Technical information supporting the 2023 Aquatic ecosystem condition environmental trend and condition report card

Department for Environment and Water
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Government of South Australia
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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.

Acknowledgements

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The data for this report were sourced from the South Australian Environmental Protection Authority (EPA) Aquatic Ecosystem Condition Reports. This is a valuable reporting process and use of the data is greatly appreciated.

Thanks also to Peter Goonan from the EPA for comments on drafts of this document. Glen Scholz from the Department provided internal review of the document and comments were greatly appreciated.

Contents

List of figures

List of tables

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 Aquatic ecosystem condition: Environment Protection Authority (EPA) condition assessments report card. The reliability of information sources used in the report card is also described.

The Aquatic ecosystem condition: EPA condition assessments report card sits within the report card Biodiversity theme and Inland waters 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 accessibly of the report cards has been reviewed and improved with each release.

1.3 Aquatic ecosystems of SA

As part of the assessment of the major environmental resources of South Australia, this technical report and associated report card assesses the trend and condition of aquatic ecosystems across the state. South Australia is the driest state on the driest inhabited continent and, as such, water is a critical resource. Water resource development has been a major part of the economic development of South Australia which has led to the state having world recognised industries, e.g. South Australian wine regions. However, the development of water resources and the subsequent use of water has had a negative effect on the water dependent ecosystems across the state.

The use of water for productive purposes means that there is less water in the system for the environment. Rivers and streams are systems that have developed in response to several key drivers, of which the amount of water and the timing of flow (the flow regime) is considered to be the master variable (Datry et al. 2014). Associated with the changes in the flow regime, are changes in other key drivers of aquatic ecosystem condition such as water quality and riparian vegetation.

Agricultural practices are associated with decreases in the quality of water in rivers and streams. The processes behind these changes range from simple input of additional nutrients through the application of fertilisers through to complex interactions between groundwater and surface water impacting salinity (Buck et al. 2004).

The changes in the flow regime and water quality have impacts on both the flora and fauna of these aquatic systems, generally resulting in negative impacts such as reduced species richness (the loss of more sensitive species), terrestrial vegetation encroachment (terrestrial vegetation moving into the river) and changes in the shape of the river and character of the river. These changes are not just associated with the reductions of ecological condition of the river, they also represent changes in the river that will have impacts for productive users of the water resource.

Due to the importance of water as a resource and the environmental value of the ecosystems that are associated with these aquatic systems, the Government of South Australia considers the management of aquatic ecosystems a high priority. The *Landscape South Australia Act 2019* provides a framework for the management of water resources by providing mechanisms for local landscape boards to control the amount of water that is used. These controls vary based on the level of risk to water resources from no controls through to active management under water allocation plans.

Monitoring of aquatic ecosystems not only provides important data, but it also provides a means for the local landscape boards to assess if the use of water is causing excessive degradation to water dependent ecosystems. In addition to the *Landscape South Australia Act 2019*, the *Environment Protection Act 1993* also contains clauses that stipulate that the environment shall be monitored (Goonan et al. 2012).

There are multiple programs that monitor the condition of the state's rivers, streams and lakes. The majority of these are localised monitoring programs that are designed to monitor effects of specific management actions or infrastructure projects. The Environmental Protection Authority (EPA) undertakes the only statewide monitoring program, the South Australian monitoring, evaluation and reporting program (MERP) for aquatic ecosystems. This program has been running in its current form since 2008 and provides a condition assessment of the state's rivers, streams and lakes. Monitoring data are used to produce aquatic ecosystem condition reports (AECRs) every year. This report will use this information as the basis of the assessment of the trend and condition of the state's rivers, streams and lakes.

The EPA provides more detailed assessments of the results of the monitoring program at the regional and site scale. These assessments include a more in depth look at the data informing the results for each site as well as points of note (e.g. important species, site based impacts). These assessments also include site based examinations of pressures and stressors as well as management recommendations. For a more detailed look at individual sites, or regional assessments, refer to the EPA Water Quality Monitoring webpage.

The EPA has previously used a random site selection process in order to facilitate a generalised picture of a region's aquatic ecosystems. However, in recent years the site selection has become more targeted in order to assess certain key areas of a region or in order to facilitate alignment between data collection programs or data uses. This is most pronounced in the former Adelaide and Mount Lofty Ranges Natural Resources Management region (now Green Adelaide and Hills and Fleurieu landscape regions) where site selection was biased towards sites with higher environmental value or known good condition.

2 Methods

2.1 Indicator

The indicator used for the aquatic ecosystem condition report card is the site condition as assessed by the EPA as part of their ongoing aquatic ecosystem condition reports (AECRs).

2.2 Data sources and collection

The AECRs assessment is undertaken using a combination of water quality measurements, riparian habitat assessments and macroinvertebrate community assessment. These assessments are undertaken at a series of both random and chosen sampling sites across each of the South Australian landscape regions on a rolling schedule, generally undertaken every five years with the exception of Alinytjara Wilurara which has no aquatic habitats suitable for assessment using the AECRs method. For a discussion of the site selections and the impacts on the results in greater detail see the individual panel reports.

