CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

KNOW YOUR COAST, 2022

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

Making progress possible. Together.

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- Click the page number at the bottom of each page to return to the contents page.

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1. INTRODUCTION

Monitoring and reporting of coastal water quality allows the City to continuously monitor cases of urban-based pollution and the effect this may have on coastal water quality. It must be noted that it is not the intent of this report to provide an advisory role in respect of public health as it relates to coastal water quality but merely to present the status and trends of coastal water quality, and the drivers of these trends, in Cape Town.

This year's report provides an overview of the 2022 results for our coastal water-quality monitoring programme. It reflects the outcome of approximately 2 400 sample bacterial tests from 99 sites along 307 km of coastline for the 12-month reporting period commencing 1 December 2021 and ending 30 November 2022. The analysis includes all relevant and available water-quality data to generate the most accurate understanding of coastal water quality in Cape Town. These data include results from the Blue Flag monitoring programme, whereby coastal water samples are collected and analysed by an independent and accredited scientific laboratory.

The coastal water-quality results are presented in tables for both the Atlantic coast of Cape Town (Table 1) as well as for False Bay (Table 2) and illustrate sampling outcomes of the previous five-year period (2018–2022). Tables reflecting results for monitoring points are included in the annexure section. This information is key to understanding the 'bigger picture' as it relates to trends in coastal water quality for beaches in Cape Town over longer temporal scales.

While enterococci are the preferred faecal bacteria indicator (and supported by the World Health Organization as the most appropriate means to measure coastal recreational water-use categories), unforeseen challenges prevented Scientific Services from analysing enterococci for a significant portion of 2022. The absence of these data resulted in many of the categories to be classified as Too Few Data (TFD). Notwithstanding this, the City continued to sample and analyse *E. coli* from the City's 99 sampling sites which have historically been indicative of coastal water quality. These data are presented as scatter plots in sections 1.5 and 1.6.

E. coli data are not used to calculate water-quality categories as the WHO, in 2021, determined that: 'No statistical relationship has been established for *Escherichia coli* that can support a dose–response guideline value'. We now only use *E. coli* as broadly indicative of pollution.

The intention of the analysis and monitoring of coastal water quality is to help the City better understand where challenges are persistently being experienced and to identify the requisite interventions to improve water quality where necessary. Similarly, viewing the water-quality results over longer periods will illustrate success where various interventions have proven effective. It is anticipated that this annual review, along with the biweekly data updates via our web portal, will empower residents, visitors and tourists alike with information on coastal water quality along Cape Town's coastline.

TABLE 1: ANNUAL WATER-QUALITY RATINGS AT RECREATIONAL NODES ALONG THE ATLANTIC COAST, 2018–2022

RECREATIONAL NODES ATLANTIC COAST	COASTAL WATER-QUALITY RATING				
	2018	2019	2020	2021	2022
1. Silwerstroomstrand resort	Excellent	Excellent	Sufficient	Excellent	Sufficient
2. Silwerstroomstrand	Excellent	Excellent	Excellent	Sufficient	TFD**
3. Melkbosstrand	Excellent	Excellent	Good	Good	Excellent
4. Big Bay	Excellent	Excellent	Excellent	Sufficient	Excellent
5. Small Bay	Good	Sufficient	Excellent	Sufficient	Poor
6. Table View	Sufficient	Good	Sufficient	Excellent	Excellent
7. Milnerton lighthouse	Excellent	Excellent	Sufficient	Sufficient	Poor
8. Lagoon Beach	Poor	Poor	Poor	Poor	Poor
9. Three Anchor Bay	Poor	Poor	Poor	Poor	Poor
10. Three Anchor Bay West	NYM*	NYM*	TFD**	Excellent	TFD**
11. Rocklands Beach	Sufficient	Sufficient	Sufficient	Excellent	Poor
12. Milton Beach tidal pool	Excellent	Excellent	Sufficient	Sufficient	Sufficient
13. Saunders' Rocks tidal pool	Good	Sufficient	Sufficient	Poor	Sufficient
14. Clifton 1–4	Excellent	Excellent	Excellent	Good	Excellent
15. Maiden's Cove tidal pool 1	Sufficient	Sufficient	Excellent	Sufficient	Excellent
16. Maiden's Cove tidal pool 2	Sufficient	Sufficient	Excellent	Sufficient	Excellent
17. Glen Beach	NYM*	NYM*	TFD**	Sufficient	TFD**
18. Camps Bay North	NYM*	NYM*	TFD**	Excellent	Excellent
19. Camps Bay	Sufficient	Sufficient	Excellent	Excellent	Good
20. Camps Bay tidal pool A	Sufficient	Good	Poor	Sufficient	TFD**
21. Camps Bay tidal pool B	Sufficient	Sufficient	Sufficient	Sufficient	Good
22. Beta Beach	Poor	Poor	Good	Poor	Poor
23. Bakoven bungalows	Sufficient	Sufficient	Poor	Poor	Good
24. Cosy Bay (Oudekraal)	Good	Excellent	TFD**	TFD**	TFD**
25. Llandudno Beach	Sufficient	Sufficient	Good	Excellent	Sufficient
26. Hout Bay Beach	Sufficient	Sufficient	Poor	Poor	Good
27. Long Beach, Kommetjie	Excellent	Excellent	Sufficient	Poor	TFD**
28. Scarborough Beach	Excellent	Sufficient	Excellent	Excellent	TFD**

* *NYM – not yet monitored*
** *TFD – too few data*

1.1 COMPARISONS BETWEEN 2021 AND 2022: ATLANTIC COAST

The results for the reporting period of 2022, if compared to the last reporting period of 2021 on the Atlantic coast, reveal that:

- In 2022, 15 beaches met the minimum requirement compared to 20 beaches in 2021. A number of beaches in 2022 were categorised as TFD (too few data). This was a result of there being insufficient data to generate a coastal water-quality category as per the Hazen method of analysis. Due to unforeseen circumstances within the Scientific Services Department, the analysis of enterococci samples could not take place over a significant period of time in the 2022 reporting year.
- In 2022, coastal water quality improved at nine locations. These were Melkbosstrand, Big Bay, Saunder's Rocks tidal pool, Clifton Beach, Maiden's Cove tidal pools 1 and 2, Camps Bay tidal pool, Hout Bay Beach and Bakoven bungalows.
- At three locations, water quality remained 'poor'. These were Lagoon Beach, Three Anchor Bay and Beta Beach.
- At three locations, water quality regressed to the 'poor' category. These were Small Bay, Milnerton lighthouse and Rocklands Beach.
- There was a decrease from seven beaches in 2021 to six beaches rated as 'poor' in 2022.

1.2 NOTABLE CHANGES: ATLANTIC COAST

The following significant changes were noted for the Atlantic coast:

- Both Maiden's Cove tidal pools 1 and 2 achieved 'excellent' status in 2022 compared to 'sufficient' status in 2021.
- Rocklands Beach regressed to 'poor' status, whereas in 2021, it was rated as 'excellent'. As per the scatter plot for Rocklands Beach, the regression to 'poor' status was as a result of a single poor result. This result can in all likelihood be attributed to discharge from a stormwater outlet located in close proximity to the sampling location.
- Small Bay displayed fluctuating results and regressed to the 'poor' category as a result of five of the samples failing the coastal recreational water use guidelines. The regression into the 'poor' category and the number of failed results are of concern and will be monitored closely by the City.

TABLE 2: ANNUAL WATER-QUALITY RATINGS AT RECREATIONAL NODES ALONG THE FALSE BAY COAST, 2018–2022

FALSE BAY COAST	COASTAL WATER-QUALITY RATING				
	2018	2019	2020	2021	2022
1. Frank's Bay	Excellent	Good	Excellent	Excellent	TFD**
2. Seaforth Beach	Excellent	Sufficient	Sufficient	Poor	Poor
3. Boulders Beach	Sufficient	Sufficient	Poor	Excellent	TFD**
4. Simon's Town Long Beach	Poor	Poor	Sufficient	Poor	TFD**
5. Glencairn Beach	Excellent	Excellent	Excellent	Excellent	TFD**
6. Fish Hoek South	NYM*	NYM*	TFD**	Excellent	TFD**
7. Fish Hoek Beach	Excellent	Poor	Poor	Sufficient	Poor
8. Clovelly	Poor	Excellent	Poor	Poor	TFD**
9. Kalk Bay harbour beach	Poor	Sufficient	Sufficient	Sufficient	TFD**
10. Kalk Bay tidal pool	Excellent	Excellent	Good	Sufficient	TFD**
11. Dalebrook tidal pool	Excellent	Sufficient	Sufficient	Excellent	TFD**
12. St James tidal pool	Excellent	Good	Excellent	Sufficient	TFD**
13. Muizenberg Station	Sufficient	Poor	Sufficient	Poor	TFD**
14. Muizenberg central	NYM*	NYM*	TFD**	Good	Excellent
15. Muizenberg Pavilion	Sufficient	Poor	Poor	Poor	Excellent
16. Sunrise Beach	Sufficient	Poor	Poor	Poor	TFD**
17. Strandfontein	Excellent	Sufficient	Sufficient	Sufficient	Poor
18. Strandfontein tidal pool	Excellent	Poor	Excellent	Sufficient	TFD**
19. Mnandi Beach West	Excellent	Sufficient	Poor	Sufficient	TFD**
20. Mnandi Beach East	Excellent	Sufficient	Poor	Sufficient	Poor
21. Monwabisi tidal pool	Excellent	Excellent	Excellent	Sufficient	TFD**
22. Monwabisi Beach	Poor	Poor	Poor	Poor	TFD**
23. Macassar Beach	Poor	Poor	Poor	Good	TFD**
24. Strand water slides	NYM*	NYM*	TFD**	Excellent	TFD**
25. Strand Beach pedestrian crossing	NYM*	NYM*	TFD**	Excellent	TFD**
26. Strand Beach	Poor	Poor	Poor	Excellent	TFD**
27. Strand Murray Street	NYM*	NYM*	TFD**	Poor	TFD**
28. Strand Pavilion jetty	Poor	Poor	Poor	Poor	TFD**

TABLE 2: ANNUAL WATER-QUALITY RATINGS AT RECREATIONAL NODES ALONG THE FALSE BAY COAST, 2018–2022

FALSE BAY COAST	COASTAL WATER-QUALITY RATING				
	2018	2019	2020	2021	2022
29. Strand Harmonie Park	Poor	Poor	Poor	Excellent	TFD**
30. Gordon's Bay	Sufficient	Poor	Sufficient	Poor	TFD**
31. Gordon's Bay Milkwood	NYM*	NYM*	TFD**	Poor	TFD**
32. Bikini Beach	Excellent	Excellent	Sufficient	Excellent	Excellent
33. Kogel Bay	Excellent	Excellent	Excellent	Excellent	TFD**

* *NYM – not yet monitored*
** *TFD – too few data*

1.3 COMPARISONS BETWEEN 2021 AND 2022: FALSE BAY COAST

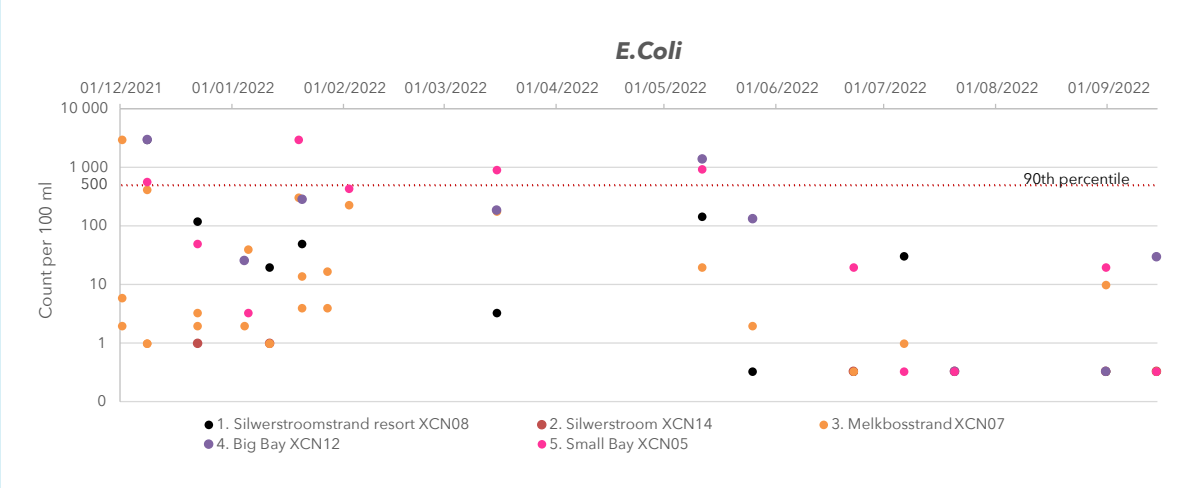
The results of the recreational nodes for the reporting period of 2022, if compared to the last reporting period of 2021, reveal that:

