



STATE OF THE YARRA AND ITS PARKLANDS
2018 REPORT



Commissioner
for Environmental
Sustainability
Victoria



Traditional Owners

The Commissioner for Environmental Sustainability proudly acknowledges Victoria's Aboriginal community and their rich culture and pays respect to their Elders past and present.

We acknowledge Aboriginal people as Australia's first peoples and as the Traditional Owners and custodians of the land and water on which we rely. We recognise and value the ongoing contribution of Aboriginal people and communities to Victorian life, and how this enriches us.

We embrace the spirit of reconciliation, working towards the equality of outcomes and ensuring an equal voice.



Dr Gillian Sparkes
Commissioner for Environmental
Sustainability, Victoria

Foreword

Welcome to the inaugural State of the Yarra and Its Parklands report. This document provides a comprehensive baseline on the environmental condition of the Yarra River corridor: a clear starting point for the current health of the environment from which future assessments can be compared. In addition to evaluating environmental condition, future reports will also report on the key objectives of the Yarra Strategic Plan (due for release in 2019).

Over the past year, my office has been working with our partners and collaborators across the community and government to produce this report. Our objective is to improve not only environmental reporting but also the processes and partnerships that underpin the reporting, creating a better environmental management system through the research impact of science and, ultimately, improving environmental outcomes.

My job as Commissioner is to provide independent and objective reporting to inform policy-makers, regulators, environmental managers, scientists and the wider Victorian community about the state of our natural environment, and to advise government. Another critical part of my job is to shine a light on the areas of the environment that are working well and on those we need to improve. *The State of the Yarra and Its Parklands (SoY) 2018* supports me in fulfilling these requirements. Through the assessment of 36 environmental and socio-economic indicators, this report tells the story of the health of the Yarra River and its parklands at a time of unprecedented population growth. The recommendations are intended to help focus effort and investment over the medium-term, to benefit the Yarra River corridor.

The State of the Environment (SoE) 2018 report provides the overarching approach to environmental reporting in Victoria. This SoY 2018 report should be read as a companion to that report and, like the SoE 2018, this report has the legislative authority to make recommendations to government and requires government to respond to those recommendations. The seven recommendations presented in this report should not be considered in isolation but rather as Yarra specific challenges that complement the 20 recommendations presented in the SoE 2018 report.

In addition to the strong scientific evidence base, this report provides a narrative that links environmental condition to cultural, social and economic aspirations for a healthy and flowing Yarra River. There is an opportunity here to strengthen monitoring and data collation along the Yarra to include cultural, social and economic indicators. This information would allow government to track progress on delivering the social coherence benefits of the Yarra Strategic Plan. Cultural, social and economic indicators are included in this inaugural report, but the data is generally poor or missing entirely. Identifying key cultural, social and economic indicators, and improving the system to enable data collection and analysis to assess them, will lead to better outcomes for the Yarra River's environment and the communities that depend on it in the face of the increasing pressures of population growth, urban development and a changing climate.

Sustainable Development Goals

The 34 United Nations Sustainable Development Goal (SDG) targets referred to in this report demonstrate how we are actively aligning Victoria with international environmental reporting frameworks. These targets have been selected from the 169 SDG targets as they align with the scientific evidence base presented in the 36 indicators of this report. This is the start of our journey to rewire and bring coherence to Victoria’s environmental management system so that the SDGs frame environmental monitoring and reporting in Victoria, helping to drive ecologically sustainable development over the next decade.

The SoE 2018, State of the Forests 2018 and this report, all prepared by my office, are the first attempt in Australia to apply the SDG framework to environmental reporting at a subnational level. The SDGs can be viewed as the missing link, providing an operating framework to bring effect to a key objective of the *Commissioner for Environmental Sustainability Act 2003* – to facilitate ecologically sustainable development in Victoria. This work will open much richer data analyses and more meaningful conversations with the community, underpinned by the SDGs and clear targets for ecologically sustainable development.

In the SoE 2018 report, there is a more detailed description of the process my office undertook to assess and align the SDGs with environmental reporting in Victoria.

Future Focus

The seven recommendations in this report are informed by, and aligned with, the recommendations in the SoE 2018 report. They aim to leverage effort and investment, build on current initiatives, and target improvement to deliver on the government’s legislative and policy frameworks including *the Yarra River Protection (Wilip-gin Birrarung murrong) Act 2017*, *Climate Change Act 2017*, *Yarra River Action Plan*, *Protecting Victoria’s Environment – Biodiversity 2037*, *Water for Victoria* and the (pending) Yarra Strategic Plan. They also align with achieving the SDG ecologically sustainable development targets and support the development of a system of environmental-economic accounts for the entire Yarra River corridor.

My aim is that this report will inform and inspire community, government and business leaders.

I would like to thank the experts who contributed their time and academic expertise and generously helped peer-review multiple iterations of the scientific assessments included in this report.

I also thank my incredibly dedicated and hard-working team of science writers and administrative staff for their effort over a long period: it has been above and beyond. We are indebted to our Melbourne Water colleagues for their time, expertise and support, and the diverse stakeholder groups, from citizen scientists measuring water quality on the Yarra River to the Monash Sustainable Development Institute for support with our work on the implementation of the SDGs.

Status	Indicators %	Trend	Indicators %	Data Quality	Indicators %
Good	3%	Improving	6%	Good	53%
Fair	20%	Stable	20%	Fair	16%
Poor	51%	Deteriorating	49%	Poor	31%
Unknown	26%	Unclear	25%		

Table 1: Comparison of the status, trend and data quality of the 36 indicators assessed

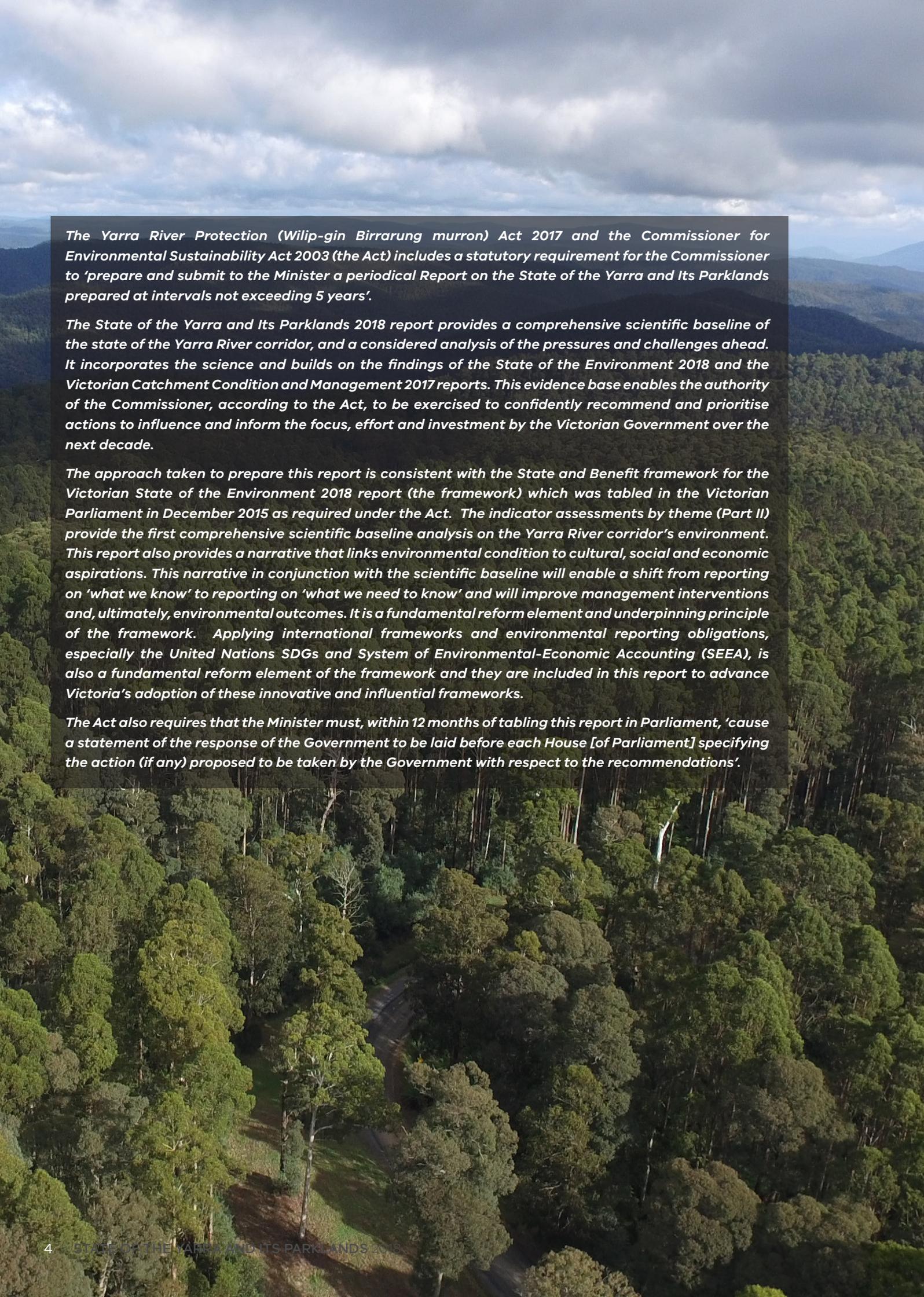
To the members of the Commissioner's Reference Group, the Environmental Reporting Project Control Board and the Technical Advisory Group, who have generously volunteered their time and expertise in the four years since the groups were established: your guidance and feedback has been invaluable to achieving the reforms and reports produced by my team since 2015.

It is an honour to serve my community as Victoria's Commissioner for Environmental Sustainability. I am pleased to present the inaugural State of the Yarra and Its Parklands 2018 report, and I hope that the findings and recommendations are utilised in ways that benefit the Yarra River corridor and its communities for many years to come.

I invite you to download the report and explore environmental case studies, news and information via our website (www.ces.vic.gov.au) and keep in touch with our work through your preferred social media channels.



Dr Gillian Sparkes
Commissioner for Environmental Sustainability,
Victoria



The Yarra River Protection (Wilip-gin Birrarung murron) Act 2017 and the Commissioner for Environmental Sustainability Act 2003 (the Act) includes a statutory requirement for the Commissioner to 'prepare and submit to the Minister a periodical Report on the State of the Yarra and Its Parklands prepared at intervals not exceeding 5 years'.

The State of the Yarra and Its Parklands 2018 report provides a comprehensive scientific baseline of the state of the Yarra River corridor, and a considered analysis of the pressures and challenges ahead. It incorporates the science and builds on the findings of the State of the Environment 2018 and the Victorian Catchment Condition and Management 2017 reports. This evidence base enables the authority of the Commissioner, according to the Act, to be exercised to confidently recommend and prioritise actions to influence and inform the focus, effort and investment by the Victorian Government over the next decade.

The approach taken to prepare this report is consistent with the State and Benefit framework for the Victorian State of the Environment 2018 report (the framework) which was tabled in the Victorian Parliament in December 2015 as required under the Act. The indicator assessments by theme (Part II) provide the first comprehensive scientific baseline analysis on the Yarra River corridor's environment. This report also provides a narrative that links environmental condition to cultural, social and economic aspirations. This narrative in conjunction with the scientific baseline will enable a shift from reporting on 'what we know' to reporting on 'what we need to know' and will improve management interventions and, ultimately, environmental outcomes. It is a fundamental reform element and underpinning principle of the framework. Applying international frameworks and environmental reporting obligations, especially the United Nations SDGs and System of Environmental-Economic Accounting (SEEA), is also a fundamental reform element of the framework and they are included in this report to advance Victoria's adoption of these innovative and influential frameworks.

The Act also requires that the Minister must, within 12 months of tabling this report in Parliament, 'cause a statement of the response of the Government to be laid before each House [of Parliament] specifying the action (if any) proposed to be taken by the Government with respect to the recommendations'.

Note from Lead Author



Dr Rebecca Koss
Senior Science Writer

It has been a wonderful opportunity to create, and curate, the inaugural State of the Yarra and Its Parklands report. Although preparing an independent and impartial report on a high-profile Victorian river is not without its challenges, I saw it as an opportunity to bring together the cultural, social, economic values of the Yarra and link them to its environmental condition. Starting with a blank canvas, my intention was to develop a SoY that not only reports on the environmental health of the Yarra River corridor, as per the requirements of the *Yarra River Protection (Wilip-gin Birrarung murrn) Act 2017* and the *Commissioner for Environmental Sustainability Act 2003*, but also respects the importance of the cultural, social and economic narrative of the communities who connect with and live near the Yarra River corridor and who depend on it for their health, wellbeing and livelihoods. My aim was to create a report that reflects the Yarra River and its parklands as one living and integrated natural entity that flows from catchment to coast and is influenced by the people who live alongside it – aligning the environmental, cultural, social and economic narratives with the *Yarra River Protection (Wilip-gin Birrarung murrn) Act 2017*.

I applied the State and Benefit Framework when writing this report. This framework focuses on the importance of working closely with a range of government organisations and agencies and adopting UN SEEA and the UN SDGs to align Victorian reporting with international standards. To curate indicator assessments across the two themes, 'Communities of the Yarra and Its Parklands' and 'Environmental Health', I worked

closely with Melbourne Water, the Victorian Department of Environment, Land, Water and Planning (DELWP), the Victorian Aboriginal Heritage Council, Aboriginal Victoria and Parks Victoria. I would especially like to thank Karen White and her team, Dr Tiana Preston and Dr Sabine Schreiber at Melbourne Water; Aunty Nellie Flagg (prior Chair), Dr Janine Major and Lucia Lancellotti at the Victorian Aboriginal Heritage Council; Mark Eccleston and Jana Boulet at Aboriginal Victoria; Alanna Maguire and Darren Baldyga at Parks Victoria; Tim Kanoa, Prachi Samir and Nikki Gemmill at DELWP; and Dr Gillian Sparkes and the OCES team for their time, commitment and support in understanding my vision and being part of this report's journey.

This SoY report represents the beginning of an environmental reporting journey on the Yarra River corridor as a natural living and flowing entity. Future reports will assess how key performance objectives of the Yarra Strategic Plan are tracking. I invite you to read the inaugural State of the Yarra and Its Parklands report as an integrated journey of flow from catchment to coast.

A handwritten signature in black ink, appearing to read 'Rebecca Koss'.

Dr Rebecca Koss
Office of the Commissioner for
Environmental Sustainability

SoY 2018 | Acknowledgements

Our thanks go to the following individuals and organisations for their considerable contribution to the development and review of the *State of the Yarra and Its Parklands 2018*.

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Environment Victoria	Victorian Department of Environment, Land, Water and Planning
Fisheries Victoria	Victorian Environmental Water Holder
Melbourne Water Corporation	Yarra River Keeper
Parks Victoria	
Trust for Nature	
Victorian Aboriginal Heritage Council	

My sincere thanks also go to my science team: Dr Scott Rawlings, Dr Rebecca Koss, Andrew Marshall and Dr Kangmin Moon for their work on this report. Thank you for your tireless effort and genuine willingness to work in collaboration with the science community and across government to prepare this report. In particular, I want to acknowledge the dedication of the lead author, Dr Rebecca Koss, for her passion, commitment and creativity in undertaking the task of preparing this landmark report and fulfilling the new legislative requirements of the Office in the *Yarra River Protection (Wilip-gin Birrarung murron) Act 2017* and the *Commissioner for Environmental Sustainability Act 2003*.

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Abbreviations

ABS	Australian Bureau of Statistics
ATAP	Australian Tourism Accreditation Program
CAM MOU	Intergovernmental Memorandum of Understanding Agreement on a Common Assessment Method for Listing of Threatened Species and Threatened Ecological Communities
CES Act	Commissioner for Environmental Sustainability Act 2003
CMA	Catchment Management Authority/ies
DDO	Design and Development Overlay
DEDJTR	Victorian Department of Economic Development, Jobs, Transport and Resources
DELWP	Victorian Department of Environment, Land, Water and Planning
ECO	Ecotourism Australia accreditation
EPA Victoria	Environment Protection Authority, Victoria
ESD	Ecologically Sustainable Development
ESO	Environmental Significance Overlay
FFG Act	Flora and Fauna Guarantee Act 1988
GDP	Gross Domestic Product
ISC	Index of Stream Condition
IUCN	International Union for Conservation of Nature
LGA	Local Government Authority
MAC	Ministerial Advisory Committee
MWRRG	Metropolitan Waste and Resource Recovery Group
OCES	Office of the Commissioner for Environmental Sustainability
SDG	United Nations Sustainable Development Goal
SEEA	United Nations System of Environmental-Economic Accounting
SEPP	State Environment Protection Policy
SEPP (WoV)	State Environment Protection Policy (Waters of Victoria)
SEPP (Waters)	State Environment Protection Policy (Waters)
SLO	Significant Landscape Overlay
SoE	State of the Environment Report
SoY	State of the Yarra and Its Parklands Report
UN	United Nations
VAGO	Victorian Auditor-General's Office
VAHC	Victorian Aboriginal Heritage Council
VAHR	Victorian Aboriginal Heritage Register
VCMC	Victorian Catchment Management Council
VEFMAP	Victorian Environmental Flows Monitoring and Assessment Program
VEWH	Victorian Environmental Water Holder
VLUIS	Victorian Land Use Information System
VPO	Vegetation Protection Overlay
YSP	Yarra Strategic Plan
Yarra MAC	Yarra River Protection Ministerial Advisory Committee

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STATE OF THE YARRA AND ITS PARKLANDS

SUMMARY REPORT PART I



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Status Summary

The Status Summary presents an overall analysis of the status assessments for 35 of 36 indicators (Table 2 and Figure 1).

Of the 35 indicators (3%), one has been assessed as in a 'good' state. This was the indicator for post settlement colonial heritage. Conversely, it is significant that the 18 indicators that have been assessed as 'poor' (51%) include 18 of the 25 environmental health indicators (72%).

Trend Summary

The Trend Summary presents an overall analysis of the trend assessments for 35 of the 36 indicators (Table 3 and Figure 2). The trend expresses whether the status of the indicator is deteriorating, improving or remaining stable. Only two indicators (6%) are assessed as 'improving'. 17 indicators have been assessed as 'deteriorating' (49%). Significantly, 16 of the 25 environmental health indicators (64%) have been assessed as in a 'poor' state with a 'deteriorating' trend.

Data Quality Summary

The Data Quality Summary presents an overall analysis for all 36 indicators (Table 4 and Figure 3). Slightly more than half of the indicators (53%) are supported by 'good' data, which means that the status and trend assessments for these indicators are presented with confidence. Nearly one-third of all indicators (31%) have been assessed as having 'poor' data (which may indicate no data at all). The indicators under Communities of the Yarra and Its Parklands are over-represented in the 'poor' data category (55% of those indicators), which shows that an improved evidence base is required for that theme.

Status	Communities of the Yarra and its Parklands (n. indicators)	Environmental health (n. indicators)	Total (a) (n. indicators)	Proportion (%)
Good	1	0	1	3
Fair	3	4	7	20
Poor	0	18	18	51
Unknown	6	3	9	26
Total	10	25	35	100

Table 2: Indicator assessments status summary

* a: One indicator in the Communities of the Yarra and Its Parklands chapter is not applicable for status assessment and is not included.

Performance

High Performance: The analysis presented here consolidates indicators with a 'good' status assessment, a 'stable' or 'improving' trend assessment, and 'good' data quality (Figure 4). 'High' suggests that not only is the indicator performing well, and expected to continue to do so, but that there is a high level of confidence in the assessment. One indicator, post-settlement colonial heritage (3%), has been assessed as 'high-performing'.

Low Performance: The analysis presented here consolidates indicators with a 'poor' status assessment, 'stable' or 'deteriorating' trend assessment, and 'good' data quality (Figure 5). This suggests not only that the indicator is of concern and is not demonstrating improvement, but also that there is a high level of confidence in the assessment. That is, we are confident that this indicator is showing poor condition, and will remain so without intervention. 39% of all indicators have been assessed as 'low-performing', including 14 of the 25 Environmental Health indicators (56% of that theme's indicators).

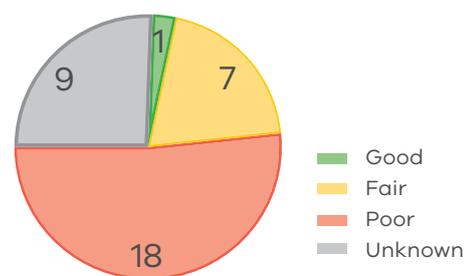


Figure 1: Indicator assessments status summary

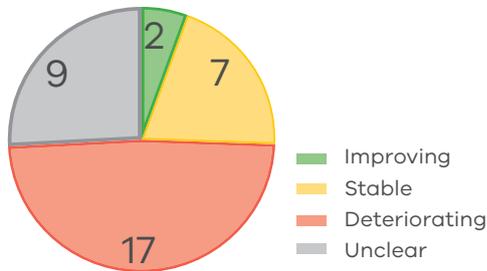


Figure 2: Trend Summary

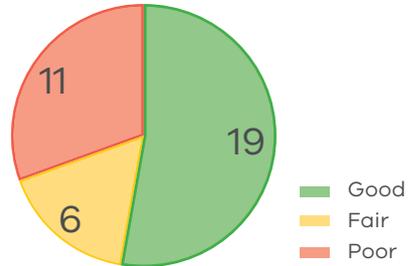


Figure 3: Data Quality Summary

Trend	Communities of the Yarra and its Parklands (n. indicators)	Environmental health (n. indicators)	Total (a) (n. indicators)	Proportion (%)
Improving	2	0	2	6
Stable	2	5	7	20
Deteriorating	0	17	17	48
Unclear	6	3	9	26
Total	10	25	35	100

Table 3: Trend Summary

* a: One indicator in the Communities of the Yarra and Its Parklands chapter is not applicable for trend assessment and is not included.

Status	Communities of the Yarra and its Parklands (n. indicators)	Environmental health (n. indicators)	Total (n. indicators)	Proportion (%)
Good	4	15	19	52
Fair	1	5	6	17
Poor	6	5	11	31
Total	11	25	36	100

Table 4: Data Quality Summary

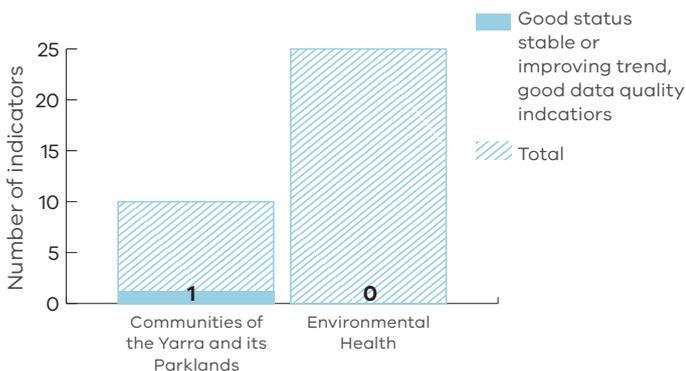


Figure 4: High-performing areas

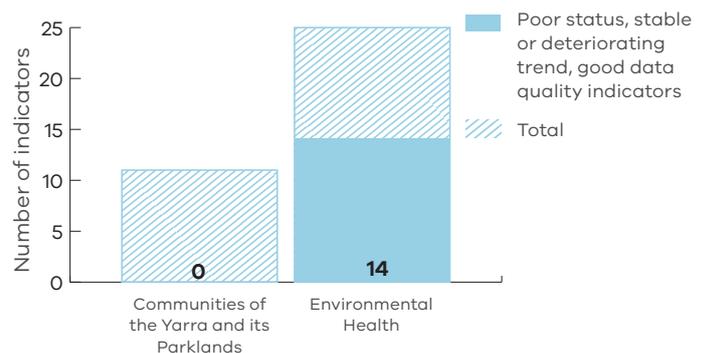


Figure 5: Low-performing areas

SoY 2018 | Report Card

Table 5: Assessments Report Card

Status

N/A Not Applicable

The indicator assessment is based on future projections or the change in environmental condition and providing a status assessment is not applicable. Only a trend assessment is provided.



Unknown

Data is insufficient to make an assessment of status and trends.



Poor

Environmental condition is under significant stress, OR pressure is likely to have significant impact on environmental condition/human health, OR inadequate protection of natural ecosystems and biodiversity is evident.



Fair

Environmental condition is neither positive or negative and may be variable across Victoria, OR pressure is likely to have limited impact on environmental condition/human health, OR moderate protection of natural ecosystems and biodiversity is evident.



Good

Environmental condition is healthy across Victoria, OR pressure is likely to have negligible impact on environmental condition/human health, OR comprehensive protection of natural ecosystems and biodiversity is evident.

Trend

N/A Not applicable

This indicator assessment is based on current environmental condition only and it is not applicable to provide a trend assessment. Only a status assessment is provided.



Unclear



Deteriorating



Stable



Improving

Data quality



Poor

Evidence and consensus too low to make an assessment



Fair

Limited evidence or limited consensus



Good

Adequate high-quality evidence and high level of consensus

Indicator

Status

UNKNOWN

POOR

FAIR

GOOD

Trend

Data Quality

Y:01 Cultural Landscape Health and Management



DATA QUALITY

Poor

Y:02 Post-Settlement Colonial Heritage



DATA QUALITY

Good

Y:03 Population Growth



N/A



DATA QUALITY

Good

Y:04 Planning



DATA QUALITY

Good

Y:05 Yarra River 50 Year Community Vision



DATA QUALITY

Poor

Y:06 Citizen Science



DATA QUALITY

Poor

SoY 2018 | Report Card

Indicator	Status				Trend	Data Quality
	UNKNOWN	POOR	FAIR	GOOD		
Y:07 Volunteers and Landcare					?	 DATA QUALITY Poor
Y:08 Parklands and Open Space					↗	 DATA QUALITY Good
Y:09 User Groups and Community Activities					?	 DATA QUALITY Poor
Y:10 Agriculture					?	 DATA QUALITY Poor
Y:11 Tourism					→	 DATA QUALITY Fair
Y:12 Litter					↘	 DATA QUALITY Fair
Y:13 Pollution					↘	 DATA QUALITY Good
Y:14 Sewerage					↘	 DATA QUALITY Good
Y:15 Stormwater					↘	 DATA QUALITY Good
Y:16 Climate Change					?	 DATA QUALITY Poor

SoY 2018 | Report Card

Indicator	Status				Trend	Data Quality
	UNKNOWN	POOR	FAIR	GOOD		
Y:17 Invasive freshwater plants and animals					?	 DATA QUALITY Poor
Y:18 Trend in Carp (<i>Cyprinus carpio</i>) Distribution					↘	 DATA QUALITY Good
Y:19 Invasive terrestrial plants					?	 DATA QUALITY Poor
Y:20 Invasive terrestrial animals					↘	 DATA QUALITY Poor
Y:21 Trend in Sambar Deer (<i>Cervus unicolor</i>) Populations and Their Distributions					↘	 DATA QUALITY Poor
Y:22 Water Quality					→	 DATA QUALITY Good
Y:23 Streamflow					↘	 DATA QUALITY Good
Y:24 Surface water harvested for consumptive use					↘	 DATA QUALITY Good
Y:25 Environmental Water					→	 DATA QUALITY Good
Y:26 Threatened species					↘	 DATA QUALITY Good

Indicator	Status				Trend	Data Quality
	UNKNOWN	POOR	FAIR	GOOD		
Y:27 Leadbeater's Possum <i>(Gymnobelideus leadbeateri)</i>						 DATA QUALITY Good
Y:28 Helmeted Honeyeater <i>(Lichenostomus melanops cassidix)</i>						 DATA QUALITY Good
Y:29 Birds						 DATA QUALITY Fair
Y:30 Fish						 DATA QUALITY Good
Y:31 Frogs						 DATA QUALITY Fair <small>(for all reaches)</small> Inner city, suburban and lower rural reaches: Fair Upper rural reach: Poor
Y:32 Microinvertebrates						 DATA QUALITY Good Inner city and suburban reaches: Poor Lower rural reach: Fair Upper rural reach: Good Inner city and suburban reaches: Deteriorating Lower and Upper rural reach: Stable
Y:33 Platypus						 DATA QUALITY Fair <small>(for all reaches)</small> Inner city and suburban reaches: Poor Lower and Upper reaches: Fair
Y:34 Riparian Vegetation						 DATA QUALITY Fair Inner city and suburban reaches: Poor Lower and upper rural reaches: Fair Inner city and suburban reaches: Deteriorating Lower and upper rural reaches: Stable
Y:35 Wetland & Billabong Ecosystem Health						 DATA QUALITY Good
Y:36 Estuary Ecosystem health						 DATA QUALITY Good

Future Focus

The recommendations included in this Future Focus section are aligned with those presented in the Victorian State of the Environment (SoE) 2018 Report and the science presented in this report. They are intended to support improvement of Victoria's environmental management system over the next decade to 2030. This is not an arbitrary time-horizon. It aligns the recommendations of the SoE 2018 and this report with the *2030 Agenda for Sustainable Development* and the reporting arrangements of the SDGs. All 193 member states of the UN have committed to achieving each goal and target by 2030 in order to 'leave no one behind'. Although most of the recommendations in the SoE 2018 and this report do not specifically suggest precise delivery timelines, except where noted, it is anticipated that they would be fully implemented by 2030, with clear progress evident within five years, commensurate with the next SoE and State of the Yarra and Its Parklands reports which are due in 2023.

The selection of these recommendations was based principally on the evidence base presented across this report, and the identified knowledge gaps and improvements to data collection and monitoring regimes revealed through the analysis. The selection has also been informed by (i) global megatrends, (ii) a set of established principles and criteria, (iii) core strategic capabilities, and (iv) the findings of the SoE 2018 report.

The *Megatrends and the Victorian Environment 2018* report was prepared by Deloitte Access Economics and is published at www.ces.vic.gov.au/publications. It analyses the anticipated key trends that will influence and impact natural capital, and our management of it, in Victoria to 2030 and beyond. The SoE 2018 report contains an abridged version of the Deloitte report, with a focus on the key insights.

These 'megatrends' have informed the Future Focus priorities and recommendations arising from the assessments across this report. The megatrends have enabled a top-down analysis, while the scientific assessments have provided a foundational, bottom-up evidence base. Combined, these analyses have identified the most important priorities for the Yarra River corridor over the next decade and beyond.

The five megatrends identified are:

1. the physical impacts of climate change
2. reducing our carbon footprint
3. clued-up citizens shaping business and government practices
4. disruptive technologies
5. natural resource constraints.

1. Deloitte Access Economics 2018, 'Megatrends and the Victorian Environment 2018', Melbourne, Victoria www.ces.vic.gov.au/Publications Publication pending report release.

Recommendations

The following principles and criteria were applied to the recommendations in this SoY report to:

- prioritise those that improve multiple environmental outcomes
- focus on improving the evidence base to deliver key legislative and policy frameworks including the *Yarra River Protection (Wilip-gin Birrarung murron) Act 2017*, *Climate Change Act 2017*, *Yarra River Action Plan*, *Biodiversity 2037*, *Water for Victoria* and the (pending) *Yarra Strategic Plan*
- be informed by the findings of other respected reports (OCES acknowledges the significant research undertaken by others, including the Victorian Environmental Assessment Council, Victorian Auditor-General's Office (VAGO), Victorian Catchment Management Council and Yarra River Protection Ministerial Advisory Committee)
- align with achieving ecologically sustainable development and SDG targets by 2030, and support the development of a system of environmental-economic accounts for Victoria.

The recommendations can broadly be grouped into the following strategic capabilities:

- Science impact – This is about 'knowing what we need to know, when we need to know it' in a format that is useful for scientists, regulators, managers, economists and the community. This includes responding to systemic environmental challenges and emerging global megatrends, and developing environmental-economic accounting as a core skill for government.
- Coordination and governance – This focuses on improving the clarity of roles and responsibilities, and reviewing allocation of existing funding models and accountabilities to deliver priorities. New money is not always needed: improving the coordination of existing resources, effort and investments will enable better outcomes.
- Delivery – A comprehensive suite of policy and action plans have been developed by the Victorian Government since 2014. Focus must now shift to delivery of this policy regime and better investment in underpinning science and skills to enable adaptive management.
- Data, monitoring, spatial information and analytics – More investment in skills and capabilities is needed from DELWP and portfolio agencies.
- Citizen science and education – Building community understanding, participation and awareness can improve policy and environmental outcomes.

