

**Independent Review of the Narran Lakes (Dharriwaa) Release from
Private Storage Event Based Mechanism Grant 2023**

Final Report to the Commonwealth Environmental Water Holder

By

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The author acknowledges the Traditional Owners and custodians of Country throughout Australia and acknowledges their continuing connection to land, waters and community. The author pays respect to their Elders past and present.

Summary

Triggered by wet conditions over 2020-2022, thousands of waterbirds were breeding during the later months of 2022 for the second year in a row at the internationally significant Narran Lakes in the lower Balonne River system in north-western New South Wales. This was the second time in 10 years that waterbirds had bred at the Narran Lakes. It was an important event for the recovery of waterbird populations, which had been in decline across the Murray-Darling Basin for the last 40 years, based on regular surveys by the University of New South Wales and reports from the Murray-Darling Basin Authority (MDBA) and others.

Colonial waterbird nests were recorded within the Ramsar area of the Narran Lakes, including threatened species and one of the largest colonies of Glossy ibis in the Basin in 2022. Pelicans were also breeding outside the Ramsar site in other parts of the wetland, with many thousands of pelicans nesting across two colony sites in Narran Lake. This was the first pelican breeding event at Narran Lakes since 1998 and was one of only four known locations for pelican breeding in the Basin.

While natural flows kicked off the breeding events, those flows had virtually stopped by the end of 2022 and there was a return to warmer conditions. Water levels in the Narran Lakes began dropping from late November 2022, with increasing risks to the successful completion of waterbird breeding.

To support the waterbirds to complete their breeding and help the young chicks to fledge, the Commonwealth Environmental Water Holder (CEWH) entered into grant arrangements in early February 2023 with a water entitlement holder on the Narran River in south-western Queensland to release water from private on-farm, off-stream storages - an event-based mechanism (EBM) to get more water to the Narran Lakes. Approximately 6.5 GL of water was released over the period from 08 to 26 February 2023 and about 2.4 GL from the release made it to the Narran Lakes system, based on stream flow gauging data. The release raised the water level in Back Lake by about 0.1 m in real terms, and replaced evaporation deficits over about 26 days, extending waterbird breeding opportunities and further supporting wetland vegetation and other habitat.

EBMs are a 'Toolkit measure' under the Intergovernmental Agreement (IGA) on Water Reform in the Murray-Darling Basin aimed at improving environmental outcomes in the northern Basin and have been under consideration by the CEWH for many years. They include temporary purchase of water harvesting allocations; purchase and release of water from private storage; no pump arrangements; or more sophisticated arrangements like permanent at-call options. The broad aims of EBMs are to develop water entitlement trading and other contractual measures to complement management of water for the environment.

In 2020, following seven years of drought, the CEWH implemented a no pump EBM in the lower Balonne River system which provided an additional 9 GL of water to the Narran Lakes to help revive critical waterbird habitat. An independent review of this no pump EBM in 2020 concluded it was well run and made some recommendations for further improvements. Subsequent EBM grant rounds were run in 2021 and 2022, informed by the 2020 independent review. However, whilst the grant was triggered in 2021, no eligible water licence holders chose to participate. In 2022, rainfall and subsequent flows were sufficient to meet environmental requirements and there was no need for additional flows under an EBM.

In May 2023, the CEWH commissioned an independent review of the 2023 Narran Lakes EBM. The review was required to assess the effectiveness of the EBM. Based on the findings, the review was also requested to provide recommendations for improving the implementation of EBMs consistent with the IGA.

Review findings

Overall, good processes were used to implement the 2023 Narran Lakes EBM, while some opportunities were identified to make mostly incremental future improvements. The development of these processes was importantly informed and assisted by the preparatory work done for the 2022 Narran Lakes EBM which also considered a release of water from private storages but ultimately did not proceed due to sufficient natural flows. The 2023 processes were underpinned by a positive enabling environment, open communications and good working relationships among the various parties who were willingly involved. The parties communicated and worked together in good faith to achieve desirable outcomes. Those outcomes included the extension of successful waterbird-breeding events in early 2023.

A very substantial amount of site monitoring data and information, supported by expert hydrological and ecological knowledge and advice, was collected to inform the decision to implement the 2023 Narran Lakes EBM. That expert advice clearly indicated that the implementation of the EBM was environmentally justified by the expected additional environmental benefits and aligned with the priorities for environmental watering established by the MDBA and the CEWH. Further dialogue with stakeholders about those priorities and their justification would be beneficial, recognising stakeholder's varying views about other environmental, economic, social and cultural assets in the lower Balonne River system.

The only EBM available for activation in January/February 2023 was the release from private storage EBM because there was water available in private storages, but there were no sufficient flows existing or forecast into the lower Balonne River system. While circumstances may be different in the future, the selection of a release from private storage EBM was appropriate for the river system conditions in the lower Balonne River system and the Narran Lakes in January/February 2023.

The process used for activation of the grant followed the Standing Operating Procedure document and assessment/approvals framework developed and documented by the CEWH in 2022. Evidence provided by the ecological and hydrological experts engaged clearly informed the CEWH's decision to activate the EBM. The decision recognised the ecological and hydrological context of the situation and the risks and benefits involved. Some of the steps to activate the grant were especially short on time and could have become problematic if the parties involved did not exercise the high levels of good-will and cooperation that they did. Having pre-activation contracts/agreements, some extra time and some further streamlining for these steps would help orderly progress.

De-activation of the grant was the time when the agreed and required volume of water (up to the maximum contracted volume) had been released from the on-farm storages and they were effectively drained down. There were also no water quality issues or risks of nests flooding that could have triggered de-activation of the 2023 Narran Lakes EBM.

Stakeholders directly involved in the management and implementation of the EBM agreed that communication and engagement with them was very good. They appreciated the direct contacts from and with the CEWH and the on-ground engagements. More direct communications and engagement with First Nations people would have been welcomed, including additional suitable activities on Country. Approaches for this should be explored with First Nations people. Information about the EBM was published on the CEWH's website and Twitter and made available through links in the CEWH's newsletter, accessed via free online subscription. A final analysis report of the 2023 Narran Lakes EBM has yet to be prepared and made public. It is highly desirable that this happens.

The Standing Operating Procedure document and approvals framework identified a broad range of risks and developed mitigation strategies so that no risks were identified as extreme nor high. That document identified moderate risks as the thin market, the potential for the storage owner to “make up” volumes sold in a later flow event, and reputational risk to the CEWH and the government agencies involved. While the current contractual arrangements for the release from private storage EBM, leveraged through timed payments by the CEWH for storage owner services and demonstrated compliance, have been shown to be robust, this matter requires further consideration by the CEWH, the Queensland department and water users. In any event, the contractual arrangements, including mutually suitable legal protections, risk assignment and payment arrangements, have to remain satisfactory to the water storage owner to participate in the EBM.

The CEWH established impressive monitoring and assessment arrangements for the 2023 Narran Lakes EBM. Contractual or other service agreements were completed to cover a range of activities and provision of expert advice, including flow monitoring and forecasts, wetland inundation monitoring and assessment, waterbird-breeding and vegetation health monitoring and advice. The Narran Waterbird Technical Advisory Group (TAG) was instrumental in providing environmental justification for the implementation of the EBM. The CEWH received regular technical updates and advice about Narran Lakes water conditions, status of waterbird colonies, water flowrates and volumes and weather forecasts.

Although individual final reports about water volumes released and water quality and individual draft reports about waterbird breeding results and vegetation health responses had been received by the CEWH, a specific 2023 Narran Lakes EBM comprehensive technical report setting out the final analyses of the on-site monitoring work, field surveys, gauging station records, modelling and other assessments was not yet available at the time of preparing this independent review report. It is critical that such a report be completed with input and review provided by all Narran Waterbird TAG members and others involved so that the information, knowledge and understandings are readily available for future decision-making.

State and Commonwealth government, university and private sector experts were engaged and contracted to undertake hydrological and ecological monitoring, assessments and evaluation of responses to the EBM. The available data and observations indicated that the 2023 Naran Lakes EBM provided on-going habitat and food resources for many waterbird species to finish successful breeding activities, in addition to building lignum health and resilience directly, which has longer-term benefits.

The environmental justification for implementation was importantly borne out by the number of waterbird species still having nests and chicks in the core wetland areas of the Ramsar site at the time when the EBM water arrived. A larger area was wet for a longer period of time to support the success of the waterbird breeding. This may also be especially important as the current forecasts are indicating drier years immediately ahead. This and other information can inform future updates of basin watering strategies and priorities. Any future report outlining the effectiveness of the 2023 Narran Lakes EBM would also benefit by having a section devoted to describing outcomes for local First Nations people.

While the 2023 Naran Lakes EBM was effective in extending successful waterbird-breeding events, it is a challenge to specify whether or to what extent the events “needed” to be extended. There is no counterfactual to demonstrate if the EBM water was not used for that purpose, what would have happened? Was the approach used absolutely the best use of the water? For example, after several years of successful waterbird breeding already, was more waterbird breeding needed, or could the

water have been used for benefits elsewhere? Expert opinion helps to answer these questions and that will also be informed by more research and increased knowledge of environmental and other water requirements across the river system and across the broader landscape. What is known at the moment is that landscapes and river systems have been modified, while recent decades have been punctuated by very severe drought periods, and waterbird numbers across eastern Australia have not yet recovered to previous levels. This supports an argument that available opportunities such as EBMs should be used whenever possible to further support waterbird breeding.

However, the use of EBMs may also have economic, social and cultural impacts and consequences which may be viewed differently by different people. This needs to be factored in when deciding to use them and how often to use them. Stakeholders generally supported the use, where possible, of more, rather than less, EBMs in the future, provided there is the necessary transparency around the circumstances under which each EBM would be implemented. This includes using CEWH water entitlements to harvest and temporarily store water in private on-farm (leased) storages for later release, under specific circumstances and conditions. It would be beneficial to undertake the necessary preparatory work to document standing operating procedures, including the decision-making framework, to enable this type of EBM (and potentially other EBMs). Necessary contractual, measurement, monitoring, modelling and verification arrangements should also be agreed and documented in advance. All of these factors recognise that time is of the essence in EBM decision making.

To further support the above, additional public information could be developed to describe the place that EBMs have in achieving better ecological and other outcomes in a modified catchment, subject to relatively high climate variability and continuing climate change.

Installing additional low flow control gates on the weirs at bifurcation 1 and bifurcation 2 in the lower Balonne River system would open up additional opportunities for more water users and more cases to be considered for application of EBMs in the lower Balonne River system, potentially increasing benefits and lowering costs. This would also provide additional opportunities and flexibility to provide benefits not only to the Narran River and Narran Lakes, but also to other distributary streams in the system, potentially improving connectivity, water quality and water security outcomes. The relative priority of environmental water, including EBM water, for the Narran River and Narran Lakes compared with the other distributary streams in the lower Balonne River system is more a matter for the relevant State, MDBA and CEWH watering plans than this review. However, several stakeholders saw the good sense in having approaches to EBMs developed to provide benefits in the other distributary streams when circumstances warrant such interventions.