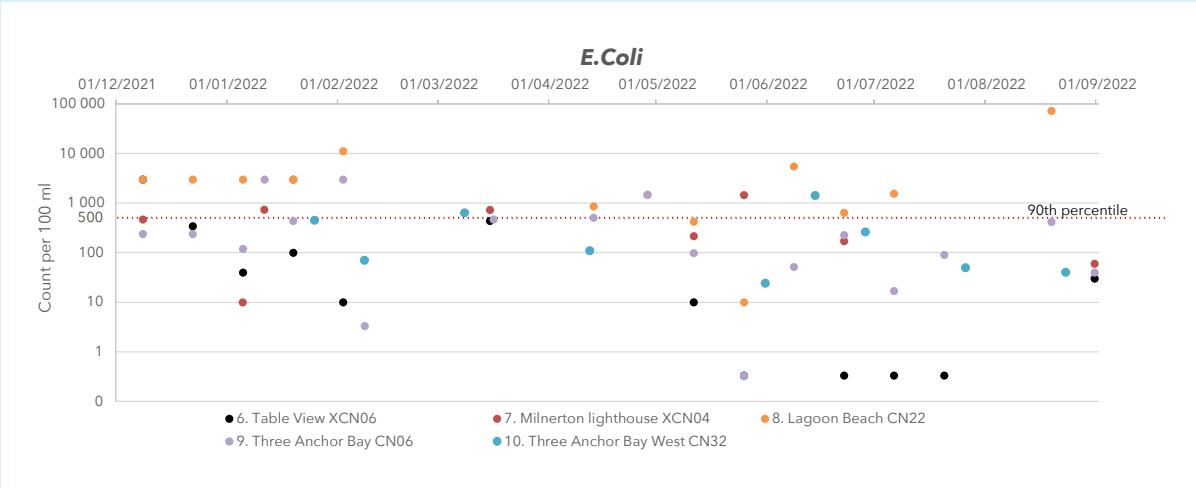
- In 2022, three beaches met the minimum requirement compared to 22 beaches in 2021. This low number is mainly attributed to the many 'TFD' categories for the False Bay coastline for the 2022 reporting period. Due to unforeseen circumstances within the Scientific Services Department, the analysis of enterococci samples could not take place over a significant period of time in the 2022 reporting year.
- At two locations, water quality improved. These included Muizenberg central (from 'good' in 2021 to 'excellent' in 2022) and Muizenberg Pavilion (from 'poor' in 2021 to 'excellent' 2022).
- At three locations, water quality regressed to the 'poor' category. These included Fish Hoek Beach, Strandfontein and Mnandi Beach East.

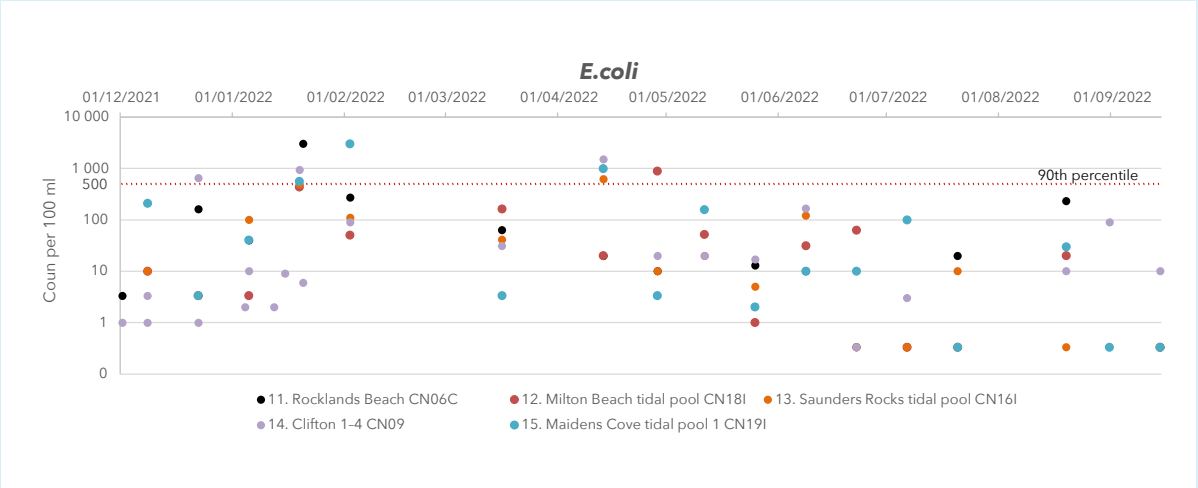
1.4 NOTABLE CHANGES: FALSE BAY COAST

- Muizenberg Pavilion has, for the first time over a period of five years, achieved 'excellent' status in 2022. While all three sample locations in Muizenberg tend to display variable results over a five-year period, the recent achievement of 'excellent' status at two sites in Muizenberg is a positive, and it is hoped that this is a result of the City's many efforts in eliminating various pollution sources in Muizenberg.
- Fish Hoek Beach regressed from 'sufficient' in 2021 to 'poor' in 2022. This sample point is located adjacent to a known pollution source – a stormwater outlet – and is the key reason why sample results for this location have reflected highly variable results over the last five years. It must be noted that, as per the coastal water-quality upload (29 March 2023), the water quality for the sample site in the south of Fish Hoek (adjacent to the Galley Restaurant), achieved 'excellent' status. This positive result is likely due to the location of this site, which is a significant distance away from the stormwater outlet.
- Water quality at Strandfondtein and Mnandi Beach East both regressed into the 'poor' category. While Mnandi Beach East has displayed a chequered history of coastal water quality over the last five years, the regression into 'poor' status at Strandfontein is a first. Since there is no major stormwater outlet at Strandfontein, it is likely that the result is due to localised runoff. The constant presence of seabirds at the tidal pool also cannot be discounted. On a positive note, for both the Strandfontein site and the tidal pool, the coastal water-quality category upload (29 March 2023) is 'sufficient'. The City will continue to monitor these sites closely.

