



Australian Government

Commonwealth Environmental Water Office

Commonwealth Environmental Water Office

# Water Management Plan

Chapter 3.1 – Border Rivers

2020–21



This document represents a sub-chapter of 'Commonwealth Environmental Water Office Water Management Plan 2020-21, Commonwealth of Australia, 2020'.

Please visit: <https://www.environment.gov.au/water/cewo/publications/water-management-plan-2020-21> for links to the main document.

#### Acknowledgement of the Traditional Owners of the Murray–Darling Basin

The Commonwealth Environmental Water Office respectfully acknowledges the Traditional Owners, their Elders past and present, their Nations of the Murray–Darling Basin, and their cultural, social, environmental, spiritual and economic connection to their lands and waters.

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## 3.1 Border Rivers

### 3.1.1 Region overview

#### (a) River system

The Border Rivers catchment covers around 49 500 km<sup>2</sup> in southern Queensland and north eastern NSW, with roughly an equal area in each state. The system is based around the Macintyre and Dumaresq rivers, which merge upstream of Boggabilla and continue as the Macintyre River (Figure 1). The Dumaresq, Macintyre and the part of the Barwon River downstream of the junction of the Weir River to Mungindi (the end of the Border Rivers system) forms the border between NSW and Queensland for approximately 470 kilometres. The Weir River, wholly in Queensland, is the only significant tributary of the lower Macintyre River.

Rainfall in the Border Rivers catchment is summer-dominant and highly variable, resulting in highly variable stream flows between years.

The major public storages are Pindari Dam on the Severn River in NSW (312 gigalitres), Glenlyon Dam on Pike Creek in Queensland (254 gigalitres), and Coolmunda Dam on Macintyre Brook in Queensland (69 gigalitres). The volume of on-farm storage is comparable to public storage, reflecting the importance of unregulated flows to irrigation supplies in the catchment. On a long-term average basis unregulated entitlement (supplementary water licences in NSW and unsupplemented water allocations in Queensland) and diversions in the Border Rivers catchment exceed regulated water entitlements and use.

#### (b) Traditional Owners

The lands of the Border Rivers catchment have been important to Aboriginal people for more than 25 000 years. Aboriginal nations of the region include the Bigambul, Euahlayi, Githabul, Kambuwal, Gomeroi/Kamilaroi, Kwiambul, and Ngarabal. Traditional owners have longstanding and continuing ties to country and hold the many billabongs along the rivers in this catchment in high regard. Of particular importance is the Morella Watercourse/Boobera Lagoon/Pungbougul Lagoon complex located on the Macintyre River floodplain south of Goondiwindi.

#### (c) Important sites and values

Key environmental assets in the Border Rivers catchment include:

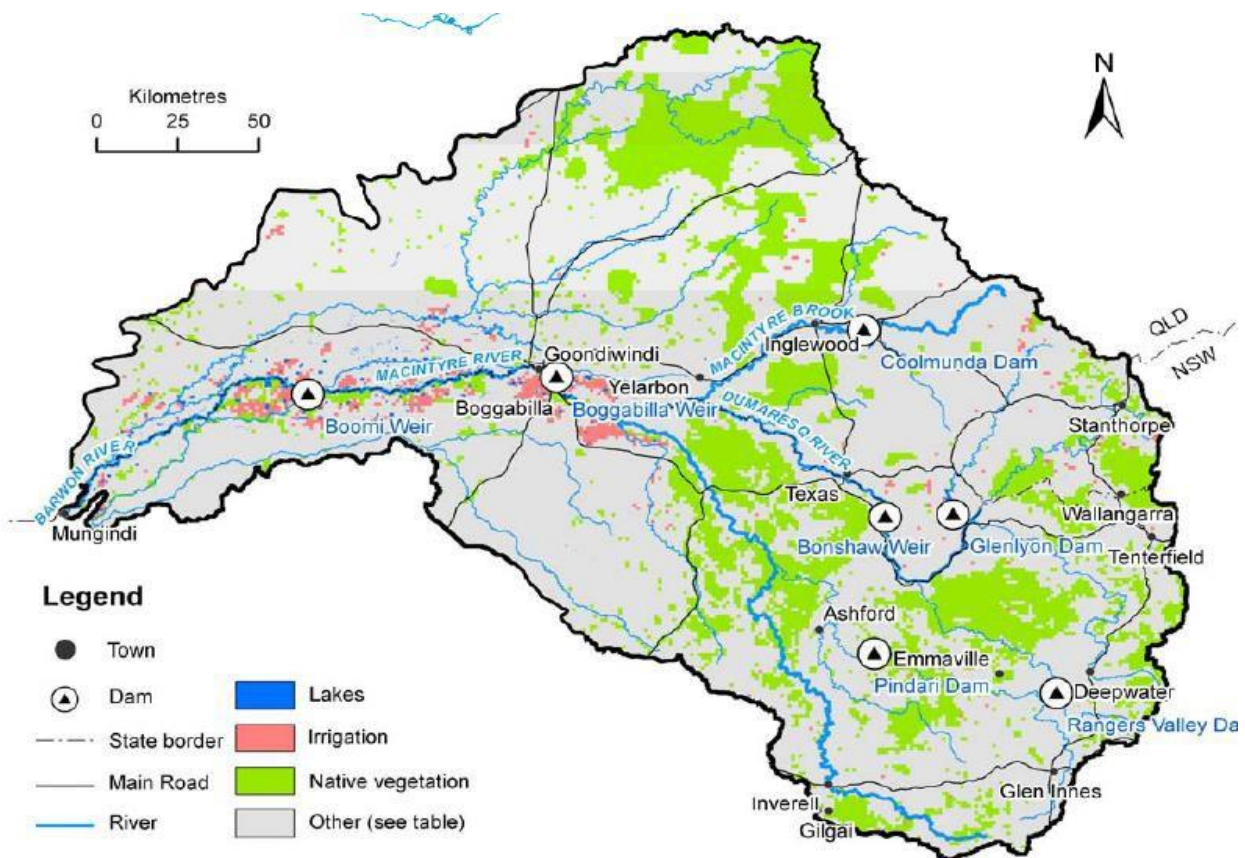
- the Border Rivers main channels (Severn, Dumaresq, Macintyre and Lower Macintyre Rivers to Mungindi and the Weir River)
- anabranches downstream of Yetman/Texas
- Queensland Macintyre River billabongs
- wetlands, billabongs and lagoons in the Lower Dumaresq/NSW Severn and Lower Macintyre rivers
- Toomelah station near the junction of the Macintyre and Dumaresq rivers.