Review recommendations

While this independent review has found that, overall, the 2023 Narran Lakes EBM was well managed and effectively implemented, several opportunities for improvement have been suggested throughout this report. It is recommended that each of these suggestions be further considered by the CEWH, in consultation with other agencies and stakeholders. In particular, it is recommended that:

1. Work continue to build the scientific base around the ecology and hydrology of the lower Balonne River system and Narran Lakes to reduce uncertainties, increase confidence in assumptions that have to be made and to further support evidence-based decision-making, including the short list of important activities identified by the teams involved in the 2023 Narran Lakes EBM.
2. Previous work done on streamflow monitoring and forecasting tools, including for water flowrates, volumes, travel times and “losses”, be updated with later data and information, including from the 2023 Narran Lakes EBM, to enhance real-time management of EBMs (and river operations generally), while also considering the impacts of a changing climate.
3. The CEWH undertake the necessary preparatory work, in consultation with stakeholders, to document standing operating procedures, including clear and transparent decision-making and approvals frameworks, for the full range of EBMs with a priority for documentation given to an EBM using CEWH water entitlements to harvest and temporarily store water in private on-farm (leased) storages for later release.
4. The CEWH, in consultation with stakeholders, consider moving away from short notice (ad hoc) grant arrangements to longer-term contract arrangements (potentially including pre-approvals, commercial put and call options supported by a decision framework on price, and/or “standing offer” arrangements), which outline the processes and main points for agreement to streamline the time and resources required and reduce the uncertainties for participation in future EBMs.
5. The CEWH, the Queensland Department of Regional Development, Manufacturing and Water and water users further consider regulatory, contractual, commercial, compliance and water accounting arrangements associated with the implementation of EBMs and the potential for additional water take, including mutually suitable legal protections, risk assignment and payment arrangements.
6. The CEWH consider using an “incident management system”, modified from approaches used by emergency management organisations for flood and fire actions, to help identify process improvement opportunities (and increase process understanding for new staff) if simulations through the full EBM implementation process are undertaken from time to time.
7. Additional low flow control gates be installed in the weirs at bifurcations 1 and 2 to help increase the number of properties for the EBM market and improve low flow management flexibility.
8. The CEWH develop additional public information to describe the place that EBMs have in achieving better ecological and other outcomes in a modified catchment, subject to relatively high climate variability and continuing climate change.
9. The CEWH and other agencies undertake additional dialogue with First Nations people to help identify and celebrate cultural outcomes resulting from the 2023 Narran Lakes EBM, and to identify additional opportunities in the future to engage local First Nations people in the monitoring and survey work, both generally and associated specifically with an EBM.
10. The main players in the implementation of the 2023 Narran Lakes EBM have their own collective feedback and review session over the coming months to enable review, updating and increased understanding of the processes and procedures and to reinforce the celebration of a team effort and the positive relationships that were needed to achieve good results.

11. The CEWH oversee the preparation and publication of a final analysis report of the 2023 Narran Lakes EBM, and communicate the results widely, including directly with local communities.
12. The CEWH update the Standard Operating Procedure document and assessment/approvals framework for a release from private storage EBM based on the results of these recommendations and future reviews of EBM implementation, supporting its continuous improvement ethic.

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1. Introduction

The Balonne River system in south west Queensland divides into a number of distributary streams within the floodplains downstream of St George. These streams flow across the Qld/NSW border and one of them, the Narran River, terminates in the Narran Lakes, east of Brewarrina (see Figure 1).

The principal environmental assets currently recognized in the river system are the instream habitats and floodplain wetlands of the distributary streams and the Narran Lakes (MDBA, 2022 and CEWH, 2022). The internationally significant Narran Lakes (Dharriwaa to the Yuwaalaraay First Nations people), including the Ramsar listed portion within the Nature Reserve, is an important wetland in the northern Murray-Darling Basin. Endangered native waterbirds and migratory waterbirds rely on the Narran Lakes to breed and survive. Dharriwaa is also of immense cultural significance – a meeting place. When water comes, frogs emerge, waterbirds breed, people arrive and ceremonies begin. Dharriwaa has been important for First Nations people for thousands of years.

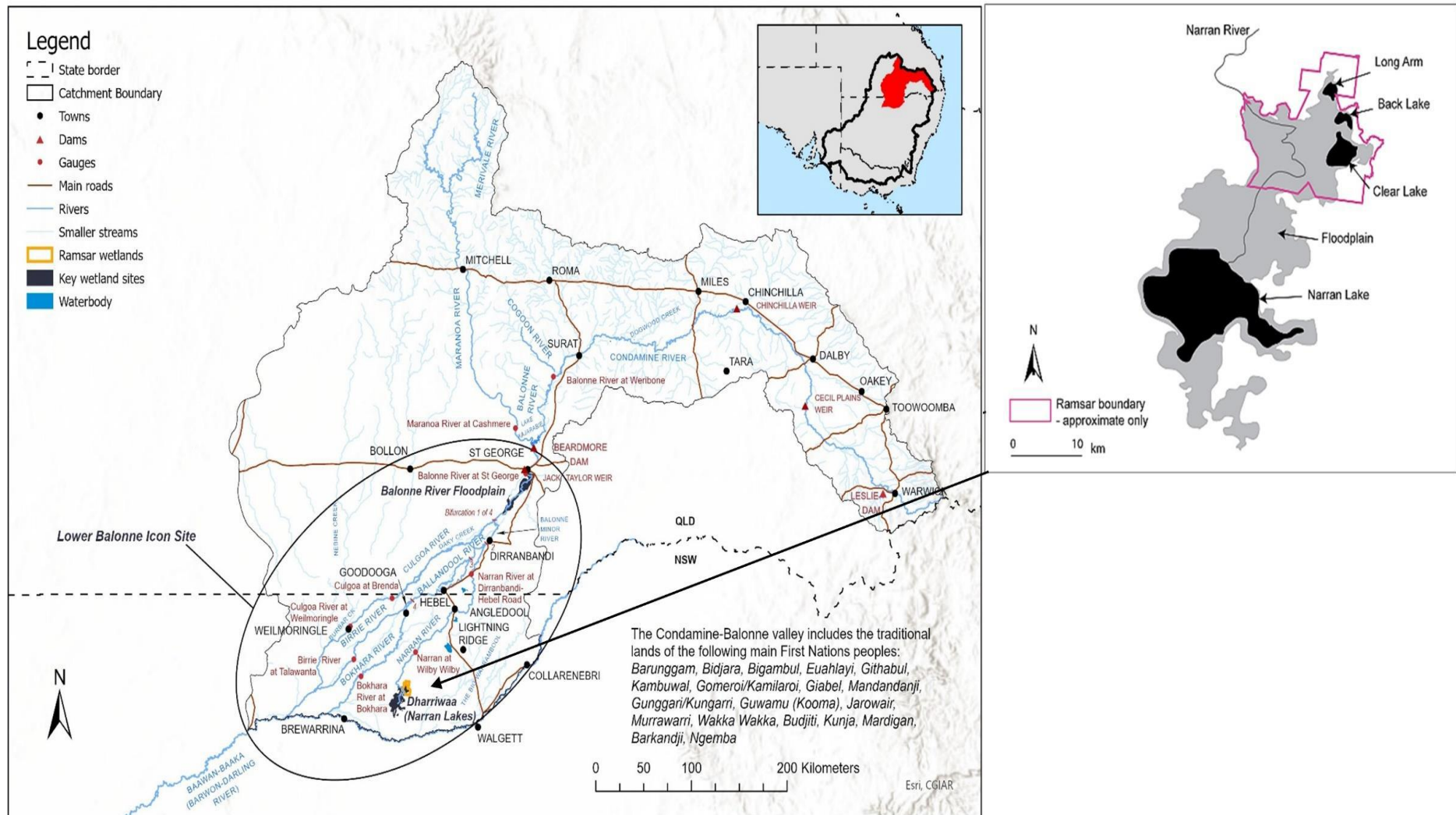
Planned environmental water (managed by the Queensland government) and the Commonwealth environmental water holdings (managed by the Commonwealth Environmental Water Holder – CEWH) currently provide environmental flows in the lower Balonne. The planned environmental water includes the environment, stock and domestic (ESD) water provided under a number of Queensland government regulatory and policy instruments (DNRME a and b, 2019). The CEWH is not responsible for meeting stock and domestic water requirements in the system.

Stakeholders recognize that there may be an opportunity to add to and/or obtain more benefits by better managing flows using event-based mechanisms (EBMs), infrequently and strategically. EBMs are a 'Toolkit measure' under the Intergovernmental Agreement (IGA) on Water Reform in the Murray-Darling Basin (COAG, 2019) as part of the implementation of recommendations of the Northern Basin Review (MDBA, 2016) and amendments to the Basin Plan in 2018 to include the development of a range of measures aimed at improving environmental outcomes in the northern Basin. Consequently, EBMs have been under consideration by the CEWH for many years and include temporary purchase of water harvesting allocations; purchase and release of water from private storage; no pump arrangements; or more sophisticated arrangements like permanent at-call options (MJA, 2019). The broad aims of EBMs are to develop water entitlement trading and other contractual measures to complement management of water for the environment.

The water needed to meet ecosystem objectives at the Narran Lakes and other key environmental assets in the lower Balonne River system has been identified and captured in key environmental water requirements (volume, magnitude, duration, timing and frequency). As flow events are highly variable in this unregulated catchment, meeting ecological objectives largely relies on unsupplemented flows delivering the right quantity of water at the right time (BDA Group and CSIRO, 2017) and EBMs can assist this (MJA, 2019).

Current Commonwealth environmental water holdings in the lower Balonne are insufficient to always support flow events to achieve ecological outcomes, such as maintaining core rookery habitat, or supporting large-scale waterbird breeding events in the Narran Lakes. Additional water is required during some occasions to strategically achieve additional ecological outcomes. A major consideration is the lack of large public storages on the unregulated river system that supplies water to the Narran Lakes. The successful augmentation of flow events will by necessity require access to private water harvesting entitlements and/or already stored water in private on-farm storages.

Figure 1-1 Condamine–Balonne river system showing inset of Narran Lakes (Dharriwaa) (Copied from CEWH, 2022)



Support for the use of EBMs grew following a successful application in 2008. In that event, the forerunner of the MDBA purchased around 10 GL of water from a private storage along the Narran River to sustain water levels in the Narran Lakes to support waterbird breeding. The purchase was viewed as an emergency one-off, as there had been very limited waterbird breeding for several years during the Millennium Drought (Jenkins et al, 2009). The purchase was conducted over a very short timeframe and made possible only through the goodwill of a water seller.

Policies and approaches for environmental water management, including EBMs, have been in development and appraisal for many years (BDA Group and CSIRO, 2017). While providing useful insights to the development of EBMs, it was apparent that significant design work was required if these mechanisms were to be more widely employed (MJA, 2019).

In 2020, following seven years of drought the CEWH implemented a no pump EBM in the lower Balonne River system which provided an additional 9 GL of water to the Narran Lakes to help revive critical waterbird habitat. An independent review of that project found that it was well managed and effectively implemented (DG Consulting, 2020). Whilst the project was well managed overall, it was noted that the circumstances around future EBM application will be different and will require further development of techniques and procedures. The independent review in 2020 developed recommendations to assist the CEWH in continuous improvement of EBM implementation and to ensure they are able to be applied over a wider range of pre-existing conditions wherever feasible.

Subsequent EBM grant rounds were run in 2021 and 2022, informed by the recommendations of the independent review in 2020. However, whilst the grant was triggered in 2021, no eligible water licence holders chose to participate. In 2022, rainfall and subsequent flows were sufficient to meet environmental requirements and there was no need for additional flows under an EBM. Even though the 2022 Narran Lakes EBM did not proceed to activation, the CEWH consolidated the preparatory work into a Standing Operating Procedure document and developed supporting decision-making and assessment/approvals frameworks, processes, templates and relationships with partner agencies, monitoring and assessment providers and relevant stakeholders.

2. Overview of the 2023 Narran Lakes Event Based Mechanism

There are several physical activities and policy matters that were important to or influenced the development and implementation of the 2023 Narran EBM. A snapshot (rather than an exhaustive list) of these activities and matters is presented in Appendix 1.

