OFFICE OF ENVIRONMENT & HERITAGE

State of the beaches
2017-2018
Central Coast region

Beachwatch

Contents

Central Coast region summary 2017–2018 1
  Beach monitoring in NSW 1
  Rainfall impacts 1

Central Coast Council 5
  Overall results 5
  Management 9
  Lakes Beach 14
  Cabbage Tree Bay Rockpool 15
  Soldiers Beach 16
  North Entrance Beach 17
  The Entrance Beach 18
  The Entrance Ocean Baths 19
  Toowoon Bay 20
  Shelly Beach 21
  Gwandalan 22
  Summerland Point Baths 23
  Chain Valley Bay 24
  Manner ing Park Baths 25
  Lake Munmorah Baths 26
  Canton Beach 27
  Wamberal Beach 28
  Wamberal Lagoon 29
  Terrigal Beach 30
  Terrigal Lagoon 31
  North Avoca Beach 32
  Avoca Beach 33
  Avoca Lagoon 34
  Copacabana Beach 35
  Cockrone Lagoon 36
  MacMasters Beach 37
  Killcare Beach 38
  Ocean Beach 39
  Umina Beach 40
Pearl Beach Rockpool 41
Davistown Baths 42
Pretty Beach Baths 43
Woy Woy Baths 44
Yattalunga Baths 45

How to read this report 46
Beach Suitability Grades 46
Explanation of tables 51
Explanation of graphs, charts, and information bars on beach pages 52

References 55
Recreational water quality has been monitored in the Central Coast region since 2002 by Central Coast Council under the Office of Environment and Heritage’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 2017–2018, 53% 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 decline in overall performance from the previous year, it largely reflects recent changes in the monitoring program to include only patrolled beaches and designated swimming sites, rather than a decline in water quality. Central Coast Council has a large proportion of lake/lagoon and estuarine swimming locations in its program which have been most susceptible to impacts from wet weather conditions.
Central Coast region summary
2017–2018

Beach monitoring in NSW

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.

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 that the information collected and reported by Beachwatch and its partners is accurate and reliable.

Rainfall impacts

Rainfall is the major driver of pollution to recreational waters, generating stormwater runoff and triggering 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 2017–2018 are based on water quality data collected over the last two to four years. Rainfall over this period has been diverse, beginning in 2014 with a very wet year for the coast, followed by mostly variable rainfall with some heavy rain events, some extended dry periods and significant wet weather.

During 2017–2018, 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.
2014–2015: wet summer with above average rainfall, particularly on the coast

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.

Early June 2017 was particularly wet with heavy rain falling on the Central Coast. Rainfall totals of 100mm at Swansea, 112mm at Norah Head and 146mm at Avoca Beach were recorded over five days from 7–11 June.

Dry weather conditions followed from July 2017 to April 2018, with mostly average to below-average rainfall recorded at most coastal areas.

Several wet weather events occurred during the warmer months. The Central Coast experienced consecutive heavy rain days during October 2017, with Swansea recording double the long-term monthly average of 131.8mm. Heavy rain was recorded over several days in early November 2017, and in late March 2018, with Avoca Beach recording a daily rainfall total of 54mm.

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 microorganisms) 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 the threat of 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