Key parts of the method include:

- Detailed assessment of water quality is undertaken on a composite sample taken from the site and assessed in a specialised water analysis laboratory,
- Macroinvertebrate samples are collected from the site and processed on site. Representative specimens from each type of macroinvertebrate collected are preserved and sent to an experienced laboratory technician for microscope identification, and
- Additional observations are made including streambed type, presence and types of aquatic plants, coverage of aquatic plants and algae, and assessments on the degree and type of terrestrial vegetation, riparian vegetation, and sediment quality (i.e. colour, odour and presence of sulfidic sediment). The land use surrounding the site is also recorded.

The results are collated and an expert panel rate the sites against an ecological condition gradient (Figure 2.1). For a detailed explanation of the methods used to assess the condition of individual sites see EPA (2016).

The River Murray is not included as part of the EPA's assessments of aquatic ecosystem condition. The River Murray is a component of the Murray–Darling Basin that covers multiple states and is managed both at the state and federal level. Specific River Murray monitoring programs assess the ecological condition of the river and its floodplains and wetlands. For an assessment of the River Murray condition refer to the River Murray and Coorong, Lower Lakes and Murray Mouth report cards.

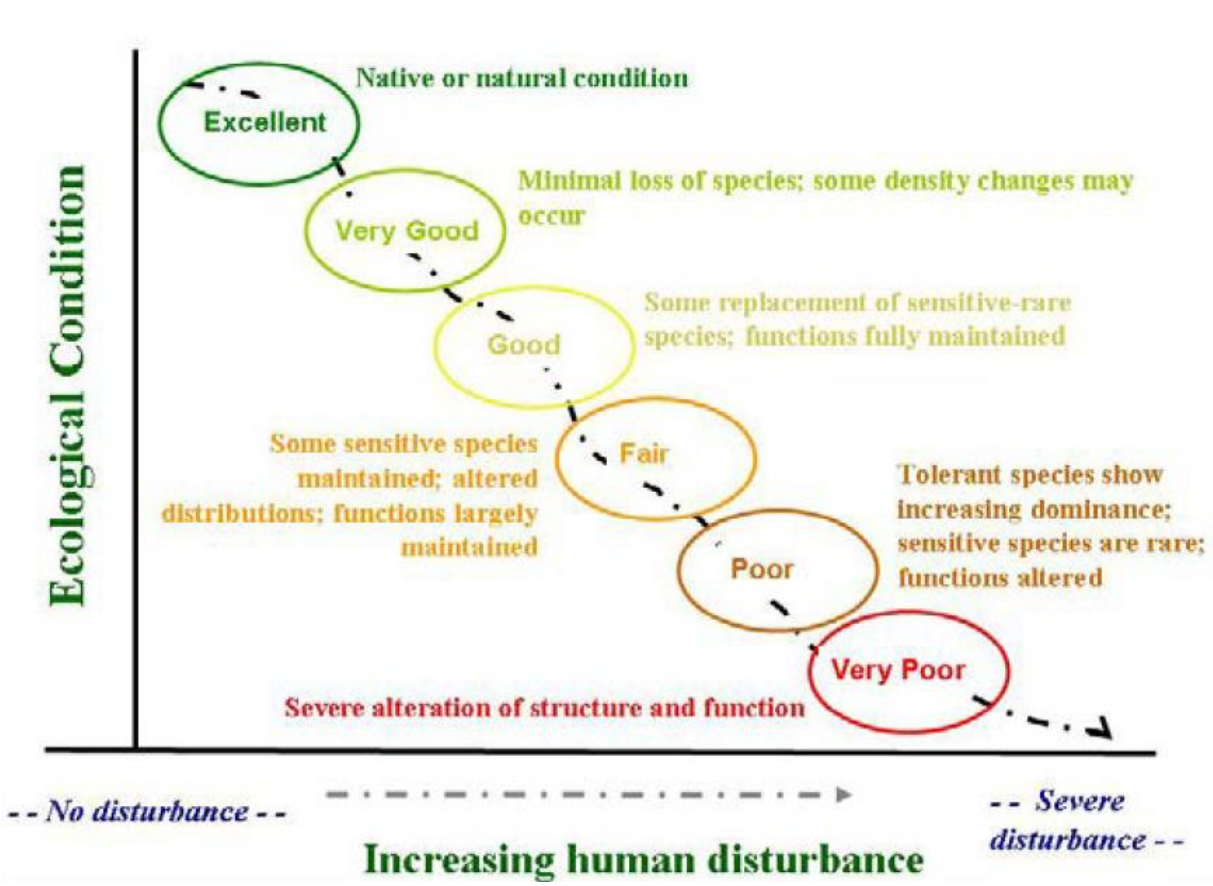


Figure 2.1. Ecological condition gradient used for the assessment of aquatic ecosystems for the EPA Aquatic Ecosystem Condition Reporting, the EPA AECR scores (Source: EPA 2018)

2.3 Data analysis

The condition assessment scores that are provided by the EPA assessment (EPA AECR scores) do not directly align with the condition assessment classes used for the SA Environmental trend and condition report cards. The EPA condition assessment uses a six class condition rating system while the report cards use a four class system. The alignment of these condition assessments is provided in Table 2.1. The landscape region names and abbreviations are provided in Appendix A.