Importantly, specific arrangements for the 2023 Narran Lakes EBM drew on the release to the Narran River from private storage in 2008 (Jenkins et al, 2009), the pilot EBM undertaken and reviewed in 2020 (DG Consulting, 2020) and the preparatory work for a proposed release from private storage in 2022. This greatly assisted the relatively intense activities to be successfully completed leading immediately up to and during the implementation of the 2023 Narran Lakes EBM.

In summary, the purpose of the 2023 Narran Lakes EBM was to support colonial waterbird breeding at, and to continue building resilience of, the Narran Lakes ecosystem in 2023. Achieving this outcome involved entering into a grant arrangement with a water allocation and/or licence holder(s) to release water from their private storage/s. Informed by independent expert advice, the envisaged benefits of releasing additional flows to the Narran Lakes and, in particular, to the Ramsar Convention listed portion within the Nature Reserve, through activation of this EBM, included:

- Providing suitable conditions for successful nesting and survival of young for the entire nesting period, including late nesting waterbirds;
- Providing foraging habitat for other colonial waterbird breeding species that rely on wetland food resources and their young including egrets, spoonbills, herons and cormorants;
- Providing foraging habitat for juvenile colonial waterbirds post-fledgling from the Narran Lakes and nearby wetlands in the northern Murray-Darling Basin, including Gwydir Wetlands and Macquarie Marshes;
- Mitigating the risk of water quality issues in the wetlands and colonies;
- Restricting access to the colonies by ground mammalian predators;
- Provision of foraging habitat for non-colonial waterbird species including vulnerable and listed migratory species;
- Improved condition of lignum and river cooba waterbird breeding habitat impacted by extended dry conditions over the extended drought between 2012-2020; and
- Extending the duration of current inundation into 2023 will continue to support lignum suitable for waterbird breeding both in this season and future years.

The release from the private storages started on 08 February 2023, independently measured and monitored at a rate of about 350ML/day. This release rate kept the water within the banks of the Narran River. The release from the storages stopped on 26 February and approximately 6.5 GL were released. The release reached the Narran Lakes around 26 February 2023, with an estimated 2.4 GL of additional water eventually provided there. This extended critical water levels in Back Lake by about 26 days.

3. Review methodology

The CEWH required that this review assess the effectiveness of the 2023 Narran Lakes EBM. The independent review was required to examine whether:

1. The implementation of the EBM was environmentally justified;
2. The type of EBM selected was appropriate;
3. An appropriate process for the activation and de-activation of the grant was effectively followed during the EBM's implementation;
4. The communications and engagement approach was effective;
5. An adequate analysis of risk was undertaken, including measures to minimise the risk of the grant recipient making up for water foregone;
6. Monitoring and evaluation activities have effectively supported the assessment of ecological response and identified the outcomes achieved from the EBM to assist in supporting future water use decisions; and
7. The observed ecological response aligns with the environmental rationale for the implementation of the EBM.

Based on the findings, the review was required to provide recommendations for improving the implementation of EBMs consistent with the IGA on Water Reform in the Murray-Darling Basin.

In addition, the reviewer was required to consult with the CEWH's monitoring partners, including the University of NSW and the NSW Parks and Wildlife Service, to assess the ecological response to the EBM.

Topics that did not fall under the scope of the independent review included:

1. Assessment of the work of the Community Grants Hub who ran the administrative process associated with the grant; and
2. Financials regarding the choice to use a grant, and how consistent the grant was with Commonwealth Grant Guidelines.

Outlined below are the key activities undertaken to meet the requirements set out above. More details about each of these activities are provided in Appendix 2.

1. Inception meeting, including agreed issue identification and assessment framework for the review;
2. Initial review of all relevant EBM planning and implementation documentation;
3. Collection and collation of responses to the assessment framework and identification and outline of issues for further investigation and assessment;
4. Progress update to the CEWH;
5. Independent analyses of documentation, responses to the assessment framework and issues raised;
6. Preparation of a draft report for consideration and feedback; and
7. Preparation and presentation of a final report

This review has been undertaken within the limits defined in the requirements for the review and has relied on the information contained in publicly available reports, documentation provided by the CEWH and others, and discussions held with individual staff and stakeholders. The conduct of the review was significantly assisted by the verbal and written contributions provided by these people. The review has used the information provided to formulate the independent reviewer's conclusions and recommendations.

4. General comments and suggestions

The sub-sections below summarise the main points made during the general discussions with more than 20 individual staff and stakeholders, combined with the results from the reviewer's independent assessment of the available documentation and other information.

4.1. What went well

Being able to successfully implement the 2023 Narran Lakes EBM in the then prevailing conditions demonstrated the strong commitment by the CEWH, water management agencies, water users, industry and the community to using these more flexible types of resource management arrangements for environmental and other benefits. This was seen positively by the parties involved. EBMs are an important element within the Northern Basin Toolkit and it is good to have a success story under the Toolkit. It was also good to have a different type of EBM implemented (in addition to the cease-to-pump pilot of 2020) and to see advances since the release from storage event of 2008.

All generally agreed that, overall, good processes were used to implement the 2023 Narran Lakes EBM. These processes were underpinned by a positive enabling environment, open communications and good working relationships among the various parties who were willingly involved. The parties communicated and worked together in good faith to achieve desirable outcomes. Those outcomes included the extension of successful waterbird-breeding events.

Setting up for the 2022 Narran Lakes EBM, which eventually didn't proceed due to sufficient rainfall and runoff in the catchment, nonetheless provided a very helpful framework to implement the 2023 Narran Lakes EBM. Contractual and working relationships were established, including arrangements for the setting up of the Narran Waterbird Technical Advisory Group (TAG), a Standard Operating Procedure document was written and several processes and measurement, monitoring, modelling and assessment methodologies were "road-tested" and proven before the 2023 Narran Lakes EBM was implemented. This provided added confidence in the implementation approach.

This helped the CEWH to "stand up" the "EBM project group" and be well led and managed to facilitate and coordinate its work. This included comprehensive approaches to information gathering and problem solving and engaging with the best technical capabilities and knowledge in a number of organisations and individuals contributing to the implementation of the EBM. That knowledge included science about what is important in terms of water levels, volumes and triggers and periodically updated observations and monitoring of on-ground conditions, system requirements and triggers to inform management of the event. All of this enabled the necessary decisions to be made, the water to be delivered and the beneficial results to be obtained.

Having this independent review was acknowledged as representing good practice and a commitment to transparency and continuous improvement.

4.2. What didn't go well

The potential for delays and corresponding uncertainties about the timing for the various decisions and approvals to proceed created some angst, including whether the EBM water would get to the required sites on time following the making of the decision to proceed. Despite this, the water did get there in time to make a positive difference.

Limited competition in the market for participating in a release from private storage EBM had the potential for the processes not to go well. This was avoided through the pre-work and good relationships noted above, but work should continue to extend the market and give extended flexibility for using EBMs for environmental and other benefits in the lower Balonne River system. Installing additional control gates in the bifurcation weirs at bifurcations 1 and 2 would help both increasing the number of properties able to participate in the potential market for EBMs and improving the flexibility of low flow management, potentially increasing benefits and lowering costs.

Some stakeholders believed that more and better communications could have occurred directly with local communities, including local First Nations people. This would still be beneficial, even after completion of the implementation of the 2023 Narran Lakes EBM.

While the undertaking of this independent review was seen as a positive by all stakeholders, some also felt that the main players in the implementation of the 2023 Narran Lakes EBM should also have their own collective feedback and review session. This would help to close the loop on what was achieved and what wasn't, including mutual discussions about lessons learned, opportunities to prioritise resources and efforts differently, and needs for improved processes, methods, documentation and/or capability, while recognising that no two events are fully the same. This could still be done over the coming months and would also enable review, updating and increased understanding of the processes and procedures. It would also reinforce the celebration of a team effort and the positive relationships that were needed to achieve good results.

4.3. Things to do differently in the future

Short notice about EBM grants presents challenges for both the CEWH and water users wishing to participate. Water users need to consider value for money, social responsibility, relationship requirements and time constraints, among other issues specific to them. Moving away from the short notice (ad hoc) grant arrangements to longer-term contract arrangements (potentially including "standing offer" arrangements), which outline the processes and main points for agreement, warrants further consideration. Having an agreed contract in place in advance of an EBM should make responses and implementation easier at short notice, with clearer safeguards, risk mitigations and pricing/value for money options.

The CEWH's internal resources required to implement an EBM does have a measurable impact on other work performed by the CEWH. Consequently, opportunities to streamline processes, including approvals, need to be pursued. This review of the 2023 Narran Lakes EBM provides one such opportunity. Using an "incident management system", modified from approaches used by emergency management organisations for flood and fire actions, may also identify process improvement opportunities (and increase process understanding for new staff) if simulations through the full EBM implementation process are undertaken from time to time.

Even though the processes used were good, certain aspects take time and are time critical, for example having water quality results at the right times to comply with Codes of Practice. Water quality data being available earlier in the process may help avoid delaying or abandoning an EBM in the future, or at least flag if there are any contaminants and/or risks to be managed. A contingency monitoring program could be set up on a contractual basis, with "triggers" identified to move to full EBM monitoring under identified circumstances. This program could cover the full list of monitoring requirements, not just water quality. Narran Waterbird TAG members and the CEWH may wish to consider this further in the future, in consultation with the yet to be formed Barwon-Darling and Intersecting Streams Environmental Watering Advisory Group.

Additional dialogue with First Nations people would help identify and celebrate cultural outcomes resulting from the 2023 Narran Lakes EBM, building on traditional knowledge about where the water comes from and where it goes to. There are also likely to be additional opportunities in the future to engage local First Nations people in the monitoring and survey work, both generally and associated specifically with an EBM.

4.4. Future challenges, innovations and research needs

Real-time management of EBMs would benefit from better streamflow monitoring and forecasting tools, including for water flowrates, volumes, travel times and “losses”. Previous work done on this could be updated with later data and information, including from the 2023 Narran Lakes EBM, while also considering the impacts of a changing climate. Better flow data and information will be especially important for a case where specific de-activation of an EBM is warranted due to upstream rainfall and runoff. It also increases flexibility in EBM implementation.

Streamflow gauging stations in the lower Balonne River system, including the Narran River, may have significant inaccuracies at low flows. Works to reduce these inaccuracies and improve flow calibrations may become warranted should greater use of EBMs occur in the future. In any case, flow records for the 2023 Naran Lakes EBM event should be analysed to improve the information base about water release volumes, river “losses” and flow travel times.

Further innovations in remote sensing (such as synthetic aperture radar), use of drones and other monitoring, assessment and communications technologies can be expected in the future. The CEWH should keep updated on these innovations with its partners and pursue suitable opportunities.

If the positive relationships between the main contracting parties reduced in the future, this could create a number of challenges, including in demonstrating accountabilities and compliance with limits on the volumes of water entitled to be harvested in the lower Balonne River system in total and by individual water entitlement holders. The current contractual arrangements for the release from private storage EBM, leveraged through timed payments by the CEWH for storage owner services and demonstrated compliance, have been shown to be robust to date.

However, to further mitigate compliance risks, multi-year accounting (MYA) of water volumes harvested under entitlements may need to be further considered in the future, rather than the current instantaneous volumetric limits (IVL) on water stored. Alternatively, the IVL methods and assumptions used to determine, monitor and manage the “air space” in storage created by the release from private storage EBM could be more tailored to individual circumstances around farming and water management practices. This matter requires further consideration by the CEWH, the Queensland department and water users. In any event, the contractual arrangements, including mutually suitable legal protections, risk assignment and payment arrangements, have to remain satisfactory to the water storage owner to participate in the EBM.

