

REVIEW OF PERFORMANCE AGAINST OBJECTIVES AND OUTCOMES – 2020-21

*Report of the Independent River Operations Review Group -
an advisory committee established by, and reporting to, the
Murray-Darling Basin Authority*

September 2021

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Reviewers' Foreword

Mr Andrew Reynolds
Acting Chief Executive Officer
Murray-Darling Basin Authority

28 September 2021

Dear Andrew

The Independent River Operations Review Group (IRORG) is pleased to submit to the Murray-Darling Basin Authority its review of the River Murray operations for 2020-21, and in particular the Authority's compliance with the General and Specific Objectives and Outcomes (O&O) set out in the O&O document, Version 9, effective from 1 June 2020.

IRORG believes that the Authority has generally fulfilled its obligations under the Objectives and Outcomes document during 2020-21, with two important exceptions.

MDBA's anticipation of the reinstatement of Menindee Lakes to the control of the Authority seemed uncoordinated, and the reasons for the delay in MDBA directed releases after 7 May 2021 was not conveyed effectively to partner jurisdictions.

IRORG believes that, during the rapidly unfolding events in April-May 2021 when the MDBA realised that it could not meet the Lake Victoria target on 31 May 2021 without serious collateral impacts, the Basin Officials Committee (BOC) and the Ministerial Council (MinCo) should have been promptly notified; and we assume that BOC would have soon followed up with its own advice to MinCo.

These, and a number of other key issues arising from this review are described in Section 7 of the report.

IRORG appreciates the assistance provided by your staff, together with key staff in the jurisdictions. In particular, MDBA's Jacki Thomson and Matthew Bethune have been most efficient and forthcoming as they have sorted through IRORG's requests for additional information, and have alerted us to work being done on many of the issues before us. We are most grateful.

Yours sincerely



Peter Hoey
Chair



Terry Hillman
Member



Garry Smith
Member



Brett Tucker
Member

Contents

Reviewers' Foreword	iii
Executive Summary	vi
Summary of recommendations	viii
List of Abbreviations	ix
1 Introduction	1
2 Review Process	2
3 Seasonal context for river operations	3
4 Performance against General O&Os (O&O clause 4)	6
5 Performance against Specific O&Os (O&O clause 5)	11
6 Other provisions in the O&O document	15
7 Issues relevant to the General and Specific O&Os	20
7.1 Capacity sharing and shortfall risks [GO&O 4(2)(b)(iii)]	20
7.2 Lake Victoria management [GO&O 4(2)(b)(iii), SO&O 12.5]	21
7.3 Goulburn IVT management [GO&O 4(2)(b)(iii)]	24
7.4 Adapting system operations [GO&O 4(2), O&O cl 10]	27
7.5 Water quality issues [GO&O4 (4) (b) (iii)]	28
7.6 Decision making and governance processes	28
8 Conclusion	31

Tables

Table 1: Summary of MDBA performance against General O&Os for 2020-21.....	8
Table 2: Assessment of MDBA performance against Specific O&Os for 2020-21.....	12

Figures

Figure 1: Seasonal rainfall deciles for 2020-21 water year	3
Figure 2: River Murray system inflows for 2020-21	5
Figure 3: Capacity and shortfall risk issues.....	20
Figure 4: Tributary IVT account deliveries to the Murray system.....	26

Acknowledgement of Traditional Owners

We pay our respects to Elders past and present, and acknowledge and recognise Traditional Owners' obligations, rights and responsibilities to use and care for their traditional lands and waters.

Executive Summary

This report sets out the findings of the Independent River Operations Review Group's (IRORG) 2021 review of the MDBA's performance in river operations. The review covers the MDBA's performance during the 2020-21 water year in relation to managing the River Murray system to meet the states' consumptive and environmental water demands, and its compliance with the provisions of the Objectives & Outcomes document.

Consistent with our previous reviews, IROrg has based this review around identification of key issues via three main lines of evidence:

- issues documented in the MDBA's River Murray System - Summary of River Operations report – 2020-21 Water Year,
- issues raised in interviews and in submissions by jurisdictions; and
- any issues arising from IROrg's own review of available information.

After a series of drier years in recent times, the 2020-21 water saw some improvement in rainfall and inflows, although rainfall was below or very much below average across the mid and lower Murray regions. Similarly, inflows improved on the 2019-20 situation, but were still well below the long term and 10-year average inflows. Perhaps the most defining feature of the 2020-21 water year was the highly variable weather conditions across the year, which were reflected in variations in water demands and inflows.

Overall, total inflows to the River Murray system were 5,325 GL for the 2020-21 water year. This volume of inflows would be expected to be equalled or exceeded in 69% of years, based on historical records. Total MDBA active storage at the end of the water year was 4,525 GL (53% of full capacity).

Operation of the River Murray system is guided by the provisions of the "Objectives and Outcomes for river operations in the River Murray System". This document has been approved by the Basin Officials Committee. The 2020-21 water year presented a range of challenges for river operations, including managing shortfall risks during peak demand periods, and responding to water quality issues across the system. All jurisdictions were of the view that the MDBA performed well in relation to overall river operations activities.

IRORG considers that the general objectives for: Water storage and delivery accounting; RMO assets; People and communities; and Environment were all achieved in 2020-21. A number of the intended outcomes of the Communications and information management category were not fully achieved and IROrg has therefore assigned a qualified achievement rating to this general objective for 2020-21.

The two outcomes that received qualified achievement ratings were as a result of:

- The MDBA's failure to provide timely advice to the Basin Officials Committee and Ministerial Council that the Lake Victoria target level could not be achieved by the end of May deadline.
- The lack of formal assurance from all jurisdictions around methods and data quality providing hydrometric monitoring services to the MDBA. There has been progress in this area, with one jurisdiction moving to provide formal quality assurance during 2020-21; however, there are still some jurisdictions that have not provided evidence of suitable quality assurance.

The Authority performed well in delivery against the specific objectives and outcomes in 2020-21. In total, 98% of the SO&Os were fully achieved, with the one area of qualified achievement related to the failure to provide timely advice that the end of May target level in Lake Victoria would not be achieved. The shortfall compared to the 31 May 2021 target was relatively modest (~ 60 GL) and the target level was reached on 17 June 2021.

In addition to the day to day operation of the River Murray system, the MDBA also undertook a range of projects to address issues and improve river operations performance. It developed a River Management Transparency Plan, which aims to provide improved information to stakeholders on how the River Murray is operated. The continuing work of the MDBA's Environmental Water Improvement Group was also commended by jurisdictions.

The operation of a water system as large and as complex as the River Murray system inevitably presents a range of challenging issues for operators. IRORG has identified and commented on a range of these issues in this review and made two recommendations to support continuous improvement in performance. These issues include the following matters:

- Capacity sharing and shortfall risks have been the subject of significant attention in previous IRORG reviews. It continues to be a very high priority issue for all States and there is strong support for the work done to date by the MDBA and the Independent Panel for Capacity Project Review. The development of a River Murray shortfall response plan in 2020-21 provides an important toolkit to guide actions in responding to shortfall risks. IRORG urges continued focus on this problem and a degree of urgency to find solutions, as it will take time to generate an enduring consensus around the best solution(s).
- Lake Victoria plays a vital role in managing the lower Murray and delivering state water orders. The 2020-21 water year highlighted the challenges in meeting long standing fixed targets for operation of this storage in the face of changing demands for water under a changing climate. The MDBA has initiated Phase 1 of a review of Lake Victoria operations, seeking to better identify and quantify all the drivers of change impacting on the lake. IRORG supports these efforts. However, until there is any agreement to changes to operational procedures, the MDBA must comply with the current requirements of the MDB Agreement and the O&O document. IRORG commends the MDBA for having initiated Phase 1 as a first step in a review of Lake Victoria operations.
- IRORG has previously recommended that the MDBA should challenge its existing assumptions and operational norms to come up with a defensible approach to managing the system in response to a changing climate. In 2020-21, the MDBA made good progress on the development of an organisation-wide Climate Adaptation Strategy, which also includes a specific section focussing in on the climate change adaptation actions that will be required for river operations and assets.
- The MDBA responded well to challenges of poor water quality in Lake Hume, caused by inflows carrying bushfire contaminants from the January 2020 fires into the reservoir. IRORG suggests that the MDBA and jurisdictions should consider whether a wider range of water quality response actions can be brought under a formal coordination framework, to provide more integrated response capabilities to adverse water quality events.
- A number of concerns were raised by jurisdictions in relation to governance processes and information sharing associated with some of the complex and contested water management

decisions that were required during the water year. There is a need to continue to evolve governance and decision making processes to meet these challenges. In the short term, the MDBA should consider a limited review of its current processes for seeking advice and decision from WLWG, RMOC and BOC, to ensure continued compliance with the O&Os and to provide effective information sharing for all parties.

Summary of recommendations

For its 2021 review, IRORG has identified two opportunities for improvement in river operations and water sharing activities. The recommendations from the 2021 review are summarised below, together with a reference to the relevant section of the report where further detail and background can be found.

Water quality issues (Section 7.5, page 28)

2021.01 IRORG **recommends** that the MDBA and jurisdictions should consider whether a wider range of water quality response actions can be brought under a coordination framework, such as existing well-developed regional Blue Green Algae co-ordination arrangements, to provide integrated response capabilities to adverse water quality events.

Decision making and governance processes (Section 7.6, page 28)

2021.02 IRORG **recommends** that the MDBA should consider a limited review of its current processes for seeking advice and decisions from WLWG, RMOC and BOC to ensure continued compliance with the O&Os and to provide effective information sharing for all parties.

List of Abbreviations

Act	Commonwealth <i>Water Act 2007</i>
Agreement	Murray-Darling Basin Agreement
AOO	Annual Operating Outlook
Authority	Murray-Darling Basin Authority
BOC	Basin Officials Committee
BMF	Barmah Millewa Forest
Committee	Basin Officials Committee
GO&O	General Objectives and Outcomes, clause 4 of the O&O document
IPCPR	Independent Panel for Capacity Project Review
IRORG	The Independent River Operations Review Group
IVT	Inter-Valley Transfer (account)
MDBA	Murray-Darling Basin Authority
MDB Agreement	Murray-Darling Basin Agreement
MinCo	Murray-Darling Basin Ministerial Council
O&O document	Objectives and Outcomes document, as reviewed annually
PPM	Pre-requisite Policy Measure (refer Chapter 7 of the Basin Plan)
RMO	River Murray Operations group
RMOC	River Murray Operations Committee
SCBEWC	Southern Connected Basin Environmental Watering Committee
SO&O	Specific Outcomes and Objectives, Appendix A to the O&O document.
WLWG	Water Liaison Working Group

1 Introduction

The River Murray system is the backbone of the major water distribution and delivery systems in the southern connected Murray-Darling Basin. It harvests, stores and delivers the shared resources available to New South Wales, Victoria and South Australia. It also links to the management of water resources undertaken within state controlled tributaries. The Murray-Darling Basin Authority (MDBA) is responsible for water sharing and operational management of the River Murray system.