The Border Rivers catchment supports a number of species and endangered ecological communities listed under the *Environment Protection and Biodiversity Conservation Act 1999*, the *NSW Biodiversity Conservation Act 2016*, or the *NSW Fisheries Management Act 1994*. These include native fish species such as Murray cod, silver perch, purple-spotted gudgeon, olive perchlet and eel-tailed catfish. Various wetlands and waterholes also support internationally and nationally significant waterbirds, for example, brolgas, Australian painted snipe, black-necked stork and magpie geese.

Parts of the Border Rivers are also included in the Lowland Darling River aquatic ecological community, which is listed as endangered under the *NSW Fisheries Management Act 1994*. This includes the Macintyre River below Graman Weir, Severn River below Pindari Dam and the Dumaresq River below the junction with the Mole River, along with their associated lagoons, billabongs, anabranches and floodplains.

*(d) Stakeholder engagement*

In the Border Rivers catchment, the planning, management, and delivery of Commonwealth water for the environment is undertaken in conjunction with a range of partners and stakeholder groups. Key stakeholders in the NSW part of the catchment include the NSW Department of Planning, Industry and Environment (DPIE), the Department of Primary Industries (DPI) – Fisheries, Local Land Services and WaterNSW. In Queensland, key stakeholders include the Queensland Department of Natural Resources, Mines and Energy (DNRME), Department of Agriculture and Fisheries (DAF), Department of Environment and Science (DES) and Southern Queensland Landscapes. Advice on the use of Commonwealth water for the environment in the Border Rivers is also provided by landholders, traditional owners, the Boomi Trust, local and regional councils, and Border Rivers Food and Fibre.



**Figure 1:** Map of the Border Rivers catchment (CSIRO 2007).

### 3.1.2 Environmental objectives

Based on long-term environmental objectives in the Basin Plan, draft state long-term watering plans, site management plans, and best available knowledge, the following objectives are relevant for environmental watering in the Border Rivers River catchment.

The objectives that are targeted in a particular year may vary, depending on available water, catchment conditions, operational feasibility, and demand for environmental water. These objectives will continue to be revised as part of the Commonwealth Environmental Water Office's (CEWO) commitment to adaptive management.

**Vegetation:** Maintain the condition, growth and survival of riparian, in-channel, floodplain and wetland vegetation.

**Waterbirds:** Increase waterbird abundance and maintain species diversity by supporting naturally triggered breeding events, and maintaining suitable refuge, feeding and breeding habitat at targeted floodplain sites.

**Native fish:** Prevent loss of native fish species and improve population structure and distribution, by supporting opportunities for movement, dispersal, reproduction, and recruitment.

**Other vertebrates and invertebrates:** Support opportunities for the reproduction and recruitment of other native aquatic species, including frogs, platypus, native water rats, turtles, and freshwater mussels.

**Connectivity:** Support longitudinal connectivity, including with the Barwon River, and lateral connectivity between the river, wetlands and floodplains.

**Processes/water quality/resilience:** Support key ecosystem functions and promote productivity; maintain water quality in channels and pools; and maintain drought refuge habitat.

### 3.1.3 First Nations environmental watering objectives

Representatives of the First Nations peoples of the Border Rivers have identified environmental objectives for their country for 2020–21 (

Table 1). These objectives were developed through the First Nations Environmental Guidance project undertaken by the Northern Basin Aboriginal Nations organisation.