Because the extent of positive relationships (and arguably trust) among the various parties involved in implementing an EBM has been identified as a key factor in an EBM’s success, approaches will be needed to foster those positive relationships even when new people come on board in the future. Government, community, Industry and individual attitudes to environmental sustainability and social licence may change over time, further impacting implementation. Having well-documented standing operating procedures and regularly having simulation runs of them may assist.

Building the scientific base around the ecology and hydrology of the lower Balonne River system and Narran Lakes is a continuing need to reduce uncertainties, increase confidence in assumptions that

have to be made and to further support evidence-based decision-making. Further research into the water requirements for successful waterbird-breeding events is needed. For example, based on the results of the 2023 Narran Lakes EBM, more may be able to be achieved than previously thought with less available water under certain conditions, recognising that the waterbird breeding events in recent years, while critically important, have been relatively small compared with some historical waterbird breeding events. Additional more detailed analyses based on the results of this event will build the evidence base, enable a review of the hydrology/ecology relationships, responses and triggers, assist future modelling and inform future decision-making.

A short list of important monitoring and knowledge building activities has been identified by the teams involved in the 2023 Narran Lakes EBM and these activities should be considered further.

Monitoring plays an important role in the ability to detect changes and respond accordingly with strategic adaptive management to conserve these unique and important inland freshwater wetlands. Monitoring recommendations for the Narran Lakes (with regards to waterbirds) include continuing with current programs to ensure continuity and the collection of long-term datasets. The bi-monthly waterbirds surveys have been critically important in capturing the changes in species diversity, composition, abundance, and changes over time, with changing wetland conditions and seasonal changes. Reproductive success and colony monitoring is an important method to collect and provide real time colony (nesting stage, waterbird health, waterbird numbers, water quality, disease, predation, water depth) information to water managers allowing for appropriately timed management responses. Reproductive success and colony monitoring methods used by UNSW have been accepted as a standard method and are applied to all colonies in the Basin where large colonies are monitored (e.g., Macquarie Marshes, Booligal wetlands, Lowbidgee wetlands) providing data that is comparable between wetlands and between breeding events (Brandis et al, 2023).

Ongoing monitoring of vegetation condition and extent, particularly lignum communities, is essential in being able to manage and maintain traditional colony sites and nesting habitat. However, a greater understanding is needed of the characteristics of lignum shrublands that make them attractive to waterbirds, and how lignum health, structure and distribution can impact on reproductive success. Research on this topic may include measures of shrub density, spatial distribution, greenness etc, which may be achievable using drone technology and remote sensing products in addition to data from colony monitoring (Brandis et al, 2023).

Another key knowledge gap in understanding factors impacting on reproductive success of large waterbird colonies is an understanding of food resources and how they influence nesting decisions, chick rearing, nest abandonment and survival of juveniles. To date there has been limited research on food resources associated with breeding events. Research on this topic could include the sampling of available food resources during breeding events to determine food types, food quality (caloric content), shifts over time and how this relates to chick development stages, etc (Brandis et al, 2023).

Maintaining vegetation health and resilience, especially in the Ramsar site, between big wet periods may become a matter of increased future focus for environmental water delivery, recognising the relatively small nesting colonies and nesting densities over 2022-2023.

Significant opportunities exist to invite the participation of First Nations people in the monitoring of flora, fauna and water at Dharriwaa. First Nations representation in management is currently through the Joint Management Committee but there are opportunities for increased participation in monitoring and other programs (Brandis et al, 2023).

4.5. Other matters relevant to using Event Based Mechanisms in the lower Balonne River system

Stakeholders recognised the flexibility that EBMs provide to manage water for environmental outcomes and to manage risks, regardless of the size of the CEWH's portfolio. They argued that this flexibility is still needed, even with additional recovery of water entitlements for the environment, which has widely varying degrees of support. However, the use of EBMs may also have economic, social and cultural impacts and consequences, which may be viewed differently by different people. This needs to be factored in when deciding to use them, and how often to use them. This is so, even though those impacts and consequences may be different from the permanent purchase of water entitlements for environmental purposes due to both past purchases and purchases still to occur. Some stakeholders expressed concerns that local communities and businesses feel the total impacts, rather than those from one cause or another. Both shorter- and longer-term impacts need to be considered and the collection of evidence to inform this would be beneficial.

Stakeholders generally supported the use, where possible, of more, rather than less, EBMs in the future, provided there is the necessary transparency around the circumstances under which each EBM would be implemented. This includes using CEWH water entitlements to harvest and temporarily store water in private on-farm (leased) storages for later release, under specific circumstances and conditions. A number of factors require further consideration here, including ways to better predict flows through the river system and to the Narran Lakes, scientific evidence to assess trade-offs between the benefits of volumes in the Narran Lakes during a flow event compared with after the event, data and information to decide under what circumstances this type of EBM would be triggered and what volumes of water should be stored and released when. Some on-farm storages, that have been de-commissioned in recent years as part of the arrangements for purchase of water entitlements, may also be suitable for this type of EBM.

The necessary preparatory work to document standing operating procedures, including the decision-making framework, to enable this type of EBM (and potentially other EBMs) should be completed over the coming year or two to provide benefits in a similar manner to the completion of the preparatory work for the 2023 Narran Lakes EBM which was undertaken during 2022. Necessary contractual, measurement, monitoring, modelling and verification arrangements should also be agreed and documented in advance. A pricing metrics decision-support framework could also be developed, enabling input of water users' individual parameters, such as crop yields and watering efficiencies, and informing their decisions as to whether to participate in an EBM or not and at what price/cost. All of these factors recognise that time is of the essence in EBM decision making.

To further support the above, some stakeholders suggested that additional public information should be developed to describe the place that EBMs have in achieving better ecological and other outcomes in a modified catchment, subject to relatively high climate variability and continuing climate change. This is also related to describing and explaining the benefits of water entitlement recovery and event based and active management approaches for managing a range of flows, and particularly low flows, in ephemeral systems.

As mentioned previously, installing additional low flow control gates on the weirs at bifurcation 1 and bifurcation 2 in the lower Balonne River system would open up additional opportunities for more water users and more cases to be considered for application of EBMs in the lower Balonne River system, potentially increasing benefits and lowering costs. This would also provide additional opportunities and flexibility to provide benefits not only to the Narran River and the Narran Lakes,

but also to other distributary streams in the system, potentially improving connectivity, water quality and water security outcomes. Further information about suggested modifications to the bifurcation weirs has been submitted to the Queensland and Commonwealth governments as a Northern Basin Toolkit measure.

The relative priority of environmental water, including EBM water, for the Narran River and Narran Lakes compared with the other distributary streams in the lower Balonne River system is more a matter for the relevant State, MDBA and CEWH watering plans than this review. However, several stakeholders saw the good sense in having approaches to EBMs developed to provide benefits in the other distributary streams when circumstances warrant such interventions.

Some stakeholders suggested that further clarity and certainty about the implementation of EBMs could perhaps be provided through including some “rules” for them in future amendments to water resource plans (and corresponding water management protocols) and possibly the Basin Plan. Such “rules” could include ways for accounting for EBM water in environmental water accounts and in short- and long-term diversion limits. Achieving the best outcomes through alternative combinations of policy, planning, regulatory and market-based instruments, including water entitlement purchases, requires further consideration by the many parties involved. Further community and industry engagement about these alternatives, their impacts and trade-offs, will be required.

In any case, there is a need for coordinated and coherent management of low flows in the lower Balonne River system. This includes clear guidelines and rules for coordinated management of flows for environmental, stock and domestic (ESD) purposes and management of EBMs when they are proposed for implementation, and operation of the bifurcation and other weirs that impact low flows in the system. Having the one stakeholder liaison group for these events may assist.

More broadly, the overall approaches taken by the CEWH to EBMs in the lower Balonne River system could be applied elsewhere in the Murray-Darling Basin, or, indeed, further afield, where applicable circumstances exist. Additional resources would be required with a scaling up of effort. Others could learn and benefit from the CEWH’s work in this area.

5. Specific evaluation comments and suggestions

The sub-sections below summarise the main points about specific evaluation questions made during the discussions with individual staff and stakeholders, combined with the results from the reviewer's independent assessment of the available documentation and other information.

5.1. Establishing the justification for and appropriateness of the 2023 Narran Lakes Event Based Mechanism

5.1.1. *Environmental justification for implementation of the 2023 Narran Lakes Event Based Mechanism*

Priority environmental outcomes to be achieved in the Northern Basin were described in the available MDBA and CEWH documentation covering basin watering strategies and annual environmental watering priorities (MDBA, 2022 and CEWH, 2022). EBMs were a strong part of the Northern Basin toolkit mechanisms, helping to offset adverse impacts on local communities of straight purchase (and retirement from consumptive use) of water entitlements.

The demand for both waterbird breeding habitat and for large scale waterbird breeding were listed as high for the 2022-23 water year. These water demands were set to maintain the ecological character of the internationally recognised wetland (CEWH, 2022). The CEWH's Condamine-Balonne Water Management Plan 2022-23 indicated that the CEWH would consider implementing a release from private storage EBM in 2022–23 to contribute to meeting the waterbird breeding and foraging habitat demands that were listed as high and critical in the Narran Lakes. If a medium sized flow event occurred, the CEWH might offer to reimburse water licence holders in the lower Balonne River system (via an ad-hoc grant) to release water from storage into the river. The trigger for the EBM to be activated would be the advent of colonial waterbird breeding at Narran Lakes and a determination that water levels at Back Lake would fall below critical levels while waterbird breeding is still underway. The approach used in preparing for the release from private storage EBM in 2021–22 would inform planning for a potential release in 2022–23.

Despite the significant flooding and breeding events across 2021–2022 due to the La Niña event, the Basin's waterbird populations were still low compared to the peaks of the 1980s (MDBA, 2022). Response to the wetter conditions had been positive; however, populations would need continued favourable conditions to recover from the preceding extended dry period (MDBA 2022). The MDBA outlined the annual watering priorities for the Basin, which included supporting the continued growth and recruitment where germination was likely to occur, such as lignum shrublands at Narran Lakes; and extending the duration of inundation to improve foraging habitats and support additional waterbird breeding. Priorities were to continue to support colonial nesting waterbird breeding and recruitment triggered by natural flows in the Narran Lakes, Macquarie Marshes and Gwydir Wetlands, to support foraging and nesting of waterbirds by ensuring shallow-water and shoreline habitat and to manage water recession at sites where there was an active waterbird breeding event.

In the latter part of 2022, the Narran Waterbird TAG reconvened to provide expert advice, recognising that previous natural water flows had triggered waterbird breeding at the Narran Lakes, while hotter and drier conditions leading into the summer of 2022-23 were causing water levels to fall. The TAG members worked well together over December 2022 and January 2023 to describe the hydrological and ecological conditions unfolding in the Narran Lakes, including the Ramsar site. Their evidence outlined risks to the environment, especially waterbird breeding, in the area and the

benefits likely to be achieved through activation of a release from private storage EBM. This evidence, based principally on present and past field observations and water modelling, was collated and advice provided in reports to the CEWH. Those reports outlined a sound rationale and justification for the EBM, consistent with available guidance and the broader environmental watering strategy for waterbirds. The TAG members could usefully undertake a hindsight review of those reports to identify any particular lessons learned and potential future improvements.

The TAG advice in late January 2023 confirmed that a large and diverse assemblage of colonially nesting waterbirds were at various stages of completion at the Narran Lakes Ramsar site. This was a significant breeding event for this wetland system. It was anticipated that the then current nests with eggs and young chicks would be fledged by the end of March 2023. Due to cessation of inflows and declining inundation levels in the colony, there was an immediate concern the remaining chicks and recent fledglings would have limited success at reaching adult stages and surviving the first years.

