

COASTAL WATER QUALITY INVESTIGATION



HOUT BAY CASE STUDY

Compiled by



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Summary

- Coastal water quality monitoring in Hout Bay has showed poor water quality ratings for two of the past four years. Interim data for the 2024 reporting period suggests that the 2024 reporting period may again have a poor rating.
- Bacterial counts in coastal waters show a very clear seasonal trend, with much higher levels of pollution in winter.
- Weekly sampling undertaken by the City in 2023-2024 demonstrates that significant rainfall events in the catchment impact negatively on coastal water quality at Hout Bay, with a clear link between higher weekly rainfall and higher enterococci counts in coastal waters.
- Daily sampling in November 2024 shows good coastal water quality at both Chapmans Peak and Mariners Wharf beach recreational sites.
- The Hout Bay River and surface stormwater system carry sewage-derived bacterial pollution from the catchment to the sea.
- Marine outfall monitoring data for 2016, 2020-2022 and for 2024 do not appear to show any influence from the marine outfall on water quality at the beach or in the nearshore area.
- The City advises beachgoers not to swim in the sea within 150 metres on either side of a river mouth or within 24 hours after heavy rainfall events.

1 Introduction

Hout Bay beach is a sheltered beach on Cape Town's Atlantic coast, popular with beachgoers, swimmers and kayakers. The two main recreation areas at Hout Bay beach are in the eastern corner (Chapmans Peak side) and the western corner (Mariners Wharf side).

Coastal water quality at Hout Bay is directly impacted by outflows from the Hout Bay River (also known as the Disa River), which discharges into Hout Bay near the centre of the beach. Other sources of pollution in the bay include a stormwater channel discharging just east of the harbour, as well as direct runoff from the harbour, industrial areas, and the Hangberg and Harbour Heights areas. The Hout Bay Marine Outfall discharges wastewater some 2.5 kilometres from the beach.

Hout Bay has historically had coastal water quality classified as **SUFFICIENT** based on the National Water Quality Guidelines using bimonthly data between 2014 and 2019 (Lwandle, 2019), which deteriorated to **POOR** in 2020 and 2021 (KYC, 2020).

Analysis and evaluation summarised in this report draws on over 14 years of existing bimonthly water quality data from Hout Bay Beach as well as weekly monitoring from October 2023 to November 2024, and a targeted case study with daily monitoring between 6 November 2024 and 22 November 2024. Coupled with data from the periodic monitoring of water quality undertaken to assess the compliance of the marine sewer outfall and the regular inland water quality monitoring in the Hout Bay River, these extensive datasets have been used to inform an assessment of the water quality of Hout Bay beach.

This brief analysis of available data for coastal water quality at the Hout Bay beach is intended to provide the City of Cape Town and the public with a better understanding of the state of water quality in the bay.

2 Methods

2.1 Approach

Existing data and assessment reports were reviewed to summarise their findings regarding bacterial pollution at Hout Bay. These included:

- The City's Know Your Coast (KYC) Reports dated 2019 to 2023
- The 2017 CSIR Report on the Outfalls Monitoring Programme in 2015/2016.
- The Lwandle and CLS 2020-2022 reports on the Hout Bay Outfall monitoring programme.
- The CLS 2022 Environmental Summary Report on the Hout Bay Outfall modelling and monitoring programmes.
- The Inland Water Quality Report (Day et al., 2024) sections on Hout Bay
- The Pollution Abatement Strategy and Action Plan for the Hout Bay Catchment, prepared by the City of Cape Town, Rev 12 dated 31 October 2024.

2.2 Data Sources

- Coastal water samples collected by CCT staff at two locations in Hout Bay between October 2023 and November 2024 (including weekly and – for a two-week period, daily sampling) were analysed by either the SABS Laboratory or WALAB Laboratory, both of which are SANAS accredited for intestinal enterococci enumeration in sea water.
- Interim data collected for the 2024-2027 Hout Bay Outfall Receiving Environment Monitoring Programme by Infinity Environmental and Anchor Environmental.

- The City of Cape Town's inland water quality data for sample sites in the Hout Bay River near the coast.
- Multi-year seasonal receiving environment water quality monitoring around the outfalls over the period 2019-2022 (Lwandle, 2020 and 2021; CLS 2022a)
- Rainfall data were sourced from the SAEON Constantiaberg station, for the period ending 10 October 2024. Rainfall data from 10 October to the date of this report were sourced from the City of Cape Town's Woodhead weather station.

