CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

KNOW YOUR COAST, 2020

Key findings from over 10 000 sample bacterial tests at 99 sites along 307 km of coastline.

Making progress possible. Together.

Acknowledgements

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INTRODUCTION

Cape Town's 307 km of coastline extends from Silwerstroomstrand on the Atlantic side to Kogel Bay on the east side of False Bay. It is among the most ecologically diverse and productive coastal environments in the world and contributes significantly to the city's economy.[1] The spectacular scenery of this coast has not only established Cape Town as a destination of choice for tourists, but is also central to residents' identity and sense of place. Renowned for their natural beauty, Cape Town beaches offer opportunities for a wide range of recreational pastimes such as swimming, surfing, adventure sports and eco-tourism.

The *KNOW YOUR COAST, 2020* report is the second coastal water-quality report published by the City of Cape Town (hereafter referred to as 'the City') – a follow-on from the *KNOW YOUR COAST, 2019* report that was first published in March 2020. This year's report provides an overview of the 2020 results for our coastal recreational water-quality monitoring programme, together with a summary of findings from the Blue Flag monitoring programme. It reflects the outcome of 2 400 sample bacterial tests from 99 sites along 307 km of coastline for the 12-month reporting period commencing 1 December 2019 and ending 30 November 2020.

[1] *An economic assessment of the contribution of Cape Town's coastline to its GDP estimates the value to be approximately R40 billion per annum (±10,7% to GDP/annum) (Urban-Econ, 2017).*

The results from this reporting period are also added to a five-year rolling period to determine potential trends in coastal water quality for recreational beaches in Cape Town over a longer term. This five-year rolling period reflects the outcome of over 10 000 sample bacteria tests along Cape Town's coastline. The intention is to help the City better understand where challenges are being experienced with water quality, and to identify the requisite interventions to improve water quality where necessary. Similarly, such trends will show success where various interventions have proven effective over a five-year period.

It must be noted that, due to exceptional circumstances caused by the Covid lockdown that commenced on 27 March 2020, the City temporarily ceased the collection of coastal water-quality samples for a period of nine weeks during April and May. The impact of the absence of data from this gap in sampling is unknown as yet.

It must also be noted that some of the recreational nodes that experienced a decline in coastal water quality is as a result of isolated spikes in poor water quality, as opposed to consistent results of poor water quality. Refer to the section on 'Determining coastal water quality' that explains how one or two poor results may impact the overall category of coastal water quality at a specific site.

The release of this report serves as an ongoing commitment by the City to provide annual feedback on the quality of our coastal waters and any significant or meaningful year-on-year changes. This report will be released in the first quarter of each year, presenting the results from the preceding reporting period.

The City is committed to managing and protecting its valuable coastal and marine environment. To this end, the City has initiated many programmes, other than water-quality monitoring, including:

- the coastal recreational water-quality monitoring programme;
- the Blue Flag programme, which includes a water-quality monitoring component;
- the marine monitoring programme associated with the three marine outfalls along the Atlantic coast;
- the marine monitoring programme associated with the two temporary (now decommissioned) seawater desalination plants completed in December 2020;
- the new ecological monitoring plans for the City's major estuaries; and
- the Helderberg Marine Protected Area monitoring programme.

It is hoped that this annual review, along with the biweekly data updates via our web portal, will empower residents, visitors and tourists alike, and serve as a platform for a new partnership between the City, Capetonians and visitors to reduce the amount of pollution we are releasing into our natural environment.

CATCHMENT TO COAST:
KEY CONTRIBUTORS TO COASTAL WATER POLLUTION

Coastal regions are the primary habitat for humanity: approximately 40% to 50% of the world's population live within 100 km of the sea, with two-thirds of the world's megacities being located at the coast (Agardy *et al*., 2005; Moser *et al*., 2012). Cape Town is no exception – its population has more than doubled in the past 40 years and is anticipated to reach approximately 5,5 million by 2030 (Western Cape Department of Health, 2020). Coastal environments are increasingly becoming sites for disproportionate human population growth and urbanisation, the consequence of which is increased pressures – including increased pollution loads – on such areas.

There are two broad classes of pollution, namely point-source and non-point-source pollution. Point-source pollution comes from discrete, easily identifiable sources. Examples include marine outfall discharges and effluent discharge from wastewater treatment works and industries, directly into the sea. Although these sources do contribute to the deterioration of coastal water quality, pollution from non-point-sources is considered to be of greater concern in many coastal cities, as these sources are less easy to identify and difficult to control or manage because they originate from a wide range of sources from wide geographical areas. They are always nearshore pollutants with much reduced dispersion and therefore increased local concentration and impact. Non-point sources of pollution include overflows from sewage pump stations, sewage system failures and illegal discharges into the stormwater system, post-rainfall urban stormwater runoff from roads and built-up areas, and runoff and discharges from agricultural areas (such as dairy farms along rivers).

The only (legal) substance that should travel down the stormwater system into the sea is runoff from a rainfall event. In essence, if it has not been raining, nothing should flow from stormwater systems. Recent international research has now revealed that the stormwater system and related urban runoff from rain events can be a major conduit of contaminants to receiving environments such as coastal waters (Masoner *et al*., 2019). Stormwater discharged from stormwater systems has a significant impact on the nearshore environment, as it's known to transport and discharge a range of bioactive and mixed contaminants into receiving environments (Masoner *et al*., 2019). Studies show that elevated levels of contaminants and bacteria can be flushed through the stormwater system after rainfall events, and include contaminants from humans and animals (discharged into the stormwater system both illegally or unintentionally), and contaminants such as fuel, oil, pesticides, herbicides or fertilisers washed from hard and soft surfaces (Kleinheinz *et al*., 2009). Bacteria are also sometimes able to thrive and multiply in stormwater pipes under certain favourable conditions.

The contribution of the stormwater system to poor coastal water quality is a global phenomenon and not unique to Cape Town. Polluted water discharged from stormwater systems result in certain beaches and recreational waterbodies being closed after rainfall events. This intervention takes place in countries such as Canada, the USA and Australia, and is undertaken by the local authorities. More specifically, recreational nodes along the coast of California are automatically closed after a rainfall event that is greater than 2,5 mm over a period of 24 hours (Ackerman & Weisberg, 2003).

Every day, the City has to deal with the domestic wastewater, solid waste and contaminated stormwater runoff generated by Cape Town's four million people, and another one million bordering the city. This amounts to approximately 500 megalitres per day of wastewater within the city, while our catchments also discharge effluents and contamination from neighbouring municipalities. In addition to this, the City can respond to up to 400 sewer system failures each day. During 2020, the City's Water and Sanitation Department cleared approximately 122 000 sewer blockages across Cape Town, the primary cause (75%) being misuse of the system, including the illegal disposal of foreign materials into the sewer system (figure 1). More than R350 million was spent on efforts to address this chronic – yet largely avoidable – problem. Refer to the section on 'Coastal water quality – how you can help make a difference' that provides more information on this aspect, and identifies ways in which the public may be able to assist in preventing this phenomenon. As activities in catchments may impact coastal waters, and to better understand the water-quality dynamics more holistically in Cape Town, this report is best read in conjunction with the ***INLAND WATER QUALITY REPORT*** that provides further information on matters relating to water quality in catchments.

FIGURE 1: FOREIGN MATERIALS REMOVED FROM THE CITY'S SEWER SYSTEM

As humans, we now consume resources at an unprecedented rate, producing substantial waste streams on a daily basis in multiple forms. The waste that we produce through our high resource consumption, as well as in the production of the products that we all use in our everyday lives (medicines, beauty products, fuels), ultimately enters our environment in one form or another. None of our waste magically disappears. Add to this that our urban populations are now larger than ever before, and this concentration of both people and their waste in urban areas is now evident in both our immediate environmental systems, as well as the most remote and isolated corners of the globe (Dasgupta *et al*., 2018). Quantities of pollution in our environment is a reminder to us all that our ecological footprint is significant. Furthermore, coastal and marine environments do not have endless capacity to assimilate waste produced by society. If this is not managed and controlled, we risk damaging or even losing one of our greatest economic, social and environmental assets – our coast.

The City's role, therefore, is to monitor the impact of urban waste on the coastal and marine environment, to ensure that the assimilative capacity of these environments is not exceeded to the detriment of the well-being of residents and the environment. By monitoring water quality, the City gains information and can make the necessary decisions and resources available to ensure this. For more information on waste streams and the 'lifecycle' of pollutants, the impact of coastal processes and dynamics on the movement of pollutants, as well as the impact of activities in river catchments on coastal waters, refer to the ***KNOW YOUR COAST, 2019*** report.

> The quality of our freshwater systems and nearshore coastal water is a mirror of our urban and land-based activities, resource consumption patterns, waste streams, and our urban growth and expansion.

DETERMINING COASTAL WATER QUALITY

Coastal water-quality testing is not an absolute nor precise science that will yield definitive results based on individual and/or isolated measurements. Individual measurements taken and assessed in isolation are in themselves largely meaningless and can be very misleading. Furthermore, the inherent nature of high bacterial variability in coastal waters means that two samples collected at the same time just a few metres apart may yield vastly differing results. The same applies from a temporal perspective: water samples taken in the same location at different times, even on the same day, may also yield vastly differing results. It is for this reason that the City applies a risk-adjusted approach, whereby measurements are taken and assessed over an extended period of time to determine a realistic representation of coastal water quality. This approach is internationally accepted as the most appropriate means to determine realistic and informative risk levels as it relates to recreational coastal water quality.

The City monitors the enterococcus group and *Escherichia coli* (*E. coli*) as indicators of faecal pollution. The enterococcus group is a subgroup of faecal streptococci that includes *E. faecalis*, *E. faecium*, *E. gallinarum* and *E. avium*. These indicator bacteria in seawater are now collected at 99 sites between Silwerstroomstrand on the Atlantic coast and Kogel Bay on the eastern shore of False Bay (figure 2). Some sites are at popular recreational beaches and in tidal swimming pools – these are known as recreational nodes. Other sites, known as coastal monitoring points, are intentionally positioned near potential or known sources of coastal water pollution (such as stormwater drains and sewer pump stations) to identify the extent of pollution from these sources.

The City has recently added 11 additional sites to its existing 88 coastal quality-sampling points, taking the total points monitored twice per month to 99. These new sites were added specifically to advance our knowledge at certain locations so as to confirm our sense of pollution patterns that, in turn, will assist us in addressing problem areas. These 11 new points and the rationale for their selection include the following:

- outer Three Anchor Bay (recreational node) – to assist in confirming that the chronic pollution is as a result of the constant discharge from the stormwater outlet into the small bay
- Glen Beach (recreational node) – never been monitored before and identified as an important sampling point
- northern Camps Bay (recreational node) – to improve our knowledge regarding the impact of localised pollution sources
- Noordhoek Beach at the Wildevoëlvlei discharge (coastal monitoring point) – carries treated effluent from the WWTW and will provide evidence on the extent of the impact of localised pollution sources
- Fish Hoek beach in the swimming area (recreational node) – to improve our knowledge at Fish Hoek
- Muizenberg corner in the surfing area (recreational node) – to improve our knowledge at Surfers Corner
- Helderberg Marine Protected Area (coastal monitoring point) – inside the MPA as it has never been monitored before and is a valuable sampling point
- Strand – three new recreational sites to help us better understand the chronic pollution patterns in this area
- Gordon's Bay (recreational node) – to help us better understand the chronic pollution patterns in this area

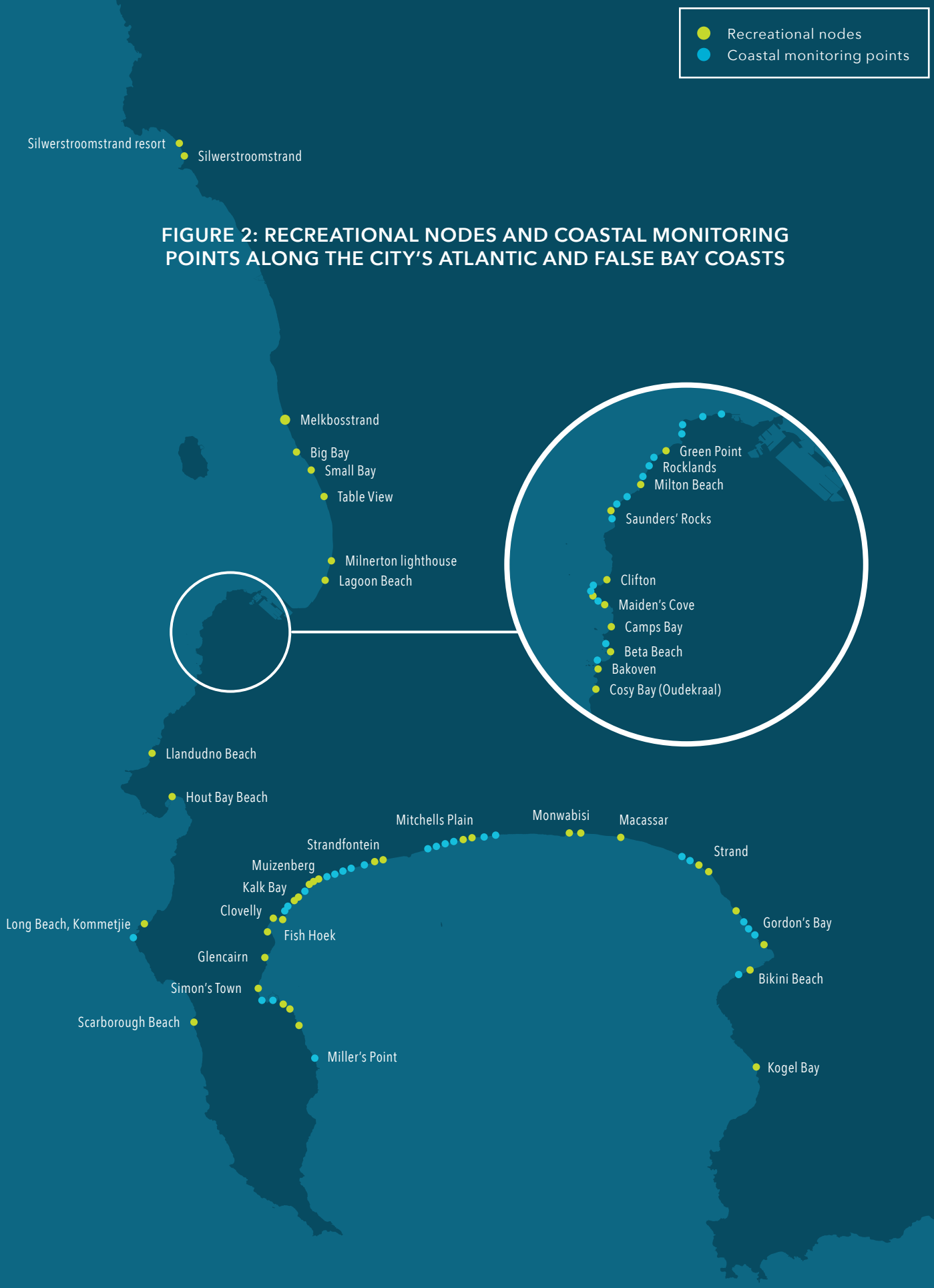


FIGURE 2: RECREATIONAL NODES AND COASTAL MONITORING POINTS ALONG THE CITY'S ATLANTIC AND FALSE BAY COASTS

Water samples are collected in the surf zone and in tidal swimming pools, fortnightly. The City's Scientific Services Branch then counts the number of intestinal enterococci and *E. coli* colonies in the water samples. Water quality is assessed by comparing the number of enterococci in the water samples and measured against the guidelines determined by the South African Water-Quality Guidelines for Coastal Marine Waters (table 1). These **guidelines**, determined by the then National Department of Water Affairs and Forestry, are based on research into whether people swimming in waters with different amounts of faecal indicator bacteria developed gastrointestinal illness. The guidelines apply a risk-adjusted approach whereby a 'tolerable risk' instead of 'no risk' at all is determined. For most healthy people, water quality that meets the targets will pose little risk to their health, and any illness they might develop will usually be minor and short-lived. This is because humans can usually tolerate exposure to low numbers of pathogens. Toddlers, the elderly, people with weakened immune systems and those that have not previously been exposed to the pathogens are more at risk. People who participate in high-exposure activities such as long-distance swimming and surfing are also at a higher risk, as they are likely to swallow more water than the ordinary person.

The number of bacteria in a water sample is counted as colony-forming units per 100 mℓ of the sample ('the count'). Percentiles of counts measured in many water samples collected over time are used to rate water quality as 'excellent', 'good', 'sufficient' or 'poor' by comparing them to the guidelines in table 1. The minimum grade for South African coastal waters for recreation is 'sufficient/fair'. This is in line with the South African Water-Quality Guidelines for Coastal Marine Waters, Volume 2: Guidelines for Recreational Use (2012).

