NSW GOVERNMENT

DEPARTMENT OF PLANNING, INDUSTRY & ENVIRONMENT

State of the beaches 2018-2019

Central Coast region

Beachwatch

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Recreational water quality has been monitored in the Central Coast region since 2002 by Central Coast Council under the Department of Planning, Industry and Environment's Beachwatch Partnership Program. This report summarises the performance of 32 swimming sites on the Central Coast of New South Wales, providing a long-term assessment of how suitable a site is for swimming. Monitored sites included ocean beaches, ocean baths, estuarine areas in Brisbane Water, designated swimming areas in Lake Macquarie, Lake Munmorah and Tuggerah Lake, and four coastal lagoons.

In 2018–2019, 50% of swimming sites in the Central Coast region were graded as Good or Very Good. These sites were suitable for swimming for most or almost all of the time. While this is a slight decline in overall performance from the previous year, a large proportion of lake/lagoon and estuarine swimming locations are included in the program, which have been most susceptible to impacts from wet weather conditions.

Central Coast region summary 2018–2019

Beach monitoring in New South Wales

Copacabana Beach
Photo: Beachwatch/EES, DPIE

The water quality of beaches and other swimming locations is monitored under the NSW Government's Beachwatch programs to provide the community with accurate information on the cleanliness of the water and to enable individuals to make informed decisions about where and when to swim. Routine assessment also measures the impact of pollution sources, enables the effectiveness of stormwater and wastewater management practices to be assessed and highlights areas where further work is needed.

Swimming sites in New South Wales are graded as Very Good, Good, Fair, Poor or Very Poor in accordance with the National Health and Medical Research Council's 2008 *Guidelines for Managing Risks in Recreational Waters*. These Beach Suitability Grades provide a long-term assessment of how suitable a beach is for swimming. The grades are determined from the most recent 100 water quality results (two to four years' worth of data depending on the sampling frequency) and a risk assessment of potential pollution sources.

See the section on **Quality assurance** in the Statewide Summary for results of the quality assurance program.

Recreational water quality has been monitored in the Central Coast region by Central Coast Council since its amalgamation in 2016. Prior to 2016, swimming sites were monitored by Wyong Shire Council from 2002 and by Gosford City Council from 2004.

A **quality assurance** program ensures the information collected and reported by Beachwatch and its partners is accurate and reliable.

Rainfall impacts

During 2018–2019, 32 swimming sites were monitored including ocean beaches, ocean baths, estuarine areas in Brisbane Water, designated swimming areas in Lake Macquarie, Lake Munmorah and Tuggerah Lake and four coastal lagoons.

Rainfall is the major driver of pollution to recreational waters, generating stormwater runoff and triggering untreated discharges from the wastewater treatment and transport systems. Changes in rainfall patterns are reflected in beach water quality over time due to variation in the frequency and extent of stormwater and wastewater inputs.

The Beach Suitability Grades for 2018–2019 are based on water quality data collected over the last two to four years. Rainfall over this period has been diverse:

- 2015–2016: wet summer, with well above average rainfall during January, including significant storm events causing heavy rain and flooding in coastal areas

- 2016–2017: the wettest March on record for many coastal areas and intense storm activity over summer
- 2017–2018: prolonged dry weather periods broken by heavy rain at times
- 2018–2019: varied rainfall, with mostly average to well below average rainfall, except for some wet months.

See the section on **How to read this report** on page 49 for an explanation of the graphs, tables and Beach Suitability Grades.

While rainfall was below the long-term average, June was particularly wet on the Central Coast. Monthly rainfall totals were more than double the long-term monthly average at Swansea and Norah Head, recording 300mm and 383mm respectively. Average to well below average rainfall followed from July to September 2018.

Consistent rain fell during October 2018. Norah Head and Swansea recorded more than three times the long-term monthly average with 245 and 220mm respectively. Avoca recorded 207mm for the month, which was more than double the long-term average for October.

Except for March 2019, rainfall conditions were average to below average from December to April 2019. Avoca received almost double the long-term monthly average in March 2019 with 289mm for the month, and 111mm in 24 hours on the 17th of the month. Norah Head recorded 62mm on the same day.

Several wet weather events occurred during the warmer months. The Central Coast experienced consecutive heavy rain days on 28–29 November 2018, with more than 90mm of rain recorded at Avoca and Norah Head over the two days. Moderate to heavy rain was also recorded occasionally between January and April 2019 on the coast.

Beachwatch issues daily **beach pollution forecasts** to enable beach goers to make informed decisions about where and when to swim.

Pollution forecasts for the Central Coast beaches can be accessed via the Beachwatch website, email subscription, Twitter and Facebook.

http://www.environment.nsw.gov.au/beachwatch

Health risks

Contamination of recreational waters with faecal material from animal and human sources can pose significant health problems to beach users owing to the presence of pathogens (disease-causing micro-organisms) in the faecal material. The most common groups of pathogens found in recreational waters are bacteria, protozoans and viruses.

Exposure to contaminated water can cause gastroenteritis, with symptoms including vomiting, diarrhoea, stomach-ache, nausea, headache and fever. Eye, ear, skin and upper respiratory tract infections can also be contracted when pathogens come into contact with small breaks and tears in the skin or ruptures of the delicate membranes in the ear or nose.

Certain groups of users may be more vulnerable to microbial infection than others. Children, the elderly, people with compromised immune systems, tourists, and people from culturally and linguistically diverse backgrounds are generally most at risk.

Beach Suitability Grades for Central Coast region

Swimming site	Site type	Beach Suitability Grade	Change
Central Coast Council			
Lakes Beach	Ocean beach	G	↓
Cabbage Tree Bay Rockpool	Ocean baths	P^	●
Soldiers Beach	Ocean beach	G	↓
North Entrance Beach	Ocean beach	G	↓
The Entrance Beach	Ocean beach	G	●
The Entrance Ocean Baths	Ocean baths	G^	●
Toowoon Bay	Ocean beach	P	↓
Shelly Beach	Ocean beach	G	●
Gwandalan	Lake/Lagoon	P	●
Summerland Point Baths	Lake/Lagoon	P^	↓
Chain Valley Bay	Lake/Lagoon	P	●
Mannering Park Baths	Lake/Lagoon	P^	●
Lake Munmorah Baths	Lake/Lagoon	P	●
Canton Beach	Lake/Lagoon	P	●
Wamberal Beach	Ocean beach	G	●
Wamberal Lagoon	Lagoon	P	●
Terrigal Beach	Ocean beach	G	↑
Terrigal Lagoon	Lagoon	P	●
North Avoca Beach	Ocean beach	G	●
Avoca Beach	Ocean beach	G	●
Avoca Lagoon	Lagoon	P	●
Copacabana Beach	Ocean beach	G	●
Cockrone Lagoon	Lagoon	P	●
MacMasters Beach	Ocean beach	VG	●
Killcare Beach	Ocean beach	VG	●

Swimming site	Site type	Beach Suitability Grade	Change
Central Coast Council (continued)			
Ocean Beach	Ocean beach	G	●
Umina Beach	Ocean beach	G	●
Pearl Beach Rockpool	Ocean baths	G	●
Davistown Baths	Estuarine	P	●
Pretty Beach Baths	Estuarine	P	●
Woy Woy Baths	Estuarine	P	●
Yattalunga Baths	Estuarine	P	●

Beach Suitability Grade					Change		
VG	G	F	P	VP	↑	●	↓
Very Good	Good	Fair	Poor	Very Poor	Improved	Stable	Declined

^ Provisional: Information required for the analysis is incomplete due to limited bacterial data or limited information on potential pollution sources in a beach catchment.

Central Coast Council

Overall results

Sixteen of the 32 swimming sites were graded as Very Good or Good in 2018–2019, which is a decline in performance from the previous year. This result is influenced by a large proportion of monitored swimming sites being in lagoons and estuaries, where the impacts of rainfall are more apparent with reduced dilution and flushing of pollution inputs.

Percentage of sites graded as Very Good or Good:

- 2018–2019: 50%
- 2017–2018: 53%
- 2016–2017: 66%
- 2015–2016: 64%.

Thirty-two swimming sites were monitored by Central Coast Council. All sampling and laboratory analysis was conducted and fully funded by the council.

All sites are sampled weekly between October and April and monthly from May to September.

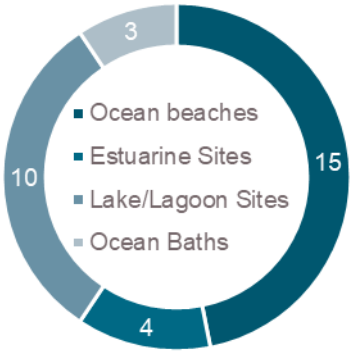
Many sites including Terrigal Beach, Avoca Beach, Avoca Lagoon, Cockrone Lagoon, MacMasters Beach, Killcare Beach, Pearl Beach Rockpool and Pretty Beach Baths have shown trends of improved microbial assessments in recent years with management actions improving water quality at these sites.

See the section on **How to read this report** on page 49 for an explanation of the graphs, tables and Beach Suitability Grades.

Best beaches

MacMasters Beach and Killcare Beach.

These sites had excellent water quality and were suitable for swimming almost all of the time.



Site types in Central Coast region

Swimming sites monitored in the Central Coast region include ocean beaches, estuarine areas in Brisbane Water, lake swimming sites in Lake Macquarie, Lake Munmorah and Tuggerah Lakes, coastal lagoons at Wamberal, Terrigal, Avoca and Cockrone, and ocean baths at The Entrance, Cabbage Tree Bay and Pearl Beach, with each site type having a different response to rainfall-related impacts.

In general, estuarine, lake and lagoon swimming sites did not perform as well as ocean beaches and ocean baths, due to lower levels of flushing increasing the time needed to disperse and dilute pollution inputs, taking longer to recover from stormwater events.

As a general precaution swimming should be avoided during and for at least one day after heavy rain at ocean beaches, and for up to three days in estuarine areas, or if there are signs of stormwater pollution such as discoloured water or floating debris.

Beach Suitability Grades for Central Coast ocean beaches

Ocean beaches

Two of the 15 ocean beaches were graded as Very Good: MacMasters Beach and Killcare Beach. Water quality at these beaches was suitable for swimming almost all of the time.

Lakes Beach, Soldiers Beach, North Entrance Beach, The Entrance Beach, Shelly Beach, Wamberal Beach, Terrigal Beach, North Avoca Beach, Avoca Beach, Copacabana Beach, Ocean Beach and Umina Beach were graded as Good. Water quality at these sites is suitable for swimming most of the time but can be susceptible to pollution following rainfall.

Terrigal Beach improved to Good from a Poor grade in 2017–2018, reflecting a slightly higher proportion of water samples collected during dry weather conditions compared to the previous year. Microbial water quality at Terrigal Beach is mostly suitable for swimming in dry weather conditions, with 89% of samples within the safe swimming limit when no rain had fallen in the previous 24 hours. While water quality at the beach has shown some improvement over the past few years, it remains close to the threshold between Good and Poor. Terrigal Beach can be impacted by several potential pollution sources, including stormwater and contaminants discharged in outflow from nearby Terrigal Lagoon.

Lakes Beach, Soldiers Beach and North Entrance Beach were downgraded to Good, from Very Good in the previous year. Water quality at these sites was mostly suitable for

swimming during dry weather conditions, however elevated bacteria levels were recorded occasionally.

Toowoon Bay was graded as Poor in 2018–2019, downgraded from Good in the previous year. A Poor grade indicates the site is more susceptible to pollution and not always suitable for swimming. While water quality at Toowoon Bay was mostly suitable for swimming in dry weather conditions, elevated enterococci levels were occasionally recorded after little or no rain. Microbial water quality at this site has declined in recent years, with slightly elevated bacterial results occurring more frequently since 2017.

It is recommended that swimming be avoided during and for up to one day after rainfall at ocean beaches or if there are signs of stormwater pollution such as discoloured water, flowing drains or outflow from lagoons, due to the possibility of pollution.

Estuarine beaches

Beach Suitability Grades for Central Coast estuarine beaches

Four estuarine swimming sites in Brisbane Water continued to be graded as Poor: Davistown Baths, Pretty Beach Baths, Woy Woy Baths and Yattalunga Baths. This result is a similar performance to previous years.

During dry weather conditions, Pretty Beach Baths and Yattalunga Baths were frequently suitable for swimming, with 77% and 82% samples within the safe swimming limit when no rain had fallen in the previous 24 hours. Elevated enterococci levels were recorded following light rainfall.

Microbial water quality at Davistown Baths and Woy Woy Baths was often elevated during dry and wet weather conditions. At these sites, the bacterial levels continued to increase significantly in response to increasing rainfall.

These swimming sites may be impacted by several significant potential sources of faecal contamination including stormwater and other sources within Brisbane Water, and have low levels of flushing.

Swimming at the estuarine beaches is not recommended during and for up to three days following rainfall or if there are any signs of stormwater such as discoloured water or floating debris.

Lake/lagoon swimming sites

Beach Suitability Grades for Central Coast lake/lagoon swimming sites

All six lake swimming sites were graded as Poor: Gwandalan, Summerland Point Baths, Chain Valley Bay, Mannering Park Baths, Lake Munmorah Baths and Canton Beach. Summerland Point Baths was downgraded from Good in 2017–2018.

The grades for Summerland Point Baths and Mannering Park Baths are provisional as the information required for the analysis is based on limited bacterial data. Further monitoring will provide a clearer indication of water quality at these sites.

Water quality at Gwandalan, Summerland Point Baths, Chain Valley Bay and Lake Munmorah Baths was mostly suitable for swimming during dry weather conditions, with between 72 and 85% of samples within the safe swimming limit when no rain had fallen in the previous 24 hours; however, elevated enterococci levels were recorded after light rainfall and sometimes in no rain. Water quality at Mannering Park Baths and Canton Beach was often elevated during dry and wet weather conditions, with enterococci levels increasing with increasing rainfall.

The impact of rainfall-related pollution is more apparent at these sites with low levels of flushing and slower dilution to disperse pollution inputs. Swimming should be avoided during and for at least three days after rainfall.

The four lagoons were graded Poor, the same result as previous years: Wamberal Lagoon, Terrigal Lagoon, Avoca Lagoon and Cockrone Lagoon. Water quality was often unsuitable for swimming during dry weather conditions and swimming should be avoided if there are any signs of pollution such as discoloured water, odours or floating debris. Bacterial levels increased significantly with increasing rainfall.

Pollution inputs can accumulate in coastal lagoons due to very low levels of flushing. Pollution is usually diluted when the lagoon entrance is open to the ocean.

Beach Suitability Grades for Central Coast ocean baths

Ocean baths

Two of the three ocean baths continued to be graded as Good in 2018–2019: The Entrance Ocean Baths and Pearl Beach Rockpool. Water quality at The Entrance Ocean Baths was generally suitable for swimming during dry and wet weather conditions. Pearl Beach Rockpool was mostly suitable for swimming after little or no rain, with elevated levels of enterococci mostly recorded following heavy rainfall.

Cabbage Tree Bay Rockpool was graded as Poor. A Poor grade indicates the site can be susceptible to pollution and not always suitable for swimming. During the assessment period, 87% of dry weather samples were within the safe swimming limit, with elevated enterococci levels often recorded following moderate rainfall. Council previously monitored the adjacent ocean beach, Cabbage Tree Bay until February 2017, which performed very well for many years. While potential pollution sources are similar at these sites, water quality at the rockpool is more frequently impacted by elevated bacterial levels. Pollution inputs are generally retained longer in the rockpool due to lower levels of flushing, taking longer to disperse and dilute than at the adjacent ocean beach.

The Entrance Ocean Baths and Cabbage Tree Bay Rockpool grades are provisional due to limited bacterial data for the assessment. Continued monitoring will provide a more complete assessment of their performance.

The Entrance Ocean Baths are cleaned regularly year-round by council, while Cabbage Tree Bay Rockpool and Pearl Beach Rockpool are flushed irregularly, and are dependent on the natural exchange of ocean water over the rocks and pool walls. It is recommended that swimming be avoided during and for up to one day after rainfall, or if there are signs of pollution such as discoloured water or floating debris.

Management

Patrolled ocean beach
Photo: Beachwatch/EES, DPIE

In 2019, the NSW Government committed $500,000 to address poor water quality at Terrigal Beach and surrounding lagoons. The NSW Department of Planning, Industry and Environment, in collaboration with Central Coast Council and University of Technology, Sydney are undertaking a catchment investigation applying nutrient, enterococci and genetic marker assay methods for a detailed audit of sources of contamination. The project will identify the sources of microbial contamination (such as humans or animals) and sub-catchments discharging the highest loads of nutrients and microbial pollutants to the receiving waters. The outcomes of the investigation will assist council in identifying and evaluating management options to improve water quality.

In February 2019, the NSW Government committed $200,000 to establish an expert panel to determine the best way to improve water quality in Tuggerah Lakes. This panel will consider all existing information and audit current management actions and their effectiveness to inform and support the development of a coastal management program (CMP) for Tuggerah Lakes. The expert panel will collaborate

with the community, government agencies and Central Coast Council using a risk-based and outcome focused process. This will guide council to formulate appropriate strategies and actions to improve water quality and ensure the sustainable health of the Tuggerah Lakes Estuary.

Central Coast Council

A **Coastal Management Program** (CMP) outlines a long-term strategy for managing the coast, in line with the *Coastal Management Act 2016*.

The NSW Government provides guidance and funding through the Coastal and Estuary Grants Program for local councils to prepare and implement CMPs.