As per the legislative authority of the *Commissioner for Environmental Sustainability Act 2003* and *Yarra River Protection (Wilip-gin Birrarung murron) Act 2017*, all SoY recommendations must be responded to by the Victorian Government within 12 months of the tabling of this report in Parliament.

The SoY 2018 report includes seven recommendations. Five of the seven recommendations are aligned with, and derivations of, the recommendations that are included in the SoE 2018 Report.

Cultural Landscape Health and Management

Deliver on the cultural indicators for future SoY reporting

There are opportunities to enhance the role of Victoria's Traditional Owners in cultural landscape health and management based on the objectives outlined in the *Aboriginal Heritage Act 2006*. Importantly, Aboriginal cultural heritage needs to be recognised as a fundamental part of Aboriginal community life and cultural identity, and celebrated as a significant part of the heritage of all Australians. There are many sources of information that can provide insights into how to progress towards medium and long-term outcomes for cultural landscapes.

Recommendation 1: That the Victorian Government, in consultation with Traditional Owners and relevant agencies, deliver on the contemporary cultural indicators to inform future environmental reporting. Delivery of these indicators must reflect the priorities of Traditional Owners, have practical and cost-effective data-collection methods, and be meaningful and demonstrate change within a five-year reporting period.

This recommendation is repeated in the SoE 2018 Report (Recommendation 1).

For further detail, see the Cultural Landscape Health and Management chapter in this report and the SoE 2018 Report.

Climate Change Impacts

Improve climate projections for the Yarra River corridor

Climate projections at a finer spatial resolution, and more accurate rainfall projections, are required to improve management outcomes. Greater detail in climate projections can improve the proactive planning for many natural assets and sectors, including agriculture, with rainfall projections a particularly valuable tool for the Yarra Strategic Plan and other actions listed in the Yarra River Action Plan. Rainfall projections are currently associated with reasonably large uncertainties (relative to other climate variables such as temperature) and reducing these uncertainties would enhance environmental management, planning and outcomes.

Recommendation 2: That Melbourne Water and DELWP, in coordination with research partners, conduct further analysis to improve climate projections for the Yarra River corridor. These findings should inform the system of environmental-economic accounts and how these values change under climate change. These projections would aim to reduce the uncertainties associated with rainfall projections as a minimum.

This recommendation is a Yarra-specific derivation of Recommendation 2 in the SoE 2018 Report.

For further detail, see Threats and Pressures (in this report) and the Climate Change Impacts chapter in the SoE 2018 Report.

Biodiversity

Improve Victoria's biodiversity outcomes on public land

This report acknowledges the good work of Melbourne Water's scientists in assessing current and future trends across environmental health indicators for the Yarra River corridor. Although the data and science available has been assessed as 'good' and can answer many of the critical questions about biodiversity condition and extent in the Yarra River corridor, there is room for improvement. For example, the lack of information on invasive animals and plants, litter, pollution and sewerage impacts, land development and inappropriate land use and increased water resource dependency by Melbourne's growing population is of concern. It highlights the fragmented approach to data monitoring, collation and reporting which is an impediment to adaptive management and improving biodiversity outcomes. The SoE 2018 analyses the causes of this fragmentation and recommends establishing the role of a Chief Biodiversity Scientist for Victoria to improve investment and coordination in biodiversity science and research (see Recommendation 5 in the SoE 2018 Report).

This report highlights the need for improved functionality of biodiversity science across the Victorian Government environment portfolio to improve the collection, coordination, curation and interpretation of biodiversity science. Perhaps most critical is the need to integrate biodiversity science to inform solutions to complex problems, cumulative threats (climate change, fire, drought, flood, heatwave, invasive pests, development) and cumulative challenges (forest, water and coastal management).

Recommendation 3: That DELWP streamline the governance and coordination of investment in the science and data capability of all government biodiversity programs and improve the coherence and impact of the publicly funded scientific endeavour. Further, that DELWP establish the position of Chief Biodiversity Scientist to oversee this coordinated effort and provide esteemed counsel to the DELWP Secretary and the Minister for Energy, Environment and Climate Change to improve the impact of investment in biodiversity research across the Victorian environment portfolio.

This recommendation is repeated in the SoE 2018 Report (Recommendation 5).

For further detail, see Environmental Health (in this report) and the Biodiversity chapter in the SoE 2018 Report.

Biodiversity

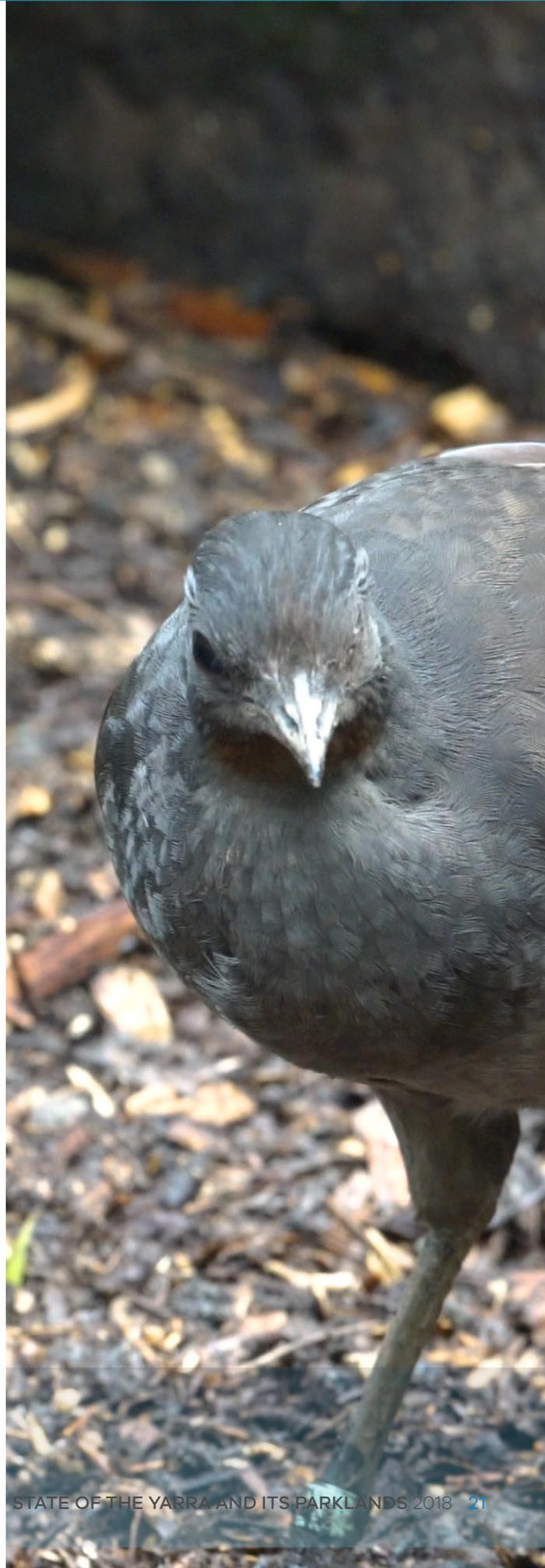
Create connected habitat corridors to allow movement for all native species

To protect and assist the movement of threatened species – such as Leadbeater’s possum, helmeted honeyeater and other native species – a larger protected corridor system in the upper and lower rural Yarra River reaches is required.

This corridor can also aid in protecting other aquatic ecosystems such as billabongs, wetlands and floodplains. A suite of investments would be required, including: resources for permanent protection, such as Public Land Acquisition Overlays and private land conservation, and associated management actions focused on high priority ecosystems and landscapes. The corridor would also require updated compliance arrangements, including local government capability to enforce: (i) Amendment GC48 (new and updated existing planning controls), (ii) Guidelines for the removal, destruction or lopping of native vegetation and (iii) Invasive Plants and Animals Policy Framework. These changes would enable state agencies and local governments to act within their jurisdiction with monitoring, reporting and actions co-designed so that assessments and outcomes can inform the Yarra Strategic Plan.

Recommendation 4: That DELWP, in collaboration with local government and private property owners, maintains and improves threatened species populations, and their habitats, by connecting Crown land in the upper and lower Yarra rural reaches, through a system of parks, reserves and private protected areas.

For further detail, see Chapter 2: Environmental Health.



Population Growth and Development

Application of planning controls in the lower and upper rural Yarra River reaches

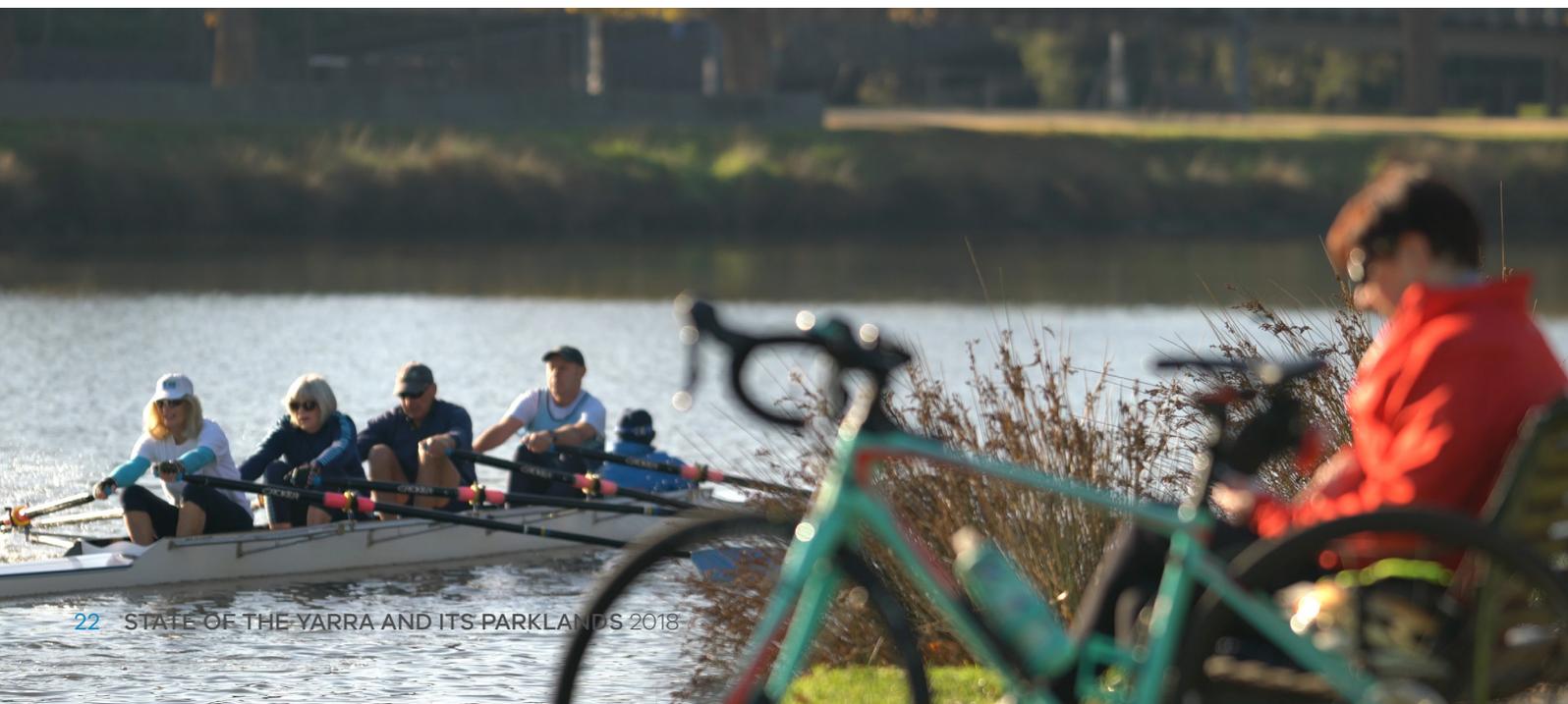
Current estimates of population growth predict that there will be 8 million people in the greater Melbourne area by 2031, and approximately 10.1 million people across Victoria by 2051.² This population growth is reflected across all Yarra River reaches. The interim Yarra River Protection Planning Controls (Amendment GC48) came into effect in 2017 to focus on managing existing and immediate development pressures on the inner city (Richmond to Fairfield) and suburban reaches (Ivanhoe to Warrandyte), such as encroachment on the Yarra River and its environs due to urban development. These interim planning controls are applied to ensure ongoing and increasing development pressures are managed appropriately in accordance with the State Planning Policy Framework. The interim planning controls ensure that this is done in a consistent manner along the entire Yarra River corridor, for example, in creating the Yarra River – Bulleen Precinct Land Use Framework which is a 50-year outlook for managing land use, open space and development. Similar

planning controls along the Yarra River corridor in the lower and upper rural reaches are also required. As Melbourne’s population continues to grow and expand outwards towards the urban growth boundary, the Yarra River will need protection against inappropriate urban development and property subdivision that can reduce the amenity and natural elements along this part of the Yarra River corridor. Similar to the Yarra River – Bulleen Precinct Land Use Framework, these planning controls should apply a 50-year outlook.

Recommendation 5: That DELWP, in collaboration with Melbourne Water and local governments, extend the geographical scope of the current interim Yarra River Protection Planning Controls (Amendment GC48) along the Yarra River corridor ranging from Warrandyte to the boundary of the Yarra Ranges National Park in support of appropriate urban development.

For further detail, see Planning within Demographics, Stewardship and Recreational Health in this report.

2. DELWP 2016, 'Victoria in Future 2016 Population and household projections to 2051', Melbourne, Victoria



International Frameworks

Establish a system of environmental-economic accounts for the Yarra River corridor

A key feature of the SoE 2018 and this report is the exploration of the use of the UN SEEA.

The State and Benefit framework aims to transition Victoria's environmental reporting regime from focusing solely on the state of Victoria's natural capital, to emphasise the direct and indirect benefits that Victorians and the Victorian economy derive from healthy and sustainable ecosystems. Reflecting this logic, environmental-economic accounting becomes a critical tool to achieve this and support investment in, and management and protection of, the environment.

In the past, the measurement of environmental assets and the benefits they provide has occurred separately, and the results could not be combined easily for policy and decision-making. Using the SEEA guidelines and standards to integrate the state and benefit components provides a robust approach to assessing multiple benefits and trade-offs among alternative policy or management options.

In 2015, DELWP produced a plan to deliver a set of environmental-economic accounts by 2020: *Valuing and Accounting for Victoria's Environment: Strategic Plan 2015–2020*.³ Although it is unclear if DELWP will be able to meet the 2020 deadline, commitment to the vision of the plan remains important. Subsequent to the release of the plan, the Victorian Government has been a leader in the interjurisdictional effort of environment ministers to release *A Common National Approach to Environmental-economic accounting: Strategy and Action Plan (2017)*.⁴

Environmental-economic accounting in this report was informed by a study by the Australian National University and only focused on the forested area in the Yarra catchment located in

the upper rural reach. There is an opportunity here to deliver a thorough environmental-economic accounts for the entire Yarra River corridor ranging from the Yarra Reservoir in the Yarra Ranges National Park to where it enters Port Phillip Bay.

The application of environmental-economic accounting can emphasise the direct and indirect benefits that Victorians and the Victorian economy derive from a healthy and sustainable Yarra River corridor.

Recommendation 6: That DELWP, in collaboration with Melbourne Water, establishes an environmental-economic accounts for the Yarra River corridor that is consistent with the SEEA guidelines and the DELWP Valuing and Accounting for Victoria's Environment strategy and aligned with the agreed common national approach. Further, that the Minister for Energy, Environment and Climate Change include in the Statement of Expectations to the Commissioner for Environmental Sustainability a requirement to incorporate environmental-economic accounts in State of the Yarra and its Parklands reporting from 2023.

This recommendation is a Yarra-specific derivation of Recommendation 19 in the SoE 2018.

For further details, see Environmental-economic accounts and International Frameworks in the SoE 2018 Report.

3. DELWP 2015, 'Valuing and accounting for Victoria's environment: Strategic Plan 2015-2020', Melbourne, Victoria.

4. Australian Government 2017, 'A Common National Approach to Environmental-Economic Accounting: Strategy and Action Plan', Canberra, Australian Capital Territory.

Apply the SDGs to State of the Yarra and Its Parklands and Yarra Strategic Plan reporting

In addition to the environmental science evidence base, this report provides a narrative that links environmental condition to cultural, social and economic aspirations for a healthy and flowing Yarra River. This information allows the community to track the achievement of their aspirations for the Yarra River and assist government to assess the delivery of the social coherence benefits of the Yarra Strategic Plan.

The 10 socio-economic indicators included in this report provide a whole-of-system narrative for the Yarra River and its parklands. However, the data is generally poor or missing entirely. Identifying key cultural, social and economic indicators, and improving the system to enable data collection and analysis to assess them, will lead to better outcomes for the Yarra River's environment and the communities that depend on it.

Developing the SDGs as an operating framework represents a fundamental shift for SoE, from reporting on what is occurring in the natural environment, to including additional analysis on how environmental change impacts society and how these impacts are managed. Assessing the SDG targets, and developing a set of environmental-economic accounts for Victoria (see Recommendation 6), will require that new skills and new data collection and monitoring regimes be developed by the environment portfolio and the Victorian Government more broadly.

Early analysis has found that Victorian Government agencies in the environment portfolio do not collect sufficient socio-economic data for many of the relevant SDG targets to be assessed. To report effectively on the SDG targets in future, data-acquisition processes will need to be broadened to include individuals (some of whom will identify as citizen scientists), organisations and agencies that have not traditionally contributed to SoE reporting.

This expanded reporting regime will require:

- broadening of the definition of conventional data inputs
- innovative and creative data-acquisition methods and supporting investment
- relationships with new data partners (both organisations and individuals)
- augmentation of current indicators and metrics, and corresponding data requirements, for each target (both quantitative and qualitative data) in consultation with experts in the respective disciplines.

However, transitioning to the SDGs as the operating framework for reporting on the Yarra River corridor will require more than data-collection reform. It will also require that government and community partners work together to maintain adaptive management principles, drive systemic change and support evidence-based decision-making at the state level.

Recommendation 7: That the Minister for Energy, Environment and Climate Change include in the Statement of Expectations to the Commissioner for Environmental Sustainability a requirement to adopt the SDGs as an operating framework for State of the Yarra and Its Parklands reporting in Victoria from 2023. This will require that DELWP and Melbourne Water support the Commissioner by leading a portfolio review of the data requirements to assess Victoria's progress against the selected SDG targets, which will include a complementary analysis of current legislation, policy and programs against the SDG targets, including the Yarra Strategic Plan, and the development of a plan to improve data-acquisition processes for socio-economic indicators by 2021.

This recommendation is a Yarra-specific derivation of Recommendation 20 in the SoE 2018.

For further details, see Sustainable Development Goals (in this report) and International Frameworks in the SoE 2018 Report.

SoY 2018 | Summary of Recommendations

Table 6: Summary of recommendations, challenges and SDG targets for future reporting by theme

Lead themes	Recommendations	Challenges addressed by the recommendation	UN SDG targets for future reporting
Cultural Landscape Health and Management	<p>1. That the Victorian Government, in consultation with Traditional Owners and relevant agencies, delivers on the contemporary cultural indicators to inform future environmental reporting. Delivery of these indicators must reflect the priorities of Traditional Owners, have practical and cost-effective data-collection methods, and be meaningful and demonstrate change within a five-year reporting period.</p> <p>This recommendation is repeated in the SoE 2018 (Recommendation 1).</p>	<p>Transitioning from a singular focus on Aboriginal cultural heritage reporting to a new approach which incorporates the social, economic, spiritual, cultural, environmental, and health and wellbeing values of Victorian Traditional Owners, Registered Aboriginal Parties and Aboriginal Victorians.</p>	<p>2.3 4.7 8.8 11.4 12.b</p>
Climate Change Impacts	<p>2. That Melbourne Water and DELWP, in coordination with research partners, conducts further analysis to improve climate projections for the Yarra River corridor. These findings should inform the system of environmental-economic accounts and how these values change under climate change. These projections would aim to reduce the uncertainties associated with rainfall projections as a minimum.</p> <p>This recommendation is a Yarra specific derivation of Recommendation 2 in the SoE 2018.</p>	<p>Regional climate projections at a finer spatial resolution and more accurate rainfall projections are required to improve management outcomes. Rainfall projections are currently associated with reasonably large uncertainties (relative to other climate variables such as temperature).</p>	<p>2.4 6.5 13.1, 13.2, 13.3</p>
Biodiversity	<p>3. That DELWP streamline the governance and coordination of investment in the science and data capability of all government biodiversity programs and improve the coherence and impact of the publicly funded scientific endeavour. Further, that DELWP establish the position of Chief Biodiversity Scientist to oversee this coordinated effort and provide esteemed counsel to the DELWP Secretary and the Minister for Energy, Environment and Climate Change to improve the impact of investment in biodiversity research across the Victorian environment portfolio.</p> <p>This recommendation is repeated in the SoE 2018 Report (Recommendation 5).</p>	<p>Various investment programs across multiple land management units have created different, inconsistent data sources and terminologies for reporting on the state of biodiversity, land and forest assets.</p> <p>Data is inadequate to answer many of the critical questions about biodiversity science.</p> <p>Victoria's biodiversity science and data capability are undermined by a lack of coordination and a strategic approach to investing in the critical research that will enable an ecosystems approach to decision-making and policy interventions.</p>	<p>4.7 6.3,6.4,6.5, 6.6, 6.b 11.4, 11.7 12.2, 12.8 13.1, 13.3 14.4 15.1,15.3,15.5,15.7, 15.8,15.9 17.17</p>

SoY 2018 | Summary of Recommendations

Lead themes	Recommendations	Challenges addressed by the recommendation	UN SDG targets for future reporting
Biodiversity	4. That DELWP, in collaboration with local government and private property owners, maintains and improves threatened species populations, and their habitats, by connecting Crown land in the upper and lower Yarra rural reaches, through a system of parks, reserves and private protected areas.	Restricted movement which impacts on the health and survival of threatened species (and other native species) in the lower and upper Yarra rural reaches.	4.7 6.6 12.2, 12.8 14.1,14.2,14.3, 14.5 15.1,15.3,15.5, 15.8
Population Growth and Development	5. That DELWP, in collaboration with Melbourne Water and local governments, extend the geographic scope of the current interim Yarra River Protection Planning Controls (Amendment GC48) along the Yarra River corridor ranging from Warrandyte to the boundary of the Yarra Ranges National Park in support of appropriate urban development.	Inappropriate urban development and property subdivision in the lower and upper Yarra rural reaches due to population growth expanding outwards towards the urban growth boundary.	8.4 11.3, 11.a 15.1, 15.5
International Frameworks: UN SEEA	6. That DELWP, in collaboration with Melbourne Water, establishes an environmental-economic account for the Yarra River corridor that is consistent with the SEEA guidelines and the DELWP Valuing and Accounting for Victoria's Environment strategy and is aligned with the agreed common national approach. Further, that the Minister for Energy, Environment and Climate Change include in the Statement of Expectations to the Commissioner for Environmental Sustainability a requirement to incorporate an environmental-economic account in State of the Yarra and Its Parklands reporting from 2023. The recommendation is a Yarra-specific derivation of Recommendation 19 in the SoE 2018.	Environmental-economic accounting capability addresses a gap in traditional SoE reporting which presents accurate and relevant environmental information on the state of Victoria's natural capital but not the direct and indirect benefits that all Victorians derive from healthy and sustainable ecosystems	15.9

SoY 2018 | Summary of Recommendations

Lead themes	Recommendations	Challenges addressed by the recommendation	UN SDG targets for future reporting
International Frameworks: UN SDGs	<p>7. That the Minister for Energy, Environment and Climate Change include in the Statement of Expectations to the Commissioner for Environmental Sustainability a requirement to adopt the SDGs as an operating framework for State of the Yarra and Its Parklands reporting in Victoria from 2023. This will require that DELWP and Melbourne Water support the Commissioner by leading a portfolio review of the data requirements to assess Victoria's progress against the selected SDG targets, which will include a complementary analysis of current legislation, policy and programs against the SDG targets, including the Yarra Strategic Plan, and the development of a plan to improve data-acquisition processes for socio-economic indicators by 2021.</p> <p>The recommendation is a Yarra-specific derivation of Recommendation 20 in the SoE 2018.</p>	<p>The Commissioner for Environmental Sustainability Act 2003 provides objectives and definition for ecologically sustainable development (ESD). However, there has been ambiguity in delivering on the guiding ESD principles. The SDGs are the missing link that provide an operating framework that bring the ESD objectives and guiding principles in the Act to life.</p>	<p>16.6, 16.7 17.14,17.17,17.19</p>



Setting the Scene: A Journey of Flow

The passing of the *Yarra River Protection (Wilip-gin Birrarung murron) Act 2017* in September 2017 followed a three-year planning conversation among community, state government, local government and other government agencies. It started in December 2015 with the introduction of the 'Yarra River Protection' planning policy, which strengthened the State Planning Policy framework under Amendment VC121. This policy guides the strategic planning and the application of statutory controls along the Yarra River corridor, from the Yarra Reservoir to where it meets Port Phillip Bay, excluding the Port of Melbourne waters and the regulation of on-water activities, commercial boats and berthing. The Yarra River Protection planning policy's objective is to:

Maintain and enhance the natural landscape character of the Yarra River corridor in which the topography, waterway, banks and tree canopy are dominant features providing a highly valued, secluded, natural environment for the enjoyment of the public.⁵

To develop the objectives and actions of the 'Yarra River Protection' planning policy, the Minister for Planning and the Minister for Environment, Climate Change and Water established a five-member Yarra River Protection Ministerial Advisory Committee (Yarra MAC) in December 2015. The committee delivered their final report in late 2016, as one of the requirements of their terms of reference. *Protecting the Yarra River (Birrarung)*⁶ provided recommendations in the form of governance reforms, projects, actions and model expansion to improve management, promotion and protection of the Yarra River and its parklands.

The report's recommendations were founded on advice from the Yarra River Protection Reference Group comprising:

- representatives from local government authorities (LGAs) with direct oversight and management responsibilities for the Yarra River and its riverscape
 - Environment Protection Authority (EPA) Victoria
 - Melbourne Water
 - Parks Victoria
 - Port Phillip and Westernport Catchment Management Authority (CMA)
 - Environmental Justice Australia
 - Yarra Riverkeeper Association
- community consultation⁷
- Yarra River corridor studies.⁸

This led to the development of the *Yarra River Action Plan*,⁹ released in February 2017, containing 30 actions for the long-term protection of the river and its parklands. This was followed closely by the passing of the *Yarra River Protection (Wilip-gin Birrarung murron) Act 2017* (the Act) in September 2017. The Act identifies the Yarra River and its corridor as one living and integrated natural entity that is to be kept alive and healthy for the benefit of future generations.¹⁰ The Act also recognises the intrinsic connection of Traditional Owners and Aboriginal Victorians to the Yarra River, Birrarung, and recognises them as the custodians of the land and waterway. The Act's preamble states, in Woi wurrung language, 'Wilip-gin Birrarung murron', which means 'keep the Birrarung alive' for all generations to come.

5. DELWP Planning 2018, 'Yarra River Controls', Melbourne, Victoria, <https://www.planning.vic.gov.au/policy-and-strategy/waterways-planning/yarra-river-controls> Accessed 20 July 2018.

6. DELWP 2017, 'Protecting the Yarra River (Birrarung) Ministerial Advisory Committee Final Report', Melbourne, Victoria.

7. DELWP 2017, 'Protecting the Yarra River (Birrarung) Community Views', Melbourne, Victoria.

8. DELWP 2016, 'Middle Yarra River Corridor Study. Recommendations Report October 2016', Melbourne, Victoria. DELWP 2016, 'Lower Yarra River Corridor Study. Recommendations Report November 2016', Melbourne, Victoria.

9. DELWP 2017, 'Yarra River Action Plan Wilip-gin Birrarung murron', Melbourne, Victoria.

10. Office of the Chief Parliamentary Counsel Victoria 2017, 'Yarra River Protection (Wilip-gin Birrarung Murron) Act 2017. No. 49 of 2017' Melbourne, Victoria www.legislation.vic.gov.au Accessed 29 October 2018.

The Act incorporates Action 14 from the Yarra River Action Plan, to develop a Yarra strategic plan (YSP). Melbourne Water is the lead agency responsible for developing the YSP, an overarching 10-year river corridor strategic framework plan based on the 50-year community vision. The three core elements of the YSP are:

1. a 50-year community vision¹¹ (Action 13 from the Yarra River Action Plan: see Chapter 1)
2. collaborative management framework and planning and delivery guidance
3. an evaluation of the land use framework for the whole Yarra River corridor.

Melbourne Water will continue to work with Yarra River communities to help shape the YSP's performance objectives and key performance indicators, with the final YSP to be publicly available in late 2019.

Why a State of the Yarra and Its Parklands 2018 Report?

Victoria's first State of the Yarra and Its Parklands (SoY) Report 2018 is a legislative requirement in the *Yarra River Protection (Wilip-gin Birrarung murron) Act 2017* (the Act) (Part 1 - Preliminary 1(g)). The report's objective is to assess the condition of the Yarra River and its parkland corridor. This was a recommendation of the Yarra MAC (Recommendation 11) and was formalised in the *Yarra River Action Plan* (Action 7) and the Act. This was the first time the *Commissioner for Environmental Sustainability Act 2003* (the CES Act) had been amended to include a second 'State of' report in addition to the five-yearly Victorian State of the Environment report.

The SoY report will be a baseline study of the environmental health of the Yarra River and its parklands based on existing research and information. The vision of this SoY report aligns with the Act's objectives and principles in that it recognises, and will report on, the Yarra River and its corridor as one living and integrated natural entity that flows from catchment to coast. The SoY report does this by linking, and recognising equally, the importance of environmental condition to cultural, spiritual, economic and social health and wellbeing indicators. The SoY explores the importance of cultural landscape health and management to Traditional Owner communities, while capturing the social and economic picture of the communities who live alongside and are dependent on the Yarra River for their health and wellbeing and economic income and prosperity. The assessment of environmental health will include threats and pressures and the current state of the main Yarra River stem and adjacent parklands.

Although this SoY report looks at the environmental, cultural, social and economic indicators across four Yarra River reaches, the results will be aggregated to provide an overall assessment of the current state of the Yarra River and its Parklands.

Future SoY reports will:

- align with, and report on, the YSP's performance objectives and indicators
- be periodically updated to align with State of Environment reporting as required by the Act and the CES Act.

11. Melbourne Water Corporation 2018, 'Yarra River 50-year Community Vision *Wilip-gin Birrarung murron*', Melbourne, Victoria.

The Yarra River Corridor and Its Parklands

The Yarra River flows for 242 km within a larger Yarra River catchment area spanning 4,000 km². The Yarra River corridor and its parklands are comprised of complex ecosystems including wetlands, billabongs, floodplains, creeks, tributaries, woodlands, forests, coastal marshes and an estuary – all of which supports the region’s productivity. Starting from its catchment in the Yarra Ranges National Park within the Great Dividing Range, the river meanders through forested hills, parklands and reserves, open farmlands, vineyards and floodplains before it enters suburban Melbourne where its open corridor space and recreational amenity are highly valued by surrounding communities. Flowing into inner Melbourne, the Yarra passes along the CBD’s southern side, becoming an estuary system and mixing with salt water as it completes its journey entering Port Phillip Bay at Newport.

The Yarra River corridor is 22% urbanised, 21% natural vegetation and 57% agricultural.¹² The Upper Yarra Reservoir, O’Shannassy Reservoir and Maroondah Reservoir harvest water from headwater tributaries.¹³ The Yering Gorge water-supply catchment flows from the upper Yarra dam wall through to the Warrandyte area where water is pumped directly from the Yarra River to Sugarloaf Reservoir and treated at Winneke Water Treatment Plant.¹⁴ This water supply contributes to 25% of Melbourne’s total water demand and, during drought, supplies around one-third of the drinking water. Between Warburton and Warrandyte, the Yarra is protected under the *Heritage Rivers Act 1992*, with significant recreation, nature conservation, scenic and cultural heritage values.¹⁵ The Port of Melbourne, Australia’s largest maritime hub for cargo, is located on the Yarra River estuary as it enters Port Phillip Bay.