These guidelines were a product of an in-depth review of similar guidelines from a number of countries and organisations worldwide that are considered to be global leaders in the field of coastal water-quality monitoring. They include organisations such as the World Health Organization and Blue Flag International, and countries such as New Zealand, the USA and Australia. Based on the outcome of this assessment, target values for the selected water-quality indicators and implementation practices were identified and adopted for the South African context. For example, internationally, water quality is rated using monitoring results over a rolling period of three to five years to provide a more consistent and risk-adjusted picture of water quality. However, since the use of long-term data poses challenges in areas where bacteria counts are highly variable, the South African Water-Quality Guidelines for Coastal Marine Waters allow the rating of water quality using the results of (at least) fortnightly sampling over a period of 12 months. The City rates annual water quality for the period 1 December to 30 November. Results for each beach as per the standards determined by the guidelines are presented in this report.

TABLE 1: COASTAL WATER-QUALITY CATEGORIES DETERMINED BY THE SOUTH AFRICAN WATER-QUALITY GUIDELINES FOR COASTAL MARINE WATERS

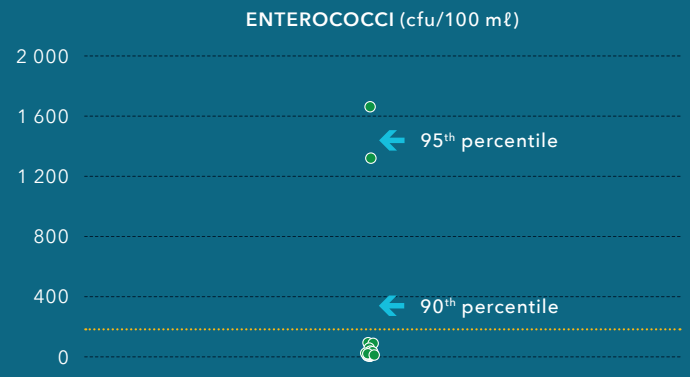
Grade	Estimated risk of illness per exposure*	Enterococci (cfu**/100 mℓ)	*Escherichia coli* (cfu/100 mℓ)
Excellent	< 2,9% gastrointestinal (GI)	< 100 (95th percentile)	< 250 (95th percentile)
Good	< 5% GI illness risk	< 200 (95th percentile)	< 500 (95th percentile)
Sufficient	< 8,5% GI illness risk	< 185 (90th percentile)	< 500 (90th percentile)
Poor	> 8,5% GI illness risk	> 185 (90th percentile)	> 500 (90th percentile)

** Exposure is defined as 10 minutes of swimming with three head immersions.* *** Colony-forming units.*

WHAT DOES 'POOR' WATER QUALITY MEAN?

Water quality is rated 'poor' if the number of enterococci bacteria colonies in water samples exceeds the targets of the South African Water-Quality Guidelines for Coastal Marine Waters. If the 95th percentile (calculated using the Hazen method* of the data over a specific period is ≤100, water quality is rated 'excellent'; if ≤200, it is rated 'good'; and if the 90th percentile over the period is ≤185, it is rated 'sufficient'. If none of these targets are met, the water quality is rated 'poor'.

This does not mean that the number of bacteria colonies in the water is consistently high, however. As few as two water samples with a high number of bacteria colonies can result in a 'poor' water-quality rating in an assessment period. A good example of this is reflected for Milnerton lighthouse (figure 5) where one poor sample has resulted in the change in category from 'excellent' in 2019 to 'sufficient' in 2020. This is because of the way in which water quality is rated, as the following example illustrates:



Over 12 months, 23 water samples collected from a beach presented enterococci counts of 2, 2, 4, 4, 4, 5, 8, 9, 11, 12, 12, 13, 14, 18, 22, 29, 32, 36, 56, 89, 93, 1 350 and 1 700 per 100 mℓ (see graph above). In this example, the 95th percentile came to 1 473, a value between the two highest counts (i.e. 1 350 and 1 700). Therefore, water quality did not achieve 'excellent' or 'good' ratings. The 90th percentile came to 344, which means water quality did not meet the 'sufficient' rating either. In this example, water quality is thus rated 'poor', even though 21 of the 23 samples fell in the 'excellent' range. Of course, beach water quality might also be rated 'poor' because a large number of samples contain high numbers of enterococci bacteria colonies.

** The Hazen method of statistical analysis applied by the City is also internationally recognised and accepted as the most appropriate formula in the determination of percentiles as it relates to coastal water-quality analysis.*

WATER QUALITY ALONG THE ATLANTIC COAST

Water quality along the Atlantic coast is now monitored at 28 recreational nodes and 17 coastal monitoring points (figure 2). Table 2A and table 2B provide an overview of water quality at these sites over a rolling five-year period (i.e. 2016–2020). The water-quality rating for recreational nodes and monitoring points for both 2019 and 2020 are illustrated in figure 4A and figure 4B for comparative purposes. In this section, the results of 2020 are reported on first, followed by a comparison of the results between 2020 and the preceding year (2019), and finally an assessment of any trends over the rolling five-year period (2016–2020).

RESULTS FOR 2020

For the reporting period of 2020 along the Atlantic coast, water quality at nineteen (79%) of the recreational nodes (figure 3 and figure 4B) met the minimum requirement for recreational use in 2020 (eight were rated 'excellent', three 'good' and eight 'sufficient'). Five (21%) of the recreational nodes were rated as 'poor'. These were Lagoon Beach, Three Anchor Bay, Camps Bay tidal pool A, Bakoven bungalows and Hout Bay Beach.

At the coastal monitoring points, water quality at eleven (69%) of the points along the Atlantic coast also met the minimum requirement for recreational use in 2020 (three were rated 'excellent', two 'good' and six 'sufficient') (table 2B). At five (31%) of these sites, water quality was rated as 'poor'. As elaborated on in more detail in the *KNOW YOUR COAST, 2019* report, sampling at coastal monitoring points are deliberately situated near potential sources of pollution. The intention is to establish the extent of the impact of these pollution sources and, as such, can be expected to reflect poorer water quality at times in these locations.

COMPARISON BETWEEN 2020 AND 2019

The results for the reporting period of 2020, if compared to the last reporting period of 2019 at recreational nodes on the Atlantic coast, reveal that at seven locations water quality improved. These were Small Bay, Llandudno Beach, Scarborough Beach, Beta Beach, Maiden's Cove tidal pool 1, Maiden's Cove tidal pool 2, and Camps Bay. At two locations, water quality remained 'poor'. These were Lagoon Beach and Three Anchor Bay. At three locations, water quality regressed to the 'poor' category. These include Camps Bay tidal pool A, Bakoven bungalows and Hout Bay Beach. This is an increase from three beaches (12%) in 2019 to five beaches (21%) rated as 'poor' in 2020. One recreational node (Cosy Bay) is not included in the evaluations as a result of too few data entries due to the Covid lockdown. The situation at these five beaches is explored in greater detail in the section on 'Unpacking instances of regression in water quality at beaches along the Atlantic coast'.

At the coastal monitoring points, 40% of the results from the monitoring sites were classified as 'poor' in 2019. In 2020, 31% were rated as 'poor'. This is an improvement of almost 10% from 2019.

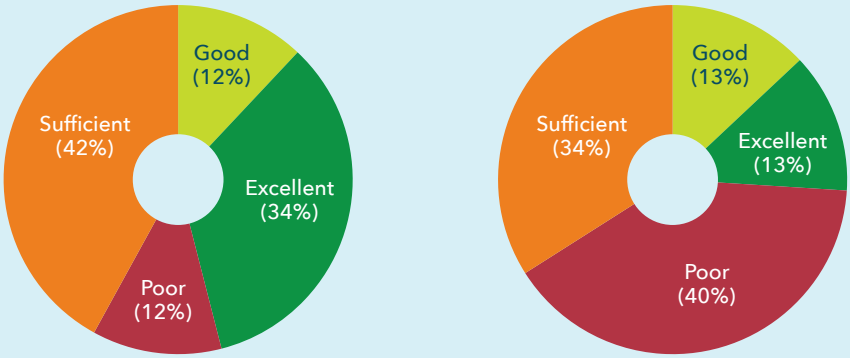
FIGURE 3: WATER-QUALITY RATINGS FOR RECREATIONAL NODES ALONG THE ATLANTIC COAST, 2020

TREND OVER ROLLING FIVE-YEAR PERIOD

When the data are viewed and analysed over the last five years (2016–2020), it shows that there has been a marginal but continual water-quality improvement at seven recreational nodes, especially at beaches along the eastern shore of the Cape Peninsula (Maiden's Cove tidal pool 1 and 2, Camps Bay, Camps Bay tidal pool B, Beta Beach and Llandudno Beach) and at one beach along the northern Atlantic coast (Small Bay). Overall, there is a pattern in the reduction in the number of discrete spikes but variability remains present. While Three Anchor Bay remained poor, this was a consequence of discrete spikes in poor water quality as opposed to consistently poor results. This is elaborated on in more detail in the section dedicated to Three Anchor Bay.

No clear trends were evident between the reporting years at most of the other recreational nodes, either showing little change or varying randomly over this period. While there was a reduction in results of 'poor' water quality by almost 10% at the monitoring points, the variable trend also persists.

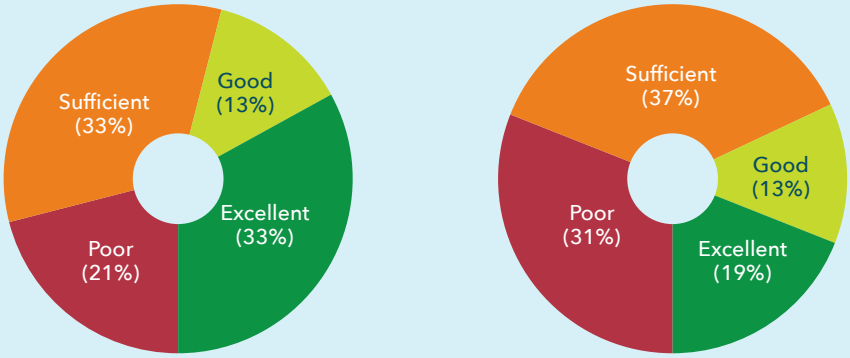
FIGURE 4A: DISTRIBUTION OF 2019 COASTAL WATER QUALITY RATINGS, ATLANTIC COAST



RECREATIONAL NODES

COASTAL MONITORING POINTS

FIGURE 4B: DISTRIBUTION OF 2020 COASTAL WATER QUALITY RATINGS, ATLANTIC COAST



RECREATIONAL NODES

COASTAL MONITORING POINTS

TABLE 2A: ANNUAL WATER-QUALITY RATINGS AT RECREATIONAL NODES ALONG THE ATLANTIC COAST, 2016–2020

RECREATIONAL NODES	COASTAL WATER-QUALITY RATING				
	2016	2017	2018	2019	2020
1. Silwerstroomstrand resort	Excellent	Excellent	Excellent	Excellent	Sufficient
2. Silwerstroomstrand	Sufficient	Excellent	Excellent	Excellent	Excellent
3. Melkbosstrand	Excellent	Excellent	Excellent	Excellent	Good
4. Big Bay	Good	Good	Excellent	Excellent	Excellent
5. Small Bay	Good	Sufficient	Good	Sufficient	Excellent
6. Table View	Good	Sufficient	Sufficient	Good	Sufficient
7. Milnerton lighthouse	Excellent	Excellent	Excellent	Excellent	Sufficient
8. Lagoon Beach	Poor	Poor	Poor	Poor	Poor
9. Three Anchor Bay	Sufficient	Poor	Poor	Poor	Poor
10. Rocklands Beach	Sufficient	Excellent	Sufficient	Sufficient	Sufficient
11. Milton Beach tidal pool	Excellent	Excellent	Excellent	Excellent	Sufficient
12. Saunders' Rocks tidal pool	Sufficient	Sufficient	Good	Sufficient	Sufficient
13. Clifton 1–4	Sufficient	Sufficient	Excellent	Excellent	Excellent
14. Maiden's Cove tidal pool 1	Sufficient	Good	Sufficient	Sufficient	Excellent
15. Maiden's Cove tidal pool 2	Poor	Excellent	Sufficient	Sufficient	Excellent
16. Camps Bay	Sufficient	Sufficient	Sufficient	Sufficient	Excellent
17. Camps Bay tidal pool A	Poor	Excellent	Sufficient	Good	Poor
18. Camps Bay tidal pool B	Sufficient	Poor	Sufficient	Sufficient	Sufficient
19. Beta Beach	Sufficient	Good	Poor	Poor	Good
20. Bakoven bungalows	Poor	Excellent	Sufficient	Sufficient	Poor
21. Cosy Bay (Oudekraal)	Sufficient	Excellent	Good	Excellent	TFD*
22. Llandudno Beach	Excellent	Excellent	Sufficient	Sufficient	Good
23. Hout Bay Beach	Sufficient	Sufficient	Sufficient	Sufficient	Poor
24. Long Beach, Kommetjie	Good	Good	Excellent	Excellent	Sufficient
25. Scarborough Beach	Good	Sufficient	Excellent	Sufficient	Excellent

** TFD – too few data.*

TABLE 2B: ANNUAL WATER-QUALITY RATINGS AT COASTAL MONITORING POINTS ALONG THE ATLANTIC COAST, 2016–2020

COASTAL MONITORING POINTS	COASTAL WATER-QUALITY RATING				
	2016	2017	2018	2019	2020
Big Bay near stormwater discharge	Excellent	Sufficient	Excellent	Excellent	Sufficient
Granger Bay	Excellent	Sufficient	Excellent	Excellent	Sufficient
Mouille Point	Excellent	Good	Good	Sufficient	Sufficient
Green Point pump station	TFD*	Good	Sufficient	Good	Poor
Park Road, Green Point	Poor	Poor	Poor	Poor	Good
Rocklands	Poor	Poor	Sufficient	Sufficient	Sufficient
Milton Beach tidal pool (outside)	Good	Good	Sufficient	Sufficient	Good
Sunset Beach tidal pool (outside)	Sufficient	Poor	Sufficient	Poor	Poor
Saunders' Rocks	Poor	Poor	Poor	Poor	Sufficient
Saunders' Rocks tidal pool (outside)	Good	Poor	Excellent	Poor	Poor
Maiden's Cove	Poor	Sufficient	Excellent	Poor	Excellent
Maiden's Cove tidal pool 1 (outside)	Good	Excellent	Sufficient	Sufficient	Poor
Maiden's Cove tidal pool 2 (outside)	Excellent	Excellent	Sufficient	Sufficient	Excellent
Camps Bay tidal pool (outside)	Sufficient	Sufficient	Good	Sufficient	Excellent
Horne Bay Beach	Poor	Sufficient	Excellent	Good	Poor
The Kom	Poor	Poor	Poor	Poor	Sufficient

** TFD – too few data.*

UNPACKING INSTANCES OF REGRESSION IN WATER QUALITY AT BEACHES ALONG THE ATLANTIC COAST

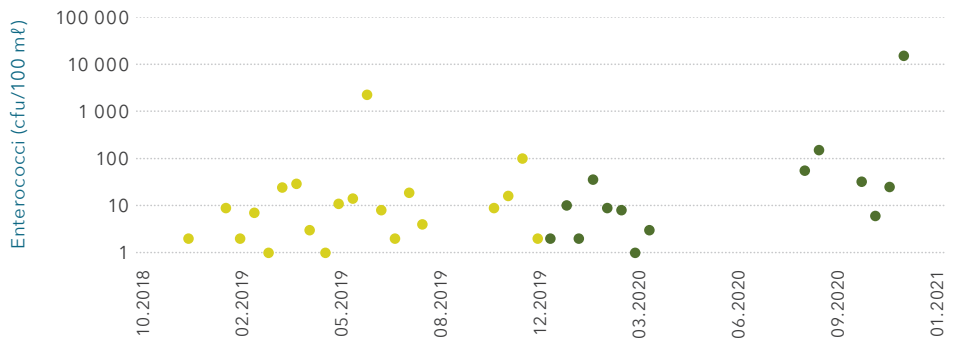
The *KNOW YOUR COAST, 2019* report identified recreational nodes that demonstrated persistently poor results. In response to the identification of these problem nodes, dedicated cross-departmental task teams were established to both identify causes of poor coastal water quality, and identify solutions to improve coastal water at these locations.

MILNERTON LIGHTHOUSE

What is the extent and trend of water quality here?

Water quality at Milnerton lighthouse regressed from 'excellent' in 2019 to 'sufficient' in 2020. The change in category to 'sufficient' in 2020 was a consequence of a single sample exceeding the >185 (90th percentile) cfu/100 mℓ. This sample was taken on Wednesday, 25 November and measured 15 000 cfu/100 mℓ (figure 5).

FIGURE 5: MILNERTON LIGHTHOUSE WATER-QUALITY RESULTS, 2019–2020



Why is this the case?

