

# Social Values

A Technical Report to inform the  
Healthy Waterways Strategy Mid-term Review





This Technical Report has been developed for Melbourne Water as part of the Healthy Waterways Strategy Mid-term Review through a collective effort with many organisations and individuals. In particular, Melbourne Water thanks:

**Report Contributors:** Dan Green, Sharyn Rosrakesh, Karen White and Rhys Coleman

**Evaluation Panel:** Michelle Dickson (chair), Tamara Boy, Leon Metzeling and Ian Rutherford

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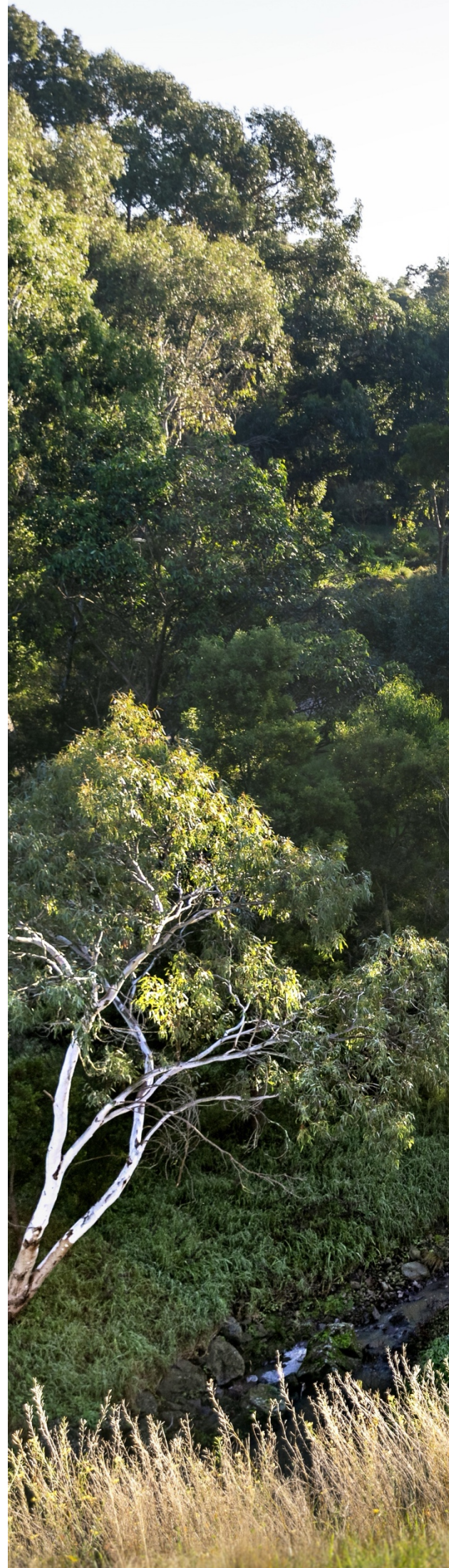
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## Glossary of terms and abbreviations

<b>BAUF</b>	business as usual future (for 2068)
<b>CURR</b>	current, 2018 baseline
<b>DEECA</b>	Department of Energy, Environment and Climate Action
<b>EPA</b>	Environment Protection Authority
<b>HSM</b>	habitat suitability model
<b>HWS</b>	Healthy Waterways Strategy 2018
<b>KEQ</b>	Key evaluation question
<b>MW</b>	Melbourne Water
<b>PO</b>	Performance objective
<b>RPO</b>	Regional performance objective
<b>SCPO</b>	Sub-catchment Performance Objective
<b>Strategy</b>	refers in this instance as the Healthy Waterways Strategy 2018
<b>Sub-KEQ</b>	Sub- key evaluation question
<b>UBG</b>	urban growth boundary

## Acknowledgement of Traditional Owners

The rivers, wetlands and estuaries of the Port Phillip and Westernport region are part of Country belonging to the Bunurong, Gunaikurnai, Taungurung, Wadawurrung and Wurundjeri Woi-wurrung peoples. These Traditional Owners have lived in and been connected to the land, water, plants and animals of this area for many thousands of years, and we offer our respect to their Elders past and present.



## Evaluation overview

The Healthy Waterways Strategy (HWS) (Melbourne Water 2018) identifies recreation, amenity and community connection as key values.

This report is one of several background reports feeding into the HWS mid-term review Science Inquiry (Melbourne Water, 2023a). It presents an evaluation of the social values in the HWS. The evaluation has focused on two key evaluation questions (KEQs) and their sub-KEQs:

- KEQ - What is the state of waterway values?
  - 3a. To what extent are key values on the target trajectory?
  
- KEQ - To what extent has progress been made towards the longer-term condition targets for rivers, wetlands and estuaries?
  - 2a. What environmental conditions (e.g. water quality) and external conditions (e.g. policy) help explain current key value trends?

For the benefit of the reader, some background and contextual information is presented relating to the HWS development and implementation to date along with an overview of how each of the KEQs will be evaluated with respect to social values (Table 1).

Table 1. Summary of the mid-term evaluation KEQs and the extent to which they are presented in this report.

KEQ	Sub-KEQ	Relevance to this report
1 – To what extent have the performance objectives of the Strategy been achieved?	1a. To what extent has collaboration and co-delivery contributed to achieving the Performance Objective targets so far?	This will be answered through the Evaluation of Collaboration and Co-delivery which is part of the Implementation Inquiry (Melbourne Water, <i>in prep</i> ).
	1b. To what extent is strategy delivery on track to achieve the Performance Objective targets by 2028?	Section 2 provides a summary of various sub-catchment and regional performance objectives. In particular results of annual tracking for the sub-catchment access and participation performance objectives are presented.
3 – What is the state of waterway values?	3a. To what extent are key values on the target trajectory?	Section 3 presents an evaluation of the 3 key social values, amenity, recreation and community connection using data and methodology which informed the HWS baseline.
	3b. What other spatial and temporal trends and patterns for key values are of significance for implementation?	Additional data from the community perception survey is presented in Section 3 for information purposes to provide insights into other potentially useful indicators/conditions. Indicators have also been compared against rainfall data, access data (based on newly completed pathways), visitation data, litter qualitative and quantitative (e.g. volume) sampling and pollution events.  Further surveys, such as DELWP’s My Victorian Waterway (2022), Melbourne Waters Reimagine Your Creek Surveys and Melbourne Waters Social Values Engagement Pilot Report surveys at locations for increased waterway amenity maintenance (2021) have also been analysed.
2 – To what extent has progress been made towards the longer-term environmental	2a. What environmental conditions (e.g. water quality) and external conditions (e.g. policy) help explain current key value trends?	Data and information relating to a number of conditions relevant to social values is presented in Section 3.

KEQ	Sub-KEQ	Relevance to this report
condition targets for rivers, wetlands and estuaries?	2b. To what extent have projected known and emerging future threats changed from 2018? Have any assumptions about impacts to key values changed?	Section 4 provides an overview of the work underway to evaluate this KEQ and summarises the potential threats to social values. Evaluation of how threats have changed since 2018 is presented in the Threats Technical Report (Melbourne Water, 2023b)
4 -To what extent have the delivery methods of the Strategy been appropriate, effective, and efficient?	4a. To what extent are interventions appropriate and effective for achieving outcomes?	Section 4 provides an overview of the work underway to evaluate this KEQ including a summary of interventions which can improve social values. A stocktake of common interventions used across the region is presented in the Interventions report (Melbourne Water, 2023c)
	4b. What are the key remaining knowledge gaps that need to be addressed in the next 5 years to improve strategy delivery or prepare for the next HWS?	Section 4 provides an overview of the work underway to evaluate this KEQ including a list of related research projects.  Identification of Knowledge Gaps is presented in Part F of the Science Inquiry Report (Melbourne Water, 2023a)
	4c. How can collaborative governance enable effective and efficient delivery of the Strategy?	This will be addressed in the Implementation Inquiry Report (Melbourne Water, <i>in prep</i> ).

Recommendations made within this document relate to the delivery of the Healthy Waterways Strategy and the attainment of targets across the time frame. They are based on whether there is sufficient evidence to suggest an area of concern that would benefit from a near-term response.

# 1. Overview of social values

In developing the Healthy Waterways Strategy (HWS), consideration was given to the value that people derive through visiting and experiencing waterways. The experiences that people have at waterways were used to define three key (social) values for the Strategy:

1. **Amenity** - Waterways provide restorative places where people can go to relax, escape normal life, appreciate nature, and feel better through a variety of multi-sensory experiences. Amenity also includes the influence of the micro-climate on people's sensory experiences of waterways, for example by reducing the impact of the urban built environment by riparian vegetation providing shade and temperature moderation.
2. **Recreation** – Waterways provide settings and opportunities for people to pursue active and/or passive activities within their leisure time, separate to activities that are necessary for their survival, such as work. Waterways can provide a good place for activities such as paddling, fishing, jogging and bike riding.
3. **Community Connection** - Liveable places are places that have a sense of community, with communities valuing waterways because they provide settings where people can join together for social interactions, learn from the environment, engage with art and culture and significant places i.e. to connect with people and nature. They also provide settings for Aboriginal people to connect with Country and their elders past and present (Stephens et al. 2007, Alluvium 2010).

Development of the conceptual models for social values at waterways is an important part of increasing the appropriateness of the management approaches to maintaining and improving the social values of waterways.

## Conceptual models for social values

The conceptual models developed for the HWS (Jacobs, 2018) were refined during the development of the HWS Resource Document (Melbourne Water 2020) to better communicate the conditions which support the key social values (Figure 1- 3).

Development of the conceptual models was based on review of relevant literature and research and use of expert opinion to identify the relationship between elements of waterway condition and the three social values.

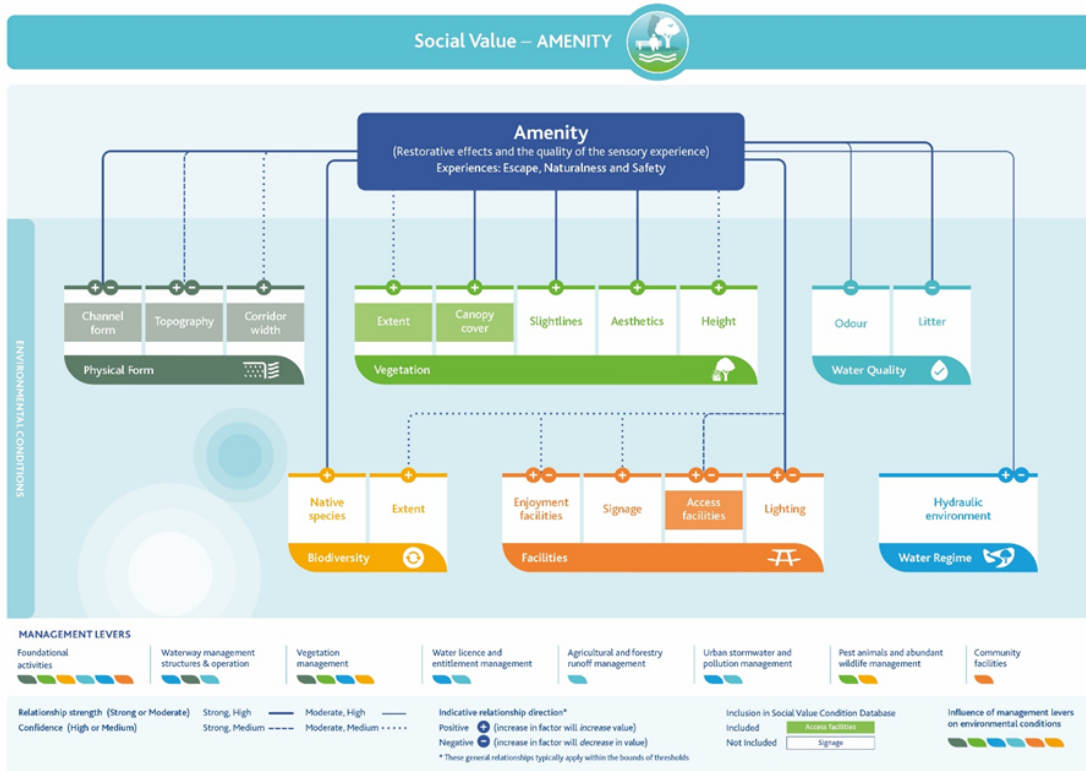


Figure 1. Conceptual model for amenity in the Melbourne Water region (based on Jacobs 2018).

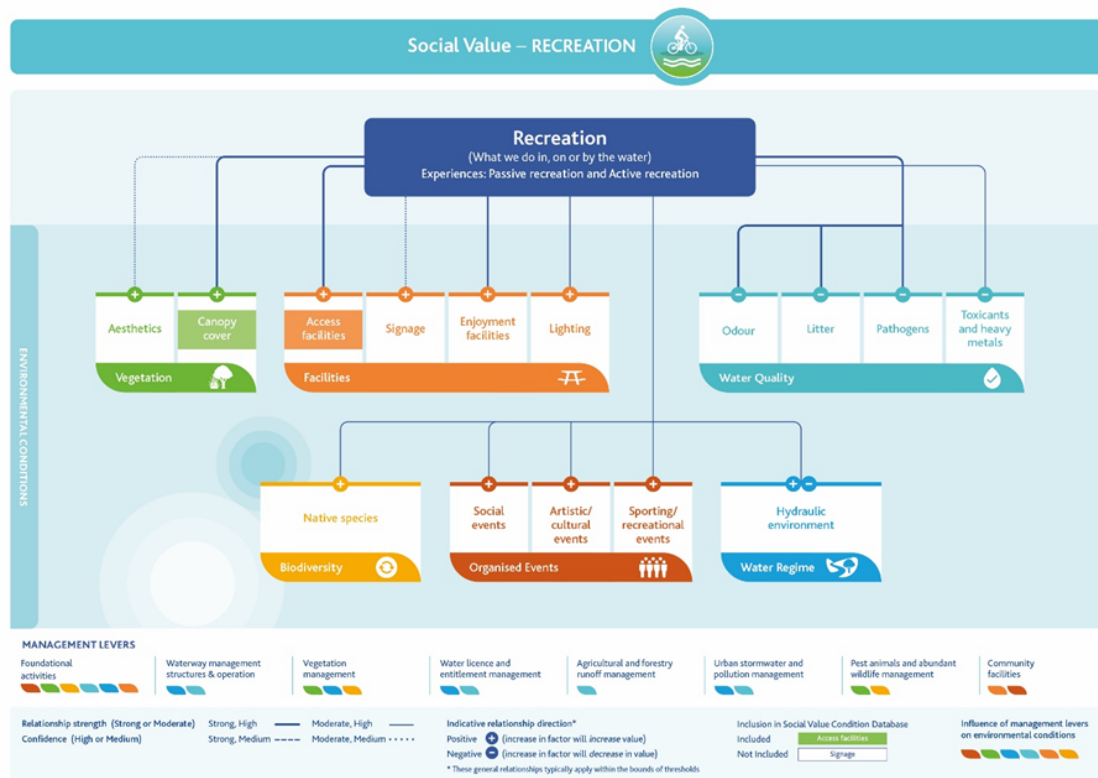


Figure 2. Conceptual model for recreation in the Melbourne Water region (based on Jacobs 2018).

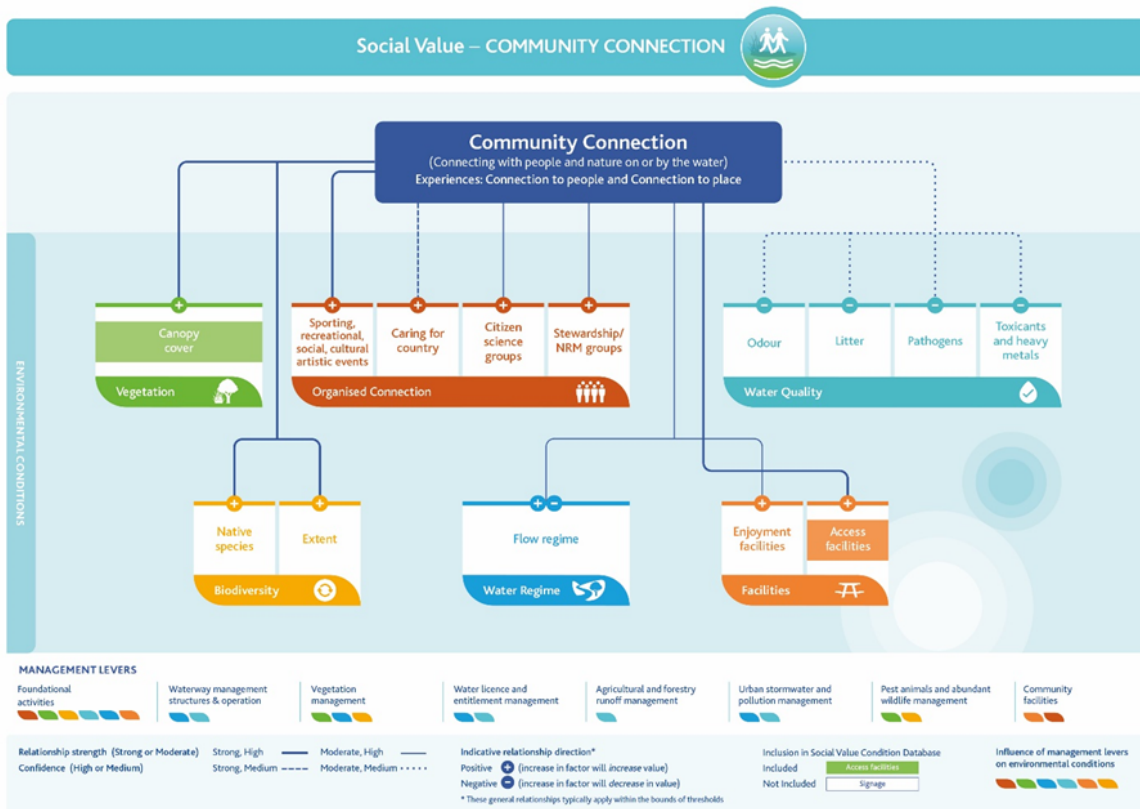


Figure 3. Conceptual model for community connection in the Melbourne Water region (based on Jacobs 2018).

## Social value metrics

A metric for defining social values (amenity, recreation, community connection) was developed for the Healthy Waterways Strategy which uses data from Melbourne Water’s bi-annual (since 2020 now annual) Community Perceptions Survey.

Unlike environmental values, the condition of social values are human dependant by their nature. That is, the condition of recreation at waterways can be understood by considering if people are experiencing recreation at waterways and if they are satisfied with that experience. The survey samples the population of greater Melbourne to understand how people use waterways, the reasons why and frequency with which they visit them and their overall satisfaction with Melbourne’s waterways. It explores perceptions about the role of waterways, threats to waterways and attributes that influence satisfaction with them.

The survey typically has a sample size greater than 2000, with around 1,500 of those having visited waterways in the last 12 months. The survey ensures coverage across the region and across age and gender.

The values are assessed by correlating survey respondents primary reason for visiting waterways with one of the three social values and then taking the average satisfaction score given in response to the survey question “How satisfied are you with Melbourne’s waterways being suitable for how you use them?”. This gives an assessment of satisfaction with waterways in relation to each social value. Table 2 indicates the “reason for visiting waterway” that were correlated to each social value.

Table 2. Correlation between social values and reasons for visiting waterways.

Corresponding social value	Correlated primary reasons for visiting waterway
Amenity	Feeding the ducks / other waterbirds General relaxation Nature appreciation Well-being  To escape to a quiet and relaxing place
Community connection	Social meetings / Family outings Picnics / BBQs / lunch Cafes/Restaurants Community and environmental volunteering i.e. planting trees, litter clean-up, monitoring water quality or wildlife To attend events/festivals  Cultural activities
Recreation	Bird watching Canoeing / kayaking / boating / rowing Commuting: walking / cycling Dog walking Exercising: cycling/walking/jogging/running Fishing  Swimming/wading

### Healthy Waterways Strategy baseline - 2016 state

A baseline was developed by averaging the above correlation of social values and satisfaction rating of reasons for visitation, for 14 catchments management units. The catchment management units have been used to maintain a consistent approach/method to what was employed for the development of the 2018 Healthy Waterways Strategy (2016 data used as baseline). Of note, since 2018 no data has been captured in three of the catchment management units; French & Phillip Island, Lower Bunyip, Lang Lang & Bass and Upper Bunyip & Tarago.

Table 3. Geographical Categorisation of Catchment Management Units.

Catchment	Management Units	Sub-catchments
Werribee River	1. Cherry, Kororoit, Laverton, Skeleton Creeks	Cherry Main Drain Kororoit Creek Lower Kororoit Creek Upper Laverton Creek Skeleton Creek
	2. Werribee and Little River Lowlands	Little River Lower Lollypop Creek Werribee River Lower
	3. Werribee and Little River Uplands	Werribee and Little River Middle and Upper
Maribyrnong River	4. Maribyrnong River Lower	Maribyrnong River Moonee Ponds Creek Steele Creek Stony Creek Taylors Creek

Catchment	Management Units	Sub-catchments
	5. Maribyrnong River Upper	Boyd Creek Deep Creek Lower Deep Creek Upper Emu Creek  Jacksons Creek
Yarra River	6. Yarra River Lower	Darebin Creek Gardiners Creek Koonung Creek Merri Creek (Rural and Forested) Merri Creek (Urban) Plenty River (Source) Plenty River Lower Plenty River Upper Yarra River Lower
	7. Yarra River Middle	Brushy Creek Diamond Creek (Rural) Diamond Creek (Source) Mullum Mullum Creek Olinda Creek Steels and Pauls Creek (Rural) Steels and Pauls Creek (Source) Stringybark Creek Watsons Creek Watts River (Rural) Woori Yallock Creek Yarra River Middle Yarra River Upper (Rural)
	8. Yarra River Upper	Little Yarra River and Hoddles Creek Watts River (Source) Yarra River Upper (Source)
Dandenong Creek	9. Dandenong Creek	Bayside Blind Creek Corhanwarrabul, Monbulk and Ferny Creeks Dandenong Creek Lower Dandenong Creek Middle Dandenong Creek Upper Eumemmerring Creek Kananook Creek
Westernport and Peninsula	10. Cardinia Creek	Cardinia, Toomuc, Deep and Ararat Creeks Dalmore Outfalls
	11. French and Phillip Island	French and Phillip Islands
	12. Lower Bunyip, Lang Lang and Bass	Bass River Bunyip Lower King Parrot and Musk Creeks Lang Lang River
	13. Mornington Peninsula	Mornington Peninsula North-Eastern Creeks

Catchment	Management Units	Sub-catchments
		Mornington Peninsula South-Eastern Creeks Mornington Peninsula Western Creeks
	14. Upper Bunyip & Tarago	Bunyip River Middle and Upper Tarago River

The average satisfaction score is then categorised to a five point scale, to align with other value assessments. Table 4 outlines how the three key social values condition ratings were defined in terms of very low to very high and how this relates to the community perception survey data.

Table 4. Social Values metric and indicator.

Key Value	Metric Description	Very low	Low	Moderate	High	Very high
Amenity	Based on data from Melbourne Water community perceptions of waterways research on 'satisfaction with waterways' in relation to amenity related activities	Very low level of satisfaction with amenity	Low level of satisfaction with amenity	Moderate level of satisfaction with amenity	High level of satisfaction with amenity	Very high level of satisfaction with amenity
	Average satisfaction scores (0 to 10) from survey respondents	0% - 39%	40% - 59%	60% - 69%	70% - 79%	80% - 100%
Connection	Based on data from Melbourne Water community perceptions of waterways research on 'satisfaction with waterways' in relation to community connection activities	Very low level of satisfaction with community connection	Low level of satisfaction with for community connection	Moderate level of satisfaction with community connection	High level of satisfaction with community connection	Very high level of satisfaction with community connection
	Average satisfaction scores (0 to 10) from survey respondents	0% - 39%	40% - 59%	60% - 69%	70% - 79%	80% - 100%
Recreation	Based on data from Melbourne Water community perceptions of waterways research on 'satisfaction with waterways' in relation to community connection activities	Very low level of satisfaction with recreation	Low level of satisfaction with recreation	Moderate level of satisfaction with recreation	High level of satisfaction with recreation	Very high level of satisfaction with recreation
	Average satisfaction scores (0 to 10) from survey respondents	0% - 39%	40% - 59%	60% - 69%	70% - 79%	80% - 100%

## Monitoring social values

A social values monitoring program has been established to track the progress of the Healthy Waterway Strategy and to provide information for adaptive management. This information is derived from datasets within the *Community Perceptions Survey*.

The first *Community Perceptions Survey* was initiated in 1994 and has asked questions related to satisfaction ratings for waterways across Melbourne. Since the inception of social values conceptual models as part of the 2018 Healthy Waterways Strategy, the program has adapted survey questions to query social values conditions found in the conceptual models. For the purposes of this review, these condition queries are not part of the equation that forms a social values (amenity, recreation, community connection) score (Table 4), but have been analysed independently in section KEQ3b.

### Current methodologies: survey questions

The below table outlines the current questions being used in the surveys to explore related social values conditions and experiences since the baseline (2016 survey). There have been four surveys conducted in this period, 2018, 2020, 2021 and 2022, however data from the 2018 was not able to be derived to produce amenity, recreation and community connection scores using a methodology consistent with the baseline findings and so has not been included in this review.

Table 5. Summary of social values survey questions.

Social value	Correlated Condition for visiting waterway – survey question “How satisfied or not are you with this location as a place for?”
Amenity	<ul style="list-style-type: none"> <li>The landscape and views</li> <li>The amount of open space</li> <li>The paths alongside the waterway (Access)</li> <li>Providing a habitat for wildlife (birds and animals)</li> <li>The land around it being well maintained and cared for</li> <li>The condition or stability of the banks</li> <li>The extent and appearance of vegetation</li> <li>Quantity of water flowing</li> <li>Smells or odours coming from the water</li> <li>The amount of litter</li> <li>The colour or clarity of water</li> <li>Escape from the urban environment</li> <li>Engage in aesthetically pleasing places</li> <li>Connect with nature</li> <li>Immerse in a natural environment</li> <li>Feel safe</li> </ul>
Community connection	<ul style="list-style-type: none"> <li>The paths alongside the waterway (Access)</li> <li>The facilities that support community and cultural events</li> <li>The visitor facilities such as toilets, seating, parking</li> <li>Learn from the environment</li> <li>Engage with a culturally significant place</li> <li>Engage with art and culture</li> </ul>
Recreation	<ul style="list-style-type: none"> <li>The paths alongside the waterway (Access)</li> <li>The facilities at and around the waterway which support sporting activities</li> <li>Engage in active physical recreation and exercise</li> <li>Use waterway corridors for commuting</li> </ul>

## Forecast trajectory under a ‘business as usual’ scenario

To forecast future condition perceived satisfaction with waterway amenity, community connection and recreation, a series of assumptions are made in relation to the impact of: climate change, urbanisation; population growth and effectiveness of policy and programs on the key drivers (the attributes of waterway condition that have a strong link with satisfaction in relation to waterway amenity, community connection and recreation). These assumptions are documented in the Healthy Waterways Strategy Technical Resource document (Melbourne Water, 2020) and presented below (Table 6 to Table 8).

Table 6. Assumptions about current trajectory for recreational values.

Recreation	BAU (continue current level of investment)			Improve (increased level of investment)		
Primary condition drivers	Recreational Water quality (driver of swimming and boating).	Shared paths along waterways (driver for cycling/walking/jogging)	Vegetation condition (indicator for the overall quality of the corridor)	Recreational Water quality (driver of swimming and boating).	Shared paths along waterways (driver for cycling/walking/jogging)	Vegetation condition (indicator for the overall quality of the corridor)
Assumptions	<p>- Recreational water quality is influenced by stormwater management practices and point source pollution current programs/policy not sufficient to meet SEPP in the majority of the waterways (some exceptions: Maribyrnong main stem in Brimbank Park);</p> <p>climate change: sees further declines in WQ</p> <p>Urban growth: reduces WQ due to changed land use (DCI); infill reduces WQ because BPEN doesn't apply.</p> <p><i>Overall - rec water quality declines</i></p>	<p>Shared paths have high profile in existing strategies current open space management arrangements lack clarity around roles/responsibilities land tenure restricts large regional projects paths are gradually being constructed, but not as quickly as community would like</p> <p>use increasing therefore suitability of paths declining (maintenance or overcrowded)</p> <p>Climate change: no impact on paths</p> <p>Urban growth and infill development offer opportunities to fill access gaps and extend access networks</p> <p><i>Overall: the level of paths is gradually improving but not at a rate that meets community expectations</i></p>	<p>Urban greening initiatives receive good level of planning and funding in the urban area (urban forest strategies): canopy increases</p> <p>climate change: negatively impacts vegetation</p> <p>Urban growth: new development neutral or negative for vegetation as new development must provide vegetated corridor but may be lesser value than existing</p> <p><i>Overall: vegetation condition will gradually decline</i></p>	<p>significant investment in retrofitting infrastructure (e.g. sewer maintenance; sewer containment upgrades; septic upgrade programs); and IWM; and rural land management investment in sanitary surveys investment in communicating to users (Yarrawatch etc.) significant investment in EPA regulation of point source pollution</p> <p><i>Overall: Rec water quality improves</i></p>	<p>shared paths have good level of planning and funding paths are being constructed at a rate that meets community needs</p> <p><i>Overall: paths improve to keep pace with increased use</i></p>	<p>vegetation improvement programs at level to meet moderate condition or above in 10 years</p>
Summary assumption	<b>Recreation trajectory will gradually decline under BAU (10% decline over time)</b>			<b>Recreation trajectory will be improved over time (10% improvement over time)</b>		

Table 7. Assumptions about current trajectory for amenity values.

Amenity	BAU (continue current level of investment)			Improve (increased level of investment)		
Primary condition drivers	Shared paths along waterways (enables access required to experience amenity)	Vegetation condition (indicator for the overall quality of the corridor)	Litter absence (indicator of degraded amenity)	Shared paths along waterways (driver of amenity as enables access to experience amenity)	Vegetation condition (indicator for the overall quality of the corridor)	Aesthetics (indicator of degraded amenity)
Assumptions	<p>As for recreation</p> <p><i>Overall: the level of paths is gradually improving but not at a rate that meets community expectations</i></p>	<p>As for recreation</p> <p><i>Overall: vegetation condition will gradually decline</i></p>	<p>Litter rates are associated with land use, population, local behavior and drains that flow to waterways.</p> <p>Existing litter management and behavior change programs are not effective in reducing overall volumes of litter.</p> <p>Increasing population and densification is expected to result in increasing litter.</p> <p><i>Overall: litter volume is expected to increase.</i></p>	<p>As for recreation</p> <p><i>Overall: the level of paths will be improved to meet community expectations – requires maintenance, upgrading and extensions to network</i></p>	<p>As for recreation</p> <p><i>Overall: vegetation condition will be improved as new paths are built, open space improved and revegetation occurs</i></p>	<p>Litter rates are associated with land use, population, local behavior and drains that flow to waterways.</p> <p>Increased focus on at source management and behavior change will be somewhat effective, but will likely be negated by with population increase; opportunity to improve significantly will be low.</p> <p>Litter volume is expected to remain constant.</p> <p><i>Overall: litter volume is expected to maintained.</i></p>
Summary assumption	<b>Amenity trajectory will gradually decline under BAU (20% decline over time)</b>			<b>Amenity trajectory will improve (10 % improvement over time)</b>		

Table 8. Assumptions about current trajectory for community connection values.

Community Connection	BAU (continue current level of investment)		Improve (increased level of investment)	
Primary condition drivers	Shared paths along waterways (driver for cycling/walking/jogging)	Participation through grants, incentive programs for land improvement, and citizen science.	Shared paths along waterways (driver for cycling/walking/jogging)	Participation through grants, incentive programs for land improvement, and citizen science reflects the level of caring across the community for waterways health.
Assumptions	As for recreation  <i>Overall: the level of paths is gradually improving but not at a rate that meets community expectations</i>	Without significant further investment in programs and program promotion it is unlikely participation numbers will increase – and will most likely decline as older people leave these programs  Visitor numbers and increased use of waterways for community based events will require additional space and facilities to keep pace with population increase  <i>Overall: community connection will gradually decline</i>	As for recreation  <i>Overall: paths improve to keep pace with increased use</i>	Increased investment in programs and program promotion will likely result in an increase to participation numbers.  Investment in additional space and facilities to will support increased visitor numbers and increased use of waterways for community based events  <i>Overall: community connection will be improved</i>
Summary assumption	<i>Community connection BAU trajectory will decline (10 %) over time</i>		<i>Community connection improve trajectory will improve (10 %) over time</i>	

### Long-term target setting

For the three social values the target is to improve or maintain the community’s level of satisfaction with waterways for activities related to amenity, community connection and recreation. Target setting was formed by testing a subset of five conditions which have a strong relationship with the values that can inform strategic direction for management, can be monitored over time (either through existing monitoring mechanisms or through new mechanisms to be developed) and can assist in differentiating between planning scenarios. The key conditions are:

- Access
- Water quality (recreational)
- Litter
- Participation
- Vegetation

Social value trajectories for each of the five key conditions considered a ‘business as usual’ or ‘improved/increased level of investment’ scenarios which helped inform long-term targets.

In setting the long term targets some general assumptions have been made in relation to factors that influence community perceptions:

- Perception is influenced by various external forces (e.g. social media) as well as individuals’ preferences and background.
- Whilst there are some community wide preferences evident (e.g. natural waterways are preferred to concrete channels) there is a continuum of preferences which makes identifying definitive relationships between value and perception difficult (e.g. one sector of the community is satisfied with a grassed park-like waterway, whilst another sector prefers a wild forested waterway). This means that a diversity of experiences is important for improving value.
- Conceptual models that set out the relationships between social values and waterway conditions are not yet mature enough to understand the quantitative nature of the relationship between condition and value (assessed through perceptions). That is we don’t have strong evidence as to how much we need to change conditions in order to improve social values. However the models do indicate the condition attributes that are

important, and some qualitative relationships between the attribute, condition and perception.

- Increasing opportunities for people to engage in a diverse range of experiences at waterways will increase positive perceptions and satisfaction with waterways.
- Improving environmental condition of waterways will generally increase positive perceptions and satisfaction with waterways.
- Setting of targets is based on the understanding that improving waterway condition in line with our conceptual models will lead to a long-term improvement in values as measured through perception.

### **Performance objectives**

In addition to long term targets there are a number of performance objectives related to improving social values. These are short term (one to ten-year) quantitative steps by which long term targets can be achieved. Performance objectives provide short-term, tangible outcomes which indicate progress towards longer-term outcomes (i.e. change in condition or in key value).

An overview of social value related performance objectives and how we are tracking against them is provided in the following section.

## 2. Summary of current management actions and progress

There are many agencies with different responsibilities for managing for social values along waterways including Melbourne Water, councils, EPA, Parks Victoria and DEECA.

To improve social values there are several performance objectives for rivers and estuaries and several regional performance objectives. These are outlined in Table 9 to 11 and are focused on improving vegetation, improving access to and along waterways, transforming urban waterways into more natural systems, community engagement, managing litter and pollution and improving knowledge. It should be noted that there are no social value related performance objectives for the HWS priority wetlands. This has been captured as a knowledge gap in the HWS and there is a Regional Performance Objective to progress work in this area.

Table 9. Types of sub-catchment performance objectives aimed at improving social values of rivers.

PO group	SCPO theme/s	Tracking method
Community places	Increase or improve access	Quantitative target
Engaged communities	Increase participation rates	Quantitative target
Vegetation	Increase vegetation extent	Quantitative target
Water quality	Maintain / protect recreational water quality	Quantitative target

Table 10. Types of Performance Objectives aimed at improving social values along estuaries (taken from the Estuaries MEP).

# POs	Example PO wording	Associated management actions	Relevant estuaries
26	Maintain and support existing high value opportunities for access and recreation/passive enjoyment, including walking, cycling, boating and fishing activities.	Maintaining shared pathways and amenity facilities (benches, bathrooms, picnic tables, boat/canoe ramps, boardwalks etc.)	Werribee River and Kororoit Creek estuaries Elwood Canal, Kananook Creek, Mordialloc Creek and Patterson Rive estuaries Stony Creek (Port Phillip Bay) and Maribyrnong River Yarra River estuary Balcombe Creek, Chinamans Creek, Merricks Creek, , Kings Creek, Olivers Creek, Tooradin Road Drain, , Bunyip River, Lang Lang River and Bass River estuaries
17	Enhance appropriate access and recreation opportunities	Renewing or building new infrastructure e.g. paths, or amenity facilities	Skeleton Creek, Laverton Creek and Kororoit Creek estuaries Moonee Ponds Creek estuary Elwood Canal estuary Balcombe Creek, , Stony Creek (WPB), Warringine Creek, Olivers Creek, Tooradin Road Drain, Cardinia Creek, Deep Creek, Bunyip River and Lang Lang River

Table 11. Regional Performance Objectives aimed at improving social values.

