



Long-term recreational water quality:
Port Phillip Bay beaches and the Yarra River



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Summary

Environment Protection Authority Victoria (EPA) undertakes microbial monitoring at 36 Port Phillip Bay (Bay) beaches and four Yarra River swimming spots each year during summer. This monitoring provides water quality information to the community to help them make informed decisions about swimming. EPA also uses monitoring data to assess long-term microbial water quality against the Environment Reference Standard (ERS). This assessment determines if locations meet long-term standards for secondary (for example, boating) and primary contact recreation (for example, swimming). To make an assessment against ERS, the previous five years of data is used.

Overall, Bay beaches and the Yarra perform better during times of no rainfall ('Dry Weather') rather than during 'All Weather'. Data is collected weekly during the swimming season, whether it rains or not. As 'All Weather' data includes rainfall events, it considers stormwater flows that can increase microbial pollution. EPA advises to avoid any contact with water for 24-48 hours following rainfall.

All Bay beaches were suitable for secondary contact recreation over the last five summers. Most beaches (69 per cent) were suitable for primary contact recreation during 'Dry Weather' in the 2016-17 to 2020-21 reporting period. Targeted sampling at beaches that did not meet standards found low levels of human origin faecal pollution. This means there is likely a low risk to human health despite these bay beaches not meeting standards.

Yarra River grades were all suitable for secondary contact recreation during the 2016-17 to 2020-21 reporting period. No sites met standards for primary contact recreation during this period. EPA works with Parks Victoria and councils along the Yarra to provide advice on healthy swimming during summer. EPA is partnering with universities and Melbourne Water to investigate sources of microbial pollution and assess microbial risk in the Yarra River. This research will help to form actions to improve water quality and potentially the development of site-specific standards.

Recreational water quality monitoring

EPA monitors microbial water quality at Port Phillip Bay (the Bay) beaches and along the Yarra River. Yarra River monitoring is undertaken in partnership with Melbourne Water. This monitoring (via the Beach Report and Yarra Watch programs) provides water quality information to the community so they can make informed decisions about swimming and other recreational water-based activities. The programs monitor 36 Bay beaches and four Yarra River sites. Both programs run during summer when recreational water use is highest (December to Labour Day weekend) and consist of:

- twice daily forecasts (to provide short-term health risk messaging to community)
- weekly water sampling (to alert the community to short-term water quality risk and inform long-term water quality management).

Beach water analyses measure levels of a group of bacteria called enterococci. Yarra River analyses measure levels of a group of bacteria called *E. coli*. EPA uses measurements of these bacteria (referred to as microbial water quality) as an indicator of faecal pollution and subsequent risk to public health, based on the Environment Reference Standard (ERS) (a legislative instrument made under the *Environment Protection Act 2017*). See more information on [EPA's website](#).

Long-term microbial water quality grades: methods and use

What long-term standards means

The long-term standards (defined in the ERS) outline the standards for long-term condition and trend in microbial water quality. The purpose of the long-term standards, for water managers, is to better understand potential health risks due to water quality and inform the long-term management of faecal contamination to provide better health outcomes. Long-term grades are also used to inform EPA's understanding and management of microbial water quality.

How the long-term standards are developed

Long-term standards link the concentration of the indicator bacteria in the water to the risk of illness associated with recreational contact. The standards are based on the best science available and take a precautionary approach for assessing water quality.

EPA has recently adopted stricter standards for assessing long-term microbial water quality. The new stricter standards are aligned with the National Health and Medical Research Guideline for Managing Risks to Recreational Water (2008). The new standards reflect the Victorian Government's commitment to protecting public health.

How long-term standards are used to calculate grades

Assessment of long-term microbial water quality is based on microbial water quality data (using long-term standards) and an assessment of the likelihood of faecal pollution occurring (see **Table 3** in Appendix A).

EPA compiles microbial data (that is, *E. coli* or enterococci) from the previous five summer periods to produce a 95th percentile microbial level for a site. A 95th percentile means the point where 5 per cent of sampling data points will exceed a value. This value is compared to the long-term standards and assigned a Microbial Assessment Category (MAC) between A and E.

EPA also conducts a sanitary inspection at each site to assess potential sources of faecal pollution. EPA assigns a Sanitary Inspection Category (SIC) to each site, ranging from 'Very Low' to 'Very High'.