2.3 Site Selection and Monitoring Frequency

2.3.1 Coastal Water Quality Data

Water samples have been collected for analysis from Hout Bay beach (Chapmans Peak – XCN10, Figure 1) from January 2014 to date (213 samples). A new point was introduced for weekly samples in August 2024 near Mariner's Wharf (HB13). Additionally, an intensive programme of daily samples was carried out in November 2024 at both Hout Bay Beach (XCN10 and Mariner's Wharf (HB13)).

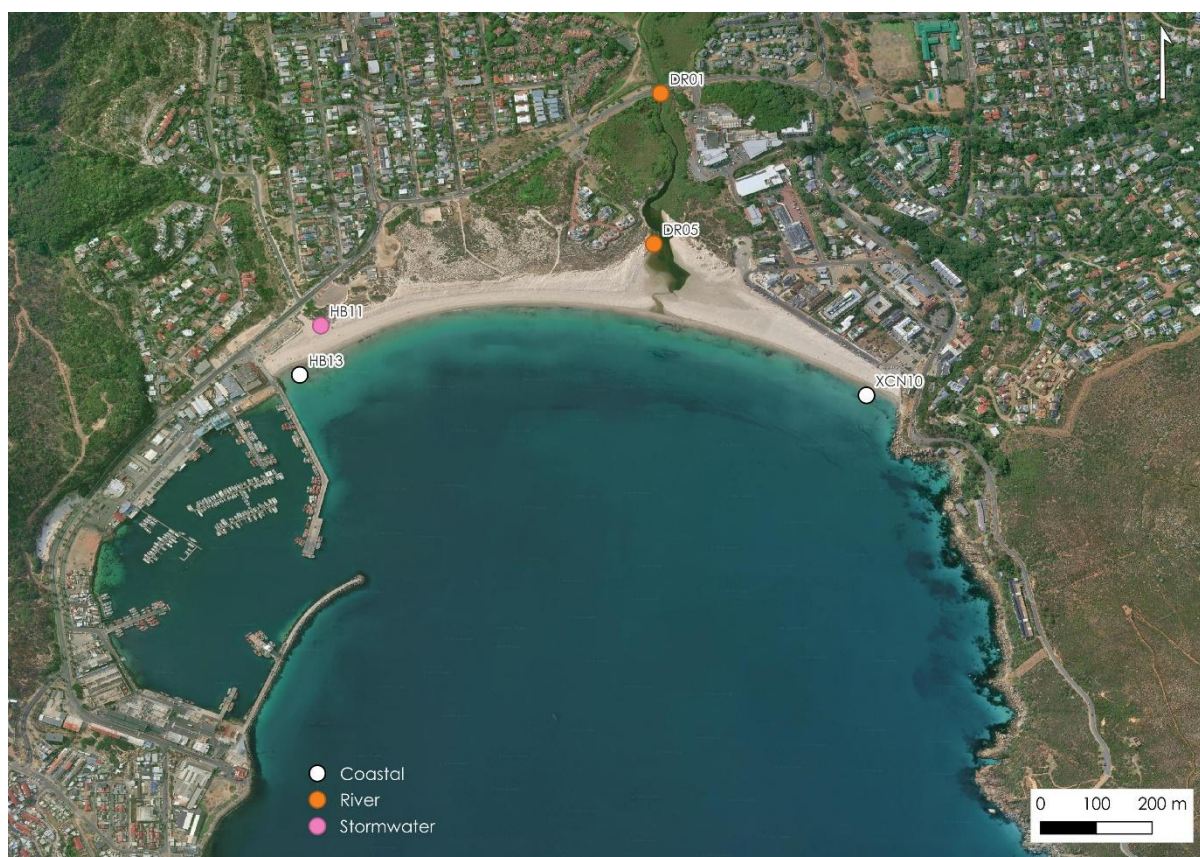


Figure 1. Sampling sites in Hout Bay for the Inland and Coastal Water Monitoring Programs

2.3.2 Inland Water Quality Data

Data from three sample sites in the Inland Water Quality dataset are of relevance. Two sites were selected from the Hout Bay River (DR01 and DR05, Figure 1), and one site was selected from the discharge point of a stormwater drain near the Yacht Club (HB11). Between the two Hout Bay River sites, 331 samples were collected between January 2017 and November 2024. 27 samples were collected from HB11 between August 2017 and October 2024.

