Victorian Murray (SS2)

INITIAL SDL ASSESSMENT RESULT

It is **likely** that the SDL reflects an environmentally sustainable level of take for this unit.

The Authority's initial assessment has also **identified a risk** that environmental outcomes for *flows and connectivity*, *ecosystem functions* and *native fish* are not being met for this Unit. Pattern of flow is the **likely** leading driver of risk due to the inability to deliver water to the floodplains.

The Authority is **proposing further work with the Victorian government** through 2026 to consider the most appropriate response to address this risk. This will include an examination of flow drivers and constraints to flow to inform the Authority's recommendation on response.

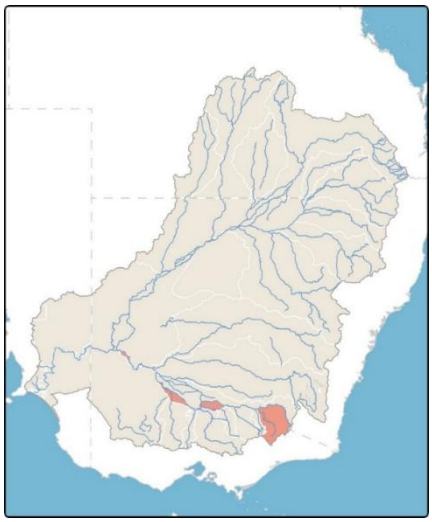

Figure 1: Victorian Murray SDL Resource Unit

The Authority is assessing whether the Sustainable Diversion Limit (SDL) for the Victorian 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)

Ramsar sites	Barmah Forest, Gunbower Forest, Hattah-Kulkyne Lakes and Kerang Wetlands (4 Ramsar Sites)
Contribution to Basin water	17% of the total water available in the Murray-Darling Basin
Key waterways	Victoria: Koetong, Cudgewa, Corryong creeks, Mitta Mitta River
Water storages	Hume Dam (3,005 GL), Dartmouth (3,856 GL), Lake Victoria (677 GL), Mid Murray storages (146 GL)
Significant groundwater connections	Goulburn-Murray: Highlands (GS8b) & Wimmera-Mallee: Sedimentary Plain (GS9b)

The Water Resource Plan (WRP) that supports this Unit commenced on 13 June 2020. The WRP includes the rules and arrangements that Victoria are using to manage this Unit and maintain sustainability. Further information on water recovery for this 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

Figure 2 below summarises the observed environmental condition in the Unit (as at June 2024).

The Authority assessed that *ecosystem functions* are in **poor** condition. *Native vegetation* is considered in **good** condition whilst all other themes are considered to be in **moderate** condition. The Authority has medium confidence in the condition assessment of *flows and connectivity, native fish* and *native vegetation* with lower confidence in the condition assessment of all other themes.

Ecosystem functions were assessed to be in poor condition in this Unit, acknowledging that there were deficiencies in the available data and confidence is very low. As such, confidence has been graded as Data Deficient.

There is high degree of variation in environmental outcomes across the Unit. The Unit features a mix of unregulated upper catchment and highly regulated mid-lower floodplain:

- The upper part of the Unit includes a mix of highly forested montane catchment area (comprising the Mitta Mitta upstream of Dartmouth Dam) and highly regulated river reaches from Dartmouth-to-Hume and Hume-to-Yarrawonga reaches which experience issues related to cold water pollution, erosion, and unseasonal flows.
- The mid part of the Unit includes The Living Murray (TLM) icon sites (Barmah and Gunbower Forests) which have benefited from long-standing environmental water delivery regimes. There

is significant influence from Victorian tributaries (e.g. Ovens, Goulburn, Campaspe) on the flow regime in this reach.

- The lower part of the catchment (from Swan Hill to the South Australian border) is characterised by a progressively widening floodplain in an arid landscape, for which operational constraints limit the inundation pattern and the associated health of floodplain vegetation. This part of the Unit includes TLM sites (Hattah Lakes and Lindsay-Mulcra-Walpolla Islands) where infrastructure supports targeted water delivery to parts of the floodplain. The Murrumbidgee and Lower Darling Rivers provide important flows which help inundate large areas during wet unregulated flow periods.