The cause of the spike on 25 November is not known. Samples taken during sewage spill events generally show correspondingly high levels of both *E. coli* and enterococci. Given the sheer difference between the enterococci reading (15 000 cfu/100 mℓ) and that of *E. coli* (94 cfu/100 mℓ), it is suggested that this sample should be treated with caution.

Furthermore, it is noted that the poor water-quality reading at Milnerton lighthouse does not correlate with the poor water-quality reading at Lagoon Beach at the same time, where Lagoon Beach is known to have consistently poor water-quality results due to contaminants entering the Diep River upstream. The same trend was evident in 2019 where, although results from the Diep River were poor, results at the Milnerton lighthouse remained excellent. The anomalous result at Milnerton lighthouse is therefore unlikely to be caused by poor water discharged from the Diep River. The nature of the spike and subsequent change in category from 'excellent' in 2019 to 'sufficient' in 2020 is not reflective of a continual decline at Milnerton lighthouse. The City is confident that results in coastal water quality at the Milnerton lighthouse will change back to 'good' or 'excellent' in 2021.

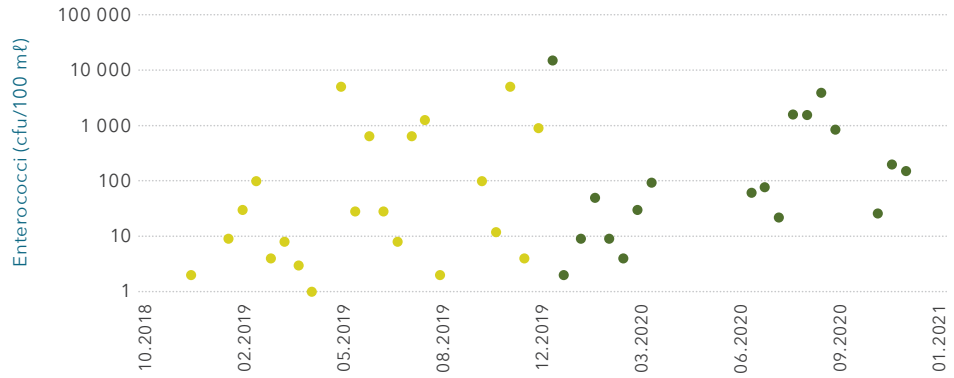
LAGOON BEACH

What is the extent and trend of water quality here?

Water quality at Lagoon Beach has been a challenge for many years. It remained 'poor' for the past five years, and remained as such in 2020. Pollution here is considered a chronic problem linked directly to the state of the Diep River and Milnerton Lagoon.

Even though the enterococci count in most surveys over the past five years was below 100 colonies per 100 mℓ (the limit set for 'excellent' water quality), the number of counts exceeding this limit remains unacceptable. This is why it continues to be rated 'poor' and is considered a chronic pollution problem. In 2020, six surveys were rated as being >185 cfu/100 mℓ. As revealed in the *KNOW YOUR COAST, 2019* report, high enterococci counts at Lagoon Beach occurred mostly in autumn and winter, coinciding with higher rainfall and higher river outflows. A similar pattern was evident in 2020, whereby a number of exceedances were experienced during August and September as rainfall months (figure 6).

FIGURE 6: LAGOON BEACH WATER-QUALITY RESULTS, 2019–2020



Why is this the case?

Lagoon Beach is located at the mouth of the Diep River, which drains a highly polluted catchment (figure 7). The catchment receives waste and contaminated runoff from a wide range of sources, including agricultural activities in the upper catchment, urban runoff from significant urban expansion over the past 15 years, large growth in informal settlements, and it is the receiving environment for the treated effluent discharged from the Potsdam wastewater treatment works.

FIGURE 7: INFLOW FROM THE DIEP RIVER, SHOWING TRAPPING IN THE SURF

Other contributing factors include sewer line failures and blockages, sewer pump station overflows and breakages, as well as load-shedding causing sewer pump station failures, especially over the past 36 months. Illegal dumping of industrial and household waste in the river and stormwater system remains a problem.

While in the *KNOW YOUR COAST, 2019* report it was indicated that the performance of the wastewater treatment works had been below optimal, which contributed significantly to the poor water-quality ratings in 2019, for the most part of 2020 the final effluent discharged by the wastewater treatment plant has met the conditions of the majority of indicators and has shown a slight improvement more recently. Repairs to belt presses and the UV disinfection system, sludge removal from the settling ponds and operational improvements have contributed to an improvement in the wastewater quality.

The way forward

While preliminary data have shown some marginal improvement, the City continues to develop and execute a comprehensive pollution abatement plan for the lower part of the catchment which falls within the City's area of jurisdiction. This action plan details immediate, medium and long-term actions with the most significant being the investment of over R2,2 billion in infrastructure improvements at the Potsdam WWTW in the next five years. The plans for the total upgrade of the Potsdam WWTW are at an advanced stage, with phase 1 demolition (to create space for the construction of modernised infrastructure) of the property complete. The plan also includes stormwater to sewer diversions to prevent polluted stormwater entering the Diep River, upgrade of pump stations and the installation of stormwater outlet litter traps. The City has also commenced with procuring services, equipment and machinery to enhance sewer spill incident response times. Public health warning signs remain in place at Lagoon Beach, the mouth of Milnerton Lagoon and at the lagoon itself. For the foreseeable future, the City advises against recreation in the lagoon where it flows into the sea until such time as water quality improves at this location.

THREE ANCHOR BAY

What is the extent and trend of water quality here?

Water quality at Three Anchor Bay has consistently tested 'poor', except in 2016, when it complied with the minimum requirement ('sufficient' rating). Contaminants that illegally enter the stormwater system and discharge into Three Anchor Bay are a major source of pollution at this recreational node. Examples of the sources of these contaminants include the washing of refuse bins and the discharge of soiled water into the stormwater system, construction site waste washing into the stormwater system, blockages in the sewer system caused by the presence of foreign materials (and subsequent overflows of sewage into the stormwater system), as well as illegal connections to the stormwater system. Three large stormwater pipes constantly discharge significant volumes of contaminated water from the surrounding city throughout the year. Table 3 reflects the extent of the poor water quality being discharged into the bay via the stormwater system.

TABLE 3: BACTERIA IN STORMWATER ON 28 OCTOBER 2020

Sampling point	*E. coli* (cfu/100 mℓ)	Enterococci (cfu/100 mℓ)
Three Anchor Bay stormwater drain A	> 100 000	> 100 000
Three Anchor Bay stormwater drain C	64 000	390 000

Why is this the case?

Contaminated water discharged from these stormwater outlets and the circulation of contaminated water at Three Anchor Bay may also be amplified by prevailing weather and ocean conditions. In summer, south-easterly winds and smaller swells often trap the polluted water in the small, sheltered bay, preventing sufficient dispersion away from the site. Dense kelp beds near the entrance also tend to break free and accumulate on the shore to decompose, which aids the growth of bacteria communities.

The latest data from 2020 do, however, indicate a marginal improvement in the water quality, with only four samples out of 19 showing values greater than 100 cfu/100 mℓ enterococci (the limit set for 'excellent' water quality). This is an improvement from 2019, where there were eight samples with readings over 100 cfu/100 mℓ. Despite this slight improvement, pollution at this site remains a chronic problem. As revealed in the *KNOW YOUR COAST, 2019* report, the seasonal assessment shows that the worst conditions tend to prevail in the winter months (higher rainfall). Compounding the matter is that Green Point is an old suburb where a historic engineering practice was to combine the stormwater with the sewer system. The exact routing of underground drains is uncertain and the sewer and stormwater systems may still be linked in places. Similarly, there are cross connections within the stormwater systems from one catchment to another in places. The rationale for these historic connections remain unknown and are very difficult to fix retrospectively.

The City has recently added an additional sampling point on the opposite side of the bay adjacent to the parking area. Preliminary results from this sampling location are very positive whereby all samples to date have fallen within the 'excellent' category (table 4). The results from this sampling location begin to suggest that stormwater discharge remains the key contributor to poor water quality inside Three Anchor Bay itself.

These findings are positive but it is important to note that the results obtained from this sampling point are not yet sufficient to generate statistically significant outcomes through the Hazen method of analysis and, as such, the formal results of this sampling point will only be included in next year's *KNOW YOUR COAST, 2021* report.

TABLE 4: PRELIMINARY RESULTS FOR WATER-QUALITY MONITORING AT ADDITIONAL SAMPLING POINT: THREE ANCHOR BAY

Date	*E. coli*	Enterococci
Tuesday 06 October 2020	2	39
Tuesday 20 October 2020	6	< 1
Tuesday 03 November 2020	< 2	< 1
Tuesday 15 December 2020	< 2	< 1
Tuesday 12 January 2021	< 2	< 1
Tuesday 26 January 2021	< 2	36
Tuesday 09 February 2021	124	14
Tuesday 23 February 2021	2	10
Tuesday 09 March 2021	156	49

The way forward

Water quality at Three Anchor Bay will improve significantly if the pollution source via the stormwater system can be identified and reduced. While stormwater pipes discharge water throughout the year, the discharge rates increase during the winter rainfall period, which coincides with a marked deterioration in water quality.

Previous attempts by the City to install UV disinfectant systems in the stormwater pipes failed within a few hours, as the high fat and oil content smothered the systems. The City will continue its efforts to identify and control the illegal pollution sources via the stormwater system. Investigations and efforts are ongoing as it relates to the illegal connections to the stormwater system and public educational drives surrounding the discharge of contaminants into the stormwater system. Furthermore, engineers will be investigating the feasibility of rerouting stormwater systems away from the bay.

BETA AND BAKOVEN BEACH:
THE VARIABLE NATURE OF COASTAL WATER QUALITY

What is the extent and trend of water quality here?

Water-quality problems at Beta Beach have only become evident in the last few years. Spikes in enterococci counts as opposed to persistently high counts present the challenge here. There is, however, no discernible negative trend over the past 13 years. In fact, water quality improved from 'poor' in 2019 to 'good' in 2020 (figure 8). Contrastingly, Bakoven Beach regressed from 'sufficient' in 2019 to 'poor' in 2020. At Bakoven, there were two samples out of 22 that measured greater than 100 cfu/100 mℓ for enterococci (the limit set for 'excellent' water quality). These two spikes were recorded on 10 June and 19 August, and both after heavy rainfall in the area (figure 9). The improvement of water quality at Beta Beach in 2020 and the regression of water quality at Bakoven Beach, which is in close proximity to Beta Beach, for the same year highlights the variable nature of coastal water quality along Cape Town's coastline, and that in this case water quality is heavily impacted by localised and, at times, discrete influences.

FIGURE 8: BETA BEACH WATER-QUALITY RESULTS, 2019–2020

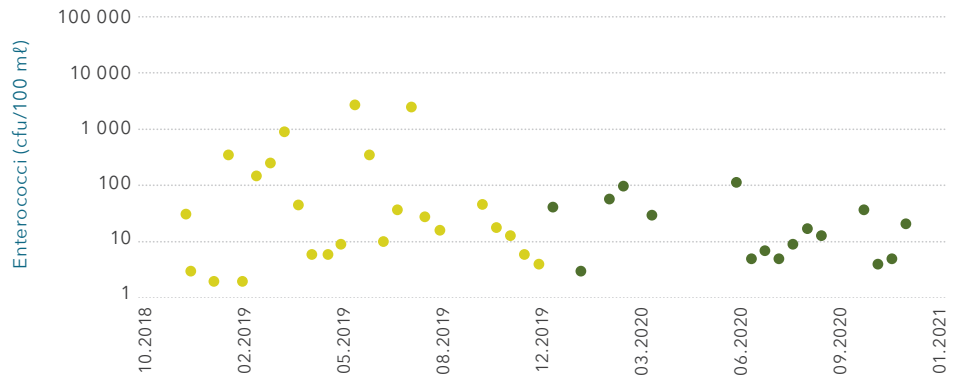
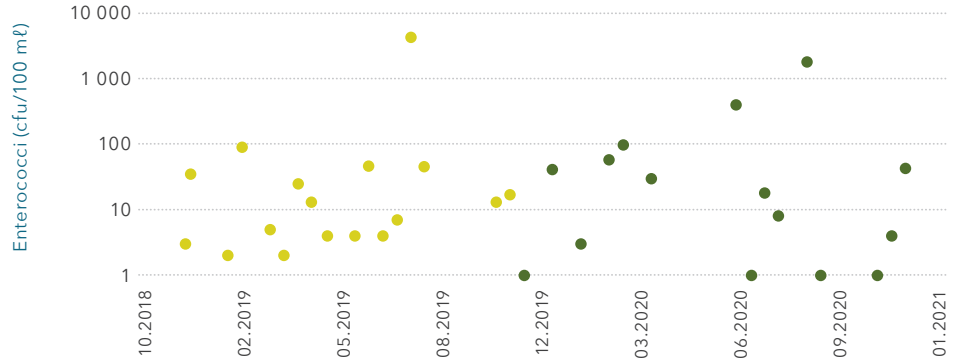


FIGURE 9: BAKOVEN BEACH WATER-QUALITY RESULTS, 2019–2020



Why is this the case?

Notwithstanding the recent improvement in water quality at Beta Beach, the City will continue to investigate ways and means of improving water quality for both Beta Beach and Bakoven. Common to beaches adjacent to urban areas, the potential sources of bacteria spikes are numerous and primarily enter the coastal area through stormwater drains. The sources of contamination typically include the flushing of catchments (especially after a dry spell) and sewer system failures (breakdowns, blockages, pump station failures, overflows and power outages). In addition, there is a sewer pump station at Bakoven, which, if it fails, will discharge wastewater into the stormwater system directly at the beach. The City is in the midst of conducting an assessment of all pump stations across the city to ensure that the risk of pump station failure and subsequent discharge into the stormwater system is minimised. Additional pressures include illegal sewer connections to the stormwater system and poor pet-hygiene practices by dog owners using this stretch of coast. In this regard, the City reminds the public of the consequences of their actions in respect of poor coastal water quality and that reporting illegal sewer connections and improved pet hygiene in public spaces may have a material impact on coastal water quality in Cape Town.

The way forward

The City is committed to reducing the number of sewer failures across Cape Town, including in the suburb of Bakoven and Beta Beach. A dedicated task team was established and has made some interim recommendations to improve the quality of stormwater being discharged at both Bakoven and Beta Beach. These recommendations include the following:

- Existing stormwater base flow data should be analysed to determine how much of the flow is natural groundwater. If necessary, further measurements must be made.
- The stormwater and sewer reticulation systems in the catchment should be surveyed and assessed, and the results recorded and shared.

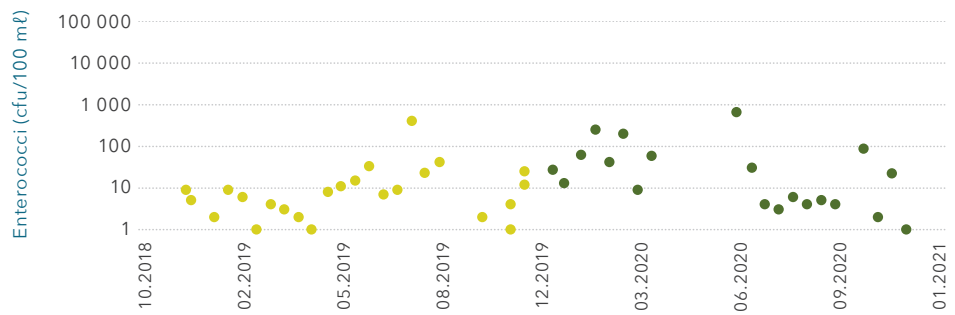
While every effort will be made to limit sewage spills, they are unfortunately inevitable. The City has developed a Coastal Sewage Spill Response Protocol. This protocol is provided at the end of this report and essentially aims to ensure an efficiently coordinated City response across multiple line departments to deal with, and limit, the impacts of such spills.

CAMPS BAY TIDAL POOL A

What is the extent and trend of water quality here?

Camps Bay tidal pool A regressed from being categorised as 'good' in 2019 to 'poor' in 2020. The regression from 'good' to 'poor' is a result of three samples exceeding the coastal water-quality threshold (figure 10). The first and second samples that failed were taken on 22 January and 19 February 2020, measuring 250 cfu/100 mℓ and 200 cfu/100 mℓ, respectively. The last sample that failed was recorded on 10 June 2020, measuring 650 cfu/100 mℓ, following heavy rainfall in the area. The first two water-quality readings were taken in the summer months and were likely not linked to a rainfall event.

FIGURE 10: CAMPS BAY TIDAL POOL A WATER-QUALITY RESULTS, 2019–2020



Why is this the case?

