

Technical information supporting the 2023 River Murray: salinity environmental trend and condition report card

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Acknowledgement of Country

We acknowledge and respect the Traditional Custodians whose ancestral lands we live and work upon and we pay our respects to their Elders past and present. We acknowledge and respect their deep spiritual connection and the relationship that Aboriginal and Torres Strait Islanders people have to Country. We also pay our respects to the cultural authority of Aboriginal and Torres Strait Islander people and their nations in South Australia, as well as those across Australia.

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Summary

The 2023 release of South Australia's environmental trend and condition report cards summarises our understanding of the current condition of the South Australian environment, and how it is changing over time.

This document describes the indicators, information sources, analysis methods and results used to develop this report and the associated 2023 River Murray: salinity report card. The reliability of information sources used in the report card is also described.

The River Murray: salinity report card sits within the report card Water theme and Surface water sub-theme. Report cards are published by the Department for Environment and Water and can be accessed at www.environment.sa.gov.au.

1 Introduction

1.1 Environmental trend and condition reporting in SA

The Minister for Climate, Environment and Water under the *Landscape South Australia Act 2019* is required to 'monitor, evaluate and audit the state and condition of the State's natural resources, coasts and seas; and to report on the state and condition of the State's natural resources, coasts and seas' (9(1(a-b))). Environmental trend and condition report cards are produced as the primary means for the Minister to undertake this reporting. Trend and condition report cards are also a key input into the State of the Environment Report for South Australia, which must be prepared under the *Environment Protection Act 1993*. This Act states that the State of the Environment Report must:

- include an assessment of the condition of the major environmental resources of South Australia (112(3(a))), and
- include a specific assessment of the state of the River Murray, especially taking into account the Objectives for a Healthy River Murray under the *River Murray Act 2003* (112(3(ab))), and
- identify significant trends in environmental quality based on an analysis of indicators of environmental quality (112(3(b))).

1.2 Purpose and benefits of SA's trend and condition report cards

South Australia's environmental trend and condition report cards focus on the state's priority environmental assets and the pressures that impact on these assets. The report cards present information on trend, condition, and information reliability in a succinct visual summary.

The full suite of report cards captures patterns in trend and condition, generally at a state scale, and gives insight to changes in a particular asset over time. They also highlight gaps in our knowledge on priority assets that prevent us from assessing trend and condition and might impede our ability to make evidence-based decisions.

Although both trend and condition are considered important, the report cards give particular emphasis to trend. Trend shows how the environment has responded to past drivers, decisions, and actions, and is what we seek to influence through future decisions and actions.

The benefits of trend and condition report cards include to:

- provide insight into our environment by tracking its change over time
- interpret complex information in a simple and accessible format
- provide a transparent and open evidence base for decision-making
- provide consistent messages on the trend and condition of the environment in South Australia
- highlight critical knowledge gaps in our understanding of South Australia's environment
- support alignment of environmental reporting, ensuring we 'do once, use many times'.

Environmental trend and condition report cards are designed to align with and inform state of the environment reporting at both the South Australian and national level. The format, design and accessibility of the report cards has been reviewed and improved with each release.

1.3 River Murray salinity

The River Murray is one of South Australia's most important natural resources. It provides water for most of the people in the state, as well as for a large proportion of the state's agriculture and industry. The River Murray also supports diverse ecosystems, and social and cultural values.

The Murray–Darling Basin, particularly in its southern parts, has a naturally salty landscape. Water in the Basin's river systems carries these salt contributions from the ground and surface water sources. Some salt in fresh water and soil is normal and can be tolerated by the plants and animals in the River Murray, but long periods of high salinity can harm the natural environment as well as crops, livestock, and infrastructure.

Salinity levels in the River Murray are influenced by natural salt-generating processes as well as human activities. River regulation and increased water extraction, in conjunction with the clearance of native vegetation and the development of agriculture across the Basin, has increased salinity levels in the River Murray.

Actions are being taken to try and reduce the effects of salinity on the Murray–Darling Basin. These include introducing more efficient irrigation, returning more water to the environment, and operating salt interception schemes.

