Macquarie-Castlereagh Regional Water Strategy: Analysis of the option to investigate changing the operation of regulated effluent creeks during dry periods

This paper presents preliminary analysis on the potential benefits and impacts of the option to change the operation of regulated effluent creeks during dry periods.

It summarises analysis presented in the *Draft Macquarie-Castlereagh Regional Water Strategy: Shortlisted Actions - Consultation Paper*[1] and contains additional analysis prepared in response to feedback received during public consultation on the strategy.

The draft strategy proposal

Gunningbar Creek, Crooked Creek and Duck Creek form part of a network of natural flood channels that branch off the main trunk of the Wambuul / Macquarie River near Warren. They are often termed the effluent creeks. Warren Weir was constructed in the 1890s to raise river levels to divert water into these creeks whenever there were flows in the river. Continuous flows have been diverted into these creeks since the construction of Burrendong Dam in the 1960s.

The *Draft Macquarie-Castlereagh Regional Water Strategy: Shortlisted Actions – Consultation Paper,* released for public exhibition in October 2022, shortlisted the option of returning Gunningbar, Duck and the upper part of Crooked creeks to a more natural regime with occasional periods of no flow during dry periods.

The strategy identified this as an option that merits further investigation to help extend water supplies in Burrendong Dam during extreme droughts.

Stakeholder feedback

During consultation we heard concerns from landholders on the effluent creeks that:

- the 'regulated' status of the effluent creeks would be changed if the option was progressed[2]
- the environmental values of the effluent creek system are not sufficiently understood and recognised but are integral to the operation of the Macquarie Marshes and, therefore be

[1] See Attachment 2 of the *Draft Macquarie-Castlereagh Regional Water Strategy: Shortlisted Actions – Consultation Paper* available from: www.water.dpie.nsw.gov.au/plans-and-programs/regional-water-strategies/what-we-heard/macquarie-castlereagh-regional-water-strategy

[2] A regulated river is a river, stream or other watercourse, the flow of which is regulated by artificial structures such as dams, weirs, off-takes, storages, etc. Regulated rivers are declared by the Minister, by order published in the Gazette.

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offered the same protections. Specifically, that water should not be taken off the creeks and provided to the Macquarie Marshes

- the pipelines would be operated in non-drought times – resulting in dry creeks more often, impacting on the amenity of the creeks and the ability of business holders to manage stock
- there would be additional costs for landholders in relation to fencing, including the need to create stock-proof borders and fencing for alternative stock watering points.

There was support from some stakeholders who noted that there are opportunities to use water more efficiently, and that savings from progressing this option could be used to keep water in the Burrendong Dam for town security. In normal years, usual flows to the effluent creeks should be supplied.

There were requests for the department to:

- undertake environmental studies before progressing with this option
- consider opportunities to trial this option in some creeks
- publish clear information on when the pipeline would operate and how any water savings that could result from the option would be managed.

This paper has been published to provide information in response to this feedback and allow all parts of the community to use this analysis to inform future discussions on whether the option would support the drought resilience of high priority water needs on the effluent creeks, improve water delivery efficiency and achieve water savings. The ecological impacts of the proposed option are also important considerations that will be assessed in future analysis.

How are regulated water supplies currently delivered to the effluent creeks?

Gunningbar Creek receives continuous regulated flows from the Wambuul / Macquarie River just upstream of Warren, and the Duck and Crooked creeks branch off from Gunningbar Creek shortly thereafter. Downstream of the 'Mumblebone' weir pool, flows along Crooked Creek are essentially unregulated.

Crooked Creek has stock and domestic water users and a single general security water user. Duck Creek and Gunningbar Creek downstream of Gunningbar Weir have a small number of general security irrigation access licences plus stock and domestic water users.

Under current arrangements, WaterNSW delivers water to these effluent creeks continuously. The flows into the creek system are regularly adjusted at Warren Weir and the Gunningbar Creek regulator to maintain flows along the regulated sections of these creeks while considering the system's variable transmission losses and water orders. Flows into the creeks increase when flows in the Wambuul / Macquarie River are high and unregulated. As a result, the amount of water flowing into the creeks can vary substantially depending on seasonal conditions.