1.5 SCATTER PLOTS: *E. COLI* – ATLANTIC COAST



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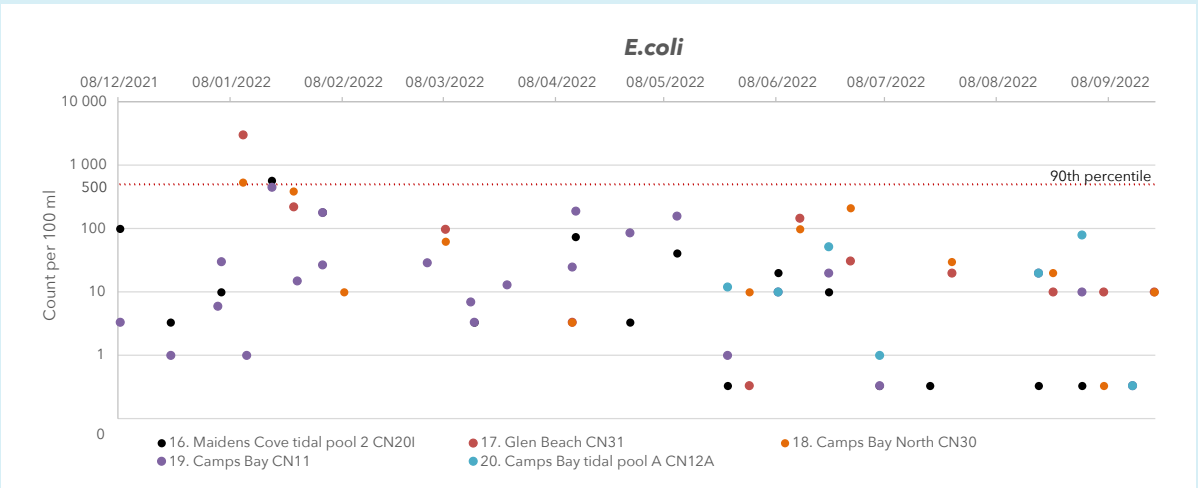
12. Milton Beach tidal pool CN18I
13. Saunders Rocks tidal pool CN16I
14. Clifton 1-4 CN09
15. Maidens Cove tidal pool 1 CN19I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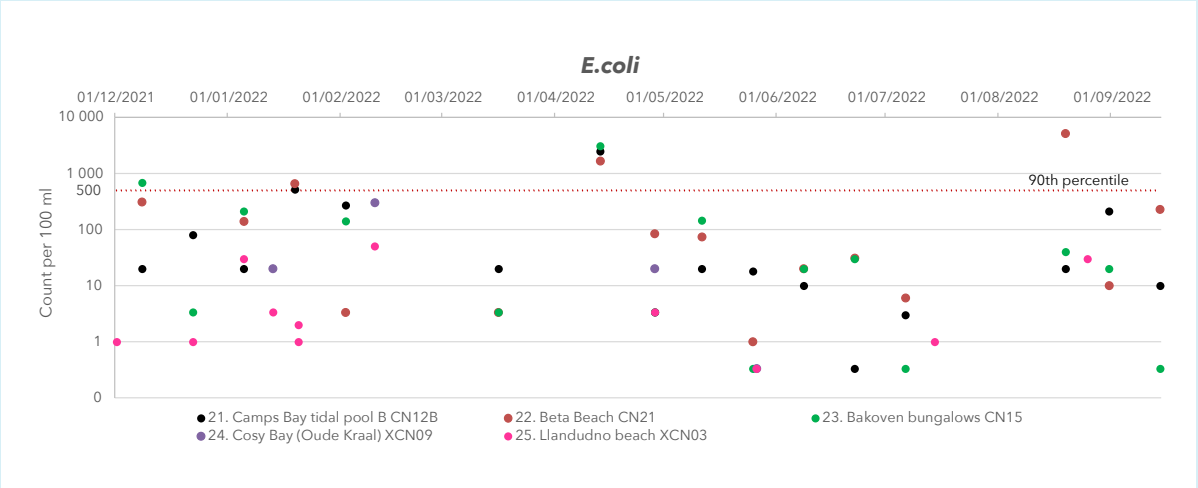
17. Glen Beach CN31
18. Camps Bay North CN30
19. Camps Bay CN11
20. Camps Bay tidal pool A CN12A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Count per 100 ml
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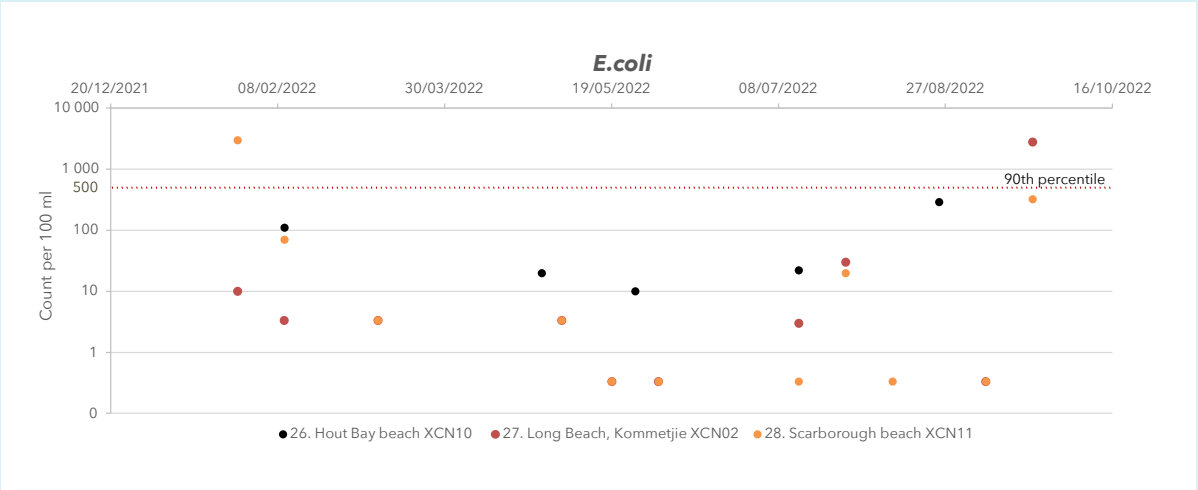
21. Camps Bay tidal pool B CN12B
22. Beta Beach CN21
23. Bakoven bungalows CN15
24. Cosy Bay (Oude Kraal) XCN09
25. Llandudno beach XCN03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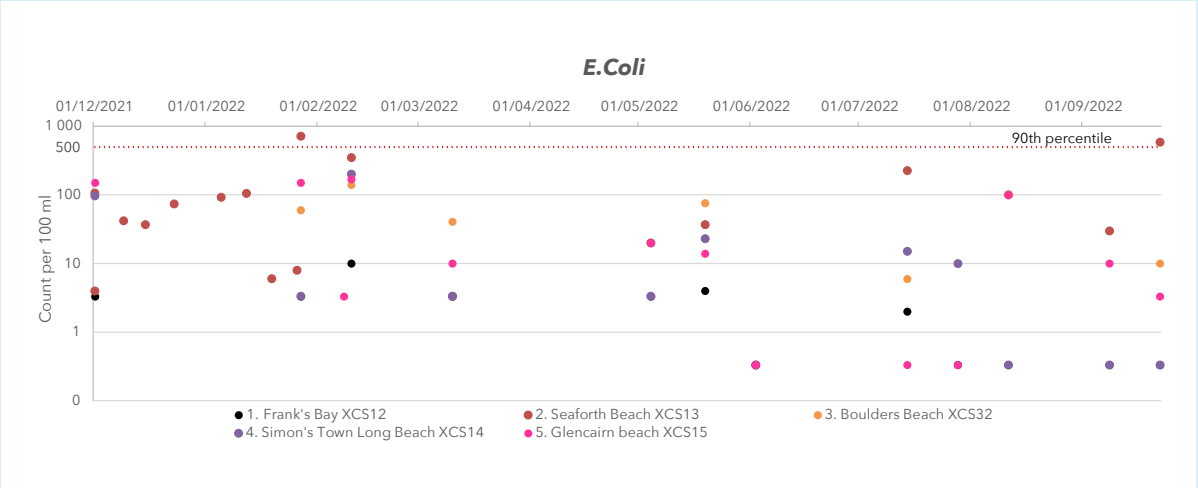
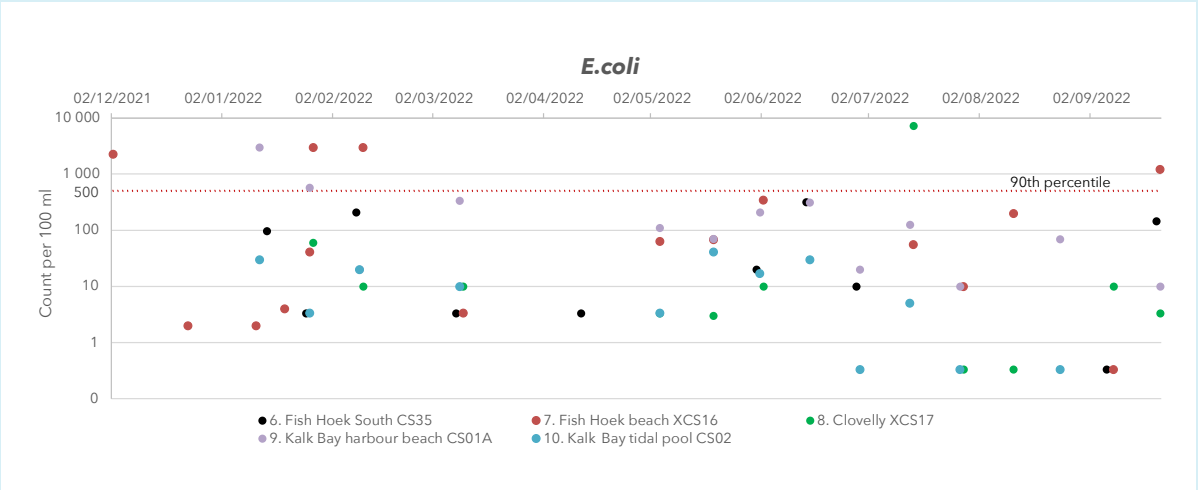
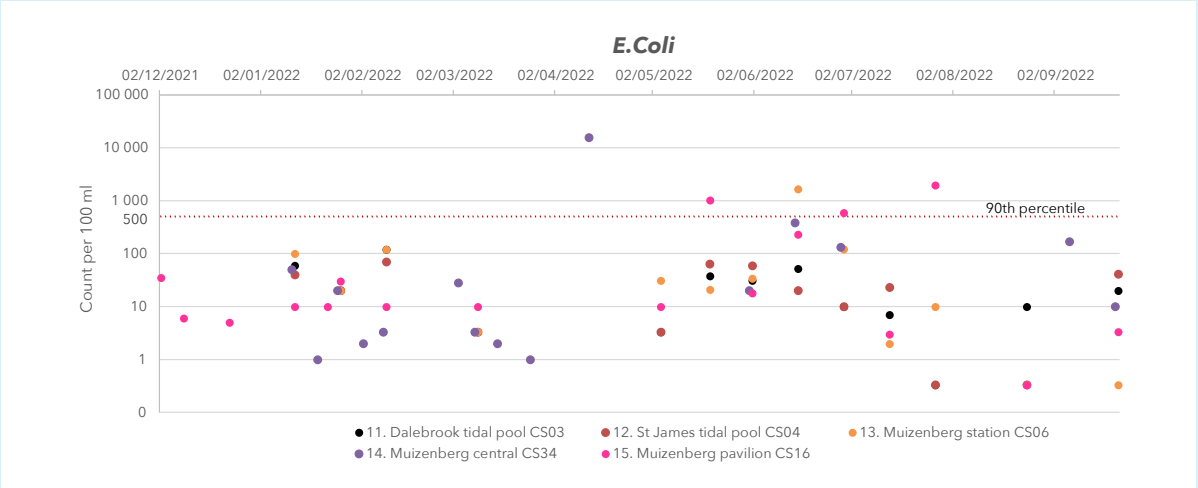
27. Long Beach, Kommetjie XCN02
28. Scarborough beach XCN11

1.6 SCATTER PLOTS: *E. COLI* – FALSE BAY COAST



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Count per 100 ml
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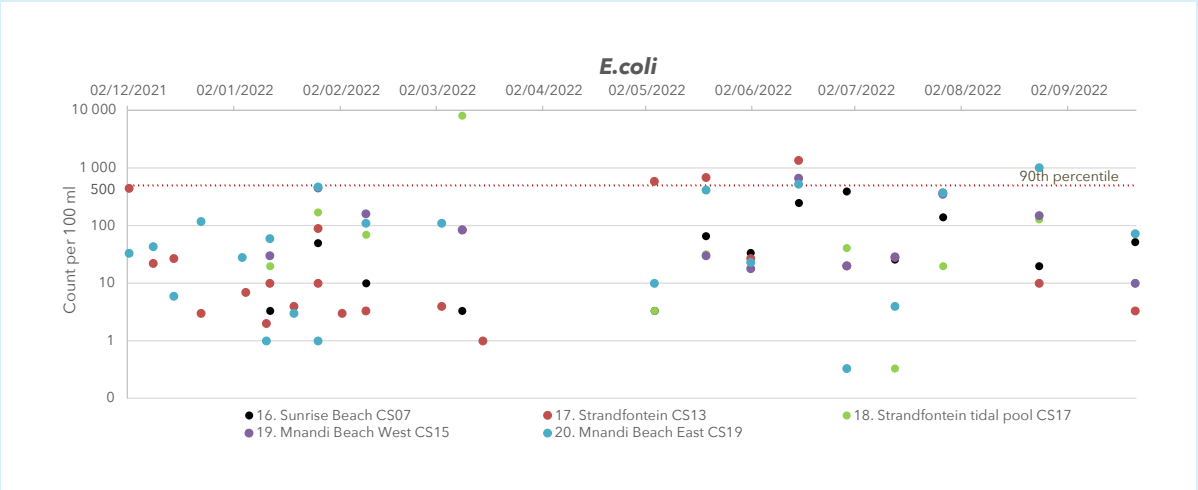
12. St James tidal pool CS04
13. Muizenberg station CS06
14. Muizenberg central CS34
15. Muizenberg pavilion CS16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Count per 100 ml
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16. Sunrise Beach CS07
17. Strandfontein CS13
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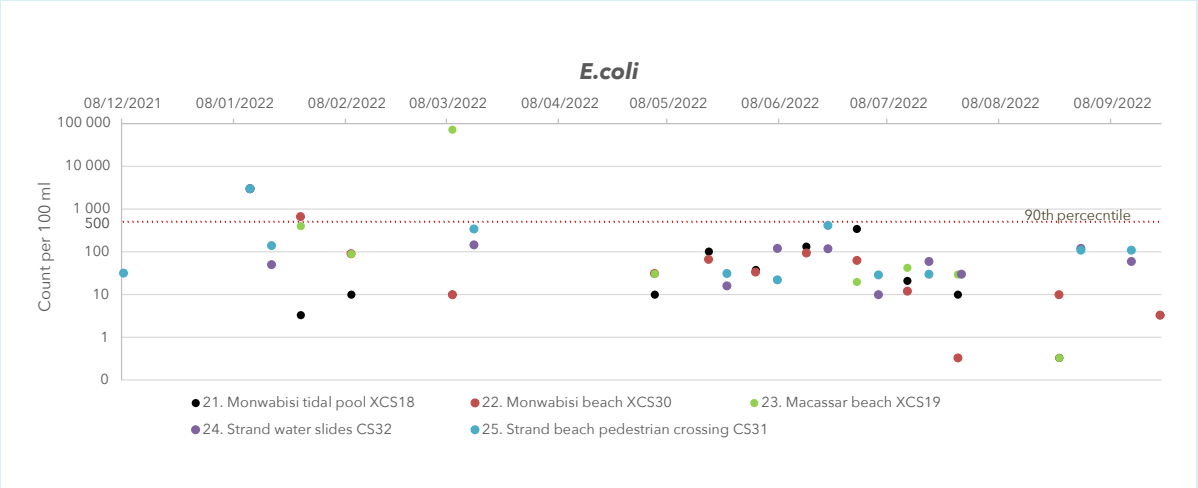
19. Mnandi Beach West CS15
20. Mnandi Beach East CS19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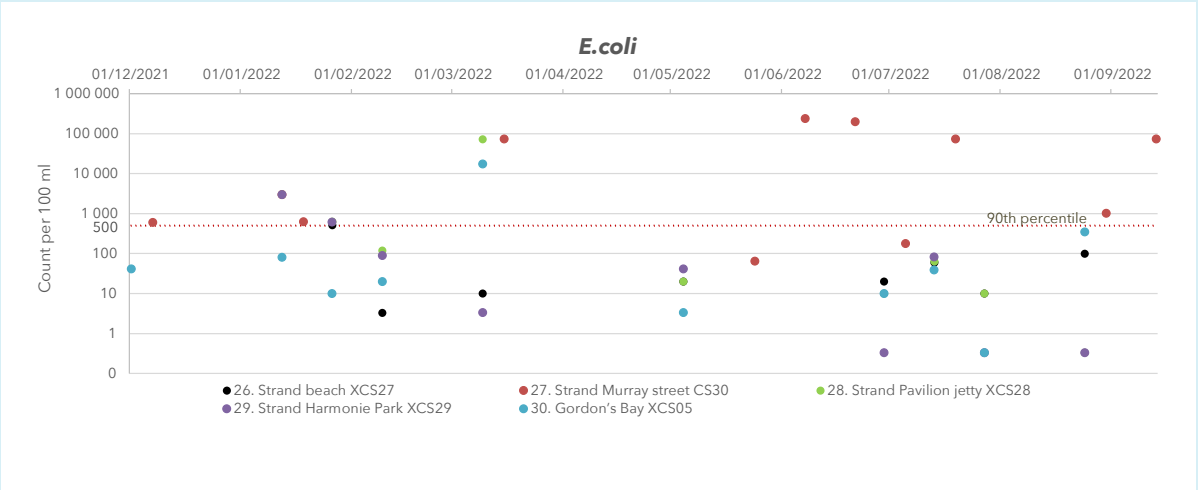
21. Monwabisi tidal pool XCS18
22. Monwabisi beach XCS30
23. Macassar beach XCS19
24. Strand water slides CS32
25. Strand beach pedestrian crossing CS31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90th percentile
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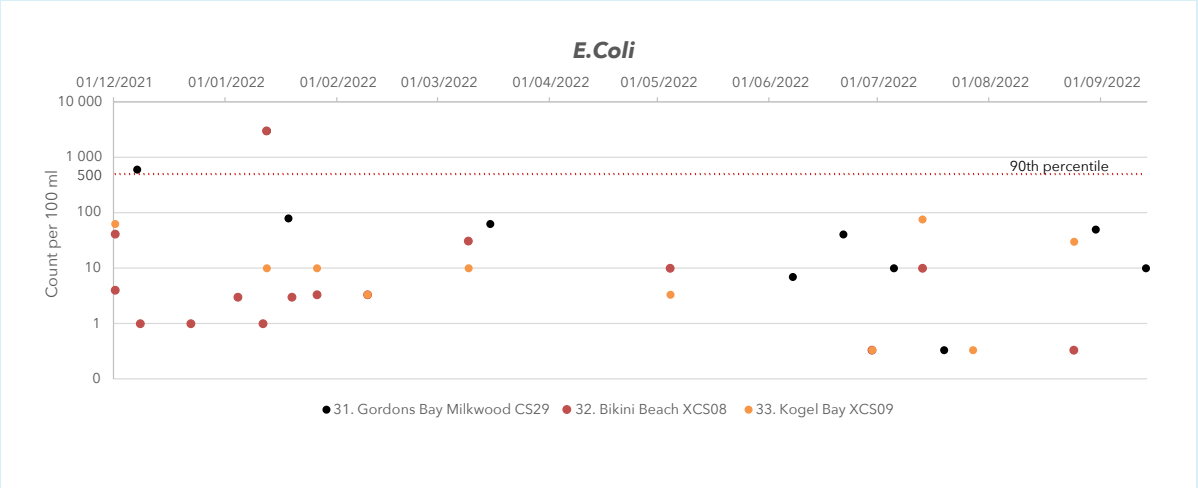
28. Strand Pavilion jetty XCS28
29. Strand Harmonie Park XCS29
30. Gordon's Bay XCS05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Count per 100 ml
90th percentile
31. Gordons Bay Milkwood CS29
32. Bikini Beach XCS08
33. Kogel Bay XCS09

