



# *Annual Water Outlook 2018-19*

Urban & Rural  
Final (October 2018)

## Revision schedule and deadlines

Table I: Action schedule and deadlines for submission of Annual Water Outlook (AWO).

Action	Endorsement / Approval	Due date
Assumptions	WRC for noting of assumptions	June
Interim	Water Resources Committee	24 July
Interim	Board of Coliban Water	24 August
Interim	Department Environment, Land, Water & Planning	31 August
Final	Water Resources Committee	23 October
Final	Department Environment, Land, Water & Planning	31 October
Final	Board of Coliban Water	16 November
Final	Department Environment, Land, Water & Planning	30 November

## Document control

Table II: Document control.

Author	Controller
Water Resources Manager (October 2018)	Water Resources Manager (October 2018)

## Revision and amendment history

Table III: Revision History

Document	Version	Revision date
Peer Review	0.1	22 May 2018
AWO 2018-19 (Interim, July 2018)	1.0	1 Aug 2018
AWO 2018-19 (Final, October 2018)	2.0	24 October 2018

### Proposed future amendments

Nil

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# Executive Summary

## Review of 2017-18

Inflows were only 66% of the median but our storages finished 2017-18 at 67% of capacity with more than two years of supply in hand. However the dry conditions mean that our catchment will require consistent rainfall to wet up and generate significant runoff.

Total aggregated demand was 43,916 ML which was 9% less than projected. The lower than expected demand may be due in part to the overall cooler conditions experienced.

## Resource Outlook for 2018-19

Our resource outlook is secure over the short-term. With persistent low rainfall recently and a moderately dry catchment the prospect for median inflow during 2018-19 remains limited. But our storages will be in a healthy position at 30 June 2019 to meet demand for Coliban Southern, if Coliban Northern (Bendigo) sources the majority of its raw water from external sources e.g. Lake Eppalock. The latter is likely to be the case by early 2019.

While opening allocations (from most external sources) have ranged from 32% up to 50% they have been increases as the season has progressed even under dry conditions. Campaspe system is the exception with 100% opening allocation. Coliban Water still holds sufficient reserves for the next 1-2 years depending on the system.

The Bureau of Meteorology's long-range climate outlook indicates El Nino like conditions (i.e. dry) from October 2018 out to March 2019 accompanied by warmer temperatures.

## Likelihood of Urban Restrictions or Low Rural Allocations

Coliban Water's rural allocations opened at 100%. The Coliban Headworks Storages continue to receive minor inflows.

Likelihood of Restrictions					
All nine raw water supply systems have adequate reserves for 2018-19. The likelihood of restrictions in any of our systems is rated as low. Rural allocations are 100%. Table 1 summaries the supply status.					

Table 1: Supply and demand for all Coliban Water supply systems.

Supply System	Available Supply		PWSR demand <sup>1</sup>		Reserve Status <sup>2</sup>
	1 July 2018	1 October 2018	'average'	'dry weather'	
Campaspe	427 ML	427 ML	69 ML	83 ML	>12 mths
Coliban Northern <sup>3</sup>	60,143 ML	69,422 ML	23,049 ML	27,994 ML	>24 mths
Coliban Southern <sup>4</sup>	46,932 ML	60,753 ML	16,203 ML	18,067 ML	>24 mths
Elmore	355 ML	355 ML	129 ML	154 ML	>12 mths
Goulburn	2,800 ML	2,825 ML	1,605 ML	1,926 ML	>12 mths
Loddon	574 ML	771 ML	374 ML	449 ML	>12 mths
Murray	4,408 ML	6,229 ML	4,434 ML	5,321 ML	~12 mths
Trentham	168 ML	168 ML	127 ML	152 ML	~12 mths
Wimmera <sup>5</sup>	360 ML	453 ML	233 ML	279 ML	>12 mths
<b>Total</b>	<b>116,167 ML</b>	<b>141,403 ML</b>	<b>46,222 ML</b>	<b>54,426 ML</b>	

Note 1: PWSR demand includes urban and rural raw water demands and losses (including evaporation and passing flow).

Note 2: Reserve status indicates compliance with Drought Policy No. 1, i.e. 24 months of reserves for the Coliban Northern and Coliban Southern systems and 12 months for all others at PWSR average demand levels (Coliban Water, Urban Water Strategy 2017).

Note 3: Includes total of Coliban Water's volumetric share of Lake Eppalock, plus water share allocations on the GMW Goulburn and Campaspe Systems, but excludes any transfer from Coliban Headworks Storages.

Note 4: Storage volume held in Coliban Headworks Storages excludes predicted future inflows.

Note 5: Includes the carryover of additional allocation that was previously purchased.

## Resource Outlook out to December 2019

The resource outlook is uncertain out to December 2019. With the last 18 months drier than average and the BoM projection of dry, warm conditions at least into autumn 2019 the upper Coliban River catchment will continue to dry out. The allocations from external bulk providers (GMW and GMMWater) are also uncertain.

## Context

### Annual Water Outlook (AWO) Guidelines and Review Process

It is a requirement of each water business to prepare an annual forward outlook on water availability. The Coliban Water, *Annual Water Outlook 2018-19* has been prepared in accordance with guidance from Department of Environment, Land, Water and Planning (DELWP).

The AWO considers the outlook based on several climate scenarios. The AWO is linked to an Annual Operating Plan (AOP) which outlines the actions and recommendations for the coming year that are necessary to maintain supply.

The Annual Operating Plan (AOP) uses the outputs from the AWO as the starting point for the consequential actions and Board recommendations. The two components should be read in conjunction with each other.

The Coliban Water, Annual Water Outlook has a forecast period from 1 July 2018 to 30 June 2019. The first iteration is prepared in July and a second (and final) iteration in October of each water year. The final AWO is submitted to DELWP after endorsement by the Board of Coliban Water. A draft is submitted to DELWP by the end of October.

Whilst this document is prepared and updated on an annual basis, regular water security updates are provided to internal and external stakeholders. The AWO review process takes into account raw water supply and demand, and any risks along with other factors. Coliban Water, along with other water businesses across Australia, also provides information to the Bureau of Meteorology on storage levels and inflows.

### Annual Water Outlook objective

The objectives in undertaking the AWO process include:

- To review the previous year, and provide a 12 month forward outlook on our resource position, and
- To ensure there is sufficient supply to meet the estimated demand, and hence meet our 'Level of Security' obligations to customers.

The AWO and AOP review processes form part of a broader risk management framework within Coliban Water.

## Overview of Coliban Water

### Coliban Water Business

Coliban Region Water Corporation (Coliban Water) is a state owned business that provides water and wastewater services to a region with a population of around 160,000 urban and rural customers across 16,500 km<sup>2</sup> of central and northern Victoria. The service area covers 49 towns in nine raw water supply systems. The supply systems and the respective towns are shown below:

Table 2: Supply systems and towns.

System	Towns Supplied <sup>1</sup>	Source Water <sup>2</sup>	Grid <sup>3</sup>
Campaspe	Goornong	Campaspe River	no
Coliban Northern	Bendigo, Axedale, Huntly, Raywood, Sebastian Heathcote, Tooborac	Coliban Headworks Storages, Lake Eppalock and Waranga Western Channel	yes <sup>4</sup>
Coliban Southern	Castlemaine, Elphinstone, Taradale, Maldon, Newstead, Harcourt, Guildford, Fryerstown Kyneton, Malmsbury, Tylden	Coliban Headworks Storages	no
Elmore	Elmore	Lower Campaspe Valley Groundwater Management Area	no

Goulburn	<b>Boort, Lockington, Rochester, Pyramid Hill &amp; Serpentine</b> (Jarklin, Macorna, Mysia, Mitiamo Dinglee)	<b>Waranga Western Channel</b>	yes <sup>5</sup>
Loddon	<b>Bridgewater</b> , Inglewood <b>Laanecoorie</b> , Tarnagulla, Bealiba, Dunolly	<b>Loddon River</b>	no
Murray	<b>Echuca</b> <b>Cohuna, Gunbower, &amp; Leitchville</b>	<b>Murray River</b> <b>Gunbower Creek</b>	yes <sup>6</sup>
Trentham	<b>Trentham</b>	<b>Spring</b> and groundwater	no
Wimmera	<b>Korong Vale</b> , Wedderburn (Borong, Wychitella)	<b>Wimmera Mallee Pipeline</b>	yes <sup>7</sup>

*Note 1: Towns shown in bold indicate the location of the water treatment plant (WTP) with all following towns supplied from that WTP. Towns within (brackets) are not supplied with potable water.*

*Note 2: Primary source indicated in bold.*

*Note 3: Indicates whether the system is connected to a water grid.*

*Note 4: Coliban Northern is connected to the GMW Goulburn System via the Colbinabbin Pump Station on the Waranga Western Channel and the GMW Campaspe System at Lake Eppalock.*

*Note 5: All the towns shown draw water from the GMW Waranga Western Channel which can also receive raw water from the GMW Campaspe and Loddon Systems.*

*Note 6: Within the Coliban Region the GMW Murray System can also receive raw water from the GMW Goulburn and Campaspe Systems.*

*Note 7: Our Wimmera System is supplied with raw water from the GWMWater Wimmera Mallee Pipeline (GWMW System 4). System 4 will soon have an alternative connection to the GMW Goulburn System via the Waranga Western Channel.*

Coliban System Northern (Coliban Northern) and Coliban System Southern (Coliban Southern) are interconnected and share water from the Coliban Headwork Storages. The flow direction is only in one direction from Coliban Southern to Coliban Northern via the Coliban Main Channel.

Water service functions carried out by Coliban Water include:

- Water harvesting, storage, treatment and distribution
- Urban wastewater collection, treatment, re-use and disposal, including trade waste, and
- Rural water supply.

### Potable Water Supply

There are 39 reservoirs and service basins to store raw water. Raw water is treated in one of our 19 water treatment plants, and distributed through 2,245 km of water mains (potable and non-potable).

*Table 3: Summary of customer connections at 30 June 2018.*

System	No. of Water Connections <sup>1,2</sup>		Major Customers
	Residential	Non Residential	
Campaspe	159	24	
Coliban Northern	45,273	3,633	Hazeldenes Chicken Farm Pty Ltd Parmalat Australia Ltd
Coliban Southern	10,153	1,115	N & C Enterprises Pty Ltd Hardwicks Meatworks Pty Ltd
Elmore	380	59	
Goulburn	2,348	391 <sup>3</sup>	Saputo Dairy Australia Pty Ltd
Loddon	1,213	162	
Murray	7,640	1,375	Kagome Food Pty Ltd Simplot Australia Pty Ltd Parmalat Australia YD Pty Ltd
Trentham	587	63	
Wimmera	590	75	
<b>TOTAL</b>	<b>68,343</b>	<b>6,897</b>	<b>8</b>

*Note 1: The number of connections at 30 June 2018.*

*Note 2: Connections include customers supplied by potable, recycled or raw water.*

*Note 3: The former Murray Goulburn Cooperative plant at Rochester has ceased operation.*

### **Wastewater Service**

The wastewater is collected through 1,904 km of sewer mains, and treated at 16 Wastewater Treatment Plants (including two 'Build Own Operate Transfer' plants). The recycled water is distributed to be used in public open spaces through 48 km of recycled water mains. The Recycled Water Factory at Epsom is designed to produce 'Class A and B' recycled water. The recycled water is mainly used to irrigate public open spaces in Bendigo and for rural non-potable use.

### **Rural Water Supply**

The Coliban Water rural system is supplied by a network of 438.5 kilometres of operational channels that receive a gravity supply released from Malmsbury Reservoir. Parts of the northern rural system can be supplemented with recycled water, or with water from GMW's Campaspe or Goulburn Systems. The raw water is delivered to customer properties generally through separate channel outlets. The water is not for drinking nor can it be used for personal hygiene.

The rural system services 1,360 rural licence customers, as at 30 June 2018. A reduction of 35 customers compared to June 2017. The two Coliban Water rural systems each account for about half of the total rural demand although the southern and northern rural demands can vary significantly in any year.

- Northern Rural System: 715 licence customers with entitlements of 5,698.2 ML.
- Southern Rural System: 645 licence customers with entitlements of 4,306.4 ML (excludes volume held by Coliban Water).



