the resource assessment as additional resource for allocation. In the highly unlikely event of a new record low inflow sequence, this assumed future inflow will not have

¹⁵ Water Sharing Plan, Clause 34

eventuated and account water will not be supported by physical water in storage. A small risk is, therefore; taken when allocating water.

In the Macquarie system the planning horizon varies from 21 months to 10 months, always ending in May, after which drought breaking inflow is received based on past records. The inflow (and the corresponding demand) gets smaller as the number of months in the horizon shortens. The planning horizon therefore has a ‘caterpillar’ action.

The resource assessment horizon during the months of May to August end at the following May. The horizon then steps out to one additional year from September. The shorter horizon prior to September improves the likelihood of general security allocation early in the season before another full year of water security is then set aside.

Future inflow is based on the net inflow into Burrendong Dam, after subtracting Cudgegong River flow at Yamble Bridge (421019). This is to avoid double counting the Windemere release, which has been included in the resource assessment as part of the bulk water transfer from Windemere.

The future inflow budget is shown below in **Table 1**. Note: the 11 November 2021 assessment example, provided later, allowed for 89 GL of future inflow arriving in the next 19 months. This was the minimum 19 month inflow to Burrendong Dam modelled from November 1918 to May 1920.

However, this was based on an old estimate (new estimate is 79 GL). The department’s Macquarie Integrated water Quantity and Quality Model (IQQM) version CC58 model, used to determine the sustainable diversion limit under the Basin Plan, is now being used to update previous historical inflow simulations. The previous and new inflow estimates are shown for comparison below in Table 1.

Table 1. Minimum inflow volume – period assessed 1892 to 2004

Planning horizon	Months	Previous Budget (GL)	Current IQQM Estimate (GL)	Months in history
Sep to May to May	21	130	101	09/1918 - 05/1920
Oct to May to May	20	96	83	10/1918 - 05/1920
Nov to May to May	19	89	79	11/1918 - 05/1920
Dec to May to May	18	43	77	12/1918 - 05/1920
Jan to May to May	17	29	77	01/1980 - 05/1981
Feb to May to May	16	26	61	02/1946 - 05/1947
Mar to May to May	15	26	53	03/1946 – 05/1947
Apr to May to May	14	26	52	04/1946 – 05/1947
May to May	13	26	51	05/1946 – 05/1947
Jun to May	12	24	51	06/1946 – 05/1947
July to May	11	21	49	07/1946 – 05/1947
Aug to May	10	18	32	08/1980 – 05/1981

Future inflow also allows for bulk water transfers from Windemere Dam, when Burrendong depletes to a low level. The transfer, when required, is planned to leave a minimum of 70 GL in

Windamere Dam, which provides a very secure supply for demands on the Cudgegong River system for the following five to seven years.

The example assessment as at 11 November 2021, provided later, allowed for a 25 GL water transfer in March 2022, when Burrendong was predicted to deplete to dead storage under a repeat of the worst dry inflow period.

Note: the actual transfer will be subject to actual storage behaviour and forecast at the time. Typically transfers can be deferred because system inflows are normally better than the planned minimums. For example, transfers have only been required twice since the inception of the water sharing plan in 2004.

Commitments

Monthly assessments for July and August set aside commitments for the current water year. Commitments for the current water year include basic landholder rights, planned environmental water (EWA), the balance of water in accounts and system overheads (discussed next).

Commitments from September onward includes a reserve to cover minimum opening allocation for the next water year. Note: the resource assessment does not explicitly consider commitments to supply users in Cudgegong River system, as these are met by the 70 GL reserve in Windamere Dam. Accordingly, commitments in the resource assessment only include water usage on the Macquarie River downstream of Burrendong Dam.

Accounts are debited as water is used, thereby reducing commitments. In rare occasions when Burrendong Dam is near full and making flood mitigation releases, a volume equivalent to the inflow into the flood mitigation zone is withdrawn from the carryover sub-accounts of general security, high security and EWA users¹⁶.

For example, the account balances shown in **Table 2** are volumes after a reduction of 79 GL, equivalent to the volume of inflow entering Burrendong Dam flood mitigation zone in October 2021. When all the carryover volume in sub-accounts is withdrawn then high security, general security and EWA accounts are reset with an allocation of 100% of entitlement, as experienced on 1 December 2021.