2. CAPE TOWN'S BLUE FLAG BEACHES

The Blue Flag programme, a world-renowned ecolabel 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. Approximately 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, safety and access-related criteria must be met.

In the 2021/22 season the City had 10 Blue Flag beaches, with five each on the Atlantic and False Bay coastlines. Unfortunately, in the 2022/23 season, the City could not apply to retain Blue Flag status for two beaches. As per table 3 below, these beaches were Strandfontein and Mnandi. Due to the use of the 95th percentile and the rolling-over effect over a four-year sampling period, the City was aware in the previous reporting period that there was a risk of Mnandi and Strandfontein dropping off the programme unless results improved. The City's concerns proved valid as Strandfontein failed due to one bad sample and Mnandi due to two failed samples, thus full status for the 2022/23 season could not be achieved. As the required 20 'excellent' samples were not obtained, the City is also unable to apply for full status for these beaches for the 2023/24 season.

Notwithstanding the loss of the two Blue Flag beaches, and in spite of the significant increase in pollution-related events across the coastline due in large part to load-shedding, the City still managed to retain the full status of eight Blue Flag beaches during the last season. These beaches have met the stringent water-quality parameters in order to be eligible for the City to apply for the 2023/24 season. The revised and streamlined sewage-response protocol played a large role in ensuring that sewage spills were stopped timeously and before they had any impact on bathing water at Blue Flag beaches.

TABLE 3: BLUE FLAG BEACHES IN CAPE TOWN

BEACH	YEARS IN PROGRAMME	BLUE FLAG STATUS AWARDED					
		2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Silwerstroomstrand	11	✓	✓	✓	✓	✓	✓
Melkbosstrand	7	✓	✓	✓	✓	✓	✓
Clifton 4th Beach	20	✓	✓	✓	✓	✓	✓
Camps Bay Beach	16	✓	✓	✓	✓	✓	✓
Llandudno Beach	13	✓	✓	✓	✓	✓	✓
Fish Hoek Beach	7	✓	✓	✓	✓	✓	✓
Muizenberg Beach	18	✓	✓	✓	✓	✓	✓
Strandfontein Beach	14	✓	✓	✓	✓	✓	x
Mnandi Beach	18	✓	✓	✓	✓	✓	x
Bikini Beach	19	✓	✓	✓	✓	✓	✓


Silwerstroomstrand
Melkbosstrand
Clifton 4th Beach
Camps Bay Beach
Llandudno Beach
Muizenberg Beach
Fish Hoek Beach
Bikini Beach

3. MARINE OUTFALLS

3.1 BACKGROUND AND INTRODUCTION

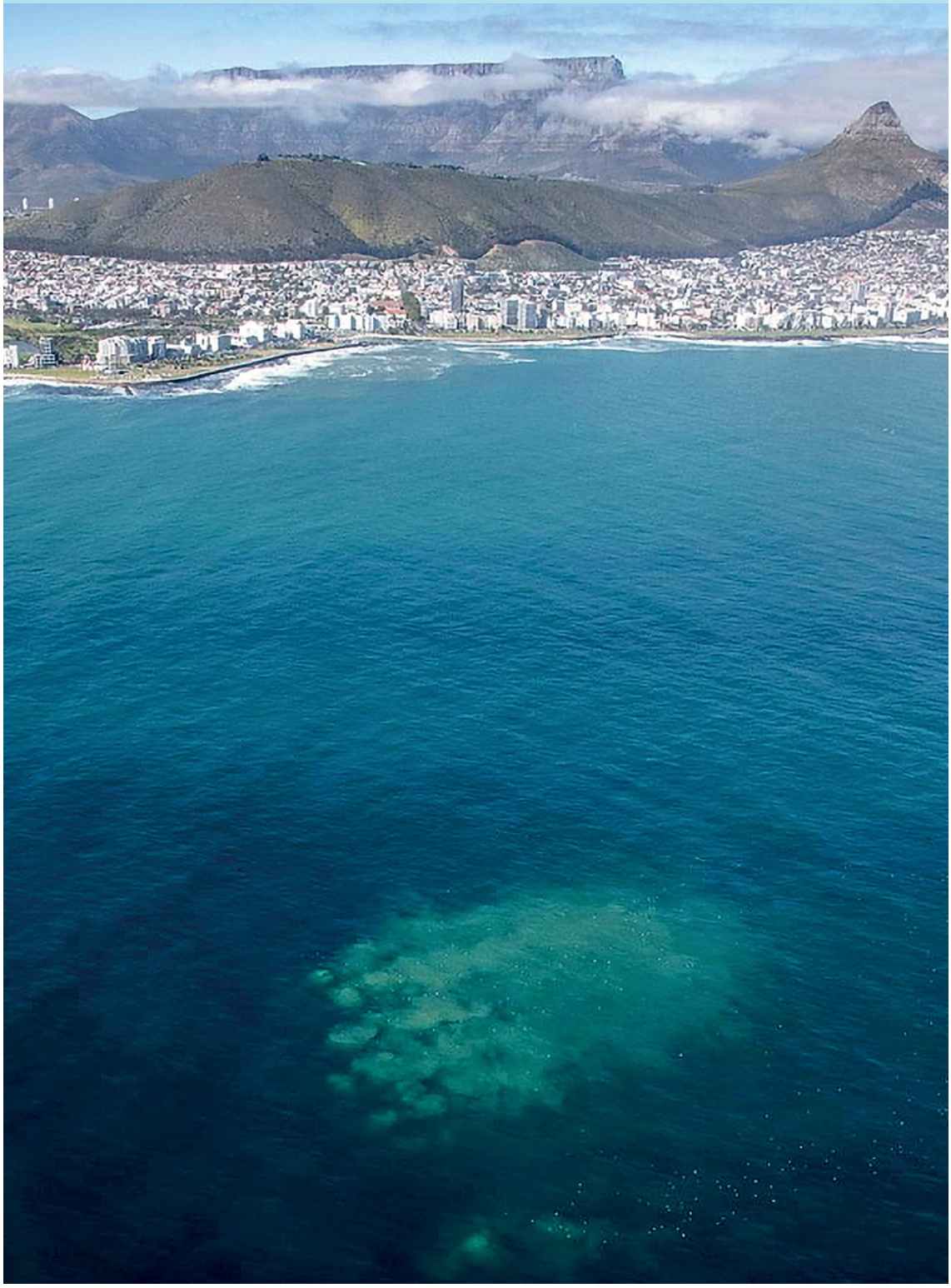
In 2016 the Water and Waste Directorate requested the assistance of the Environmental Management Department's (EMD) Coastal Management Branch in assessing marine and environmental concerns related to the three marine outfalls, namely the Green Point outfall, Camps Bay outfall and the Hout Bay outfall. This request coincided with substantial and increased public and media interest that evolved from photographs of the outfall plume at Green Point being widely published on social media and in local print media.

At the time, the Wastewater Department had just appointed the CSIR (Dr Brent Newman) to begin and complete a substantial technical Marine Outfall Monitoring Report as part of their Coastal Waters Discharge Permit application process. Coastal Waters Discharge Permits are legally required in terms of the National Integrated Coastal Management Act. EMD's Coastal Management agreed to assist with the completion of the technical Marine Outfall Monitoring Report as well as assist the Wastewater Department with dissemination of the results and findings of that technical report.

This report was published in 2017, and while it should stand alone as a comprehensive assessment of the environmental implications associated with the three marine outfalls, it was agreed that further monitoring and assessment were required in order to continue to build a better long-term understanding of the marine and environmental impacts of the three marine outfalls.

As a result, Coastal Management has partnered with the Wastewater Department since 2016, undertaking a wide range of investigations associated with the ongoing monitoring of the three outfalls, including the completion of detailed numerical dispersion modelling (to understand the behaviour of the wastewater plume under different environmental conditions) for each of the outfalls, biodiversity assessments and seasonal water-quality monitoring.

FIGURE 1: GREEN POINT PLUME PHOTOGRAPHED BY JEAN TRESFON IN 2022



3.2 OBJECTIVES

The objective is to assess all available data to inform a clear perspective presented as a summary report on the marine and environmental implications of each of the marine outfalls based on the work done to date as well as any external published reports/papers.