Under the previous *Coastal Protection Act 1979*, councils developed a **Coastal Zone Management Plan** (CZMP) to address coastal issues. Councils can continue to implement priority actions from certified CZMPs with funding assistance from the NSW Government's Coastal and Estuary Grants Program until 2021.

Central Coast Council have a number of monitoring programs which assess catchment, estuary and coastal water quality throughout the Central Coast. The information from these monitoring programs helps to guide management actions through the Estuary Management Plans and Coastal Zone Management Plans (CZMPs), prepared in accordance with NSW legislation. The overarching objective of these plans is to achieve long-term improvement in the health of these waterways.

Central Coast Council investigates and advises the community with temporary advisory signs or media releases when algal blooms, sewage contamination and stormwater pollution are detected at designated swimming sites.

Council has placed permanent advisory signs at each designated swimming area to advise that the area is affected by stormwater pollution for up to three days following heavy rain at lake, lagoon and estuarine sites and one day at ocean beaches and oceans baths, and that swimming is not recommended during these periods.

Central Coast Council is developing an audit program to investigate locations with long-term declining trends in ocean recreational water quality as reported in the NSW State of the Beaches reports. The audits will assess stormwater and sewer networks near beaches for breaks or possible overflow points, as well as sample stormwater entering the beach for enterococci and trace pharmaceuticals. Council commenced a water quality catchment audit at Terrigal in January 2019 and is working towards detecting and resolving water quality issues at this location. This audit is being undertaken alongside the NSW Government and the University of Technology, Sydney. Catchment audits have also started at Cabbage Tree Bay Beach in October 2018 and Toowoon Bay Beach in May 2019, with investigation of the sewer networks, with enterococci and trace pharmaceuticals sampling underway.

Central Coast Council and the University of Newcastle are investigating the Central Coast's estuaries, undertaking microbial profiling at designated swimming sites to understand contamination and anthropogenic stress in Lake Macquarie, Tuggerah Lakes and Brisbane Water. The microbial profiling will assess nutrients, enterococci and

bacteria DNA to assist in identifying whether microbial contamination is from human or non-human sources (such as wildlife and domestic animals), to refine management actions to improve water quality. The molecular data will be assessed to determine if enterococci are a good indicator of health risks in estuaries, and enable council to evaluate whether to include molecular-based monitoring techniques in environmental monitoring programs. The data from this investigation will also provide useful information on the overall health of the estuaries.

Terrigal Beach
Photo: Beachwatch/EES, DPIE

Central Coast Council has invested approximately $87.5 million in sewage capital works in the last five years to improve the performance, reliability and capacity of the sewerage reticulation system, sewage pumping stations and sewage treatment plants (STPs) throughout the Central Coast local government area.

Works completed recently include:

- upgrades to the sewer and sewer pump stations in North Avoca, Avoca, Kincumber and Woy Woy, Wyong and Wyong South. These works protect the community and environment against overflows and odours, and improve reliability and eliminate service deficiencies at treatment plants
- replacement of the temporary sewer main across Terrigal Lagoon which will improve the amenity of the lagoon and minimise potential environmental impacts
- construction of the Cockle Bay Towns Sewerage Project providing reticulated sewer service to Empire Bay, Bensville and Kincumber South. More than 300 properties have been connected to the system and no longer manage their sewer onsite. This could lead to a significant improvement in environmental outcomes for downstream areas. Properties will continue to be connected to the system.

Major works currently underway include:

- upgrading beachfront sewage pumping stations at Norah Head, Toowoon Bay and Bateau Bay beaches, increasing the capacity and addressing a number of service deficiencies
- upgrading vacuum sewage pumping stations in the Tacoma and Tuggerawong area to improve reliability and service to over 700 properties in this catchment
- upgrading sewage pumping stations located within close proximity to lakes, estuaries and coastal lagoons at Tuggerawong, Budgewoi, Narara, Woy Woy and MacMasters Beach to improve reliability, increase capacity and address a number of service deficiencies
- improvements to the major sewage transfer system servicing Forresters Beach, Terrigal, North Avoca,

Avoca and Kincumber, enhancing the operation and capacity of the existing system located near Avoca Lake.

Sewage capital works scheduled to commence during 2019–2022 include:

- renewal of gravity sewer infrastructure at targeted locations to reduce sewer infrastructure failures and prevent overflows from entering nearby waterways
- upgrading sewage pumping stations within close proximity to lakes, estuaries and coastal lagoons at Noraville, Tuggerawong, Tuggerah, The Entrance, Wamberal, Tascott, MacMasters Beach and Umina Beach to improve reliability, increase capacity and address a number of service deficiencies
- upgrading the Bateau Bay and Charmhaven STPs to improve reliability and address a number of service deficiencies at each treatment plant.

Umina Beach
Photo: Beachwatch/EES, DPIE

Council continued its monitoring program of over 8000 onsite sewage management systems throughout the council area. Due to the number of systems, not every system can be monitored each year. Throughout the Central Coast there are a large number of private onsite sewage management systems including pump-out systems, aerated wastewater treatment systems, septic tank systems, commercial systems and other miscellaneous systems such as composting systems.

To reduce the volume of stormwater and improve water conservation at Terrigal Beach and in Erina Creek, council manages two water harvesting and re-use schemes. These involve underground storage, treatment and reticulation systems which can store and use 1.6 million litres of stormwater.

The Tuggerah Lakes Estuary and Catchment Improvement Project funded by the Australian Government's Improving Your Local Parks and Environment Program aims to improve the water quality of the Tuggerah Lakes estuary and improve knowledge of water quality issues to direct future management actions. Under this funding a range of waterway improvement projects are being completed including foreshore, streambank and wetland rehabilitation, development of educational materials, construction of new gross pollutant traps and upgrades to wrack collection infrastructure. In total over the past decade council has invested $50 million into initiatives to improve the health of the Tuggerah Lakes estuary, about half of which was grant funded.

Council continues to install new gross pollutant traps and upgrade existing infrastructure improving stormwater quality. Council now maintains over 360 stormwater quality

North Entrance Beach
Photo: Beachwatch/EES, DPIE

improvement devices. As a result, over 967 tonnes of sediment and pollutants were prevented from entering wetlands, creeks, rivers, lakes, lagoons and the ocean in the 2017–2018 financial year.

Council's wrack and algal collection program saw more than 14,855m^3 of wrack (dead and free-floating seagrass) and algae removed from the Tuggerah Lakes estuary during 2017–2018, which led to improvements in the water quality of the nearshore zone.

Council also continued programs such as installation of dog poo bins in popular dog walking areas; stormwater and waterway community education projects; maintenance of key wetlands all across the Central Coast; riparian rehabilitation; and enforcement of council's erosion, sediment and nutrient control regulations.

Sampling sites and Beach Suitability Grades in Central Coast Council (northern)

Sampling sites and Beach Suitability Grades in Central Coast Council (southern)

Lakes Beach

Beach grade: G

See ‘How to read this report’ for key to map.

Lakes Beach is at the southern end of an eight kilometre stretch of beach. The beach is patrolled during summer.

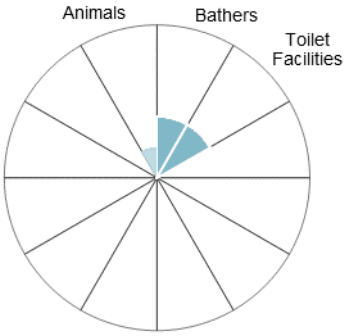
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of minor faecal contamination.

Enterococci levels had little response to rainfall and generally remained below the safe swimming limit across all rainfall categories.

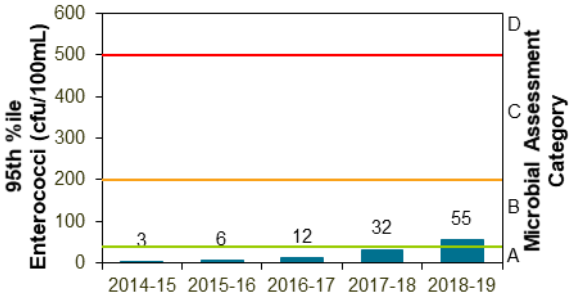
The site has been monitored since 2002.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Aug 2016 to Apr 2019	95%	100	Declined

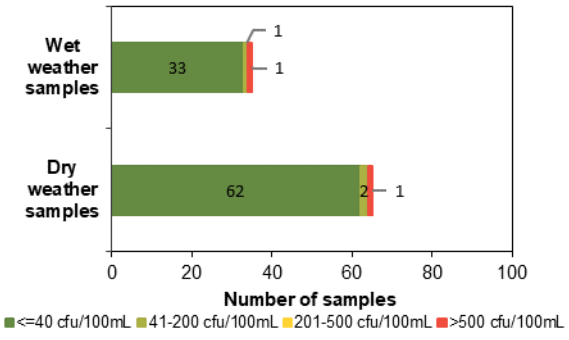
Sanitary inspection: Low



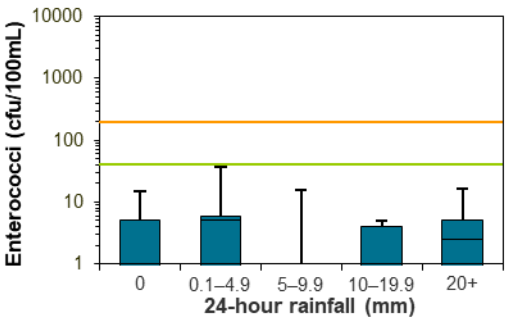
Microbial Assessment Category: B



Dry and wet weather water quality

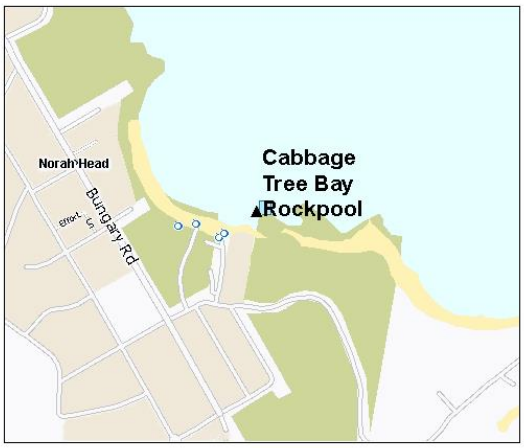


Water quality in response to rainfall



Cabbage Tree Bay Rockpool

Beach grade: P^



See ‘How to read this report’ for key to map.

Cabbage Tree Bay Rockpool is located within a sheltered bay of Cabbage Tree Harbour, Norah Head and is naturally flushed by the ocean.

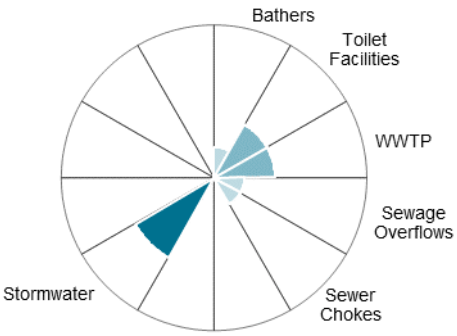
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to pollution, particularly after rainfall and occasionally during dry weather conditions, with several sources of potential faecal contamination.

Enterococci levels increased with increasing rainfall, occasionally exceeding the safe swimming limit after little or no rain, and often after 10mm or more of rainfall.

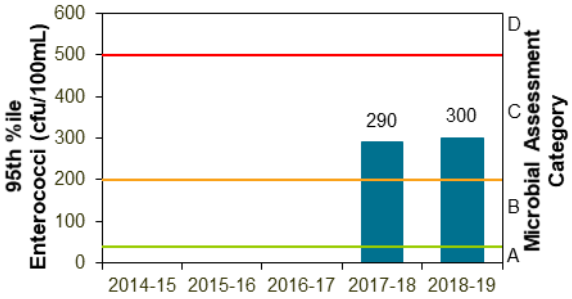
The site was monitored from 2002 until 2005, and since 2017.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean baths	Feb 2017 to Apr 2019	87%	48	Stable

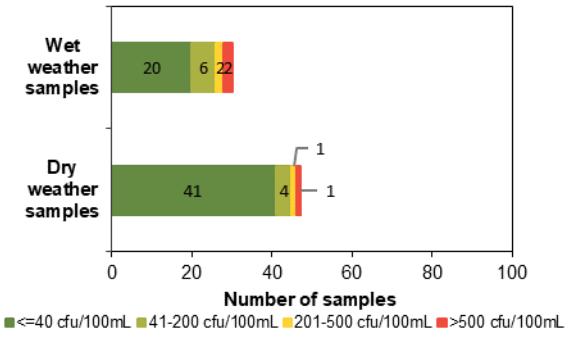
Sanitary inspection: Moderate



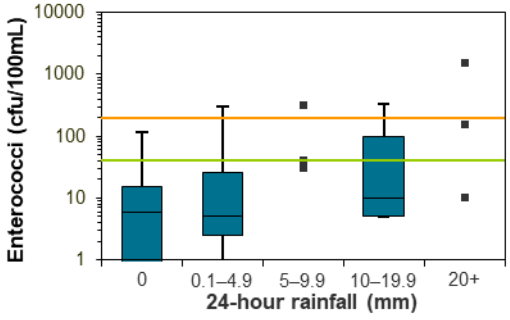
Microbial Assessment Category: C



Dry and wet weather water quality



Water quality in response to rainfall



Soldiers Beach

Beach grade: G

See ‘How to read this report’ for key to map.

Soldiers Beach is a popular beach surrounded by reserve, and is patrolled over summer.

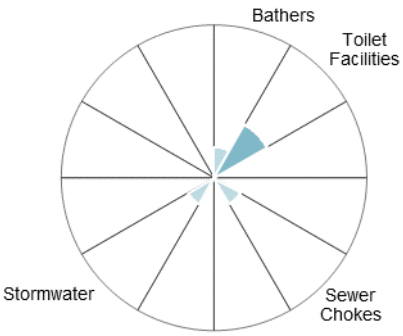
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of minor faecal contamination.

Enterococci levels increased slightly with increasing rainfall but generally remained below the safe swimming limit across most rainfall categories.

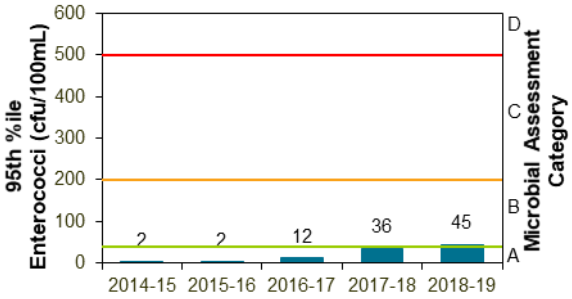
The site has been monitored since 2002.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Aug 2016 to Apr 2019	95%	100	Declined

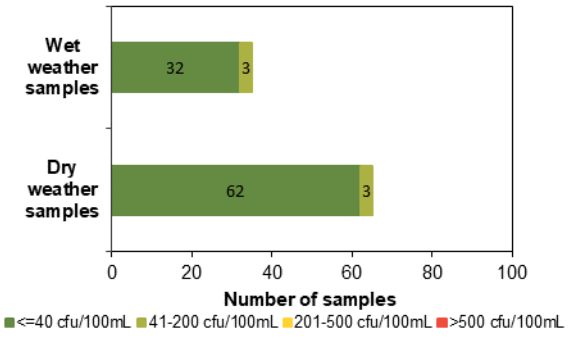
Sanitary inspection: Low



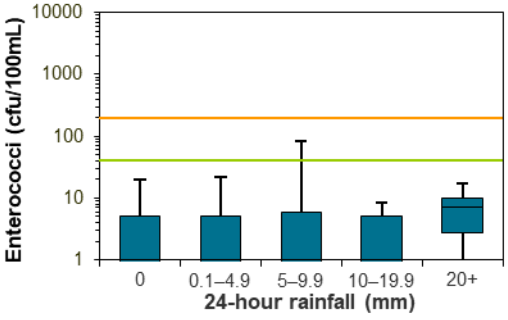
Microbial Assessment Category: B



Dry and wet weather water quality

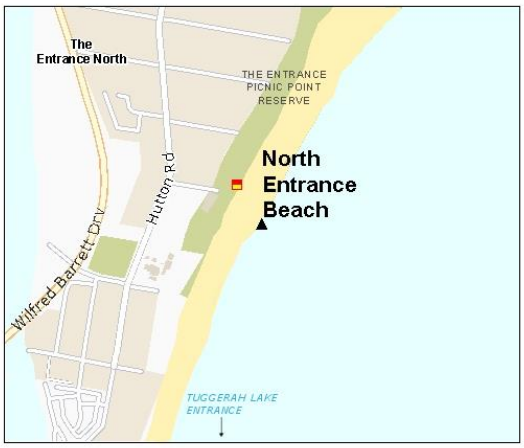


Water quality in response to rainfall



North Entrance Beach

Beach grade: G



See 'How to read this report' for key to map.

North Entrance Beach is located to the north of the entrance to Tuggerah Lake, and is patrolled over summer.

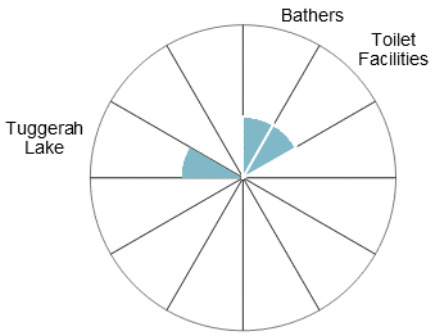
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of minor faecal contamination.