PO group	Regional Performance objectives
Engaged communities	RPO-37 Participation rates in education, capacity building, incentive programs and citizen science activities have increased and enable greater levels of environmental stewardship for our waterways. RPO-38 Key messages, stories and resources for waterways and waterway health are collaboratively developed and broadly distributed, increasing community knowledge and engagement around waterways

PO group	Regional Performance objectives
	<p>RPO-39 Systems and pathways to share knowledge and information between communities and stakeholders have been developed and expanded to empower communities to participate and influence waterway management (for example, digital portals, social media, Communities of Practice, signage programs).</p> <p>RPO-40 The profile of waterways is lifted, local connections to waterways are increased, and leaders in waterway management are celebrated and fostered.</p>
Community places	<p>RPO-19 Options to transform modified waterways by creating more natural, community-loved spaces are identified and implemented.</p> <p>RPO-20 The amenity, community connection and recreation values of wetlands are better understood. Performance objectives are developed to enhance these values.</p> <p>RPO-21 The multiple benefits of waterways investment are tracked and understood.</p> <p>RPO-22 Cooler, greener and more liveable urban environments are created through revegetation and as part of managing excess stormwater.</p> <p>RPO-27 Incidence of littering and illegal dumping is reduced through raised community awareness and knowledge, infrastructure and enforcement.</p>
Water quality	<p>RPO-24 Risk-based programs are in place to mitigate sources of urban pollution (licensed and unlicensed discharges) to protect bays and waterways.</p> <p>RPO-26 Methods are in place to assess volume and source of litter to inform and promote litter reduction programs.</p>
Management	<p>RPO- 43 The social values framework, information and methods used to develop values assessments, targets and performance objectives are further developed and improved during the life of the Strategy</p>

## Progress towards social value performance objectives

This section provides an overview of progress towards some key social values related performance objectives. The access, participation, water quality for recreation and vegetation performance objectives are tracked quantitatively and a rubric determines whether each major catchment is on track or not.

### Access

Of the 69 sub-catchments, there are 44 sub-catchments which have access performance objectives and therefore targets. The broad aim of these performance objectives is to “increase or improve access to and along waterways, by filling gaps between pathways, improving connections or creating new pathways”.

The total target length of access performance objectives is to improve or increase waterway access in the region by 202 km by June 2028. This is made up of targets at the catchment and sub-catchment scale (Figure 4).

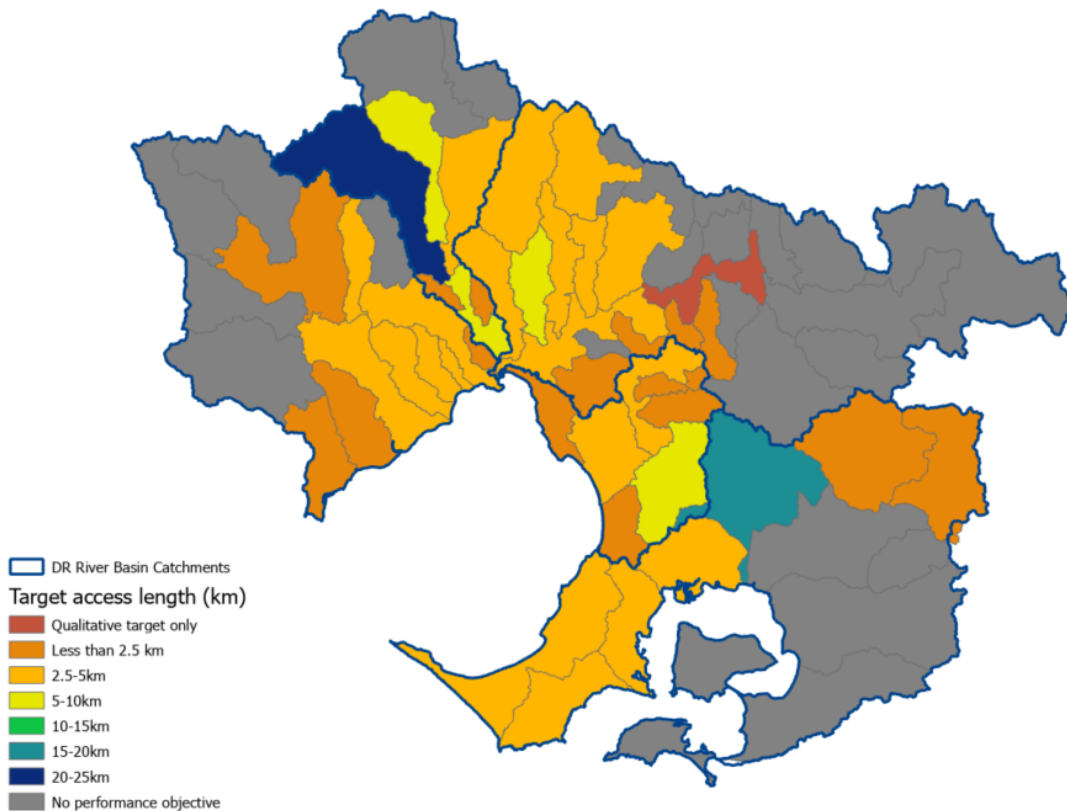


Figure 4. HWS access PO targets at catchment and sub-catchment scale.

Data from the HWS Annual reporting process for 2021/22 financial year was used to evaluate progress towards the performance objective access target. The Yarra River, Werribee River, Dandenong Creek and Westernport catchments are well above the targets for 21/22 and are “On Track” (Table 12). Maribyrnong catchment is “Significantly Off Track”.

Table 12. Status of Access Performance Objectives – Catchments 21/22 data.

Catchment	Results (km)	Target* (21/22)	Target 2028	Status - Achieved to Date	Performance Rating
Werribee River	25.9	> 9 km	34	76%	On Track
Maribyrnong River	7.2	> 14 km	57	13%	Significantly Off Track
Yarra River	25.7	> 11 km	43	60%	On Track
Dandenong Creek	14.8	> 7 km	26	57%	On Track
Westernport	11.3	> 11 km	42	27%	On Track

Waterway access in the region increased or improved by 37.2 km in 21/22 and a total of 84.9 km of increased or improved access to waterways has been delivered since July 2018. The majority (80%) of improvements were due to new access to waterways in greenfield development areas. Werribee River Catchment had the highest result (14.8 km) and Maribyrnong River the lowest (1.1 km).

Maribyrnong River is “Significantly Off-Track” because the rate of development along waterways has not progressed according to targets made in 2018. It is likely that the target will be met, but not within the life of the Strategy (2028) but through other programs such as the Suburban Parks Program at Jacksons Creek planned by 2040 (access target of 25 km).

Interestingly, although the other catchments have numerous sub-catchments that are “Significantly Off-Track”, they are considered “On Track” at the catchment scale due to some of the waterway access increases or improvement lengths in a few sub-catchments contributing to the cumulative total that are meeting the 2021/22 access targets for individual catchments. Appendix 1 provides more details on how access is calculated, targets and the rubric for tracking performance.

Table 13. Status of Access Performance Objectives – Sub-catchments.

Catchment	Sub Catchment	Target – 2028 (km)	Improvement @ 21/22 (km)	Tracking
<b>Werribee River</b>				
	Cherry Creek	3	0	Significantly Off Track
	Kororoit Creek Lower	5	7.70	On Track
	Laverton Creek	5	3.20	On Track
	Little River Lower	2	0	Significantly Off Track
	Lollypop Creek	2	3.00	On Track
	Skeleton Creek	5	6.90	On Track
	Toolern Creek	5	2.26	On Track
	Werribee River Lower	5	0.53	Significantly Off Track
	Werribee River Middle	2	2.00	On Track
<b>Maribyrnong River</b>				
	Deep Creek Lower	5	-	Significantly Off Track
	Emu Creek	8	-	Significantly Off Track
	Jacksons Creek	25	1.30	On Track
	Maribyrnong River	10	1.08	Significantly Off Track
	Moonee Ponds Creek	3	2.00	On Track
	Steele Creek	2	-	Significantly Off Track
	Stony Creek	2	0.30	Significantly Off Track
	Taylors Creek	2	0.50	Slightly Off Track
<b>Yarra River</b>				
	Brushy Creek	1	0.20	Slightly Off Track
	Darebin Creek	5	3.26	On Track
	Diamond Creek (Rural)	5	7.10	On Track
	Gardiners Creek	1	3.10	On Track
	Merri Creek Lower	10	1.37	On Track
	Merri Creek Upper	5	3.17	On Track
	Mullum Mullum Creek	1	-	Significantly Off Track (Small target)
	Olinda Creek	1	1.00	On Track
	Plenty River Lower	5	-	Significantly Off Track
	Plenty River Upper	5	-	Significantly Off Track
	Steels and Pauls Creek (Rural)			
	Yarra River Middle	5	1.00	Significantly Off Track
	Yarra River Lower	4	0.65	Significantly Off Track
<b>Dandenong Creek</b>				
	Bayside	1	0.45	On Track
	Blind Creek	2	0.60	On Track
	Corhanwarrabul, Monbulk and Ferny Creeks	2	1.00	On Track
	Dandenong Creek Lower	3	4.10	On Track
	Dandenong Creek Middle	5	2.00	On Track
	Dandenong Creek Upper	1	-	Significantly Off Track (small target)
	Eumemmerring Creek	10	4.60	On Track
	Kananook Creek	2	2.00	On Track
<b>Westernport &amp; Mornington Peninsula</b>				
	Bunyip River Middle and Upper	1	-	Significantly Off Track (small target)

Catchment	Sub Catchment	Target – 2028 (km)	Improvement @ 21/22 (km)	Tracking
	Cardinia, Toomuc, Deep and Ararat Creeks	20	8.60	On Track
	Dalmore Outfalls	5	2.20	On Track
	Mornington Peninsula North-Eastern Creeks	5	0.4	Significantly Off Track
	Mornington Peninsula South-Eastern Creeks	5	-	Significantly Off Track
	Mornington Peninsula Western Creeks	5	0.24	Significantly Off Track
	Tarago River	1	-	Significantly Off Track (small target)

Annual progress tracking for access is shown in Appendix 2: Annual Access and Participation Performance Objective Tracking. A case of improving access is outlined below.

### Case Study: Improving on-water access to the Yarra River

For the first time, the Healthy Waterways Strategy 2018 includes on-water access targets to encourage recreational paddling activities and improve community safety. Melbourne Water has partnered with Manningham City Council and Paddle Victoria to undertake works to improve canoe and kayak access to the Yarra River near Westerfolds Park, Templestowe. To maintain our assets and improve the natural amenity and liveability of the area, mudstone steps have been installed down the bank into the river beneath Fitzsimmons Lane Bridge. Formalised judging and spectator seating areas adjacent to the bridge have been installed to support slalom kayaking competitions in the area. Revegetation works have also been undertaken to create a green and improved space for people to enjoy. It was important for Melbourne Water to collaborate with Paddle Victoria and our customers, to ensure that river user needs were considered and understood.

**This is important because** with Melbourne’s population increasing in size and density, waterways provide a popular space for recreation and connection to nature. With increased interest in paddling (canoeing, kayaking) demonstrated across Melbourne, Melbourne Water and its partners have a responsibility to ensure that the community has safe access at both existing and any new access points created. We also need to ensure the experience of accessing our waterways are suitable for a diverse range of users, such as people with mobility limitations. These works will contribute towards achieving the strategic objectives and vision of the Regional Paddle Sports Centre.

**Next we need to** continue to improve recreation outcomes along the Yarra River to support the future Regional Paddle Sports Centre, which includes upgrading the main canoe launch facility downstream with all access infrastructure to encourage people with disabilities to access the river. Melbourne Water and our partners are have also developed a Lower Werribee Amenity Action Plan which includes initiatives to deliver further on-water access facilities and increase recreation outcomes in the Werribee River Catchment.



## Participation

Participation is defined as community (community currently means the general public and any group that are funded by Melbourne Water through a grant) involvement in stewardship activities that are related to caring for a waterway. Stewardship activities include;

- Citizen science (e.g. Waterwatch, frog census, platypus spot, environmental DNA sampling, Birdlife surveys)
- Incentives (e.g. funding for weed control and revegetation on stream frontages, rural land management, stormwater management, funding for community groups)
- Events (e.g. training, workshops,)
- Education (school programs, Kids teaching Kids, tours of Western Treatment Plant, webinars etc,)
- Digital engagement (e.g. Your Say, participation in apps, interaction on social media)

The participation performance objective in the HWS is typically worded as follows: *“Increase participation rates from moderate to very high; support community groups and citizen science, connect with growth area communities and build capacity of land owners through rural programs.”*

Contribution towards targets only applies to the delivery of activities within sub-catchments that have a participation performance objective. Participation numbers are capped at the target value for each sub-catchment (e.g. if participation for a year was 25 people but the overall target is 20 by 2028, then only the value of 20 can be counted for that year).

The target is based on the trajectory of participation over the past 10 years with a 'stretch' factor and takes into account the population living within the sub-catchment. Specifically it was based on the number of participants in Melbourne Water funded waterway improvement grants and citizen science programs.

Progress towards the participation performance objectives are presented below (Table 14), all catchments are 'On-Track'. As highlighted in the progress reports (Appendix 2), COVID19 significantly impacted participation activities. While incentives were typically much lower than previous years, digital engagement increased substantially. Fortunately, Melbourne Water and partners were able to adapt to ensure participation was in line with COVID-Safe guidelines.

Table 14. Status of Participation Performance Objectives.

Catchment	Target (21/22)	Results (People)	Status - Achieved to Date	Performance Rating
Werribee River	2,771	3,183	115%	On Track
Maribyrnong River	2,477	2,919	118%	On Track
Yarra River	7,190	9,343	130%	On Track
Dandenong Creek	3,412	4,599	135%	On Track
Westernport	1,973	2,948	149%	On Track

Results have not been provided at a sub-catchment scale because:

- Unlike most other performance objectives which are cumulative (i.e. build over time), participation results restart from zero each year. This means that targets may be reached in one year but not in consequent years, such as the year of reporting. Currently the reporting of participation rates at a sub-catchment scale is more sensitive to annual changes.

- There has been a trend with more participation occurring online, so many participation results can only be attributed at a regional scale (i.e. social media likes or webinar attendance). In 21/22 there were 8,711 participants (38%) that could only be attributed at a regional scale. Therefore we are unable to accurately determine to which sub-catchment these participants should be accounted to as information pertaining to where people live is not considered. To ensure we count these towards the performance objective results, the regional value is split across the 5 catchments proportionally based on population.

The method for assessing and rating participation performance objectives is under review.

Annual progress tracking for participation is shown in *Appendix 2: Annual Access and Participation Performance Objective Tracking*.

### Water Quality for Recreation

Activities in and on the water, such as swimming (primary contact), and boating (secondary contact), provide an important recreational value as well as connection to the waterway.

Recreational water quality can be impacted by the presence of water-borne pathogens that can increase the risk of illness. These pathogens can arise from a variety of sources including illegal cross connections between sewers and stormwater, leaking sewers, poorly operating or old-design septic tanks, food waste discharges and faeces directly deposited or washed into waterways from livestock, wild, or domestic animals.

Measurements of the bacteria *Escherichia coli* are used as an indicator for the presence of pathogens and faecal pollution. This is often referred to as microbial water quality. EPA Victoria's Environment Reference Standard (2021) and the National Health and Medical Research Council's Guidelines for Managing Risks in Recreational Waters (2008) provide guidance on assessing microbial water quality and characterising risks to public health.

Based on the latest water quality results from 2021-22, the Werribee River and Dandenong Creek catchments are currently 'On Track' to meet performance objectives in the Healthy Waterways Strategy (Table 15) .

The Yarra River catchment is 'Slightly Off-Track' and a study is currently underway to better understand the health risk from pathogens in the Yarra River. The Maribyrnong River catchment is 'Significantly Off Track' and further investigation is required to better understand the causes of faecal pollution in this catchment.

Stormwater runoff is the most common cause of water pollution during and after rainfall. Therefore, climate fluctuations have a significant influence on long-term condition and there is typically some annual variability in recreational water quality. Regardless, recreational water quality in these four catchments has remained relatively steady or has improved over the past five years.

Table 15. Status of Water Quality for Recreation Performance Objectives.

Catchment	Relevant Sub Catchment	Recreational water quality monitoring sites	Status 2021-22	Comment
Dandenong Creek	Dandenong Creek Lower, Kananook Creek	Patterson River at the National Water Sports Centre, Kananook Creek	On-Track	Two monitoring sites in the Dandenong catchment met the long-term standard to support recreational activities for boating (secondary contact) in dry weather. In wet weather (rainfall in the 24 hours prior to testing), the standard was not met at Kananook Creek due to elevated levels of <i>E.coli</i> . Water quality at these locations has remained relatively steady or has improved over the past five years.
Maribyrnong River	Maribyrnong River	Maribyrnong River at Brimbank Park, Maribyrnong River at Canning St Ford, Maribyrnong River at Ascot Vale	Significantly off-track	Three monitoring sites in the Maribyrnong catchment met the long-term standard to support recreational activities for boating (secondary contact) only. Water quality at Brimbank Park and also downstream at Braybrook and Ascot Vale were not suitable for swimming (primary contact) due to elevated levels of <i>E.coli</i> . Water quality at these locations has remained relatively steady over the past five years.
Werribee River	Cherry Creek, Werribee River Lower	Cherry Lake, Werribee River at the irrigation weir in Riverbend Park	On-Track	Two monitoring sites in the Werribee catchment met the long-term standard to support recreational activities for boating (secondary contact) at Cherry Lake and the Werribee River at Riverbend Park. In dry weather, water quality in the Werribee River at Riverbend Park also met the long-term standard for swimming (primary contact). Water quality at these locations has remained relatively steady over the past five years.
Yarra River	Yarra River Lower, Yarra River Upper (Rural)	Yarra River at Kew, Yarra River, at Warrandyte, Yarra River at Healesville, Yarra River at Launching Place	Slightly Off-track	Four monitoring sites in the Yarra River met the long-term standard for boating (secondary contact) but not swimming. In dry weather, water quality at Warrandyte regularly met the short-term standard for swimming (primary contact). However, the other three monitoring sites (Launching Place, Healesville and Kew) were not suitable for swimming. Water quality at these locations has remained relatively steady over the past five years.

### Increasing vegetation extent:

Vegetation extent is a key condition relevant to a number of waterway values, and is measured based on canopy cover from remote sensing data. In regards to waterway amenity, recreation and community connection, vegetation extent impacts the aesthetic landscape, provides a sense of connection to nature (including wildlife) and physically provides urban cooling through shade (e.g. health and wellbeing outcomes).

The vegetation extent target is to achieve a 50% canopy cover along streams within the Urban Growth Boundary. If these reaches were not already prioritised for environmental values then the gap to 50%

was estimated (based on a 10m wide buffer) and added to the sub-catchment performance objective. This equates to 1km or 24 ha. The status of performance objectives for vegetation is shown in Table 16 and Table 17. Further details are presented in the Vegetation Technical Report for Mid-term Review (Melbourne Water, 2023d).

Table 16. Status of Vegetation Extent (canopy) Performance Objectives - Catchment Scale.

Catchment	Target 2028 (ha)	Results (ha)	Status - Achieved to Date	Performance Rating
Werribee	1755	291.51	17%	Significantly Off Track
Maribyrnong	1622	292.98	18%	Significantly Off Track
Yarra	1500	367.46	24%	Slightly Off Track
Dandenong	157	128.6	82%	On Track
Westernport	2849	438.58	15%	Significantly Off Track

Table 17. Status of Vegetation Extent (canopy) Performance Objectives – Sub-Catchment Scale.

Catchment	Sub Catchment	Target - 2022 (ha)	Improvement (ha)	Tracking
<b>Werribee River</b>				
	Cherry Creek	1.6	14	On Track (Complete)
	Kororoit Creek Lower	34	63.1	On Track (exceeding target)
	Kororoit Creek Upper	72	3.4	Significantly Off Track
	Laverton Creek	22.8	42.1	On Track (exceeding target)
	Lerderderg River	12.8	40.2	On Track (exceeding target)
	Little River Lower	39.6	9.1	Significantly Off Track
	Little River Upper	145.2	4.9	Significantly Off Track (Large Target)
	Lollypop Creek	40	3.5	Significantly Off Track
	Parwan Creek	14.8	1	Significantly Off Track
	Skeleton Creek	61.2	3.6	Significantly Off Track
	Toolern Creek	47.6	51.8	On Track (exceeding target)
	Werribee River Lower	45.6	30.4	Slightly Off Track (Large Target)
	Werribee River Middle	79.6	21.2	Slightly Off Track (Large Target)
	Werribee River Upper	85.2	3.4	Significantly Off Track (Large Target)
<b>Maribyrnong River</b>				
	Boyd Creek	50.4	2.8	Significantly Off Track
	Deep Creek Lower	61.6	1.6	Significantly Off Track
	Deep Creek Upper	230	171.6	Slightly Off Track (Large Target)
	Emu Creek	63.6	18.3	Slightly Off Track
	Jacksons Creek	155.6	64.7	Slightly Off Track (Large Target)
	Maribyrnong River	33.2	30.1	Slightly Off Track
	Moonee Ponds Creek	52.4	0	Significantly Off Track
	Steele Creek	1.2	4	On Track (Complete)
	Stony Creek			On Track (small target)
	Taylors Creek	0.8	0	On Track (small target)
<b>Yarra River</b>				
	Brushy Creek	0.8	0	On Track (small target)
	Darebin Creek	48.8	1.1	Significantly Off Track
	Diamond Creek (Rural)	40.4	38.3	Slightly Off Track
	Diamond Creek (Source)	6.8	0.5	Significantly Off Track
	Gardiners Creek	2	0	On Track (small target)
	Koonung Creek	1.2	0	On Track (small target)
	Little Yarra River and Hoddles Creek	17.6	64.9	On Track (Complete)
	Merri Creek Lower	4	2	Slightly Off Track
	Merri Creek Upper	85.2	25.5	Slightly Off Track (Large Target)
	Mullum Mullum Creek	2.8	0	On Track (small target)

Catchment	Sub Catchment	Target - 2022 (ha)	Improvement (ha)	Tracking
	Olinda Creek	13.6	23.6	On Track
	Plenty River (Source)			Slightly Off Track
	Plenty River Lower	22.8	17.5	On Track (small target)
	Plenty River Upper	58	12.9	Significantly Off Track
	Steels and Pauls Creek (Rural)	11.2	1.2	Significantly Off Track
	Steels and Pauls Creek (Source)	1.2	0	On Track (small target)
	Stringybark Creek	11.6	3.9	Slightly Off Track
	Watsons Creek	12.4	1.7	Significantly Off Track
	Watts River (Rural)	11.2	3.1	Slightly Off Track
	Watts River (Source)	0.4	0	On Track (small target)
	Woori Yallock Creek	78.4	56.5	Slightly Off Track
	Yarra River Lower	24	73.1	On Track (Complete)
<b>Dandenong Creek</b>				
	Bayside	2.4	0	On Track (small target)
	Blind Creek	1.6	0	On Track (small target)
	Corhanwarrabul, Monbulk and Ferny Creeks	15.2	53.8	On Track (Complete)
	Dandenong Creek Lower	4.4	0	Significantly Off Track
	Dandenong Creek Middle	18.8	63.6	On Track (Complete)
	Dandenong Creek Upper	4	2.5	Slightly Off Track
	Eumemmerring Creek	5.2	0	Significantly Off Track
	Kananook Creek	11.2	8.4	Slightly Off Track
<b>Westernport &amp; Mornington Peninsula</b>				
	Bass River	86.4	69.7	Slightly Off Track (Large Target)
	Bunyip Lower	139.6	93.9	Slightly Off Track (Large Target)
	Bunyip River Middle and Upper	69.6	56	Slightly Off Track
	Cardinia, Toomuc, Deep and Ararat Creeks	118.8	48.3	Slightly Off Track (Large Target)
	Dalmore Outfalls	70	4.5	Significantly Off Track
	French and Phillip Islands	66.8	5.8	Significantly Off Track
	King Parrot and Musk Creeks	64.4	2.1	Significantly Off Track
	Lang Lang River	307.2	36.6	Significantly Off Track (Large Target)
	Mornington Peninsula North-Eastern Creeks	4.4	12.3	On Track (Complete)
	Mornington Peninsula South-Eastern Creeks	34.8	55.2	On Track
	Mornington Peninsula Western Creeks	73.6	32.5	Slightly Off Track
	Tarago River	104	21.6	Significantly Off Track (Large Target)

## Regional Performance Objectives

There has been substantial effort towards RPO-19 which is about transforming modified waterways. The 21/22 summary is provided below and there are a couple of case studies on the website as well: [2020 Waterway improvements social outcomes | Healthy Waterways Strategy for Port Phillip and Westernport, Victoria](#). While there are multiple benefits to these types of works, they are proving to be very expensive. For example, naturalisation of a 600 m reach of Moonee Ponds Creek was costed at \$6.77 million, with provisional costs of an additional \$5 million for disposal of contaminated waste.

Additional highlights from a few more social values related RPOs are provided in Table 18.

Table 18. Highlights from HWS 20/21 annual report for RPOs which relate to social values.

Regional Performance Objective	Highlights from the 2020/21 annual report
RPO- 19: Options to transform modified waterways by creating more natural, community-loved spaces are identified and implemented.	<b>In Progress:</b> A number of Reimagine Your Creek naturalisation projects are underway and are at varying levels of delivery. Tarralla Creek in Croydon is recently completed and is now open to the public. Construction will commence in August on Moonee Ponds Creek in Strathmore. Design on Moonee Ponds in Westmeadows has commenced. The next stage of Blind Creek and Lewis Park has now gone out to tender with construction due to commence in early Jan 2023 and when complete will facilitate the delivery of Knox City Council's Masterplan for the site. The D1 Drain in Hoppers Crossing has gone out to tender for design which began community engagement in September. The restoration of these creeks will activate open space and provide improved access to waterways in highly urbanised areas for community benefit. The projects have delivered a series of walking paths, boardwalks and bridges that connect the community to nature and each other, and has improved pedestrian and cycling connections with other transport links.
RPO-20: The amenity, community connection and recreation values of wetlands are better understood. Performance objectives are developed to enhance these values.	Conceptual models were developed to consider the balance, conflicts and interlinks between wetland ecosystem values and the associated impacts from community access in 2021.
RPO-22: Cooler, greener and more liveable urban environments are created through revegetation and as part of managing excess stormwater.	Melbourne Water prioritised sites and selected 5400 hectares where tree planting can be undertaken to maximise cooling benefits and deliver on outcomes for councils urban forest and cooling strategies. This includes the delivery of a 15 hectare shade and cooling project at Galada Tamboore in Campbellfield. This project will enhance amenity and public use of the shared path through Galada Tamboore, while protecting remnant grassland vegetation and biodiversity values within the reserve.
RPO-26: Methods are in place to assess volume and source of litter to inform and promote litter reduction programs.	Research project was completed under the Aquatic Pollution Prevention Partnership (A3P) led by RMIT. field assessments of qualitative and quantitative monitoring methods for assessing litter on banks and throughout stormwater drain networks were completed, and were trialled across the sites with different stream size, riparian conditions, as well as in wetlands. Monitoring, Evaluation, Reporting and Improvement (MERI) for Litter Program incorporated a broadscale monitoring program for understanding the principal types, sources and quantities of litter entering waterways in key Melbourne Water catchments while providing the baseline information on catchment litter condition at 26 sites in 6 sub-catchments. DEECA have been developing an online portal to collate and display litter data collected by community groups and government agencies.
RPO- 27: Incidence of littering and illegal dumping is reduced through raised community awareness and knowledge, infrastructure and enforcement.	EPA has a dedicated team in place that aims to stop people littering from vehicles. When members of the community report incidents of littering from a vehicle to EPA, the team investigate and verify the report. The team may also issue an infringement notice where appropriate. In the 2021/2022 financial year, EPA issued over 6,900 infringement notices for littering offences. The Lower Dandenong Creek Litter Collaboration (LDCLC) facilitated by Melbourne Water aims to develop a whole-of-sub-catchment collaboration model to reduce litter loads entering waterways. Working with lead partners: City of Casey, Kingston City Council and City of Greater Dandenong the collaboration seeks to build knowledge of litter hotspots and current litter reduction infrastructure and investment. In 21/22 an assessment of litter generation and management was undertaken for the Lower Dandenong Creek sub-catchment. From this, an action plan is now being drafted exploring activities such as efficiency assessment and renewal of key litter management infrastructure like GPTs, improved maintenance of key assets especially ahead of high rainfall events to prevent mobilisation downstream, targeted compliance and enforcement to prevent key commercial and industrial areas putting trade waste down the stormwater system, targeted communication and education, trialling an additional instream litter trap.
RPO-37: Participation rates in education, capacity building, incentive programs and citizen science activities have increased and enable greater levels of	In line with COVID-Safe guidelines, participation was primarily via webinars, virtual workshops (involved over 14,000 participants) or digital volunteering through the Frog Census App. A major upgrade to the Frog Census App was delivered in June 2022. The App enables community volunteers to record and submit frog calls directly to Melbourne Water, contributing to waterway management. The App

Regional Performance Objective	Highlights from the 2020/21 annual report
environmental stewardship for our waterways.	<p>upgrade was informed by customer feedback and an accessibility audit, with the new version being easier to use and providing new content and features.</p> <p>Strategic macroinvertebrate monitoring at Monbulk Creek, Belgrave continued with Waterwatch working with community citizen scientists and an expert aquatic scientist to collect data. Ecological data for the creek has been built on yearly, providing a greater understanding of the biological impacts of improvement works that have occurred at the creek. This involvement of the community is helping build community stewardship over the waterway.</p> <p>Waterwatch also partnered with Cannibal Creek Landcare to collect several eDNA samples along a reach of Cannibal Creek in the Bunyip catchment. A pump-powered eDNA sampler was trialed and resulted in a larger number of samples being collected and higher confidence in sampling results. This project supported Cannibal Creek Landcare's strategic goal of encouraging other landholders in the catchment to get involved in biodiversity projects.</p> <p>A total of 838 private landholder, community and public land manager grants were awarded through Melbourne Water's Stream Frontage Management, Rural Land, and Liveable Communities Liveable Waterways Programs in 2021-22. This amounted to over \$9.9 million in support over multiple years for our delivery partners to utilise their skills, expertise and local knowledge to create great outcomes for waterways across the region</p>
RPO-38: Key messages, stories and resources for waterways and waterway health are collaboratively developed and broadly distributed, increasing community knowledge and engagement around waterways.	<p>Melbourne Water delivered The Creek Project education program to local primary and secondary school groups as part of the Enhancing our Dandenong Creek project. The education program connects local children and schools to Dandenong Creek to increase knowledge and understanding of the creek. By involving students in hands-on activities including water-quality testing and identifying waterbugs (macroinvertebrates) they learn about biodiversity in creek and how to assess creek health. Students and teachers learn directly from Melbourne Water staff and experts from Native Fish Australia and A3P-Aquatic Pollution Prevention Partnership RMIT University.</p> <p>Melbourne Water sponsorship of the 2021 Kids Teaching Kids Conference supported the engagement of over 2,000 students from over 35 schools in an impactful day of environmental education. 100% of all students demonstrated an increase in confidence and increased understanding of environmental issues, and 77% of schools launched new environmental projects.</p> <p>For a week in February, Melbourne Water staff educated the community on water health with stories told through an augmented reality experience hosted at the Melbourne Zoo. The event encouraged people to spend time at their waterways, and take care of the animals that live there by Making Litter Extinct.</p> <p>The Western Treatment Plant virtual tour was updated in early 2022, with new videos, images and content added with stories on biodiversity and the internationally significant wetland areas of the site. This digital resource has been popular with schools, students and the community and increases knowledge and appreciation for this area of Melbourne.</p> <p>Celebrating the Platypus in the Diamond Creek event is an example of events for the community which provide different ways to celebrate and learn about waterways. To protect platypus, signs were installed featuring children's drawings from a poster competition run by Bacchus Marsh Platypus Alliance.</p>
RPO-43: The social values framework, information and methods used to develop values assessments, targets and performance objectives are further developed and improved during the life of the Strategy.	<p>The social values assessment framework has been further refined in 2021/22, considering new methodologies for calculating the social values scores for Amenity, Recreation and Community Connection. New approaches to evaluate access metrics and rubrics were evaluated and mapped. Methods and levels of service for assessing the condition 'Litter' were also initiated through the A3P The Aquatic Pollution Prevention Partnership (RMIT) and will provide better guidance for scoring Litter at a sub-catchment scale in future Report Cards. This work is ongoing and the findings will be integrated into the updated social values framework. Melbourne Water has also commenced testing 'visitation' data around waterways, this approach will be incorporated in the future years as the dataset and its value is better understood. The completion of this RPO has been further recommended in as part of this review.</p>

### 3. Evaluation questions and approach

The social values framework, for Amenity, Recreation and Community Connection has been calculated following a consistent methodology in accordance with the Healthy Waterways Strategy 2018 baseline (using 2016 survey data). The following analysis is based on a comparison that tracks changes between the baseline (2016) datasets and most recent survey dataset (2022). Error bars have been included in key evaluation criteria (KEQ) 3a assessments of waterway amenity, recreation and community connection graph to indicate uncertainty, these are graphed to one standard deviation for data samples pertaining to a given catchment. Graphs have also been fitted with the score categories for reference (e.g. low, moderate, high).

It's also worth noting the following limitations when considering the calculation method and data sources used:

- Of the 69 sub-catchments; only a fraction (between 13– 24 sub-catchments) have statistically significant data sample sizes, the *Community Perceptions Survey* reports consider this when a sub-catchment has a sample size greater than 20.
- Over the years, the supplier and methodology conducting survey questioning has changed, with different creeks and rivers being options within the survey and a digital pin drop function also included in recent surveys. Post 2018 survey questions have considered the Social Values Conceptual Model conditions as part of the survey questions (e.g. how satisfied are you with condition of litter) whereas previous surveys questions included some lines of questions not identified in the conceptual models (e.g. do you visit to feed the ducks and my level of satisfaction is...), however these questions do not form part of the scoring method for waterway amenity, recreation and community connection (KEQ3a) but are considered separately in KEQ3b.
- Data about waterway satisfaction can be traced back to the 1998 survey, however in the initial years this data was only collected for selective or pre-selected sub-catchments (e.g. 1998 included Lang Lang, Kororoit Creek, Mullum Mullum Creek, Merri Creek and Diamond Creek). These sub-catchment datasets have been used as 'proxy's' to represent the greater catchment (e.g. Lang Lang represents Westernport catchment), and as the survey progressed new sub-catchments have been added to the list (while some have also been removed).
- Due to the types of questions posed and data received, only surveys since 2012 have been able to derive satisfaction scores for Amenity (2012), Recreation (2012) and Community Connection (2018) using the current calculation method, however these pre-HWS2018 years have not been used to evaluate social values trajectory because data is of a small sample size and only attributed to a limited number of catchments.

#### KEQ 3a. To what extent are key values on the target trajectory?

The current indicator (satisfaction) and metrics used to analyse the community perceptions data as outlined in the Rivers MEP is presented in Table 19.

Table 19. Social Values metric and indicator.

Key Value	Metric Description	Very low	Low	Moderate	High	Very high
Amenity	Based on data from Melbourne Water community perceptions of waterways research on 'satisfaction with waterways' in relation to amenity related activities	Very low level of satisfaction with amenity	Low level of satisfaction with amenity	Moderate level of satisfaction with amenity	High level of satisfaction with amenity	Very high level of satisfaction with amenity
	Average satisfaction scores (0 to 10) from survey respondents	0 - 4	4 - 6	6 - 7	7 - 8	8 - 10
Connection	Based on data from Melbourne Water community perceptions of waterways research on 'satisfaction with waterways' in relation to community connection activities	Very low level of satisfaction with community connection	Low level of satisfaction with for community connection	Moderate level of satisfaction with community connection	High level of satisfaction with community connection	Very high level of satisfaction with community connection
	Average satisfaction scores (0 to 10) from survey respondents	0 - 4	4 - 6	6 - 7	7 - 8	8 - 10
Recreation	Based on data from Melbourne Water community perceptions of waterways research on 'satisfaction with waterways' in relation to community connection activities	Very low level of satisfaction with recreation	Low level of satisfaction with recreation	Moderate level of satisfaction with recreation	High level of satisfaction with recreation	Very high level of satisfaction with recreation
	Average satisfaction scores (0 to 10) from survey respondents	0 - 4	4 - 6	6 - 7	7 - 8	8 - 10

As a performance rating rubric to assess this KEQ was not developed as part of the Rivers MEP one has been developed specifically for this mid-term evaluation. This rubric (Table 20) considers where each of the social values are at relative to the 2018 baseline, where they are now relative to the long term target.

Table 20. Performance tracking rubric for social values.

Performance Rating	Performance criteria / evidence
<b>On-track</b> to achieving long term target	Value is greater than or equal to baseline
<b>Slightly Off-track</b> to achieving long term target	Value is one category less than baseline (e.g. High to Moderate)
<b>Significantly Off Track:</b> High chance that long term target will not be met	Value condition is more than 1 category less than baseline

Substantially significant population samples of survey data cannot be attributed to each of the 69 sub-catchments, but from recent annual surveys, the following number of sub-catchments are accounted:

Table 21. Sub-catchments where community perception surveys were conducted.