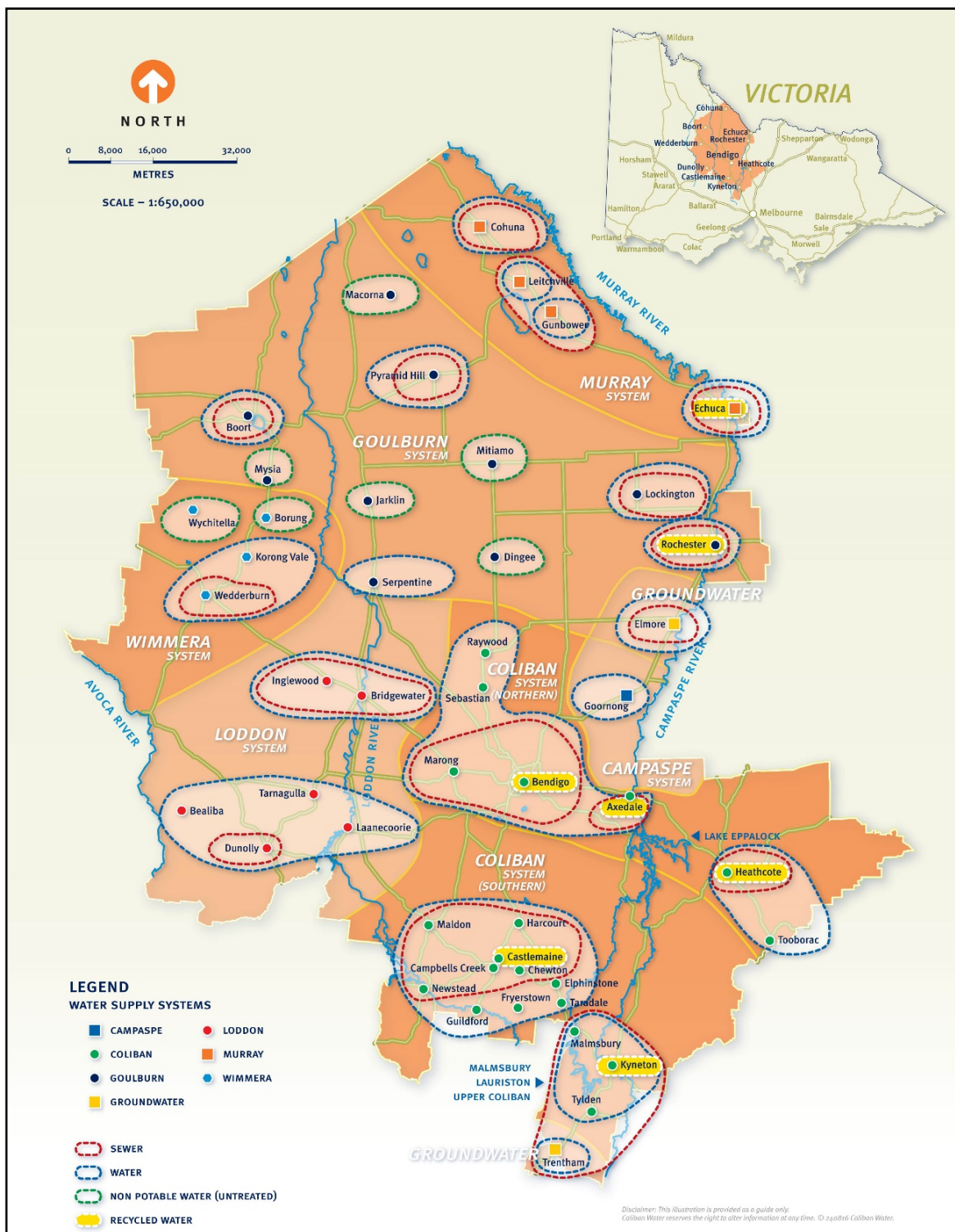


Figure 1: Map of Coliban Water region showing the water and non-potable supplies and the wastewater and recycled water systems.

## Geographical Context

Our raw water supply sources are spread out across Victoria from the alpine areas (GMW Murray and Goulburn Systems) to western Victoria (GWMWater Wimmera Glenelg System) in the Grampians.



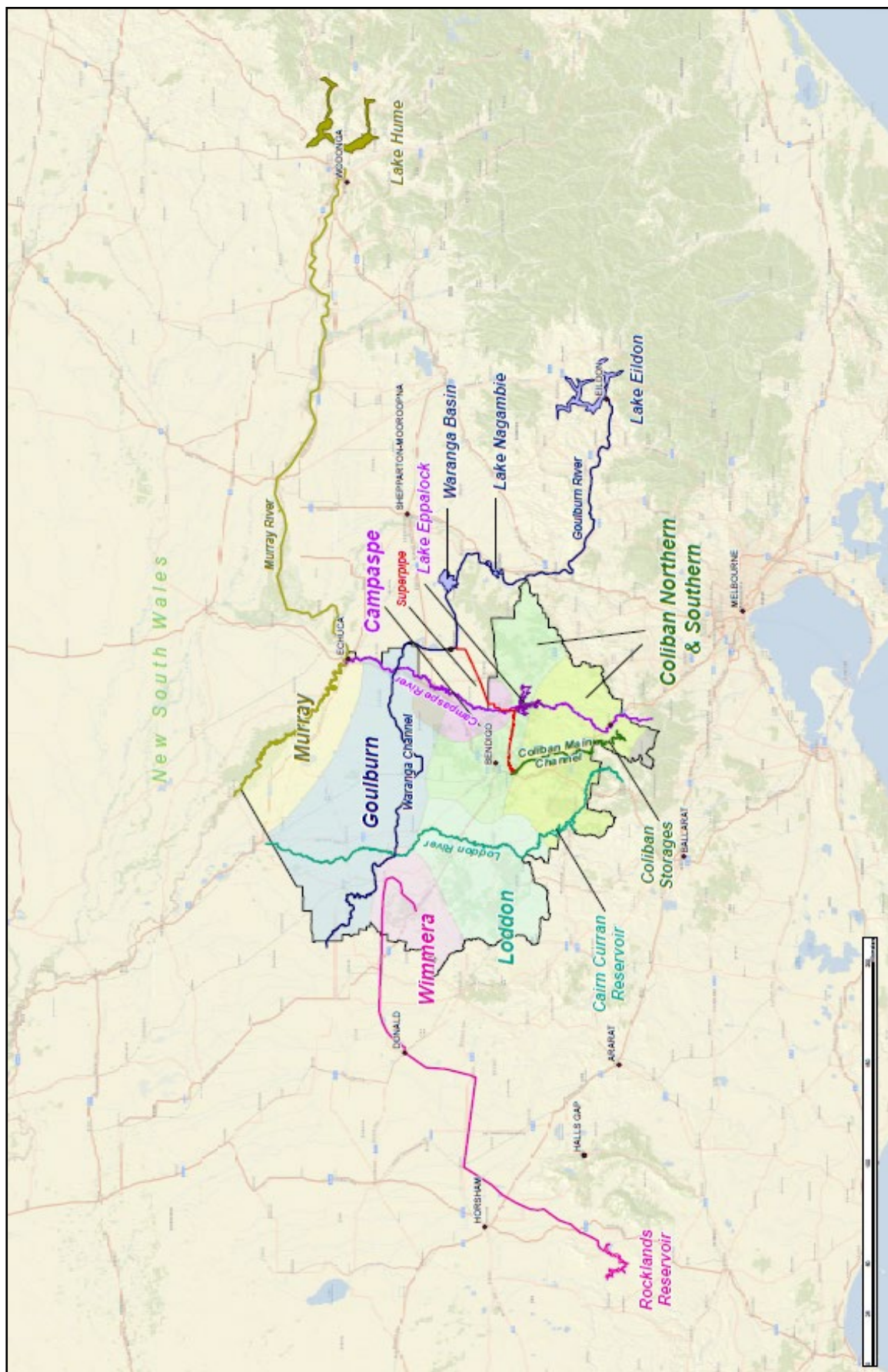


Figure 2: Raw Water Supply sources, including external supplies.

# Water Resources

## Water assets

Coliban Water holds entitlements to surface water and groundwater. A major proportion of our raw water supply is sourced from the Coliban River and stored within our Coliban Headworks Storages (CHS). We also have access to a portion of the inflows and storage capacity of Lake Eppalock. External raw water providers are Goulburn-Murray Water (GMW) (Campaspe, Goulburn, Loddon and Murray Systems) and Grampians Wimmera Mallee Water (GWMWater) (Wimmera System).

### Current status of water assets

Following the Millennium Drought (1997 – 2009), we hold an expanded portfolio of water assets (bulk entitlements, water allowances, water shares, and groundwater licenses). The major change in water assets has been the acquisition of water shares on the Goulburn-Murray Water (GMW) Goulburn System and Campaspe System. A complementary change in infrastructure assets is the capacity to transfer seasonal allocations from GMW Goulburn System via the Goldfields Superpipe and Colbinabbin Pump Station to Bendigo (Coliban Northern).

Assuming 100% allocation on external water sources and full storages, we could access more than two years supply at unrestricted demand at PWSR levels (Permanent Water Saving Rules). Any allocation carried over would provide additional security in the subsequent year(s).

For several of our supply systems (Campaspe, Coliban Northern, Goulburn, Loddon, and Murray), the opportunity exists to enter the water market for allocation trade (surface and groundwater) and the purchase of additional water shares. The water market is most active on the GMW Goulburn and Murray Systems, however water trade exists in other markets but opportunities are more limited.

Table 4 lists our water entitlements and available raw water supply from all sources for each supply system. The table provides the following detail as at 1 July and 1 October;

- Type of entitlement, entitlement volume, and water supply source, including the ability to trade,
- Seasonal allocation percentage and volume,
- Carryover, spillable and total available water, and
- Volume held in Coliban Water storages and our share in Lake Eppalock.

The notes below relate to Table 4 on the following page.

*Note 1: The BE allows Coliban Water to take an average of 17,440 megalitres per year, averaged over three years from Lake Eppalock. The amount noted in "Available" is the available volume of Coliban Water's share.*

*Note 2: BE allows Coliban Water to draw an average of 50,260 ML per annum from our Coliban Headworks Storages over a 3 year period.*

*Note 3: BE and licensed volume.*

*Note 4: Entitlement volume is averaged over 3 years.*

*Note 5: Volume of unused water allocation as at 30 June. In the majority of systems entitlement holders cannot 'carryover' more than 100% of their entitlement volume.*

*Note 6: Volume of water determined to be at risk of spilling. If a 'low risk of spill declaration' is made later in the season then the volume in the 'spillable water' account becomes available.*

*Note 7: Combined volume of Upper Coliban, Lauriston, Malmsbury, McCay and Barkers Creek Reservoirs.*

*Note 8: Coliban Water also holds 960 ML of groundwater licence that is available for full or partial trade.*

*Note 9: The carryover and available volumes represent Coliban Water's share and exclude any carryover volume leased by third parties.*

Abbreviations used in Table 4: BE (Bulk Entitlement), HRWS (High Reliability Water Share), and LRWS (Low Reliability Water Share), GW (groundwater), WA (water allowance).

Table 4: Coliban Water - entitlements (current as at 1 October 2018) and current year allocations.

Water entitlements					1 July 2018					1 October 2018			
Supply		Entitlement		Trade Yes/No	Allocation		Carryover <sup>5</sup> ML	Spillable <sup>6</sup> ML	Available ML	Allocation		Spillable <sup>6</sup> ML	Available ML
System	Source	Type	ML		%	ML				%	ML		
Campaspe	GMW Campaspe	BE	349	Yes	100%	349	78	0	427	100%	349	0	427
	sub-total		349	Yes		349	78	0	427		349	0	427
Coliban Northern	GMW Goulburn <sup>9</sup>	HRWS	22,774	Yes	32%	7,288	57	0	7,334	74%	16,853	0	16,910
	GMW Goulburn	LRWS	2,857	Yes	0%	0	1,272	0	1,272	0%	0	0	1,272
	Lake Eppalock	BE <sup>1</sup>	17,440	N/A	N/A	N/A	N/A	N/A	48,820	N/A	N/A	N/A	48,534
	GMW Campaspe	HRWS	2,591	Yes	100%	2,591	30	0	2,622	100%	2,591	0	2,621
	GMW Campaspe	LRWS	646	Yes	0%	0	85	0	85	0%	0	0	85
	sub-total		46,308			9,879	1,444	0	60,133		19,444	0	69,422
Coliban Southern	CW Storages <sup>7</sup>	BE <sup>2</sup>	32,820	N/A	N/A	N/A	N/A	N/A	46,932	N/A	N/A	N/A	60,753
	sub-total		32,820			N/A	N/A	N/A	46,932	N/A	N/A	N/A	60,753
Elmore	Groundwater	Licence <sup>3</sup>	284	No	100%	284	71	N/A	355	100%	284	0	355
	sub-total		284			284	71	N/A	355		284	0	355
Goulburn	GMW Goulburn	BE	2,420	Yes	100%	2,420	361	0	2,781	100%	2,420	0	2,781
	GMW Goulburn	WA	60	No	32%	19	N/A	N/A	19	74%	44	0	44
	sub-total		2,420			2,439	361	0	2,800		2,464	0	2,825
Loddon	GMW Loddon	BE <sup>8</sup>	820	Yes	50%	410	164	N/A	574	74%	607	0	771
	sub-total		820			410	164	N/A	574		607	0	771
Murray	GMW Murray	BE	6,285	Yes	41%	2,577	1,794	0	4,371	82%	5,154	750	6,198
	GMW Murray	HRWS	55	Yes	41%	23	0	0	23	82%	45	29	16
	GMW Murray	LRWS	162	Yes	0%	0	15	0	15	0%	0	0	15
	sub-total		6,364			2,600	1,809	0	4,409		5,199	779	6,229
Trentham	Groundwater	BE <sup>4</sup>	120	N/A	N/A	120	N/A	N/A	120	N/A	120	N/A	120
	Groundwater	Licence	48	N/A	N/A	48	N/A	N/A	48	N/A	48	N/A	48
	sub-total		168			168	N/A	N/A	168		168	N/A	168
Wimmera	GWM Water	BE <sup>1</sup>	300	Yes	9%	27	333	0	360	40%	120	0	453
	sub-total		300			27	333	0	360		120	0	453
TOTAL			89,833			16,156	4,260	0	116,158		28,635	779	141,403

## Raw water balance - Coliban Water and external sources

On 1 July 2018 the total amount of raw water available for all our supply systems was 116,158 ML. In comparing this volume to last year we are commencing the season with 10,570 ML less. Refer to Table 4 for available water for each supply system and Table 5 for storages.