Local scale works (regulators, pumps and infrastructure) are improving outcomes in TLM icon sites, yet benefits are spatially uneven across the Unit. The condition of native vegetation, including river red gums, shows improvement in areas targeted by water for the environment with these localised benefits extending to improved habitat availability for waterbirds, and other species (including frogs and turtles). For areas where environmental water cannot be managed and there is a reliance on unregulated flows, the condition of these themes is more variable.

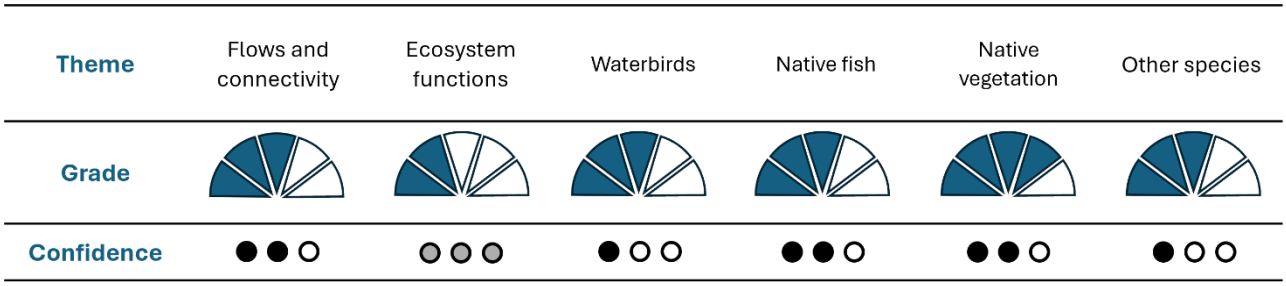

Figure 2. Environmental condition assessment in the Unit. Across each theme environmental condition is graded as *Very Poor, Poor, Moderate, Good* or *Very Good* (as indicated by segments) and confidence in this grading is assessed as *Low, Medium* or *High* (as indicated by dots) or *Data Deficient (*as indicated by grey dots*)*. 'Other species' refers to animals including frogs, platypuses, crayfish and turtles.

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*.

These results capture the Unit-scale environmental condition, but it is noted that there is a wide range of condition along this Unit due to the substantial changing nature of the river-dependent ecosystem and the effectiveness of environmental water delivery when moving downstream from the upper to the lower part of the Unit.

Theme	The *likelihood* that the pattern and volume of flow will support the objectives for each ecological 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			●				●●○
	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, platypuses, crayfish and turtles.

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 *flows and connectivity, ecosystem functions* and *native fish*. There is a medium to high level of confidence in the assessment of *flows and connectivity* and *native fish,* and a lower confidence in the assessment of *ecosystem functions*.

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. For this Unit, the evidence summarised in the Constraints Relaxation Implementation Roadmap (and referenced studies) has been a primary supporting line of evidence for the likelihood assessment, specifically in relation to flow pattern requirements to achieve floodplain outcomes.

The *flows and connectivity, ecosystem functions* and *native fish* themes are considered 'at risk' and were taken through to a further consequence assessment step.

Outcomes for the *waterbirds, native vegetation* and *other species* themes have been identified as **more likely than not** to be supported by the pattern and volume of flow under Lines of Enquiry 1 and 2, 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 assessments and modelled flow data indicate potential risks to *flows and connectivity, ecosystem functions* and *native fish* themes. A consequence assessment, primarily considering Line of Enquiry 2, has been undertaken for these themes (Table 2).