The Murray-Darling Basin Agreement (the Agreement) sets out detailed provisions for the management and sharing of the basin water resources. The Agreement also establishes the functions of the Basin Officials Committee (BOC), which includes making high-level decisions in relation to river operations within the River Murray System. The key river operations decisions approved by BOC are captured in the Objectives and Outcomes (O&O) document, which specifies the objectives and outcomes that the Authority should achieve in relation to river operations (refer clause 31 of the Agreement).

The Agreement and the O&O document provide a framework for the Authority to undertake its river operation functions. The O&O document includes provisions for the Authority to appoint an Independent River Operations Review Group (IRORG) to review river operations. IRORG is an advisory committee established under the provisions of Section 203 of the Water Act 2007 (the Act). IRORG's current members¹ are:

- Peter Hoey (Chair)
- Terry Hillman
- Garry Smith
- Brett Tucker

IRORG's terms of reference require it to assess whether the MDBA, in operating the River Murray System, has complied with the General and Specific Objectives and Outcomes set out in the O&O document. IRORG's role also includes identifying any improvements to either the MDBA's processes or the O&O document.

This report sets out IRORG's findings, observations and recommendations on these issues.

¹ IRORG members have wide ranging expertise in water management issues. As part of their consulting roles or involvements with state water resource management agencies, IRORG members may have knowledge of or prior exposure to some water management matters that may be addressed in the review. Members disclose these matters, and where appropriate the Chair of IRORG, in consultation with the MDBA's Executive Director River Management, ensures that members with a potential conflict of interest in relation to an issue do not participate in development of IRORG findings on that issue.

2 Review Process

The Authority provided IRORG with a range of material to assist it in reviewing river operations during 2020-21. This material included:

- River Murray System Summary of River Operations report – 2020-2021 Water Year².
- River Murray System Annual Operating Outlook 2020-21 Water Year³.
- River Murray system Annual Operating Outlook – 2020-21 water year – Update (End October 2020)⁴.
- The River Murray System Water accounts – as at end of May 2021.
- Objectives and outcomes for river operations in the River Murray System Version 10 – 1 June 2020⁵.
- RMS Environmental Water Implementation Report 2020-21 – August 2021

In the course of its review, IRORG also sought and received additional information from the MDBA to address specific questions and information gaps.

IRORG's review process is based around identification of key issues via three main lines of evidence:

- issues documented in the Summary of River Operations report
- issues raised in interviews and in submissions by the jurisdictions⁶; and
- any issues arising from IRORG's own review of available information

This review addresses the MDBA's performance for the 2020-21 water year, which covers the period 1 June 2020 – 30 May 2021. IRORG developed its findings, observations and recommendations following investigation and analysis of the identified issues.

IRORG has relied on the information provided to it by the MDBA and in the verbal and written submissions from jurisdictions in helping it to formulate its findings; however, the conclusions and recommendations included in this report are entirely those of IRORG.

² This report is subsequently referred to as the Summary of River Operations report.

³ This report is available on the MDBA website

⁴ ibid

⁵ ibid

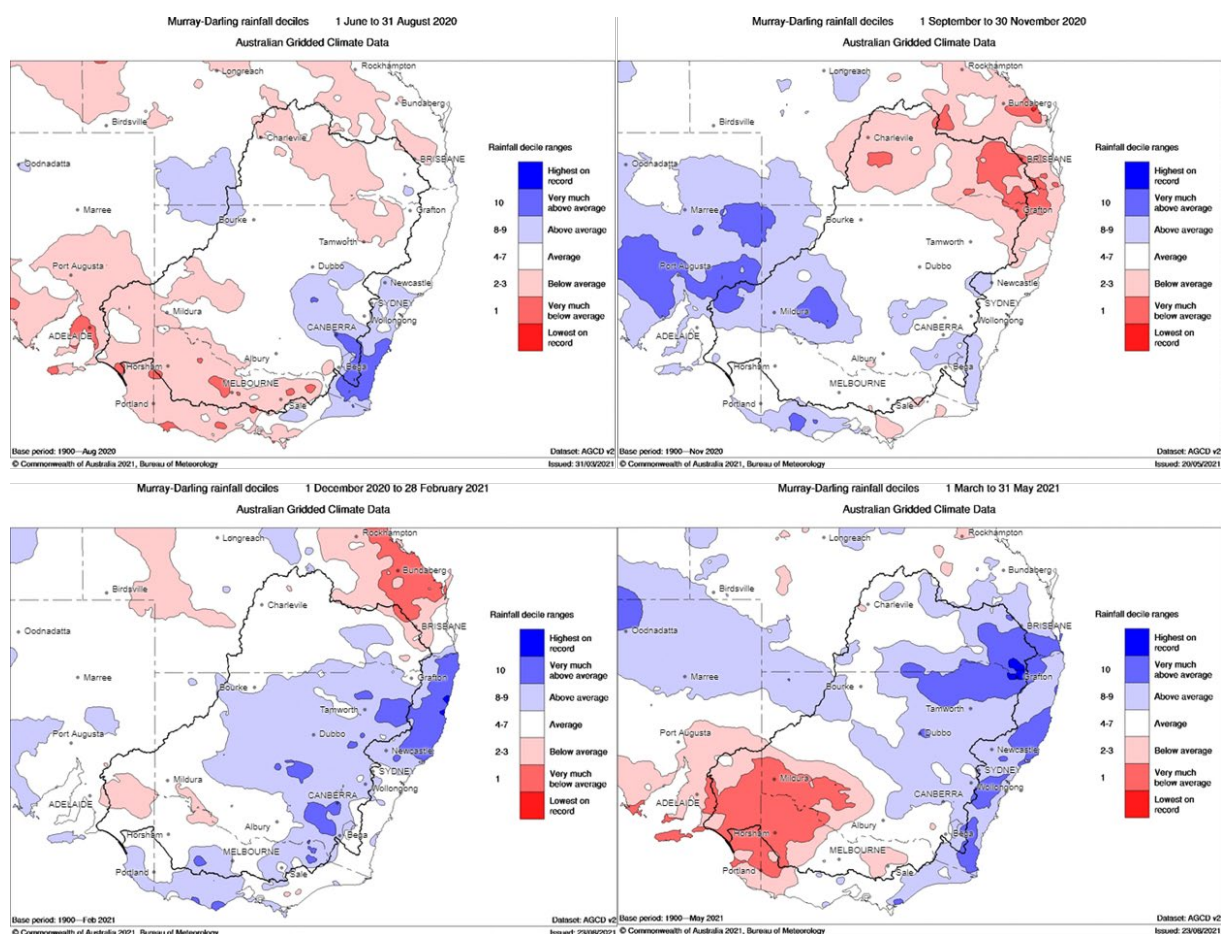
⁶ In relation to the operation of the River Murray System, the relevant jurisdictions are the Commonwealth, New South Wales, South Australia and Victoria. These jurisdictions are all represented on the Water Liaison Working Group (WLWG) which advises the MDBA on river operations issues.

3 Seasonal context for river operations

After a series of drier years in recent times, the 2020-21 water saw some improvement in rainfall and inflows, although rainfall was below or very much below average across the mid and lower Murray regions. Similarly, inflows improved on the 2019-20 situation, but were still well below the long term and 10-year average inflows (refer Figure 2).

In relation to River Murray System operations, perhaps the most defining feature of the 2020-21 water year was the highly variable weather conditions across the year, which were reflected in variations in water demands and inflows (refer Figure 1).

Figure 1: Seasonal rainfall deciles for 2020-21 water year



Notes: Clockwise from top left, these charts show rainfall deciles for winter, spring, autumn and summer 2020-21

Key features of the weather and water demands across the year were:

- Winter saw below average rainfall across the southern basin; however, a number of heavy rain events sustained tributary inflows and enabled periods of unregulated flow across the winter. Lower rainfall and access to unregulated flows also boosted demand above normal winter levels in parts of the system.

- Conditions turned wetter in spring with average to above average rainfall across the southern basin, largely driven by very much above average October rainfall. Spring also saw above average temperatures, and a decline in rainfall in November resulted in the corresponding emergence of high irrigation demands in the Sunraysia region.
- Summer saw average to below average rainfall across the irrigation areas in the southern basin. Drier conditions and relatively good water availability (including through access to carryover) led to higher summer diversions from the River Murray system than experienced in recent years. Significant rainfall commenced in December across the northern basin, initiating flows in the upper Darling system. Inflows to the Menindee Lakes commenced in late January 2021.
- Autumn rainfall was below or well below average across much of the southern basin, with sustained higher irrigation demands until late in the water year. Late March also saw significant rainfall and flooding across the northern basin, generating further significant inflows to the Barwon-Darling system. This ultimately led to water storage in the Menindee Lakes rising above 640 GL and returning to MDBA control late in the water year (7 May 2021).

