

Illawarra region

Councils

The Illawarra region of NSW extends from the southern border of the Royal National Park to Gerroa. Swimming locations are monitored in all three local council areas (Figure 29):

- Wollongong City Council
- Shellharbour City Council
- Kiama Municipal Council.

The programs

The Beachwatch Program was extended to the Illawarra region in 1996. The program currently covers 17 ocean beaches and one lagoon site (Table 23).

All sites are sampled by Sydney Water Corporation. Monitoring at 15 sites is conducted as a requirement of the Environment Protection Licences for wastewater treatment plants in the region. These sites are sampled every sixth day throughout the year and have been tested for enterococci since 1996.

Monitoring at the remaining three sites (Austinmer Beach, Thirroul Beach and Surf Beach Kiama) is conducted as a community service (Table 23). These sites are sampled every sixth day throughout the swimming season only (October to April). Testing for enterococci was introduced in 2006.

To ensure that the data collected and reported under the Beachwatch Program are accurate and reliable, quality assurance of sampling, microbial analysis and reporting is undertaken. The findings of the quality assurance program are described in the quality assurance section of this report.

2011–2012 results

Of the 18 swimming locations monitored in the Illawarra region, 17 were graded as Good or Very Good (Table 24), making this region one of the best performing on the NSW coast.

Ocean beaches

Nine of the Illawarra's ocean beaches were graded as Very Good: Austinmer Beach, Woonona Beach, Wollongong City Beach, Coniston Beach and Fishermans Beach in the Wollongong City Council area; Warilla Beach and Shellharbour Beach in the Shellharbour City Council area; and Boyds Jones Beach and Werri Beach in the Kiama Municipal Council area.

These beaches had consistently excellent water quality and a low risk of microbial contamination from pollution sources in their catchments.

Eight Illawarra ocean beaches were rated as Good (Table 24), indicating that water quality is suitable for swimming for most of the time, but there may be impacts following heavy rainfall due to a number of potential sources of microbial contamination.

Table 23: Monitoring of Illawarra swimming sites

Organisation	Sampling frequency	Number of sites					Total
		Ocean beaches	Ocean baths	Estuarine	Lagoon/ lake	Freshwater river/lake	
Sydney Water Corporation (EPA licence)	Every 6 days (year-round)	14	–	–	1	–	15
Sydney Water Corporation (community service)	Every 6 days (October to April)	3	–	–	–	–	3

Lagoon

Entrance Lagoon Beach was graded as Poor. Microbial water quality was generally suitable for swimming during dry weather conditions, with elevated enterococci levels recorded following rainfall. This site may be susceptible to faecal contamination from a number of sources, including outflow from Lake Illawarra and stormwater. It is recommended that swimming at this location be avoided during and up to three days following rainfall or if there are signs of stormwater such as discoloured water or odour or floating debris.

Extreme wet weather events and flooding during 2011–2012 impacted many lagoon swimming

locations in NSW. Poor water quality associated with these events resulted in several sites being downgraded from the previous year. At Entrance Lagoon Beach, more than half of the samples collected during the 2011–2012 swimming season were associated with rainfall in the preceding 96 hours. It is anticipated that an improvement in water quality will occur on return to average rainfall conditions.

The Lake Illawarra Authority has erected signage at the site advising that swimming should be avoided for up to three days after heavy rainfall.

Table 24: Beach Suitability Grades in the Illawarra region, 2011–2012

	Site	Site type	Sanitary Inspection Category	Microbial Assessment Category	Beach Suitability Grade
Wollongong City Council	Austinmer Beach	Ocean beach	Low	Category A	Very Good
	Thirroul Beach	Ocean beach	Moderate	Category A	Good
	Bulli Beach	Ocean beach	Moderate	Category A	Good
	Woonona Beach	Ocean beach	Low	Category A	Very Good
	Bellambi Beach	Ocean beach	Moderate	Category B	Good
	Corrimal Beach	Ocean beach	Moderate	Category B	Good
	North Wollongong Beach	Ocean beach	Moderate	Category A	Good
	Wollongong City Beach	Ocean beach	Low	Category A	Very Good
	Coniston Beach	Ocean beach	Low	Category A	Very Good
	Fishermans Beach	Ocean beach	Low	Category A	Very Good
	Port Kembla Beach	Ocean beach	Moderate	Category A	Good
Shellharbour City Council	Entrance Lagoon Beach	Lagoon/lake	Moderate	Category C	Poor
	Warilla Beach	Ocean beach	Low	Category A	Very Good
	Shellharbour Beach	Ocean beach	Low	Category A	Very Good
Kiama Municipal Council	Boyd's Jones Beach	Ocean beach	Low	Category A	Very Good
	Bombo Beach	Ocean beach	Moderate	Category A	Good
	Surf Beach	Ocean beach	Moderate	Category B	Good
	Werri Beach	Ocean beach	Low	Category A	Very Good

Wollongong City Council

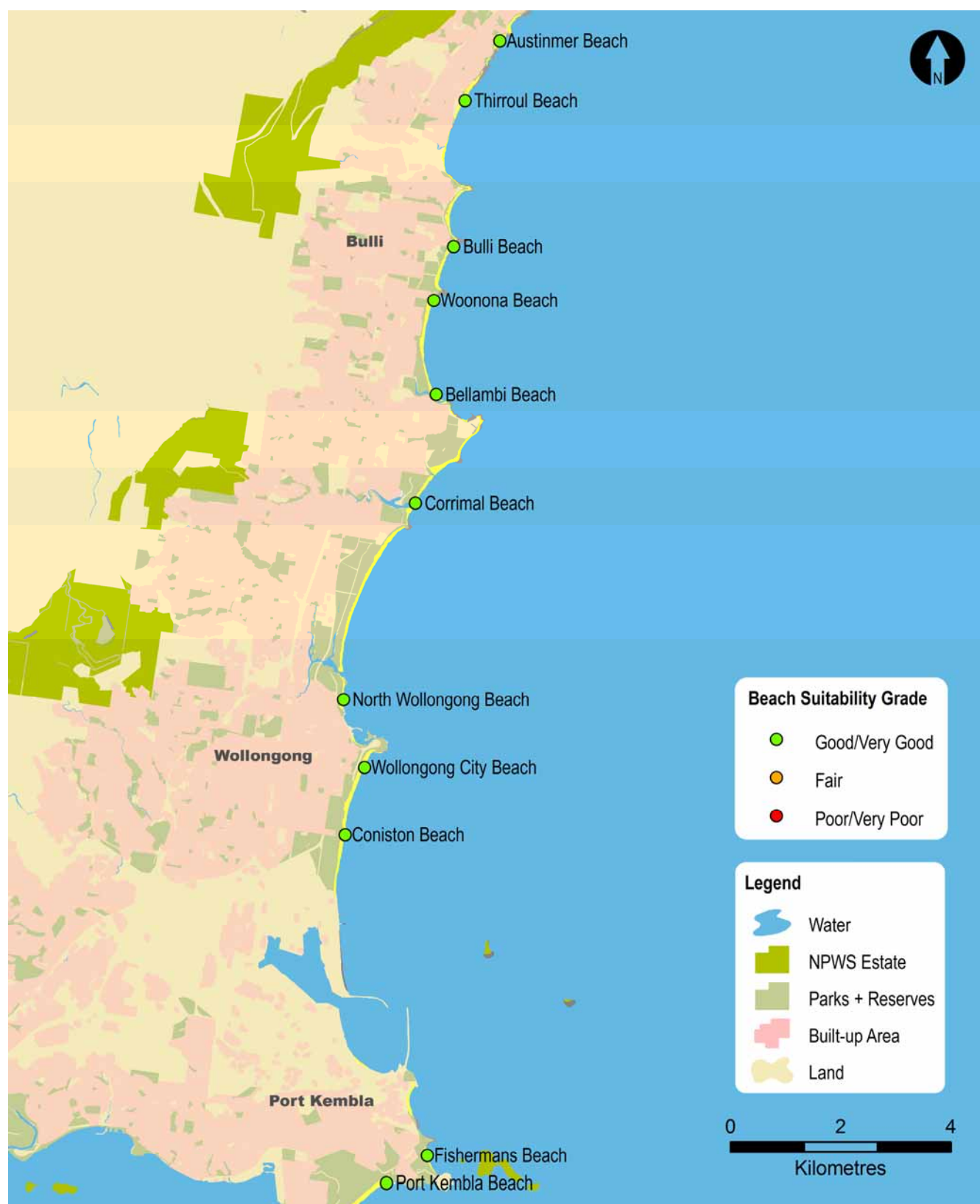


Figure 30: Sampling locations and Beach Suitability Grades in the Wollongong City Council area

Overview of the area

Description

Wollongong City Council stretches from Helensburgh in the north to the entrance of Lake Illawarra in the south, covering an area of 684 square kilometres. The area had an estimated local resident population of 192,418 at the 2011 Census (ABS 2012), showing an average growth rate of 0.89 per cent per year since the 2006 Census (ABS 2007).

The ocean beaches occupy a 40 kilometre stretch of coastline. The landscape is dominated by the Illawarra Escarpment, and urban development is concentrated in a narrow coastal strip. Urban development is highest in the south of the council area.

Land use in the Wollongong ocean beach catchments is diverse and includes residential, rural, commercial, parks/reserves, industrial and bushland.

Rainfall

There were several significant rain and flooding events in the Illawarra region during 2011–2012 (BOM 2012):

- Particularly heavy rainfall in mid October saw Wollongong receiving 126 mm of rainfall in one day. During this event Bellambi received 100 mm which is the highest daily rainfall ever recorded in this area for October.
- High levels of rainfall along the east coast in February included a daily total of 98 mm in Wollongong which resulted in flash flooding in parts of the region.
- High levels of rainfall continued in March, with particularly heavy rainfall at Bellambi in the beginning of the month when 88 mm of rain fell in one day.

Assessment

Microbial water quality

NHMRC recommends that at least 20 samples are collected each year, providing 100 data points over a five year period. The sampling frequency in the Wollongong City Council area is higher than this minimum for most sites, with 60 samples collected each year at the nine locations monitored under Environment Protection Licence and 35 samples collected each year at Austinmer and Thirroul beaches (which are monitored by Sydney Water Corporation as a community service).

The Microbial Assessment Category for 2011–2012 was calculated from the most recent 100 data points up until the end of the 2011–2012 swimming season: September 2010 until April 2012 at nine sites, and slightly longer (November 2009 until April 2012) at Austinmer and Thirroul beaches.

Sanitary inspections

Sanitary inspections have been completed for all monitored swimming locations in the Wollongong City Council area. These are scheduled for review during 2012–2013.

Beach Suitability Grades

All 13 ocean beaches monitored in the Wollongong City Council area were graded as Good or Very Good during 2011–2012 (Figure 30).

Very Good

Five ocean beaches were graded as Very Good: Austinmer Beach, Woonona Beach, Wollongong City Beach, Coniston Beach and Fishermans Beach.

These sites all had excellent water quality during the assessment period (Microbial Assessment Category A) and few potential sources of microbial contamination (Sanitary Inspection Categories of Low).

Good

Six swimming locations were graded as Good: Thirroul Beach, Bulli Beach, Bellambi Beach, Corrimal Beach, North Wollongong Beach and Port Kembla Beach.

These sites had mostly good water quality during the 2011–2012 assessment period (Microbial Assessment Category A or B) but had several, or more significant, potential sources of microbial contamination, such as stormwater drains and discharges from creeks or lagoons.

Fair

No beaches were graded as Fair.

Poor

No beaches were graded as Poor.

Very Poor

No beaches were graded as Very Poor.

Management

Wastewater management

Sydney Water manages the public sewer in the area, including the Wollongong Wastewater Treatment Plant (WWTP) and two storm sewage treatment plants (SSTP) (EPA NSW 2012).

Wollongong WWTP services an estimated population of 199,000. Effluent is tertiary treated and disinfected and approximately 8.5 billion litres is re-used each year by Bluescope Steel, Port Kembla Coal Terminal, Wollongong Golf Club and Wollongong City Council. The remainder is discharged via a near-shore outfall.

Bellambi SSTP and Port Kembla SSTP store and treat excess wastewater flows only during extended wet weather events, with all dry weather flows transferred to Wollongong WWTP for high-level treatment. Prior to 2009, these facilities were WWTPs and discharged treated effluent from shoreline outfalls.

Sydney Water has extended sewerage services to approximately 850 households in Coalcliff, Stanwell Park, Stanwell Tops and Otford under its Priority Sewerage Scheme. Nearly all eligible properties have connected to the scheme.

To reduce the incidence of wet weather sewage overflows in beach catchments from Austinmer to Port Kembla, Sydney Water is amplifying pipes and pumps and including storage tanks.

Sydney Water is inspecting, cleaning and repairing those sewer mains in beach catchments from Austinmer to Bulli and North Wollongong to Port Kembla that have a high likelihood of discharging sewage to waterways if they become blocked. When significant tree root intrusion to the public sewer from the private sewer is identified, property owners are requested to remedy the problem.

Sydney Water also undertakes dry weather monitoring of main stormwater drains to identify sewer leaks. Leaks from public sewers are repaired by Sydney Water and leaks from private sewers are referred to local councils.

Stormwater management

Wollongong City Council has developed a stormwater management plan for its coastal catchments, as well as estuary management plans covering major estuaries in the region. The plans identify issues and appropriate management actions.

A number of projects have already been completed, including the installation of stormwater quality improvement devices at various locations, with drains that flow to Corrimal, North Wollongong and Brighton beaches. These devices are designed to capture stormwater litter and sediment, preventing them from reaching the beaches. This work was partly funded by grants from the Southern Rivers Catchment Management Authority and OEH.

Wollongong City Council has also installed a litter boom on Fairy Creek, which drains to Fairy Creek Lagoon and, when the lagoon is open, to the southern end of Fairy Meadow Beach. The boom collects gross pollutants such as cans, plastic bottles, plastic bags and polystyrene, while permitting the passage of fish and other aquatic organisms in the creek.

To address poor water quality in Towradgi Creek and Fairy Creek, the council is undertaking a foreshore pollutant audit to identify the location and impact of pollution sources. This information will be used to develop remediation options.

Lifeguard service

Wollongong City Council lifeguards and Surf Life Saving Australia volunteers provide lifeguard services at 17 beaches in the area.

Austinmer Beach

Beach Suitability Grade: **Very Good**



See page 21 for key to map

The beach is 250 metres long and backed by a park and picnic area. Swimming can be hazardous because of the strong permanent rips at each end of the beach. Lifeguards patrol the beach from September to April.

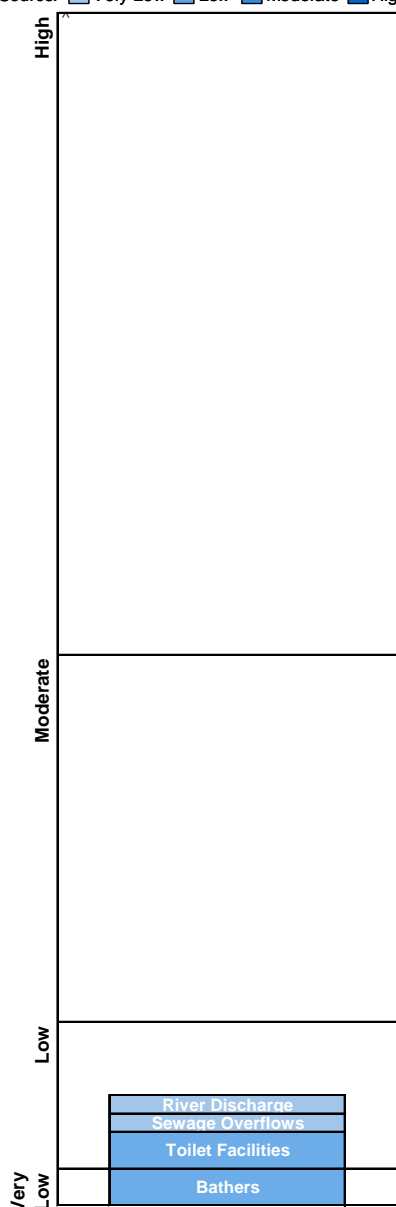
The Beach Suitability Grade of Very Good indicates that microbial water quality is considered suitable for swimming almost all of the time, with few potential sources of faecal contamination.

