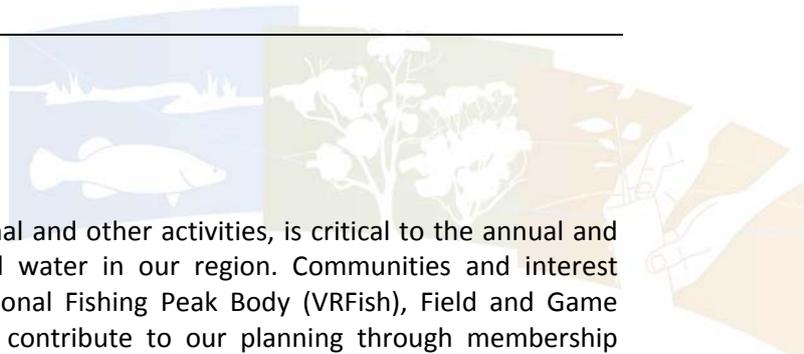




North Central Catchment Management Authority's Submission to the Environment, Natural Resources and Regional Development Committee in the public inquiry into environmental water.

1. Introduction

- 1.1.** The North Central Catchment Management Authority (CMA) welcomes the Environment, Natural Resources and Regional Development Committee (ENRRDC) parliamentary inquiry into environmental water. The North Central CMA manages a mature and extensive environmental water program, comprising seven systems. The systems within the North Central CMA region include the regulated Campaspe River, Coliban River, Loddon River (including Tullaroop, Serpentine and Pyramid creeks) and Birch's Creek river systems, the Mid-Loddon wetlands, Central Murray Wetlands complex and Wimmera Mallee Pipeline wetlands. It is a complex program with each system comprising multiple sites, multiple environmental entitlements pursuing multiple environmental outcomes while seeking shared benefits for our regional communities and Traditional Owners.
- 1.2.** In the highly regulated and hydrologically modified rivers, floodplains and wetlands in our region, environmental water is a critical management intervention, particularly in between the extremes of droughts and floods, to recover populations of our water dependent flora and fauna species and to build resilience to the population crashes that those events can cause.
- 1.3.** We see the inquiry as a vehicle to demonstrate the important role of environmental water to the broader community. The North Central CMA hopes that the outcomes of the inquiry help to enhance the understanding of the broader community that environmental water provides benefits to our waterways and wetlands, which in turn contributes to a healthier community through provision of recreational and economic benefits.
- 1.4.** Since the development of irrigation systems in the North Central CMA region, many waterways and wetlands have been sustained by irrigation water. Historically the artificial operating regime differed significantly from that which would have occurred naturally. While the irrigation operating regime supported some high value water dependant assets, it also created disbenefits for others that had adapted important life cycle behaviours to the natural flow regime. With the improvements made to water use efficiency over the past decade, and the water savings made through changes in practice and infrastructure upgrades, irrigation system operators no longer have water available to provide the environmental benefits they once did. Environmental water, which has often been secured through water savings, is able to target the watering requirements of our high value water dependent assets need. We have presented a number of case studies below.
- 1.5.** The North Central CMA recognises and supports the aspirations of Traditional Owners to actively participate in the management and governance of environmental water on Country in the longer term. The CMA is working closely with Traditional Owner groups to assist with building capability to contribute to these processes, including providing opportunities for Traditional Owners to work on Country, to undertake assessments of the cultural health of our waterways and wetlands, and training in ecological monitoring.
- 1.6.** The North Central CMA values the connection that communities have to our waterways and wetlands. This connection and knowledge gained through years of interactions with



these environments through recreational and other activities, is critical to the annual and long term planning for environmental water in our region. Communities and interest groups, such as the Victorian Recreational Fishing Peak Body (VRFish), Field and Game Australia (FGA) and Birdlife Australia, contribute to our planning through membership Environmental Water Advisory Groups (EWAGs). Our EWAGs members provide local and historical knowledge and share experiences that help guide our water management decisions. The EWAG members assist the CMA in achieving environmental outcomes and identify opportunities to maximise the recreational and other shared benefits that environmental water can contribute to.