Salt interception schemes pump saline groundwater into salt management basins. The water slowly evaporates, concentrating the salt or gradually leaking it back into the groundwater systems. There are 7 of these schemes within South Australia which move tonnes of salt away from the River Murray each year.

2 Methods

2.1 Indicator

The indicator used for the River Murray: salinity report card is measured electrical conductivity (salinity) at Lock 6, Morgan, and Murray Bridge.

2.2 Data sources

Continuous monitoring data for salinity is available from Water Data SA (DEW 2023). Salinity at Lock 6 (Water Data SA location A4260510), Morgan (A4260554) and Murray Bridge (A4261162) were used for this assessment.

All salinity monitoring and dataset custodianship is with the Department for Environment and Water (DEW).

2.3 Data collection

All data used in this assessment are from monitoring sites that are continuously monitoring parameters at sub-daily intervals. The sites are telemetered so that data are collected and transmitted to DEW's data storage system, the Surface Water Information Management System (SWIMS) in near real-time. This 'unverified telemetry' data may be viewed and downloaded, but with metadata indicating that it has not been verified. Datasets are subsequently verified by DEW hydrographers. Verified data classified as either 'fair' or 'good' were used in this analysis.

2.4 Data analysis

The assessment periods for salinity reflect the commencement of continuous records for each site: January 1980 for Murray Bridge, October 1997 for Morgan, and June 2008 for Lock 6. All sites were assessed up to 30 June 2022.

The trends for salinity were assessed using linear regression.

2.5 Methods to assign trend, condition and reliability

2.5.1 Trend

Definitions for the trend classes for River Murray salinity are shown in Table 2.1.

Table 2.1. Definition of trend classes used

Report card trend	Description
Getting better	Over a scale relevant to tracking change in the indicator it is improving in status with good confidence
Stable	Over a scale relevant to tracking change in the indicator it is neither improving nor declining in status
Getting worse	Over a scale relevant to tracking change in the indicator it is declining in status with good confidence
Unknown	Data are not available, or are not available at relevant temporal scales, to determine any trend in the status of this resource
Not applicable	This indicator of the natural resource does not lend itself to being classified into one of the above trend classes

2.5.2 Condition

Condition for River Murray salinity in South Australia was based on the Basin Plan targets of 580 EC, 800 EC and 830 EC at Lock 6, Morgan and Murray Bridge respectively.

Table 2.2. Definition of condition classes used for River Murray salinity

Condition	Description
Very good	The natural resource is in a state that meets all environmental, economic and social expectations, based on this indicator. Thus, desirable function can be expected for all processes/services expected of this resource, now and into the future, even during times of stress (e.g. prolonged drought)
Good	The natural resource is in a state that meets most environmental, economic and social expectations, based on this indicator. Thus, desirable function can be expected for only some processes/services expected of this resource, now and into the future, even during times of stress (e.g. prolonged drought)
Fair	The natural resource is in a state that does not meet some environmental, economic and social expectations, based on this indicator. Thus, desirable function cannot be expected from many processes/services expected of this resource, now and into the future, particularly during times of stress (e.g. prolonged drought)
Poor	The natural resource is in a state that does not meet most environmental, economic and social expectations, based on this indicator. Thus, desirable function cannot be expected from most processes/services expected of this resource, now and into the future, particularly during times of stress (e.g. prolonged drought)

2.5.3 Reliability

Information is scored for reliability based on the minimum of subjective scores (1 [worst] to 5 [best]) given for information currency, applicability, level of spatial representation and accuracy. Definitions guiding the application of these scores are provided in Table 2.3 for currency, Table 2.4 for applicability, Table 2.5 for spatial representation and Table 2.6 for accuracy.