CEWO identifies the need to establish working partnerships with local Traditional Owners and the local Aboriginal communities in the Toomelah-Boggabilla and Mungindi communities of the Border Rivers. Government has had very little engagement with these communities to date. This lack of engagement has left these communities feeling neglected and will require healing, which we hope to begin to address via a more formal process. CEWO is looking to grow relationships around environmental water management with these and other Traditional owners and Aboriginal communities in the Border Rivers. Toomelah-Boggabilla and Mungindi community members place great value on the flows in rivers and creeks and connectivity to lagoons and billabongs to support life for all creatures, including human beings. There are many places of great importance in the Border Rivers, especially Boobera Lagoon, as well as the Morella – Pungbougall lagoons complex, along with many sites and parts of the Dumaresq and Macintyre Rivers, the Barwon River at and around Mungindi, Whalan Creek and Boomi River.

Some of these objectives sit outside the scope of water for the environment to influence, while for others, the link between water for the environment and the site or species is not well understood.

The CEWO is committed to working with First Nations groups to better understand their objectives. The CEWO will use environmental flows to contribute to these objectives where possible and where this is consistent with the Commonwealth Environmental Water Holder's statutory responsibility of protecting and restoring environmental assets in the Basin.

**Table 1:** First Nations environmental objectives for the Dumaresq and Macintyre rivers for 2020–21 (NBAN Ltd. 2020)

<p><b>River flows and Connectivity</b></p> <p><i>Priority sites:</i> Macintyre River – provide backflow at Rainbow Reserve for waterbird breeding and nesting. Macintyre Brook and Dumaresq River – provide flows to support local platypus populations. Grinding grooves site<sup>i</sup>.</p> <p><i>Other flows and connectivity:</i> (All Border Rivers) maintain flows. Local advice is needed to inform this objective. Regular flow events which support instances of breeding and reproduction for shellfish and crustaceans (including mussels and shrimp). Maintain flows at Texas and Inglewood so that a healthy waterway is achieved, allowing us to continue to practise our way of life<sup>i</sup>.</p>
<p><b>Native Vegetation</b></p> <p><i>Indicator species:</i> Gidgee gum<sup>i</sup>, blue gum<sup>i</sup>, bulrush, water lily, sedges, tea trees<sup>i</sup>, sandalwood<sup>i</sup>, iron bark (poplar box)<sup>i</sup>, bloodwood<sup>i</sup>, lomandra and other aquatic reeds and grass species.</p>
<p><b>Native Birds</b></p> <p><i>Indicator species:</i> Brolgas, teals, crimson wings<sup>i</sup>, budgerigar<sup>i</sup>, ground parrot<sup>i</sup>, wood duck, black duck, water hen.</p>
<p><b>Native Animals</b></p> <p><i>Indicator species:</i> Dhufish (eel-tailed catfish), yellowbelly, purple-spotted gudgeon, platypus, crucifix frog, silver perch, mussel, turtle, shrimp, water dragon (and other lizards), water rats.</p>
<p><b>Connecting with Country</b></p> <p>To continue practising our way of life in a way that is not only healthy for the river and environment but keeps us healthy as well<sup>i</sup>. Collection of reeds and grasses for weaving<sup>i</sup>. Gathering (fishing, swimming and camping) Collection of bush tucker and medicine<sup>i</sup>. Hunting and tool making<sup>i</sup>. To gather and heal together<sup>i</sup>.</p>

<sup>i</sup> Water for the environment targeting other environmental outcomes may influence this species or objective

### 3.1.4 Recent conditions and seasonal outlook

#### (a) Recent conditions and environmental water use

In 2018–19 and the first half of 2019–20, the Border Rivers experienced very hot and dry conditions, with some areas experiencing the lowest rainfall and highest temperatures on record. Storage levels in the Border Rivers were very low, and there was zero access to water for general security users. From August 2019, the catchment was managed under Stage 4 (the highest level) of the NSW Extreme Events Policy, with water prioritised for critical human needs. A block release from Glenlyon Dam was made in September and October 2019 to move water to Boggabilla for Goondiwindi town water supply.

Conditions began to improve in early 2020, with above average to very much above average rainfall across the catchment, resulting in an increase in soil moisture and small flows into Pindari and Glenlyon dams. Good flows occurred in the regulated system downstream of the dams, and in most unregulated tributary and distributary systems. Temporary orders were put into place in late February 2020 to protect these flows.

These improvements in water availability meant that supplementary access was announced in the NSW Border Rivers in late February, March and April 2020. It also resulted in the restrictions on access to high and general security water being eased in February 2020, and the system was downgraded to Stage 3 of the NSW Extreme Events Policy in March 2020.

However, the episodic rainfall following extended hot and dry conditions resulted in rapid reductions in dissolved oxygen in the Border Rivers. This led to localised fish kill events in some locations in early 2020, and large-scale deaths of freshwater mussels. Bushfires also affected parts of the Border Rivers in spring 2019, resulting in fish deaths in November (Reedy Creek and Dumaresq River, downstream of Reedy Creek,



Tenterfield Creek and Millers Creek in the vicinity of Tenterfield). In the NSW parts of the catchment fish rescue measures were undertaken in spring and summer 2019–20.