Waterways have an important role in the daily lives of Victorians. The Yarra River and its parklands system strongly links to Victorians’ sense of health and wellbeing, providing places for cultural gatherings, recreation and contemplation. Traditional Owner communities

have a deep cultural and spiritual connection to the Birrarung. Residents and tourists are attracted to the Yarra’s natural beauty and the opportunities it provides to connect with nature. With an estimated overall annual value of \$730 million,¹⁶ the Yarra River and its surrounding corridor (parklands and other green spaces) provides a range of ecosystem services, including, 70% of Melbourne’s drinking water¹⁷, food from agricultural production and recreational and amenity services. There are 15 different government agencies who manage the Yarra River corridor. The estimated investment by public entities along the Yarra River corridor in 2017–18 was \$31 million.¹⁸

Across the Yarra River corridor, parklands and public open spaces total 7,795 hectares.¹⁹ Access to quality open spaces for the wellbeing of people of all ages and abilities is becoming even more critical as Melbourne’s population continues to increase, with a current estimated population of 1,105,698 people currently living across the nine local government areas that run the length of the Yarra River. Current threats and pressures to the Yarra River and its parklands include: invasive animals and plants; pollution and sewerage; amenity loss due to inappropriate development; biodiversity loss; increasing dependency on water resources by Melbourne’s growing population; and adverse impacts of climate change such as droughts, fires and floods.

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12. Melbourne Water Corporation 2018, ‘Progress Report for the Yarra Strategic Plan – October 2018’, Melbourne, Victoria.
 13. VEWH 2018, ‘Seasonal watering plan 2018-19 central region’, Melbourne, Victoria.
 14. Melbourne Water Corporation 2018, ‘Yarra strategic plan map book current state land use for the Yarra strategic plan September 2018’, Melbourne, Victoria.
 15. Melbourne Water Corporation 2018, ‘Yarra: working together for Healthy Waterways. Catchment works program to support the draft Healthy Waterways Strategy’, Melbourne, Victoria.
 16. Melbourne Water Corporation 2018, ‘Progress report for the Yarra strategic plan – October 2018’, Melbourne, Victoria.
 17. VEWH 2018, ‘Seasonal watering plan 2018-19 central region’, Melbourne, Victoria.
 18. Melbourne Water Corporation 2018, ‘Progress report for the Yarra strategic plan – October 2018’, Melbourne, Victoria.
 19. Melbourne Water Corporation 2018, ‘Yarra strategic plan map book current state land use for the Yarra strategic plan September 2018’, Melbourne, Victoria.

Geographic Scope of this Report

The geographic scope of this SoY report encompasses the Yarra River's journey from its source in the Yarra Ranges National Park to the river's mouth which enters Port Phillip Bay. This includes:

- Yarra River waterway corridor which comprises the river itself, including its bed, soil and banks (defined as 'Yarra River land' in the *Yarra River Protection (Wilip-gin Birrarung murron Act 2017)*)
- government-owned freehold land (Crown and state) within 500 m of the Yarra's banks
- more than 7,500 hectares of government land within 500 m of the Yarra's banks
- land of any kind that is located within one kilometre either side of a bank of the Yarra
- Yarra River land – land within approximately 500 m of the Yarra River between Punt Road, Richmond and the outer extent of the township of Warrandyte²⁰
- Greater Yarra Urban Parklands, which includes Yarra River land that is used as public open space or as a park and is within a municipal council district between Punt Road, South Yarra and the urban growth boundary in Warrandyte. This also includes any other land that the land owner agrees may be covered which is within an urban growth boundary specified in a planning scheme.
- public or private land that is located one kilometre each side of a Yarra River bank that is wholly within the municipal districts of any of the specified municipal councils and that is not excluded land.

It excludes:

- private freehold land such as homes, clubs and businesses
- freehold land owned by local councils.

The SoY report applies the same four Yarra River reaches that feature in the YSP (Table 7). Each reach reflects the unique characteristics and communities of the Yarra River and its parklands. It should be noted that the YSP does not include the geographic area below Webb Bridge in the Docklands due to current planning of the Fishermans Bend precinct, but the SoY report does include this area in its assessment. As the YSP develops, additional parklands and planning overlays may be added to the different Yarra River reaches in the future.

20. Office of the Chief Parliamentary Counsel Victoria 2017, 'Planning and Environment Act 1987, Banyule, Boroondara, Manningham, Nillumbik, Stonnington and Yarra Planning Schemes. Amendment GC48. Explanatory Report', http://www.parliament.vic.gov.au/images/stories/daily-hasard/Council_2017/Council_Daily_Extract_Tuesday_7_March_2017_from_Book_5.pdf Accessed on August 2018

Yarra River reach	Geographic scope
Upper rural Yarra reach	Yarra Reservoir in the Yarra Ranges National Park to Healesville
Lower rural Yarra reach	Healesville to Warrandyte
Suburban reach	Warrandyte to Abbotsford (Dights Falls)
City reach	Abbotsford (Dights Falls) to Newport

Table 7: Yarra River reaches and their geographic scopes adapted from the Yarra Strategic Plan

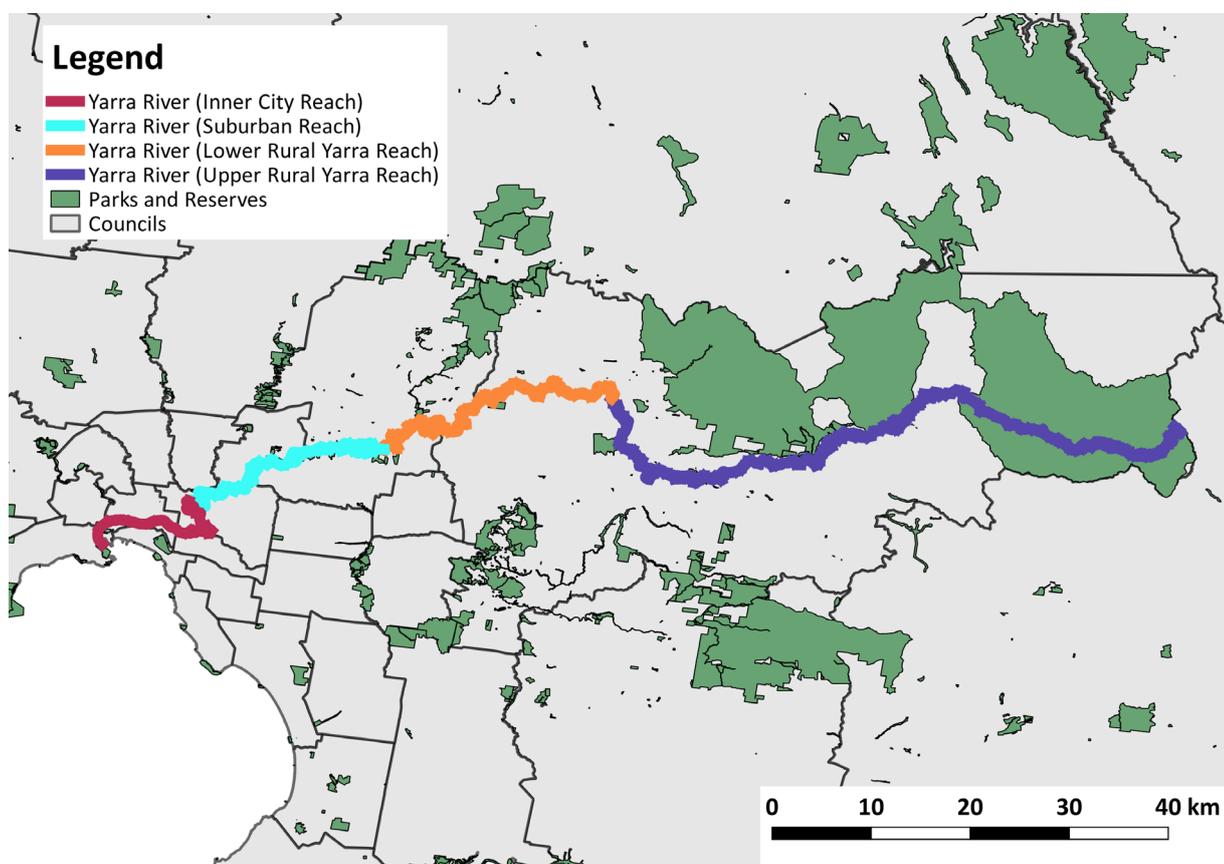


Figure 6: Map of the Yarra River showing the boundaries of each of the four reaches





STATE OF THE YARRA AND ITS PARKLANDS

RESEARCH SYNTHESIS PART II



Commissioner
for Environmental
Sustainability
Victoria

Chapter 1: Communities of the Yarra and Its Parklands

Introduction

The Yarra River and its parklands hold diverse environmental and social values for the different communities who live alongside or nearby.

Although it is important to view the Yarra River as one living entity, the reality is that the Yarra River and its parklands will hold different social and environmental meanings and interests for the communities at different reaches of the Yarra. This includes environmental, cultural, social and economic aspirations for the Yarra River and its parklands.

Maintaining the guiding principle that the Yarra River and its parklands are one living entity, this chapter aims to understand:

- How do the diverse communities at different reaches of the Yarra value, use and connect with the river and its parklands?
- What are their future aspirations for keeping the Yarra alive?
- Do these values and aspirations change moving downstream?

The 11 indicators (Y:01–11) that form Chapter 1 of this report are the first attempt in Victoria to assess the socio-economic benefits derived from the natural assets of the Yarra River and its parklands. Therefore, the information provided in this chapter either establishes a baseline for future trend assessments or, for seven indicators where data is absent or poor, creates a foundation from which the development of more nuanced cultural, social and economic indicators can be developed. As indicators Y:01–11 will also need to be integrated and aligned with the environmental health indicators that form the YSP Performance Objectives (due for release in late 2019), some adjustment to these indicators may be required in the next reporting cycle (2019–23).

Communities of the Yarra and Its Parklands

Cultural Landscape Health and Management

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:01 Cultural Landscape Health and Management	Wurundjeri Land and Compensation Cultural Heritage Council Aboriginal Corporation, other Traditional Owner organisations, Victorian Aboriginal Heritage Council, Aboriginal Victoria						 DATA QUALITY Poor

Aboriginal existence and identity is underpinned by healthy cultural landscapes. Along with water and other natural resources, the land that is now the State of Victoria was managed for thousands of years according to traditional laws, customs and practices. Shaped by a sustainable-use regime and managed with a deep understanding of natural systems embedded in lore and culture, Country (land, water, animals, plants, people, spirits and customs) has provided for the material, cultural and spiritual needs of thousands of generations of Aboriginal people.²¹

Victoria’s cultural landscapes are unique. They are host to one of the oldest continuous cultures in the world and home to a vast array of plants, animals and places that have both symbolic and practical value to Aboriginal Victorians and all other Victorians. Today’s cultural landscapes reflect how Aboriginal people engaged with their world and experienced their surroundings. They are the product of generations of economic activity, material culture and settlement patterns. While colonisation resulted in the

landscape being broken up into different land tenures and the establishment of different management regimes, Aboriginal people remain connected to Country and cultural landscapes which are continuous across current management boundaries.²²

Defined as the river of mists and shadows, the Birrarung (Yarra River) is also viewed as one whole living cultural landscape by its First Peoples, the Kulin Nation.²³ The Yarra River is the ancestral home of Wurundjeri, Boon Wurrung and Bunurong. They bring their knowledge, connections, understanding, aspirations and objectives to the development of the YSP.

21. Parks Victoria 2018, ‘Managing Country Together’, Melbourne, Victoria, https://parkweb.vic.gov.au/_data/assets/pdf_file/0006/724695/Managing-Country-Together.pdf Accessed 7 December 2018.
 22. Ibid
 23. Wurundjeri Land and Compensation Cultural Heritage Council Aboriginal Corporation 2018, ‘Nhanbu narrun ba ngargunin twarn Birrarung - ancient spirit & lore of the Yarra’, Melbourne, Victoria.

Communities of the Yarra and Its Parklands

Traditional Owners and Registered Aboriginal Parties of the Birrarung

The Wurundjeri Land and Compensation Cultural Heritage Council Aboriginal Corporation (Wurundjeri) has been appointed as a Registered Aboriginal Party²⁴ by the Victorian Aboriginal Heritage Council (the Council) under the *Aboriginal Heritage Act 2006* (the Act). Wurundjeri's Registered Aboriginal Party area includes a large area to the north, north-east and north-west of Melbourne and most of the Yarra River. As a Registered Aboriginal Party, the Wurundjeri is responsible under the Act for its cultural heritage within its appointed area (Figure 7).

The following Traditional Owner organisations have made it known that they seek to represent Traditional Owner interests outside the boundaries of the appointed area:

- Bunurong Land Council Aboriginal Corporation (Bunurong)
- Boon Wurrung Foundation Limited (Boon Wurrung)

- Yaluk-Ut Weelam Elders Council Aboriginal Corporation (Yaluk-Ut)
- Wurundjeri Land and Compensation Cultural Heritage Council Aboriginal Corporation (Wurundjeri)

The Commonwealth *Native Title Act 1993* and the Victorian *Traditional Owner Settlement Act 2010* formally recognise the rights and interest in land and water that Victoria's Traditional Owners have sustained for many thousands of years. The *Traditional Owner Settlement Act 2010* recognises that access to water is a Traditional Owner right; this is included in Section 8a of the Victorian *Water Act 1989* as well as Chapter 6 ('Recognising and managing for Aboriginal values') in *Water for Victoria*, the Victorian Government's 2016 strategy.²⁶

24. Office of the Chief Parliamentary Counsel Victoria 2006, 'Section 150 Application and registration under the Aboriginal Heritage Act 2006' No. 16 of 2006', Melbourne, Victoria.
25. Aboriginal Victoria 2018, 'Registered Aboriginal Parties in Victoria map',
26. DELWP 2016, 'Water for Victoria Water Plan', Melbourne, Victoria.

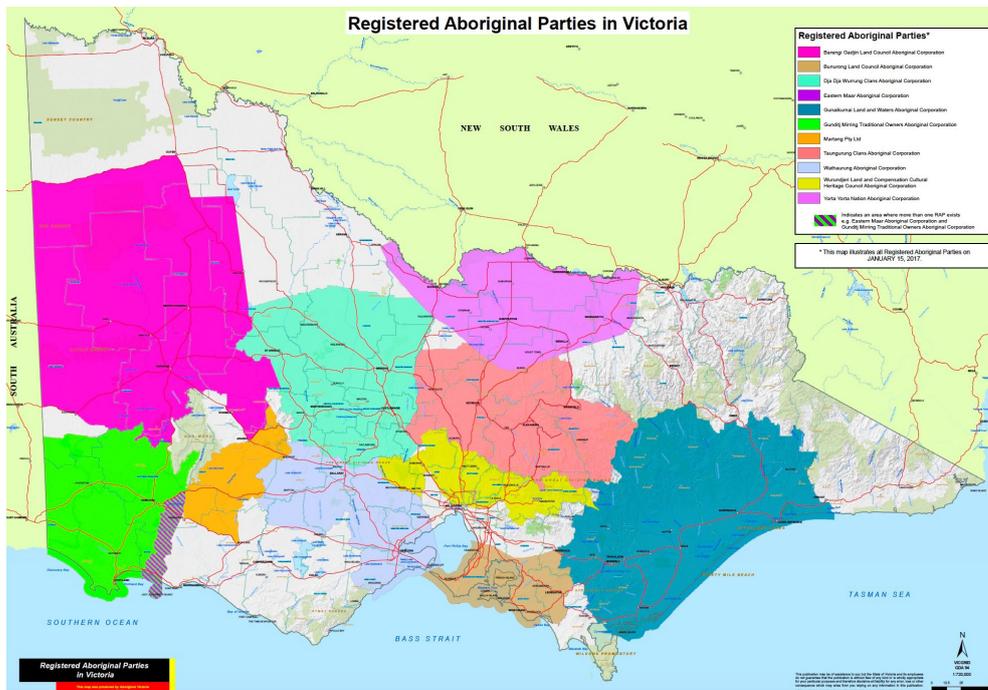


Figure 7: Map of the 11 Registered Aboriginal Parties in Victoria, including Wurundjeri Land and Compensation Cultural Heritage Council Aboriginal Corporation and Bunurong Land Council Aboriginal Corporation

Note: Wurundjeri Land and Compensation Cultural Heritage Council Aboriginal Corporation – yellow
Bunurong Land Council Aboriginal Corporation – brown (Source: Aboriginal Victoria)²⁵

Cultural Aspirations and Objectives for the Birrarung

The Wurundjeri's focus is on the cultural, social, environmental, heritage and economic benefits of participation in the management and care of the Birrarung and its greater catchment. A key aspiration, and central to Wurundjeri's vision, is returning the Birrarung to a healthy, cleaner river.²⁷

To achieve this, the Wurundjeri has set out their performance objectives and targets in their water policy, *Nhanbu narrun ba ngargunin twarn Birrarung* (Ancient Spirit and Lore of the Yarra),²⁸ creating a baseline for future measures in achieving their aspiration and vision for a healthy and cleaner Birrarung. These objectives will allow the Wurundjeri People to effectively expand their capability in natural resource management, cultural heritage and other areas, so that they can fulfil their cultural obligations and participate effectively in planning and implementation at all levels of river management as well as development and implementation of the YSP.²⁹

The cultural, social, environmental, heritage and economic aspirations and objectives of the Bunurong Land Council Aboriginal Corporation and Boon Wurrung Foundation Limited/Yaluk-Ut Weelam Elders Council Aboriginal Corporation were still being developed at the time of writing this SoY report. These aspirations and objectives will be included and aligned with the four central themes of Cultural Landscape Health and Management in the next SoY report.

For this report, each of the objectives and targets outlined in the Wurundjeri's *Nhanbu narrun ba ngargunin twarn Birrarung* have been aligned to four Cultural Landscape Health and Management themes (Table 8) that were adapted from *Health and Wellbeing Outcomes of the Aboriginal and Torres Strait Islander Gathering Place Model in Victoria: A Place for Inclusion, Connection and Empowerment – Final Report*^{30,31} and the Aboriginal Waterways Assessment Program.³² This approach establishes a baseline that can be assessed in future SoY reports. Sharing of cultural indicator data and stories to inform reporting on Cultural Landscape Health and Management is at the discretion of Wurundjeri and other Victorian Aboriginal organisations.

27. Ibid

28. Wurundjeri Land and Compensation Cultural Heritage Council Aboriginal Corporation 2018, '*Nhanbu narrun ba ngargunin twarn Birrarung - ancient spirit & lore of the Yarra*', Melbourne, Victoria.

29. Ibid

30. Thorpe A, Munro-Harrison E, Kingsley J 2016, 'Health and Wellbeing outcomes of the Aboriginal and Torres Strait Islander gathering place model in Victoria: A place for inclusion, connection and empowerment.' Indigenous Health Equity Unit, The University of Melbourne and Gathering Place Reference Group, Melbourne, Victoria.

31. Kingsley J, Munro-Harrison E, Jenkins A, Thorpe A, 2018, "'Here we are part of a living culture': understanding the cultural determinants of health in Aboriginal gathering places in Victoria, Australia.' *Health & Place*, 54, pp. 210-220.

32. Murray-Darling Basin Authority 2015, 'Aboriginal Waterways Assessment Program', Victoria, Australia.

Communities of the Yarra and Its Parklands

Theme	Cultural objective and target
Connection and caring for Country: cultural knowledge, protocols and practices	<ul style="list-style-type: none"> • Clean out flood plains and recreate historical flood patterns • Recreate billabong systems along parts of the Yarra • Identify the cultural water (volumes and timing) required to sustain the natural, cultural and spiritual values along the length of the Birrarung • Reintroduce traditional fire and river management practices where applicable.
Capacity-building: programs, resources, education and training provided by organisations	<ul style="list-style-type: none"> • Identify resources to allow for employment of Wurundjeri people to participate in the design, implementation, management and monitoring, evaluation, reporting and improvement (MERI) of assessments and strategies for flora and fauna maintenance and restoration projects.
Land justice, self-determination, governance and mechanisms for sustainability	<ul style="list-style-type: none"> • Develop a Wurundjeri River Management and Access Plan • Develop a whole-of-system approach to removal of refuse, and pollution points into the river • Establish a Healthy River Fund (Birrarung Bank) to attract funding for long-term development of Birrarung restoration and enhancement projects • Develop strategies to establish cultural and environmental corridors within whole of Yarra catchment • Secure water resources required to meet cultural water values • Utilise Wurundjeri flora and fauna assessments as critical planning tools for future management of the catchment.
Pathways to other organisations	<ul style="list-style-type: none"> • Wurundjeri to work with partner organisations to develop an independent framework of ongoing funding and accountability for its obligations as a responsible public entity • Establish and embed partnership protocols with relevant agencies to develop the mechanisms necessary for Wurundjeri Council to participate and achieve the complete list of objectives.

Table 8: The objectives and targets outlined in the Wurundjeri's Nhanbu narrun ba ngargunin twarn Birrarung aligned to Cultural Landscape Health and Management themes.

Note: Future reporting will also include the cultural aspirations and objectives of the Bunurong, Boon Wurrung and Yaluk-Ut.

Watering of the Bolin Bolin Billabong

For the past 5,000 years, the Bolin Bolin Billabong (translated as ‘many lagoons’), has been a significant meeting place for the Kulin Nation and remains a significant cultural heritage site. The Wurundjeri Land and Compensation Cultural Heritage Council Aboriginal Corporation in partnership with the Victorian Environmental Water Holder (VEWH), Manningham Council, Melbourne Water and Parks Victoria initiated watering of the Bolin Bolin Billabong in October 2017. Yarra River water was used to restore the natural water flow regimes, remove weeds and rehabilitate the billabong to improve habitats essential for native wildlife while improving community amenity. Future watering and post-watering evaluation is being planned by the project partners. This collaborative management approach to cultural and environmental watering brings together modern-day river management and traditional cultural knowledge for cultural and environmental outcomes.

At the time of writing this report, the Victorian Government was investigating the potential to provide a water licence to support environmental outcomes in the lower Yarra River wetlands – including the Bolin Bolin Billabong – after 1,100 megalitres became available following the sale of the Amcor Paper Mill in Alphington, providing a secure water source. The investigation will ensure there are no negative environmental or third-party impacts from using the water for these lower Yarra River wetlands. It will also look for opportunities to maximise environmental, cultural and social benefits.

Victorian Aboriginal Cultural Heritage

The Victorian Aboriginal Heritage Council (the Council) was established under the *Aboriginal Heritage Act 2006* (the Act) to ensure that Traditional Owners throughout Victoria play a central role in the protection and management of their heritage. It is the only Victorian statutory authority embodying Aboriginal self-determination. It consists of up to 11 Traditional Owners who are appointed by the Minister for Aboriginal Affairs.³³ Aboriginal cultural heritage can include tangible and intangible archaeological, historical and anthropological Aboriginal heritage places, including landforms and land categories.

All Aboriginal heritage places must be registered on the Victorian Aboriginal Heritage Register (VAHR). The VAHR is maintained by the Secretary, Department of Premier and Cabinet through their delegate, the Registrar, Aboriginal Victoria. The VAHR is not an open-access register. Access is limited to persons listed in the Act and information that is listed as sensitive has further access restrictions. Sensitive information includes information about Aboriginal ancestral remains and burials. Registered Aboriginal Parties, and the Council in non-Registered Aboriginal Party areas, have the right to determine if and how information on the VAHR can be accessed.

33. Victorian Aboriginal Heritage Council 2017, ‘Annual Report 2016 -2017’, Melbourne, Victoria.

Communities of the Yarra and Its Parklands

Aboriginal people are the primary guardians, keepers and knowledge holders of their heritage. The Act empowers Traditional Owners as protectors of their cultural heritage on behalf of Aboriginal and all other people. Registered Aboriginal Parties are Traditional Owner groups appointed by the Council who have statutory responsibility for the protection and management of Aboriginal cultural heritage in their appointed area. Registered Aboriginal Parties are appointed by the Council according to criteria set out in the Act and Council's own decision-making principles for Registered Aboriginal Party applications.

As part of the Council's work in the protection and management of cultural heritage, it has provided input into *Victoria's Climate Change Adaptation Plan 2017–2010* (the Plan) through representation on the Climate Change Advisory Panel. The Plan recommends a specific cultural focus and link to Victorian legislation and/or policy. Although further consultation with Traditional Owners is required regarding the Plan, it provides a foundation for the upcoming State of Cultural Heritage Report, to be initiated in 2019 by the Council, which can then inform future SoY reporting.

All waterways, and land within 200 m of a waterway, are areas of cultural heritage sensitivity as defined in the Aboriginal Heritage Regulations 2018. The Yarra River's main stem and its environs within 200 m is therefore an area of cultural heritage sensitivity. Water plays a significant role in the cultural, spiritual, health and wellbeing practices of Aboriginal culture. The designation of cultural sensitivity means that a permit and a cultural heritage management plan may be required under the Act for any proposals that disturb the ground in these areas. There are currently 179 recorded Aboriginal archaeological and cultural sites along the Yarra River.³⁴ The culturally sensitive significant sites reported below are representative examples and are not a definitive list; potentially, other sites of Aboriginal cultural heritage significance may be identified through the delivery of *Nhanbu narrun ba ngargunin twarn Birrarung* (Ancient Spirit and Lore of the Yarra) and the development of the YSP.

Upper Rural Reach

Among the many sites of Aboriginal cultural heritage significance in the upper rural reach, Coranderrk Aboriginal Cemetery and Coranderrk Aboriginal Reserve are highly significant. Further sites may be identified through the delivery of *Nhanbu narrun ba ngargunin twarn Birrarung* and the development of the YSP.

Lower Rural Reach

There are 10 indicative sites of Aboriginal cultural heritage and significance in the lower rural reach, with many areas of Aboriginal cultural heritage sensitivity. Garambi Baan ('Laughing Waters') near Warrandyte was a site where Wurundjeri ancestors practised aquaculture.³⁵ Further sites may be identified through the delivery of *Nhanbu narrun ba ngargunin twarn Birrarung* and the development of the YSP.

Suburban Reach

Bolin Bolin Billabong is a site of Aboriginal cultural heritage significance in the suburban reach. In the 2017–18 financial year over \$1.1 million was invested to support cultural values in this reach.³⁶ Further sites may be identified through the delivery of *Nhanbu narrun ba ngargunin twarn Birrarung* and the development of the YSP.

Inner City Reach

Melbourne is a significant and important meeting place for the Kulin Nation with the annual Tanderrum ceremony held adjacent to the Yarra River bank. The inner city reach, at the time of writing this report, is a non-Registered Aboriginal Party area. Further sites may be identified through the development of the cultural aspirations and objectives of the Bunurong, Boon Wurrung, Yaluk-Ut and Wurundjeri and the development of the YSP.

34. Melbourne Water Corporation 2018, 'Progress report for the Yarra strategic plan – October 2018', Melbourne, Victoria.

35. Ibid

36. Ibid

Demographics, Stewardship and Recreational Health

Indicator	Data Custodian	Status	Trend	Data Quality
		UNKNOWN POOR FAIR GOOD		
Y:02 Post-Settlement Colonial Heritage	Heritage Victoria			 DATA QUALITY Good

Along the length of the Yarra River, there are many sites of colonial heritage value which are significant to the river’s history. These sites provide a post-settlement narrative of Melbourne’s growth and development history (as well as that of the surrounding rural area). These sites have a Heritage Overlay, which requires a permit from Heritage Victoria (the Victorian Government heritage authority) to demolish or modify the site. There are numerous heritage places along the Yarra River and its parklands, and those listed below are only representative examples of some well-known sites. The Victorian Heritage Register lists all sites protected under the *Heritage Act 1995*.

Upper Rural Reach

There are 13 representative examples of heritage sites of significance in the upper rural reach as identified by a Heritage Council of Victoria study. These sites represent different periods in the river’s colonial heritage and include: Wanderstore (c.1920s), Yarra Junction War Memorial (c.1920s), Inverarity Mill, Yarra Yarra hydraulic gold sluicing company, Alpine Retreat Hotel (c.1920s), Sanitarium Health Foods (c.1930s), Ezards Sawmill, Cement Creek plantation (c.1930s), Cumberland Scenic Reserve (c.1920s), Upper Yarra Dam (1957), Yarra Ranges National Park, Yarra Track (Yarra Glen–Healesville section c.1860s) and Old Federal Mill (c.1920s).

Lower Rural Reach

There are 10 representative examples of heritage sites of significance in the lower rural reach as identified by a Heritage Council of Victoria study.³⁷ These sites represent different periods in the river’s colonial heritage and include: Neil Douglas & Helen (Abbie) Heathcote

house (c.1970s), Burns House (‘Kangaroo’, c.1970s), Yering Station (c.1850s), Yering Station camping site, Gulf Station (c.1840s), Yarra Glen–Healesville narrow gauge railway, The Elms slab cottage (c.1840), Notre Dame Abbey, Tarrawarra (c.1918; 1957) and Balance, Yeringberg (c.1860s). Environmental sites of heritage significance include Sugarloaf Reservoir.

Suburban Reach

There are 25 representative examples of heritage sites of significance in the suburban reach as identified by a Heritage Council of Victoria study.³⁸ These sites represent different periods in the river’s colonial heritage and include: John Wren house, Xavier (1857), Fairlea Women’s Prison and Yarra Bend Lunatic Asylum (1848), Fairfield Infectious Diseases Hospital (c.1900s), Fairfield Boathouse (c.1890s), Yarra Bend Golf Club House (c.1920s), Alphington Swimming Pool (c.1920s), Tower Hotel, Napier Waller house (c.1922), The Boulevard (c.1933), Mount Eagle Estate (c.1912), Snelleman House (c.1950s), Boral brickyard, Canoe tree at Heide, Heide I and Heide II (c.1940s), Banyule Homestead (c.1840s), Monsalvat (c.1930s) and Pound Bend Tunnel (c.1860s). Environmental sites of heritage significance include Warrandyte State Park, Banyule Flats Reserve, Warringal Parklands, Quarries Park and Studley Park.

Inner City Reach

There are 51 representative examples of heritage sites of significance in the inner city reach. These sites represent different periods in the river’s colonial heritage. They are too numerous to list here, but range from houses to bridges, education institutes, signs, industrial heritage and parks.

37. Melbourne Water Corporation 2018, ‘Community engagement workshop map book: developing the Yarra strategic plan’, Melbourne, Victoria

38. Ibid

Communities of the Yarra and Its Parklands

Demographics, Stewardship and Recreational Health

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:03 Population Growth	ABS	 N/A				N/A	 DATA QUALITY Good

At the end of 2017, Victoria was home to 6.4 million people. This figure is projected to grow to approximately 8 million people in the greater Melbourne area by 2031, and approximately 10.1 million citizens across Victoria by 2051.³⁹ This population growth is reflected across all Yarra River reaches, with the City of Melbourne experiencing the highest estimated resident population percentage increase of 8.8%, followed by the City of Yarra with 3.3% between 2016 and 2017.⁴⁰ Nillumbik Shire Council experienced the lowest estimated resident population percentage increase; 0.7% between

2016 and 2017.⁴¹ It should be noted that there has been resident population increases across all Yarra River reaches between 2016 and 2017. Of the nine LGAs along the Yarra River corridor, the suburban and inner city reaches have the highest population and human density numbers (Table 9).