Year	Sub-catchments
2016	13 sub-catchments included (grouped to Management Units rather than sub-catchments): Yarra River (Lower), Yarra River (Middle), Yarra River (Upper), Maribyrnong River (Lower), Maribyrnong River (Upper), Dandenong Creek (not distinguished between lower, middle upper), Werribee River (lower), Werribee River (upper), Kororoit Creek, Cardinia Creek, Lower Bunyip/Lang Lang/Bass River, Upper Bunyip/Tarago, Mornington Peninsula
2020	19 sub-catchments included: Werribee River, Kororoit Creek, Moonee Ponds Creek, Maribyrnong River, Jacksons Creek, Yarra River Lower (x2), Yarra River Middle, Yarra River Upper (Rural), Merri Creek, Darebin Creek, Plenty River, Diamond Creek, Olinda Creek, Mullum Mullum Creek, Dandenong Creek Lower, Dandenong Creek Middle, Kananook Creek, Eumemmerrring Creek, Cardinia/Toomuc/Deep/Ararat Creeks
2021	19 sub-catchments included: Werribee River, Kororoit Creek, Moonee Ponds Creek, Maribyrnong River, Jacksons Creek, Yarra River Lower, Yarra River Middle, Yarra River Upper (Rural), Merri Creek, Darebin Creek, Plenty River, Diamond Creek, Olinda Creek, Mullum Mullum Creek, Dandenong Creek Lower, Dandenong Creek Middle, Kananook Creek, Eumemmerrring Creek, Cardinia/Toomuc/Deep/Ararat Creeks

Year	Sub-catchments
2022	25 sub-catchments included: Werribee River, Kororoit Creek, Moonee Ponds Creek, Maribyrnong River, Jacksons Creek, Yarra River Lower, Yarra River Middle, Yarra River Upper (Rural), Merri Creek (urban), Merri Creek (Rural and Forested), Darebin Creek, Plenty River, Diamond Creek, Olinda Creek, Mullum Mullum Creek, Dandenong Creek Lower, Dandenong Creek Middle, Kananook Creek, Eumemmerring Creek, Cardinia/Toomuc/Deep/Ararat Creeks, Mornington Peninsula Western Creeks, Blind Creek, Brushy Creek, Skeleton Creek, Stony Creek

This inconsistency or gap in datasets covering all sub-catchments is relevant to the methodology used to score each catchment for amenity, recreation, and community connection, as the results consider the average score across each sub-catchment sampled within a greater catchment scale. As noted earlier in the methodology, catchment data samples have been grouped into the management units below.

Table 22. Management Units and Sampled Sub-Catchments.

Catchments categorisation in 2016 (Management Units)	Relevant sub-catchments reported	Number of sub-catchments sampled for 2022 data (representative range)
Dandenong	Bayside Blind Creek Corhanwarrabul, Monbulk and Ferny Creeks Dandenong Creek Lower Dandenong Creek Middle Dandenong Creek Upper Eumemmerring Creek Kananook Creek	5 out of 9 (55%) – High Confidence  Dandenong Creek Middle Kananook Creek Eumemmerring Creek Lower Dandenong Creek Blind Creek
Maribyrnong Lower	Maribyrnong River Moonee Ponds Creek Steele Creek Stony Creek Taylors Creek	3 out of 5 (66%) – High Confidence  Maribyrnong River Moonee Ponds Creek Stony Creek
Maribyrnong Upper	Boyd Creek Deep Creek Lower Deep Creek Upper Emu Creek Jacksons Creek	1 out of 5 (20%) – Low Confidence  Jacksons Creek
Cherry, Kororoit, Laverton, Skeleton	Cherry Creek Kororoit Creek Lower Kororoit Creek Upper Laverton Creek Skeleton Creek	2 out of 5 (40%) – Medium Confidence  Kororoit Creek Lower Skeleton Creek
Werribee and Little River Lowlands	Little River Lower Lollypop Creek Werribee River Lower	1 out of 3 (33%) – Medium Confidence  Werribee River
Werribee and Little River Middle and Upper	Lerderberg River Little River Upper Parwan Creek Toolern Creek Werribee River Middle Werribee River Upper	1 out of 6 (17%) – Low Confidence  Arnolds Creek
Cardinia Creek	Cardinia, Toomuc, Deep and Ararat Creeks Dalmore Outfalls	1 out of 3 (33%) – Medium Confidence  Cardinia Creek
French and Phillip Islands	French and Phillip Islands	Unable to assess
Lower Bunyip, Lang Lang and Bass	Bass River Bunyip Lower King Parrot and Musk Creeks Lang Lang River	Unable to assess

Catchments categorisation in 2016 (Management Units)	Relevant sub-catchments reported	Number of sub-catchments sampled for 2022 data (representative range)
Mornington Peninsula	Mornington Peninsula North-Eastern Creeks Mornington Peninsula South-Eastern Creeks Mornington Peninsula Western Creeks	1 out of 3 (33%) – Medium Confidence  Mornington Peninsula Western Creeks (Balcombe Creek)
Upper Bunyip and Tarago	Bunyip River Middle and Upper Tarago River	<i>Unable to assess</i>
Yarra Lower	Darebin Creek Gardiners Creek Koonung Creek Merri Creek (Rural and Forested) Merri Creek (Urban) Plenty River (Source) Plenty River Lower Plenty River Upper Yarra River Lower	7 out of 9 (78%) – High Confidence Darebin Creek Gardiners Creek Merri Creek (urban) Merri Creek (Rural and Forested) Plenty River (Lower) Yarra River Lower (D/S Dights) Yarra (Dights-Warrandyte)
Yarra Middle	Brushy Creek Diamond Creek (Rural) Diamond Creek (Source) Mullum Mullum Creek Olinda Creek Steels and Pauls Creek (Rural) Steels and Pauls Creek (Source) Stringybark Creek Watsons Creek Watts River (Rural) Woori Yallock Creek Yarra River Middle Yarra River Upper (Rural)	5 out of 13 (39%) – Medium Confidence  Yarra River Middle (Warrandyte - Healesville) Brushy Creek Diamond Creek (Rural) Mullum Mullum Creek Olinda Creek
Yarra Upper	Little Yarra River and Hoddles Creek Watts River (Source) Yarra River Upper (Source)	1 out of 3 (33%) – Medium Confidence  Yarra River Upper (Healesville to Upper Yarra Reservoir)

\*Confidence rubric considers: High (>50%), Medium (30%-50%), Low (<30%).

## Amenity

Amenity results across the management units are shown in Table 23. For the 11 management units where data exists, none are 'Off Track' with four 'On Track'. Both Werribee and Little River Middle and Upper and Maribyrnong River Upper were performing better than in the baseline year (2016).

Individual sub-catchments with data showed in 2022 the average amenity satisfaction score was 68% across 28 sample locations (24 sub-catchments). The maximum amenity satisfaction score was 80% recorded within the Dandenong Creek Middle (Tarralla Creek) and the minimum was 61% recorded at Kananook Creek sub-catchment, both these catchments are located within the Dandenong Creek catchment.

In performance rating terms for amenity satisfaction, 8 sub-catchment samples scored high, 19 sub-catchment samples scored 'moderate' and 1 sub-catchment sample (Dandenong Creek Middle at Tarralla Creek) scored very high.

As a comparison of all amenity satisfaction data, there were some statistically significant recordings (where a score is outside the 95% confidence level). These included:

- Dandenong Creek Middle (Tarralla Creek sample) sub-catchment score of 80% satisfaction in 2022 was significantly ‘high’ (outside the upper bound limit 78%).
- Olinda Creek sub-catchment score of 79% satisfaction in 2020 was significantly ‘high’ (outside the upper bound limit 78%).
- Kananook Creek sub-catchment score of 61% satisfaction in 2022 was significantly lower than other amenity scores (below the lower bound limit 62%).

Table 23. Amenity Performance Ratings.

Catchments (Management Units)	Baseline (2016) Score	2022 Score	Performance Rating
Dandenong Creek	High	Moderate	Slightly off track
Maribyrnong River Lower	High	Moderate	Slightly off track
Maribyrnong River Upper	Moderate	High	On Track
Cherry, Kororoit, Laverton, Skeleton	High	Moderate	Slightly off track
Werribee and Little River Lowlands	High	Moderate	Slightly off track
Werribee and Little River Middle and Upper	Low	Moderate	On Track
Cardinia Creek	High	Moderate	Slightly off track
French and Phillip Islands	N/A	N/A	N/A
Lower Bunyip, Lang Lang and Bass	High	N/A	N/A
Mornington Peninsula	High	High	On Track
Upper Bunyip and Tarago	Moderate	N/A	N/A
Yarra River Lower	High	Moderate	Slightly off track
Yarra River Middle	Very High	High	Slightly off track
Yarra River Upper	High	High	On Track

Maribyrnong River Upper has improved from moderate (69%) to high (70%) rating since 2016 and is rated ‘On Track’, however although this is a categorical improvement the statistical improvement is insignificant (only 1%). Conversely Maribyrnong River Lower has declined from a high to moderate rating and is considered ‘Slightly Off Track’.

Two management units could be assessed in 2022 for the Maribyrnong River catchment, from four sub-catchments of data (Maribyrnong River, Moonee Ponds Creek, Jacksons Creek and Stony Creek), including 2 new sub-catchments in 2021 plus one more sub-catchment in 2022. One sub-catchment, Jacksons Creek scored high in 2022, the other three all scored moderate ranging from 69% satisfaction (Maribyrnong River sub-catchment) to 62% satisfaction (Moonee Ponds Creek Creek).

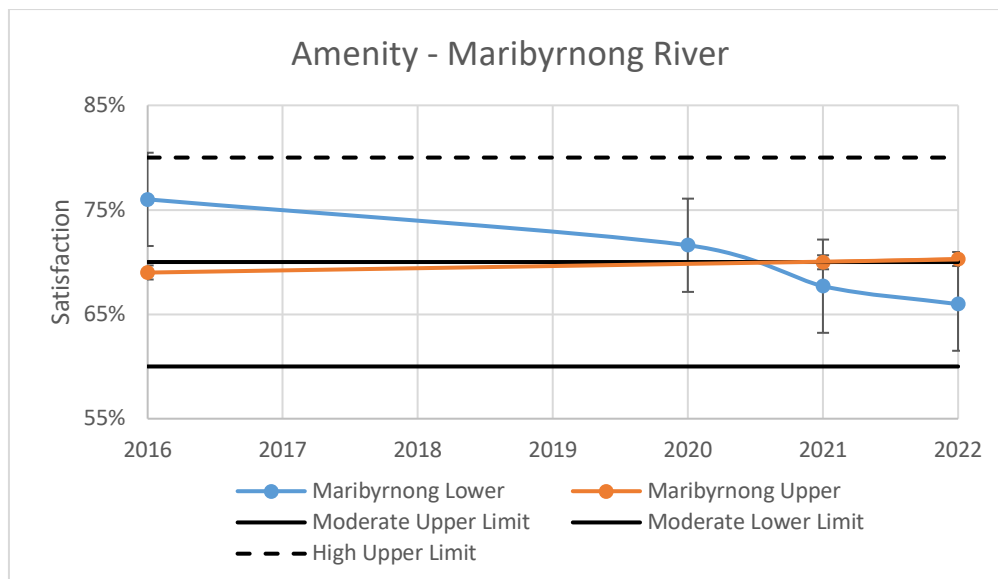


Figure 5. Amenity Performance Rating - Maribyrnong Catchments.

For the Werribee River catchment, three management units could be assessed in 2022, from four sub-catchments of data (Werribee River Lower, Werribee River Upper Kororoit Creek and Skeleton Creek), including 2 new sub-catchments in 2022. The Werribee and Little River Middle and Upper management unit is rated as 'On Track' and both Werribee and Little River Middle and Lower and Cherry, Kororoit, Laverton, Skeleton Creeks management units rated 'Slightly Off Track'.

All four sub-catchments units scored moderate amenity satisfaction in 2022, scores ranged between 67% and 63% satisfaction. Kororoit Creek sub-catchment recorded declines in amenity satisfaction, from 71% (high) in 2020 to 66% (moderate) in 2022.

Werribee & Little River Middle & Upper has increased but from a lower base, improving from low to moderate in 2022. The 2022 data included a new data sample from Arnolds Creek, which has recently received significant investment through the Reimagining Your Creek program to naturalise the drain and enhance surrounding landscape features and open space. However, it is difficult to conclude that there is a causal relationship from the Reimagining 'Arnolds' Creek program because no other samples were recorded within the Werribee and Little River Middle & Upper catchment and no previous amenity satisfaction data was recorded at Arnolds Creek prior to the investment to trace trajectory. The conditions analysis and a separate survey undertaken by the Reimagining Your Creek survey have been further reviewed under KEQ3b section of this report.

Furthermore, the 2021 *Community Perception Survey* report qualitatively noted that safety, which forms a key experience related to amenity as outlined in the Amenity Conceptual Model (Figure 1), is the most important factor for the Werribee River (25%) compared to the regional average (19%). However satisfaction with safety averaged across the Werribee River (upper, middle and lower) catchments only rated at 66%, which is below the regional average (70%), noting this is not statistically significant difference but of interest considering the importance held to safety.

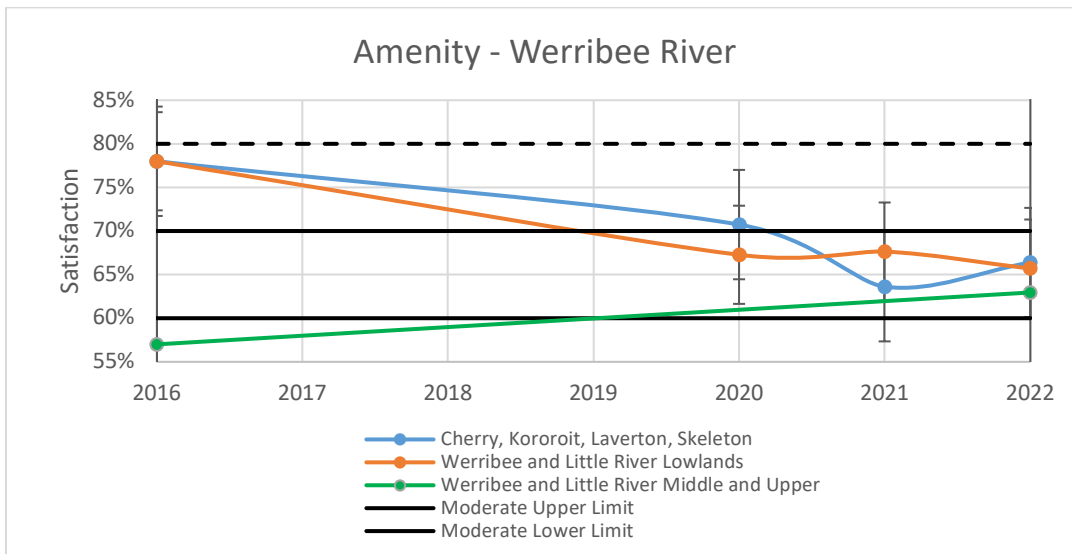


Figure 6. Amenity Performance Ratings - Werribee Catchments.

The other catchments that are 'On Track' are the Mornington Peninsula (Figure 7) and Yarra River Upper (Figure 8). Neither catchment has seen an improvement in performance ratings but rather they have remained with a score of high from 2016 to 2022. The long-term target for both catchments is also high.

For Westernport and Peninsula catchments, two management units could be assessed in 2022, from two sub-catchments of data which were reported from 2021. In 2022, Mornington Peninsula rated as 'On Track' recording a high amenity score with 72% satisfaction. Cardinia Creek was rated as 'Slightly Off Track', scoring a moderate amenity score in 2022 with 66% satisfaction. More data samples are required to better understand the community connection performance in this catchment.

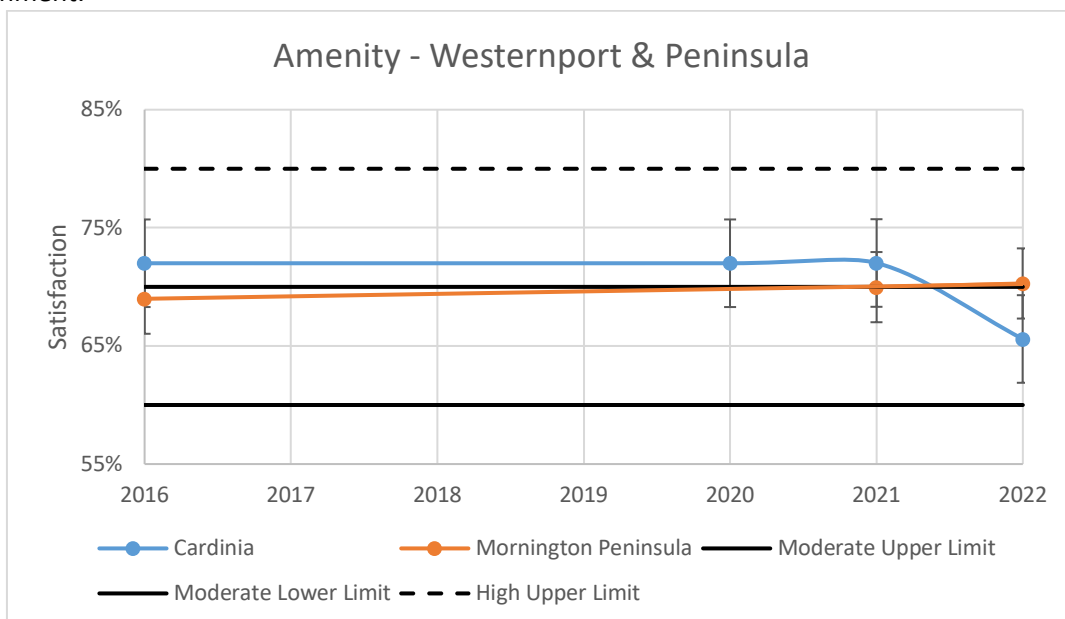


Figure 7. Amenity Performance Rating - Westernport and Mornington Catchments (Noting insufficient data for French & Phillip Island, Lower Bunyip Lang Lang & Bass, Upper Bunyip & Tarago catchments).

For the Yarra River catchment (Figure 8), three management units could be assessed in 2022 from 11 sub-catchments of data, including two new sub-catchments in 2022. Yarra River Upper was rated as 'On Track', and Yarra River Middle and Lower were 'Slightly Off-Track'. The Yarra River Upper is 'On Track' with scores in the same category from the baseline (high).

The Yarra River Middle catchment had a significant downward trajectory over the timeline of the review, starting with a performance rating of very high in 2016 (baseline), it reduced to high in 2020 then moderate in 2021 but increased back to high in 2022. The long-term amenity target for the Yarra River Middle is very high. The Yarra River Lower has seen a continual decline, although this is not statistically significant (within 2 standard variations). However Yarra River Upper was 'On Track' in 2022, where the performance rating is the same as the baseline year (2016).

Five sub-catchments scored high in 2022 for amenity satisfaction; Yarra River Middle sub-catchment, Yarra River Upper sub-catchment, Mullum Mullum Creek, Plenty River and Olinda Creek. Olinda Creek sub-catchment score of 79% satisfaction in 2020 was significantly the highest of any catchment across the region in 2020.

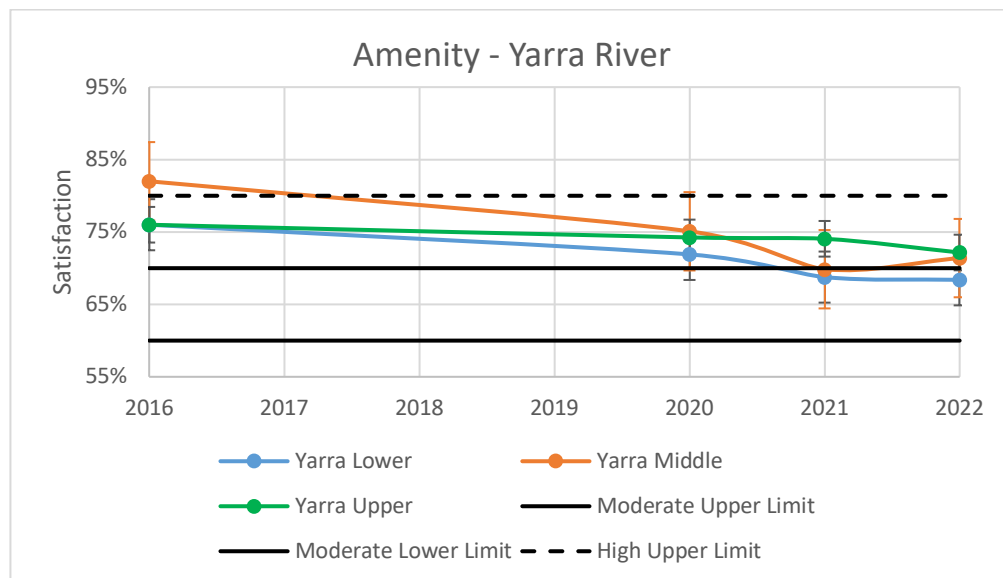


Figure 8. Amenity Performance Rating – Yarra River Catchment.

The Dandenong Creek is reflected as a single management unit, although there were five sub-catchments and six data samples (sites) represented in 2022. The Dandenong Creek is 'Slightly Off-Track' (Figure 9) as the 2022 performance rating is moderate and below the baseline (2016) rating of high.

In 2022, two sub-catchments rated high (Dandenong Creek Middle and Blind Creek). All other sub-catchments rated as moderate. Dandenong Creek Middle sub-catchment score of 80% satisfaction in 2022 was of significance as the maximum amenity satisfaction scores across all catchments and years.

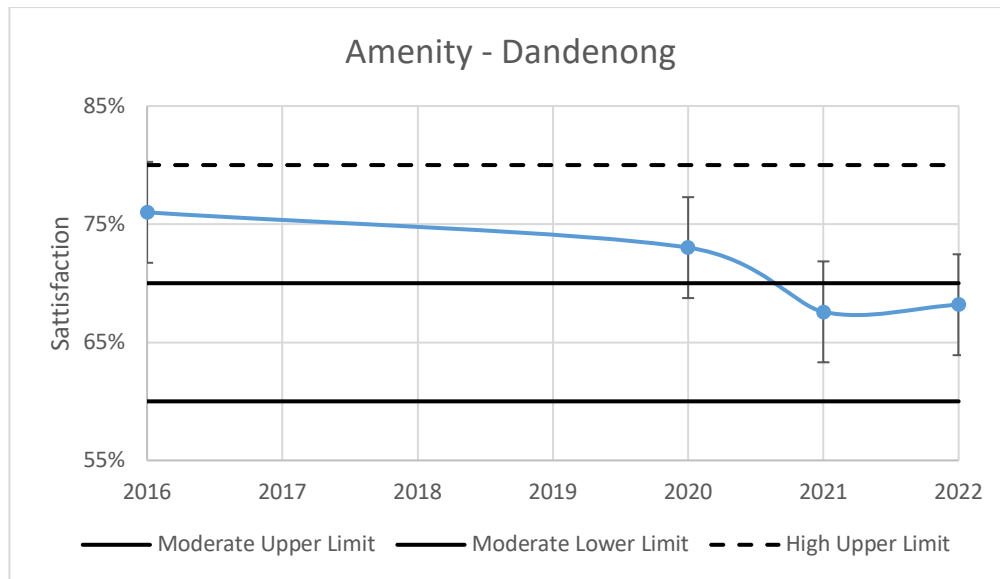


Figure 9. Amenity Performance Rating - Dandenong Catchment.

## Recreation

Recreation results across the management units are shown in Table 24. For the 11 management units where data exists, no catchment management units are significantly 'Off Track', with three 'On Track' whereby they are performing better than in the baseline year (2016). Recreation scores ranged from 62% satisfaction (Cherry, Kororoit, Laverton & Skeleton Creeks catchments in 2021) to 76% satisfaction (Maribyrnong River Lower in 2016). In 2022 the average recreation satisfaction score was 68%, slightly declined from 69% in 2021 and 71% in 2020.

At a sub-catchment scale, the maximum recreation satisfaction score was 81% recorded within the Dandenong Creek Middle (Tarralla Creek) and the minimum was 60% recorded at Kananook Creek sub-catchment, both these catchments are within the Dandenong Creek catchment. This range of recreation satisfaction scores is representative of all other years sampled, representing the minimum and maximums for the data set across all years. The range in 2021 was between 78% and 62% and in 2020 was between 75% and 66%, with the average across all year's 69%.

In performance rating terms for recreation satisfaction, only one management unit catchment scored high - Yarra River Lower in 2022. However at a sub-catchment scale 8 sub-catchment samples scored high (one in Maribyrnong Catchment, five in Yarra Catchment and one in Werribee Catchment), and one sub-catchment sample (Dandenong Creek Middle at Tarralla Creek) scored very high.

As a comparison of all recreation satisfaction data, there were some statistically significant recordings (where a score is outside the 95% confidence level). These included:

- Dandenong Creek Middle (Tarralla Creek sample) sub-catchment score of 81% satisfaction in 2022 was significantly above the upper bound limit (77%).
- Eumemmerring Creek sub-catchment score of 78% satisfaction in 2021 was significantly above other recreation satisfaction scores (outside the upper bound limit of 77%).
- Kananook Creek sub-catchment score of 60% satisfaction in 2022 was significantly below other recreation satisfaction scores (below the lower bound limit of 62%).

Table 24. Recreation Performance Ratings.

Catchments (Management Units)	Baseline (2016) Score	2022 Score	Performance Rating
Dandenong Creek	High	Moderate	Slightly off track
Maribyrnong River Lower	High	Moderate	Slightly off track
Maribyrnong River Upper	High	Moderate	Slightly off track
Cherry, Kororoit, Laverton, Skeleton	High	Moderate	Slightly off track
Werribee and Little River Lowlands	High	Moderate	Slightly off track
Werribee and Little River Middle and Upper	Moderate	Moderate	On Track
Cardinia Creek	High	Moderate	Slightly off track
French and Phillip Islands	N/A	N/A	N/A
Lower Bunyip, Lang Lang and Bass	Moderate	N/A	N/A
Mornington Peninsula	High	Moderate	Slightly off track
Upper Bunyip and Tarago	Moderate	N/A	N/A
Yarra River Lower	High	High	On Track
Yarra River Middle	High	Moderate	Slightly off track
Yarra River Upper	Moderate	Moderate	On Track

Werribee and Little River Middle and Upper has ‘On Track’ performance rating due to a maintained moderate satisfaction score between 2016 baseline and 2022. Werribee River catchments recorded downward trajectories from 2016 to 2021, which was significant for the Cherry, Kororoit, Laverton and Skeleton Creek catchments however the trajectory increased in 2022.

At a sub-catchment scale, only the Skeleton Creek recorded a high score (70%) in 2022. There is no statistically significant variation (95%) between sub-catchments or year to year scores across the Werribee River Catchment. Sub-catchments where satisfaction data is available across the timeline of the review (2016-2022) are Kororoit Creek and Werribee River (main) Lower.

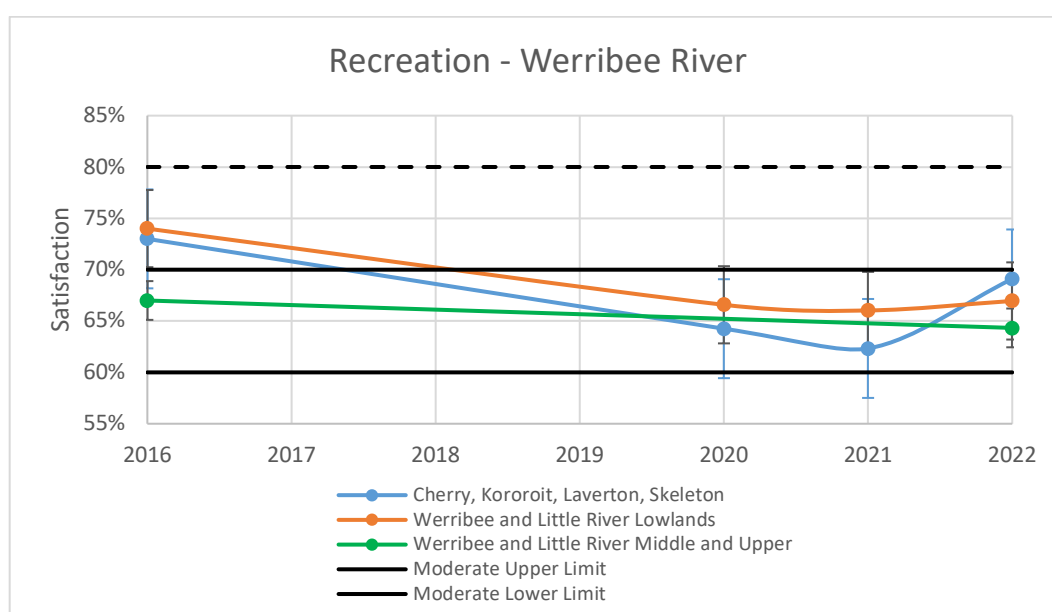


Figure 10. Recreation Performance Rating - Werribee River Catchment.

The Yarra River is the only other catchment with ‘On-Track’ performance ratings, with the Yarra River Lower and Upper maintaining satisfaction scores high and moderate respectively. All three management units could be assessed in 2022 using 11 sub-catchments of data, including 2 new sub-catchments in 2022. The Yarra River Lower and Yarra River Upper both rated ‘On Track’ as scores remained in the same category from the baseline (high and moderate respectively).

There were 5 sub-catchments with recreation satisfaction scores of high in 2022 (Plenty River, Gardiners Creek, Olinda Creek, Brushy Creek and Diamond Creek), the remaining 6 sub-catchment recreation scores were 'moderate'. There is no statistically significant variation (95%) between sub-catchments or year to year scores across the Yarra River Catchment.

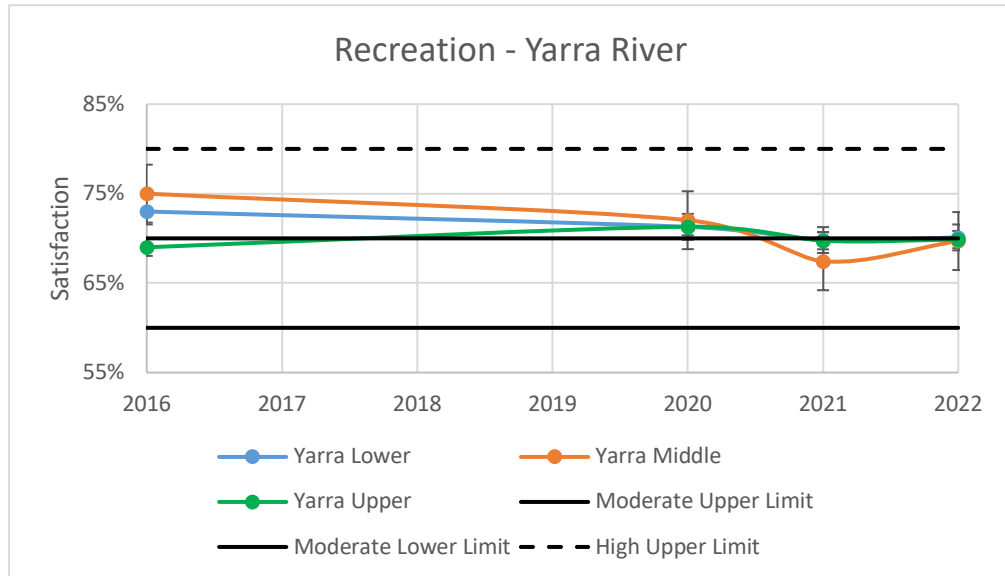


Figure 11. Recreation Performance Rating - Yarra River.

Dandenong Creek represents 1 management unit but consists of 5 sub-catchments of data, including 2 new sub-catchments in 2022. The Dandenong Creek Catchment is 'Slightly Off-Track' as recreation satisfaction scores have declined from high at the 2016 baseline to 'moderate' in 2021 and 2022.

However as mentioned, at a sub-catchment scale the Dandenong Creek Middle (Tarralla Creek sample) score of 81% recreation satisfaction in 2022 was significantly above the upper bound limit (77%) and the sub-catchment is rated very high. This is countered by the Kananook Creek sub-catchment rating of moderate which is a statistically significantly lower recreation satisfaction score of 60% in 2022 compared to all other sub-catchments across the region (below the lower bound limit of 62%).

Across the time period of the review, all Dandenong Creek sub-catchments declined between 2016 baseline and 2022, except the Eumemmerring Creek sub-catchment which increased in 2021 with recreation satisfaction score of 78%, which is above the statistically significant (95%) confidence as a comparison for all recreation data, this score had declined in 2022 to 65% (rating of moderate).

Kananook Creek sub-catchment score of 60% satisfaction in 2022 was the lowest of any recreation satisfaction scores for all catchments across the region and years. There are no clear explanations as to why the recreation satisfaction for Kananook Creek sub-catchment is the lowest. Dandenong Creek Middle (at Tarralla Creek) consistently recorded the highest recreation score however a survey here was only introduced in 2022. High satisfaction scores may be related to the Reimagine Tarralla Creek project, which commenced in 2020 and involved investment in creek naturalisation and surrounding landscape improvements, although it is unclear if these interventions are having a direct impact on satisfaction scores.

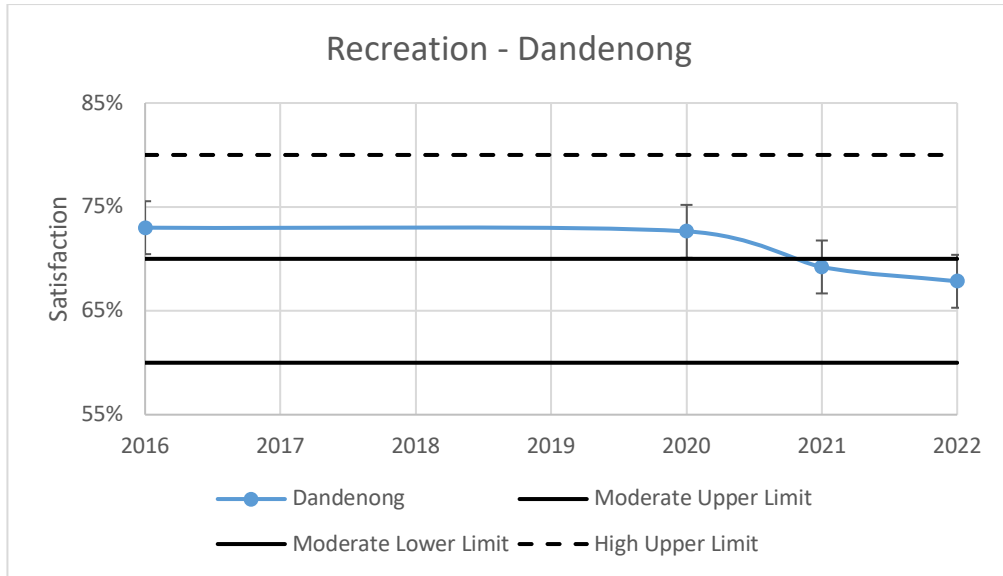


Figure 12. Recreation Performance Rating - Dandenong Creek Catchments.

For the Maribrnyng River catchment, two management units could be assessed in 2022 from four sub-catchments of data (Maribrnyng River, Moonee Ponds Creek, Jacksons Creek and Stony Creek), including 2 new sub-catchments in 2021 plus one more sub-catchment in 2022. Both the Maribrnyng River Upper and Lower have recent 2022 recreation satisfaction scores of moderate and are 'Slightly Off Track'. These recreation satisfaction scores have decreased from the baseline score (high in 2016). The Maribrnyng River Lower catchment had a significant decline in recreation satisfaction scores from 2020 to 2022.

At a sub-catchment scale the Maribrnyng River (main) has scored the highest recreation score with 72% satisfaction or 'high', however this is not a statistically significant in the context of recreation satisfaction data but is the only sub-catchment in the Maribrnyng (Upper or Lower) to record a high rating in 2022. All three other sub-catchments scored moderate in 2022 ranging from 69% satisfaction (Jacksons Creek) to 62% satisfaction (Moonee Ponds Creek).

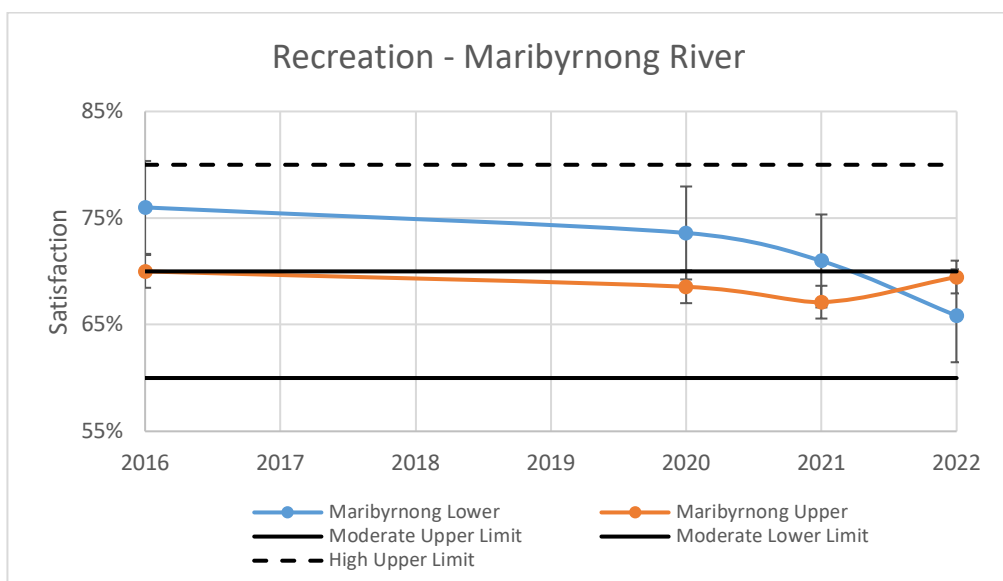


Figure 13. Recreation Performance Rating - Maribrnyng River.