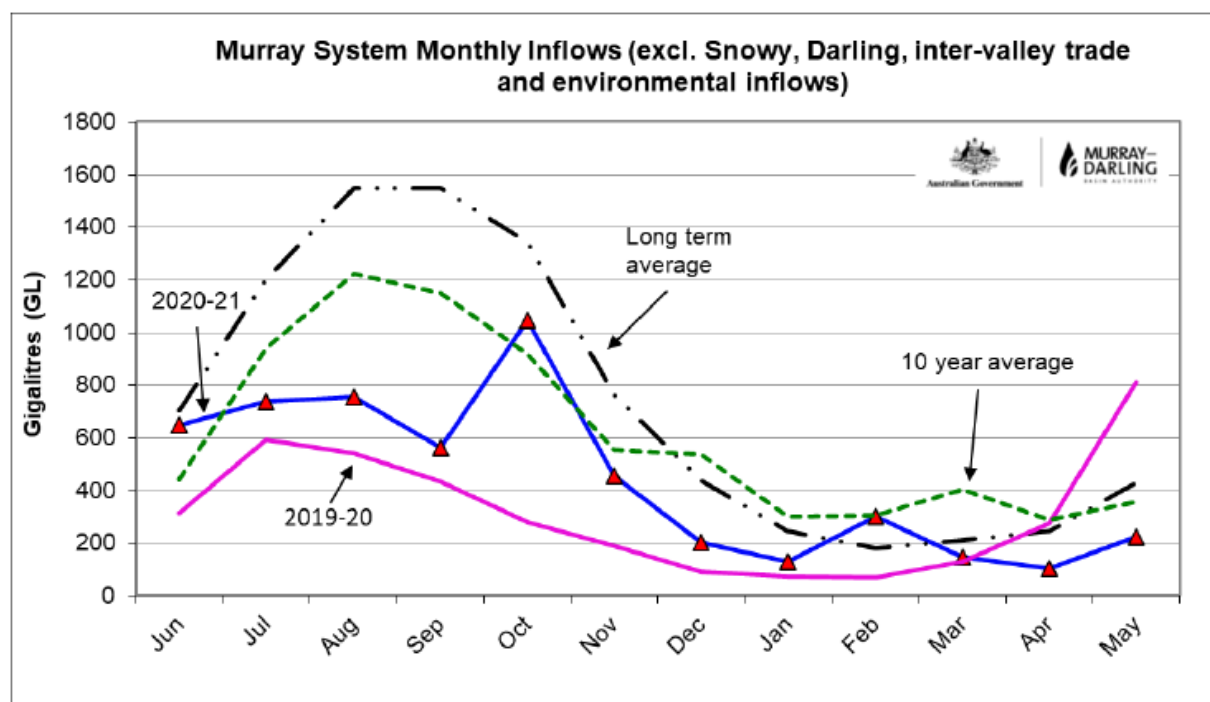
Inflows reflected these conditions (see Figure 2), with below long term average inflows across the important winter/spring storage filling season. February rain events provided a small boost to inflows, however dry conditions saw autumn inflow decline to low levels. Overall, total inflows to the River Murray system⁷ were 5,325 GL for the 2020-21 water year. This volume of inflows would be expected to be equalled or exceeded in 69% of years, based on historical records. Total MDBA active storage at the end of the water year was 4,525 GL (53% of full capacity).

Other notable operational issues during 2020-21 included:

- High inflows for tributaries downstream of Lake Hume resulted in the commencement of unregulated flow conditions on 27 June 2020. By late July inflows had started to recede and unregulated flows ceased for upstream reaches of the system. Further rain in August boosted inflows and unregulated flows recommenced in all reaches. Unregulated flow conditions concluded on 25 September 2020.
- A total of 323 GL of environmental water releases were made from Lake Hume between August and December 2020. In total, over 707 GL of environmental water was delivered throughout the River Murray system in 2020-21.
- The MDBA responded to a water quality event in Lake Hume in February -March 2021. Inflows from catchment areas affected by the 2020 bushfires resulted in low dissolved oxygen levels as well as high levels of minerals such as manganese. Key water users including urban water supply agencies were alerted to enable them to adjust their water treatment processes. A portion of the downstream releases were diverted through the cone valves for aeration, and compressed air was added to the release through the power station to increase dissolved oxygen levels.

⁷ River Murray System inflows include unregulated inflows to Dartmouth, Hume and from the Kiewa River, plus inflows from the NSW and Victorian tributaries, but exclude environmental water deliveries and IVT, as well as Menindee when not part of the shared resource.

Figure 2: River Murray system inflows for 2020-21



Source: Summary of River Operations report

4 Performance against General O&Os (O&O clause 4)

Clause 4 of the O&O document sets out a series of general objectives that the Authority should aim to achieve. The O&O also describes a series of target outcomes that are to be delivered in support of these objectives. The General Objectives and Outcomes (GO&Os) are grouped under five main themes:







- Water storage and delivery accounting.
- RMO assets.
- People and communities.
- Environment.
- Communications and information management

The Authority has reported in detail on its performance against each of the target outcomes.

Key points

- The 2020-21 water year presented a range of challenges for river operations, including managing shortfall risks during peak demand periods, and responding to water quality issues across the system.
- All jurisdictions were of the view that the MDBA performed well in relation to overall river operations activities.
- Concerns were identified in relation to the MDBA's failure to provide timely advice to the Basin Officials Committee and Ministerial Council that the Lake Victoria target level could not be achieved by the end of May deadline.
- IRORG considers that the general objectives for: Water storage and delivery accounting; RMO assets; People and communities; and Environment were all achieved in 2020-21.
- IRORG considers that a number of the intended outcomes of the Communications and information management GO&O were not fully achieved and has therefore assigned a qualified achievement rating to this GO&O for 2020-21.

How to read Table 1: A brief example of Table 1 content is provided below. The text [IN SQUARE BRACKETS AND CAPITALS] summarises the key content of the table, and the additional column to the right provides a description of how the colour coding applied the IRORG assessment column in Table 1 should be interpreted.

O&O Clause	Outcome area	Target outcome	IRORG comments/assessment*	Legend for IRORG assessment rating in the previous column
4(2)	Water Storage and delivery accounting [GENERAL OBJECTIVE CATEGORY]		<i>IRORG considers that the objectives for water storage and delivery and accounting were achieved.</i> [IRORG COMMENTS OR NOTES ON OVERALL ACHIEVEMENT AGAINST THE GENERAL OBJECTIVE. COLOUR OF CELL SHADING INDICATES IRORG ASSESMENT RATING]	 Achieved
				 Qualified achievement
				 Not achieved
4 (2) (b) (i)	Water conservation [INDIVIDUAL OUTCOMES UNDER EACH GENERAL OBJECTIVE]	The conservation of water and minimisation of losses [BRIEF SUMMARY OF THE TARGET OUTCOME STATEMENT FROM O&O]	The Authority effectively managed losses in a year with high temperatures and low tributary inflows... [IRORG COMMENTS OR NOTES ON ACHIEVEMENT AGAINST EACH OUTCOME AREA UNDER A GENERAL OBJECTIVE]	 Achieved
				 Qualified achievement
				 Not achieved

* IRORG's assessment of achievement against General O&O. Key to assessment levels is:

- Achieved – Intended outcome was fully achieved in line with the General O&O provisions, or was achieved with only relatively minor or limited deviations, which had no material impact (*indicated by green shading in table*).
- Qualified achievement – Intended outcome was generally achieved; however, some deviations from the intended outcomes occurred. Deviations were limited in duration, or were largely outside of the control of the MDBA and did not result in significant adverse impacts (*indicated by amber shading in table*).
- Not achieved - Intended outcome was generally not achieved, or deviations which occurred resulted in significant adverse impacts (*indicated by red shading in table*).

Table 1: Summary of MDBA performance against General O&Os for 2020-21

O&O Clause	Outcome area	Target outcome	IRORG comments/assessment*
4(2)	Water Storage and delivery accounting		<i>IRORG considers that the outcomes for water storage and delivery and accounting were achieved.</i>
4 (2) (b) (i)	Water conservation	The conservation of water and minimisation of losses	The Authority operated the system efficiently in 2020-21. Overall losses for 2020-21 were below median historic levels. Lake Victoria was filled from harvested tributary inflows. Unregulated flows occurred from late June until late September. The MDBA also managed the system so as to retain the majority of the available resources in Lake Dartmouth at the end of the water year, one of its most efficient storages.
4(2) (b) (ii)	Preparation of accounts and water resource assessments	The accurate and timely preparation, delivery, review and, where necessary, amendment of water accounts and water resource assessments.	No jurisdictions raised material concerns with the accuracy or timeliness of accounts. Jurisdictions had confidence in the water resource assessments. The accounts also accurately tracked the volumes of water held in SA's storage right under Schedule G of the MDB Agreement.
4 (2) (b) (iii)	Delivery of state water orders	The delivery to the Southern Basin states of their authorised water orders unless physical constraints of the River Murray System prevent this from occurring.	The MDBA met all authorised state water orders in 2020-21. RMO actively monitored and managed the risk of delivery shortfall over the summer using a new shortfall risk assessment tool, coupled with regular reporting on Lake Victoria actual and projected levels.
4 (3)	RMO assets		<i>IRORG considers that the outcomes for RMO assets were achieved.</i>
4 (3) (b) (i)	Effective management of RMO assets	The effective management, maintenance, repair, renewal and replacement, and the protection of the security, of RMO assets.	No asset issues were experienced which impacted the MDBA's ability to operate the system and deliver state water orders
4 (3) (b) (ii)	Emergency management	The effective management and mitigation of any emergency occurring at RMO assets.	No emergencies occurred in 2020-21 at RMO assets. The water quality issues in Lake Hume did not reach the threshold for treatment as an emergency.
4 (3) (b) (iii)	Structural and operational integrity of RMO assets	Conduct river operations in ways that protect the structural and operational integrity of RMO assets	Operations were conducted in collaboration with state constructing authorities and within specified operating ranges. The MDBA and constructing authorities also undertake regular condition monitoring of assets.
4 (3) (b) (iv)	Flood management	The management of floods in accordance with the criteria established in the O&O.	There were no flood events at MDBA storages during 2020-21.
4 (3) (b) (v)	More effective environmental delivery	Use existing and new RMO assets to deliver environmental water more effectively.	MDBA used existing assets to support environmental deliveries, including through the use of the Barmah Millewa Forest regulators. Weir pool levels were also manipulated for environmental benefits

O&O Clause	Outcome area	Target outcome	IRORG comments/assessment*
4(4)	People and communities		<i>IRORG considers that the outcomes for people and communities were achieved.</i>
4 (4) (b) (i)	Maintenance of productive relationships	Productive relationships are maintained with river managers and other stakeholders.	The MDBA maintained effective relationships with jurisdictions. The MDBA expanded its program of information provision for stakeholders through the development of the River Management Transparency Plan, including hosting a series of webinars on river management issues.
4 (4) (b) (ii)	Limit flooding damage	Subject to the O&O provisions, damage to downstream communities is limited when managing flooding.	No flood operations were required in 2020-21.
4 (4) (b) (iii)	Mitigating water quality impacts	Events that may adversely affect the water quality mitigated.	Significant efforts were made to mitigate water quality risks: <ul style="list-style-type: none"> Implementation of Lake Victoria flushing rule in Jan 2021 to address Blue green Algae risks in the lower Murray Worked in partnership with other agencies to respond to and mitigate poor water quality in Lake Hume generated by runoff from bushfire affected areas. See also Section 7.5.
4(4) (b) (iv)	Navigation and recreation	Navigational and recreational uses of the River Murray System are properly considered, including major public events using parts of the River Murray System	A calendar of river-based community events was included in the AOO and considered in the development of operational scenarios. Minimum water level targets at specified locations were met. The level of recreational activities appears to have been impacted by COVID-19 restrictions.
4 (4) (b) (vi)	Cultural heritage	Appropriate regard is given to cultural heritage matters.	Lake Victoria was operated in accordance with the cultural heritage protection strategy. Care was taken to minimise potential erosion on sensitive cultural sites.
4 (5)	Environment		<i>IRORG considers that the outcomes for environment were achieved.</i>
4 (5) (b) (i)	Achieving multiple objectives	River operations are managed to ensure that multiple objectives can be achieved	MDBA facilitated significant environmental watering activities. Action to include environmental water demands in the AOO was positively recognised by jurisdictions.
4 (5) (b) (ii)	Improving environmental watering practices	The knowledge, documentary and practice bases for effective environmental watering are all improved.	The Environmental Water Improvement Group continued to positively advance environmental watering practices. Accounting arrangements for e-water use in Barmah-Millewa Forest were updated and data and advice were provided to support development of e-water use rates in state tributaries.
4 (5) (b) (iii)	Timely provision of advice	WLWG and any other relevant committee receive timely information about any significant actual or predicted change to the River Murray System's water resources.	WLWG & SCBEWC chairs were advised of and kept informed in relation to periods of declared unregulated flows. An updated draft of the procedure for determination of unregulated flow periods was also produced.