39. DELWP 2016, 'Victoria in Future 2016 Population and household projections to 2051', Melbourne, Victoria.
 40. Australian Bureau of Statistics 2018, '3218.0 Regional Population Growth, Australia', Canberra, Australian Capital Territory, <http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/3218.02016-17?OpenDocument> Accessed 9 October 2018.
 41. Ibid

LGA and suburbs within geographic scope of the SoY report	Estimated resident population, entire LGA (n.)	Population density for entire LGA (persons per km ²)	Land area for entire LGA (km ²)	Land use for entire LGA
Upper rural Yarra reach				
Yarra Ranges	156,891	63.6	2,468.2	Rural land used mainly for agriculture, horticulture and viticulture
Chirnside Park				
Coldstream				
Gruyere				
Tarrawarra				
Yarra Glen				
Yering				
Yelingbo				
Yarra Junction				
Don Valley				
Launching Place				
McMahons Creek				
Millgrove				
Reefton				
Warburton (East)				
Wesburn				
Woori Yallock				

Table 9: Local governments and population distribution along the Yarra River corridor, by reach

(continues over page)

Communities of the Yarra and Its Parklands

LGA and suburbs within geographic scope of the SoY report	Estimated resident population, entire LGA (n.)	Population density for entire LGA (persons per km ²)	Land area for entire LGA (km ²)	Land use for entire LGA
Lower rural Yarra reach				
Nilumbik Eltham South Bend of Islands Kangaroo Ground North Warrandyte	64,626	149.5	432.3	Urban and rural areas, with agriculture, parkland and residential
Suburban reach				
Manningham Bulleen Templestowe Templestowe Lower Warrandyte Wonga Park	124,262	1,096.3	113.3	Urban and peri-urban, parklands (conservation), small-scale agriculture
Banyule Eaglemont Ivanhoe (East) Lower Plenty Heidelberg Viewbank	129,125	2,064.7	62.5	Mostly residential with significant open spaces and parklands
Boroondara Balwyn North Kew (and Kew East)	179,640	2,985.2	60.2	Mostly residential, some educational and commercial
Stonnington Balwyn North Toorak	113,737	4,433.9	25.7	Residential, commercial and parklands

(continues over page)

Communities of the Yarra and Its Parklands

LGA and suburbs within geographic scope of the SoY report	Estimated resident population, entire LGA (n.)	Population density for entire LGA (persons per km ²)	Land area for entire LGA (km ²)	Land use for entire LGA
Inner city reach				
Yarra Abbotsford Alphington Burnley Clifton Hill Cremorne Fairfield Richmond (North & Central)	95,981	4,911.4	19.5	Residential, industrial and commercial
Melbourne Docklands East Melbourne Melbourne Port Melbourne South Yarra West Southbank	148,044	4,254.8	37.4	Residential, commercial, administrative, cultural, entertainment, tourist and recreational
Hobsons Bay Newport Spotswood Williamstown	93,392	1,480.0	64.2	Residential and industrial
Total	1,105,698		3,283.3	

(Source: ABS, 2018)⁴² note: footnote pages 45-47

42. Australian Bureau of Statistics 2018, '3218.0 regional population growth, Australia', Canberra, Australian Capital Territory <http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/3218.02016-17?OpenDocument> Accessed 9.10.2018 and <http://content.id.com.au/community-profiles-australia> Accessed 20 July 2018.

Communities of the Yarra and Its Parklands

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:04 Planning	Melbourne Water, DELWP						 <small>DATA QUALITY</small> Good

The interim Yarra River Protection Planning Controls (Amendment GC48) came into effect in February 2017 because of Yarra MAC’s Recommendation 21 and *Yarra River Action Plan* Action 10 (both calling for stronger planning controls) and the Yarra protection principles listed in Part 2 of the *Yarra River Protection (Wilip-gin Birrarung murron) Act* 2017. These controls focus on managing existing development pressures on the inner city (Richmond to Fairfield) and suburban reaches (Ivanhoe to Warrandyte) on an interim basis to address immediate pressures, such as encroachment on the Yarra River and its environs due to urban development.⁴³ Amendment GC48 introduced new and updated existing planning controls, specifically: Design and Development Overlay (DDO) ‘Yarra River (Birrarung) Protection’ and Significant Landscape Overlay (SLO) ‘Yarra River (Birrarung) Corridor’.

These planning controls must be applied, on an interim basis, to ensure ongoing and increasing development pressures are managed appropriately in accordance with State Planning Policy Framework clause 12.05-2. The interim period will allow sufficient time for:

- state and local government to consult with local communities and monitor the operation of the controls over time to determine whether further refinement and improvement are required
- the Yarra River Trust (or similar entity) to be established, with an involvement in developing planning strategies as per the Victorian Government’s policy commitment
- an exhibited planning scheme amendment process to occur and the establishment of an independent planning panel/advisory committee to review submissions prior to final controls being introduced

- transitional provisions to be included in all planning controls to ensure fairness and consistency in application.

The expiry date for the controls is 31 January 2021.

These overlay schedules have been applied to all land irrespective of tenure from the Yarra River to an area identified within the Landscape Setting Corridor. These overlay schedules extend from the lower rural to inner city Yarra River reaches.⁴⁴ Implementing consistent DDO controls across multiple municipalities will protect the character and physical characteristics of the Yarra River corridor. The new SLO replaces the previous eight planning controls which varied from municipality to municipality. The SLO defines the Yarra River corridor environs and landscape management objectives to assist with proper management of the river and its environs. The SLO manages the siting and design of buildings, removal of vegetation and earthworks within the broader Yarra River corridor setting. The SLO schedules include the following landscape character objectives:

- landscape, environmental and cultural value
- protection of waterway and riparian zone
- public open space and access
- siting and design of built form.

43. DELWP Planning, ‘Yarra River Controls’, Melbourne, Victoria, <https://www.planning.vic.gov.au/policy-and-strategy/waterways-planning/yarra-river-controls> Accessed 20 July 2018.

44. Office of the Chief Parliamentary Counsel Victoria 2017, ‘Planning and Environment Act 1987, Banyule, Boroondara, Manningham, Nillumbik, Stonnington and Yarra Planning Schemes. Amendment GC48. Explanatory Report’, [http://dsewebapps.dse.vic.gov.au/Shared/ATSAttachment2.nsf/\(attachmentopen\)/DCC03A4573C98EB3CA258152003C366B/\\$File/GC48+Explanatory+Report+Approval+Gazetted.pdf](http://dsewebapps.dse.vic.gov.au/Shared/ATSAttachment2.nsf/(attachmentopen)/DCC03A4573C98EB3CA258152003C366B/$File/GC48+Explanatory+Report+Approval+Gazetted.pdf) Accessed 16 August 2018.

Communities of the Yarra and Its Parklands

Six municipal toolkits have been developed and implemented. These set out planning provisions and changes to planning schemes and controls for the following local government areas: Banyule, Boroondara, Manningham, Nillumbik, Stonnington and Yarra. These planning provisions apply to both private and public land adjacent to the Yarra River and address the following topics:⁴⁵

- vegetation removal
- restrictions on overshadowing of the Yarra River, its banks and adjacent public spaces
- height limitations of all new buildings
- setbacks for all development from the Yarra River's edge
- fencing, swimming pool, tennis courts and other works in proximity to the Yarra River.

As these municipal toolkits were only introduced recently, it is still too early to assess their implementation effectiveness. They will be evaluated in the next SoY report.

Each Yarra River reach has specific planning overlays which are described below.

Upper Rural Reach

The upper rural reach contains sections with Environmental Significance Overlays (ESOs) and Public Conservation and Resource Zones on public land to protect native plants and animals of high environmental value that are important to the health of the Yarra River and its catchment. The Yering Gorge Drinking Water Catchment flows from the upper Yarra dam wall to Warrandyte, where water is pumped directly from the Yarra River to Sugarloaf Reservoir and treated at the Winneke Water Treatment Plant. This water supply contributes 25% of Melbourne's total water demand, and, during drought, provides one-third of Melbourne's drinking-water supply. There is no formal planning protection of this drinking water supply catchment, which increases the risk to water quality caused by unsustainable activities and incompatible land development.⁴⁶

Lower Rural Reach

The lower rural reach contains sections with ESOs, SLOs and Vegetation Protection Overlays (VPOs). These overlays protect landscape areas which have high scenic, cultural and environmental values that are important to the health of the Yarra River and its catchment. An ESO applies to the area in and surrounding The Bend of Islands and Wonga Park heading upstream towards Coldstream. The area around and including the Yarra Glen Recreation Reserve and Showground is a priority stormwater subcatchment, with 75% of this reach forming part of the Yering Gorge (drinking water) catchment. Similar to the upper rural reach, there is no formal planning protection of this drinking-water supply catchment in the lower rural reach, which increases the risk to water quality caused by unsustainable activities and incompatible land development.⁴⁷

Suburban Reach

The suburban reach is defined by a near-continuous network of open spaces and parklands that line the Yarra River's banks from Warrandyte into the city. This reach contains sections with ESOs, SLOs and VPOs. These overlays protect the open spaces and parklands that line the Yarra River from building and vegetation removal that impact on scenic and environmental values. The ESO extends along the main Yarra River stem from Alphington to the boundary of this reach in North Warrandyte. Melbourne's urban extent spreads across most of this reach to the urban growth boundary in Warrandyte. The upper boundary of this reach in North Warrandyte forms part of a priority stormwater subcatchment.⁴⁸

45. Ibid

46. Melbourne Water Corporation 2018, 'Community engagement workshop map book: developing the Yarra strategic plan,' Melbourne, Victoria.

47. Ibid

48. Melbourne Water Corporation 2018, 'Progress report for the Yarra strategic plan – October 2018', Melbourne Water Corporation, Victoria.

Communities of the Yarra and Its Parklands

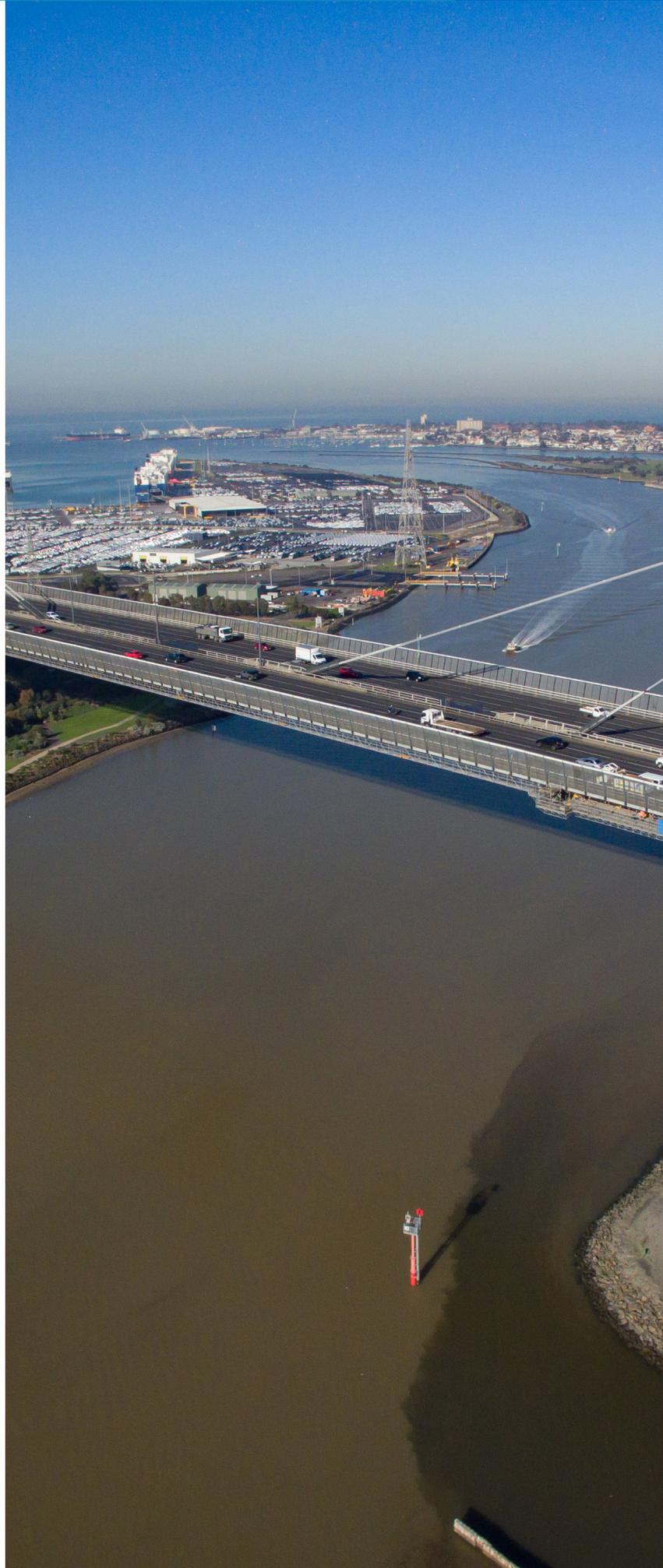
Inner City Reach

Compared to the above Yarra reaches, the inner city reach has limited areas with natural Yarra River land. These areas concentrate on remnant bushland found in Burnley Park and Yarra Bend Park and areas of riparian vegetation extending from Cremorne to Burnley. ESOs are located along the lower Yarra estuary to include Westgate Park and riparian areas along Fishermans Bend. The Port of Melbourne manages the Yarra waterway and land between the Docklands and the Yarra mouth extending into Port Phillip Bay. The inner city reach is the most intensively developed area compared to other Yarra River reaches.⁴⁸

Development of the Yarra River – Bulleen Precinct Land Use Framework Plan

The Yarra River – Bulleen Precinct Land Use Framework Plan, applied within Wurundjeri's Registered Aboriginal Party Area, is a 50-year outlook for managing land use, open space and development. Located in the suburban reach of the Yarra River, this plan covers Bulleen – Banyule Flats which includes Ivanhoe East, Eaglemont, Heidelberg, Bulleen, Lower Templestowe, Viewbank and Lower Plenty. A key element of this plan is for this area to be recognised internationally as a significant cultural precinct that brings together the arts, nature and Aboriginal heritage. Strategic work will include: the Wurundjeri mapping their cultural values along the Yarra River, a draft Framework Plan for completion by the end of 2018, and draft Planning Scheme Amendments and options for implementing both these strategies.

49. Melbourne Water Corporation 2018, 'Yarra River 50-year community vision Wilip-gin Birrarung murrn', Melbourne, Victoria.



Communities of the Yarra and Its Parklands

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:05 Yarra River 50-Year Community Vision	Melbourne Water, DELWP					?	

At the time of writing this report, the community vision document, *Yarra River 50-year Community Vision: Wilip-gin Birrarung murrn*, had just been released and therefore an assessment will be provided in the next SoY report.

The community vision document was developed by the Yarra River Community Assembly in collaboration with Melbourne Water.⁴⁹ The Yarra River Community Assembly was comprised of 24 people randomly selected from 300 applicants, with six drawn from each of the four reaches of the river. The Yarra River 50-year Community Vision fulfilled a key obligation of the *Yarra River Protection (Wilip-gin Birrarung murrn) Act 2017*, *Yarra River Action Plan* (Action 13) and Yarra MAC (Recommendation 4).

The 50-year vision describes how the Yarra River and its land are to be protected, cared for, developed, used and managed in the future. Custodianship for the Yarra River and its land is a prominent element across each community vision. The Yarra River 50-year Community Vision is expressed across three central tenets:

1. Natural environment and cultural landscape health – An improvement and enhancement of the natural features of the main water stem, surrounding native vegetation and animals across all Yarra River reaches, through marrying current management practices with traditional knowledge and practices of the Wurundjeri across their Registered Aboriginal Party area and Kulin Nation communities throughout the non-Registered Aboriginal Party area.

2. Economic and social – The interdependency between an enhanced and improved natural Yarra River environment leading to prosperous economic conditions for agricultural, tourism, hospitality and Aboriginal businesses. A system of well-connected networks of green spaces for cultural, spiritual, social, recreational, relaxation and sporting experiences.
3. Future development – Preserving the natural character of the Yarra River and its lands in future development through well-considered planning and control overlays.

These three central tenets come together to provide a whole-of-river 50-year community vision:⁵⁰

Our Yarra River, Birrarung, is recognised around the world as an iconic example of a nurturing relationship between a river and its community. Flowing from source to sea, it is the resilient lifeblood of past, present and future generations of Victorians. It connects and enriches our flourishing city, suburbs, regions and beyond.

The above three central tenets have also been expressed within each Yarra River reach vision to suit local community aspirations.

50. Ibid

Communities of the Yarra and Its Parklands

Upper Rural Reach

Flowing from the Upper Yarra Dam down to Healesville, the upper rural reach of the Yarra River is surrounded by many interconnected environmental and social values. These include: national park and state forest, numerous reserves and townships, and farming and tourism industries.

The upper rural reach is culturally significant to the Wurundjeri people. The community vision for the reach combines the desire for careful and innovative management of the Yarra River and neighbouring lands to ensure the natural replenishment of local billabongs and wetlands to support indigenous vegetation and the social and economic wellbeing of local communities through employment and their strong connection with the water and land of the Yarra River.⁵¹ To achieve this vision, the communities of the upper rural reach outlined the following priorities and values for the next 50 years:⁵²

- Promote and celebrate local cultural heritage through collaboration and community education
- Develop new opportunities around local tourism, including river-based learning
- Celebrate and promote opportunities for people to immerse themselves in the unique landscape, local wildlife and biodiversity
- Provide an expanded river access network for recreation and social connection
- Foster healthy local ecosystems for the river, its wetlands and billabongs, which are recharged through environmental flows
- Work with local farming communities to ensure sustainable water use
- Celebrate personal connections to the river.

Lower Rural Reach

Comprising of farming and agritourism businesses, the lower rural reach contains sectors which contribute significantly to the Victorian economy. There are also significant areas of high biodiversity value including the Yering Gorge and numerous sites of cultural significance to the Wurundjeri people such as Mount Lofty and the Brushy Creek confluence. The community's vision for the lower rural reach is that the Birrarung and its surrounding environments are embraced and cared for through a deep understanding and sense of custodianship, the way the Wurundjeri have always done.⁵³ Additionally, many farmers call the Yarra River and its surrounds home; here, they make their livings and care for the river and its lands.

To achieve this vision, the communities of the lower rural reach outlined the following priorities and values for the next 50 years:⁵⁴

- Improve community access at sensitive locations to enrich local connections, while protecting the region's natural environment
- Bring improved biodiversity to the local area, enhancing indigenous vegetation, animal, insects and fish in the habitat corridor and surrounding billabongs
- Foster and support sustainable agricultural practices which exist in harmony with the river and its lands
- Work with the Wurundjeri people to protect and enhance knowledge of local cultural values and sites
- Explore innovative tourism opportunities around activities such as education, cultural heritage and fishing to showcase rural river experiences
- Preserve the rural and bush character of the river and its landscape through collaboration and careful management of future development.

51. Melbourne Water Corporation 2018, 'Yarra River 50-year Community Vision Wilip-gin Birrarung Murrn', Melbourne, Victoria.

52. Ibid

53. Ibid

54. Ibid

Communities of the Yarra and Its Parklands

Suburban Reach

Peri-urban and suburban landscapes support farming, formal recreation areas, bushland and urban spaces within the Yarra River's suburban reach. Recreational activities are supported through a near-continuous network of accessible parklands, public and private golf courses and conservation areas which support the natural character of the river corridor, while protecting local populations from flood.⁵⁵ The Bolin Bolin Billabong and the confluence of the Merri Creek and Yarra River are sites of cultural significance for the Wurundjeri people.⁵⁶

The suburban reach's vision differs from the visions above as it considers private land ownership. Here, the vision describes a covenant of custodianship adopted by private landowners along the reach, embedding a culture of respect and responsibility for river values. Additionally, the vision aspires to have a river corridor that provides a healthy natural environment enabling swimming, relaxation and other recreational activities. A healthy natural environment is described here as a flourishing natural ecosystem, including networks of billabongs and wetlands, for native plants and animals. Similar to the visions above, the suburban reach vision acknowledges the benefits of an integrated approach to governance and land management with the wisdom and practices of the Wurundjeri. To achieve this vision, the communities of the suburban reach outlined the following priorities and values for the next 50 years:⁵⁷

- Expand the river's local parklands and trails to improve continuous access, increase biodiversity and enhance river health
 - Celebrate the community's spiritual connection to the river and its surrounds
 - Establish new habitat for endangered birds, fish and wildlife
 - Employ collaborative planning processes for development to ensure changes are for the benefit of the river and the advantage of all in the community, not just the few
- Collaborate to provide innovative immersive experiences with nature by expanding natural river tracks and creating environmental playgrounds along the corridor
 - Explore opportunities for community education and connection to Wurundjeri knowledge, cultural practice and significant sites.

55. Ibid

56. Ibid

57. Ibid

Communities of the Yarra and Its Parklands

Inner City Reach

The inner city reach is dominated by Melbourne’s central business district of tall buildings, promenades and social infrastructure. The main river stem is popular for recreational and sporting activity, while green spaces along the river’s banks provide places for relaxation. There are numerous sites of Aboriginal significance for the Kulin Nation. The inner city reach is also the location of the first European settlement with a modern history of industrial activity. The community’s vision for the inner city reach is a thriving river for a thriving city, providing a place of transition, both spiritually and physically.⁵⁸ Recognising that the Yarra River is an important Melbourne meeting place, the vision endorses the river as an inclusive place for connection, celebration, recreation and learning. It also envisions a place of green spaces and clean waters providing a healthy habitat for all.⁵⁹

To achieve this vision, the communities of the inner city reach outlined the following priorities and values for the next 50 years:⁶⁰

- Celebrate the river as the centrepiece of Melbourne, acknowledging its role in recent history and how it drives the city’s continued success
- Position the river as a symbol of learning and respect for Aboriginal culture, deepening community understanding of Traditional Owners
- Foster innovative urban waterway and open space planning to ensure the needs of a growing city are balanced with the future environmental health of the river
- Expand the connected network of Yarra parklands, creating better access and more spaces for relaxation and recreation
- Showcase the river as a place for sustainable and creative events, with a focus on culture, sport, ecology and education
- Position the river as an environmental educator, helping communities better understand their role in keeping Victoria healthy in the past, present and into the future.



58. Ibid
59. Ibid
60. Ibid

Communities of the Yarra and Its Parklands

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:06 Citizen Science	Melbourne Water, DELWP, Birdlife Australia, Museums Victoria, City of Melbourne, CSIRO					?	 DATA QUALITY Poor

Citizen science enlists the help of the public to gather scientific data that contributes to scientific research across many knowledge disciplines.^{61,62} Examples of citizen science date back to the 19th century; however, at the time, they were not recognised.⁶³ There has been a proliferation of citizen science projects over the past decade, with many projects now harnessing new technologies such as smartphone apps to increase accessibility and remote participation and capture real-time data. This has been termed 'citizen cyberscience'. Today, public participation in science is increasingly based on access to smartphones and the internet, where online projects are most likely to attract a technically literate audience.⁶⁴ The megatrend internet of things, defined as networks of interconnected physical devices, sensors and digital technologies that connect and exchange data,⁶⁵ has allowed the public to participate in science en masse. It provides a means for raising public awareness of scientific projects and environmental issues, assisting professional scientists in collecting data and creating environmental stewardship.

There are estimated to be at least 41 citizen science programs across all Victorian ecosystems ranging from animal counts to the recording of animal sounds for species identification to litter counts (Table 10). Specific to the Yarra River and its corridor, there are at least 13 diverse citizen science programs where some of the collected data contributes towards management decisions. For example, platypusSPOT is a program which collects data on platypus sightings along the Yarra River and has aided Melbourne Water in managing the main Yarra water stem to protect and enhance platypus populations.

Although the approximate number of citizen science programs is presented in this SoY report, exact information, such as volunteer numbers per annum, is unavailable for reporting. Although this information may be held by each respective organisation or citizen science program, there is no central database where information is available. There is an opportunity here for a centralised citizen science platform where social and biophysical science data can be annually assessed.

61. Martin VY, Christidis L, Pecl GT 2016, 'Public interest in marine citizen science: is there potential for growth?' *BioScience*, 66(8), pp. 683-692.
62. Science Communication Unit 2013, 'Science for environment policy in-depth report: environmental citizen science', University of the West of England, Bristol. A report produced for the European Commission DG Environment.
63. Ibid
64. Ibid
65. CSIRO 2017, 'Mining the Internet of Things', Canberra, Australian Capital Territory, <https://blog.csiro.au/mining-the-internet-of-things/> Accessed 7 December 2018.

Communities of the Yarra and Its Parklands

Program name	Lead Organisation	Indicator	Measures
playpusSPOT	Melbourne Water	Platypus	Sightings: numbers, locations
Waterbug Census	Melbourne Water	Macroinvertebrates	Pollution sensitivity: number & diversity
Frog Census – contributes to Atlas of Living Australia and Victorian Biodiversity Atlas	Melbourne Water	Frogs	Frog calls
WaterWatch	Melbourne Water	Waterways	Water quality: pH, electrical conductivity, dissolved oxygen, transparency/ turbidity, temperature, reactive phosphorous, macroinvertebrates, habitat survey
Clean Bay Blueprint	Port Phillip EcoCentre, Yarra Riverkeeper Association	Microplastics	Types, sizes and total volume of microplastics
Community Rain Reader	Melbourne Water	Rain	Total rainfall
BowerBird	Museum Victoria & Atlas of Living Australia	Flora and Fauna	Sightings and images
Melbourne Bioblitz	City of Melbourne	Fauna	Sightings: numbers, locations
Victorian Biodiversity Atlas	DELWP	Flora and Fauna	Sightings: numbers, location and date
Atlas of Living Australia	CSIRO	Flora and Fauna	Sightings: numbers, location and date
Bird Atlas	Birdlife Australia	Birds	Sightings: numbers, location and date
Fungimap	Royal Botanic Gardens Melbourne	Fungi	Species sightings and location

Table 10: Citizen science programs specific to the Yarra River and its corridor

Communities of the Yarra and Its Parklands

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:07 Volunteers and Landcare	Port Phillip & Westernport CMA, DELWP, Parks Victoria						 DATA QUALITY Poor

There are many active 'Friends of' and community volunteer groups along the Yarra River corridor spending approximately 50,000 hours per year managing the parks. There are five major Landcare Networks mostly focused in the upper and lower rural reaches: Yarra Ranges Landcare Network, Northern Yarra Landcare Network, Nillumbik Landcare Network, Middle Yarra Landcare Network and Bili Landcare at Westgate Park.

There is limited information to assess this indicator. Although information may be held by each respective organisation or group, there is no central database where information is available. There is an opportunity here for volunteer and Landcare information to be part of a centralised platform with citizen science so that social and biophysical science data can be annually assessed.



Communities of the Yarra and Its Parklands

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:08 Parklands and Open Space	Melbourne Water, DELWP, Parks Victoria						 DATA QUALITY Good

Across the Yarra River corridor, parklands and public open spaces total approximately 7,800 hectares. Access to quality open space for the wellbeing of people of all ages and abilities is becoming even more critical as Melbourne’s population continues to increase. Demographic change and cultural shifts will influence recreational preferences which will place increased demands on open spaces and community facilities throughout Victoria.⁶⁶

The Yarra River corridor offers a complex array of parks, public lands and recreational and sporting facilities. This includes bushland parks, landscaped areas, playgrounds, sporting facilities, wilderness areas, a national park, wetlands, pastoral settings, the Royal Botanic Gardens, rail trails, treed areas and places of environmental and cultural significance. These will differ across each reach.

Upper Rural Reach

The upper rural reach consists of the Yarra Ranges National Park, Yarra State Forest and other nature conservation reserves and bushland parks that provide public access to wilderness areas. Public access to the river and the area alongside the river is more limited in the upper rural reach than downstream. Although there are five swimming recreation hotspots, water access is informal, with no boat ramp or jetty. The Lilydale–Warburton Rail Trail, used by pedestrians, cyclists and horse riders, passes alongside parts of the Yarra River. There is public transport access via a tourist rail line and public bus routes with stops close to the river. There are some car parks in proximity to the river that allow direct public access. There are four formal viewing platforms but there are large gaps between bike paths and walking trails along the Yarra River that require connectivity.

Lower Rural Reach

Within the lower rural reach, there are 654 hectares of wilderness areas, parklands and recreational spaces including: Warrandyte State Park, Chirnside Park, Sugarloaf Reservoir Park, Warrandyte– Kinglake Nature Conservation Reserve, Yering Gorge Bushland Reserve and the Yarra Glen Recreation Reserve and Showground. Warrandyte State Park, Chirnside Park and Sugarloaf Reservoir Park are considered significant viewing areas for the Yarra River and its parklands. Upstream of Warrandyte there are few areas of public open space along the river corridor and access to the river’s edge is limited. Isolated open spaces include Spadonis Nature Reserve. Access to the Yarra River corridor in the lower rural reach is limited with only localised tracks and trails through only a few parklands with no connectivity between these areas. Only one formal boat ramp exists in the lower rural reach creating limited access for recreational watercraft users. However, there are four swimming recreation hotspots. There is also limited public transport and car access to the Yarra River in this reach. The Lilydale–Warburton Rail Trail runs through this reach but not alongside the Yarra River corridor.

66. Melbourne Water Corporation 2018, ‘Community engagement workshop map book: developing the Yarra strategic plan,’ Melbourne, Victoria

Communities of the Yarra and Its Parklands

Suburban Reach

Within the suburban reach there are 2,128 hectares of parks and open spaces. The suburban reach consists of 10 parks, which create the Greater Yarra Urban Parklands. These parks include Yarra River land that is used as public open space or as a park estate, starting beside Punt Road in South Yarra and extending to the urban growth boundary in Warrandyte. An extensive open space network exists along the Yarra River's floodplains, including Westerfolds Park and Warrandyte State Park. There are at least 24 key viewing points across this reach. Near-continuous bike and walking paths run alongside the Yarra River, extending from Yarra Bend Park and ending at Tikalara Park, allowing easy foot access to the main river stem for water recreation activities. Melbourne's public transport network is near the river, providing accessibility to the city's population. This network decreases towards the urban growth boundary. There are six formal boat ramps for recreational watercraft access and five swimming hotspots. In Kew at Chandler Highway Bridge is the most southern location along the Yarra River where it is legal to swim.⁶⁷

Inner City Reach

The inner city reach features wide pedestrian promenades, formalised parks and sporting grounds located along the banks of the Yarra River. There are 403 hectares of open space in this reach, with the parks estate consisting of Yarra Bend Park, Burnley Park, Herring Island, Yarra Park and Westgate Park. The Royal Botanic Gardens and Fitzroy Gardens provide open green spaces for recreational activities. Yarra Bend Park contains Dights Falls and a significant bushland habitat for the grey headed flying fox colony. There are 26 key viewing points across this reach. There are continuous and linked bike and pedestrian trails along the Yarra waterway and public transport access points. There are numerous on-water access points for watercraft with formal boat ramps, jetties and rowing launches between Herring Island and Yarra Bend Park. It is illegal to swim in the Yarra River downstream of Gipps Street, Abbotsford.⁶⁸

67. EPA 2017, 'Yarra Watch summer highlights report 2016-17', Melbourne, Victoria, <https://yarraandbay.vic.gov.au/yarra-watch/2016-17-summer-highlights-report> Accessed 20 July 2018.

68. Melbourne Water Corporation 2018, 'Community engagement workshop map book: developing the Yarra strategic plan,' Melbourne, Victoria.

Communities of the Yarra and Its Parklands

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:09 User Groups and Community Activities	DELWP, Parks Victoria, Melbourne Water, LGAs					?	 <small>DATA QUALITY</small> Poor

Community and user groups are attracted to, and use, the Yarra River and its parklands for diverse reasons ranging from sporting activities to cultural events, festivals, markets and environmental activities. Similar to citizen science (Y:06), Landcare and volunteer groups (Y:07), there is limited information to assess this indicator. A centralised platform that hosts this data can contribute to annual assessments of stewardship and recreational health. Information that is available is provided for each reach below has been sourced from local government data.

Upper Rural Reach

The three top recreational activities in the upper rural reach include: nature appreciation, picnics and barbeques, and bird watching.⁶⁹ In the upper rural reach there are fewer venues for community activities and events and these are generally located in places outside of the river corridor – except near Warburton. There are large areas of open space with potential links to the Yarra. Community events in this reach include the River Folk Festival, Warburton Trail Festival, Giro della Donna cycling race and community and farmer markets.

Lower Rural Reach

The top three recreational activities in this reach are: visiting cafes and restaurants, holding picnics and barbeques, and dog walking.⁷⁰ The network of publicly used open space in the lower rural reach is fragmented, meaning there are fewer activities concentrated around the Yarra River’s main stem compared to other reaches. The Yarra Glen Recreation Reserve and Showground provides a venue for community events and activities. The major annual community event is the Warrandyte Festival, which celebrates food, music and culture. The Gardiners Run Golf Course and sections of the Lilydale–Warburton Rail Trail are recreational hotspots.

