

# South Australian Murray (SS11)

## INITIAL SDL ASSESSMENT RESULT

The Authority has **identified a risk** that environmental outcomes are not being met for this Unit. Further work is required to assess whether the SDL reflects an environmentally sustainable level of take.

The initial assessment of this risk indicates that *flows and connectivity, ecosystem functions, native fish and waterbird* outcomes are not being met in this Unit. Pattern of flow is a **likely** leading driver of risk due to constraints. Sufficiency of flow has also been identified as a potential factor.

The Authority is **proposing further work with Basin governments** through 2026 to further explore these risks and to consider the most appropriate response. This will include an examination of flow drivers and constraints to flow to inform the Authority's recommendation on response.



Figure 1: SA Murray SDL Resource Unit

The Authority is assessing whether the Sustainable Diversion Limit (SDL) for the SA Murray SDL Resource Unit (the **Unit**) continues to support environmental outcomes and reflect an environmentally sustainable level of take (ESLT). This initial assessment refers only to outcomes in this Unit.

This Assessment Summary provides an overview of the factors which are relevant to that work and the Authority's initial view. The summary draws on three 'Lines of Enquiry', engaging with the likelihood that flow regimes support environmental outcomes, the Authority's confidence in that assessment, and the consequence of an at risk finding. Line of Enquiry 2 – full Basin Plan implementation – has been considered as the primary line of enquiry. Assumptions for each Line of Enquiry are documented in the *Summary of Assessment Approach* available on the MDBA website.

Information on the Lines of Enquiry and methodology used in this assessment is available in the *Summary of Assessment Approach* and the *SDL Assessment and Response Framework*. Information on the *Basin Plan Review Discussion Paper* and process for making a submission are also available on the MDBA website.

## About this Unit (as at June 2024)

<b>Ramsar sites</b>	The Coorong, Lakes Alexandrina and Albert Wetland, Riverland, Banrock Station Wetland Complex <sup>1</sup>
<b>Contribution to Basin water</b>	Not calculated (end-of-system)
<b>Key waterways</b>	River Murray, portions of Angas Bremer and Finnis Rivers and Currency Creek

<sup>1</sup> The Coorong, and a portion of the Banrock Station Ramsar site are within the SA non-prescribed SDL resource unit (SS10).

<b>Water storages</b>	N/A
<b>Significant groundwater connections</b>	SA Murray Salt Interception Schemes (GS7)

The Water Resource Plan (WRP) that supports this Unit commenced on [16 November 2019](#). The WRP includes the rules and arrangements that South Australia are using to manage this Unit and maintain sustainability. Further information on water recovery for this SDL Resource Unit is available at the Department of Climate Change, Energy, the Environment and Water’s [surface water recovery factsheet](#).

Given the range of spatial and hydrological complexities throughout the River Murray system, SDL Resource Unit boundaries in the three Murray assessments have been arranged to sensibly capture on-ground hydrological relationships. Key points of distinction to be aware of through this assessment:

- The River Murray channel is assessed as part of the NSW Murray SDL Resource Unit.
- The NSW reach of the River Murray downstream of the junction with the Murrumbidgee River to the SA border geographically sits within the Lower Darling SDL Resource Unit, however it has been considered as part of the NSW Murray SDL Resource Unit due to hydrological connectivity.
- Sites connected to the River Murray on the Victorian Murray floodplain that geographically sit in other SDL Resource Units have been considered in the Victorian Murray SDL assessment. For example, the Hattah Lakes are within the Wimmera-Mallee SDL Unit but are hydrologically connected to the River Murray so have been considered as part of the Victorian Murray SDL Resource Unit.
- The Coorong has been considered in the SA Murray SDL Resource Unit rather than in the SA Non prescribed areas SDL Resource Unit. The inclusion of the Coorong is informed by the strong links between outcomes in the Coorong and the management of the Coorong, Lower Lakes and Murray Mouth system.