System overheads

System overheads are volumes that are required to operate the river. In the resource assessment, the following three overheads items are explicitly considered:

- evaporation loss
- transmission loss
- operational surplus

Evaporation loss

Evaporation loss is a direct function of storage level and the drawdown pattern. The current assessment extrapolates drawdown based on the 2017-18 use pattern.

The resource assessment calculates a monthly evaporative loss volume using the average exposed surface area of Burrendong storage during the month, multiplied by an evaporative loss (mm) and pan factor for that month. Monthly evaporation totals 2,122 mm annually¹⁷.

¹⁶ Water Sharing Plan, Clause 44(3)

¹⁷ Further multiplied by a pan factor of 0.7

The evaporation rate approximates the maximum annual evaporation of 1,973 mm observed in 1982. Resource assessment keeps track of actual evaporation volumes from Burrendong and Windamere storages.

Water in carryover sub-accounts is debited based on the net evaporation¹⁸ resulting from the extra surface area generated by the carried over water. This reduction in carryover volume as a result of evaporation is applied in Victoria, but not widely in NSW.

Transmission loss

Delivery of water through natural river systems incurs water loss through seepage into the riverbed and banks. This is accounted as transmission loss.

Operators analysed observed flows and losses from 1994 to 2018. The analysis highlighted water years starting 1994, 1997, 2006, and 2017 as representative of high loss years.

Based on these high loss years, at the start of each water year the resource assessment considers a fixed 145 GL base loss per year irrespective of delivery demand, plus an incremental loss of 4% of delivery volumes expected over the assessment period. A regular adjustment (reduction or increase) is made during each assessment as the water year unfolds and antecedent conditions change.

For example, in water years when replenishment flows to effluent creeks have already been met by downstream tributary flows, then the transmission losses associated with these deliveries are not included in the resource assessment. In summary, a conservative budget is set aside for transmission losses and, to the extent that losses are less than budget at each assessment, that water is released for allocation.

Conversely, in the unlikely event that transmission losses are greater than budget in any monthly assessment, then a temporary deficit may need to be carried forward until a subsequent assessment shows that inflow has recovered, and the deficit erased.

Operational surplus

In a hypothetical water delivery scenario with perfect control, the end of the river should exactly discharge the minimum flow rate or simply stop flowing if there were no end-of-system flow target.

In practice, water delivery efficiency is subject to variable weather patterns and the skill of river operators to adjust daily. Uncertainties includes forecast tributary inflows, attenuation of volumes through flow routing, precautionary extra release to ensure water orders are met, re-capture of flows when orders are cancelled (rainfall rejections) and the necessary releases and flow rates to maintain flow continuity.

As a result, a volume greater than the minimum flow requirement is likely to discharge from the bottom of the system. This is considered an operational surplus and the challenge for river operators is to minimise this loss.

The annual budget for operational surplus forms part of the 145 GL base loss described above and is regularly re-assessed as the water year unfolds.

Water allocation example of 11 November 2021

The table below is showing the water allocation computation behind the statement published on 11 November 2021. The assessment returned a 14% allocation to general security entitlements.

¹⁸ Water Sharing Plan, Clause 44(3a)

Allocation Methodology Summary

Macquarie Cudgegong Regulated River Water Source



Higher priority licence categories had previously received full allocations on 1 July 2021. The summary is shown in **Table 2**.

Table 2. Macquarie-Cudgegong assessment summary for 11 November 2021

Assessment Items (11/21 to 5/23)	Item Volume (GL)	Balance (GL)
Burrendong storage (31/10/21)	1178	
Future inflow budget (11/21 to 5/23)	89	
Potential Bulk Water Transfer from Windamere Dam (3/23)	25	1292
<i>Less commitments</i>		
Domestic and stock below Burrendong (11/21 to 6/22, 2022-23)	10	
Local water utility below Burrendong (11/21 to 6/22, 2022-23)	31	
Environmental water allowance	121	
High security below Burrendong (11/21 to 6/22, 2022-23)	25	
General security account balance below Burrendong	595	
<i>Less system overheads</i>		
Evaporation (11/21 to 5/22)	107	
Dead storage, unusable storage	38	
Rights, transmission and operation loss	258	
Water for Allocation (or deficit)		107 GL