The following technical, monitoring and marine assessment works were completed between 2016 and 2022 and were included in the analysis for the summary reports:

- The Technical Report on Marine Outfall Monitoring and Assessment (CSIR, 2017)
- Continuation of monthly bacterial water-quality monitoring at each outfall 2017–2019
- Detailed dispersion modelling for each marine outfall (PRDW, 2020/21)
- Six seasons (winter/summer) of seawater-quality monitoring (CLS, 2020–2021)
- Preliminary Biodiversity Assessment at Camps Bay Marine Outfall (CLS, 2022)
- Initial Benthic Macrofauna Survey at Camps Bay Marine Outfall (CLS, 2022)
- Assessment of Pharmaceutical Compounds in Cape Town's Coastal Waters in both Winter and Summer (CSIR, 2021)

Coastal Management, through the use of Term tender 375C, appointed PRDW and their sub-consultants CLS to assemble a team of highly experienced and recognised marine scientists, chemists and engineers to review all the reports and submit a short and detailed Environmental Summary Report for each outfall. Coastal Management further requested that the full set of reports as well as the resulting Environmental Summary Reports undergo a final and independent review by a recognised and highly experienced, independent marine scientist.

The expert panel consisted of:

- Dr Robin Carter (40+ years' marine science expertise)
- Lisa Holden (10+ years' marine science expertise)
- Dr Barry Clark (30+ years' marine science expertise)
- Dr Brent Newman (25+ years' marine chemist expertise)
- Stephen Luger (25+ years' coastal engineering and modelling expertise)
- Independent review: Dr Lynn Jackson (40+ years' marine science expertise)

This report makes a number of internal recommendations to Water and Sanitation as it relates to Coastal Management's experience and findings from monitoring, assessing, investigating and engaging on the marine outfalls over the last seven years. These recommendations are informed by both the outcomes of the Environmental Summary Reports as well as Coastal Management's first-hand experience working on the marine outfalls.

The marine scientists' results, analyses and findings inform the City's position around the outfalls and are available at https://bit.ly/Coastalwaterquality. Alternatively, log onto www.capetown.gov.za, search for 'coastal water quality' and scroll down to the section on 'marine outfalls'.

3.3 DISCHARGING LAND-DERIVED WASTE VIA OFFSHORE OUTFALLS

3.3.1 MARINE OUTFALLS OVERVIEW

Marine outfalls are widely used across the world in coastal cities as a means of disposing of urban wastewater. In the most simple terms we are (essentially) using the ocean environment to assimilate and disperse wastewater generated by humans. The basic principle is that, providing we do not outstrip the capacity of the receiving environment to assimilate our waste, wastewater can be discharged into the marine environment with environmental impact or loss minimised and limited to remain within 'acceptable' levels. Where we do outstrip that assimilative capacity, environmental degradation and loss quickly follows. In the case of offshore marine outfalls, the intention through engineering design is deep-water release within a very large, open and powerful ocean system where dispersion and assimilation of wastewater are rapid and environmental impacts are therefore minimal and remain within acceptable levels.

Determining what are acceptable environmental levels/limits/impactsm, however, remains an ongoing challenge. In an ideal world, there would be no pollution, but this is simply not possible. What is acceptable environmental impact to one person/expert may not be to another. In addition, as science and technology progresses, we are learning more about impacts previously unknown and as such, these acceptable limits are a continuously changing space.

In this report, we use current recognised pollution and water-quality limits/standards as set by various national departments informed by global standards to determine what is acceptable and within limits. These pollution and water-quality standards are by no means perfect but it is what we have to work with, and by using them, individual or personal judgement/opinion is removed from the assessment.

3.3.2 UGLY EFFICIENCY, MARINE CATASTROPHE OR SOMEWHERE IN-BETWEEN?

The central question is whether the marine outfalls as they are currently operating remain an acceptable wastewater disposal mechanism in Cape Town.

They are certainly 'environmentally ugly' and are a very vivid reminder that we pollute our coastal environment on a daily basis. This is particularly stark in Cape Town with our spectacular and globally recognised marine and coastal environment. There is also little doubt that the ocean outfalls are controversial, publicly disliked and are focal points for activism.

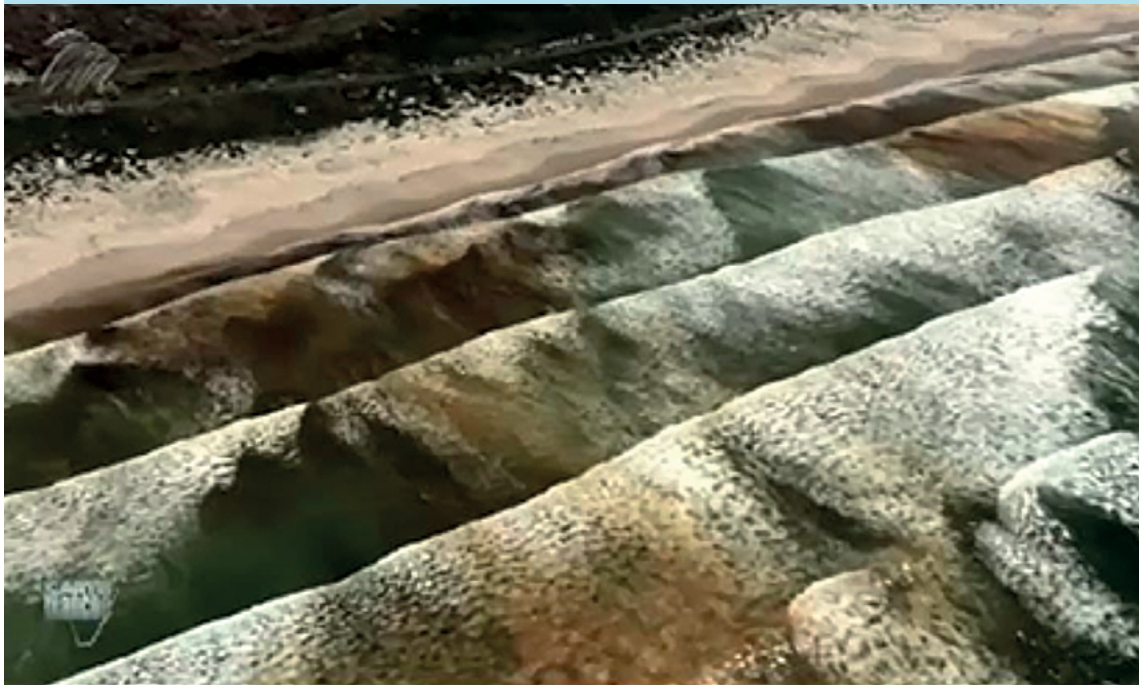
In considering this question, some key lessons learned over the last seven years are presented below. These lessons learned do not provide answers but demonstrate perhaps that the many scientific results/outcomes/findings do not align with the general expectations that the outfalls are destructive, and obvious and significant marine polluters.

- Marine outfalls are certainly 'basic, ugly and unpleasant'. However, regardless of how we may feel personally, the extensive data collected and analysed in the studies to date show surprisingly low environmental impact. This is even more surprising when one considers the very long duration of direct wastewater disposal to these three coastal environments. At all three locations, wastewater has been disposed of directly into the ocean ever since permanent settlement – in excess of 350 years at Green Point. This is a very long period of direct and daily discharge of wastewater pollution. Prior to embarking on the detailed monitoring programme, Coastal Management's expectation was to find data that showed a much higher level of marine and environmental impact than what has actually been found to date. This document can only report on what has been found even if those findings and data do not align with general perceptions that there must be a much higher level of marine impact.
- When considered against land-based tertiary wastewater treatment works, it would appear (based only on the data to date) that the three marine outfalls may be at least comparative to or in some cases even less environmentally impactful than some of the land-based treatment works. The land-based systems are contaminating and polluting multiple environmental systems (land, groundwater, river, estuary and the ocean) and often exceed the carrying/assimilative capacity of these much-smaller systems (i.e. Diep River, Eerste River), resulting in their ecological deterioration. Through seven years of data collection by the City of Cape Town, an equivalent environmental impact is yet to be shown/demonstrated at any one of the three outfalls compared to some of the land-based environments where WWTW discharge into small systems, notably the Diep River, Black River and Eerste River.

- Regardless of data showing rapid dispersion and assimilation from marine outfall diffuser points, it is always disturbing when one directly experiences the outfall plume. Seeing and smelling the oily slick that can reach the surface is always unpleasant. Pictures widely circulated on social media of the plumes at all locations surely generate an emotive and intuitive response in many citizens that 'we should not be doing this – there must be a better way'.
- The simple fact that we have marine outfalls has consequences. It can shape and influence public perception in respect of their views, beliefs and feelings as to the quality of their coastal environment. This 'perception impact', whether informed by factual data or not, must be included in the final evaluation and analysis as it has many negative public implications and by extension exposes the City, rightly or wrongly, to reputational risk. The following are two factual accounts that reflect this 'perception impact':
    - A well-respected, retired professional who lives in Clifton explained at length how after being told (incorrectly) that there is raw sewage everywhere, she has not swum at Clifton 4th Beach in five years. Further, she indicated that whenever she opened her windows at her home above Clifton, she felt nauseated by the sewage smell coming from the water. Her view and position would not change even after showing and explaining 22 years' worth of water-quality data (hundreds of samples) that show consistently excellent recreation water quality at Clifton, and that it is not possible for the outfall to create a sewage odour at Clifton Beach.
    - A father doing Nippers lifesaving training at Clifton 4th Beach contacted Coastal Management, outraged that his young Nippers squad had emerged from a swim with brown flecks in their hair. He believed this to be human faeces. After a careful conversation, the City could demonstrate that the brown flecks were in fact naturally occurring ocean algae, very common after a cold-water ocean upwelling event at Clifton. Both accounts demonstrate the high social and perception impact of the marine outfalls.

- Marine outfalls are (deservedly) focal points for environmental activism. With that can come misinformation, exaggeration and myths that grow in stature and are often amplified by social media platforms reaching increasingly larger audiences. Two accounts below demonstrate evidence of these entrenched narratives making this an exceedingly difficult space to manage:
    - During a ratepayers meeting in Sea Point in 2018, the challenge was put to the City by an informed and influential resident that claimed that when scuba diving off Sea Point, he and a fellow diver noted that all the urchins they saw while diving were female. He stated that this was as a direct result of the high levels of oestrogen released into the water from the Green Point outfall causing sex change to the entire urchin population in Sea Point. While endocrine disruptors may certainly have an impact on animal gender at relevant concentrations, this account as described by the resident cannot be true. Determining the gender of an urchin requires harvesting the animal and a laboratory analysis under a microscope or the weighing of the urchin's gonads to determine whether it is male or female. To avoid embarrassing the resident, City officials chose not to point this out in the meeting. As a result, this factually incorrect statement became fact within the community and further solidified the public narrative surrounding marine outfalls.
    - In 2016 *Carte Blanche* did a detailed story on the three marine outfalls. They used footage of a naturally occurring harmless diatom (*Anaulus australis*) bloom in False Bay as part of their programme, implying that this brown water was in fact raw sewage. This is readily accepted as fact by members of the public. The adjacent screen grab shows the footage that was aired by *Carte Blanche* (as an aside, it is useful to note that wastewater is grey-white, not brown).

FIGURE 2: IMAGE OF HARMLESS DIATOM BLOOM IN FALSE BAY, INCORRECTLY REFERENCED AS WASTEWATER BY *CARTE BLANCHE* (2016)



These two accounts demonstrate the highly complex and combative space within which discussions and debates have occurred and the extent of misinformation that characterises this discussion.

- Understanding of wastewater, wastewater disposal systems and treatment is limited in the public space. This includes a lack of knowledge by the public as to where it goes, how it is managed, where it lands up and the daily volumes that are produced in the city.
- The Coastal Management Branch has been openly accused of manipulating sampling points to positively affect the resulting data to show the outfalls in a positive light. Nothing could be further from the truth. Coastal Management staff have advocated for the protection and management of the coastline for over 20 years. Coastal Management can only present the data and results that are collected. This highlights the external belief that the level of measured impact must be much higher/worse than is reported and therefore 'the data the City presents simply cannot be correct or true'.