## Current condition

In recognition of the wide range of ecological diversity and hydrological drivers through this Unit, the condition, environmental risk and consequence assessments are presented in parallel for two areas: the SA River Murray Channel and Floodplain, and the Coorong, Lower Lakes and Murray Mouth (CLLMM).

The observed environmental condition for these areas is shown in Figures 2a and 2b respectively (as at June 2024).

The Authority assessed that across the Unit, about half of the environmental outcomes are in a **moderate** or better condition, with *native fish* assessed as being in **poor** condition for the SA River Murray Channel and Floodplain, while *waterbirds* and *other species* are assessed as being in **poor** condition in the CLLMM area. *Ecosystem functions* are assessed as being in **poor** condition across both areas.

In the SA Murray River Channel and Floodplain area, flow delivery (i.e. magnitude and duration) to the SA border is the key driver of condition, through flow regulating structures (primarily those within

Chowilla, Pike and Katarapko wetlands) and a series of weirs along the main river lead to differences in flow characteristics and drivers of environmental conditions at local scales. The condition of diverse wetland habitats (freshwater to hypersaline) in the CLLMM area varies within and across years, largely in response to freshwater inflows through the barrages. This spatial variation in condition and associated response is drawn out through this assessment where relevant.

Figure 2a. SA River Murray Channel and Floodplain

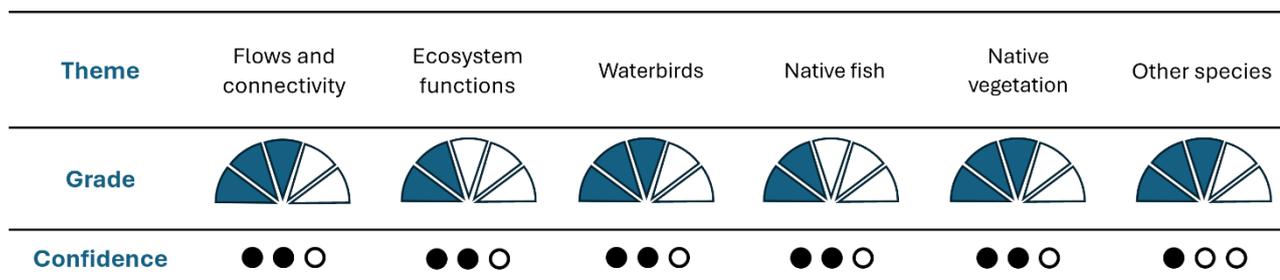


Figure 2b. Coorong, Lower Lakes and Murray Mouth

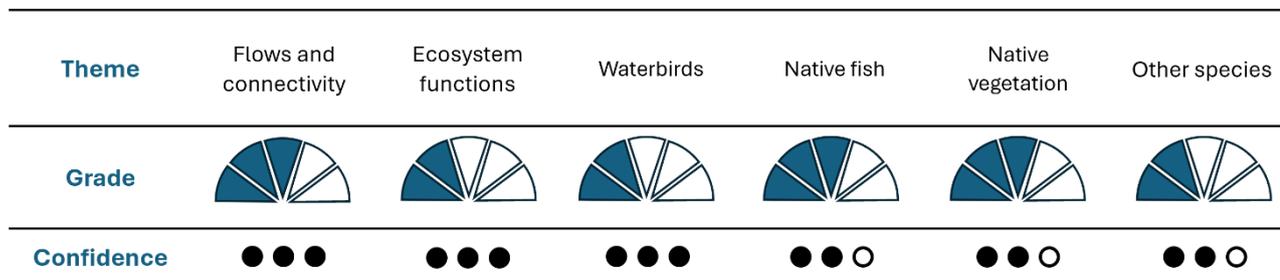


Figure 2. Environmental condition assessment in the Unit: 2a) SA River Murray Channel and Floodplain, and 2b) Coorong, Lower Lakes and Murray Mouth. Across each theme environmental condition is graded as *Very Poor*, *Poor*, *Moderate*, *Good* or *Very Good* (as indicated by segments) and confidence in this grading is assessed as *Low*, *Medium* or *High* (as indicated by dots). ‘Other species’ refers to animals including frogs, turtles and macroinvertebrates.