The response to rainfall graph indicates that enterococci levels generally remained below the safe swimming limit across all rainfall categories.

The site has been monitored since 2006 and microbial water quality has generally been of a very high standard.

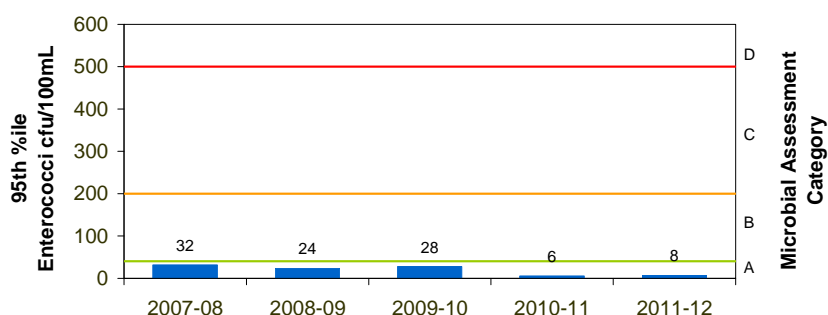
Sanitary Inspection: **Low**

Source: ■ Very Low ■ Low ■ Moderate ■ High



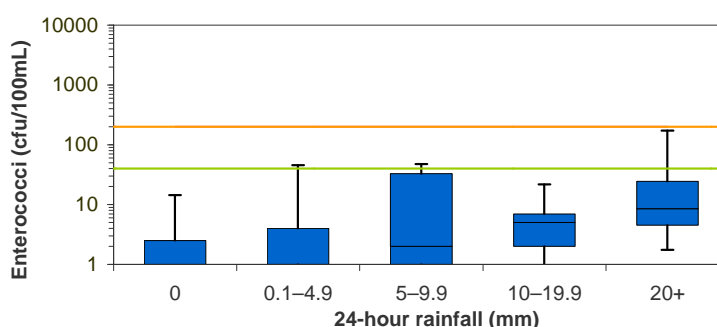
Microbial Assessment: **A**

Monitoring period for 2011–12 result is November 2009 to April 2012.

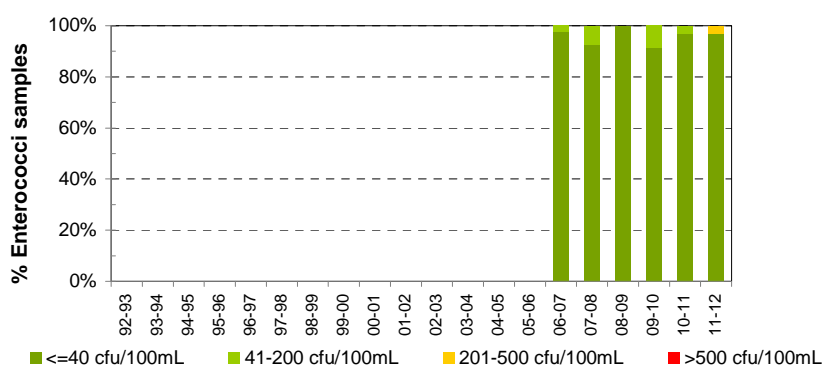


Response to rainfall

Rainfall from Bellambi rain gauge



Trends in enterococci data through time



Thirrourl Beach

Beach Suitability Grade: **Good**



See page 21 for key to map

The beach is one kilometre long. It is backed by a large, grassy reserve. Swimming can be potentially hazardous because of permanent and shifting rips. A 50 metre ocean pool and wading pool are located midway along the beach. Lifeguards patrol the beach from September to April.

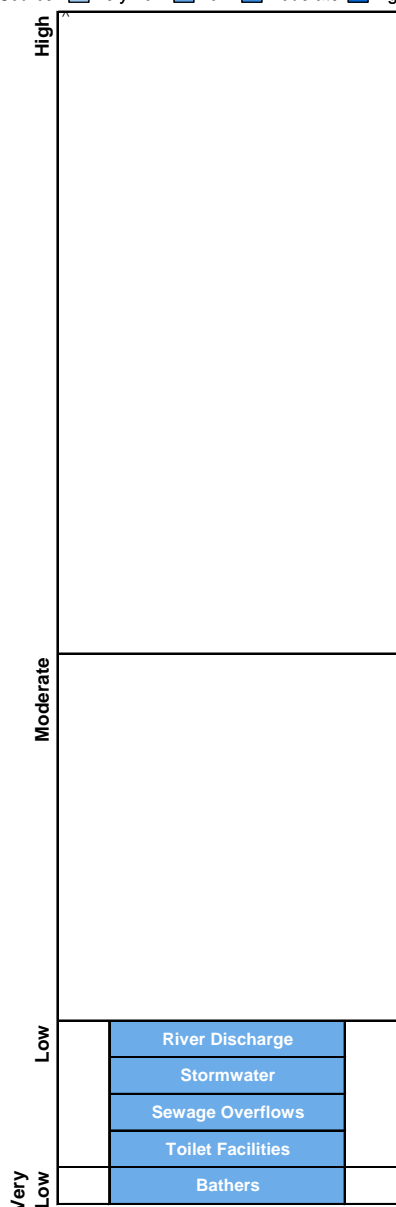
The Beach Suitability Grade of Good indicates that microbial water quality is generally suitable for swimming but the water may be susceptible to pollution from a number of potential sources of faecal contamination.

The response to rainfall graph indicates that enterococci levels increased slightly with increasing rainfall, occasionally exceeding the safe swimming limit in response to 20 mm of rainfall or more.

The site has been monitored for enterococci since 2006 and microbial water quality has generally been of a high standard.

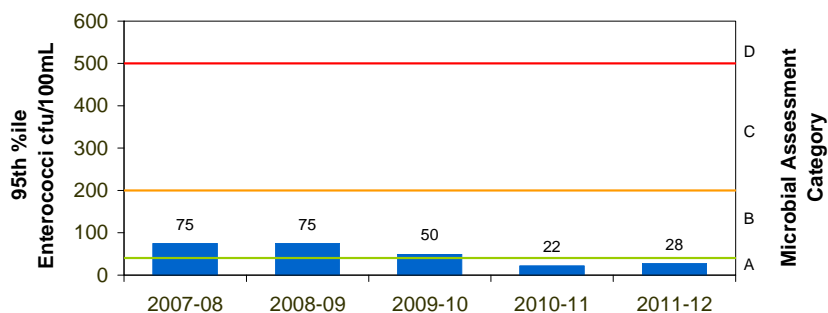
Sanitary Inspection: **Moderate**

Source: Very Low Low Moderate High



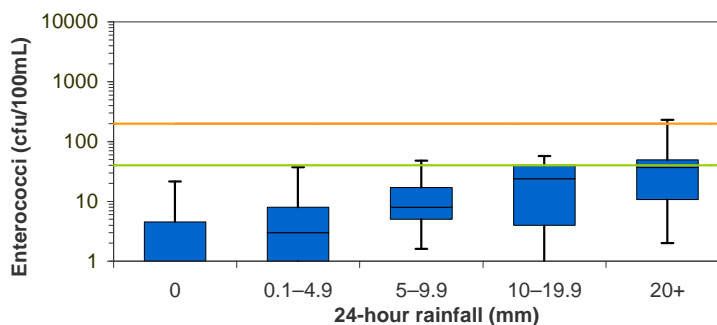
Microbial Assessment: **A**

Monitoring period for 2011–12 result is November 2009 to April 2012.

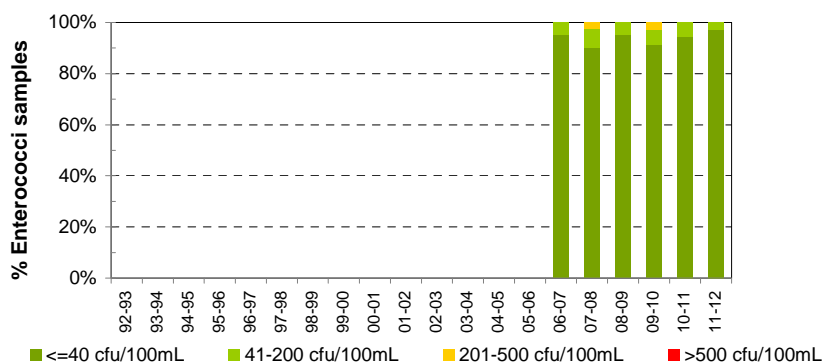


Response to rainfall

Rainfall from Bellambi rain gauge



Trends in enterococci data through time



Bulli Beach

Beach Suitability Grade: **Good**



See page 21 for key to map

The beach is 900 metres long and is backed by sand dunes and a reserve. Beach conditions are safest in the patrolled area at the northern end of the beach. Lifeguards patrol the beach from September to April.

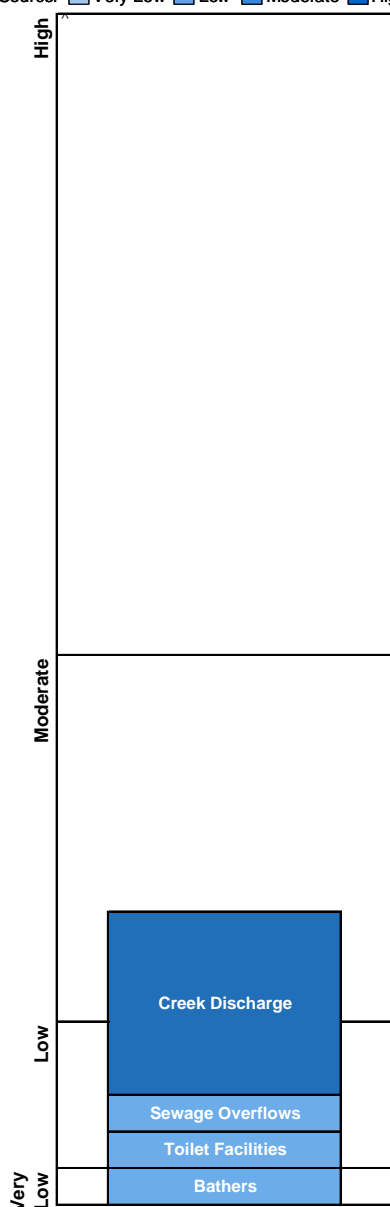
The Beach Suitability Grade of Good indicates that microbial water quality is generally suitable for swimming but the water may be susceptible to pollution from a number of potential sources of faecal contamination, including sewage overflows and discharge from Wharons Creek.

The response to rainfall graph indicates that enterococci levels increased with increasing rainfall, often exceeding the safe swimming limit in response to 10 mm of rainfall or more.

The site has been monitored since 1996 and microbial water quality has generally been of a high standard.

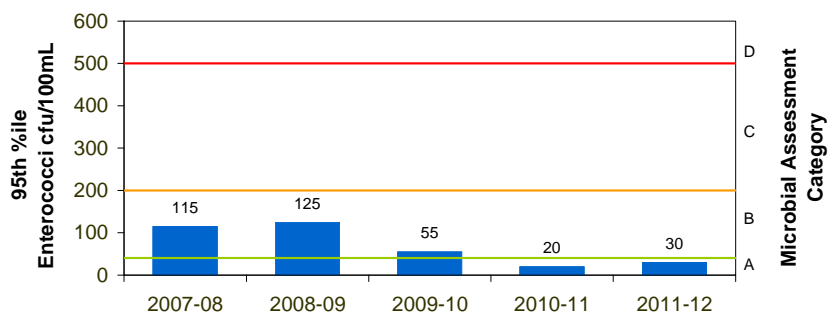
Sanitary Inspection: **Moderate**

Source: Very Low Low Moderate High



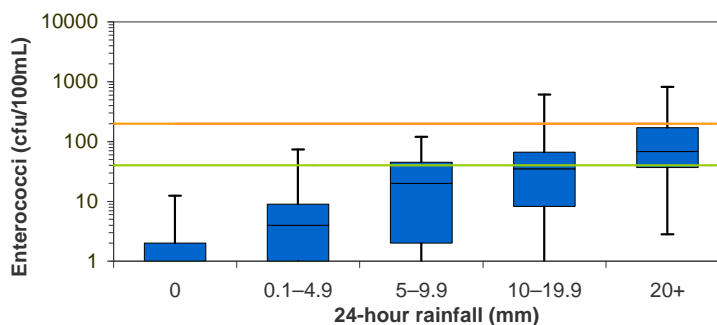
Microbial Assessment: **A**

Monitoring period for 2011–12 result is October 2010 to April 2012.

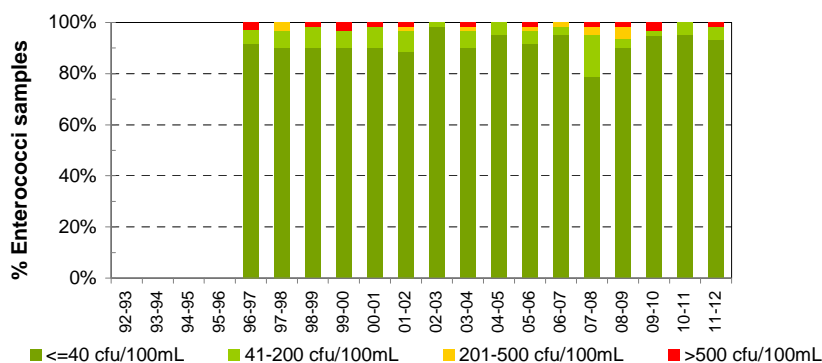


Response to rainfall

Rainfall from Bellambi rain gauge



Trends in enterococci data through time



Woonona Beach

Beach Suitability Grade: **Very Good**



See page 21 for key to map

Woonona Beach is at the northern end of a two kilometre stretch of beach and is backed by sand dunes and a reserve. Beach conditions are safest in the patrolled area at the northern end of the beach. Lifeguards patrol the beach from September to April.

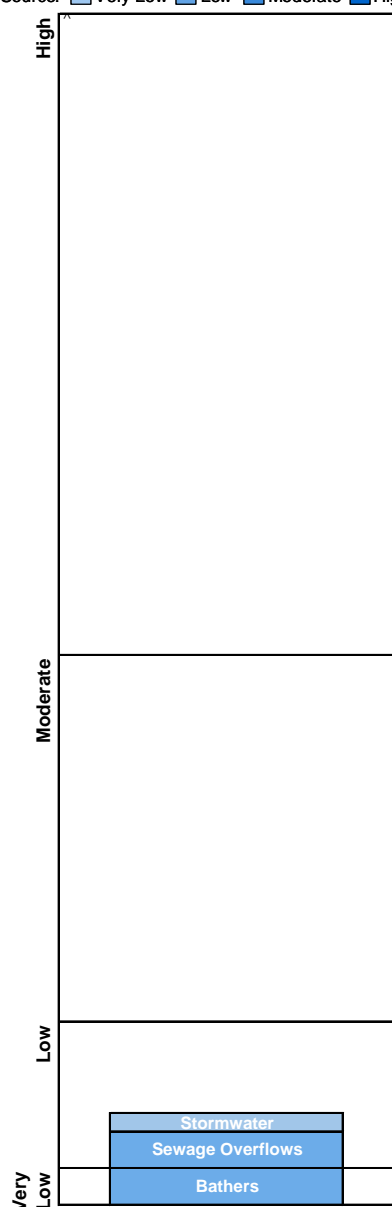
The Beach Suitability Grade of Very Good indicates that microbial water quality is considered suitable for swimming almost all of the time, with few potential sources of faecal contamination.