<table>
<thead>
<tr>
<th>Swimming site</th>
<th>Site type</th>
<th>Beach Suitability Grade</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Coast Council</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lakes Beach</td>
<td>Ocean beach</td>
<td>VG</td>
<td></td>
</tr>
<tr>
<td>Cabbage Tree Bay Rockpool*</td>
<td>Ocean baths</td>
<td>P</td>
<td>Provisional</td>
</tr>
<tr>
<td>Soldiers Beach</td>
<td>Ocean beach</td>
<td>VG</td>
<td></td>
</tr>
<tr>
<td>North Entrance Beach</td>
<td>Ocean beach</td>
<td>VG</td>
<td></td>
</tr>
<tr>
<td>The Entrance Beach</td>
<td>Ocean beach</td>
<td>G</td>
<td></td>
</tr>
<tr>
<td>The Entrance Ocean Baths*</td>
<td>Ocean baths</td>
<td>G</td>
<td>Provisional</td>
</tr>
<tr>
<td>Toowoon Bay</td>
<td>Ocean beach</td>
<td>G</td>
<td></td>
</tr>
<tr>
<td>Shelly Beach</td>
<td>Ocean beach</td>
<td>G</td>
<td></td>
</tr>
<tr>
<td>Gwandalan</td>
<td>Lake/Lagoon</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Summerland Point Baths*</td>
<td>Lake/Lagoon</td>
<td>G</td>
<td>Provisional</td>
</tr>
<tr>
<td>Chain Valley Bay</td>
<td>Lake/Lagoon</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Mannering Park Baths*</td>
<td>Lake/Lagoon</td>
<td>P</td>
<td>Provisional</td>
</tr>
<tr>
<td>Lake Munmorah Baths</td>
<td>Lake/Lagoon</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Canton Beach</td>
<td>Lake/Lagoon</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Wamberal Beach</td>
<td>Ocean beach</td>
<td>G</td>
<td></td>
</tr>
<tr>
<td>Wamberal Lagoon</td>
<td>Lagoon</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Terrigal Beach</td>
<td>Ocean beach</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Terrigal Lagoon</td>
<td>Lagoon</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>North Avoca Beach</td>
<td>Ocean beach</td>
<td>G</td>
<td></td>
</tr>
<tr>
<td>Avoca Beach</td>
<td>Ocean beach</td>
<td>G</td>
<td></td>
</tr>
<tr>
<td>Avoca Lagoon</td>
<td>Lagoon</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Copacabana Beach</td>
<td>Ocean beach</td>
<td>G</td>
<td></td>
</tr>
<tr>
<td>Cockrone Lagoon</td>
<td>Lagoon</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>MacMasters Beach</td>
<td>Ocean beach</td>
<td>VG</td>
<td></td>
</tr>
<tr>
<td>Killcare Beach</td>
<td>Ocean beach</td>
<td>VG</td>
<td></td>
</tr>
<tr>
<td>Swimming site</td>
<td>Site type</td>
<td>Beach Suitability Grade</td>
<td>Change</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>---------------</td>
<td>-------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Central Coast Council (continued)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ocean Beach</td>
<td>Ocean beach</td>
<td>G</td>
<td></td>
</tr>
<tr>
<td>Umina Beach</td>
<td>Ocean beach</td>
<td>G</td>
<td></td>
</tr>
<tr>
<td>Pearl Beach Rockpool</td>
<td>Ocean baths</td>
<td>G</td>
<td></td>
</tr>
<tr>
<td>Davistown Baths</td>
<td>Estuarine</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Pretty Beach Baths</td>
<td>Estuarine</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Woy Woy Baths</td>
<td>Estuarine</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Yattalunga Baths</td>
<td>Estuarine</td>
<td>P</td>
<td></td>
</tr>
</tbody>
</table>

* New site

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

Seventeen of the 32 swimming sites were graded as Very Good or Good in 2017–2018. While this is a decline in overall performance from the previous year, it largely reflects recent changes in the monitoring program with the addition and removal of swimming sites to only include patrolled beaches and designated swimming areas, rather than a decline in water quality.

Percentage of sites graded as Very Good or Good:

- 2017–2018: 53%
- 2016–2017: 66%
- 2015–2016: 64%
- 2014–2015: 57%*

* combined results from the former Wyong Shire Council and Gosford City Council.

The overall performance of the Central Coast region is influenced by a large proportion of swimming sites being in lagoons and estuaries, where the impacts of rainfall are more apparent with reduced dilution and flushing of pollution inputs.

In February 2017, significant changes were made to Central Coast’s water quality monitoring program, following the amalgamation of Wyong Shire Council and Gosford City Council, to only include sites managed and patrolled by Central Coast Council. Four swimming sites were added to the program, including two ocean baths and two additional sites in Lake Macquarie. Sixteen unpatrolled swimming sites were removed from the monitoring program, including 13 ocean beaches with good water quality.

Many sites including Wamberal Lagoon, Terrigal Beach, Avoca Beach, Avoca Lagoon, Cockrone Lagoon, MacMasters Beach, Killcare Beach, Ocean Beach, Pearl Beach Rockpool, Davistown Baths 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 46 for an explanation of the graphs, tables and Beach Suitability Grades.
Best beaches

Lakes Beach, Soldiers Beach, North Entrance Beach, MacMasters Beach and Killcare Beach.

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

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.

Ocean beaches

Five of the 15 ocean beaches were graded as Very Good: Lakes Beach, Soldiers Beach, North Entrance Beach, MacMasters Beach and Killcare Beach. MacMasters Beach and Killcare Beach improved to Very Good, from a Good grade in 2016–2017. Water quality at these sites was suitable for swimming almost all of the time. These sites showed little response to rainfall, and enterococci levels rarely exceeded the safe swimming limits.