Table 2.1. Condition assessment used for the assessment of trend for the aquatic ecosystem assessment of rivers, streams and lakes for South Australia

EPA condition assessment (EPA AECR condition score)	Report card condition class	EPA definition	Report card definition
Excellent	Very good	Natural or unaffected by human activity, with extensive areas of remnant native vegetation in the catchment area. It is possible some creeks and lakes in remote areas of the state may be given an Excellent rating, however the vast majority are likely to be affected by humans in some way.	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)
Very good	Very good	Minimal changes in biological condition and the way the ecosystem functions as a result of human settlement. These sites continue to provide a healthy environment for a natural diversity of animal and plant life.	
Good	Good	Often the best we can expect given significant changes to the natural landscape after more than 170 years of European settlement. Although changes to the environment and its animal and plant life are likely to be relatively minor, there will be clear, emerging signs of human impact, which could lead to further decline.	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	Fair	Moderate changes to animal and plant life at the site, and some change to the way the ecosystem functions. The effects of nutrient enrichment are often evident. The condition of these creeks and lakes is unlikely to meet community expectations for a healthy aquatic ecosystem at least some of the time.	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)

EPA condition assessment (EPA AECR condition score)	Report card condition class	EPA definition	Report card definition
Poor	Poor	These creeks or lakes are degraded, with evidence of major changes in the animal community and plant life, and moderate changes to the way the ecosystem functions. These sites typically have little native vegetation remaining and very high nutrient levels. Their condition is unlikely to meet community expectations for a healthy aquatic ecosystem most of the time.	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)
Very poor	Poor	Major changes to both the animal and plant life are apparent with a significant breakdown in the way the ecosystem functions because of human impact. These creeks and lakes are unlikely to meet community expectations for a healthy aquatic ecosystem.	

2.4 Methods to assign trend, condition and reliablity

2.4.1 Trend

Sites that have been visited three or more times were used for the assessment of trend at the site scale. For regional assessment, regions were required to have three or more sites with a trend assessment to be included in the assessment.

The EPA condition assessment time series data for each site was analysed using a Bayesian linear modelling approach. This modelling approach was used as it provides more information surrounding the results. Bayesian modelling also provides credible intervals allowing for an objective and transparent assessment of trend as it provides an estimate of the likelihood of the trend assessed. Modelling was undertaken using a binomial model looking at the EPA condition score (scored from 0 to 5, with 0 being very poor and 5 being excellent). Analysis was undertaken in R Studio (version 1.1.383, running R version 3.4.2) (R Core Team 2013) using Bayesian Generalized Linear Models (using the stan-glm function in the rstanarm package) (Stan Development Team 2016).

The state trend model was run using both catchment and landscape region as random factors. The regional trend model was run using a fixed factor of landscape region and a random factor of catchment.

The following values were estimated from the posterior distribution resulting from the Bayesian analysis:

- slope (trend)
- change between 2008 and 2021 (magnitude of any change).

Generic definitions for trend are provided in Table 2.2, including the specific values used as thresholds to define the trend classes.

Regions that did not have any sites that were visited three or more times were classed as unknown.

Table 2.2. Trend definitions used for the assessment of trend for the aquatic ecosystem assessment of rivers, streams and lakes for South Australia

Trend	Description	Threshold
Getting better	Over a scale relevant to tracking change in the indicator it is improving in status with good confidence	Greater than or equal to 90% likelihood that target achievement trends are positive
Stable	Over a scale relevant to tracking change in the indicator it is neither improving or declining in status	Less than 90% likelihood that target achievement trends are positive or negative
Getting worse	Over a scale relevant to tracking change in the indicator it is declining in status with good confidence	Greater than or equal to 90% likelihood that target achievement trends are negative
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	-

2.4.2 Condition

The condition results are summarised for sites within each of the landscape regions based on the condition classes defined in Table 2.1, however, overall conditions (by landscape region and statewide) are not provided due to limitations with the data relating to the methods of site selection.

2.4.3 Limitation

The original intent of the AECRs is to provide an assessment of a selection of sites across the landscape to look at the general condition. This was achieved using random site selection and allowed for a general assessment of condition across the region. The gradual shift to specifically selected sites since the mid-2010s means that the use of the data to provide an overarching assessment of condition is no longer appropriate, i.e. a region may opt for the EPA to sample a selection of the best quality sites in the region, skewing the condition data for the region. For this reason, condition assessments are not provided for the state or landscape regions.

2.4.4 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.

Table 2.3. Scoring system for the reliability of the information used to underpin the analysis for the aquatic ecosystem condition report card

Score given	Information currency	Information applicability	Spatial representation	Information accuracy
1	Information >10 years old	Data are based on expert opinion of the measure	From an area that represents less than 5% the spatial distribution of the asset within the region/state or spatial representation unknown	Better than could be expected by chance
2	Information up to 10 years old	All data based on indirect indicators of the measure	From an area that represents less than 25% the spatial distribution of the asset within the region/state	> 60% better than could be expected by chance
3	Information up to 7 years old	Most data based on indirect indicators of the measure	From an area that represents less than half the spatial distribution of the asset within the region/state	> 70 % better than could be expected by chance
4	Information up to 5 years old	Most data based on direct indicators of the measure	From across the whole region/state (or whole distribution of asset within the region/state) using a sampling design that is not stratified	> 80 % better than could be expected by chance
5	Information up to 3 years old	All data based on direct indicators of the measure	From across the whole region/state (or whole distribution of asset within the region/state) using a stratified sampling design	> 90 % better than could be expected by chance

2.5 Data transparency

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

3 Results

3.1 Trend

Since 2008 a total of 69 sites have been visited three or more times by the EPA's MERP for aquatic ecosystems. The number of these sites per region is provided in Table 3.1. The maximum number of times a site has been visited was 5, while most sites were only visited three times. Due to only having two sites with three or more visits, the trend assessment for Eyre Peninsula was not modelled, however, the site results did contribute to the state based assessment.