O&O Clause	Outcome area	Target outcome	IRORG comments/assessment*
4 (5) (b) (iv)	Reducing adverse environmental impacts	The risk of significant adverse environmental events is reduced, or impacts are mitigated.	The MDBA sought to minimise adverse environmental impacts associated with river operations, subject to continuing to meet state water orders.
4 (5) (b) (v)	Timely provision of environmental water use estimates.	The Authority will supply, in a timely manner, the Water Liaison Working Group and the participating government environmental water holders with relevant retail and wholesale level estimates of environmental water use if requested by WLWG	Summaries of daily environmental water use estimates were provided monthly to jurisdictions. It is also noted that it is proposed that states will assume the primary responsibility for retail e-water usage information in 2021-22
4 (6)	Communication and Information management		<i>IRORG considers that there was qualified achievement of the outcomes for communication and information management.</i>
4 (6) (b) (i)	Accurate river operations information	The Ministerial Council, BOC, the River Murray Operations Committee, WLWG, other relevant committees, other stakeholders with an interest in the Authority's river operations and the public are each provided with appropriate, timely and accurate information about the Authority's river operations.	The MDBA undertook a range of measures to provide information on river operations, which are detailed in the Summary of River Operations report. This included updating the procedures for determining unregulated flow conditions. This has been an area of considerable effort by the MDBA, which is commended by IRORG. See also details under O&O clause 4 (4) (b) (i) report.
4 (6) (b) (ii)	Communications with WLWG and BOC	Effective referral of matters to the WLWG & BOC.	Due to changing demand and river conditions in May, MDBA was unable to meet the end of May target level in Lake Victoria (target was met 17 days late). Although the sequence of events did not allow time for the Ministerial Council (MinCo) to approve a delay in reaching the target, timely advice that this target would not be reached by end of May should have been provided to BOC and MinCo. Further detail is provided in Section 7.2.
4 (6) (b) (iii)	Implementing review processes and outcomes	Any BOC recommendations in relation to the establishment, terms of reference, operations or recommendations of IRORG are implemented.	The MDBA continued to apply the arrangements endorsed by BOC for the annual review.
4 (6) (b) (iv)	Management of hydrometric stations	Hydrometric stations forming part of RMO assets are managed according to best practice methods to collect, transfer, store and assure the quality of all data.	The MDBA contracts states to undertake hydrometric monitoring and is moving to ensure all states can provide formal assurance of data quality and methods. NSW has now established such a process. In the absence of formal assurance around methods and data quality from all jurisdictions providing services, IRORG has opted for qualified achievement of this GO&O. IRORG has previously recommended development of an overall risk-based data quality assurance strategy and framework for the MDBA river operations.

5 Performance against Specific O&Os (O&O clause 5)

The O&O document includes a range of Specific Objectives and Outcomes (SO&Os) for designated reaches of the River Murray System, designated river operation activities or specific assets.

IRORG's assessment of the Authority's performance in relation to each of the SO&Os for the 2020-21 water year is provided in Table 2. The MDBA also provided detailed reporting to the jurisdictions, so IRORG has focussed on reporting by exception on breaches of the SO&Os in Table 2.

Key Points

- Overall, the Authority performed well in delivery against the SO&Os in 2020-21, as shown in the following table
- The one area of qualified achievement related to a failure to provide timely advice to the Ministerial Council that the end of May target level in Lake Victoria would not be achieved. It is noted that the shortfall on 31 May 2021 was relatively modest (~ 60 GL) and the target level was reached on 17 June 2021.
- Issues were identified with the accuracy at low flows of an update to the rating table for Heywood's gauging station which measures releases from Lake Hume (SO&O 2.3). Investigations into this issue have not yet been completed. Whilst alternative measurement sites were available downstream (Doctor's Point), accurate measurement of releases from Lake Hume is an important element of effective management of the River Murray system. The MDBA is urged to resolve this matter as soon as reasonably possible.

Performance against SO&O	Number of SO&Os	Percentage
Achieved (or not applicable in 2020-21)	56	98%
Qualified achievement	1	2%
Not achieved	0	0%
Total	57	100%

Table 2: Assessment of MDBA performance against Specific O&Os for 2020-21

SO&O Ref. No. ¹	Summary interpretation of SO&O ²	Assessment ³ (see notes for info. on ratings)	Comments or reference to further explanatory notes
1.1	Dartmouth Dam - maximum planned regulated release	Achieved	
1.2	Dartmouth Dam– Airspace management and flood operations.	Achieved	No flood operations in 2020-21
1.3	Dartmouth Dam - Maximum rate of rise and fall in River level during planned regulated release	Achieved	Minor breaches of rise/fall limits reported, with no identified material impacts. Breaches were associated with AGL power station releases. While not associated with RMO release actions, IRORG is of the view that the MDBA needs to ensure that AGL complies with the adopted operational limits and requirements.
1.4	Dartmouth Dam – Minimum planned regulated release	Achieved	Isolated minor breaches of minimum flow rate
2.1	Hume Dam - Maximum planned regulated releases	Achieved	
2.2	Hume Dam – Maximum rate of fall in River level during planned regulated releases	Achieved	One minor breaches of rate of fall– no adverse impact reported.
2.3	Hume Dam - Minimum planned regulated releases	Achieved	A number of apparent breaches occurred in Aug 2020 following implementation of a rating table update at Heywood’s gauge. Flows met target at Hume outlet (and Doctor’s Point) at all times and measurement reverted to the outlet valve rating while the issue was further investigated.
2.4	Hume Dam – Directed releases	Achieved	
2.5	Hume Dam - Assumed use for directed releases of HEW	Achieved	
2.6	Hume Dam - post flood operations, storage to be 99% of full capacity when demand exceeds inflows. Target airspace to be between 30 GL – 386 GL.	Achieved	No flood operations in 2020-21
3.1	Yarrawonga Weir max. planned flows (a) When inundation of the Barmah-Millewa Forest is desirable (b) When inundation of the Barmah-Millewa Forest is undesirable	Achieved Achieved	
3.2	Yarrawonga Weir – flood operations	Achieved	No flood operations in 2020-21
3.3	Lake Mulwala - pool level during the irrigation season.	Achieved	
3.4	Lake Mulwala – Supporting social and recreational use.	Achieved	
3.5	Yarrawonga Weir – Minimum planned regulated release	Achieved	
4.1	Barmah-Millewa Forest Environmental Water Allocation accounting provisions	Achieved	No BMF EWA used in 2020-21
4.2	Barmah-Millewa Forest – Regulator operations	Achieved	

SO&O Ref. No. ¹	Summary interpretation of SO&O ²	Assessment ³ (see notes for info. on ratings)	Comments or reference to further explanatory notes
5.1	Wakool system – Use of system	Achieved	No MDBA transfers through the Wakool system in 2020-21
5.2	Edward River - Offtake operation	Achieved	
5.3	Gulpa Ck. - Offtake operation	Achieved	
5.4	Werai Forest – Regulator operations	Achieved	
5.5	MDBA water orders d/s of Stevens Weir	Achieved	
7.1	Swan Hill – Minimum water level	Achieved	
8.1	Wentworth Weir – Minimum River Murray flow contribution	Achieved	
9.1	Lake Victoria – Operating Strategy	Achieved	
9.2	Lake Victoria - Inlet and outlet flow rates	Achieved	There may be scope to improve the specification of targets for min. flow levels with reference to river and groundwater level differentials
9.3	Lake Victoria – Full supply level	Achieved	
9.4	Lake Victoria – Directed releases	Achieved	No directed releases in 2020-21
9.5	Lake Victoria level – Maximum rate of rise in lake level	Achieved	4 minor exceedances, associated with localised rainfall events.
9.6	Lake Victoria - Improving water quality using Lake.	Achieved	
10.1	Menindee Lakes - Maximum planned regulated release downstream	Achieved	Menindee Lakes returned to MDBA control on 7 May 2021.
10.2	Menindee Lakes – Maximum rate of rise and fall in flow rates downstream.	Achieved	1 exceedance, no adverse impact reported
10.3	Menindee Lakes - Minimum planned regulated releases	Achieved	
10.4	Menindee Lakes - Directed releases	Achieved	No directed releases in 2020-21
10.5	Menindee Lakes – distribution of stored water.	Achieved	
11.1	Lower Lakes Barrages – operations.	Achieved	
12.1	Harmony operation of Dartmouth and Hume Reservoirs	Achieved	
12.2	Harmony operation of Menindee Lakes and Lake Victoria	Achieved	
12.3	Additional Dilution Flows to SA	Achieved	Additional Dilution Flows to South Australia were not triggered in 2020-21
12.4	Bulk transfer from Dartmouth Reservoir to Hume Reservoir	Achieved	
12.5	Bulk transfers from Hume Reservoir to Lake Victoria	Qualified achievement	End of May target for Lake Victoria was not met until 17 June. Refer also Section 7.2.
12.6	Management of rain rejection events	Achieved	
12.7	Unregulated flow advice planning and communication	Achieved	

SO&O Ref. No. ¹	Summary interpretation of SO&O ²	Assessment ³ (see notes for info. on ratings)	Comments or reference to further explanatory notes
12.8	River flow variability.	Achieved	
12.9	Use of bypasses of the Barmah Choke	Achieved	
12.10	Lindsay River Allowance	Achieved	
12.11	Dealing with shortfalls in meeting water demands.	Achieved	
12.12	Adjustment of flows to SA for rating table changes.	Achieved	
12.13	Determining the minimum inflow prediction	Achieved	
13.1	Maintenance of the Water Accounts, Water Accounting Model, model code and associated data	Achieved	
14.1	Maintenance of the Water Resource Assessment model, including the model code and associated data.	Achieved	
14.2	Minimising the impacts of one state leaving a period of special accounting.	Achieved	
15.1	Advances of water – advances should support critical human water needs and the conveyance reserve.	Achieved	No Tier 2 or 3 water sharing arrangements were in place
15.2	Remedial actions are implemented to support the provision of water for critical human needs, conveyance and the conveyance reserve.	Achieved	No Tier 2 or 3 water sharing arrangements were in place
15.3	Priority for water allocations to meet and deliver critical human water needs.	Achieved	No Tier 2 or 3 water sharing arrangements were in place
15.4	Setting aside the conveyance reserve	Achieved	

Notes:

- SO&O reference is the Section number from the O&O document, Appendix A: Specific Outcomes and Objectives.
- For full description of outcomes and interpretation, refer to the O&O document, Appendix A: Specific Outcomes and Objectives.
- IRORG's assessment of achievement against SO&O. Key to assessment levels is:
 - Achieved – Intended outcome was fully achieved in line with the nominated targets in SO&O, or was achieved with only relatively minor or limited duration deviations from the targets, which had no material impact (*indicated by green shading in table*).
 - Qualified achievement – Intended outcome was generally achieved; however, deviations occurred that were either significantly outside targets or extended for a considerable period (e.g. around 10% of time or longer). Deviations did not result in significant adverse impacts (*indicated by amber shading in table*).
 - Not achieved - Intended outcome was generally not achieved, or deviations which occurred resulted in significant adverse impacts (*indicated by red shading in table*).