The Entrance Beach, Toowoon Bay, Shelly Beach, Wamberal Beach, North Avoca Beach, Avoca Beach, Copacabana Beach, Ocean Beach and Umina Beach were graded as Good. While Avoca Beach improved from a Poor grade in the previous year, the beach can be impacted by more significant sources of pollution including stormwater and contaminants discharged from Avoca Lagoon. The Entrance Beach and Shelly Beach were downgraded to Good, from Very Good in 2016–2017. Water quality at these sites was mostly suitable for swimming during dry weather conditions, however elevated bacteria levels were recorded after rainfall.
Terrigal Beach continued to be graded Poor as in previous years. A Poor grade indicates the site is more susceptible to pollution and not always suitable for swimming. While water quality at Terrigal Beach was mostly suitable for swimming in dry weather conditions, elevated enterococci levels were often recorded after light rainfall. During the assessment period 87% of samples from Terrigal Beach were within the safe swimming limit if no rainfall had fallen in the previous 24 hours. Despite the Poor grade, Terrigal Beach has shown some improvement and is 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.

It is recommended that swimming be avoided during and for up to one day after rainfall 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**

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

Pretty Beach Baths and Yattalunga Baths were frequently suitable for swimming during dry weather conditions, however elevated levels of enterococci were recorded following light rainfall. Water quality at Davistown Baths and Woy Woy Baths was often elevated during dry and wet weather conditions.

These swimming sites may be impacted by a number of 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

Summerland Point Baths in Lake Macquarie was added to the program in 2017 and was graded as Good. The grade is provisional as the information required for the analysis is based on limited bacterial data. The results to date show water quality was suitable for swimming most of the time, but elevated enterococci levels were occasionally recorded after little or no rain. Further monitoring will provide a clearer indication of the site’s water quality.

Five lake swimming sites were graded as Poor: Gwandalan, Chain Valley Bay, Mannering Park Baths, Lake Munmorah Baths and Canton Beach. Chain Valley Bay was downgraded from Good in 2016–2017. Mannering Park Baths was added to the program in 2017. This site has limited bacterial data so the Poor grade is provisional until more bacterial data is available for the assessment. Water quality at these sites was mostly suitable for swimming during dry weather conditions, however elevated enterococci levels were recorded after light rainfall and sometimes in no rain. 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 continued to be graded as Poor as in 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. Coastal lagoons have very low levels of flushing, and so pollution inputs can accumulate at these sites when they are not open to the ocean.

Ocean baths

Two of the three ocean baths were graded as Good: The Entrance Ocean Baths and Pearl Beach Rockpool. Water quality was generally suitable for swimming during dry weather, with elevated enterococci levels mostly recorded following heavy rainfall.

Cabbage Tree Bay Rockpool was graded as Poor. While 88% of dry weather samples were within the safe swimming limit during the assessment period, elevated enterococci levels were often recorded following moderate rainfall. Council previously monitored the adjacent ocean beach, Cabbage Tree Bay, 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 were added to the program in 2017 and have limited bacterial data available to assess their beach grades. Their grades are provisional until more bacterial data is collected to provide a more complete assessment of their performance.

The Entrance Ocean Baths is regularly cleaned 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

Central Coast Council investigates algal blooms, sewage contamination and stormwater pollution at designated swimming sites. If algal blooms are confirmed, the council erects algal bloom signs and liaises with the NSW Office of Water’s Hunter Regional Algal Coordinating Committee (HRACC). If sewage or stormwater contamination is suspected temporary advisory signs are immediately erected and a media release issued if warranted. Only when water quality results indicate the site is suitable for swimming are the signs removed.

Council has placed permanent advisory signs at all monitored swimming sites that have Poor or Very Poor Beach Suitability Grades. The signs advise that the sites are affected by stormwater pollution for up to three days following heavy rain at lake, lagoon and estuarine sites and for up to one day at ocean beaches and oceans baths, and that swimming is not recommended during these periods.

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. Major works included:

- upgrading vacuum sewage pumping stations in the Tacoma and Tuggerawong area to improve reliability and service to over 700 properties in this catchment
- upgrading beachfront sewage pumping stations at Norah Head, Toowoon Bay and Bateau Bay, increasing the
capacity and addressing a number of service deficiencies

- 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

- upgrading the main sewer pump station in Wyong. This station receives sewage from 26 subsidiary pump stations and is a critical piece of sewage infrastructure in the north

- upgrading the Wyong South, Kincumber and Woy Woy STPs to improve reliability and address a number of service deficiencies at each treatment plant

- 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.

Upgrades to the sewer and three sewer pump stations are complete in North Avoca, Avoca and Kincumber. These works will protect the community and environment against overflows and odours. Permanent replacement of the temporary sewer main across Terrigal Lagoon is complete and operational, and the temporary main has been removed. The works will improve the amenity of the lagoon and minimise potential environmental impacts.