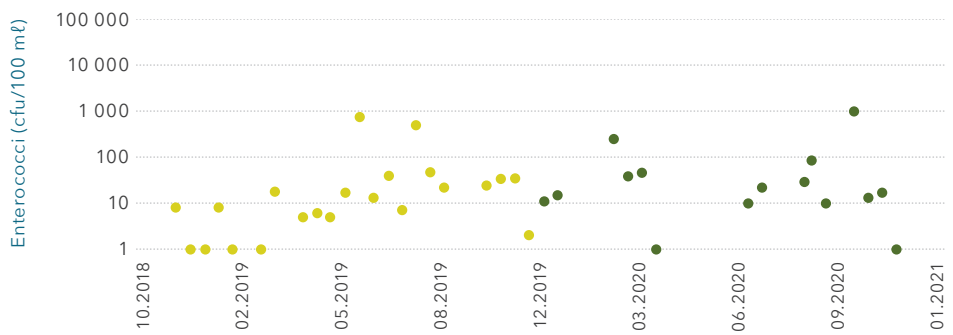
The other sampling points in Camps Bay and the sampling location in the same tidal pool (Camps Bay tidal pool B) did not yield a 'poor' rating, indicating that the issue is very localised. Again, as with the Beta Beach and the Bakoven example, the case of Camps Bay tidal pool A is demonstrative of the highly variable nature of coastal water quality along our coastline, and that water quality may vary vastly within a relatively close spatial proximity. Similarly, this highlights the potential for multiple sources of contaminants to have a significant and very localised impact in a specific area at a specific point in time. This localised impact is evidenced by the preliminary results from the new sampling location north of Camps Bay Beach, where readings of enterococci are way below the thresholds, as are the results of independent sampling undertaken in terms of the Blue Flag programme for Camps Bay. Similar positive results are also evident at the new sampling point at the neighbouring Glen Beach and are detailed in the section on 'Improvements on the Atlantic coast'.

HOUT BAY BEACH

What is the extent and trend of water quality here?

Hout Bay Beach regressed from being categorised as 'sufficient' in 2019 to 'poor' in 2020. The regression from 'sufficient' to 'poor' is a result of two samples exceeding the coastal water-quality threshold. The first of the samples that failed was taken on 12 February 2020, measuring 250 cfu/100 mℓ and the other on 7 October 2020, measuring 1 000 cfu/100 mℓ (figure 11). These water-quality readings were taken in the summer months and are not linked to a rainfall event.

FIGURE 11: HOUT BAY BEACH WATER-QUALITY RESULTS, 2019–2020



Why is this the case?

Hout Bay does have a number of potential sources of pollution that include discharge from the Disa River, discharge from the Hout Bay harbour, stormwater runoff, and substantial sewage spills into the Disa River linked to the Imizamo Yethu (IY) informal settlement. A number of significant sewage spills directly into the Disa River were recorded in the 2020 reporting period.

There is also the possibility that due to the gap in the sampling caused by the Covid lockdown and subsequent reduced number of samples, that the two poor results had a greater impact on the overall outcome and caused the regression from 'sufficient' to 'poor'.

The way forward

Challenges in the catchment of Hout Bay are a key contributory factor to poor water quality at Hout Bay Beach. More specifically is the lack of service infrastructure in IY, and the subsequent discharge of sewage into stormwater systems that ultimately discharge into, and negatively impact, the eastern section of Hout Bay Beach. The City is in the process of upgrading wastewater treatment systems in IY to address this specific concern. It is anticipated that these interventions will have positive impacts on coastal water quality in Hout Bay.

IMPROVEMENTS ON THE ATLANTIC COAST

There were a number of improvements along the Atlantic coast. These included the following:

- Maiden's Cove tidal pool improved (at both sampling points) from 'sufficient' in 2019 to 'excellent' in 2020.
- Camps Bay Beach improved from 'sufficient' in 2019 to 'excellent' in 2020.
- Beta Beach improved from 'poor' in 2019 to 'good' in 2020.
- Llandudno Beach improved from 'sufficient' in 2019 to 'good' in 2020.
- Scarborough Beach improved from 'sufficient' in 2019 to 'excellent' in 2020.

With respect to Camps Bay, it must also be noted that there have been a number of additional improvements in and around the Camps Bay Beach area. Firstly, the preliminary results for the new sampling area at the north end of Camps Bay Beach are very positive. All of the nine samples collected to date at this site have rated as 'excellent' (table 5). The results for the neighbouring Glen Beach reveal similar results where all the results to date are also rated as 'excellent' (table 6). These positive results are effectively a function of the increased distance between the sampling points and stormwater outlets as known sources of pollution discharge.

TABLE 5: PRELIMINARY RESULTS FOR WATER-QUALITY MONITORING AT ADDITIONAL SAMPLING POINT: CAMPS BAY (NORTHERN SECTION)

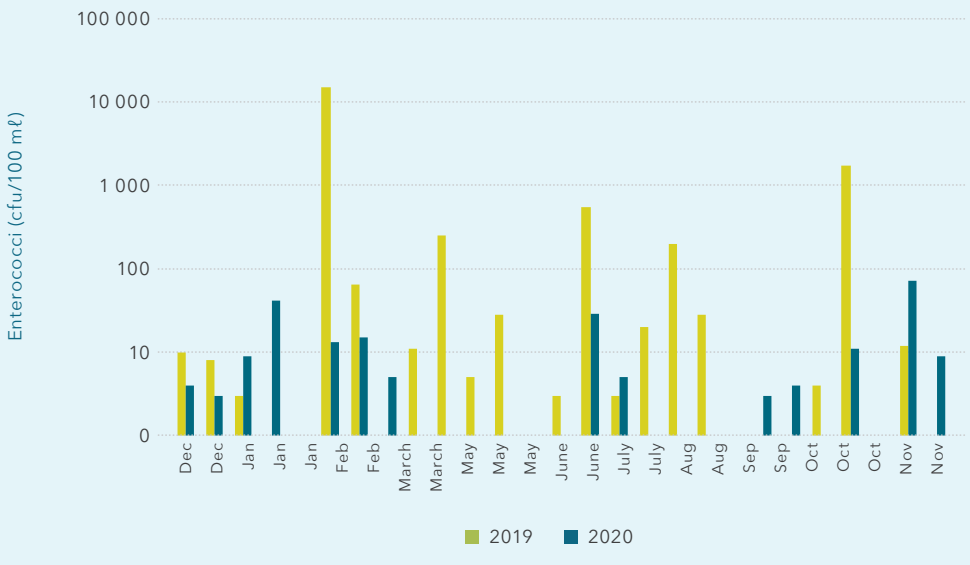
Date	*E. coli*	Enterococci
Tuesday 06 October 2020	< 2	2
Tuesday 20 October 2020	2	15
Tuesday 03 November 2020	< 2	< 1
Tuesday 15 December 2020	< 2	< 1
Tuesday 12 January 2021	< 2	< 1
Tuesday 26 January 2021	< 2	< 1
Tuesday 09 February 2021	4	18
Tuesday 23 February 2021	68	38
Tuesday 09 March 2021	8	12

TABLE 6: PRELIMINARY RESULTS FOR WATER-QUALITY MONITORING AT ADDITIONAL SAMPLING POINT: GLEN BEACH

Date	*E. coli*	Enterococci
Tuesday 06 October 2020	2	34
Tuesday 20 October 2020	< 2	24
Tuesday 03 November 2020	< 2	< 1
Tuesday 15 December 2020	< 2	< 1
Tuesday 12 January 2021	< 2	< 1
Tuesday 26 January 2021	< 2	< 1
Tuesday 09 February 2021	< 2	12
Tuesday 23 February 2021	< 2	12
Tuesday 09 March 2021	< 2	3

For Camps Bay Beach, there has been a notable decline in spikes of bacterial counts between 2019 and 2020. Figure 12 provides a comparative analysis for each month over a two-year period where green represents 2019 and blue represents 2020.

FIGURE 12: COMPARATIVE ANALYSIS OF WATER-QUALITY RESULTS FOR CAMPS BAY, DECEMBER 2019 TO NOVEMBER 2020



WATER QUALITY ALONG THE FALSE BAY COAST

Along the False Bay coast, water quality is now monitored at 33 recreational nodes and 21 coastal monitoring points (figure 2). Table 7A and table 7B provide an overview of annual water-quality ratings at these sites over a rolling five-year period (i.e. 2016–2020). Figure 14A and figure 14B present the overall categories for both recreational nodes and monitoring points for 2019 and 2020, respectively. In this section, the results of 2020 are reported on first, followed by a comparison of the results between 2020 and the preceding year (2019), and finally an assessment of any trends over the rolling five-year period (2016–2020).

RESULTS FOR 2020

For the sampling period of 2020 in False Bay, water quality at fifteen (56%) of the recreational nodes along the False Bay coast complied with the minimum requirement for recreational use (six tested 'excellent', one 'good' and eight 'sufficient'). Twelve (44%) of the recreational nodes were rated as 'poor' (figure 13 and figure 14B).

At the coastal monitoring points, water quality at five (25%) of the points in False Bay also met the minimum requirement for recreational use in 2020 (four were rated 'excellent' and one as 'sufficient') (table 7B). At fifteen (75%) of these sites, water quality was rated as 'poor'. As elaborated on in more detail in the *KNOW YOUR COAST, 2019* report, sampling at coastal monitoring points are deliberately situated near potential sources of pollution. The intention is to establish the extent of the impact of these pollution sources and, as such, can be expected to reflect poorer water quality at times.

COMPARISON BETWEEN 2019 AND 2020

The results for the reporting period of 2020, if compared to the last reporting period of 2019 at recreational nodes, reveal that at six locations water quality improved. These were Frank's Bay, Simon's Town Long Beach, St James tidal pool, Muizenberg Station, Strandfontein tidal pool and Gordon's Bay. At eight locations, water quality remained in the 'poor' category. These were Fish Hoek, Muizenberg Pavilion, Sunrise Beach, Monwabisi Beach, Macassar Beach, Strand Beach, Strand Pavilion jetty and Strand Harmony Park. At four locations, water quality regressed to the 'poor' category. These were Boulders Beach, Clovelly, Mnandi Beach west and Mnandi Beach east. The situation at these beaches is explored in greater detail in the section on 'Unpacking instances of regression in water quality at beaches along the False Bay coast'.

At the coastal monitoring points for 2019, 55% of the results from the monitoring sites were classified as 'poor'. In 2020, 75% were rated as 'poor'. This is an increase in 20% of 'poor' water-quality ratings at monitoring sites from 2019 to 2020.

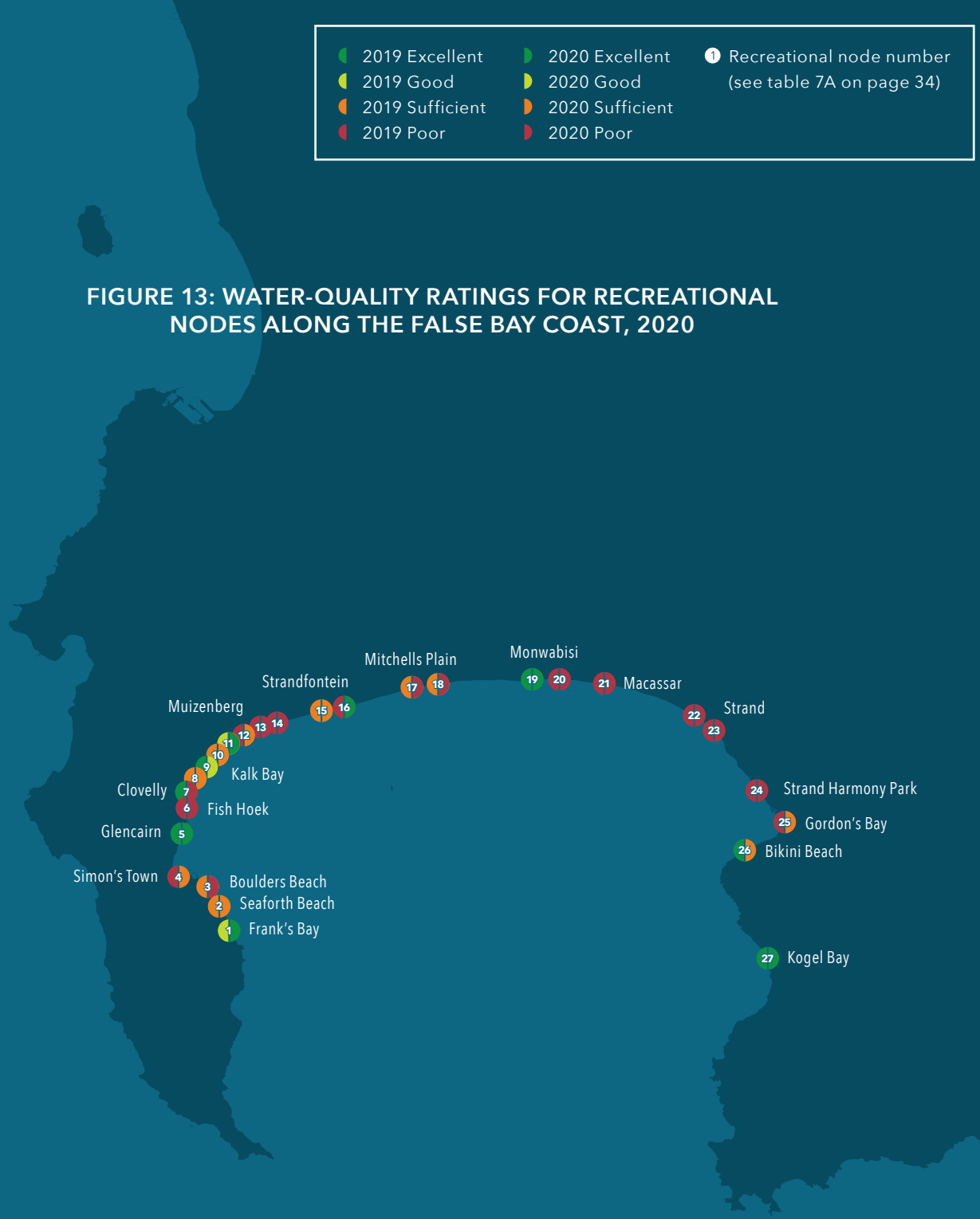


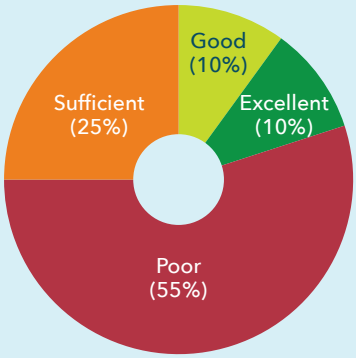
FIGURE 13: WATER-QUALITY RATINGS FOR RECREATIONAL NODES ALONG THE FALSE BAY COAST, 2020

TREND OVER ROLLING FIVE-YEAR PERIOD

At eight locations (Frank's Bay, Simon's Town Long Beach, Glencairn Beach, Muizenberg Station, Strandfontein, Strandfontein tidal pool, Monwabisi tidal pool and Gordon's Bay), water quality has shown gradual improvement over the five-year rolling period (2016–2020). While water quality remained 'poor' at Fish Hoek, Macassar Beach, Strand Beach, Strand Pavilion and Strand Harmony Park over the last few years, there were fewer spikes in 2020 for these locations as compared to 2019. Thus, while they remain 'poor', the drop in discrete spikes is encouraging in that it suggests that water quality is improving as opposed to being consistently poor at these locations. Water quality at the remaining sites either showed little change or varied randomly.