2.4 Guidelines

- Intestinal enterococci were enumerated in line with SANAS standard methodologies (using accredited membrane filtration methods for quantifying enterococci). Intestinal enterococci were used as they are the internationally accepted faecal indicator bacteria (FIB) for assessing levels of wastewater pollution and associated human health risk in coastal and marine environments. Further information on the use of enterococci can be found in the CCT [Know Your Coast 2023](#) report and in **Box 1** overleaf.
- In line with the South African Department of Environmental Affairs "South African Water Quality Guidelines for Coastal Marine Water - Volume 2: Guidelines for Recreational Use", the upper limit for the 95th percentile of results indicating pollution is 200 CFU/100ml of intestinal enterococci. As a precaution, 200 CFU/100ml has also been used in this report for a single sample limit of good water quality. This is a more cautious approach than the 2012 Guidelines that recommend a single sample threshold of 240 CFU/100ml for the operational management of beaches in South African sea water.
- Recreational Water Quality categories are determined for each set of results as follows:
 - National Recreational Water Quality Guidelines recommend determining the 95th and 90th percentiles of intestinal enterococci counts to determine the recreational water quality of a given beach. The City has been using the Hazen method (see **Box 2**) as it provides a conservative estimate of water quality, and the guidelines do not specify what method to use. The guideline thresholds are laid out below:
 - 95th Percentile should be ≤ 100 CFU for Excellent water quality
 - 95th Percentile should be ≤ 200 CFU for Good water quality
 - 90th Percentile should be ≤ 185 CFU for Sufficient water quality
 - The 2021 World Health Organisation Guidelines on Recreational Water Quality use the following classification system based on the rounded 95th percentile.
 - 95th Percentile for Category A: ≤ 40 CFU /100ml
 - 95th Percentile for Category B: 41-200 CFU /100ml
 - 95th Percentile for Category C: 201-500 CFU /100ml
 - 95th Percentile for Category D: >500 CFU /100ml
 - The WHO does not prescribe a specific acceptable class of water.
 - Class A and B are within tolerable levels of risk according to the South African (and most other) guidelines on recreational water quality
- For inland (fresh) water systems, *Escherichia coli* (*E. coli*) are the standard and counts of these bacteria are compared against a modified version of the 1996 DWAF recreational water quality guidelines and the Resource Quality Objectives for the Berg catchment as described in Day et al. 's (2024) Inland Water Quality Report.

Table 1. Risk Criteria for Recreational Use of Coastal Waters in South Africa

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

* Exposures are defined as 10 minutes of swimming with three head immersions.

** Colony-forming units

BOX 1: ENTEROCOCCI - GLOBAL STANDARD FOR COASTAL FAECAL INDICATOR BACTERIA

Faecal indicator bacteria (FIB) are measured as a surrogate for a complex suite of pathogens (bacteria, viruses, and others) present in sewage and used to estimate the risk of gastrointestinal and other health effects in humans using recreational waters.

- The WHO guidelines 2003 stated “*Escherichia coli* is intrinsically suitable for fresh waters but not marine waters” (WHO, 2003). The updated WHO 2021 guidelines also support using only intestinal enterococci as a FIB in marine environments.
- No statistical relationship has been established for *E. coli* that can support a clear dose–response guideline value in marine waters.
- At the time of writing these guidelines, only enterococci had been used in epidemiology studies addressing marine and fresh waters and shown to reflect, in a dose–response manner, gastrointestinal illness in recreational water users (Wade et al., 2010).
- These FIB are not themselves the causative agents of illness.
- Monitoring of two FIB introduces avoidable complexity in analysis and interpretation of results (WHO, 2021), without improving the management of human health risk.

At present, most global health and environmental authorities agree on using intestinal enterococci as the sole FIB in marine environments in their respective guidelines for recreational water quality. This includes the World Health Organisation Guidelines on Recreational Water Quality (2021), United States Environmental Protection Agency (US EPA 2012), Health Canada (2024), New Zealand Ministry of Health (2021), and Australian National Health and Medical Research Council (2008).