Suburban Reach

Bike riding is the top recreational activity in this reach, followed by canoeing and rowing, and visiting cafes and restaurants.⁷¹ Over 1,000 cycle commuters travel along the Main Yarra Trail during peak morning and evening hours on weekdays, with many of these cyclists most likely to be local residents. The network of open spaces, Greater Yarra Urban Parklands and sports grounds host a variety of community and sporting events such as markets and festivals. Westerfolds Park hosts the Trail Running Series and guided walks throughout the year. Sills Bend at Heidelberg hosts the Twilight Sounds music festival, Kids Arty Farty Festival and Grand Parade all during early Autumn.⁷²

69. Melbourne Water Corporation 2018, 'Progress report for the Yarra strategic plan – October 2018', Melbourne, Victoria.

70. Ibid

71. Ibid

72. Ibid

Communities of the Yarra and Its Parklands

Inner City Reach

The top three recreational activities in this reach include: nature appreciation, picnics and barbeques, and dog walking. Over 3,250 cyclists ride to work daily along the Yarra River paths.⁷³ Open spaces along the Yarra River are used for recreation and sport, and walking and public transport are the two main methods used to access this reach.⁷⁴ Many riverside events, for example, sport, culture and food, are concentrated in the Melbourne area. The Head of the Yarra rowing event attracts over 10,000 people to the Yarra River.⁷⁵ Birrarung Marr, Southbank Promenade and South Wharf have markets, festivals and holiday celebrations throughout the year. The annual White Night festival occurs alongside the Yarra River. The waterway hosts regatta events, including the Inflatable Regatta. The annual Herring Island Summer Arts Festival hosts local artwork which is viewed along the Yarra River. Over \$2.5 million was invested during the 2017–18 financial year to improve community use and amenity in this reach.⁷⁶

Finns Reserve Canoe Launch

Canoeing Victoria, in collaboration with Melbourne Water, is working to improve boat launch facilities across the Yarra River corridor. An upgraded canoe launch at Finns Reserve in Templestowe Lower (Manningham Council) has provided safer access to the river via a new path, steps and launching area while reducing damage to the surrounding natural environment. New canoe access facilities which are inclusive of all people and abilities are currently being planned.

73. Ibid
74. Ibid
75. Ibid
76. Ibid



Communities of the Yarra and Its Parklands

Agriculture

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:10 Agriculture	DELWP, DEDJTR						 DATA QUALITY Poor

The Yarra River corridor provides land for mixed-use farming including grazing, orchards, groves, plantations, vineyards and market gardens. Agriculture data pertaining to the Yarra River corridor was obtained from the Victorian Land Use Information System 2016⁷⁷ and buffered 1.1 km around the Yarra River corridor, which is greater than the geographic scope applied to the rest of this report. The Victorian Land Use Information System 2016 dataset has been created by the Spatial Sciences Group of the Agriculture Victoria Research Division in the Department of Economic Development, Jobs, Transport, and Resources (DEDJTR). It covers the entire landmass of Victoria and separately describes the land tenure, land use and land cover across the state at the cadastral parcel (property title register) level.⁷⁸

The Gross Regional Product of the Yarra Valley and Dandenong Ranges is \$574 million.⁷⁹ There is a higher proportion of mixed farming and grazing and vineyards in the lower rural reach compared to the other Yarra River reaches (Table 11). Coldstream (lower rural reach) has the greatest area of mixed farming, grazing and vineyards comparatively to other suburbs in both the upper and lower rural reaches.

Table 11: Types of agricultural practices dependent on the Yarra River in the upper and lower rural reaches within a 1.1 km buffer of the Yarra River corridor

Yarra River reach and suburb	Mixed farming and grazing* (m ²)	Vineyard (m ²)
Upper rural reach		
Launching Place	68,037,938	463,995
Healesville	6,203,872	4,812,533
East Warburton	6,339,008	0
Wesburn	6,203,872	0
Warburton	2,480,172	0
Lower rural reach		
Coldstream	9,822,123	6,657,537
Woori Yallock	7,218,707	0
Yering	6,443,243	89,673
Yarra Glen	3,209,304	35,844,962
Gruyere	2,325,201	2,914,696
Christmas Hills	2,058,080	0
Millgrove	2,037,665	0
Tarrawarra	1,012,579	2,580,779
Chirnside Park	901,542	637,772
Yarra Junction	900,852	0
Kangaroo Ground	774,278	0
Don Valley	656,034	0
McMahons Creek	457,833	0
Seville East	83,589	0
Total	653,923,391	21,741,947

* Farms are generally more than 20 ha in size

77. DELWP 2018, 'Victorian land use information system (VLUIS) 2016', Melbourne, Victoria <https://www.data.vic.gov.au/data/dataset/victorian-land-use-information-system-2016> Accessed 30 August 2018.

78. Ibid

79. Melbourne Water Corporation 2018, 'Progress report for the Yarra strategic plan – October 2018', Melbourne, Victoria.

Communities of the Yarra and Its Parklands

Tourism

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:11 Tourism	Parks Victoria						 DATA QUALITY Fair

The Yarra River, its parklands and the surrounding areas are a destination for international and local tourists and visitors. Healesville Sanctuary, the Yarra Valley vineyards and Southbank Boulevard are some examples of key tourist locations. Parks Victoria has licensed 119 tourist operators across the Yarra River corridor including those who have Ecotourism Australia accreditation (ECO) and those who are certified by the Australian Tourism Accreditation Program (ATAP) (Table 12). Tourist activities range from on-water boat sightseeing to adventure activities to other land-based activities.

Table 12: Number of different licensed tourist operators operating along the Yarra River on parks estate

Park	Number of operators	Vehicle-based sightseeing	Outdoor	Specialist activity provider	Number of accredited operators
Yarra Ranges National Park	39	10	10	19	11: 2 ECO & 9 ATAP
Yarra Bend	19	1	6	12	5 ATAP
Yarra Valley Parklands	9	-	4	5	2 ATAP
Yarra Flats	1	1	-	-	-
Yarra River	30	13 (a)	7	10	1 ATAP
Warrandyte State Park	15	1	9	5	3 ATAP
Westgate Park	6	1	-	5	1 ATAP
Total	119	27	36	56	23: 2 ECO & 21 ATAP

(Data Source: Parks Victoria 2018)

(a) Vessel Note: Licensed operators have been split into typologies to include: Vehicle-based sightseeing - vehicle/vessel based sightseeing tours; Outdoor education provider - provision of outdoor education activities that usually includes several educational and adventure activities; Specialised activity provider - provision of a specific activity, e.g. horse trial riding, mountain biking or rock climbing). A number of these licensed tour operators are Ecotourism Australia accreditation (ECO) and/or an Australian Tourism Accreditation Program (ATAP)

Communities of the Yarra and Its Parklands

Upper Rural Reach

The upper rural reach is a key tourist destination with 10 wineries, Healesville Sanctuary, Sandra Bardas Art Gallery, Mont De Lancey Historic Homestead and Rayners Orchard. Tourists also visit key natural features including: Ben Cairn Rock, Mount Donna Buang, Yarra Valley ECOSS, Rainforest Gallery, La La Falls, Cement Creek Redwood Forest, Steavenson Falls, Big and Little Peninsula Tunnels, Ada Tree and Upper Yarra Reservoir Park.

Lower Rural Reach

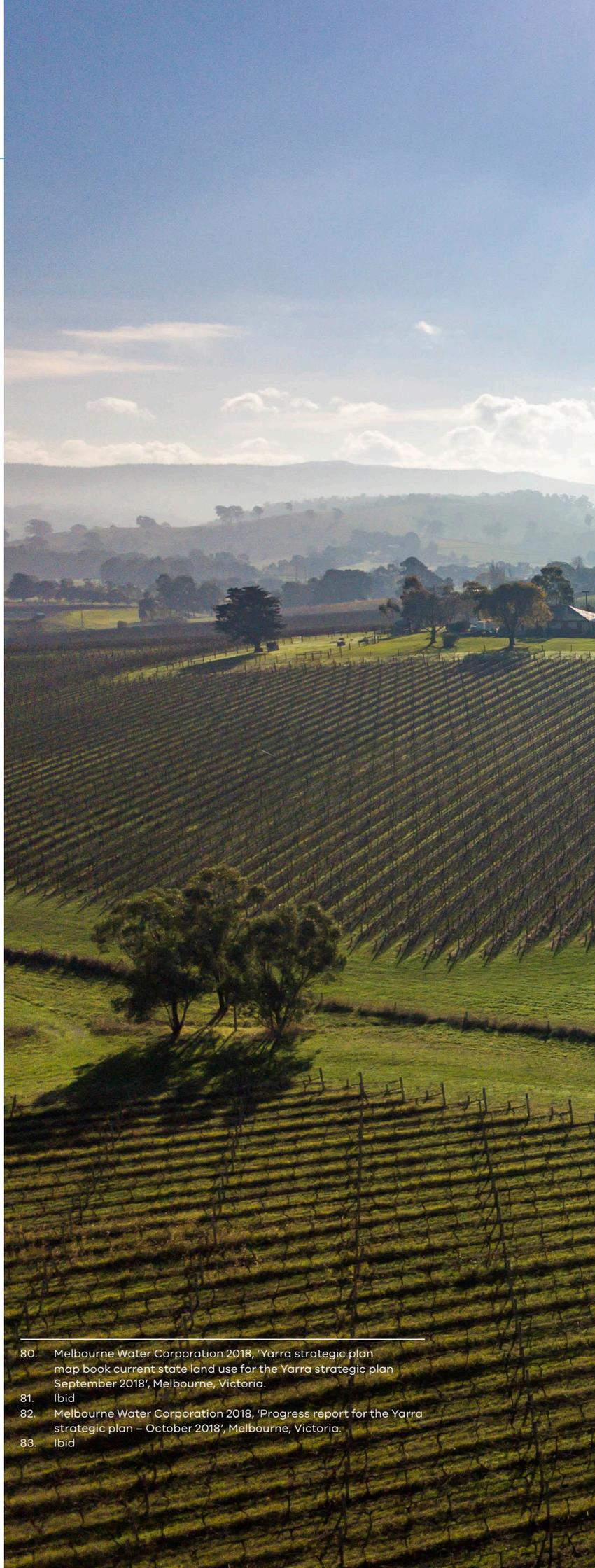
The lower rural reach experienced high tourist visitation during 2017–18, with 1.1 million people visiting the Yarra Valley area.⁸⁰ This represents 4% of all visitors to Victoria and is a 23% increase from the previous year.⁸¹ There are 23 wineries, a golf course, a dairy, a chocolaterie, a race course, a Museum of Art, a number of art studios, Yarra Valley Railway and Tarrawarra Abbey. Other tourist activities include hot air ballooning, visiting and viewing natural features such as Yering Gorge Bushland Reserve, Alowyn Gardens, Lubra Bend Garden and Maroondah Reservoir Park. It is expected that 1.1 million visitors will visit the Yarra Valley in 2018-19.⁸²

Suburban Reach

The suburban reach includes two key tourist destinations: Heide Museum of Modern Art and Rob Dolan Wines.

Inner City Reach

The inner city reach sees the highest number of tourist visitation, with 2.8 million international tourists visiting Melbourne during 2017–18.⁸³ Key international and national tourist attractions include: Southbank Promenade, Royal Botanic Gardens, National Gallery of Victoria, Federation Square, Birrarung Marr, Melbourne Cricket Ground, Olympic Boulevard, Herring Island, Yarra River cruising, Abbotsford Convent, Collingwood Children’s Farm, Yarra Boulevard and Fairfield Boathouse. Natural features such as Alexandra Gardens and Dights Falls also attract visitors.



80. Melbourne Water Corporation 2018, 'Yarra strategic plan map book current state land use for the Yarra strategic plan September 2018', Melbourne, Victoria.

81. Ibid

82. Melbourne Water Corporation 2018, 'Progress report for the Yarra strategic plan – October 2018', Melbourne, Victoria.

83. Ibid





Chapter 2 : Environmental Health

Introduction

Chapter 1 highlighted the community vision for a healthy and flowing Yarra River that provides cultural, social and economic benefits. This community aspiration needs to be underpinned by strong evidence-based science with cultural, social and economic indicators directly linked to biophysical indicators. This is because healthy land, water and biodiversity within and along the Yarra River and its parklands determine the health and wellbeing of all Victorians who interact with this living system. A healthy Country is fundamental to the cultural, spiritual, physical and economic wellbeing of Traditional Owners and Aboriginal Victorians. It provides ecosystem services such as clean air, drinking water and improved soil health for food production and the health benefits derived from contact with nature. Biodiversity in parks and reserves provides green and blue spaces for recreation and an escape from the fast pace of Melbourne's central business district.

This chapter aims to understand the environmental condition of the Yarra River and its parklands as an integrated whole living entity. It will do this by evaluating the current state of biophysical indicators across each Yarra River reach and providing an overall summary for that indicator.

Each biophysical indicator will be evaluated by applying the SoE Indicator Assessment. This assessment approach is applied consistently across 'State of' reporting by the Commissioner for Environmental Sustainability, Victoria.

Threats and Pressures

The Yarra River corridor is exposed to many threats and pressures including: inappropriate land development along the river bank, invasive pest plants and animals, litter, pollution (including sewerage), stormwater, climate change and population growth. This section explores these issues, where data and information are available.

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:12 Litter	Metropolitan Waste and Recovery Group, Parks Victoria, Port Phillip EcoCentre						 DATA QUALITY Fair

Land-based sources and rivers act as major transport pathways for all sizes and types of litter. High plastic litter loads in rivers, including both macro and microplastics, is due to high levels of mismanaged plastic waste arising from population-rich river catchments.⁸⁴ The *State of the Bays 2016* highlighted the impact of waterway litter on Port Phillip Bay beaches.⁸⁵ The Victorian Government has funded litter reduction initiatives to decrease litter entering the Yarra River and flowing into Port Phillip Bay. These initiatives include: Litter Hotspots Program, Victorian Litter Innovation Fund, Victorian Waste Education Strategy, Parks Victoria’s Yarra River litter traps, and the Yarra Riverkeeper Association and Port Phillip EcoCentre’s Clean Bay Blueprint and Yarra River Blitz.

The Metropolitan Waste and Resource Recovery Group (MWRRG) led a Litter Hotspots Program between 2014 and 2017, to address litter in and along the Yarra River and flowing out into Port Phillip Bay. With a budget of \$2.15 million from the Victorian Sustainability Fund, this program:⁸⁶

- collected 179 tonnes of litter, including 1.29 million cigarette butts
- identified 436 litter hotspots
- installed 3,317 additional litter infrastructure units
- contributed to a 96.8% reduction in litter since program inception
- funded 35 programs resulting in 267 new organisational partnerships and over \$2 million in cash and in-kind contributions.

Since the MWRRG program formally concluded, 90% of its grant recipients are still active in litter reduction activities.

In the suburban and inner city Yarra reaches, Parks Victoria has 17 litter traps. Although first

installed in 1996, data reported here includes litter and debris, measured in cubic metres, from 1998 to 2016 (Figure 8). Data from 1996 to 1997 was inconsistent and therefore not used in this analysis. Litter is defined as anything manufactured (such as plastic bottles and coffee cups) whereas debris is organic matter (such as tree limbs). There seemed to be a downward trend in annual litter collection between 2009 and 2015, which shifted to an upwards trend from 2016. There was no clear debris trend, with a high level of variability between 1998 and 2016. Due to inconsistent data processing, only broadscale results are reported here and a detailed analysis of debris and litter is not possible.

The Port Phillip EcoCentre – in partnership with Yarra Riverkeeper Association and funded through the Victorian Government’s Port Phillip Bay Fund and ‘Turn off the Tap’ program – has conducted boat-based river trawls in the inner city reach to investigate the impacts of litter pollution in the Yarra River. Initial findings from a pilot study found that 6,335 litter items were removed from the top 20 cm of the Yarra River’s water column in the inner city reach. Microplastics accounted for 77% of the total litter count with polystyrene, nurdles and plastic bottle caps as the most pervasive.⁸⁷ Seasonally, the Yarra River carries a greater amount of litter loads in autumn and winter, but it is unclear from these initial findings what creates the difference in litter items and seasonal variations. These questions will be investigated over the next two years by the Port Phillip EcoCentre and Yarra Riverkeeper Association.⁸⁸

84. Schmidt C, Krauth T, Wagner S 2017, ‘Export of plastic debris by rivers into the sea’, *Environmental Science & Technology*, 51, pp. 12246–12253.

85. CES 2016, ‘State of the Bays 2016’, Melbourne, Victoria.

86. Dennis R, Clarke D, Gilmour P 2017, ‘Litter hotspots program final evaluation: final report’, prepared for Metropolitan Waste and Resource Recovery Group, Melbourne, Victoria.

87. Charko F, Blake N, Kowalczyk N, Johnstone C, Seymore A, Quek Y 2018, ‘Microplastics in the Maribyrnong and Yarra Rivers, Melbourne, Australia’, Port Phillip EcoCentre, St Kilda, Victoria.

88. Ibid

Environmental Health

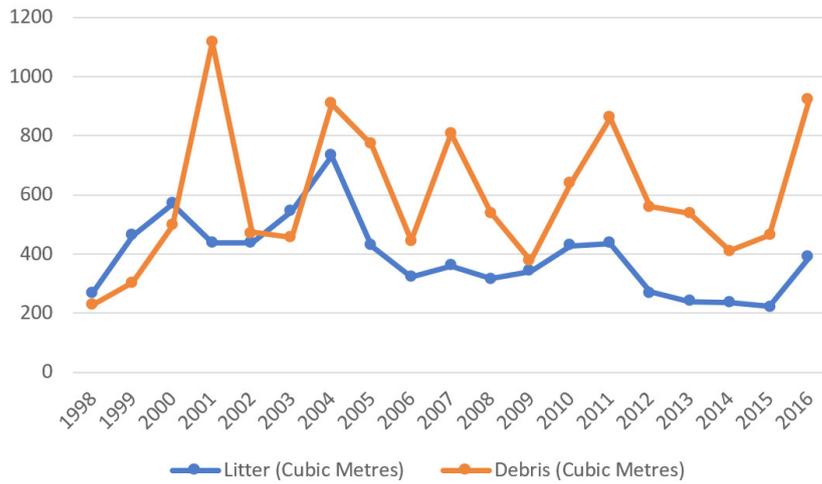


Figure 8: Cubic metres of litter and debris collected in the Parks Victoria litter trap system annually, 1998–2017



Environmental Health

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:13 Pollution	EPA Victoria						 <small>DATA QUALITY</small> Good

Between 2013 and 2017, EPA Victoria received 338 water pollution reports across the Yarra River. Pollution incidents include: fish deaths, industrial pollution, residential construction and sewer overflow. Of these 338 reports, the majority were reported in the inner city reach followed by the lower rural reach (Table 13 and Figure 9). All other suburbs along the Yarra River main stem received fewer than 10 reports. It is likely that the higher number of pollution reports along the inner city reach is due to the combination of higher population densities and more operational industrial sites located along the main Yarra stem.

Reach and suburb	Pollution reports
Inner city reach	
Melbourne	78
Abbotsford	54
Alphington	35
Docklands	33
Southbank	18
Fairfield	17
Lower rural reach	
Warburton	12

Table 13: Pollution reports received by EPA Victoria for the Yarra River, 2013–17

(Data Source: EPA Victoria 2018)

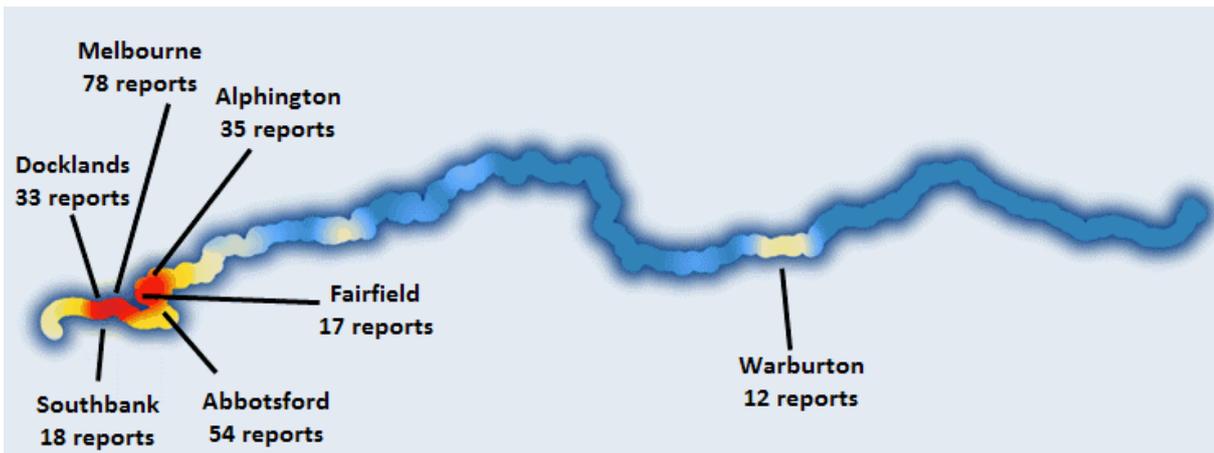


Figure 9: Heat map of EPA Victoria pollution water reports, with a 200m buffer around the Yarra River line

Environmental Health

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:14 Sewerage	Yarra Valley Water						 <small>DATA QUALITY</small> Good

The VAGO report *Managing the Environmental Impacts of Domestic Wastewater* was tabled in Parliament in September 2018.⁸⁹ This report focused on both the Mornington Peninsula and the Yarra Ranges, where unsewered areas (serviced by septic tanks) have been identified as high risk to: public health (for example, drinking water contaminated by human pathogens), the natural environment (polluted surface waters causing harm to native plants and animals) and amenity (impacts to sight and smell caused by untreated wastewater). These risks are created when on-site systems (for example septic systems, which receive all wastewater that flows from household use) discharge into stormwater systems. They are worsened by on-site systems that are used beyond their intended life span, are not well-maintained, or are permitted on small subdivided allotments that could not contain wastewater within their boundaries because the area was prioritised for a sewer that was never installed.⁹⁰

The report examined whether relevant state agencies such as DELWP, EPA Victoria, South East Water, Yarra Valley Water and local governments (Mornington Peninsula Shire and Yarra Ranges Council) are effectively managing the environmental and health risks posed by on-site wastewater treatment systems, for example septic tanks.⁹¹ An overall recommendation was to apply integrated water cycle management for stormwater, sewerage and alternative water services rather than planning and managing for different water and wastewater streams in isolation. An integrated management system can benefit both the community and surrounding environment, creating more sustainable towns and cities.

VAGO provided a total of 18 recommendations to the Victorian Government, referring to all the agencies listed above. These ranged from improving the regulatory framework for domestic wastewater management, to developing a risk assessment framework for system performance based on Australian Standards, to developing monitoring and compliance programs.⁹² At the time of writing this report, the government had not provided a response to these recommendations. It is anticipated that the next SoY report will evaluate the recommendations implementation across government.

In response to the VAGO audit, and a focus on the Yarra River, Yarra Valley Water is advocating an approach that links monitoring of catchment and waterway health (and public amenity) to evidence-based investment. This investment will look at issue locations and seek to understand the causes (Figure 10). For example, if there are elevated nutrient levels in a reach of a waterway, it will examine whether the evidence support a single source-point issue, such as a sewerage treatment plant discharge, or failing on-site wastewater management systems, or stormwater runoff, or a combination of a number of sources.

89. VAGO 2018, 'Managing the environmental impacts of domestic wastewater. Independent assurance report to Parliament 2018-19:10', Melbourne, Victoria.

90. Ibid

91. Ibid

92. Ibid

Raw Sewerage Investigations in the Yarra Catchment

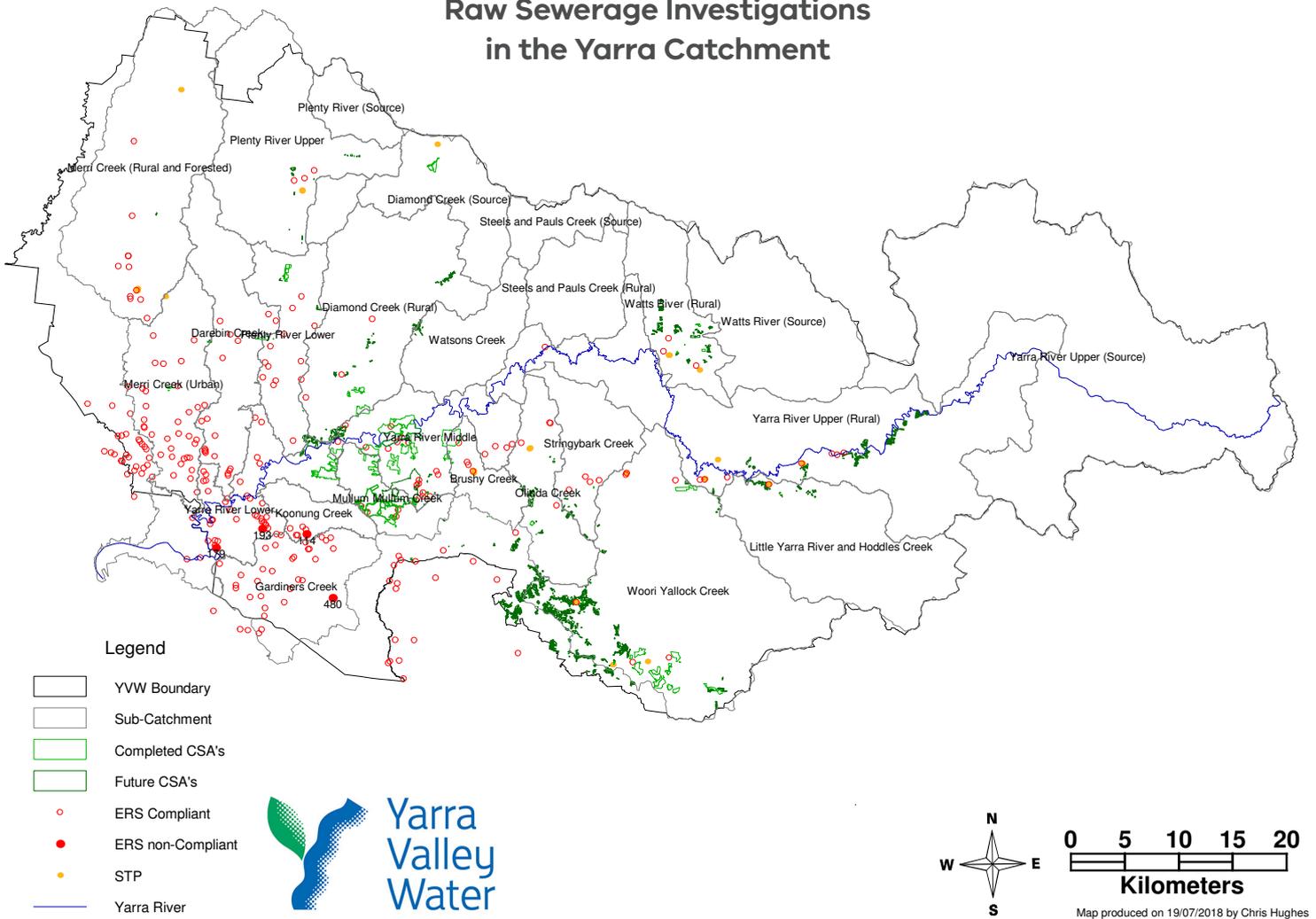


Figure 10: Works undertaken to provide sewerage services in areas previously serviced by septic tanks, Yarra Catchment

Note: Data is represented by an overlay of Melbourne Water's Yarra catchment area with Yarra Valley Water's Community Sewer Areas (CSA). The map also shows emergency relief structures on Yarra Valley Water sewers (ERSs) and Sewerage Treatment Plans (STPs) that discharge to waterways or land. (Yarra Valley Water 2018)

Environmental Health

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:15 Stormwater	Melbourne Water						 DATA QUALITY Good

Discharge of stormwater into the Yarra River via stormwater drains, especially during rain events, can influence water quality. Stormwater condition is measured by directly connected imperviousness, which is the proportion of the impervious surface in the catchment that is directly connected to a stream through a conventional drainage connection.⁹³

Recognising the impact of stormwater not only on the Yarra River but also across Victoria, the Improving Stormwater Management Advisory Committee was established in April 2018 to provide independent advice and future policy directions to the Minister for Planning and the Minister for Water on how to improve stormwater management and linkages between urban planning and urban water management. Two short-term planning reforms and 16 longer-term policy directions were recommended in August 2018 with a focus on changing the planning system to improve stormwater management and encourage integrated water management. The short-term planning reforms came into effect during October 2018 and include:

- new arrangements under the Victoria Planning Provisions to expand the current stormwater management requirements to include commercial subdivisions and developments, industrial subdivisions and developments, public use developments, and residential multidwelling subdivisions and developments
- a new integrated water management clause in the State Planning Policy Framework to embed integrated water management objectives and strategies into urban land-use planning.

At the time of writing this report, the stormwater short-term planning reforms addressed Action 19 of the *Yarra River Action Plan*, 'Extend coverage of stormwater standards'. This action focuses on all subdivisions to maintain water quality in the Yarra River at current levels. As the short-term planning reforms only came into effect in October 2018, future SoY reporting will assess the impacts of implementation and uptake of these reforms.

93. Melbourne Water Corporation 2018, 'Co-designed catchment program for the Yarra catchment. Working together for healthy waterways', Melbourne, Victoria.

Environmental Health

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:16 Climate Change	DELWP, Melbourne Water						 <small>DATA QUALITY</small> Poor

Climate change will see a reduction in water flow into Victoria’s waterways. Hydroclimatic projections for Victoria in 2040 and 2065 predict declines in rainfall and land surface runoff, with increased evaporation due to rising temperatures.⁹⁴ The Yarra catchment is becoming hotter and drier and is facing more periods of extreme heat and drought, reductions in annual rainfall, and increases in intense rainfall events.⁹⁵ This is a threat to the creeks that run into the main Yarra River stem and the Yarra’s wetlands, billabongs and estuary – all of which are important systems for drought refuge. These systems are cooler and have localised microclimates and greater water availability through groundwater and flooding.⁹⁶ The Yarra River corridor’s human population is growing, resulting in increased dwellings. Under a drier climate, an increase in paved landscapes due to dwelling development poses a threat to the natural values of the Yarra River, its wetlands and its estuaries and their ability to be green and cool spaces within the urban landscape.⁹⁷ Although Melbourne Water has done some climate change scenario work⁹⁸, there is no central database where information is available.

Invasive Plants and Animals

Invasive terrestrial and freshwater plants and animals are defined as species that have been brought into a natural system by humans across a geographical barrier and are recognised as a serious threat to biodiversity.⁹⁹ Their impacts are likely to be exacerbated by operating in concert with other emerging and ongoing threats such as climate change, habitat degradation and urbanisation.¹⁰⁰ These species pose a major threat to biodiversity, ecosystem health, primary production and landscape aesthetics.

Invasive terrestrial and freshwater plants and animals in the Yarra River waterway and along its riparian land are a threat to the health of the entire system. The establishment and spread of invasive pest plants and animals is often a result of:

- land-use change, disturbance and stock access (especially in the riparian zone)
- water flowing downstream and/or across floodplains and associated wetlands
- major flood events.

However, due to a lack of a consistent and comprehensive Yarra River dataset on the population number and management of invasive terrestrial and freshwater plants and animals, their state and impacts cannot be reported here. This section will focus on specific species where data and information are available from a statewide assessment in the SoE 2018.