## Environmental outcomes under a fully implemented Basin Plan

Table 1 presents a compilation of:

- the *likelihood* that flows will support environmental outcomes for the six surface water themes for this Unit; and
- the Authority’s *confidence* in that assessment, i.e. low (L), medium (M) or high (H) surety of the finding.

The findings in Table 1 consider condition monitoring, assessment of the relative achievement of Environmental Watering Requirements (EWRs) under river model scenarios, and other relevant evidence that provided additional information. Information on the methodology and EWRs used in this assessment is available in the *Summary of Assessment Approach* and the *SDL Assessment and Response Framework*.

Table 1a. SA River Murray Channel and Floodplain

The likelihood that the pattern and volume of flow will support the objectives for each ecological theme								
Theme	Line of enquiry	Very unlikely	Unlikely	About as likely as not	More likely than not	Likely	Very likely	Confidence
Flows and connectivity	LoE 1	Very unlikely	Unlikely	●	More likely than not	Likely	Very likely	● ● ○
	LoE 2			●				● ● ○
Ecosystem functions	LoE 1			●				● ○ ○
	LoE 2			●				● ○ ○
Waterbirds	LoE 1			●				● ● ○
	LoE 2			●				● ● ●
Native fish	LoE 1			●				● ○ ○
	LoE 2			●				● ○ ○
Native vegetation	LoE 1			●				● ● ○
	LoE 2			●				● ● ●
Other species	LoE 1			●				● ● ○
	LoE 2			●				● ● ●

Table 1b. Coorong, Lower Lakes and Murray Mouth

The likelihood that the pattern and volume of flow will support the objectives for each ecological theme								
Theme	Line of enquiry	Very unlikely	Unlikely	About as likely as not	More likely than not	Likely	Very likely	Confidence
Flows and connectivity	LoE 1	Very unlikely	Unlikely	●	More likely than not	Likely	Very likely	● ● ●
	LoE 2			●				● ● ●
Ecosystem functions	LoE 1			●				● ○ ○
	LoE 2			●				● ○ ○
Waterbirds	LoE 1			●				● ○ ○
	LoE 2			●				● ○ ○
Native fish	LoE 1			●				● ● ●
	LoE 2			●				● ● ●
Native vegetation	LoE 1			●				● ● ●
	LoE 2			●				● ● ●
Other species	LoE 1			●				● ○ ○
	LoE 2			●				● ○ ○

**Table 1:** Initial likelihood assessment of the flows supporting the objectives for ecological themes in Unit. Note: LoE 1 refers to Line of Enquiry 1 - current Basin Plan implementation and LoE 2 refers to Line of Enquiry 2 - full Basin Plan implementation. ‘Other species’ refers to animals including frogs, turtles and macroinvertebrates.

Under both Line of Enquiry 1 and Line of Enquiry 2 it is assessed as **about as likely as not** that the flow requirements are supporting objectives for *ecosystem functions* (low confidence) across both areas and are considered ‘at risk’ at the Unit scale. Themes that were assessed as **about as likely as not** that the flow requirements are supporting objectives at an area scale include *native fish* and *flows and connectivity* in the SA River Murray Channel Floodplain (with low and medium confidence respectively), and *waterbirds* and *other species* (low confidence) in the CLLMM.

For those themes in which the likelihood assessment is rated **about as likely as not**, the MDBA have explored additional lines of evidence to determine whether a consequence assessment is warranted. This process drew on a broader suite of available information to further explore whether there is risk or compromise to the ESLT and the relative influence of the level of take or other identified drivers. This step applied Authority expertise and insight – based on a range of considerations, options, and trade-offs in light of the Basin’s contextual operating environment – to determine the best available information.