- A series of five epidemiological studies conducted by the US EPA between 2003 and 2009 (Wade et al., 2010) confirmed that intestinal enterococci are the appropriate faecal indicator bacteria for seawater, and found that *E. coli* did not display a clear dose–response relationship between bacterial levels and the gastrointestinal illness risk to recreational users in seawater. These studies followed numerous others conducted in the 1980's that were the basis for intestinal enterococci being widely adopted as the main FIB in marine environments (Cabelli et al., 1982; Cabelli, 1983; Dufour, 1984).
- A 2019 report compiled for the government of New Zealand reviewed over 100 published scientific papers to determine whether enterococci are still the most appropriate FIB in coastal waters. The report recommended minor updates to thresholds but found enterococci to be effective for weekly monitoring of faecal contamination risk posed to recreational users of coastal waters (McBride et al., 2019).
- Any suggestion that enterococci are monitored in an effort to provide “better” results is not supported by long term data sets. Enterococci have been found to be a more sensitive indicator bacteria in seawater than *E. coli*, having been shown to exceed single sample standards most often during all weather and environmental conditions (i.e. dry weather, wet weather, along beach's, and near stormwater inputs) (Noble et al., 2003).
- Intestinal enterococci's unique resistance to salinity (and ability to grow in saline environments) is thought to contribute to their “better performance as indicators of human health risk in marine recreational waters than members of the coliform group” such as *E. coli* (Byappanahalli et al., 2012). Past studies have demonstrated that intestinal enterococci have a significantly longer survival time in marine environments than *E. coli* (Hanes and Fragala, 1967; Sieracki, 1980; Noble et al., 2001). These studies also noted *E. coli* are more sensitive to sunlight than enterococci.

Box 2: Percentiles and category calculations

Hazen Method

The Hazen method is a statistical approach used to analyse enterococci levels in water quality data. It is generally a very conservative way of determining water quality (i.e., it will err on the side of poorer water quality estimates):

- **Ranking the Data:** All enterococci measurements are arranged in order from the smallest to the largest value. Each measurement is assigned a rank.
- **Percentile Calculation:** The method identifies the value at which a specified percentage of the data lies below it (e.g., the 90th or 95th percentile).
- **Interpolation:** To achieve greater precision, the Hazen method uses interpolation. This means it calculates a value that might fall between two actual measurements to give a more accurate percentile estimate.

For example:

- For an excellent rating, 95% of the data points must be below 100 cfu/100 ml. The Hazen method determines this cut-off point even if it doesn't align perfectly with an actual measurement.

3 Pollution Sources

Water quality in coastal waters at Hout Bay beach is influenced by the quality and volume of flows from rivers and stormwater systems in the catchment, as well as by the quality of seawater in the bay.

3.1 Land-based pollution sources

The Hout Bay River receives flows from a catchment of approximately 37 km², which includes:

- Natural upper slopes in the Table Mountain National Park
- Formal residential areas and smallholdings on both sides of the Hout Bay River
- Formal housing with backyard dwellers in Imizamo Yethu and Hangberg areas
- Informal dwellings in Imizamo Yethu, which includes a fairly large informal settlement, with limited services
- Commercial areas along the coast and surrounding the harbour

The 2024 Inland Water Quality Report (Day et al., 2024) notes that the main sources of water pollution in the catchment are:

- smallholdings and horses,
- sewage overflows from blocked pipes and pump station failures, mainly in the middle to lower reaches of the catchment and often linked to disposal of foreign objects into the sewer system, and
- input and runoff of sewage-contaminated water into the stormwater system from the largely informal Imizamo Yethu settlement, which flows into the lower reaches of the Hout Bay River, as well as from the Hangberg area where a large portion of the formal housing is associated with backyard dwellings.

Sewer pump stations are located in the lower reaches of the catchment. The main pump station located on the Hout Bay River is the Disa River Pump station, located in the lower reach of the river. A pump station failure occurred at this pump station on 4 October, spilling sewage

into the river for approximately half an hour. Further upstream on the Hout Bay River at Victoria Road is a Low Flow Diversion pump system with one pump. This pump has experienced regular failure due to the volume of silt wash-down from the catchment.