3.4 BROAD CONSIDERATIONS FOR THE MARINE OUTFALLS

3.4.1 CONSIDERATIONS COMMON TO ALL THREE OUTFALLS

I. Based on the data and findings to date, the three outfalls are largely operating in accordance with their original design and are disposing of urban wastewater as intended, planned and built.

II. Based on the data to date, the findings and analyses indicate that the environmental and human health impacts are concentrated in the allowable mixing zone (ZID) at each outfall and dissipate quickly outside of the ZID. Modelling (supported by WQ data) indicates that at no point on the shoreline are the WQ guidelines for recreational activities exceeded due to the offshore marine outfalls.

III. It is important to recognise that in addition to points I and II above, the outfalls are adding suspended solids (SS) and chemicals of emerging concern (CEC) to the wider ocean environment through dispersion and ocean distribution. The statement is therefore not that there is NO pollution.

IV. While data indicate low environmental impact of the marine outfalls, an important consideration is that the receiving environment within the localised mixing/impact zone may have adapted to the wastewater discharge over time. If this environmental adaptation has taken place it will reduce the measurable impacts – i.e. measurements are being taken in an already impacted/altered environment, and as such, the impact appears lower than it may have originally been when the outfall was commissioned many decades ago.

V. Although not yet measured or quantified, it is assumed that the outfalls are discharging microplastics into the marine environment.

VI. Regardless of the data collected, public perception of the marine outfalls is and remains substantially negative. This negative perception is likely to increase over time with the resultant increasing pressure on the City to address the issue of marine outfalls as an unacceptable practice in its current form.

VII. Coastal Management is not of the view that additional data or reports demonstrating low impact will meaningfully shift this public perception.

VIII. Water and Sanitation must confirm the status of the Coastal Waters Discharge Permits.

3.4.2 CONSIDERATIONS SPECIFIC TO THE HOUT BAY MARINE OUTFALL

I. The high levels of SS at Hout Bay may in part be due to harbour and/or industrial-generated waste being disposed of via the sewer system.

II. There may be some risk to human health for big-wave surfing at Dungeons. Enterococci over 185/100 ml are modelled to reach the area, although only very periodically. This concentration or anything that exceeds this is unlikely to coincide with big-wave surfing conditions (which are highly specific and perhaps occur less than 10 days per annum) and as such is not considered a high risk but must remain as an acknowledged health risk.

III. The model shows that surface enterococci do not reach Duiker Island at levels outside of the National Water Quality Guidelines. Risk to any tourist/recreational activities associated with seal diving/snorkelling is therefore low.

IV. The scuba dive sites of Aster and Katsu Maru may be exposed to elevated enterococci at mid-water depths in winter.

V. The scuba dive sites of Aster, Katsu Maru, Tafelberg and Klein Tafelberg may be exposed to elevated enterococci at mid-water depths in summer for short periods.

VI. The Hout Bay outfall discharges into a Marine Protected Area (MPA). While the environmental impacts (based on the available data) appear to be limited to the allowable mixing zone and not significant or deleterious, it remains counteractive to marine conservation objectives embedded in the intention of MPAs.

VII. It is important to note that the MPA declaration occurred many years post outfall establishment, and it would appear that the reports and documentation prepared in respect of establishing the MPA did not identify the marine outfall as an environmental concern, risk or as problematic/counteractive to the establishment, intention and management of the MPA.

VIII. Impacts on marine biodiversity at the Hout Bay outfall are not known. Establishing direct cause and effect will be challenging due to multiple other potential causes of anthropogenic-induced change, including high marine-resource extraction (both legal extraction, i.e. commercial fisheries, and illegal extraction, i.e. poaching) and multiple pollution sources (harbour, highly polluted Disa River, various stormwater outlets which discharge pollutants into the bay). Anecdotal evidence suggests that if there is a meaningful biodiversity impact, it is limited to the immediate discharge area. This is on the basis that popular dive sites, such as Vulcan Rock, are reportedly healthy and rich in marine biodiversity.

IX. A benthic macrofauna survey should be undertaken as initial evidence at Camps Bay suggests possible alterations to benthic macrofauna populations may be occurring in close proximity to the diffusers. In addition, due to higher sand substrate levels at Hout Bay, there is potential for greater accumulation of pollutants in the sediment. This should be investigated and reported on.

X. Accumulation of CEC in the tissues of marine species as a direct result of the marine outfall will occur via direct assimilation or via the food chain. Multiple sources of CEC in the Hout Bay environment compound this issue and include the heavily polluted Disa River, harbour and stormwater discharges. Removal of the outfall will not result in a CEC-free Hout Bay marine environment, but total concentrations of CEC being released into the marine environment at Hout Bay would of course be locally reduced. Much of those CEC from the outfall would, however, still find their way back into the total marine environment via any alternate discharge. With current WWTW technology available, removing the marine outfall from Hout Bay may therefore not substantially reduce total CEC contribution to the overall marine environment.

3.4.3 CONSIDERATIONS SPECIFIC TO THE CAMPS BAY MARINE OUTFALL

I. Risk to human health at the shoreline is possible for surfers at Glen Beach where elevated bacterial counts may occur for short periods. Water-quality guidelines for recreational use are not transgressed at any point on the shoreline (including at Glen Beach), however this risk must remain as an acknowledged health risk.

II. With a growth in popularity of open-water swimming in recent years, human health risk may have increased due to individual swimmers and swimming groups using a more offshore environment with greater possible exposure to the edges of the plume at times. Highest risk is likely if swimmers swim from Camps Bay to Clifton around Maiden's Cove.

III. Although still very low, Camps Bay is likely to have the higher human health risk of the three marine outfalls, attributed primarily to the increase in offshore open-water swimming.

IV. Preliminary and initial biodiversity assessment data show little to no impact on marine biodiversity at Camps Bay.

V. The preliminary macrofauna survey shows a possible and likely localised impact directly around the diffuser but needs to be confirmed. This impact is limited to a narrow geographical area and has not resulted in either a monospecies environment or the presence of unexpected species in the benthos and is therefore not considered environmentally significant.

VI. The dispersion model shows that the recognised scuba diving sites (Clifton Rocks and Cleeve's Tunnel) may be exposed to elevated enterococci counts (185–300) for very short periods of time in both summer and winter. Due to the short duration of exposure these are not considered high risk but must be acknowledged as a risk nonetheless.

VII. As with Hout Bay, the outfall discharges into a Marine Protected Area. While the environmental impacts (based on the available data) appear to be limited and not significant or deleterious, it remains counteractive to marine conservation objectives embedded in the intention of MPAs and their establishment to discharge preliminary treated wastewater directly into the MPA.

VIII. As with the Hout Bay outfall, it is important to note that the MPA declaration occurred many years post outfall establishment, and it would appear that the reports and documentation prepared in respect of establishing the MPA did not identify the marine outfall as an environmental concern, risk or as problematic/counteractive to the establishment, intention and management of the MPA.

IX. Accumulation of CEC in the tissues of marine species as a direct result of the marine outfall will occur via direct assimilation or via the food chain. Removal of the outfall will not result in a CEC-free Camps Bay marine environment, but total concentrations of pharmaceutical CEC being released into the marine environment at Camps Bay would be substantially reduced. Other local sources of CEC at Camps Bay are limited to urban run-off via the stormwater and the local stream more likely to be carrying herbicide/pesticide CEC, while pump station failures at Bakoven and Maiden's Cove will add pharmaceutical CEC. Much of the CEC from the outfall would, however, still find their way into the marine environment via the alternate discharge were it to be removed. With current WWTW technology available, removing the marine outfall at Camps Bay may not therefore substantially reduce total CEC contribution to the overall marine environment.

3.4.4 CONSIDERATIONS SPECIFIC TO THE GREEN POINT MARINE OUTFALL

I. Due to the volume of wastewater discharged at Green Point, the scale and geographic extent of the ZID and concentrated impacts are much larger than the other two outfalls.

II. Any risk to human health at the shoreline is likely for surfers at Mouille Point, where elevated bacterial counts may occur for very short periods in summer. Water-quality guidelines for recreational use are not exceeded at any point on the shoreline.

III. Surfskiing and kayaking are popular activities taking place between Three Anchor Bay and the Cape Boat and Ski Club at Granger Bay. Kayakers may at times be exposed to the plume if they paddle far offshore and away from the coastline. Health risk is considered negligible, while the negative visceral experience of confronting the plume is considered high.

IV. There are no data on marine biodiversity impacts. Table Bay is the receiving environment for substantial urban waste discharges from the outfall, Diep River, Black/Salt River, port and Robben Island. If biodiversity impacts were identified it would be very difficult to definitively link the change to any one source.

V. The dispersion model shows that the recognised scuba diving sites SS Cape Matapan, RMS Athens and SS SA Seafarer may be exposed to elevated enterococci counts (185–300) for very short periods of time in both summer and winter. Due to the short duration of exposure, these are not considered high risk but must be acknowledged as risk.

VI. Green Point does not discharge into a Marine Protected Area but operates adjacent to two MPAs.

VII. It is important to note that the MPA declaration of both the Table Mountain National Park and Robben Island MPAs occurred many years post outfall establishment, and it would appear that the reports and documentation prepared in respect of establishing both the MPAs did not identify the marine outfall as an environmental concern, risk or as problematic/counteractive to the establishment, intention and management of either of the MPAs.

VIII. Accumulation of CEC in the tissues of marine species as a direct result of the marine outfall will occur via direct assimilation or via the food chain. Removal of the outfall will not result in a CEC-free Table Bay marine environment. Even if the outfall was somehow diverted to Athlone or Potsdam, most of the CEC would find their way back into Table Bay via the WWTW discharges out the Diep and Black/Salt rivers. With current WWTW technology available, removing the marine outfall would not substantially reduce total CEC contribution to the overall marine environment.

IX. Coastal Management raised the concern that there may be some leaking of wastewater from the pump station into the near shore environment. This should be investigated by Water and Sanitation.

3.5 LOOKING TO THE FUTURE

While the data, modelling and outcomes show that on the whole all three outfalls are operating within the limits of marine environmental standards as determined by current pollution guidelines with no associated evidence of deleterious marine impacts, the City should continuously look towards reducing pollution wherever possible and feasible. The following key points further inform this view:

- The City, through its own policies, has committed itself to the protection and management of the extraordinary rich natural environment that is so central to Cape Town's identity, economy and global desirability. As such, the City must continuously work towards reducing environmental pollution through the application of best practice and technology across and as part of all of its operations and service delivery;
- A commitment to continual environmental improvement, where both financially and technically feasible and viable, should inform all operations across City service departments. Ongoing exploration and investigation into enhanced environmental performance and responsibility should remain part of core business;
- Two of the outfalls discharge directly into a proclaimed MPA, while the third discharges adjacent to two MPAs. Reducing urban pollution to the MPAs is a responsibility of not only the City but all organisations, communities and individuals;
- Ongoing investigations into and the possible implementation of improved and enhanced predischarge treatment levels will provide far greater public assurance of environmental marine outfalls: Environmental Monitoring Programme 11 commitment and governance by the City than any data or results demonstrating low impact of the marine outfalls;
- Discharging screened wastewater into the marine environment without additional higher levels of pretreatment is increasingly unacceptable to the public and the City should begin proactive planning in response; and
- Global best practice for wastewater marine outfalls is a higher level of predischarge treatment to the benefit of the environment and the reduction of human health risks.

3.6 KEY RECOMMENDATIONS

Taking into account the generally favourable, dynamic and physical conditions (assimilative capacity) along the City's Atlantic coastline, responsible disposal of wastewater to the marine environment remains a viable means of wastewater disposal, providing that all reasonable efforts have been made to minimise pollution through optimising pretreatment levels.

In this regard it is important that the City set its own objectives for water quality that aligns with the South African Marine Water Quality Guidelines, while considering present national and global trends in policies on marine waste disposal, pollution minimisation and water conservation.