The resource shortfall in the Border Rivers has eased, with the possibility of general security allocation being announced in the future, should inflows continue. Nevertheless, further significant inflows are still required before there is sufficient water available to meet all system requirements in 2020–21 or announce any new allocations.

Commonwealth environmental water use in the Border Rivers in 2019–20 was limited to Queensland ‘un-supplemented’ (unregulated) entitlements in February 2020. The total contribution of Commonwealth environmental water was 3 165 megalitres.

Details of previous Commonwealth environmental use in the Border Rivers catchment are available at: [http://www.environment.gov.au/water/cewo/catchment/Border Rivers/history](http://www.environment.gov.au/water/cewo/catchment/Border%20Rivers/history).

### *(b) Seasonal outlook*

According to the Bureau of Meteorology outlook on 2 July 2020, above median rainfall is forecast across the Border Rivers from late winter through spring. While this forecast indicates that the severe dry conditions may ease, several months of above average rainfall are needed to see a recovery from the current long-term drought. Additionally, maximum temperatures are likely to remain above average over the coming months.

### *(c) Water availability*

The volume of Commonwealth environmental water carried over in the Border Rivers for use in 2020–21 is 2.2 GL (1.3 GL in Queensland and 0.9 GL in NSW (NSW DPIE 2020). The Commonwealth also has 1 437 megalitres in NSW supplementary entitlement, and up to 19 986 megalitres in Queensland ‘un-supplemented’ entitlements. However, as these entitlements rely on large inflows in excess of regulated river requirements, they are also unlikely to be available unless resource availability significantly improves.

Based on the expected available volume of water held by the Commonwealth and other water holders, as well as recent and forecast catchment conditions, it is expected that the overall resource availability will be very low to low in 2020–21. Should conditions remain dry, no environmental water will be available for use in 2020–21.

### *(d) Environmental demands*

Considering the ongoing drought, the potential for further hot and dry conditions in the Border Rivers Catchment in future, and need to avoid further damage to key assets, there are a number of environmental demands that require water urgently in 2020–21.

The environmental water demands for assets in the Border Rivers Catchment in 2020–21 are represented in **Table 2**, Note that the capacity to contribute to these environmental demands is contingent on a substantial improvement in water availability in the catchment.



**Table 2:** Environmental demands, priority for watering in 2020–21 and outlook for coming year in the Border Rivers catchment