6 Other provisions in the O&O document

There are range of provisions in the O&O document that set out procedural arrangements to support and enable delivery of outcomes in the GO&Os and SO&Os. The MDBA's performance in relation to these provisions is summarised in this section of the report.

Key Points

IRORG believes that the Authority has generally complied with the requirements of clauses 7 to 18 of the O&O document, with one significant omission:

- BOC and the Ministerial Council were not informed in a timely manner of the likelihood of the inability to meet the end-of-year target storage of 350 GL at Lake Victoria.

IRORG also identified two events involving deferral of environmental water deliveries that may have warranted referral to WLWG.

Referring instances of conflicts and/or possible non-compliance to others [O&O cl 7]

If the MDBA concludes that it may be unable to achieve one or more of the general or specific objectives and outcomes because of a conflict between either or both of those objectives and outcomes, or for any other various specified reasons, it is required to seek the advice of the WLWG, on the need for further referral to the River Murray Operations Committee (RMOC) or BOC.

The Authority advised that there were no instances in terms of this O&O of conflict between achieving the objectives and outcomes and/or possible non-compliance, and therefore no instances needed to be referred to WLWG, RMOC or BOC.

Emergencies [O&O cl 9]

The Authority advised that no emergencies arose and therefore the Emergency Action Plan was not enacted during 2020-21.

IRORG is of the view that the potentially serious water quality event in February and March 2021, where bushfire contaminants triggered low dissolved oxygen levels and high levels of suspended minerals in the waters of Hume Reservoir and downstream, could have escalated into an emergency.

The MDBA is commended on its efforts to coordinate the responses of a number of agencies to ameliorate impacts of water quality on town water supplies and biota. However, these actions were reactive and lacking in a structured approach to an emerging situation bordering on an emergency.

In its review of the 2019-20 water year, IRORG recognised bushfire water quality risks and recommended *inter alia* that the MDBA considers the use of formal incident management processes for these types of events. Many organisations activate formal incident response structures in these sorts of situations to ensure that there is strong organisation wide co-ordination and management of activities and resources in place. Effective incident management processes also allow for the rapid scaling up of response activities if required.

During the current IRORG review, the MDBA advised that in 2021-22 it will be undertaking the development of an overarching incident response framework to ensure the MDBA is better prepared for future climate events and natural disasters which may impact water quality and environmental conditions in the River Murray system.

Preparation of AOP [O&O cl 10]

O&O clause 10 requires the MDBA to prepare and adopt an Annual Operating Plan (which is now referred to as the Annual Operating Outlook or AOO), by 31 July each water year.

Following extensive consultations with WLWG and SCBEWC, including advice sought regarding the management of the Goulburn IVT limits over the summer months, and having regard for watering plans of environmental water holders, the AOO for 2020-21 was adopted on 31 July 2020 and published on the MDBA website. In accordance with clause 10(1)(c), the AOO was provided to RMOC on 19 August 2020 (out-of-session), and to BOC 75 on 25 August 2020, for noting

The AOO was reviewed monthly in consultation with WLWG, including the provision of quarterly summaries of data relating to the implementation as required under clause 10(3) of the O&O. In early December, the MDBA published the end of October update of the AOO, with a revised analysis and update to the trajectories of the planning scenarios based on system conditions in late spring, and on the climate outlook.

IRORG has reviewed and is satisfied with the 2020-21 AOO and the processes of its development, monitoring and update.

Determining the volume of State water entitlements [O&O cl 11]

O&O clause 11 (Determining the volume of State water entitlements) requires the Authority to make monthly water resource assessments and to provide these to the WLWG.

The water resource assessments were uploaded onto GovTEAMS throughout the water year, including a Year 2 assessment uploaded on 11 May 2021. Details of the dates for provision of water assessments were provided. IRORG is satisfied that the requirements of clause 11 have been met.

Water accounts [O&O cl 12 (1)]

O&O clause 12(1) requires the Authority to prepare monthly water accounts for each Southern Basin State.

Information provided to IRORG shows that water resource assessments were uploaded onto GovTEAMS, and hence provided to all relevant parties, at the end of each month during 2020-21. IRORG is satisfied that the requirements of clause 12 have been met.

Annual River Operations report [O&O cl 12 (2)]

The Authority is required to prepare and give BOC and RMOC an Annual River Operations Report by 31 July each year. The Report is required to summarise the river operations carried out by the Authority during the preceding water year; indicate the degree to which the general and specific objectives and outcomes were achieved, including any departures from the general and specific outcomes and objectives that were approved by BOC; set out each matter which the Authority referred to the Committee for determination; and set out any other significant resolutions made, or actions taken by either or both of the Committee and the Authority in relation to river operations.

The Authority is also required to provide a copy of this Report to IRORG by 1 August each year. The River Murray System Summary of River Operations report for 2020-21 Water Year was made available to IRORG on 30 July 2021.

IRORG was pleased with the detailed information contained within this report which facilitated much of our review. Where more information was required by IRORG, a number of additional information requests were made in writing and responses were provided either in writing and/or by videoconference presentations.

Matters referred to BOC for advice, information or determination [O&O cl 13]

Clause 13 is a general descriptive clause, not requiring assessment. Clause 13 states that the Authority must refer to BOC for determination, after first seeking the advice of RMOC on any decision that the Authority proposes to make in relation to river operations that has the potential to have a material effect on a State water entitlement. This is a general clause covered by the more detailed requirements of clauses 14, 15 and 16.

Matters referred to BOC [O&O cl 14]

Under clause 14, the Authority must refer to the BOC for determination, after first seeking the advice of RMOC, matters arising from the following circumstances:

- a) Insufficient channel capacity if it is likely to result in either insufficient water for downstream orders for water, or downstream channel capacity being exceeded if all downstream orders for water are met.

- b) Reduction in water allocations within a State if such an adjustment is likely to require a State to reduce the volume of allocations it has previously announced.
- c) Matters referred to BOC by the Authority when it has received notification from two or more members of BOC re matters not covered by the O&O document, and that the matter has the potential to have a material effect on a State water entitlement.

At BOC Meeting No. 76 on 29 September 2020, and again via an out-of-session paper dated 2 December 2020, a determination was sought from BOC on the approach to manage a possible shortfall with associated impacts on states' water entitlements. In both cases BOC declined to make a decision to limit the rate of call out of the Goulburn IVT. This matter is discussed further in Section 7.3 of this report.

BOC and the Ministerial Council were not informed of the likelihood of failing to meet the end-of-year target storage of 350 GL at Lake Victoria. This matter also is dealt with in Section 7.2 of this report.

Other matters referred to BOC [O&O cl 15]

Clause 15 states that the Authority must refer to BOC for determination, after first seeking the advice of the RMOC, any matter that:

- a) is not dealt with in, or is inconsistent with, a specific objective, a specific outcome or with any other provision of the O&O document; or
- b) two or more members of WLWG consider may have the potential to have a material effect on any State water entitlement because a determination relating to that matter may require a State to reduce the volume of allocations it has previously announced as being available to water entitlement holders in that water year.

Also, if the Authority considers that any of the following events is reasonably likely to occur, it must notify the WLWG as soon as practicable:

- c) Special accounting, where the Authority declares or terminates a period of special accounting pursuant to clauses 123 or 129 of the Agreement.
- d) Direction about a valley account, where the Authority gives, amends or cancels a direction about water standing to the credit of a valley account pursuant to sub-clause 11(4) of Schedule D of the Agreement.
- e) Unregulated flows, as defined in sub-clause 15(2)(c) of the O&O; including notifying the Chair of SCBEWC.
- f) Variation of monthly quantities for SA, where the Authority varies any monthly quantity which South Australia is otherwise entitled to receive, pursuant to clause 90 of the Agreement.
- g) Change in the Authority's ability to direct releases from Menindee Lakes.
- h) Internal spill within the meaning of clause 116 of the Agreement.

IRORG has been advised that a range of notifications were made in accordance with clause 15, including matters relating to:

- Special accounting, including the impact of NSW leaving special accounting.
- The Authority's intention to request the delivery of IVT.

- The unregulated flow which occurred from 27 June until 25 September 2020 (the Chair of the SCBEWC was also so advised).
- The Authority's access to Menindee Lakes from 7 May 2021.
- Internal spills at Lake Victoria which occurred during October and November 2020 totalling 65 GL from Victoria to NSW.

Matters which need not be referred to BOC if the Authority seeks the advice of the WLWG [O&O cl 16]

Clause 16 of the O&O document requires the Authority to notify WLWG when it proposes to exercise a function relating to river operations which might be regarded as being of particular significance, and to consider any relevant advice from WLWG.

The MDBA advised IRORG that there were no significant operational activities or exercise of its functions which it considered a Southern Basin State might regard as being of "particular significance", and therefore no notifications to WLWG were required under this clause.

Noting concerns raised in submissions from two jurisdictions, IRORG is aware of calls for consumptive water releases during environmental water delivery events with the former taking precedence over the latter. Examples were provided: operational deliveries from Hume in November 2020 and May 2021, and an increased call-out of IVT water also in May 2021. IRORG concludes that these events may have warranted a referral for advice from WLWG.

While the prioritising of operational water over environmental demands is an important issue yet to be resolved, timely referral and advice to WLWG of significant events is clearly required by clause 16.