2. Environmental water management and blackwater events

2.1. It is important to make the distinction between:

- Beneficial blackwater: which is the result of tannins leaching from leaf litter, is rich in carbon compounds and nutrients and is a critical component of the aquatic food web; and
- Toxic blackwater events: is created through the same process as above but the rate of leaf litter decay is greater than the oxygen available resulting in low to no dissolved oxygen.

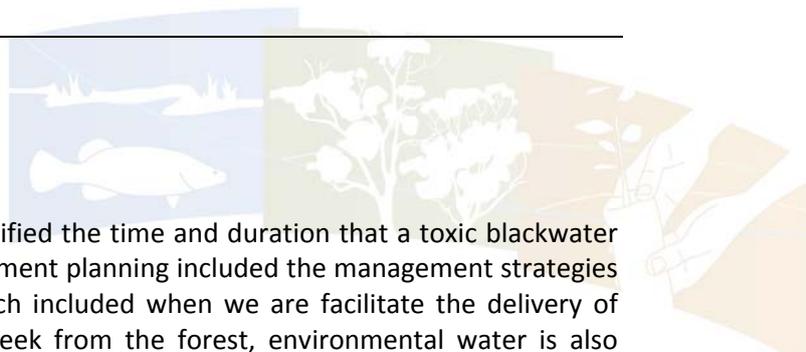
2.2. Beneficial blackwater is an important part of healthy and functioning wetland and river systems, prior to river regulation under natural flooding conditions leaf litter would have been washed off river banks and the floodplain much more frequently and would have provided a regular source of carbon and nutrients for the base of the food web.

2.3. Toxic blackwater events can occur during any flood event, under the right conditions, however there are usually areas of good water quality where animals such as fish can move to. The risk for many fish is when they are unable to escape the toxic blackwater event either because it is so extensive, or because barriers to movement, such as road crossings and weirs, or even shallow water, prevent them from moving away.

2.4. Planning for environmental water creates opportunities to facilitate the transfer of beneficial blackwater while also working to prevent or mitigate toxic blackwater events. Environmental water can be used to provide areas of refuge for aquatic animals, and to dilute carbon rich water before it becomes a toxic blackwater event.

2.5. **Managing forest watering - facilitating good blackwater inputs and preventing toxic blackwater events (case study):** During the environmental watering of the Gunbower Forest during 2014 and 2015 the North Central CMA opened the regulators between the forest and Gunbower Creek to allow for the free movement of fish and carbon between forest wetlands and the creek. The beneficial blackwater discharging from Gunbower Forest to Gunbower Creek provided a strong environmental cue for native fish to move into Gunbower Forest. It also added carbon and nutrients to the creek that provide the basis of the food web, including biofilms on snags, and waterbugs. These, in turn, are eaten by other animals such as platypus and native fish. Monitoring from the last three years are showing an upward trajectory in fish populations in Gunbower Creek as a result of a combination of improving food availability and environmental flows in the creek (see paragraph 0 below).

To ensure that forest watering did not lead to a toxic blackwater event, prior to the first large scale environmental watering of the forest the North Central CMA completed a litter load and blackwater risk assessment using a tool developed by the Murray Darling



Freshwater Research Centre. This identified the time and duration that a toxic blackwater event could have occurred. Our management planning included the management strategies recommended in the assessment, which included when we are facilitate the delivery of beneficial blackwater to Gunbower Creek from the forest, environmental water is also delivered through the creek to meet and dilute the water that exits the forest.