The opening allocations on 1 July 2018, for GMW high reliability water shares varied between 32% and 100% compared to 36% and 100% last year. Further allocation announcements are anticipated from the GMW Resource Manager with all high reliability water share accounts expected to receive increases up to 100% (assuming average to dry conditions). GWMWater's opening allocation for the Wimmera System was 9% compared to 37% last year. During 2017-18 water for Coliban Northern was mainly supplied from the Coliban Headworks Storages, however pumping from Lake Eppalock resumed on 4 June 2018. In total 903 ML was pumped from Lake Eppalock between 1 July 2017 and 30 June 2018.

### Raw water outlook for 2018-19

#### July 2018 Outlook

On 1 July 2018, Coliban Northern was supplied from GMW Campaspe System (Lake Eppalock). This was the case until the storages received sufficient inflow to be above the volumetric trigger. Around 22 GL was required to fill the storages at that point in time.

The inflow during 2017-18 was in the lowest portion of the 95% confidence limit for median inflow of 49.2 GL (only 66% of median). The Bureau of Meteorology (BoM) is forecasting a less than 25% chance of wetter than average conditions for the July to September period. The long-term climate outlook is for neutral conditions over the next nine months until at least March 2019, however the majority of global climate models are predicting a trend to El Nino conditions by spring.

The prospects for median inflow during 2018-19 is low and likely to be similar or less than 2017-18.

#### October 2018 Outlook

By the end of September 2018 our storages had failed to fill but remain above the 50 GL volumetric trigger hence Coliban Northern remains supplied from our headworks storages. However the level of inflows is tracking more closely with the median 'post-1997' climate baseline. The long-range climate outlook is for dry conditions until at least March 2019 (the limit of the outlook period). Should dry conditions persist then 2019-20 is likely to be more challenging however overall reserves are good.

Table 5: Coliban Water storages raw surface water balance as at 1 July and 1 October 2018.

Storage	Capacity	1 July 2018	% Capacity	1 October 2018	% Capacity
Upper Coliban	37,770 ML	28,476 ML	75.4%	37,771 ML	100%
Lauriston	19,790 ML	15,700 ML	79.3%	18,990 ML	96.0%
Malmsbury	12,034 ML	2,756 ML	22.9%	3,992 ML	33.2%
<b>Sub-total</b>	<b>69,594 ML</b>	<b>46,932 ML</b>	<b>67.4%</b>	<b>60,753 ML</b>	<b>87%</b>
Lake Eppalock	54,837 ML	48,820 ML	89.0%	48,534 ML	88.5%
<b>Sub-total</b>	<b>54,837 ML</b>	<b>48,820 ML</b>	<b>89.0%</b>	<b>48,534 ML</b>	<b>88.5%</b>
Barkers Creek	1,690 ML	622 ML	36.8%	622 ML	36.8%
McCay	1,360 ML	1,152 ML	84.7%	1,200 ML	88.2%
Caledonia	214 ML	181 ML	84.4%	105 ML	49.1%
Sandhurst	2,590 ML	2,180 ML	84.2%	1,811 ML	69.9%
Spring Gully	1,680 ML	917 ML	54.6%	992 ML	59.0%
Trentham <sub>1</sub>	84 ML	69 ML	82.1%	89 ML	106%
<b>Sub-total</b>	<b>7,618 ML</b>	<b>5,121 ML</b>	<b>67.2%</b>	<b>4,819 ML</b>	<b>63.3%</b>



<b>Total</b>	<b>132,049 ML</b>	<b>100,873 ML</b>	<b>76.4%</b>	<b>114,106 ML</b>	<b>86.4%</b>
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Note 1: Combined raw water volume held in Trentham No. 1 and Trentham No. 2 Reservoirs.

## Supply - Demand balance ("reserve rule")

The reserve status column of Table 6 uses actual supply (1 July or 1 October, whichever is the most recent) and indicates the degree of compliance with 'Drought Policy No. 1 Raw Water Reserves' (Coliban Water, *Urban Water Strategy 2017*). The reserve status uses the PWSR adjusted demand ('average' demand) as estimated at 1 July each year and compares this to the actual reserves.

Supply – Demand outlook for 2018-19	
<b>July 2018</b>	All our supply systems have access to sufficient reserves to meet PWSR adjusted demand for the current year and over two years in the major systems.
<b>October 2018</b>	No change. For 2019-20 the Wimmera system may require the purchase of additional allocation however the South-West Loddon Pipeline project is likely to be operational by this time and hence provide access to an alternative source of water for this system.

Table 6: Supply to Demand for all Coliban Water Supply Systems (1 July 2018 and 1 October 2018).

Supply System	Available Supply		PWSR demand <sup>1</sup>		Reserve Status <sup>2</sup>
	1 July 2018	1 October 2018	'Adjusted'	'Forecast'	
Campaspe	427 ML	427 ML	69 ML	83 ML	>12 mths
Coliban Northern <sup>3</sup>	60,133 ML	69,422 ML	23,049 ML	27,994 ML	>24 mths
Coliban Southern <sup>4</sup>	46,932 ML	60,753 ML	16,203 ML	18,067 ML	>24 mths
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Note 1: PWSR demand includes urban and rural raw water demands and losses (including evaporation and passing flow).

Note 2: Reserve status indicates compliance with Drought Policy No. 1, i.e. 24 months of reserves for the Coliban Northern and Coliban Southern systems and 12 months for all others at PWSR adjusted demand levels. (Coliban Water, *Urban Water Strategy 2017*.)

Note 3: Includes total of Coliban Water's volumetric share of Lake Eppalock, plus water share allocations on the GMW Goulburn and Campaspe Systems, but excludes any transfer from Coliban Headworks Storages.

Note 4: Storage volume held in Coliban Headworks Storages excludes projected inflows.

Note 5: Includes the carryover of additional allocation that was previously purchased.

## Inflows into Coliban Headworks Storages

From 1 July 2017, Coliban Water has used revised baselines for rainfall and inflows i.e. the 'current climate' baseline and 'post-1997' baseline. The latter is also referred to as the 'step change' baseline. The calculation of the baselines are based on guidelines issued by DELWP as part of the development of our *Urban Water Strategy 2017*. Broadly the revised baselines indicate a reduction in median rainfall and median inflows, hence some of the information presented in this Annual Water Outlook is not directly comparable to previous years. The section on 'climate risk' presents more detail on the revised methodology and the use of the 'standardised precipitation index' as a drought indicator.

During 2017-18 the total inflow into storages managed by Coliban Water was 32,491 ML compared to 100,293 ML the previous year. The total inflow was only 66% of the median of around 49,200 ML (current climate baseline median inflow revised during 2017-18). There is only a 33% probability of receiving less than this level of inflow. The Bureau of Meteorology's (BoM) long-range forecast indicates neutral conditions for July to September for the Pacific and Indian Oceans but the soils within the Coliban River catchment are already

relatively dry. In October 2018 this outlook has changes to 'dry'. This three month period coincides with the period of the year when inflows are consistent, but with a high variation in magnitude between years as mentioned previously. Average to 'dry' conditions are expected over spring and summer which may lead to increased demand and lower storage volumes by June 2019.

The preceding weather conditions have been relatively dry, and the prospect for median inflow for 2018-19 is now dependent on sustained rainfall events over the coming months. The long-range climate forecast suggests a trend to El Nino (dry) conditions.

*Table 7(a): Inflow projections for 2018-19 based on 'current climate baseline' (July 1975 to June 2017).*

Year	Climate Scenario		
	Dry <sup>1</sup>	Average <sup>2</sup>	Wet <sup>3</sup>
2015-16 (actual)	8.3 GL <sup>4</sup>		
2016-17 (actual)			100.3 GL <sup>4</sup>
2017-18 (actual)	32.5 GL <sup>5</sup>		
2018-19 (July-Sept)	4.3 GL	34.1 GL	58.4 GL
<b>2018-19 (actual)</b>	<b>17.0 GL</b>		
2018-19 (annual)	9.1 GL	49.2 GL	97.5 GL

Note 1: 'dry' is based on the 10<sup>th</sup> percentile inflow using the 'current climate' baseline.

Note 2: 'average' is based on the 50<sup>th</sup> percentile (i.e. median) inflow using the 'current climate' baseline.

Note 3: 'wet' is based on the 90<sup>th</sup> percentile inflow using the 'current climate' baseline.

Note 4: There is less than a 10% probability of receiving this inflow based on the 'current climate' baseline.

Note 5: The worst single year on record was during 2006-07 when only 3.1 GL of inflow was received. The worst continuous three years averaged 4.8 GL of inflow during the Millennium Drought.

*Table 7(b): Inflow projections for 2018-19 based on 'post-1997 climate baseline' (July 1997 to June 2017).*

Year	Climate Scenario		
	Dry <sup>1</sup>	Average <sup>2</sup>	Wet <sup>3</sup>
2018-19 (July-Sept)	3.5 GL <sup>5</sup>	16.4 GL	36.7 GL
2018-19 (annual)	7.3 GL	23.5 GL	87.1 GL

Note 1: 'dry' is based on the 10<sup>th</sup> percentile inflow using the 'post-1997 climate' baseline.

Note 2: 'average' is based on the 50<sup>th</sup> percentile (i.e. median) inflow using the 'post-1997 climate' baseline.

Note 3: 'wet' is based on the 90<sup>th</sup> percentile inflow using the 'post-1997 climate' baseline.

#### **Inflow to Headworks Storages outlook for 2018-19**

##### **July 2018 – Potential for median inflow is less than 50%**

It is uncertain if median inflow of around 49.2 GL will be achieved during 2018-19. Based on the long-range climate forecast and preceding dry catchment conditions there is limited prospect of median inflows or of Malsbury Reservoir spilling by the end of winter or early spring. The Standardised Precipitation Index (SPI) for rainfall at Malsbury Reservoir was at -0.59 on 30 June 2018, indicating moderately dry conditions (with respect to rainfall) over the preceding 12 months. The index would need to be remain positive to increase our prospects of achieving median inflow.

Around 22,000 ML is needed to fill the storages (ignoring demands). There is around an 80% chance of receiving this level of inflow based on the 'current climate' baseline.

The storage levels of the major and minor storages at the beginning of July 2018 were around 37% and 84% full respectively. The minor storages are generally in a similar starting position to July 2017 as they have deliberately been kept close to capacity. The exception is Barkers Creek Reservoir which will be refilled once works on the Coliban Main Channel are complete.

##### **October 2018 – Potential for median inflow is much less than 50%**

The inflow between 1 July and 30 September 2018 was well below the current climate median of 34.1 GL with only 17.0 GL received. Given the dry long-range forecast and the existing dry conditions it would take an exceptional event to achieve median inflow this year. The net deficit in rainfall has not been great however it has persistently been relatively low over an extended period of time. By 30 September 2018 the SPI has

dropped only marginally to -0.69. While this negative value does not signify a meteorological drought the catchment response to rainfall has been more related to a mild drought.

The climate scenarios in Figures 3 and 4 represent the following percentile values.

- 'wet' represents the 90<sup>th</sup> percentile
- 'average' represents the 50<sup>th</sup> percentile i.e. the median
- 'dry' represents the 10<sup>th</sup> percentile.