Enterococci levels increased slightly with increasing rainfall, occasionally exceeding the safe swimming limit after 20mm or more of rainfall.

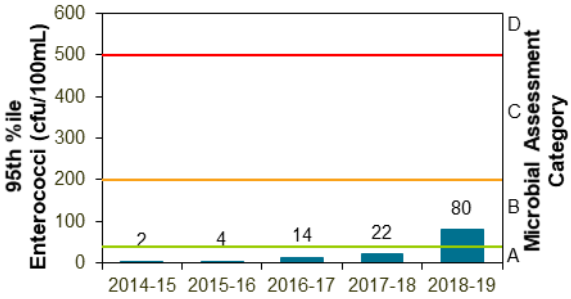
The site has been monitored since 2002.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Aug 2016 to Apr 2019	96%	100	Declined ↓

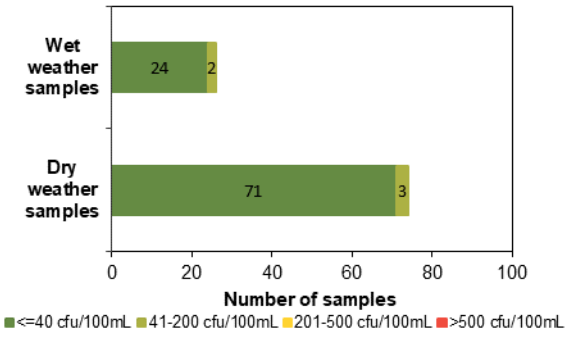
Sanitary inspection: Low



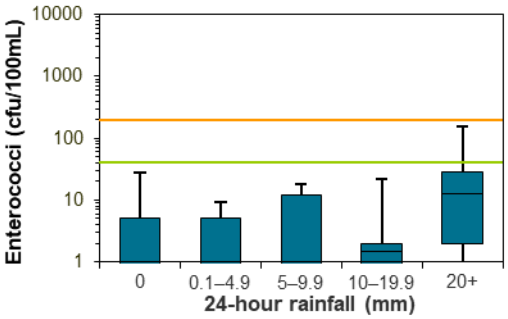
Microbial Assessment Category: B



Dry and wet weather water quality



Water quality in response to rainfall



The Entrance Beach

Beach grade: G

See ‘How to read this report’ for key to map.

The Entrance Beach is located to the south of the entrance to Tuggerah Lake and is patrolled over summer.

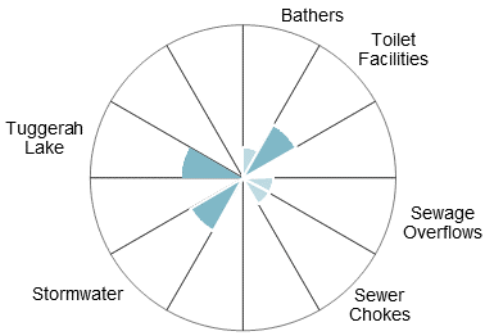
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but can be susceptible to pollution after rain, with several potential sources of minor faecal contamination.

Enterococci levels generally increased with increasing rainfall, occasionally exceeding the safe swimming limit after light rain, and often after 20mm or more of rainfall.

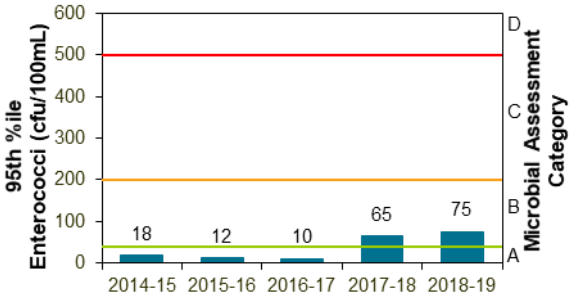
The site has been monitored since 2002.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Sep 2016 to Apr 2019	95%	100	Stable

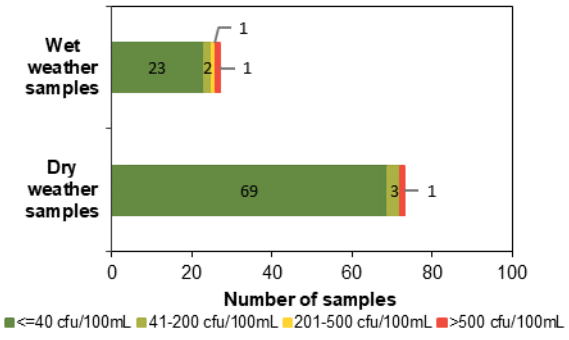
Sanitary inspection: Low



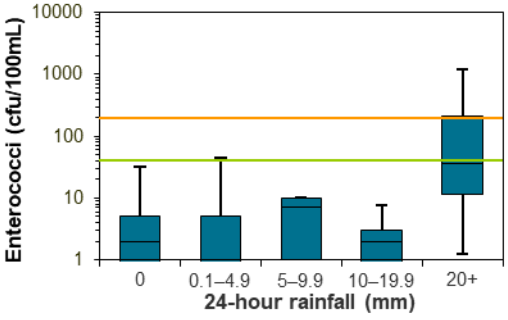
Microbial Assessment Category: B



Dry and wet weather water quality

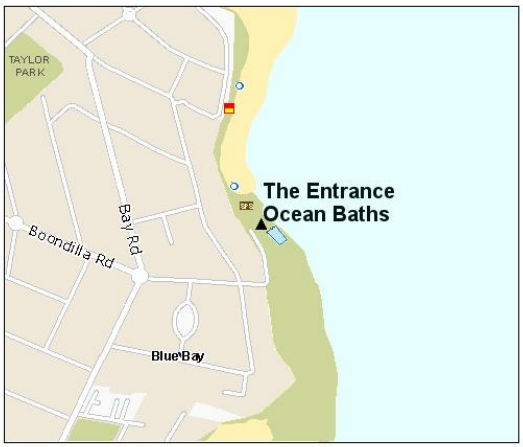


Water quality in response to rainfall



The Entrance Ocean Baths

Beach grade: G^



See ‘How to read this report’ for key to map.

The Entrance Ocean Baths include a 50 metre concrete pool and two smaller wading pools located at the southern end of The Entrance Beach, and are patrolled over summer.

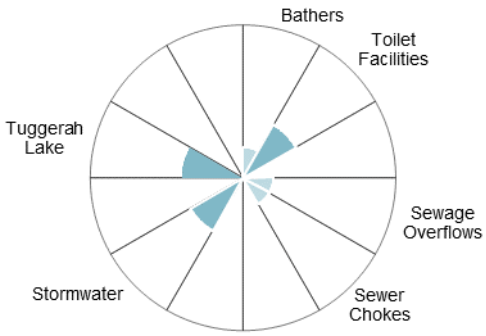
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but can be susceptible to pollution after rain, with several potential sources of minor faecal contamination.

Enterococci levels increased slightly with increasing rainfall, occasionally exceeding the safe swimming limit after little or no rain.

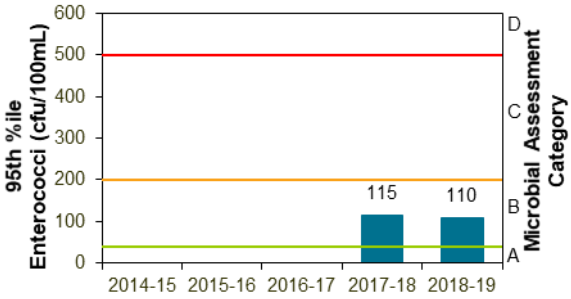
The site has been monitored since 2017.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean baths	Feb 2017 to Apr 2019	93%	48	Stable

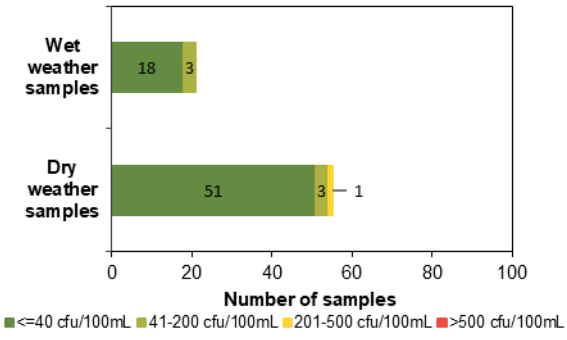
Sanitary inspection: Low



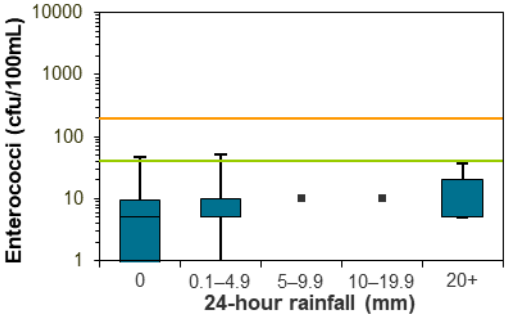
Microbial Assessment Category: B



Dry and wet weather water quality



Water quality in response to rainfall



Toowoon Bay

Beach grade: P

See 'How to read this report' for key to map.

Toowoon Bay is a relatively calm ocean beach protected by headlands and a tombola. The beach is patrolled during summer.

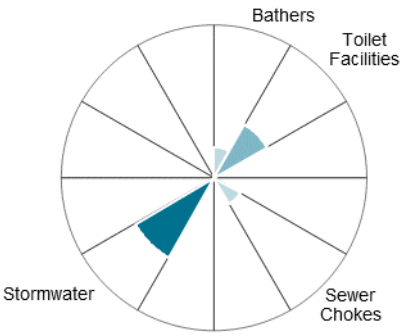
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including stormwater.

Enterococci levels increased slightly with increasing rainfall, occasionally exceeding the safe swimming limit after little or no rain and often after 20mm or more of rainfall.

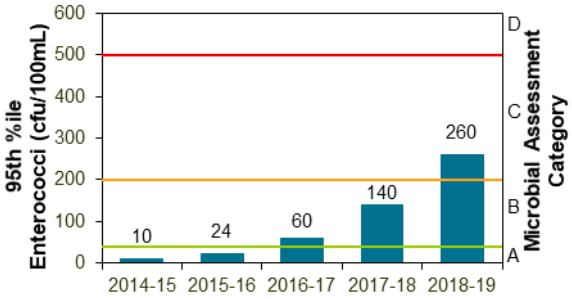
The site has been monitored since 2002.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Sep 2016 to Apr 2019	80%	100	Declined

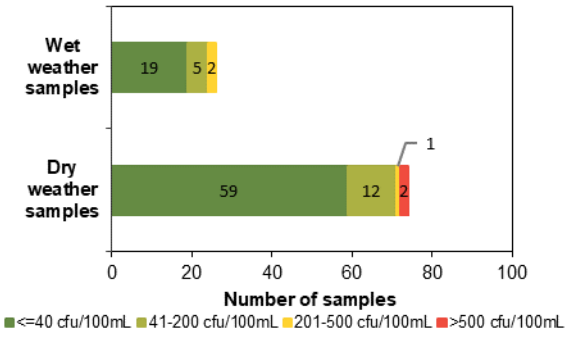
Sanitary inspection: Moderate



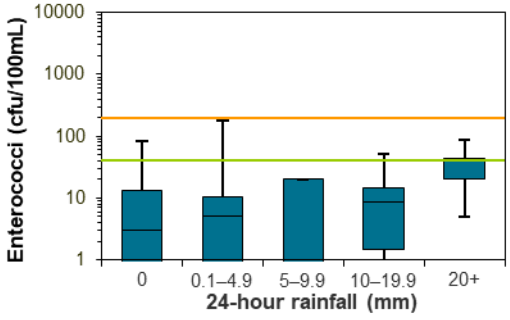
Microbial Assessment Category: C



Dry and wet weather water quality



Water quality in response to rainfall



Shelly Beach

Beach grade: G

See ‘How to read this report’ for key to map.

Shelly Beach is a popular patrolled beach, backed by a high dune system and golf course.

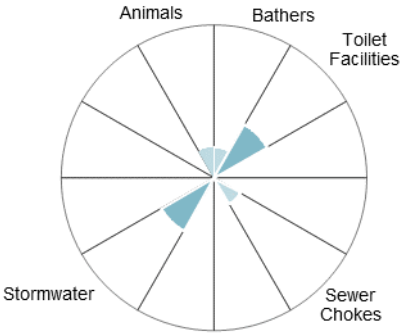
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of minor faecal contamination.

Enterococci levels increased slightly with increasing rainfall, occasionally exceeding the safe swimming limit in response to light rain, and often after 5mm or more of rainfall.

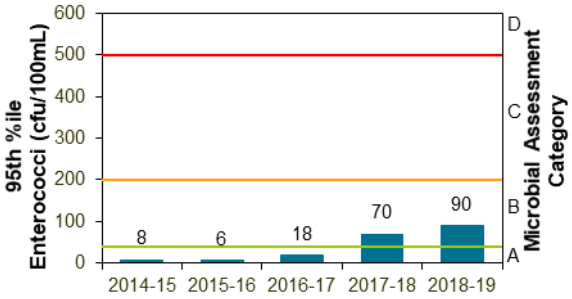
The site has been monitored since 2002.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Aug 2016 to Apr 2019	92%	100	Stable

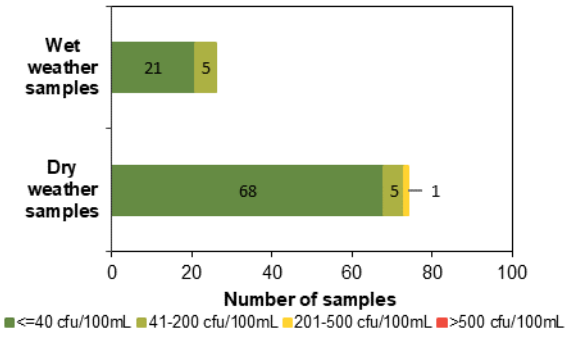
Sanitary inspection: Low



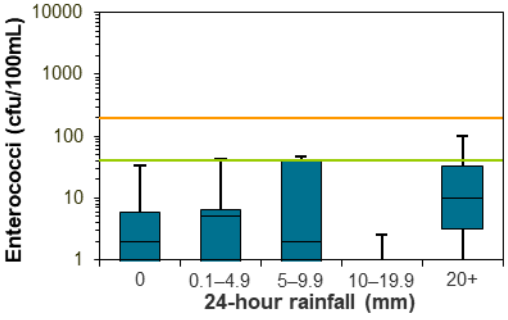
Microbial Assessment Category: B



Dry and wet weather water quality

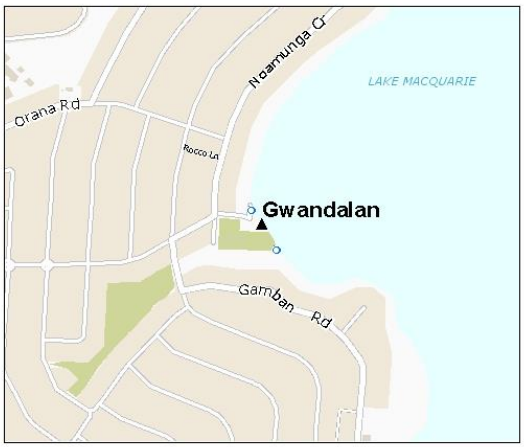


Water quality in response to rainfall



Gwandalan

Beach grade: P



See ‘How to read this report’ for key to map.

Gwandalan is a netted swimming enclosure within Crangan Bay in southern Lake Macquarie.

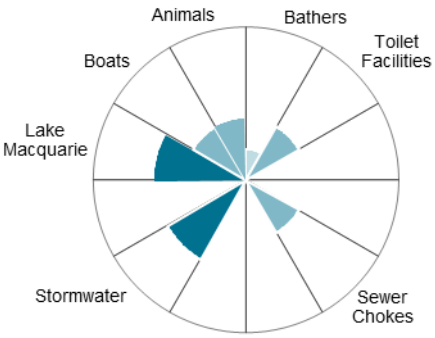
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including Lake Macquarie and stormwater.

Enterococci levels increased with increasing rainfall, often exceeding the safe swimming limit in response to no rain, and regularly after rainfall.

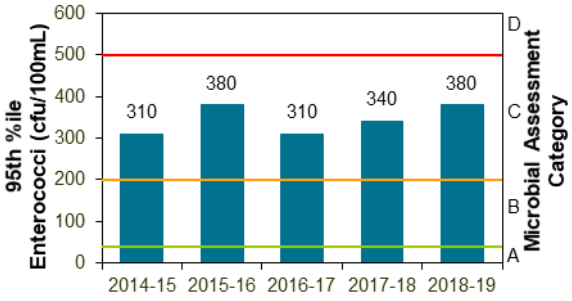
The site has been monitored since 2002.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Lake/Lagoon	Mar 2016 to Apr 2019	76%	100	Stable

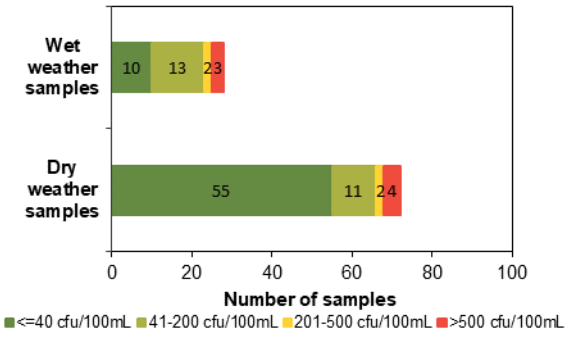
Sanitary inspection: Moderate



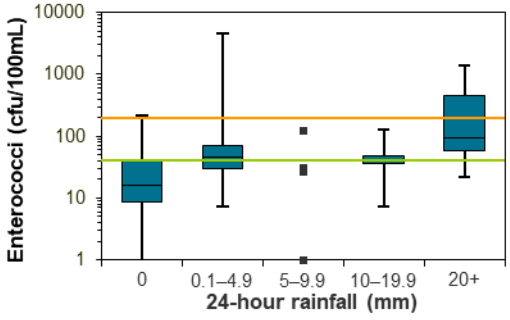
Microbial Assessment Category: C



Dry and wet weather water quality



Water quality in response to rainfall



Summerland Point Baths

Beach grade: P^

See ‘How to read this report’ for key to map.