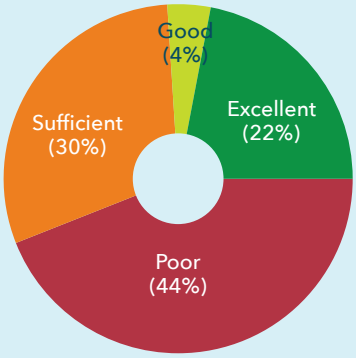
FIGURE 14A: DISTRIBUTION OF 2019 COASTAL WATER-QUALITY RATINGS, FALSE BAY COAST

RECREATIONAL NODES

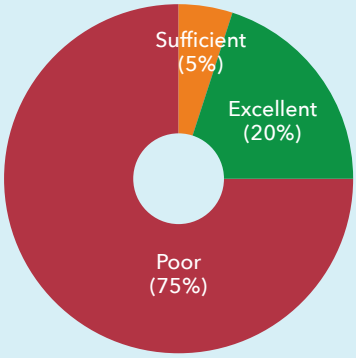


COASTAL MONITORING POINTS

FIGURE 14B: DISTRIBUTION OF 2020 COASTAL WATER-QUALITY RATINGS, FALSE BAY COAST



RECREATIONAL NODES



COASTAL MONITORING POINTS

TABLE 7A: ANNUAL WATER-QUALITY RATINGS AT RECREATIONAL NODES ALONG THE FALSE BAY COAST, 2016–2020

RECREATIONAL NODES	COASTAL WATER-QUALITY RATING				
	2016	2017	2018	2019	2020
1. Frank's Bay	Good	Excellent	Excellent	Good	Excellent
2. Seaforth Beach	Sufficient	Excellent	Excellent	Sufficient	Sufficient
3. Boulders Beach	Sufficient	Sufficient	Sufficient	Sufficient	Poor
4. Simon's Town Long Beach	Poor	Sufficient	Poor	Poor	Sufficient
5. Glencairn Beach	Good	Sufficient	Excellent	Excellent	Excellent
6. Fish Hoek Beach	Poor	Poor	Excellent	Poor	Poor
7. Clovelly	Sufficient	Poor	Poor	Excellent	Poor
8. Kalk Bay harbour beach	Poor	Poor	Poor	Sufficient	Sufficient
9. Kalk Bay tidal pool	Poor	Sufficient	Excellent	Excellent	Good
10. Dalebrook tidal pool	Good	Excellent	Excellent	Sufficient	Sufficient
11. St James tidal pool	Excellent	Excellent	Excellent	Good	Excellent
12. Muizenberg Station	Poor	Sufficient	Sufficient	Poor	Sufficient
13. Muizenberg Pavilion	Sufficient	Sufficient	Sufficient	Poor	Poor
14. Sunrise Beach	Poor	Poor	Sufficient	Poor	Poor
15. Strandfontein	Sufficient	Excellent	Excellent	Sufficient	Sufficient
16. Strandfontein tidal pool	Sufficient	Good	Excellent	Poor	Excellent
17. Mnandi Beach west	Excellent	Sufficient	Excellent	Sufficient	Poor
18. Mnandi Beach east	Sufficient	Sufficient	Excellent	Sufficient	Poor
19. Monwabisi tidal pool	Good	Poor	Excellent	Excellent	Excellent
20. Monwabisi Beach	Poor	Poor	Poor	Poor	Poor
21. Macassar Beach	Sufficient	Poor	Poor	Poor	Poor
22. Strand Beach	Excellent	Poor	Poor	Poor	Poor
23. Strand Pavilion jetty	Good	Poor	Poor	Poor	Poor
24. Strand Harmony Park	Excellent	Poor	Poor	Poor	Poor
25. Gordon's Bay	Excellent	Poor	Sufficient	Poor	Sufficient
26. Bikini Beach	Excellent	Poor	Excellent	Excellent	Sufficient
27. Kogel Bay	Good	Poor	Excellent	Excellent	Excellent

TABLE 7B: ANNUAL WATER-QUALITY RATINGS AT COASTAL MONITORING POINTS ALONG THE FALSE BAY COAST, 2016–2020

COASTAL MONITORING POINTS	COASTAL WATER-QUALITY RATING				
	2016	2017	2018	2019	2020
Miller's Point	Excellent	Excellent	Excellent	Sufficient	Excellent
Simon's Town harbour	Excellent	Sufficient	Sufficient	Excellent	Excellent
Simon's Town diving school	Excellent	Good	Good	Excellent	Excellent
Kalk Bay rocks	Excellent	Sufficient	Excellent	Sufficient	Excellent
Ex Sandown Hotel site	Excellent	Excellent	Good	Good	Poor
Lifebox 21	Poor	Poor	Poor	Poor	Poor
Lifebox 23	Poor	Poor	Poor	Poor	Poor
Sonwabe	Poor	Poor	Poor	Poor	Poor
Ribbon parking area	Poor	Poor	Poor	Sufficient	Poor
Lifebox 30	Poor	Poor	Poor	Poor	Poor
Lukannon Drive wastewater pump station	Sufficient	Sufficient	Good	Sufficient	Poor
Mitchells Plain wastewater effluent discharge	Poor	Poor	Good	Poor	Sufficient
Mitchells Plain stormwater west discharge (East)	Poor	Poor	Poor	Poor	Poor
Mitchells Plain stormwater west discharge (West)	Poor	Poor	Poor	Poor	Poor
Mitchells Plain stormwater east discharge (East)[2]	Poor	Poor	Poor	TFD*	TFD*
Mitchells Plain stormwater east discharge (West)	Poor	Poor	Poor	TFD*	TFD*
Strand opp. Woltemade St	Excellent	Poor	Poor	Poor	Poor
Strand near Lourens River mouth	Excellent	Poor	Poor	Poor	Poor
Gordon's Bay wastewater treatment works	Poor	Poor	Poor	Poor	Poor
Gordon's Bay harbour island	Poor	Poor	Good	Good	Poor
Gordon's Bay harbour	Sufficient	Poor	Sufficient	Sufficient	Poor
Near Sir Lowry's Pass River	Poor	Poor	Poor	Poor	Poor

** TFD – too few data.*

[2] *Due to security concerns surrounding the collection of coastal water samples at both the Mitchells Plain stormwater outlets (east and west), sampling at these sites will be discontinued.*

UNPACKING INSTANCES OF REGRESSION IN WATER QUALITY AT BEACHES ALONG THE FALSE BAY COAST

The poor water quality in False Bay is as a result of a number of factors. Primarily, these include increased wastewater and/or discharges from the stormwater systems associated with rapid urban development (including informal settlements) and the more sheltered nature of False Bay that, in turn, reduces the assimilative capacity of the bay compared to Cape Town's more turbulent Atlantic shores (refer to the *KNOW YOUR COAST, 2019* report for more detail on this). Furthermore, the increased rainfall experienced in 2020 and resultant discharges via rivers and stormwater systems into False Bay are suspected of contributing to poor coastal water quality in False Bay. Overall, water quality along the Atlantic coast was better than along the False Bay coast for 2020 and, given the circumstances surrounding False Bay, the difference in water quality between the two coasts is likely to persist.

BOULDERS BEACH

What is the extent and trend of water quality here?

Boulders Beach regressed from being categorised as 'sufficient' in 2019 to 'poor' in 2020. The regression from 'sufficient' to 'poor' is a result of one sample exceeding the coastal water-quality threshold. The sample was taken on 26 August 2020 and measured 600 cfu/100 mℓ.

Why is this the case?

The water quality at Boulders Beach is not considered a chronic problem but instead is attributed to the large population of penguins resident in the Simon's Town African Penguin Colony. There is also a possibility of some local contamination by stormwater at times during rainfall events, but bacterial counts are higher in areas where bird colonies reside and it is almost certainly impacting the water-quality results at this location.

The way forward

With ongoing efforts to ensure the long-term conservation of the African Penguin at this location, it is likely that water-quality sampling will always result in highly variable outcomes and, at times, spikes in the readings will result in an overall categorisation of 'poor'.

SIMON'S TOWN LONG BEACH

What is the extent and trend of water quality here?

The water quality improved from 'poor' in 2019 to 'sufficient' in 2020. There was one sample that failed in 2020 compared to four out of 24 in 2019. However, since 2016 the rating has fluctuated between 'poor' and 'sufficient' (table 7A) and therefore pollution here is considered chronic. At this location, there is a pattern of discrete spikes in bacterial counts that are almost certainly linked to sewer pump station failure, overflows at the beach and rainfall events. The main Simon's Town sewer pump is located here and all sewage from Simon's Town drain to this pump station before being pumped up to the WWTW in Dido Valley.

Why is this the case?

There is increased pressure on the Simon's Town sewer system and pump station due to significant urban growth and development in the past 15 years, and associated load-shedding has exacerbated the problem. Seasonal patterns show that rainfall events are not the reason for the spikes.

The way forward

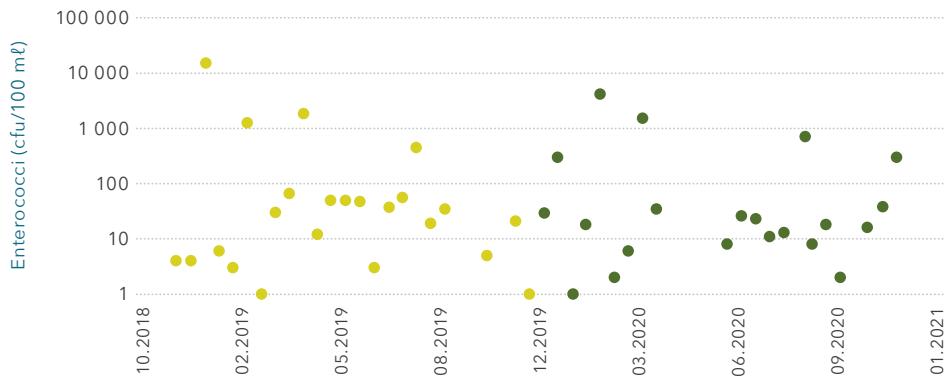
The City will install a pump station overflow containment sump to stop the spillage of sewage directly onto the shoreline in the event of pump failure or overflow. The removal of the pump station overflow directly into the sea should significantly reduce bacterial spikes and result in a marked improvement in water quality at this beach. A remaining unknown factor is the sewage system in the Naval dockyard that is outside of the City's control but is unlikely to be impacting here.

FISH HOEK BEACH AND CLOVELLY BEACH

What is the extent and trend of water quality here?

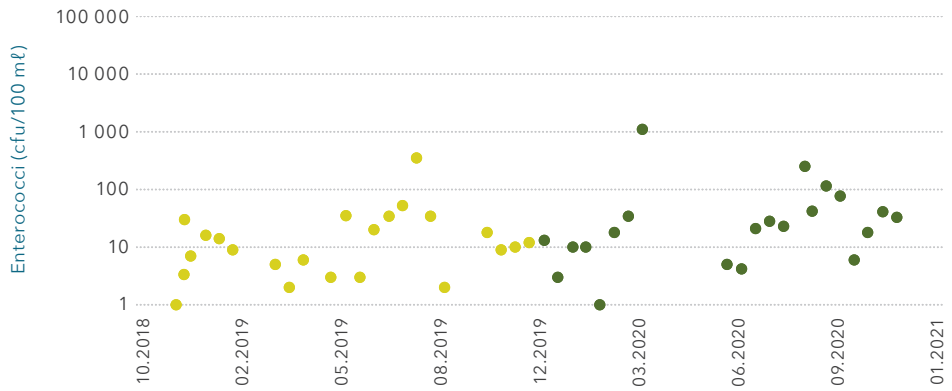
Except for 2018, when Fish Hoek Beach achieved an 'excellent' water-quality rating, water quality here has consistently tested 'poor' from 2016 to 2020. This is mostly a result of discrete spikes in bacteria counts as opposed to consistently high counts. The latest data show that there were five out of 22 samples greater than 100 cfu/100 mℓ (the limit set for 'excellent' water quality). Of these five, four were during Cape Town's summer months, indicating that rainfall and the subsequent flushing of the stormwater system are not the only contributors to poor water quality at Fish Hoek (figure 15).

FIGURE 15: FISH HOEK BEACH WATER-QUALITY RESULTS, 2019–2020



Clovelly Beach, which is part of Fish Hoek Bay, has regressed from an 'excellent' rating for 2019 to 'poor' in 2020. There were three samples out of 21 that were greater than 100 cfu/100 mℓ in 2020 compared with one sample in 2019 (figure 16). As with Fish Hoek, this beach displays high variability in water quality.

FIGURE 16: CLOVELLY BEACH WATER-QUALITY RESULTS, 2019–2020



Seasonal patterns suggest that rainfall events are not the only reason for the spikes at Fish Hoek and Clovelly, and that the bay of Fish Hoek is impacted by local sources of pollution via the stormwater system and the sewer pump station at Clovelly.

Why is this the case?

Two key sources of pollution are the two stormwater outlets that have constant water discharging year round and which is known to be contaminated. The City performed numerous investigations to determine whether there are illegal sewage connections to the stormwater system, or whether the sewage reticulation system perhaps connects or leaks into the stormwater system. These were conducted using smoke to discover any breaks or illegal connections. The Fish Hoek Ratepayers' Association also launched a private investigation and conducted regular analyses of samples taken along the main stormwater outlets, which showed very high bacteria counts. The City also performed a CCTV inspection of the stormwater system to detect any illegal sewer connections and any issues that may be causing blockages. The sewer system in the lighthouse catchment was cleaned and lined to prevent sand ingress and blockages.

In total, there were 23 confirmed connection contraventions and 70 unconfirmed contraventions of the sewer system. There were also four confirmed infrastructure defects. The high bacteria count in the stormwater system is also likely to originate from direct discharges into the stormwater system at the Fish Hoek central business district, as the catchment is relatively small and comprises only residential and commercial developments. Contaminants that illegally enter the stormwater system and which discharge on the coast are often a major source of pollution. Stormwater structures also promote bacterial growth and house many rodent populations. Examples of the sources of these contaminants include the washing of refuse bins and the discharge of soiled water into the stormwater system, construction site waste washing into the stormwater system, blockages in the sewer system caused by the presence of foreign materials and subsequent overflows of sewage into the stormwater system, illegal connections into the stormwater system, and poor pet hygiene by owners.

Clovelly was also impacted in this reporting period by a number of recorded sewage pump station failures that discharged into the Silvermine River mouth, increasing the impact of the bacterial load. Fish Hoek Bay as a whole is also vulnerable to the accumulation and trapping of pollutants, which amplifies any pollution problems, as described in the *KNOW YOUR COAST, 2019* report.

How is it possible for Fish Hoek beach to have retained Blue Flag status?

As described repeatedly throughout this and the previous report, water-quality results are highly variable based on the exact location that the sample was taken. The City sampling point, the results of which are used to define the water-quality category, is located near the stormwater discharge. This impacts the results significantly. The samples taken for Blue Flag status are done independently by the SABS and are taken in the bathing area away from the stormwater discharge point and, as such, yield better water-quality results in accordance with Blue Flag standards. Further to this, Blue Flag status is awarded for the summer season. Water quality is only measured during two months of the peak summer period which eliminates the impact of rainfall and subsequent stormwater discharge on the water-quality results.

The way forward

In the *KNOW YOUR COAST, 2019* report, a number of issues were identified as contributing factors to poor water quality at Fish Hoek. In response to this, the City undertook a range of interventions to address them with the view to improving coastal water quality at Fish Hoek. In addition to the measures listed in the previous report, the following interventions have been undertaken:

- construction of a stormwater to sewer low-flow diversion on Recreation Road;
- sinking of two wellpoints along the beachfront to determine groundwater quality;
- rectification of the transgressions of stormwater connections;
- maintenance and repairs of stormwater and sewer infrastructure at Fish Hoek; and
- conducting education and awareness campaigns.

Despite these interventions, water quality at Fish Hoek clearly remains a challenge and highlights the difficulties of eliminating the various sources of pollution in urban environments. The City will persist in addressing what is clearly a systemic challenge to water quality at Fish Hoek. Encouragingly, and with the exception of one anomalous sample result, the preliminary results from the new sampling location at Fish Hoek show better results (table 8). The result for 20 October of 15 000 cfu/100 mℓ for enterococci must be treated with caution. If, on 20 October, sewage was present when sampling took place, then the *E. coli* readings for the same sample would have been similarly high, as they are also faecal bacteria indicators (as is evident in the result depicted in table 9 for Muizenberg, Surfers Corner, on 6 October). However, as can be seen in table 8, *E. coli* measurements for the same sample were very low. There is also the possibility that there has been a sampling error with the *E. coli* measurement. For these reasons, we reiterate that this result must be treated with caution.

TABLE 8: PRELIMINARY RESULTS FOR WATER-QUALITY MONITORING AT NEW SAMPLING POINT: FISH HOEK (SOUTH SECTION OF BEACH, NEAR JAGER'S WALK)

Date	*E. coli*	Enterococci
Tuesday 06 October 2020	< 2	15
Tuesday 20 October 2020	< 2	> 5000
Tuesday 03 November 2020	< 2	< 1
Tuesday 15 December 2020	2	10
Tuesday 12 January 2021	12	1
Tuesday 26 January 2021	< 2	6
Tuesday 09 February 2021	< 2	2
Tuesday 23 February 2021	< 2	6
Wednesday 10 March 2021	2	13

MUIZENBERG STATION AND PAVILION

What is the extent and trend of water quality here?

Muizenberg Station Beach improved from 'poor' in 2019 to 'sufficient' in 2020 with the five-year trend also indicating an improvement. There were two samples out of 22 that failed, both recorded in August, and were likely connected to rainfall and flushing of contaminants that entered the stormwater system. There were heavy rainfall events on the day before both samples were taken.

Muizenberg Pavilion has been rated 'poor' in both 2019 and 2020. There were four samples out of 22 that were greater than 100 cfu/100 mℓ enterococci (the limit set for 'excellent' water quality). This is on par with the 2019 results, indicating that the beach has not regressed to worse water quality. However, the samples were not limited to the rainy season, indicating that there are other causes at play.

Why is this the case?