The response to rainfall graph indicates that enterococci levels increased slightly with increasing rainfall, occasionally exceeding the safe swimming limit in response to 20 mm of rainfall or more.

The site has been monitored since 1996 and microbial water quality has generally been of a high standard.

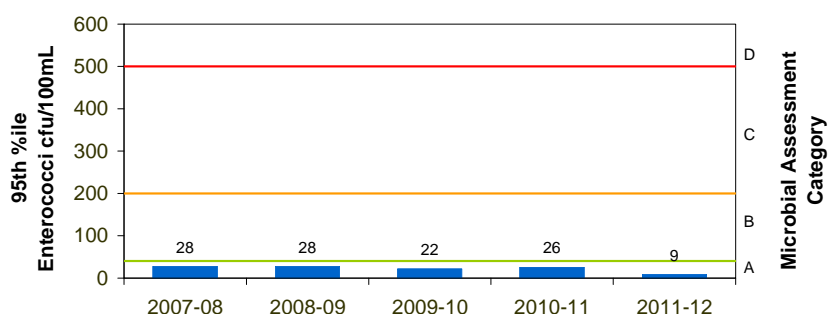
Sanitary Inspection: **Low**

Source: Very Low Low Moderate High



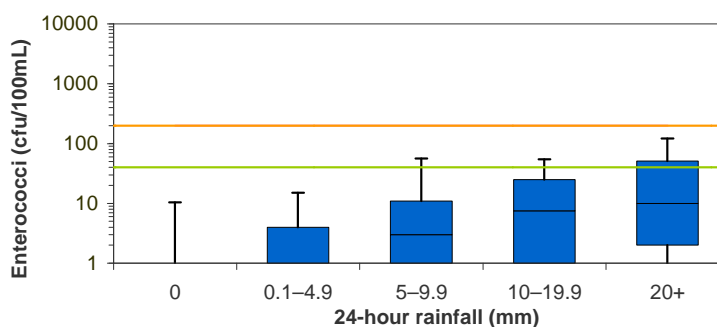
Microbial Assessment: **A**

Monitoring period for 2011–12 result is October 2010 to April 2012.

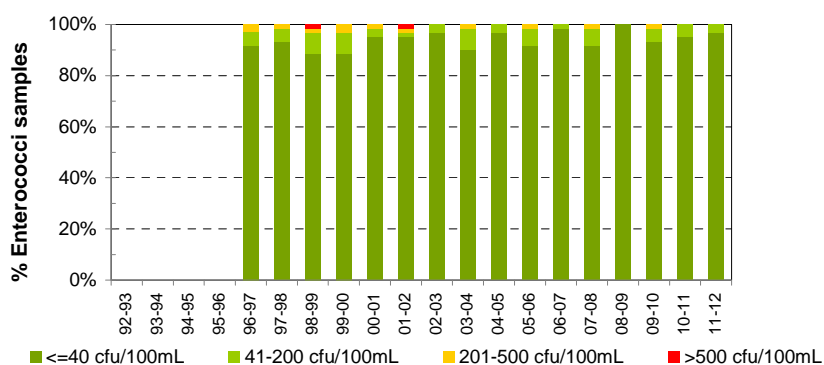


Response to rainfall

Rainfall from Bellambi rain gauge



Trends in enterococci data through time



Bellambi Beach

Beach Suitability Grade: **Good**



See page 21 for key to map

Bellambi Beach is at the southern end of a two kilometre stretch of beach and is backed by a reserve. Beach conditions are relatively safe and lifeguards patrol the beach from September to April.

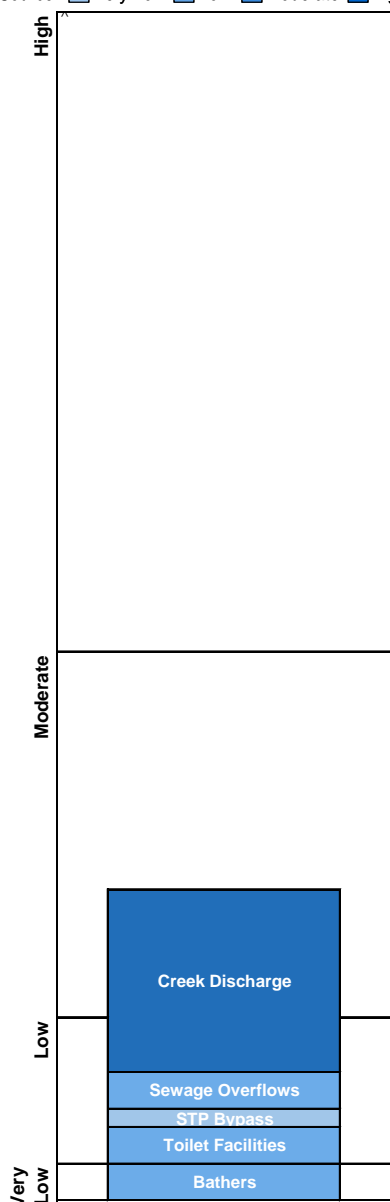
The Beach Suitability Grade of Good indicates that microbial water quality is generally suitable for swimming but the water may be susceptible to pollution from a number of potential sources of faecal contamination, including discharge from Bellambi Creek.

The response to rainfall graph indicates that enterococci levels increased with increasing rainfall, regularly exceeding the safe swimming limit in response to 10 mm of rainfall or more.

The site has been monitored since 1996 and elevated enterococci levels have been recorded in a small percentage of samples in most years.

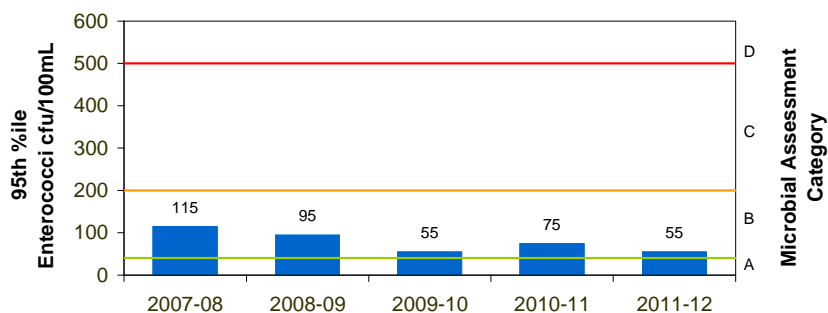
Sanitary Inspection: **Moderate**

Source: Very Low Low Moderate High



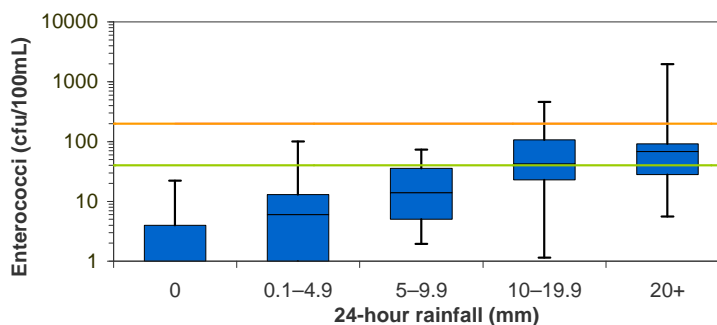
Microbial Assessment: **B**

Monitoring period for 2011–12 result is October 2010 to April 2012.

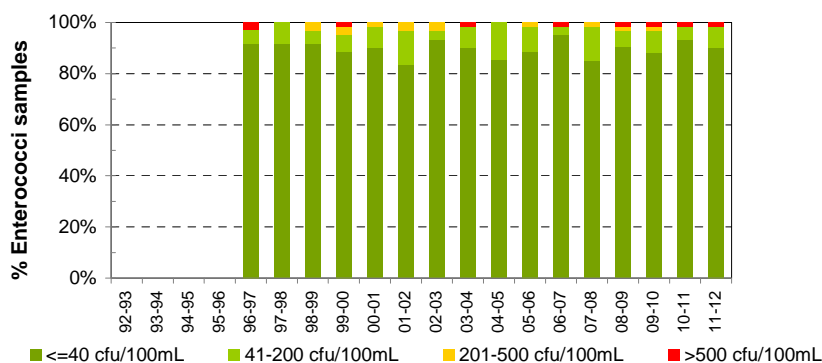


Response to rainfall

Rainfall from Bellambi rain gauge



Trends in enterococci data through time



Corrimal Beach

Beach Suitability Grade: **Good**



See page 21 for key to map

The beach is 1.4 kilometres long and is backed by a reserve and caravan park. Several dominant rips are present and beach conditions are safest at the southern end. Lifeguards patrol the beach from September to April.

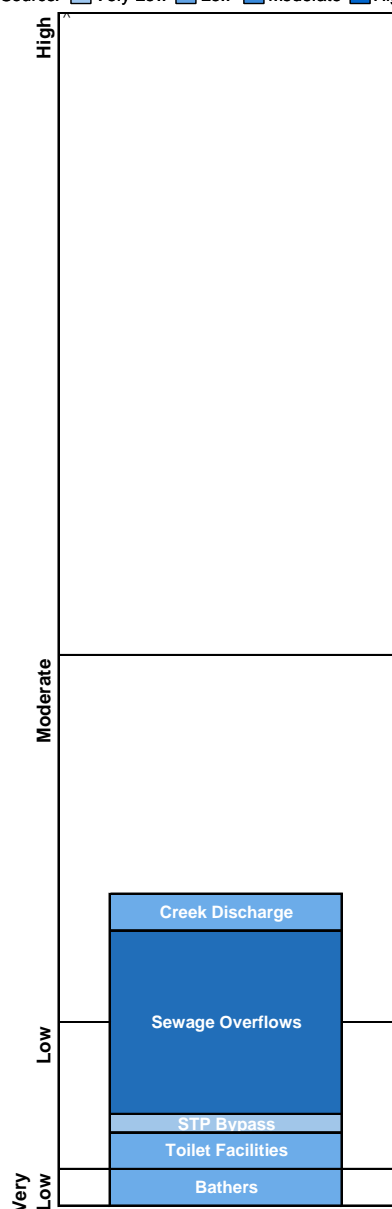
The Beach Suitability Grade of Good indicates that microbial water quality is generally suitable for swimming but the water may be susceptible to pollution from a number of potential sources of faecal contamination.

The response to rainfall graph indicates that enterococci levels increased with increasing rainfall, often exceeding the safe swimming limit in response to 10 mm of rainfall or more.

The site has been monitored since 1996 and elevated enterococci levels have been recorded in a small percentage of samples in most years.

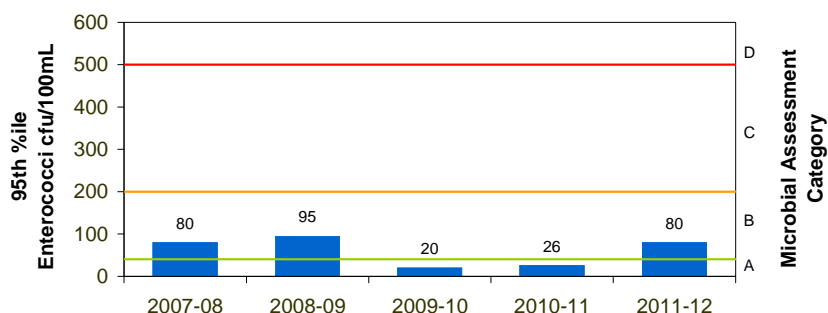
Sanitary Inspection: **Moderate**

Source: Very Low Low Moderate High



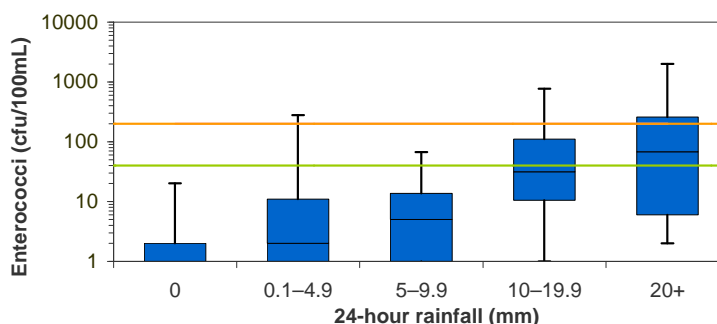
Microbial Assessment: **B**

Monitoring period for 2011–12 result is October 2010 to April 2012.

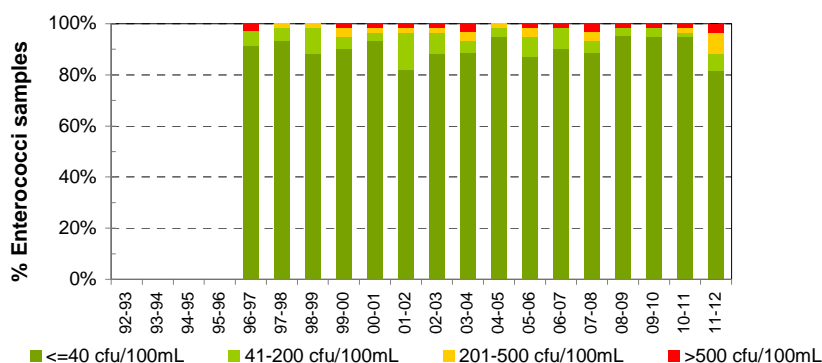


Response to rainfall

Rainfall from Bellambi rain gauge



Trends in enterococci data through time



North Wollongong Beach

Beach Suitability Grade: **Good**



See page 21 for key to map

North Wollongong Beach is 500 metres long and is backed by steep bluffs, a reserve and a picnic area. A number of rock and ocean pools are located at the southern end. Lifeguards patrol the beach all year round.

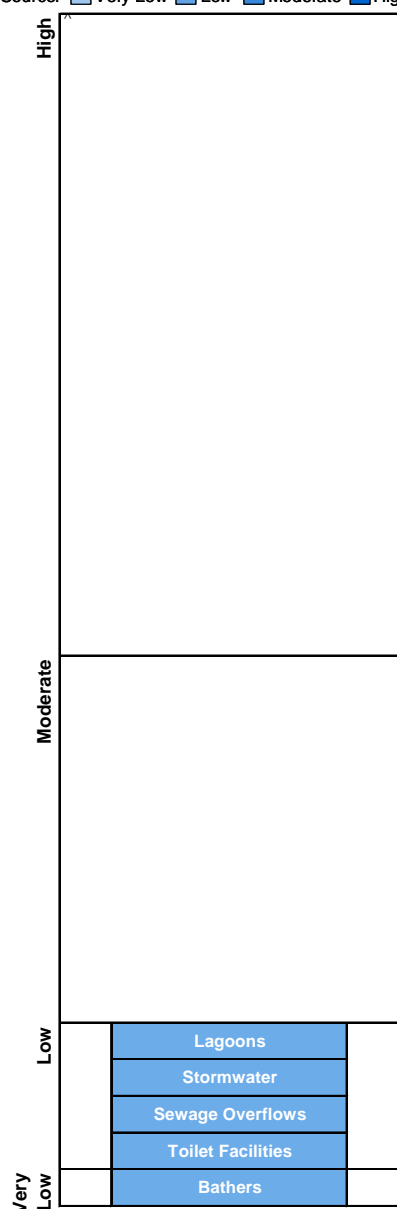
The Beach Suitability Grade of Good indicates that microbial water quality is suitable for swimming for most of the time, but the water may be susceptible to pollution from a number of potential sources of faecal contamination.

The response to rainfall graph indicates that enterococci levels increased slightly with increasing rainfall but rarely exceeded the safe swimming limit.

The site has been monitored since 1996 (excluding 1997), with some variation in enterococci results among years.