Environmental assets	Target values	Indicative demand (for all sources of water in the system) <sup>6</sup>		Watering history <sup>7</sup>  (from all sources of water)	2020–21		Implications for future demands  Likely urgency of demand in 2021–22 if watering occurred as planned in 2020–21
		Flow/Volume	Required frequency (maximum dry interval)		Environmental demands for water (all sources)	Potential Commonwealth environmental water contribution?	
<b>Border Rivers main channels: Dumaresq, Severn (NSW), Macintyre, lower Macintyre to Mungindi (including Weir River)</b>  Native fish Instream aquatic ecosystems	Native fish resilience, reproduction, conditioning and maintenance.  Maintain in-channel habitats during low flows, water quality and longitudinal connectivity.  Instream aquatic ecosystem processes e.g. scouring habitat inundation	<b>Baseflows, flow variability and connectivity</b> <u>Dumaresq</u> 100 ML/day baseflow (BF) at Glenarbon <u>Severn/Macintyre Rivers</u> 50 ML/day BF at Ducca Marrin <u>Lower Macintyre River</u> 400 ML/day at Mungindi for connectivity Duration and frequency of baseflows dependent on outcomes required (e.g. 7 days in Sept–March in 1 in 1–2 years to provide connectivity and sufficient depth for fish movement).	As required in extreme dry conditions or to provide variability. Potential triggers extended cease-to-flow: <10 ML/day for more than 25 days gauged at Glenarbon (Dumaresq) and <2 ML/day at Ducca Marrin (Severn) impacting on persistence of larger waterholes in the Dumaresq or Severn)  To provide variability (triggers: cease to flow (<30ML/d) for more than 30 days at Mungindi).	<u>Dumaresq</u> Demands were met annually since 2012 to 2018–19. In 2019–20 demand was met but flows at Glenarbon were <20 ML/day from July to September 2019 and mid-October 2019 to early February 2020. Required annually – therefore a high demand.  <u>Severn/Macintyre</u> Demand met annually since 2012. Demand partially met in 2019–20 (flows >50 ML/day at Ducca Marrin on 18/02/2020 only, but flows were >2 ML/day throughout 2019–20. Required annually – therefore a high demand.  <u>Lower Macintyre</u> Demand met annually 2012–18 with exception of 2014–15. Demands not met 2018–19. Extended cease-to-flow conditions (<30 ML/day) at Mungindi from June 2019 to February 2020 but demands met February–March 2020 and again in April 2020. Required annually – therefore a high demand.	High	A high priority for watering in 2020–21, including under a low resource availability scenario.	High
		<b>Fish spawning/recruitment flow targeting long-lived in-channel specialist species (small in-channel fresh for 14–34 days)</b> <u>Dumaresq River</u> Spawning – 515–1 040 ML/day at Roseneath for minimum 14 days (small fresh – SF) Recruitment – 340–600 ML/day at Roseneath for minimum 20 days <u>NSW Severn / Macintyre rivers</u> Priming pulse – initial peak of 2 000 ML/day at Ducca Marrin followed by recession (duration variable) (large fresh – LF) <u>Lower Macintyre River</u> Large scale spawning and recruitment aligned with large unregulated pulse in the Weir River post winter (at least 2 m rise and water temp >23°C)	8 in 10 years July–Aug (Priming pulse before spawning and recruitment) Aug–Oct (Peak recruitment season for Murray cod and freshwater catfish)	<u>Dumaresq River and NSW Severn/Macintyre</u> Demands not met 2012–2015, met 2015–16 to 2017–18. Not achieved in 2018–19. Dumaresq recruitment demands not met in 2019–20 but spawning demands were met. NSW Severn/ Macintyre spawning and recruitment not met in 2019–20 (priming pulse). Moderate to high demand 2020–21, moving to moderate in 2021–22 if watering occurs as planned.  <u>Lower Macintyre River</u> Met 2015–2017. Not met in 2017–18, 2018–19 or 2019–20. High demand 2020–21, becoming moderate to high in 2021–22 if watering occurs as planned.	Moderate to High	Secondary priority for Commonwealth environmental watering. Will occur only if natural trigger is met, or under moderate–high resource availability. Demand may be met by other means.	Moderate
		<b>Fish spawning/recruitment flow targeting long-lived flow dependent specialists (small to medium fresh for at least 3 days)</b> <u>Dumaresq River / NSW Severn / Macintyre rivers</u> Flow height with at least a 2 m rise and water temp >23°C	8 in 10 years Oct–April (Recruitment season for silver and golden perch)	<u>Dumaresq River</u> Dumaresq: Not met 2012–2015, achieved 2015–18. Not achieved 2018–19. Achieved in 2019–20 (flow spike with flow height rise at Roseneath of at least 2 m in February 2020). Moderate to high demand in 2020–21, moving to moderate if watering occurs as planned.  <u>Severn/Macintyre</u> Not achieved in 2018–19 or 2019–20. Moderate to high demand in 2020–21, moving to moderate if watering occurs as planned.  <u>Lower Macintyre River</u> Demand met 2015–16 and 2016–17. Not met 2018–19 or 2019–20. High demand in 2020–21, becoming moderate to high if watering occurs as planned.	Moderate to High		Moderate
			Moderate to High	Moderate			
					High	Moderate to High	