The water quality at Muizenberg Pavilion is almost certainly a result of stormwater contamination and perhaps its proximity to the Zandvlei and Zeekoevlei River mouths. These mouths are artificially manipulated to open at varying times of the year. Due to the prolonged periods of closure, there may be an accumulation of bacteria in the shallow stagnant water in both systems. When these mouths are artificially opened, this water is then flushed into the sea and may coincide with the coastal water-quality sampling, thereby causing the results to spike. Contaminants that illegally enter the stormwater system and discharge into False Bay are also a major source of pollution. Muizenberg is also vulnerable to the accumulation and trapping of pollutants due to circulation patterns in False Bay, as initially described and elaborated on in the *KNOW YOUR COAST, 2019* report. Notwithstanding this, the preliminary results from the new sampling point at the southern end of Muizenberg Beach is showing less severe results, where for enterococci there has been one exceedance beyond 100 cfu/100 mℓ as indicated in table 9.

TABLE 9: PRELIMINARY RESULTS FOR WATER-QUALITY MONITORING AT NEW SAMPLING POINT: MUIZENBERG (EXTREME SOUTHERN END OF SURFERS CORNER)

Date	*E. coli*	Enterococci
Tuesday 06 October 2020	> 200	> 100
Tuesday 20 October 2020	< 2	9
Tuesday 03 November 2020	< 2	< 1
Tuesday 15 December 2020	2	6
Tuesday 12 January 2021	90	22
Tuesday 26 January 2021	< 2	2
Tuesday 09 February 2021	10	18
Tuesday 23 February 2021	< 2	< 1
Tuesday 09 March 2021	12	22

The way forward

The water quality at this stretch of beach must improve. An investigation was launched involving visual inspection, smoke detection and cleaning of sewage infrastructure in Muizenberg. With the impact of cleaning proving to be limited due to the sheer quantity of sand entering the sewer system, the following actions were initiated and completed:

- All the pipes from Surfers Corner to Zandvlei were lined to prevent leakages. This was completed in January 2020.
- The main sewer in Albertyn Road was found to be half filled with sand, causing sewage spills. The sand was removed and the problem has since been resolved.
- The main sewer in Axminster Road and Clifton Road was also blocked with sand, causing the system to back up. The sand has been removed and the problem has since been resolved.

The City will continue to explore additional aspects where improvements can be made in this area. In the interim, coastal water quality will be monitored closely but it is hoped that such interventions will result in improved coastal water quality.

MNANDI BEACH

What is the extent and trend of water quality here?

Mnandi east and west beaches have consistently varied between 'excellent' and 'sufficient' since 2016. However, in 2020 both beaches are now rated 'poor'. Again, there is a pattern of bacteria spikes intermixed with 'excellent' water-quality results. There were four and five out of 22 samples that were greater than 100 cfu/100 mℓ enterococci (the limit set for 'excellent' water quality) at Mnandi west and east, respectively. Water quality is becoming more chronic, as is evident at other coastal monitoring sites along this part of the coast. Seasonal patterns suggest that rainfall is one reason for the bacteria spikes, as higher counts occurred more often in autumn and winter, but it is not the only contributor.

Why is this the case?

Large wastewater treatment works (such as the Cape Flats plant) release effluent to the northern shores of False Bay. Contamination at Mnandi, therefore, is likely associated with effluent and possible groundwater seepage from these works, along with significant urban expansion in Khayelitsha adjacent to the coastline.

The way forward

Poor water quality on the northern shores of False Bay is not a new problem, and investigations as far back as the 1980s show similar results. In recognition of the need to prevent further deterioration of coastal water quality in False Bay and to keep pace with the rate of urban development in the area, the City has recently commenced with a R1,7 billion upgrade to the Zandvliet WWTW. The Zandvliet plant treats effluent from the southern parts of Kuils River, Delft, Blackheath, Blackheath Industria, Blue Downs, Eerste River, De Wijnlanden, Thembokwezi, Mxolisi Phetani and Khayelitsha. Currently, the plant handles 72 million litres of wastewater per day. Upgrades include the construction of a membrane bioreactor, sludge dewatering facilities, new inlet works, pump stations, primary settling tanks, and disinfection facilities. Upon completion of the upgrade (anticipated to be 2023), the plant will be able to process an additional 18 million litres per day, bringing the total capacity to 90 million litres per day. The plant is also being designed in a manner that will cater for further expansion to keep pace with the anticipated future rate of urban growth in the area.

The upgrade is expected to have a significant positive impact on the City's ability to treat and process increasing quantities of wastewater within acceptable standards. Despite these significant and positive developments, it must be noted that due to the sheer rate of urban growth in Cape Town in tandem with the hydro-dynamics of False Bay, poor water quality in the bay and bacterial contamination are expected to persist into the future. For a 'step change' to be created in permanently resolving water quality in False Bay, wastewater would need to be piped to the mouth of False Bay (a distance of approximately 35 km) where ocean currents would assist in the dispersal of wastewater away from the bay. The cost, however, of doing this is considered to be exorbitant and unaffordable.

STRANDFONTEIN TIDAL POOL

What is the extent and trend of water quality here?

Water quality in the tidal pool has generally been at least 'sufficient' since 2016. The water quality regressed to 'poor' in 2019 but it has since improved to 'excellent' in 2020. This is a positive outcome and reaffirms the City's view that the 'poor' result in 2019 was the exception as opposed to the norm.

Why is this the case?

If there are any poor results at the tidal pool, it can generally be explained by localised runoff, as there is no stormwater drainage or effluent discharges directly into the tidal pool. Localised runoff is generally from hard surfaces and ablution facilities surrounding the tidal pool, people using the pool (especially during periods of high use), or the high number of birds that perch on the tidal pool wall. As semi-enclosed waterbodies, tidal pools inherently do not have good dispersion properties and are vulnerable to any pollutant load.

The way forward

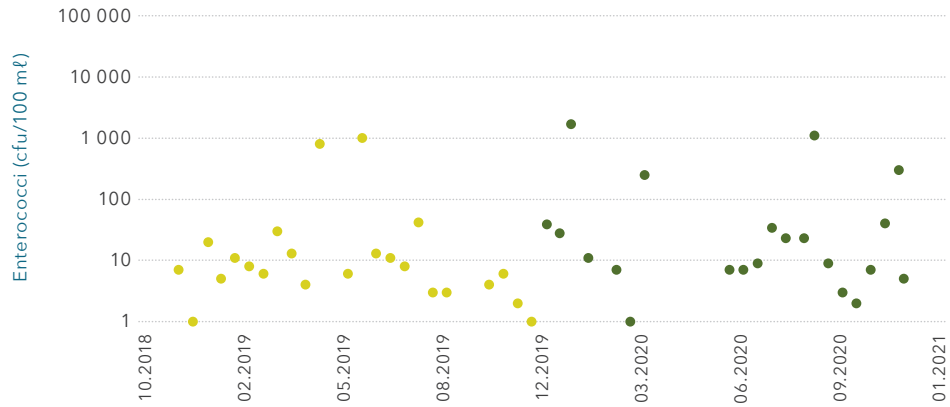
The City will continue to monitor the water quality at the tidal pool to maintain the good results. If the water-quality trend at the tidal pool turns negative over the next few years, the City will investigate diverting runoff from the surrounding pavilion away from the tidal pool. This is not considered necessary at this stage based on the history of results, especially during the holiday season.

MONWABISI BEACH

What is the extent and trend of water quality here?

Water quality at this beach was rated 'poor' for the past five years. It must be noted that the poor water quality is primarily a consequence of discrete spikes in bacteria counts instead of persistently high counts. The latest data indicate that there were four samples out of 22 that were greater than 100 cfu/100 mℓ enterococci (the limit set for 'excellent' water quality) (figure 17). There is no clear seasonal trend evident at this beach.

FIGURE 17: MONWABISI BEACH WATER-QUALITY RESULTS, 2019–2020



The long-term trend at Monwabisi Beach, in fact, shows a marginal but steady improvement over the past 15 years. Water quality of the adjacent tidal pool, which is the main swimming amenity, has been rated 'excellent' for three consecutive years (2018–2020).

Why is this the case?

There is no single cause for the poor water quality at Monwabisi Beach. There are many interacting challenges that will require large-scale systemic interventions for improving the coastal water quality.

Spikes in bacteria counts at this beach are a result of very poor water quality in a stormwater retention pond situated just east of Monwabisi Beach. The pond water has some of the highest bacteria counts in Cape Town, and if it overflows during rainfall events, it will contaminate the shoreline.

The water quality at Monwabisi Beach, however, is not solely related to rainfall. The situation is further challenging due to ablutions adjacent to the tidal pool becoming unusable, the growing population and increased demand for infrastructure and services in close proximity to Monwabisi Beach, and the inability to service the illegally occupied land in close proximity to Monwabisi.

The offshore breakwater at Monwabisi Beach results in a counter-clockwise eddy current that circulates just off Monwabisi Beach. As a result of the eddy current that is formed, polluted water entering Monwabisi Beach may remain in circulation for longer periods of time if compared to exposed coastlines.

The way forward

The City is planning an entire beach precinct upgrade at Monwabisi and, as part of this large investment, options to negate the impact of the stormwater pond to the east will be developed as part of the upgrade. These interventions include increasing the capacity and the removal of sediment from the pond, inspections to determine potential external sources of pollution, and clearing litter out of the system. The City is also currently undergoing analysis of all of its pump stations and will continue to engage with residents.

CHRONIC POLLUTION CHALLENGES:
EASTERN SECTION OF FALSE BAY

Beaches in the eastern section of False Bay show similarities in terms of the causes of poor water quality and, as such, they are all dealt with collectively in this section. For the rolling five-year period from 2016 to 2020, and as indicated in table 7A and table 7B, water quality remains by and large poor for this section of coast and is a major concern for the City. The reasons for this are multiple and are indicative of a systemic challenge to water quality in this section of False Bay, where a complete reversal in water quality is unlikely in the short to medium term. The following factors are considered to be key contributors to poor water quality in the eastern section of False Bay:

- wider circulation characteristics in False Bay and the consequent reduced assimilative capacity of pollutants and the convergence of circulation in this section of False Bay;
- pollution from urban and stormwater runoff;
- polluted water from various rivers, including the Eerste/Kuils, Lourens, Soet and Sir Lowry's Pass rivers that discharge into this section of False Bay;
- extensive industrial development that has taken place in the various catchments and associated pollution discharges;
- rapid expansion of informal settlements in the various catchments – lower levels of basic service provision at the household level has lead to a marked deterioration in the quality of stormwater and rivers;
- discharge of effluent from various WWTW (both in and outside the City's municipal area of jurisdiction) into this section of the bay; and
- nearshore reefs, particularly in the Strand area, which can trap water in the nearshore area and limit wider circulation and mixing in False Bay, which ultimately results in poor water-quality readings for this area.

In an effort to better understand pollution challenges and associated dynamics in this section of the False Bay coast, the City has added an additional five sampling points for this area. The preliminary results for these sampling points are indicated in tables 10–12.

Water quality at Macassar Beach remained poor from 2017 to 2020. As indicated in the *KNOW YOUR COAST, 2019* report, seasonal patterns suggest that rainfall events and associated stormwater discharges are not the only reasons for spikes in bacteria counts but that there is a more consistent source of pollution discharge at Macassar Beach. As identified in the *KNOW YOUR COAST, 2019* report, the source of pollution is suspected as being the Eerste and Kuils rivers. The latest data for 2020 reveal a slight improvement in the water quality, with five samples out of 21 showing greater than 100 cfu/100 mℓ enterococci (the limit set for 'excellent' water quality) compared to 2019, where there were eight samples with readings over 100 cfu/100 mℓ.

Water quality at Strand Beach, the Strand Pavilion jetty and Harmony Park all rated as 'poor' over the last four years, with 2016 being the exception. However, for this stretch of coast, and including up to Gordon's Bay, there were fewer spikes greater than 100 cfu/100 mℓ enterococci (the limit set for 'excellent' water quality) in 2020 when compared to 2019 (generally around four out of 22 samples at each beach in 2020 compared to around 10 at each beach in 2019).

The way forward

In respect of the water-quality challenges in the eastern section of False Bay, the City commits to the following:

- continue with upgrades and increase the capacity of the various WWTW that have an impact on False Bay;
- investment in the City's wider WWTW infrastructure;
- continue with the pollution abatement in the Soet River catchment – mapping and assessment of the entire stormwater system and identifying any points of contamination (upgrades and investments in services are also required in the Lwandle settlement);
- investigate improved waste removal and ablution facilities in the Strand area;
- continue with trialling litter traps and explore the feasibility of low-flow diversions in the Soet River;
- continue with enzyme dosing as and when required in the Soet River after pollution incidents;
- continue with mechanical and manual cleaning in the various catchments and waterways due to the high prevalence of littering and illegal dumping; and
- public educational drives on matters relating to coastal and inland water quality.

IMPROVEMENTS ON THE FALSE BAY COAST

There were a number of improvements along the False Bay coast. These included the following:

- Frank's Bay improved from 'good' in 2019 to 'excellent' in 2020.
- Simon's Town Long Beach improved from 'poor' in 2019 to 'sufficient' in 2020.
- St James tidal pool improved from 'good' in 2019 to 'excellent' in 2020.
- Strandfontein tidal pool improved from 'poor' in 2019 to 'excellent' in 2020.

Initial results for the new sampling location in the Strand (adjacent to the water slides) are very positive, where there were no exceedances of 100 cfu/100 mℓ for enterococci (table 10) in 2020. Similar results are evident for the new sampling points at Strand Beach (table 11) and Gordon's Bay (table 12), where there were no exceedances. These results are to be expected given that these sampling points are not located at stormwater outlets. Bacterial levels at the new monitoring sites for the Helderberg MPA and the Strand stormwater outlet have demonstrated variable results to date.

TABLE 10: PRELIMINARY RESULTS FOR WATER-QUALITY MONITORING AT NEW SAMPLING POINT: STRAND BEACH (ADJACENT TO WATER SLIDES)

Date	*E. coli*	Enterococci
Tuesday 13 October 2020	< 2	2
Tuesday 27 October 2020	8	< 1
Tuesday 01 December 2020	3	< 1
Tuesday 22 December 2020	< 2	< 1
Tuesday 02 February 2021	< 2	< 1
Tuesday 02 March 2021	< 2	6
Tuesday 16 March 2021	22	14

TABLE 11: PRELIMINARY RESULTS FOR WATER-QUALITY MONITORING AT NEW SAMPLING POINT: STRAND BEACH

Date	*E. coli*	Enterococci
Tuesday 13 October 2020	6	18
Tuesday 27 October 2020	20	< 1
Tuesday 01 December 2020	4	< 1
Tuesday 22 December 2020	6	< 1
Tuesday 02 February 2021	2	< 1
Tuesday 02 March 2021	< 2	12
Tuesday 16 March 2021	600	34

TABLE 12: PRELIMINARY RESULTS FOR WATER-QUALITY MONITORING AT NEW SAMPLING POINT: GORDON'S BAY

Date	*E. coli*	Enterococci
Tuesday 13 October 2020	2	7
Tuesday 27 October 2020	< 2	< 1
Tuesday 01 December 2020	2	< 1
Tuesday 22 December 2020	34	< 1
Tuesday 02 February 2021	6	8
Tuesday 02 March 2021	8	51
Tuesday 16 March 2021	8	200

THE PHENOMENA OF DIATOM BLOOMS IN FALSE BAY

Diatoms are photosynthetic, single-celled microorganisms (phytoplankton) that can be found in a multitude of waterbodies, from freshwater rivers and dams to the ice sheets of Antarctica. They range in size of up to half a millimeter and can be solitary or colonial. Diatoms have a characteristic frustule composed of silicate.

Surf zone diatoms are diatoms that inhabit the wave-entrenched areas of sandy beaches specifically, and of the seven species identified globally, two have been found in South Africa: *Anaulus australis* and *Asterionellopsis glacialis*. *A. australis* is found exclusively in the surf zones of sandy beaches in the southern hemisphere, and in South Africa they have been sighted at Sundays River, Maitland River, Muizenberg, Macassar, Struisbaai, De Hoop, Vleesbaai, Glentana, Wilderness, Sedgefield, Buffalo Bay, Van Stadens, and Cintsa beaches (Odebrecht *et al.*, 2014). The presence of these diatoms has been suspected at many other beaches, and more research is needed to determine the species distribution and changes thereof. All surf zone diatoms are known to form dark green or reddish-brown patches in the surf zone, and these patches are often mistaken for pollution (figure 18 and figure 19). While the water may appear 'dirty' during these blooms, it must be stressed that such diatom blooms caused by *A. australis* are not toxic and do not pose a swimming hazard to the public.