Based on this information, the *flows and connectivity*, *ecological functions*, and *native fish* themes are considered ‘at risk’ in the SA River Murray Channel and Floodplain and *flows and connectivity*, *ecological functions*, *waterbirds* and *other species* themes are considered ‘at risk’ in the CLLMM. These themes are taken through to a further consequence assessment step.

Outcomes for all other themes have been identified as **more likely than not** or **likely** to be supported by the pattern and volume of flow under Lines of Enquiry 1 and/or 2, with medium to high confidence, and are considered ‘not at risk’.

This assessment draws on MDBA model scenarios and associated ecological analysis. Contemporary river system models developed for the Basin Plan Review draw on improved calibration, higher quality datasets and a more realistic representation of hydrological and operational processes across the Basin. The MDBA will continue to explore the model analysis with Basin state partners and other stakeholders to test assumptions and uncertainties. Further modelling and analysis are planned in 2026 to ensure the final assessment draws on best available science and knowledge, and it is anticipated that this process will increase shared confidence in the model analysis and findings.

## Consequence assessment

Condition and likelihood assessments (Figure 2 and Table 1) indicate potential risks to the *flows and connectivity*, *ecosystem function* and *native fish* themes in the River Murray Channel and Floodplain, and *flows and connectivity*, *ecosystem function*, *waterbirds* and *other species* themes in the CLLMM. A consequence assessment, primarily considering Line of Enquiry 2, has been undertaken for these themes (Table 2).

**Table 2a. SA River Murray Channel and Floodplain**

Theme	Nature of impact	Spatial scale of impact	Impact on key values	Final Rating
<b>Flows and connectivity</b>	Reduced flows and altered hydrological regimes limiting connectivity, nutrient cycling, and subsequent habitat quality and availability	<b>Moderate-</b> SDL unit impact	<b>Yes-</b> multiple Ramsar sites and Basin-wide Environmental Watering Strategy (BWS) important assets affected	<b>HIGH</b>
<b>Ecosystem function</b>	Physical disconnection of floodplain and wetland habitats from the river channel limits the movement of biota, reducing recruitment, resilience, and ecological interactions.	<b>Moderate-</b> SDL unit impact	<b>Yes-</b> multiple Ramsar sites and BWS important assets affected	<b>HIGH</b>
<b>Native Fish</b>	Inadequate flows and subsequent loss of hydraulic habitat features and habitat connectivity lead to reduced	<b>High-</b> Basin Scale impact	<b>Yes-</b> includes BWS important assets for fish	<b>CRITICAL</b>

Theme	Nature of impact	Spatial scale of impact	Impact on key values	Final Rating
	breeding and recruitment success, and reduced population resilience.			

Table 2b. Coorong, Lower Lakes and Murray Mouth

Theme	Nature of impact	Spatial scale of impact	Impact on values	Final Rating
<b>Flows and connectivity</b>	Insufficient freshwater inflows to export salt and nutrients, maintain critical water levels and connectivity to the sea.	<b>High-</b> Basin scale impact	<b>Yes-</b> significant impact for Ramsar site, The Living Murray (TLM) icon site, and BWS important assets affected	<b>CRITICAL</b>
<b>Ecosystem function</b>	Insufficient pattern and volume of freshwater inflows leading to elevated salinity, elevated nutrient loads, and algal blooms, which reduces productivity and habitat quality.	<b>High-</b> Basin scale impact	<b>Yes-</b> significant impact for Ramsar site, TLM icon site, and BWS important assets affected	<b>CRITICAL</b>
<b>Waterbirds</b>	Insufficient flows reduce the quality and availability of critical waterbird breeding, foraging, and drought refuge habitats for the Basin, leading to reduced diversity, abundance and breeding success.	<b>High-</b> Basin scale impact  <i>* International scale for migratory shorebirds</i>	<b>Yes-</b> significant impact for Ramsar site, TLM icon site, and BWS important asset for waterbirds. The CLLMM is a key site for waterbird populations in the Basin.	<b>CRITICAL</b>
<b>Other species</b>	Inadequate flows lead to increased salinities, high sediment nutrient loads and acid sulfate soil issues; negatively impacting macroinvertebrate, turtle and frog populations.	<b>Low</b> – local or site scale	<b>Yes</b> – significant impact for Ramsar site	<b>MEDIUM</b>

Table 2: Consequence assessment results.