Since November 2023, an average of 11 sewer spills have been reported in the catchment each week, with up to 27 per week during peak periods (according to C3 data on reported incidents, shown spatially as a 'heat map' in **Figure 2**). Sewer blockages and spills are concentrated in Imizamo Yethu where blockages caused by solid waste, illegal stormwater cross-connections to the sewer network, and high residential densities exacerbate the problem. Sewage enters the stormwater system as surface flow and is then conveyed to the river system and discharges into the river.

Day et al. (2024) report that at all three river sampling sites downstream of Imizamo Yethu, mean *E. coli* concentrations were in the Poor and Unacceptable categories in Reporting Year 2023, indicating sewage contamination in these lower reaches of the river.

It must be noted that the inland water quality data for *E. coli* between April 2021 and January 2022 are unreliable due to laboratory issues, and are not reported in Day et al. (2024).

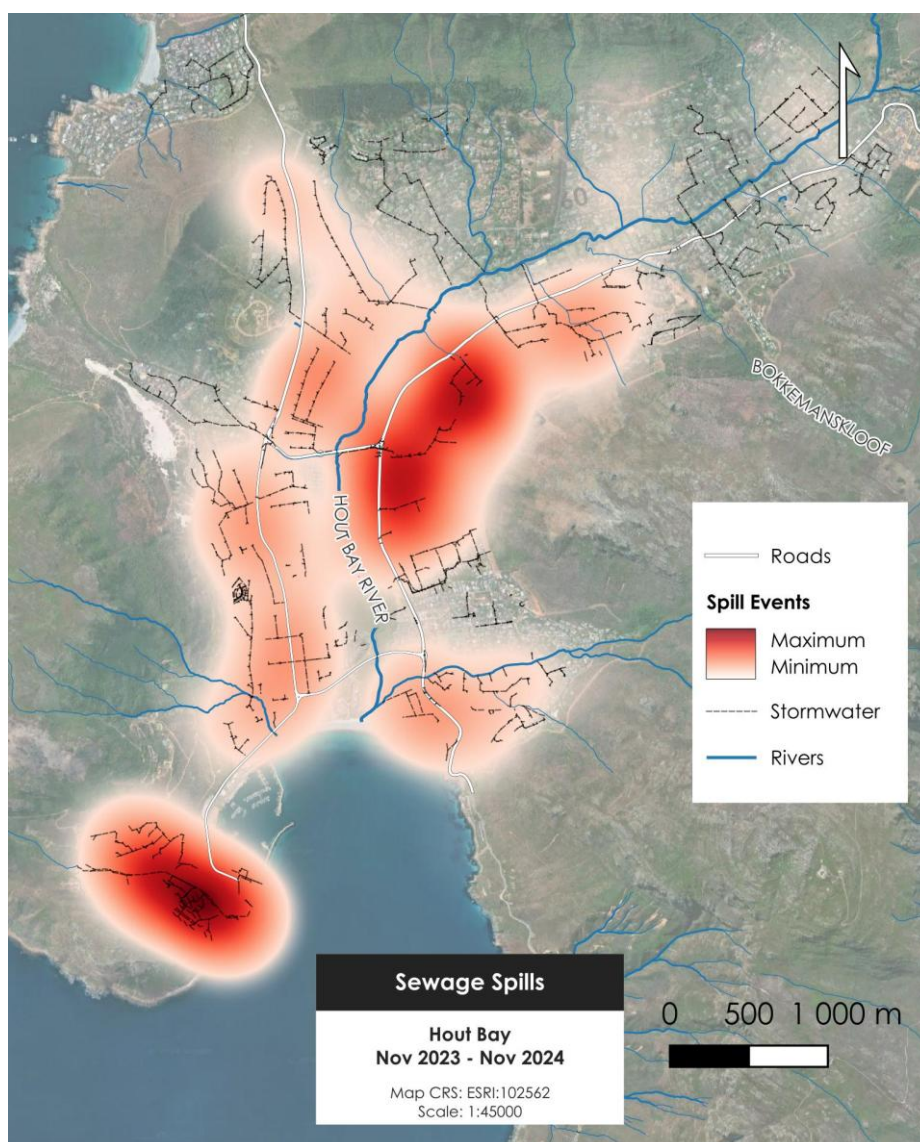


Figure 2. Heat map of sewer spills in the Hout Bay catchment December 2023- October 2024 showing areas of higher frequency of C3 reports for 'Sewer Blocked / Overflow' events.