For the Westernport and Peninsula catchments, two management units could be assessed in 2022, from two sub-catchments of data which were reported from 2021. Performance ratings for Westernport and Peninsula catchments are all 'Slightly Off Track', however satisfaction data is poor for the Mornington Peninsula with sub-catchment samples only introduced in 2022. For the Cardinia Creek catchment, recreation satisfaction has declined from high rating to 'moderate' in the most recent 2022 survey.

More data samples are required to better understand the community connection performance in this catchment. There is no recreation satisfaction survey data representing; French & Phillip Islands, Lower Bunyip Lang Lang & Bass or Upper Bunyip & Tarago catchments.

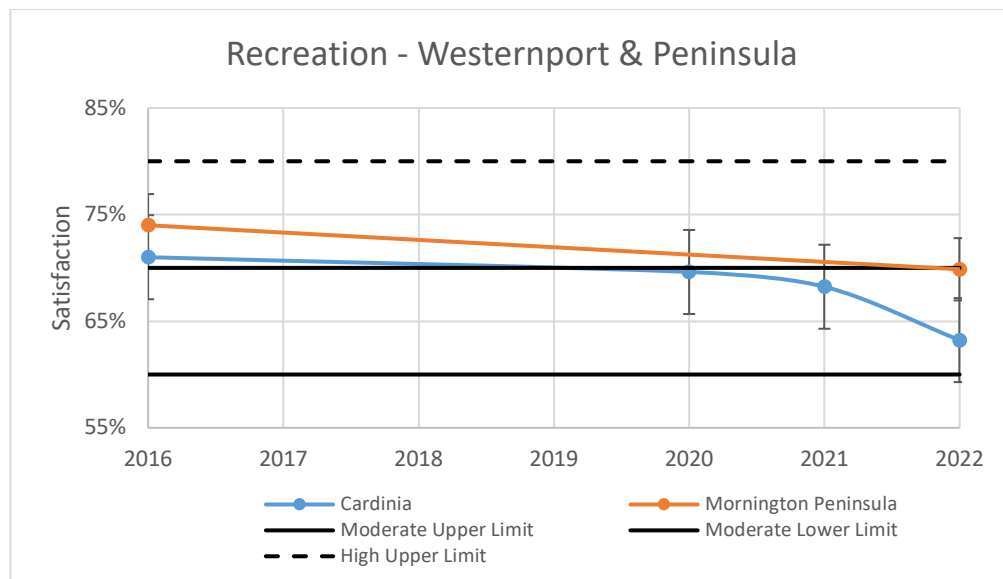


Figure 14. Recreation Performance Rating - Westernport and Peninsula Catchments.

In section KEQ3b we have further explore the satisfaction results relating to the conditions that underpin recreation values, including the satisfaction with recreational facilities (e.g. on-water paddling) and use of waterway corridors for commuting.

### Community Connection

Community connection results across the management units are shown in Table 25. For the 11 management units where data exists, all performance ratings for community connection were moderate in 2022, with scores only ranging from 62% (Werribee & Litter River Middle & Upper) to 68% (Yarra River Upper). A statistical significance low satisfaction score recorded at Werribee & Little River Lowlands in 2020 with 58% satisfaction, however community connection satisfaction had improved by 2022 to 67% (still below 71% satisfaction at baseline).

Cherry, Kororoit, Laverton & Skeleton Creeks and Yarra River Upper were the only catchments rated as 'On-Track' because no reductions occurred in 2022 from the 2016 baseline. These management units both had a baseline score of moderate and returned moderate scores in 2022, rather than most other management units where the baseline community connection score was high.

The 2022 average community connection satisfaction score was 65%, slightly down from 66% in 2020 and 72% in 2016. At a sub-catchment scale, the maximum community connection satisfaction score was 76% recorded within the Eumemmerring Creek (Dandenong Creek management unit) in 2021 and the minimum was 58% recorded at Kananook Creek (Dandenong Creek management unit),

Blind Creek (Dandenong Creek management unit) and Moonee Ponds Creek (Maribryngong River Lower management unit) sub-catchments in 2022.

As a comparison of all community connection satisfaction data, there were some statistically significant recordings (where a score is outside the 95% confidence level). These included:

- Dandenong Creek Middle (Tarralla Creek sample) sub-catchment score of 74% satisfaction in 2022 was higher than other community connection satisfaction scores (outside the upper bound limit of 73%) across the region and years.
- Eumemmerring Creek sub-catchment score of 76% satisfaction in 2021 and 74% in 2020 was significantly higher than other community connection satisfaction scores (outside the upper bound limit of 73%) across the region and years.
- Diamond Creek sub-catchment score of 73% satisfaction in 2020 was not significantly higher than other community connection satisfaction scores but substantially high, being equal to the upper bound limit.

Table 25. Community Connection Performance Ratings.

Catchments (Management Units)	Baseline (2016) Score	2022 Score	Performance Rating
Dandenong Creek	High	Moderate	Slightly off track
Maribyrngong River Lower	High	Moderate	Slightly off track
Maribyrngong River Upper	High	Moderate	Slightly off track
Cherry, Kororoit, Laverton, Skeleton	Moderate	Moderate	On Track
Werribee and Little River Lowlands	High	Moderate	Slightly off track
Werribee and Little River Middle and Upper	High	Moderate	Slightly off track
Cardinia Creek	High	Moderate	Slightly off track
French and Phillip Islands	N/A	N/A	N/A
Lower Bunyip, Lang Lang and Bass	High	N/A	N/A
Mornington Peninsula	High	Moderate	Slightly off track
Upper Bunyip and Tarago	Moderate	N/A	N/A
Yarra River Lower	High	Moderate	Slightly off track
Yarra River Middle	High	Moderate	Slightly off track
Yarra River Upper	Moderate	Moderate	On Track

For the Werribee River catchment, three management units could be assessed in 2022, from four sub-catchments of data (Werribee River Lower, Werribee River Upper, Kororoit Creek and Skeleton Creek), including two new sub-catchments in 2022. The Cherry, Kororoit, Laverton and Skeleton Creeks is one of 2 management units rated as 'On Track' across the region, the other two Werribee River management units were rated 'Slightly Off Track'.

Within the Werribee River catchment, the Cherry Creek, Kororoit Creek and Skeleton Creek is performing 'On-Track' for community connection satisfaction. This is because scores have remained equal to the 2016 baseline score of moderate in 2022, although scores here did decline to low in 2021 but then improved in 2022. The Werribee Lower and Upper catchments also had 'moderate' scores in 2022, however due to their declines from scoring high in 2016, their performances are rated as 'Slightly Off Track'.

All four sub-catchments scored moderate in 2022, scores ranging between 66% and 62% satisfaction. Only Kororoit Creek sub-catchment recorded increases in community connection satisfaction, improving from 58% (low) in 2020 to 66% (moderate) in 2022.

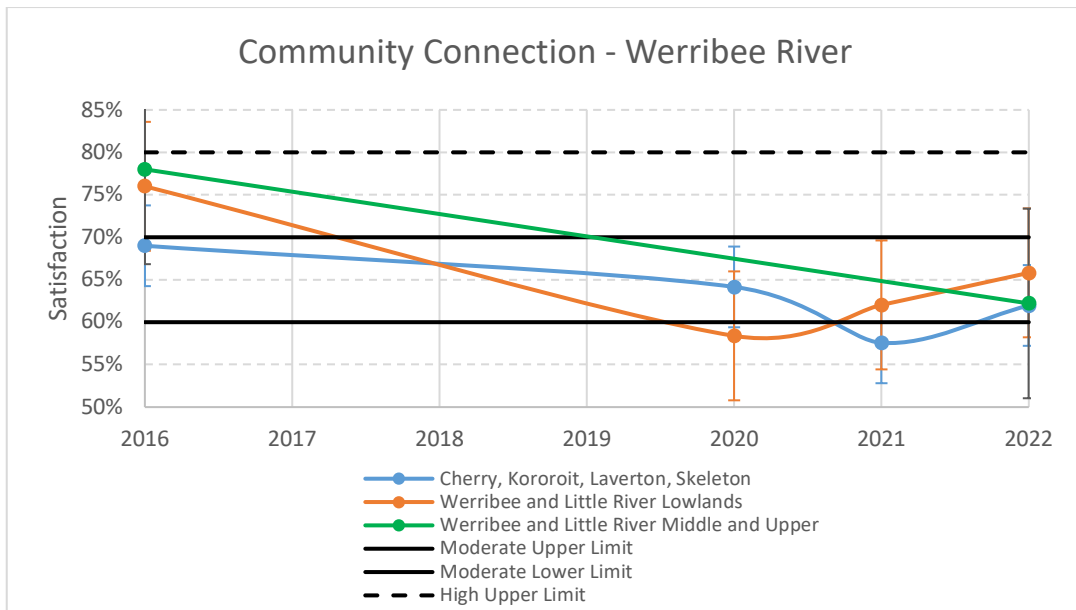


Figure 15. Community Connection Performance Ratings - Werribee River Catchments.

For the Yarra River catchment, three management units could be assessed in 2022 from 11 sub-catchments of data, including two new sub-catchments in 2022. Yarra River Upper rated as 'On Track', Yarra River Middle and Lower were 'Slightly Off-track'.

The Yarra River Upper is also performing 'On Track' as satisfaction scores have remained at their 2016 baseline levels of moderate. There was little variation between both sub-catchment scores and catchment (i.e. management unit) scores across the Yarra River in 2022, with all samples scoring moderate (six sub-catchments sampled, all between 60% minimum at Gardiners Creek and 68% maximum at Plenty River sub-catchment).

The only statistically significant change in community connection within the Yarra River Catchment was received for the Diamond Creek (Yarra River Middle) which scored 73% satisfaction (high) in 2020, which then declined to 'moderate' in 2021 and 2022. The Yarra River (main stem) is the only other sub-catchment sample to score higher than 70% (high), which occurred in 2020 with a satisfaction score of 72%.

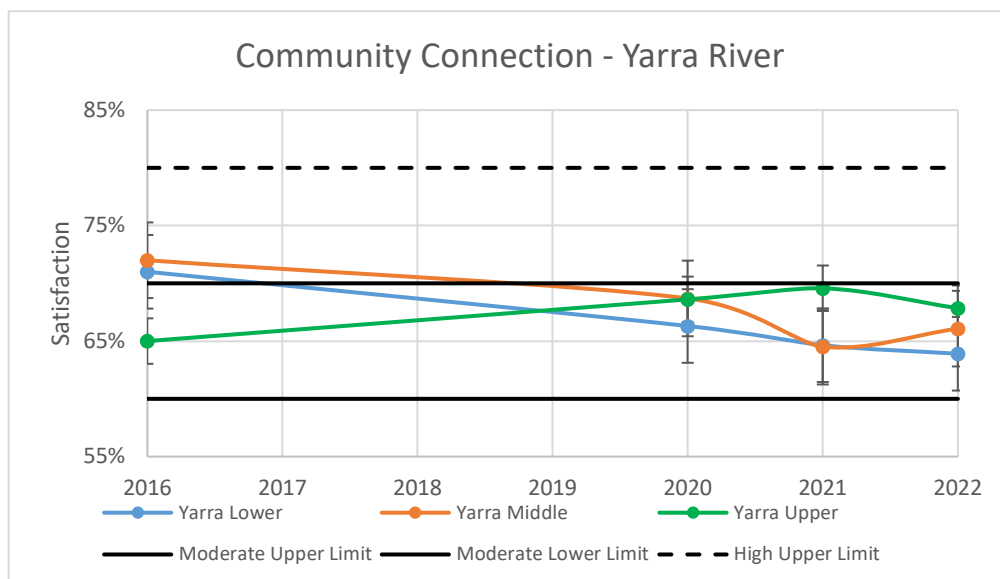


Figure 16. Community Connection Performance Ratings - Yarra River Catchments.

The Dandenong Creek catchment is represented by one management unit but consists of five sub-catchments of data, including two new sub-catchments in 2022. Dandenong Creek rated as 'Slightly Off Track' for community connection. The Dandenong Creek catchment is 'Slightly Off Track' and has a significantly declining trend from a score of high in the 2016 baseline year, to scores within the moderate rating range in 2020 to 2022.

At a sub-catchment scale, community connection satisfaction scores are more varied in the Dandenong Creek Catchment, comparable to amenity and recreation values. The maximum community connection satisfaction score for all catchments across the region and years was 76% recorded within the Eumemmerring Creek in 2021 and the equal lowest was 58% recorded at Kananook Creek sub-catchment in 2021 and 2022, Kororoit Creek in 2021, Moonee Ponds Creek in 2022 and Blind Creek in 2022.

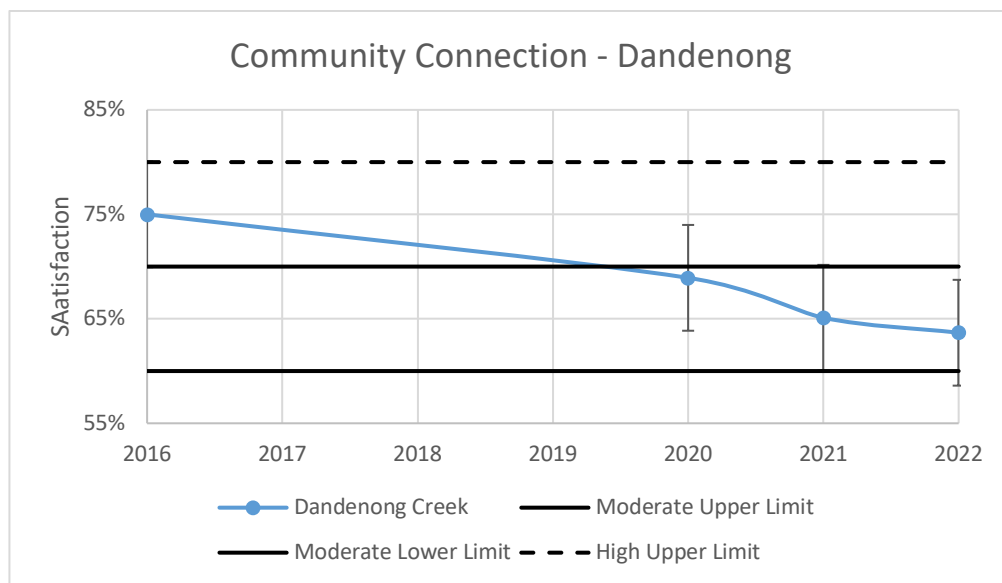


Figure 17. Community Connection Performance Ratings - Dandenong Creek Catchment.

For the Maribyrnong River catchment, two management units could be assessed in 2022 (Maribyrnong River Lower and Maribyrnong River Upper), from four sub-catchments of data (Maribyrnong River, Moonee Ponds Creek, Jacksons Creek and Stony Creek), including 2 new sub-catchments in 2021 plus one more sub-catchment in 2022.

Both Upper and Lower Maribyrnong River catchments are 'Slightly Off-Track'. Three sub-catchments scored moderate in 2022 ranging from 67% satisfaction (Jacksons Creek), to 66% (Maribyrnong River - main) to 65% satisfaction (Stony Creek). One sub-catchment (Moonee Ponds Creek) scored low with 58% satisfaction, down from 62% (moderate) in 2021.

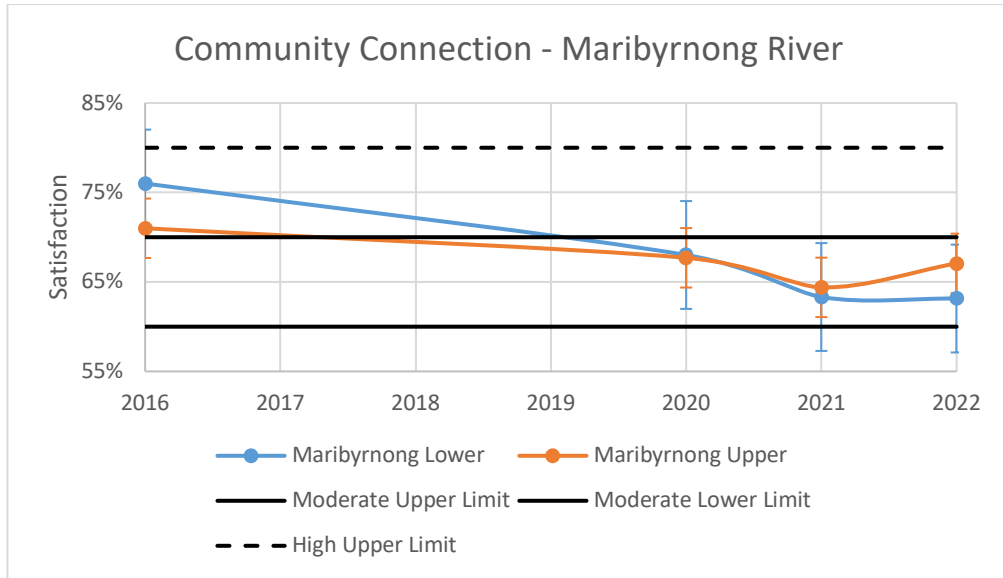


Figure 18. Community Connection Performance Ratings - Maribyrnong River.

For Westernport & Peninsula catchments, two management units could be assessed in 2022 (Cardinia Creek and Mornington Peninsula), from two sub-catchments of data which were reported from 2021. Both management units rated as 'Slightly Off Track', as performance ratings for each have declined from high to moderate in 2022.

At a sub-catchment scale, community connection satisfaction scores were recorded for the baseline in 2016 however proceeding this scores were only recorded from 2021 for Cardinia Creek Catchment and 2022 for Mornington Peninsula Western Creeks (sampled at Balcombe Creek). No other sample locations have recorded data for these two catchments, with no sample data available for; French and Phillip Islands, Lower Bunyip Lang Lang & Bass and Upper Bunyip and Tarago catchments. More data samples are required to better understand the community connection performance in this catchment.

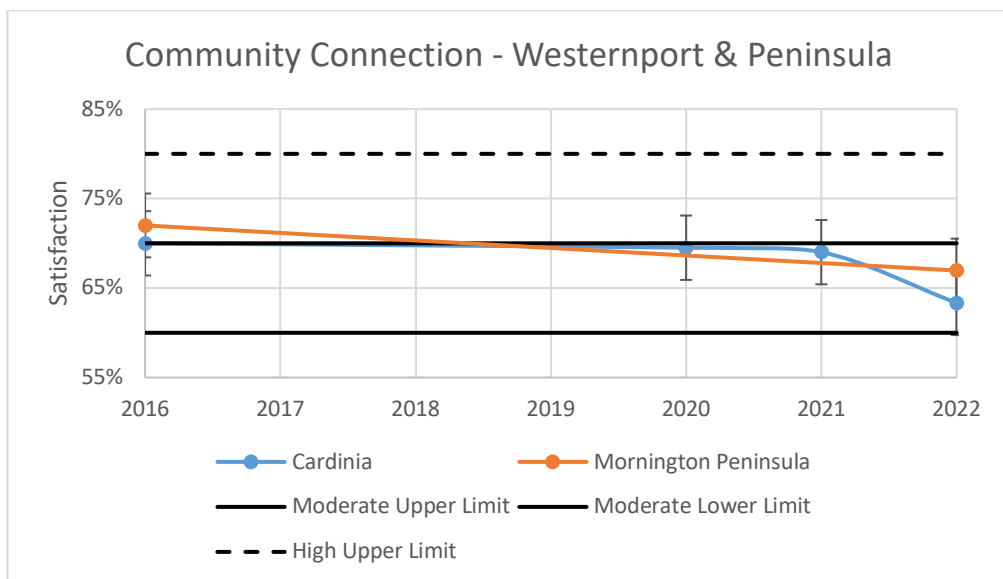


Figure 19. Community Connection Performance Ratings - Westernport and Mornington Peninsula Catchments.

In section KEQ3b we have further explored the satisfaction results relating to the conditions that underpin community connection values, including the satisfaction with engagement with and facilities supporting art and culture.

## Summary

**Amenity:** is 'On-Track' at four catchments including Maribyrnong Upper, Werribee & Litter River Middle & Upper, Mornington Peninsula and Yarra River Upper. Amenity also scored high for the Yarra River Middle however is considered 'Slightly Off-Track' because amenity had reduced from very-high levels in 2016. Of note is the geographical spread where amenity is performing well, which are not in inner-city or more urbanised areas, but rather supporting the amenity experiences of connection to and escape to nature. At a sub-catchment scale, there are ten sub-catchments that recorded 'high' scores in 2022 (36% of all catchments recorded), these were regionally distributed across all except the Werribee Catchment.

**Recreation:** satisfaction scores have generally slightly declined since the 2016 baseline, with only Werribee and Little River Middle and Upper and Yarra River Lower and Upper maintaining baseline levels and therefore 'On Track'. Only the Yarra River Lower scored a satisfaction rating of high in 2022.

**Community Connection:** there was a general decline in community connection satisfaction scores, with no catchments scoring a high or above for community connection. The exception to this decline was Cherry, Kororoit, Laverton, Skeleton Creeks and Yarra River Upper which is 'On Track' because it maintained baseline performance ratings, however noting that Cherry, Kororoit, Laverton, Skeleton Creeks declined to a 'low' rating in 2021 before returning to a moderate score in 2022.

Across all social values, the Dandenong Creek Catchment was notable for producing a variability of performance ratings, the Dandenong Creek Middle and Eumemmerring Creek sub-catchments consistently produced scores significantly above other sub-catchment satisfaction scores, but the catchment was countered by Kananook Creek sub-catchments (and at times Blind Creek sub-catchment), which consistently produced scores significantly below other sub-catchment satisfaction scores for amenity, recreation and community connection satisfaction.

## Catchment Rankings

Table 26 below shows the catchment (management unit) rankings across the three social values as standing in 2022 for; amenity, recreation and community connection satisfaction. These rankings were calculated based on each catchments 2022 satisfaction score and therefore not a consideration of performance tracking (e.g. On-Track, Slightly Off Track).

Table 26. Amenity, Recreation and Community Connection Rankings.

Amenity Rankings			Recreation Rankings			Community Connection Rankings		
Rank	Catchment	Score	Rank	Catchment	Score	Rank	Catchment	Score
1	Yarra Upper	72%	1	Yarra Lower	70%	1	Yarra Upper	67.8%
2	Mornington Peninsula	71.8%	2	Mornington Peninsula	69.9%	2	Maribyrnong Upper	67.1%
3	Yarra Middle	71.4%	3	Yarra Upper	69.9%	3	Mornington Peninsula	67%
4	Maribyrnong Upper	70	4	Yarra Middle	69.7%	4	Yarra Middle	66.1%
5	Yarra Lower	68.4%	5	Maribyrnong Upper	69.5%	5	Werribee and Little River Lowlands	65.8%
6	Dandenong	68.2%	6	Cherry, Kororoit, Laverton, Skeleton	69.1%	6	Yarra Lower	63.9%
7	Cherry, Kororoit, Laverton, Skeleton	66.4%	7	Dandenong	67.8%	7	Dandenong	63.7%
8	Maribyrnong Lower	66%	8	Werribee and Little River Lowlands Maribyrnong Lower	67% 65.8%	8	Cardinia	63.3%
9	Werribee and Little River Lowlands	65.7	9	Maribyrnong Lower	65.8%	9	Maribyrnong Lower	63.1%
10	Cardinia	65.6%	10	Werribee and Little River Middle and Upper	64.3%	10	Werribee and Little River Middle and Upper	62.2%
11	Werribee and Little River Middle and Upper	63%	11	Cardinia	63.2%	11	Cherry, Kororoit, Laverton, Skeleton	62%
-	French and Phillip Islands	-	-	French and Phillip Islands	-	-	French and Phillip Islands	-
-	Lower Bunyip, Lang Lang and Bass	-	-	Lower Bunyip, Lang Lang and Bass	-	-	Lower Bunyip, Lang Lang and Bass	-
-	Upper Bunyip and Tarago	-	-	Upper Bunyip and Tarago	-	-	Upper Bunyip and Tarago	-

- Unable to Assess

There's a consistency between catchment rankings across the three social values, with a similar grouping of catchments in the top five-six for each value. When aggregated (Table 27), two sets of social values classes are apparent, with a top-five high ranking group consisting of; Yarra River

Upper, Mornington Peninsula, Yarra River Middle, Maribyrnong River Upper and Yarra River Lower. Although it should be noted that the Mornington Peninsula only includes a single sub-catchment sampled (Mornington Peninsula Western Creeks sampled at Balcombe Creek).

The second grouping consist of catchments where only on one occasion, Werribee and Little River Lowlands for Community Connection, has a catchment appeared in the top-five.

Catchment groupings do not follow a clear geographical trend, with upper and lower catchments appearing in both groupings. However interestingly all three Yarra River catchments appear in the top ranked grouping.

A third bottom-tiered grouping consist of three catchments where no satisfaction scores have been recorded in recent years.

Table 27. Overall Social Values Rankings.

Overall Ranking	Catchments (Management Units)	Overall Ranking Score
1	Yarra Upper	5
2	Mornington Peninsula	8
3	Yarra Middle	11
4	Maribyrnong Upper	11
5	Yarra Lower	12
6	Dandenong	20
7	Werribee and Little River Lowlands	23
8	Cherry, Kororoit, Laverton, Skeleton	24
9	Maribyrnong Lower	25
10	Cardinia	29
11	Werribee and Little River Middle and Upper	31
N/A	French and Phillip Islands	
N/A	Lower Bunyip, Lang Lang and Bass	
N/A	Upper Bunyip and Tarago	

## Recommendations for consideration in Science Inquiry

Yarra River Upper, Mornington Peninsula, Yarra River Middle, Maribyrnong River Upper and Yarra River Lower. Although it should be noted that the Mornington Peninsula only includes a single sub-catchment sampled (Mornington Peninsula Western Creeks sampled at Balcombe Creek).

Recommendations for consideration under the following categories:

## 1. Improving Data Scale and Confidence (short term actions)

- a. Expanding breadth of the survey data: Although there are limitations to the current method of measuring social values using the Melbourne Water annual *Community Perceptions Survey*, it remains a valuable data collecting process for the intrinsic and somewhat abstract value (amenity, recreation and community connection). The breadth of sub-catchments with statistically significant data (36% of sub-catchments in 2022) is viewed as the most significant limitation, particularly when reporting on performance ratings at a river catchment scale (for instance two of twelve sub-catchments in the Mornington and Westernport region are represented). To improve on this, we recommend:
  - i. Adopting additional surveys to 'fill the data gaps' at targeted sub-catchment locations. For instance conducting on-site intercept surveys or collaborating with and interviewing local groups about their experiences. These targeted intercept surveys could also be designed to capture insights from segments of the community who aren't typically captured in the Community Perceptions Survey (e.g. young children through engagements with local school groups) or who may not be able to access or feel excluded from visiting local waterways (e.g. people with mobility issues). Additional surveys could be delivered as; intercept surveys, community pop-ups (e.g. at nearby festivals or events), focus groups (including delivered by walking tours), community forums or conversation toolkits (self-guided activities provided to groups such as schools/teachers where feedback is recorded and provided back to Melbourne Water).

Catchments (scaled to management units) of particular note which do not have reportable data include:

- French & Phillip Islands
- Lower Bunyip, Lang Lang, Bass
- Upper Bunyip, Tarago

Catchments could also be prioritised based on factors such as demographics (e.g. population), health and wellbeing and community access to open space.

- i. Investigate further the use of visitation (GIS) data and continue to collect every year to provide multiple timeframes to compare and analyse.
- b. Review social value performance rating rubric: the rubric (Table 20), which considers progress against the baseline (2016 survey) results, was developed during this review. We recommend further investigating this rubric because once a longer period of data is collected (by 2028 at least ten separate survey samples of data should be available). The quality of the 2016 survey data is also not validated as the original spreadsheets and workings were not able to be sourced for this review.

## 2. Recommendations for consideration to Support End of Strategy Review

Improve understandings around Traditional Owner values: The reviews authors would like to acknowledge the important connection and interaction between Traditional Owners and social values of waterways. The Healthy Waterways Strategy Technical Resource Document "recognises the connection of Traditional Owners to the waterways and the significant value and importance of their knowledge to sustainable management of these important assets". Additionally the conceptual models, particularly Community Connection value under the 'Caring for Country' condition, outline how this relationship is considered.

An assessment of Traditional Owner values has not been included in this review. The method for calculating Community Connection in the questionnaire does not include a satisfaction question considering cultural connection or satisfaction of 'Caring for Country' or traditional owner values more broadly. In recent (2020-2022) community perceptions survey, we have included follow up questions relating to cultural experiences, however these are focused towards broader cultural experiences such as 'facilities for cultural events' and 'engaging with art'.

We consider the rating of Traditional Owner values subjective and sensitive and without a well-defined understanding and collaborative partnership with Traditional Owners, suggest that it could not be evaluated through a survey with non-traditional owners.

Melbourne Water has continued to engage with Traditional Owners through programs and commitments such as Melbourne Water's Innovate Reconciliation Action Plan, we are committed to actions such as "Improve our local understanding of and respect for Aboriginal and Torres Strait Islander histories, cultures, knowledge, sites of significance and local stories". The HWS2018 also specifically addresses Traditional Owner values which are tracked against at least four regional performance objectives (RPO-1, RPO-2, RPO-3, and RPO-6), all are in progress.

These initiatives are ongoing beyond the sphere of the Healthy Waterways Strategy Social values monitoring program. However the capture of Traditional Owner values through separate perceptions surveys or conducting targeted and collaborative engagements with individual Traditional Owner groups relevant to waterway catchments would provide salient insights into the progress of Traditional Owner values.

### **3. Potential catchment focused Initiatives and Interventions to improve community satisfaction social values scores**

Based on satisfaction ratings from individual sub-catchments, the follow insights were considered:

Dandenong Creek: sub-catchments within the Dandenong Catchment recorded the most variable range of satisfaction scores across the timeline of the review. Dandenong Creek Middle (at Tarralla Creek) consistently recorded the highest amenity, recreation and community connection ratings on record when a survey was introduced in 2022. This may be related to the Reimagine Tarralla Creek project, which in 2020 commenced investing in creek naturalisation and surrounding landscape improvements, although it is unclear if these interventions are having a direct impact on satisfaction scores. Eumemmerring Creek, also in the Dandenong Catchment had significantly high satisfaction scores across all social values in years 2020 and 2021 however declines were measured in 2022 against all social values. While Kananook Creek regularly had significantly low scores (amenity and recreation in 2022) or the lowest satisfaction score of all sub-catchments (i.e. community connection 2022). Kananook Creek's trajectory also declined year on year for all three social values. Further investigations and additional surveys understanding the key factors leading to Kananook Creeks decline are recommended to better understand how meaningful improvements could improve social values scores. Eumemmerring Creek, which is located next to Kananook Creek, would be an interesting comparison particularly as it's recorded declines in 2022.

Werribee River: was the only river catchment not to record any 'High' amenity scores at a sub-catchment scale. This includes catchments such as Kororoit Creek, Skeleton Creek, Cherry Creek and Laverton Creek. As a region forecast to experience rapid population growth and as a focus area for the Waterways of the West program, explore why amenity is lagging in the

Werribee Catchment and identify the conditions that could lead to priority interventions and improvements.

Maribyrnong River: understand why Maribyrnong River Lower satisfaction scores are all following a declining trajectory, in particular why Moonee Ponds Creek sub-catchment has a substantially low community connection satisfaction score (in 2022), particularly given recent collaborative programs (i.e. Moonee Ponds Creek Chain of Ponds) to transform the creek into an iconic waterway that provides high social, cultural and environmental benefits.

Yarra River: is well represented in terms of sub-catchments sampled across the lower, middle and upper management units, however there's room to increase sampling in the middle and upper. Yarra River values also scored well across all three social values, but the Yarra River has higher expectations than most, with policy such as the Yarra Strategic Plan (Burndap Birrarung burndap umarkoo) and the Yarra River Protection (Willip-gin Birrarung Murrn) Act 2017, setting a motion to deliver more waterway improvements. This is reflective in the HWS2018 of the amenity target of 'very high' by 2070 for the Yarra River Middle sub-catchment. An opportunity exists to converge Yarra Strategic Plan actions, targets and data closely with Healthy Waterways Strategy social values.

Westernport and Peninsula: further sub-catchments need to be measured to ensure a better representation of this catchment is captured in the dataset. Much of the Westernport and Peninsula Catchment is rural/agricultural, so there are limited sub-catchment locations where communities can access to experience waterway amenity, recreation and community connection.

### **KEQ 3b. What other spatial and temporal trends and patterns for key values are of significance for implementation?**

In the *Community Perceptions Surveys* from 2020 to 2022, questions were included to further explore satisfaction conditions as related to the conceptual models. The below section has further assessed these results.

#### **Amenity**

The amenity conditions included in the satisfaction survey included both the related experiences (escape from urban environment, naturalness and safety) as well as conditions such as physical form (channel form, topography/landscape views, corridor widths/open space), vegetation (extent, maintenance, sightlines), biodiversity (habitat), facilities (pathways) and water regime (flow). Water quality (odour/litter/dumping) although a condition related to all three social values has been assessed under the social value waterway amenity for this review (and not recreation and community connection) to avoid duplication.

Across the region, amenity experiences averaged 72% satisfaction for escape from urban environment and naturalness and safety satisfaction average 70% satisfaction. There were no significant differences for satisfaction of these experiences across the catchment management units, with catchment scores only ranging between the minimum of 65% (safety for the Werribee & Little River Middle and Upper) and maximum 79% (escape from urban environment for the Yarra River Upper).

There were some changes to conditions related to amenity over the years, of note included:

Litter satisfaction generally only had minor variations across the catchments between 2020 and 2022 (Figure 20). However of note was the minor increased satisfaction in litter for the Dandenong Creek and Yarra River Middle catchments. Commencing in 2020, partner agencies initiated the Lower Dandenong Creek Litter Collaboration, which included; Cities of Casey, Greater Dandenong and Kingston, Parks Victoria, Melbourne Water and the EPA, along with the local community. The aim of the collaboration is to tackle litter at a catchment scale and develop a collaborative Action Plan to reduce incidence and impacts of litter on the areas around Eumemmerring Creek, Lower Dandenong Creek, Patterson River and Mordialloc Creek. As the initiative is still mainly in a planning and investigative stage, it's unlikely to conclude that the collaboration has directly led to the improved litter satisfaction ratings. However as the collaboration continues and matures we recommend monitoring and comparing litter satisfaction ratings within the Dandenong Creek Catchment against other catchments for the end of strategy review.

Conversely, substantial litter satisfaction reductions occurred in Cardinia Creek and Cherry Kororoit Laverton & Skeleton Creek catchments. Litter condition specific survey questions have only been recorded for three years, with some catchments only recording data in 2022 (Mornington Peninsula and Werribee & Litter River Middle and Lower) or not at all (Phillip & French Island, Lower Bunyip, Lang Lang and Bass and Upper Bunyip and Tarago catchments). In 2022, the whole Werribee River catchment as an average (combined x3 management units) had a low score of only 53% as opposed to an average litter satisfaction score of 63% for all other catchments.

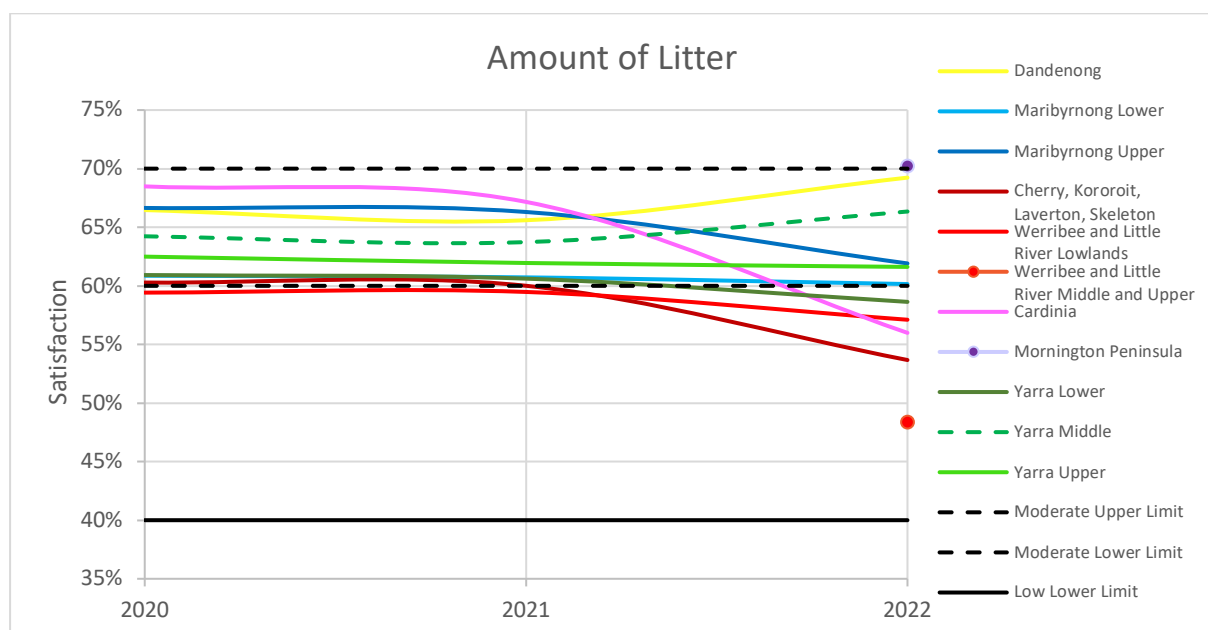


Figure 20. Satisfaction with catchment Litter condition.