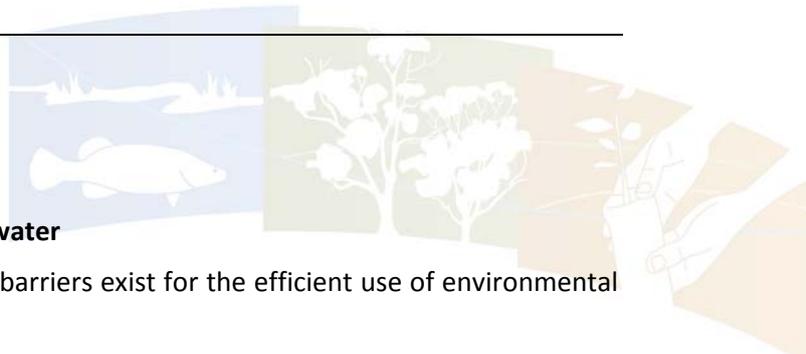
During the natural flooding of 2016, and the toxic blackwater event along the Murray River the North Central CMA prevented water from leaving the floodplain and entering the creek to protect the native fish populations in the creek.

2.6. Provision of refuge in North Central CMA tributaries when Murray River was experiencing a toxic blackwater event (case study): In spring 2016, when a large area of the Murray River was experiencing a toxic blackwater event environmental flows in the Campaspe River, which were released from Eppalock Reservoir, maintained water with good levels of dissolved oxygen to sustain fish populations. Thanks to the construction of fish passage on the weir at Echuca 45 kilometres of river was available as refuge for fish from the Murray River.

2.7. Learning from previous small scale toxic blackwater event and delivering flows to freshen water quality in summer (case study): In the summer of 2015 a summer fresh was in the Loddon River delivered during the hottest days of the month. The watering caused a small scale toxic blackwater event that killed three carp at Canary Island- Leaghur Road. The CMA investigated the event to understand the likely cause and had adapted its management responses accordingly. This was tested in 2017, when under similar summer conditions and deteriorating water quality, the North Central CMA timed the delivery of a summer fresh prior to predicted hot weather to successfully mitigate against a potential toxic blackwater event.

3. Carryover of environmental water

3.1. Carryover is an important tool that helps ensure environmental water can be delivered at a time that is of the greatest value to the environment. Environmental water managers make management decisions on the use of carryover through extensive formal and adaptive management mechanisms. As required under s. 192 of the *Water Act 1989*, each year the North Central CMA develops seasonal watering proposals (SWPs) with its agency and community partners. The SWPs outline watering actions under various climate scenarios. These range from management actions required to prevent catastrophic loss of plant and animal species during periods of low water availability to management actions to build resilience in populations of plants and animals when there is more water available. As the year unfolds the North Central CMA works with the Victorian Environmental Water Holder to determine the most efficient use of water in each system it manages and the potential requirements for the following year, with a preference to working towards building resilience in populations whenever possible. Over the last few years management tools such as carryover are part of the suite of interventions that are contributing to the improvement in the health of our waterways, with indicator species such as native fish showing increases in population numbers.



4. Barriers and efficient use of environmental water

The North Central CMA recognises the following barriers exist for the efficient use of environmental water in our region:

4.1. Water is a finite source: since 1996 our region has experienced a significant reduction in storage inflows (e.g. Figure 1). As described above the water entitlements available to the environment are subject to the same allocation rules as all other entitlements. Further, the entitlements, particularly in rivers, do not hold enough water to cover the full suite of environmental flow recommendations for the systems. This necessitates adaptive water management strategies beyond the current management framework. There is a need for more flexible water management due to changing climatic and environmental conditions. The use and delivery of water needs to consider the use of consumptive AND environmental water collectively to get the best outcome for all users. This relies on the strong partnerships that the CMA has with the rural water corporations and Victorian Environmental Water Holder.