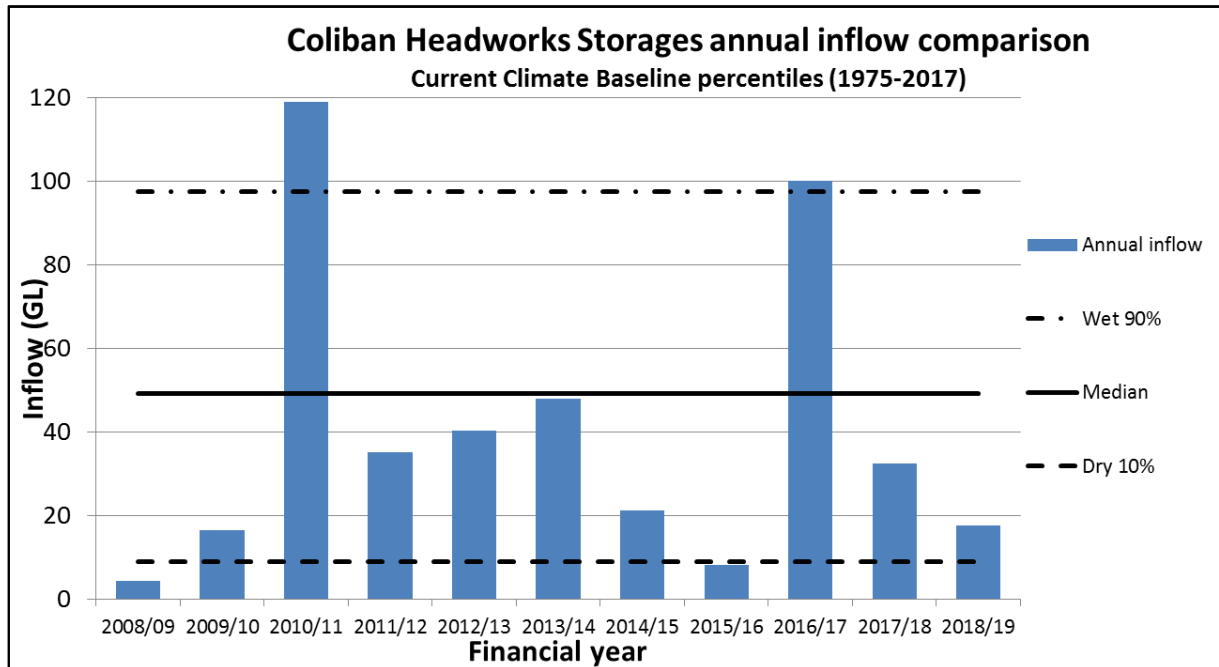


Figure 3: Monthly inflows into Coliban Water Headworks Storages compared to climate scenarios.

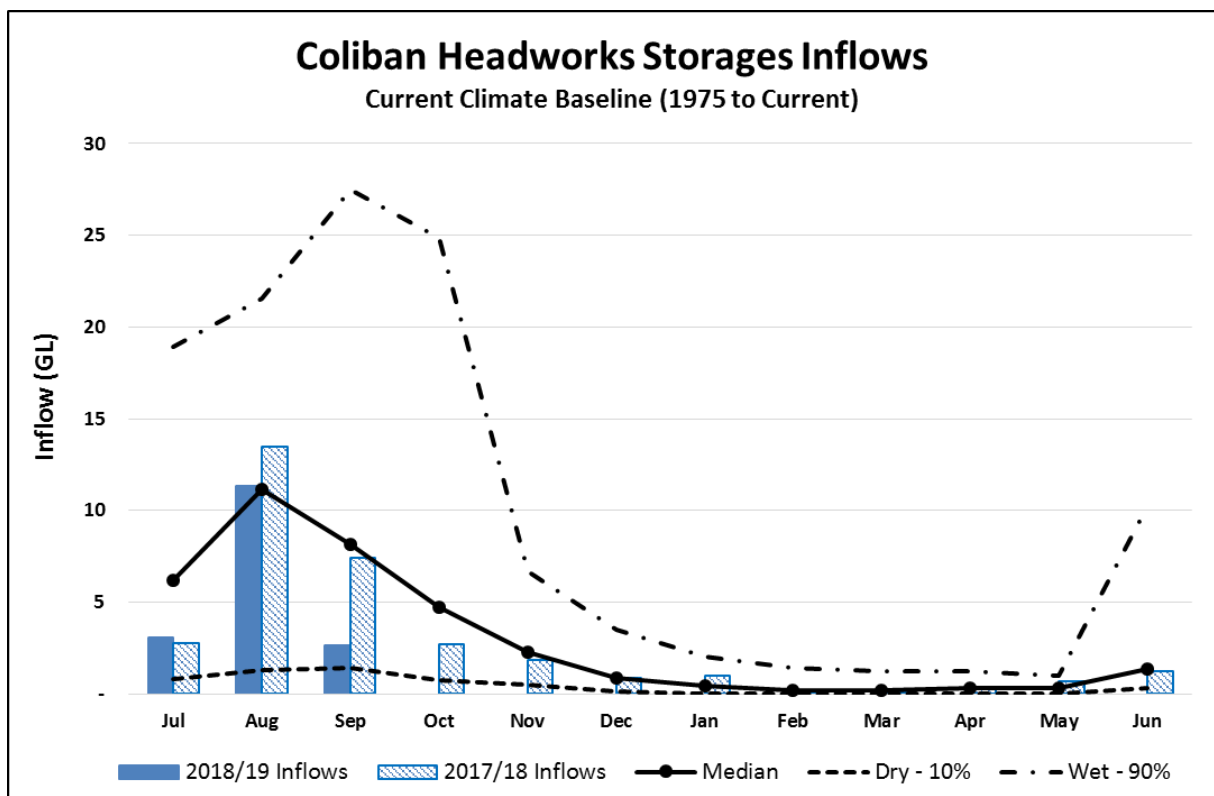


Figure 4: Annual inflows into Coliban Water Headworks Storages compared to climate scenarios.



## Seasonal allocations Bulk Suppliers (GMW and GWMWater)

Seasonal allocations vary between all raw water supply systems and between Bulk Entitlements and water shares. We have access to different forms of entitlement across our nine supply systems. Seasonal (annual) allocations are progressively announced throughout the water year and are traditionally linked to an irrigation season (spring-autumn period). The GMW irrigation system generally operates from mid-August through to mid-May the following year.

### Seasonal allocation outlook for 2018-19

#### July 2018 – Opening allocations under ‘average’ conditions

##### **GMW opening allocations range between 32% and 100% for High Reliability Water Shares (HRWS)**

While seasonal allocations are not finalised for all systems the opening allocations are positive with the Murray opening on 41%, Goulburn on 32%, Loddon on 32%, and Campaspe on 100%. Future allocations will be assessed based on the inflows received.

##### **GWMWater opening allocation of 9%**

The season has opened with 9% allocation. The major GWMWater storages that supply our Wimmera System have commenced 2018-19 with storage volumes over 46% of capacity. Inflows over the preceding 12 months have been well below historical averages.

#### October 2018

##### **GMW allocations range between 74% to 100% for HRWS**

While this is an overall improvement compared to 1 July it still represents a shortfall in our preferred resource position. Further improvements to allocations in the Goulburn, Loddon and Murray are anticipated.

##### **GWMWater allocations have reached 40% (Oct' 2018)**

The allocation for the 'Wimmera Mallee Pipeline' has reached 40% there is limited prospect for significant further improvements. Inflows into the GWMWater storages have been very low compared to historical averages.

When carryover volumes are high, low opening allocations do not represent a water security challenge. Coliban Water will always seek to carryover sufficient volumes to meet foreseeable demand in accordance with its reserve rules (24 months of reserves for Coliban Northern and Coliban Southern, and 12 months in all other systems). In our Wimmera System we endeavor to maximise our carryover volume as the system is vulnerable to dry years and carryover is uncapped. (The carryover volume at 30 June 2018 was in excess of 12 months of average demand).

## Risk of spill

The risk of spilling water that is in excess of 100% of entitlements depends on the current storage capacity, predicted inflows into storages and consumptive demands. During a period of high inflows any water held in a 'spillable' account is at risk of spill. A storage manager can also decide to pre-release water from storage in order to create headspace to capture future inflows. Such a pre-release would proportionally reduce the volume of water held in a spillable account.

Until a 'low risk of spill declaration' is made by the relevant resource manager spillable water cannot be used or traded.

### Risk of spill outlook for 2018-19

#### July 2018

##### **Risk of Spill 1: Goulburn-Murray Water – low to moderate**

Opening allocations in all GMW supply systems have been mostly favourable. With residual volumes and the prospect of additional inflows into the major storages such as Eildon (Goulburn), Eppalock (Campaspe), Hume and Dartmouth (Murray) the risk of spill this year is significantly lower than 2017-18. The risk of spill ranges from 12% to 59% (GMW, Resource Manager 2 July 2018).

The Loddon storages of Tullaroop, Cairn Curran, and Laanecoorie are only collectively at 53% of capacity compared to 70% the previous year. The risk of spill remains low.

##### **Risk of Spill 2: Grampians Wimmera Mallee Water – low**

GWMWater storages have considerable headspace to store further inflows. The major storages that are used to supply our Wimmera System are around 40% of capacity, slightly less than last year.

**Risk of Spill 3: Coliban Water – moderate**

At the start of July 2018 our major storages were over 67% of capacity compared to over 65% last year. However the seasonal rainfall forecast is for drier than average conditions during the most reliable time of the year for inflows.

**October 2018****Risk of Spill 1: Goulburn-Murray Water – low**

The proportion of full supply level (FSL) of GMW's major storages ranges from 52% for Cairn Curran Reservoir (Loddon) to 85% for Dartmouth Dam (part of the Murray System). A low risk of spill declaration has already been made for the Murray System.

**Risk of Spill 2: GWMWater - very low to low**

The major GWMWater storage (Rocklands Reservoir) is only at 43 % of FSL. The storage that supplies the bulk of water to System 4 (Lake Bellfield) is at 86% of FSL. The latter storage is mostly used to provide raw water to our Wimmera System.

**Risk of Spill 3: Coliban Water - low**

While the Coliban River storages are at 87% of FSL the overall risk of spill is low as traditionally the majority of our inflows occur between July and September.

## Water quality and risks

Many water quality parameters can impact negatively on the availability of water and hence impose a water quality supply constraint. Any given raw water source can experience wide variation in water quality. However the ability of a water treatment plant (WTP) to deal with any deterioration in water quality will determine if there is a potential supply constraint.

Parameters that can impact on raw water quality include sediments (increased turbidity), high nutrient concentrations or organics (taste, odour and potentially algal outbreaks), elevated levels of naturally occurring minerals e.g. iron and manganese (taste and odour), and salinity (taste). High organic concentrations that occasionally occur on flood recession when water drains off floodplains can result in 'black water' events that not only impact on aquatic ecosystems but also test the capacity of WTPs to treat the raw water to potable standards.

We have limited capacity to manage these parameters 'at source' and hence we maintain capacity at our water treatment plants to manage the risks and ensure on-going security of supply.

Outbreaks occurred during the warmer and cooler months of 2017-18, similar to the previous year. The duration of individual outbreaks was shorter than 2016-17 and generally not as severe but still widespread. In towns where the water treatment plants that did not have the capacity to remove any taste, odour or toxins, water from alternative sources was carted in by tanker.

*Table 8: Poor water quality events experienced during 2017-18.*

System Town	Source Water	Duration (weeks)	Maximum Alert Level <sup>2</sup>	Comments
<b>Campaspe</b>				
Goornong	Campaspe River	16	2	water carting
<b>Coliban Northern</b>				
Heathcote	Lake Eppalock/Caledonia	26	2	managed
<b>Coliban Southern</b>				
Castlemaine	McCay Reservoir	2	1	managed
Kyneton	Lauriston Reservoir	1	1	managed
<b>Goulburn</b>				
Boort	service basin	11	2	managed
Dingee <sup>3</sup>	service basin	8	1	managed
Lockington	service basin	13	2	managed
Mitiamo <sup>3</sup>	service basin	7	3	water carting
Mysia	service basin	10	1	managed
Pyramid Hill	service basin	24	2	managed
Rochester	Waranga Western Channel	10	2	managed

<b>Murray<sup>1</sup></b>				
Cohuna	Gunbower Creek	17	2	managed/carting
Echuca	Murray River	14	2	managed
Gunbower	Taylor's Creek	14	2	managed
Leitchville	Gunbower Creek	25	3	managed
<b>Loddon</b>				
Laanecoorie	Loddon River	1	2	managed
<b>Trentham</b>				
Trentham	Reservoir No. 2	31	2	water carting

*Note 1: All treatment plants in our Murray System are capable of managing these poor water quality events.*

*Note 2: The alert levels are triggered by the volume of algae and the presence of potentially toxic algae.*

*Note 3: Generally only towns without water treatment plants required water to be carted in except for Goornong.*

<b>Water quality outlook for 2018-19</b>	
<p>No raw water quality constraints are known at this point in time. With the long-range climate forecast indicating warmer conditions there is a risk that raw water quality may be poor during the warmer periods. If future conditions generate flooding then there is the potential for increased sediment and nutrient loads into waterways and ultimately into water treatment plants. Calm warm conditions can also impact on the quality of water held in storage. However unless the water quality deterioration is severe there is unlikely to be a potable water supply constraint.</p>	

## Rural Network

Rural customers received 100% allocation at the start of 2018-19.