Providing relevant information [O&O cl 18]

When it refers matters to WLWG, RMOC or BOC, the MDBA is required to give those bodies all information available to the Authority that is relevant to the matter referred, together with any further information sought.

In 2020-21, despite some lapses in communications, IRORG found no evidence from jurisdictions that the Authority had intentionally not provided full information to advisers and decision-makers.

Review and Revision [O&O cl 19]

BOC is obliged to review the operation of the Objectives and Outcomes document at least annually, and to have regard for IRORG's report as part of its review of the O&O document operation. BOC reviewed the O&O document in June 2020 and determined that no changes were required at that time. A further review was undertaken in April 2021 and a number of amendments were approved, which will take effect from 1 June 2021. These changes will apply to river operations activities during the 2021-22 water year.

7 Issues relevant to the General and Specific O&Os

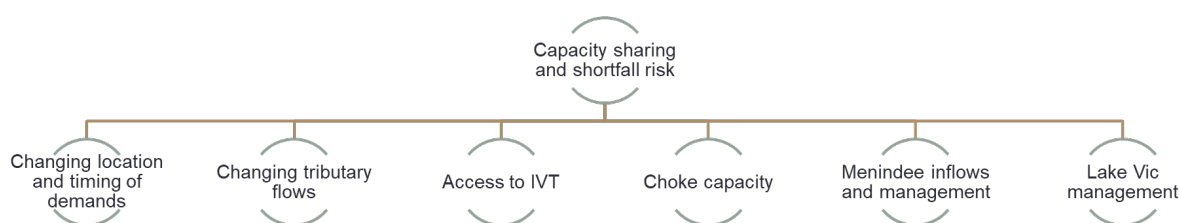
In the course of its 2020-21 review of river operations, IRORG has identified a number of opportunities for improvements to current operating arrangements. These are discussed below, with a cross reference to the General O&O (GO&O) or Specific O&O (SO&O) that each issue relates to.

7.1 Capacity sharing and shortfall risks [GO&O 4(2)(b)(iii)]

Capacity sharing and shortfall risks have been the subject of significant attention in previous IRORG reviews. It continues to be a very high priority issue for all States and there is strong support for the work done to date by the MDBA and the Independent Panel for Capacity Project Review (IPCPR). The development of a River Murray shortfall response plan in 2020-21 provides an important toolkit to guide actions in responding to shortfall risks.

One of the defining features of the capacity sharing and shortfall risks issue is that it is the overall umbrella issue that integrates and brings into sharp focus the impacts of a range of different issues across the system (refer Figure 3).

Figure 3: Capacity and shortfall risk issues



IRORG has specifically considered a number of the sub-elements of the overall shortfall risk dimension in subsequent sections of this report. Given that there is a dedicated project with high levels of expertise already addressing the overall capacity sharing and shortfall issue, it is unnecessary for IRORG to make any specific recommendations on this matter; however, the following observations are provided in recognition of the need to continue to progress this important issue.

- The search for solutions to shortfall risks is complex and potential solutions could include costly infrastructure options. It is therefore of some concern that there appears to have been limited/uneven action to address one of the potential causes of future increases in summer demands for water – expanding horticultural plantings in the lower Murray. IRORG is of the view that, in the absence of clear limits on maximum extraction rates from this reach, any

options which reduce shortfall risks may merely encourage further development until shortfall risks again reach intolerable levels. Jurisdictions are urged to take consistent, aligned action to limit overall increases in extraction that are likely to contribute to increased demands in peak summer periods.

- It is also noted that in 2020-21, river operators requested environmental water managers to agree to delay delivery to SA of previously approved environmental water orders, in order to reduce shortfall risks. Environmental water managers were able to accommodate this request in 2020-21 without compromising overall environment outcomes. This may not always be the case, highlighting the need to continue to push for sustainable solutions to capacity sharing and shortfall risks for consumptive and environmental water demands.
- In 2020, IRORG recommended that the MDBA consider adopting a more quantitative risk assessment approach to provide improved clarity and assist in making complex river operations trade-off decisions. IRORG was briefed on actions underway by the IPCPR to develop principles to guide decision making on shortfall issues. We are optimistic that these principles will support efforts for improved quantification of risks and trade-offs in river operations, whilst also reducing the time and transactional activity required to make sound decisions.
- Shortfall risks have arisen in response to a range of changes in system demands, delivery capacities and water availability. As system operations respond and adapt to these changes, there is potential for these changes to have implications for water users in other parts of the River Murray system. Development of solutions and day-to-day operational planning will need to take a “whole of system” approach and have regard for these issues, to ensure that in solving the shortfall issues we don’t create new problems elsewhere.
- As noted previously, there is a need for continued focus on this problem and a degree of urgency to find solutions, as it will take time to generate an enduring consensus around the best solution(s). States should recognise that development of solutions will require access to their expertise and will also require focussed attention and support from BOC.

7.2 Lake Victoria management [GO&O 4(2)(b)(iii), SO&O 12.5]

Lake Victoria plays a vital role in the lower Murray region. It can be used to harvest tributary inflows entering the Murray downstream of Lake Hume to boost available resources. It also plays an important role in being able to release water directly into the lower Murray to rapidly respond to changing water needs and to help ensure peak demands can be met over critical periods.

Maintaining sufficient water in Lake Victoria to supplement supplies during peak demand periods is critical to minimising risks of shortfall, but this also needs to be balanced against the chance of ending the irrigation season with more water than required in Lake Victoria and potentially foregoing important harvesting opportunities during the following winter/spring. Managing Lake Victoria requires careful balancing of a number of competing objectives, including compliance with the Lake Victoria Operating Strategy to protect cultural heritage values.

RMO staff direct a significant amount of effort into developing operating plans and strategies for transfer of water from upper Murray storages to Lake Victoria and seeking to balance these

competing objectives and to works within the available capacities of the connected southern basin system. In 2020-21, the MDBA produced fortnightly updates on the Lake Victoria storage outlook and operations planning to keep WLWG members informed on these issues.

Clause 103 of the MDB Agreement sets out the requirements for minimum water reserves that need to be held across the system as at the end of May. The first 250 GL of reserves must be held in Lake Victoria, unless the Ministerial Council determines otherwise. Allowing for dead storage, this equates to an end of May target level of 350 GL to be held in Lake Victoria. These requirements are also reflected in the provisions of SO&O 12.5.

In 2021, the MDBA did not meet the required end of May level in Lake Victoria. It is also noted that the target has not been met for some years prior for a range of reasons, although in these prior years approval to vary the target was obtained.

On 31 May 2021, Lake Victoria held 289 GL, some 61 GL below the target level. The storage reached the target level of 350 GL, 17 days later (i.e. on 17 June 2021). This matter was discussed extensively at WLWG, but BOC was not advised of this possibility and approval to vary the end of May target level was not sought from the Ministerial Council.

IRORG has reviewed the circumstances surrounding Lake Victoria water level management late in the 2020-21 water year. The key relevant issues were:

- The MDBA had developed and was implementing sound operational plans based around achieving the end of May target levels in Lake Victoria.
- Rain in March boosted inflows and releases from upstream storages were reduced to conserve water.
- In mid-April, drying conditions led to high late season demands and increased losses, reducing flows reaching Lake Victoria. It became clear that additional sources of supply needed to be found in order to meet the target.
- A range of possible options were canvassed:
 - Additional water was called out from IVT accounts, noting that this had some flow-on impacts in relation to reducing environmental water deliveries that were in progress in the Goulburn system in order to avoid impacts on the lower Goulburn River. This impacted on environmental return flows that could be delivered to downstream sites in the River Murray.
 - Calling additional water from Lake Hume was not favoured in order to maximise water conservation, and sufficient additional releases may not have reached Lake Victoria before the end of May due to river travel times.
 - There was potential for some additional spills and unregulated flows from the upper Murrumbidgee storages; however, timing of their arrival at Lake Victoria was uncertain and was likely to be too late to achieve the end of May target.
 - Water was flowing into the Menindee Lakes; however, accurately forecasting the losses and travel time for Darling River flows upstream of Menindee is difficult. There was uncertainty as to when control of this storage would revert to the MDBA and therefore when releases could be called on.
 - There were also a number of concerns in relation to environmental issues and water security that needed to be worked through with the local community as part of

initiating releases from Menindee Lakes to the Murray, which took time. By the time these matters were resolved, high rates of release would have been required to deliver sufficient water by 31 May, which could not all have been re-harvested at Lake Victoria, resulting in loss of resource.

- Other possible short term water borrowing and repayment options were canvassed, but agreement couldn't be reached between NSW and Victoria in time for this option to be implemented.
- The MDBA found itself somewhat “jammed”, with no alternative water sources available that could be guaranteed to reach Lake Victoria in time to meet the end of May target, but was confident that the storage target would be met within weeks of the 31 May 2021. Once the local issues at Menindee Lakes were worked through, water was called out and the target level was reached 2½ weeks late on 17 June.

These experiences late in the water year raised two key issues for IRORG's consideration; water management issues, and governance and decision making processes. These are discussed below.

Lake Victoria water management issues

In relation to water management, all states acknowledged the difficulties and competing objectives that the MDBA faced in trying to meet the Lake Victoria target level, whilst also seeking to maximise the harvesting and conservation of water and dealing with considerable uncertainty in assessing options for additional inputs to the lake.

In recognition of the changes in water demands and the risks of shortfall etc., jurisdictions were also supportive of a review of the operation of Lake Victoria. The rigidity of the end of May target level is an obvious issue, and the experience in 2021 highlighted that some greater flexibility in the specification of the target may support better outcomes for all parties. Suggestions that are worthy of further consideration included:

- Establishing a time window and/or an acceptable bandwidth of levels to target.
- A risk based decision framework that seeks to assess the risks associated with a flexible range of end of water year reserves in storages, allowing for the scenario which offers the greatest opportunity/lowest risk outcome to be selected. For example, lower target levels might be adopted when the Bureau of Meteorology seasonal climate outlook indicated a high likelihood of future harvesting opportunities.

The current end of May target level for Lake Victoria was established in 1948 and has remained unchanged since then. This raises the question – do the issues and rationale that led to the adoption of this target level 73 years ago still apply?

The significant changes in climate, inflows to the river system and changes in the location and timing of consumptive and environmental water demands suggest that history is unlikely to be a good guide to the optimal future management of Lake Victoria.

IRORG has previously advocated for a substantial review of the operational strategies for management of Lake Victoria, not just a limited review of end of May targets. Pleasingly, the MDBA has initiated Phase 1 of a review of Lake Victoria operations, seeking to better identify and quantify

all the drivers of change impacting on the lake. Jurisdictions are strongly encouraged to support this review and ensure priority is given to pursuing subsequent phases.