To assess if a site meets standards for secondary contact recreation (for example, boating, canoeing), the MAC must be no greater than D in **Table 3**. To assess if a site meets standards for primary contact recreation (for example, swimming), EPA combines the MAC and SIC for each site to determine a long-term grade.

- A site graded 'Very Good', 'Good' or 'Fair' has microbial levels meeting long-term standards for primary contact recreation.
- A site graded 'Poor' or 'Very Poor' does not have microbial levels meeting standards for primary contact recreation.

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Grades are reported as 'provisional' if minimum data required is not available for MACs (for example, due to removal of wet weather data for analysis of dry weather conditions), or sanitary surveys needing external review. Provisional grades are still indicative of long-term microbial water quality condition and their reporting is allowed under the NHMRC Guidelines for Managing Risks to Recreational Waters (2008). The grades reported in here are provisional.

'All Weather' and 'Dry Weather' grades

Two grades are calculated for each site: 'All Weather' and 'Dry Weather'. 'All Weather' grades use microbial data from wet and dry conditions, including samples taken during and after rain. Stormwater pollution can cause high microbial levels in these samples.

'Dry Weather' grades use microbial data from dry conditions when there has not been recent rainfall. The current method for removing wet weather data may not result in all wet weather data being removed. As a result, these grades are only indicative of dry conditions. EPA is doing further work to improve data quality and ensure 'Dry Weather' grades reflect dry conditions.

Possible sources of microbial pollution during dry weather are:

- dry weather flows from drains (caused by something other than rainfall, such as a sewage cross-connection, sewage spill, sewer leak, residential discharge or business discharge)
- people swimming (shedding of bacteria into the water)
- damaged toilet facilities, or facilities with septic tanks or on-site systems that could leak sewage
- sewer spills
- animal faeces
- creek and river flows reaching sites, as they can carry their own run-off and microbial pollution water with high microbial levels reaching beaches from
- boat discharge.

Long-term water quality grades

'All weather' results for the Bay



Figure 1: 'All Weather' provisional long-term grades for 36 beaches for primary contact recreation. Colour indicates grades for each site for 2016-17 to 2020-21.

All 36 beaches met long-term microbial water quality standards for secondary contact recreation. For primary contact recreation, 12 beaches met long-term microbial water quality standards and were graded as either 'Good' or 'Fair'.

Stormwater pollution after rain is the biggest influence on long-term microbial water quality. High microbial levels in stormwater pollution can increase the risk of illness during swimming. Some sites are more susceptible to stormwater pollution than others. It is difficult to predict which beaches will be impacted during and after isolated rain events. For this reason, as a precaution, EPA advises avoiding any contact with water for 24-48 hours following rainfall.

'Dry Weather' results for the Bay



Figure 2: 'Dry Weather' provisional long-term grades for 36 beaches for primary contact recreation. Colour indicates grades for each site for 2016-17 to 2020-21.

'Dry Weather' grades use the same microbial data as 'All Weather' grades, however data from samples collected during or after rainfall are removed. Refer to section: 'All Weather' and 'Dry Weather' grades.

Most beaches (25 out of 36) had microbial water quality meeting standards for primary contact recreation during dry weather. Eleven beaches did not meet standards, as they had elevated microbial levels during dry weather periods.

Beaches not meeting long-term standards still had microbial water quality suitable for swimming on most days during summers of 2016-17 to 2020-21. During summer, sampling results are assessed against short-term standards and advice is provided to community on whether water quality is suitable for swimming. For recent short-term results, see EPA publication: [Beach Report and Yarra Watch results 2020-2021](#).

High microbial results were infrequent at these beaches. Where high microbial results were found, follow up sampling showed that the microbial water quality improved by the next day.