*Table 9: Summary of the Coliban Northern Southern rural network at 30 June 2018.*

<b>System</b>	<b>No. of Licences</b>	<b>Total Licence Volume (ML)</b>	<b>Total Usage (ML)</b>	<b>No. of Licences Supplied</b>
Coliban Northern <sup>2</sup>	715	5,698.2	2,612.0	543
Coliban Southern <sup>3</sup>	645	10,043.6 <sup>1</sup>	2,021.1	481
<b>Total</b>	<b>1,360</b>	<b>15,741.8</b>	<b>4,633.1</b>	<b>1,024</b>

*Note 1: Includes a volume held by Coliban Water from licences that have been surrendered, or licences that have been 'brought back'. This volume forms part of the broader water reserves for urban and rural customers.*

*Note 2: Entitlements include s51 'take & use' licences and 'supply by agreement' for those rural customers that also have access to recycled water.*

*Note 3: All entitlements are s51 'take & use' licences.*

## Climate Outlook

### Current climate baseline (July 1975 to June 2017)

In 2016, DELWP issued guidelines on developing climate baselines e.g. rainfall and inflows as part of the development of Urban Water Strategies. The climate guidelines were developed in consultation with water corporations and research institutions; CSIRO and the Bureau of Meteorology (BoM). The 'current climate' baseline has been derived from records that cover the period from July 1975 to June 2017 and will be updated in line with the periodic review of our Urban Water Strategy (nominally every five years).

The time period aligns with recommendations from the CSIRO and BoM to use a 30-40 year period of record that has both 'wet' and 'dry' conditions and is recent enough to have been affected by climate change. By contrast some of our historical records date back to the late 1800s, a time when the impacts of climate change were not being felt to any great extent.

The DELWP guidelines also provided climate change projections for temperature, rainfall and runoff for Victorian catchments out to 2040 and 2065. Further, the guidelines allow water corporations to assess whether a 'step change' in climate has been experienced. Coliban Water's own analysis suggests that the upper Coliban River has undergone a shift in inflows into our storages post-1997 i.e. the catchment does not respond to rainfall

events as it had in the past. In the literature this is referred to as 'non-stationarity' which makes it inherently difficult to make accurate predictions in relation to streamflow.

The text box "Climate Change Impact" indicates the magnitude of the downward shift in rainfall and inflows.

#### Climate Change Impact

##### **'Current Climate' Baseline (July 1975 to June 2017)**

###### **Median Inflow – 49.2 GL per annum**

The inflow used in current long-term planning (Coliban Water, *Urban Water Strategy 2017*) uses a slightly shorter period (July 1975 to June 2016). Overall the volume has been revised upwards and includes the high inflows received during 2016-17. From 1 July 2018 the 'current climate' baseline of 49.2 GL will be used for comparison purposes.

###### **Median Rainfall – 720.6 mm per annum (Malmesbury)**

The previous median rainfall was 735 mm per annum. The median rainfall figure will be revised every five years in line with the development of the Urban Water Strategy.

In recent years Coliban Water has used 'median' values in lieu of 'average', as the median better reflects the natural variation in rainfall and inflow.

##### **'Post-1997 Climate' Baseline ('Step Change') (July 1996 to June 2017)**

###### **Median Inflow – 23.5 GL per annum**

This represents a 48% decline on the current climate baseline. This is a significant reduction, that if sustained will affect how we operate the Coliban Northern and Coliban Southern systems.

###### **Median Rainfall – 637.9 mm per annum (Malmesbury)**

The decline in rainfall is around 11.5% compared to the current climate baseline, however for every percentage point decline in rainfall there is typically a 2-3% decline in inflow. CSIRO and BoM analysis of climate change projections indicates that there will be at least a 2-3 fold decline in streamflow compared to rainfall. Our post-1997 experience aligns with these projections even though our relative decline in inflow has been more severe in some years.

## Standardised Precipitation Index (SPI)

In *Climate Change in Australia* (BoM & CSIRO, 2015), the Bureau of Meteorology and CSIRO introduced a useful methodology to quantify the severity and duration of 'drought' conditions based only on the cumulative rainfall for the preceding 12 months compared to the historical mean. The methodology relies on rainfall exhibiting, in statistical terms, a 'normal' distribution around the mean (average). Rainfall data does not typically display a 'normal' distribution, i.e. when plotted it does not produce a traditional bell shaped distribution for a random variable. Hence the data needs to be 'standardised'.

Coliban Water has analysed rainfall data from our Malmesbury rainfall station and prepared a 'standardised precipitation index' (SPI) based on the historical record. In Figure 5 the last 10 years is shown. What is clear is that Coliban Water has continued to experience below normal rainfall for most of this period with the exception of 2010-11, which were the two wettest calendar years on record and 2016-17.

## Standardised Precipitation Index

### July 2018

The SPI is at -0.59 as of 30 June 2018. We are currently in a dry period but still within 'normal' values i.e. between +1.0 and -1.0. This indicates that our upper Coliban River catchment has a net deficit of rainfall over the preceding 12 months and will continue to dry out unless rainfall increases significantly over the coming months.

If the index returns to 0 there will still be a muted response to rainfall events given that soil moisture levels have declined over the last few months.

### October 2018

The SPI is at -0.69 as of 30 September 2018. While the value is still within normal values it reinforces the fact that the upper Coliban River catchment has remained nominally dry for an extended period of time and this is reflected in the low inflows to date.

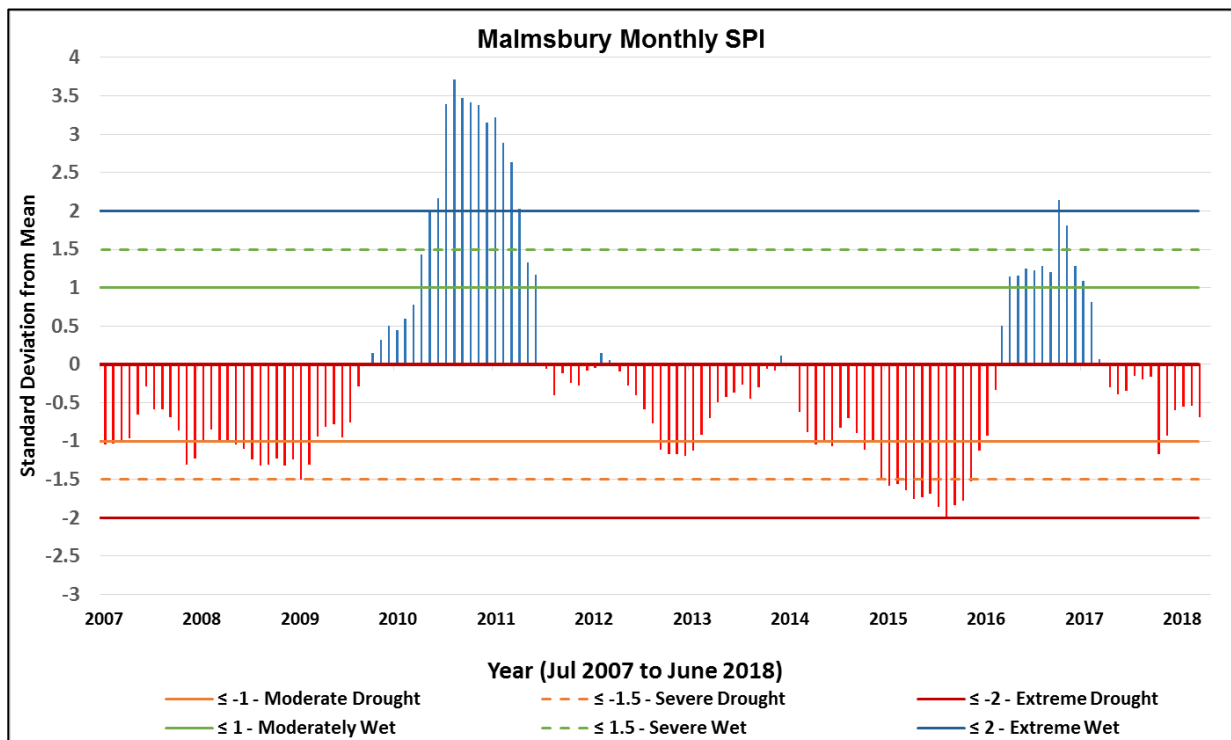


Figure 5: Standardised Precipitation Index (SPI) for Malmesbury Reservoir, July 2007 to September 2018.

Note 1: Bars in red indicate that the preceding cumulative 12 month total of rainfall is less than the mean.

Note 2: Variations between +1.0 and -1.0 indicate 'normal' year to year variations in rainfall.

Note 3: Values between -1.00 and -1.49 are defined as moderate drought, values between -1.50 and -1.99 severe drought and values at or below -2.0 extreme drought.

## Climate characteristics

The climate of north-central Victoria, north of the Great Dividing Range, exhibits a high degree of intra and inter-year variation in rainfall and subsequent runoff. Our primary storages are located at the southern boundary of the Murray-Darling Basin, which is subject to the variable southeast Australian climate. The rainfall (Figures 8 and 9) and runoff (Figures 3 and 4) values elsewhere in this AWO provide evidence of the climatic variability which impacts on water resource management decisions.

## Climate outlook for 2018-19

### **July 2018 climate outlook – ‘dry’ conditions with a low expectation of median rainfall and a likelihood of above median temperatures**

We will initially adopt a ‘dry’ climate outlook for 2018-19. Neutral conditions are likely to persist until early 2019 [July 2018, Figure 6(a) & 6(b)]. With the June 2018 SPI negative at -0.59 i.e. still indicating a moderately dry period, median inflows may only be realised this year provided that soil moisture levels rise in the very near future.

Rainfall over the last 12 months has been above and below average compared to our current climate baseline. Future rainfall may begin to result in significant runoff into storage if the catchment wets up. This is dependent on follow up rain being received in a timely manner. Short-term day and night time maximum temperature forecasts predict warmer than average temperatures.

### **October 2018 climate outlook – ‘dry’ with a very low expectation of median rainfall and a high likelihood of above median temperatures**

The ‘dry’ climate outlook will remain in place until actual conditions improve e.g. average rainfall and average inflows. The SPI remains negative and would need to trend back to positive values before there was any certainty of improved conditions. Over the next six months this is unlikely.

The BoM provides seasonal forecasts for several climate parameters. These have traditionally taken a short-term outlook (three months) (Figures 7(a) & 7(b) Rainfall). Since mid-2013 BoM has commenced providing long-range forecasts (Figures 6(a) POAMA & 6(b) ACCESS-S). In August 2018, BoM adopted a new long-range projection model – the ‘Australian Community Climate Earth-System Simulator – Seasonal’ (ACCESS-S) [see Figure 6(b)]. The model still relies on the same atmospheric physics as POAMA but with a higher resolution (approximately 60 km). The ACCESS-S model has also replaced the models used for the seasonal forecasts [i.e. 3 month outlook, Figure 7(b)].

POAMA forecasts took a nine month forward look of potential trends in rainfall based on several different models and numerous model runs. The ACCESS-S provides a six month forward look and runs a suite of 99 scenarios to provide a median value (solid line).

Only one of the suite of model runs is shown in Figure 6(a) and Figure 6(b). Three of the models deal with the Pacific Ocean climatic conditions [i.e. El Nino (dry) – La Nina (wet) probabilities], while the fourth deals with the Indian Ocean [the Indian Ocean Dipole (IOD)]. As at October 2018 the Pacific and Indian Ocean models indicate dry conditions with a 50% chance of an El Nino developing – about double the normal probability. As of 9 October 2018 the probability of an El Nino has increased to 70%, about the triple the normal probability. The models are re-run on a fortnightly basis.