3.2 The Hout Bay marine outfall

The City of Cape Town utilises a marine outfall pipeline to dispose of wastewater emanating from the Hout Bay sewer catchment. The Hout Bay marine wastewater outfall has a total length of 2 162 m, extending out into the bay from the shoreline south of the Hout Bay harbour and bending south then southwest to run parallel with the coastline. The discharge point is approximately 750 m from the nearest shoreline – the Sentinel at the northwestern head of the bay. The design capacity of the outfall is 9.6 megalitres per day and was constructed in 1993 to replace an earlier surfzone discharge point south of the harbour. Prior to discharge, preliminary treatment comprising screening, degritting, and maceration takes place at the Hout Bay wastewater treatment works. The outfall discharges at a depth of 37 m below sea level. Its metered discharge varied between 5.32 ML per day on average in the winter/spring and 5.05 ML per day in the summer/autumn in previous studies (PRDW, 2020). These volumes increase under wet weather conditions as stormwater ingress into the sewer increases discharge flows. The volume of wastewater however does not increase.

The City has monitored water quality around the outfall in a series of monitoring programmes, key findings of which are summarised in section 4.2.

4 Coastal Water Quality in Hout Bay

This section describes available datasets from various monitoring programmes with a relevance to coastal water quality at the Hout Bay beach:

- Section 4.1 describes **inland water quality** in the two watercourses regularly monitored as part of the Inland Water Quality programme.
- Section 4.2 describes **nearshore water quality** assessed out as part of the marine outfalls monitoring programmes in the past 10 years.
- Section 4.3 outlines the **coastal water quality** monitored on Hout Bay beach between 2014 and 2021.
- Section 4.4 describes the results of more frequent **weekly coastal water quality** monitoring at Hout Bay since October 2023.

4.1 Inland water quality in the Hout Bay catchment, 2017-2023¹

The *E. coli* concentrations observed in the Disa River (Hout Bay River) near the Hout Bay beach are consistently high (DR05 - Figure 3), with most values being either 'tolerable' or 'unacceptable' in relation to the recommended thresholds described by Day et al (2024). There is no clear difference between the two sites, but both indicate a strong discharge of polluted water from the catchment area into the bay. Values exceeding 1 million cfu/100 mL are observed for both sites from 2020 to 2022 as well as Feb 2024, and values exceeding 100 000 cfu/100 mL are commonly found. These values are well above the 'unacceptable risk' levels for full-contact or intermediate-contact recreational use.

¹ **NOTE:** Inland water quality is monitored using *Escherichia coli* as an indicator of sewage pollution.