Allocation hierarchy

As of 10/11/2021, HS allocation = 100%, GS allocation = 63%	
GS and EWA allocation increment possible is 14%, distributed as follows:	
GS increment, volume used below Burrendong 613.7 GL x 14%	85.9 GL
Less, 1% evaporation reduction: (594.9+85.9+trade 7.0) GL x 1%	-6.9 GL
EWA increment, volume used: 160 GL x 14%	22.4 GL
Less, 1% evaporation reduction: (121.1+22.4) GL x 1%	-1.4 GL
Volume to supply allocation traded in from upstream of Burrendong	7.0 GL
Total volume distributed	107 GL

Disclaimer

Allocations are based on a very conservative future inflow budget. However, during extended dry periods, inflow may be less than the budget, with higher than expected delivery losses also potentially creating shortfalls in resources. The management of allocation deficit during extreme drought is beyond the scope of this summary guide. Readers are referred to the [NSW Extreme Events Policy](#) for more details.

The routine water allocation computation, while following this guideline, is also subject to wider hydrological considerations not covered in this summary document. This is a guide only and subject to improvements and changes over time. Water users should use this information with caution and are encouraged to seek their own expert advice as needed.

Version History

First Edition	August 2020	R Murray
Revised Draft	August 2021	R Murray, S Chowdhury, C Barclay
Submitted for Public Release	March 2022	S Chowdhury, B Graham

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Annexure

Example: Water Allocation Statement - 11 November 2021

11 November 2021

Macquarie and Cudgegong Regulated Rivers Water Source

Water allocation update

There is sufficient resource available to provide an **allocation of 14% of entitlement to general security (GS)** licences in the Macquarie and Cudgegong regulated rivers water source. This increment brings the cumulative GS allocation to 77% of entitlement for the current water year. All higher priority licences were allocated their maximum 100% of entitlement on 1 July 2021.

2021-22	High Security	General Security
Cudgegong	100%	77%
Macquarie	100%	77%

Inflows totalling 83,000 megalitres (ML) into Burrendong Dam were observed during October, and storage levels were in the Flood Mitigation Zone (FMZ) for the majority of that month. As required under the water sharing plan, carryover allocations remaining in GS accounts, high security (HS) accounts and environmental water allowance (EWA) were proportionately withdrawn on 31 October with a volume equivalent to the inflows to Burrendong Dam while storage levels were in the FMZ. In total, around 79,000 ML was withdrawn from accounts. General security water availability is approximately 111% of entitlement, with about 34% of carryover currently remaining in accounts.

As Burrendong Dam is highly likely to re-enter the FMZ during November, the carryover withdrawal and reallocation process will continue should further inflows arrive and FMZ releases be needed. Another resource assessment will be conducted at the end of November and a new allocation will be announced in the December statement. When all remaining carryover volume has been withdrawn, GS, HS and EWA accounts are reset to 100%. This potential reset occurs based on the end of month assessment.

The current planning horizon for resource assessments runs to May 2023. The assessment secures the higher priority needs in the system for the next 19 months before further allocating to general security users.

Tributary flows and FMZ releases from Burrendong Dam will continue to be managed adaptively to meet higher priority commitments. Transfers from Windamere Dam to Burrendong Dam are currently forecast to not be required until at least February 2023.

Storage levels (as at 9 November 2021)

- Burrendong Dam is 97.9 % full – falling – holding about 1,166,200 ML
- Windamere Dam is 36.5% full – steady – holding about 134,900 ML

Seasonal climatic outlook

The Bureau of Meteorology's seasonal outlook for November to January indicates that maximum temperatures are likely to be about or below median while there is a good chance that rainfall will be at least median.