The Narran Waterbird TAG advice was that the likely benefits of releasing additional flows to the Narran Lakes would include:

- Provision of suitable conditions for successful nesting and survival of young for the entire nesting event including late nesting waterbirds;
- Provision of foraging habitat for other colonial-waterbird breeding species and their young including egrets, spoonbills, herons and cormorants;
- Provision of foraging habitat at Clear Lake and Narran Lake for pelicans nesting at Narran Lake;
- Provision of foraging habitat for juvenile colonial waterbirds post-fledgling from the Narran Lakes and neighbouring wetlands in the northern Murray-Darling Basin including Gwydir Wetlands and Macquarie Marshes;
- Provision of foraging habitat for non-colonial waterbird species including vulnerable freckled duck and black-necked stork (NSW Biodiversity Conservation Act 2016) and listed migratory species sharp-tailed sandpiper, detected during recent ground surveys;
- Improved condition of river cooba and lignum waterbird breeding habitat which had been impacted by extended dry conditions over the 2012-2020 period; and
- Optimized resilience of Narran Lakes for an anticipated future dry period (El Nino).

Some stakeholders suggested that there could have been further explanations provided to the community about the justification for implementing the 2023 Narran Lakes EBM, especially because the preceding two to three years had been relatively wet with good river flows and volumes in the Narran Lakes. Several stakeholders commented that they would not have previously envisaged an EBM being required so soon after such seasons. Waterbird breeding had occurred during those years, not only in the Narran Lakes but across several other parts of the Murray-Darling Basin.

While the available evidence indicated that implementation of the EBM would increase the incidences of waterbird breeding success in the Narran Lakes, some stakeholders questioned whether “enough” waterbird breeding had already occurred and the available water may have been used beneficially in a different way. Other stakeholders suggested that all things possible should be done to support waterbird breeding events given overall reduced numbers across the Basin and forecasts of future drier conditions.

Reconciling these differing views requires consideration of the additional environmental benefits (and likely other social and cultural benefits) and the additional economic and financial costs associated with implementing the EBM. This is a major piece of work in itself, complicated by the fact

that we now only have evidence from what happened as a result of implementing the EBM. We can only surmise the results of not implementing the EBM.

5.1.2. Appropriateness of the type of Event Based Mechanism selected

Previous reports identified several types of EBMs that could be applied in the lower Balonne River system (BDA Group and CSIRO, 2017; MJA, 2019; DG Consulting, 2020). These include temporary purchase of water harvesting allocations; purchase and release of water from private storage; no pump arrangements; or more sophisticated arrangements like permanent at-call options.

The only EBM available for activation in January/February 2023 was the release from private storage EBM because there was water available in private storages, but there were no sufficient flows existing or forecast into the lower Balonne River system.

While circumstances may be different in the future, the selection of a release from private storage EBM was appropriate for the river system conditions in the lower Balonne River system and the Narran Lakes in January/February 2023. The volumes involved were a relatively small proportion of the total environmental water account for the water year. Nevertheless, significant benefits can be achieved from a relatively small volume of water under an EBM.

5.2. Assessing appropriate, efficient and effective implementation of the 2023 Narran Lakes Event Based Mechanism

The grant opportunity guidelines for the 2023 Narran Lakes EBM (DCCEEW, 2023) contained substantial information about the EBM grant, including eligibility criteria, the assessment process and acceptance criteria. This grant opportunity was established as a one-off ad hoc grant. The CEWH considered that this was an appropriate type of selection process considering the nature of the grant was specifically aimed at supporting waterbird breeding at Narran Lakes, by providing water.

The grant would be activated if the CEWH identified that providing water from storage would help provide conditions and habitat for colonial waterbird breeding species; provide foraging habitat for other non-colonial and listed migratory species; mitigate risks such as water quality and predation; and continue to improve the condition of waterbird breeding habitat impacted by extended dry conditions from 2012-2020. Partner agencies and monitoring providers would undertake regular risk assessments to inform the grant activation. Potential grant recipients would be required to confirm their water balance before and after releasing water from their storage, including pump meter records, storage gauge meter readings, a property water balance before and after the grant was activated, and dated photographs of storages. Potential grant recipients would also have to demonstrate how they had complied with the Code of practice for the release of stored water from privately owned farm storages to receiving waters in the Queensland Murray-Darling Basin, including water quality monitoring (DEHP, 2016).

If the potential grant recipient operated under the instantaneous volumetric limit (IVL) water sharing rule, a conversion would be applied for this interim measure. That is, if a water allocation holder participated in the grant and released an agreed volume of water from their storage, they also agreed to temporarily reduce their effective storage capacity (or IVL) to ensure there was not a growth in use across the Queensland Condamine Balonne Water Plan area. This reduction had the effect of acknowledging the intent of the grant, where a portion of the volume of water released was no longer available to the water allocation holder for an agreed period. The temporary reduction in capacity and the period for which it applied would be agreed in writing between the CEWH and the

potential grant recipient before the grant was activated. The temporary reduction would be informed by an independent assessment of the volume of water to be released compared with the potential for that volume to grow a crop, including the planted area, monthly water demand, and monthly storage evaporation rate.

The price per megalitre of water released from private storage was \$330 per megalitre (excluding GST). This had been based on an independent price assessment by consulting economists (MJA, 2023), with the approach generally supported by most stakeholders, subject to further opportunities to consider individual circumstances. The price had been calculated taking into account the market conditions including time of the year, the crops that could be grown, the value of cotton seed as a potential stock feed, water prices in neighbouring regions, and discussions with water market advisors. The independent price assessment has been published on the CEWH's website.

5.2.1. Process used for activation and de-activation of the grant

The process used for activation of the grant followed the Standing Operating Procedure document and assessment/approvals framework developed and documented by the CEWH in 2022. This benefitted from the lessons learned when preparing for a release from storage EBM in early 2022, even though that EBM was not activated at the time.

Very extensive data and information, of high quality and details, were included in the approvals briefs sighted by the independent reviewer. The CEWH applied the approved standard operating procedure to activate the grant and confirm that the conditions for activating the grant had been met. This had been informed by multiple lines of evidence, including advice from agency, university and private sector partners and experts.

Evidence provided by the Narran Waterbird TAG members clearly informed the CEWH's decision to activate the EBM. The decision recognised the ecological context of the situation and the risks and benefits involved.

Hydrological modelling of the release rate and volume was reasonably fit-for-purpose (see Figure 2), though some further cross-correlations of the modelled and actual results for various locations could now be done. The modelling procedure used should be formally documented and perhaps added to the Standing Operating Procedure document.

Some of the steps to activate the grant were especially short on time and could have become problematic if the parties involved did not exercise the high levels of good-will and cooperation that they did. These steps include the actual contract agreement between the CEWH and the storage owner and the confirmation that the quality of the water to be released complied with the Code of Practice. Having even a few extra days for these steps would help orderly progress.

Leading up to the activation of the grant, the independent valuation of the water held in storage was undertaken at a particular point in time. Factors such as water availability, commodity prices and service costs can change quickly, outside of the control of the CEWH and the water storage owner. In addition to differences among farming enterprises, the value of the water can depend on the timing in the crop cycle, being different for planting across a full growing season compared with the value of water required only to finish off a crop. A direct approach to the market could have been made at different times, recognising it is currently a very thin market and relevant water users have to make business decisions quickly. There does not seem to be a clear right or wrong option to pursue.

De-activation of the grant was not triggered by any upstream flows in the river system itself, but rather by the time when the agreed and required volume of water (up to the maximum contracted

amount) had been released from the on-farm storages. There were also no water quality issues or risks of nests flooding that could have triggered de-activation of the 2023 EBM. There could be circumstances in the future when de-activation of the release from storage is triggered by the presence or forecast of flows upstream and through the lower Balonne River system, including to the Narran Lakes. Deciding if and when to de-activate the release from storage in such circumstances may be much more difficult, since it will involve predicting if and when sufficient volumes of upstream streamflows will reach the Narran Lakes (or whatever target ecological asset). This reinforces the need for good upstream streamflow measurement and forecasting tools and the ability to model a range of scenarios.

More than one water holder may be involved in a release from storage (or other) EBM in the future. This may require specific additional coordination, which was not required with only a single water holder involved in the 2023 Narran Lakes EBM, to achieve overall desired flow rates, volumes and timings.

5.2.2. Approaches used for communications and engagement

From the information available to the independent reviewer, the CEWH closely followed the communications and engagement processes outlined in the Standing Operating Procedure document. These processes were extensive and generally well considered.

Partners and stakeholders directly involved in the management and implementation of the EBM agreed that communication and engagement with them was very good. They appreciated the direct contacts from and with the CEWH and the on-ground engagements. The CEWH was active in particular forums when they met, such as the Narran Waterbird TAG, the Northern Basin Environmental Working Group, the Lower Balonne Roundtable and the Basin Community Committee.

More direct communications and engagement with First Nations people would have been welcomed, including suitable activities on Country. Approaches for this should be explored with First Nations people and could be included in an update of the Standard Operating Procedures document.

Resources, including time, devoted to communications and engagement activities often requires review, based on lessons learned, and that is also the case for the 2023 Narran Lakes EBM. More can always be done with more resources and time. One of the factors impacting broader community information and knowledge sharing in the area is the reduced number of local media outlets. To overcome this, greater use could be made of other collaborative networks including via relevant farming, environmental management, Local Government, and First Nations organisations, among others, to increase awareness and understanding of progress being made and outcomes achieved.

Information about the 2023 Narran Lakes EBM was published on the CEWH website and made available through links in the CEWH's newsletter, accessible via free online subscription. This information included three "Lower Balonne Flow Updates" during February, March and April 2023 and four Twitter posts on 14 February 07 March 03 April and 28 April 2023.

A final analysis report of the 2023 Narran Lakes EBM has yet to be prepared and made public. It is highly desirable that this happens. More broadly, stakeholders identified a need to more regular and more informative reports after each flow event in the lower Balonne River system. Such reports should contain full water balance data for the event and help to build a "history" of factual information about inflows, water uses, water storage, outflows and outcomes across the area.

The CEWH's communications team also provided information to other directly involved organisation's communications teams who were then able to use that information for their purposes

if they wished. This recognised implementation of the event was a team effort and enabled some spreading of a generally positive news story in an otherwise often contested environment. In future, consideration could be given to also providing this type of information to other collaborative networks such as those mentioned above.

Some stakeholders expressed concerns that parts of the published information could have been clearer about the source of funding for, need for, results from and the benefits of the EBM itself, while other parts could be construed as being somewhat misleading. For example, the EBM water did not make it to the main Narran Lake where there was extensive pelican nesting (with published photos), though pelicans were seen feeding in locations which did benefit from EBM water.

5.2.3. Analyses, management and mitigation of risks

The Standing Operating Procedure document and approvals framework have addressed these matters to identify a broad range of risks and develop mitigation strategies so that no risks were identified as extreme nor high. That document identified moderate risks as the thin market, the potential for the storage owner to “make up” volumes sold in a later flow event, and reputational risk to the CEWH and the government agencies involved.

From the perspectives of engaged partners and stakeholders, a key risk related to limitations and uncertainties in the available ecological data, knowledge and understandings and the hydrological data and modelling. This was mitigated through the expertise and experience of the Narran Waterbird TAG members and other experts engaged, including their knowledge specifically of the lower Balonne River system and Narran Lakes, and the use of the best available data and accredited modelling approaches. Access for timely on-site observations and assessments can be a limiting factor in the lower Balonne River system and Narran Lakes, and the availability of new and emerging technologies may help that in the future. It will be important to analyse and document the ecological and hydrological results of the 2023 Narran Lakes EBM to add to the data and knowledge banks which can further inform future decision-making and the associated uncertainties and risks.