Under the regulated surface water sharing plan for the region, 15GL of water is also set aside from assured inflows and reserves in Burrendong Dam to provide a replenishment flow to the lower

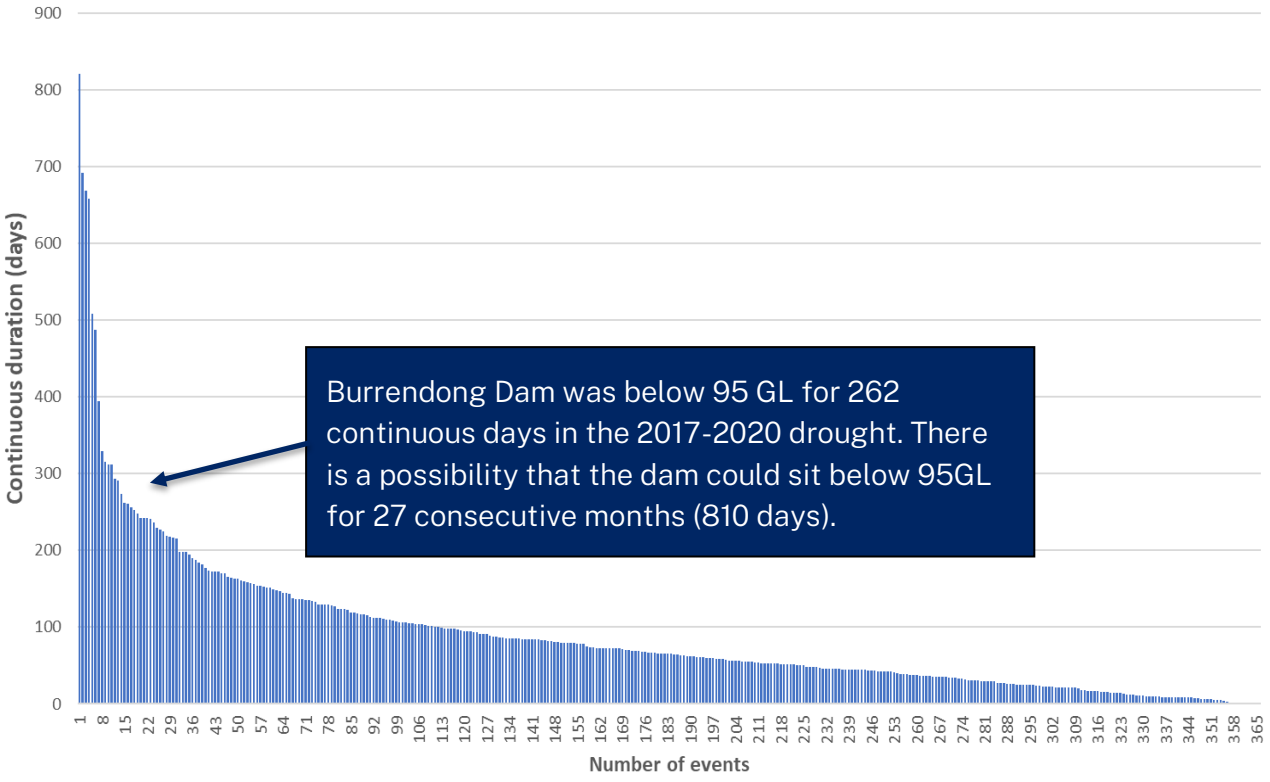
Bogan River, downstream of its junction with Gunningbar Creek. Water flows to the Bogan River via Gunningbar Creek and these replenishment flows can help provide water along this creek.

During dry periods water seeps into the river bed and evaporates. These 'transmission losses' in the river and creeks far exceeds the volumes of water extracted for domestic and stock and basic landholder rights users. The focus during extremely dry periods is on preserving the remaining water for critical human and environmental needs and delivering the water as efficiently as possible. Maintaining regulated flows in the creeks system during these periods requires about 27GL/year.

During the 2017–2020 drought in order to conserve the remaining water in the Burrendong Dam for critical town water supplies, the NSW Government ceased water flows to Duck, Crooked and Gunningbar creeks. Landholders on these creeks were required to cart water to their properties, find alternative water supplies for their stock or destock these areas.

Our analysis using the long-term historic climate dataset[3] suggests that there is a real possibility that prolonged droughts worse than the 2017–2020 could occur in the future, and that Burrendong Dam could sit at critically low levels for longer (Figure 1) resulting in a higher probability of flows ceasing to the effluent creeks.