FIGURE 18: MUIZENBERG DURING A DIATOM BLOOM EVENT

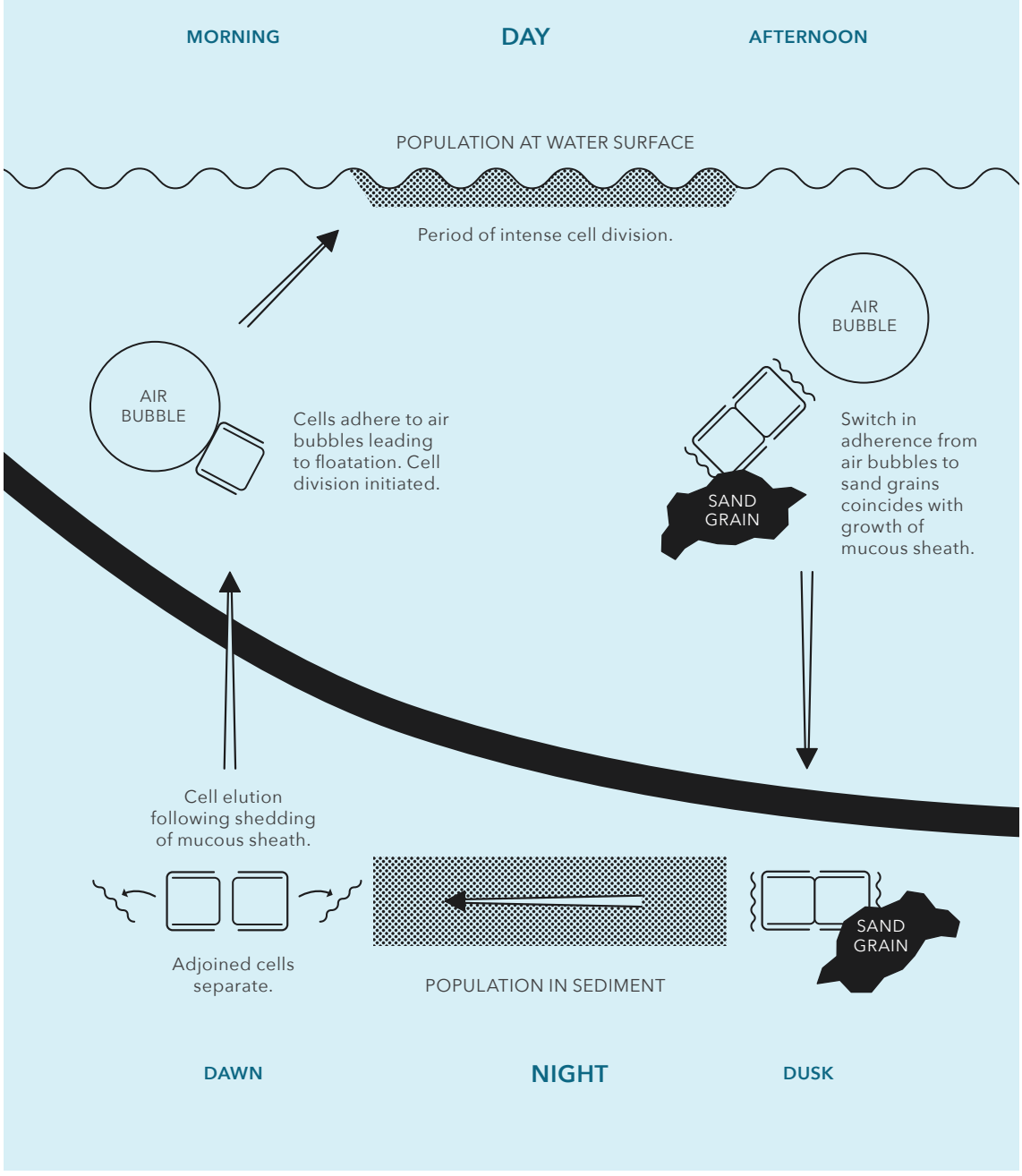
FIGURE 19: DIATOM BLOOM AT SURFERS CORNER, MUIZENBERG

A. australis forms distinctive dark reddish-brown patches that have been studied extensively at Sundays River Beach, Algoa Bay, with research underway at Muizenberg Beach, False Bay. The other species of surf zone diatom found in South Africa, *A. glacialis*, forms patches similar to that of *A. australis* but has only been sighted and recorded on a single occasion at Sundays River Beach.

Generally, diatoms (including some surf zone diatoms) form patches through rapid asexual reproduction via cell division; these high-density patches are called 'blooms'. However, in the case of *A. australis*, cell division only accounts for a maximum of 21% of the growth of the population during these patch events (Talbot & Bate, 1986). The current hypothesis is that these patches are the result of vertical migration of cells in the water column combined with the influence of physical features and water circulation in the surf zone area. Common physical features of beaches where these patches occur are wide surf zones with medium- to high-energy wave action, well-developed rip currents, and proximity to dunes overlying nutrient-rich aquifers (Campbell & Bate, 1997).

Most surf zone diatoms, including *A. australis*, display diel periodicity (daily cycles) where the concentration of cells increases rapidly to a peak during the late morning, with the cells disappearing from the water column in the late afternoon (figure 20). This phenomenon is thought to be caused by diel periodicity in the cell's floatation mechanism. Large reservoirs of these cells have been found in the sediment of the inner surf zone, acting as a source for the rapid increase in cell concentrations in the overlying waters under favourable conditions. Diatom cells or cysts lie dormant in the sediment and, when resuspended by high wave action and turbulence, repopulate the water column (Du Preez & Bate, 1992). Once suspended, the cells accumulate in the inner surf zone, often adjacent to rip currents where surface circulation holds the population in place, and they quickly achieve dominance over other less abundant species (Talbot & Bate, 1986).

FIGURE 20: VISUALISATION OF THE PROPOSED DIEL CYCLE OF *A. AUSTRALIS* AT SUNDAYS RIVER BEACH, ALGOA BAY



The mechanism by which the cells rise to the surface is under investigation. It is hypothesised that cells attach to wave-entrained bubbles to rise to the surface, forming a foam that is pushed to the inner surf zone by onshore winds (Sloff *et al.*, 1984; Campbell & Bate, 1988). Sharp decreases have been observed in the number of dividing cells in the surf zone in the afternoon (Talbot & Bate, 1986). This decrease was initially attributed to the formation of a mucous layer on the cells in the afternoon, which would allow adherence of particles to the cell, causing them to sink to the sediment (Talbot & Bate, 1988). However, there is limited experimental evidence supporting bubble-influenced surface transport and particle-influenced sinking; much of current speculation is inferred from work conducted at Copalis Beach, Washington, on a surf zone diatom species, *Chaetoceros armatum*.

Talbot and Bate (1986) proposed an alternative hypothesis, explaining the diel cycle of cell abundances on the basis of a diel cycle of cell division. They found that cells increased 52% in size during cell division, which occurs in the early morning, without a corresponding increase in mass. The decreased density of the cells would increase their susceptibility to turbulent mixing and increase their mobility, allowing them to be transported into the inner surf zone. Thus, our current hypothesis for the situation in False Bay is that *A. australis* cells divide in the early morning (just after sunrise) and are swept into the inner surf zone because of a decrease in cell density. By afternoon, the cells have regained weight through photosynthesis and their increased densities cause them to sink from the water column. More research is needed to investigate this hypothesis.

Surf zone diatom accumulations are natural phenomena and are recognised as an important food source in sandy beach ecosystems. Because sandy beaches generally do not have an abundance of primary producers like macroalgae, the flora typically consists of benthic microalgae and surf zone phytoplankton. Both components can be dominated by diatoms, which are consumed by filter feeders like mussels, numerous small crustaceans, mullet, and sand prawns (Talbot *et al.*, 1990). The brown patches are likely to sustain a large portion of the consumers found in sandy beach ecosystems.

CAPE TOWN'S BLUE FLAG BEACHES

The **Blue Flag programme**, a world-renowned eco-label established in 1987, is operated under the auspices of the Foundation for Environmental Education headquartered in Copenhagen, Denmark. The programme aims to promote the sustainable growth and development of tourism in coastal areas. About 47 countries participate in the programme, and South Africa is the first country outside Europe to have been awarded Blue Flag accreditation. To qualify for this prestigious annual award, a series of stringent environmental, educational, and safety and access-related criteria must be met.

The City's greatest challenge to remaining compliant with Blue Flag standards are the sewage spills that take place at or near our Blue Flag beaches. Many – if not all – of the spills in close proximity to Blue Flag beaches were as a result of load-shedding or a consequence of blocked sewer lines caused by foreign materials. Despite the challenge of sewage spills, all of the Blue Flag beaches managed to maintain their status. This is also thanks in part to the swift reactions of City officials in implementing the Sewage Spill Response Protocol, which often prevented the spilled material from reaching seawater at Blue Flag beaches.

The City currently has 10 Blue Flag beaches, with five each on the Atlantic and False Bay coastlines (table 13 and figure 21). In accordance with the international Blue Flag standards, each beach has to submit at least five samples per season, no more than 30 days apart. It is very important to note that the Blue Flag season is only from 1 December to 31 January for most of the beaches. For more popular beaches (Camps Bay, Muizenberg and Strandfontein), Blue Flag season continues until 31 March. With a season of four months, a sample must be taken every month in addition to a pre-season sample, and this equates to five samples per year. However, the City exceeds this sampling regime, as we obtain weekly or biweekly samples necessary for the beaches that only have a two-month season.

The sampling dates are set at least six months before they take place, as the municipality must submit a sampling calendar in conjunction with the annual Blue Flag applications, usually in April or May, and samples must be within four days of the dates submitted. Again, in accordance with the international standards, an accredited, independent laboratory is sourced each year and is responsible for both sampling and analysis. Two bacteria are sampled – enterococci and *E. coli* with limits of 100 and 250, respectively, which is identical to the parameters of our national guidelines and is defined as excellent.

For the 2020/21 Blue Flag season, False Bay's results were not as good as the Atlantic side of Cape Town. This is not surprising given the water-quality challenges evident in False Bay and which this report has demonstrated more widely. Mnandi had a particularly poor sample, the cause of which was not identified but fortunately all of the other samples were excellent. Due to the use of the 95th percentile and the rolling-over effect that takes place over a four-year sampling period, there is a slight risk of Mnandi dropping off the programme unless results in the 2021/22 season improve.

FIGURE 21: CAPE TOWN'S BLUE FLAG BEACHES

TABLE 13: HISTORICAL OVERVIEW OF THE STATUS OF BLUE FLAG BEACHES ALONG CAPE TOWN'S COAST

BEACH	YEARS IN PROGRAMME	BLUE FLAG STATUS AWARDED				
		2016/17	2017/18	2018/19	2019/20	2020/21
Silwerstroomstrand	9	✓	✓	✓	✓	✓
Melkbosstrand	5	✓	✓	✓	✓	✓
Clifton 4th Beach	18	✓	✓	✓	✓	✓
Camps Bay Beach	14	✓	✓	✓	✓	✓
Llandudno Beach	11	✓	✓	✓	✓	✓
Fish Hoek Beach	5	✓	✓	✓	✓	✓
Muizenberg Beach	16	✓	✓	✓	✓	✓
Strandfontein Beach	13	✓	✓	✓	✓	✓
Mnandi Beach	17	✓	✓	✓	✓	✓
Bikini Beach	17	✓	✓	✓	✓	✓

THE CITY'S COASTAL WATER-QUALITY MONITORING VERSUS BLUE FLAG MONITORING

Discrepancies between the water-quality rating obtained by the City's coastal water-quality programme and the Blue Flag programme at some of Cape Town's Blue Flag beaches are often due to a technical difference in how the results are treated. In the event of high faecal indicator bacteria counts, the Blue Flag programme allows follow-up samples to be collected to show that a pollution event was short-lived (for instance, an event associated with rainfall). This is to prevent a few samples from influencing the water-quality rating to such an extent that it does not reflect the long-term state. If the results of the follow-up samples show that a pollution event was short-lived and has passed, the original high count may be replaced with the results of a follow-up sample (but only to a maximum of 15% of samples, or one sample in a specific bathing season, whichever is greater). The City, however, does not follow such a discounting procedure in its coastal water-quality monitoring programme. If it did, water quality at sites overlapping with Blue Flag beaches would likely also be rated 'excellent'.

SUMMARY OF KEY FINDINGS

Reflecting on the City's coastal water-quality monitoring programme, the following key findings emerge from the 2020 reporting year:

On the Atlantic coast:

- Milnerton lighthouse experienced a slight decline in water-quality category from 'excellent' to 'sufficient'.
- Camps Bay saw an improvement from 'sufficient' to 'excellent' – good water-quality results were also evident at the new sampling point north of Camps Bay Beach and at Glen Beach.
- At Bakoven, one sampling point improved (Beta Beach) while another declined (Bakoven Beach).
- Llandudno showed a small improvement from 'sufficient' to 'good'.
- Hout Bay declined from 'sufficient' to 'poor'.
- Maiden's Cove tidal pool improved (at both sampling points) from 'sufficient' in 2019 to 'excellent' in 2020.
- Beta Beach improved from 'poor' to 'good'.
- Scarborough Beach improved from 'sufficient' to 'excellent'.

While on the False Bay coast:

- Boulders Beach declined from 'sufficient' to 'poor'.
- Clovelly Beach declined to 'poor'.
- Frank's Bay improved from 'good' to 'excellent'.
- Simon's Town Long Beach improved from 'poor' to 'sufficient'.
- St James tidal pool improved from 'good' to 'excellent'.
- Strandfontein tidal pool improved from 'poor' to 'excellent'.
- Mnandi Beach declined from 'sufficient' to 'poor'.
- The eastern section of False Bay, with the exception of Gordon's Bay, Bikini Beach and Kogel Bay, remained 'poor'.

Overall, and at a city-wide scale, there have been no significant changes in coastal water quality across Cape Town. Recreational beaches rated as 'poor' in 2020 are mainly a result of three or fewer results of high bacterial counts as opposed to consistently high counts in bacterial readings. Although few, such results do affect the overall water-quality rating through the application of the Hazen method of statistical analysis.

Beaches that do not have stormwater outlets, or are far away from river mouths, usually have 'good' or 'excellent' water quality. This highlights the impact of:

- urban pollutants on the coastline;
- waste generated by residents, business and visitors; and
- waste via the stormwater system and rivers on nearshore coastal water quality.

Areas with chronic coastal water-quality problems are:

- Lagoon Beach
- Three Anchor Bay
- central False Bay
- Macassar to Gordon's Bay

The City is determined to improve water quality in these areas and will implement various interventions to drive an incremental improvement of the water quality along the False Bay coastline in particular.

COASTAL WATER QUALITY:
HOW YOU CAN HELP MAKE A DIFFERENCE

ILLEGAL DISCHARGE INTO THE SEWER SYSTEM

Cape Town's sewer reticulation system operates under tremendous stress due to the illegal discharge of foreign items into the sewer system. The sewer reticulation system is only geared to accept toilet waste (urine, excrement and toilet paper) and sink/basin/bath waste (water, washing liquid and soap). Anything other than this has a negative impact on the systems and ultimately causes blockages, and where such overflows take place in close proximity to the coast, it enters the stormwater system and discharges into the receiving marine and coastal environment.

During 2020, the City's Water and Sanitation Department cleared approximately 122 000 sewer blockages across Cape Town. Approximately 75% of these cases are the result of misuse of the sewer system. Items commonly removed include tyres, old clothes, shoes, building rubble, rags, newspaper, nappies, feminine hygiene products, condoms, wet wipes, animal carcasses and food waste (figure 22 and figure 23). Compounding the situation are the high levels of cooking fat/oil that is discharged into the sewer system. When fats/oils are poured or flushed down the sink and drain, they harden and build up on the inside of the sewer pipes and act like glue, attracting rags, hair, paper, plastics and other debris. The hardness of these blockages can also make them very difficult to clean out. It is items such as these that can cause up to 400 sewer overflows per day across the city.

FIGURE 22: BUILDING MATERIAL REMOVED FROM SEWER INFRASTRUCTURE

FIGURE 23: FOREIGN MATERIAL, INCLUDING TYRES AND A GAS COOKER, REMOVED FROM THE SEWER SYSTEM

The City spent approximately R350 million last year specifically due to misuse of the system. This is expenditure that can be avoided through improved awareness and education, and gradual behaviour change. Members of the public can contribute to limiting sewage blockages and subsequent spills into the receiving environment by doing the following:

- Flush only human waste, toilet paper, and cleaning detergent down the toilet. Everything else such as rags, cooking oil/fats, newspapers, feminine hygiene products, condoms, nappies, wet wipes and building materials need to be disposed of via the appropriate solid waste services that are provided by the City. Flushing anything apart from human waste and toilet paper is illegal in terms of the **Wastewater and Industrial Effluent By-law, 2013**.
- Install and properly maintain a grease trap if you run a restaurant or are involved in food preparation.
- Put a strainer in the sink to catch food and do not wash food scrapings down the drain. Throw these in the rubbish bin. Do not install a food grinder in your sink.
- Manholes must not be used for dumping/waste disposal. These should remain closed as they are only used for inspection and maintenance purposes.
- Report missing manhole covers to the City. Manhole covers prevent objects like sand, stones and discarded items from falling into our sewers. They are also important for safety and prevent bad smells and cockroaches from leaving the system. Missing manhole covers and any other faults may be reported to the City **here**.
- Check that tree roots are not growing into your sewer system.
- Ensure that your drains are fitted with suitable covers to prevent sand, leaves and other foreign material from entering the sewer system.
- Sweep sand away from drains and dispose of it in small amounts in the normal household bin, or at your local **drop-off site**.
- Ensure that rain gutters, downpipes and surface runoff on your property flow into stormwater drains in the street rather than sewers. Illegal discharge of stormwater (i.e. from rain gutters) into sewers contributes to overflows by overloading the capacity of the pipes, particularly during heavy rainfall.
- Call a qualified, **registered plumber** to unblock sewers on your private property. Call our Technical Operation Centre if the blockage is in the street or on public land.