Satisfaction with colour and clarity of water (Figure 21) generally only had minor variations across the catchments between 2020 and 2022. However of note was the increased satisfaction in water colour & clarity for the Yarra River Upper Catchment and slight improved trajectory for Yarra River Middle catchment. Conversely, substantial colour & clarity satisfaction reductions occurred in Werribee & Little River Lowlands, Yarra River Lower and Cherry Kororoit Laverton and Skeleton Creek catchments, which declined from moderate to low ratings. Water colour & clarity condition specific survey questions have only been recorded for three years, with some catchments only recording data in 2022 (Mornington Peninsula and Werribee & Litter River Middle and Lower) or not at all (Phillip & French Island, Lower Bunyip, Lang Lang and Bass and Upper Bunyip and Tarago catchments).

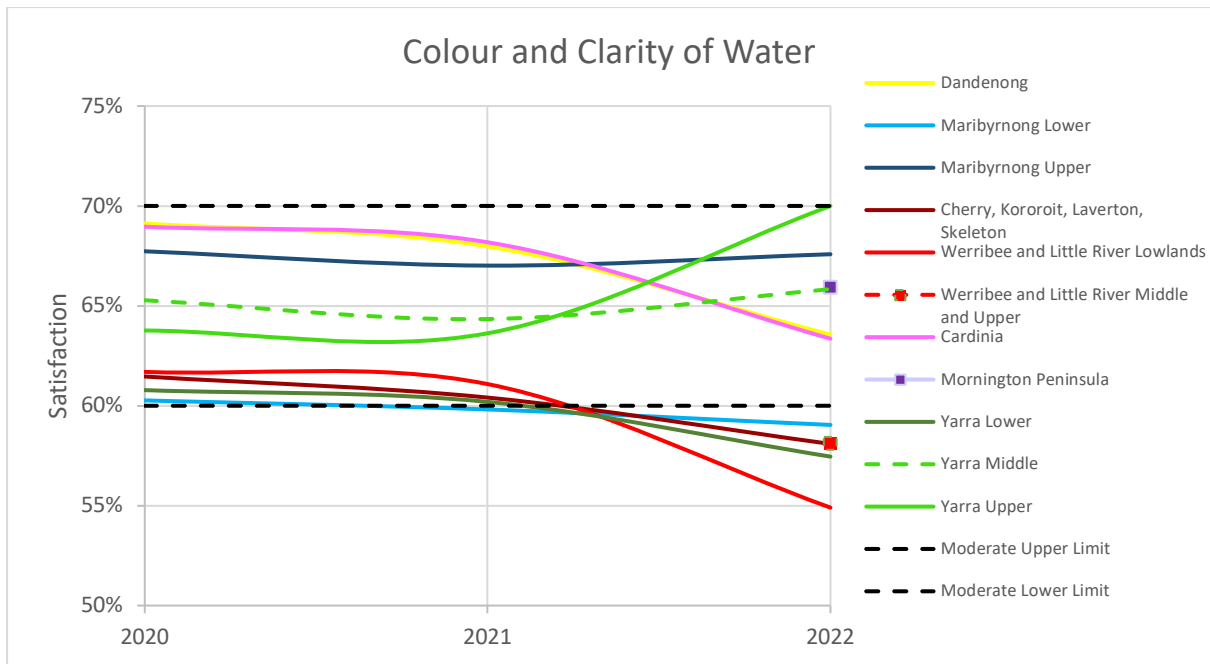


Figure 21. Satisfaction with colour & clarity of water condition.

Satisfaction with smells and odours coming from the water (Figure 22) generally only had minor variations across the catchments between 2020 and 2022. However, of note was the increased satisfaction trajectory for the Maribyrnong River Lower and Upper. Conversely, substantial smells & odours satisfaction reductions occurred in Cardinia Creek, Werribee and Little River Lowlands and Cherry, and Cherry, Kororoit, Laverton and Skeleton Creek catchments, which in 2021 was significantly below the satisfaction scores as compared to all other catchments. Smells & odours condition specific survey questions have only been recorded for three years, with some catchments only recording data in 2022 (Mornington Peninsula and Werribee & Little River Middle and Lower) or not at all (Phillip & French Island, Lower Bunyip, Lang Lang and Bass and Upper Bunyip and Tarago catchments).

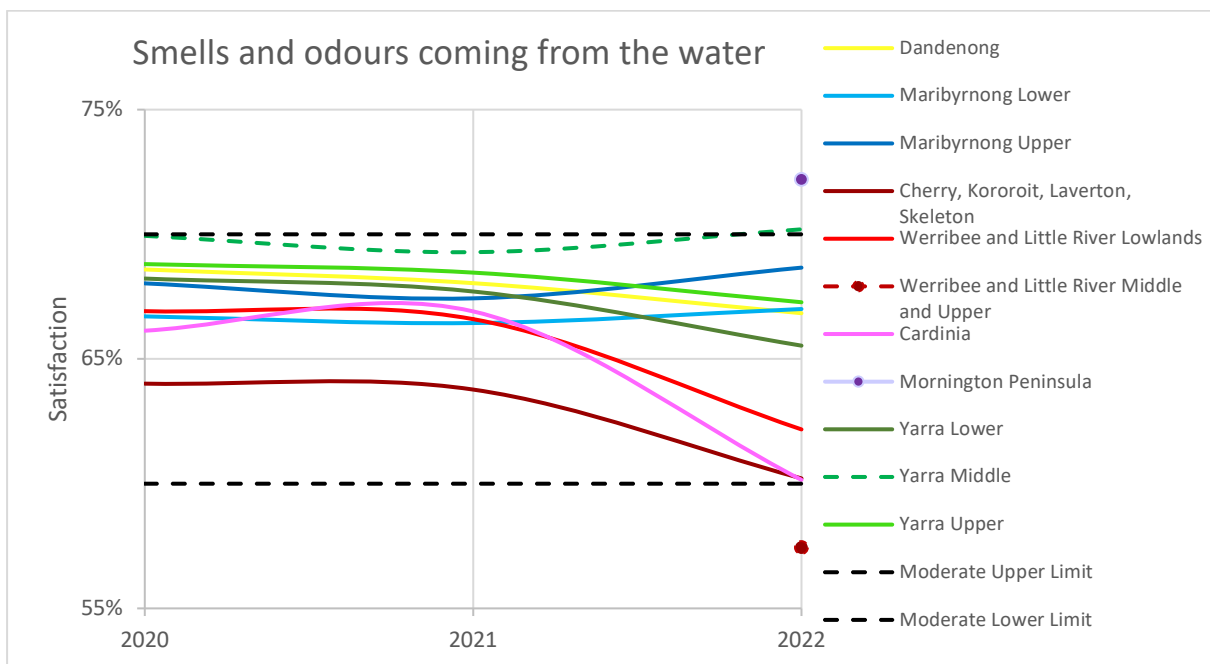


Figure 22. Satisfaction with smells & odours condition.

At a sub-catchment scale, there are ten sub-catchments that recorded either high or very high amenity satisfaction scores in 2022, these were regionally distributed across all except the Werribee

Catchment. In consideration of amenity related conditions (litter, odour and water colour/clarity), Cardinia Creek consistently had declining scores as did the three Werribee River catchments collectively.

The Yarra River Lower (Yarra main stem sub-catchment) had significant annual declines in amenity satisfaction scores in 2022 when compared to previous years. This was evident for the conditions; litter and illegal dumping, colour & clarity of water, smells & odours from water, habitat for wildlife, vegetation extent and appearance. Consequently the amenity related experiences; naturalness and escape the urban environment also significantly declined in 2022 (although feeling safe had not significantly declines). No other sub-catchments across the region recorded significantly declined annual trajectories in amenity satisfaction conditions. Noting that the above amenity condition figures do not capture the annual declining trajectories at Yarra River Lower (main stem), the Yarra River Lower Management Units shown include other waterway sub-catchments (e.g. Merri Creek, Darebin Creek).

Conversely the Yarra River Middle sub-catchment recorded statistically significant improvements in amenity satisfaction scores in 2022 when compared to other years. This was evident for the conditions; colour & clarity of water, smells & odours from water, habitat for wildlife, vegetation extent and appearance, quantity of river flow and landscape views. Likewise all the amenity related experiences; naturalness, escape the urban environment and also including feeling safe significantly improved by 2022.

As mentioned earlier in the evaluation of KEQ3a, Kananook Creek sub-catchment within the Dandenong Creek Catchment consistently performed poorly against all social values and conditions. Although Kananook Creek did not necessarily score the lowest or a statistically significant low compared to all regional sub-catchments, Kananook Creek still did produce consistently 'low' ratings (i.e. less than 60% satisfaction) for amenity related indicators such as; litter, colour & clarity of water, smells and odours and landscape views by 2022.

Amenity condition trajectories generally did follow a similar pattern to overarching amenity values. However values generally followed a decline from 'high' to 'moderate' trajectories (Figure 5 to Figure 9), however amenity conditions generally commenced from baseline (2016) at 'moderate' and either remained moderate or declined to a low score by 2022.

## Recreation

The recreation conditions included in the satisfaction survey included both the related experiences, such as active recreation through physical exercise and the use of the waterway for commuting. The survey also assessed recreation conditions, notably satisfaction with pathways and facilities for sporting activities.

Across the region, recreation experiences averaged 72% satisfaction for physical exercise in 2022 but only 61% satisfaction for using the waterway corridors for commuting. This translates to a categorical score of 'high' for physical exercise and only a 'medium' for commuting. For physical exercise experiences around waterways (Figure 23), most sub-catchments remained within the bounds for a score of 'high' across the three years measured, except for Cardinia Creek sub-catchment which had a significant decline from 'high' in 2020 and 2021 to moderate by 2022.

Yarra River Lower and Middle had the highest satisfaction recordings for this experience, although slight reductions occurred in 2022. Yarra River has seen investment in on-water recreation facilities in recent years, such as canoe platforms at Finns Reserve, Westerfold Park and Spadonis' Reserve, which may be contributing to this level of satisfaction. To support this, the most recent *Community Perceptions Survey* (2022) has noted that the most common reason for visiting the Yarra River (main

stem) was for canoeing/kayaking, except for the stretch between Dights Falls and Warrandyte where it was second (only by a single count) to cycling.

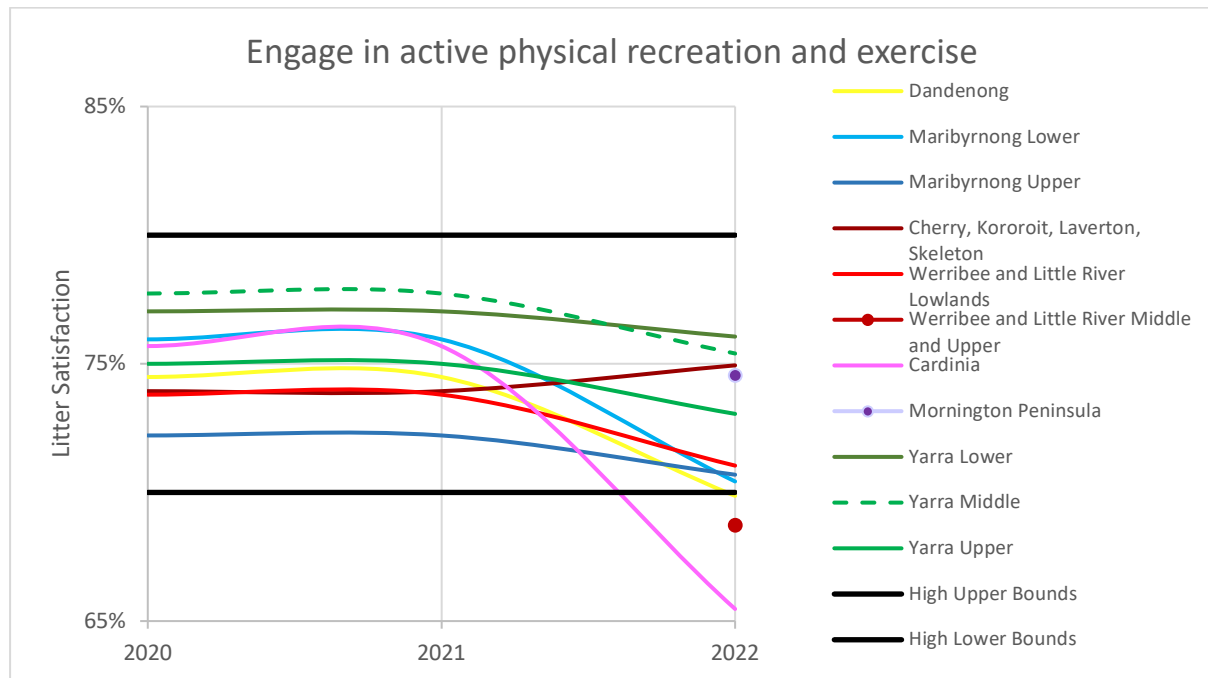


Figure 23. Satisfaction Annual Changes - Physical Exercise.

For satisfaction with experiences using waterways corridors for commuting (Figure 24), most sub-catchments remained within the bounds for a score of ‘moderate’ across the three years measured. However, Werribee & Little River Lowlands, Yarra River Lower and Maribyrnong River Lower declined from ‘moderate’ scores to ‘low’ by 2022. Most significant was Cardinia Creek where condition satisfaction declined from ‘high’ in 2020 to “almost” low by 2020 (actual score was moderate with 60%). Maribyrnong River Upper saw the most relative improvement, although the satisfaction with commuting through this waterway corridor remained fairly stable and did not improve to a scoring of ‘high’ category. Of note, the Upper Maribyrnong River catchments, except for some small sections through Jacksons Creek, has very little access infrastructure (i.e. pathways) currently on-ground (see Table 13) so satisfaction ratings may not accurately reflect what infrastructure is available on ground. Further investigations and improvements to the social values framework (see Appendix 6), including methods for how social values are measured should consider how the availability of on-ground assets, facilities and activities can support or build on qualitative data on community satisfaction.

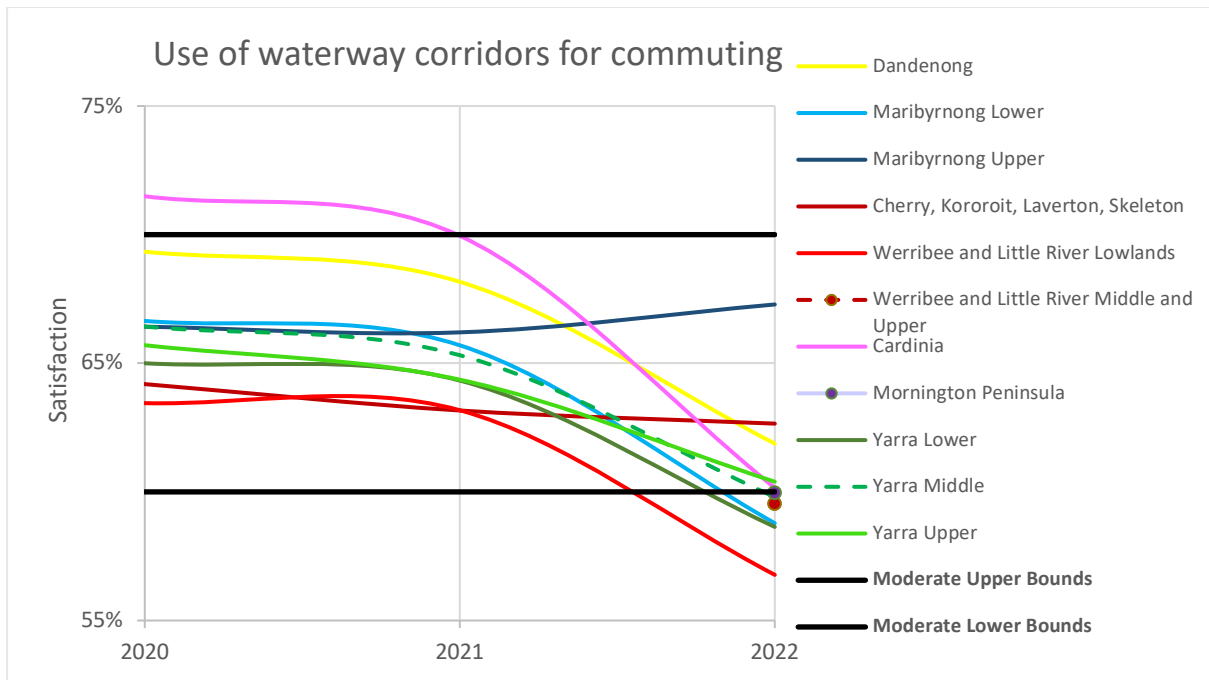


Figure 24. Satisfaction Annual Changes – Commuting.

For conditions scores related to sporting facilities around waterways (Figure 25), most sub-catchments remained within the bounds for a score of ‘moderate’ across the years measured, with an average score in 2022 across all management units of 66%. Only Yarra River Upper rated high in 2022 but just with a score of 70%.

As previously noted the Yarra River Lower and Middle sub-catchments have recently received new/upgraded recreational on-water paddling access ramps at Westerfolds Park, Finns Reserve and Spadonis’ Reserve, there are also including a number of existing recreational paddling facilities below Dights Falls. These interventions do not seem to have influenced conditions scores related to satisfaction with sporting facilities, however as noted waterway recreation values in the Yarra River Lower was the only catchment to rate ‘high’ (Table 24) which occurred in all years measured.

The Maribyrnong River Lower declined from the equal highest with 70% satisfaction (high rating) to the equal lowest with a 2022 score of 61% (low rating) across years measured. The on-water navigability opportunity of this catchment highlight the priority for improvements of recreation and access facilities in the Maribyrnong River Lower.

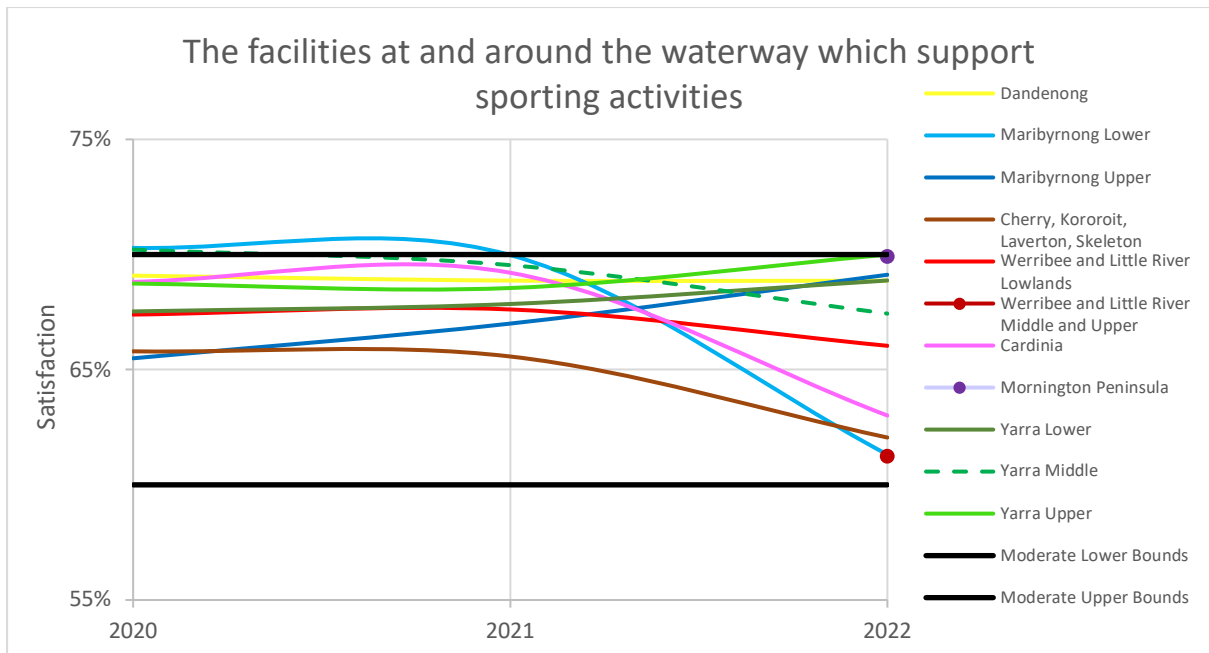


Figure 25. Conditions scores for sporting facilities satisfaction.

For satisfaction with conditions related to paths along waterways (Figure 26), most sub-catchments remained within the bounds for a score of 'high' across the three years measured. Except for Cardinia Creek which declined from high score to moderate by 2022, also the lowest scoring catchment by 2022.

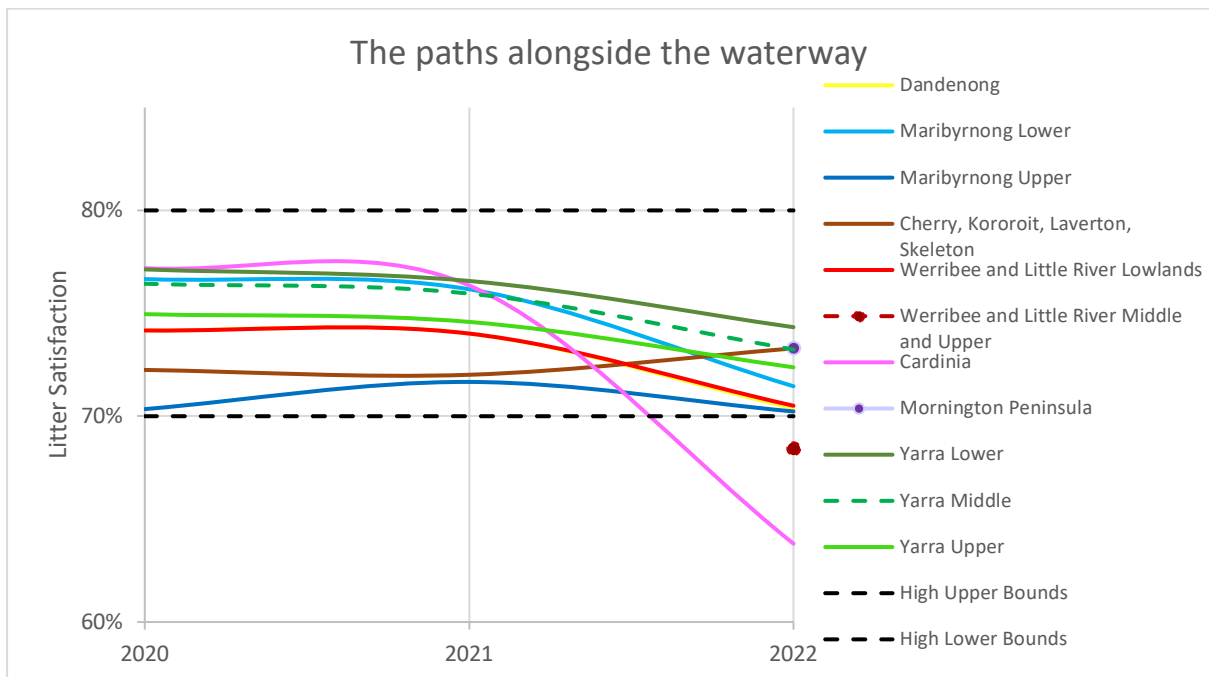


Figure 26. Conditions scores for paths along waterways.

Recreation condition trajectories generally remain within a 'moderate' scoring category and follow a similar trajectory for overarching recreation values (Figure 10 to Figure 14), except which generally reduce from a 'high' category to 'moderate' category. However, the catchments of Werribee River Lower, Maribyrnong River Lower and Cardinia Creek recorded trajectories in alignment with recreation values, declining from 'high' to 'moderate' and conditions scores declining from 'high' to 'moderate' or 'moderate' to 'high'.

## Community Connection

The community connection conditions recorded in the satisfaction survey focused on ‘organised connections’ condition grouping from the conceptual model (Figure 3), in particular satisfaction with engaging in cultural events and art around waterways (connection to people experiences) and culturally significant places (connection to place experiences).

Across the region, community connection conditions averaged ‘moderate’ scores with 66% satisfaction for engaging with cultural events, 62% satisfaction for engaging with culturally significant places, but only a low score of 59% for engaging with art in 2022.

For engaging with art condition (Figure 27) around waterways, many sub-catchments began within the bounds for a score of ‘moderate’ but had declined to a ‘low’ category score by 2022. Of note this occurred for all three Yarra River catchments, Dandenong Creek and Cherry/Kororoit/Laverton/Skeleton Creeks. Of note at a sub-catchment scale was the Merri Creek (Yarra River Lower) and Blind Creek (Dandenong Creek) which both recorded only 47% satisfaction. Furthermore, with only 57% across all regions, engaging with art and culture produced the lowest average satisfaction score for any condition measured in 2022.

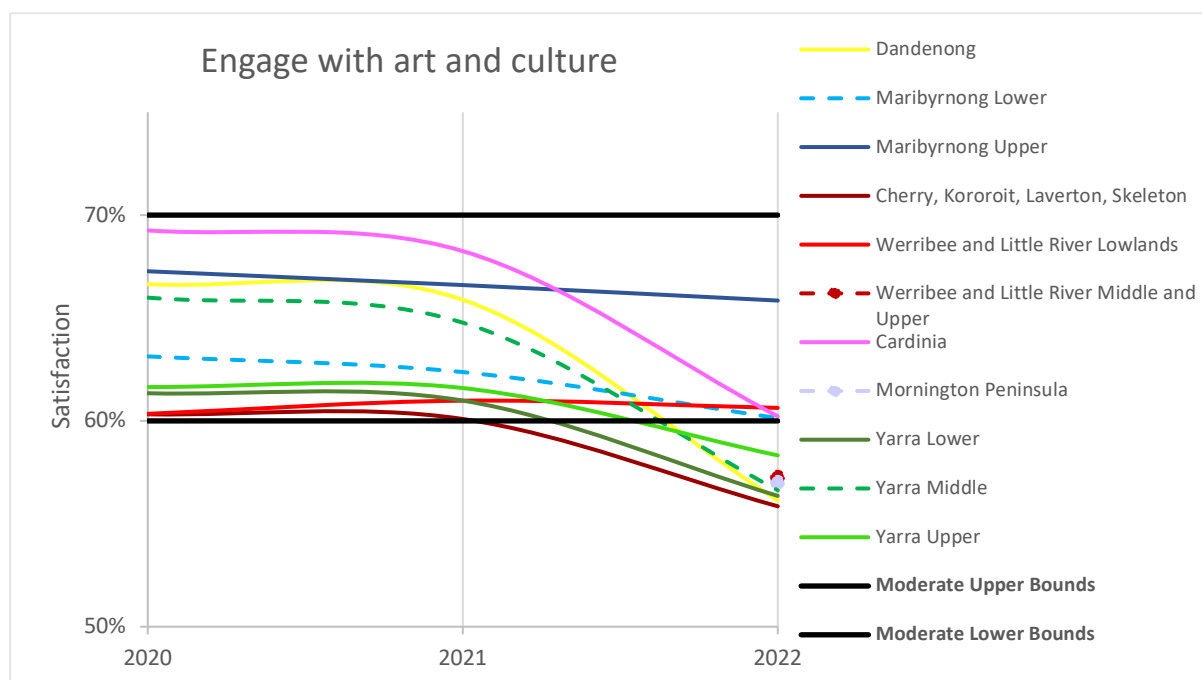


Figure 27. Satisfaction Annual Changes - Engage with art and culture.

For engaging with culturally significant places condition (Figure 28) around waterways, there was consistency with most catchments beginning and ending the evaluation period with a score category of moderate. The exceptions are Cardinia Creek which declined from a high to moderate in 2022 and Yarra River Lower declining from moderate to low rating over the years recorded. Of note at a sub-catchment scale was the Merri Creek (Yarra River Lower) which recorded only 50% satisfaction. Only Blind Creek (Dandenong Creek) sub-catchment rated lower in 2022 with 45% satisfaction.

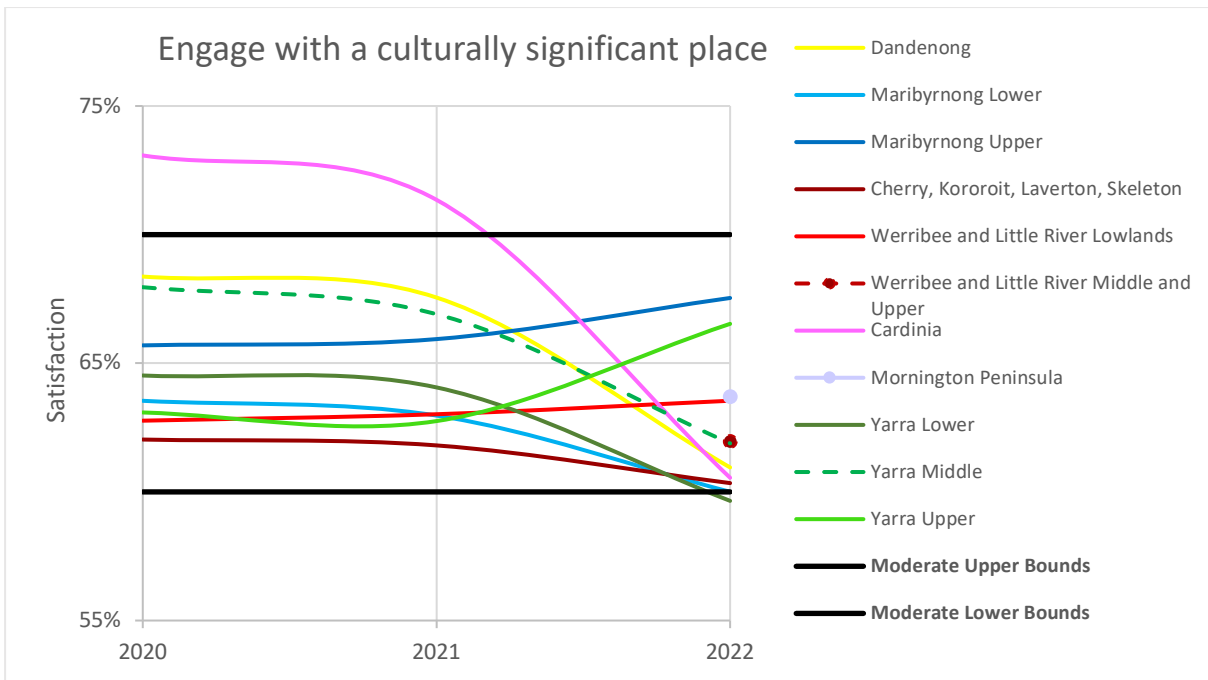


Figure 28. Satisfaction Annual Changes: Engage with culturally significant place.

For facilities that support community & cultural events condition (Figure 29) around waterways, catchments mostly remained with a score of ‘moderate’ between 2016 and 2022. Exceptions were Cardinia Creek, Yarra River Middle and Dandenong Creek catchments which began with scores of ‘high’ but declined to ‘moderate’ by 2022. All other catchments remained within the bounds of a ‘moderate’ score over the years of recording.

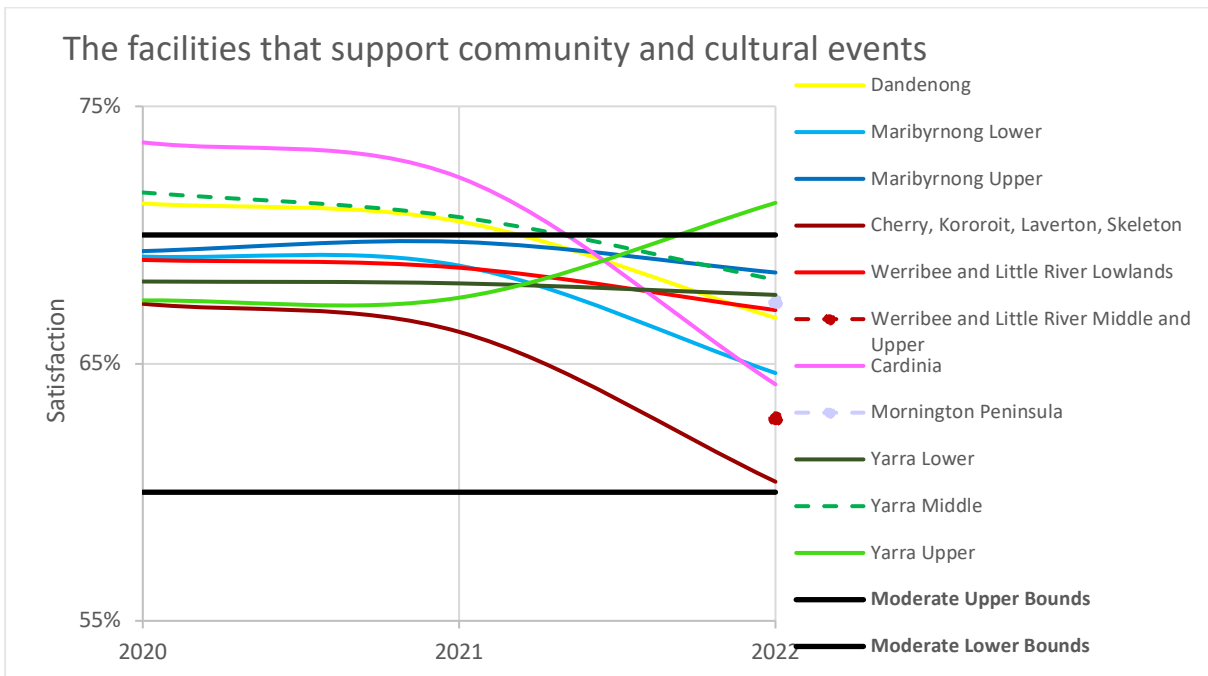


Figure 29. Satisfaction Annual Changes: Facilities for culture.

Community connection condition trajectories generally remain within their scoring categories (e.g. moderate to moderate) and do not follow a similar trajectory for overarching community connection values (Figure 15 to Figure 19) which generally reduce from a ‘high’ category to ‘moderate’ category.

## Open Space

All social values (amenity, recreation and community connection), consider open space under differing types of conditions, such as corridor width (amenity) and enjoyment facilities for all three values (e.g. sports fields). For satisfaction with open space condition (Figure 30) around waterways, all catchments (except Werribee & Little River Middle & Upper catchment in 2022) remained with a score of 'high' between 2020 and 2022. Slight downward trends were found for all except the Cherry Kororoit Laverton Skeleton Creek catchment, however ratings remain within the 'high' category. This is a condition to monitor in the future and is not yet considered to be significantly declining 'Off-Track'.

Additionally, the 2021 *Community Perception Survey* report noted that (green) open spaces for Darebin Creek, at 9% satisfaction is a lower factor in importance for the community than the regional average of 15%, but cultural importance is 33% and significantly higher than the regional average of 15%. This nuance from the feedback is not reflected in the satisfaction data reported but provides interesting considerations to follow up with the local community and may provide an indication on priority community needs and interventions which would help improve waterway amenity, recreation and community connection scores for the Yarra River Lower. The report highlighted qualitative statements suggesting “the arts and culture be used as a way to encourage visitation to the waterway (i.e. artists trails, sculpture parks, etc.”).

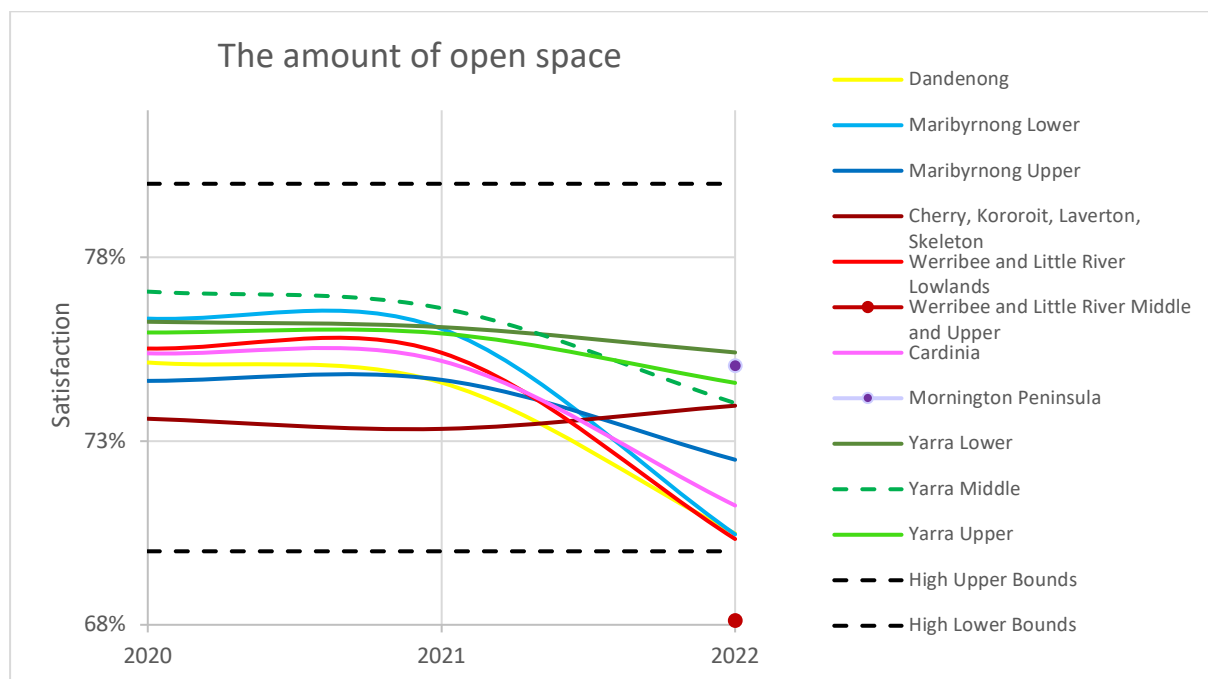


Figure 30. Satisfaction Annual Changes: The amount of open space.