'All Weather' and 'Dry Weather' results in the Yarra River

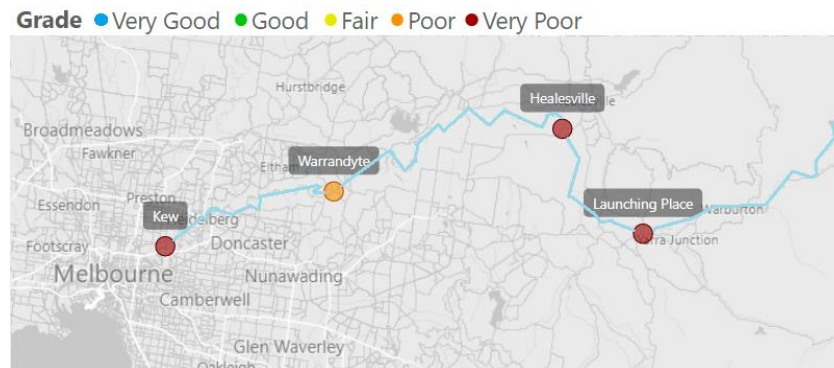


Figure 3: 'Dry Weather' provisional long-term water quality grades for the Yarra River (2016-17 to 2020-21). The light blue line indicates the course of the Yarra River to Kew. The stretch below Kew is not included as it is illegal to swim in the Yarra downstream of Abbotsford.

Each Yarra site is considered representative of a section of river upstream, referred to as a 'reach'. A representative site is based on several locations in the reach having similar historical microbial data and Sanitary Inspection Categories. Each reach extends from the sampling site upstream to the next site (for example Kew reach extends from Kew sampling site to Warrandyte sampling site).

All four reaches on the Yarra met long-term microbial water quality standards for secondary contact recreation during the 5 year period of this analysis (2016-17 to 2020-21).

For primary contact recreation, no reach met standards during wet or dry weather conditions, with 'All Weather' and 'Dry Weather' grades either being 'Poor' or 'Very Poor' along the Yarra. Stormwater pollution is the most likely driver of poor microbial levels during and after rain. As a precaution EPA advises to avoid any contact with water for 24-48 hours following rainfall.

Although Warrandyte reach was graded 'Poor' during 'Dry Weather', microbial levels met short-term standards during weekly sampling over the last five summers. This is due to the short-term ERS standards providing advice on suitability for swimming, rather than long-term water

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quality management. For recent short-term results, see EPA publication: [Beach Report and Yarra Watch results 2020-2021](#).

Sanitary inspections for sites in the Warrandyte reach indicate few stormwater drains to transport pollution compared to the reach downstream. Additionally, the sanitary inspections do not show animal faecal pollution as a likely source of pollution, unlike in upstream reaches with large agricultural land use. These are two areas where Warrandyte reach appears to have fewer inputs of microbial pollution.

Kew, Healesville, and Launching Place reaches all received grades of 'Very Poor' during 'Dry Weather'. The Kew sanitary inspection suggests possible pollution sources such as stormwater drains. In the highly urbanised catchment, pollution may come from dry weather flows and stormwater flows after rain. Healesville and Launching Place sanitary inspections suggest farm animals as possible faecal sources. The Healesville sanitary inspection also shows possible impacts from past sewage overflows, while Launching Place has many creeks upstream that may be contributing to higher microbial levels, as the creeks could carry microbial pollution to the river.

'Dry Weather' grades of 'Poor' or 'Very Poor' in the Yarra indicate an increased risk to swimmers. EPA has worked with Parks Victoria; Manningham, and Yarra Ranges Council; and the Department of Health to ensure there are signs at sites in these reaches to minimise this public health risk. The advice for healthy swimming is:

- Avoid swimming near stormwater drains
- Avoid swimming for 48 hours after rain
- Try not to swallow water during recreation
- Cover cuts and scratches with waterproof bandages
- Wash your skin with soap after touching the water and shower after swimming.

Trends in long-term microbial water quality

Beach trends

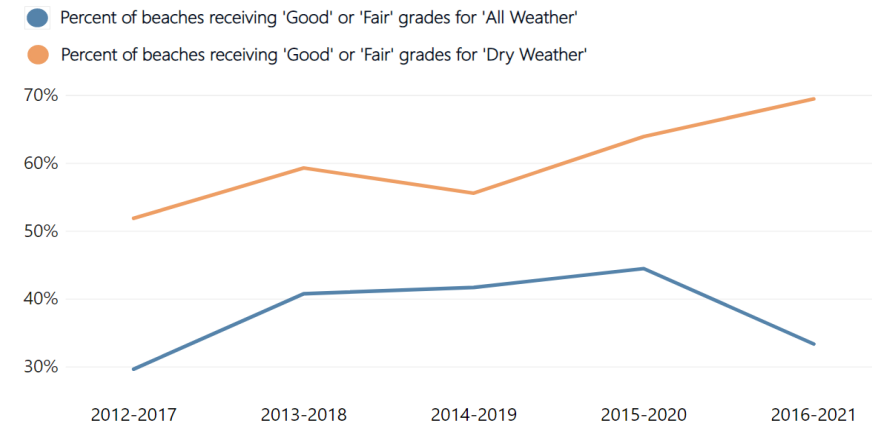


Figure 4: Percentage of beaches meeting long-term primary contact recreation standards in last five reporting periods.