Summerland Point Baths are a netted swimming area located at the southern end of Lake Macquarie.

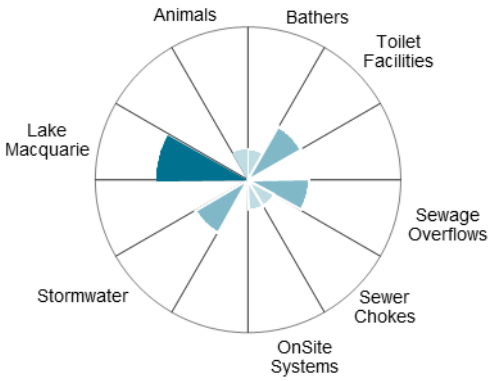
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including Lake Macquarie.

Enterococci levels increased slightly with increasing rainfall, occasionally exceeding the safe swimming limit in response to little or no rain.

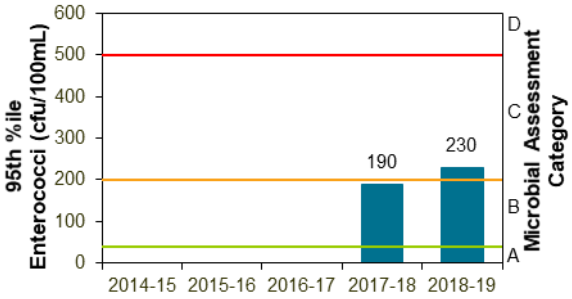
The site has been monitored since 2017.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Lake/Lagoon	Jun 2017 to Apr 2019	85%	34	Declined ↓

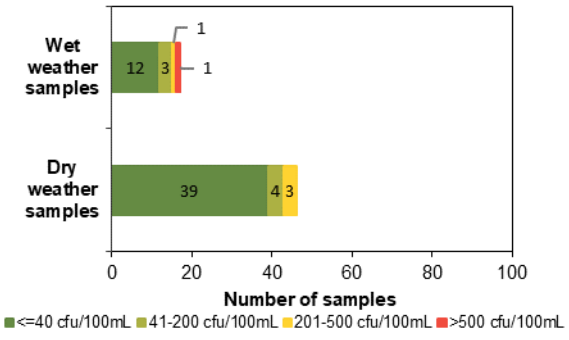
Sanitary inspection: Moderate



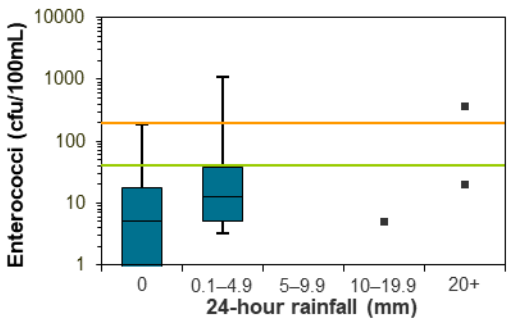
Microbial Assessment Category: C



Dry and wet weather water quality



Water quality in response to rainfall



Chain Valley Bay

Beach grade: P

See 'How to read this report' for key to map.

Chain Valley Bay is an enclosed swimming area located at the southern end of Lake Macquarie.

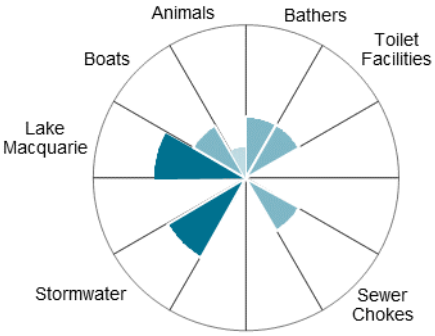
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions from several potential sources of faecal contamination including Lake Macquarie and stormwater.

Enterococci levels increased with increasing rainfall, occasionally exceeding the safe swimming limit in response to little or no rain, and often after 5mm or more of rain.

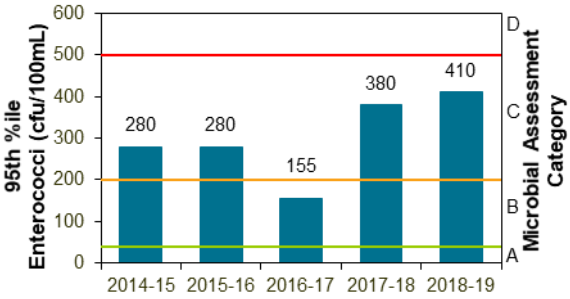
The site has been monitored since 2002.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Lake/Lagoon	Mar 2016 to Apr 2019	72%	100	Stable

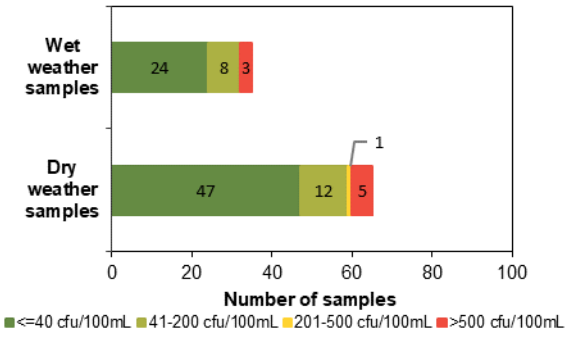
Sanitary inspection: Moderate



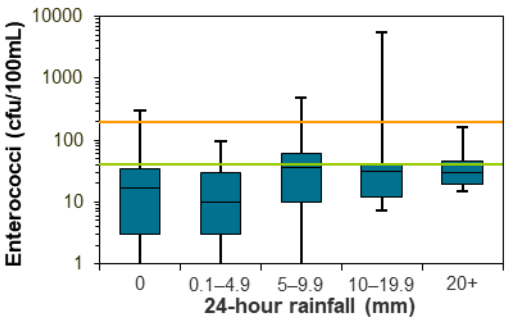
Microbial Assessment Category: C



Dry and wet weather water quality

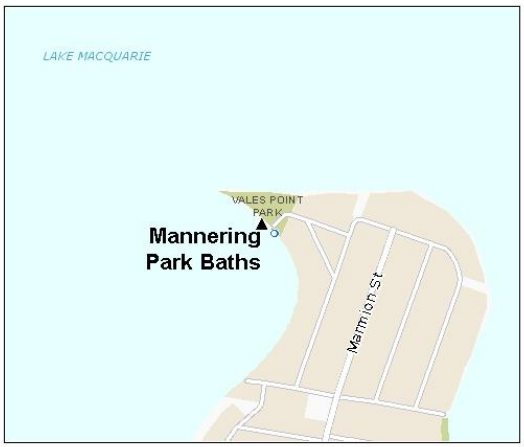


Water quality in response to rainfall



Mannering Park Baths

Beach grade: P^



See ‘How to read this report’ for key to map.

Mannering Park Baths is a netted swimming area located at Vales Point at the southern end of Lake Macquarie.

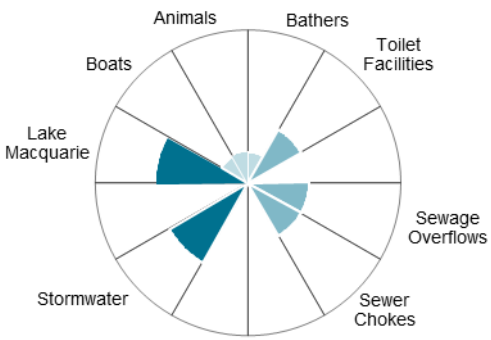
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including Lake Macquarie and stormwater.

Enterococci levels generally increased with increasing rainfall, often exceeding the safe swimming limit in response to little or no rain.

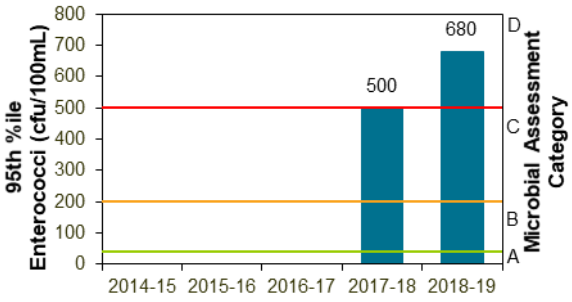
The site has been monitored since 2017.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Lake/Lagoon	Jun 2017 to Apr 2019	55%	34	Stable

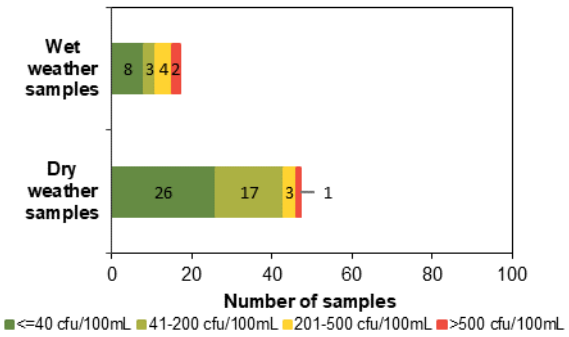
Sanitary inspection: Moderate



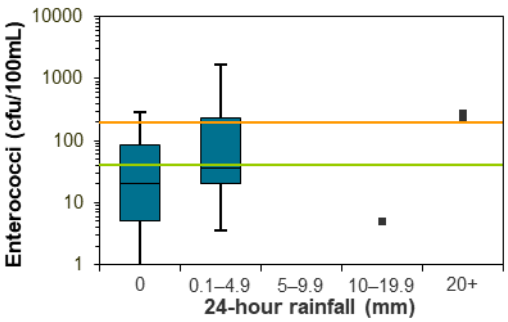
Microbial Assessment Category: D



Dry and wet weather water quality



Water quality in response to rainfall



Lake Munmorah Baths

Beach grade: P

See ‘How to read this report’ for key to map.

Lake Munmorah Baths is an enclosed swimming area in the north of Lake Munmorah.

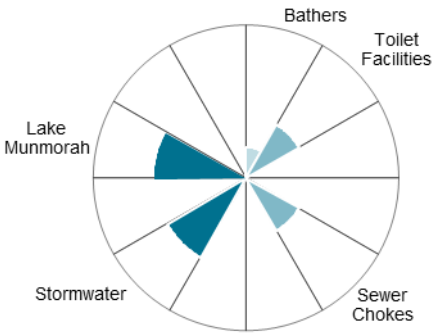
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including Lake Munmorah and stormwater.

Enterococci levels increased with increasing rainfall, occasionally exceeding the safe swimming limit after little or no rain and regularly after 5mm or more of rain.

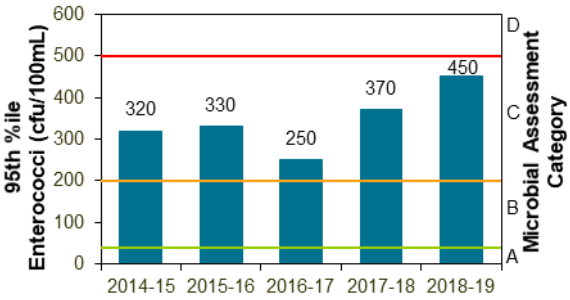
The site has been monitored since 2010.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Lake/Lagoon	Mar 2016 to Apr 2019	80%	100	Stable

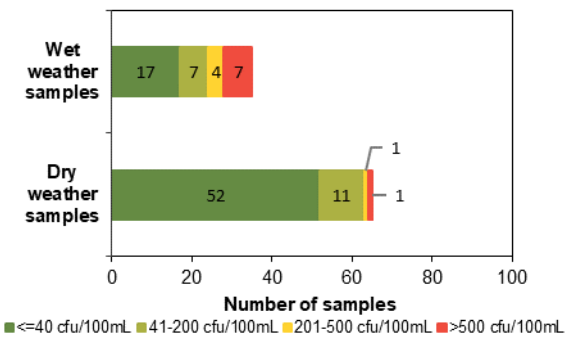
Sanitary inspection: Moderate



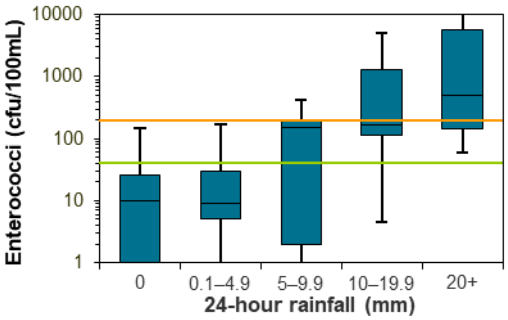
Microbial Assessment Category: C



Dry and wet weather water quality



Water quality in response to rainfall



Canton Beach

Beach grade: P

See 'How to read this report' for key to map.

Canton Beach is within Tuggerah Lake and is backed by a narrow reserve and picnic area.

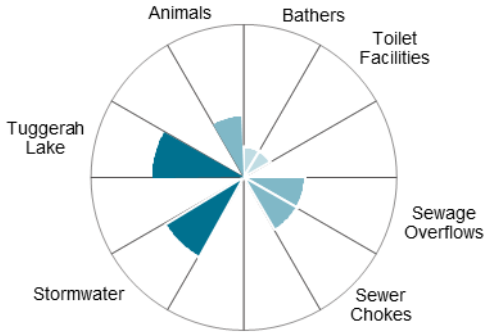
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including Tuggerah Lake and stormwater.

Enterococci levels increased with increasing rainfall, often exceeding the safe swimming limit after little or no rain, and frequently after 5mm or more of rain.

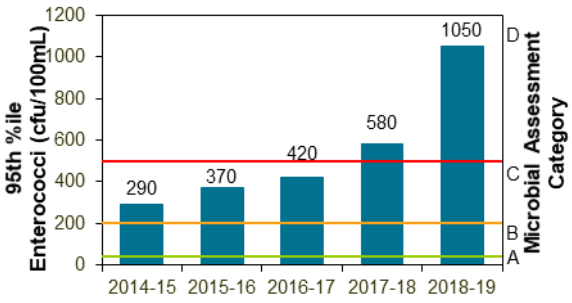
The site has been monitored since 2002.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Lake/Lagoon	Mar 2016 to Apr 2019	63%	100	Stable

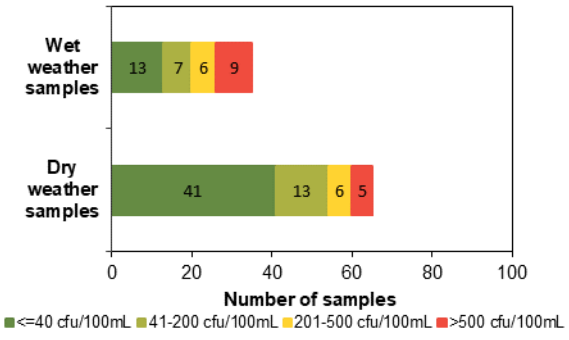
Sanitary inspection: Moderate



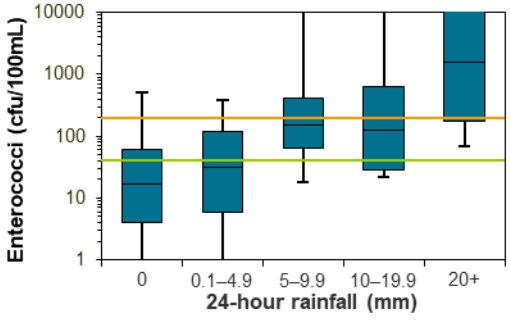
Microbial Assessment Category: D



Dry and wet weather water quality



Water quality in response to rainfall



Wamberal Beach

Beach grade: G

See 'How to read this report' for key to map.

Wamberal Beach is a long open beach backed by a lagoon and is patrolled over summer.

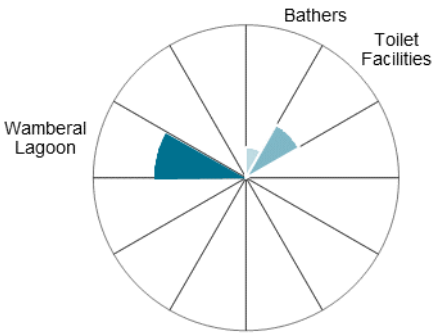
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with potential sources of faecal contamination including discharge from Wamberal Lagoon.

Enterococci levels increased slightly with increasing rainfall, occasionally exceeding the safe swimming after little or no rain.