Governance and decision making processes

The efforts of the MDBA and jurisdictions to seek to balance competing objectives and achieve the best possible outcomes in managing Lake Victoria are commendable. Despite these good intentions, some jurisdictions felt they were not adequately consulted on some of the options being pursued and given the time constraints being faced in trying to resolve this issue late in the water year, this is not entirely surprising. Ultimately the 31 May storage target was not able to be achieved.

IRORG believes that there are a number of important lessons to be gained from this experience in relation to decision making and governance:

- Regardless of the good intentions driving their efforts, the MDBA must comply with the requirements of the MDBA Agreement and the O&O document. Where these requirements or targets cannot be met, the Authority should provide timely advice to BOC and/or the Ministerial Council, and where possible to seek the necessary approvals.
- This may mean that in some situations, options may need to be more constrained or opportunities for better outcomes may not be able to be pursued due to limitations on time and the lead time required to advise governing bodies of conflicts between objectives or to seek approval to vary a target. Jurisdictions will need to decide whether their dissatisfaction with the status-quo is sufficient to provide the necessary incentive to review current arrangements and codify more suitable ones in the O&Os or Agreement. IRORG supports a review of current arrangements.
- Delegation of authority for some decisions on river operations from the Ministerial Council to BOC may offer more responsive decision making in a limited number of areas, but this is unlikely to be fully effective unless the underlying issues are properly reviewed and more enduring, fit-for-purpose decision making guidance is agreed to by all parties.
- The MDBA is extremely conscious of the need to keep all parties adequately informed on deliberations about river operations, but there have been recent lapses. This can be time consuming and may be somewhat at odds with flexibility, responsive decisions making; however, transparency, effective sharing of information and full participation by all parties in contested issues are essential to the success of the joint venture between the jurisdictions to manage the River Murray system.

7.3 Goulburn IVT management [GO&O 4(2)(b)(iii)]

In 2019-20, IRORG reported on challenges associated with management of the Goulburn IVT call out. The 2020-21 water year presented similar challenges, following a further request from Victoria to aim to limit summer/autumn flows in the lower Goulburn River to prevent environmental damage.

There was some concern that dry conditions could lead to significant water demands in the lower Murray, with real risks that there would be a shortfall in meeting this demand if the Goulburn IVT callout was limited to the requested maximum of 40 GL/month over the summer/autumn. In

December 2020 the MDBA sought a determination from BOC to either endorse the proposed approach to managing system operations including planning to limit the rate of Goulburn IVT call out, or to advise on any required changes to the proposed approach. One of the key aspects associated with this issue, where consensus had not been able to be reached in WLWG, was the allocation of risk for any physical or internal spills within Lake Victoria that may occur if IVT water was transferred there in late spring ahead of summer peak demands (i.e. should the risk be treated as a shared system wide risk issue or be borne solely by Victoria).

BOC did not make a determination on this issue. The MDBA was in fact able to limit its call on the Goulburn IVT as per the Victorian Government request with no material impact on water resources or increased shortfall risk across the year. During 2020-21, the Victorian government also consulted widely on proposed changes to Goulburn to Murray trade rules to apply limits to the total volume of trade that could be delivered to the Murray within a flow regime that would limit the risk of unacceptable environmental impacts on the lower Goulburn River. It is expected that in future this rule change should reduce the challenges in calling out IVT water and avoid damage to the environment.

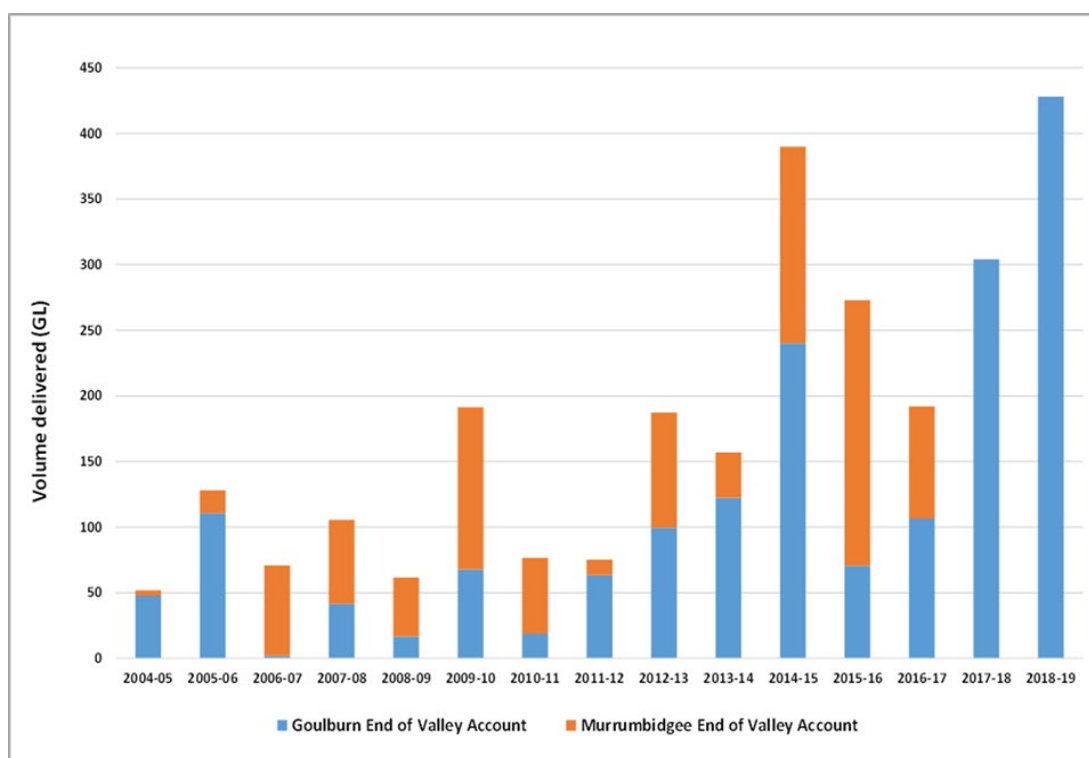
After consideration of a range of perspectives on this issue, and noting it is also intimately linked to wider consideration of shortfall risk mitigation, IRORG makes the following observations.

- In the discussion of options around this issue, under the provisions of the MDB Agreement, if no agreement could be reached to operate in accordance with the requested Victorian flow limits, the MDBA would have to revert to “prior practice”. This was characterised as calling out water from the Goulburn IVT as required to reduce the risk of shortfall, including at rates higher than 40 GL/month.

When considering these types of water management issues, context matters. While prior practice may have been to call out water as required to reduce shortfall risk, this was in the context of total deliveries from the Goulburn IVT typically not exceeding 100 GL/year (see Figure 4). With these limited overall volumes of IVT callout, extended periods of high summer flows were not the norm and riparian vegetation and instream habitats had opportunities for recovery.

Established prior practice up to 2016-17 did not contemplate delivering volumes in the range of 300 – 425 GL/year, which required extended periods of high summer flow and resulted in significant environmental damage. Labelling this recent damaging operation as “prior practice” is probably not appropriate.

Figure 4: Tributary IVT account deliveries to the Murray system



- In relation to the question of risk allocation, one jurisdiction suggested that since Victoria was requesting this flow limit then it should bear all the risk of any possible adverse impacts (which could presumably include spills or shortfalls). Some relevant observations include:
 - Other restrictions on system capacity have been accepted as shared problems without questions around risk allocation. Examples include the decreased capacity of Barmah Choke, which has been readily accepted and operations adjusted accordingly. IRORG is also aware of long-standing limits on flow rates for callout of Murrumbidgee IVT to avoid operational and safety issues along the river.
 - Consideration of beneficiaries of IVT callout may also be relevant to risk allocation discussions. IVT callouts are used to meet the water demands of all users across all jurisdictions, and the water in IVT accounts includes water traded to multiple jurisdictions. If IVT callouts create shared benefits, it may be reasonable to share the “cost” of mitigations needed to address any impacts.
 - An important question about risk allocation could be: - are the proposed limits based on sound evidence and best scientific advice, and are they proportionate to the observed or expected impacts that they seek to mitigate? IRORG has been well briefed on the clear evidence of the basis for the proposed Goulburn IVT limits. We note that the limits were widely consulted on as part of the Regulatory Impact Statement process required before changes to the Victorian trade rules could be approved.
 - There are wide ranging requirements under the Basin Plan and the Water Act 2007 for all parties to prepare plans and to manage flows which support the achievement of multiple objectives, including the environmental protection of Basin rivers. IVT callouts at rates that are highly likely to damage the lower Goulburn environment

are at odds with these requirements. Schedule D of the MDB Agreement provides guidance on the administration of and water accounting for transfer of water entitlements and allocations between valleys. This Schedule obliges the jurisdiction to act consistently with the Basin Plan in managing intervalley transfers, and also provides for limits on intervalley transfers in situations where “the use or management of water comprised in entitlements or allocations transferred under this Schedule have increased or accelerated environmental degradation”. The environmentally sustainable flow limits for the River Murray system and its regulated tributaries need to be understood and should be respected in operational management of these rivers.

IRORG is of the view that this issue is most effectively addressed as part of a suite of inter-related issues including capacity sharing and shortfall risks. Importantly this requires a whole of southern-connected basin perspective to obtain consensus on this issue.

7.4 Adapting system operations [GO&O 4(2), O&O cl 10]

IRORG has previously recommended that the MDBA should challenge its existing assumptions and operational norms to come up with a defensible approach to managing the system in response to a changing climate. The issues that were flagged included:

- Updated inflow statistics to better reflect current climate conditions.
- Developing an improved understanding of changes to intra-seasonal rainfall and inflow patterns, and the implications for system operations.
- Risk assessments and probability-based decisions on transfers and release planning.
- Likely future access to water from the Menindee Lakes and the implications this may have for meeting peak demands in the lower Murray River.
- Future patterns of consumptive and environmental demands.

In 2020-21, the MDBA made good progress on the development of an organisation-wide Climate Adaptation Strategy. This strategy also includes a specific section focussing in on the climate change adaptation actions that will be required for river operations and assets.

Jurisdictions are also keen for the MDBA to be able to develop and rapidly assess a wider range of possible scenarios, and to quantify and compare the outcomes and risks associated with different options for system operations. The proposed actions under the MDBA Climate Adaptation Strategy will deliver this capability.

IRORG strongly supports these efforts by the MDBA in relation to operational adaptation to climate change. One of the key enabling capabilities needed to deliver many of the identified actions is the implementation of the Source model to support river operations. This modelling platform will provide the advanced tools and computational capabilities needed to rapidly assess future water demands, apply improved streamflow forecasting techniques and compare alternate operating plans. Implementing this step change in operational planning capabilities requires committed resourcing.