Environmental assets	Target values	Indicative demand (for all sources of water in the system) <sup>6</sup>		Watering history <sup>7</sup>  (from all sources of water)	2020–21		Implications for future demands
		Flow/Volume	Required frequency (maximum dry interval)		Environmental demands for water (all sources)	Potential Commonwealth environmental water contribution?	Likely urgency of demand in 2021–22 if watering occurred as planned in 2020–21
Border Rivers main channels (ctd)		<p><b>Fish condition and maintenance flow targeting long lived in-channel specialists and flow-dependent fish guilds (small/large fresh for minimum 5 days)</b></p> <p><u>Dumaresq River</u> Up to 2 300–6 250 ML/day at Roseneath (SF)</p> <p><u>NSW Severn / Macintyre rivers</u> Peak up to 2 000 ML/day at Ducca Murrin (LF)</p> <p><u>Lower Macintyre River</u> Natural inflows in the lower Macintyre River reach, including Weir river. Optimal flow height, duration and volume unknown.</p>	<p>1 in 1–2 years (Maximum dry interval unknown) June–July (Pre-spawning conditioning) March–May (Pre-winter maintenance)</p>	<p><u>Dumaresq River</u> Not met 2018–19. Met in 2019–20 (bankfull flows at Roseneath in February 2020, peaking at 15 000 ML/day) (pre-winter maintenance). Moderate demand in 2020–21, remaining moderate if watering occurs as planned.</p> <p><u>NSW Severn / Macintyre rivers</u> Met 2015–2018. Demand not met 2018–19 or 2019–20. High demand in 2020–21, moving to moderate to high if watering occurs as planned.</p> <p><u>Lower Macintyre River</u> Not met from 2017–2019. Met in 2019–20, with natural inflows in the lower Macintyre River reach, including Weir River in February–April 2020. Moderate to high demand, moving to moderate if watering occurs as planned.</p>	Moderate	Secondary priority for Commonwealth environmental watering. Will occur only if natural trigger is met, or under moderate–high resource availability. Demand may be met by other means.	Moderate
				High	Moderate to High		
					Moderate to High		Moderate
		<p>Fish movement/spawning/reproduction/recruitment flows targeting short-lived stable low flow spawning fish species.</p>	<p><b>Stable low flow for 7–60 days (spawning*/reproduction/recruitment)</b></p> <p><i>* A minimum stable low flow 7–21 days needed for spawning</i></p> <p><u>Dumaresq River</u> Up to 100 ML/day at Roseneath (BF)</p> <p><u>NSW Severn and Macintyre rivers</u> 50 ML/day at Ducca Murrin (BF)</p>	<p>1 in 1–2 years (low uncertainty) Up to 3 years (high uncertainty) Sept–Dec (Peak spawning season for olive perchlet, includes purple-spotted gudgeon)</p>	<p><u>Dumaresq River</u> Met 2015–16, 2016–17 and 2018–19. Not met in 2019–20. Moderate to high demand in 2020–21, moving to moderate if watering occurs as planned.</p> <p><u>Severn and Macintyre rivers</u> Stable flows not met 2015–20. High to critical demand in 2020–21, moving to high if watering occurs as planned.</p>	Moderate to High	Secondary priority for Commonwealth environmental watering. Will occur only if natural trigger is met, or under moderate–high resource availability. Demand may be met by other means.
				High to Critical	High		
	<p>Scouring, inundate inter-connected riparian areas and improved longitudinal connectivity for fish movement, (including maintenance and conditioning) of all native species</p>	<p><b>Large in-channel fresh (Aug–Dec)</b></p> <p><u>Dumaresq River</u> Peak between 6 250–19 000 ML/day at Roseneath (LF)</p> <p><u>NSW Severn and Macintyre rivers</u> Flows &gt;2 000 ML/day at Ducca Murrin to change periphyton species (LF)</p>	<p>All reaches Up to 3 years for scouring (Max. dry interval unknown) Anytime (only if naturally occurring)</p>	<p><u>Dumaresq River</u> Achieved 2016–17, not achieved 2017–18, 2018–19 or 2019–20 (within August–Dec time window). Assessed as moderate to high for 2020–21, moving to moderate if watering occurs as planned.</p> <p><u>NSW Severn and Macintyre rivers</u> Achieved in 2016–17, 2017–18 and 2018–19. Not achieved in 2019–20. Assessed as low to moderate, remaining low if watering occurs as planned.</p>	Moderate to High	Secondary priority for Commonwealth environmental watering. Will occur only if natural trigger is met, or under moderate–high resource availability. Demand may be met by other means.	Moderate
				Low to Moderate	Low		
	<p>Inundate key habitat (large woody debris), support key ecosystem functions (nutrient, sediment and carbon cycling) and support recruitment opportunities for a range of native aquatic species (fish, frogs, turtles and invertebrates)</p>	<p><b>Small in-channel fresh</b></p> <p><u>Lower Macintyre and Barwon Rivers</u> 4 000 ML/day at Mungindi (end of system) for a minimum 5–11 days (SF).</p>	<p>1 in 3–4 years (Max. dry interval of 7–14 years) Oct–Dec (inundate habitat) 1 in 2–3 years (Max. dry interval of 6–8 years) Oct–Mar (support key ecosystem functions) Occur twice a year every 1 in 3–4 years (max. dry interval unknown) Oct–Dec (needs of threatened native fish)</p>	<p><b>(Inundate habitat and meet needs of threatened fish species (Oct–Dec)</b></p> <p>Last met 2016 (not met 2013, 2014 or 2015). Not met 2017–18, 2018–19 or 2019–20. Environmental demand high in 2020–21, moving to moderate to high if watering occurs as planned.</p> <p><b>Oct–March (key ecosystem functions)</b> Met in 2012–13 (not met between 2013–14 and 2018–19). Partially met in 2019–20 (mean daily flows at Mungindi &gt;4 000 ML/day for five days between 23 February 2020 and 27 February 2020). Environmental demand high, moving to moderate to high if watering occurs as planned.</p>	High	Unable to receive Commonwealth environmental water due to constraints.	Moderate to High