As there are 36 Bay beach sites, trends for beaches are reported as the percentage of all Bay beaches meeting long-term primary contact recreation standards. Results cover 27 beaches in the 2012-2017 and 2013-2018 reporting periods, and 36 beaches for 2014-2019, to 2016-2021. In 2014, beach sites were updated to align with lifesaving clubs. Other sites have been added to improve spatial coverage.

The number of beaches meeting standards for 'All Weather' has been variable over time (**Figure 4**). This is most likely due to changing rainfall patterns at individual beaches. As expected, a lower percentage of beaches meet standards in 'All Weather' compared to 'Dry Weather'.

There has been an increase in the percentage of beaches meeting standards for 'Dry Weather' over time. This improvement may be due to:

- improved drain and sewer infrastructure
- better management of other faecal sources in the beach catchments or foreshore.

Yarra River trends

Table 1: Yarra River long-term ‘All Weather’ grades in last five reporting periods.

	Reporting period				
	2012-2017	2013-2018	2014-2019	2015-2020	2016-2021
Launching Place	Very Poor	Very Poor	Very Poor	Very Poor	Very Poor
Healesville	Very Poor	Very Poor	Very Poor	Very Poor	Very Poor
Warrandyte	Poor	Poor	Poor	Very Poor	Poor
Kew	Very Poor	Very Poor	Very Poor	Very Poor	Very Poor

Table 2: Yarra River long-term ‘Dry Weather’ grades in last five reporting periods.

	Reporting period				
	2012-2017	2013-2018	2014-2019	2015-2020	2016-2021
Launching Place	Very Poor	Very Poor	Very Poor	Very Poor	Very Poor
Healesville	Very Poor	Very Poor	Very Poor	Very Poor	Very Poor
Warrandyte	Fair	Fair	Poor	Fair	Poor
Kew	Poor	Very Poor	Very Poor	Very Poor	Very Poor

Yarra River trends are reported for each reach as there are only four reaches. The trends in Yarra River long-term water quality remain mostly unchanged. Each grade here represents a five-year reporting period.

Launching Place, Healesville and Kew reaches consistently do not meet standards for primary contact recreation, with grades of ‘Poor’ or ‘Very Poor’ across ‘All Weather’ and ‘Dry Weather’ conditions in recent years. The trend in microbial water quality during dry weather at Warrandyte reach is an exception. Long-term microbial water quality is variable over time at Warrandyte, but has met standards during ‘Dry Weather’ in three out of the last five reporting periods.

Understanding and managing water quality

Difficulties in meeting standards

The standards in the ERS are conservative for protecting public health. To meet these standards, no more than five percent of samples can exceed microbial levels that could cause an outbreak of illness (that is, exceed MAC B in **Table 3**). As a result, even a small number of high microbial results over a five-year period can result in a site not meeting long-term standards.

The standards are also harder to meet in the Bay because it has less mixing than ocean beaches (that is, less wave action, currents at Bay beaches). Many Bay beaches and parts of the Yarra also have stormwater outlets nearby and can be impacted by faecal contamination from their catchments.

When long-term grades do not meet standards (that is, ‘Very Poor’ and ‘Poor’ grades), this indicates a site that is more susceptible to faecal pollution. The site may pose a higher health risk for recreational users over the five-year period of analysis. However, it does not necessarily mean the site is unsuitable for contact during the summer (when recreational use is highest and EPA forecast water quality). EPA’s microbial monitoring shows that in summer, water quality generally meets standards for primary contact recreation when there has not been recent rain.

To inform community decision-making about swimming during summer, Beach Report and Yarra Watch programs provide twice daily water quality forecasts. Additionally, if short-term standards are exceeded in weekly sampling, then warnings are issued to the community. Warnings reduce the community’s short-term exposure to microbial levels that may result in higher risk of illness.