94. VCMC 2017, ‘Catchment condition and management report’, Melbourne, Victoria.
 95. Melbourne Water Corporation 2018, ‘Yarra: working together for healthy waterways. Catchment works program to support the draft Healthy Waterways Strategy’, Melbourne, Victoria.
 96. Selwood KE, Thomson JR, Clarke RH, McGeoch MA, Mac Nally R 2015, ‘Resistance and resilience of terrestrial birds in drying climates: do floodplains provide drought refugia?’, *Global Ecology and Biogeography*, 24, pp. 838-848.
 97. Ibid
 98. Howe C, Jones RN, Maheepala S, Rhodes B 2005, ‘Implications of potential climate change for Melbourne’s water resources’, a collaborative project between Melbourne Water and CSIRO Urban Water and Climate Impact groups, Melbourne, Victoria.
 99. White M, Cheal D, Carr GW, Adair R, Blood K, Meagher D 2018, ‘Advisory list of environmental weeds in Victoria’, Arthur Rylah Institute for Environmental Research Technical Report Series No. 287, Heidelberg, Victoria.
 100. Ibid

Environmental Health

Invasive Plants and Animals

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:17 Invasive freshwater plants and animals	DELWP, DEDJTR, Melbourne Water					?	 DATA QUALITY Poor

Invasive freshwater plant species can form dense infestations that reduce the diversity of native freshwater plants and can have secondary impacts on native freshwater animals such as invertebrates and fish.¹⁰¹ These impacts can alter freshwater habitats and threaten their long-term function if not managed.¹⁰² Invasive freshwater plants can also impact on recreational values such as swimming, fishing and boat navigation. In some cases of dense invasive plant populations, unpleasant odours can affect those living near or interacting with the water body.¹⁰³ In irrigation channels, invasive plant species can limit water flow, and, in some cases of excessive plant growth, cause channels to overflow.¹⁰⁴

The costs of the impact of invasive species for waterways in Victoria have not been fully estimated.¹⁰⁵ The Victorian Waterway Management Strategy outlines a risk-based approach framework for managing invasive species dependent on freshwater and riparian habitats in Victorian waterways.¹⁰⁶ In addition to the direct costs of freshwater invasive species management, invasive species can undermine the outcomes of previous investment into waterway management activities.¹⁰⁷ Aside from carp (*Cyprinus carpio*), the SoY 2018 is unable to report on this indicator due to a lack of data.

101. Dugdale TM, Hunt TD, Clements D 2013, 'Aquatic weeds in Victoria: where and why are they a problem, and how are they being controlled?', *Plant Protection Quarterly*, 28(2), pp. 35-40.

102. Ibid

103. Ibid

104. Ibid

105. DEPI 2013, 'Improving our waterways. Victorian waterway management strategy', Melbourne, Victoria.

106. DEPI 2013, 'Improving our waterways. Victorian waterway management strategy', Melbourne, Victoria.

107. Ibid

Environmental Health

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:18 Trend in Carp (<i>Cyprinus carpio</i>) Distribution	DELWP, DEDJTR, Melbourne Water						 DATA QUALITY Good

Carp is a highly successful, invasive fish species that is abundant in south-east Australia. Carp are considered pests because they are destructive and can dominate aquatic environments to the detriment of native fish species and other parts of the freshwater ecosystem.¹⁰⁸ Control of carp is difficult; actions to date have largely been localised with a focus on harvesting adult fish or using the Williams carp separation cage.¹⁰⁹

Carp control through mortality is only part of the approach to managing populations. Management needs to consider the capacity of populations to increase through reproduction and recruitment, both locally and from movements from other locations.¹¹⁰ Reproduction and movement of carp are linked to flows – especially over-bank flows that inundate wetlands and floodplains, giving them access to favoured habitats for spawning and recruitment of young. The delivery of water, either for irrigation demands or to achieve environmental outcomes, may inadvertently benefit carp by enhancing their access to preferred breeding habitats, creating the need to consider management trade offs.¹¹¹

In 2016, the Australian Government initiated the National Carp Control Plan. The plan is due to be completed in 2018 but had not been completed at the time of writing this report. The plan will consider the research and consultation necessary to enable an informed decision on carp biocontrol using cyprinid herpesvirus 3 (CyHV-3), a naturally occurring strain of carp herpesvirus. As part of the National Carp Control Plan, Victoria’s Arthur Rylah Institute for Environmental Research, in partnership with La Trobe University, will lead a five-state collaborative project to determine how many carp are in eastern Australia.¹¹² The study will be undertaken across a range of habitat types including rivers, lakes, billabongs and estuaries and will allow for fluctuating carp numbers through time. The project aims to:

- provide a robust estimate of carp abundance, distribution and biomass
- contribute to the development of virus release strategies
- help predict locations where there may be high carp mortalities to plan for clean-up and management of potential impacts on water quality
- benchmark environmental condition prior to release of the carp virus.

The results of this study and any management actions will inform future SoY reporting for this indicator.

108. Stuart IG, Conallin AJ 2018, ‘Control of globally invasive common carp: an 11 year commercial trial of the Williams’ cage’, North American Journal of Fisheries Management, 38, pp. 1160-1169.
 109. Ibid
 110. Koehn JD, Todd CR, Zampatti BP, Stuart IG, Conallin A, Thwaites L, Ye Q 2018, ‘Using a population model to inform the management of river flows and invasive carp (*Cyprinus carpio*)’, Environmental Management, 61, pp. 432-442.
 111. Ibid
 112. ARI 2018, ‘Preparing for carp herpesvirus’, Heidelberg, Victoria, <https://www.ari.vic.gov.au/research/pests-weeds-and-overabundant-species/preparing-for-carp-herpesvirus> Accessed 24 October 2018.

Environmental Health

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:19 Invasive terrestrial plants	DELWP, DEDJTR						

The status and trend of invasive terrestrial plants within the specific geographic scope of this SoY report is unknown and unclear respectively. This is because there is a lack of data on the number and distribution of invasive terrestrial plants in the report’s geographical scope. However, statewide status and trend for invasive terrestrial plants can be applied as a proxy for this indicator and includes the following terrestrial pest plant categories:

- Naturalised flora taxa – Naturalised taxa originate from either outside Australia or interstate, or they are Victorian natives that have become established long-term self-sustaining populations outside their pre-European range. Examples of Victorian natives that have become naturalised taxa include spotted gum (*Corymbia maculata*) and coastal umbrella bush (*Acacia cupularis*), used as ornamental plantings.¹¹³ Naturalised flora taxa may not adversely impact native plants and/or animals or functioning ecosystems.
- Environmental weeds – Environmental weeds are a subset of naturalised taxa. These plants invade native ecosystems and have the potential to adversely affect the survival of native plants, animals and functioning ecosystems. They include plant species that have been introduced to Australia from other countries, as well as native plant species that have spread beyond their previous natural range due to changed land management or practices (examples include sallow wattle, coastal wattle and coastal tea tree).¹¹⁴ Environmental weeds are a threat to Australia’s biodiversity because they can displace native plant species, disrupt ecological processes such as fire and soil erosion patterns, and alter the genetic composition of native plant populations.¹¹⁵

Table 13 shows that the number of naturalised plants has increased steadily since settlement, with a fourfold increase since the early 20th century.^{116,117} Victoria is home to at least 1,451 naturalised plant taxa, which is about 25% of the total flora.^{118,119} Of these, 1,235 species (85%) are environmental weeds that are established in Victorian native vegetation.¹²⁰ This is almost double the number of environmental weeds identified in 1992 (584, equating to 48% of the total flora).^{121,122} Many more plant species than those currently recognised as environmental weeds have been introduced into Victoria, and a proportion of these are likely to escape their current confines (such as gardens and aquariums), and become established in the wild.¹²³

Table 14: Increasing trend in the number of naturalised plants and environmental weeds established in Victorian native vegetation, 1909–2018

Year	Naturalised	Environmental weeds
1909	363	Unknown
1928	461	Unknown
1976	747	Unknown
1988	878	Unknown
1992	1,221	584
1993	1,221	584
2018	1,451	1,235

113. White M, Cheal D, Carr GW, Adair R, Blood K, Meagher D 2018, 'Advisory list of environmental weeds in Victoria', Arthur Rylah Institute for Environmental Research Technical Report Series No. 287, Heidelberg, Victoria.
 114. Ibid
 115. Ibid
 116. Carr GW 1993, 'Exotic flora of Victoria and its impacts on indigenous biota', In: Flora of Victoria Volume 1, pp 256-97. Foreman DB and Walsh NG (eds). Inkata Press, Port Melbourne, Victoria.
 117. White M, Cheal D, Carr GW, Adair R, Blood K, Meagher D 2018, 'Advisory list of environmental weeds in Victoria', Arthur Rylah Institute for Environmental Research Technical Report Series No. 287, Heidelberg, Victoria.
 118. VNPA 2014, 'Natural Victoria: conservation priorities for Victoria's natural heritage. Nature Conservation Review. Full Report', Melbourne. Victoria.

References continued on following page

Environmental Health

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:20 Invasive terrestrial animals	DELWP, DEDJTR						 DATA QUALITY Poor

Pest animals originate from either outside Australia or interstate, and they have established long-term, self-sustaining populations. Overabundant population numbers of local native animals can also be pest animals (for example, koalas, kangaroos and possums). Pest animals are also referred to as invasive animals in this indicator.

Established terrestrial pest animals in Victoria include foxes, rabbits, feral pigs, feral goats, feral horses, deer and feral cats, with their impacts recognised through several listings under the *Flora and Fauna Guarantee Act 1988 (FFG Act)*. Statewide pest animal population numbers in Victoria are currently unknown; however, it is thought that populations, and their distribution, are expanding across Victoria. Although specific population numbers are not available, the issues posed by increasing deer and horse numbers are described below.

The Parliament of Victoria Environment, Natural Resources and Regional Development Committee Inquiry into the Control of Invasive Animals on Crown Land found that there is a lack of robust data about population numbers and extent of invasive animals and the effectiveness of control methods.¹²⁶ Additionally, the Inquiry found that Victoria’s complex legislative framework and division of responsibilities have contributed to confusion and inefficiencies in controlling invasive animals. Of the 33 Inquiry recommendations, the Victorian Government accepted 29 with one under review.

Recommendation 1 tasked the Victorian Government with allocating resources to the appropriate authority to undertake work to quantify and measure the numbers and impact of invasive species populations.¹²⁷ The government supports this recommendation in principle with Agriculture Victoria, in DEDJTR, having responsibility for the government’s investment in research and development to advance effective policy tools for invasive animal management.¹²⁸ The government agencies involved in the development of the government’s response will be responsible for prioritising the delivery of the 29 recommendations. Resources to implement these recommendations will be assessed against the government’s investment and service delivery priorities.¹²⁹

119. White M, Cheal D, Carr GW, Adair R, Blood K, Meagher D 2018, 'Advisory list of environmental weeds in Victoria', Arthur Rylah Institute for Environmental Research Technical Report Series No. 287, Heidelberg, Victoria.
120. Ibid
121. Carr GW, Yugovic JV, Robinson KE 1992, 'Environmental weed invasions in Victoria: conservation and management implications', Department of Conservation and Environment, Melbourne, Victoria.
122. White M, Cheal D, Carr GW, Adair R, Blood K, Meagher D 2018, 'Advisory list of environmental weeds in Victoria', Arthur Rylah Institute for Environmental Research Technical Report Series No. 287, Heidelberg, Victoria.
123. Ibid
124. Carr GW, Yugovic JV, Robinson KE 1992, 'Environmental weed invasions in Victoria: conservation and management implications', Department of Conservation and Environment, Melbourne, Victoria.
125. ENRRDC 2017, 'Inquiry into the control of invasive animals on Crown land', Environment, Natural Resources and Regional Development Committee, Parliament of Victoria, Melbourne, Victoria.
126. Ibid
127. Ibid
128. DELWP 2017, 'Government response to the Environment, Natural Resources and Regional Development Committee Inquiry into the control of invasive animals on Crown land. Final report', Melbourne, Victoria.
129. DELWP 2018, 'Invasive plants and animals', Melbourne, Victoria, <https://www.environment.vic.gov.au/invasive-plants-and-animals/invasive-animals-parliamentary-inquiry> Accessed 2 October 2018.

Environmental Health

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:21 Trend in Sambar Deer (<i>Cervus unicolor</i>) Populations and Their Distributions	DELWP, DEDJTR						 DATA QUALITY Poor

Increasing deer populations have been expanding their distribution across Crown and private land. The environmental impacts of deer include: destruction to native vegetation and regeneration; increased revegetation costs; and damage to orchards, vegetable gardens, pastures and fencing.¹³⁰ Deer can also cause erosion and concentration of nutrients.¹³¹

There is a wild, self-sustaining breeding population of sambar deer (*Cervus unicolor*) across an estimated 66,915 km² of Crown land in Victoria (29% of the state's total land area). This species is listed as a pest animal in the FFG Act. Of relevance to this report is the discrete (that is, reproductively isolated) sambar deer population of eastern Victoria that currently covers 66,300 km² of the state. This population constitutes 99% of the sambar deer distribution within Victoria and it is expanding, with sightings around the Yarra River as far south as Kew (Figure 11).

Continued expansion and distribution of sambar deer has consequential impacts on native biodiversity through the reduction and degradation of native Victorian vegetation. For example, sambar deer rub their antlers against native trees causing ringbark which increases the susceptibility of native plants to fungal infections and pests.^{132,133} Sambar deer can also impact agriculture infrastructure (for example, by causing damage to fences) and reduce pasture and crop harvest outputs (through feeding).¹³⁴

A better understanding of deer ecology could guide deer management, yet at present this is limited. Addressing this knowledge gap can assist in developing and prioritising cost-effective management strategies.¹³⁶ At the time of writing this report, the Draft

Deer Management Strategy, a partnership document between DELWP and DEDJTR, had been released for public comment.¹³⁷

The strategy is an action under the Victorian Government's Sustainable Hunting Action Plan 2016–2020 and it is recognised in Protecting Victoria's Environment – Biodiversity 2037 Implementation Framework. The objectives of the draft strategy are to protect ecological, social, economic, cultural and agricultural assets from the impacts of deer and provide diverse, quality hunting opportunities. The performance objectives and associated management actions of the final management strategy will be assessed in the next SoY report.

130. VCMC 2017, 'Catchment Condition and Management Report 2017', Melbourne, Victoria.

131. Ibid

132. DSE 2009, 'Draft Flora and Fauna Guarantee Action Statement: reduction in biodiversity of native vegetation by Sambar Deer (*Cervus unicolor*)', Melbourne, Victoria.

133. Bennett A, Coulson G 2011, 'The impacts of Sambar Deer, *Cervus unicolor*, on the threatened Shiny Nematolepis *Nematolepis wilsonii*', *Pacific Conservation Biology*, 16, pp. 251–260.

134. Lindeman MJ, Forsyth DM 2008, 'Agricultural impacts of wild deer in Victoria', Arthur Rylah Institute for Environmental Research Technical Report Series No. 182, Heidelberg, Victoria.

135. Forsyth DM, Stamation K, Woodford L, 2015, 'Distributions of Sambar Deer, Rusa Deer and Sika Deer in Victoria', Arthur Rylah Institute for Environmental Research unpublished client report for the Biosecurity Branch, Department of Economic Development, Jobs, Transport and Resources, Heidelberg, Victoria.

136. Davis NE, Bennett A, Forsyth DM, Bowman DMJS, Lefroy EC, Wood SW, Woolnough AP, West P, Hampton JO, Johnson CN, 2016, 'A systematic review of the impacts and management of deer (family Cervidae) in Australia', *Wildlife Research*, 43, pp. 515–532.

137. DELWP 2018, 'Draft deer management strategy', Melbourne, Victoria, <https://www.environment.vic.gov.au/invasive-plants-and-animals/draft-deer-management-strategy> Accessed 24 October 2018.

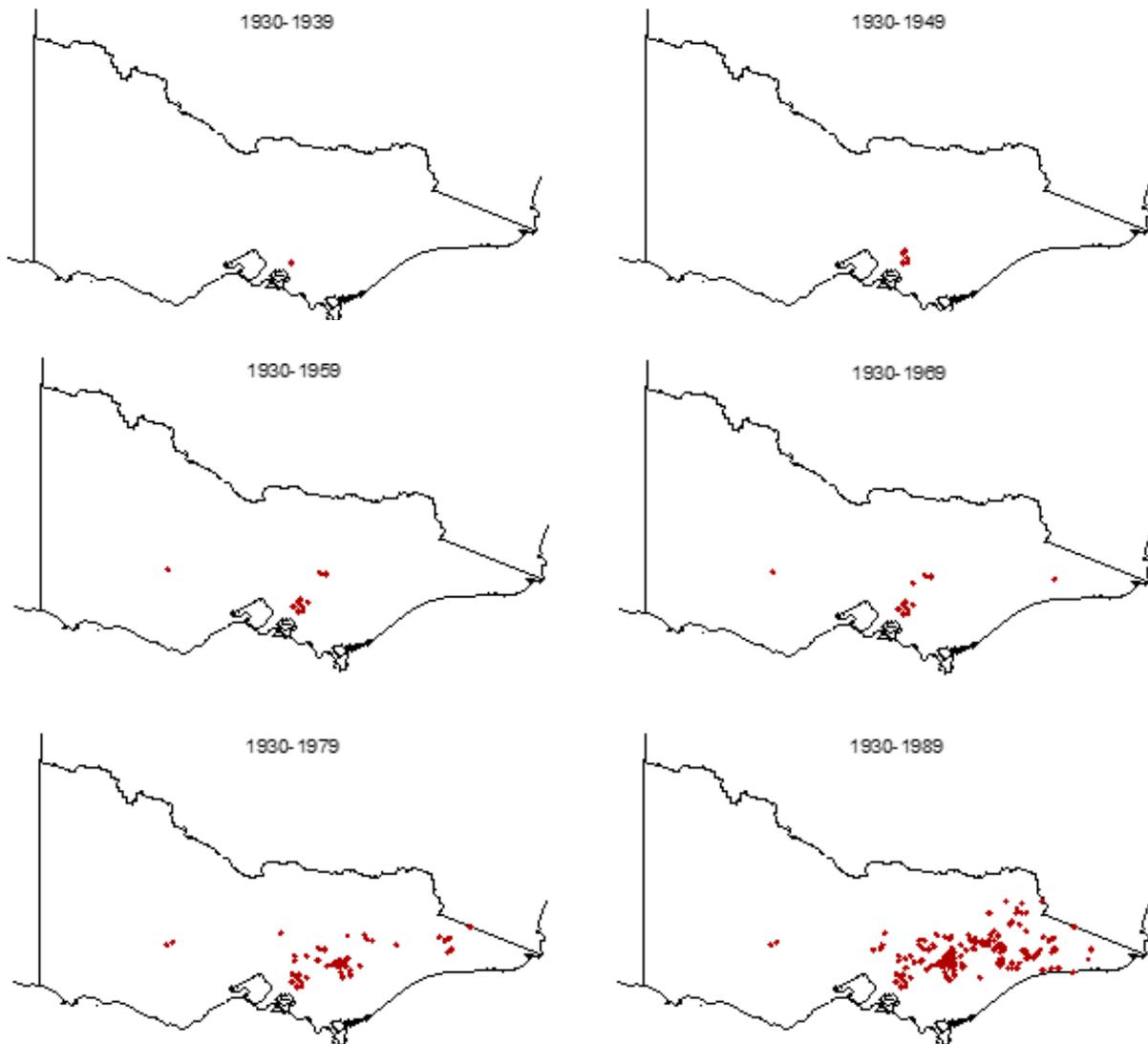


Figure 11: Expansion and distribution of sambar deer in Victoria (sighted records, 1930–2015)

(Source: Forsyth, Stamation and Woodford 2015¹⁹⁵)

Environmental Health

River Ecosystem Health

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:22 Water Quality	DELWP, EPA Victoria, Melbourne Water						 DATA QUALITY Good

Healthy aquatic ecosystems depend on the quality of water for critical processes such as nutrient cycling, primary production and creation of suitable habitats to support diverse communities of aquatic animals and plants.

Water quality is influenced by a range of factors including:

- climate (patterns of rainfall and drought)
- land use (adjacent to waterways, but also in the catchment)
- water resource use (extraction of water for drinking and agriculture, and discharge of stormwater and wastewater)
- ecosystem processes such as water-sediment interactions and nutrient cycling
- extreme events such as bushfires.

There are many aspects of water quality, including physical properties such as temperature and water clarity, concentrations of chemical components such as salinity and dissolved oxygen, and biological processes such as algal growth. This SoY report provides two main assessments of water quality:

1. EPA Victoria's Yarra & Bay Report Card,¹³⁸ based on regular monitoring throughout the year
2. DELWP's statewide water quality assessment, which focuses on five water quality indicators: dissolved oxygen, salinity (electrical conductivity), nutrients (total nitrogen and total phosphorus), water clarity (turbidity) and alkalinity (pH), and is monitored annually.

No data was available for suspended solid concentrations, water temperature and chlorophyll-a concentration.

EPA Victoria Yarra & Bay Report Card

The Yarra River and Port Phillip Bay Report Card was developed to report on the environmental health of Port Phillip Bay and its associated catchments using water quality indicators. An overall water quality score is provided by combining the results of five standard water quality parameters including: nutrients, water clarity (turbidity), dissolved oxygen, salinity (conductivity) and pH (acidity/alkalinity). The score is calculated based on the level of attainment of the relevant indicators against water quality objectives in the *State Environment Protection Policy (Waters of Victoria)* (SEPP (WoV)) and its Schedule F6 (Waters of the Port Phillip Bay). The Yarra catchment also has specific environmental quality objectives for seven different segments within it under Schedule F7 of SEPP (WoV). Water quality scores are determined for each financial year from July to June to ensure they include data over a complete summer period. While a number of monitoring sites are located along the Yarra River, it should be noted that the scores applied here are for the whole Yarra catchment (Table 15). Overall, there has been a stable poor water quality trend in the Yarra catchment from 2000 to 2017 (Figure 12). A poor score here indicates that the system is under considerable stress, mostly in the lower urbanised catchment of the Yarra River.

138. EPA 2018, 'Yarra Catchment', Melbourne, Victoria, https://yarraandbay.vic.gov.au/report-card/report-card-2017/port-philip/yarra#top_of_report Accessed 31 October 2018.

Environmental Health

Financial year	2012–13	2013–14	2014–15	2015–16	2016–17
Water Quality Score	Poor	Poor to Fair	Poor	Poor	Poor

Table 15: Yarra River and Port Phillip Bay Report Card – Yarra catchment water quality, 2012–17

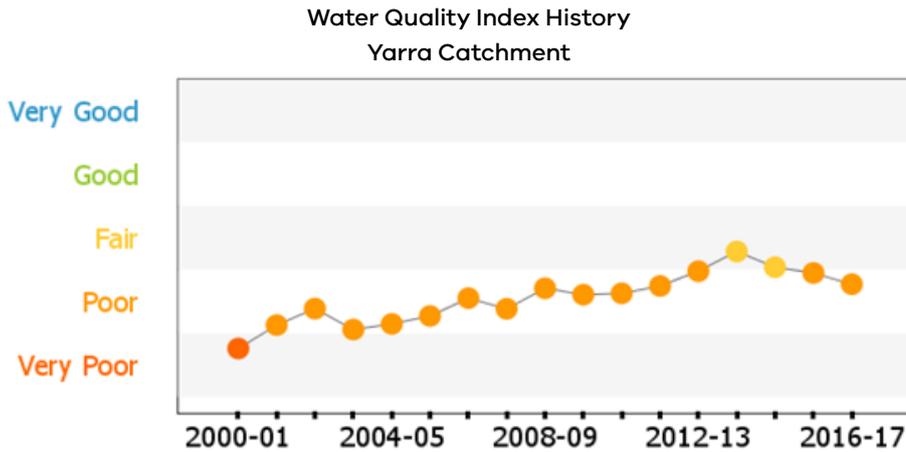


Figure 12: Yarra River and Port Phillip Bay Report Card – Yarra (catchment water quality, 2000–17)

(Data source: EPA Victoria 2018¹³⁹)

DELWP's Water Quality Assessment

Water quality data was collected from 2010 to 2017 and spans a range of climatic conditions from the wet years of 2010 and 2011 (when the millennium drought ended), to the dry years of 2014 and 2015, to above-average rainfall in 2016–17. This analysis enabled an assessment of water quality over a period that resembles the projected climate for Victoria – generally hotter and drier but interspersed with more extreme rainfall events.

SEPP (WoV) provides water quality objectives for Victorian surface waters. Measurements that meet (attain) the objective are considered to be indicative of good conditions and measurements that exceed the objective are a warning of potentially poor conditions. SEPP (WoV) water quality objectives differ across Victoria based on local conditions and the expected water quality.

In this report, surface water quality for the entire extent of the Yarra River has been measured using the current 2003 SEPP (WoV) attainment measures and the Index of Stream Condition (ISC) subindex scores. The SEPP (WoV) policy was the subject of a recent review, and the 2018 SEPP (Waters) replaced this policy from 19 October 2018. It should be noted that the water quality objectives for rivers and streams that are of relevance to this report have not changed substantially between the 2003 SEPP (WoV) policy and SEPP (Waters).

139. Ibid

The ISC is an established Victorian method for evaluating the condition of rivers and streams. It comprises several subindices, including water quality. There have been several applications of the ISC across the state, with the most recent in 2010, based on data collected from 2004 to 2009. Methods developed for the ISC water quality subindex were applied to data collected from Victorian rivers and streams, including the Yarra River, in 2010 to 2017, for five indicators: electrical conductivity (an indicator of salinity), pH, turbidity, total phosphorus and nitrogen (Table 16). The ISC method assigns scores that are integrated across these indicators and ranked in five categories: very poor, poor, moderate, good and excellent. Trends in water quality of surface water have been reported here, comparing the 2004–09 assessment to the 2010–17 assessment. Water samples were taken from 47 sites along the Yarra River’s main stem.

The ISC water quality trend assessment for the two periods, 2004 to 2009 and 2010 to 2017, categorised the Yarra River as poor (scores of 3.7 and 4 respectively). The 2004–09 ISC assessment spans six years of drought conditions in Victoria, with the 2010–17 period representing dry years (2014 and 2015) as well as a wet year (2011). The slight improvement in ranking score for 2010–17 was due to increased water flow from the wet year.

Water quality subindicators	SEPP attainment (%)	ISC subindex score
Salinity (electrical conductivity)	34.2	2.0
Turbidity	12.0	0.7
pH	52.0	2.5
Dissolved oxygen	86.0	Not assessed
Total nitrogen	4.0	0.2
Total phosphorus	11.0	0.6

Table 16: Subindicators contributing to water quality of the Yarra River, 2010–17

Salinity

Salinity for the Yarra River was ranked as moderate for the 2010–17 period for both SEPP (WoV) attainment and ISC water quality subindex score. An assessment of longer-term trends in water quality indicated that while there had been increased salinity during the millennium drought, the increased rainfall in recent years has led to a decrease in salinity in most river systems across the state, including the Yarra River. Salinity is a measure of the total concentration of inorganic salts in the water column. Electrical conductivity (the ability of water to conduct an electrical current) is typically used to measure salinity in fresh and brackish waters where the concentration of salts is relatively low. Salinity is an important aspect of water quality and affects aquatic biota, through either direct toxicity or disruptions to ecosystem processes and functions.^{140,141} Animals and plants generally have a narrow salinity range that they can tolerate for optimum growth and reproduction. Increased salinity in Australian freshwater systems can lead to:

- a reduction in the diversity of native fish, with eggs and larval stages more susceptible than adults in many instances
- decreased diversity and growth of freshwater aquatic and riparian vegetation
- reduced diversity of macroinvertebrate communities
- negative impacts on frogs, particularly eggs and tadpoles.¹⁴²

140. Kefford BJ, Schäfer RB, Liess M, Goonan P, Metzeling L, Nuggeoda D 2010, 'A similarity-index based method to estimate chemical concentration limits protective for ecological communities', *Environmental Toxicology and Chemistry*, 29(9), pp.2123–31.

141. Schäfer RB, Bundschuh M, Rouch DA, Szöcs E, Peter C, Pettigrove V, Schulz R, Nuggeoda D, Kefford BJ 2012, 'Effects of pesticide toxicity, salinity and other environmental variables on selected ecosystem functions in streams and the relevance for ecosystem services', *Science of the Total Environment*, 415, pp. 69–78.

142. Hart BT, Lake PS, Webb JA, Grace MR, 2003, 'Ecological risk to aquatic systems from salinity increases', *Australian Journal of Botany*, 51(6), pp.689–702.

Turbidity

Turbidity for the Yarra River was ranked as poor for the 2010–17 period for both SEPP (WoV) attainment and ISC water quality subindex score. Long-term trends in turbidity were influenced by rainfall and flow, with generally decreased turbidity in the drought years and increased turbidity during wet periods when runoff washes sediment from the surrounding landscape into streams and rivers. Land use also plays an important role in turbidity, with increased land clearing, agricultural activities that lead to bank erosion (such as access of livestock to streams) and water resource use all implicated.¹⁴³

Turbidity is a measure of the particulate matter (sediment particles, organic matter and phytoplankton) suspended within the water column (resulting in cloudiness). Turbidity is influenced by not only the amount of suspended matter in the water column but also the size, shape and composition of the particles. For example, small amounts of fine particles such as clay will result in a much higher turbidity (lower water clarity) than an equivalent amount of sand particles. Turbidity can effect aquatic ecosystems by:

- decreasing light penetration through the water column, which inhibits photosynthesis and reduces submerged plant growth
- reducing underwater visibility, which affects visual feeders, including some species of fish, turtle and waterbird
- physically impacting on the gills of fish and macroinvertebrates (in the case of very high levels of suspended matter in the water column).¹⁴⁴

pH

pH for the Yarra River was rated as good for the 2010–17 period for both SEPP (WoV) attainment and ISC water quality subindex score. This ranking was lower than all other rivers across Victoria. pH is a measure of the acidity or alkalinity of water. It is measured on a logarithmic scale from 0 (acidic) to 14 (alkaline), with a pH of 7 indicating neutral conditions. Most natural freshwaters have a pH in the range of 6.5 to 8.0, depending on the soil and underlying geology of the catchment. Factors such as land use, exposure of acid sulfate soils and the balance of buffering carbonates in the water column all influence the pH of river systems.¹⁴⁵ Increases and decreases in pH can have ecological effects: in ideal conditions, water should be neither too alkaline nor too acidic. Altered pH disrupts physiological processes at a cellular level, with obligate aquatic species, such as fish, more exposed to pH changes. Juvenile stages of fish and frogs are highly susceptible to altered pH. In addition, increased acidity (lower pH) can affect the release of heavy metals from sediments and influence the toxicity of other chemicals such as ammonia.¹⁴⁶

143. CRC for Water Sensitive Cities, 2015, 'Repairing water quality; what to do in the catchment', Clayton, Victoria.

144. Davies RJ, Smith DG 2001, 'Turbidity suspended sediment, and water clarity: a review', *Journal of the American Water Resources Association*, 37(5), pp.1085-1101.

145. Batley GE, Apte SC, Stauber JL, 1999, 'Acceptability of aquatic toxicity data for the derivation of water quality guidelines for metals', *Marine & Freshwater Research*, 50, 729-738.

146. Emerson K, Russo RC, Lund RE, Thurston RV 1975, 'Aqueous ammonia equilibrium calculations: effect of pH and temperature', *Canadian Journal of Fisheries and Aquatic Science*, 32, pp.2379-2383.
Randall DJ, Tsui TKN 2002, 'Ammonia toxicity in fish,' *Marine Pollution Bulletin*, 45(1-12), pp.17-23.

Dissolved Oxygen

Dissolved oxygen in the Yarra River was rated as excellent for the 2010–17 period for both SEPP (WoV) attainment and ISC water quality subindex score. Dissolved oxygen is a measure of gaseous oxygen held within the water column. Dissolved oxygen is influenced by temperature, salinity and biological activity and can vary considerably over short periods of time. In most aquatic systems dissolved oxygen follows a diurnal cycle. Aquatic plants including phytoplankton are net producers of oxygen during the day (as a by-product of photosynthesis) and consumers of oxygen during darkness (when respiratory consumption exceeds photosynthetic production). In addition to the diurnal cycle of dissolved oxygen concentration, there is a longer-term pattern that is balanced by diffusion of oxygen from the atmosphere and consumption of oxygen by biota. The former is influenced by factors such as wind and stream flow (which can increase turbulence and facilitate movement of oxygen into the water column) and temperature (which affects the total amount of oxygen that water can hold). Biota that access oxygen from the water column – such as fish, tadpoles and macroinvertebrates – are highly susceptible to decreases in dissolved oxygen. While the dissolved oxygen requirements of fish species and different life stages can vary significantly, mortality can occur at concentrations lower than 3 mg/L.¹⁴⁷

Nutrients

Nutrients in aquatic ecosystems are significant for the role they play in primary production, with nitrogen and phosphorus being the two key nutrients in freshwater systems. Nutrients are reported here as total concentrations of nitrogen and phosphorus; that is, the combination of both dissolved and particulate organic and inorganic forms. While total nitrogen and total phosphorus are the form of nutrients for which there are SEPP (WoV) water quality objectives, any patterns in concentration are difficult to interpret.