Table 3.1. The number of sites visited three or more times for each of the landscape regions used for the trend assessment

Landscape Region	Count
HF	24
EP	2
GA	16
KI	3
LC	17
NY	7

The statewide trend was classed as getting better (Table 3.2 and Figure 3.1). The regional trend was classed as stable across each of the four regions assessed, with the exception of Green Adelaide which was classed as getting better (Table 3.2 and Figure 3.2 and Figure 3.3). It should be noted that, with the exception of Limestone Coast, the regions classed as stable were close to the 90% requirement of positive slopes to be classed as getting better.

Table 3.2. Regional assessment of trend based on sites with three or more visits summarised from the 4000 Bayesian modelling runs

Region	Mean Slope	Percentage of negative slopes	Percentage of positive slopes	Lower credible interval	Upper credible interval	Trend
GA	0.065	8.4%	91.6%	-0.013	0.141	Getting Better
HF	0.045	11.4%	88.7%	-0.016	0.106	Stable
KI	0.089	19.1%	81.0%	-0.081	0.257	Stable
LC	-0.003	53.1%	46.9%	-0.073	0.068	Stable
NY	0.104	10.8%	89.2%	-0.033	0.242	Stable
State	0.051	9.1%	90.9%	-0.016	0.125	Getting better

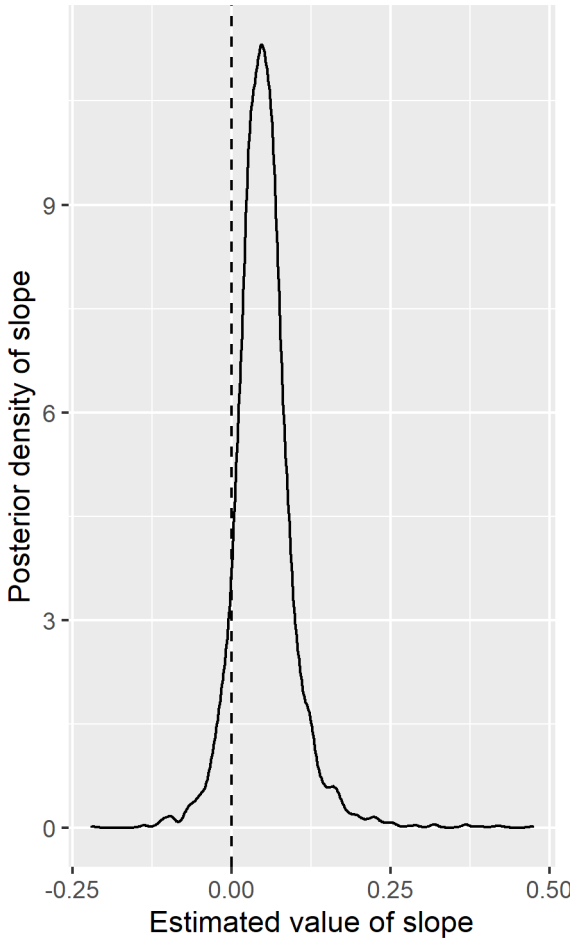


Figure 3.1. Estimates of the slope (trend) across of South Australia for the 4000 Bayesian modelling runs