## Drivers of impact

### Unit-scale

In this Unit, *flows and connectivity*, *ecosystem functions*, *native fish* and *waterbirds* have been rated as **high to critical** and *other species* rated as **medium**.

The initial assessment has identified flow as a leading driver of this outcome, characterised by insufficient freshwater flows, ongoing constraints to delivery of flow, reduced lateral connectivity and inadequate flows to maintain an open Murray Mouth (without needing dredging).

### SA River Murray Channel and Floodplain

In the SA River Murray and Floodplain area, flow constraints have limited overbank flows and lateral connectivity, preventing environmental water delivery to many wetland and floodplain ecosystems. Infrastructure-assisted inundation has mitigated some impacts and provide significant local-scale outcomes at a few managed wetlands, but not across all themes. Water quality risks such as hypoxia and cyanobacterial blooms have been identified in weir pools due to poor flushing and extended low-flow periods as well as the arrival of poor-quality water from upstream.

Poor *native fish* condition in this area is driven by interacting factors including loss of insufficient variability in flows, reduced in-channel flows and lateral connectivity to nursery habitat and floodplain, in-stream barriers, competition with introduced species, and water quality issues.

#### *Coorong, Lower Lakes and Murray Mouth*

Freshwater inflows from the River Murray are the predominant driver of environmental outcomes in the CLLMM. Freshwater flows are required to maintain the salinity gradient of the system, support critical Lower Lakes and Coorong water levels, maintain system connectivity, and export salt and nutrients out to sea.

Under conditions of current and full Basin Plan Implementation, flows through the barrages are improved relative to pre-Basin Plan conditions, but are not always sufficient to achieve water quality and availability outcomes, particularly in dry years. Insufficient freshwater inflows and limited flushing of salt and nutrients remain key drivers of ecosystem decline in the Coorong (particularly in the South Lagoon), resulting in poor water and sediment quality, algal blooms, and reduced outcomes for some waterbirds, macroinvertebrates and fish. Despite these pressures, environmental water delivery and improved barrage operations have supported the CLLMM during low-flow periods; improving conditions in the Lower Lakes and Coorong North Lagoon in particular. Along with unregulated inflows, environmental water has helped improve salinities, support wetland habitats, maintain connectivity for native fish movement and breeding, and supported the CLLMM's role in supporting nationally and internationally significant waterbird populations at key stages in their life cycle.

## Environmental outcomes under a climate impacted future

For a description of anticipated climate impacts across the Basin see the *Summary of Assessment Approach* available on the MDBA website.

Table 3 presents a summary of the anticipated environmental impacts of climate change for the SA River Murray Channel and Floodplain area in the Unit by reference to the likelihood of flow regimes being met for the six environmental themes. The shaded bars represent the plausible range of future climates, and the black dots represent the anticipated likelihood under a median (50<sup>th</sup> percentile) future climate scenario.

An equivalent table summarising anticipated environmental impacts for the CLLMM region has not been provided due to the presence of significant uncertainties unique to this asset. Instead, a narrative explanation is provided to effectively convey the complexity of CLLMM climate change impacts in this document.