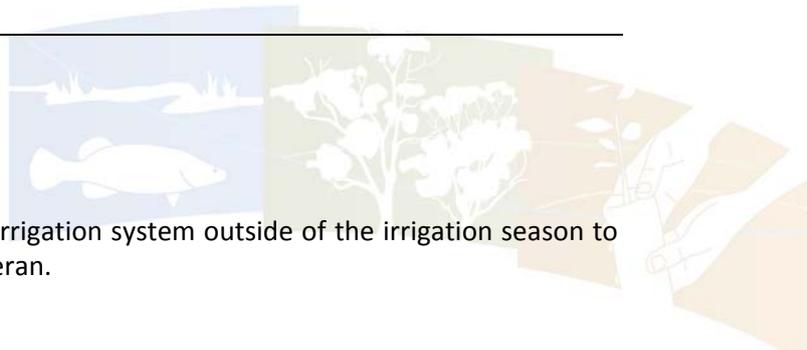
Managing for environmental outcomes in irrigation water carriers – working toward making every drop count twice (case study). The Gunbower Creek is an anabranch of the Murray River. It is highly regulated and there are no natural inflows from the Murray as the National Channel Headworks Regulator prevents these from entering the creek. Even in the most recent large floods of 2010 and 2016, there were no unregulated (not ordered) flows through Gunbower Creek. The challenge, in such highly regulated systems, is to deliver environmental water without impacting on irrigation supply. To achieve this in Gunbower Creek, the North Central CMA targets environmental water using the conceptual model of the Murray cod life history to develop a full year hydrograph to drive environmental flow delivery, without compromising irrigation flows. We have targeted Murray cod, because our monitoring revealed a marked decline in fish numbers, and little evidence of recruitment in the population since the Millennium Drought. The conceptual model identified the following flow components as being vitally important for Murray cod - winter flows, spring rise, stable flows, engaging the littoral zone and ramp down.

The stable flow component is the most challenging. When the creek is being managed purely to meet irrigation demand the creek levels fluctuate dramatically, in some cases the flow rate can change by hundreds of megalitres/day over a couple of hours. To achieve stability we used environmental water to raise the water level, filling the gap between irrigation demand and our target flow rate. This enables us to meet our target hydrograph, and to smooth out the overt variation. Monitoring these flows has demonstrated that Murray cod have spawned and that young fish have been surviving over the last four years. The most recent survey found fish that were aged from one to four, with previous surveys usually only finding adult fish.

4.2. Hydrological disconnection of wetlands in the floodplain: Many wetlands in the North Central CMA region are disconnected, isolated and cut off from rivers and their floodplains and not all wetlands that are ecologically significant within our region, and possibly across the state, have access to the appropriate water regime. This could be resolved through reinstating the floodplain pathways or connecting these wetlands to a water source through infrastructure. For example we have identified a number of ecologically significant wetlands within our region that require intervention to improve their water regime, including but not limited to, Tang Tang Swamp, Woolshed Swamp, Tragowel Swamp, Lake Lalbert and Red Gum Swamp.



- 4.3. Water alone is not the only solution:** The North Central CMA develops Environmental Water Management Plans for all of the systems it manages environmental water for. In the risk assessment of these plans we identify where actions such as including fish passage to facilitate juvenile dispersal and migration for spawning, screens to prevent fish losses to the irrigation system, riparian rehabilitation works to prevent sedimentation and provide terrestrial carbon inputs, instream woody habitat reinstatement, and pest plant and animal control. **Case study (Pyramid Creek environmental water and complementary works)** – the North Central CMA recently secured funding through recreational fishing grants and Victorian Government’s Water for Victoria to install over 30 complexes of instream woody habitat (snags). Fishways have been constructed at Kerang Weir and recently through the Goulburn Murray Water Connections Project, at the Box Creek regulator on Kow Swamp. Monitoring of recent environmental flows through Pyramid Creek have shown that native fish, such as golden and silver perch and the iconic Murray cod are using the fishways, and has also shown that native fish are starting to use the snags as either homes or resting/feeding points as they move from the Murray River to Kow Swamp. This will significantly improve the fishery at Kow Swamp for recreational fishers in Victoria.
- 4.4. Flexibility and adaptive management:** management of environmental water needs to be flexible and adapt to the climatic conditions that occur in a given water year. **Case Study – Campaspe piggybacking on tributary inflows downstream of Eppallock:** The maximum volume of water that can be delivered from Lake Eppalock is 1,800 ML/day. The minimum bankfull flow in the river is 8,000 ML/day, so environmental water alone cannot provide the full benefit to the river bank vegetation. The current approval processes for delivering environmental water usually take around two weeks, which hinders the flexibility to piggyback environmental water on tributary inflows to get enhanced benefits for the river. Monitoring indicates that where environmental water reaches on the banks of the Campaspe River native grasses are flourishing. Above the water line the bank is dominated by weeds.
- 4.5. Old and restrictive infrastructure:** The infrastructure at the Eppalock and Laanecoorie reservoirs are examples of aged infrastructure. These structures require frequent maintenance that require the rivers to stop flowing. This is usually during winter and can create significant stress to biota such as fish, in particular juvenile fish that were spawned the previous spring, which require higher flows over winter to inundate habitat on the edges of the river so that they can escape from predators and access to food.
- 4.6. Interruptible supply:** during the irrigation season the water delivery for the environment is an interruptible supply as the environment does not hold delivery share. The North Central CMA is not advocating the creation of delivery share for the environment, however, there is a need to investigate and implement innovative ideas to overcome the negative impacts to environmental assets that interruptible supply can create. **Case study: Impact of interruptible supply on filling Lake Meran:** In 2015 the North Central CMA installed a probe in Lake Meran to continuously monitor the water level of the lake. The capacity of the channel and outlet that delivers environmental water to Lake Meran is around 100 ML/day. When the flow rate dropped below 20 ML/day the water level effectively ceased to rise for around two fill weeks. This is likely due to evaporation rates being equal to the flow rate entering the lake. Conversely, the following year, water was delivered during a wet period and the environment had full access to the channel system. The water level rise was steady and the water was delivered in significantly less time. As such, the North Central CMA and the Victorian Environmental Water Holder are negotiating with