## Correlation between Social Values and Conditions

The *Community Perceptions Survey* has not been designed to causally relate satisfaction with values and conditions that support each value. Noting this, we've undertaken a regression analysis to find any correlations between values.

Of interest is the interaction between satisfaction with access and amenity, based on the assumption that good access to a waterway enables people to immerse in amenity experiences such as connection to nature, this was found to have a positive correlation ( $R^2 = 0.57$ ). Given the subjective and intrinsic nature of satisfaction data, we consider the correlation between amenity and access satisfaction to be strong.

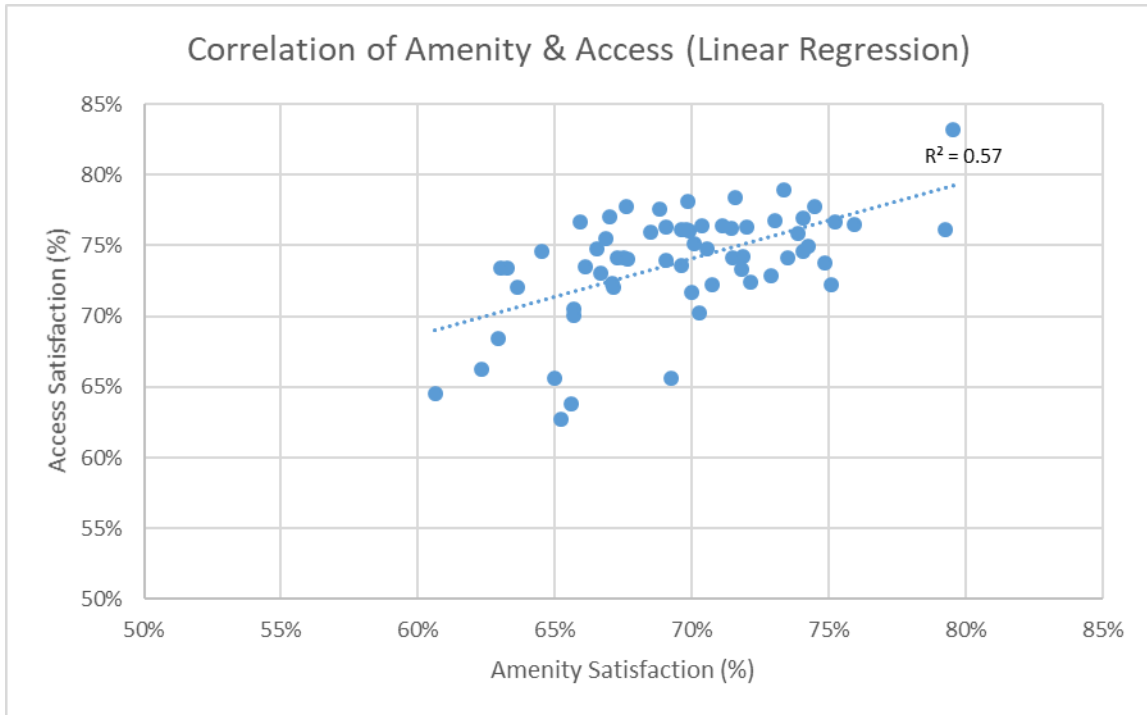


Figure 31. Correlation of amenity satisfaction vs access satisfaction.

We've also tested the assumption that satisfaction with litter (absence) will lead to a higher satisfaction with waterway amenity. Analysis shows (Figure 32) that there is a positive correlation between waterway amenity and litter satisfaction score ( $R^2 = 0.49$ ). Given the subjective and intrinsic nature of satisfaction data, we consider the correlation between amenity and litter satisfaction to be moderate/strong. The continued collection of litter and amenity satisfaction data and the proposed expansion of the litter monitoring program (see recommendation 4) for the life of the strategy will provide a better understanding about this relationship.

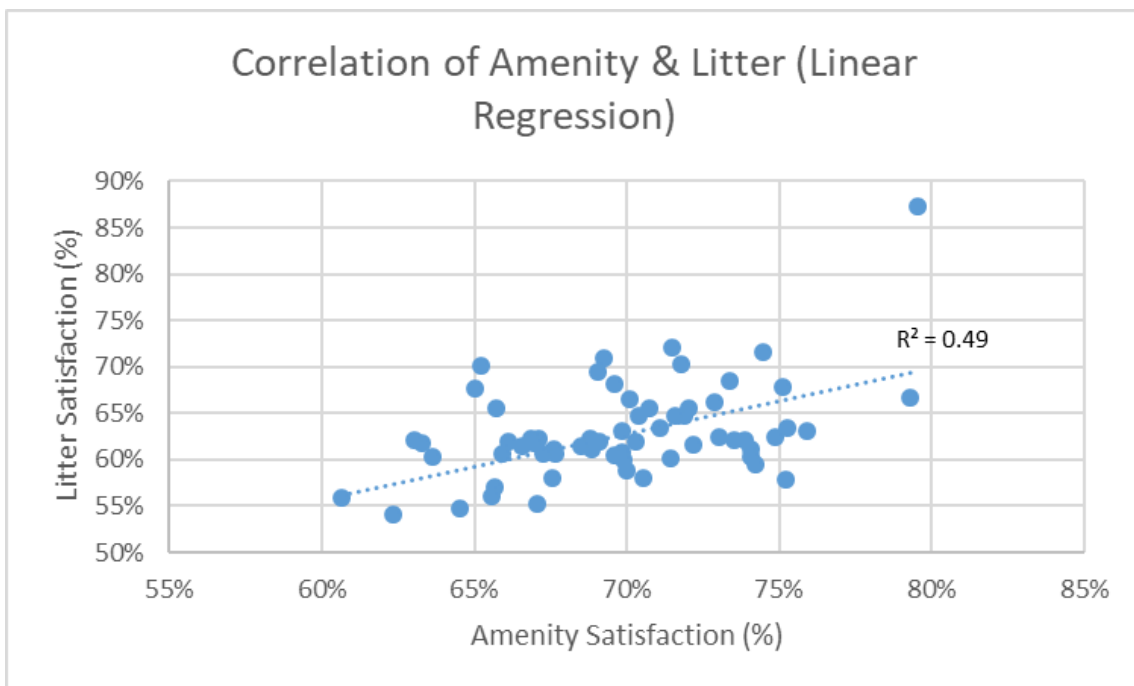


Figure 32. Regression analysis of Litter vs Amenity.

## Other Social Values Insights

Three other waterways related surveys have been evaluated to compare findings and potentially inform recommendations. The surveys are:

### 1. DELWP's My Victorian Waterway Survey (2022) conducted by Quantum Market Research.

This surveyed 6,240 participants over 5 weeks in March and April 2022 and represented all regions and waterways of the state of Victoria, Australia. The survey found that 69% of respondents visited a waterway at least monthly, mainly for relaxation (71%), exercise (59%) and to engage with nature (47%). For respondents within the Melbourne region, waterways were considered particularly valuable for escaping the urban environment. Recreational boating was ranked the fifth highest reason for visiting waterways followed by fishing in sixth.

The most important factor related to waterway health across Victoria was pollution/litter, reflecting the 2022 Community Perceptions Survey data, which showed that litter was the fourth-worst-ranked condition overall (after engaging with art and culture, using waterways for commuting, and engaging with culturally significant places).

Amenities/facilities ranked to “focus of future investments/resources” included; toilets (57%), paths/access (51%) and picnic facilities (43%). Fishing and cultural events were ordered only as the equal eleventh most important (12%) and boating facilities was thirteenth (8%).

Factors that were considered to be impacting Victorian waterway values mainly focused on pollution/litter (66%), followed by water flows (43%), which was only reflected in the *Community Perception Survey* results in the Maribyrnong River Catchment at Moonee Ponds Creek and Stony Creek sub-catchments where condition scores of ‘low’ were received in 2022.

Interestingly improving access was the lowest ranked factor, compared to the *Community Perceptions Survey* where regionally across all Melbourne waterways pathway access is the highest ranked characteristic in 2021 and 2022.

The condition “flowing water” differed between the two surveys, being the fifth most important factor in the My Victorian Waterway Survey compared to the 11<sup>th</sup> ranked in the 2022 *Community Perceptions Survey*.

### 2. Melbourne Waters Social Responses to Reimagine Your Creek across Four Sites: Tarralla Creek, Moonee Ponds Creek, Blind Creek and Arnolds Creek (2022) conducted by RMIT.

This survey was conducted to understand the impact on recently transformed drains into naturalised waterways at two locations; Arnolds Creek (Werribee River Upper Catchment) and Blind Creek (Dandenong Creek Catchment). As well as to form baseline understanding at two sites pre-naturalisation at Moonee Ponds Creek (Maribyrnong River Lower Catchment) and Tarralla Creek (Dandenong Creek Catchment) pre-naturalisation.

The survey recorded some interesting demographic differences, with more women visiting Tarralla, Moonee Ponds and Blind Creeks, but men more likely to visit Arnolds Creek. Similar age demographic differences were found with Tarralla, Moonee Ponds and Blind Creeks mostly within the 34-44 age group and 65-74, most common at Arnolds Creek.

All groups and waterways stated that they visited more often during COVID lockdowns and also valued the open space around waterways more since. Health and wellbeing was also the main reason people stated that they visited all waterways, 95% using for exercise, 88% use the waterway for relaxation and 84% to connect to nature.

Many respondents now frequent the waterways that have undergone transformation, 72% stating this at Arnolds Creek and 47% at Blind Creek. The biggest issues considered were; rubbish/litter except at Moonee Ponds Creek, maintenance such as overgrown vegetation at Arnolds Creek and Moonee Ponds Creek and cyclists at Tarralla, Moonee Ponds and Blind Creeks. These scores were somewhat reflective in the *Community Perceptions Survey (2022)* for litter at Arnolds Creek. Except Moonee Ponds Creek scored poorly (low) for litter and Blind Creek and Tarralla Creek scored 'high' and 'very high' respectively for litter. Likewise for vegetation management; Moonee Ponds Creek scored 'low', and Arnolds Creek scored 'moderate'. The threat of cycling to waterway social values (i.e. to amenity satisfaction) was not raised in the *Community Perceptions Surveys*.

### **3. Melbourne Water's Social Values Engagement: Pilot Report (2021) conducted by Capire Consulting.**

This survey was initiated by Melbourne Water to better understand the impact that an increased maintenance program (i.e. grass cutting and litter collection) had on community perceptions. The surveys were conducted at Cherry Creek and Dandenong Creek Middle sub-catchments.

The survey reported that the main reasons for visiting both waterways were:

- Cherry Creek: exercise (56%) and nature appreciation (33%)
- Dandenong Creek Middle: dog walking<sup>1</sup> (34%), exercise (21%) and nature appreciation (15%).

At Cherry Creek, the most important factor impacting waterways was litter, followed by paths and landscape views. Regarding waterway satisfaction with these factors, the best ranked factor was open space (grass) maintenance with 80% satisfaction, only 51% of respondents were satisfied with litter. The worst factor was regarding safety due to poor lighting, with 4% of respondents satisfied or 37% dissatisfied.

At Dandenong Creek Middle the most important factor impacting waterways was litter, followed by having unsealed paths (to retain natural feel) and landscape views. The lowest factor was signage. Regarding waterway satisfaction with these factors, the best ranked factor was landscape views with 90% of respondents satisfied followed by paths with 84% satisfied. Only 40% of respondents were satisfied with the condition of litter even though this was highlighted as the most important factor pertaining to waterway health. Lighting was again the least satisfied condition with only 5% of respondents satisfied with the lighting.

However, Dandenong Creek Middle survey included the use of a conversation toolkit which took a self-guided group of community with disabilities and recorded qualitative feedback. Responses showed that wheelchairs were unable to access the land around the waterway (due to barriers) and there was poor seating along the path. This component highlighted discrepancies and nuances in survey data when targeting a specific group, particularly those that are under-represented in most surveys.

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<sup>1</sup> Note survey was focused on a known dog walking parkland

#### **4. Parks Victoria's Visitor Satisfaction Monitoring: Brimbank Park, Plenty Gorge Westerfolds Park, Yarra Bend Park.**

Parks Victoria conducts a number of community surveys at regional parks they manage across the State in 2021-22. This review has focused on four surveys conducted at parklands by Parks Victoria which are closely connected to a HWS waterway, they are:

- Brimbank Park – Maribyrnong River Lower sub-catchment
- Plenty Gorge Park – Plenty River Lower sub-catchment
- Westerfolds Park – Yarra River Middle sub-catchment
- Yarra Bend Park – Yarra River Lower sub-catchment

The surveys found that the main activity undertaken by respondents at all parks was walking (46% at Brimbank Park, 49% at Plenty Gorge Park, 48% at Westerfolds Park and 68% at Yarra Bend Park). Of interest at Westerfolds Park (Yarra River Middle) was that recreational paddling (e.g. kayaking) was not listed in the survey, which is surprising given the recent focus and investment towards recreational paddling infrastructure here as Victoria's primary paddle sports location (competition on rapids).

The most common reason highlighted in all surveys for visiting each park was convenience at all parks, followed by 'natural experiences' which aligns with the waterways conceptual model for amenity.

Similarly to Melbourne Waters *Community Perceptions Surveys*, these surveys also enquired about satisfaction with the primary reasons for visiting. Of note:

- At Brimbank Park (Maribyrnong River Lower); in 2022 there was 85.1% satisfaction with the park visit, compared to 70% satisfaction for amenity recorded in KEQ3a. Satisfaction with safety scored 87.2%
- At Plenty Gorge Park (Plenty River Lower); in 2022 there was 84.6% satisfaction with the park visit, compared to 72% satisfaction for amenity recorded in KEQ3a. Satisfaction with safety scored 87.7% and satisfaction with plant and animal life 83.5%.
- At Westerfolds Park (Yarra River Lower); in 2022 there was 82.4% satisfaction with the park visit, compared to 71% satisfaction for amenity recorded in KEQ3a.
- At Yarra Bend Park (Yarra River Middle); in 2022 there was 83.7% satisfaction with the park visit, compared to 71% satisfaction for amenity recorded in KEQ3a.

For all four parks, the most important issue raised was either litter (first at Westerfolds Park and Yarra Bend Park) or safety (first at Brimbank Park and Plenty Gorge Park), however neither litter or safety were in the "bottom 5" for satisfaction scores at any park, it is not clear how litter and safety satisfaction scored for each park.

What is most apparent when comparing Parks Victoria survey results and Melbourne Waters *Community Perception Survey* results is how Parks Victoria satisfaction scores are much higher. This may be due to the fact that respondents are surveyed on site at the park. Through this approach, we can confidently assume that they have experienced the features of the park, unlike the Community Perception Survey, where respondents are asked to reflect on waterways that they have most frequented in the previous year and consider their satisfaction from that visit. Future Melbourne Water monitoring should consider if there are significant differences in satisfaction scores when comparing surveys conducted onsite compared to reflective surveys such as conducted through the *Community Perception Survey*.

### Estimating Historical Satisfaction: Comparing Social Values Against Overall Community Perceptions Score

As part of Melbourne Water’s *Community Perceptions Survey*, a ‘regional’ score considering all Melbourne waterways is generated. This score differs from the calculations so far discussed because it considers all waterways collectively, whereas the method to calculate amenity, recreation and community connection scores only considers the waterway that a respondent ‘visits most’. The regional score is also a general rating (%) on waterway satisfaction, and does not consider the reasons (activities) that for respondents which is used in the evaluation of waterway amenity, recreation and community connection.

The below graph (Figure 33) shows the historical satisfaction with Melbourne’s waterways from 1993 to 2022 compared to total average social values satisfaction scores. Overall regional satisfaction levels have been increasing since 2014. Scores in recent years have peaked above and around 90% satisfaction, however 2021 and 2022 saw a decline to 89% and 84% respectively.

Social values focused satisfaction scores were only included since the 2016 survey report. We’ve also analysed the 2012 and 2014 reports where amenity and recreation scores were generated at approximately eleven catchments. Although these do at least represent all five river catchment systems, the methodology behind the calculation of these scores could not be determined and so consideration needs to be given to the confidence in the amenity and recreation scores pre-2016.

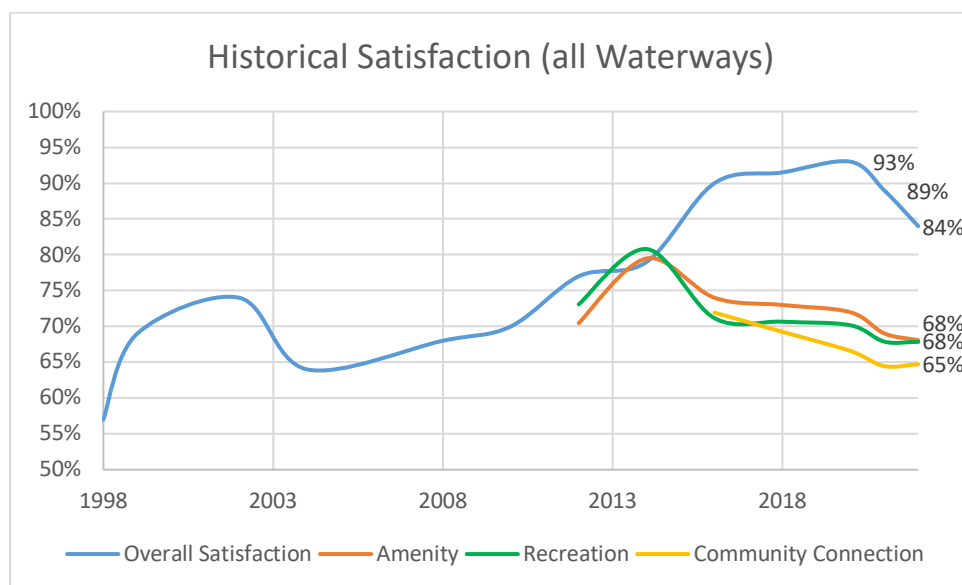


Figure 33. How satisfied or dissatisfied are you with the waterways in the greater Melbourne area overall?

Given the limited historical context, there’s no discernible comparative trends or relationships between overall waterway satisfaction ratings and recent waterway amenity, recreation and community connection satisfaction ratings (based on waterway most visited by respondent). Particularly as scores have diverged from around 2014, there is no reasonable confidence to retrospectively report on waterway amenity, recreation or community connection scores using the overall waterway satisfaction scores as a guide.

## KEQ 2a. What environmental conditions (e.g. Water quality) and external factors (e.g. policy) help explain current key value trends?

Several environmental conditions are explored in this section to see if they help to explain current value trends. These include:

- Visitation related to COVID19
- Water colour and clarity satisfaction scores as a consequence of rainfall
- Recreational water quality

### Visitation and Melbourne's Pandemic Lockdowns

The E5 Blue Spaces investigation analysed *Community Perceptions Survey* (2020) data, digital data (human movement data based on mobile phone geolocations) and conducted a further online survey to understand the communities' behaviours interacting with blue-green spaces (i.e. waterways) during the coronavirus COVID19 lockdowns. A summary is provided here but full details are available in the Healthy Waterway Strategy mid-term review research factsheet.

The investigation found some conflicting statements when comparing how people self-assessed their degree of interaction with blue green space. According to the *Community Perceptions Survey* only 12% of respondents visited their local waterway more during COVID19 restrictions. However, based on a separate survey conducted as part of this research, the majority (80%) of survey respondents said they spent more time in blue and green spaces as a result of the COVID-19 restrictions. Visits to blue and green spaces were frequent, with "daily" or "several times a week" the most commonly selected categories. This was supported by Google's COVID-19 Community Mobility digital geolocation data showing a 112% increase in engagement with local natural spaces (e.g. waterways) between February 2020 and May 2021 (Neighbourlytics 2020).

Regarding understanding how we better measure the social values of waterways, the E5 Blue Spaces project demonstrates that the methodology should expand beyond just the *Community Perceptions Survey*, tapping into other data sources (e.g., digital data, human movement data) or building in targeted surveys that dive-deeper into specific social values topics. The findings, particularly the digital data and human movement data, also highlights that more people were visiting waterways during the COVID19 lockdowns as communities were restricted to 5 kilometre limits to their households.

COVID19 restrictions could be assumed to have both positive and negative impacts on amenity, recreation and community connection values around waterways. The positive assumption is that appreciation of waterway values has increased as a result of people spending more time in blue-green spaces. The research found that 89% of respondents had a stronger appreciation for blue green spaces as a result from COVID19 restrictions. Many respondents particularly appreciated having blue and green spaces in close proximity to their homes while others noted the lack or poor quality of blue and green spaces within their local area compared to the blue and green spaces they visited prior to the COVID-19 restrictions.

Negative assumptions may include:

- Increased visitation has led to degradation to natural spaces through vegetation damage and erosion,
- The perceived 'busyness' of blue-green spaces has diminished the quality of escape and connect to nature experiences.

The research asked further questions regarding community awareness of local blue and green spaces and how they changed during the COVID19 restrictions, finding that litter (supporting findings from *Community Perceptions Survey*) and safety were the most recurrent concerns reported by survey respondents. With regards to safety, respondents frequently mentioned concerns around shared pedestrian and cycling paths.

Additionally, the increased levels of visitation to blue green spaces (waterways) during 2020 and 2021 when Melbourne residents were restricted to their local neighbourhoods may have contributed to:

- Declining amenity satisfaction scores in the 2020 and 2021, particularly in Melbourne's more urbanised and inner catchments of Werribee, Maribyrnong, Yarra and Dandenong.
- Similar declining recreation scores from 2020 onwards, particularly in more urbanised inner catchments. This may be attributed to the banning of organised sports, with many sports fields located along waterway corridors.
- Declining community connection scores from 2020 onwards for all catchments (Table 25). This may be attributed to the restrictions on social gatherings, including picnics and other informal events along waterways and formal events (e.g. festivals) or community organisations (e.g. friends groups, scouts etc.).

The research findings support KEQ3a *Recommendation 1* to improve data by expanding the geographic location of samples, target or deep dive into specific issues (e.g. litter) and adopt additional metrics such as visitation data. The research also highlighted discrepancies between the *Community Perceptions Survey* and targeted/deep-dive surveys such as those conducted through this research, which should be considered as the scoring methodology is improved as part of the social values framework (RPO-43).

### **Developing Litter Monitoring Methods for Tracking Condition and Target Setting**

To effectively manage, and mitigate litter impacts, we need to understand the principal types, sources and quantities of litter entering waterways and the relative impacts (HWS performance objective RPO -26). To achieve this there is a need to ensure that relevant and robust data are available that allows a comprehensive analysis of the nature and sources of litter, as well as providing an understanding of changes in litter through time, particularly in response to management interventions.

While some litter data along waterways was collected prior to the development of the Healthy Waterways Strategy (e.g. volumes of litter cleaned out during routine litter trap maintenance), it was not able to support the development of region-wide litter condition ratings and management targets. It also provided little guidance on litter hotspots or the major sources of litter to help prioritise management efforts. As such, a standardized sampling framework needed to be developed that supports different aspects of litter management. The development of long-term, broad scale comparative studies that allow Melbourne Water to prioritise litter prevention actions and investment, asset management regimes, as well as ecological impact studies (e.g. platypus) have been the focus of research by the Aquatic Pollution Prevention Partnership (A3P).

The objective of the A3P project was to develop a framework for conducting litter assessments to address different Melbourne Water business needs around litter. In working to achieve this, the project identified the purposes for litter assessments and reviewed appropriate survey methods for these purposes. The project then validated methods for different purposes through field case studies

and developed a set of guidelines for surveying and monitoring litter that can be applied in a litter program framework. A3P has now made significant steps towards filling knowledge gaps to inform the establishment of a litter monitoring and assessment program, including litter volumes and sources, to underpin litter reduction programs (RPO-26) and reduce the incidence of illegal dumping and littering through raised community awareness and knowledge, infrastructure and enforcement (RPO-27)

In 2022, a case study was initiated trialling a broad-scale type monitoring program for understanding *the principal types, sources and quantities of litter entering waterways* at 26 sites from 6 MW sub-catchments. Sites have been surveyed on three occasions since initiation. Results are being used to assess differences in litter type and quantity occurring at sites within each sub-catchment and between sub catchments. Preliminary results from quantitative surveys show that Dandenong Creek and Moonee Ponds Creek have consistently higher litter loads, while Werribee River has the lowest (See Figure 35). Key litter types contributing to litter loads include food related packaging, expanded polystyrene and soft plastics, while at select sites cigarettes, hard plastics and paper items are also significant contributors. Data has been used to develop catchment ratings which are shown in Figure 34. More detail about the A3P litter project is provided in the Healthy Waterway Strategy mid-term review research factsheet.

Catchment						
	Dandenong Creek	Yarra River	Stony Creek	Moonee Ponds Creek	Werribee River	Cherry Creek
Catchment score	6	5.4	6.8	7	5.4	6.8
Catchment Rating	moderate	high	moderate	moderate	high	moderate

Figure 34. Litter Catchment Ratings (A3P Research Partnership).

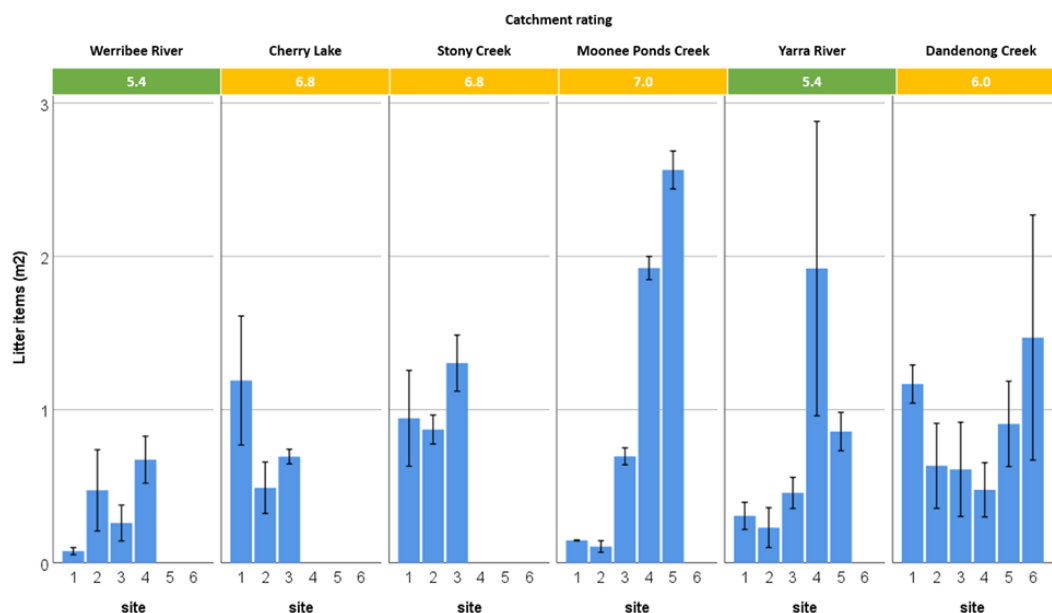


Figure 35. Quantitative catchment ratings and survey results for 26 sites across 6 sub-catchments.

Although this research project is limited to only six catchments and the litter satisfaction data from the *Community Perceptions Survey* is limited to only three years, there are conflicting comparisons. Litter satisfaction results (Figure 20) were 'low' for the Werribee River Lower and in 2022 the lowest

satisfaction of any performing catchment, with these perceptions of litter the opposite of the actual litter loads recorded ('high' rating based on litter load study). The Moonee Ponds Creek (Maribyrnong River Lower) had a 'moderate' satisfaction with litter amounts but high litter loads (low rating) measured in this study. The Dandenong Creek catchment had improving litter satisfaction scores, although still rate as 'moderate', as opposed to the high litter loads (but matching 'moderate' rating) recorded in this study. These findings highlight the need to consider actual litter volumes/loads in consideration with perception survey results as the social values framework is improved (RPO-43).

### Water colour and clarity satisfaction scores as a consequence of rainfall

Water "colour and clarity" is the on average the second lowest rating condition after litter, reducing amenity satisfaction scores.. Water colour and clarity could possibly be inferred as turbidity, and so caused by increased rainfall and runoff (amongst other possible factors).

At a catchment scale, there was minor annual variability between water colour and clarity satisfaction ratings. Figure 36 shows these catchment scale changes.

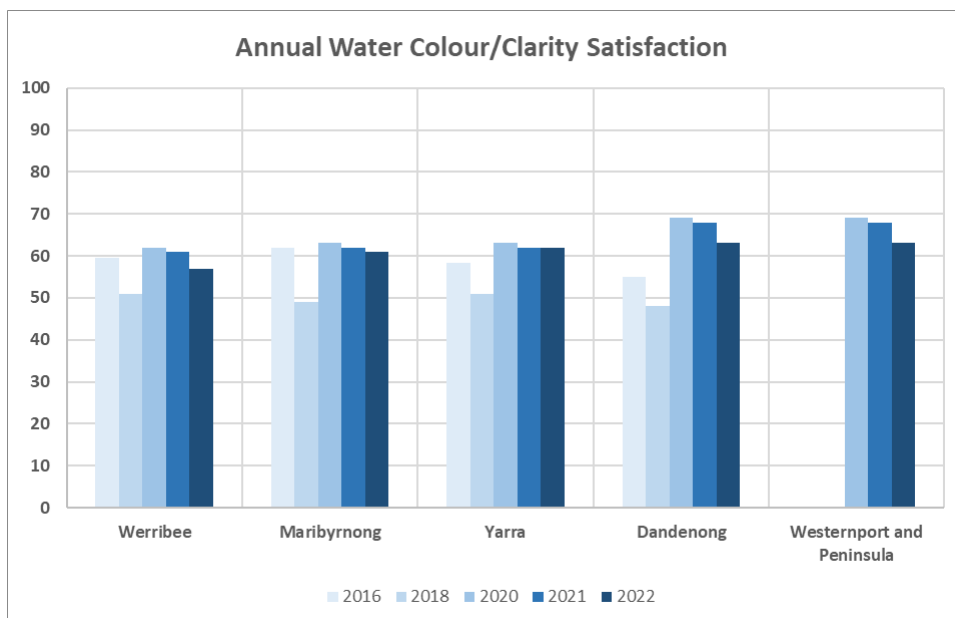


Figure 36. Annual water colour and clarity satisfaction scores per catchment.

When comparing water colour and clarity against annual rainfall totals, there is a similar trend across all catchments (Figure 37), noting Westernport and Peninsula has limited data. This would indicate that there is a good relationship between community perceptions of water colour/clarity and rainfall (and therefore runoff). Annual catchment rainfall data comparisons were taken from the following locations:

- Werribee River = Laverton RAAF
- Maribyrnong River = Melbourne Airport
- Yarra River = Toolangi (Mount St Leonard DPI)
- Dandenong Creek = Moorabbin Airport
- Westernport and Peninsula = Berwick (Buchanan Road)

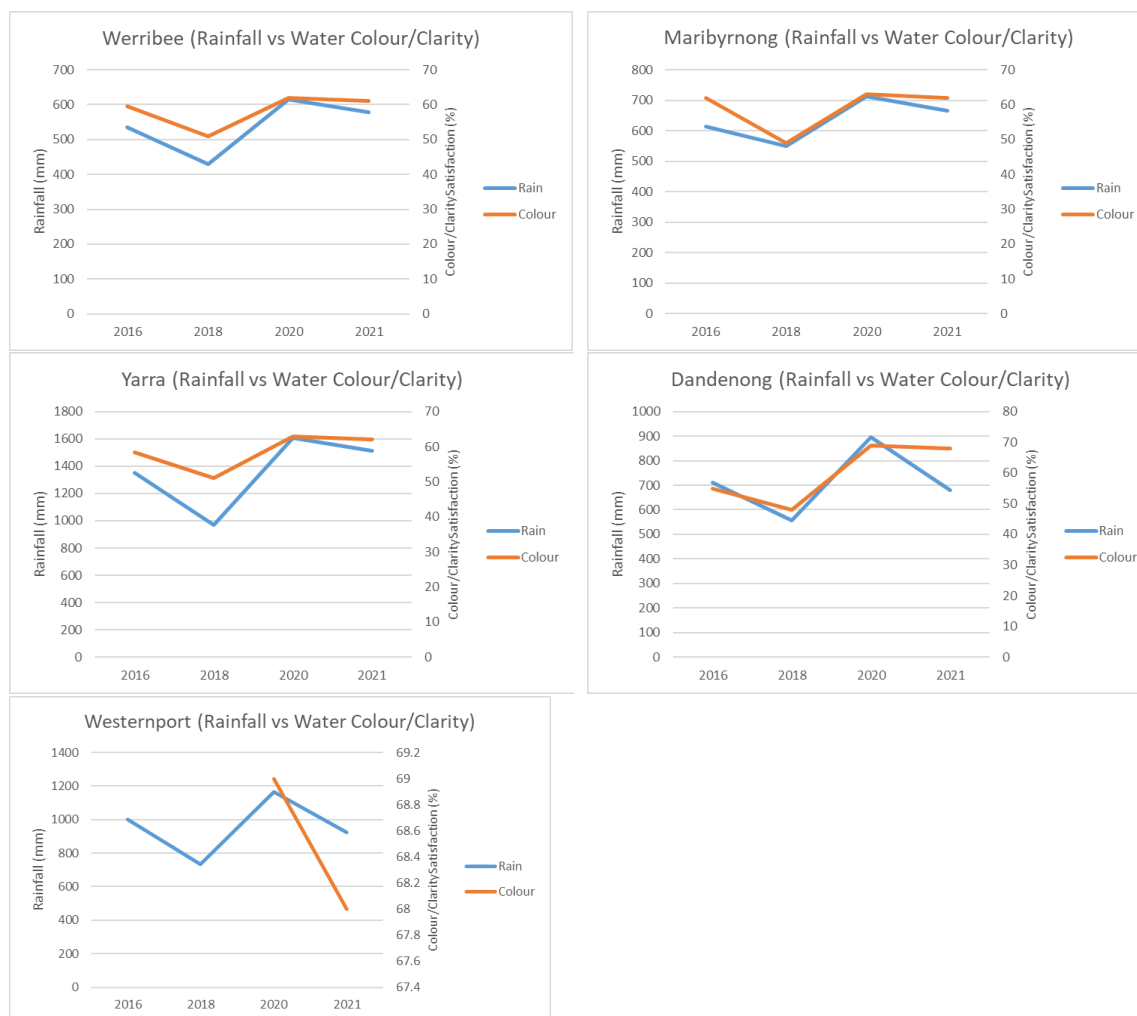


Figure 37. Rainfall vs water colour/clarity satisfaction scores per catchment.

However, because satisfaction surveys are sampled annually (i.e. once a year) compared to rainfall data sampled at diel intervals (total annual rainfall considered), a strong relationship or consequence cannot be concluded. Actual water colour and clarity measures such as turbidity should be considered in the development of the social values framework (Recommendation 6)

### Recreational water quality

For recreational activities involving contact with water, water quality, specifically microbial water quality is the critical condition that determines recreational suitability. Many reaches of the Yarra consistently report 'Poor' recreational water quality and over the years and this has attracted significant public interest.

The use of faecal indicator bacteria, such as *E.coli*, to assess water quality for recreation is a widely accepted scientific method. However, it applies a standardised estimate of illness risk based on several key epidemiological studies (NHMRC 2008). In many cases these epidemiological studies were undertaken in Europe, and there is some uncertainty about their applicability to Australian conditions and the correlation of faecal indicator species such as *E. coli* and enterococci with actual pathogens.

To better understand the problem Melbourne Water teamed up with the EPA and Monash University to undertake a research project. It used a Quantitative Microbial Risk Assessment or

QMRA which estimates human health risks through examination of the actual pathogens present, their number and infectivity, the potential exposure dose and the sensitivity of the person being exposed.

The project is summarised in more detail in the mid-term review research fact sheets, however the key finding is that faecal indicators or organisms (FIB and FIB respectively e.g. *E.coli*) over estimates the potential health risk for recreators in the rural and peri-urban reaches of the Yarra River.

As a next step, Melbourne Water is working with EPA Victoria and Monash University to further embed research findings into practice. A project is being scoped up to run in parallel to the Yarra Watch summer season 2022-23 to streamline the methodology for broader application and to test its viability on a waterway with much less available data.