The likelihood that the pattern and volume of flow will support the objectives for each ecological theme

Theme	Line of enquiry	Very unlikely	Unlikely	About as likely as not	More likely than not	Likely	Very likely	Confidence
Flows and connectivity	LoE 3 (~2030s)							● ○ ○
	LoE 3 (~2050s)							● ○ ○
Ecosystem functions	LoE 3 (~2030s)							● ○ ○
	LoE 3 (~2050s)							● ○ ○
Waterbirds	LoE 3 (~2030s)							● ○ ○
	LoE 3 (~2050s)							● ○ ○
Native fish	LoE 3 (~2030s)							● ○ ○
	LoE 3 (~2050s)							● ○ ○
Native vegetation	LoE 3 (~2030s)							● ○ ○
	LoE 3 (~2050s)							● ○ ○
Other species	LoE 3 (~2030s)							● ○ ○
	LoE 3 (~2050s)							● ○ ○

**Table 3:** Assessment of the flows supporting the objectives for ecological themes at 2030 and 2050 levels of global warming in the unit. Note: LoE 3 (~2030s) refers to Line of Enquiry 3 - possible future 2030s hydroclimate sequences and LoE 3 (~2050s) refers to Line of Enquiry 3 - possible future 2050s hydroclimate sequences. Confidence in this grading is assessed as *Low*, *Medium* or *High*. ‘Other species’ refers to animals including frogs, turtles and macroinvertebrates.

The results in Table 3 indicate that there is a substantial range in the plausible ecological impacts of climate change for this Unit, such that the precise impacts will depend on the nature of the future climate, demonstrated by the wide range of possibilities across themes.

For this Unit, a consistent finding across the plausible range is that *ecosystem functions* and *native fish* are anticipated to be the most exposed to climate change in the SA Murray River Channel and Floodplain area. The 2025 Sustainable Yields and the MDB Outlook programs demonstrated that water availability and runoff are *very likely* to decline throughout the southern Basin such that reduced inflows and higher evaporation rates is likely. This is expected to see an increasing risk to channel connectivity, declining water quality driven by dissolved oxygen and water temperatures, and increased risk of habitat contraction likely driven by an increase in the likelihood and severity of bushfires due to drier fuels, reduced breeding and vegetation recruitment opportunities and survival rates, restricted migration, and shrinking refuge habitats during drought sequences.

In the CLLMM, flow-dependent ecosystems face heightened vulnerability under climate change due to multiple interacting stressors. These include the likely exceedance of ecologically tolerable thresholds for salinity, dissolved oxygen, and water temperature, which are critical for sustaining aquatic life and ecosystem health. Such changes will significantly reduce opportunities for breeding and vegetation recruitment, lower survival rates for key species, and restrict migration pathways. In addition, shrinking refuge habitats during extended drought sequences will further compromise resilience, leaving species such as fish, waterbirds, and other fauna at increased risk of localised decline.

A unique and compounding challenge for this region is sea-level rise, an impact not observed elsewhere in the Murray–Darling Basin. Rising sea levels are expected to increase water levels in the

Murray Mouth and the Coorong North and South Lagoons, potentially causing significant biophysical changes to the system. These changes could alter salinity gradients, inundation patterns, and sediment transport processes, with cascading effects on habitat availability and ecological function.

The magnitude and direction of these impacts remain highly uncertain because they depend on sedimentation rates within the Murray Mouth and estuary, which are poorly understood and difficult to predict. This uncertainty is amplified by the complex interaction between marine and freshwater dynamics, seawater intrusion, and climate-driven reductions in inflows, making future projections for the CLLMM particularly challenging.

## Initial Assessment

On the balance of all three Lines of Enquiry, **the Authority's initial assessment is that there is a risk that environmental outcomes are not being met in this Unit.** *Flows and connectivity, ecosystem functions, native fish, and waterbirds* have been identified as 'at risk' themes, and it is anticipated that climate change will exacerbate the risks further as water availability and runoff are *very likely* to decline throughout the southern Basin into the 2030s and beyond.

Flow has been identified as a leading driver of this finding, specifically sufficiency of flows, constraints to delivery, and limited lateral connectivity. The SDL is one factor that determines the pattern of flow in the river and the extent to which it is supporting environmental outcomes, but there are many other important factors such as water sharing rules, management arrangements, current infrastructure, and decisions made by environmental water holders.