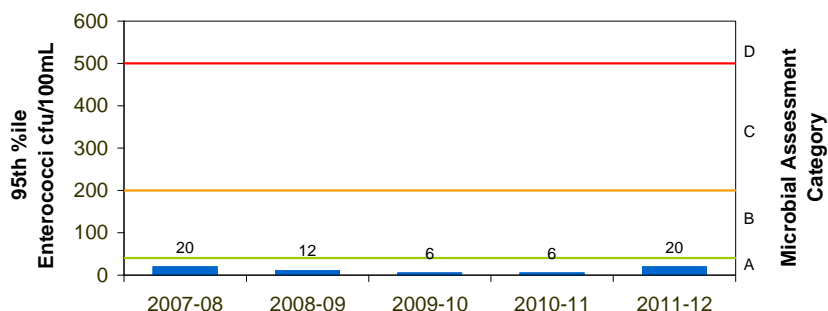
Sanitary Inspection: **Moderate**

Source: Very Low Low Moderate High



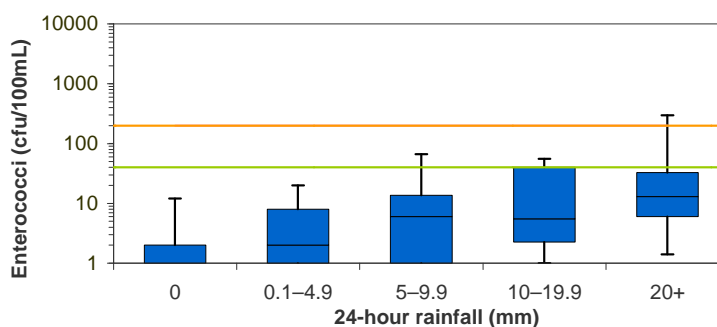
Microbial Assessment: **A**

Monitoring period for 2011–12 result is October 2010 to April 2012.

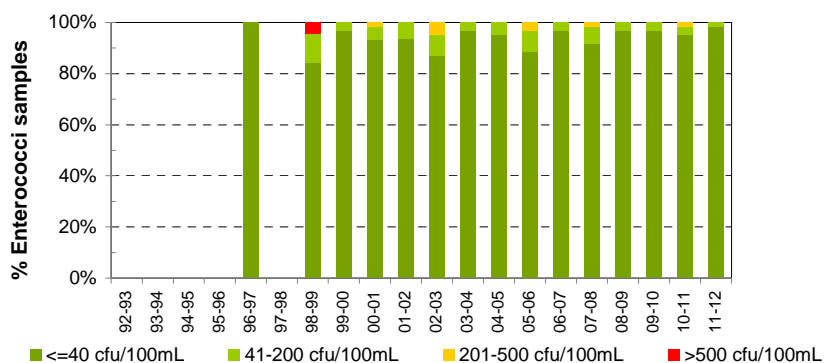


Response to rainfall

Rainfall from Wollongong WWTP rain gauge



Trends in enterococci data through time



Wollongong City Beach

Beach Suitability Grade: **Very Good**



See page 21 for key to map

Wollongong City Beach is located at the northern end of a four kilometre stretch of beach. Beach conditions are safest at the patrolled northern end. Elsewhere, swimming is potentially hazardous because of the prevalence of rips. Lifeguards patrol the beach from September to April.

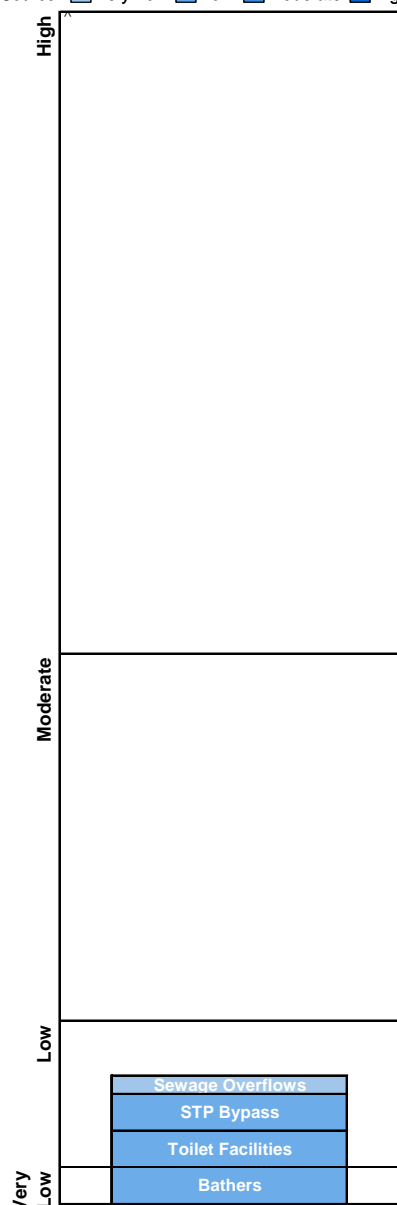
The Beach Suitability Grade of Very Good indicates that microbial water quality is considered suitable for swimming almost all of the time, with very few potential sources of faecal contamination.

The response to rainfall graph indicates that enterococci levels increased slightly with increasing rainfall but rarely exceeded the safe swimming limit.

The site has been monitored since 1996, with small variations in results among years due to rainfall.

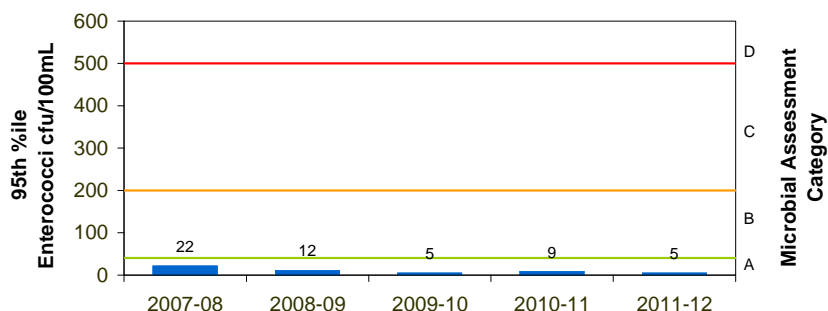
Sanitary Inspection: **Low**

Source: ■ Very Low ■ Low ■ Moderate ■ High



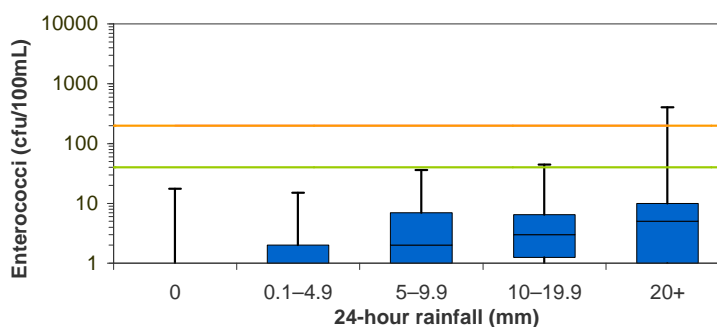
Microbial Assessment: **A**

Monitoring period for 2011–12 result is October 2010 to April 2012.

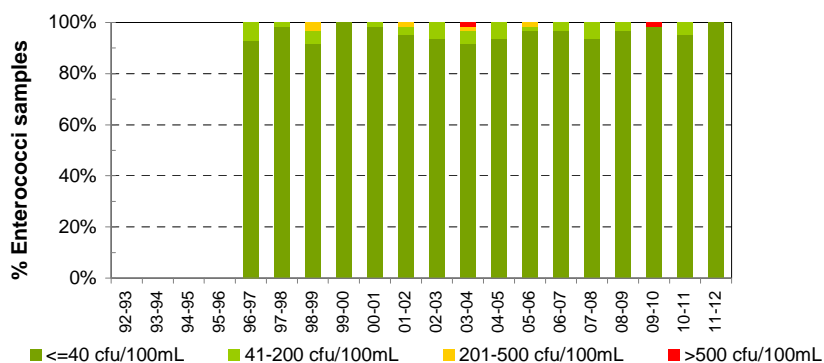


Response to rainfall

Rainfall from Wollongong WWTP rain gauge



Trends in enterococci data through time



Coniston Beach

Beach Suitability Grade: **Very Good**



See page 21 for key to map

Coniston Beach is at the southern end of a four kilometre stretch of beach that extends north to Flagstaff Point. It is a steep, narrow beach and is backed by a golf course. Coniston Beach has a mobile lifeguard patrol during daylight-saving months.

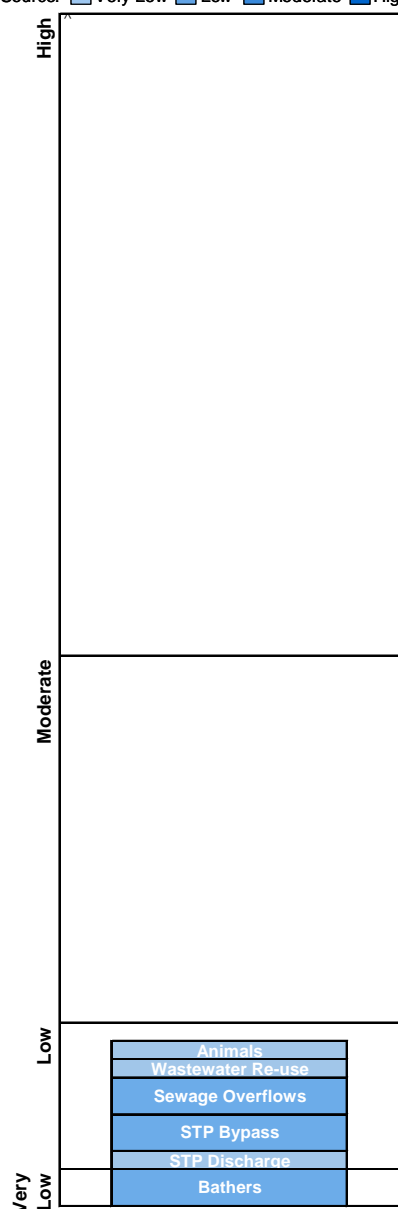
The Beach Suitability Grade of Very Good indicates that microbial water quality is considered suitable for swimming almost all of the time, with few potential sources of significant faecal contamination.

The response to rainfall graph indicates that enterococci levels increased slightly with increasing rainfall but rarely exceeded the safe swimming limit.

The site has been monitored since 1996, with small variations in results among years due to rainfall.

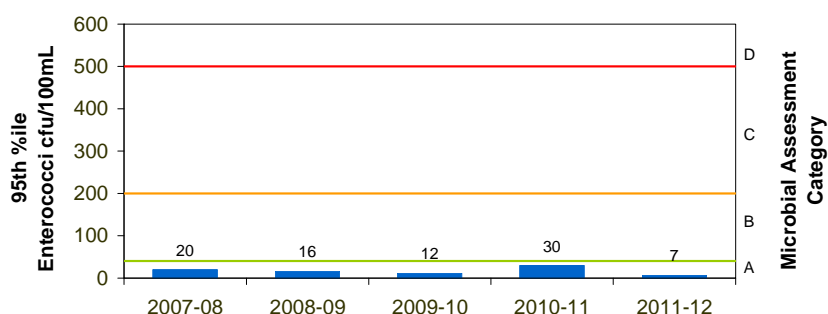
Sanitary Inspection: **Low**

Source: Very Low Low Moderate High



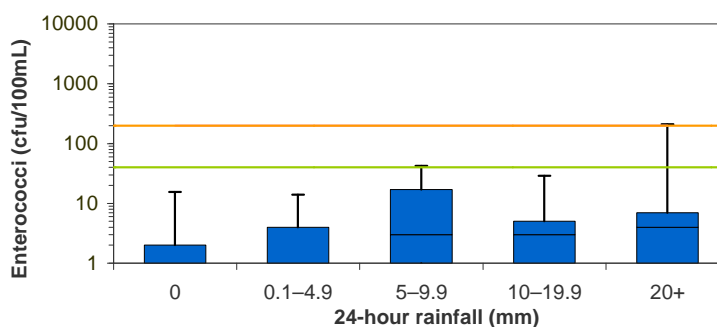
Microbial Assessment: **A**

Monitoring period for 2011–12 result is October 2010 to April 2012.

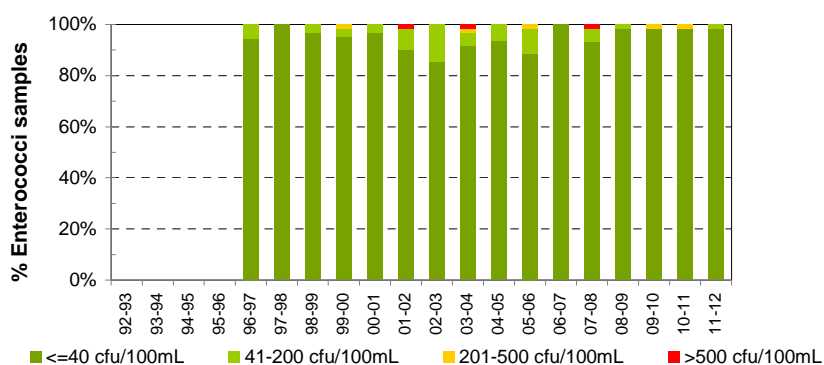


Response to rainfall

Rainfall from Wollongong WWTP rain gauge



Trends in enterococci data through time



Fishermans Beach

Beach Suitability Grade: **Very Good**



See page 21 for key to map

Fishermans Beach is 500 metres long and has a low headland at each end. It is backed by a small reserve and residential land. Beach conditions are safe most of the time, but it is not patrolled by lifeguards.

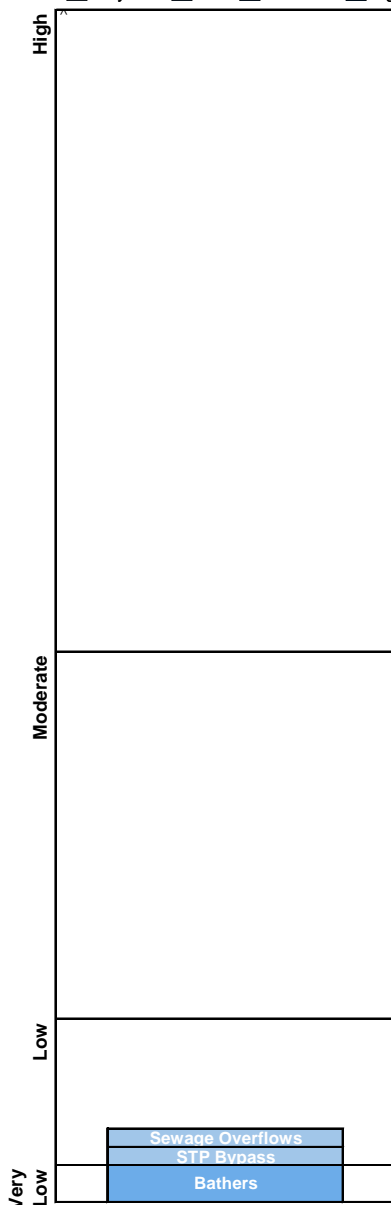
The Beach Suitability Grade of Very Good indicates that the water quality is considered suitable for swimming almost all of the time, with few potential sources of faecal contamination.

The response to rainfall graph indicates that enterococci levels increased slightly in response to 20 mm of rainfall or more, but mostly remained below the safe swimming limit.

The site has been monitored since 1996. Water quality has improved since 2004, when dry weather discharges from the Port Kembla WWTP ceased. Wet weather discharges still occur following large storm events.