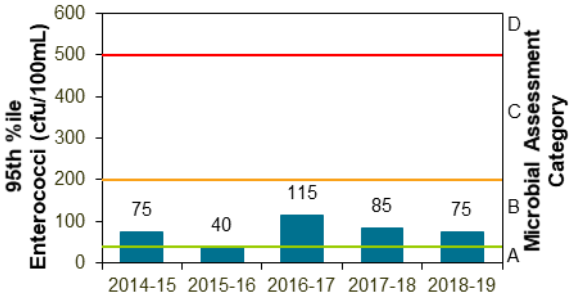
The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Apr 2016 to Apr 2019	93%	100	Stable

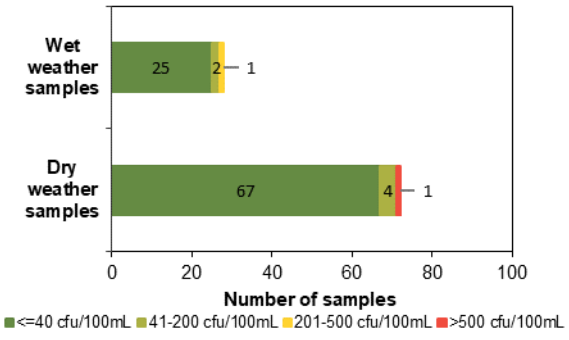
Sanitary inspection: Moderate



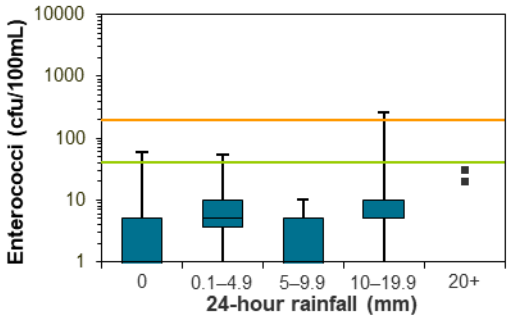
Microbial Assessment Category: B



Dry and wet weather water quality



Water quality in response to rainfall



Wamberal Lagoon

Beach grade: P

See 'How to read this report' for key to map.

Wamberal Lagoon is intermittently open to the ocean toward the southern end of Wamberal Beach.

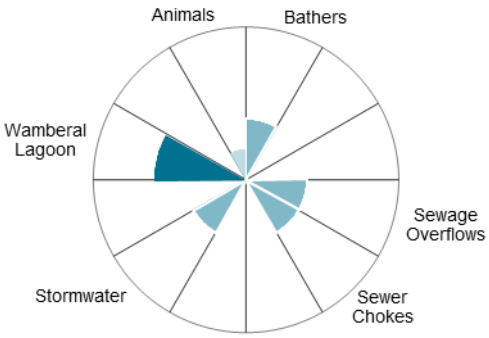
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including Wamberal Lagoon.

Enterococci levels increased with increasing rainfall, often exceeding the safe swimming limit after no rain and frequently after 5mm or more of rain.

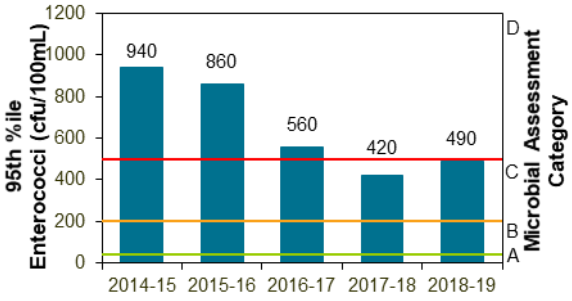
The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Lagoon	Mar 2016 to Apr 2019	74%	100	Stable

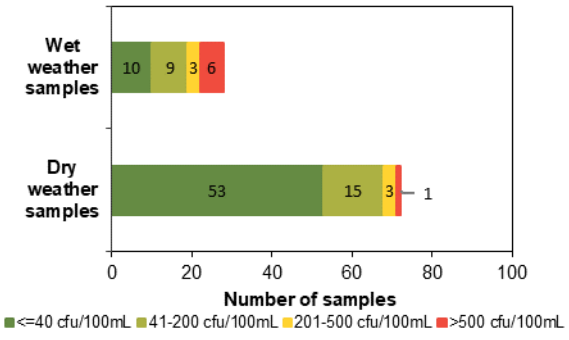
Sanitary inspection: Moderate



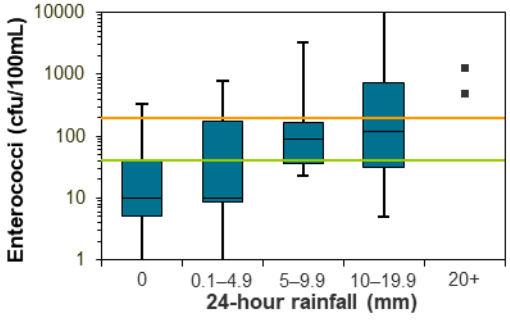
Microbial Assessment Category: C



Dry and wet weather water quality



Water quality in response to rainfall



Terrigal Beach

Beach grade: G

See ‘How to read this report’ for key to map.

Terrigal Beach is a very popular north-east facing beach and is patrolled during the warmer months.

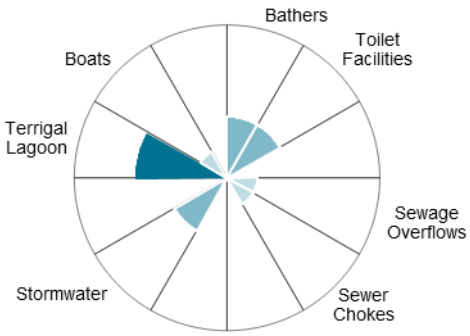
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with potential sources of faecal contamination including discharge from Terrigal Lagoon.

Enterococci levels increased with increasing rainfall, occasionally exceeding the safe swimming limit after little or no rain, and often after 5mm or more of rain.

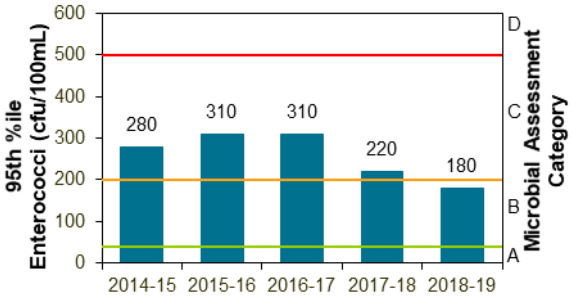
The site has been monitored since 2006.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Apr 2016 to Apr 2019	89%	100	Improved

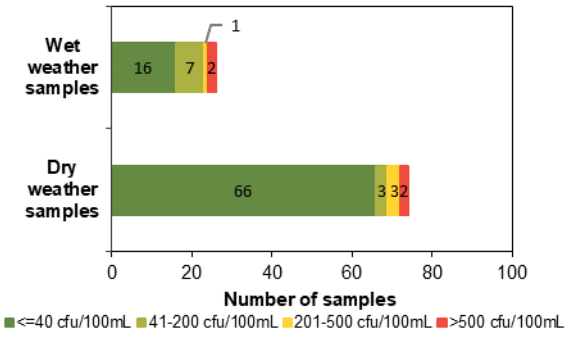
Sanitary inspection: Moderate



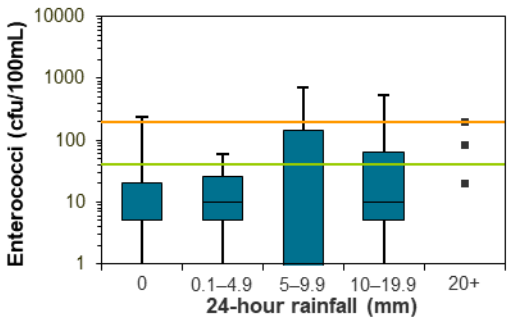
Microbial Assessment Category: B



Dry and wet weather water quality



Water quality in response to rainfall



Terrigal Lagoon

Beach grade: P

See ‘How to read this report’ for key to map.

Terrigal Lagoon is intermittently open to the ocean to the north of Terrigal Beach.

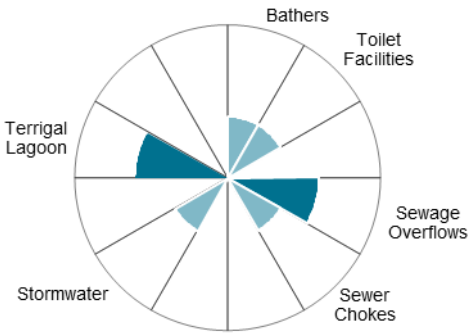
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including sewage overflows and from within Terrigal Lagoon.

Enterococci levels increased with increasing rainfall, often exceeding the safe swimming limit after little or no rain, and frequently after 5mm or more of rainfall.

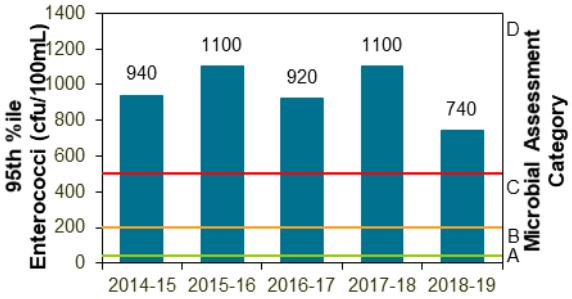
The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Lagoon	Mar 2016 to Apr 2019	68%	100	Stable

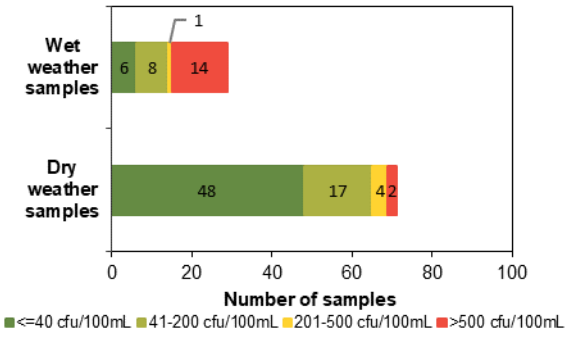
Sanitary inspection: Moderate



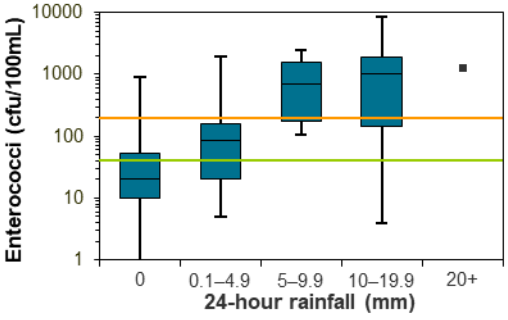
Microbial Assessment Category: D



Dry and wet weather water quality



Water quality in response to rainfall



North Avoca Beach

Beach grade: G

See ‘How to read this report’ for key to map.

North Avoca Beach is at the northern end of the beach and is patrolled during the summer swimming season.

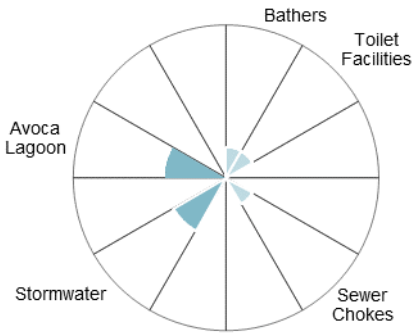
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of minor faecal contamination.

Enterococci levels generally increased with increasing rainfall, occasionally exceeding the safe swimming limit after little or no rain and often after 20mm or more of rain.

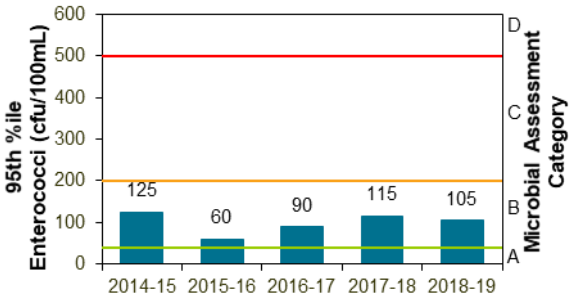
The site has been monitored since 2007.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Apr 2016 to Apr 2019	92%	100	Stable

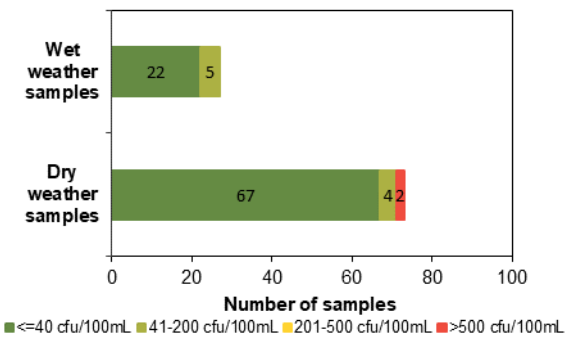
Sanitary inspection: Low



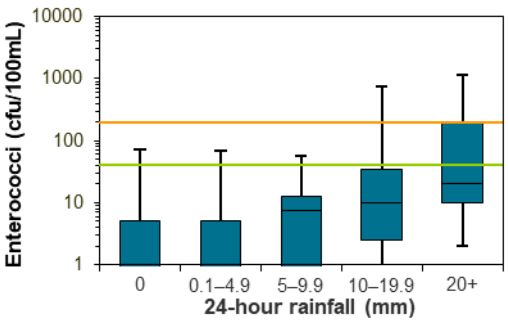
Microbial Assessment Category: B



Dry and wet weather water quality

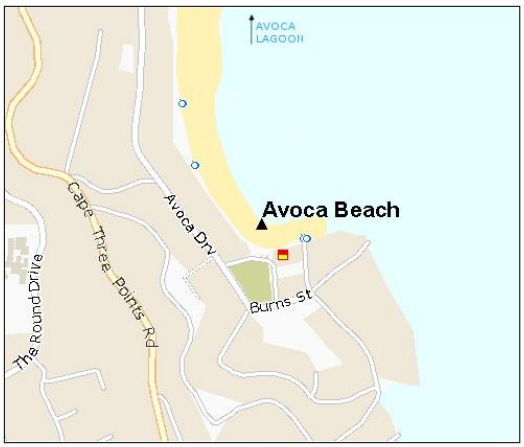


Water quality in response to rainfall



Avoca Beach

Beach grade: G



See ‘How to read this report’ for key to map.

Avoca Beach is in the southern corner of the beach and is patrolled during summer.

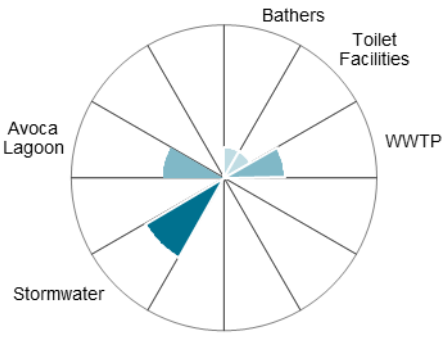
The Beach Suitability Grade of Good indicates microbial water quality is suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of faecal contamination including stormwater.

Enterococci levels increased with increasing rainfall, occasionally exceeding the safe swimming limit in response to little or no rain, and regularly after 10mm or more of rain.

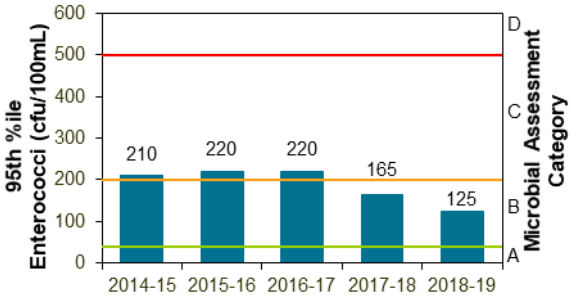
The site has been monitored since 2006.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Sep 2016 to Apr 2019	91%	100	Stable

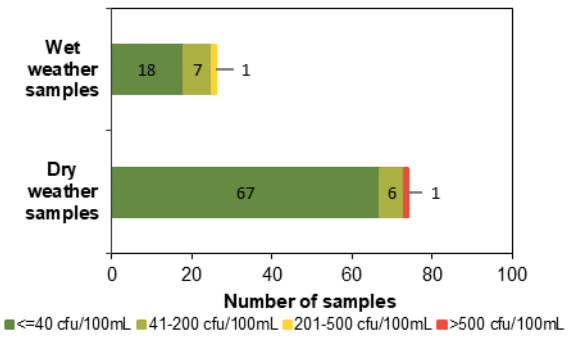
Sanitary inspection: Moderate



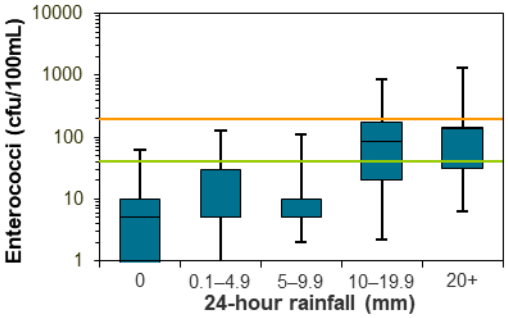
Microbial Assessment Category: B



Dry and wet weather water quality



Water quality in response to rainfall



Avoca Lagoon

Beach grade: P

See ‘How to read this report’ for key to map.

Avoca Lagoon is intermittently open to the ocean and located to the north of Avoca Beach.

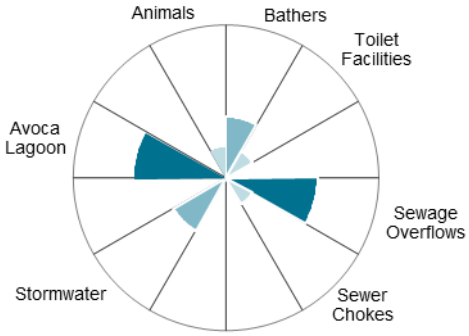
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and often during dry weather conditions, with several potential sources of faecal contamination including sewage overflows and from within Avoca Lagoon.

