



Assessment of the salt export objective and salinity targets for flow management 2021–22

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The guidance and support received from the Murray Lower Darling Rivers Indigenous Nations, the Northern Basin Aboriginal Nations and our many Traditional Owner friends and colleagues is very much valued and appreciated.

Aboriginal people should be aware that this publication may contain images, names or quotations of deceased persons.

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Basin salinity management

Salinity management across the Murray–Darling Basin is a significant challenge with a range of strategic intervention measures implemented to manage the ongoing salinity problem. Since 1988, Basin Governments have implemented 3 consecutive strategies to manage salinity, the most recent strategy being <u>Basin Salinity Management 2030</u>. If not managed well, salinity poses an ongoing threat with risks to the Basin's land and water resources. While salt occurs naturally in the Basin's landscape, activities such as irrigation development and land clearing can cause salts to concentrate in certain places presenting management challenges and impacting agricultural production and, in some cases, potable water supplies, particularly during extreme low flow periods.

Water flowing through the River Murray system and out to the Southern Ocean through the Murray Mouth is the main natural process by which salt can be completely exported from the Basin, whereas salt interception schemes divert saline groundwater away from the river to disposal basins. To maintain good salinity levels in the River Murray system, the Basin Plan includes an objective to flush out salt through the Murray Mouth and there are also salinity targets for flow management at 5 reporting sites. The flushing is augmented by the delivery of environmental water recovered under the Basin Plan as it frequently increases end of system flows compared to a pre-Basin Plan scenario where end of system flow volumes were less.

This environmental water is particularly important during dry years under regulated flow conditions as in some circumstances there would be little-to-no end of system flows and salt would accumulate in the Lower Murray system until flow conditions improved. The minimum annual discharge through the barrages required to achieve (95% of the time) a salinity target of <1,000 EC in Lake Alexandrina is a minimum of 650 gigalitres (GL) in any year to be achieved for 95% of years. Provision of this 650 GL flow also provides many additional benefits to the River Murray system when enroute to South Australia and may be provided in the form of return flows from other watering actions and directed releases from the headwater storages to meet a demand at the South Australian border. Delivery can come from a range of different storages throughout the southern Murray–Darling Basin. Additional complementary benefits include outcomes in the Ramsar Convention listed Coorong, including facilitating fish passage, salinity management in the Coorong (both the north and to a lesser extent the south lagoon), reducing the rate of sand ingress inside the Murray Mouth and the transport of nutrients for estuarine ecosystem support and functioning.

When unregulated flows occur, they also provide an opportunity for the mass export of salt and nutrients from the River Murray system through the flushing of floodplains and drainage disposal basins further increasing the salt export out into the Southern Ocean. The salt drainage basis are located within the floodplain corridor and not in the highland areas such as Stockyard Plains and Noora evaporation basin.

Salt export objective

The Basin Plan includes a salt export objective which aims to ensure adequate flushing of salt from the River Murray system. Achievement of the salt export objective is assessed each year by the

MDBA.¹ Note the methodology relating to the calculation of salt export is being reviewed in 2022–23 and a new approach may be adopted.

Over the 3-year assessment period from July 2019 to June 2022, the annualised rate of salt export at the barrages was 0.98 million tonnes per year (Figure 1). This is less than the Basin Plan's indicative figure of 2 million tonnes per year. However, in 2021–22 due to higher flows the estimated amount of salt exported was 1.98 million tonnes (Figure 1). The amount of salt exported is a function of flow over the barrages and over the last year this was assisted by unregulated flows in addition to the delivery of environmental water. The total flow across the South Australian border was approximately 9,090 GL in 2021–22, which is well above the normal regulated entitlement flow of 1,850 GL plus environmental water flows which can be on average up to 1,000 GL per year.

Flushing salt from the river system helps reduce salt accumulation and adverse impacts on water users. Flushing salt also supports healthy river and floodplain ecosystems including the environment of the Coorong. Salt interacts with in-stream biota (animals and plants), changing the ecological health of streams and estuaries and builds resilience coming into droughts and low flow periods when flushing opportunities may be reduced.

Generally, more salt is flushed out to the Southern Ocean during higher flow years and less in lower flow years. Provision of environmental water in dry years is the primary driver of barrage flows. The level of salt flushing in a year is also impacted by river regulation, irrigation diversions and current levels of development, including salt interception works. Due to low inflows into the River Murray system between 2018–2020, it was not possible to export 2 million tonnes of salt per year as an average over the period from July 2018 to June 2021, despite the additional flows provided to mimic natural flow patterns using water for the environment under the Basin Plan.

The achievement of the salt export objective should therefore be viewed in the wider context of overall salinity management, including all the measures implemented in the Basin over the last 3 decades.

While it is anticipated that the increased environmental flows resulting from the Basin Plan will assist to flush salts from the Basin and particularly the River Murray system over time, it will still be difficult to export salt during dry times when water availability and river flows are low.

As recommended in the 2017 Basin Plan Evaluation, the 2020 review of water quality and salinity targets in the Basin Plan examined the appropriateness of the indicative figure of 2 million tonnes as an indicator of adequate flushing of salt from the river system in the context of a variable climate. The review found that the salt export objective was not effective and recommended that the objective be improved ahead of the 2026 review of the Basin Plan. A review is also supported by the Productivity Commission. Options to improve the salt export objective will be considered as part of a review commencing in 2022–23.

¹ A detailed description of the methodology is provided in the following report: <u>MDBA 2013, Approach for</u> <u>estimating salt export from the River Murray System to the Southern Ocean, Murray–Darling Basin Authority,</u> <u>Technical Report 2013/09</u>.