Table 2.3. Guides for applying information currency

Currency score	Criteria
1	Most recent information > 10 years old
2	Most recent information up to 10 years old
3	Most recent information up to 7 years old
4	Most recent information up to 5 years old
5	Most recent information up to 3 years old

Table 2.4. Guides for applying information applicability

Applicability score	Criteria
1	Data are based on expert opinion of the measure
2	All data based on indirect indicators of the measure
3	Most data based on indirect indicators of the measure
4	Most data based on direct indicators of the measure
5	All data based on direct indicators of the measure

Table 2.5. Guides for applying spatial representation of information (sampling design)

Spatial score	Criteria
1	From an area that represents less than 5% the spatial distribution of the asset within the region/state or spatial representation unknown
2	From an area that represents less than 25% the spatial distribution of the asset within the region/state
3	From an area that represents less than half the spatial distribution of the asset within the region/state
4	From across the whole region/state (or whole distribution of asset within the region/state) using a sampling design that is not stratified
5	From across the whole region/state (or whole distribution of asset within the region/state) using a stratified sampling design

Table 2.6. Guides for applying accuracy information

Reliability	Criteria
1	Better than could be expected by chance
2	> 60% better than could be expected by chance
3	> 70 % better than could be expected by chance
4	> 80 % better than could be expected by chance
5	> 90 % better than could be expected by chance

2.6 Data transparency

Data transparency for this report card is represented in Appendix A.

3 Results

3.1 Trend

Figure 3.1 shows the increase in daily salt interception capacity in the Murray–Darling basin progressing with the commissioning of salt interception schemes since the late 1960s. Most of the schemes are located adjacent to the River Murray from Mallee Cliffs upstream of Mildura to Sunlands Qualco adjacent to Lock 2 (MDBA 2023).

The long-term trend in River Murray salinity in South Australia clearly indicates that salinity is getting better, as shown in Figure 3.2 and Figure 3.3. While there is a downward trend at all three locations assessed (Lock 6, Morgan and Murray Bridge), the largest changes have been for Morgan and Murray Bridge where average salinities have approximately halved since the year 2000.

Figure 3.2 and Figure 3.3 indicate that the trend in salinity may have stabilised from around 2020 onwards, with the last two years of salinity less variable at all locations.

The proportion of environmental water delivery in the lower flow years is large enough that it could have a significant impact on in-river salinity.

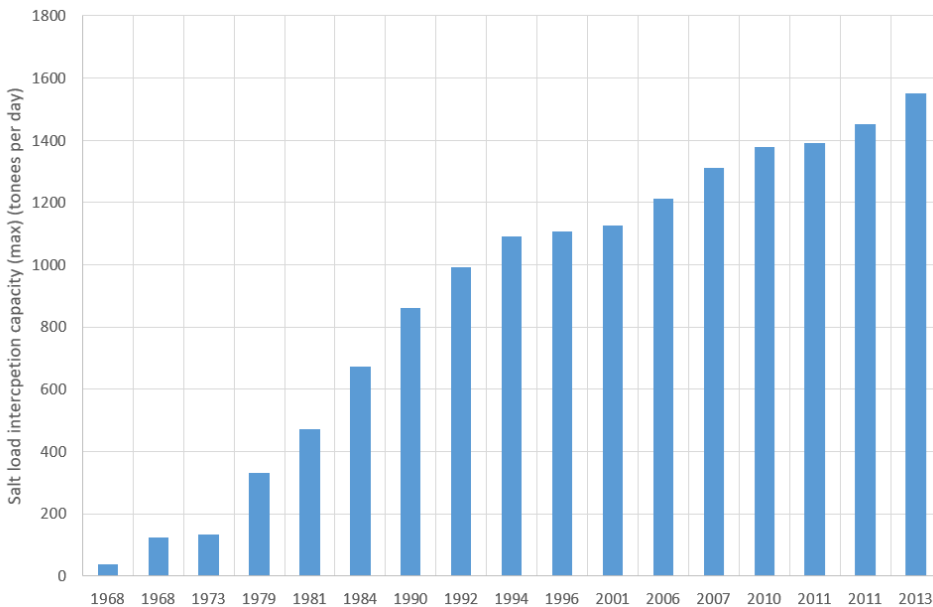


Figure 3.1. Constructed salt interception scheme salt interception capacity (data sourced from MDBA 2023)