Construction of the Cockle Bay Towns Sewerage Project is complete, with customers currently connecting to the system. This project will deliver an improved sewer service to over 300 properties located within the townships of Empire Bay, Bensville and Kincumber South. Ninety-six per cent of these properties previously managed their sewer on site. So far, 181 properties have connected to the system, which could see a significant improvement in environmental outcomes for downstream areas. Properties will continue to be connected to the system this year.

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 is monitored each year. The onsite sewage management systems include pump-out systems, aerated wastewater treatment systems, septic tank systems, commercial systems and other miscellaneous systems such as composting systems.

Two water harvesting and re-use schemes are in place including 1.6 million litres of underground storage, a water treatment plant and reticulation in Terrigal and a similar plant in East Gosford. These plants reduce the volume of stormwater released to Terrigal Beach and Erina Creek.
Coastal Zone Management Plans are being implemented for all catchments within the Central Coast local government area. These plans provide direction and guidance for the management of receiving waterways and their catchments to achieve long-term improvements in waterway health.

The Tuggerah Lakes Estuary and Catchment Improvement Project funded by the Australian Government’s Improving Your Local Parks and Environment Program follows on from the positive work completed under the previous grant funded programs. Under this funding a range of waterway improvement projects will be completed including foreshore and wetland vegetation rehabilitation, streambank rehabilitation, production of educational materials, construction of new gross pollutant traps and upgrades to wrack collection infrastructure. All the projects are aimed at improving the water quality of the Tuggerah Lakes estuary and improving knowledge of water quality issues to direct future management actions.

Council continues to install new gross pollutant traps and upgrade existing infrastructure improving stormwater quality, and now maintains over 360 stormwater quality improvement devices. As a result, over 1300 tonnes of sediment and pollutants were prevented from entering wetlands, creeks, rivers, lakes, lagoons and the ocean in the 2016–2017 financial year.

Council’s wrack and algal collection program saw more than 13,640m³ of wrack (dead and free-floating seagrass) and algae removed from the Tuggerah Lakes estuary during 2016–2017, 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; restoration of key wetlands at Bensville and Erina; 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

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 Very Good indicates microbial water quality is considered suitable for swimming almost all of the time, with few potential sources of 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.
Cabbage Tree Bay Rockpool

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 no rain, and often after 5mm or more of rainfall.

The site has been monitored since 2017.

<table>
<thead>
<tr>
<th>Site type</th>
<th>Monitoring period</th>
<th>Dry weather samples suitable for swimming</th>
<th>Water samples</th>
<th>Beach grade status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocean baths</td>
<td>Feb 2017 to Apr 2018</td>
<td>88%</td>
<td>48</td>
<td>Provisional</td>
</tr>
</tbody>
</table>

Sanitary inspection: Moderate

Microbial Assessment Category: C

Dry and wet weather water quality

Water quality in response to rainfall
Soldiers Beach

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

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 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.

<table>
<thead>
<tr>
<th>Site type</th>
<th>Monitoring period</th>
<th>Dry weather samples suitable for swimming</th>
<th>Water samples</th>
<th>Beach grade status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocean beach</td>
<td>Sep 2015 to Apr 2018</td>
<td>96%</td>
<td>100</td>
<td>Stable</td>
</tr>
</tbody>
</table>

Sanitary inspection: Low

Microbial Assessment Category: A

Dry and wet weather water quality

Water quality in response to rainfall
North Entrance Beach

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

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 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, Monitoring period, Dry weather samples suitable for swimming, Water samples, Beach grade status

<table>
<thead>
<tr>
<th>Site type</th>
<th>Monitoring period</th>
<th>Dry weather samples suitable for swimming</th>
<th>Water samples</th>
<th>Beach grade status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocean beach</td>
<td>Sep 2015 to Apr 2018</td>
<td>99%</td>
<td>100</td>
<td>Stable</td>
</tr>
</tbody>
</table>

---

**Sanitary inspection:** Low  
**Microbial Assessment Category:** A

---

**Dry and wet weather water quality**  
**Water quality in response to rainfall**
The Entrance Beach

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, often exceeding the safe swimming limit after 20mm or more of rainfall.

The site has been monitored since 2002.

<table>
<thead>
<tr>
<th>Site type</th>
<th>Monitoring period</th>
<th>Dry weather samples suitable for swimming</th>
<th>Water samples</th>
<th>Beach grade status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocean beach</td>
<td>Sep 2015 to Apr 2018</td>
<td>96%</td>
<td>100</td>
<td>Declined</td>
</tr>
</tbody>
</table>

Sanitary inspection: Low

Microbial Assessment Category: B

Dry and wet weather water quality

Water quality in response to rainfall
The Entrance Ocean Baths

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.