Enterococci levels increased with increasing rainfall, often exceeding the safe swimming limit after no rain, and regularly after rainfall.

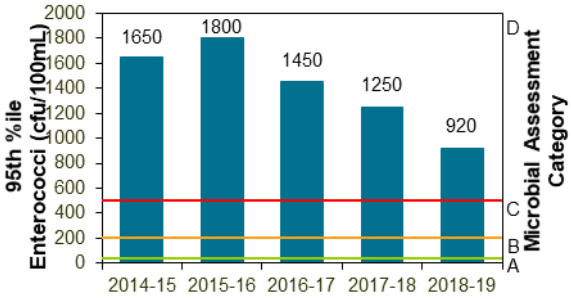
The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Lagoon	Mar 2016 to Apr 2019	67%	100	Stable

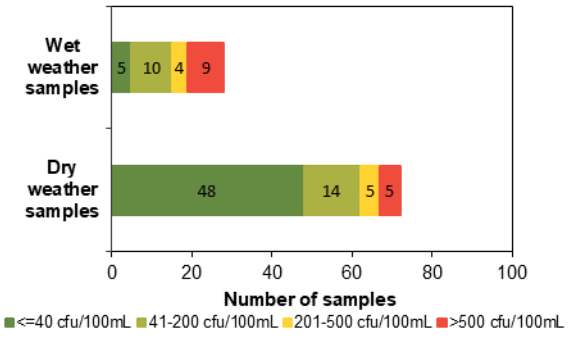
Sanitary inspection: Moderate



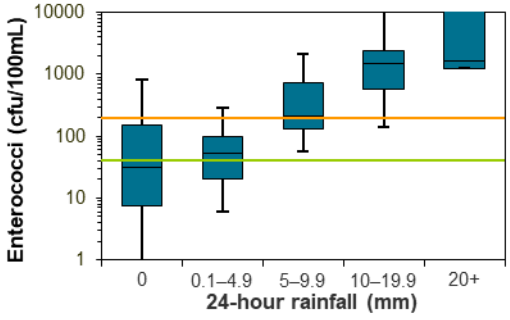
Microbial Assessment Category: D



Dry and wet weather water quality



Water quality in response to rainfall



Copacabana Beach

Beach grade: G

See ‘How to read this report’ for key to map.

Copacabana Beach is at the northern end of a one kilometre stretch of beach and is patrolled during the summer swimming season.

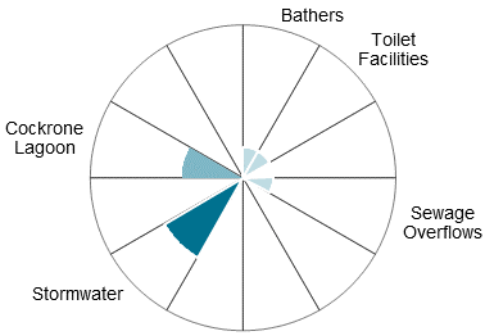
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of faecal contamination including stormwater.

Enterococci levels increased with increasing rainfall, occasionally exceeding the safe swimming limit after little or no rain, and regularly after 5mm or more of rain.

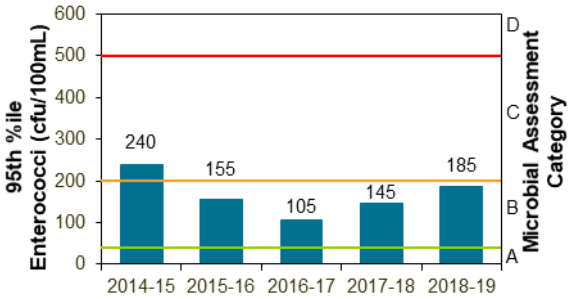
The site has been monitored since 2006.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Apr 2016 to Apr 2019	90%	100	Stable

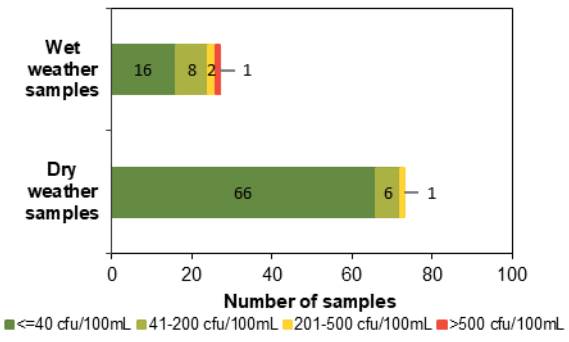
Sanitary inspection: Moderate



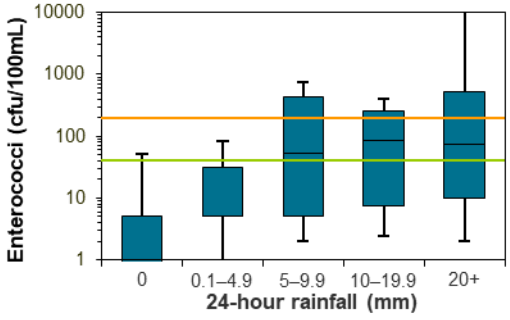
Microbial Assessment Category: B



Dry and wet weather water quality



Water quality in response to rainfall



Cockrone Lagoon

Beach grade: P

See ‘How to read this report’ for key to map.

Cockrone Lagoon is intermittently open to the ocean and is located between Copacabana and MacMasters beaches.

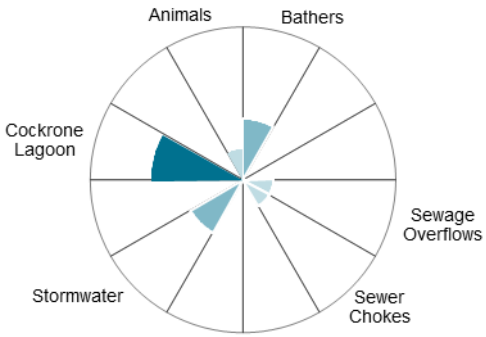
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including Cockrone Lagoon.

Enterococci levels increased with increasing rainfall, often exceeding the safe swimming limit after little or no rain and regularly after 5mm or more of rain.

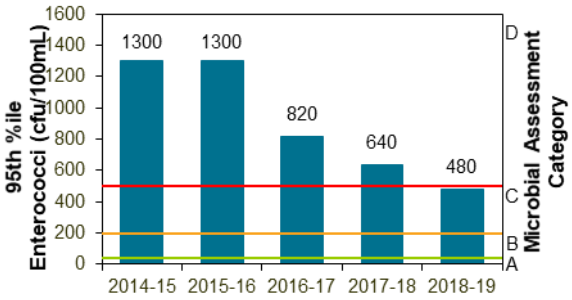
The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Lagoon	Mar 2016 to Apr 2019	82%	100	Stable

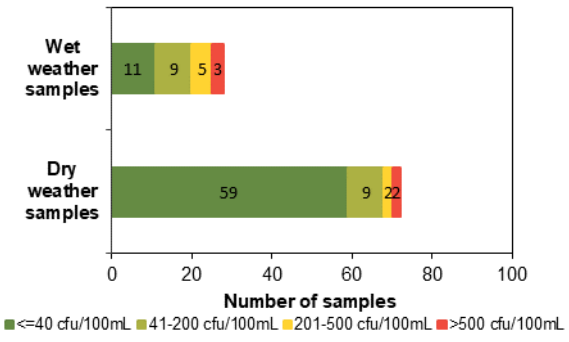
Sanitary inspection: Moderate



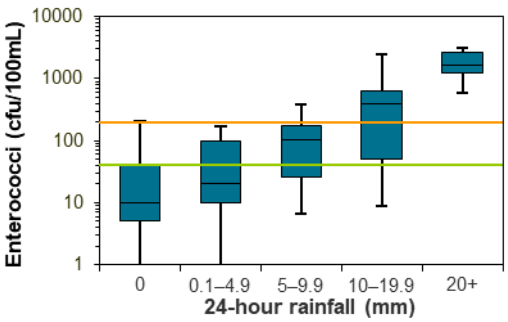
Microbial Assessment Category: C



Dry and wet weather water quality



Water quality in response to rainfall



MacMasters Beach

Beach grade: VG

See 'How to read this report' for key to map.

MacMasters Beach is at the southern end of a one kilometre stretch of beach and is patrolled during the warmer months.

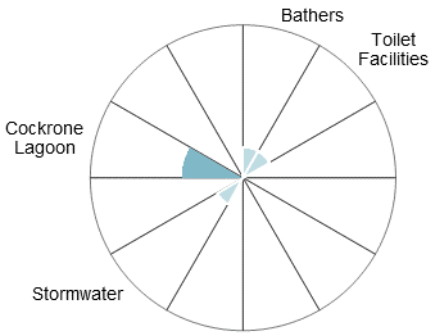
The Beach Suitability Grade of Very Good indicates microbial water quality is considered suitable for swimming almost all of the time, with few potential sources of minor faecal contamination.

Enterococci levels increased slightly with increasing rainfall, occasionally exceeding the safe swimming limit after 5mm or more of rainfall.

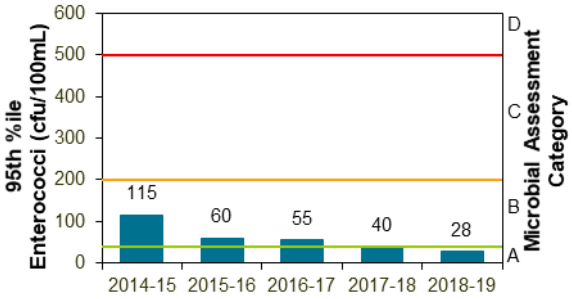
The site has been monitored since 2006.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Apr 2016 to Apr 2019	100%	100	Stable

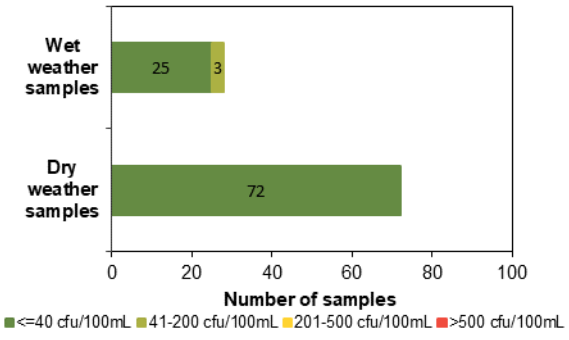
Sanitary inspection: Low



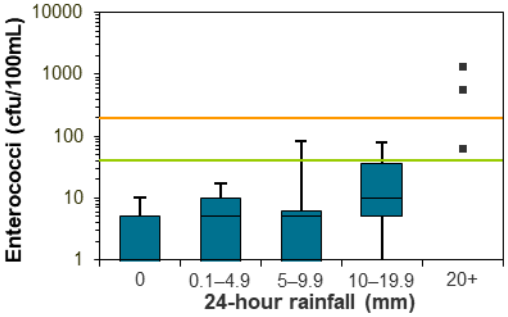
Microbial Assessment Category: A



Dry and wet weather water quality



Water quality in response to rainfall



Killcare Beach

Beach grade: VG

See 'How to read this report' for key to map.

Killcare Beach is a south facing beach backed by vegetated dunes. It is patrolled over the summer swimming season.

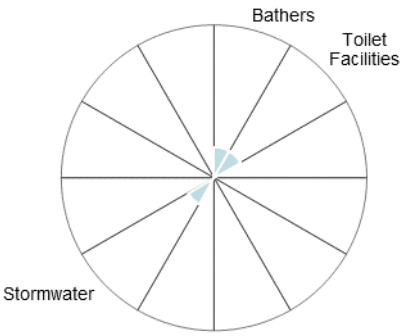
The Beach Suitability Grade of Very Good indicates microbial water quality is considered suitable for swimming almost all of the time, with few potential sources of minor faecal contamination.

Enterococci levels increased slightly with increasing rainfall, occasionally exceeding the safe swimming limit in response to 5mm or more of rain.

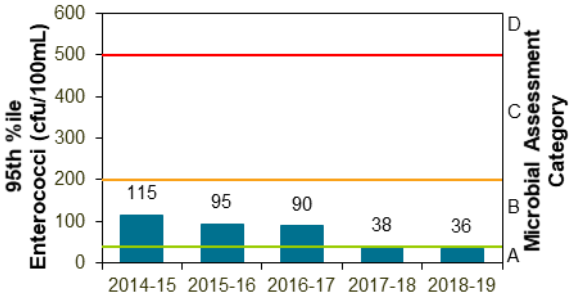
The site has been monitored since 2006.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Apr 2016 to Apr 2019	96%	100	Stable

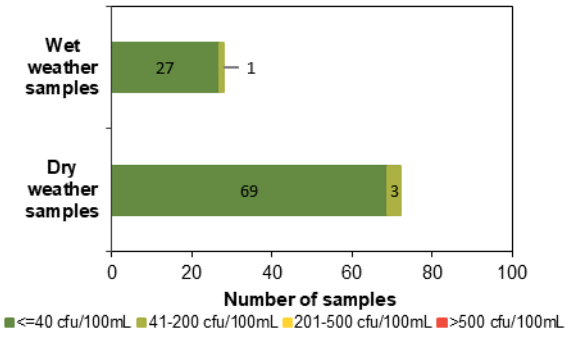
Sanitary inspection: Low



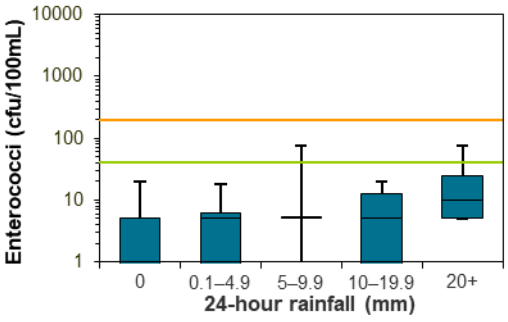
Microbial Assessment Category: A



Dry and wet weather water quality



Water quality in response to rainfall



Ocean Beach

Beach grade: G

See ‘How to read this report’ for key to map.

Ocean Beach is in Broken Bay near the entrance to Brisbane Water. The beach is patrolled during the summer swimming season.

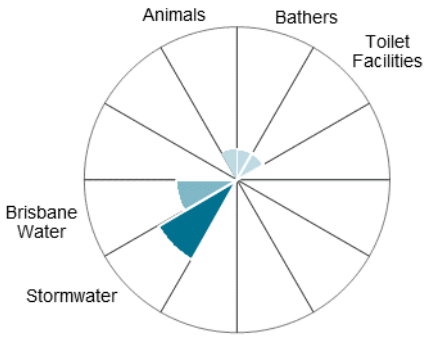
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of faecal contamination including stormwater.

Enterococci levels generally increased with increasing rainfall, occasionally exceeding the safe swimming limit after light rain, and regularly after 20mm or more of rainfall.

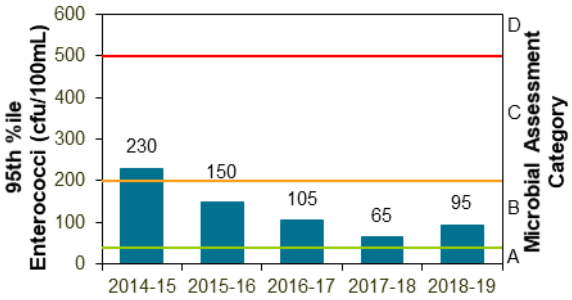
The site has been monitored since 2011.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Apr 2016 to Apr 2019	100%	100	Stable

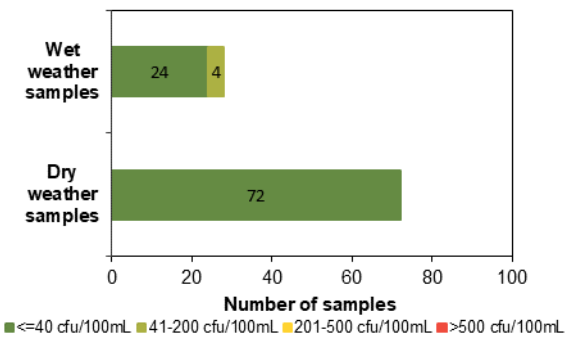
Sanitary inspection: Moderate



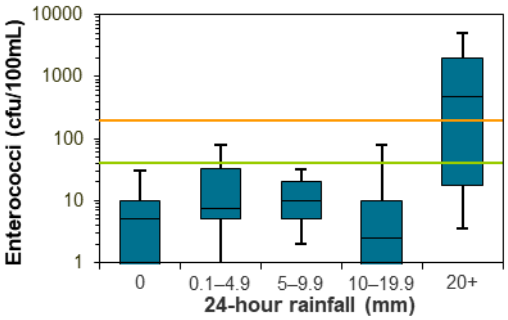
Microbial Assessment Category: B



Dry and wet weather water quality



Water quality in response to rainfall



Umina Beach

Beach grade: G

See ‘How to read this report’ for key to map.

Umina Beach is in Broken Bay near the entrance to Brisbane Water. The beach is patrolled during the summer swimming season.

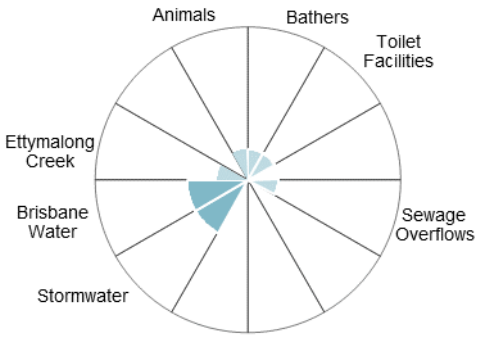
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of faecal contamination.