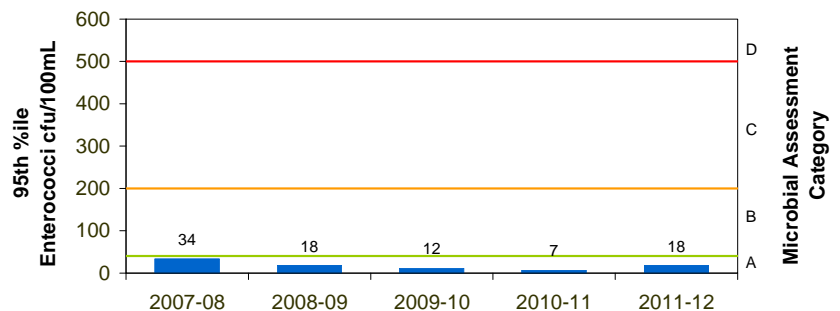
Sanitary Inspection: **Low**

Source: ■ Very Low ■ Low ■ Moderate ■ High



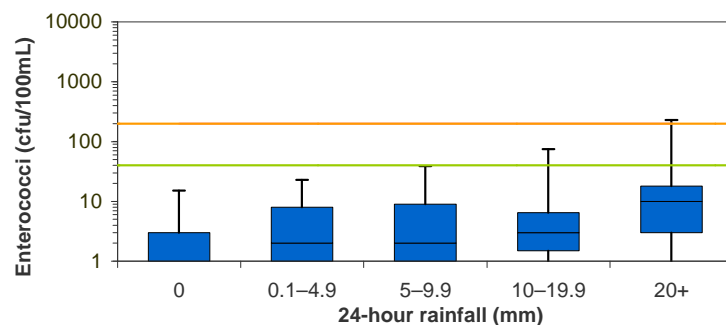
Microbial Assessment: **A**

Monitoring period for 2011–12 result is October 2010 to April 2012.

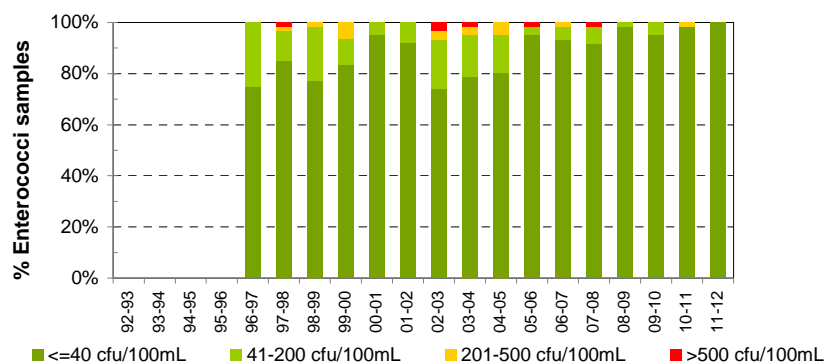


Response to rainfall

Rainfall from Wollongong WWTP rain gauge



Trends in enterococci data through time



Port Kembla Beach

Beach Suitability Grade: **Good**



See page 21 for key to map

Port Kembla Beach is backed by sand dunes and a reserve. Beach conditions are safest in the patrolled area at the northern end of the beach. Lifeguards patrol the beach from September to April.

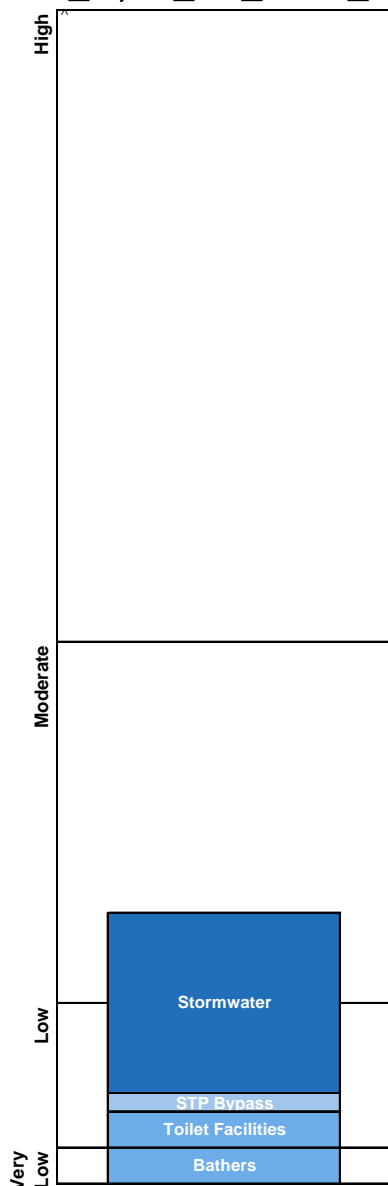
The Beach Suitability Grade of Good indicates that microbial water quality is generally suitable for swimming but the water may be susceptible to pollution from several potential sources of faecal contamination.

The response to rainfall graph indicates that enterococci levels increased slightly with increasing rainfall, often exceeding the safe swimming limit after 20 mm of rainfall or more.

The site has been monitored since 1996, with variation in results due to rainfall.

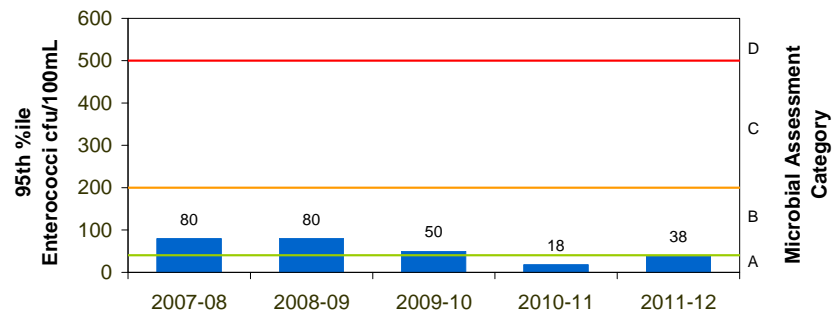
Sanitary Inspection: **Moderate**

Source: ■ Very Low ■ Low ■ Moderate ■ High



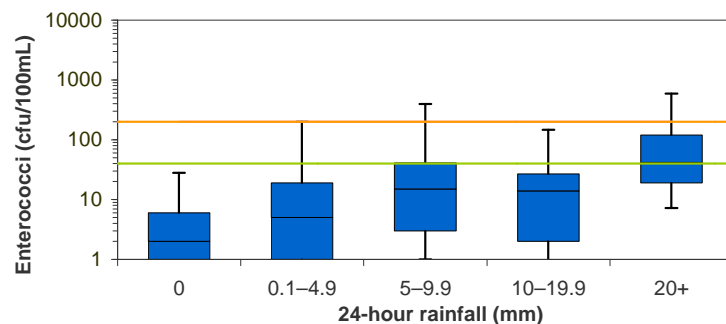
Microbial Assessment: **A**

Monitoring period for 2011–12 result is October 2010 to April 2012.

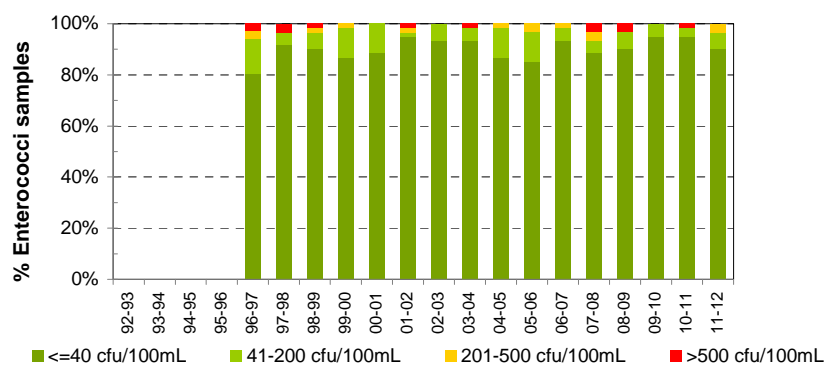


Response to rainfall

Rainfall from Wollongong WWTP rain gauge



Trends in enterococci data through time



Shellharbour City Council



Figure 31: Sampling locations and Beach Suitability Grades in the Shellharbour City Council area

Overview of the area

Description

Shellharbour City Council is located 100 kilometres south of Sydney and covers an area of 147 square kilometres. The local government area extends from the entrance to Lake Illawarra in the north to Macquarie Rivulet in the south and had an estimated local resident population of approximately 63,605 at the 2011 Census (ABS 2012).

The Shellharbour City Council beaches stretch along 21 kilometres of coastline. Land use in the beach catchments is diverse and includes residential, rural, commercial, parks/reserves, industrial and bushland.

The local government area contains the Bushrangers Bay Aquatic Reserve, located at the eastern end of Bass Point. The reserve covers the entire bay, including the shoreline and intertidal zones.

Rainfall

There were several significant rain and flooding events in the Illawarra region during 2011–2012 (BOM 2012):

- Particularly heavy rainfall in mid October saw parts of the region receiving 126 mm of rainfall in one day.
- In November, heavy rainfall and thunderstorms resulted in localised flash flooding in Shellharbour.
- High levels of rainfall along the east coast in February included a daily total of 98 mm which resulted in flash flooding in parts of the region.
- High levels of rainfall continued in March, with particularly heavy rainfall in the beginning of the month when 88 mm of rain fell in one day.

Assessment

Microbial water quality

NHMRC recommends that at least 20 samples are collected each year, providing 100 data points over a five year period. The sampling frequency in the Shellharbour City Council area is higher than this minimum, with 60 samples collected each year by Sydney Water Corporation at all three locations.

The Microbial Assessment Category for 2011–2012 was calculated from the most recent 100 data points

up until the end of the 2011–2012 swimming season (September 2010 until April 2012).

Sanitary inspections

Sanitary inspections have been completed for all monitored swimming locations in the Shellharbour City Council area. These are scheduled for review during 2012–2013.

Beach Suitability Grades

Two of the three swimming locations monitored in the Shellharbour City Council area were graded as Very Good during 2011–2012 (Figure 31).

Very Good

Two swimming locations were graded as Very Good: Shellharbour Beach and Warilla Beach.

These sites had very good water quality during the assessment period (Microbial Assessment Category A) and few potential sources of microbial contamination.

Good

No Shellharbour City Council beaches were classified as Good.

Fair

No Shellharbour City Council beaches were classified as Fair.

Poor

Entrance Lagoon Beach was graded as Poor. Microbial water quality was generally suitable for swimming during dry weather conditions, with elevated enterococci levels recorded following rainfall. This site may be susceptible to faecal contamination from a number of sources, including outflow from Lake Illawarra, and stormwater. It is recommended that swimming at this location be avoided during and up to three days following rainfall or if there are signs of stormwater such as discoloured water or odour or floating debris.

Extreme wet weather events and flooding during 2011–2012 impacted many lagoon swimming locations in NSW. Poor water quality associated with these events resulted in several sites being downgraded from the previous year. At Entrance Lagoon Beach, more than half of the samples collected during the 2011–2012 swimming season were associated with rainfall in the preceding 96 hours. It is anticipated that an improvement in water quality will occur on return to average rainfall conditions.

The Lake Illawarra Authority has erected signage at Entrance Lagoon Beach advising that swimming should be avoided for up to three days after heavy rainfall.

Very Poor

No beaches were classified as Very Poor.

Management

Wastewater management

Sydney Water manages the public sewer in the area, including the Shellharbour Wastewater Treatment Plant (WWTP) (EPA NSW 2012).

Shellharbour WWTP services an estimated population of 60,000 and discharges approximately 16 million litres of secondary-treated and disinfected effluent each day from a shoreline outfall at Barrack Point. The WWTP was amplified in 2006 to meet the demands of population growth in the Albion Park and Shellharbour areas up to 2025. These works included construction of additional grit and primary tanks, improvements to treatment processes and modifications to the outfall to improve effluent dispersion.

In addition to the reticulated sewerage system, there are 356 on-site sewage management systems in the LGA, most of which are located on rural-residential developments (Shellharbour City Council 2009). Shellharbour City Council inspects the systems to ensure they are operating correctly and to identify risks to human health or the environment.

Sydney Water undertakes dry weather monitoring of main stormwater drains in the area to identify sewer leaks. Leaks from the public sewer are repaired by Sydney Water and leaks from the private sewer are referred to the local council.

Stormwater management

Shellharbour City Council's stormwater management is guided by catchment specific stormwater management strategies for both the

Elliott Lake and southern Lake Illawarra catchments. The stormwater strategies incorporate review findings of the effectiveness of existing stormwater treatment measures. They also provide a strategic approach to implementation of future prioritised management initiatives to improve water quality and entrance stability. Since the development of the catchment-specific strategies, a number of stormwater improvement initiatives have been implemented including the installation of stormwater quality improvement devices in the Shellharbour Village foreshore catchment, the Oakey Creek catchment, Lake Illawarra and the Tongarra Creek catchment, Elliott Lake. A bioretention systems feasibility assessment has recently been completed for select Lake Illawarra catchments, which identifies areas suitable for future stormwater improvements.

Water quality monitoring is undertaken by Council at priority locations across the LGA. Monitoring locations include Macquarie Rivulet, the entrance to Elliott Lake and its tributaries, several streams draining to Lake Illawarra and a number of artificial water bodies. The information collected is used to assess catchment land-use change, performance benchmarks and provide baseline data and insight into physical, chemical and biological processes. The primary objective of stormwater quality monitoring is to assess the quality of water discharging through the stormwater network to receiving waters and the effectiveness of stormwater quality treatment.

Water quality actions identified in the Elliott Lake Estuary Management Plan aimed at assisting with improving water quality and overall catchment health, remain high priority. Riparian restoration works continue to be completed along Tongarra Creek, Elliott Lake and Oakey Creek, Lake Illawarra.

Lifeguard service

Shellharbour City Council provides a lifeguard service at six beaches and at the Shellharbour Rockpool.

Entrance Lagoon Beach

Beach Suitability Grade: **Poor**



See page 21 for key to map

This swimming site is located on the southern shore of the entrance to Lake Illawarra and is partly enclosed by a rock breakwater that allows for tidal flushing. It is backed by a large reserve with toilet facilities, a playground and a cycleway.

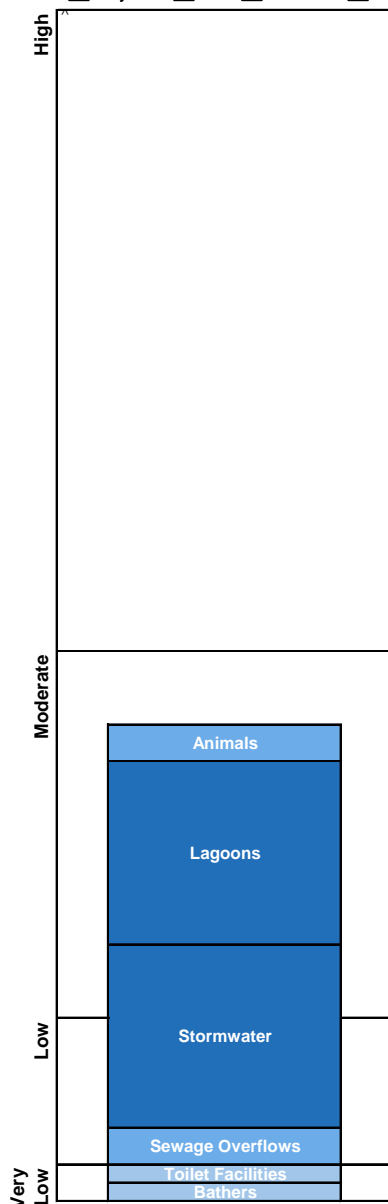
The Beach Suitability Grade of Poor indicates that microbial water quality is susceptible to pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources including outflow from Lake Illawarra, stormwater and birds.

The response to rainfall graph indicates that enterococci levels increased with increasing rainfall, occasionally exceeding the safe swimming limit in most rainfall categories, and regularly after 20 mm of rain or more.