Figure 1 Salt loads at key locations in the Murray–Darling Basin

Variable	2019–20 (million tonnes/year)	2020–21 (million tonnes/year)	2021–22 (million tonnes/year)
Salt diverted away from the river and adjacent landscapes through operation of SIS	0.47	0.45	0.37
Estimated salt export over the lower lake barrages (annualised average over the 3 preceding years)	0.43	0.47	0.98

Table 1 Estimated salt export over the barrages and salt diverted away from the river system by salt interception schemes

Salinity targets for flow management

The Basin Plan also includes salinity targets for flow management (operational targets) at 5 reporting sites between Burtundy (Lower Darling River) and Milang at Lake Alexandrina. These targets seek to ensure River Murray water is suitable for drinking, agriculture, recreation and the environment.

Salinity levels will vary significantly between years and are linked to both flow conditions at the reporting site and upstream conditions. For example, low to no flow periods on the Lower Darling River can result in elevated salinity levels at Burtundy due to the absence of suitable flushing events to mobilise salt from the Lower Darling River.

Similarly, salt can accumulate in Lake Alexandrina when sufficient water isn't flowing down the River Murray and into the Coorong during hot-dry and low water availability years. The ability to discharge into the Coorong is also impacted by the downstream water levels and during elevated water events (often driven by a combination of wind and high tides) the barrages can be closed to partially mitigate the upstream estuarine intrusion.

Salinity levels at the 5 reporting sites listed in the Water Quality and Salinity Management Plan of the Basin Plan in *Section 9.14 Targets for managing water flows* (Lock 6, Morgan, Murray Bridge, Milang and Burtundy) were monitored continuously over the 5-year reporting period (2017–2022). The targets are deemed to have been met if the percentage of days above the target is less than 5%, or the salinity has been below the target 95% of the time.

Over the reporting period (July 2017 to June 2022), the assessment indicates the targets have been met at 3 of the 5 reporting sites, being Lock 6, Morgan and Murray Bridge. The recorded salinity at the Burtundy site had finally fallen below the target value of 830 EC in 2021–22 due to reconnection flows from February to March 2020 in the Barwon-Darling River system providing a dilution benefit, however for the 5-year reporting period the target was exceeded for 13.3% of the time.

The salinity target for Burtundy was not achieved over the 5-year reporting period primarily due to the historically low inflows experienced for a number of years in the northern Murray–Darling Basin. This resulted in the Darling River (including the Lower Darling River) becoming a series of disconnected pools across 2018 –2020. Rainfall across the Northern Basin in March 2020 recommenced Darling River flows, with water reaching the River Murray on 14 April 2020. Over the 12-month period from 1 July 2021 to 30 June 2022, the peak salinity level recorded at Burtundy was 426 EC on 20 April 2022, coinciding with the arrival of flows above 13,000 ML/d and improved system connectivity and the movement of salt.

The salinity target for Milang in Lake Alexandrina is 1,000 EC. The target was not achieved over the 5-year reporting period as salinity levels were less than 1,016 EC for 95% of the time, which is slightly above the target. In the 12-month period from 1 July 2021 to 30 June 2022, recorded salinity levels at Milang peaked at 1,223 EC on 15 June 2022.

Salinity levels at Milang in 2021-22 exceeded the 1000 EC value for 11 days, therefore above the threshold for 3% of the year or 7.23% over the rolling 5-year period 2017–2022, or 121 days exceeding the value of 1000 EC. The Milang site is often influenced by reverse flows through and over the barrages from the Coorong with saline water intruding into Lake Alexandrina. The Department for Environment and Water instructs SA Water to leave barrages open at times allowing saltwater plumes to enter Lake Alexandrina, which provides for improved fish passage separate to the fishways. This action results in increased salinity levels inside Lake Alexandrina and depending on the local weather conditions can influence monitoring sites at significant distances from the barrages.

Table 2 Salinity levels at the reporting sites over the 5-year period from 1 July 2017 to 30 June 2022, compared to the target values in Basin Plan (Section 9.14)

Reporting site	Target value (EC*) (μS/cm)	Non-exceedance salinity at 95% of the time (µS/cm)**	% of days above the target value
River Murray at Murray Bridge	830	462	0
River Murray at Morgan	800	466	0
River Murray at Lock 6	580	261	0
Darling River downstream of Menindee Lakes at Burtundy	830	1,073	13.3
Lower Lakes at Milang	1,000	1,016	7.23

EC is an electrical conductivity unit commonly used to indicate salt concentration or the salinity of water.

As a guide, EC > 800 μ S/cm is marginal for drinking, EC > 1,600 μ S/cm is brackish, EC > 4,800 μ S/cm is saline.

** Salinity values are compiled from best available data (daily mean values derived from continuously logged data).

As recommended in the 2017 Basin Plan Evaluation, the 2020 review of the water quality and salinity targets in the Basin Plan examined the appropriateness of salinity targets, particularly at Burtundy and Milang. The review found that exceedance of the salinity target at Burtundy, and potential for future exceedance of the salinity target at Milang, warrants further detailed investigation to determine whether the target values represent an acceptable level of risk to Basin Plan objectives, and need to be redefined, and/or whether further management action is required to reduce salinity levels at these sites. Both of these sites are influenced by climate extremes and local operations. Any review will need to take such factors into account to provide a full picture of what is occurring at the target sites.

These findings will be considered by Basin governments and the Authority and may be progressed in line with, or as part of, the other findings and recommendations coming out of the 2025 Basin Plan Evaluation and other Basin Plan reviews.

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