There is a high degree of variability in the storage levels of our major storages which has been accentuated by the recent Millennium Drought. However there is a single consistent feature, and that is, the cyclic peak in storage levels during August to October. This period follows on from winter which is the only relatively consistent season in relation to rainfall and inflows, however even this is quite variable. Overall the Coliban River catchment has experienced a decline in cool season (April - September) rainfall and inflows. This is in line with climate projections from CSIRO and BoM that have a high degree of confidence for southern Australia.

Given that the long-range BoM models indicate a dry pattern there is a limited possibility that median (‘average’) conditions will be experienced. Our catchments are already dry and the short-term forecast is for more warm dry weather. With the long-range models predicting dry conditions a more conservative position is warranted for the following reasons.

- 2017-18 rainfall and inflow were below median with limited prospect for improvements in the short-term
- The three month seasonal outlook predicts drier and warmer than average conditions
- Four out of eight climate models predict El Nino conditions in spring or summer with a tripling of the likelihood compared to neutral conditions
- The Indian Ocean Dipole also indicated dry conditions over the next three months until January 2019.
- Coliban River catchment has experienced a net deficit in rainfall for several months with the SPI at -0.69
- The Southern Oscillation Index is negative at -7.7 (7 October 2018) (values below -7 typically indicate El Nino conditions)
- The upper Coliban River catchment remains relatively dry in the lower and deep soil profiles

Conditions can change rapidly, however until this occurs a conservative approach will be taken.

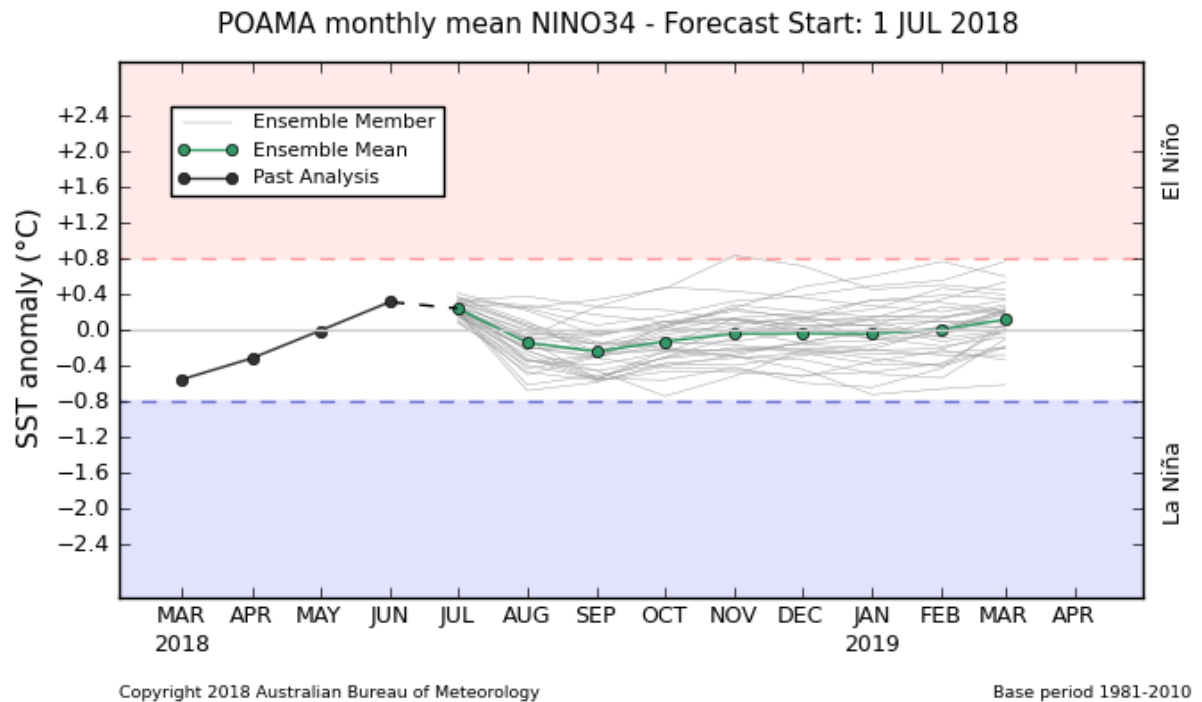


Figure 6(a): BoM 'Predictive Ocean and Atmosphere Model for Australia' (July 2018).

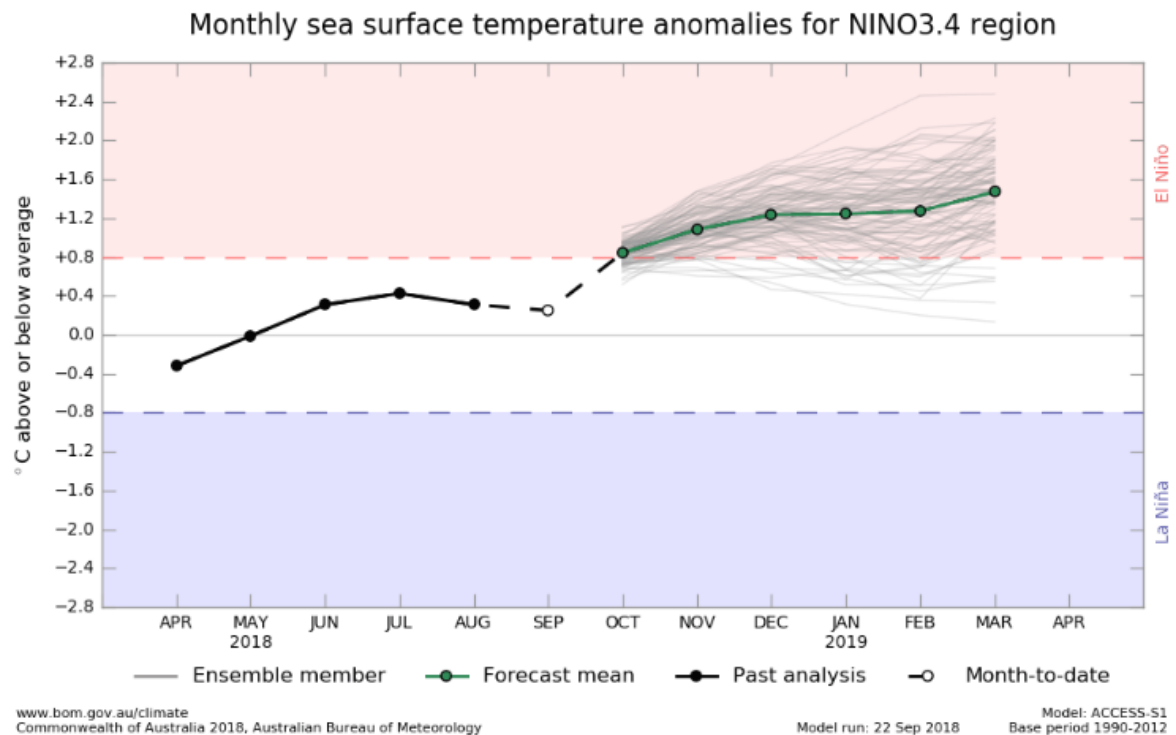


Figure 6(b): BoM 'Australian Community Climate Earth-System Simulator - Seasonal' (22 September 2018).



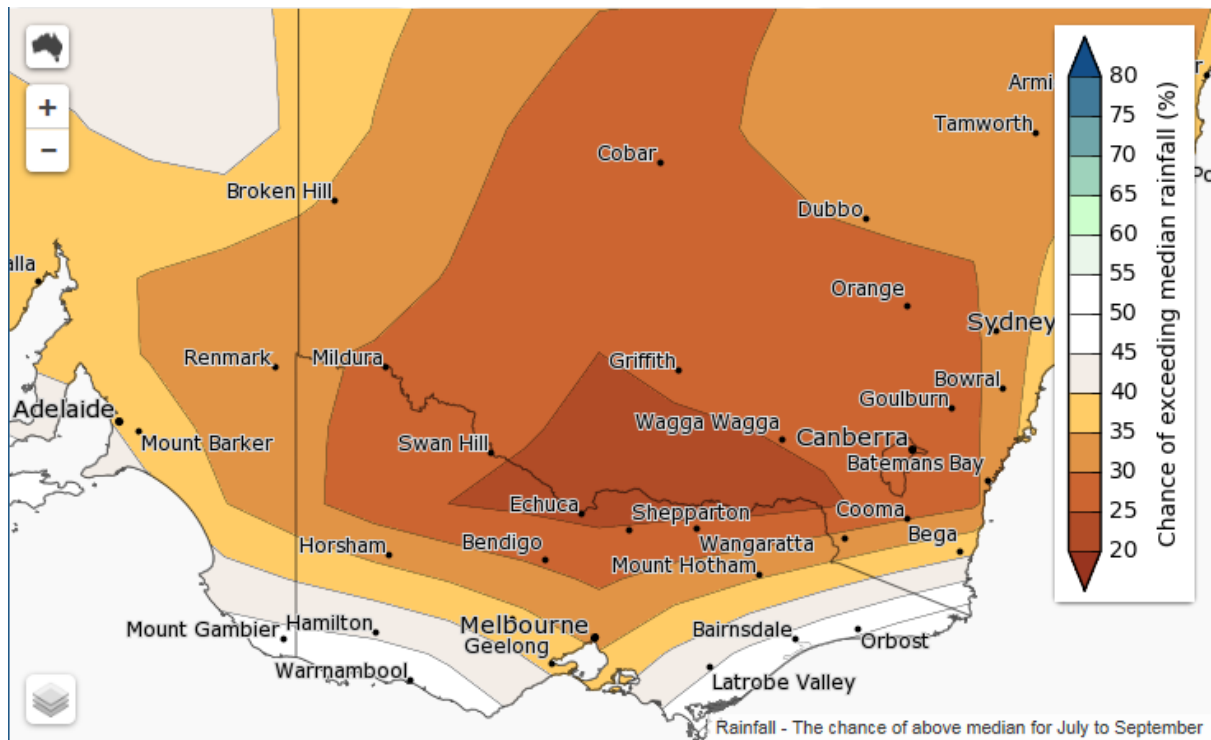


Figure 7(a): Bureau of Meteorology seasonal rainfall forecast for south-east Australia (Issued 28 June 2018).

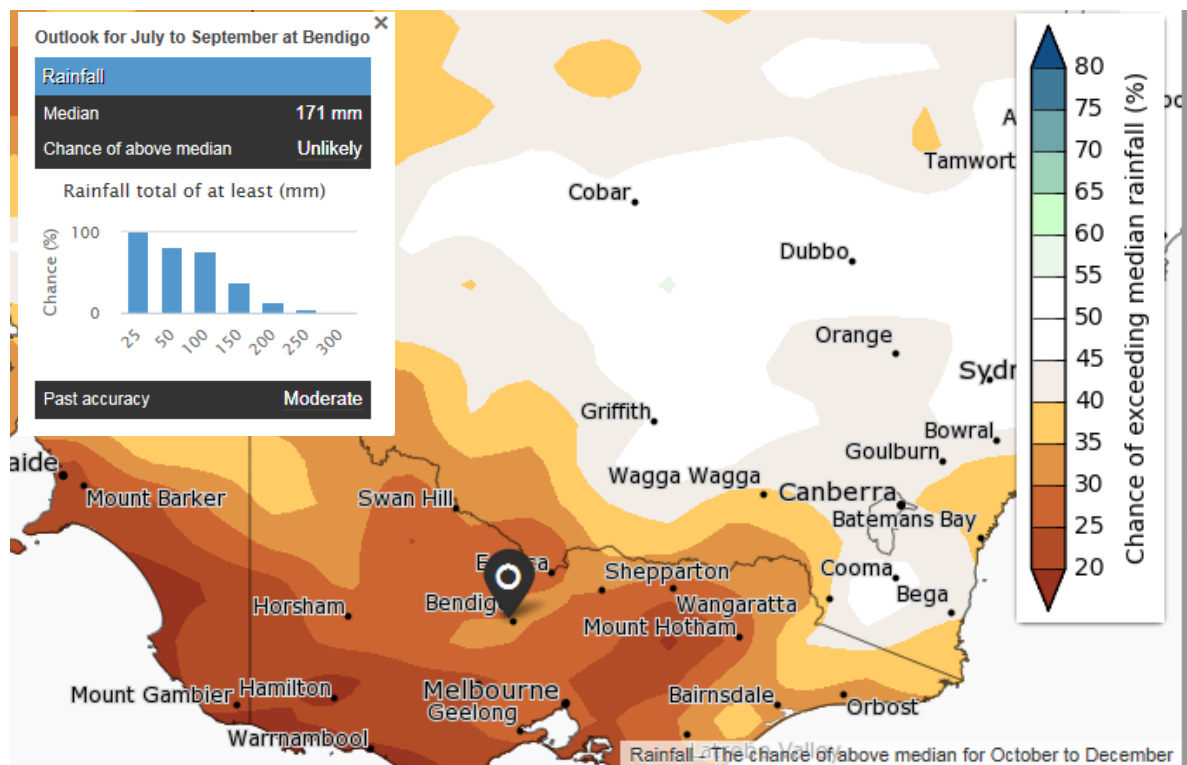


Figure 7(b): Bureau of Meteorology seasonal rainfall forecast for south-east Australia (Issued 27 September 2018).