Goulburn Murray Water to access the irrigation system outside of the irrigation season to deliver environmental water to Lake Meran.

5. Environmental water charges

The North Central CMA will defer to the current environmental water charges review being carried out by DELWP under Action 3.7 of *Water for Victoria*. The North Central CMA have participated in this process.

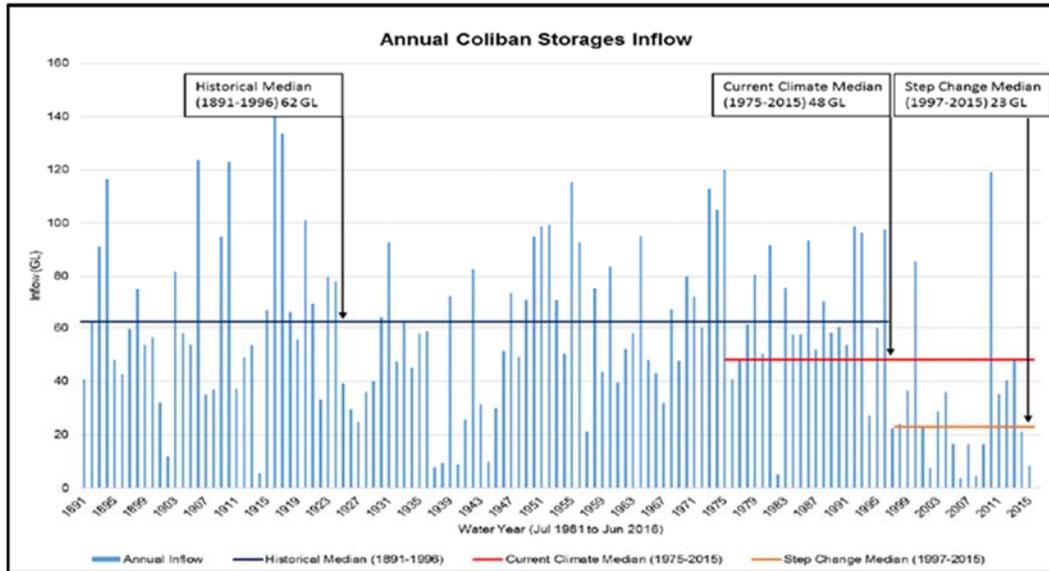


Figure 1: Annual inflows (July – June) into Coliban Headworks Storages showing median historical (62.3 GL), current climate (48.1 GL/a), and post-1997 (23.0 GL/a).