The risk related to compliance and enforcement concerning the take and management of water in accordance with entitlement conditions has been managed to date, including through engagement of an independent hydrologist to verify the volume released and ensure compliance before final payment is made. The CEWH’s leverage with private storage owners is timed payments following release of water as agreed through contractual terms. If the storage owner takes water in a way that is not compliant with contractual terms and causes a “growth in use” during a period, payments for earlier releases may be with-held by the CEWH. Nevertheless, from a water resource management perspective, the CEWH has no regulatory compliance and enforcement powers under a release from private storage EBM.

Water resource management powers rest with the State regulatory agencies with the Commonwealth Inspector-General of Water Compliance and the MDBA each providing certain oversights. If “growth in use” happened because of a release from private storage EBM in Queensland (that is, if more water was taken from the water resource than was permitted under the accredited Condamine-Balonne water resource plan 2019 and the MDBA’s Basin Plan 2012), then this would become a water accounting problem for Queensland.

While the current contractual arrangements for the release from storage EBM, leveraged through timed payments by the CEWH for storage owner services and demonstrated compliance, have been shown to be robust to date, this matter requires further consideration by the CEWH, the Queensland department and water users. In any event, the contractual arrangements, including mutually suitable

legal protections, risk assignment and payment arrangements, have to remain satisfactory to the water storage owner to participate in the EBM.

Even though water quality monitoring is undertaken immediately before and after the release and the likelihood of not complying with water quality guidelines are considered to be low, the consequences may be very high, for example, calling off an EBM. Consequently, having a longer-term water quality monitoring approach in place warrants consideration.

5.2.4. Monitoring and evaluation activities

In the Condamine–Balonne valley, monitoring is routinely undertaken by the MDBA (native fish), Queensland and NSW agencies, including the Queensland Department of Regional Development, Manufacturing and Water (DRDMW) and the Department of Environment and Science (DES) (flow, hydrology, water quality, native fish) and the NSW Department of Planning and Environment (DPE), Environment and Heritage Group (EHG), National Parks and Wildlife Service (NPWS) (vegetation, waterbirds and other animals), the NSW Department of Primary Industries (DPI) – Fisheries (native fish), and WaterNSW (hydrology and flow delivery data). The CEWH has also been funding several short-term intervention monitoring projects, including with the University of NSW (UNSW) and Griffith University (GU), to evaluate the environmental responses of native fish, waterbirds and vegetation in the Condamine–Balonne and elsewhere across the Murray-Darling Basin.

During flow events, the CEWH routinely receives twice daily updated advice about existing and predicted flows in the lower Balonne River system and relevant parts of the upstream catchment as does other water entitlement holders in the area. The CEWH also routinely has access to specific additional advice from the Bureau of Meteorology to assist its management of its portfolio of water entitlements and its implementation of an EBM in the lower Balonne River system. Such regular updates are appropriate for this relatively highly variable river system and were received during the 2023 Narran Lakes EBM.

A local respected independent contractor monitored and measured the release from the on-farm storages using a number of techniques for cross-verification. The CEWH also had access to telemetered storage data during the event. Approximately 6.5 GL were released from storage into the Narran River during the 2023 Narran Lakes EBM.

The contractor, the State departments, the MDBA and the CEWH monitored various parts of the passage of the water down the Narran River and into the Narran Lakes, including the Nature Reserve. This monitoring included on-ground inspections, interrogation of telemetered stream flow gauging stations and satellite imagery. Approximately 2.4 GL from the release made it to the Narran Lakes, based on stream flow gauging data. The release raised the water level in Back Lake by about 0.1 m in real terms, and replaced evaporation deficits over about 26 days (see Figure 2).

As an adjunct to the on-ground flow and volume monitoring, follow-up hydrological modelling runs could be undertaken as the event unfolded to provide a further check that what is happening on the ground is as expected. This would also enable updating of previous work regarding low flow travel times and volumes of “losses” under different antecedent conditions, adding to the hydrological data bank.

There are several in-stream weirs on the Narran River between the release from storage location and the Narran Lakes. The CEWH made direct contact with these weir owners to have the released water pass through the weirs in good faith and that relationship seems to have been respected.

Queensland and New South Wales departmental officers could undertake surveillance of the

operations of these weirs if it was considered appropriate and necessary for compliance and enforcement requirements under the respective weir licence conditions.

Independent monitoring of the water quality in the on-farm storages and the river system in the immediate vicinity of the water release site was undertaken to confirm compliance with Queensland's Code of Practice. A longer-term program of water quality monitoring would help build confidence that an EBM could be activated at short notice, especially if the necessary contractual arrangements were in place beforehand.

Ecological monitoring, including monitoring of waterbird-breeding, has been undertaken by State agencies in the lower Balonne River system and Narran Lakes for many years. This monitoring has been augmented by a number of short-term programs managed by the CEWH, with longer-term programs in development to meet specific needs of the CEWH. Participants involved agreed that a good, streamlined monitoring program has been adopted, including important real-time monitoring of waterbird colonies using drones where necessary. There may be future opportunities to include local anecdotal information and First Nations knowledge in the evidence base.

Draft reports (for example Brandis et al, 2023) and other information notes sighted by the independent reviewer contained extensive data sets and summary results about waterbird numbers, species and status and vegetation and habitat condition. These indicated that the ecological monitoring undertaken was generally timely, thorough and informative. A specific 2023 Narran Lakes EBM comprehensive technical report setting out the final analyses of the on-site ecological monitoring work, field surveys, and other assessments was not yet available at the time of preparing this independent review report. It is critical that such a report be completed with input and review provided by all Narran Waterbird TAG members and others involved so that the information, knowledge and understandings are readily available for future decision-making.

5.2.5. Quality assurance of overall project management

The Standing Operating Procedure document outlined overall project management requirements. The procedures were well followed by the CEWH team with specific individuals undertaking specific tasks including project delivery leadership and coordination, grant administration and management, data collection and collation, local engagement and communications.

The CEWH used a comprehensive internal spreadsheet, updated daily, to track and record conditions around and progress of the event. Data and information to populate this spreadsheet came from many sources, requiring collation and analyses.

Implementing an EBM can be an intense piece of work, in certain cases somewhat akin to an incident or emergency (flood or fire) management procedure. In the CEWH's case, a relatively small team is directly involved with executive leadership support, and care is required in terms of preparation, back-up, support, management of fatigue, succession planning and the like. Standing up a simulation exercise from time to time may also assist management of these matters.

5.3. Overall effectiveness of the 2023 Narran Lakes Event Based Mechanism

State and Commonwealth government, university and private sector experts were engaged and contracted to undertake hydrological and ecological monitoring, assessments and evaluation of responses to the EBM. As mentioned previously, a specific 2023 Narran Lakes EBM comprehensive report setting out the final analyses of the monitoring and evaluation work was not yet available at the time of preparing this report for this independent review. It is critical that such a report be

completed and published as soon as possible. It will be important to document and analyse how long the EBM water kept a greater area of wetland inundated and to evaluate the outcomes from that. Any report outlining the effectiveness of the 2023 Narran Lakes EBM would also benefit by having a section devoted to describing outcomes for local First Nations people.

Nevertheless, hydrological data have been collected and analysed to show how volumes and water levels in the Ramsar site and Nature Reserve changed as the EBM unfolded. Gauging records indicated that an estimated 2.4 GL of water was delivered to the Narran Lakes from the storage release.

Figure 2 shows the water level changes at the gauge board in Back Lake. Measurements at Back Lake indicate that the water levels in Back Lake began to rise again on 26 February 2023 and rose by about 0.1 m to 09 March 2023. It took until 24 March 2023 until the water level fell again to the 26 February 2023 water level, thereby extending the period above that level by about 26 days.

The correlations between the modelled and measured water levels in Back Lake for a 6.5 GL release were generally very good, giving confidence in the modelling assumptions, though the measured travel time for water to reach the Narran Lakes was a few days longer than modelled. The modelling of a 3 GL release scenario compared with the no release scenario indicated much smaller benefit from that scenario, especially compared with the modelling results for the 6.5 or 7.5 GL release scenarios.

The environmental justification for implementation was importantly borne out by the number of waterbird species still having nests and chicks in the core wetland areas of the Ramsar site and Nature Reserve at the time when the EBM water arrived. A larger area was wet for a longer period of time to support the success of the waterbird breeding. This may also be especially important as the current forecasts are indicating drier years immediately ahead.

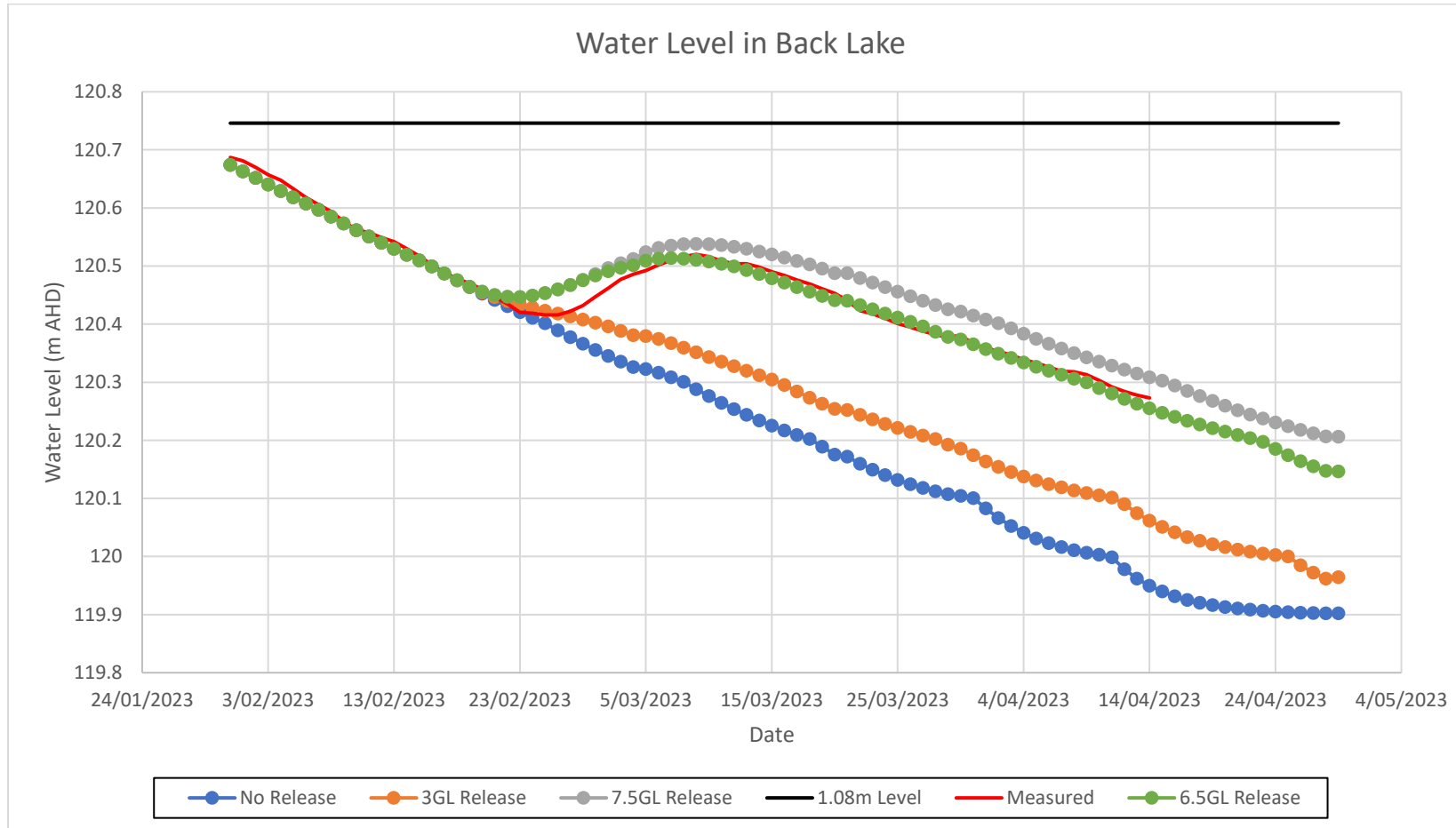
Monitoring showed that vegetation (particularly lignum) health and resilience in the Nature Reserve area improved as a result of the EBM. Further data about this will be available later this calendar year as monitoring and evaluation proceeds. The available data and observations indicated that the 2023 Narran Lakes EBM provided on-going habitat and food resources for many waterbird species to finish successful breeding activities, in addition to building lignum health and resilience directly, which has longer-term benefits. There were also in-stream benefits from water moving down the Narran River for a longer period of time. Further monitoring of fish and food resources may be useful in the future with cross-referencing to broader Basin Plan monitoring and the basin watering strategy. This and other information can inform future updates of basin watering strategies and priorities.