Current and past work to understand microbial risk

Current ERS standards are based on overseas criteria using the best available science, however these criteria are not always comparable to conditions in the Bay and Yarra River. The ERS allows site-specific standards to be used where there has been a study to determine the likely health risk from local faecal sources. Local studies can also be used

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to design targeted interventions to manage faecal contamination sources.

EPA is working with its partners (including Melbourne Water, local councils, and Monash University) to better understand water quality.

This work has included:

- an EPA study in 2017-18 using quantitative microbial risk assessment (QMRA) at Altona, Elwood, and Frankston beaches to better understand health risks from swimming. QMRA is an evidence-based approach to assess the microbial safety of water. This study involved the monitoring of pathogens in the bay, rather than just indicator bacteria and an assessment of the risks of getting sick when ingesting water containing these pathogens. It makes it a useful tool for informing water quality management, reporting and communication
- an EPA study on microbial source tracking (MST) in 2019-20 at 14 beaches in the Bay to understand what types of faeces (for example, dog, bird) are contributing to microbial detection levels. This is important as faeces from animal sources may contain pathogens less susceptible to causing sickness in people than human faeces
- a Melbourne Water study in 2020-21 on QMRA and source tracking in sections of the Yarra River.

The QMRA and source tracking at beaches showed that most faecal contamination in the Bay is from birds and dogs rather than human sources (for example, sewage). This means that the current long-term microbial water quality standards in the ERS are likely to overestimate health risks as they assume human sources are the main driver of pollution. Results are pending from the Yarra River work.

Findings from these assessments will be used to determine if site-specific standards can be developed. Site-specific standards would better reflect the risk of illness at specific beaches in the Bay and Yarra River.

The Environment Protection Act 2017

From 1 July 2021, EPA is using the enhanced powers from the *Environment Protection Act (2017)* to prevent risks to the environment and human health. The general environmental duty (GED) is at the centre of the

new Act and applies to all Victorians. Government, businesses, and community conducting activities that pose a risk to human health and the environment must understand those risks. They must also take reasonably practicable steps to eliminate or minimise those risks.

The GED will be used in this context to educate and work with stakeholders to reduce faecal pollution at recreational sites and improve recreational water quality.

Conclusions and further actions

Recreational water quality remains an important area of investigation for EPA.

Most beaches in Port Phillip Bay met long-term standards for primary contact recreation for 'Dry Weather'. For those beaches not meeting standards, targeted sampling found only a low level of faecal contamination associated with microbial levels. This low-level contamination mainly originated from animal sources rather than human sources, which pose a higher risk to human health.

None of the Yarra reaches met long-term standards during dry weather for the 2016-2021 reporting period. Warrandyte reach has a history of meeting standards. In 2016-2021 the Warrandyte reach 95th percentile was 261 *E. coli*/100 mL, the lowest possible value to receive a MAC C and not meet standards. EPA is actively working with Melbourne Water on a QMRA and MST to better understand health risk and faecal sources in the Yarra.

This work is near completion.

Assessment against long-term standards for beaches and the Yarra indicates that most beaches and Yarra reaches are highly susceptible to stormwater pollution during and after rain. EPA advice is to avoid any contact with water for 24-48 hours following rainfall.

QMRA and source tracking results for beach investigations have shown that most faecal contamination in the Bay is from birds and dogs.

This suggests that current ERS standards likely overestimate health risks for Bay beaches. Similar investigative work in the Yarra River will provide information on the appropriateness of current standards for Yarra reaches. These studies will be used to determine if site-specific standards can be developed. Site-specific standards would more accurately estimate the risk of illness at specific beaches and Yarra reaches, informing targeted pollution mitigation and communication approaches to recreational users.

Appendix A: Classification of long-term recreational water quality

Table 3: Classification matrix for long-term microbial environmental quality indicators and standards for primary and secondary contact recreation.