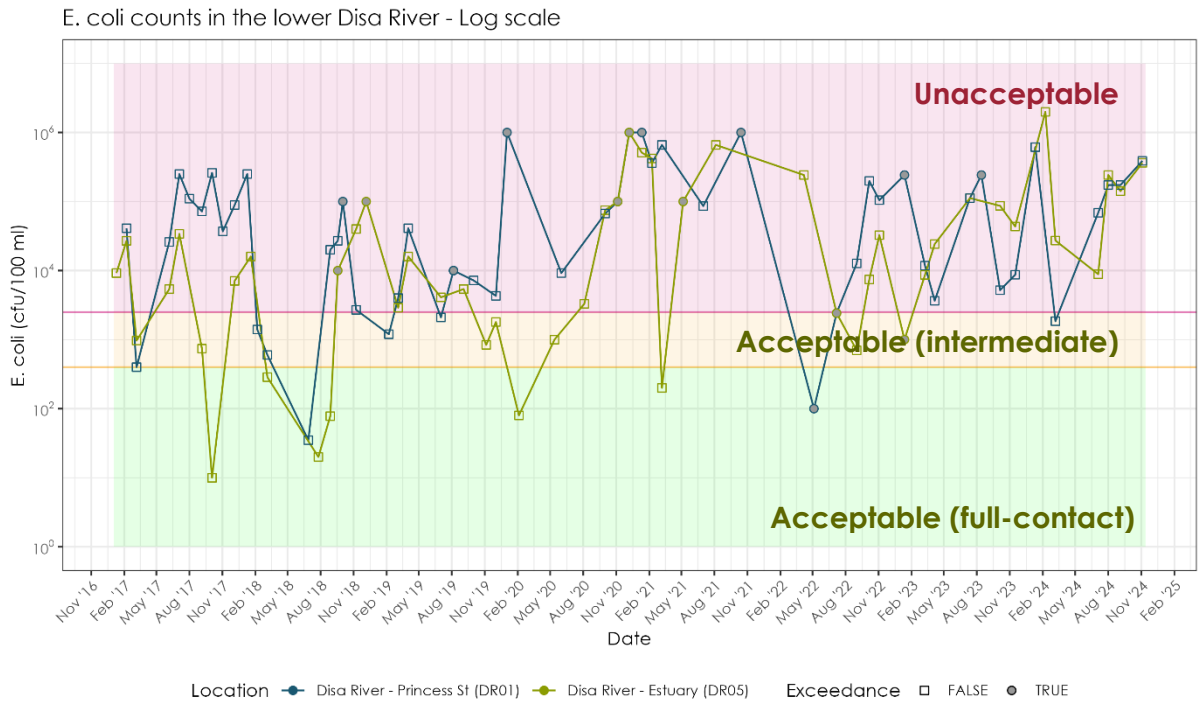


Figure 3. E. coli concentrations (log scale) recorded at two sampling stations in the Disa River near Hout Bay beach. Shading corresponds to the recommended water quality limits for recreational use as described in Day et al. 2024 based on the DWAf 1996 guidelines. The green region corresponds to 'acceptable' risk for full-contact recreation for faecal coliform count (>400 cfu/100 mL), orange region corresponds to 'acceptable' risk for intermediate contact (>2500 - 4000) and the red region to 'tolerable' and 'unacceptable' risk (>4000 cfu/100 mL) for intermediate contact.