<table>
<thead>
<tr>
<th>Site type</th>
<th>Monitoring period</th>
<th>Dry weather samples suitable for swimming</th>
<th>Water samples</th>
<th>Beach grade status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocean baths</td>
<td>Feb 2017 to Apr 2018</td>
<td>91%</td>
<td>48</td>
<td>Provisional</td>
</tr>
</tbody>
</table>

Sanitary inspection: Low

Microbial Assessment Category: B

Dry and wet weather water quality

Water quality in response to rainfall
Toowoon Bay

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 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 no rain and after 10mm or more of rainfall.

The site has been monitored since 2002.

<table>
<thead>
<tr>
<th>Site type</th>
<th>Monitoring period</th>
<th>Dry weather samples suitable for swimming</th>
<th>Water samples</th>
<th>Beach grade status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocean beach</td>
<td>Sep 2015 to Apr 2018</td>
<td>86%</td>
<td>100</td>
<td>Stable</td>
</tr>
</tbody>
</table>

Sanitary inspection: Low

Microbial Assessment Category: B

Dry and wet weather water quality

Water quality in response to rainfall
Shelly Beach

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 5mm or more of rainfall.

The site has been monitored since 2002.

<table>
<thead>
<tr>
<th>Site type</th>
<th>Monitoring period</th>
<th>Dry weather samples suitable for swimming</th>
<th>Water samples</th>
<th>Beach grade status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocean beach</td>
<td>Sep 2015 to Apr 2018</td>
<td>93%</td>
<td>100</td>
<td>Declined</td>
</tr>
</tbody>
</table>

Sanitary inspection: Low

Microbial Assessment Category: B

Dry and wet weather water quality

Water quality in response to rainfall
Gwandalan

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 from within Lake Macquarie and stormwater.

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

The site has been monitored since 2002.

<table>
<thead>
<tr>
<th>Site type</th>
<th>Monitoring period</th>
<th>Dry weather samples suitable for swimming</th>
<th>Water samples</th>
<th>Beach grade status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake/Lagoon</td>
<td>May 2015 to Apr 2018</td>
<td>75%</td>
<td>100</td>
<td>Stable</td>
</tr>
</tbody>
</table>

Sanitary inspection: Moderate

Microbial Assessment Category: C

Dry and wet weather water quality

Water quality in response to rainfall
Summerland Point Baths

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

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, from 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
- **Lake/Lagoon**

### Monitoring period
- Jun 2017 to Apr 2018

### Dry weather samples suitable for swimming
- 84%

### Water samples
- 34

### Beach grade status
- Provisional

### Sanitary inspection: Moderate

### Microbial Assessment Category: B

### Dry and wet weather water quality

### Water quality in response to rainfall
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, often exceeding the safe swimming limit in response to no rain and after rain.

The site has been monitored since 2002.

<table>
<thead>
<tr>
<th>Site type</th>
<th>Monitoring period</th>
<th>Dry weather samples suitable for swimming</th>
<th>Water samples</th>
<th>Beach grade status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake/Lagoon</td>
<td>Jun 2015 to Apr 2018</td>
<td>74%</td>
<td>100</td>
<td>Declined</td>
</tr>
</tbody>
</table>

Sanitary inspection: Moderate

Microbial Assessment Category: C

Dry and wet weather water quality

Water quality in response to rainfall
Mannering Park Baths

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.

<table>
<thead>
<tr>
<th>Site type</th>
<th>Monitoring period</th>
<th>Dry weather samples suitable for swimming</th>
<th>Water samples</th>
<th>Beach grade status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake/Lagoon</td>
<td>Jun 2017 to Apr 2018</td>
<td>64%</td>
<td>34</td>
<td>Provisional</td>
</tr>
</tbody>
</table>

Sanitary inspection: Moderate

Microbial Assessment Category: C

Dry and wet weather water quality

Water quality in response to rainfall
Lake Munmorah Baths

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.

<table>
<thead>
<tr>
<th>Site type</th>
<th>Monitoring period</th>
<th>Dry weather samples suitable for swimming</th>
<th>Water samples</th>
<th>Beach grade status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake/Lagoon</td>
<td>May 2015 to Apr 2018</td>
<td>83%</td>
<td>100</td>
<td>Stable</td>
</tr>
</tbody>
</table>

Sanitary inspection: Moderate

Microbial Assessment Category: C

Dry and wet weather water quality

Water quality in response to rainfall
Canton Beach

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.