The site has been monitored since 2007.

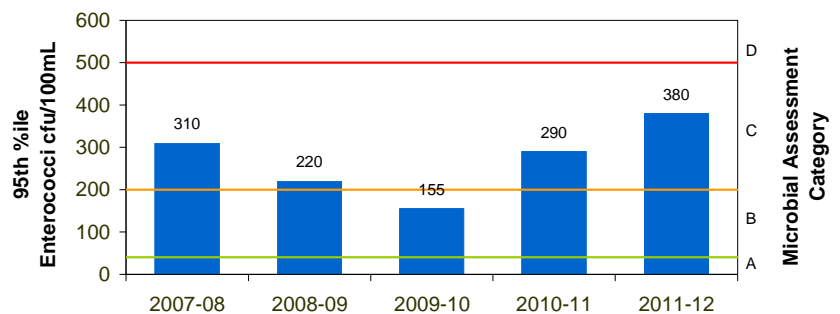
Sanitary Inspection: **Moderate**

Source: ■ Very Low ■ Low ■ Moderate ■ High



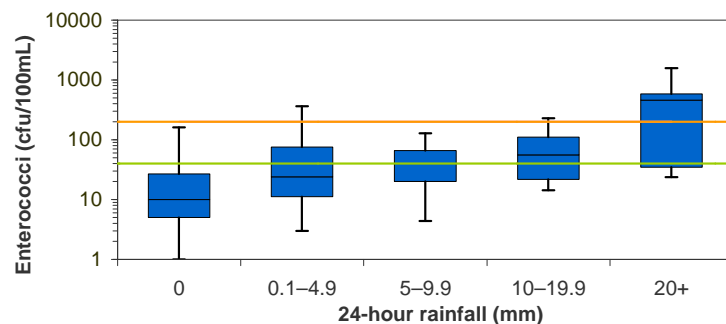
Microbial Assessment: **C**

Monitoring period for 2011–12 result is October 2010 to April 2012.

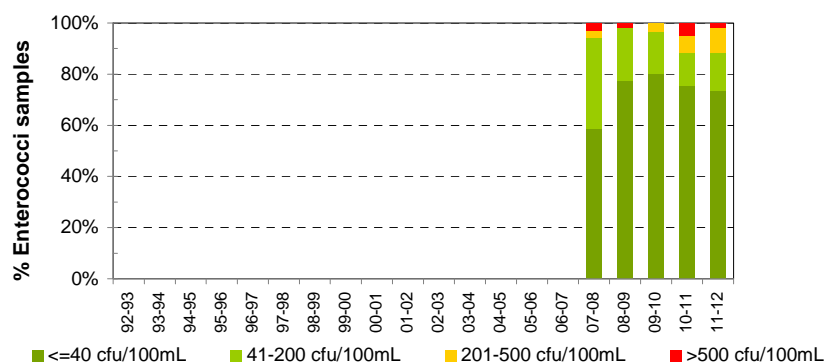


Response to rainfall

Rainfall from Wollongong WWTP rain gauge



Trends in enterococci data through time



Warilla Beach

Beach Suitability Grade: **Very Good**



See page 21 for key to map

The beach is backed by a reserve and residential land. Beach conditions are potentially hazardous, with rips dominating the surf. Lifeguards patrol the beach from October to April.

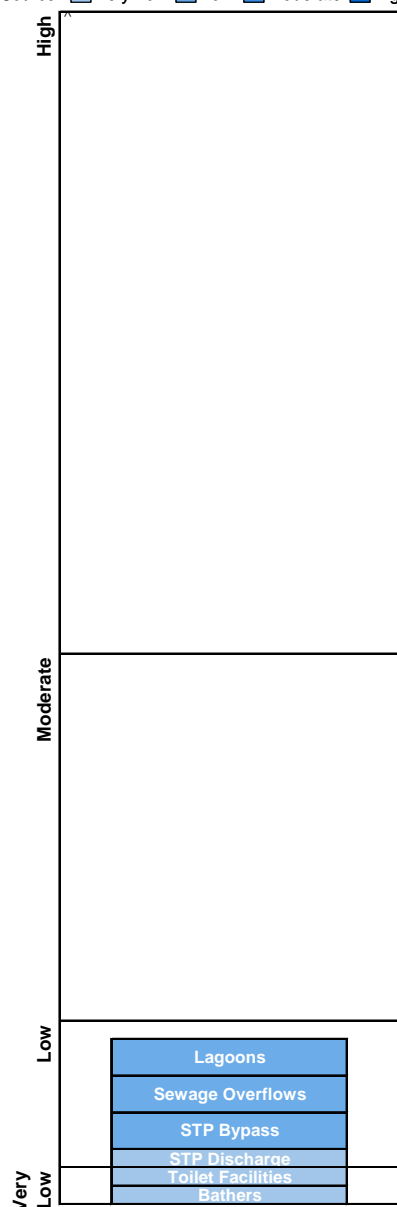
The Beach Suitability Grade of Very Good indicates that microbial water quality is considered suitable for swimming most of the time, with few potential sources of significant faecal contamination.

The response to rainfall graph indicates that enterococci levels increased slightly with increasing rainfall, often exceeding the safe swimming limit in response to 20 mm of rainfall or more.

The site has been monitored since 1996. Water quality has been of high standard throughout this period, with some minor variation the result of variations in rainfall patterns.

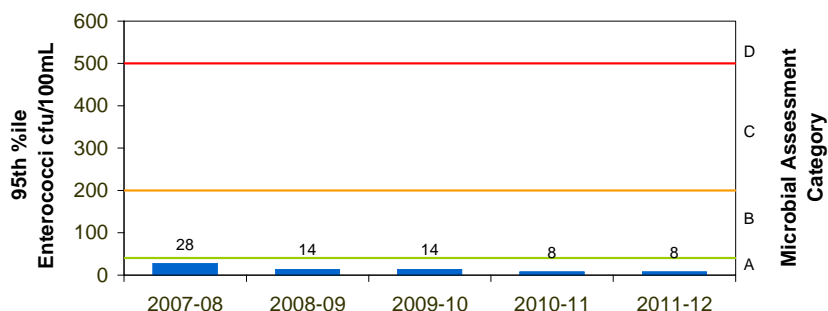
Sanitary Inspection: **Low**

Source: Very Low Low Moderate High



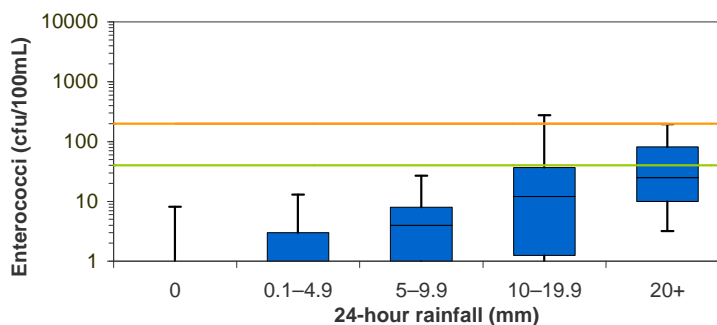
Microbial Assessment: **A**

Monitoring period for 2011–12 result is October 2010 to April 2012.

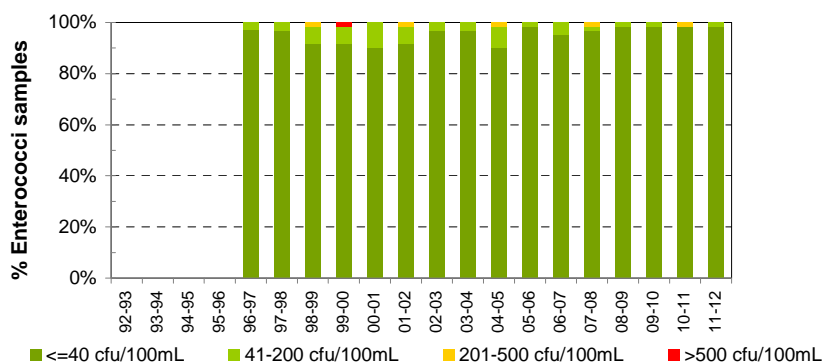


Response to rainfall

Rainfall from Wollongong WWTP rain gauge



Trends in enterococci data through time



Shellharbour Beach

Beach Suitability Grade: **Very Good**



See page 21 for key to map

Shellharbour Beach is backed by a reserve, with conditions safest in the patrolled area at the southern end, as permanent rips run out along the rocks at either end of the beach during moderate to high wave action. Lifeguards patrol the beach from October to April.

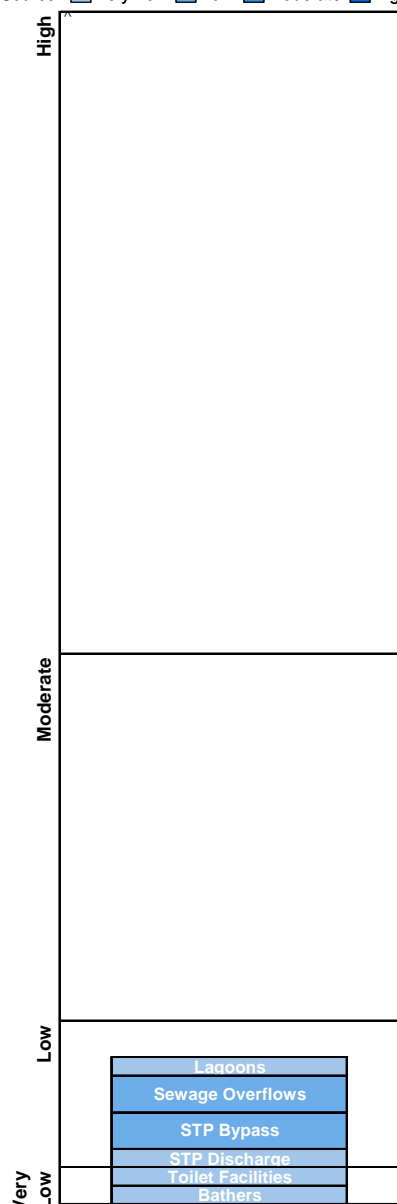
The Beach Suitability Grade of Very Good indicates that microbial water quality is considered suitable for swimming for most of the time, with few potential sources of significant faecal contamination.

The response to rainfall graph indicates that 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 1996. Water quality has been of high standard throughout this period.

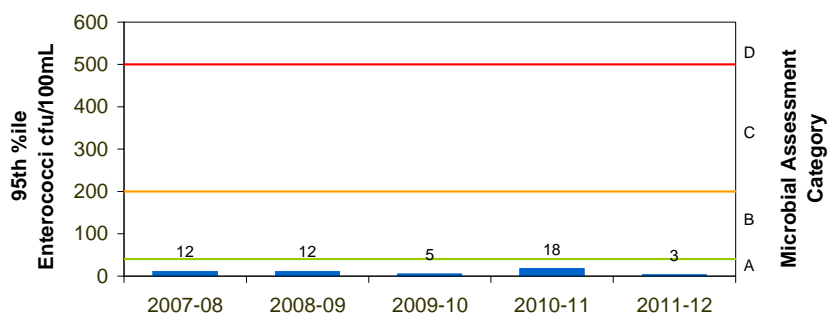
Sanitary Inspection: **Low**

Source: ■ Very Low ■ Low ■ Moderate ■ High



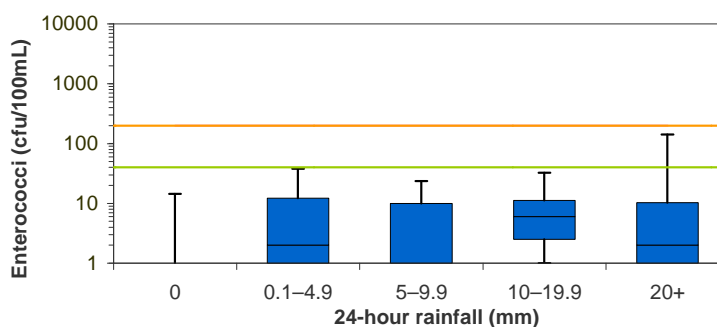
Microbial Assessment: **A**

Monitoring period for 2011–12 result is October 2010 to April 2012.

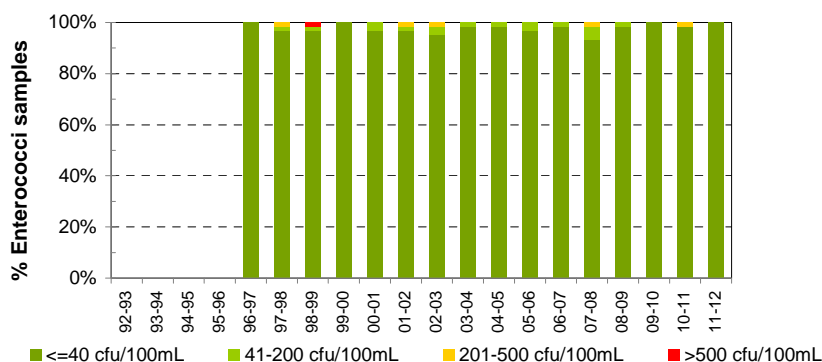


Response to rainfall

Rainfall from Wollongong WWTP rain gauge



Trends in enterococci data through time



Kiama Municipal Council

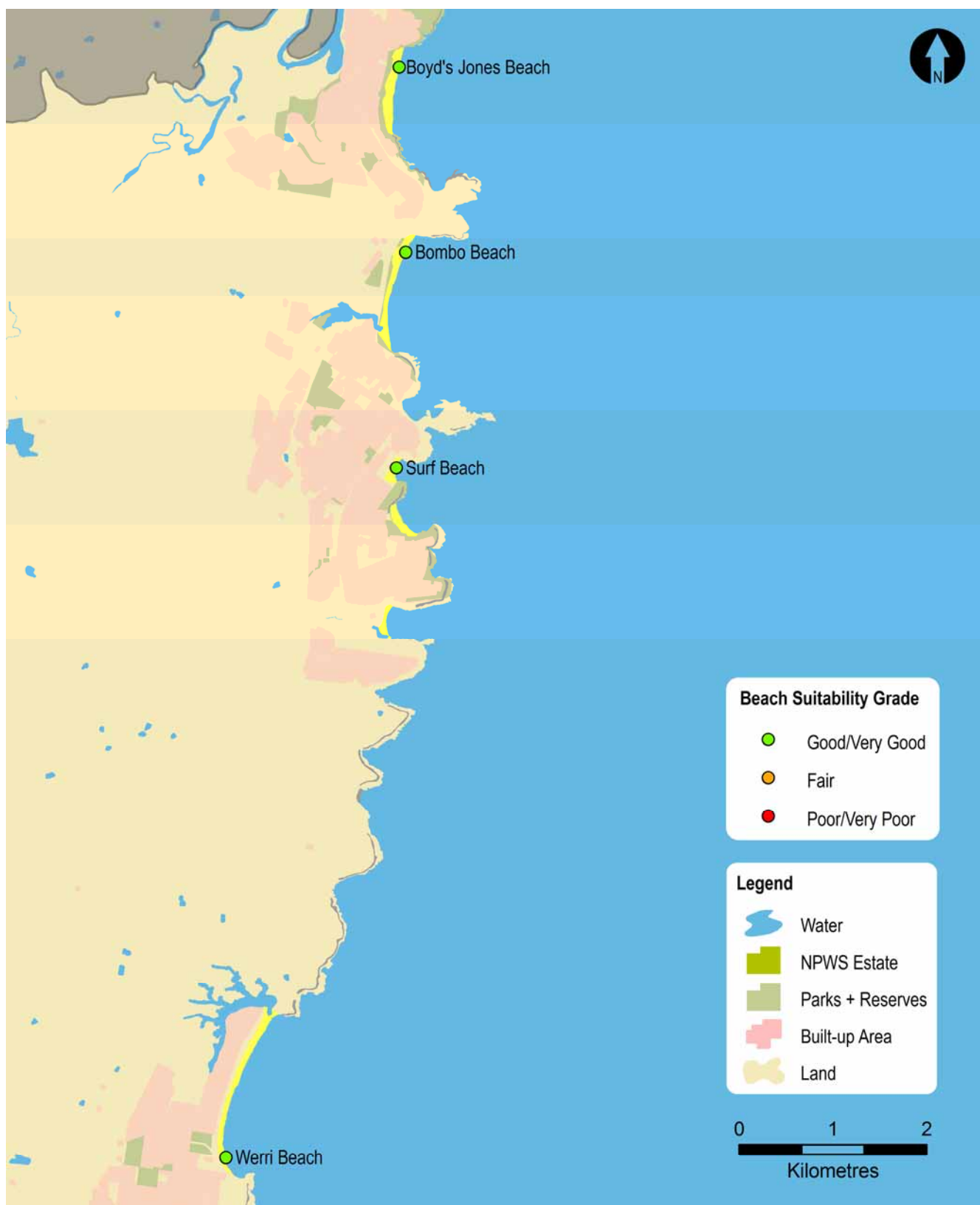


Figure 32: Sampling locations and Beach Suitability Grades in Kiama Municipal Council area

Overview of the area

Description

Kiama Municipal Council extends from the Minnamurra River in the north to Gerroa in the south, covering an area of 258 square kilometres. The local government area had an estimated local resident population of 19,986 at the 2011 Census (ABS 2012) and attracts a large number of tourists each year.