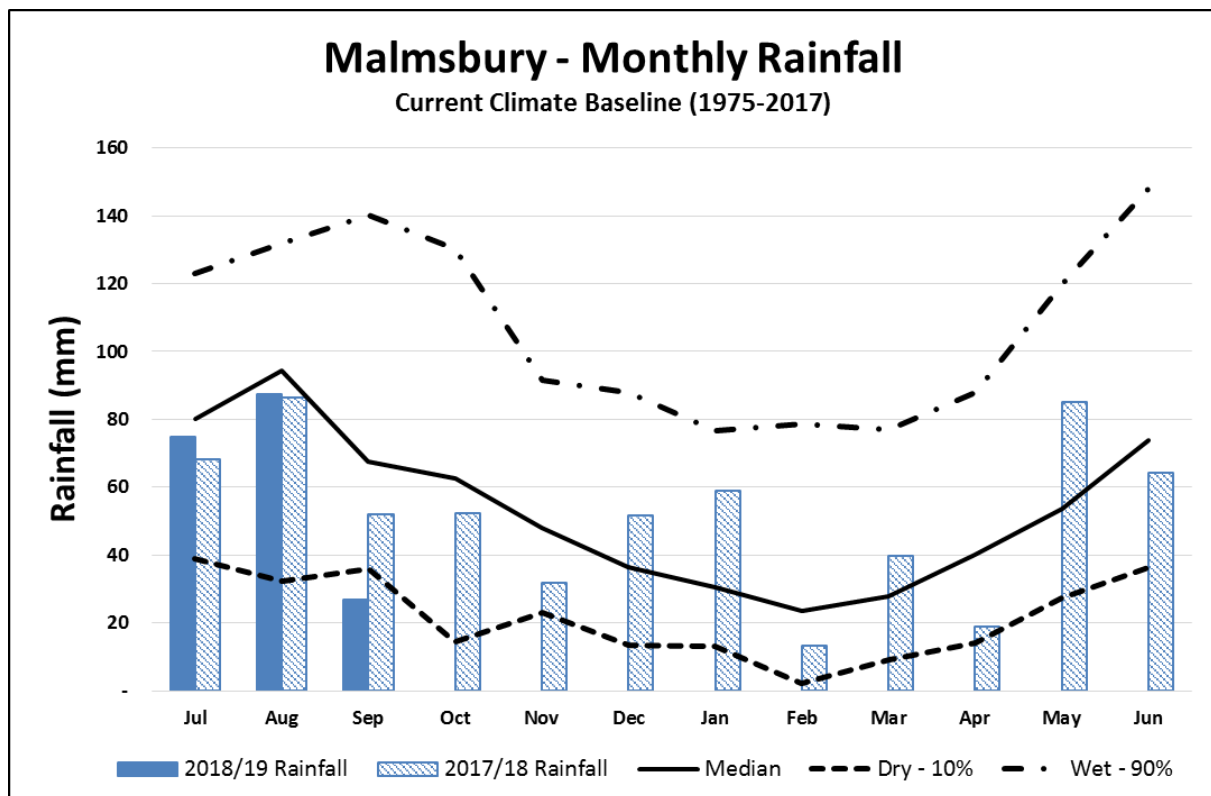


Figure 8: 2017-18 monthly rainfall at Malmsbury compared to the post 1997 climate baseline.

Note 1: The 'horizontal' lines in Figure 8 represent percentile ranges:

Note 2: 'wet' conditions have only a 1 chance in 10 of being exceeded,

Note 3: 'average' conditions have a 5 in 10 chance of being exceeded, and

Note 4: 'dry' conditions have a 9 in 10 chance of being exceeded.

Note 5: The vertical bars indicate actual rainfall recorded at the Malmsbury rainfall gauge. The actual rainfalls demonstrate the high degree of intra-year variation in rainfall compared to the historical record.

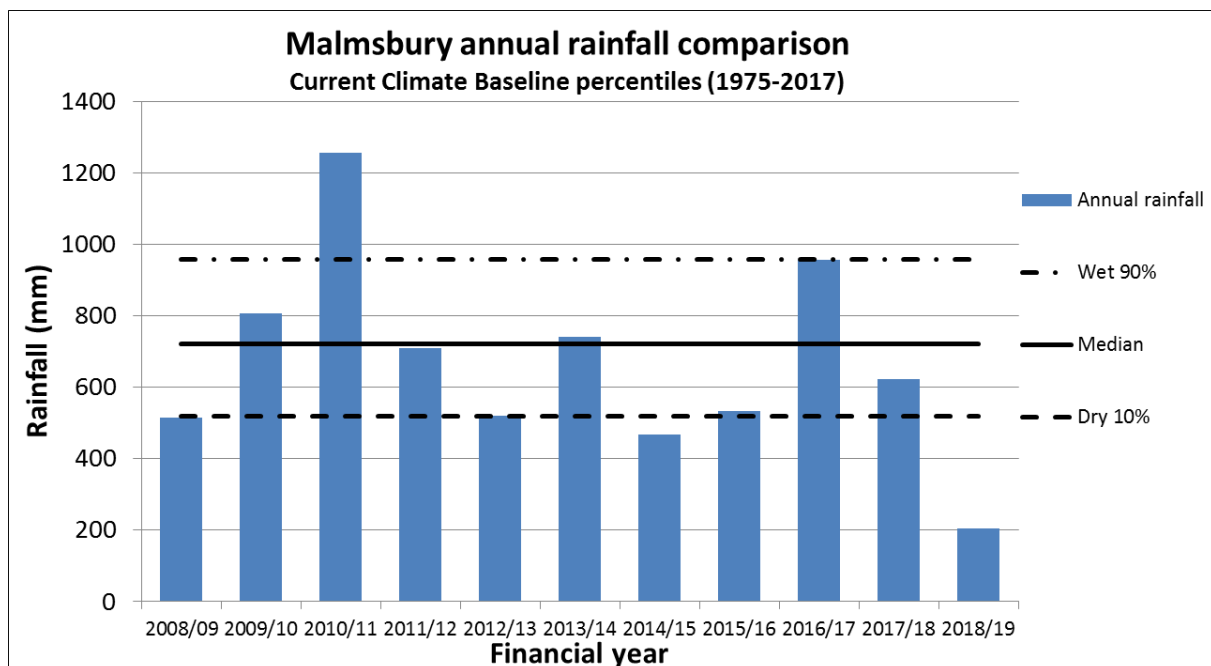


Figure 9: Long-term annual rainfall at Malmsbury compared to the last 10 years.

Note 1: The horizontal lines in Figure 9 represent the same percentile ranges as Figure 8.

*Note 2: The vertical bars indicate actual annual rainfall recorded at the Malmesbury rainfall gauge. The actual rainfalls demonstrate a high degree of inter-year variation and the fact that over the last decade only four years were at or above 'average'.*

Note: Up to date information regarding weather forecasts can be obtained through the Bureau of Meteorology website - [http://www.bom.gov.au/seasonal outlooks](http://www.bom.gov.au/seasonal_outlooks).

## Demand, Treatment Plants and Allocation Trade

### PWSR adjusted demand ('average' demand)

Our Water Resources Group undertakes a review of system demands each year in conjunction with other internal stakeholders. PWSR adjusted demand is based on a three year rolling average of actual demand. During 2019-20 we will move to medium term demand forecasts up to five years ahead. The PWSR adjusted demand is the total raw water demand required to meet all the demand components e.g. consumptive demand ('billable'), system operational water (backwash, mains flushing, leakage, fire-fighting), evaporative losses, and any passing flow requirements.

Coliban Water has a requirement under its Bulk Entitlement to provide 18% of the evaporative losses from Lake Eppalock and 18% of the passing flows into the Campaspe River. From 2016-17 we have specifically included these requirements as a demand. On average these add an additional 3,246 ML (evaporation) and 1,615 ML (passing flow) of demand per annum. The annual estimates are based on daily records from 1999 provided by GMW.

*Note: The annual values vary considerably between years hence the use of an annual average is indicative only. For example the net evaporative loss (Coliban Water's share) from Lake Eppalock during 2016-17 was 6,130 ML and the passing flow was 3,249 ML which reflect the more favourable resource position during the year.*

The 'forecast demand' allows for dry weather and comprises two components: the PWSR adjusted demand, plus a 20% allowance to compensate for any unexpected increase in urban demand and 50% increase for rural usage. The 20% allowance is nominally two standard deviations from the mean used in the PWSR adjusted demand calculation. The PWSR forecast demand ('dry weather') is an indicator of maximum probable demand.

#### Demand outlook for 2018-19

##### **PWSR adjusted demand for raw water during 2018-19 is 46.2 GL**

Since the introduction of Permanent Water Saving Rules and the mostly 'average' weather conditions the raw water demands have not rebounded to pre-Millennium Drought levels. By comparison the PWSR adjusted demand volume for 2017-18 was 48.2 GL. The current estimate is about 4% lower than 2017-18. The actual demand experienced is expected to be between the adjusted ('average') and 'dry weather' demand values.

Taking into account the Bureau of Meteorology's long-range weather forecast conditions during winter and spring the demand outlook for 2018-19 may be more than 46.2 GL if summer is drier than average.

The PWSR 'dry weather' (forecast) demand for all supply systems (urban and rural) is 54.4 GL. This is the demand used for modeling and planning purposes and represents a conservative estimate (i.e. high). The PWSR 'dry weather' (forecast) demand is revised annually and is also reviewed every five years as part of the pricing submission process.

Actual demand (PWSR adjusted demand) over the 12 months of the Annual Water Outlook will vary from year to year based on weather patterns (e.g. rainfall, temperature and humidity), population change, consumer behavior, and prevailing economic conditions (commercial and industrial demands).

*Table 10: Comparison of aggregated raw water demand estimates and actual demand.*

Year	Estimated Demand <sup>1,3</sup>		Actual Demand	Percentage of Estimate <sup>2</sup>
	adjusted	'dry weather'		
2014-15 PWSR	38,127 ML	45,753 ML	35,680 ML	94%
2015-16 PWSR <sup>5</sup>	40,445 ML	49,624 ML	48,668 ML	120%
2016-17 PWSR	46,490 ML	54,607 ML	46,715 ML	100%
2017-18 PWSR	48,168 ML	56,757 ML	43,916 ML	91%

2018-19 PWSR <sup>4</sup>	46,211 ML	54,411 ML	-	-
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*Note 1: Includes evaporation from storages, system losses and leaks, firefighting, and operational water needed for flushing mains and back wash in water treatment plants, and passing flow.*

*Note 2: Percentage PWSR adjusted ('average') demand estimate, rounded off to a whole number.*

*Note 3: PWSR adjusted demand estimates were introduced on 1 July 2014.*

*Note 4: The demand volume for 2018-19 includes evaporative losses and passing flows from Lake Eppalock and the Coliban Headworks Storages plus an allowance of ~30% of rural demand to account for channel losses.*

*Note 5: The actual demand was above the PWSR estimate due to the prevailing dry, warm conditions experienced during 2015-16. It was however, within our forecast demand estimate (dry weather).*

## Water Treatment Plant Performance

Our water treatment plants have a range of capacities to supply peak demand. During 2017-18 all plants operated within rated capacity. Although the weather was dry, demands were generally lower than expected. The summer months were not as severe as previous years which resulted in reduced demand.

Coliban Water is currently undertaking a forward planning project that will consider potential future upgrades to our water treatment plants. These upgrades will include plant performance and improvements to meet new potable water quality guidelines.