<table>
<thead>
<tr>
<th>Site type</th>
<th>Monitoring period</th>
<th>Dry weather samples suitable for swimming</th>
<th>Water samples</th>
<th>Beach grade status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake/Lagoon</td>
<td>May 2015 to Apr 2018</td>
<td>71%</td>
<td>100</td>
<td>Stable</td>
</tr>
</tbody>
</table>

Sanitary inspection: Moderate

Microbial Assessment Category: D

Dry and wet weather water quality

Water quality in response to rainfall
Wamberal Beach

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.

<table>
<thead>
<tr>
<th>Site type</th>
<th>Monitoring period</th>
<th>Dry weather samples suitable for swimming</th>
<th>Water samples</th>
<th>Beach grade status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocean beach</td>
<td>Feb 2015 to Apr 2018</td>
<td>91%</td>
<td>100</td>
<td>Stable</td>
</tr>
</tbody>
</table>

Sanitary inspection: Moderate

Microbial Assessment Category: B

Dry and wet weather water quality

Water quality in response to rainfall
Wamberal Lagoon

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 little or no rain and frequently after 5mm or more of rain.

The site has been monitored since 2004.

<table>
<thead>
<tr>
<th>Site type</th>
<th>Monitoring period</th>
<th>Dry weather samples suitable for swimming</th>
<th>Water samples</th>
<th>Beach grade status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lagoon</td>
<td>Feb 2015 to Apr 2018</td>
<td>77%</td>
<td>100</td>
<td>Stable</td>
</tr>
</tbody>
</table>

Sanitary inspection: Moderate

Microbial Assessment Category: C

Dry and wet weather water quality

Water quality in response to rainfall
Terrigal Beach

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

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 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.

<table>
<thead>
<tr>
<th>Site type</th>
<th>Monitoring period</th>
<th>Dry weather samples suitable for swimming</th>
<th>Water samples</th>
<th>Beach grade status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocean beach</td>
<td>Mar 2015 to Apr 2018</td>
<td>87%</td>
<td>100</td>
<td>Stable</td>
</tr>
</tbody>
</table>

Sanitary inspection: Moderate

Microbial Assessment Category: C

Dry and wet weather water quality

Water quality in response to rainfall
Terrigal Lagoon

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 in little or no rain, and frequently after 5mm or more of rainfall.

The site has been monitored since 2004.

<table>
<thead>
<tr>
<th>Site type</th>
<th>Monitoring period</th>
<th>Dry weather samples suitable for swimming</th>
<th>Water samples</th>
<th>Beach grade status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lagoon</td>
<td>Feb 2015 to Apr 2018</td>
<td>66%</td>
<td>100</td>
<td>Stable</td>
</tr>
</tbody>
</table>

Sanitary inspection: Moderate

Microbial Assessment Category: D

Dry and wet weather water quality

Water quality in response to rainfall

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

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.

<table>
<thead>
<tr>
<th>Site type</th>
<th>Monitoring period</th>
<th>Dry weather samples suitable for swimming</th>
<th>Water samples</th>
<th>Beach grade status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocean beach</td>
<td>Mar 2015 to Apr 2018</td>
<td>89%</td>
<td>100</td>
<td>Stable</td>
</tr>
</tbody>
</table>

Sanitary inspection: Low

Microbial Assessment Category: B

Dry and wet weather water quality

Water quality in response to rainfall
Avoca Beach

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 often after 10mm or more of rain.

The site has been monitored since 2006.

<table>
<thead>
<tr>
<th>Site type</th>
<th>Monitoring period</th>
<th>Dry weather samples suitable for swimming</th>
<th>Water samples</th>
<th>Beach grade status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocean beach</td>
<td>Mar 2015 to Apr 2018</td>
<td>91%</td>
<td>100</td>
<td>Improved</td>
</tr>
</tbody>
</table>

Sanitary inspection: Moderate

Microbial Assessment Category: B

Dry and wet weather water quality

Water quality in response to rainfall
Avoca Lagoon

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 a number of potential sources of faecal contamination including sewage overflows and 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.

<table>
<thead>
<tr>
<th>Site type</th>
<th>Monitoring period</th>
<th>Dry weather samples suitable for swimming</th>
<th>Water samples</th>
<th>Beach grade status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lagoon</td>
<td>Feb 2015 to Apr 2018</td>
<td>58%</td>
<td>100</td>
<td>Stable</td>
</tr>
</tbody>
</table>

Sanitary inspection: Moderate

Microbial Assessment Category: D

Dry and wet weather water quality

Water quality in response to rainfall
Copacabana Beach

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 light rain, and often after 5mm or more of rain.

The site has been monitored since 2006.