A high concentration may indicate a high amount of bioavailable nutrients that could stimulate algal growth, or it could mean a high algal load from nutrients bound within phytoplankton cells. It could also be related to bound nutrients on sediment particles which are not readily biologically available.

Trends in total nitrogen and phosphorus are influenced by rainfall and flow, with generally increased nutrient loads washing into streams during periods of heavy rainfall and floods. Trends are also strongly influenced by site factors (including surrounding land use, slope, soil types and stream bank and bed stability) and the cycles and forms which nitrogen and phosphorus take within the water column, sediments and biota.

Total Nitrogen

Total nitrogen for the Yarra River was rated as very poor for the 2010–17 period for both SEPP (WoV) attainment and ISC water quality subindex score.

Total Phosphorus

Total phosphorus for the Yarra River during the 2010–17 period was rated as poor for both the SEPP (WoV) attainment and ISC water quality subindex score.

147. Small K, Kopf RK, Watts RJ, Howitt J 2014, 'Hypoxia, blackwater and fish kills: experimental lethal oxygen thresholds in juvenile predatory lowland river fishes', PLOSOne, 9(4): e94524.

Can I Swim in the Yarra River?

Various stretches of the Yarra River are used for recreational swimming throughout the summer. EPA Victoria and Melbourne Water, through the Yarra Watch program, have consistently monitored and forecasted recreational water quality at four group sites along the Yarra River between 2013 and 2017 during the summer period, including:

1. Launching Place – Millgrove and Launching Place
2. Healesville – Coldstream and Healesville
3. Warrandyte – Templestowe, Heidelberg and Warrandyte
4. Kew – Docklands, Southgate, South Yarra, Abbotsford and Kew

Table 17 shows the trends for these sites.

Recreational swimming water quality, and whether a Yarra River site is suitable for swimming, is determined by the types of bacteria, and their levels, in the water column. Bacteria contained in stormwater pollution after rain events is harmful to human health. During dry weather, that is during a period where there are no rain events, harmful bacteria can also be present. This is due to animal and human faecal contamination, originating from the Yarra's rural and upper catchment, entering the river and traveling downstream.

Water quality for recreational water activities in the Yarra River has varied over the last four years. The only site that did not meet the water quality objective for swimming over the past four summer seasons was Launching Place, due to variable bacteria levels. This does not mean Launching Place was unsafe for swimming throughout the entire swimming season, rather that there were a higher number of days with poorer water quality, increasing the risk of swimmers exposed to disease-causing bacteria. Poor water quality during dry weather was less frequent but may be due to a range of pollution sources such as leaking septic tanks and animal faeces (from agricultural livestock and birds).¹⁴⁸ EPA Victoria will be working with Melbourne Water to better understand and track pollution sources in the upper rural and lower rural reaches where dry-weather pollution is present.¹⁴⁹ It should be noted that all sites met objectives for secondary contact recreation such as boating, rowing and canoeing.¹⁵⁰

148. EPA 2018, 'Yarra Watch Summer Highlights Report 2016-17', Melbourne, Victoria, <https://yarraandbay.vic.gov.au/yarra-watch/2016-17-summer-highlights-report> Accessed 20 July 2018.

149. Ibid

150. Ibid

151. Ibid

Yarra River stretch	Location	2013–14	2014–15	2015–16	2016–17	Water quality trend
Upper rural reach	Launching Place	✗	✗	✗	✗	No change
	Healesville	✗	✓	N/A	✓	Variable
Lower rural reach	Warrandyte	✓	✓	✓	✓	No change
Suburban reach	Kew	✓	✓	N/A	✓	Variable

Table 17: Water quality trends for swimming at different locations along the Yarra River as monitored by EPA Victoria and Melbourne Water

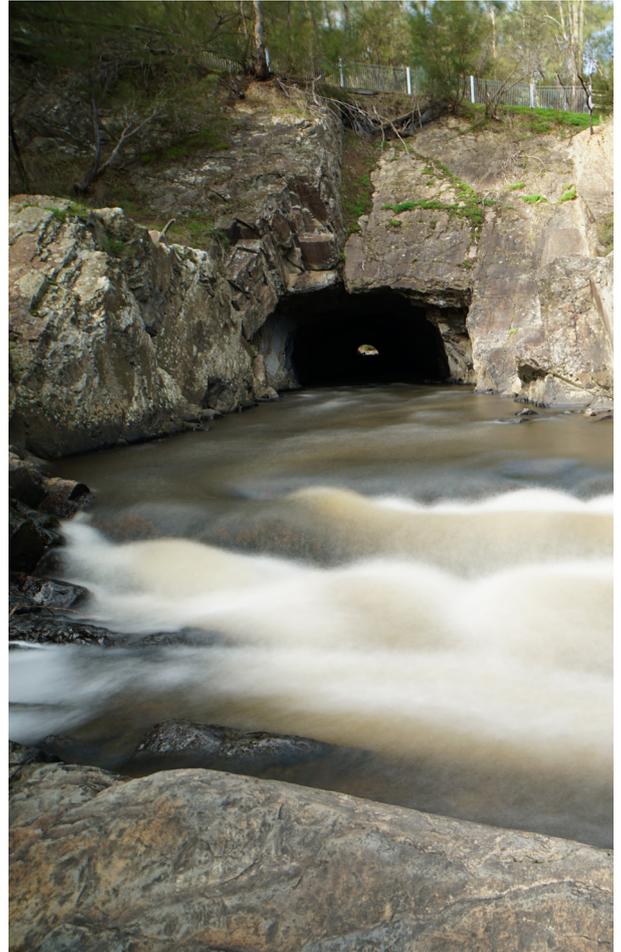
N/A = samples were not taken at these locations for the given year. (Source: EPA Victoria 2018¹⁵¹)

Environmental Health

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:23 Streamflow	DELWP, Melbourne Water						 <small>DATA QUALITY</small> Good

Streamflow (or 'catchment inflow') can be highly variable across Victorian rivers, including the Yarra River, which receives only a fraction of its average flow in most years. Flows through the Yarra River system have been highly regulated due to the construction of major water storages that capture natural runoff and allow the controlled removal of water for consumptive use.¹⁵²

Since 2011, the average annual streamflow in the Yarra River has been decreasing (*Table 18: Annual Yarra River streamflow as a percentage of the long-term average for 2011–16*). The generally dry conditions have been punctuated by wet years resulting in more than the average flows which replenish the Yarra River system and storages. Direct and indirect pressures on the Yarra River's flow regime can include: vegetation clearing, agriculture, irrigation, groundwater extraction, farm dams, plantation forestry or agroforestry, regrowth following bushfires, flow regulation, water harvesting, urbanisation and the occurrence of levee banks. In addition, the Upper Yarra Dam causes a 95% reduction in flow immediately downstream. These pressures affect the Yarra River's hydrology, groundwater storages and wetland communities.



152. VEW 2018, 'Seasonal watering plan 2018-19. Central Region', Melbourne, Victoria.

	2015–16		2014–15		2013–14		2012–13		2011–12		
	ML	Average %	ML	Average %	ML	Average %	ML	Average %	ML	Average %	
Average annual Yarra River streamflow (ML)											
	1,054,000	495,720	47	597,406	57	699,325	66	914,537	87	1,200,267	114

Table 18: Annual Yarra River streamflow as a percentage of the long-term average for 2011–16

Environmental Health

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:24 Surface water harvested for consumptive use	DELWP, Melbourne Water						 DATA QUALITY Good

The percentage of total streamflow leaving a river basin (that is, water remaining after extraction) is an indicator of the pressure that consumption exerts in each river basin. Water consumption reduces the water available to support aquatic ecosystems and increases the impact of dry conditions on biodiversity. During times of low flow, there is increased pressure on aquatic ecosystems when water resources become scarce. In some river basins, the absence of rainfall means that large percentages of available water are extracted to supply domestic, industrial and agricultural needs.

The highest volume of streamflow leaving the Yarra River occurred from 2011 to 2013 (Table 19). This correlated with above-average rainfall during this period. Total streamflow leaving the Yarra River decreased for 2015–16, reflecting the reduced overall flow during that year. The volume of surface water taken under bulk entitlements for 2015–16 was 191,332 ML (Table 20). The volume of water taken for take and use licences was 20% of the total volume of licences.

2011–12			2012–13			2013–14			2014–15			2015–16		
Total flow if no diversions (ML)	Volume leaving the basin (ML)	Total flow leaving the basin (%)	Total flow if no diversions (ML)	Volume leaving the basin (ML)	Total flow leaving the basin (%)	Total flow if no diversions (ML)	Volume leaving the basin (ML)	Total flow leaving the basin (%)	Total flow if no diversions (ML)	Volume leaving the basin (ML)	Total flow leaving the basin (%)	Total flow if no diversions (ML)	Volume leaving the basin (ML)	Total flow leaving the basin (%)
1,200,267	833,073	69	914,537	650,795	71	699,325	410,630	59	597,406	370,448	62	495,720	275,730	56

Table 19: Surface water volume leaving the Yarra River basin, 2011–16

Bulk entitlements			Licences			Small catchment dams
Entitlement volume (ML)	Volume taken (ML)	Proportion of entitlement taken (%)	Entitlement volume (ML)	Volume taken (ML)	Proportion of entitlement taken (%)	Variable
400,000	191,332	48	42,793	8,356	20	17,346

Table 20: Water volume allocated and taken for the Yarra River under surface water entitlements, 2015–16



Environmental Health

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:25 Environmental Water	DELWP, VEWH						 <small>DATA QUALITY</small> Good

The Environmental Water Reserve was established by the *Water Act 1989* (Vic.) and preserves the environmental values and health of water ecosystems, including their biodiversity, ecological functioning and quality of water and other uses that depend on environmental condition. Environmental entitlements that form part of the Environmental Water Reserve enable active management of water to meet specific environmental needs such as fish spawning triggers or maintaining critical habitat during drought.

Environmental flows are vital in regulated river systems, such as the Yarra River, where water storages and extraction alter natural variations in streamflow, including a reduction in the size and frequency of flood events. Environmental flows help to maintain aquatic ecosystem health by:

- improving the quality and connectivity of instream habitat
- flooding wetlands and floodplain and riparian vegetation
- improving water quality
- providing ideal conditions for aquatic fauna life histories, for example, fish breeding.

Seasonal watering proposals are required to be produced under section 192A of the *Water Act 1989*. These are used by VEWH to inform the development of Seasonal Watering Plans, which outline the full scope of statewide priorities for use of the Water Holdings.¹⁵³ Annual seasonal watering proposals are based on the assumption that all water required to meet environmental watering targets can be delivered, as it is unknown what constraints will be in place at any one time within the water year. During times of low river flow, the water allocation system reduces environmental flows more than it reduces water for consumptive uses. This can have severe consequences for aquatic systems, which receive lower amounts of water during times of increased need.

The Yarra River annually receives environmental flows to maintain its environmental health, cultural values and recreational benefits (Table 21). Altered water regimes are one of the many threats to the Yarra River’s health. Environmental objectives for seasonal watering will not be fully met without simultaneously addressing a number of issues such as: excessive catchment erosion, barriers to fish movement, high nutrient loads, loss of streambank vegetation and invasive species. Melbourne Water, as the waterway and storage manager of the Yarra River system, works in collaboration with VEWH to develop annual seasonal watering proposals.

153. Melbourne Water Corporation 2017, ‘Seasonal watering proposal 2017/18. Yarra River environmental entitlement 2006’, Melbourne, Victoria

Environmental Health

Environmental value	Environmental watering objective
Plants	Increase, strengthen and maintain plant life on the riverbank and in the channel, as well as on the upper Yarra floodplain and in the billabongs along the river.
Fish	Protect and increase populations of native fish including threatened species (such as the Australian grayling, Macquarie perch and river blackfish).
River and system operations	Maintain the form of riverbank and bed scour silt build-up and clean cobbles in the river to ensure fish, platypus and other water animals have access to healthy habitat pools and places to feed, spawn and shelter.
Macroinvertebrates	Protect and increase communities of waterbugs, which break down dead organic matter and support the river's food chain.
Water quality	Improve water quality in river pools, ensuring adequate dissolved oxygen concentrations in the water to support fish, crustaceans and waterbugs.

Table 21: Environmental watering objectives for the Yarra River system

(Source: VEWH 2018¹⁵⁴)

Environmental water for the Yarra River corridor can be released from the Upper Yarra, Maroondah and O'Shannassy reservoirs. The upper rural and lower rural Yarra reaches are priority locations for environmental watering. There is 17,000 ML of water available annually within the Yarra River Environmental Entitlement that can be delivered into the Yarra River and adjoining billabongs in the waterway's floodplain¹⁵⁵. However, the amount of water used within any annual allocation will vary, with allocations based on rainfall received, making it difficult to provide a future trend analysis for environmental water in the Yarra River (Table 22).

The Yarra River catchment experienced dry conditions at the start of the 2017–18 water year and environmental flows were used to meet winter flow objectives.¹⁵⁶ There was higher-than-average rainfall in August 2017.¹⁵⁷ As a result, many of the minimum environmental flow recommendations were met naturally throughout the main stem of the Yarra during the 2017 spring and early 2018 summer months. Environmental flows were used to deliver a higher flow in spring 2017 to trigger Australian grayling migration back up the Yarra River and to improve spawning habitat for Macquarie perch. Environmental flows in the 2018 summer were delivered along the Yarra River to maintain habitat for macroinvertebrates, allow fish movement and improve water quality.¹⁵⁸

Bolin Bolin and Yering Backswamp billabongs received environmental flows in spring, and frogs were quick to respond as evidenced by an increase in the number of species detected. This was followed by natural filling of Spadonis and Bolin Bolin billabongs from a large storm in early December 2017.

In a dry scenario, environmental flows in the Yarra River will focus mainly on meeting the low-flow objectives throughout the year to provide sufficient habitat and water quality for fish, and, in autumn, the high flows to support fish breeding and targeted billabong watering.¹⁵⁹ These watering actions are also a high priority under average and wet scenarios, but environmental flows may also be delivered in summer and autumn if conditions allow. The autumn high flow aims to trigger Australian grayling migration and spawning and is a high priority as the fish have a short lifespan and spawning was not achieved in 2017.¹⁶⁰ Less environmental flows are expected to be used under a wet scenario, because many of the priority watering actions are likely to be met by natural flows.¹⁶¹

154. VEWH 2018, 'Seasonal Watering Plan 2018-19. Central Region', Melbourne, Victoria.

155. Ibid

156. Ibid

157. Ibid

158. Ibid

159. Ibid

160. Ibid

161. Ibid

Environmental Health

The high security of the environmental entitlement in the Yarra River system, and an ability to carry over a water entitlement to the next water year, means there should be sufficient water for the environment to achieve all the potential watering actions for each planning scenario in 2018–19. A minimum of 5,000 ML carryover into 2019–20 is required (in addition to the 17,000 ML annual allocation) to deliver the highest-priority flows if average conditions continue into 2019.¹⁶²

Table 22: Managed environmental water volume delivered in the Yarra River, 2011–16

2011–12 (ML)	2012–13 (ML)	2013–14 (ML)	2014–15 (ML)	2015–16 (ML)	2016–17 (ML)
4,771	12,589	16,835	29,251	8,817	21,544

(Data Source: VEWH 2018)

Native Animals and Riparian Vegetation

The Yarra River and its parklands are home for many native species, including the iconic platypus and threatened species such as the helmeted honeyeater and Leadbeater’s possum. It also supports a diverse range of fish, frogs, birds, macroinvertebrates and flora. In the 2017–18 financial year over \$5.53 million was invested to improve the environmental health of the Yarra River corridor across all reaches.¹⁶³ Indicator assessments reported here have been obtained from research and associated metrics that have informed Melbourne Water’s 2018 co-designed catchment program for the Yarra Catchment as part of the Healthy Waterway Strategy (HWS).^{164,165} A description of current state metrics can be accessed online from the HWS assessment.¹⁶⁶ It should be noted that the HWS for the Yarra Catchment has combined the inner city and urban reaches for its assessment, but in the future will align its assessment areas with the YSP.

162. Ibid

163. Melbourne Water Corporation 2018, ‘Progress report for the Yarra strategic plan – October 2018’, Melbourne, Victoria.

164. Melbourne Water Corporation 2018, ‘Yarra: working together for Healthy Waterways. Catchment works program to support the draft Healthy Waterways strategy’, Melbourne, Victoria.

165. Coleman RA, Chee, YE, Bond N, RossRakesh S, Walsh CJ 2018, ‘Benefits and challenges of incorporating spatially-explicit quantitative modelling and action prioritisation in Melbourne Water’s Healthy Waterway Strategy’, Proceedings of the 9th Australian Stream Management Conference, Hobart, Tasmania.

166. To access the HWS metric values, please use this link <https://yoursay.melbournewater.com.au/healthy-waterways/document-library> and click on the box titled, ‘Yarra Catchment Region’ Accessed 23 July 2018.

Environmental Health

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:26 Threatened species	DELWP						 DATA QUALITY Good

The FFG Act provides the Victorian framework for listing threatened species, conserving threatened species and communities, and managing potentially threatening processes. There are over 700 fauna and flora species and ecological communities listed as threatened under this legislation. In addition to the FFG Act Threatened List, DELWP also maintains the Threatened Species Advisory Lists (the Advisory Lists). The Advisory Lists do not have a legislative basis, and they include species that are considered likely to be threatened but have not been through the formal listing processes required under the FFG Act. The Advisory Lists are based on technical information and advice obtained from a range of experts, and they are reviewed periodically. The information in these lists can be used in planning processes, such as the preparation of National Park Management Plans, local government planning schemes and regional catchment strategies, as well as in setting priorities for actions to conserve biodiversity.

There are no direct legal requirements or consequences that flow from inclusion of a species in an Advisory List, although they are afforded some protection through Victoria's Native Vegetation Management Framework. Also, some of the species in these advisory lists are also listed as threatened under the FFG Act. The FFG Act Threatened List only includes species and communities that have been nominated, assessed by the Scientific Advisory Committee and approved for listing by the Minister for Energy, Environment and Climate Change and the Minister for Agriculture.

The increase in the number of Victorian flora and fauna species and ecological communities listed as threatened is due to the loss, fragmentation and degradation of habitat due to clearing for agriculture, urban development, timber harvesting, weed invasion, inappropriate fire regimes, grazing, climate change and alternation to flows and temperatures in rivers and streams.¹⁶⁷ Competition for resources and predation by introduced species (such as foxes, rabbits, deer and carp) has also had a significant effect on many native species.¹⁶⁸

In 2018, Victoria signed the Intergovernmental Memorandum of Understanding Agreement on a Common Assessment Method for Listing of Threatened Species and Threatened Ecological Communities (CAM MoU).¹⁶⁹ The CAM MoU requires signatory parties to adopt the International Union for Conservation of Nature (IUCN) Red List of Threatened Species categories and criteria through legislative reform, to establish a Single Operational List of threatened species in each jurisdiction and to collaborate in the assessment and periodic review of the conservation status of native species in Australia.

167. ARI 2018, 'Threatened plants and animals', Heidelberg, Victoria, <https://www.ari.vic.gov.au/research/threatened-plants-and-animals> Accessed 27 September 2018.

168. Ibid

169. Intergovernmental Memorandum of Understanding 2017, 'Agreement on a common assessment method for listing of threatened species and threatened ecological communities', <https://www.environment.gov.au/system/files/resources/36ece4ab-82dc-4de9-aac6-9cc54bd7a820/files/mou-cam.docx> Accessed 27 September 2018.

Environmental Health

The IUCN Red List of Threatened Species provides taxonomic, conservation status and distribution information on plants, fungi and animals that have been globally evaluated using the IUCN Red List Categories and Criteria.¹⁷⁰ This system is designed to determine the relative risk of extinction, with the main purpose being to catalogue and highlight those plants, fungi and animals that are facing higher risk of global extinction. Applying the IUCN Red List Categories and Criteria can assess and determine whether plants, fungi and animals are: Data Deficient, Least Concern, Near Threatened, Vulnerable, Endangered, Critically Endangered, Extinct in the Wild, Extinct or Not Evaluated.¹⁷¹ DELWP is midway through a project to reassess all currently listed Victorian rare and/or threatened species, according to the IUCN Red List Categories and Criteria, including species listed in the FFG Act Threatened List and the DELWP Advisory Lists. As well as yielding a single, comprehensive list of Victorian threatened species, this work will also provide the baseline for key targets in Biodiversity 2037. This new list will not be comparable to the current DELWP Advisory Lists, creating a new baseline for future trend reporting. An update on this new comprehensive Victorian threatened species list will be made available in 2019.

At the time of writing this report, DELWP was leading a review process for the FFG Act, which included public consultation to inform the development of reforms to the Act. The Flora and Fauna Guarantee Amendment Bill was introduced into Victorian Parliament on 23 May 2018. The Bill was debated in the Legislative Assembly and passed without amendment. It was subsequently introduced into the Legislative Council but was not debated before the final scheduled parliamentary sitting day of the 58th Parliament of Victoria.

170. IUCN 2018, 'IUCN Red List of Threatened Species', <http://www.iucnredlist.org> Accessed 27 July 2018.

171. IUCN 2018, 'IUCN Red List of Threatened Species Technical Documents', <http://www.iucnredlist.org/technical-documents/categories-and-criteria> Accessed 27 July 2018.



Environmental Health

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:27 Leadbeater's Possums <i>(Gymnobelideus leadbeateri)</i>	Melbourne Water						 DATA QUALITY Good

The Leadbeater's possum is a small critically endangered arboreal possum found only in Victoria, where it is largely confined to the ash forests of the Central Highlands, northeast of Melbourne. This includes forested areas in the upper and lower rural Yarra reaches. In 2013, the Victorian Government established the Leadbeater's Possum Advisory Group. In 2014, the group made 13 recommendations to support the species' recovery, including to establish timber harvest exclusion zones around all verified records of Leadbeater possum sightings from 1998 onwards to protect colonies and their habitat. In order to identify and locate more colonies for protection, it was found necessary to conduct additional surveys across the species' range.

Working with arborists, the Arthur Rylah Institute installed automated cameras in trees, using creamed honey as a lure for Leadbeater's possums. Cameras were set on tree trunks at varying heights (up to 47 m), targeting areas of well-connected vegetation, such as among a wattle layer, where Leadbeater's possums are most likely to be moving or foraging.

Using these automated cameras, the Institute surveyed 290 sites over two years, targeting areas containing important habitat features for the Leadbeater's possum to maximise the likelihood of detecting the possums.^{172,173} Surveys located Leadbeater's possums at 149 sites (52% of those surveyed). Results also indicated that hollow-bearing trees are in low numbers across the areas of state forest surveyed. The remaining hollow-bearing trees will be critical for providing nesting habitat for the Leadbeater's possum in coming years. There remains, however, a predicted future shortage of hollows, and it may be necessary to supplement these natural hollows, using alternative approaches for providing den sites while natural hollows develop over the coming decades.

Timber harvesting exclusion zones have now been established around these sites to increase protection of these newly detected colonies and their habitat. In a third year of surveying, further sampling was undertaken in state forest to increase the network of protected areas, as well as within parks and reserves and areas burnt in the 2009 bushfires. This has improved knowledge of Leadbeater's possum distribution and habitat use across the species' range

172. Nelson JL, Durkin LK, Cripps JK, Scroggie MP, Bryant DB, Macak PV, Lumsden LF 2017, 'Targeted surveys to improve Leadbeater's possum conservation', Arthur Rylah Institute for Environmental Research Technical Report Series No. 278, Heidelberg, Victoria.
173. Nelson JL, Lumsden LF, Durkin LK, Bryant DB, Macak PV, Cripps JK, Smith SJ, Scroggie MP, Cashmore MP 2015, 'Targeted surveys for Leadbeater's possum in 2014-15. Report for the Leadbeater's possum Implementation Committee', Arthur Rylah Institute for Environmental Research, Heidelberg, Victoria.

Environmental Health

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:28 Helmeted Honeyeaters <i>(Lichenostomus melanops cassidix)</i>	DELWP, Zoos Victoria						 DATA QUALITY Good

The helmeted honeyeater (*Lichenostomus melanops cassidix*) is critically endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth), threatened under the FFG Act and critically endangered on DELWP's Threatened Advisory Lists. Only found in Victoria, there are currently three small semiwild populations established in remnant streamside swamp forest in the Yellingbo Nature Conservation Reserve just south of the Yarra River (near the lower rural reach). Numbers declined from 167 birds in 1967 to 50 birds in 1990.

The Helmeted Honeyeater Recovery Program was established in 1989 and comprises efforts from organisations including Zoos Victoria and Birdlife Australia as well as community groups and volunteers. Its aim is to reduce potential threats to the species and establish a stable wild population of at least 10 distinct but interconnected colonies. As part of the Recovery Program, Zoos Victoria is involved in captive breeding, reintroducing captive-bred birds into the wild, and monitoring them after release.

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:29 Birds	Melbourne Water						 DATA QUALITY Fair

A number of native bird species inhabit riparian vegetation along the length of the Yarra River corridor. Significant species observed include: powerful owl, little egret, intermediate egret and eastern great egret. As a large section of the upper Yarra rural reach is closed to public access, there are insufficient bird observations to establish bird status. Should current policies and efforts continue, the current trend for birds will see native bird state remain stable except for the inner city reach and urban reach where it will deteriorate due to development caused by population growth. Under climate change, targeted investment will be needed to ensure that riparian vegetation remains in at least fair status to provide habitat, foraging and nesting areas for native bird species.



Environmental Health

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:30 Fish	Melbourne Water, DELWP						 DATA QUALITY Good

This SoY report provides two main assessments of fish:

1. Melbourne Water's Healthy Waterways Strategy 2018
2. DELWP's Victorian Environmental Flows Monitoring and Assessment Program (VEFMAP)¹⁷⁴ Stage 5 monitoring and assessment program, which provided limited fish data sampled between 2004 and 2016.

Healthy Waterways Strategy

Fish condition score ranged between poor and fair across most reaches, indicating that there is a lack of suitable instream and riparian habitat to support fish life cycle stages, and there are barriers to fish movement (for example, dams or weirs).¹⁷⁵ Threatened species that occur in the Yarra River include: Murray cod, Australian grayling, Macquarie perch and Australian mudfish. The current trajectory for fish, should current policies and efforts continue, is poor to stable. Fish movement is restricted in the upper rural reach, specifically at the river source, due to fish barriers such as dams and weirs. Improvements to fish passage can increase habitat suitability for native fish species such as River blackfish.

VEFMAP

The VEFMAP¹⁷⁶ Stage 5 monitoring and assessment program results provide limited fish data sampled between 2004 and 2016 across nine regulated river systems, including the Yarra River. This fish dataset is linked to regional environmental flow delivery schedules. This sampling period coincided with hydrological extremes across Victoria, including the millennium drought (1996–2010) and major statewide floods of 2010–11. The final sampling period occurred before the winter/spring floods of 2016.¹⁷⁷ Across all sampling periods, seasonal and interannual variation influences the abundance and biodiversity of all fish populations.

In the Yarra River, Australian smelt were strongly dominant representing 49% of the mean catch, followed by short-finned eels (7%). Macquarie perch and common galaxias were also reasonably common representing 7% and 5% of the mean catch, respectively. There were low catch numbers of Australian bass, Australian grayling, common galaxias, river blackfish, short-headed lamprey and southern pygmy perch. Of the non-native fish species, carp were caught in large numbers and comprised 13% of the mean catch, followed by roach (8%) and redfin (4%). Australian grayling spawning migration in the Yarra River was in response to environmental flow variations from prevailing conditions rather than flow events of a specific magnitude, therefore, even low flows can trigger downstream spawning movements.¹⁷⁸ For fish species higher in the catchment, flow durations may need to be extended to enable fish to reach downstream spawning habitats.

174. DELWP 2018, 'Victorian Environmental Flows Monitoring and Assessment Program – Stage 5 Report', Melbourne, Victoria.

175. Melbourne Water Corporation 2018, 'Yarra: working together for Healthy Waterways. Catchment works program to support the draft Healthy Waterways Strategy', Melbourne, Victoria.

176. DELWP 2018, 'Victorian Environmental Flows Monitoring and Assessment Program – Stage 5 Report', Melbourne, Victoria.

177. Ibid

178. Ibid

Environmental Health

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:31 Frogs	Melbourne Water, DELWP						 DATA QUALITY Fair

(for all reaches)
Inner city, suburban and lower rural reaches: Fair
Upper rural reach: Poor

Frog status scores ranged between fair in the inner city, suburban and lower rural reaches of the Yarra River to poor in the upper rural reach. Although fair status scores were given, data availability was low. Significant frog species in the inner city and suburban reaches include the brown (bilbron's) toadlet and southern toadlet. The attributed poor status score in the upper rural reach was due to the very few

species recorded compared to the number that were expected to be in this reach. A significant species in this reach is the growling grass frog. Due to a lack of data, frog status at the river source in the upper rural reach cannot be provided. The current trajectory for frogs is deteriorating, highlighting a need to invest in appropriate management to improve and maintain frog status.

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:32 Macroinvertebrates	Melbourne Water, DELWP, EPA Victoria						 DATA QUALITY Good

Inner city and suburban reaches: Poor
Lower rural reach: Fair
Upper rural reach: Good

↘ Inner city and suburban reaches: Deteriorating
→ Lower and upper rural reach: Stable

Macroinvertebrates' status ranged from poor in the inner city and urban reaches to fair in the lower rural reach and good in the upper rural reach. Poor riparian and instream habitats in the inner city and suburban reaches are resulting from large-scale land-use changes upstream. Under climate change, in combination with the current trajectory for macroinvertebrate status, this poor score is unlikely to improve without significant improvements in habitat and stormwater management. Poor instream and fair riparian habitat condition in the lower rural reach contributed to a fair macroinvertebrates' status score. Urbanisation and climate change are threats to macroinvertebrate status in this reach, but improved riparian vegetation

and better management of flows, including stormwater quality inputs, will improve the status in the long-term. The upper rural reach provides fair riparian and instream habitat for macroinvertebrates, with the Mount Donna Buang stonefly being recorded at the river source. Improving the status and future trend of macroinvertebrates, especially under climate change, will require maintenance of high-quality riparian vegetation across all Yarra reaches, protecting flows and implementing the stormwater recommendations derived by the Improving Stormwater Management Advisory Committee (see Y:15 for more information).

Environmental Health

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:33 Platypus	Melbourne Water						 DATA QUALITY Fair

Inner city and suburban reaches: Fair
Upper rural reaches: Good

(for all reaches)

The platypus status score – based on population number – ranged from fair in the inner city, suburban and lower rural reaches to good in the upper rural reach and river source respectively. The lack of suitable instream and riparian habitat, combined with urban stormwater impacts, contributes to the fair status across the inner city, suburban and lower rural reaches. Climate change and associated urban stormwater impacts from increased

storm events will reduce the status score to poor under the current trajectory of policies and management efforts. Improving riparian vegetation and flows, through management actions, can increase the status score to good in the long-term for these reaches. Good status in the upper rural reach and river source is due to good instream habitats and riparian vegetation. Improving and maintaining these habitats and managing flows are essential for maintaining this status under climate change.