The results of the 2023 Narran Lakes EBM aligned with the MDBA's annual watering priorities for 2022-23 in that management of environmental water should focus on providing flows to support continued growth and recruitment where germination was likely to occur, such as lignum shrublands at Narran Lakes. The results also aligned with the priority of building on wetter conditions by using environmental water to extend inundation to improve foraging habitats and support additional waterbird breeding. Similarly, the results aligned with NSW annual watering priorities in 2022-23 to ensure adequate vegetation condition and water level should further inflows trigger colonial waterbird breeding. All of this enabled the CEWH to meet its legislative obligations.

While the 2023 Narran Lakes EBM was effective in extending opportunities for successful waterbird-breeding events, it is a challenge to specify whether or to what extent the events "needed" to be extended. There is no counterfactual to demonstrate if the EBM water was not used for that

purpose, what would have happened? Was the approach used absolutely the best use of the water? For example, after several years of successful waterbird breeding already, was more waterbird breeding needed, or could the water have been used for benefits elsewhere?

Figure 5-1 Modelled and measured water levels in Back Lake in the Narran Lakes Ramsar site (adapted from data from the Queensland Department of Environment and Science)



Expert opinion helps to answer these questions and that will also be informed by more research and increased knowledge of environmental and other water requirements across the river system and across the broader landscape. What is known at the moment is that landscapes and river systems have been modified, while recent decades have been punctuated by very severe drought periods, and waterbird numbers across eastern Australia have not yet recovered to previous levels (MDBA, 2022). This supports an argument that available opportunities such as EBMs should be used whenever possible to further support waterbird breeding.

One other feature of the 2023 waterbird breeding events was that waterbird breeding continued successfully at water levels (more than 0.3 m) lower than previously set as the ideal target or trigger level. One of the reasons for this may be that the Narran Lakes had been wet for the previous two years and consequently the food resources available were relatively high. Consequently, the target level/s may be able to be set lower after a wet period compared with extended dry antecedent conditions, depending on the timing of the waterbird breeding, available food resources which may prompt nest abandonment or not, and the rate of fall in water levels – with a relatively rapid fall being of most concern.

A somewhat related matter is whether the river system is behaving any differently hydrologically and/or hydraulically to what experienced river operators may have been expecting? While a re-analysis of such behaviour may require considerable time and resources, it may be instructive in view of changes in climate, changes in catchment landuse and potentially runoff behaviour, and changes in environmental water in the system.

6. Conclusions

From 08 to 26 February 2023 via the activation and de-activation of an EBM grant, the CEWH facilitated the release of about 6.5 GL of water from private on-farm storages in the lower Balonne River system in south-western Queensland into the Narran River. The aim of this release, which occurred after the river system had ceased to flow, was to provide additional water to extend significant waterbird-breeding events in the Ramsar listed Narran Lakes in north-western NSW. These waterbird breeding events had been triggered by larger flows in the river system over 2020-2022.

This additional water provided refreshing flows in the Narran River, reconnecting waterholes and improving habitat and food sources for fish and waterbirds, with approximately 2.4 GL reaching Narran Lakes. These flows successfully assisted key wetlands areas in the Ramsar site to remain wet at a critical time for waterbird breeding, including for four threatened species (Black-necked stork, Brolga, Freckled duck and Blue-billed duck). The extended inundation also assisted vegetation health, though further monitoring and assessment work is to be undertaken to understand the extent of the changes.

Overall, good processes were used to implement the 2023 Narran Lakes EBM, while some opportunities were identified to make mostly incremental future improvements. The development of these processes was importantly informed and assisted by the preparatory work done for the 2022 Narran Lakes EBM which also proposed a release of water from private on-farm storages, but ultimately did not proceed due to sufficient natural flows in the lower Balonne River system. The 2023 Narran Lakes EBM processes were underpinned by a positive enabling environment, open communications and good working relationships among the various parties who were willingly involved. The parties communicated and worked together in good faith to achieve desirable outcomes. Those outcomes included the extension of successful waterbird-breeding events in early 2023.

A very substantial amount of site monitoring data and information, supported by expert hydrological and ecological knowledge and advice, was collected to inform the decision to implement the EBM. That expert advice clearly indicated that the implementation of the EBM was environmentally justified by the expected additional environmental benefits and aligned with the priorities for environmental watering established by the MDBA and the CEWH. Further dialogue with stakeholders about those priorities and their justification would be beneficial, recognising stakeholder's views about other environmental, economic, social and cultural assets in the lower Balonne River system.

Nevertheless, while large scale colonial waterbird breeding at Narran Lakes is often associated with large scale inundation as a result of natural rainfall and flooding (Brandis et al. 2023), results from the 2023 Narran Lakes EBM showed that EBM water can play a key role in supporting breeding colonies when established through the provision of additional flows to extend duration, increase water depth, maintain water quality and provide foraging areas.

While this independent review has found that, overall, the 2023 Narran Lakes EBM was well managed and effectively implemented, several opportunities for improvement have been suggested throughout this report. It is recommended that each of these suggestions be further considered by the CEWH, in consultation with other agencies and stakeholders. Broadly, the recommendations cover:

- Continuing to build the ecological and hydrological data, information and knowledge base in the Balonne River system, its distributary streams and the Narran Lakes to provide the

required evidence to support decision making about the need for, timing for and implementation of EBMs;

- Undertaking additional preparatory work to pre-set and streamline processes and procedures required to implement a range of types of EBMs in the lower Balonne River system in the future;
- Extending communication and engagement activities, including through providing additional public information about the 2023 Narran Lakes EBM and about EBMs in general, directly engaging further with local communities about such matters, and undertaking additional dialogue with First Nations people to identify additional future engagement opportunities; and
- Collaboratively completing the post-implementation review of the 2023 Narran Lakes EBM and updating documentation and procedures based on the lessons learned to support continuous improvement.

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8. Acknowledgments

The author acknowledges and sincerely thanks those individuals and organisations who have contributed information, ideas and comments to inform this report. Their comments and suggestions have provided a basis for this report. However, I take full responsibility for the content of this report, which invariably includes my interpretation of what I “heard” from time to time. I welcome further feedback on that and any other aspect of this report.

Appendix 1. Timeline of key physical activities and policy matters for the 2023 Narran Lakes EBM

DATE	ACTIVITY/MATTER
2004	Queensland Minister approved a water resources plan outlining water entitlement and management arrangements for the Queensland section of the Condamine-Balonne river system.
2008	MDBC (transitioning to MDBA) purchased just over 10 GL of water from a private on-farm storage to release to the Narran River to extend a critical waterbird breeding event in the Narran Lakes after a prolonged dry period.
2008	CEWH formed under the Commonwealth Water Act to manage Commonwealth environmental water holdings, funded and acquired by the Commonwealth department, for the purpose of protecting and restoring areas of environmental significance within the Murray-Darling Basin.
2012	MDBA developed a Basin Plan, including sustainable diversion limits for water taken, adopted by the Commonwealth Minister. The Basin Plan also required the development of a Basin wide environmental watering strategy.
2015	CEWH prepared a report "Overview of purchase of water for Narran Lakes" for discussion with lower Balonne stakeholders.
2016	MDBA undertook a Northern Basin Review which proposed certain reductions to sustainable diversion limits in specific localities and the implementation of "Toolkit measures", including EBMs.
2017	Consultants BDA Group/CSIRO prepared a report for the CEWH outlining comparative assessments of a number of types of EBMs.
2018	MDBA amended the Basin Plan to enable implementation of Northern Basin Review outcomes.
2019	COAG amended the IGA for implementing water reform in the MDB to enable implementation of Northern Basin Review outcomes.
2019	Consultants MJA prepared a report for the CEWH outlining an overview of implementation of EBMs in the lower Balonne River system.
2019	Queensland Minister approved an updated and amended water resources plan and an associated water management protocol for the Qld section of the Condamine-Balonne river system and the plan was accredited by the MDBA.
2013 - 2019	The Condamine-Balonne river system, including the Narran Lakes, experienced very dry conditions and low flows.
2020 - February	CEWH approved detailed procedures for the activation, implementation and de-activation of a pilot "no-pump" EBM grant in the lower Balonne River system to provide more water for the environment of the Narran Lakes.
2020 - February	CEWH and grant recipients implemented the pilot "no pump" EBM which delivered an estimated 9.7 GL of additional water to the Narran Lakes.
2020 - May	DG Consulting prepared a report for the CEWH, providing conclusions and recommendations based on an independent review of the 2020 EBM pilot.
2021	CEWH triggered an EBM grant round, but no eligible water licence holders chose to participate.
2022	CEWH triggered a release from private storage EBM grant round, but rainfall and subsequent flows were sufficient to meet environmental requirements and there was no need for additional flows under an EBM.
2022	CEWH prepared a comprehensive Standard Operating Procedure document and contractual agreement and approval templates for grant implementation, monitoring and assessment activities, provision of expert pricing, hydrological and ecological technical advice, risk and probity management for the activation