		Microbial Assessment Category (MAC) 95 th percentile (Hazen method)				
		A	B	C	D	E
Freshwater		<130 <i>E. coli</i> /100ml	130-260 <i>E. coli</i> /100ml	261-550 <i>E. coli</i> /100ml	551-5500 <i>E. coli</i> /100ml	>5500 <i>E. coli</i> /100ml
Freshwater, Marine, Estuarine		<40 Enterococci/100ml	40-200 Enterococci/100ml	201-500 Enterococci/100ml	501-5000 Enterococci/100ml	>5000 Enterococci/100ml
Sanitary Inspection Category (SIC)	Very Low	Very Good	Very Good	Follow-up	Follow-up	Follow-up
	Low	Very Good	Good	Follow-up	Follow-up	
	Moderate	Good	Good	Poor	Poor	
	High	Good	Fair	Poor	Very Poor	
	Very High	Follow-up	Follow-up	Poor	Very Poor	

EPA combines the MAC and SIC to give each site a grade. "Meeting standards" for secondary contact recreation means a site receiving a MAC of A, B, C, or D. "Meeting standards" for primary contact recreation means a site grade of "Very Good", "Good" or "Fair". For more details, see **How long-term standards are used** to calculate grades.

Notes

1. A 95th percentile indicates that 95 per cent of the time data points are below that value and 5per cent of the time they are above that value.
2. A site graded 'Follow-up' may need the SIC investigated; samples reviewed to ensure data related to heavy rainfall is included; and data reviewed for possible analytical errors. There may also be non-sewage sources of faecal indicators (for example, livestock), which need to be verified.
3. For long term assessment for water-based recreation (primary contact and secondary contact), a rolling water quality dataset with a minimum number of 60 samples must be developed and maintained. The microbial assessment category must be assessed in both general weather (a range of weather conditions) and Dry Weather conditions.
4. For long term assessment for primary contact water-based recreation, data must be collected during periods of high recreational use and a sanitary inspection at a site is required.
5. Site-specific microbial long-term standards may be used if a 'Follow-up', 'Poor' or 'Very Poor' long term water quality grade is determined. Site-specific standards must be derived from a risk assessment approach, following industry best practice and guidance published or approved by EPA.

Appendix B: Long-term microbial water quality grades at Port Phillip Bay beaches

The following maps show 'Dry Weather' provisional long-term microbial water quality grades for beaches in Port Phillip Bay. These results should not be used for making decisions on swimming during summer. During summer, refer to twice daily forecasts issues by Beach Report and Yarra Watch at epa.vic.gov.au/BeachReport.