For further details: www.bom.gov.au/climate/outlooks/#/overview/summary

Resource Distribution (November 2021 to May 2023)	Volume (GL)
Current and Future Resources ⁽¹⁾	1,292
<i>less</i>	
General Security account balance ^{(2), (7)}	681
Planned Environmental Water ⁽³⁾	142
Domestic, Stock, Town ⁽⁴⁾	41
Inaccessible Storage ⁽⁶⁾	38
High Security ⁽⁴⁾⁽⁷⁾	25
Essential Requirements and Losses ⁽⁵⁾	258
Evaporation from Storage	107
<i>equals</i>	
Surplus (or deficit) ⁽⁸⁾	0

Notes:

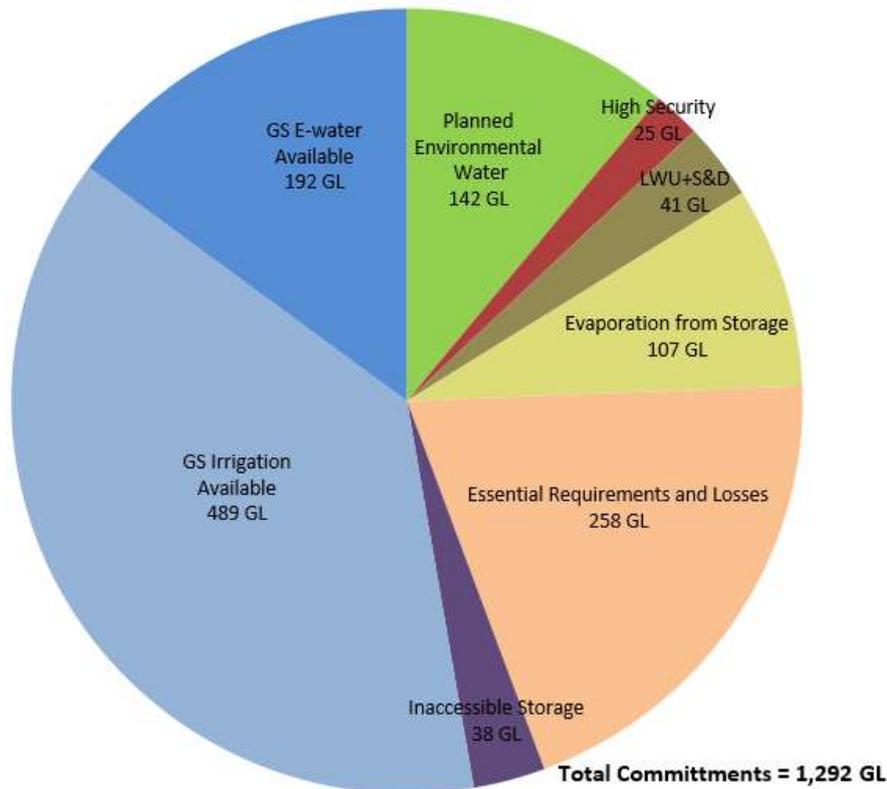
- ⁽¹⁾ End of October 2021 storage volume in Burrendong Dam plus minimum budgeted dam inflows from November 2021 to May 2023 plus 25 GL planned transfer from Windamere Dam.
- ⁽²⁾ Volume remaining in general security accounts, discounted for evaporative losses and including about 215 GL (34%) of carryover.
- ⁽³⁾ Water allocated to the Environmental Water Allowance (EWA) under the water sharing plan to provide for the Macquarie Marshes and the riverine environment. Excludes 'licence-based' environmental water.
- ⁽⁴⁾ Reserves required to meet the full use of allocated water by Domestic, Stock, Town and High Security WALs below Burrendong Dam over the assessment horizon.
- ⁽⁵⁾ Replenishments, basic rights and system overheads to run the river under dry conditions over the next 19 months. System overhead includes transmission losses and operational loss. This estimate is regularly refined as the year unfolds.
- ⁽⁶⁾ Dead storage of 34 GL plus 4 GL of unallocated storage to ensure valve operations at very low storage levels.
- ⁽⁷⁾ This volume may contain held environmental water (HEW). The reporting of HEW is indicative only, prior to reconciliation of usage and net trade, and is estimated to be 192 GL of GS and 0 GL of HS. These entitlements are held and/or managed either singly or jointly by various environmental holder groups, including the NSW DPIE Environment, Energy and Science (EES) and the Commonwealth Environmental Water Holder (CEWH).
- ⁽⁸⁾ This value indicates balance remaining after all allocations (negative = deficit). The system is secure at least to May 2023.

Water Allocation Statement

Water availability and allocation update



Resource Distribution (November 2021 to May 2023)



Next announcement

The next routine water allocation statement for the Macquarie and Cudgegong Regulated Rivers Water Source will be issued on **Friday 10 December 2021** or earlier if there is a significant change in the resource situation.

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