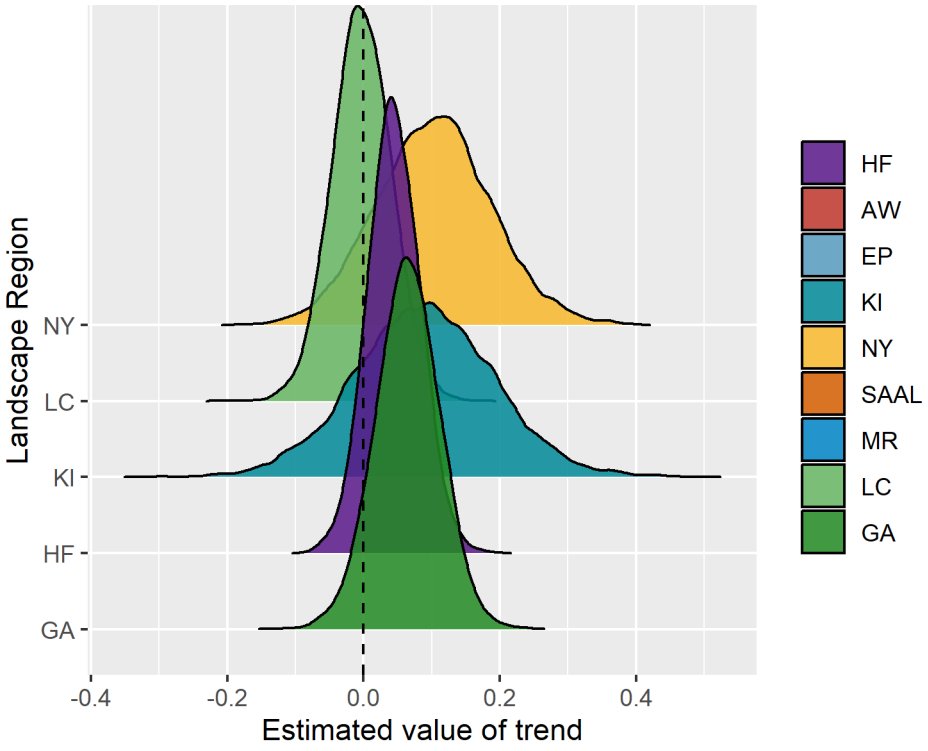


Figure 3.2. Estimates of the slope (trend) across the different landscape regions of South Australia for the 4000 Bayesian modelling runs

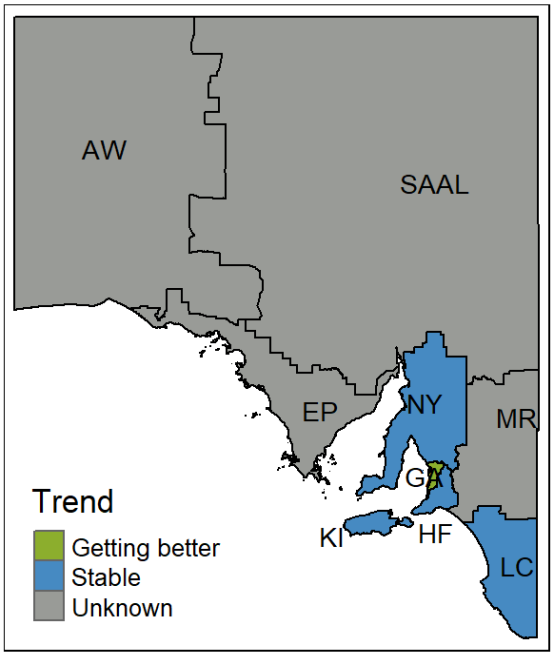


Figure 3.3. Map of the trend assessment results for the aquatic ecosystem assessment for the period 2008 to 2021

3.2 Condition

The condition ratings for the most recent sampling event for each site is provided in Table 3.3 and shown in Figure 3.4. The results show a strong bias towards poor and fair condition, comprising nearly 80% of the data

across the state. There is also a strong bias of data in the Hills and Fleurieu Landscape region (141 sites assessed). This is due to the former Adelaide and Mount Lofty Ranges Natural Resources Management region engaging the EPA to undertake their AECRs assessment every 2 years rather than the normal 5 years. As most of these sites now sit within Hills and Fleurieu landscape region, the site count for this region is correspondingly high.

Table 3.3. Long term condition results across the landscape regions. Condition results reported use the report card condition score, not the EPA AECRs condition

Landscape region	Number of sites in each condition class				Total sites assessed
	Poor	Fair	Good	Very good	
HF	38	71	32	0	141
EP	20	14	0	0	34
GA	11	14	18	1	44
KI	14	22	11	2	49
LC	46	27	3	0	76
MR	10	8	0	0	18
NY	33	30	3	0	66
SAAL	5	20	32	4	61
State	177	206	99	7	489