Grade ● Very Good ● Good ● Fair ● Poor ● Very Poor

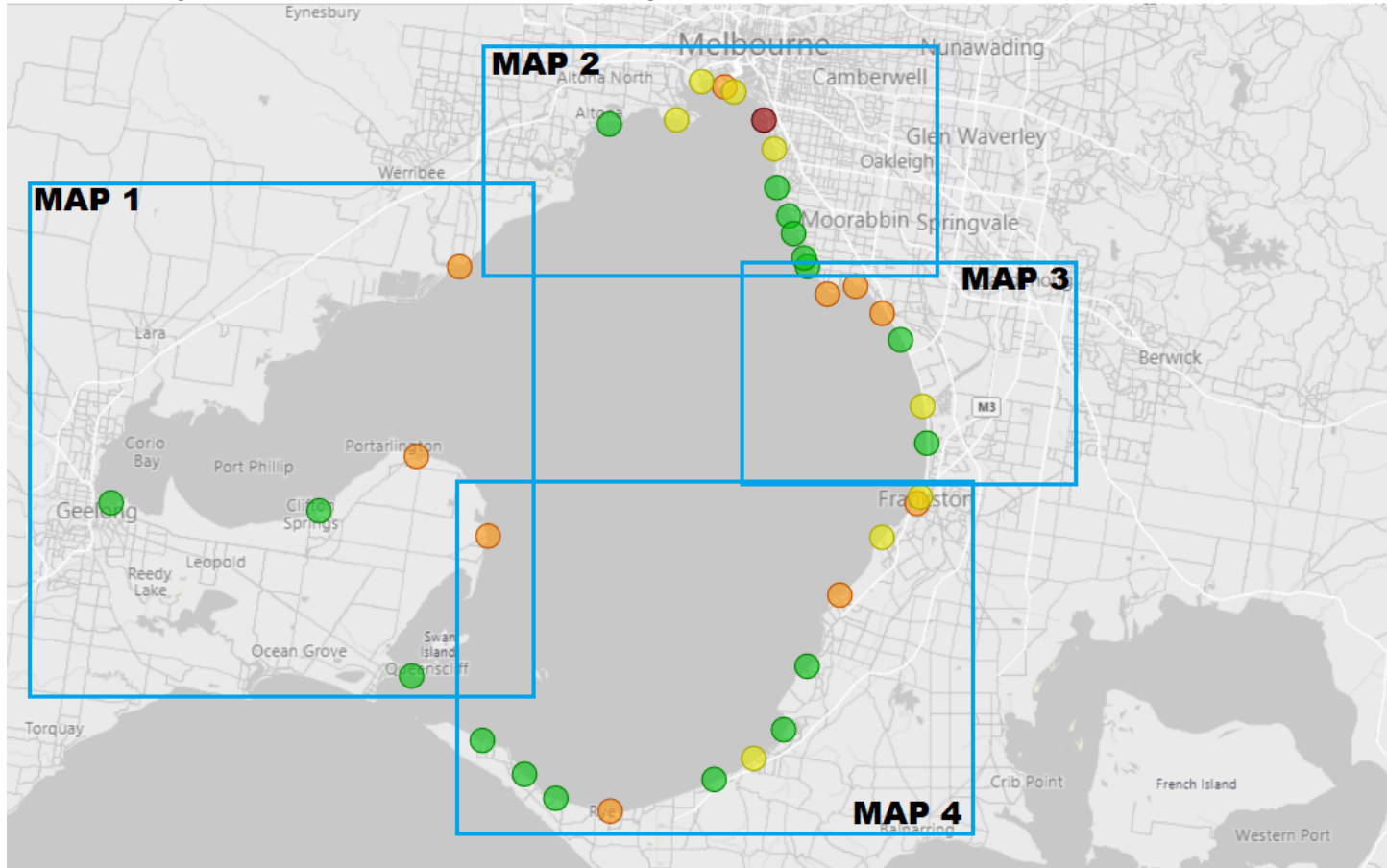


Figure 5: Sections of Port Phillip Bay shown in subsequent maps. Each map shows a section of Port Phillip Bay.

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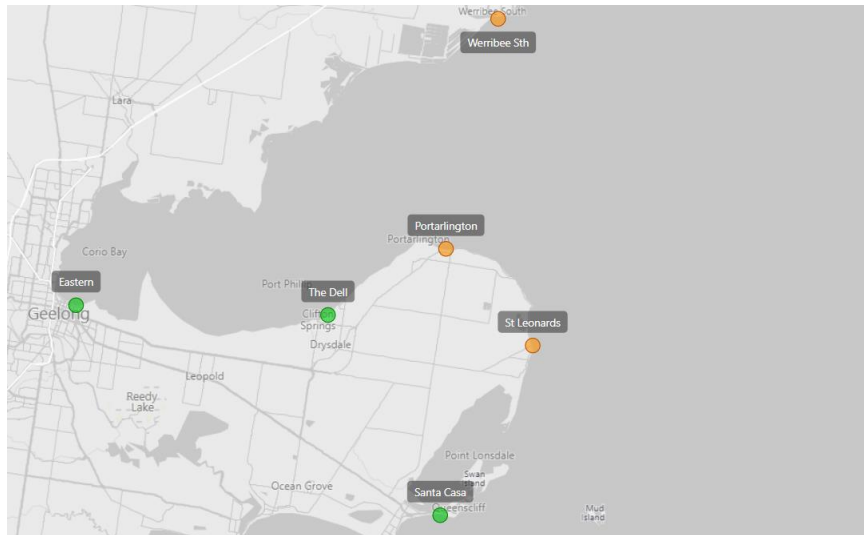


Figure 6: 'Dry Weather' long-term microbial grades for beaches in the west of Port Phillip Bay