	and de-activation of a release from private storage EBM in the lower Balonne River system.
2020 - 2022	The Condamine-Balonne river system, including the Narran Lakes, experienced wet to very wet conditions and high flows, triggering several waterbird-breeding events (from December 2021 and September 2022 onwards) in parts of the Narran Lakes and many other beneficial environmental outcomes in the lower Balonne River system, including the Narran Lakes. For example, the largest ever Commonwealth water for the environment use in the northern Murray–Darling Basin (almost 317 GL accounted for at St George and over 127 GL accounted for at the Qld/NSW border) was delivered in the 2021–22 water year (July to June). Queensland ESD water was discharged for more than 200 days during 2021–22. Flows moved downstream into the Darling River reaching Menindee Lakes before continuing into the Murray River.
2022 – mid year	MDBA observed that the Basin’s waterbird populations were still low compared to the peaks of the 1980s, despite the significant flooding and breeding events across 2021–2022. The MDBA set annual 2022-2023 watering priorities for the Basin, including supporting continued vegetation growth and recruitment where germination was likely to occur, such as lignum shrublands at Narran Lakes, and extending the duration of inundation to improve foraging habitats and support additional waterbird breeding. The priorities were to continue to support colonial nesting waterbird breeding and recruitment triggered by natural flows, to support foraging and nesting of waterbirds by ensuring shallow-water and shoreline habitat, and to manage water recession at sites where an active waterbird breeding event was underway.
2022 – mid year	CEWH listed the demand for both waterbird breeding habitat and for large scale waterbird breeding as high for the 2022-23 water year. These water demands were set to maintain the ecological character of the internationally recognised wetlands. CEWH flagged that it will consider implementing a release from private storage EBM in 2022–23 to contribute to meeting the waterbird breeding and foraging habitat demands listed by it as high and critical. The trigger for the EBM to be activated would be the advent of colonial waterbird breeding at Narran Lakes and a determination that water levels at Back Lake will fall below critical levels while waterbird breeding is still underway.
2022 – Sep-Dec	CEWH “stood up” its project team in preparation for a possible EBM, based on the above. Contractual or other service agreements were completed to cover a range of activities and provision of expert advice, including flow monitoring and forecasts, wetland inundation monitoring and assessment, waterbird-breeding and vegetation health monitoring and advice. The Narran Waterbird Technical Advisory Group (TAG) was reconvened to provide expert advice, including about the waterbird breeding, the potential impacts of falling water levels and the possibility of an EBM. Stakeholder and advisory groups, including members of the Lower Balonne Roundtable, the Lower Balonne Monitoring Group, and the Northern Basin Environmental Watering Group were informed of the possibility of an EBM.
2022 - late	Conditions in the lower Balonne River system and Narran Lakes began drying back relatively rapidly from late November 2022.
2023 - January	CEWH received regular technical updates and advice about Narran Lakes water conditions, status of waterbird colonies, potential risks to colonies due to decreasing water levels and possible management options. Flowrates and volumes and weather forecasts were also regularly updated. CEWH procured an independent assessment of the price for water released from private

	storage in the lower Balonne River system. CEWH progressed administrative, probity and risk management requirements for a release from private storage EBM in accordance with the Standing Operating Procedure document.
2023 – Jan 26	CEWH approved progressing with the 2023 Narran Lakes EBM and commitment of funds, based on the evidence provided over the previous weeks and consideration of the risks of not progressing.
2023 – Jan 30	CEWH started daily collation and summary of available information on current and forecast weather and river conditions, inundation extent, storage capacities and monitoring updates. This continued until 27 February 2023.
2023 – Jan 30	CEWH provided an alert via email to potential grant applicants of the expected upcoming grant opportunity.
2023 – Feb 01	CEWH received the latest hydrological modelling report of different potential release volumes (3-7.5 GL) and impact on water levels at Back Lake. CEWH engaged an independent hydrologist to provide estimates of flows in the Narran River and water balance information to ensure the agreed volume could be released from private on-farm storages and to verify the water balance on-farm at the end of the temporary storage reduction period prior to final payment being made.
2023 – Feb 01	CEWH and the Community Grants Hub of the Commonwealth department updated their websites with details about the EBM and the grant opportunity. Potential grant applicants were informed the Hub was able to send a Letter of Invitation, Grant Opportunity Guidelines and a sample Letter of Agreement to them.
2023 – Feb 02	Questions could be directed through the Hub. Any technical questions would be provided onto the CEWH. Question period ended 5pm AEDT.
2023 – Feb 03	Closing date and time (5pm AEDT) for responses to the Letter of Invitation to be received back at the Hub. Positive responses to the Letter of Invitation were required for an eligible grant applicant. The Hub confirmed that, at the time of closing, only one response was received.
2023 – Feb 03	CEWH informed the Narran Waterbird TAG of the latest plans to activate the 2023 Narran Lakes EBM.
2023 – Feb 04	CEWH received a Letter of Acceptance of grant opportunity from the private storage owner with the confirmed volume to be released and grant price.
2023 – Feb 04	CEWH approved activation of the grant based on the provided evidence (including monitoring updates, analysis of weather, river flow conditions and areas inundated) and approved the proposed release approach.
2023 – Feb 07	CEWH informed the Northern Basin Environmental Watering Group of the latest plans to proceed with the 2023 Narran Lakes EBM.
2023 – Feb 08	CEWH issued final approval to proceed with the release following water quality sampling results. Pre-release sampling results indicated that water held in the private storages was of sufficient quality to enable the release to proceed with little risk to the biota of the Narran River.
2023 – Feb 08	Private storage owner started the water release, independently measured and monitored at approximately 350 ML/day, in accordance with the approved release approach.
2023 – Feb 08	CEWH issued a media release about the 2023 Narran Lakes EBM.
2023 – Feb 08	Measurement and monitoring of the release from storage and flow rates and travel times down the Narran River started.
2023 – Feb 14	CEWH published a Lower Balonne Flow Event Update on its website providing information about the environmental rationale for the 2023 Narran Lakes EBM and initial release volumes. CEWH uploaded first Twitter post about the EBM.

2023 – Feb 26	Private storage owner stopped release as agreed storages had drawn down and volumes had been released in accordance with the approved release approach. Approximately 6.5 GL of water was released. Flow tracking in the Narran River and inundation analyses in the Narran Lakes continued until at least 10 March 2023. An estimated 2.4 GL of water reached the Narran Lakes from the EBM release, the water level in Back Lake rose 0.1 m from its lowest level before the release reached the lake, overcoming evaporation and other deficits, and the water level was kept above this previous lowest level for an extra 26 days.
2023 – Mar 02	CEWH received the independent hydrologist’s report verifying the volume of water released from storage.
2023 – Mar 03	CEWH published a Lower Balonne Flow Event Update on its website providing information on progress of flows and monitoring activities. (CEWH uploaded a second Twitter post on 07 March 2023.)
2023 – Mar-Jul	Ecological monitoring including waterbirds and vegetation continued and regular updates and specific reports were provided to the CEWH. More reports to be provided post this time to confirm ecological outcomes.
2023 – 14 Apr	CEWH published a Lower Balonne Flow Event Update on its website providing information on the volumes released and flows into Narran Lakes, and outcomes of the flows. (CEWH uploaded Twitter posts on 03 and 28 April 2023.)
2023 – 19 Apr	CEWH received final report on water quality monitoring pre and post release. Post-release sampling results found improved water quality downstream of the discharge point, suggesting an extended benefit of the EBM release.
2023 – 18 May	Inception meeting for this independent review.

Appendix 2. Review methodology details

1. Inception meeting

An inception meeting was held via videoconference with staff from the CEWH to discuss and agree the proposed key activity process and timelines, including identification of key agency contacts and reference personnel, availability and supply of previous relevant work and documentation, a suggested issue identification and assessment framework for the review, the extent of analyses to be undertaken, and the extent of key stakeholder engagement. The meeting also confirmed any communication protocols and any other related requirements for the independent review.

The agreed issue identification and assessment framework for the review included consideration of:

- a. General comments and suggestions
 - What went well and why?
 - What didn't go well and why?
 - What are some things that would be good to do differently in the future – who should do them, when, how and why?
 - What future challenges may emerge and what further innovations and research could be undertaken to address those challenges?
 - What other matters may be relevant to using EBMs in the lower Balonne River system in the future?
- b. Specific evaluation comments and suggestions
 - Establishing the Justification for and Appropriateness of the 2023 Narran Lakes EBM
 - Was the need for and appropriateness of the EBM clearly established in relation to the:
 - i. environmental justification for implementation?
 - ii. b. appropriateness of the type of EBM selected?
 - Assessing Appropriate, Efficient and Effective Implementation of the EBM
 - Was the EBM appropriately, efficiently and effectively implemented in relation to the:
 - i. a. process used for activation and de-activation of the grant?
 - ii. b. approaches used for communications and engagement?
 - iii. c. analyses, management and mitigation of risks?
 - iv. d. monitoring and evaluation activities used to support assessment of ecological responses and identification of outcomes?
 - v. e. quality assurance of overall project management?
 - Determining Overall Effectiveness of the 2023 Narran Lakes EBM
 - Was the observed ecological response able to be determined and aligned with the environmental rationale for the implementation of the EBM?

2. Initial review of all relevant EBM planning and implementation documentation

An initial review of all relevant EBM planning and implementation documentation provided by the CEWH was conducted. The documentation provided was very extensive and included:

- A Standing Operating Procedure for activation and de-activation of a release from private storage EBM in the lower Balonne River system, including approval arrangements for key aspects of the EBM;
- Field notes and reports from the Narran Waterbird TAG describing on-ground conditions and outlining benefits and risks of undertaking/not undertaking an EBM in early 2023;

- A report outlining the independent assessment of the price for water released from private storage in the lower Balonne River system (MJA, 2023);
- Core documents and published guidelines for the 2023 grant arrangements;
- Information and data used to confirm compliance with the grant conditions, probity arrangements and management of risks;
- Procedures and reports for estimating, measuring, recording and confirming water quality, flows, volumes, travel times and wetland areas inundated;
- Spreadsheets showing daily collation and summaries of available information on current and forecast weather and river conditions, inundation extent, storage capacities and monitoring updates;
- Draft reports outlining assessments of waterbird breeding and vegetation conditions and responses;
- Communications materials and updates published on the CEWH website.
- Technical reports supporting the development of the EBM processes. (Publicly available reports and information have been referenced in this report and references are listed in section 7.)

Any initial points of clarification were sought from the CEWH, together with the availability of any additional documentation or the process to obtain additional information that may be required to adequately undertake the agreed assessment and review.

3. Collection and collation of responses to the assessment framework and identification and outline of issues for further investigation and assessment

Individual discussions were held via videoconference and telephone with the CEWH, other relevant agency staff and key stakeholders to elucidate responses to the assessment framework (as outlined above) and identify any issues that arose with the EBM (what worked/did not work well, suggestions for change, emerging future challenges and what further innovations and research could be undertaken to address those challenges).

Meeting participants were provided with a list of potential discussion points and questions relevant to the context and scope of the activity prior to each meeting. Participants were invited to provide any further verbal or written comments after each meeting.

Discussions were held with the CEWH's monitoring partners, including the University of NSW, the NSW Parks and Wildlife Service and private contractors and other stakeholders, including the water storage owner participating in the 2023 Narran Lakes EBM, MDBA and NSW and Queensland agency staff involved in the Narran Waterbird TAG and other processes relevant to the EBM, members of the Northern Basin Environmental Watering Group, members of the Lower Balonne Roundtable and a member of the Narran Lakes Nature Reserve Aboriginal Joint Management Committee. More than 20 individual discussions were held.

4. Progress update to the CEWH

A progress update was provided to the CEWH via videoconference. The update provided information on any initial findings following the completion of Key Activity 2 and 3 above, and discussed any emerging key points for the review.

5. Independent analyses of documentation, responses to the assessment framework and issues raised

Independent analysis was undertaken of the available documentation provided by the CEWH and responses to the assessment framework, issues and suggestions for change identified during the various discussions. Other matters were also considered within the context and scope of the key activities that may inform findings and recommendations.

6. Preparation of a draft report for consideration and feedback

A draft report was prepared and provided to the CEWH and to those with whom earlier discussions had been held. The draft report consolidated and collated comments and suggestions made and provided draft findings and recommendations. The CEWH and those with whom earlier discussions had been held were requested to provide written and/or verbal feedback on the draft report.

7. Preparation and presentation of a final report

Feedback on the draft report from all respondents (being more than half of those to whom a request was made) was assessed and a final report was provided to the CEWH. A meeting with the CEWH was held to discuss feedback on the draft report and how the feedback on the draft report had been addressed in the final report. A presentation on the final report will be made to the CEWH and other relevant stakeholders in due course.