*Table 11: Water treatment plant performance during 2017-18.*

System	Town	Nominal Capacity (ML/day)	Peak Demand <sup>2</sup> (ML/day)	Performance <sup>1</sup>
<b>Campaspe</b>	Goornong	0.43	0.24	56%
<b>Coliban Northern</b>	Bendigo	126.00	53.87	43%
	Heathcote	2.82	1.41	50%
<b>Coliban Southern</b>	Castlemaine	18.40	9.47	51%
	Kyneton	7.00	3.96	56%
<b>Elmore</b>	Elmore	1.64	0.53	32%
<b>Goulburn</b>	Boort	1.47	1.08	73%
	Lockington	0.41	0.30	73%
	Pyramid Hill	1.32	0.47	36%
	Rochester	7.80	3.05	39%
	Serpentine	0.39	0.14	36%
<b>Loddon</b>	Bridgewater	2.39	1.03	43%
	Laanecoorie	2.64	0.62	23%
<b>Murray</b>	Cohuna	5.50	2.99	54%
	Echuca	27.10	13.94	51%
	Gunbower	0.62	0.21	34%
	Leitchville	1.28	0.86	67%
<b>Trentham</b>	Trentham	0.85	0.51	67%
<b>Wimmera</b>	Korong Vale	1.36	0.97	71%

*Note 1: The performance relates to the highest proportion of plant capacity reached during 2017-18.*

*Note 2: The volumes represent the 'average' daily demand during the month that has the highest demand.*

*Actual peak daily demand may exceed this volume.*

## Allocation and entitlement trade

As a holder of Bulk Entitlements, and High and Low Reliability Water Shares, we are able to participate in the water market within the southern inter-connected Murray-Darling Basin. The majority of water entitlements are held on the GMW Goulburn and Campaspe Systems. During the Millennium Drought, we were active in the market in relation to purchase of permanent entitlement and allocation.

Where the allocation volumes are in excess of water needed to meet our level of service obligations, the opportunity arises to participate in the water market and trade (i.e. sell). Assuming 100% allocations each year we do not need to retain a large volume of carryover to meet our water supply obligations.

The 'trade' relates to entitlements, allocation and innovative products such as leasing of 'carry-over' capacity. In December 2012, the Board of Coliban Water adopted the *Intangible Water Products Transactions Policy* that sets out the conditions under which trade can take place. The policy was revised in 2015.

Coliban Water holds water shares, as well as Bulk Entitlements, on major raw water supply systems. Most systems have an active water market dominated by allocation trade. Allocation trade provides a mechanism for water entitlement holders to buy or sell seasonal allocation i.e. temporarily trade their water. The water market also deals with trade in permanent entitlements. During 2017-18 we actively participated in the water market.

On most of our allocation accounts we are able to 'carry-over' up to 100% of our entitlement volume from one water year to the next i.e. from 30 June to 1 July. When Coliban Water is not likely to carry-over 100% of its allocation volume the 'spare' capacity can be leased out to third parties. During 2017-18 we took advantage of this ability to lease out part of our carry-over capacity.

#### Review of water trading for 2017-18

##### **Allocation trade – Coliban Water sold 34,798 ML of seasonal allocation from the Campaspe, Goulburn, Loddon and Murray**

GMW allocations all reached 100% and our storages received below median inflows. During 2017-18 we had the capacity to trade a substantial volume of water.

When any trade takes place a breakdown by system and volume is provided in Table 12. All allocation trade is conducted in accordance with our *Intangible Water Products Transactions Policy 2015*.

##### **Leasing of carry-over capacity – Coliban Water leased 13,800 ML of carry-over capacity**

Given our holdings of water shares we were able to lease out some capacity at the end of June 2018. The volume of capacity will vary from year to year depending on season and allocations.

Table 12: Allocation and entitlement trade for the preceding year (2017-18).

Raw Water Supply System	Volume	Trade Type		% of Entitlement <sup>1</sup>
Campaspe (Zone 4A)	3,400 ML	allocation	sale	100%
Goulburn (Zone 1A & 1B)	30,698.1 ML	allocation	sale	120%
Loddon (Zone 5A)	150 ML	allocation	sale	18%
Murray (Zone 7)	550 ML	allocation	sale	9%
Murray (Zone 7) LRWS	(138.1 ML)	entitlement	purchase	N/A
Wimmera	0 ML	N/A	N/A	N/A
<b>Total</b>	<b>34,798.1 ML</b>		-	-

Note 1: Percentage of the total entitlements held (BE, HRWS plus LRWS). This is not equivalent to the total water available for trade which is typically higher due to carryover between years.

Opening allocations (1 July 2018), for GMW high-reliability water shares that Coliban Water relies on varied between 32% and 100% - similar to last year. Further allocation announcements have been made and now vary between 77% and 100%. All high reliability water share accounts are expected to receive 100% by February 2019 under dry conditions. By comparison the opening allocation for the GWMWater was 9% and has only reached 40%. GWMWater supplies our Wimmera System.

## Further Information

### Water Resource Updates for Stakeholders

We generate numerous internal and external reports for regulators, the Board of Coliban Water, and other stakeholders (internal and external). Table 13 lists the periodic resource statements that are generated.

Table 13 also provides an indication of the broad scope of water related reports. Not included in the table are internal reports and reports that are primarily of a regulatory nature.

Table 13: Water resource status reports available to customers and stakeholders.

Frequency and stakeholder	Report title and comments
<b>Daily</b>	
Public (website storage levels)	<i>Reservoir Levels</i> – Updates rainfall compared last year and historical levels, inflows into major reservoirs along with volumes. Service basins are updated weekly.
<b>Monthly</b>	
Public (online newsletter)	<i>Water Summary Newsletter</i> – Covers the preceding month only. Provides a snapshot of the status of water usage and water availability on a system by system basis.
<b>Quarterly</b>	
Public (website)	<i>Seasonal Wrap Summary</i> – Provides a water resource status summary of the previous quarter's data. Produced at the end of winter, spring, summer and autumn.
<b>Annual and 'as needed'</b>	
DELWP	<i>Annual Report</i> – Provides information on water services managed by the Water Resources Group, comment on performance in meeting Level of Service obligations.
Public (website and DELWP)	<i>AWO and AOP</i> – Provides a review of the previous year and provides an 'outlook' to the coming year and outlines water resource related decisions.
Public (rural customers, media releases and community newsletters)	<i>Rural Allocation Outlook</i> – March (indicative) and June (declaration). Provides an indication to rural customers of what the likely allocations are going to be for the next 'water year'.
Bureau of Meteorology	<i>Restriction Information</i> – Provided on an irregular basis as part of a national database.

## Reference Material

Department of Environment, Land, Water and Planning (2016). *Guidelines for the development of Urban Water Strategies and the Melbourne Water System Strategy*.

Department of Environment, Land, Water and Planning (December 2016). *Guidelines for assessing the impact of climate change on water supplies in Victoria*.

## Useful Websites

**Bureau of Meteorology** - <http://www.bom.gov.au>

Climate Outlooks (select 'seasonal outlooks' for 3 month and long-range outlook (6 month), and El Nino updates)

Soil Moisture (select 'agriculture – water and the land', then select 'water information' followed by 'water in the landscape')

## Glossary

Allocation	Water that is actually available to use or trade in any given year, including new allocations and carryover. The water that is actually in the dam in any given year is allocated against water shares. The seasonal allocation is the percentage of water share volume available under current resource conditions, as determined by the resource manager.
Aquifer	Underground layer of water-bearing permeable rock, rock fractures or unconsolidated
Blue-green algae	Algal blooms can cause water to be unsafe for all users of water including agriculture, irrigation and recreation.



Build Own Operate Transfer	Is a public-private partnership project model in which a private organisation conducts a development project under contract to a public-sector partner.
Bulk Entitlement	The right to water held by water corporations and specified entities defined in the <i>Water Act 1989</i> . The bulk entitlement defines the amount of water that an authority is entitled to from a river, water storage or aquifer, and may include the rate at which it may be taken and the reliability of the entitlement.
Carryover	Allows entitlement-holders to retain ownership of unused water into the following season.
Climate change	A change in global or regional climate patterns.
Coliban Headwork Storages	Upper Coliban, Lauriston and Malmsbury Reservoirs.
Cool season	The months of April to October.
Groundwater	All subsurface water, generally occupying the pores and crevices of rock and soil.
High Reliability Water Shares	Water shares are classed by their reliability, which is defined by how often full seasonal allocations are expected to be available. Allocations are made to high-reliability water shares before low-reliability shares.
Historical climate	Past climate taken from as far back as records allow.
Inflows	Water flowing into a storage or waterway.
Irrigation season	Occurs between mid-August and mid-May.
Level of service	Coliban Water has a Level of Service of 95% reliability at no more than Stage 3 Restrictions.
Low Reliability Water Shares	Water shares are classed by their reliability, which is defined by how often full seasonal allocations are expected to be available.
Median	The middle value of a data set.
Meteorological drought	A climate driven restriction on raw water supply beyond Coliban Water's control.
Millennium Drought	The drought in south-east Australia spanning from 1997 to 2009.
Nominal capacity	The intended full-load sustained output of a treatment facility.
Non-potable	Water that is not of drinking quality.
Permanent Water Saving Rules	The Victorian Government's permanent water saving rules are a set of common-sense rules to reduce demand and make sure we use water efficiently. Makes up the new unrestricted demand.
Post-1997	The post Millennium Drought period of 1997 to 2017 ('Step-change').
Potable water	Water of suitable quality for drinking.
Raw water	Raw water is natural water found in the environment and has not been treated, nor have any minerals, ions, particles or living organisms removed. Raw water includes rainwater, ground water, water from infiltration wells, and water from bodies like lakes and rivers.
Recycled water	Water derived from sewerage systems or industry processes that is treated to a standard appropriate for its intended use.





Reliability	A measure of how often restrictions may occur over the period to 2065 in keeping with our Level of Service of 95% of no more than Stage 3 restrictions.
Rural water	Raw or recycled water for stock and domestic use.
Runoff	The draining away of water from the surface of an area of land, a building or structure, etc.
Shortfall	The maximum amount of water that may be available will not meet the projected PWSR demand.
Spill	Water that is not captured within the storage due to excessive volume.
Stakeholder	A party that has an interest in the company, and can either affect or be affected by the business.
Streamflow	The flow of water in streams, rivers and other channels.
Stormwater	Water that originates during precipitation events.
System reliability	The system reliability is the indication of how reliable the supply system is to meet the current and future demands under the adopted levels of service when appropriate management measures are in place.
Urban demand	Water demand based on a town or city.
Water corporation	Principal supplier of water, wastewater and drainage services within an area.
Water share	An ongoing entitlement to a share of the water available in a water system.
Water year	July to June. (Fiscal year).
Volumetric trigger	The volumetric trigger applies to the combined storage volume of the Coliban Headworks Storages. It is used to balance the raw water supply between the Coliban Northern and Southern systems based on long-term climate outlook, inflow, and storage volume.

## Abbreviations

ACRONYM	DEFINITION
<b>AOP</b>	Annual Operating Plan
<b>ACCESS-S</b>	Australian Community Climate Earth-System Simulator – Seasonal (BoM climate model)
<b>AWO</b>	Annual Water Outlook (from October 2017 the AOP will be incorporated into the AWO)
<b>BE</b>	Bulk Entitlement
<b>BoM</b>	Bureau of Meteorology
<b>BOOT</b>	Build Own Operate Transfer
<b>CSIRO</b>	Commonwealth Scientific and Industrial Research Organisation
<b>DELWP</b>	Department of Environment, Land, Water and Planning
<b>DPP</b>	Drought Preparedness Plan; previously the Drought Response Plan (DRP)
<b>ENSO</b>	El Niño Southern Oscillation



<b>GL</b>	Gigalitre (1,000 megalitres)
<b>GMW</b>	Goulburn Murray Water
<b>GWMWater</b>	Grampians Wimmera Mallee Water
<b>HRWS</b>	High Reliability Water Shares
<b>IOD</b>	Indian Ocean Dipole
<b>kL</b>	Kiloliter (one thousand liters)
<b>km</b>	Kilometer
<b>km<sup>2</sup></b>	square kilometer
<b>LRWS</b>	Low Reliability Water Shares
<b>ML</b>	Megalitre (1 Million litres)
<b>POAMA</b>	Predictive Ocean Atmosphere Model for Australia
<b>PWSR</b>	Permanent Water Saving Rules
<b>RWF</b>	Recycled Water Factory
<b>SOI</b>	Southern Oscillation Index
<b>SoO</b>	Statement of Obligations
<b>SPI</b>	Standardised Precipitation Index
<b>UWS</b>	Urban Water Strategy; previously called the Water Supply Demand Strategy (WSDS)
<b>VEWH</b>	Victorian Environmental Water Holder
<b>VHRWS</b>	Very High Reliability Water Share
<b>WTP</b>	Water Treatment Plant
<b>WWTP</b>	Wastewater Treatment Plant



## Appendices - Coliban Water Systems

Appendix A – Campaspe System

Appendix B – Coliban System Northern (Coliban Northern)

Appendix C – Coliban System Southern (Coliban Southern)

Appendix D – Elmore System

Appendix E – Goulburn System

Appendix F – Loddon System

Appendix G – Murray System

Appendix H – Trentham System

Appendix I – Wimmera System