Environmental assets	Target values	Indicative demand (for all sources of water in the system) <sup>6</sup>		Watering history <sup>7</sup>  (from all sources of water)	2020–21		Implications for future demands
		Flow/Volume	Required frequency (maximum dry interval)		Environmental demands for water (all sources)	Potential Commonwealth environmental water contribution?	Likely urgency of demand in 2021–22 if watering occurred as planned in 2020–21
<b>In channel assets – Boomi River</b>	Inundate key habitat Boomi (large woody debris and fallen timber on bench platforms and inset floodplain areas), native fish assets (including recorded or expected threatened native fish species).	BF (>5 ML/day) for 7 days (Sept–Mar) at Boomi River upstream of Boomi Weir Offtake SF1 (>20 ML/day at Boomi River upstream of Boomi Weir Offtake) for minimum 10 days (Oct–Apr) SF2 20–750 ML/day for minimum 14 days (Sept–Apr) LF1 (>750 ML/day) for 5 days (Jul–Sept) LF2 (>750 ML/day) for five days (Oct–Apr)	1 in 1–2 years (75%) (baseflow) (max. dry interval unknown) Annual (100%) (SF1) (max. dry interval 1 year) 1 in 1–2 years (75%) (SF2) (LF1) 1 in 1–2 years ((75%) (LF1) 1 in 2–3 years (42%) (commencing as a rising flow only) (LF2)	Base flow met annually since 2013–14. Required every 1–2 years so moderate environmental demand, moving to low if watering occurs as planned. SF1 met in each year between 2013–14 and 2019–20. Required annually, therefore a high environmental demand. SF2 met in each year between 2013–14 and 2019–20. Required every 1–2 years so moderate environmental demand, moving to low if watering occurs as planned. LF1 Not met since 2013–14. Required every 1–2 years, therefore a critical environmental demand. LF2 Not met in 2013–14, 2014–15, 2015–16, 2017–18 or 2018–19, but met in 2016–17 and 2019–20. Required every 2–3 years, therefore a moderate environmental demand moving to low–moderate if watering occurs as planned.	Moderate	A low priority for Commonwealth environmental water contribution under low water resource availability scenarios, however Commonwealth unregulated entitlements could contribute unregulated flows, if triggered.	Low
					High		High
					Moderate		Low
					Critical		Critical
					Moderate		Low to Moderate
<b>Anabranches downstream of Yetman/Texas</b>  Nutrient and carbon cycling, enhanced primary production.  Support fish movement and condition.	Infrastructure assisted watering to maintain refuge habitat E.g. Morella watercourse lagoons (if agreed with landholders) 1 500–4 000 ML per action (infrastructure assisted) to target specific wetlands with long-term flow deficit	1 500–4 000 ML per action (infrastructure assisted) to target specific wetlands with long-term flow deficit	Maximum: up to 10 years between filling (Morella watercourse)	Little to no inflows since 2010, however local rainfall provided some water to Morella watercourse and Boobera Lagoon in 2019–20. Moderate environmental demand, moving to low–moderate if watering occurs as planned.	Moderate	Additional information needed before supporting a watering action.	Low
<b>Wetlands, lagoons and billabongs</b>	Support movement, spawning and recruitment of aquatic species.  Riparian vegetation health.  Nutrient and carbon cycling  Maintain refuge for aquatic biota and fish  Lateral and longitudinal connectivity, support movement, spawning and recruitment of aquatic species.  Maintain riparian habitat for other species i.e. water birds	<b>Connection to lower Dumaresq wetlands / NSW Severn wetlands</b> <u>Dumaresq River</u> SF to connect >30% of wetlands in the Dumaresq reach  > 1 040 ML/day at Roseneath (SF) <u>NSW Severn and Macintyre rivers:</u> 1 200 ML/day at Ducca Marrin (LF) to connect upper reach wetlands	1 in 3 to 4 years for wetland vegetation 1 in 2 to 3 years for fish outcomes	<u>Dumaresq River</u>  Demands met 2017–18, 2018–19, and 2019–20 but not met between 2012–2017. Low demand, remaining low if watering occurs as planned.  <u>NSW Severn and Macintyre rivers</u>  Met annually from 2012 to 2018–19 but not met in 2019–20. Moderate environmental demand, moving to low if watering occurs as planned.	Low	A low priority for CEW under low to moderate water resource availability scenarios. Potential for contribution under a high water resource availability scenario, in conjunction with similar flow requirements for fish outcomes	Low
					Moderate	A low priority for CEW under low water resource availability scenarios, however, Commonwealth unregulated entitlements could contribute unregulated flows, if triggered.	Low





### 3.1.5 Water delivery in 2020–21

Based on the demand for water for the environment, water availability (supply), and catchment conditions, the overall purpose for managing Commonwealth water for the environment in the Border Rivers catchment in 2020–21 (subject to water resource availability improving significantly) is to avoid damage and protect the health and resilience of aquatic ecosystems. This includes in-channel habitats, drought refugia and fish condition and resilience, particularly in the Border Rivers main channels.

In the Border Rivers catchment, the capacity to deliver regulated water for the environment in 2020–21 is contingent on an increase in water availability, and there being no further restrictions on accessing water from Glenlyon and/or Pindari Dams. It also requires there to be sufficient reserves in the dams to resume normal river operations.

Consistent with the demands and purpose identified, the CEWO is considering supplying water for the environment to the following actions in 2020–21.

Subject to an increase in water availability, and in some cases the occurrence of other flow events, deliver water to:

- Avoid extended cease to flow conditions, provide flowing water habitats, and maintain suitable river depth. This will help to support native fish and other native aquatic animals such as freshwater mussels and shellfish, shrimp, platypus, turtles, frogs, water dragons, water rats (rakali).
- Contribute to suitable flow regimes to help maintain and restore instream and riparian vegetation at important sites in the Dumaresq, Severn and Macintyre systems.
- Contribute to suitable flow regimes in the Dumaresq, Macintyre and Severn rivers to support priming, reproduction, conditioning and movement opportunities for native fish communities, including Murray cod, silver perch, freshwater catfish, purple-spotted gudgeon and olive perchlet.
- Contribute to suitable flow regimes to support refuges, feeding resources and breeding opportunities for waterbirds including listed migratory and threatened species, and species of economic, social and cultural importance.