Jurisdictions are encouraged to ensure that this project continues to be allocated sufficient priority and resources to deliver this important tool as soon as possible.

7.5 Water quality issues [GO&O4 (4) (b) (iii)]

The Summary of River Operations report provides detail on the MDBA's efforts to respond to and mitigate poor water quality in Lake Hume, caused by inflows carrying bushfire contaminants from the January 2020 fires into the reservoir.

The MDBA did excellent work in this area and has proposed expanding monitoring to improve detection of these water quality issues. Given the predicted changes to bushfire and extreme weather risks arising from climate change, these types of water quality events are likely to become more frequent in future.

Although the MDBA responded promptly, the process was resource intensive and required interactions with a range of water users, including urban water supply authorities that are not part of the routine water management stakeholders that the MDBA deals with on a day-to-day basis. If this sort of response is to become part of business as usual it would seem sensible to build on existing response and co-ordination processes wherever possible, rather than duplicate them.

IRORG **recommends** that the MDBA and jurisdictions should consider whether a wider range of water quality response actions can be brought under a coordination framework, such as existing well-developed regional Blue Green Algae co-ordination arrangements, to provide integrated response capabilities to adverse water quality events.

7.6 Decision making and governance processes

During the 2020-21 review, a number of concerns were raised by jurisdictions in relation to governance processes and information sharing associated with some of the complex and contested water management decisions that were required during the water year.

Some jurisdictions didn't feel that they were adequately briefed or informed about some negotiations and decisions. Key examples cited included late season management of Lake Victoria (detailed above), and decision making about timing of releases from Menindee Lakes once they returned to MDBA control in early May 2021. Incomplete information on the discussions and rationale for decision on these issues led to questions around how and to what extent all potentially affected interests were taken into account in the process of arriving at the final decision. There was also a strong desire to more clearly understand where decisions followed established guidelines or precedents or where they may have based on assessment of new information/issues.

IRORG has considered these concerns from a range of perspectives. The underlying drivers behind these concerns appear to include:

- Water management decisions are now more complex, and there is an appetite to explore more options.

- The conditions being experienced in relation to water demands, climate and sources of supply are now more dynamic and variable than was the case historically.
- Reduced water availability has driven a focus on improved efficiency and optimisation of our water systems. This has eroded much of the previously available resilience/buffer capacity, so that water systems are much more finely balanced and at higher risk of impact when disruptive events occur.
- Communities are now more highly informed and are seeking multiple benefits covering social, recreational, environmental, cultural and economic outcomes from water system operations.
- The simple, fixed rules for system operation which have served us well in the past may no longer meet the needs or challenges of the current and future uncertain and changing operating environment.

This creates a dilemma for the MDBA, as stakeholders seek more involvement in decisions that affect them, and are interested in more adaptive management, whilst the MDBA is required to comply with the provision of the Agreement and the O&Os. These instruments do not always provide adaptive and flexible decision making within a rapidly changing environment. There is a need to continue to evolve governance and decision making processes to meet these challenges. Some suggested approaches could include:

- Short term:
 - MDBA needs to ensure it continues to comply with existing requirements in the O&Os and the Agreement. This may mean less ability to respond flexibly or at short notice to issue or opportunities.
 - Develop agreed interim contemporary guidance for decision making on Lake Victoria and Menindee Lakes water management and seek endorsement from MinCo.
 - Governance and decision making processes should ensure there is a clear focus on:
 - Where authority for decisions lies
 - What the options were.
 - What the decision was and what the reasons for the decision were.
 - Informing all parties of progress and final outcomes
- Medium term:
 - There are opportunities to consider more responsive decision making, potentially including delegations from MinCo to BOC. The Claydon report of March 2019, and BOC's response in December 2019 are relevant to this and wider matters of governance.
 - There may be further opportunities to simplify and streamline the O&Os, and/or to include more conditional decision options rather than a fixed rule.
 - Both of these measures will require development of agreed decision making principles and improved guidance. The work of the IPCPR may provide a lead in this area.
- Longer term:
 - Review of the Agreement – this should be a strategic review that looks at the form and structure of an agreement that may be needed to meet future challenges.

Good governance is the foundation upon which trust and co-operation are built. While IRORG has not identified any serious governance issues in its current review, it is clear that there are continuing challenges.

There is a need to take a more strategic approach to simplifying and improving decision making and governance processes. Continuing to bolt-on additional prescriptions and requirements onto already complex governance process will only add to the cost and complexity and slow down the speed of decision making.

In the meantime, IRORG **recommends** that the MDBA should consider a limited review of its current processes for seeking advice and decisions from WLWG, RMOC and BOC to ensure continued compliance with the O&Os and to provide effective information sharing for all parties.

8 Conclusion

IRORG has reviewed the MDBA's performance in relation to compliance with the provisions of the O&O document across the 2020-21 water year.

The 2020-21 water year continued to challenge river operators. Weather conditions were highly variable across the year, resulting in significant variations in water demands and inflows across the year.

IRORG's overall assessment is that the MDBA performed well throughout the water year, and all jurisdictions endorsed this position.

IRORG considers that the general objectives for: Water storage and delivery accounting; RMO assets; People and communities; and Environment were all achieved in 2020-21. A number of the intended outcomes of the Communications and information management category were not fully achieved and IRORG has therefore assigned a qualified achievement rating to this general objective for 2020-21.

The two outcomes that received qualified achievement ratings were as a result of:

- The MDBA's failure to provide timely advice to the Basin Officials Committee and Ministerial Council that the Lake Victoria target level could not be achieved by the end of May deadline.
- The lack of formal assurance from all jurisdictions around methods and data quality providing hydrometric monitoring services to the MDBA. There has been progress in this area, with one jurisdiction moving to provide formal quality assurance during 2020-21, however there are still some jurisdictions that have not provided evidence of suitable quality assurance.

The Authority performed well in delivery against the specific objectives and outcomes in 2020-21. In total, 98% of the SO&Os were fully achieved, with the one area of qualified achievement related to the failure to provide timely advice that the end of May target level in Lake Victoria would not be achieved. The shortfall compared to the 31 May 2021 target was relatively modest (~ 60 GL) and the target level was reached on 17 June 2021.

IRORG also believes that the Authority has generally complied with range of provisions in the O&O document that set out procedural arrangements to support and enable delivery of outcomes in the general and specific O&Os.

The MDBA also undertook a range of projects to address issues and improve river operations performance in 2020-21. It developed a River Management Transparency Plan, which aims to provide improved information to stakeholders on how the River Murray is operated. The continuing work of the MDBA's Environmental Water Improvement Group was also commended by jurisdictions.

The operation of a water system as large and as complex as the River Murray system inevitably presents a range of challenging issues for operators. IRORG has identified and commented on a range

of these issues in this review and made two recommendations to support continuous improvement in performance. These issues include the following matters⁸:

- Capacity sharing and shortfall risks have been the subject of significant attention in previous IRORG reviews. It continues to be a very high priority issue for all States and there is strong support for the work done to date by the MDBA and the Independent Panel for Capacity Project Review.

While a delivery shortfall was avoided in 2020-21, the risks of a shortfall remained high during the peak demand periods over summer. The cooperation of environmental water managers in agreeing to delay delivery of previously approved environmental water orders helped to reduce these risks, but this opportunity cannot always be guaranteed.

It is also of some concern that there appears to have been limited/uneven action to address one of the potential causes of future increases in summer demands for— expanding horticultural plantings in the lower Murray.

The development of a River Murray shortfall response plan in 2020-21 provides an important toolkit to guide actions in responding to shortfall risks. IRORG urges continued focus on this problem and a degree of urgency to find solutions, as it will take time to generate an enduring consensus around the best solution(s).

- Lake Victoria plays a vital role in managing the lower Murray and delivering state water orders. The 2020-21 water year highlighted the challenges in meeting long standing fixed targets for operation of this storage in the face of changing demands for water under a changing climate.

The MDBA has initiated Phase 1 of a review of Lake Victoria operations, seeking to better identify and quantify all the drivers of change impacting on the lake. In response to the challenges experienced in meeting the end of May target level in Lake Victoria, whilst also seeking to conserve water in upper storages, a number of suggestions were identified for more flexible and adaptive approaches to lake target levels.

IRORG supports these efforts. However, until there is any agreement to changes to operational procedures, the MDBA must comply with the current requirements of the MDB Agreement and the O&O document. IRORG commends the MDBA for having initiated Phase 1 as a first step in a review of Lake Victoria operations.

- In 2019-20, IRORG reported on challenges associated with management of the Goulburn IVT call out. The 2020-21 water year presented similar challenges, following a further request from Victoria to aim to limit summer/autumn flows in the lower Goulburn River to prevent environmental damage.

Ultimately, the MDBA was able to manage Goulburn IVT callout in line with the requested limits, but the differing views across jurisdictions on this matter highlights the need for

⁸ Where a recommendation has been made, the number in brackets is the recommendation number assigned to each recommendation for future reference.

further work to develop principles to guide decision making on shortfall issues. The environmentally sustainable flow limits for the River Murray system and its regulated tributaries need to be understood and should be respected in operational management of these rivers.

- IRORG has previously recommended that the MDBA should challenge its existing assumptions and operational norms to come up with a defensible approach to managing the system in response to a changing climate. In 2020-21, the MDBA made good progress on the development of an organisation-wide Climate Adaptation Strategy, which also includes a specific section focussing in on the climate change adaptation actions that will be required for river operations and assets.
- The MDBA experienced challenges with poor water quality in Lake Hume, caused by inflows carrying bushfire contaminants from the January 2020 fires into the reservoir.

The MDBA responded well; however, the process was resource intensive and required interactions with a range of water users, including urban water supply authorities that are not part of the routine MDBA water management stakeholder activities.

Given the predicted changes to bushfire and extreme weather risks arising from climate change, these types of water quality events are likely to become more frequent in future. IRORG **recommends** that the MDBA and jurisdictions should consider whether a wider range of water quality response actions can be brought under a coordination framework, such as existing well-developed regional Blue Green Algae co-ordination arrangements, to provide integrated response capabilities to adverse water quality events (2021.01).

- A number of concerns were raised by jurisdictions in relation to governance processes and information sharing associated with some of the complex and contested water management decisions that were required during the water year. There is a need to continue to evolve governance and decision making processes to meet these challenges.

In the short term, IRORG **recommends** that the MDBA should consider a limited review of its current processes for seeking advice and decisions from WLWG, RMOC and BOC to ensure continued compliance with the O&Os and to provide effective information sharing for all parties (2021.02)



The Independent River Operations Review Group – an advisory committee established by, and reporting to, the Murray-Darling Basin Authority