For further information, refer to the **Bin it, Don't Block It Campaign**.

ILLEGAL DISCHARGE INTO THE STORMWATER SYSTEM

Cape Town's stormwater system drains the city and prevents disruption and inconvenience to everyday life activities during rain events and assists with the management of flooding. The stormwater system is an extensive network of built infrastructure – such as pipes and culverts – and natural systems like our rivers and wetlands.

Cape Town's stormwater system consists of:

- 150 000 gullies/intakes
- 16 630 km of pipes and culverts
- 890 detention ponds
- 236 stormwater treatment wetlands
- 1 910 km of rivers and streams
- thousands of wetlands, including 'vleis' and estuaries
- 27 stormwater pump stations
- 59 rainfall and flow monitoring stations
- approximately 200 inland and coastal water-quality monitoring stations

It is illegal for residents or businesses to discharge anything other than clean stormwater into the stormwater system. Placing any other substance into our stormwater system not only leads to blockages that can cause flooding by reducing the capacity of the stormwater system, but may lead to the contamination of the receiving coastal environment.

CITY'S STORMWATER STENCILLING PROJECT

The aim of the project is to raise public awareness of the connection between the city's stormwater system and the coastal environment. The goal is to encourage the public not to litter and pollute stormwater catchpits that drain into the sea. This is achieved by way of clear and concise messaging stencilled on stormwater drains along popular coastal roads, targeting areas where there is particularly high pedestrian activity.

The City has identified three short messages, along with the design of simple sea creatures. These short messages include the following:

- KEEP CLEAN! DRAINS TO SEA
- KEEP CLEAN! DRAINS TO RIVERS
- ONLY RAIN IN THE DRAIN

The City is currently in the process of initiating three stormwater drain stencilling pilot projects at the following locations:

- Surfers Corner, Muizenberg
- Sea Point Main Road and Beach Road
- St George's Mall pedestrian walkway

Approximately 70 stencils have been painted to date at these locations (figure 24) but the project has been delayed as a consequence of beach closures due to the Covid lockdown.

FIGURE 24: STORMWATER STENCILLING: KEEP CLEAN! DRAINS TO SEA

HELP PREVENT OCEAN POLLUTION IN CAPE TOWN

Cape Town is experiencing pollution incidents caused by the disposal of unwanted materials and substances into the stormwater system, which flows directly into the sea. In terms of various City by-laws, it is illegal to discharge any substance that may have a harmful impact on the quality of the water in the stormwater system, and/or poses a threat to the health of people and our natural environment. The stormwater system links our homes, businesses and streets to the natural environment, which includes the sea. It is not for waste disposal.

We all share the responsibility of taking as many steps as possible in preventing pollution from entering our ocean. The coastline is one of our most important socio-economic, cultural and environmental assets, and we need to do everything possible to protect it as a shared space. It is very difficult to trace the source of pollution in stormwater, so it helps if people inform the City if they are aware of waste dumping or discharging of substances into the stormwater system.

PLEASE REPORT the following using the contact details provided:

Blocked drains and waste substances being illegally discharged into the stormwater system	
Online	www.capetown.gov.za/servicerequests
WhatsApp	063 407 3699
Email	water@capetown.gov.za
SMS	31373 (max 160 characters)
Call	0860 103 089
Visit	City walk-in centres: www.capetown.gov.za/facilities

Illegal dumping	
Call	021 444 6231/6224/3
Email	solidwaste.bylaw@capetown.gov.za

Informal settlement waste	
SMS	32772 (max 160 characters)

Removal of dead animals	
WhatsApp	082 563 2712

Other waste-related queries	
Call	0860 103 089
Email	wastewise.user@capetown.gov.za

WHERE TO SAFELY DISPOSE OF HAZARDOUS/ DANGEROUS SUBSTANCES

Athlone Household Hazardous Waste Drop-off and Bellville Integrated Waste Management Facility[3]
– Paint or substances used to dissolve paint – Anti-freeze and other waste products from cars – Household cleaning products – Fertilisers, insecticides and herbicides
Vissershok Landfill Facility – special waste
– Blood and animal by-products (permit or prior approval needed)
Sewer system on your property
– Detergents used to wash refuse bins and the contaminated water from bin washing – Detergents from car washing and engine cleaners – Hygienic detergents used in portable toilets – Animal/bird faeces – Building site runoff
Disposed as general/recyclable waste (in own or nearest bin) or at City drop-off sites
– Litter such as plastic bags, bottle tops and cigarette butts – Household cooking oil (rather than in the sewer or stormwater system) – Hygiene products (wet wipes, earbuds, feminine hygiene products, nappies, disposable face masks) – Engine oil (City drop-offs)
Solid Waste Management Department
– Dead animals (please send a **WhatsApp** to **082 563 2712**)

Disposal details	
Athlone Refuse Transfer Station Note: Only small volumes are accepted	Off Bhunga Avenue, Settlers Way, Athlone
Bellville Integrated Waste Management Facility Note: Only small volumes are accepted	Sacks Circle, Bellville
Vissershok (special waste)	Off N7, Frankdale Road, near Table View

For more information, search for 'Household hazardous waste drop-off' at **www.capetown.gov.za**

Enquiries	
City solid waste drop-off sites	**0860 103 089** for more information or search for 'Drop off your waste' at **www.capetown.gov.za**
Sewer	For more information, email **water@capetown.gov.za**
Solid Waste Management	For assistance, contact **0860 103 089** (option 1) or email **wastewise.user@capetown.gov.za**

[3] *Waste of residential origin ONLY in a vehicle with a carrying capacity of less than 1,5 tonnes. Waste from other sources (non-residential) to be disposed at Vissershok Landfill Facility with the relevant permit.*

CITY'S COASTAL SEWAGE SPILL RESPONSE PROTOCOL

Sewage spills are inevitable. The City has established a Coastal Sewage Spill Response Protocol that provides for a timeous, efficient and well-coordinated response by City departments to sewage spills that impact Cape Town's coastal waters.

COASTAL SEWAGE SPILLS

Coastal sewage spills are defined in the protocol as:

- raw sewage that flows directly onto the beach
- raw sewage that flows directly into the ocean
- raw sewage that flows directly into the coastal environment, including dunes, coastal wetlands or coastal veld

SEWAGE SPILL RESPONSE PROCEDURE

On receiving a report/complaint of sewage entering the coastal environment, the following actions must be undertaken:

- The City official that receives the complaint must first verify the complaint. Providing that the complaint is legitimate, the sewage spill must be formally logged through the Water and Sanitation hotline (0860 103 089, option 2) and a reference number obtained.
- An immediate site inspection must be conducted by the relevant sewer reticulation team to identify the source of the leak and the sewage discharge point on the coastline.
- Stop the sewage leak.
- Assess the level of the incident.
- Notify relevant Environmental Health, Coastal Management, and Catchment, Stormwater and River Management (CSRM) officials.
- Undertake all necessary actions to repair the damaged sewer infrastructure that led to the spill.
- Communicate progress of sewer infrastructure repair work with the district Environmental Health official and the relevant Coastal Management official.

While and where raw sewage is running into the coastal environment, the district Water and Sanitation official, in consultation with the Coastal Management official, must determine the most appropriate course of action to contain the sewage already spilled, including:

- bunding off the contaminated area to contain the sewage
- opening channels to allow sewage to flow into the ocean for dispersion
- channelling the sewage spill away from wetlands, estuaries, rock pools, tidal or other sensitive coastal areas
- pumping of sewage spilled for removal from the coastal environment
- application of bio-augmentation, disinfection and anti-odour measures if necessary

The following actions must be undertaken to communicate with the public and make the area safe:

- Environmental Health, in cooperation with Recreation and Parks, must immediately ensure the erection of temporary pollution signage where sewage spills have taken place at nodal recreation areas. To facilitate this, Environmental Health has to ensure signage is stored at strategic locations across the city for quick access and distribution to spill sites. These locations and signs are to be accessible to line departments listed in the protocol at all times.
- Environmental Health officials in conjunction with Coastal Management officials must jointly make a decision as to whether the affected coastal environment should be closed to the public for safety reasons.

Should a decision be made to close the beach, Environmental Health must notify the following officials:

- City communications;
- principal Facility Officer from Recreation and Parks responsible for the beach facilities in the area in which the sewage spill has occurred;
- local area law enforcement; and
- in cases where City lifesavers are present, lifesavers must instruct the public that for their own safety, the beach, ocean and affected areas are closed until further notice. If need be, lifeguards are to be deployed to call people from the water.

Protocol for issuing a media statement

- All media statements relating to the sewage spill must be signed off by the Executive Director: Social Services and Executive Director: Informal Settlements, Water and Waste Services prior to being released.

POST-SEWAGE SPILL CLEAN-UP PROCEDURE

- Upon the sewage leak being contained, Environmental Health must engage with the relevant district Water and Sanitation official, Solid Waste official and Coastal Management official to determine the most appropriate response to disinfect and clean the coastal area.
- If necessary, Solid Waste must engage with Specialised Services to assist in the removal of raw sewage from the site.
- Collected waste (including any contaminated substrate) must be removed from the site and immediately disposed of at a registered landfill site.
- Should physical removal of sewage or contaminated substrate not be possible, bio-augmentation and disinfection must be applied.
- The coastal clean-up will be done under the guidance of the Coastal Management official, in consultation with the district Water and Sanitation official.

MONITORING POST-SEWAGE SPILL EVENT

- Environmental Health must request that Scientific Services take representative samples for the analysis of both *E. coli* and enterococci from the affected area. These samples should be taken from water courses and/or affected stormwater systems and the receiving ocean environment to determine the level of contamination post the sewage spill event.
- Environmental Health must report results to the relevant line departments.
- The affected coastal area may only be reopened to the public when the following thresholds are met in the bathing area closest to the spill location:

  – *E. coli*: < 500 cfu/100 mℓ
  – Enterococci: < 200 cfu/100 mℓ

NEMA REPORTING

The City is obliged to report on significant sewage spill events in terms of the National Environmental Management Act's Environmental Impact Assessment regulations.
A 'significant' sewage spill in terms of these regulations is one that:

- has the potential to cause a serious or detrimental impact on the receiving natural environment;
- poses a significant health and safety hazard to the general public; and
- results in closure (temporary or permanent) of the beach.

If the spill is considered to be 'significant', Water and Sanitation will report the incident to the Head: EMS and Environmental Audit.

The protocol details by individual name and cell number of the various City officials who are responsible for responding and are listed in the protocol as per the example template below.

Responsible department	Official/Proxy	Designation/Area
City Health		
Water and Sanitation		
Recreation and Parks		
Coastal Management		
Law Enforcement		
Solid Waste		

TIPS FOR A SAFER BEACH EXPERIENCE

Avoid swimming in the sea or paddling in rock pools near stormwater outlets. This has been shown to increase the risk of illness.

Avoid swimming for 12 to 24 hours after moderate to heavy rainfall. Rainfall increases the possibility of poor water quality, as it washes faecal matter from land and overflowing sewers. This advice applies particularly to beaches where the water quality is rated 'sufficient' or 'poor'.

Avoid swimming in the mouths of estuaries and sheltered lagoons. The water might be of a poorer quality.

Do not swim if you have an open wound.

LIST OF TABLES AND FIGURES

REFERENCES

Ackerman, D. & Weisberg, S.B. (2003). 'Relationship between rainfall and beach bacterial concentrations on Santa Monica Bay beaches', *Journal of Water and Health*, 1(2): 85-89.

Agardy, T., Alder, J., Dayton, P., Curran, S., Kitchingman, A., Wilson, M., Catenazzi, A., Restrepo, J., Birkeland, C., Blaber, S., Saifullah, S., Branch, B., Boersma, D., Nixon, S., Dugan, P., Davidson, N. & Vorosmarty, C. (2005). 'Coastal systems', *Millennium ecosystem assessment, ecosystems and human well-being*. Island Press: Washington DC, (1): 513-549.

Campbell, E.E. & Bate, G.C. (1988). 'The estimation of annual primary production in a high-energy surf-zone', *Botanica Marina*, 31(4): 337-344. DOI: 10.1515/botm.1988.31.4.337.

Campbell, E.E. & Bate, G.C. (1997). 'Coastal features associated with diatom discoloration of surf-zones', *Botanica Marina*, 40(3): 179-185. DOI: 10.1515/botm.1997.40.1-6.179.

Dasgupta, S., Peng, X., Chen, S., Li, J., Du, M., Zhou, Y.H., Zhong, G., Xu, H. & Ta, K. (2018). 'Toxic anthropogenic pollutants reach the deepest ocean on Earth', *Geochemical Perspectives Letters*, (7): 22-26. DOI: 10.7185/geochemlet.1814.

Du Preez, D.R. & Bate, G.C. (1992). 'Dark survival of the surf diatom *Anaulus Australis* Drebes *et* Schulz', *Botanica Marina*, 35(4): 315-320. DOI: 10.1515/botm.1992.35.4.315.

Kleinheinz, G.T., McDermott, C.M., Hughes, S. & Brown, A. (2009). 'Effects of rainfall on *E. coli* concentrations at Door County, Wisconsin Beaches', *International Journal of Microbiology*. DOI: 10.1155/2009/876050.

Masoner, J.R., Kolpin, D.W., Cozzarelli, I.M., Barber, L.B., Burden, D.S., Foreman, W.T. & Hopton, M.E. (2019). 'Urban stormwater: An overlooked pathway of extensive mixed contaminants to surface and groundwaters in the United States', *Environmental Science and Technology*, (53): 10070-10081.

Moser, S.C., Williams, S.J. & Boesch, D.F. (2012). 'Wicked challenges at Land's End: Managing coastal vulnerability under climate change', *Annual Review of Environment and Resources*, (37): 51-78.

Odebrecht, C., Du Preez, D.R., Abreu, P.C. & Campbell, E.E. (2014). 'Surf zone diatoms: A review of the drivers, patterns and role in sandy beaches food chains', *Estuarine, Coastal and Shelf Science*, (150): 24-35. DOI: 10.1016/j.ecss.2013.07.011.

Sloff, D.S., McLachlan, A. & Bate, G.C. (1984). 'Spacial distribution and diel periodicity of *Anaulus birostratus* Grunow in the surf zone of a sandy beach in Algoa Bay, South Africa', *Botanica Marina*, 27(10): 461-466. DOI: 10.1515/botm.1984.27.10.461.

Talbot, M. & Bate, G. (1986). 'Diel periodicities in cell characteristics of the surfzone diatom *Anaulus birostratus*: their role in the dynamics of cell patches', *Marine Ecology Progress Series*, 32(1): 81-89. DOI: 10.3354/meps032081.

Talbot, M. & Bate, G. (1988). 'The use of false buoyancies by the surf diatom *Anaulus birostratus* in the formation and decay of cell patches', *Estuarine, Coastal and Shelf Science*, (26): 155-167.

Talbot, M.M.B., Bate, G.C. & Campbell, E.E. (1990). 'A review of the ecology of surf-zone diatoms, with special reference to *Anaulus australis*', *Oceanography and Marine Biology: An Annual Review*, (28): 155-175.

Urban-Econ. (2017). *Economic inputs into coastal economic and spatial strategic framework for the City of Cape Town: Final Draft Report.* Cape Town.

Western Cape Department of Health. (2020). ***Population data***.

ACRONYMS

CCTV	closed-circuit television
cfu	colony-forming units
Covid	coronavirus disease
CSRM	Catchment, Stormwater and River Management
GDP	gross domestic product
IY	Imizamo Yethu
MPA	Marine Protected Area
SABS	South African Bureau of Standards
TFD	too few data
UV	ultraviolet
WWTW	wastewater treatment works

This report can be found online at:
www.capetown.gov.za

Information on Cape Town's coastline, beaches and coastal amenities is available on the City's website.

If you wish to report a pollution incident, please visit: www.capetown.gov.za/ServiceRequests

If you see pollution or witness it being discharged into the stormwater system:

Emergencies:	Call 107 from a landline, 112 toll free or 021 480 7700 from a cellphone
Water and Sanitation:	Call 0860 103 089, select option 2 (24 hours)
SMS:	31373 (max 160 characters)
Email:	waterTOC@capetown.gov.za

Please help us keep our oceans clean and safe.

CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

Making progress possible. Together.