<table>
<thead>
<tr>
<th>Site type</th>
<th>Monitoring period</th>
<th>Dry weather samples suitable for swimming</th>
<th>Water samples</th>
<th>Beach grade status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocean beach</td>
<td>Mar 2015 to Apr 2018</td>
<td>94%</td>
<td>100</td>
<td>Stable</td>
</tr>
</tbody>
</table>

Sanitary inspection: Moderate

Microbial Assessment Category: B

Dry and wet weather water quality

Water quality in response to rainfall
Cockrone Lagoon

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 no rain and frequently after 5mm or more of rain.

The site has been monitored since 2004.

<table>
<thead>
<tr>
<th>Site type</th>
<th>Monitoring period</th>
<th>Dry weather samples suitable for swimming</th>
<th>Water samples</th>
<th>Beach grade status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lagoon</td>
<td>Feb 2015 to Apr 2018</td>
<td>70%</td>
<td>100</td>
<td>Stable</td>
</tr>
</tbody>
</table>

Sanitary inspection: Moderate

Microbial Assessment Category: D

Dry and wet weather water quality

Water quality in response to rainfall
MacMasters Beach

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 faecal contamination.

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

The site has been monitored since 2006.

<table>
<thead>
<tr>
<th>Site type</th>
<th>Monitoring period</th>
<th>Dry weather samples suitable for swimming</th>
<th>Water samples</th>
<th>Beach grade status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocean beach</td>
<td>Mar 2015 to Apr 2018</td>
<td>100%</td>
<td>100</td>
<td>Improved</td>
</tr>
</tbody>
</table>

Sanitary inspection: Low

Microbial Assessment Category: A

Dry and wet weather water quality

Water quality in response to rainfall
Killcare Beach

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 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.

<table>
<thead>
<tr>
<th>Site type</th>
<th>Monitoring period</th>
<th>Dry weather samples suitable for swimming</th>
<th>Water samples</th>
<th>Beach grade status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocean beach</td>
<td>Feb 2015 to Apr 2018</td>
<td>94%</td>
<td>100</td>
<td>Improved</td>
</tr>
</tbody>
</table>

Sanitary inspection: Low

Microbial Assessment Category: A

Dry and wet weather water quality

Water quality in response to rainfall
Ocean Beach

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 usually after 20mm or more of rainfall.

The site has been monitored since 2011.

<table>
<thead>
<tr>
<th>Site type</th>
<th>Monitoring period</th>
<th>Dry weather samples suitable for swimming</th>
<th>Water samples</th>
<th>Beach grade status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocean beach</td>
<td>Mar 2015 to Apr 2018</td>
<td>100%</td>
<td>100</td>
<td>Stable</td>
</tr>
</tbody>
</table>

Sanitary inspection: Moderate

Microbial Assessment Category: B

Dry and wet weather water quality

Water quality in response to rainfall
Umina Beach

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 10mm or more of rain, and usually after 20mm or more of rain.

The site has been monitored since 2004.

<table>
<thead>
<tr>
<th>Site type</th>
<th>Monitoring period</th>
<th>Dry weather samples suitable for swimming</th>
<th>Water samples</th>
<th>Beach grade status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocean beach</td>
<td>Mar 2015 to Apr 2018</td>
<td>99%</td>
<td>100</td>
<td>Stable</td>
</tr>
</tbody>
</table>

Sanitary inspection: Low

Microbial Assessment Category: B

Dry and wet weather water quality

Water quality in response to rainfall
Pearl Beach Rockpool

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 or no rain, and usually after 20mm or more of rainfall.

The site has been monitored since 2004.

<table>
<thead>
<tr>
<th>Site type</th>
<th>Monitoring period</th>
<th>Dry weather samples suitable for swimming</th>
<th>Water samples</th>
<th>Beach grade status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocean baths</td>
<td>Feb 2015 to Apr 2018</td>
<td>95%</td>
<td>100</td>
<td>Stable</td>
</tr>
</tbody>
</table>

Sanitary inspection: Moderate

Microbial Assessment Category: B

Dry and wet weather water quality

Water quality in response to rainfall
Davistown Baths

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.

<table>
<thead>
<tr>
<th>Site type</th>
<th>Monitoring period</th>
<th>Dry weather samples suitable for swimming</th>
<th>Water samples</th>
<th>Beach grade status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estuarine</td>
<td>Jan 2015 to Apr 2018</td>
<td>78%</td>
<td>100</td>
<td>Stable</td>
</tr>
</tbody>
</table>

Sanitary inspection: Moderate

Microbial Assessment Category: C

Dry and wet weather water quality

Water quality in response to rainfall

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

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, often exceeding the safe swimming limit in response to little or no rain, and regularly after 10mm or more of rainfall.