The research factsheet outlines a recommendation to consider options to develop site-specific objectives for the Yarra River that better represent health risk, as an alternative to the state-wide objectives in the Environment Reference Standard. Consider using pathogen concentrations, rather than faecal indicators, as a more useful method for future monitoring of recreational water quality.

## Recommendations for consideration in Science Inquiry

### 4. Implement litter monitoring program

Litter is a major detractor to social values scores across the region, which has also been reflected in qualitative feedback from Melbourne Water community perception surveys and also the most important factor listed in the My Victorian Waterway survey (DELWP 2022). Litter satisfaction scores are frequently the lowest (or near lowest) across most catchments. When ranking, litter condition satisfaction in 2022 was overall the fourth worst performing indicator across all catchments. From year to year, the litter satisfaction scores generally have little variability between years with most catchments remaining within a 'moderate' category, except for Yarra River Lower, Cardinia Creek, Werribee River Lower and Cherry, Kororoit, Laverton, Skeleton Creeks which all declined from 'moderate' to 'low' ratings. Furthermore, at an individual sub-catchment scale litter satisfaction scores included the lowest ratings since collecting litter perceptions data (scores of 45% at Skeleton Creek and Blind Creek in 2022).

With Melbourne Water investing in litter for amenity maintenance programs from 2020 and limited improvements to litter satisfaction scores, further research is needed to determine whether the actual amount of waterway litter is consistently in a poor condition or is there an underlying and ongoing perception amongst the community that litter condition is poor regardless of the physical volumes present.

As discussed, the A3P litter partnership between Melbourne Water and RMIT is building a litter monitoring framework to standardise methods and better measure litter on ground. This new framework is currently being trialled across 6 sub-catchments, with the project due for completion in 2023 a small sample of actual litter volumes will be available and rated towards a litter (volume) score. In the immediate future, comparing litter volume ratings against sub-catchment community perceptions scores may provide an insight into litter as a social paradigm that is constantly a significant issue or support the accuracy of surveys as an accurate method for rating waterway litter.

Once a monitoring framework is finalised, Melbourne Water should also collaborate with partners to implement a litter monitoring program across more Healthy Waterways Strategy sub-catchments, ideally at annual intervals. Data from a litter monitoring program will support more accurate catchment scale reporting and also enable land and waterway managers to target waterways with

the most significant and consistent litter issues for maintenance, rather than deciding on locations based on public complaints.

Where specific social values condition such as litter is performing particularly poor (or good) in a sub-catchment, further survey data collection (as mentioned in recommendation 1a) should be undertaken by delivering tailored surveys on specific topics. For instance, from the 2022 survey catchments in the Werribee River received significantly lower litter satisfaction scores compared to Dandenong Creek Catchment. Further surveys that interrogate why people have these perceptions, what they consider bad/good litter condition and other qualitative insights would be useful to understand the impact that litter has on social values and how perceptions may differ between different community segments.

High priority catchments based on litter satisfaction are ranked in Appendix 4. Further collaboration is required with other organisations located within these catchments, including the interrogation of other survey results (e.g. council or Parks Victoria surveys).

#### **5. Review Performance Objectives (e.g. Access) and evolve new performance objectives and targets**

For the end of strategy review and in anticipation of the development of the next version of the Healthy Waterways Strategy, review the existing performance objectives conditions (e.g. Access), addressing the suitability of the metrics (e.g. km's of new paths, % canopy cover, km's naturalised creeks) and if updates are required (e.g. number of visitors using paths). Consider validity of existing performance objective long-term targets, based on current tracking within each sub-catchment and likelihood of delivery consider any known factors such as plans, investment timelines and external factors such as land use (or future land use). Apply this thinking to the development of a performance objective for wetlands and estuaries. For wetlands in particular, finalise conceptual model development for wetlands and performance objectives (see Appendix 5).

Consider the development of new plans and actions relevant to Melbourne's waterways and social values, such as Suburban Parks Program Regional Park Plans (DELWP), Lower Werribee Amenity Action Plan (Melbourne Water) and council recreation/open space (access) and urban forest (tree canopy) strategies as an example.

Furthermore, review the calculation method for assessing participation. This metric has been adapted in recent years to consider additional means of participation such as interaction through online programs and social media. This was a required feature as a result of COVID19 impacts on community waterway programs (e.g. grants). Unlike most other performance objectives which are cumulative (i.e. build over time), participation results restart from zero each year. This means that targets may be reached in one year but not in consequent years, such as the year of reporting. Currently, the reporting of participation rates at a sub-catchment scale is more sensitive to annual changes.

#### **6. Develop and update the Social Values Framework:**

The current method for measuring social values in this review is based on data obtained from Melbourne Waters annual *Community Perceptions Survey*. At the time of the development of the Strategy, this was the most appropriate dataset available. However, the *Community Perceptions Survey* was never designed with the intention of being used for measuring social values of waterways, so there are shortfalls with its use. For instance, a statistically significant sample of survey data is not captured across all 69 sub-catchment, 36% of sub-catchments captured in 2022 survey and 12% of sub-catchments captured in 2016 (baseline) could be accounted. Expansion of this monitoring program has been suggested in Recommendation 1 (3a).

Furthermore, if the scoring methodology for river catchment scores are based on an average of all sub-catchments within, then a distorted amenity, recreation or community connection score is obtained and weighted towards catchments with higher populations (or persons participating in the survey), but also sub-catchment nuances are lost when averaged (i.e. Dandenong Creek Catchment). As shown in this review, catchments such as the Yarra River Lower have a more complete understanding of satisfaction at a sub-catchment scale than outer or rural regions such as the Westernport Catchment.

In this review, there are positive moderate correlations between social values (amenity, recreation and community connection) as an outcome of improved conditions (e.g. access facilities). Further investigations are required to better understand these relationships between conditions (e.g. litter and access) and how that impacts social values (perceptions and realities).

Improvements to the social values framework (in alignment with RPO-43) needs to also determine what other indicators or data sources could compliment the survey data (e.g. conditions information such as corridor width) and compliment rather than replace the existing social values scoring calculation method. Improving geographical sub-catchment data gaps while ensuring historical data and scores can continue to be used.

The HWS Regional Monitoring and Evaluation Plan (MEP) identifies performance expectations for community places regional performance objectives (RPOs), stating “*Conflicts between social and environmental values of waterways is understood and guidance provided to practioners of how to navigate this*”. The conflicts and trade-off’s need to also be considered as part of the development and maturity of a social values framework.

Furthermore, an evolved social values framework will support the further development of future Healthy Waterways Strategy performance objectives (e.g. evolving from length of access pathways to also consider visitation numbers, number of recreational facilities, number of people using access facilities such as canoe ramps). In practice, providing a ‘roadmap’ identifying management interventions which would contemporaneously lead to an improved social values rating, while balancing conflicting demands and impacts on ecological values.

Preliminary considerations for improving the social values framework, which includes the categorisation of waterway typologies has been outlined in (Appendix 6: Potential Alternative Social Values Framework ). We recommend that the existing social values framework, including metrics, methodologies and rubrics be further investigated and reviewed by the end of the Healthy Waterways Strategy.

#### **7. Better understand community connections to cultural activities:**

When ranking condition satisfaction in 2022, community connections to culture were the worst performing condition, ranking in reverse order; first (engage with art and culture) and third (engage with a culturally significant place). Further investigations should be undertaken to understand this further, including why scores are relatively better in the Stony Creek (Maribyrnong), Eumemmerring Creek (Dandenong) and Yarra River Lower sub-catchments.

Investigations should explore potential interventions with partners, for instance could activities to connect community to culture, such as through signage provide a meaningful approach to improve satisfaction? Longer-term and through appropriate community collaborations (including Traditional Owners), new performance objectives could be developed for cultural connections to waterways (and wetlands) and delivered through the *Liveable Communities Liveable Waterways Incentive*

(LCLW) Program under the 'Liveable Cities' theme (preceded by a LCLW Prioritisation and Implementation Action Plan).

**8. Actively recruit under-represented groups in surveys:**

As highlighted within the Melbourne Water waterway amenity maintenance program focused surveys at Cherry Creek and Dandenong Creek Middle sub-catchments, discrepancies and nuances can be found when comparing large quantitative data samples compared to targeted and qualitative surveys. In particular at the Dandenong Creek Middle where a conversation toolkit survey was conducted with a self-guided disability group, opposing levels of satisfaction with access (e.g. pathways and furniture such as seating) was recorded, with the group with disability overserving that they were "unable to access the site" whilst the larger survey group ranked access as the second highest satisfaction levels.

**9. Investigate informal access (e.g. gravel paths, grassed areas) impacts on waterway social values:**

Currently access is measured through *the Community Perceptions Survey* (satisfaction) and as a performance objective based on new facilities built (i.e. pathways). As observed through the social values framework and the Dandenong Creek Middle survey, informal access can be preferred particularly in catchments that have 'wilderness' attributes and provide a connection to nature. The status of access in such catchments, particularly if in outer (non-urban) catchments is not well understood. Further investigations are required to understand the relationships between usage and access facilities (i.e. pathways) and delve into factors that could better measure access performance in 'wilderness' catchment typologies (e.g. visitation data versus community perceptions analysis).

**10. Investigate impact of water quality on recreation in the bays (Port Phillip and Westernport):**

To date the data and review considers recreation within or next to waterways and the negative impacts from threats such as water quality pollution. Further investigations should consider water quality impacts on recreation in Port Phillip and Westernport Bays, including community perceptions to perceived risks and likely risks as a result of events such as floods (stormwater runoff issues).

**11. Catchment specific recommendations related to conditions**

Based on satisfaction ratings from individual sub-catchments, the follow insights were considered:

Werribee River: investigate opportunities to improve satisfaction related to recreation conditions, particularly use of Werribee River catchment for commuting corridors. Although performance ratings considering satisfaction with pathways (Figure 26) and access targets (Table 12) are "On-Track", understanding the reasons why commuting experiences are lagging are valuable considering the increased population and development forecast for the region, including Plan Melbourne 2050 hubs such as National Employment and Innovation Cluster's (NEIC).

Explore conditions impacting declining waterway amenity, in particular poor water quality & clarity (Werribee River Lowlands), Litter (Cherry, Kororoit, Laverton, Skeleton) and odours (all). Support investments opportunities such as Suburban Parks Program and other council open space masterplan which have identified development of Werribee River, Kororoit Creek and Toolern Creek into Regional Parklands and link into these parkland programs to collect further data from community surveys and other conditions mapping (e.g. location of new paths, canoe platforms, naturalised creeks etc.).

Maribyrnong River: conditions relating to waterway recreation and community connection values were of most concern for the Maribyrnong Catchment, particularly for the Maribyrnong River Lower. For recreation, this was related to conditions related to access pathways (e.g. for commuting) and

for community connection this was related to engaging with and facilities for cultural events. Litter was also highlighted both through the survey at the Moonee Ponds Creek sub-catchment (4<sup>th</sup> worst sub-catchment in 2022) and in the litter research partnership (Moonee Ponds and Stony Creek receiving moderate litter scores) regarding actual volumes measured. Given recent collaborative programs and designs (i.e. Moonee Ponds Creek Chain of Ponds) to transform the creek into an iconic waterway that provides high social, cultural and environmental benefits, continue to focus monitoring at Moonee Ponds Creek in alignment with planned interventions and investments to determine how this impacts community satisfaction..

Yarra River: conditions related to amenity and recreation values are generally improving across Yarra River catchments. For amenity related conditions, litter is improving in the Yarra River Middle as is colour and clarity in the Yarra River Upper and Middle catchments. These are reflective of the amenity satisfactions scores. Recreation conditions are also generally improving except experiences related to commuting through the Yarra River Upper and Lower catchments. Considering satisfaction with pathways is performing well, this may be related to additional elements related to commuting beyond the path which need to be better understood (e.g. signage).

Community connection condition satisfaction scores have the most room for improvement and in particular are lowest in central urban sub-catchment areas such as Merri Creek, Darebin Creek and Yarra River (lower and middle) sub-catchments. As noted in the 2022 survey, community connection conditions such as engaging with art and culturally significant places are of high importance particularly in sub-catchments such as Darebin Creek (and Merri Creek sub-catchment according to survey data). The reasons behind these community sentiments need to be better understood and interventions in art and cultural initiatives (e.g. events, funded artwork and displays) investigated with partners (e.g. Traditional Owners) or community groups (through LCLW Incentives Program).

Dandenong Creek: As noted in Section KEQ 3a of the review, the Kananook Creek, recorded significantly lower amenity, recreation and community connection value scores across all years. Likewise the Kananook Creek sub-catchment recorded low amenity related conditions satisfaction scores, including for litter, dumping, odour, water colour & clarity and landscape views. Melbourne Water and partners should continue to monitor how the Lower Dandenong Creek Litter Collaboration impacts litter satisfaction ratings leading into the end of strategy review, particularly as a comparison against other catchments and investigate opportunities to improve amenity related conditions around the Kananook Creek sub-catchment.

Dandenong Creek Catchment was the second worst for engaging with culturally significant places, in particular Blind Creek sub-catchment which reported the lowest (including engaging with art) for all sub-catchments across the region, should be the focus of community connection interventions that increase awareness and appreciation of cultural values.

Westernport and Peninsula: further sub-catchments need to be measured to ensure a better representation of this catchment is captured in the dataset. Much of the Westernport and Peninsula Catchment is privately owned rural/agricultural land uses, so there are limited sub-catchment locations where communities can access to experience waterway amenity, recreation and community connection. Also, safety related to access to and along waterways (e.g. pathways) as impacted from overgrown vegetation is a major concern to the public. Interventions should consider prioritising managing vegetation for amenity and access (noted in E5 Blue Spaces). Support investments such as Suburban Parks Program and other council open space masterplan which have identified development of Cardinia Creek and Clyde Creek Regional Parklands and present significant opportunities to increase access and other amenity related infrastructure.

## 4. Information relevant to remaining KEQs

This section provides an update on information that is relevant to the remaining KEQs.

### KEQ 2b. To what extent have projected known and emerging future threats changed from 2018? Have any assumptions about impacts to key values changed?

A project has been initiated to look at ‘what’s changed’ since the HWS was released. The results of this project will feed into KEQ2b and be outlined in the Science Inquiry. The project will also provide useful data for the Implementation Inquiry (Melbourne Water, *in prep*) which will evaluate the extent to which performance objectives have been achieved along with the effectiveness of collaboration.

The project will focus on:

1. What has changed in the external environment in the past few years to now, that may impact our effectiveness?
2. What is happening in our waterways and drainage operating environment and strategy implementation, that may impact our effectiveness, now and to the final strategy review?
3. How have our assumptions around threats to waterways changed since the strategy was developed? Have they increased, remained the same or decreased?

The project will look at Melbourne Water’s annual environment operating scan to identify external conditions relevant to the implementation of the HWS. It will consider new information (e.g. how threats have changed as well policy and institutional arrangements) and will also draw on on-ground intelligence that may impact implementation of the HWS.

The project will consider the impacts of these changes through a SWOT analysis to identify what’s significant for future implementation of the HWS. A complete list of threats to social values is currently being compiled and is being refined as each Key Value paper is prepared. Further work is underway to determine datasets and information which will provide evidence for how threats and assumptions have changed since the HWS was developed.

For this review, threats to social values identified through HWS Resource Document and the development of social values conceptual models were considered (Table 28). Threats to social values are considered in the context of the conditions identified in the amenity, recreation and community connection conceptual models. An estimation of the likelihood of the threat impacting the trajectory considers:

- High – the threat has been impacting the condition since the initiation of the 2018 Healthy Waterways Strategy across the region and there are no substantial mitigations in place at a regional scale.
- Moderate – the threat has been impacting the condition since the initiation of the 2018 Healthy Waterways Strategy but is not a region-wide threat or the threat has so far not detrimentally impacted the condition enough to prevent related social values experiences experiences.

Note further understandings of threat potential, data availability and confidence, threat impact, trajectory and assumptions are needed. Further information about threats to social values is outlined in the HWS Threats Technical Paper (Melbourne Water, 2023b).

Table 28. Summary of threats to social values.

Social Value Condition	Threat category	Likelihood of threat impacting the long term trajectory and has occurred since 2018	Impacts on the Social Values Framework Typologies
Physical form (corridor width, channel form)	<b>Urbanisation:</b> Inappropriate urban development reducing waterway corridor (width) through encroachment, overshadowing, views and vistas. Physical alterations: piping or modification of headwater streams and building over wetlands, drains and levees, deepening for flood storage, LWD removal, illegal alteration of waterway (e.g. channelization) or creation of on-line wetlands.	Moderate: has occurred in some locations	Naturalness values
Vegetation	<b>Climate change:</b> reduction in average rainfall and annual flow volumes, increased storm intensity and floods, increased bushfires, increased frequency of storms, increased urban heat island, sea level rise, increased invasive species. <b>Vegetation clearing:</b> Illegal tree removal and forestry practices. <b>Access:</b> Poor or inappropriate access (i.e. into sensitive areas)	High – has occurred	Naturalness values (habitat) Human/social values (health and wellbeing urban cooling)
Water Quality	<b>Litter:</b> from urban areas, dumping, fishing equipment, opera house traps, grates (stormwater/water supply). <b>Wastewater:</b> Sewerage treatment plants, emergency relief structures, spills, untreated sewerage ingress, poor septic performance/maintenance. Recycled water use. <b>Urbanisation:</b> Urban land uses typically lead to elevated pollutants including sediments, nutrients, toxicants and micro plastics. Industrial land uses typically have higher risk profiles and require tailored interventions. This threat category also includes the threat of elevated pollutants during the construction phase of development. <b>Odours:</b> from chemical spills, stormwater run-off and septic tanks	High – has occurred	Naturalness values
Water Regime	<b>Climate change:</b> reduced rainfall and runoff <b>Water use:</b> Potable water supply dams, agricultural and other water demands e.g. surface water diversions, groundwater extractions, farm dams. Unregulated flows are closely related to the agricultural threat.	Moderate – occurring but not preventing related activities (e.g. recreational paddling)	Naturalness values
Biodiversity (Native species)	<b>Access and recreation:</b> as a counter to increased human access and recreation from use of the formal/designated road and track network as well as illegal off-road trail creation. Impacts can lead to noise, light, litter, excrement (pollution), dogs (pests), erosion, and vegetation clearance which can impact biodiversity habitats, breeding and other behaviours. <b>Vegetation clearing:</b> Illegal tree removal and forestry practices.	High – has occurred	Naturalness values

Social Value Condition	Threat category	Likelihood of threat impacting the long term trajectory and has occurred since 2018	Impacts on the Social Values Framework Typologies
	<p><b>Pest, plants and animals:</b> Unfenced grazing land (e.g. cattle, deer, rabbits etc.) over abundant native wildlife. Issues include over grazing, trampling, pugging, introduction of weeds and bank erosion. Predators e.g. exotic fish, dogs and cats disturbing native species.</p> <p><b>Instream barriers:</b> restricting migration and movement, such as gauging station weirs, dam walls, erosion control structures, roads and other urban development infrastructure.</p> <p><b>Access:</b> Poor or inappropriate access (i.e. into sensitive areas)</p> <p><b>Light and noise:</b> introduced as parkland or urban infrastructure, increased human activities, events or urbanisation</p>		
Facilities - Access	<p><b>Inappropriate maintenance:</b> unsightly or unsafe vegetation crossing/blocking paths. Path damaged caused by flooding and erosion. On-water access impacted by instream (high-value) habitat (e.g. snags).</p> <p><b>Poor planning and collaboration:</b> Incomplete trails or located in inappropriate areas (e.g. trail or on-water ramps consistently impacted by flooding)</p> <p><b>Safety:</b> Inappropriate/poor lighting, poor signage, low visitation (passive surveillance).</p> <p><b>Urbanisation:</b> development, including private property or public infrastructure (e.g. roads, rail) that blocks continuous movement along a waterway corridor.</p> <p><b>Climate Change:</b> paths and on-water access (e.g. boat ramps) impacted from rising sea levels (particularly in estuaries), increased flooding and bushfire.</p>	High – has occurred	Human/social Values
Organised events (social, recreational, cultural, sporting, art) and organised connections (e.g. citizen science, NRM groups, Caring for Country)	<p><b>Lack of appropriate facilities:</b> including assets for accessing, securely displaying (e.g. art) and which is available for a range of abilities.</p> <p><b>Catastrophic events:</b> natural events such as flooding and bushfires may take facilities and spaces out of use temporarily or permanently. Human related issues such as pandemics have been seen to halt community events.</p> <p><b>Climate change:</b> causing health or wellbeing issues may result in people not being able or wanting to visit waterways (e.g. urban heat)</p>	High – has occurred	Human/social Values

## KEQ 4a. To what extent are interventions appropriate and effective for achieving outcomes?

### Overview of interventions to improve social values

There are many different types of interventions for social values currently applied for the Healthy Waterways Strategy. Melbourne Water led initiatives however mainly focus on either ‘amenity’ or ‘community connection’ initiatives. Recreation initiatives, such as new paths or sporting facilities are mainly the responsibility of obligated recreational managers such as councils.

Most of the Melbourne Water initiatives have commenced in recent years and since the inception of the 2018 Healthy Waterways Strategy.

Table 29 outlines some of the interventions delivered by Melbourne Water and partners, confidence rating considers the impact an intervention has in improving relevant performance objectives.

A thorough technical report on HWS interventions has separately been undertaken as part of the mid-term review (Melbourne Water 2023c), however the paper only reviewed effectiveness and appropriateness for some interventions outlined in Table 30.

Table 29. Social value interventions used in relation to Healthy Waterways Strategy.

Intervention type	Specifics	Confidence	Adoption Stage
Waterway access	Improve or construct new pathways (inc shared pathways), canoe ramps, bridges, stepping-stones	High	Part of BAU - Council & Parks Vic (various) capital shared pathway program
		Low	Early adoption - (MW) On ground - new program: capital for 5 new on water access sites
Citizen science programs	‘Traditional’ Citizen science programs such as Waterwatch, Birdlife	Medium	Part of BAU – Melbourne Water Parks Victoria
	Creation of digital technologies (e.g. apps such as Frog Censes), which also provide assumptive feedback about waterway social engagement/ awareness levels.	Low	Early adoption - (MW) (recent years since HWS2018)
Educational signage	Signage program to improve community awareness and outline dangers (e.g. canoe rapids).	High	Part of BAU – Councils, Parks Vic & Melbourne Water
	New feature of including digital features such as QR codes. Monitoring program to collect further social values data (perceptions and actual usage)	Low	Research in scoping phase - Partnership between land and waterway management agencies (e.g. Melbourne Water and councils)
Maintenance	Maintenance along waterways in terms of litter for environmental values.	High	Part of BAU – Councils, Parks Vic & Melbourne Water

Intervention type	Specifics	Confidence	Adoption Stage
	Maintenance in grass cutting and litter management to support amenity values.	Low	Early adoption -MW Pilot Program at 14 grass cutting waterways and 13 litter management 'amenity hotspot' sites
Events	Organised connections: increase participation in environmental stewardship (e.g. planting days, Clean Up Australia Day), cultural, social, and sporting events around waterways	Low - High	Part of BAU: MW frog census / waterwatch / platypus spot events Pilots – cultural and art incentives (Liveability finding) Partnership between land and waterway management agencies (e.g. Melbourne Water and councils)
Incentives	Incentives to provide benefits for social values alongside waterways	Low	Part of BAU: MW Liveable Community Liveable Waterways
River restoration	Daylighting of a reach of waterway previously piped	Low - Medium	Early adoption – MW New program called Reimagine your Creek: capital Partnership between land and waterway management agencies (e.g. Melbourne Water, Parks Victoria, and councils)
Open space	Master planning of open space near waterways increasing parkland, corridor widths and open space around waterways.  New program (i.e. Suburban Parklands),	High  Low - Medium	Part of BAU (in the past) – DELWP, Councils, Parks Vic & Melbourne Water  Scoping, planning stage – Suburban Parks Program, delivery not expected until after end of this strategy. Partnership between land and waterway management agencies (e.g. DELWP Melbourne Water, Parks Victoria, councils, and Traditional Owners)

Table 30. Social value Interventions to be included in the mid-term review evaluation.

Intervention Group	Intervention type	Specifics	Current extent of use in region	Relevant program or research project
Establish	Waterway access	Improve or construct new canoe ramps	Low	New canoe ramp program: capital for 5 new on water access sites

Establish	River Restoration	Daylighting of a reach of waterway previously piped	Low	MW Reimagine your Creek program – 4 sites completed
Maintain/protect	Citizen science programs	Creation of digital technologies (e.g. apps)	High	The impacts of ‘next generation’ citizen science programs
Establish	Educational signage	Signage with new feature of including digital features such as QR codes.	Low	Partnership between land and waterway management agencies (e.g. Melbourne Water and councils)

### KEQ 4b. What are the key remaining knowledge gaps that need to be addressed in the next 5 years to improve strategy delivery or prepare for the next HWS?

Knowledge gaps related to all social values (amenity, recreation and community connection) are mainly concerned with the limitations surrounding the method and means for collecting data.

- Survey data: The data source used to calculate waterway amenity (Community Perceptions Survey) is subjective as based on personal satisfaction perceptions. This method is still producing valuable data and has allowed large data samples sizes to be collected, particularly considering the intrinsic and abstract nature of waterway amenity, recreation and community connection concepts. However, it is difficult to validate that a respondent has indeed visited a stated waterway or can recall their satisfaction with this waterway, particularly if this was not recent. Comparisons with other surveys conducted onsite have produced varying results, often more positive.
- Geographical distribution and catchment sample sizes: The breadth of sub-catchments with statistically significant data (36% of sub-catchments in 2022) is viewed as a significant limitation, particularly when reporting on performance ratings at a river catchment scale (for instance two of twelve sub-catchments in the Mornington and Westernport region are represented).
- Litter monitoring method: litter satisfaction ratings are generally low and consistent of this across catchments and years. There are also differences when comparing litter satisfaction to a select number of sub-catchments that have been measuring litter volume and loads (Aquatic Pollution Prevention Partnership). For instance litter satisfaction results were ‘low’ for the Werribee River Lower and in 2022 the lowest satisfaction of any performing catchment, which are the opposite of the actual litter loads recorded (‘high’ rating based on litter load study).

These limitations have been addressed through KEQ3a and KEQ3b recommendations, in particular:

1. Improving Data Scale and Confidence

- a. Expanding the breadth of survey data including through new metrics such as GIS mobility data.
4. Implement a litter monitoring program
6. Development and update the Social Values Framework:
7. Better understand community connections to cultural activities:
8. Actively recruit under-represented groups in surveys

### Summary of future directions on social values

This review has demonstrated valuable insights into community perceptions of waterway amenity, recreation and community connection values along with the conditions that underpin these values, highlighting key geographical concerns around litter and connections to art and culture. However there are limitations to the data samples, with only a portion (approximately one-third) of sub-catchments recorded. The immaturity of the monitoring program also makes it difficult to understand social value trajectories when data samples only cover a small number of years (between one to four years of good data depending on catchment).

Further in-depth data monitoring needs to occur, targeting catchment data gaps (e.g. Westernport Catchment) while delving deeper into the reasons why (e.g. community perceptions of why litter is bad). Increased monitoring could come from both expanding the geographical scale of the Community Perceptions Survey or by including additional programs such as intervention surveys or targeted engagement programs with specific groups (e.g. disability groups).

As the social values program evolves, it should also investigate how other indicators/metrics can complement survey data. For instance consideration of investments and construction of assets (e.g. new paths or on-water access, naturalized creeks), activities (e.g. tree planting for urban cooling, maintenance to manage litter and overgrown vegetation) or other datasets such as human movement/visitation GIS data insights. Recommendations on these “amenity-related” programs and how they should be delivered cannot be made until these are considered as part of an upgraded social values framework. This framework will also help inform the understanding of threats to social values and identify research gaps. Furthermore an updated social values framework will help partners and community expand and develop performance objectives at a sub-catchment scale (e.g. litter, naturalized creeks etc.), while refining the metrics and targets used for current performance objectives (i.e. access, participation).

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## Appendix 1: Access Targets and Rubrics

A key factor underpinning all three social values is the condition 'Access' which impacts amenity, recreation and community connection through the provision of on-ground pathways or on-water access facilities (e.g. canoe ramps).

Access to the waterway and riparian corridor enables people to derive value from a range of experiences. Access can capture many variables that allow people to experience the waterway including access: to/or along the waterway corridor; to/or along the waterway itself for swimming/paddling; quality of access such as legible environments (e.g. wayfinding signage); visual access; connection to points of interest (Jacobs, 2018).

In addition to access being a condition that supports the key social values, the HWS includes performance objectives and targets for Access. **To evaluate how access as an environmental condition helps to explain the current social value trends, it has been assumed that the access performance objective targets represent the performance *expectation* for access as a condition over the next 10 years in terms of its' contribution to the social values.**

### Access Targets

Of the 69 sub-catchments, there are 44 sub-catchments which have access performance objectives and therefore targets. The broad aim of these performance objectives is to "increase or improve access to and along waterways, by filling gaps between pathways, improving connections or creating new pathways".

The total target length of access performance objectives is to improve or increase waterway access in the region by 202 km by June 2028. This is made up of targets at the catchment and sub-catchment scale.

The targets were developed to respond to catchment needs around social values identified by collaboration partners during the HWS co-design process. They were set predominately for urban sub-catchments to improve or increase access within 200 m of waterways and typical actions for meeting the targets include path construction, path improvement (widening, relocation, upgrading) installation of canoe ramps and improvement in connections between existing paths (i.e. construction of a bridge, ramp or steps).

The target for each sub-catchment was based on a 'current score' (ratio of waterway access as of 1<sup>st</sup> July 2018 to waterway length), an understanding of proposed levels of investment gained through the co-design process (for example investment proposed through council plans and strategies; Precinct Structure Plan's), and regional opportunities (for example proposals for shared trails extending from urban areas to rural towns, plus a "stretch" factor). Some sub-catchments do not have targets and these are generally located within rural or forested areas. The targets don't consider the feasibility and practicality of constructing a path at a certain location in the future (e.g. is the land too steep for a path). The delivery of access targets relies on a coordinated response by HWS partners including local government, Parks Victoria, Melbourne Water and DELWP.

Contribution of progress towards targets only applies to the delivery of activities within sub-catchments that have access POs and is based on kilometres of waterway with increased or improved access – not the kilometres of path. Construction also needs to have started before the end of financial year for the contribution to be counted.

Within the Rivers MEP, new or improved access that can be counted is defined as a pathway, discrete point (such as a lookout or bridge) or facility (i.e. steps) that provides some form of connection (physical or visual) to a waterway within 200 metres. Of note is that the target was not originally set-up to incorporate on-water access and, as a result, on-water access (ie canoe platform) can only be reported qualitatively at this stage. A specification outlining further details about what can be counted as increased or improved waterway access is documented in the Rivers MEP.

### Evaluation Approach

The Rivers MEP outlines the rubrics for access targets at a catchment scale as shown in Table 31. The rubrics have been designed to slowly ‘ramp up’ to achieving the targets in recognition that the access performance objective is a new type of target that also requires significant co-delivery by HWS partners.

Table 31. Rubric for assessing performance of the access target at the catchment scale.

WERRIBEE (kms)	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28
On-track	≥1	≥2	≥3	≥9	≥12	≥15	≥20	≥27	≥31	34
Slightly off-track (up to 20% off on-track)	0.5-0.9	1.4-1.9	2.7-2.9	7-8.9	10-11	12-14	16-19	22-26	24-30	27-33
Significantly (>20% off track)	<0.5	<1.4	<2.7	<7	<10	<12	<16	<22	<24	<27

MARIBYRNONG (kms)	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28
On-track	≥1	≥3	≥6	≥14	≥20	≥26	≥34	≥46	≥51	57
Slightly off-track (up to 20% off on-track)	0.9	2.3-2.9	4.6-5.9	11.4-13.9	16-19	21-25	27-33	36-45	41-50	46
Significantly (>20% off track)	<0.9	<2.3	<4.6	<11.4	<16	<21	<27	<36	<41	<46

YARRA (kms)	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28
On-track	≥0.9	≥2	≥4	≥11	≥15	≥19	≥26	≥34	≥39	43
Slightly off-track (up to 20% off on-track)	0.7-0.8	1.7-1.9	3.4-3.9	8.6-10.9	12-14	15-18	21-26	28-33	31-38	34-42
Significantly (>20% off track)	<0.7	<1.7	<3.4	<8.6	<12	<15	<21	<28	<31	<34

DANDENONG (kms)	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28
On-track	≥0.5	≥1.3	≥3	≥7	≥9	≥12	≥16	≥21	≥23	26
Slightly off-track (up to 20% off on-track)	0.4	1.0-1.2	2.1-2.9	5.2-6.9	7-8	9-11	12-15	17-20	19-22	21-25
Significantly (>20% off track)	<0.4	<1	<2.1	<5.2	<7	<9	<12	<17	<19	<21

WESTERNPORT (kms)	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28
On-track	≥0.8	≥2.1	≥4	≥11	≥15	≥19	≥25	≥34	≥38	42
Slightly off-track (up to 20% off on-track)	0.7	1.7-2	3.4-3.9	8.4-10.9	12-14	15-18	20-24	27-33	30-37	34-41
Significantly (>20% off track)	<0.7	<1.7	<3.4	<8.4	<12	<15	<20	<27	<30	<34

While the HWS Annual reporting process tracks progress on these targets (as outlined in Section 2), it does not provide information at the sub-catchment scale. To understand how access as a condition may influence key value trends, an evaluation at the sub-catchment provides a more nuanced assessment in conjunction with the community perception survey satisfaction results for access. The rubric for evaluation at the sub-catchment scale is shown in the below table.

Table 32. Rubric for assessing performance of the access target at the catchment scale.

Performance Rating	Performance Rating Description
On track	Equal to or greater than the PO sub-catchment target for 20/21
Slightly off track	Up to 20% less than the PO sub-catchment target for 20/21
Significantly Off track	Greater than 20% less than the PO sub-catchment target for 20/21

#### Limitations

- Data pertaining to the metric for access (i.e. length of new and improved paths) lags from the time of delivery to the time it is counted. However, all data included in a financial year represents waterway access project improvement or increase that commenced during this time but was not necessarily finished.
- Sub-catchment targets for access were gained through the co-design process (for example investment proposed through council plans and strategies; PSP's), and regional opportunities (for example proposals for shared trails extending from urban areas to rural towns, plus a "stretch" factor). These may not reflect physical, environmental and land ownership on-ground realities.
- The evaluation is based on 20/21 data to ensure 'like for like' comparison. Ideally 21/22 data would be better due to the increased time period and the intention is to update this evaluation in the next draft using the data from the HWS Annual Report 21/22 which should be available in October.

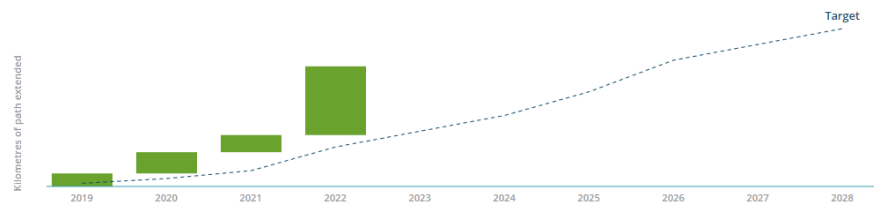
# Appendix 2: Annual Access and Participation Performance Objective Tracking

## Access

### Werribee River

**10 year catchment target:** Increase access to and along waterways by 34 km by improving connections with existing path networks and extending paths into new urban areas.

#### Progress

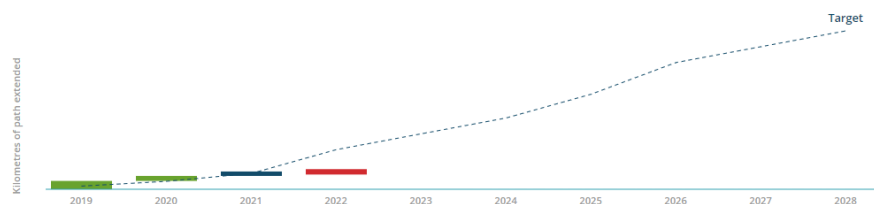


The Werribee catchment had the longest length of waterway access increased or improved in 2021/22 with a total of 14.8 kilometres. The majority of this was through new access constructed as part of greenfield developments near Lollypop Creek, Skeleton Creek, Dry Creek and Doherty's drain. Brimbank Council extended the Kororoit Creek Shared User Path from Isabella Williams Memorial Reserve in Deer Park to the boundary with Melton City Council, near Shepherds Grove in Kings Park. This extension creates a link to Caroline Springs and beyond and was the last section of the creek in Brimbank that did not have a shared user path.

### Maribyrnong River

**10 year catchment target:** Increase access to and along waterways by 57 km by improving connections with existing path networks and extending paths into new urban areas.

#### Progress



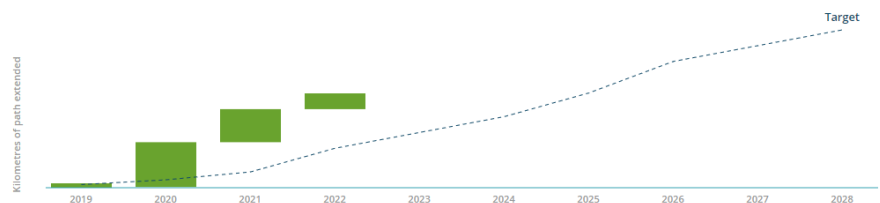
The target for the Maribyrnong catchment was primarily developed to increase pathway access in new development areas. The catchment target is significantly off-track because the rate of development along waterways has not progressed according to predictions made in 2018. It is likely that the target will be met but not within the life of the Strategy.