**Hence this initial assessment is unable to resolve whether the SDL continues to reflect an environmentally sustainable level of take and is adequately supporting Basin Plan environmental outcomes. The Authority is proposing further work is required to explore all contributing factors before a determination on the SDL can be made.**

This assessment has found some environmental outcomes in this Unit are at risk, specifically those in the CLLMM related to barrage flows, salinity in the Coorong South Lagoon, and Murray Mouth opening. This assessment has been conducted against the objectives specified in the Basin-Wide Environmental Watering Strategy, a component of the Environmental Watering Plan. These objectives were developed in 2014 based on the best available science and knowledge at the time, notably the modelling and analysis that informed the finalisation of the Basin Plan in 2012.

The Discussion Paper notes that some assumptions made during Basin Plan development regarding the relationship between barrage flows and environmental outcomes may require further reconsideration. This finding is based on the improved knowledge about this system that has emerged over this period, such as greater understanding of hydrological and coastal processes, sediment movement, and advances in river system modelling.

Flow is the main factor that shapes the condition of the Coorong, Lower Lakes and Murray Mouth, but it is not the only one. Outcomes depend on how much water flows, when it arrives, how long it lasts, and which paths it takes. More work is needed with Basin governments to further understand and resolve these complex and interdependent issues.

As Basin Plan implementation is still underway, the MDBA has made assumptions about water recovery under the 450GL program, the completion of infrastructure and rules projects under the SDL

Adjustment Mechanism (SDLAM), and the completion of the 2026 SDLAM Reconciliation. The analysis demonstrates that additional water recovery in the southern Basin (beyond the recovery status as of June 2024) would yield improved environmental benefits in this Unit.

## Consideration of response

The Authority is proposing more work with the South Australian and other Basin governments to further explore the specific flow drivers and the most appropriate response to this initial assessment. This work will include additional modelling, analysis and other lines of evidence to ensure that the findings for the Basin Plan Review report are based on robust evidence and the best available scientific knowledge.

High-level response options currently under consideration for this Unit and upstream units include:

- Targeted changes to rules or management settings
- Addressing upstream flow constraints
- Review environmental objectives and outcomes, including further discussion on Murray Mouth targets
- Environmental works and measures, including:
  - Weir pool modifications or alternate operations to support native fish outcomes
  - Consideration of infrastructure options to enhance flushing of salt and nutrients from the Coorong (e.g. the *Healthy Coorong Healthy Basin* program)
  - Complementary management actions as described in the Long-term environmental watering plan for the South Australian River Murray Water Resource Plan Area
- Change the Sustainable Diversion Limit

The achievement of environmental outcomes in this Unit is highly dependent on upstream drivers. South Australia has largely completed its constraints management program, and achieving the full Basin wide environmental benefits now requires addressing current water delivery constraints in upstream parts of the Basin. The Authority will continue work with Basin governments to implement key findings from the [Constraints Relaxation Implementation Roadmap](#) and facilitate more coordinated delivery across the southern Basin constraints projects.

The risks of a changing climate continue to be actively considered in the Basin.

Noting this finding, the Basin Plan settings in connection with monitoring, evaluation and assessment activities warrant review as they apply to this Unit. Other relevant factors include planning by the South Australian government for the management of local and site-specific areas of concern to maintain environmental outcomes. The Authority supports the continuing efforts of environmental water managers and river operators to make the most of water delivery to support the Basin's environmental outcomes. These efforts continue to evolve in response to new techniques and emerging knowledge, and are often required to balance multiple (and sometimes competing) environmental objectives across a range of geographic scales.

## Evidence summary

The standard evidence sources are presented in the *Summary of Assessment Approach* on the MDBA website.

The Authority utilised the best available evidence. Through the Basin Plan Review 12-week public consultation process, and the subsequent consideration of submissions and engagements over the course of the 2026 Basin Plan Review, the Authority will continue to build on the evidence used through the initial SDL Assessments to address uncertainties and knowledge gaps.