While all the data over multiple studies show marine impacts within acceptable limits as per national guidelines and without evidence (yet) of deleterious or catastrophic environmental outcomes, the City should still aim to minimise pollution and wastewater at source, and therefore:

- Water and Sanitation should investigate all potential options and their financial and operational feasibility to further mitigate impact on the marine environment, and this should include:
    - additional higher-level pretreatment on land prior to discharge
    - potential water reuse technology
- Water and Sanitation should commit to implementing the most appropriate and cost-achievable pollution minimisation option that emerges from the assessment/investigation;
- Water and Sanitation should review and optimise all three outfalls, daily operational plans to ensure optimal and efficient operation;
- Given that the data indicate low impacts to date, there is adequate time for proactive planning for the implementation in accordance with the City's capital project planning process; and
- Knowing that this process is formally underway will give assurance to the public that marine pollution will be further reduced over time.

In addition, the following are also recommended:

- All reports and data attached to this report should be submitted to the Department of Forestry, Fisheries and Environment: Oceans and Coasts;
- All reports and data attached to this report should be made publicly available;
- City Health should consider and determine based on the attached reports what level of additional health warning and information are required in the vicinity of the marine outfalls, specifically:
  - Hout Bay: surfing at Dungeons, scuba diving and general kayaking
  - Camps Bay: surfing at Glen Beach, open-water swimming, scuba diving and general kayaking
  - Green Point: surfing at Mouille Point, scuba diving and general kayaking
- Valid, up-to-date CWDP must be in place for each outfall, and Water and Sanitation must ensure that all conditions in the permits are met;
- Water and Sanitation must ensure ongoing compliance monitoring based on the Coastal Waters Discharge Permit (CWDP) and regular reporting to DFFE;
- Coastal Management should complete a benthic macrofauna survey at Hout Bay and report publicly on the findings;
- Coastal Management to continue with marine biodiversity and benthic macrofauna surveys at Camps Bay outfall;
- Coastal Management must undertake a microplastics quantification exercise at all three outfalls and report on the findings; and
- Water and Sanitation should consider an extensive public information programme specifically for the marine outfalls to take them 'out of the shadows' and ensure the correct information is widely known and understood. Other countries have dedicated information portals on their marine outfalls.

4. FREQUENTLY ASKED QUESTIONS ON MARINE OUTFALLS

4.1 GENERAL INFORMATION AND HISTORY OF CAPE TOWN'S MARINE OUTFALLS

Q: How many marine outfalls do the City of Cape Town operate?

A: The City operates three marine outfalls, which are located offshore at Hout Bay, Green Point and Camps Bay.

Q: When were these marine outfalls built?

A: The Camps Bay marine outfall was commissioned in 1977.
The Hout Bay marine outfall was commissioned in 1993.
The Green Point marine outfall in its current form was completed in 1993.

Q: How far do the marine outfalls extend and at what depths are the diffusers located?

A: Marine outfalls in Cape Town extend approximately 1,670 km (Green Point), 2,162 km (from the sandy shoreline at Hout Bay) and 1,497 km (Camps Bay) out to sea and at a depth of approximately 28 m, 39 m and 23 m respectively.

Q: How was sewage disposed of at these three locations prior to the marine outfalls being built?

A: Previously at all three sites, sewage was disposed into the sea via short pipes over the beaches. This practice was undertaken since the very first permanently established human settlements at all three locations.

Q: What is the design capacity of each of the marine outfalls?

A: Camps Bay has a design capacity of approximately 5 Ml/day (currently operates at around 50% of that). Green Point has a design capacity of approximately 40 Ml/day (currently operates at about 60–65% of that). Hout Bay has a design capacity of approximately 9 Ml/day (currently operates at around 60% of that).

Q: How much preliminary treated sewage in total is discharged daily in Cape Town from the three marine outfalls, and how does this compare internationally?

A: The City discharges around 30 Ml/day from the three marine outfalls. Sydney, Australia (by comparison) discharges up to 950 Ml/day. This is treated to primary level, which is one stage of

treatment more than preliminary treatment.

Q: How much do the three marine outfalls discharge relative to the City's land-based wastewater treatment works (WWTW)?

A: In percentage terms, Cape Town's marine outfalls contribute approximately 5% of the total amount of wastewater produced in Cape Town. Ninety-five per cent of Cape Town's wastewater is produced from land-based WWTW. While these WWTW may be land-based, effluent from these WWTW are discharged into river systems, which then ultimately enter into the sea.

Q: Does pretreatment take place for marine outfalls?

A: Yes. Cape Town's marine outfalls have preliminary treatment in the form of screenings removal. The preliminary treatment includes the removal of wastewater constituents such as rags, sticks, floatables, grit and grease that may cause maintenance or operational problems with the treatment operations, processes and ancillary systems.

The current operation at the outfalls also includes two stages of screening, namely coarse and fine (3 mm) screens, as part of the preliminary treatment of the raw wastewater.

Q: Is the City considering further pretreatment of wastewater before it is discharged into the marine environment?

A: Yes. The City has commissioned a study that will determine the feasibility of various higher-level pretreatment interventions. The report for this study is anticipated to be completed in 2023.

Q: Are there any other marine outfalls in the coastal waters of Cape Town which are not operated by the City of Cape Town?

A: Yes. There is a marine outfall located on the eastern shore of Robben Island, which is administered by the Robben Island Museum. Effluent, which is currently macerated, is discharged 465 m offshore from Robben Island into Table Bay. There are currently plans underway to build a WWTW on Robben Island with a throughput capacity of 300 m^3 per day.

Q: How many outfalls are there in South Africa that discharge effluent into coastal waters?

A: There are approximately 126 outfalls that discharge various types of effluent into the coastal waters of South Africa.

4.2 MARINE PROTECTED AREAS AND MARINE OUTFALLS

Q: When were the marine outfalls built in relation to the proclamation of the Table Mountain National Park Marine Protected Area (TMNP MPA), and do Cape Town's marine outfalls discharge into the TMNP MPA?

A: The TMNP MPA was proclaimed in 2004, a full 27 years after the Camps Bay marine outfall was commissioned. The outfall at Camps Bay discharges into a control zone in the TMNP MPA and not into a sanctuary or 'no take' zone of the TMNP MPA.

The Hout Bay outfall was commissioned in 1993, 11 years before the MPA was declared. The Hout Bay marine outfall discharges into the TMNP MPA.

The Green Point marine outfall was commissioned in 1993 and does not discharge effluent into the TMNP MPA.

It must be noted that at all three locations, wastewater has never been disposed of differently since the construction of the marine outfalls. Prior to the construction of the marine outfalls, wastewater was discharged over the shoreline.

Q: How is it possible to allow a marine outfall to discharge into the TMNP MPA?

A: During the investigation and motivations to declare the TMNP MPA, the Camps Bay marine outfall and its operation was not identified as an impediment or risk to the TMNP MPA in terms of its marine and environmental impact. No reference was made to the need for, or requirement to, consider decommissioning the Camps Bay marine outfall during the declaration of the TMNP MPA. The TMNP MPA was therefore declared with the full knowledge of a pre-existing marine outfall at Camps Bay.

4.3 REGULATION OF MARINE OUTFALLS

Q: Are marine outfalls regulated by law?

A: Yes. Each marine outfall is required to have a Water Use Licence in terms of the National Water Act (Act 36 of 1998) as well as a Coastal Waters Discharge Permit in terms of the National Integrated Coastal Management Act (Act 24 of 2008).

Q: What is the purpose of the Water Use Licence (WUL) and Coastal Waters Discharge Permit (CWDP)?

A: The WUL and CWDP are required by national government to ensure that marine outfalls operate according to, and within, various parameters and requirements set by the National Department of Water Affairs as well as the National Department of Forestry, Fisheries and the Environment. The WUL and CWDP also set strict monitoring requirements for the three marine outfalls, which are the responsibility of the operator (in this case the City of Cape Town) to uphold in the use of these marine outfalls.

Q: What is the current permitting status of the marine outfalls?

A: Hout Bay has a Coastal Waters Discharge Permit. Camps Bay and Green Point have each been issued with Coastal Waters Discharge Permits, which are under finalization pending a public consultation process. All three have Water Use Licences.

4.4 MARINE SCIENCE SPECIALIST STUDIES

Q: What marine science studies did the City commission to better understand the impact of marine outfalls in Cape Town?

A: The City commissioned the following specialist marine science studies over the last six years:

- The Technical Report on Marine Outfall Monitoring and Assessment (CSIR, 2017)
- Detailed dispersion modelling for each marine outfall (PRDW, 2020/21)
- Six seasons (winter/summer) of seawater-quality monitoring (CLS, 2020–2022)
- Preliminary Biodiversity Assessment at Camps Bay Marine Outfall (CLS, 2022)
- Initial Benthic Macrofauna Survey at Camps Bay Marine Outfall (CLS, 2022)
- Assessment of Pharmaceutical Compounds in Cape Town's Coastal Waters in both Winter and Summer (CSIR, 2021)

Q: What other marine outfall reports were commissioned by the City?

A: An expert panel was asked to prepare an Environmental Summary Report for Camps Bay, Green Point and Hout Bay marine outfalls using the data and findings from the aforementioned marine science studies. This panel of experts included the following:

- Dr Robin Carter (40+ years' marine science expertise)
- Lisa Holden (10+ years' marine science expertise)
- Dr Barry Clark (30+ years' marine science expertise)
- Dr Brent Newman (25+ years' marine chemist expertise)

Q: Were these Environmental Summary Reports reviewed by an independent expert?

A: Yes, these Environmental Summary Reports were reviewed by Dr Lynn Jackson (40+ years' marine science expertise).

Q: Can I see all the reports and data produced by these marine science experts?

A: The marine scientists' results, analyses and findings inform the City's position around the outfalls and are available at https://bit.ly/Coastalwaterquality. Alternatively, log onto www.capetown.gov.za, search for 'coastal water quality' and scroll down to the section on 'marine outfalls'.

4.5 FINDINGS OF THE MARINE SCIENCE STUDIES

Q: What were the key findings of these specialist marine science studies?

A: Seven major studies were undertaken by different marine science experts (all investigating different measurable aspects) over the last six years. They found commonality and replicability in their findings – including bacterial samples, toxicity samples, mussel growth monitoring, animal tissue samples, preliminary biodiversity surveys, chemicals of emerging concern (CEC) studies, dissolved oxygen and detailed numerical modelling – that the pollution is concentrated in the allowable mixing zone located close to the diffuser and does not yet show evidence of significant or deleterious environmental impacts. Their overall key conclusion is that: 'The marine outfalls are meeting their design objectives in reducing potential deleterious ecological and/or human health effects of discharged effluent by taking advantage of increased effluent dilution offered by deep water'.

Q: What are the other key take-away findings from the studies and environmental summary reports?

A: Additional key findings include the following:

- All three outfalls are operating in accordance with their original design, which is to dispose of preliminary treated wastewater (screened wastewater) by using deep-water dispersion so that the ocean assimilates waste without exceeding its environmental capacity.
- Data collected from multiple studies and supported by detailed numerical dispersion modelling indicate that the effluent discharged through the Green Point, Camps Bay and Hout Bay outfalls is not having a major, deleterious or significant ecological impact on the Cape Town outfalls study area.
- Detailed numerical dispersion modelling and extensive water sampling show that the South African Water Quality Guidelines for Coastal Marine Waters: Guidelines for Recreational Use are not exceeded anywhere along the shoreline due to the effluent from the marine outfalls.

- Detailed numerical dispersion modelling and analysis of over 4 000 water samples show that:

  • **Green Point**
  The minimum number of dilutions achieved at the edge of the 256 m radius mixing zone is 528 in winter/spring and 628 in summer/autumn.

  • **Camps Bay**
  The minimum number of dilutions achieved at the edge of the 274 m radius mixing zone is 3 480 in winter/spring and 2700 in summer/autumn.

  The low port discharge rates and low port velocities result in the effluent being trapped near the seabed, resulting in the lowest dilutions and highest bacterial counts occurring near the seabed.