The site has been monitored since 2004.

<table>
<thead>
<tr>
<th>Site type</th>
<th>Monitoring period</th>
<th>Dry weather samples suitable for swimming</th>
<th>Water samples</th>
<th>Beach grade status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estuarine</td>
<td>Jan 2015 to Apr 2018</td>
<td>78%</td>
<td>100</td>
<td>Stable</td>
</tr>
</tbody>
</table>

Sanitary inspection: Moderate

Microbial Assessment Category: C

Dry and wet weather water quality

Water quality in response to rainfall

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

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 regularly after 10mm or more of rainfall.

The site has been monitored since 2004.

<table>
<thead>
<tr>
<th>Site type</th>
<th>Monitoring period</th>
<th>Dry weather samples suitable for swimming</th>
<th>Water samples</th>
<th>Beach grade status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estuarine</td>
<td>Jan 2015 to Apr 2018</td>
<td>60%</td>
<td>100</td>
<td>Stable</td>
</tr>
</tbody>
</table>

Sanitary inspection: Moderate

Microbial Assessment Category: D

Dry and wet weather water quality

Water quality in response to rainfall

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

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 no rain, and often in response after light rain.

The site has been monitored since 2004.

### Dry and wet weather water quality

<table>
<thead>
<tr>
<th>Wet weather samples</th>
<th>Dry weather samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>55</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
<tr>
<td>20</td>
</tr>
<tr>
<td>40</td>
</tr>
<tr>
<td>60</td>
</tr>
<tr>
<td>80</td>
</tr>
<tr>
<td>100</td>
</tr>
</tbody>
</table>

### Water quality in response to rainfall

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

### Site type Monitoring period Dry weather samples suitable for swimming Water samples Beach grade status

| Estuarine | Nov 2014 to Apr 2018 | 82% | 100 | Stable |

### Sanitary inspection: Moderate

### Microbial Assessment Category: C

<table>
<thead>
<tr>
<th>Year</th>
<th>Enterococci (cfu/100mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013-14</td>
<td>340</td>
</tr>
<tr>
<td>2014-15</td>
<td>330</td>
</tr>
<tr>
<td>2015-16</td>
<td>360</td>
</tr>
<tr>
<td>2016-17</td>
<td>450</td>
</tr>
<tr>
<td>2017-18</td>
<td>330</td>
</tr>
</tbody>
</table>
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 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.

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.


Enterococci are measured in colony forming units per 100mL of sample (cfu/100mL).
NSW State of the beaches 2017–2018

Beach Suitability Grades are determined by using the following matrix:

<table>
<thead>
<tr>
<th>Sanitary Inspection Category</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Low</td>
<td>Very Good</td>
<td>Very Good</td>
<td>Follow Up</td>
<td>Follow Up</td>
</tr>
<tr>
<td>Low</td>
<td>Very Good</td>
<td>Good</td>
<td>Follow Up</td>
<td>Follow Up</td>
</tr>
<tr>
<td>Moderate</td>
<td>Good</td>
<td>Good</td>
<td>Poor</td>
<td>Poor</td>
</tr>
<tr>
<td>High</td>
<td>Good</td>
<td>Fair</td>
<td>Poor</td>
<td>Very Poor</td>
</tr>
<tr>
<td>Very High</td>
<td>Follow Up</td>
<td>Fair</td>
<td>Poor</td>
<td>Very Poor</td>
</tr>
</tbody>
</table>

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 (Wyer et al 1999).

**Risk of illness associated with Microbial Assessment Categories**

<table>
<thead>
<tr>
<th>Category</th>
<th>Enterococci (cfu/100mL)</th>
<th>Illness risk*</th>
</tr>
</thead>
</table>
| 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.
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 28/06/18].

**Sanitary Inspection Category (SIC)**

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 (WWTP), sewage overflows, sewer chokes, onsite systems, wastewater reuse, 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 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 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.
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. 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 monitoring 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 monitoring 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.

**Key to maps**

- ▲ Sampling Site
- 🏖️ Surf Life Saving Club
- 🚰️ Wastewater Treatment Plant
- 💦 Sewage Pumping Station
- ⚪️ Sewage Overflow
- 🌊 Stormwater Drain
- 🛓️ Water
- 🛁️ Baths
- 🇲️ National Park/Reserve/Other Park
- 🏦 Built-up Area
- 🏝️ Sand
- 🜁 Roads
- 🟒 Major Roads
- ♂ Baths – Netted Area
- ⬇️ Breakwater/Wharf

**References**