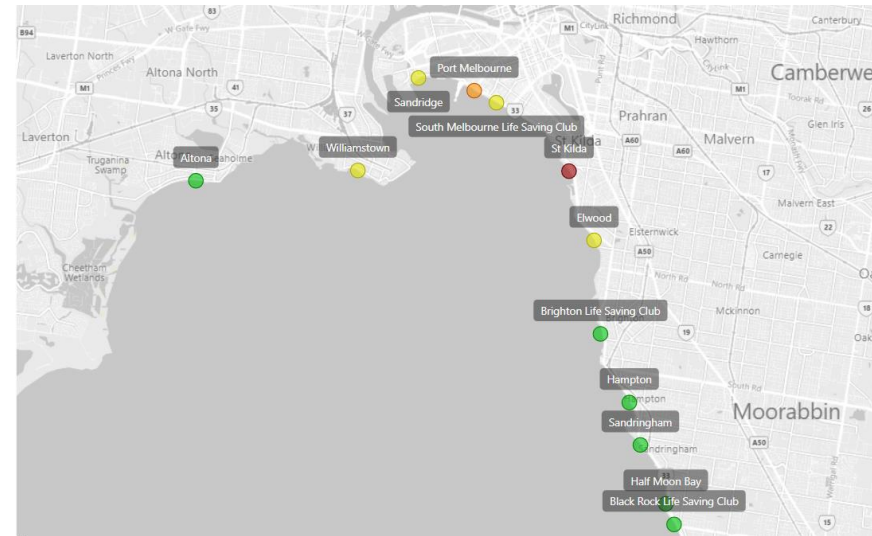


Figure 8: 'Dry Weather' long-term microbial grades for beaches in inner Melbourne.

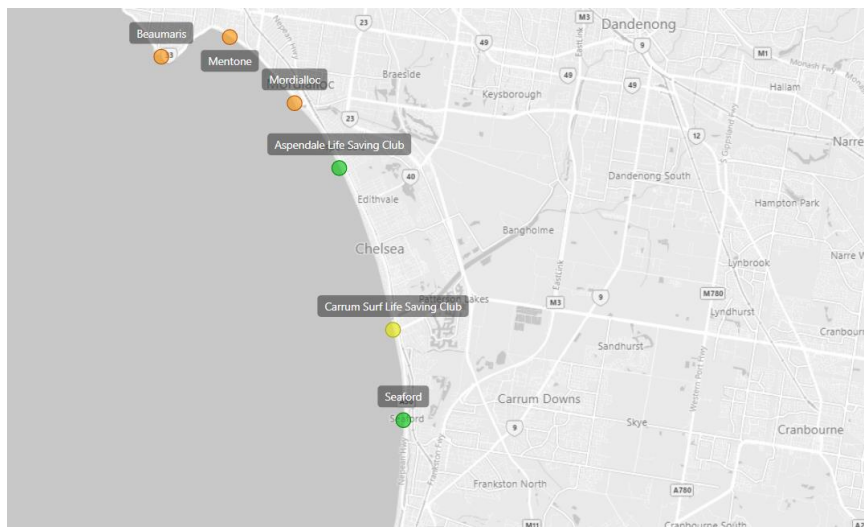


Figure 7: 'Dry Weather' long-term microbial grades for beaches in south-east Melbourne.

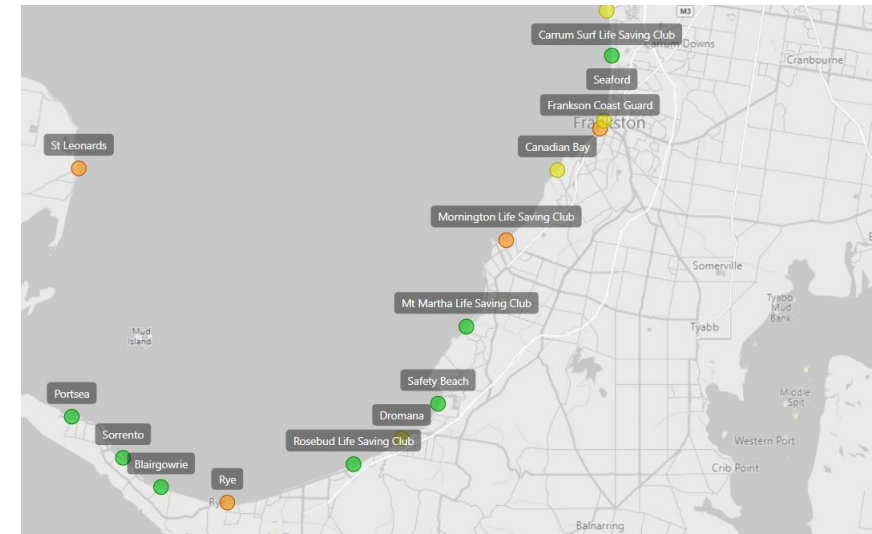


Figure 9: 'Dry Weather' long-term microbial grades for beaches in the lower south-east and the Mornington Peninsula. *Note: Frankston Lifesaving Club is indicated as 'Poor' just south of Frankston Coast Guard.*