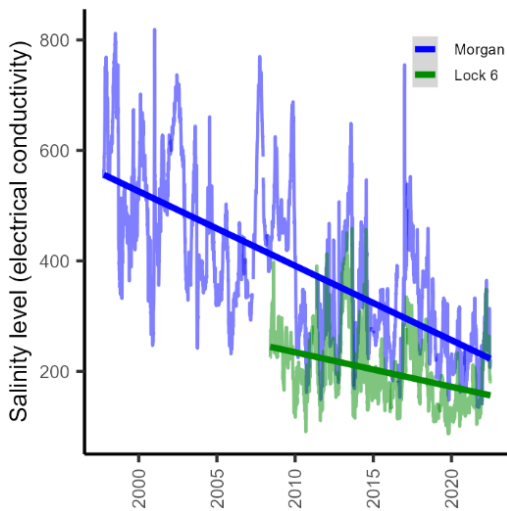


Figure 3.2. Salinity trends at Morgan and Lock 6 on the SA River Murray

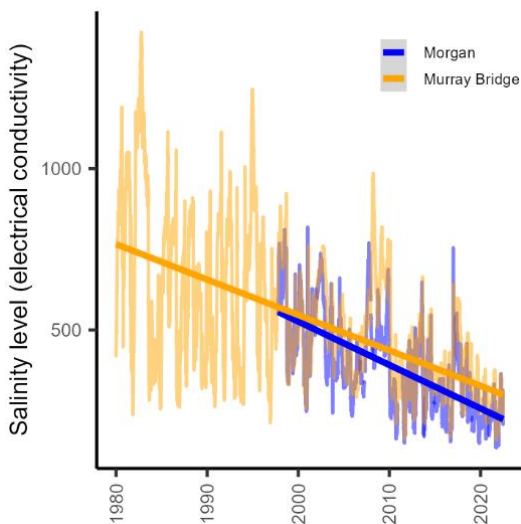


Figure 3.3. Salinity trends at Murray Bridge and Morgan on the SA River Murray

3.2 Condition

The condition of salinity in the River Murray in South Australia for 2021–22 was good. The maximum salinities at Lock 6, Morgan and Murray Bridge were 349 EC, 365 EC, and 377 EC, respectively. Salinity at all three locations was below 300 EC at least 75% of the time and below the respective Basin Plan targets at all times during 2021–22. In 2021–22, the 7 salt interception schemes in South Australia intercepted more than 270,000 tonnes of salt (DEW 2022). Environmental site operations such as weir pool manipulation as well as water delivery are managed to ensure that salinity impacts on the River Murray within South Australia are minimised including maintaining sufficient passing flows when floodplain infrastructure is operated.

3.3 Reliability

The reliability scores for the indicator and for each criterion in the report card are provided in Table 3.1 and are based on the guiding definitions provided in Tables 2.3 to 2.6.

The overall reliability score for the River Murray: salinity report card is 4, a reliability of 'very good'.

Table 3.1. Information reliability scores for River Murray: salinity

Indicator	Currency	Applicability	Spatial	Accuracy	Reliability
River Murray: salinity	5	5	4	5	4

3.3.1 Notes on reliability

The information reliability scores are based on:

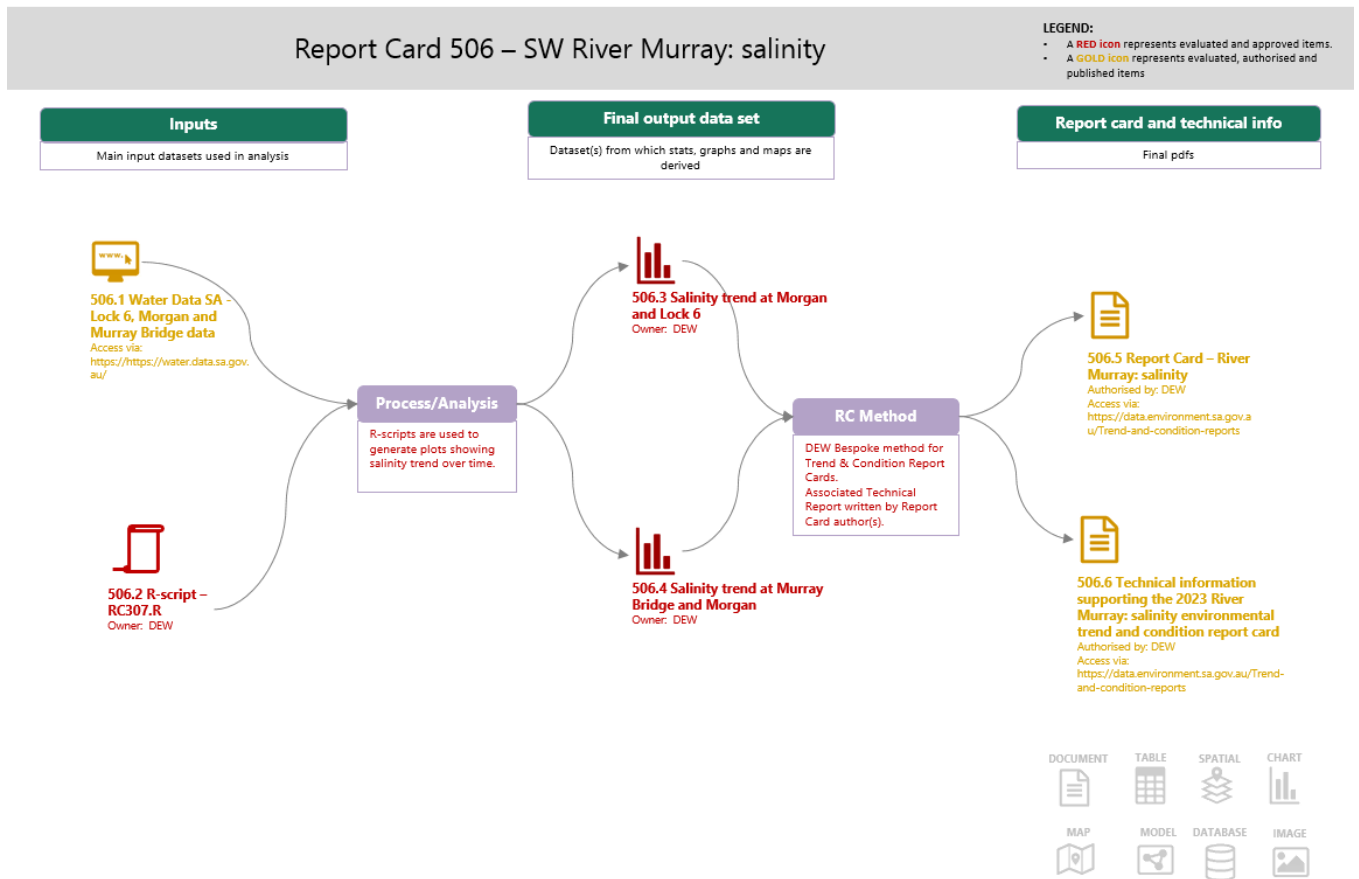
- Information applicability for River Murray salinity was rated as 5 as all data are based on direct indicators of the measure.
- Information currency rated as 5 because inputs for salinity are measured continuously, and most recent information is up to 3 years old.
- Spatial representation had a rating of 4 because 3 representative sites along the River Murray in South Australia have been assessed for this indicator.
- Information accuracy was rated as 5 for salinity because the continuous electrical conductivity monitoring at multiple sites provides data of a quality that exceeds what is required to identify trend and condition in the River Murray relative to Basin Plan targets. Salinity monitoring sites are positioned to be representative of the average salinity across the section of the river.

4 Discussion

The operation of salt interception schemes, improved irrigation efficiency, and active management to minimise the impacts of salt loads and salinity such as dilution flows, has resulted in a sustained downward trend in average River Murray salinity in South Australia.

5 Appendices

A. Managing environmental knowledge for River Murray: salinity



6 References

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