Enterococci levels generally increased with increasing rainfall, occasionally exceeding the safe swimming limit after 5mm or more of rain, and regularly after 20mm or more of rain.

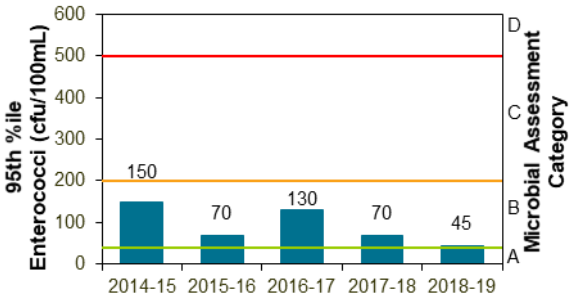
The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Apr 2016 to Apr 2019	97%	100	Stable

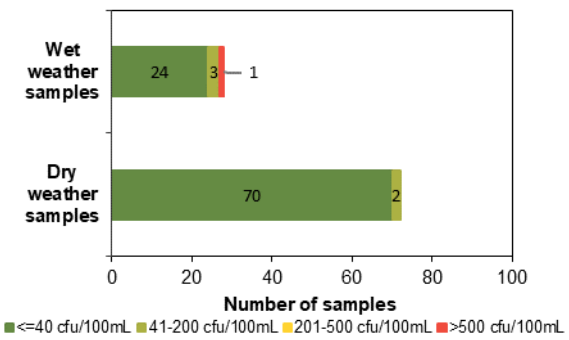
Sanitary inspection: Low



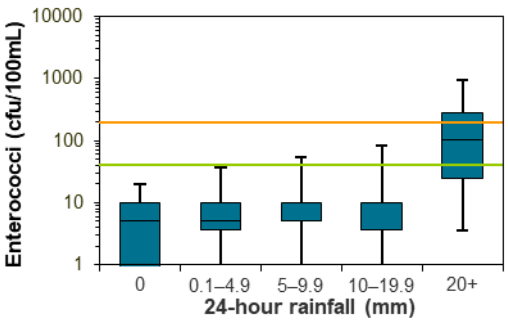
Microbial Assessment Category: B



Dry and wet weather water quality

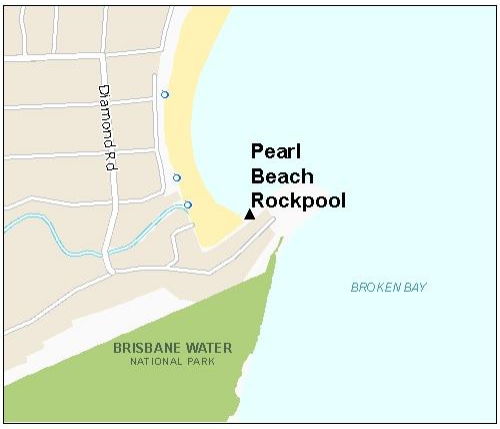


Water quality in response to rainfall



Pearl Beach Rockpool

Beach grade: G



See ‘How to read this report’ for key to map.

Pearl Beach Rockpool is a constructed ocean pool at the southern end of Pearl Beach.

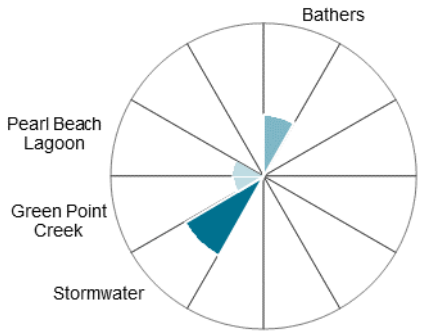
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of faecal contamination including stormwater.

Enterococci levels increased with increasing rainfall, occasionally exceeding the safe swimming limit in response to little rain, and usually after 20mm or more of rainfall.

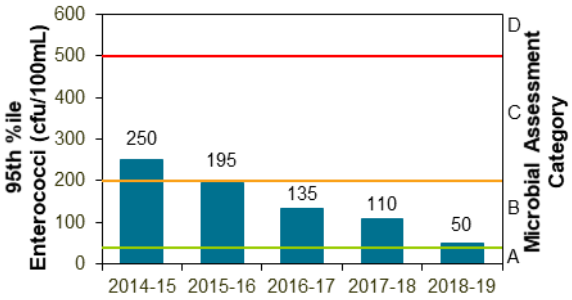
The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean baths	Mar 2016 to Apr 2019	97%	100	Stable

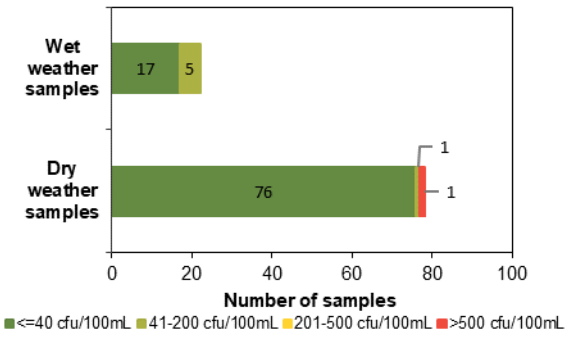
Sanitary inspection: Moderate



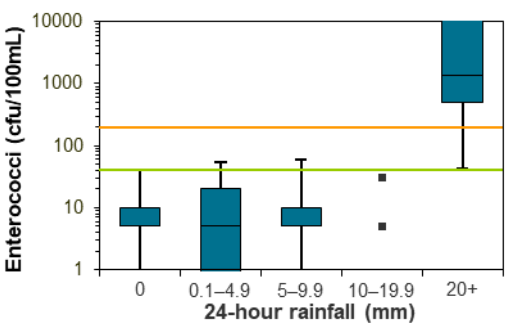
Microbial Assessment Category: B



Dry and wet weather water quality

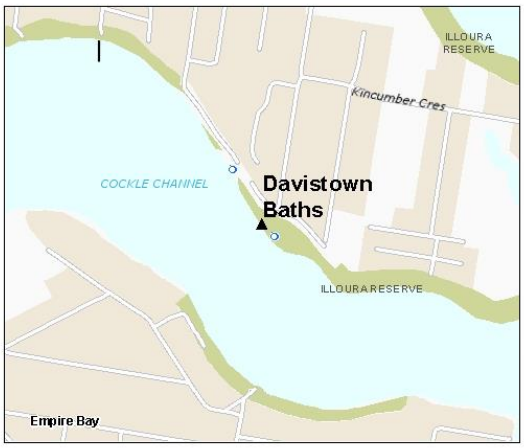


Water quality in response to rainfall



Davistown Baths

Beach grade: P



See 'How to read this report' for key to map.

The Davistown Baths are a netted swimming enclosure in the channel between Brisbane Water and the Kincumber Broadwater.

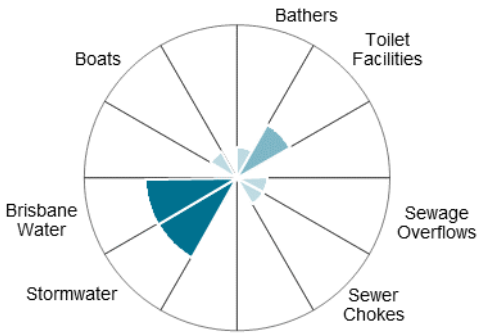
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including Brisbane Water and stormwater.

Enterococci levels increased with increasing rainfall, often exceeding the safe swimming limit after little or no rain, and regularly after 5mm or more of rainfall.

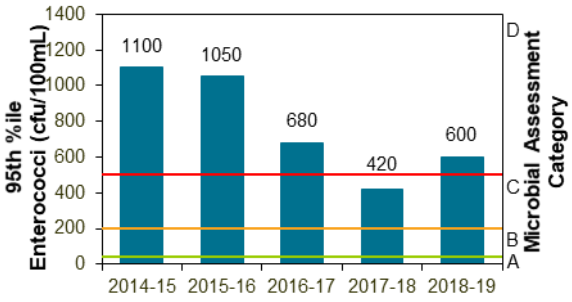
The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Estuarine	Mar 2016 to Apr 2019	72%	100	Stable

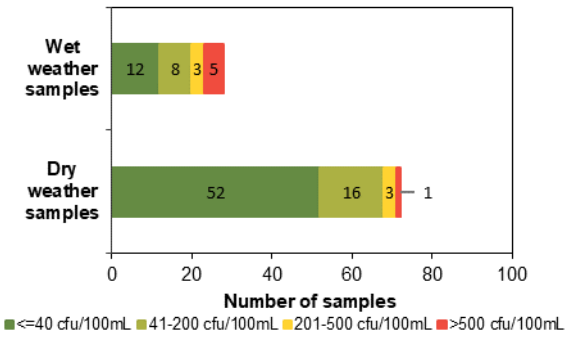
Sanitary inspection: Moderate



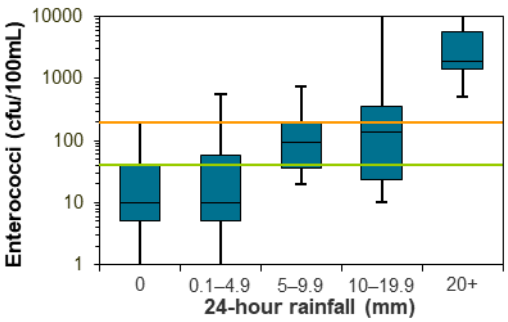
Microbial Assessment Category: D



Dry and wet weather water quality

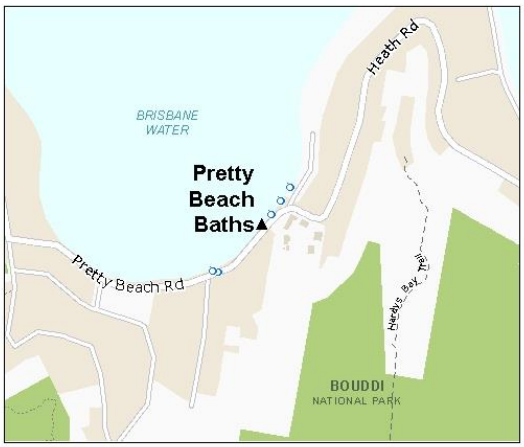


Water quality in response to rainfall



Pretty Beach Baths

Beach grade: P



See 'How to read this report' for key to map.

Pretty Beach Baths is a netted swimming enclosure in Brisbane Water near the entrance to Broken Bay.

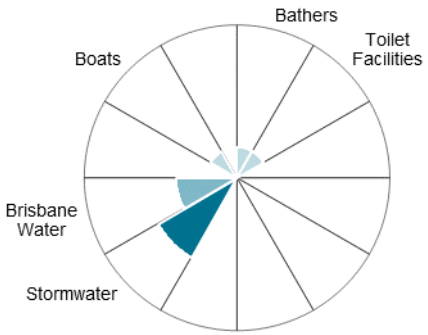
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including stormwater.

Enterococci levels increased with increasing rainfall, occasionally exceeding the safe swimming limit in response to little or no rain, and frequently after 10mm or more of rainfall.

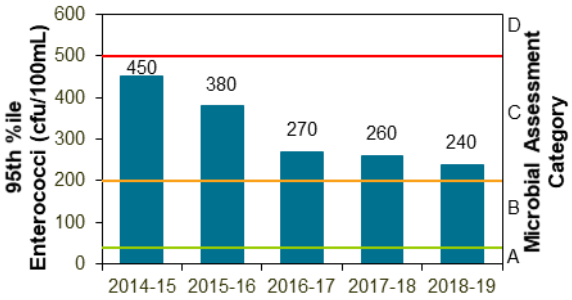
The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Estuarine	Feb 2016 to Apr 2019	77%	100	Stable

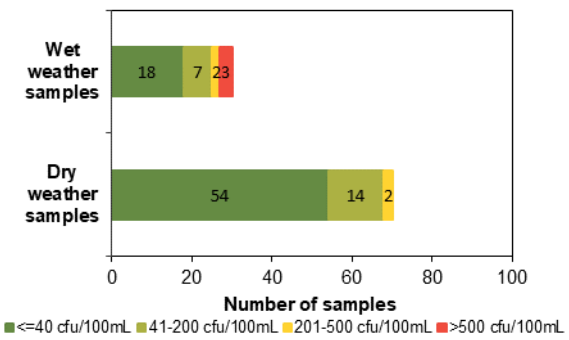
Sanitary inspection: Moderate



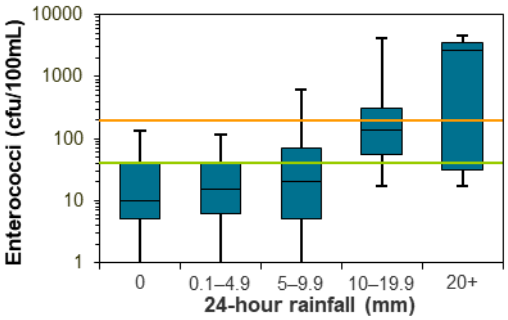
Microbial Assessment Category: C



Dry and wet weather water quality

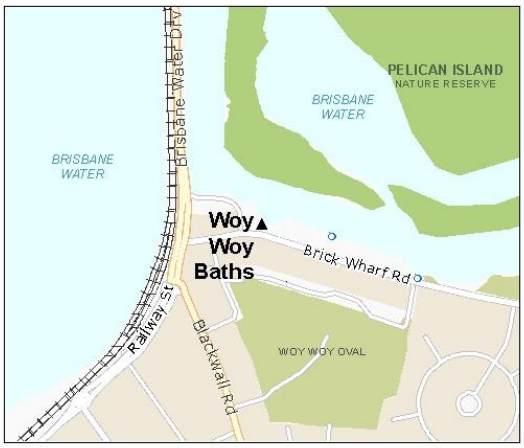


Water quality in response to rainfall



Woy Woy Baths

Beach grade: P



See 'How to read this report' for key to map.

Woy Woy Baths is a netted swimming area located in Woy Woy channel in Brisbane Water.

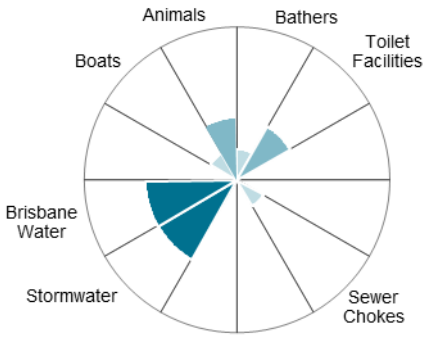
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including Brisbane Water and stormwater.

Enterococci levels increased with increasing rainfall, often exceeding the safe swimming limit after little or no rain, and usually after 20mm or more of rainfall.

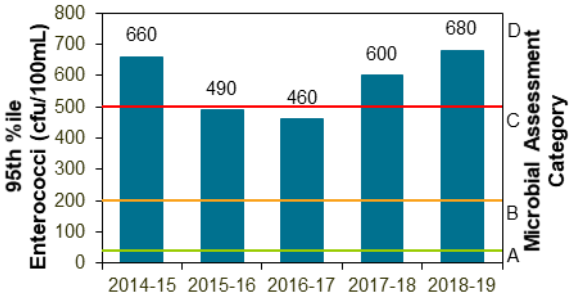
The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Estuarine	Mar 2016 to Apr 2019	55%	100	Stable

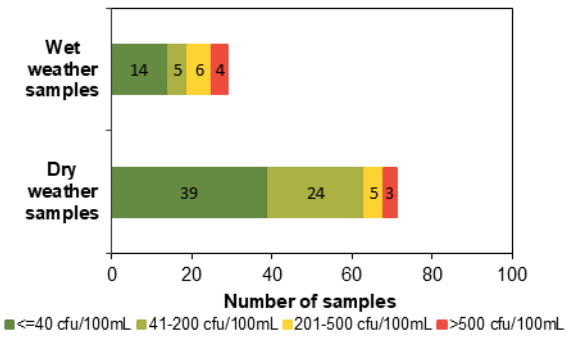
Sanitary inspection: Moderate



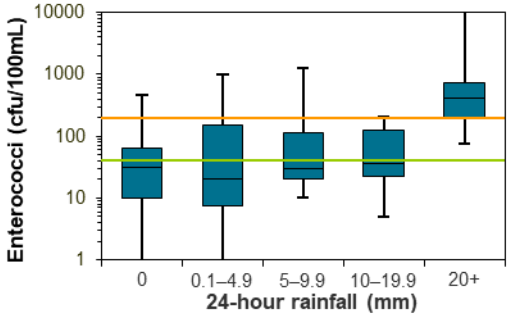
Microbial Assessment Category: D



Dry and wet weather water quality

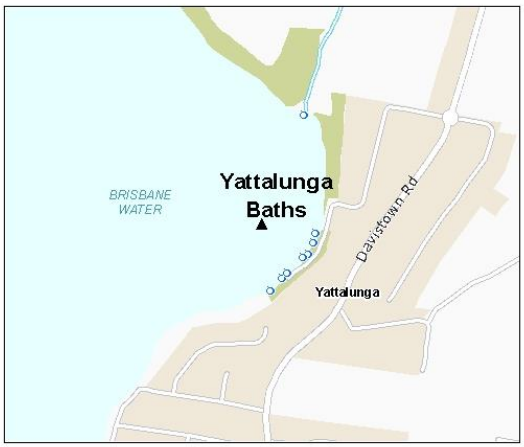


Water quality in response to rainfall



Yattalunga Baths

Beach grade: P



See 'How to read this report' for key to map.