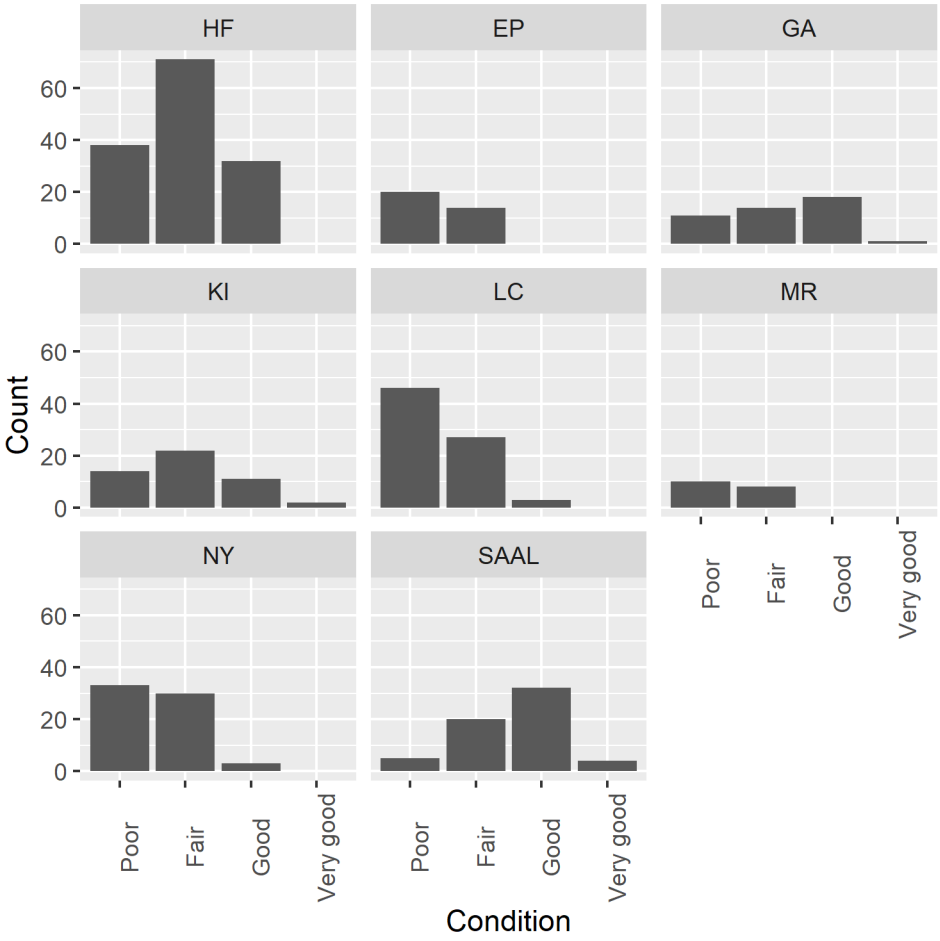


Figure 3.4. Condition scores for the most recent sampling event per site across the different landscape regions. Condition is reported as the report card condition class, not the EPA AECRs condition

3.3 Reliability

The overall reliability score for this report card is 1 out of 5 based on Table 3.4. This is considered as Poor reliability.

Table 3.4. Information reliability scores for aquatic ecosystem condition

Indicator	Applicability	Currency	Spatial	Accuracy	Reliability
Aquatic ecosystem condition scores	4	3	1	2	1

3.3.1 Notes on reliability

The reliability score was based on several considerations including:

- EPA condition scores are derived based on expert opinion. However, they are very closely tied to a large site-specific dataset that provides evidence for the assessment (Applicability score of 4).

- Time since collection varies from region to region with the most recent data for a given site ranging from 2008 to 2021 (Currency score of 3).
- Spatial coverage is limited to a small number of sites across the state. While there is a random element to the sampling design, increasingly sites are selected based on outside drivers (i.e. regions want a closer look at the better sites or a focus on a particular catchment). Due to this, the sites are not considered representative of the region. The number of sites sampled compared to the number of aquatic habitats is less than 5% of the state. Smaller drainage lines are also not sampled due to being too ephemeral in nature. (Spatial score of 1).
- Data is collected by trained staff in the manner described in EPA (2016). The site selection does not represent a true cross section of the aquatic ecosystems of the state (Accuracy score of 2).

4 Discussion

Managing the state's water resources responsibly to ensure that there is an acceptable balance of water between users, including the environment, is a key role of the Government of South Australia. As part of this role, plans for managing water are developed in which the needs of economic, social and environmental users of water are considered. This is complemented by on-ground programs run by the landscape regions that focus on reducing the impacts of the other pressures noted above by fencing off and revegetating rivers and streams.

It should be noted that the EPA collect the AECRs data for the purpose of monitoring condition across selected sites per region, however, the selection of sites was never intended to facilitate the type of analysis preformed in this report. The shift from NRM regions to landscape regions further complicates this with any design in the sampling program relative to region effectively removed. The landscape regions are not based on catchment boundaries as the old NRM regions were, meaning that catchments are now split and in some cases the watercourse is the boundary between landscape regions. This means that the side of the watercourse sampled, or the accuracy of the GPS coordinates provided could determine the region it is ascribed to. While the data are considered robust enough to allow for the assessment undertaken in this report, these issues need to be flagged.

4.1 Trend

The assessment of the condition of aquatic ecosystems across the state as getting better needs to be viewed in the context of several key pieces of information. The sampling for the AECRs started in 2008 during the worst parts of the Millennium Drought. Many of the sites used for the assessment have their initial data point in this 2008–2010 period, which was when the condition of aquatic ecosystems was likely at its most stressed in response to the drought. The assessment of getting better in this instance is most likely linked to the recovery of condition following the Millennium Drought. Outside of this general climatic recovery, there have been no broad changes to management of water resources or actions to restore aquatic ecosystem condition in South Australia.

The trend for the Limestone Coast landscape region shows a nearly even split between the positive and negative slopes in contrast to the other regions that all show a strong skew to positive slopes. This is most likely driven by the ongoing below average rainfall over the recent years as well as the nature of many of the systems in the region which are artificial drains rather than true watercourses.

As the conditions across the state continue to dry in response to the changing climate, it is possible that the current trends in aquatic ecosystem condition will not continue without management and intervention. Noting that the 2008–2010 baseline was heavily impacted by drought, any declines in condition relative to this baseline are likely to reflect severe declines in condition and are likely to reflect state shifts in aquatic ecosystems as river systems degrade from perennial to seasonal to ephemeral.

The assessment used to describe trend in this report is considered suitable as only sites with repeat visits are used. This removes the effect of the site selection and focuses on the pattern within the sites with sufficient repeat visits.

4.2 Condition

The site selection method used by the AECRs process is suited for the EPA's purposes but is not suitable for generalisation across regions or the state. The potential biases introduced by non-random site selection are not accounted for in the assessment methods and therefore, the overall condition of aquatic ecosystems of South Australia, or of the individual regions, has not been classified by this assessment.