Theme	Nature of impact	Spatial scale of impact	Impact on key values	Final Rating
Flows and connectivity	Constraints to flow and altered flow patterns are impacting both longitudinal and lateral connectivity.	**High** – Basin scale impact	**Yes** – TLM and Ramsar sites impacted. Basin-wide Environmental Watering Strategy (BWS) outcomes for connectivity are affected	**CRITICAL**
Ecosystem function	Altered flow regimes have simplified instream hydraulics, with reduced flow diversity and channel complexity limiting habitat types and sediment transport. Reduced frequency of overbank flows have reduced organic matter and carbon exchange, increasing litter loads and the risk of hypoxic carbon rich events.	**Moderate** – SDL unit impact	**Yes** –TLM and Ramsar sites impacted. BWS outcomes for ecosystem functions are affected	**HIGH**
Native fish	Altered flow regimes are impacting native fish condition with a range of expected native fish species absent, poor recruitment of most native fish, and a low proportion of native species compared to introduced species	**High** – Basin scale impact	**Yes** –TLM and Ramsar sites impacted. BWS outcomes for native fish abundance, movement and recruitment are affected	**CRITICAL**

Table 2: Consequence assessment results.

Drivers of impact

In this Unit, *flows and connectivity* and *native fish* have been rated as **critical**, and *ecosystem functions* rated as **high** in the consequence assessment. The initial assessment has identified flow pattern and ongoing constraints to delivery as leading drivers of this outcome, characterised by reduced lateral connectivity to the floodplain (outside of large natural flood events) and river regulation.

In mid and lower reaches of this Unit (from Yarrawonga Weir to the South Australian border), constraints in delivery of flow and river regulation (presence of weir pools and dams, water extraction and unseasonal flows) are reducing flow variability, frequency of overbank inundation, and lateral connectivity.

Reduced lateral connectivity and less frequent overbank inundation have increased reliance on floodplain infrastructure to inundate floodplain wetland habitats. Such infrastructure operations have improved ecological conditions at local scales, notably at TLM icon sites, by mimicking natural connectivity and inundation patterns, and allowing movement and exchange of native fish species and nutrients between the river and its floodplain. While localised infrastructure improves functional wetland connectivity, unregulated inundation and high-flow connection events provide greater benefits to the ecosystem through nutrient and sediment transport, and channel forming processes.

Infrequent reach scale flooding has contributed to high leaf litter (carbon loads) accumulating on the floodplain, which has the potential to exacerbate poor water quality events during a flood. These impacts have resulted in fish kills and threats to other aquatic species.

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.

The future climate is uncertain. The MDBA has applied a set of climate model scenarios to explore the ecological effects of climate change against a plausible range of future climates. Table 3 presents a summary of the anticipated environmental impacts of climate change for 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 (50th percentile) future climate scenario.

Theme	The *likelihood* that the pattern and volume of flow will support the objectives for each ecological 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, platypuses, crayfish and turtles.

Ecosystem functions are anticipated to be the most exposed to climate change, along with *flows and connectivity, native fish* and *native vegetation*. The 2025 Sustainable Yields and the MDB Outlook demonstrated that water availability and runoff are *very likely* to decline throughout the southern Basin such that there is likely to be reduced inflows and higher evaporation rates. 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.

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,** and that these risks would likely be exacerbated under a future climate**.** *Flows and connectivity, ecosystem functions* and *native fish* have been identified as 'at risk' themes.

Flow pattern has been identified as a leading driver of this finding, specifically deficiencies in lateral connectivity and unseasonal flow patterns. 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, and decisions made by environmental water holders.

It is likely that the SDL reflects an environmentally sustainable level of take, but additional investigation is warranted. The Authority is proposing further work is required to explore all contributing factors before a determination on the SDL can be made.

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 Victorian government 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 the findings for the Basin Plan Review report are based on robust evidence and the best available scientific knowledge.

The Authority will continue work with the Victorian and other Basin governments to implement key findings from the Constraints Relaxation Implementation Roadmap and facilitate more coordinated delivery across the southern Basin constraints projects.

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

- Environmental works and measures, including the *Victorian Constraints Measures Program*
- Targeted changes to rules or management settings
- Change the Sustainable Diversion Limit
- Review environmental objectives and outcomes

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 Victorian 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.