Yattalunga Baths is a netted swimming enclosure located in the upper reaches of Brisbane Water.

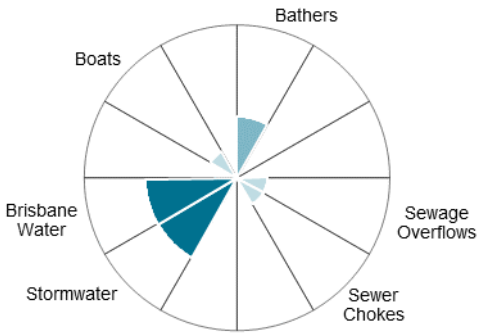
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including Brisbane Water and stormwater.

Enterococci levels increased with increasing rainfall, occasionally exceeding the safe swimming limit after little or no rain, and often after 5mm or more of rain.

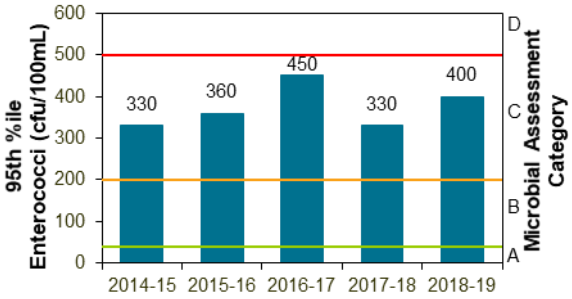
The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Estuarine	Jan 2016 to Apr 2019	82%	100	Stable

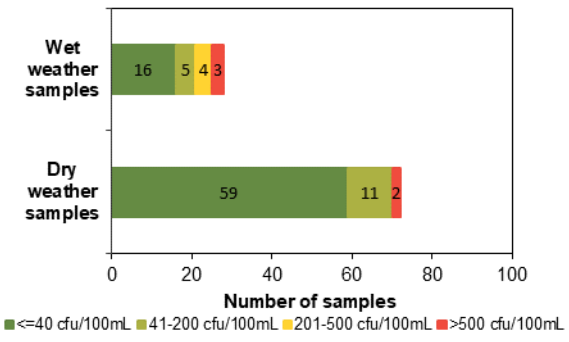
Sanitary inspection: Moderate



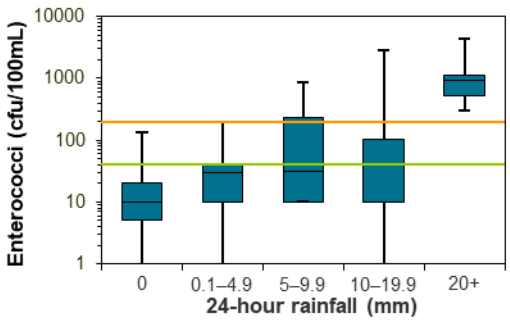
Microbial Assessment Category: C



Dry and wet weather water quality



Water quality in response to rainfall



How to read this report

Beach Suitability Grades

Beach Suitability Grades provide an assessment of the suitability of a swimming location for recreation over time and are based on a combination of sanitary inspection (identification and rating of potential pollution sources at a beach) and microbial assessment (water quality measurements gathered over previous years). There are five grades ranging from Very Good to Very Poor:

VG **Very Good**

Location has generally excellent microbial water quality and very few potential sources of faecal pollution. Water is considered suitable for swimming almost all of the time

G **Good**

Location has generally good microbial water quality and water is considered suitable for swimming most of the time. Swimming should be avoided during and for up to one day following heavy rain at ocean beaches and up to three days at estuarine sites

F **Fair**

Microbial water quality is generally suitable for swimming, but because of the presence of significant sources of faecal contamination, extra care should be taken to avoid swimming during and for up to three days following rainfall or if there are signs of pollution such as discoloured water or odour or debris in the water

P **Poor**

Location is susceptible to faecal pollution and microbial water quality is not always suitable for swimming. During dry weather conditions, ensure that the swimming location is free of signs of pollution, such as discoloured water, odour or debris in the water, and avoid swimming at all times during and for up to three days following rainfall

VP **Very Poor**

Location is very susceptible to faecal pollution and microbial water quality may often be unsuitable for swimming. It is generally recommended to avoid swimming at these sites almost all of the time

Some of the Beach Suitability Grades in this report are **provisional**, as the information required for the analysis is incomplete due to limited bacterial data or limited information on potential pollution sources in a beach catchment.

The guidelines

The National Health and Medical Research Council's *Guidelines for managing risks in recreational water*[1] were adopted for use in New South Wales in May 2009. These guidelines have been adopted in all Australian states and territories and are supported by guidance notes developed by the Department of Health Western Australia[2].

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[1]NHMRC 2008, *Guidelines for managing risks in recreational water*, National Health and Medical Research Council, Australian Government Publishing Service, Canberra, ACT.

[2]Department of Health, Western Australia 2007, *Microbial quality of recreational water guidance notes in support of chapter 5 of the National Health and Medical Research Council guidelines for managing risks in recreational water, 2006*, Department of Health, Western Australia and The University of Western Australia, October 2007, available at ww2.health.wa.gov.au/Articles/A_E/Environmental-waters-publications, accessed on 17/06/19.

Enterococci

The national guidelines advocate the use of enterococci as the single preferred faecal indicator in marine waters.

These bacteria are excreted in faeces and are rarely present in unpolluted waters. Enterococci have shown a clear dose–response relationship to disease outcomes in marine waters in the northern hemisphere. In accordance with the guidelines, Beachwatch tests for enterococci only. The enterococci density in water samples is analysed in the laboratory using method AS/NZS 4276.9:2007.

AS/NZS 4276.9:2007, *Water microbiology Method 9: Enterococci – Membrane filtration method (ISO 7899-2:2000, MOD)*, Standards Australia International Ltd, Sydney and Standards New Zealand, Wellington.

Enterococci are measured in colony forming units per 100mL of sample (cfu/100mL).

Beach Suitability Grades are determined by using the following matrix:

		Microbial Assessment Category			
		A	**B**	**C**	**D**
Sanitary Inspection Category	Very Low	Very Good	Very Good	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	Fair	Poor	Very Poor

Using the Beach Suitability Grade classification matrix, sites assigned a moderate Sanitary Inspection Category can only be rated as Good or Poor with no option of Fair grades. This can create the impression of a large change in water quality when in fact there need only be a slight increase in bacterial counts to push it over the threshold, with no significant increase in the risk to public health.

Microbial Assessment Category (MAC)

There are four Microbial Assessment Categories (A to D) and these are determined from the 95th percentile of an enterococci dataset of at least 100 data points. Each MAC is associated with a risk of illness determined from epidemiological studies. The risks of illness shown below are not those associated with a single data point but are the overall risk of illness associated with an enterococci dataset with that 95th percentile[1].

Risk of illness associated with Microbial Assessment Categories

Category	Enterococci (cfu/100mL)	Illness risk*
A	≤40	GI illness risk: <1% AFR illness risk: <0.3%
B	41–200	GI illness risk: 1–5% AFR illness risk: 0.3–1.9%
C	201–500	GI illness risk: >5–10% AFR illness risk: >1.9–3.9%
D	>500	GI illness risk: >10% AFR illness risk: >3.9%

* GI = gastrointestinal illness; AFR = acute fever and rash

Calculating the MAC

The 95th percentile is a useful statistic for summarising the distribution of enterococci data at a site. It embodies elements of both the location of the distribution (how high/low the enterococci counts are) and the scale of the distribution (how variable the enterococci counts are).

The 95th percentile values for each of the four Microbial Assessment Categories were determined by the World Health Organization using enterococci data collected from swimming locations across Europe. These values will represent different probabilities of illness if the distribution of enterococci data from swimming locations in New South Wales differs from the European distribution.

[1] Wyer MD, Kay D, Fleisher JM, Salmon RL, Jones F, Godfree AF, Jackson G and Rogers A 1999, An experimental health related classification for marine waters, *Water Research* 33(3), pp.715–722.

In recognition of this issue, Dr Richard Lugg (Department of Health, Western Australia) has developed a Microsoft® Excel tool for calculating a modified 95th percentile that takes into account the distribution of data. This tool has been used to calculate the 95th percentile values presented in this report and has been adopted for use by other state governments in Australia.

The tool can be downloaded from: http://ww2.health.wa.gov.au/Articles/A_E/Environmental-waters-publications under *Forms and templates* [accessed 17/06/19].

Sanitary Inspection Category (SIC)

More information about the **sanitary inspection** process is available at:

www.environment.nsw.gov.au/topics/water/beaches/reporting-beach-water-quality/guidelines/sanitary-inspection.

The aim of a sanitary inspection is to identify all sources of faecal contamination that could affect a swimming location and assess the risk to public health posed by these sources. It is an assessment of the likelihood of bacterial contamination from identified pollution sources and should, to some degree, correlate with the bacterial water quality results obtained from sampling.

The main sources of faecal contamination considered in the sanitary inspection are: bathers, toilet facilities, wastewater treatment plants (WWTPs), sewage overflows, sewer chokes, onsite systems, wastewater re-use, stormwater, river discharge, lagoons, boats and animals.

Rivers, lakes and estuaries themselves can be potential sources of faecal contamination to sites located in these waterbodies, with contaminated water from upstream or surrounding areas impacting water quality at the swimming location. This source is captured in river discharge or lagoon category and shown as the waterbody in the sanitary inspection charts.

Through the sanitary inspection process, beaches are categorised to reflect the overall likelihood of faecal contamination. There are five categories: Very Low, Low, Moderate, High and Very High.

Stormwater at Coogee Beach
Photo: Beachwatch/EES, DPIE

Stormwater in urban areas often contains sewage from leakages, overflows or sewer chokes when the sewerage system fails.

Sewage overflows can occur in wet weather when the network has exceeded capacity due to rainwater entering the system. The mix of sewage and rainwater discharges from designated overflow points and drains to waterways, usually via the stormwater system. Overflows from the sewerage system can also occur in dry weather due to mechanical failure or power outage.

Sewer chokes occur due to blockages in the pipes usually due to tree roots, oil, grease or debris. This causes sewage to back up and escape via sewer inspection points, designed overflow structures or cracks in the pipes, then drain to waterways, usually via the stormwater system.

Where there is a known history or evidence of sewage overflows or sewer chokes in the catchment they are identified as sources of potential faecal contamination, particularly if they are located close to the swimming location. In these instances, the risk posed by stormwater is adjusted accordingly to ensure the overall risk to public health is not overestimated.

Explanation of tables

Each region contains tables listing all monitored swimming sites including site type, beach grade and change in grade from the previous year.

The following symbols are used to show the change in beach grade from the previous year:

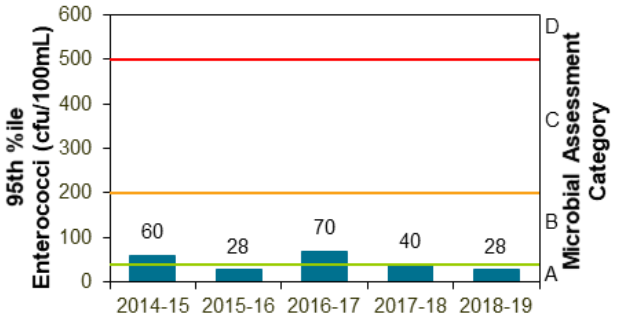
- Stable
- Improved
- Declined

A provisional grade indicates the assessment is based on limited data collected during the assessment period and should not be compared to the beach grade from the previous year.

Explanation of graphs, charts, and information bars on beach pages

Microbial Assessment Category (MAC) chart

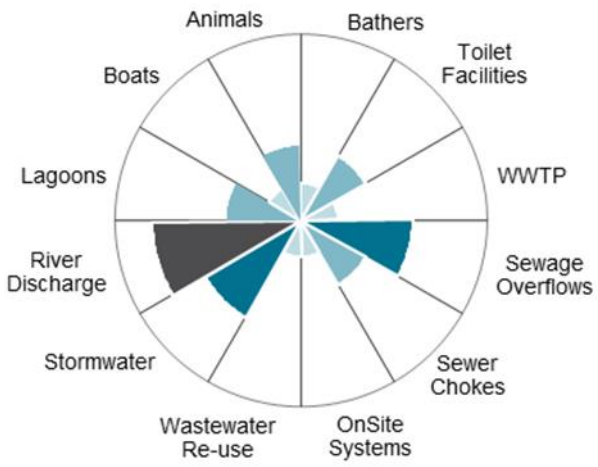
On each beach page, the MACs for the last five years are displayed on a simple bar chart. The MAC for the current year is based on enterococci data collected during the assessment period. The bars are labelled with the 95th percentile value for each year and the thresholds dividing the A, B, C and D categories are marked in green, amber and red for reference.



Sanitary Inspection Category (SIC) chart

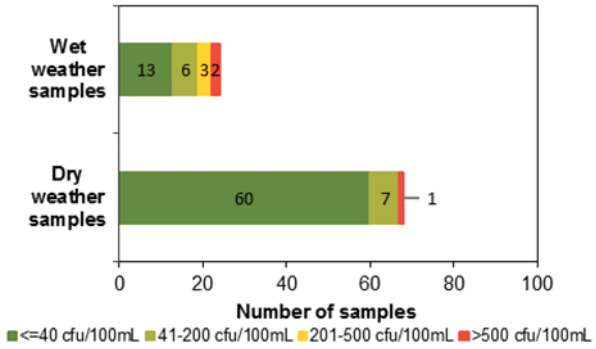
The results of the sanitary inspection for each swimming location are presented in a radar pie chart. The chart shows the likelihood that each identified pollution source will contribute to faecal contamination at a swimming site, as indicated by the size and colour of the segment, ranging from very low (lightest colour) to very high (darkest colour) as shown below. The sum of these contributions is the overall likelihood, or Sanitary Inspection Category.

Very Low	Low	Moderate	High	Very High



Wet and dry weather water quality chart

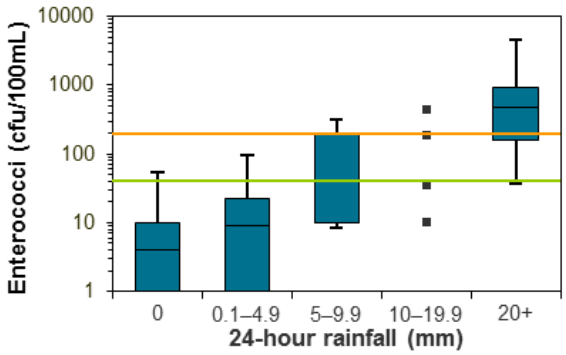
Enterococci levels in wet and dry weather conditions are presented for each swimming location as a bar graph. All data collected during the assessment period is included in the analysis. Dry weather is defined as no rainfall recorded in the previous 24 hours. Each bar is colour coded to show the number of enterococci results up to 40cfu/100mL, between 41 and 200cfu/100mL, between 201 and 500cfu/100mL and greater than 500cfu/100mL. These categories reflect the Microbial Assessment Category thresholds and are coloured on the graph as dark green, light green, amber and red respectively.



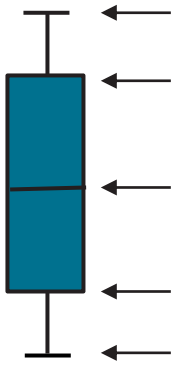
It is expected that swimming sites with lower levels of flushing show some elevated bacterial results in dry weather samples (no rainfall in the previous 24 hours) due to the longer time needed to recover from a rainfall event. At some estuarine and lake/lagoon swimming locations the impacts of stormwater pollution on beach water quality may be detected up to three days after rainfall.

Water quality in response to rainfall

Trends in enterococci levels in response to rainfall are shown using a box plot. For reference, enterococci levels of 40cfu/100mL and 200cfu/100mL are indicated with a green and orange line, respectively. The 40cfu/100mL level is referred to as the ‘safe swimming limit’. The enterococci data were obtained from the last five years of monitoring. Rainfall data were obtained from rain gauges situated close to the sample site and are 24-hour totals to 9am on the day of sampling. If there are fewer than five enterococci data points in a rainfall category, individual data points are presented instead of a box plot. At sites where many results are below the detection limit (1cfu/100mL), only the upper portion of the box plots will be visible.



Each part of the box plot represents a significant percentile value of the sample population:



95% of the samples lie below the top whisker

75% of the samples lie below the top of the box

half the samples are on each side of the middle line of the box (median or 50%ile)

25% of the samples lie below the bottom of the box

5% of the samples lie below the bottom whisker.

Information bars

Information bars on each beach page provide a summary of details about the swimming site.

The **assessment period** shows the timeframe in which the water samples were collected. The NHMRC guidelines state beach grades should be determined from the most recent 100 water quality results collected within a five-year period. The assessment period varies between sites depending on sampling frequency.

Dry weather samples suitable for swimming (**dry weather swimmability**) shows the percentage of water samples with enterococci levels below 40cfu/100mL. Dry weather is defined as no rainfall in the previous 24 hours. Swimming sites with lower levels of flushing often have a lower percentage of dry weather samples within the safe swimming limit due to the impacts of rainfall detected up to three days after the event.

Explanation of maps

A map of individual swimming locations is presented on each beach page. The scale of the maps is 1:10,000. Each map shows the location of the sampling site, land use and features such as surf lifesaving clubs. Potential pollution sources such as stormwater drains, sewage pumping stations, wastewater treatment plants, lagoons, rivers and creeks, are shown where accurate data is held.