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:34 Riparian Vegetation	Melbourne Water						 DATA QUALITY Fair

Inner city and suburban reaches: Poor
Lower and rural reaches: Fair

↘ Inner city and suburban reaches: Deteriorating
→ Lower and upper rural reaches: Stable

The riparian vegetation status score varied from poor in the inner city and suburban reaches to fair in the lower and upper rural reaches. Large-scale land-use impacts contribute to the poor status in the inner city and suburban reaches where there are 22 listed plant species dependent on water for their life cycle and survival. On its current trajectory, the trend for this area of the Yarra River will deteriorate unless strategies are put in place to reduce urban infill along the river and reduce the numbers of pest plants and animals. Riparian vegetation in the lower and upper rural reaches ranges from fragmented sections dominated by mid and upper canopy species to high-quality stretches along forested sections. Agriculture stock access, invasive plant and animals

(specifically deer) and climate change can reduce this status to poor unless mitigated by management interventions. There are 47 and 26 listed water-dependent plant species in the lower and upper rural reaches respectively. The river source is a protected forested catchment with 18 listed water-dependent plant species. Invasive plants and animals (particularly deer) and climate change threaten to move the trend from stable to deteriorating in the upper rural reach if appropriate management action is not implemented. To address the stable-to-deteriorating trend in riparian vegetation, the whole main Yarra River stem has been allocated a 10-year priority vegetation plan in the *Healthy Waterways Strategy 2018* to improve riparian vegetation.

Natural Value	Inner city and urban reaches		Lower rural reach		Upper rural reach	
	Current state	Trend	Current state	Trend	Current state	Trend
Threatened species	Poor	Declining	Poor	Declining	Poor	Declining
Leadbeater's possum	Unknown*	Unknown*	Poor	Deteriorating	Poor	Deteriorating
Helmeted honeyeater	Unknown*	Unknown*	Poor	Deteriorating	Poor	Deteriorating
Birds	Fair	Stable	Fair	Stable	Unknown*	Unknown*
Fish	Poor	Deteriorating	Poor	Deteriorating	Poor	Deteriorating
Frogs	Fair	Deteriorating	Fair	Deteriorating	Poor	Deteriorating
Macroinvertebrates	Poor	Deteriorating	Fair	Stable	Good	Stable
Platypus	Fair	Stable	Fair	Stable	Good	Stable
Riparian vegetation	Poor	Deteriorating	Fair	Stable	Fair	Stable

Table 23: Current state and trend for the Yarra River's natural values

* There is insufficient data to establish an assessment of current state and trend (Data source: Melbourne Water Corporation 2018¹⁷⁹)

Improving Yarra River Riparian Land Management for Waterway Health

Melbourne Water's River Health Incentives Program provides financial and technical assistance to landowners, local government, other agencies and community groups to carry out work to improve the condition of rivers or creeks, or improve the quality of water running off their land. The River Health Incentives Program consists of four different program types, targeting different landholders and seeking different project outcomes: Stream Frontage Management Program, the Rural Land Program, Community Grants and the Corridors of Green program (Figure 13).

The Stream Frontage Management Program, which works closely with landowners, improves waterway health and supports best practice land management near stream frontages. Commencing in 1996, with an allocation of \$50,000 for landowners in the Westernport and Yarra catchments, the program targeted degraded frontages on cattle grazing properties where uncontrolled stock had access to the riparian zone and the Yarra River, posing threats to on-site and downstream values.

The program works with land managers to deliver cost-effective on-ground waterway projects that improve the condition of waterways by protecting and enhancing streamside vegetation and minimising erosion. The program also equips land managers with the appropriate skills and knowledge to implement and maintain waterway improvement projects. Funding is provided for on ground management works including: streamside fencing, weed control, setting up water points for livestock away from rivers, revegetation, ongoing maintenance, technical advice, training and education.

179. Melbourne Water Corporation 2018, 'Yarra: Working together for Healthy Waterways. Catchment works program to support the draft Healthy Waterways Strategy', Melbourne, Victoria.

Environmental Health

Since 1996, more than 4,000 Stream Frontage Projects have been funded in the Yarra catchment, representing over 1 million (1,060,677) plantings to restore habitat and 485 km of fencing built to protect waterways to reduce threats associated with uncontrolled stock access (Table 24, Table 25, and Figure 14).¹⁸¹ The program also provides intangible benefits through its emphasis on community collaboration and participation. This includes

involving land managers in the site assessment process, building on existing knowledge and enthusiasm for waterway management, providing training to develop management skills and sharing the costs and effort for project delivery with the recipients. This approach has resulted in increased empowerment, stewardship and advocacy among land managers and the community.

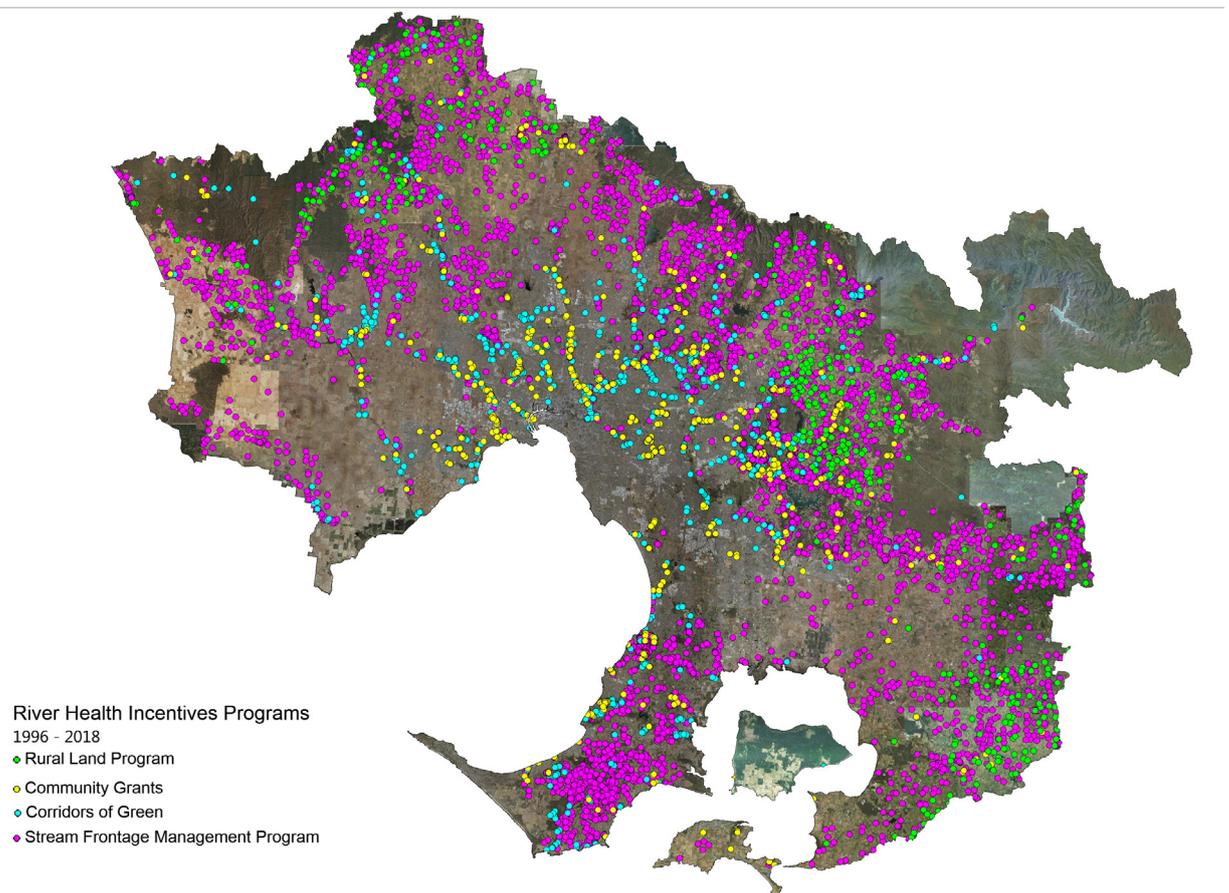


Figure 13: Melbourne Water's River Health Incentives Program project sites across the Port Phillip and Western Port catchment, 1996–2018

(Source: Melbourne Water 2018 ¹⁸⁰)

180. MW 2018. RHIP Target data 1km buffer Yarra stem for State of the Yarra Report. Melbourne Water Corporation, Victoria.

181. Ibid

Environmental Health

Program and Yarra River reach	Number of project sites
Stream Frontage Management Program	
Suburban and inner city	112
Upper rural and lower rural	193
<i>Total Stream Frontage Management Program</i>	<i>305</i>
Community Grant	
Suburban and inner city	118
Upper rural and lower rural	10
<i>Total Community Grant</i>	<i>128</i>
Corridors of Green	
Suburban and inner city	119
Upper rural and lower rural	46
<i>Total Corridors of Green</i>	<i>165</i>

Table 24: Melbourne Water's River Health Incentives Program outputs – project sites

Note: Number of project sites reported for all programs are indicative of the number of locations, not the number of grants, as a property or site might be funded multiple times over several years.

River Health Incentives Program Targets	km
Constructed stock exclusion fencing	
Suburban and inner city	1
Upper rural and lower rural	33
<i>Total constructed stock exclusion fencing</i>	<i>34</i>
Established vegetation	
Suburban and inner city	87
Upper rural and lower rural	56
<i>Total established vegetation</i>	<i>143</i>
Corridors of Green	
Suburban and inner city	76
Upper rural and lower rural	126
<i>Total managed vegetation</i>	<i>202</i>

Table 25: Melbourne Water's River Health Incentives Program outputs – extent

Note: All output values are located within a 1 km buffer of the Yarra River water corridor, including the total number of Stream Frontage Management Program properties.

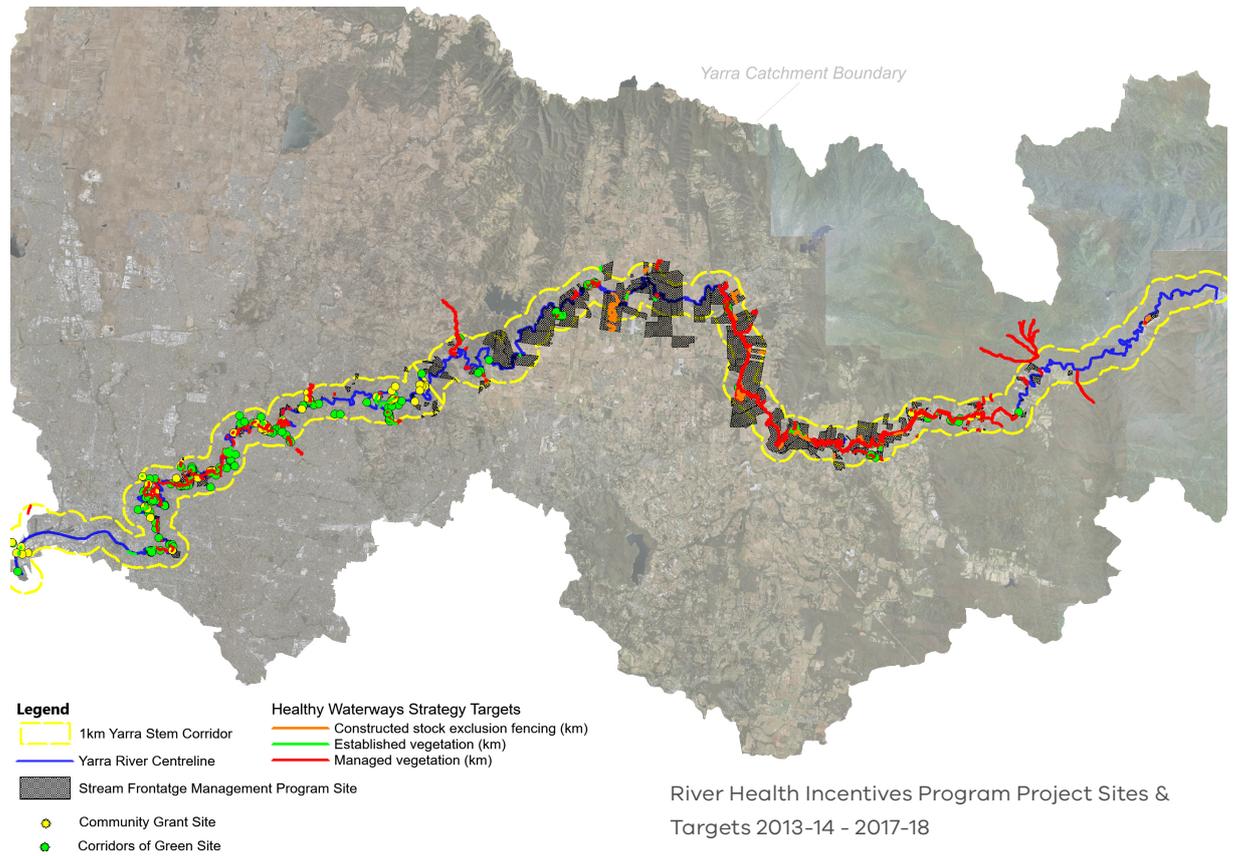


Figure 14: Melbourne Water's Stream Frontage Management Program project sites along the Yarra River, 2013–18
 (Source: Melbourne Water 2018¹⁸²)

182. Ibid

Wetland & Billabong Ecosystem Health

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:35 Wetland & Billabong Ecosystem Health	DELWP, Melbourne Water						 DATA QUALITY Good

Wetlands along the Yarra River corridor have been impacted by poor quality stormwater inputs, drainage, clearing of vegetation and urban development. Construction of levees and water harvesting means river-fed wetlands, including billabongs, are less frequently inundated and less able to act as nursery and breeding areas.¹⁸³ Only wetlands within the geographic scope of this report, and where data is available, will be reported here; these are adapted from values that have informed the co-designed catchment program for the Yarra Catchment as part of the Healthy Waterway Strategy and can be accessed online.¹⁸⁴

The Domaine Chandon Billabongs are located on the Yarra floodplain in Coldstream in the lower rural reach. Fauna state is poor, and vegetation is fair. On its current trajectory, fauna for this billabong will trend to improving. This is due to planned environmental watering that will improve the billabong’s overall condition, providing opportunistic use by fish and frogs through expansion of breeding habitat. Although the billabong is not formally recognised as a bird habitat, environmental watering can also provide opportunistic use of improved habitat to expand bird population ranges. On the current trajectory of policies and management efforts, the billabong’s vegetation and water quality will deteriorate unless threats are reduced and water properties improved.

Spadonis Billabong is in Yering on the Yarra River floodplain within the Spadonis Nature Reserve located in the lower rural reach. The billabong is listed in the Directory of Important Wetlands in Australia (maintained by the Australian Department of the Environment and Energy)¹⁸⁵ and is a drought refuge. The fair state of vegetation is directly linked to the poor state of birds. On the current trajectory, there will be an improvement to both these natural values due to the planned delivery of

environmental flows which will improve water quality (currently in a fair state), and improve vegetation condition, specifically those species which are water-dependent for their life cycle. Although fish state is good and is predicted to remain stable, frogs status is poor. The upper rural reach frog data was applied to this billabong, highlighting that there is a lack of frog data specific to this billabong. On its current trajectory, frog trend is predicted to improve due to environmental watering, improved water quality and vegetation condition.

Yering Backswamp is located 5 km southwest of Yarra Glen on the Yarra River in the lower rural reach. Covering 4.8 hectares, it is a site of biological significance that contains threatened vegetation including the swamp water-starwort, slender bittercress and Australian basket-grass; and threatened fauna including Peron’s tree frog and river blackfish. The bird state is poor and on the current trajectory of management and policies, will remain so. There is very little fish data and this metric will be developed through the development of the HWS and YSP. Frog and vegetation status are good and expect to remain stable due to water regime maintenance. This status is not consistent with water quality, which is poor and is set to remain at this status on the current trajectory of water regime maintenance.

183. Melbourne Water Corporation 2018, 'Yarra: Working together for Healthy Waterways. Catchment works program to support the draft Healthy Waterways Strategy', Melbourne, Victoria. <https://yoursay.melbournewater.com.au/healthy-waterways/document-library> Accessed 23 July 2018.

184. Ibid

185. Australian Government 2018, 'Directory of important wetlands in Australia – Victoria references', <http://www.environment.gov.au/water/wetlands/australian-wetlands-database/directory-important-wetlands/vic-data> Accessed 23 July 2018.

The Yarra Bridge Streamside Reserve Billabong is located on the Yarra River in Launching Place in the lower rural reach. This billabong is listed in the Directory of Important Wetlands.¹⁸⁶ The current state of frogs and wetland vegetation is poor, while the state of fish is fair. On its current trajectory, the fish and frogs state will shift to good due to improvements in water regimes. Bird state will remain poor unless there is improvement to vegetation state. If vegetation trend improves through management actions, which include new water regimes, bird state will shift to good.

Annulus Billabong is located within the Annulus Wildlife Sanctuary that is part of the Yarra Flats Park located in the suburban reach. The current bird state is poor and is projected to improve to fair under the current trajectory of policies and management, due to the introduction of planned environmental watering. There is very little fish data and this metric will be developed through the development of the HWS and YSP. The current state of frogs (poor) is projected to change to good due to planned environmental watering and the reduction of threats associated with poor water quality and water regimes. Billabong vegetation is currently fair and under the current trajectory is projected to deteriorate to a poor state. It is predicted that improvements to the water regime, through planned environmental watering, will improve vegetation state. Poor water quality is predicted to shift to fair due to water regime improvements influencing water properties.

Banyule Flats Billabong is part of the Banyule Flats Reserve located at Viewbank in the suburban reach. Although this billabong has a fair bird state and is projected to remain stable, 153 species have been sighted including Victorian listed rare and threatened species and some significant migratory species. The current state of fish is poor, with a projected shift to fair due to long-term improvements in wetland habitat form, vegetation and buffer condition and maintenance of water regimes which will allow opportunistic use of floodplains for breeding and life cycles. The current fair vegetation state is predicted to improve to good due to long-term improvements as mentioned

above. Poor water quality is predicted to shift to fair due to water regime improvements influencing water properties.

Bolin Bolin Billabong, located in Bulleen along the Yarra River, has high ecological and cultural values. Both bird and fish states are currently poor. Recent and future planned environmental watering are predicted to improve these states to fair for both fauna groups. The current fair vegetation state also influences the poor fish and bird scores. Vegetation state is predicted to improve from fair to good through improvements in water regimes via environmental watering and other management activities. The frog state is good, with significant species recorded at this site, and it is predicted to remain stable due to improvement in water regimes through environmental watering. The water quality state is projected to remain fair.

The 2017–18 water year was the first time that Bolin Bolin Billabong received water for the environment. Watering was undertaken by the Wurundjeri Land and Compensation Cultural Heritage Council Aboriginal Corporation in partnership with the VEWH, Manningham Council, Melbourne Water and Parks Victoria. Data collected during the watering, as well as the existing knowledge held by the Wurundjeri Council and the experiences of being on Country as part of the monitoring for Bolin Bolin, will inform future management objectives and practices. At the time of writing this report, the Victorian Government was investigating the potential to provide a water licence to support environmental outcomes in the lower Yarra River wetlands – including the Bolin Bolin Billabong – after 1,100 megalitres became available following the sale of the Amcor Paper Mill, providing a secure source for the lower Yarra wetlands. The investigation will ensure there are no inadvertent environmental or third-party impacts from using the water for these wetlands. It will also look for opportunities to maximise environmental and cultural benefits.

¹⁸⁶. Ibid

Burke Road Billabong is in Kew alongside the Yarra River within the suburban reach. Bird and fish state is poor with a predicted trajectory to fair for both groups due to planned environmental watering. Frogs and vegetation are currently fair and both are predicted to change to good due to improved water regimes through environmental watering. Vegetation improvement is also due to significant conservation work by a local community group. Water quality is poor and predicted to shift to fair through environmental watering.

Hays Paddock Billabong is part of the Willsmere–Chandler Park located alongside the Yarra River in Kew within the suburban reach. The current bird state is poor and predicted to shift to a fair state because of planned environmental watering. This positive shift in state will be similar for frogs, transitioning from fair to good due to environmental watering improving habitats required for life cycles. There is very little fish data and this metric will be developed through the development of the HWS and YSP. The current poor state of vegetation is predicted to shift to fair, with planned environmental watering improving water quality and condition for species that have water dependent life cycles and on-ground management efforts to improve vegetation quality and reduce threats such as pest plants. Water quality is also predicted to improve to fair through planned environmental watering.

Willsmere Billabong is also part of the Willsmere–Chandler Park. The bird state is currently poor and is predicted to shift to fair due to an improvement in vegetation and habitat from planned environmental watering. The fish state is good with the opportunity for population expansion into adjacent floodplains predicted due to planned environmental watering. The current fair vegetation state is predicted to improve to good, due to planned environmental watering and on-ground management action to reduce threats and improve vegetation quality. Wetland water quality is currently poor and predicted to improve to fair with planned environmental watering.

Westgate Park Wetlands comprises two wetlands within Westgate Park located along the Yarra River estuary in Port Melbourne in the inner city reach. These wetlands are not naturally occurring and have formed due to historic sand quarrying in this location. The larger of the two wetlands is freshwater, providing habitat to a large and diverse bird population and significant frog species. The smaller wetland is highly saline, polluted with heavy metals and frequently pink in colour due to algae. Vegetation state across the two wetlands is poor, although there are significant vegetation communities present. It is predicted that the vegetation state will shift to fair through extensive reduction of weed threats and improving of buffer vegetation. There is very little fish data and this metric will be developed through the development of the HWS and YSP. Water quality is currently poor and predicted to remain poor. Environmental projects have increased the ecological and social values of these two wetlands.

Environmental Health

Wetland	Natural values (current state)				
	Birds	Fish	Frogs	Vegetation	Water quality
Upper rural reach					
Domain Chandon Billabongs	Poor	Poor	Poor	Fair	Poor
Spadonis Billabong	Poor	Good	Fair	Poor	Fair
Yering Backswamp	Poor	Unknown*	Good	Good	Poor
Yarra Bridge Streamside Reserve	Poor	Fair	Poor	Poor	Fair
Lower rural reach					
Annulus Billabong, Yarra Flats Park	Poor	Unknown*	Fair	Fair	Poor
Banyule Flats Billabong	Fair	Poor	Good	Fair	Poor
Bolin Bolin Billabong	Fair	Poor	Good	Fair	Fair
Burke Road Billabong	Poor	Poor	Fair	Fair	Poor
Hays Paddock Billabong	Poor	Unknown*	Fair	Poor	Poor
Willsmere Billabong	Poor	Good	Fair	Fair	Poor
Lower rural reach					
Westgate Park Wetlands	Fair	Unknown*	Good	Poor	Poor

Table 26: Current condition of the Yarra River's natural values

*There is insufficient data to establish an assessment of current state.
(Source: Melbourne Water 2018 187)

187. Ibid



Estuary Ecosystem Health

Indicator	Data Custodian	Status				Trend	Data Quality
		UNKNOWN	POOR	FAIR	GOOD		
Y:36 Estuary Ecosystem health	Melbourne Water						 DATA QUALITY Good

The Yarra River estuary extends 22 km from Dights Falls in Abbotsford to Newport where the river mouth enters Port Phillip Bay. It is considered a salt-wedge estuary where the heavier saline water from Port Phillip Bay sits at the bottom of the water column and the less dense freshwater from inflows sits on top. The estuary has high recreation, ecological, social, economic and aesthetic values as it passes through the eastern Melbourne suburbs and Melbourne’s central business district. The current bird state is poor and is predicted to remain in this state for the long-term. This is due to the poor state of estuarine vegetation, which is highly fragmented and not suitable as bird habitat. It is predicted that estuarine vegetation will remain in this poor state as intensive urban and industrial infrastructure will limit vegetation connectivity, and improved condition, in the future. The fish state is good, with a good diversity of estuarine dependent species including the Australian grayling. This state is predicted to remain stable in the long-term. The current water quality state is poor and is predicted to remain so.¹⁸⁸ For further information about the influence of the Yarra River on Port Phillip Bay, refer to the *State of the Bays Report 2016*.¹⁸⁹

Environmental-Economic Accounts

The estimated annual benefit of the Yarra River corridor from waterway health, recreation and amenity values; cultural and heritage values; and landscape features and values is \$730 million.¹⁹⁰ An assessment of environmental-economic accounts for the Central Highlands provides some insights into the economic value of ecosystems for the following sectors: agriculture, forestry, tourism and recreation and water.¹⁹¹ The evaluation also includes a value for carbon sequestration. The assessment applied the UN SEEA approach. In terms of this report’s geographic scope, the values reported here were extracted and restricted to the Yarra River upper reach (Table 27). This highlights an opportunity for a full environmental-economic accounts assessment, including cultural ecosystem services, for the whole of the Yarra River and its parklands.

188. Melbourne Water Corporation, 2018, ‘Yarra: working together for Healthy Waterways. Catchment works program to support the draft Healthy Waterways Strategy’, Melbourne, Victoria. <http://www.environment.gov.au/water/wetlands/australian-wetlands-database/directory-important-wetlands/vic-data> Accessed 23 July 2018

189. CES, 2016, ‘State of the Bays 2016’, Accessed 23 July 2018

190. Melbourne Water Corporation, 2018, ‘Progress report for the Yarra Strategic Plan – October 2018’, Melbourne, Victoria.

191. Keith H, Vardon M, Stein J, Lindenmayer D, 2017, ‘Experimental ecosystem accounts for the Central Highlands of Victoria’, Fenner School of Environment and Society, Australian National University, Canberra, Australia. http://www.nespthreatenedspecies.edu.au/Ecosystem%20Complete%20Report_V5_highest%20quality.pdf Accessed 23 July 2018

Environmental Health

Ecosystem service	Sector	Measure	Economic value in AUD (for a specific year)		
Provisioning	Water	Value of Freshwater as an Ecosystem Service	\$101 million in total for 2013-14		
		Contribution of Freshwater supply to Industry Value Added	\$310 million in total for 2013-14		
	Agriculture	Ecosystem Services used by Agriculture	\$121 million in total for 2013-14		
		Revenue derived from Agriculture	\$659 million in total for 2013-14		
		Industry Value Added from Agriculture	\$312 million in total for 2013-14		
	Forestry	Native Forest Timber as an Ecosystem Service (Total)	Native Forest Timber as an Ecosystem Service (\$ per hectare)	\$71 per hectare for 2013-14	
			Native Forest Timber as Industry Value Added (Total)	\$12 million in total for 2013-14	
		Native Forest Timber as Industry Value Added (\$ per hectare)	Plantation Timber as an Ecosystem Service (Total)	\$9 million in total for 2013-14	
			Plantation Timber as an Ecosystem Service (\$ per hectare)	\$250 per hectare for 2013-14	
		Plantation Timber as Industry Value Added (Total)	Plantation Timber as Industry Value Added (\$ per hectare)	\$823 per hectare for 2013-14	
			Plantation Timber as Industry Value Added (\$ per hectare)	\$30 million in total for 2013-14	
		Regulating	Carbon Sequestration	Carbon Sequestration as an Ecosystem Service (Total)	1.64 Mt C in total for 2013-14
				Monetary value of Carbon Sequestration from all land cover types	\$63 million in total for 2013-14
Cultural	Tourism and Recreation	Tourism and Recreation as an Ecosystem Service	\$49 million in total for 2013-14 (3,500 jobs)		
		Contribution of Tourism and Recreation to Industry Value Added	\$260 million in total for 2013-14		

(Data source: Keith H, Vardon M, Stein J, Lindenmayer D, 2017¹⁹²)

Table 27: An assessment of environmental-economic accounts for sectors in the Yarra River upper reach only

192. Ibid

UN Sustainable Development Goals

Sustainable Development Goals

There are 34 SDG targets that align with SoY indicators (Table 28). It is important to note that the current list of selected SDG targets may change over time, as the sophistication of the operating framework improves and the narrative becomes more precise. This is intended as the beginning, not the end, of the journey of applying the SDGs to SoY reporting.

SDG Targets	
Biophysical targets aligned with SoY	13
Socio-economic targets aligned with SoY	21
Out-of-scope	135
Total	169

Table 28: SDG Targets by category

Aligning the SoY indicators with SDG targets

- Within established (biophysical) SoY scope
- New and emerging (socio-economic) SoY scope

SDG goal	SDG target	Status	Trend	Data quality
 <p>2 ZERO HUNGER</p>	2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment	Unknown	Unclear	Poor
	2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality	Unknown	Unclear	Poor
 <p>4 QUALITY EDUCATION</p>	4.7 By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development	Unknown	Unclear	Poor

UN Sustainable Development Goals

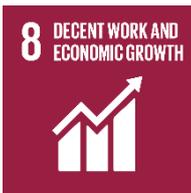
-  Within established (biophysical) SoY scope
-  New and emerging (socio-economic) SoY scope

SDG goal	SDG target	Status	Trend	Data quality
6 CLEAN WATER AND SANITATION 	6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimising release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally	Poor	Stable	Good
	6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity	Poor	Deteriorating	Good
	6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation, as appropriate	Poor	Deteriorating	Good
	6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes	Poor	Stable	Good
	6.b Support and strengthen the participation of local communities in improving water and sanitation management	Unknown	Unclear	Poor

UN Sustainable Development Goals

■ Within established (biophysical) SoY scope

■ New and emerging (socio-economic) SoY scope

SDG goal	SDG target	Status	Trend	Data quality
 <p>8 DECENT WORK AND ECONOMIC GROWTH</p>	8.4 Improve progressively, through to 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10 Year Framework of Programmes on Sustainable Consumption and Production, with developed countries taking the lead	Poor	Deteriorating	Good
	8.8 By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products	Fair	Stable	Fair
 <p>11 SUSTAINABLE CITIES AND COMMUNITIES</p>	11.3 By 2030, enhance inclusive and sustainable urbanisation and capacity for participatory, integrated and sustainable human settlement planning and management in all countries	Fair	Improving	Good
	11.4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage	Unknown	Unclear	Poor
	11.7 By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities	Fair	Improving	Fair
	11.a Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning	Fair	Stable	Fair

UN Sustainable Development Goals

-  Within established (biophysical) SoY scope
-  New and emerging (socio-economic) SoY scope

SDG goal	SDG target	Status	Trend	Data quality
	12.2 By 2030, achieve the sustainable management and efficient use of natural resources	Fair	Stable	Fair
	12.8 By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature	Unknown	Unclear	Poor
	12.b Develop and implement tools to monitor sustainable development impacts for sustainable tourism that creates jobs and promotes local culture and products	Fair	Stable	Fair
	13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries	Fair	Improving	Fair
	13.2 Integrate climate change measures into policies, strategies and planning	Fair	Improving	Fair
	13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning	Unknown	Unclear	Poor

UN Sustainable Development Goals

- Within established (biophysical) SoY scope
- New and emerging (socio-economic) SoY scope

SDG goal	SDG target	Status	Trend	Data quality
 <p>14 LIFE BELOW WATER</p>	14.1 By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution	Poor	Deteriorating	Good
	14.2 By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans	Poor	Deteriorating	Good
	14.3 Minimise and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels	Poor	Deteriorating	Good
	14.4 By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics	Poor	Deteriorating	Good
	14.5 By 2020, conserve at least 10% of coastal and marine areas, consistent with national and international law and based on the best available scientific information	Poor	Deteriorating	Good

UN Sustainable Development Goals

-  Within established (biophysical) SoY scope
-  New and emerging (socio-economic) SoY scope

SDG goal	SDG target	Status	Trend	Data quality
 <p>15 LIFE ON LAND</p>	15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements	Poor	Deteriorating	Good
	15.3 By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world	Fair	Improving	Fair
	15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species	Poor	Deteriorating	Good
	15.7 Take urgent action to end poaching and trafficking of protected species of flora and fauna and address both demand and supply of illegal wildlife products	Poor	Deteriorating	Good
	15.8 By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species	Poor	Deteriorating	Good
	15.9 By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts	Fair	Improving	Good
	 <p>16 PEACE, JUSTICE AND STRONG INSTITUTIONS</p>	16.7 Ensure responsive, inclusive, participatory and representative decision-making at all levels	Unknown	Unclear
 <p>17 PARTNERSHIPS FOR THE GOALS</p>		17.17 Encourage and promote effective public, public-private and civil-society partnerships, building on the experience and resourcing strategies of partnerships	Unknown	Unclear
	17.19 By 2030, build on existing initiatives to develop measurements of progress on sustainable development that complement GDP, and support statistical capacity-building in developing countries	Fair	Stable	Poor

Authorised by the Commissioner for Environmental Sustainability

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