However, two projects contributed to improving access to waterways in the Maribyrnong catchment in 2010/21. Moreland Council constructed a shared user concrete path running along the northern edge of Joyce Reserve and constructed an unsealed gravel path near the eastern bank of Westbreen Creek to improve the network of walking paths in and around Westbreen Creek. VicRoads upgraded Raleigh Bridge which included widening the footpath and improving connections to the river trails north and south of the bridge.

### Yarra River

**10 year catchment target:** Increase access to and along waterways by 43 km by improving connections with existing path networks and extending paths into new urban areas.

#### Progress

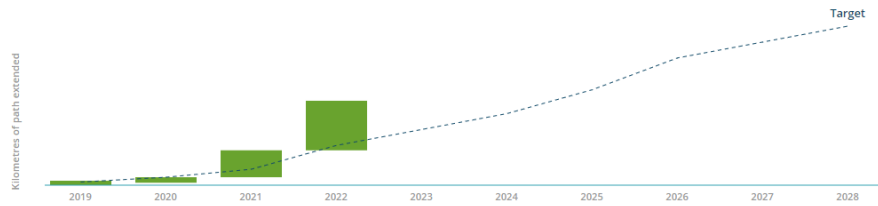


A total of four projects contributed to increasing or improving access to waterways and wetlands in the Yarra catchment in 2021/22. The majority of projects were related to upgrading existing paths by widening or realigning them for safety reasons. Upgrade locations included Edgars Creek Trail (0.3 km) and Darebin Creek Trail (0.9 km). Yarra Ranges Council constructed Stage 3B of the Green Spine which was the missing link along the Southern side of Maroondah Hwy. The project included over 200 metres of elevated walkway alongside Mooroolbark drain which ensures safe accessibility for all.

### Dandenong Creek

**10 year catchment target:** Increase access to and along waterways by 26 km by improving connections with existing path networks and extending paths into new urban areas.

**Progress**

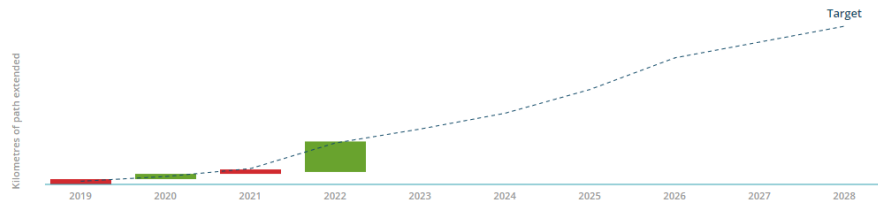


Six projects contributed to increasing access to waterways and wetlands in the Dandenong catchment in 2021/22. Five of these were through greenfield developments delivering 3.8 kilometres of new access to waterways in the Cranbourne West, Brompton Lodge and Berwick Waterways Precinct Structure Plan (PSP) areas. A new 2 kilometre shared use path along Kananook Creek was built as part of works to remove level crossings in the Edithvale-Chelsea-Bonbeach area.

## Westernport and Mornington Peninsula

**10 year catchment target:** Increase access to and along waterways by 42 km by improving connections with existing path networks and extending paths into new urban areas.

**Progress**

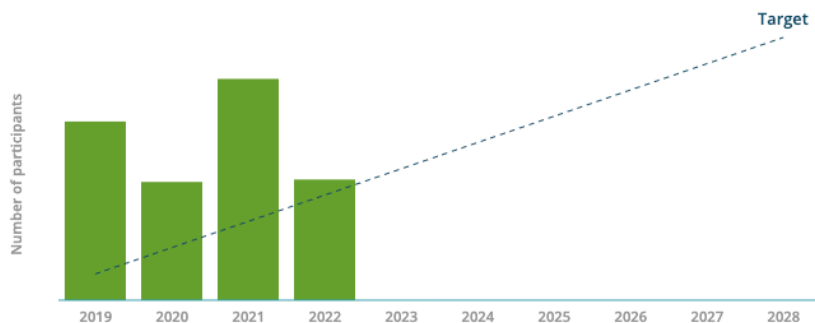


Ten projects contributed to increasing access by 7.4 kilometres to waterways in the Westernport catchment in 2021/22. All of these projects were part of greenfield development creating new access to Cardinia Creek, Clyde Creek and Wylie Drain in the Cardinia, Officer and Clyde Precinct Structure Plan (PSP) regions. Two projects by Melbourne Water improved access to waterways by 0.7 kilometres. The first project improved informal access through a changed mowing regime to provide a path around wetland to improve access to Drum Drum Creek and the second project improved access points along Deep Creek by removing blackberry among other works.

## Participation

### Werribee River

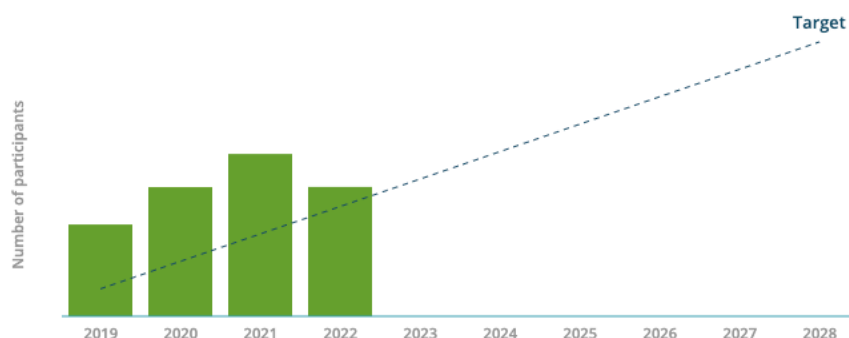
**Progress**



Participation in the Werribee catchment was significantly down this year compared to last year, following the region-wide trend. The reduction was largely driven through fewer participants in citizen science (down by 81%), and education (down by 75% mainly due to litter program and Port Phillip and Westernport Catchment Management Authority programs finishing). The Western Treatment Plant remains a key focus for participation and the online experience continued to prove popular with schools with similar participation numbers to last year. Social media also had similar numbers to last year. Three community group grants were awarded by Melbourne Water for the catchment which involved over 700 volunteers. A total of 52 incentives were granted through the Melbourne Water Liveable Communities Liveable Waterways program in the Werribee catchment which was slightly down from last year (57). These results include the addition of 1,220 towards the catchment target that represents a proportion (based on % of population) of region wide participation in social media or online webinars.

## Maribyrnong River

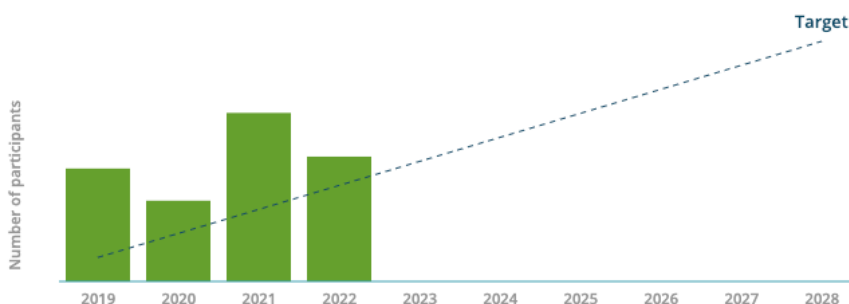
### Progress



Participation in the Maribyrnong catchment is on track this year but is down by 20% in terms of total number of participation compared to last year. Participation this year was largely driven through social media, incentives and citizen science. Maribyrnong was the only catchment to buck the declining trend in citizen science participants, with an increase of 130% compared to last year due to water quality monitoring, citizen eDNA collection, frog census and bird monitoring. Over 110 incentives were granted through the Melbourne Water Liveable Communities Liveable Waterways program, a similar number to last year. Digital engagement through Melbourne Water's Your Say platform was similar to last year with consultation for the Reimaging Moonee Ponds Creek program continuing. These results include the addition of 958 towards the catchment target that represents a proportion (based on % of population) of region wide participation in social media or online webinars.

## Yarra River

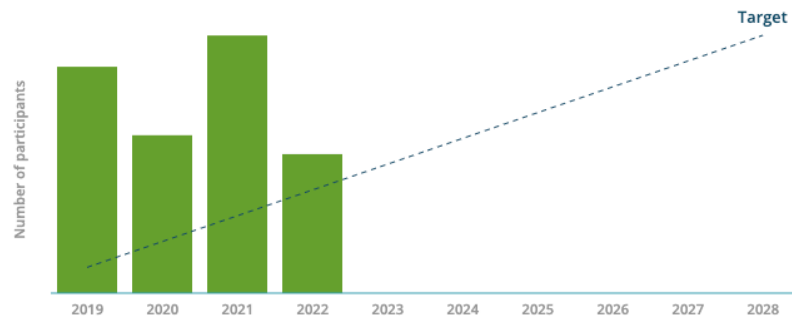
### Progress



The Yarra catchment continued to have highest participation rates of all the catchments and is on track but overall, was slightly down on last year's numbers. Whilst the shift continued towards increased digital and social media engagement for the Yarra, participation numbers for events, citizen science and education were down compared with last year, most likely a reflection of COVID-19 restrictions. Community group grants were again in demand in the Yarra catchment with 12 community grants awarded by Melbourne Water which involved over 800 community volunteers. The number of incentives granted through the Melbourne Water Liveable Communities Liveable Waterways program decreased by 15% and this may be attributed to a number of factors including change in eligibility criteria and less applicants due to COVID-19 restrictions. These results include the addition of 3,397 towards the catchment target that represents a proportion (based on % of population) of region wide participation in social media or online webinars.

## Dandenong Creek

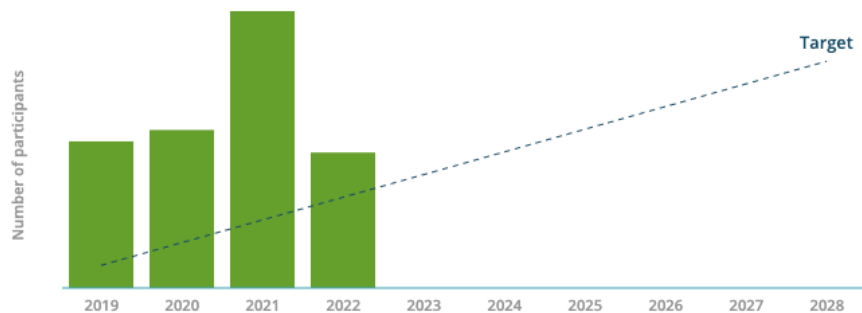
## Progress



Participation in the Dandenong catchment is on track this year despite a drop in number compared to the last two years. The drop in participation numbers is due to the continued impacts of COVID-19 limiting the extent of participation in citizen science (down 40%) and education (down 64%). Interestingly, participation via social media was significantly down (89%) and can be attributed to less posts related to activities and news in the Dandenong catchment this year. There was an overall reduction in participation on Melbourne Water's Your Say platform due to several programs ending such as Reimagining Blind Creek and Tarralla Creek however, this was partly compensated by online consultations for the next phase of Enhancing our Dandenong Creek Program. In contrast, there was an increase in incentives granted this year (71) compared to last year (total of 50). Three community group grants were awarded by Melbourne Water which involved over 380 community volunteers. These results include the addition of 2,901 towards the catchment target that represents a proportion (based on % of population) of region wide participation in social media or online webinars.

## Westernport and Mornington Peninsula

### Progress



The Westernport catchment participation values this year were the lowest recorded in four years and this can be attributed to the reduced number of participants attending events and education workshops (down by 60%) compared to last year. Overall, the number of incentives granted through the Melbourne Water Liveable Communities Liveable Waterways program increased by 25% most likely due to the program adding new themes that are eligible for funding. Participation through citizen science dropped significantly by 46% due to reduced participants in water quality monitoring and birdlife monitoring. The number of community group incentives granted increased slightly to five awarded by Melbourne Water which involved over 350 community volunteers. These results include the addition of 1,045 towards the catchment target that represents a proportion (based on % of population) of region wide participation in social media or online webinars.

## Appendix 3: Annual Water Quality for Recreation Targets and Rubrics

### Indicators and monitoring methods

The HWS resource document (Melbourne Water 2020) outlines the method used to determine a metric for recreational water quality, how the baseline was set and how long term targets were derived. Essentially the long term targets were for all sub-catchments to achieve at least secondary contact standards (High) over the 50 year time frame and for areas currently achieving primary contact (Very high) to be maintained.

The metric is essentially based on compliance with SEPP (Waters) recreational water quality objectives (swimming is considered as primary contact) (Table 115). When the HWS was developed the metric referred to the previous criteria within SEPP, however the changes were minimal and as such the new criteria will be applied to the score. A review of the metric has been recommended by the EPA and will be part of the final HWS evaluation ahead of setting new targets.

### Recreational Water Quality condition metric

Score	Explanation of Score
<b>Very High</b>	Meets primary contact objectives (good)
<b>High</b>	Meets secondary contact objectives (fair)
<b>Moderate</b>	Not applicable
<b>Low</b>	Does not meet secondary contact objectives (poor)
<b>Very Low</b>	Not applicable

Monitoring methods for assessing *e-coli* are well documented and the program is summarized in the table below.

### Summary of recreational water quality monitoring

Monitoring method	Where monitoring is required	Monitoring frequency (when)	Monitoring responsibility	Baseline data	Data storage
Water samples tested for <i>e coli</i>	12 sites	Weekly over summer (12 weeks)	MW, Waterways and Drinking Water Quality, IP	HWS2018	Envirosys

## Appendix 4: Prioritisation of sub-catchment surveys based on litter

Catchments (Management Units)	Litter Satisfaction
Dandenong Creek	6.9
Maribyrnong River Lower	6.0
Maribyrnong River Upper	6.2
Cherry, Kororoit, Laverton, Skeleton	5.4
Werribee and Little River Lowlands	5.7
Werribee and Little River Middle and Upper	4.8
Cardinia Creek	5.6
French and Phillip Islands	N/A
Lower Bunyip, Lang Lang and Bass	N/A
Mornington Peninsula	7.0
Upper Bunyip and Tarago	N/A
Yarra River Lower	5.9
Yarra River Middle	6.6
Yarra River Upper	6.2

Mean = 6

Minor standard dev = 5.4 Max standard dev = 6.6

## Appendix 5: Case Study: Progress of social values conceptual models for wetlands

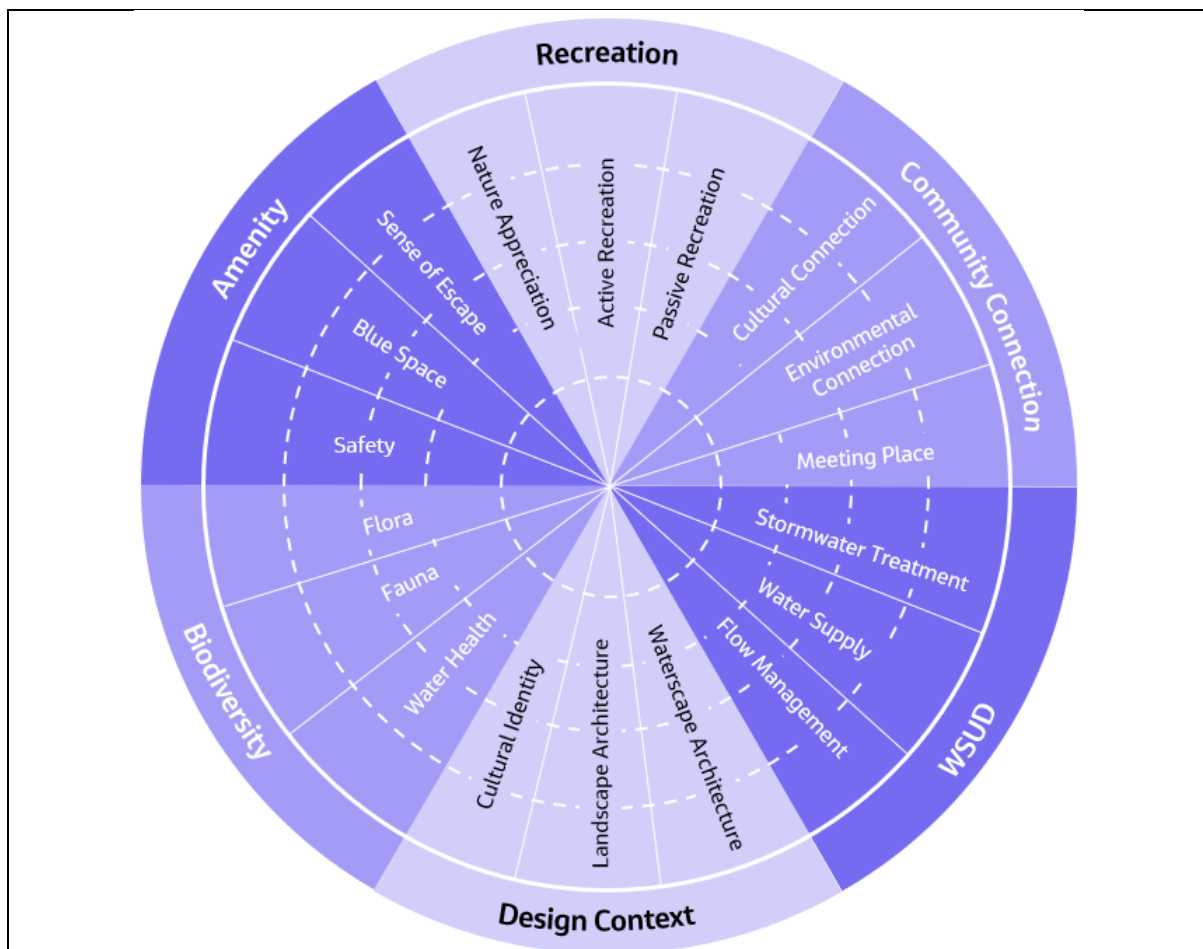
### ***Case Study: Progress of social values conceptual models for wetlands***

The 2018 version of the *Healthy Waterways Strategy* does not include performance objectives or inform conceptual model for the social values of wetlands as was developed for the consideration of waterway social values. However regional performance objective (RPO-20) required that “the amenity, community connection and recreation values of wetlands are better understood. Performance objectives are developed to enhance these values.”

In previous years, Melbourne Water has engaged Jacobs Consulting to develop social values conceptual models for wetlands. This project considered the conceptual models developed and currently in use for waterways and also took into account the unique characteristics of wetlands, such as their ‘radial’ shape and structure (as opposed to waterways more linear structure), value to differing urban landscapes and alternative functions (e.g. flood protection, stormwater treatment, conservation and recreation), which led to three differing wetland typologies and conceptual models.

An initial literature review analysis formed a baseline conceptual model. Elements of the model consist of:

- Values: Located on the outermost ring of the model. They are the values that society gains from wetlands.
- Experiences: Located in the innermost ring of the model. They are the experiences that lead to the values being upheld.
- Conditions: Need to be met for experiences to be had so that values are upheld. For clarity, the conditions are located in an evidence database
- Suggested metrics: These are metrics that will be used to measure whether conditions are being met. Requires further development.

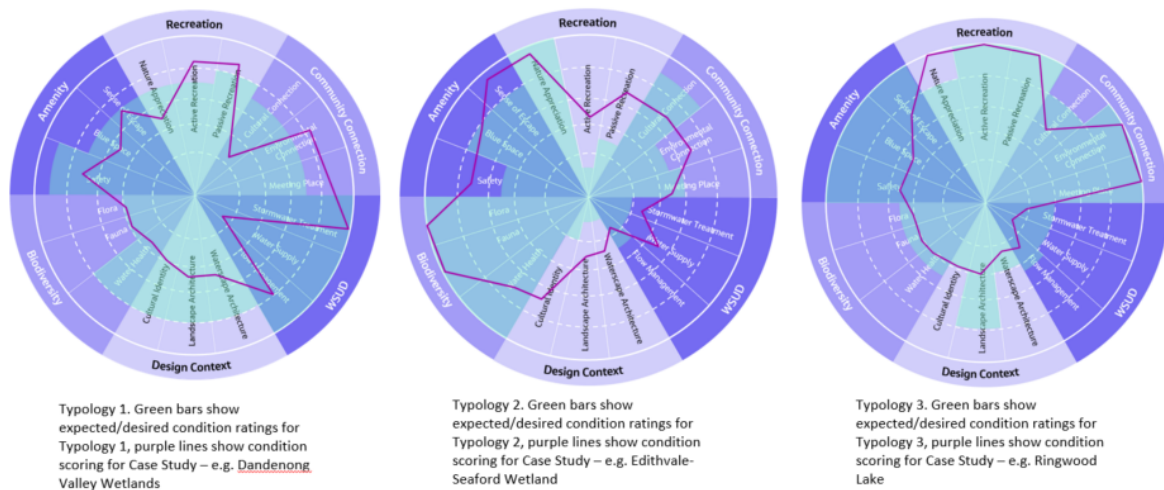


Melbourne Water is responsible for the management of a number of different wetland types, from natural wetlands through to constructed and highly modified wetlands. Each of these types exhibit different characteristics, support different values/experiences, and are managed in different ways to support primary values or objectives. To demonstrate application of the Social Values Conceptual Models to different wetland types three wetland typologies were identified for this project:

- **Typology 1: a wetland that was constructed for specific water management or treatment function** e.g. stormwater treatment and/or flow management wetland. Examples of these types include stormwater treatment and flow management (retardation) wetlands such as Dandenong Valley Wetlands and Hendersons Creek Wetlands (Mill park), or stormwater treatment wetlands in urban development areas. This wetland type may also provide ecological services and hold high social values but their primary function is for stormwater management.
- **Typology 2: a natural wetland. These types of wetlands are those that have retained their natural condition**, they have high ecological and nature conservation values, especially in the context of the overall loss of natural wetlands across the region. For these wetlands certain social interactions may be a threat to ecological values and hence these types of wetlands may require restricted or limited public access to enable ecological values to be protected. Examples include Seaford-Edithvale Ramsar wetlands, natural billabongs along the floodplains of rivers such as the Yarra River, and wetlands that while constructed, may support significant ecological values, such as wetlands associated with the Western Treatment Plant.
- **Typology 3: urban lakes and wetlands that may have been constructed as part of drainage systems** and that may or may not have been modified from natural systems. Wetlands in this

type weren't specifically constructed or managed for a specific stormwater treatment function. Often they have significant open space and facilities associated with the land around them such as walking trails, parks and playgrounds, BBQs, and toilets. The relative importance of social values of these wetlands is unique to each wetland depending on the wetland setting. Examples of this type of wetland are Ringwood Lake or Ruffey Lake.

An expected score reflective of social values for each typology has been assigned, as shown in the figures below. Scoring that has been provided is indicative for demonstration purposes. Melbourne Water could further develop the scoring using a collaborative approach process with stakeholders and Melbourne Water experts. An example wetland has been identified for each wetland type as case studies for the application of the social values conceptual model. Desktop research was undertaken for each case study typologies and assigned a preliminary score based on the findings to demonstrate the social values conceptual model. The preliminary case study score has been overlaid in each figure below. These case study scores are preliminary based would need to be refined if they were used as part of implementation/performance objective setting.



The social values conceptual model for wetlands is a decision-making tool that will help inform whether the expected or desired values of a wetland are being met. It takes into account the appropriate balance between ecological services and environmental values, as well as being able to be applied to constructed, modified natural, or unmodified natural wetlands. The development of the wheel concept was informed by the literature review of social values and wetlands (CRCWSC Sustainable Water Governance Wheel 2015). The urban-design values were highlighted in the literature review along with further information explained in the [report](#).

The conceptual model can be used to inform the maintenance and management of wetlands, as well as business case development for funding applications. Finally, framing wetlands as a social service can promote environmental health and the sustainable management of wetlands. The protection of wetlands for their social values will contribute to their environmental protection, by setting limitations on the level of enhancements for some values depending on typologies (e.g. limiting Recreation for Typology 2 wetlands).

Further recommendations required identified include:

- Develop metrics for all conditions and values. Jacobs provided suggested metrics informed by the research undertaken for this project but there needs to be further development of the scoring method for the conceptual model to be utilised appropriately.

- Undertake process to develop and refine the typologies, including the expected conditions scores for each typology and used this as a mechanism for determining wetland levels of service.
- Assess priority wetlands (i.e. Typology 3 - amenity/recreation primary purpose wetlands) against desired levels of service (for that wetland type) to inform investment and management needs.
- Complete a Cost Benefit Analysis (CBA) to assess the economic, social, and environmental impact of social value interventions for wetlands in Melbourne Water catchment areas. Undertaking a CBA could provide effective comparisons and assessment of the potential impact of future projects and maintenance of wetlands.
- Undertake more research into wellbeing and wetlands. Consider adopting wellbeing as a social value in the HWS.

## Appendix 6: Potential Alternative Social Values Framework

The 2018 version of the *Healthy Waterways Strategy* includes regional performance objective (RPO-43) required that *“The social values framework, information and methods used to develop values assessments, targets and performance objectives are further developed and improved during the life of the Strategy”*. A limitation with the current method is that progress of waterway social values does not consider the causal effect of interventions and assets that are delivered on the ground. For instance, the naturalisation of a concrete drainage channel is not currently counted towards an improvement towards waterway amenity (i.e. physical form). Likewise investment in a litter management program that removes significant volumes of litter from a waterway does not currently count towards waterway amenity improvements (i.e. water quality).

Currently social values, including waterway amenity, recreation and community connection, are evaluated using an annual community perceptions survey which measures public satisfaction for a number of reasons related to why people visit waterways. Although this is a useful metric to measure waterway social values, there’s no evidence to suggest that satisfaction survey results are indicative of on-ground improvements and management programs, but rather may capture public preconceptions of waterway amenity, recreation and community connection values.

Furthermore the current approach does not return statistically significant data to provide a score for all 69 Healthy Waterway Strategy sub-catchments, at best only around one-third of catchments are recorded which are skewed to catchments with larger population densities.

A new approach needs to be tested which combines the qualitative insights captured from community perception surveys with known, tangible conditions such as built assets. As an example, considering the waterway amenity conceptual model the following indicators could be used as part of a social values framework scoring methodology:

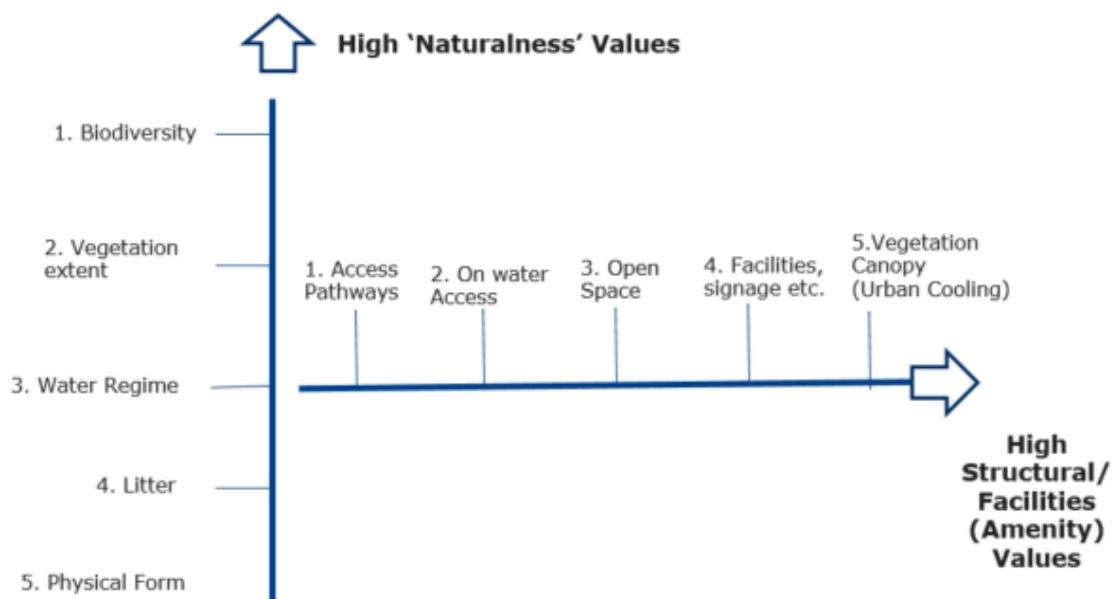
- Physical form:
  - Channel form: % length of waterway that is not concrete or underground (i.e. is natural)
  - Corridor width: average width (metres) of waterway of open space / average hectares of open space within a waterway corridor
- Vegetation:
  - Canopy cover (urban cooling outcomes): % tree canopy along waterway corridor
  - Aesthetics: weed control and removal condition / works
- Water Quality:
  - Litter: Amount (volume) of litter removed / Amount (volume) of litter present (see A3P RMIT research)
- Biodiversity:
  - Extent: of biodiversity present in waterway sub-catchment (indicator of nature appreciation activities such as bird watching)
- Facilities:
  - % of waterways with access pathways within 200m (see existing Access performance objectives).
  - Number of on-water recreational access facilities (e.g. boat ramps, carparks).
- Water regime:
  - Condition of hydraulic environment / presence of suitable flows/water levels for recreational paddling

We suggest that an index approach that considers the conflicting ‘trade-offs’ often associated between social and environmental values could be applied. An index approach may sum indicators and derive a score as a percentage of a possible total score, where a weighting is applied to each indicator (e.g. based on confidence of data in metric). The benefits of this that an individual waterway sub-catchment (or at a smaller scale waterway reach) is recognised by both the unique conditions and features present within and the typologies and surrounding characteristics of its place (e.g. is the waterway in a densely urbanised area with a high demand for public spaces and parkland, or is the waterway located mostly in a pristine natural environment like a National Park?).

The results from community perceptions scores, which in essence measure social value outcomes (rather than outputs suggested above), could be integrated as an indicator in the social values framework or as a method in the process ‘validate’ social values scores.

A potential framework, we’ve considered Cooper, Crase and Mayberry (2017)<sup>2</sup> model for “Incorporating amenity and ecological values of urban water into planning frameworks”. Although this study used this model to conduct an economics willingness to pay study, it provides a salient framework to categorically disaggregate ecological indicators against anthropological indicators (i.e. amenity). This method also enables alternative community segments with differing value systems (i.e. human centred versus natural values) to be equally considered (as noted by Kendall & Karrar 2016 in *HWS Technical Resource Document*) and the balance between amenity and biodiversity management decisions to be considered (Corney et al, 2015)<sup>3</sup>.

A social values framework that incorporates an ecological and anthropomorphic index has been considered as follows:



When fitting this to the Cooper, Crase and Mayberry model, we get the following framework that produces four categories:

<sup>2</sup> Cooper B, Crase L., & Mayberry D., (2017) Incorporating amenity and ecological values of urban water into planning frameworks: evidence from Melbourne, Australia, *Australasian Journal of Environmental Management*, 24:1, 64-80, DOI: 10.1080/14486563.2016.1277559

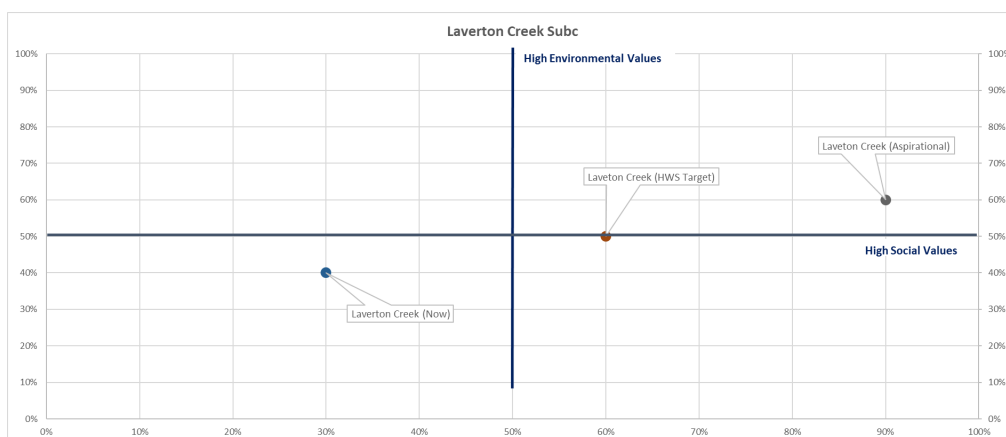
<sup>3</sup> Corney, Helen, Christopher D. Ives and Sarah A. Bekessy. “Amenity and ecological management: A framework for policy and practice.” *Ecological Management and Restoration* 16 (2015): 199-205.

1. Near Natural Waterways (Wilderness): high environmental but low amenity values
2. Natural Waterway Parklands: high environmental and high amenity values
3. Urban Waterway Parklands: low environmental but high amenity values
4. Highly Modified Waterway (Disturbed): low environmental and low amenity values



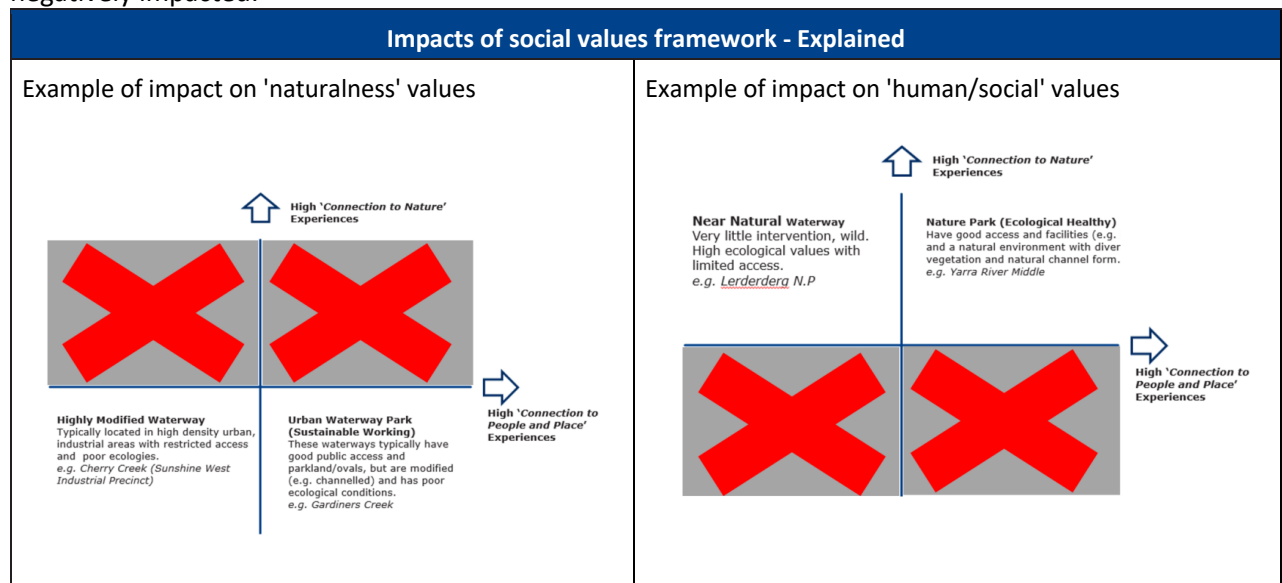
Applying the framework to the Healthy Waterways Strategy region, enables trajectories to be mapped (current > targets) as a given waterway evolves from one category to an improved state based on community expectations and preferences (e.g. Highly Modified to Natural Waterway Parkland). For instance as an untested example of how the Laverton Creek might currently be profiled but could be improved has been modelled below given “assumed” but not validated indicators. This has been based on improvements such as (note performance rubric not provided):

- Increasing the access pathway network from the current condition of 26% to target of 44%
- Increasing tree canopy vegetation cover from current condition of 2% to target of 21%
- Improving litter conditions to high
- Improving physical form (e.g. % of waterway natural form or area of surrounding open space) from low to high



It also provides an evidence-based guide for prioritising high value sub-catchments and therefore planning investment in ‘community places; performance objectives. From a community engagement perspective, the framework can distinguish waterways by their profiles, rather than prioritising against one another, which was a directly quoted as part of the co-development of the Healthy Waterways Strategy from the community.

Regarding the impact of threats (Table 28) The following social value typologies are likely to be negatively impacted:



**Recommendations:** currently this framework is a concept using a simplified GIS assessment. A more rigorous assessment, probably tested on just one catchment first, is required. Further validation of this framework is required with local waterway stakeholders, including experts (e.g. Melbourne Water Waterways & Land Officers, Council Rangers) and community groups. A performance rubric for each indicator also needs to be developed, preferably using academic research benefits (e.g. tree canopy cover urban cooling benefits when >30% cover) or policy and strategy standards (e.g. public open space requirements – hectares/person).

Cooper B, Crase L., & Maybery D., (2017) Incorporating amenity and ecological values of urban water into planning frameworks: evidence from Melbourne, Australia, *Australasian Journal of Environmental Management*, 24:1, 64-80, DOI: 10.1080/14486563.2016.1277559

Corney, Helen, Christopher D. Ives and Sarah A. Bekessy. "Amenity and ecological management: A framework for policy and practice." *Ecological Management and Restoration* 16 (2015): 199-205.



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Contact: [Waterway.Strategy@melbournewater.com.au](mailto:Waterway.Strategy@melbournewater.com.au)