There are two factors to the potential bias in the site selection. The first is the site selection that has a bias towards better quality sites in order to assess changes to these ecosystems as a priority. This is driven by the landscape regions and their desire to keep surveillance on good quality habitat. This is most obvious in the Green Adelaide

and Hills and Fleurieu regions where the condition of sites was higher than observed in other regions. While it could be expected that the condition of these ecosystems is better due to the higher rainfall, there is also more intensive water resource development and production from these areas. Qualitatively, there are many poor condition areas in these regions as well, so the site selection is likely a key factor in the higher conditions scores for these regions.

The second factor is that the EPA assessments are mainly focused on aquatic ecosystems that are more permanent with pools of water present for much of the year. This limits the selection of sites and temporary or ephemeral systems may not be monitored. These systems are especially impacted by development in the catchment and are often documented to be the source of nutrient enrichment for areas further down the river system. It is likely that if more of these seasonal or ephemeral areas were included, the number of poor sites would increase.

The high proportion of sites that have been classed as either poor or fair across state suggests that, despite potential biases towards better quality sites, the majority of sites across the state are likely in this poor or fair condition. As a general explanation of this, many drivers of aquatic ecosystem condition have been heavily impacted by human activates, especially since European settlement. Key amongst these is the clearance of vegetation from the landscape for agriculture (especially along riparian corridors), the development of water resources for productive use reducing the water available for the environment and the introduction of alien species of plants and animals. All of these factors as well as other, more site specific factors, apply pressure to aquatic ecosystems and limit their ability to function, ultimately resulting in degraded condition.

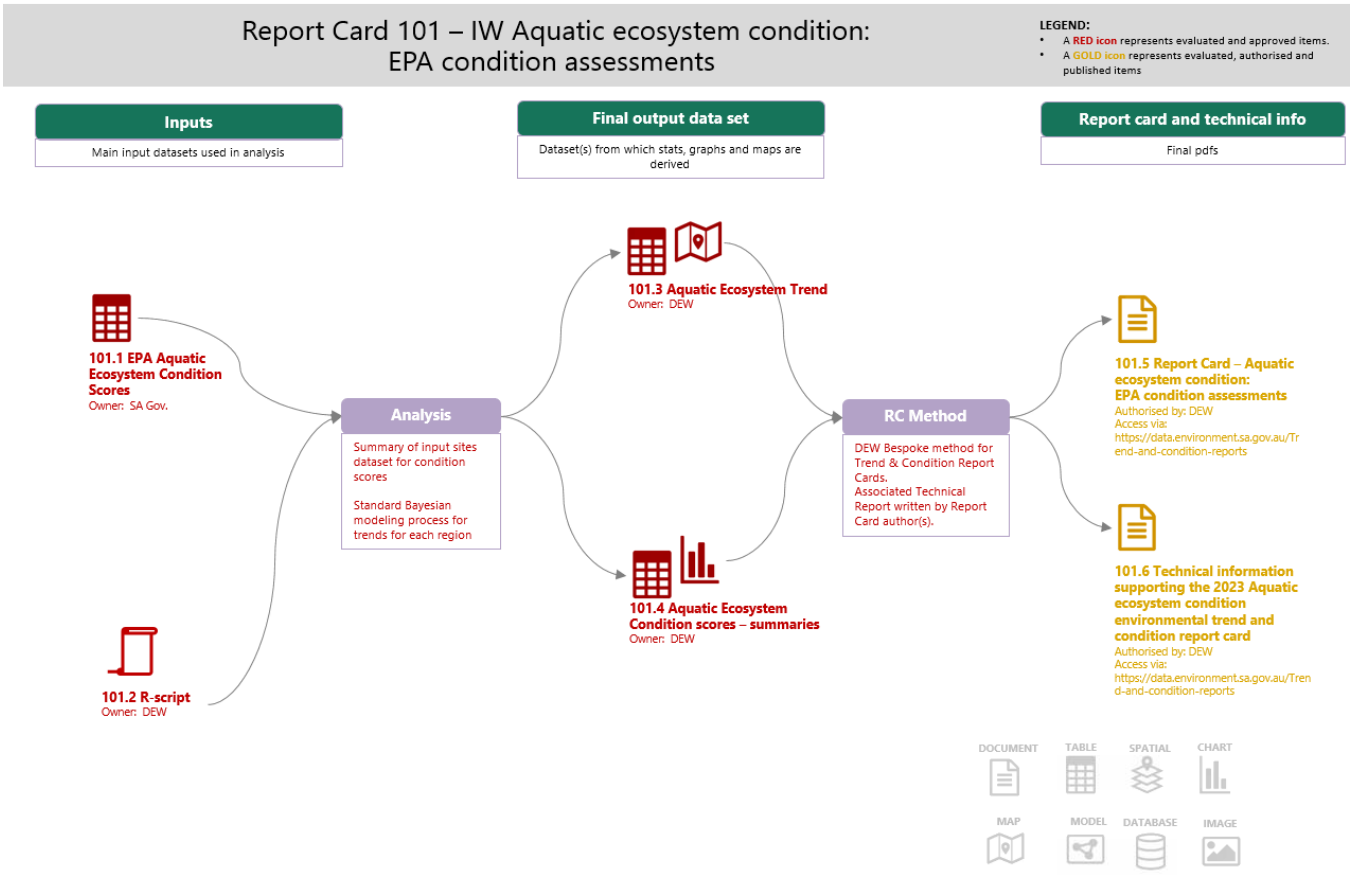
It is interesting to note that the only very good condition sites are located in areas with minimal disturbance. On Kangaroo Island the very good condition sites were located in Rocky River and Breakneck River, both of which are nearly entirely contained within national parks. Green Adelaide has a single site rated as very good in the headwaters of First Creek, above the waterfall, and the catchment is almost entirely within Cleland Conservation Park. The SA Arid Lands region has several sites classed as very good. The SA Arid Lands region is unique in that the impacts that are linked to degraded condition across much of the state are not overly present in the region. There are other pressures, such as pugging by hooved animals, but the lack of wholescale hydrological alteration impacts leads to a higher proportion of sites in good or very good condition.