  • **Hout Bay**
  The minimum number of dilutions achieved at the edge of the 272 m radius mixing zone is 1 500 in winter/spring and 1 970 summer/autumn.

  Plume has lowest dilutions and highest bacterial concentrations at mid-depth.

  Dungeons big-wave surf spot may be exposed at times to bacterial levels that exceed the national guidelines for short-duration events.

- For further information and context surrounding dilution results from the marine outfall analysis, please refer to the PRDW 2020/21 reports.

4.6 OTHER KEY FINDINGS

Q: What were some of the key findings of the marine science studies?

A: Other important findings included the following:

- One hundred and ninety-six marine toxicity tests were completed – all were found to be nontoxic to marine biota.
- Twelve bags of mussels were moored around each outfall every winter and every summer for three years (six sets of 12 mussel bags across two seasons, over three years) – there was no statistically significant difference in growth rates or in the accumulation of metals in the mussel tissue close to the marine outfalls vs control sites located in relatively isolated areas away from known pollution sources.
- Preliminary and initial biodiversity assessment data show little to no impact on marine biodiversity (abundance and diversity) at Camps Bay.
- The preliminary macrofauna survey shows a possible and likely localised impact directly around the diffuser but needs to be confirmed. This impact is limited to a narrow geographical area and has not resulted in either a monospecies environment or the presence of unexpected species in the benthos. It is therefore not considered environmentally significant.
- The marine outfalls are discharging CEC – so are all the City's WWTW, which produce approximately 95% of the City's wastewater. There is no technology available globally that can remove CEC from wastewater at a city scale in a manner that is practically and financially possible. This is a global challenge and is not only a marine outfall issue. Near-shore concentrations of CEC are highest in rivers, stormwater and estuaries. Currently the only way to stop this contamination would be for people to stop using all chemicals, including pharmaceuticals commonly used in daily medication.
- Contribution to eutrophication and algal blooms by the outfalls is 'miniscule'.
- There is no evidence yet of long-term build-up of organic or inorganic contaminants in the sediment.
- There is no evidence of dissolved oxygen stress in the water column.
- Marine outfalls have a very high (negative) public perception impact.
- Marine outfalls significantly impact on (negative) public perception on the quality of the coastal environment in Cape Town.

4.7 MARINE OUTFALLS, ALGAL BLOOMS AND SEAL BEHAVIOUR

Q: Do marine outfalls cause algal blooms?

A: On average, the three western seaboard marine outfalls (Green Point, Camps Bay and Hout Bay) discharge 2,62 x 1 010 milliMoles (mM) of ammonia-nitrogen to the sea per year (estimated from data in CSIR 2017 and the PRDW 2020 reports).

However, natural upwelling in the region is the major source of inorganic nutrient supply to the euphotic zone. The Atlantic seaboard outfalls lie in the Cape Point upwelling cell, the southernmost of the major upwelling nodes on the west coast. See the Environmental Summary Report for Camps Bay that provides the scientific basis for this.

There are approximately 19 natural upwelling events of varying intensities and durations per year in the southern Benguela Current region, which may inject 2,0 x 1 014 mM N to the euphotic zone.

It was therefore concluded that contributions of discharged effluent ammonia and nitrogen to regional eutrophication are at most minuscule and that, in the vicinity of the outfalls, metocean conditions and seabed topography largely limit algal bloom development and consequences. See page 21 of the Environmental Summary Report for Camps Bay, which provides further information on this.

Q: Are the sewage outfalls increasing domoic acid levels in our waters?

A: There is no evidence yet documented that domoic acid (which is produced by a naturally occurring species of algae) has increased in our waters in any way. The species of algae that can/does produce domoic acid has always been present as part of the algal species diversity and is not new. This type of algae is common around the world.

Q: Is domoic acid a problem and causing aggressive behaviour of seals towards humans?

A: National government (Department of Forestry, Fisheries and the Environment), the state veterinarian and research organisations are yet to definitively identify domoic acid as accumulating in seals to any level of concern. Domoic acid has not been linked to seal aggression by any state or research organisation, and this is currently a working hypothesis.

4.8 REMOVAL OF CHEMICALS OF EMERGING CONCERN FROM WASTEWATER

Q: Is it possible to remove chemicals of emerging concern (CEC) from wastewater?

A: Yes, by means of advanced water treatment processes typically used for drinking-water production. It is important to note that this kind of treatment process still produces a 'toxic brine' containing many of the removed chemicals that still have to be disposed of somewhere. None of our waste simply disappears.

Q: Why can't the City apply the same technology to all wastewater produced in Cape Town?

A: The limiting factor is cost and affordability. The estimated capital cost for an advanced treatment process is R25 million/ML per day of treated capacity.

4.9 PRESENCE OF CHEMICALS OF EMERGING CONCERN IN MARINE BIOTA

Q: Does the presence of CEC in marine biota (such as fish, penguins, seaweed, etc.) mean that these CEC originate exclusively from effluent discharged from marine outfalls?

A: No. While marine outfalls contribute to the presence of CEC in the marine environment, they are by no means the only contributor. There are a range of other contributors, including effluent discharged from WWTW into rivers (which ultimately discharge into the sea and which amounts to approximately 95% of wastewater produced in Cape Town), industrial and urban run-off into stormwater systems which discharge into the sea, agricultural run-off into river systems, etc. For detailed research on the contribution of urban stormwater systems to the presence of CEC in the receiving environment, please refer to the following study as an example: Urban Stormwater: An Overlooked Pathway of Extensive Mixed Contaminants to Surface and Groundwaters in the United States. Unfortunately, due to the numerous pathways with which CEC can enter the marine and coastal environment, CEC are now ubiquitous in both populated and remote areas of the marine and coastal environment, which is a global phenomenon. For example, a scientific study in Cape Town identified the presence of CEC at Diaz Beach, which is located at the tip of Cape Point and is one of the most isolated areas of Cape Town. See Assessment of Pharmaceutical Compounds in Cape Town's Coastal Waters: Winter and Summer for further information on this. Another study, and indicative of this phenomenon being a global challenge, identified the presence of toxic anthropogenic pollutants in the deepest ocean on Earth.

Q: What are other examples of how pollutants and CEC may enter the marine and coastal environment?

A: A study from the Netherlands, for example, estimated that wear and tear from car tyres contributes significantly to the flow of microplastics into the environment. The study estimated that, and as a global average, almost one kilogram of microplastics per capita is released into the environment per annum. Further, the emission of these microplastics through car tyre wear and tear contributes approximately 5–10% of the total amount of plastics that land up in our oceans. Of further concern is that metals may be leaching from these microplastics and that such metals may have toxic and human health impacts. For further information on this study, please click on the following link:

Wear and Tear of Tyres: A Stealthy Source of Microplastics in the Environment

4.10 MARINE OUTFALLS AND BLUE FLAG STATUS

Q: What is the Blue Flag status of Clifton and Camps Bay, and who monitors the water quality for Blue Flag beaches?

A: Both Camps Bay and Clifton have had Blue Flag status for over 10 years. Water-quality samples for determining and awarding Blue Flag status are not taken by the City at these beaches. Coastal water-quality samples are instead taken and analysed by an independent laboratory. Results are submitted to the Wildlife and Environment Society of South Africa (WESSA) for evaluation.

Q: Has the presence of marine outfalls impacted the ability of Camps Bay and Clifton to retain their Blue Flag status?

A: No. As indicated previously, Camps Bay and Clifton have retained their Blue Flag status for over 10 years. While these beaches have at times lost their status, these incidents have only been for a short duration and were a result of land-based incidents of sewage spills. The monitoring of coastal water quality at these beaches is undertaken by an independent laboratory and analysed in accordance with the South African Water Quality Guidelines for Coastal Marine Waters: Guidelines for Recreational Use. Their consistent achievement of Blue Flag status is indicative of the presence of marine outfalls not impacting coastal water quality in terms of the Blue Flag requirements.

ANNEXURES

ANNEXURE A1: COASTAL WATER-QUALITY CATEGORIES FOR COASTAL MONITORING POINTS, ATLANTIC COAST

COASTAL MONITORING POINTS ATLANTIC COAST	COASTAL WATER-QUALITY RATING				
	2018	2019	2020	2021	2022
Big Bay near stormwater discharge	Excellent	Excellent	Sufficient	Sufficient	Good
Granger Bay	Excellent	Excellent	Sufficient	Sufficient	Poor
Mouille Point	Good	Sufficient	Sufficient	Sufficient	Poor
Green Point pump station	Sufficient	Good	Poor	Sufficient	Poor
Park Road, Green Point	Poor	Poor	Good	Poor	Poor
Rocklands	Sufficient	Sufficient	Sufficient	Sufficient	Poor
Milton Beach tidal pool (outside)	Sufficient	Sufficient	Good	Excellent	Poor
Sunset Beach tidal pool (outside)	Sufficient	Poor	Poor	Excellent	Good
Saunders' Rocks	Poor	Poor	Sufficient	Poor	TFD**
Saunders' Rocks tidal pool (outside)	Excellent	Poor	Poor	Excellent	Poor
Maiden's Cove	Excellent	Poor	Excellent	Excellent	Sufficient
Maiden's Cove tidal pool 1 (outside)	Sufficient	Sufficient	Poor	Excellent	Sufficient
Maiden's Cove tidal pool 2 (outside)	Sufficient	Sufficient	Excellent	Sufficient	Sufficient
Camps Bay tidal pool (outside)	Good	Sufficient	Excellent	Sufficient	Excellent
Horne Bay Beach	Excellent	Good	Poor	Sufficient	Good
Noordhoek South	NYM*	NYM*	TFD**	Excellent	TFD**
The Kom	Poor	Poor	Sufficient	Sufficient	TFD**

* *NYM – not yet monitored*
** *TFD – too few data*

ANNEXURE A2: COASTAL WATER-QUALITY CATEGORIES FOR COASTAL MONITORING POINTS, FALSE BAY COAST

COASTAL MONITORING POINTS FALSE BAY COAST	COASTAL WATER-QUALITY RATING				
	2018	2019	2020	2021	2022
Miller's Point	Excellent	Sufficient	Excellent	Excellent	TFD**
Simon's Town harbour	Sufficient	Excellent	Excellent	Excellent	TFD**
Simon's Town diving school	Good	Excellent	Excellent	Excellent	TFD**
Kalk Bay rocks	Excellent	Sufficient	Excellent	Sufficient	TFD**
Ex Sandown Hotel site	Good	Good	Poor	Sufficient	TFD**
Lifebox 21	Poor	Poor	Poor	Poor	TFD**
Lifebox 23	Poor	Poor	Poor	Poor	TFD**
Sonwabe	Poor	Poor	Poor	Poor	TFD**
Ribbon parking area	Poor	Sufficient	Poor	Poor	TFD**
Lifebox 30	Poor	Poor	Poor	Poor	TFD**
Lukannon Drive wastewater pump station	Good	Sufficient	Poor	Poor	TFD**
Mitchells Plain wastewater effluent discharge	Good	Poor	Sufficient	Poor	TFD**
Mitchells Plain stormwater west discharge, East	Poor	Poor	Poor	Poor	TFD**
Mitchells Plain stormwater west discharge, West	Poor	Poor	Poor	Poor	TFD**
Strand MPA	NYM*	NYM*	TFD**	Poor	TFD**
Strand opp Woltemade St	Poor	Poor	Poor	Sufficient	TFD**
Strand near Lourens River mouth	Poor	Poor	Poor	Sufficient	TFD**
Gordon's Bay wastewater treatment works	Poor	Poor	Poor	Sufficient	TFD**
Gordon's Bay Harbour Island	Good	Good	Poor	Poor	TFD**
Gordon's Bay harbour	Sufficient	Sufficient	Poor	Poor	TFD**
Near Sir Lowry's Pass River	Poor	Poor	Poor	Poor	TFD**

** NYM – not yet monitored*
*** TFD – too few data*

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.