Kiama Municipality's beaches lie along a 20 kilometre stretch of coastline. Land use in the beach catchments includes residential, industrial and rural, with small remnants of bushland.

Rainfall

There were several significant rain and flooding events in the Illawarra region during 2011–2012 (BOM 2012):

- Particularly heavy rainfall in mid October saw parts of the region receiving 126 mm of rainfall in one day.
- In November, heavy rainfall and thunderstorms resulted in flash flooding in parts of the region. During this event Kiama received 45 mm of rainfall in one day, which is the highest daily rainfall ever recorded in October in the town.
- High levels of rainfall along the east coast in February included daily totals of almost 50 mm of rainfall at Bombo on two days.
- High levels of rainfall continued in March, with particularly heavy rainfall at Kiama in the beginning of the month when 79 mm of rain fell in one day.

Assessment

Microbial water quality

NHMRC recommends that at least 20 samples are collected each year, providing 100 data points over a five year period. The sampling frequency in the Kiama Municipal Council area is higher than this minimum, with 60 samples collected each year at the three locations monitored under Environment Protection Licences (Boyd's Jones Beach, Bombo Beach and Werri Beach).

Surf Beach Kiama is monitored by Sydney Water Corporation as a community service during the swimming season (October to April), with 35 samples collected at this site each year.

The Microbial Assessment Category for 2011–2012 was calculated from the most recent 100 data points up until the end of the 2011–2012 swimming season: September 2010 until April 2012 at three sites, and slightly longer (November 2009 until April 2012) at Surf Beach Kiama.

Sanitary inspections

Sanitary inspections have been completed for all monitored swimming locations in the Kiama Municipal Council area. These are scheduled for review during 2012–2013.

Beach Suitability Grades

All four ocean beaches monitored in the Kiama Municipal Council area were graded as Good or Very Good during 2011–2012 (Figure 32).

Very Good

Two ocean beaches were graded as Very Good: Boyd's Jones Beach and Werri Beach.

These sites had excellent water quality during the assessment period (Microbial Assessment Category A) and few potential sources of microbial contamination (Sanitary Inspection Categories of Low).

Good

Two ocean beaches were graded as Good: Bombo Beach and Surf Beach Kiama.

These sites had excellent water quality during the 2011–2012 assessment period (Microbial Assessment Category A or B), but Bombo Beach had several potential sources of microbial contamination, and Surf Beach had a significant potential source of contamination from stormwater.

Fair

No beaches were graded as Fair.

Poor

No beaches were graded as Poor.

Very Poor

No beaches were graded as Very Poor.

Management

Wastewater management

Sydney Water manages the public sewer in the area, including the Bombo Wastewater Treatment Plant (WWTP) (EPA NSW 2012).

Bombo WWTP services an estimated population of 13,000 and discharges approximately 3.64 million litres of secondary-treated, denitrified and disinfected effluent each day from a shoreline outfall on the northern headland of Bombo Beach.

The Gerringong–Gerroa Sewage Treatment Plant is operated by Veolia Water under a 20-year design, build and operate contract with Sydney Water Corporation. The plant treats effluent to a high standard, with on-site re-use for agricultural irrigation. Excess effluent is discharged to sand dune systems and (if these reach capacity) to the Crooked River at the northern end of Seven Mile Beach.

Sydney Water has extended sewerage services to Jamberoo under its Priority Sewerage Scheme. Works included construction of the reticulation system, storage tanks, a pumping station and an eight kilometre transfer pipe to Bombo WWTP. Approximately 98 per cent of eligible properties have connected to the scheme (Kiama Municipal Council 2009).

In addition to the reticulated sewerage system, there are 857 on-site sewage management systems in the LGA. Kiama Municipal Council has implemented an inspection program to ensure that these are operating correctly and to identify risks to human health or the environment.

Sydney Water undertakes dry weather monitoring of main stormwater drains in the area to identify and fix sewer leaks. Leaks from the public sewer are

repaired by Sydney Water and leaks from the private sewer are referred to councils.

Stormwater management

Kiama Municipal Council has developed a stormwater management plan to mitigate the impacts of stormwater from existing and future development in the LGA. It has also developed an entrance management policy for Werri Lagoon.

Council is also working on a range of initiatives in the Minnamurra River estuary, including bank stabilisation work as part of the NSW Estuary Program and a stormwater pollution and riparian management project under a grant from the Southern Rivers Catchment Management Authority. Works have included the installation of gross pollutant traps in stormwater drains, fencing to protect mangroves, stormwater education in schools and educational signage.

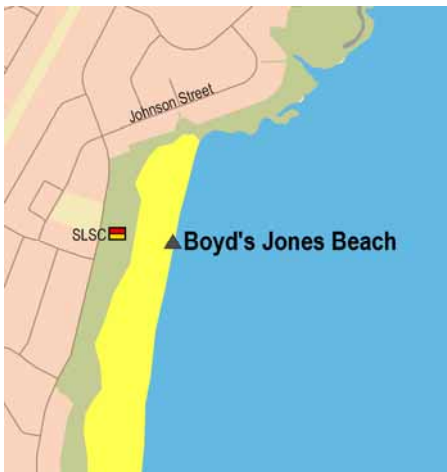
A Catchment Caretakers grant has enabled the council to install 31 stormwater filtration units in the Surf Beach catchment and around Jamberoo. A continuous deflective separation unit has also been installed in the Surf Beach catchment to prevent gross pollutants, sediments, oil and grease from reaching Surf Beach. The grant has also been used for a range of educational initiatives.

Lifeguard service

Kiama Municipal Council provides a professional lifeguard service at seven beaches in the LGA.

Boyd's Jones Beach

Beach Suitability Grade: **Very Good**



See page 21 for key to map

Boyd's Jones Beach is one kilometre long and backed by dunes and a reserve. Permanent rips occur against each headland. Lifeguards patrol the beach from October to April.

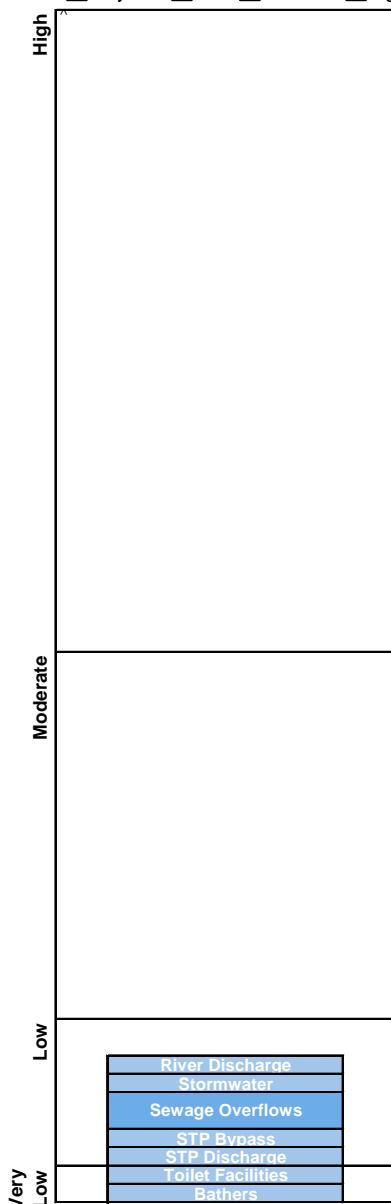
The Beach Suitability Grade of Very Good indicates that microbial water quality is considered suitable for swimming almost all of the time, with few significant sources of faecal contamination.

The response to rainfall graph indicates that enterococci increased slightly with increasing rainfall but generally remained below the safe swimming limit across all rainfall categories.

The site has been monitored since 1996 and microbial water quality has generally been of a high standard.

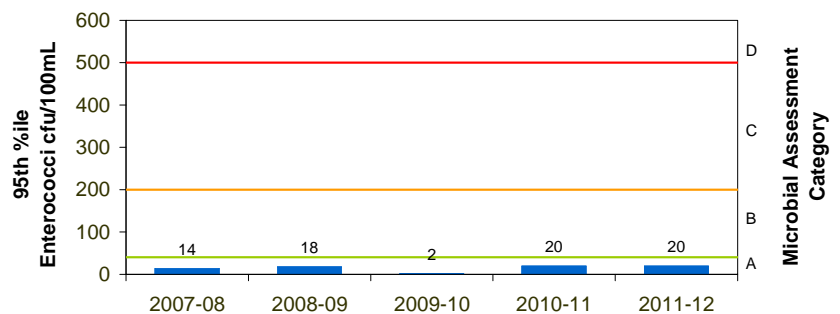
Sanitary Inspection: **Low**

Source: ■ Very Low ■ Low ■ Moderate ■ High



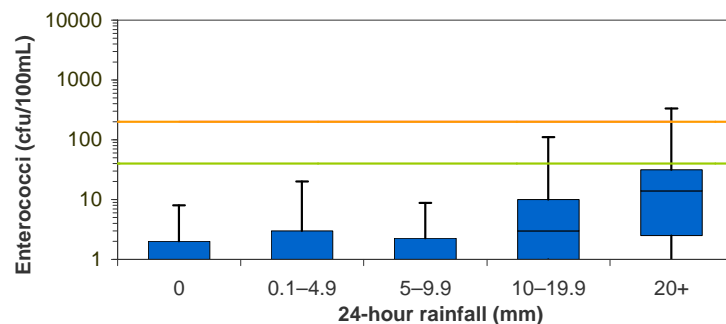
Microbial Assessment: **A**

Monitoring period for 2011–12 result is October 2010 to April 2012.

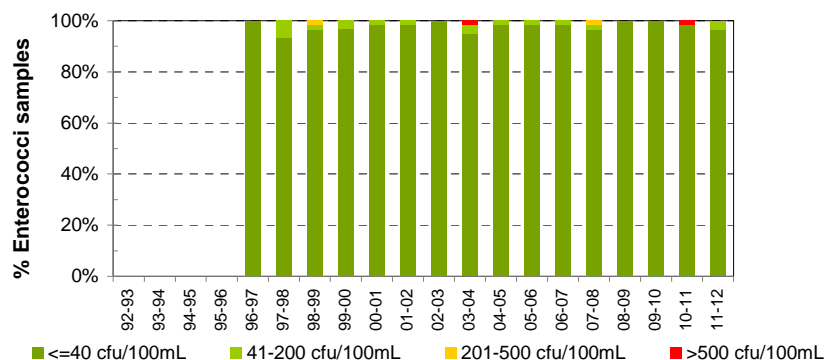


Response to rainfall

Rainfall from Bombo WWTP rain gauge



Trends in enterococci data through time



Bombo Beach

Beach Suitability Grade: **Good**



See page 21 for key to map

Bombo Beach is backed by a narrow reserve. There can be persistent rips along the length of the beach, making swimming dangerous for the inexperienced. Lifeguards patrol the beach for six weeks over the summer school holidays.

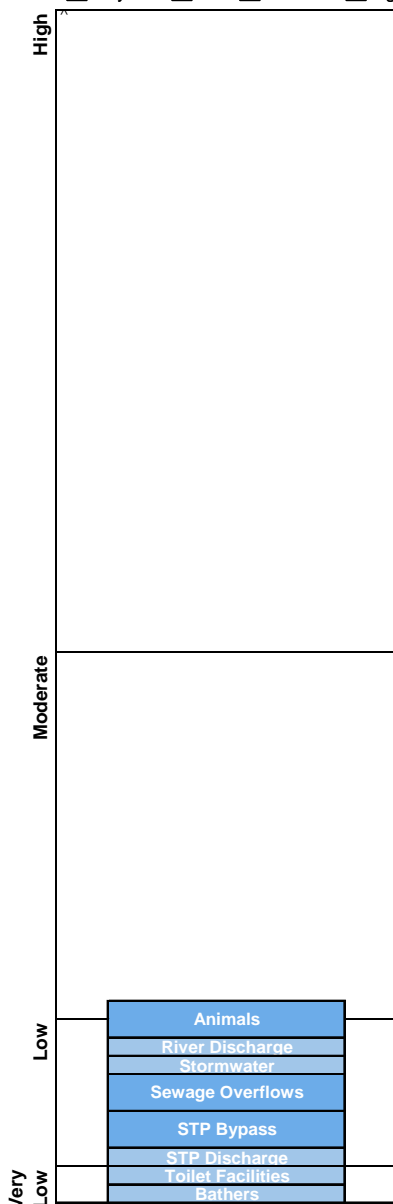
The Beach Suitability Grade of Good indicates that microbial water quality is suitable for swimming most of the time but the water may be susceptible to pollution from several potential sources of faecal contamination.

The response to rainfall graph indicates that enterococci levels increased slightly with increasing rainfall, often exceeding the safe swimming limit in response to 20 mm of rainfall or more.

The site has been monitored since 1996. Water quality has generally remained constant, with variation among years due to rainfall.

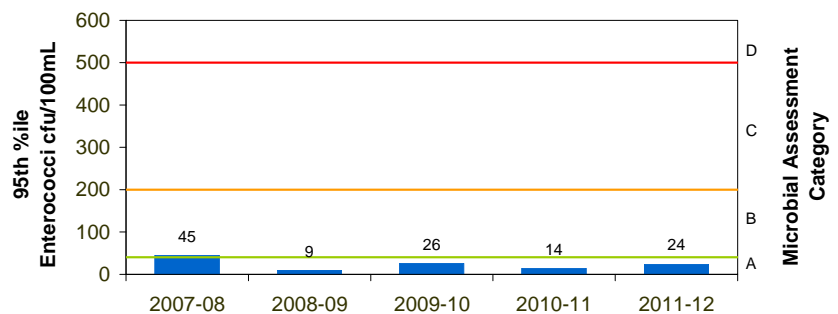
Sanitary Inspection: **Moderate**

Source: ■ Very Low ■ Low ■ Moderate ■ High



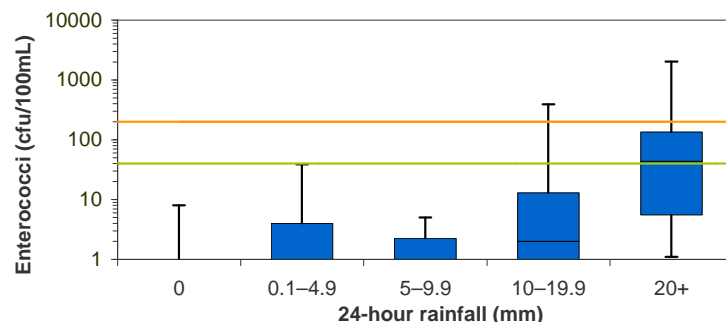
Microbial Assessment: **A**

Monitoring period for 2011–12 result is October 2010 to April 2012.