Figure 1. The number and duration of continuous events below 95 GL (61 GL active storage) in the long-term historic climate dataset



[3] To support development of regional water strategies, we are using the recorded dataset as well as 2 plausible climate scenarios to test their respective implications for regional water resources. This includes the long-term historical past climate dataset, which is 10,000 years of stochastic-generated climate data developed using paleo climatic information from The University of Adelaide, Australia.

What is the purpose of investigating changes to the operation of the regulated creeks?

Changing the operation of regulated creeks would be to support the drought resilience of communities on the creeks and across the catchment. The intention is to only change the flows of water delivered to the creeks during extreme dry periods when it would not be possible to efficiently deliver water to those needs.

This option would look at:

- understanding the appropriate triggers for ceasing flows to the regulated effluent creeks from Burrendong Dam during dry periods, recognising that future droughts could be more prolonged than the 2017–2020 drought. This would need to be done in consultation with communities. Our intention is that the change could occur when drought stage 4: extreme drought is declared in the Macquarie-Castlereagh catchment under the NSW Extreme Events Policy. Our analysis suggests that these events occur in 4.3% of years under the long-term historical past climate dataset.
- proactively identifying ways to secure water for basic landholder rights on the regulated effluent creeks to ensure landholders have a secure source of water during extreme droughts, noting that even without any changes there are likely to be more instances where it is not possible to deliver water to the creeks from Burrendong Dam.

This option is not intended to cease flows into the regulated effluent creeks during average or wet periods. The option is a drought resilience measure.

Option analysis

How often would there be no flows in the effluent creeks with and without this option?

Under the option we have assessed, stock and domestic water deliveries could be delivered to the effluent creeks via pipelines rather than having all water deliveries suspended. If this option was in place during the 2017-2020 drought, water would be delivered to the creeks via pipelines for 1–7 months longer than without the option. The pipelines would not be operated in non-drought sequences.

This could help in proactively supporting the drought resilience of stock and domestic and basic landholder need on the effluent creeks rather than relying on water carting and destocking during extreme dry periods.

If this option were to progress, the actual difference in water availability in the creeks would depend on any final rules negotiated on when water deliveries to the regulated effluent creeks would cease. These parameters would be developed in close consultation with affected parties.

How much water could be saved?

Flows to the effluent creeks ceased in the 2017–2020 drought. This included:

- flows along Duck Creek and Crooked Creek ceased from 26 August 2019[4] when Burrendong Dam fell to approximately 7% of its total storage capacity (87GL).[5] This was to reduce transmission losses and extend the availability of water for town supply
- flows to Gunningbar Creek ceased on 9 December 2019[6] when Burrendong Dam fell to approximately 5% of its total storage capacity (67 GL).[7]

The temporary structures to block flows at Gunningbar Creek, Duck Creek and Crooked Creek regulators were removed on 23 February 2020.

During this time, landholders on the regulated effluent creeks carted water to their properties or invested in groundwater bores to have access to water.

This option would have benefits to those landholders by better equipping them with alternative water supplies during dry periods.

Our analysis also suggests that changing the operation of effluent creeks could result in up to 1–3GL of annual water savings on average. This is a long-term average and these savings would not be realised every year, however during dry periods the annual water savings could be greater. Importantly, the majority of the water savings associated with this action results from being able to potentially repurpose the 15 GL set aside for replenishment flows in extreme dry periods, as well as savings in transmission losses.

The final long-term water savings will depend on the operating procedures of any pipelines and changes to water sharing plans.

For the purpose of this modelling exercise, any potential water savings have been expressed in terms of increased general security irrigation water. However, this increased irrigation water is only being used as a surrogate for quantifying the extra water available, and the water may be used for other purposes.

[4] See WaterNSW's August 2019 Operations Update: Macquarie Valley Temporary Drought Works, available from www.waternsw.com.au/__data/assets/pdf_file/0018/147510/Ops-Update-Drought-Relief-Macquarie-Valley-August-2019.pdf

[5] This is equivalent to approximately 5% (55 GL) of its active/effective storage in Burrendong Dam.

[6] See WaterNSW's Regional Drought Monthly Report (13 December 2019), available from www.waternsw.com.au/__data/assets/pdf_file/0008/151892/Regional-Drought-Monthly-Report-December-2019.pdf

[7] This is equivalent to approximately 3% (33 GL) of its active/effective storage in Burrendong Dam.