5 Appendices

A. Landscape region acronyms used in this report

Landscape region	Landscape region acronym
Eyre Peninsula	EP
Green Adelaide	GA
Hills and Fleurieu	HF
Kangaroo Island	KI
Limestone Coast	LC
Murraylands and Riverlands	MR
Northern Yorke	NY
South Australian Arid Lands	SAAL
Alinytjara Wilurara	AW

B. Managing environmental knowledge chart for Aquatic ecosystem condition



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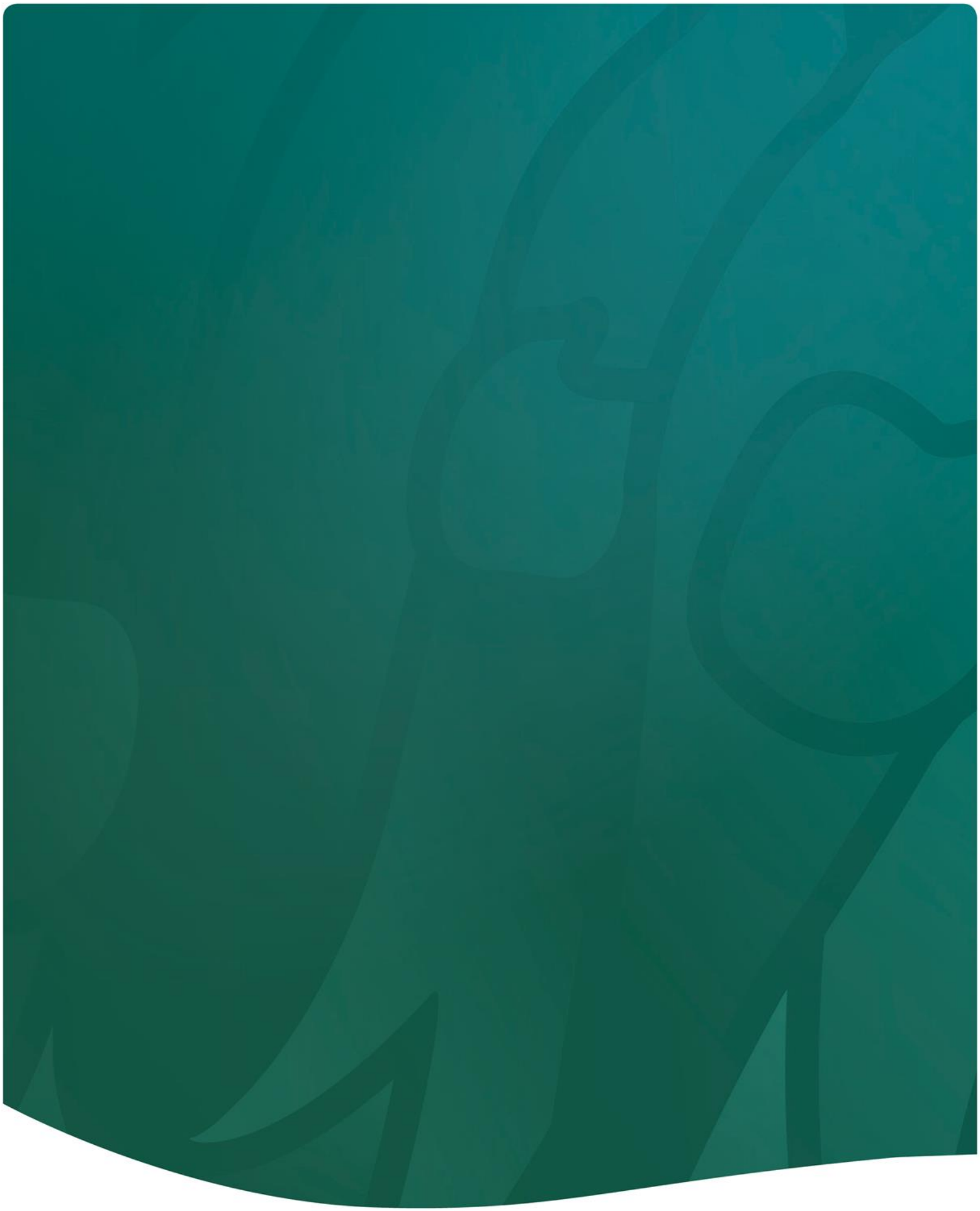

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