As in previous years, the use of Commonwealth water for the environment in the Border Rivers will be adaptively managed throughout 2020–21, in response to changing water resource availability and environmental conditions and demands.

### 3.1.6 Monitoring and Lessons learned

#### *(a) Monitoring*

In the Border Rivers Catchment, monitoring is undertaken by NSW and Queensland agencies including NSW DPI – Fisheries (native fish), NSW DPIE Water (water quality) and Queensland DNRME, DAF and DES. The CEWO has also funded a number of short-term intervention monitoring projects to evaluate the environmental responses of native fish, and to map aquatic habitat in the Dumaresq and Macintyre Rivers.

Details of monitoring activities funded by the CEWO in the Border Rivers Catchment can be found at: <https://www.environment.gov.au/water/cewo/catchment/border-rivers/monitoring>

**(b) Lessons learned**

Outcomes from monitoring and lessons learned in previous years are a critical component for the effective and efficient use of Commonwealth water for the environment. These learnings are incorporated into the way environmental water is managed.

Key findings from fish<sup>1</sup>, aquatic habitat<sup>2</sup> and flow monitoring<sup>3</sup> in the Border Rivers Catchment is summarised in Table 3.

**Table 3:** Key lessons learned in the Border Rivers Catchment

Theme	Lesson learned
Native fish and aquatic invertebrates	<ul style="list-style-type: none"> <li>• Water for the environment benefits the relatively healthy and diverse native fish community in the Border Rivers, which includes a number of nationally and state listed threatened species (e.g. Murray cod, olive perchlet). For example, water for the environment helps maintain habitat, supports condition and recruitment, and provides opportunities for movement and increased productivity.</li> <li>• The unregulated Weir River in the Border Rivers catchment has relatively healthy spawning and recruitment of golden perch, which are largely absent from other areas in the Border Rivers.</li> <li>• Water for the environment in the Border Rivers during late winter/early spring contributes to increased Murray cod and freshwater catfish spawning and recruitment. It also provides benefits to unspecked hardyhead, Murray-Darling rainbowfish and carp gudgeon (abundance, spawning and recruitment).</li> <li>• Rapid assessment of priority refuge pools in parts of the Border Rivers through the NSW native fish drought response process suggests that the Lower Macintyre fish community may be in relatively poor condition. Extensive die-off of freshwater mussels was also observed at some sites. There are also concerns about the status of the Darling River hardyhead in the Border Rivers.</li> </ul>
Aquatic habitat	<ul style="list-style-type: none"> <li>• Mapping of aquatic habitat features in parts of the Border Rivers (Dumaresq from Pike Creek to connection with the Macintyre) has identified habitat that is important for native fish and other animals. Riparian vegetation condition was also mapped. Key habitat features noted included large woody habitat, refuge pools, and bars and benches.</li> </ul>
Connectivity	<ul style="list-style-type: none"> <li>• Recent learnings from water management in the Border Rivers and connection with the downstream Barwon–Darling suggest that: <ul style="list-style-type: none"> <li>○ The volume of water needed to replenish waterholes and allow for seepage is much greater if a river has already ceased-to-flow and antecedent conditions are dry, compared to when a river is still flowing.</li> <li>○ Within catchment water requirements need to be balanced with broader system needs when environmental water availability is low.</li> <li>○ Travel times for regulated releases from storage need to be considered when coordinating flows between systems.</li> </ul> </li> <li>• The Northern Connectivity Event in 2017–18 and the Northern Fish Flow in 2018–19 have highlighted the importance of coordinated flow delivery and protection of environmental flows from the Border Rivers and Gwydir system into the Barwon–Darling. Further monitoring undertaken by Queensland DRNME and NSW DPI – Fisheries will help to better understand the role of protecting unregulated tributary</li> </ul>

<sup>1</sup> NSW DPI and Q DAF 2019

<sup>2</sup> NSW DPI 2018b

<sup>3</sup> DAWE 2020

Theme	Lesson learned
	flows for waterhole persistence and connectivity, water quality, and native fish response.
Other aquatic animals	<ul style="list-style-type: none"> <li>• There are platypus colonies in the Border Rivers catchment, including in the Severn River (Sundown National Park, near Ashford and reaches downstream of Pindari Dam), Tenterfield Creek; the Dumaresq River downstream of Glenlyon Dam; and also possibly Macintyre Brook. There are historical records of platypus in lowland areas of the Border Rivers as far downstream as Goondiwindi, but these populations are no longer present.</li> <li>• Delivery of the Pindari stimulus flow in previous years (NSW planned environmental water) took the flow needs of platypus into account, and research in other parts of Australia has also sought to better understand their environmental flow needs. The Rakali or native water rat is also widespread throughout the Border Rivers but little is known about their flow requirements in the catchment.</li> <li>• Additional information on these water dependent species is required to better inform the future management of water for the environment.</li> </ul>



### 3.1.7 Bibliography

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