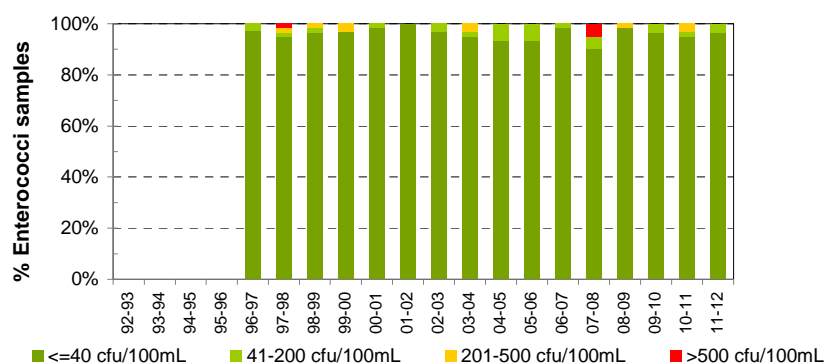


Response to rainfall

Rainfall from Bombo WWTP rain gauge



Trends in enterococci data through time



Surf Beach Kiama

Beach Suitability Grade: **Good**



See page 21 for key to map

Surf Beach in Kiama is 250 metres long and backed by a park and surf club. Swimming is potentially dangerous during periods of large swell. There are permanent rips along the rocks at either end. Lifeguards patrol the beach from October to April.

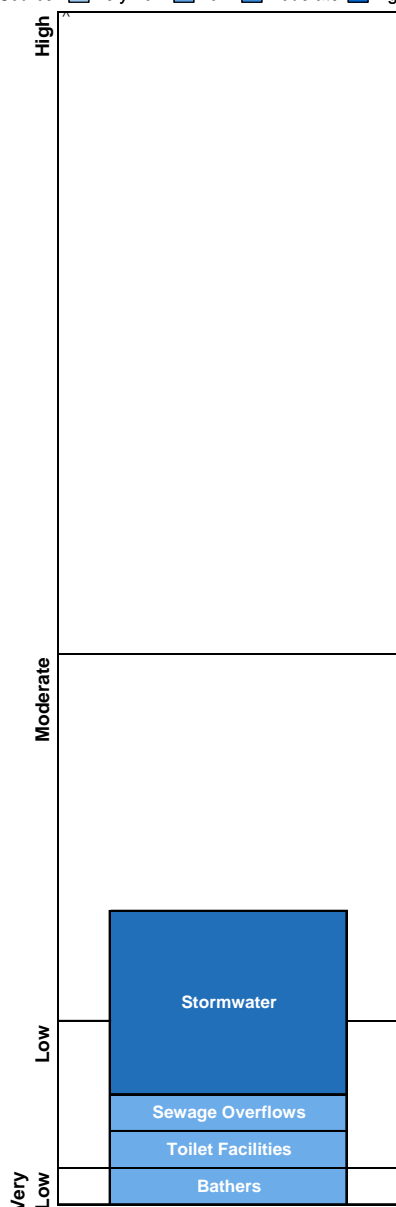
The Beach Suitability Grade of Good indicates that microbial water quality is suitable for swimming most of the time but the water may be susceptible to pollution after heavy rain, with potential faecal contamination from stormwater.

The response to rainfall graph indicates that enterococci levels increased with increasing rainfall, often exceeding the safe swimming limit in response to 10 mm of rainfall or more.

The site has been monitored since 2006. Water quality has generally remained at a high standard.

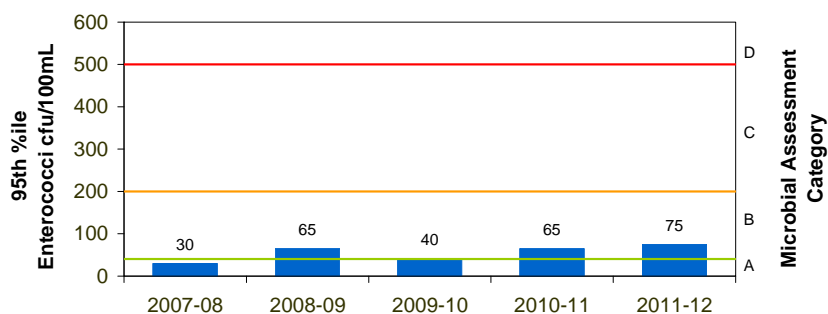
Sanitary Inspection: **Moderate**

Source: ■ Very Low ■ Low ■ Moderate ■ High



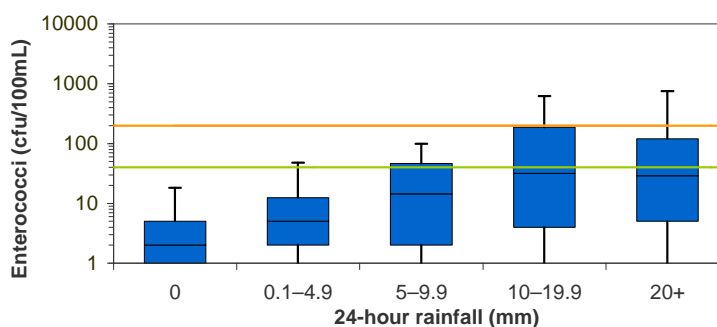
Microbial Assessment: **B**

Monitoring period for 2011–12 result is November 2009 to April 2012.

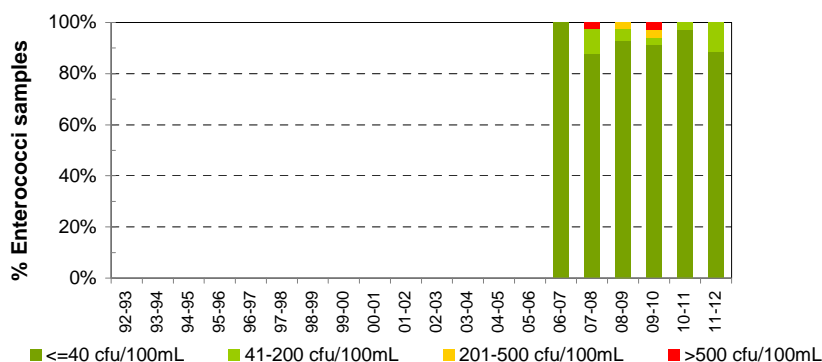


Response to rainfall

Rainfall from Bombo WWTP rain gauge



Trends in enterococci data through time



Werri Beach

Beach Suitability Grade: **Very Good**



See page 21 for key to map

Werri Beach is 1.7 kilometres long and is backed by a narrow reserve and residential land. An ocean pool is located on the southern rock platform. Swimming is safest at the southern end, where lifeguards patrol for a six week period over the summer school holidays.

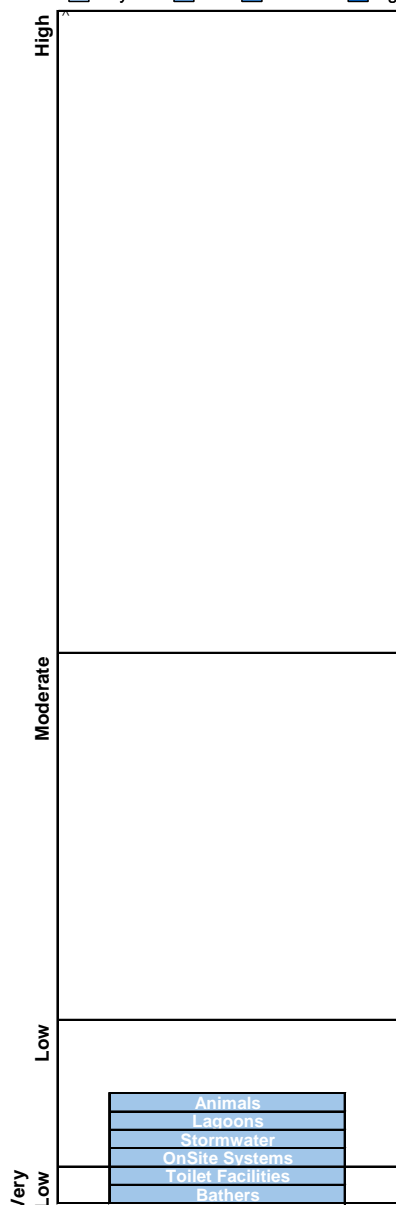
The Beach Suitability Grade of Very Good indicates that microbial water quality is considered suitable for swimming almost all of the time, with few significant sources of faecal contamination.

The response to rainfall graph indicates that enterococci levels increased slightly with increasing rainfall, occasionally exceeding the safe swimming limit in response to 20 mm of rainfall or more.

The site has been monitored since 1996.

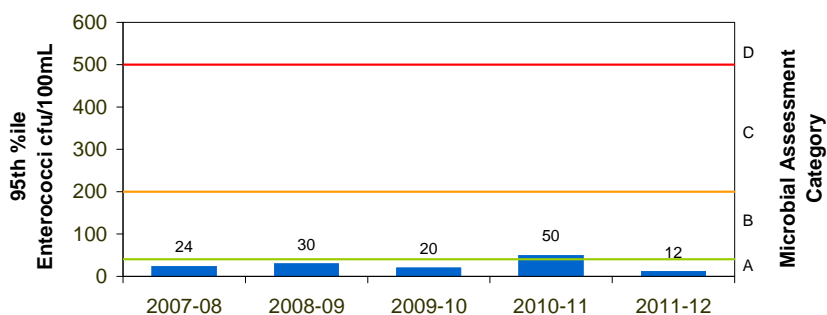
Sanitary Inspection: **Low**

Source: Very Low Low Moderate High



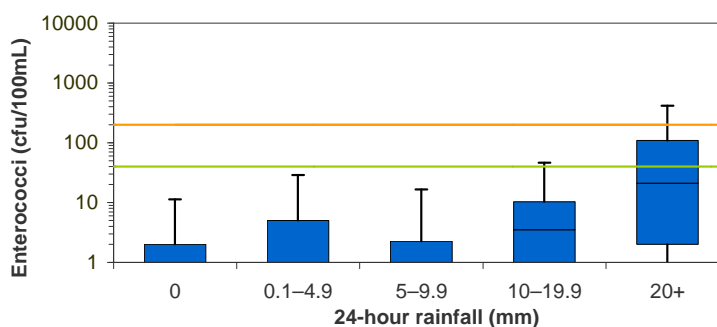
Microbial Assessment: **A**

Monitoring period for 2011–12 result is October 2010 to April 2012.

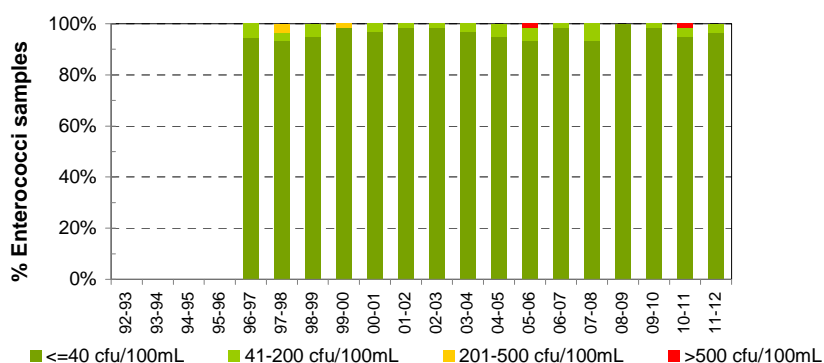


Response to rainfall

Rainfall from Bombo WWTP rain gauge



Trends in enterococci data through time



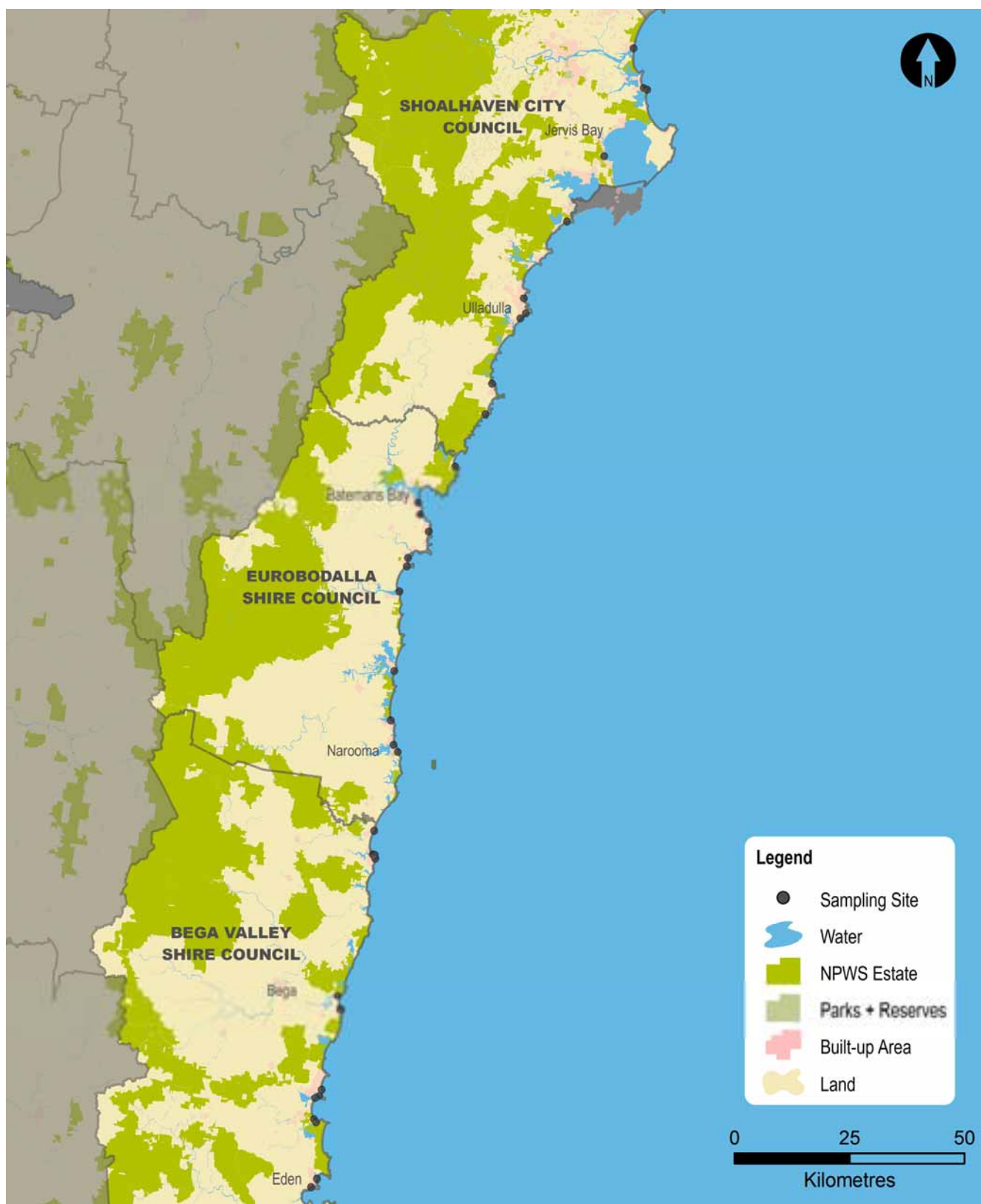


Figure 33: Councils and sampling locations in the South Coast region