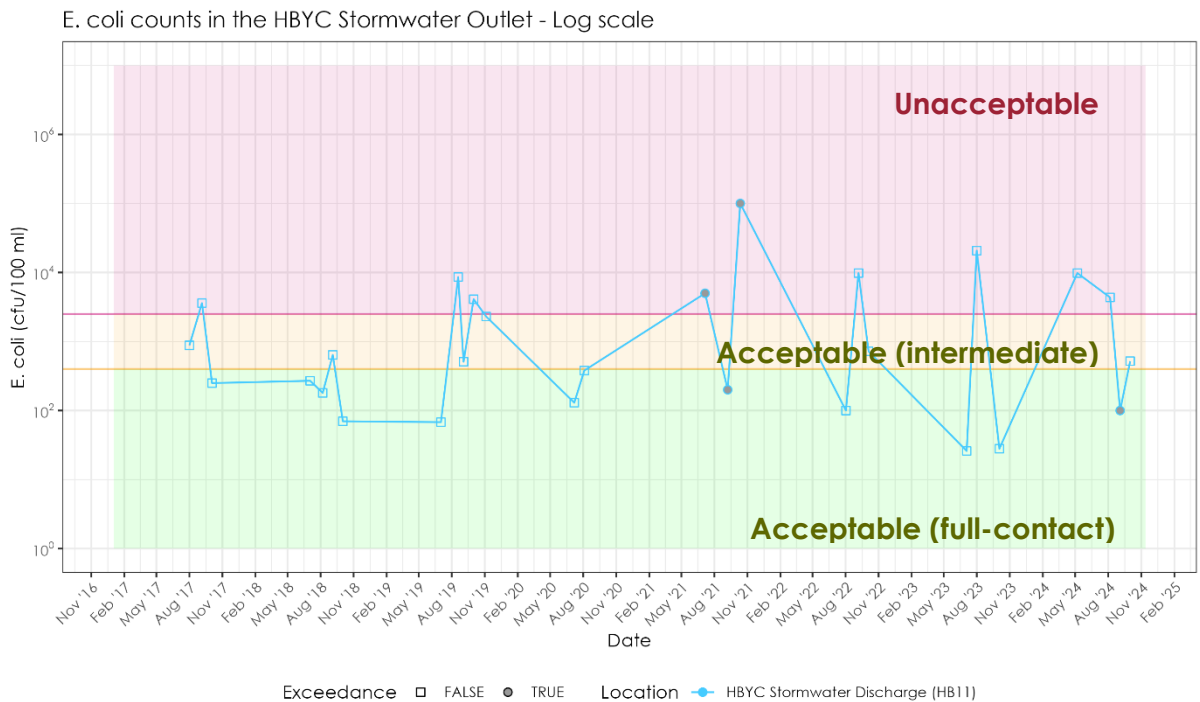


Figure 4. E. coli concentrations (log scale) at the stormwater discharge point near the Hout Bay Yacht Club (HB11). Shading corresponds to the recommended water quality limits for recreational use as described in Day et al. 2024 based on the DWAf 1996 guidelines. The green region corresponds to 'acceptable' risk for full-contact recreation for faecal coliform count (>400 cfu/100 mL), orange region corresponds to 'acceptable' risk for intermediate contact (>2500 - 4000) and the red region to 'tolerable' and 'unacceptable' risk (>4000 cfu/100 mL) for intermediate contact.

In addition, the stormwater discharge at the Yacht Club (HB11, Figure 4) generally has lower concentrations of *E. coli* than the Disa River, with most values fitting the 'acceptable' or 'tolerable' descriptions. This is a smaller flow relative to the Disa River and discharges from a different catchment area, mainly flowing out of the mountains to the north-west of Hout Bay.

There is no clear seasonal signal observed in the inland water quality data, with consistently poor quality in the Hout Bay River due to significant sewage pollution in the catchment.

4.2 Outfalls monitoring data 2015-2022

The City of Cape Town has monitored water quality around the marine outfall in a series of monitoring programmes, key findings of which are summarised below. For further details, refer to the [2022 Summary Report](#) on the Hout Bay outfall.

4.2.1 Outfalls Monitoring Programme - CSIR 2015/2016

The CSIR conducted monthly sampling for enterococci in surface waters at stations across Hout Bay in 2015/2016. In eight of the months, enterococci counts were below 100 cfu/100 ml. at all stations. One month had a single station where counts were between 100 and 500 and three months had a single station where counts >500 cfu/100 ml were recorded – in both cases above the end of the outfall diffuser structure. The spatial distributions of these exceedances show that high counts occurred at or close to the outfall diffuser bank, and reduced rapidly with distance.

4.2.2 Outfalls Monitoring Programme - CLS 2019-2022

CLS SA carried out summer and winter water quality surveys across Hout Bay over the three-year period 2019-2022 (CLS, 2022b). Data from this period indicate that water quality attained *SUFFICIENT* status according to the DEA (2012) guidelines (90th percentile of the counts <180 cfu/100 ml) but fell short of the *EXCELLENT* status (95th percentile <100 cfu/100 ml).

- There is clear evidence that mid-depth enterococci counts are higher than those in the surface and bottom water samples in the Zone of Initial Dilution boundary and Hout Bay interior samples which is consistent with the modelling results.
- The nearshore samples differ as the highest counts are in the surface samples. This is consistent with a freshwater source, e.g., estuary and/or stormwater
- Reinforcing the above highest counts are recorded in the swash zones of the beaches. The distributional data in the CLS SA reports do not show connectivity with the offshore discharge implying a local source of pollution, possibly the Hout Bay (Disa) River estuary at the beach swash zones

4.2.3 Nearshore monitoring data July to November 2024 for Hout Bay marine outfall

Monthly nearshore monitoring has taken place since July 2024 as part of the City's Marine Outfalls Environmental Monitoring Programme, implemented by Infinity Environmental and Anchor Environmental. The programme includes bacterial sampling at 16 sites in the bay: six surrounding the allowable mixing zone at the outfall, two screens of three sites between the outfall and the beach, and three nearshore sites along the surf zone of the beach (Figure 8). One site is situated at the Dungeons surf break west of the bay.

The first five months of data for enterococci analyses are summarised in Figure 5 to Figure 7. No exceedances of recreational water quality guidelines took place during the period at nearshore sites, although elevated enterococci counts occurred in mid-water samples (17 metres depth, on average) at the edge of a radius of ~272 metres around the outfall diffuser

on five occasions (consistent with the modelled scenario of a mid-water 'bulge' in the plume) and at the surface near the outfall on one occasion in November 2024.

The monthly outfall monitoring data from this five-month period do not appear to show any occurrences of effluent plumes from the marine outfall being advected toward the beach. Nearshore water quality was within the *EXCELLENT* range during all sampling events.

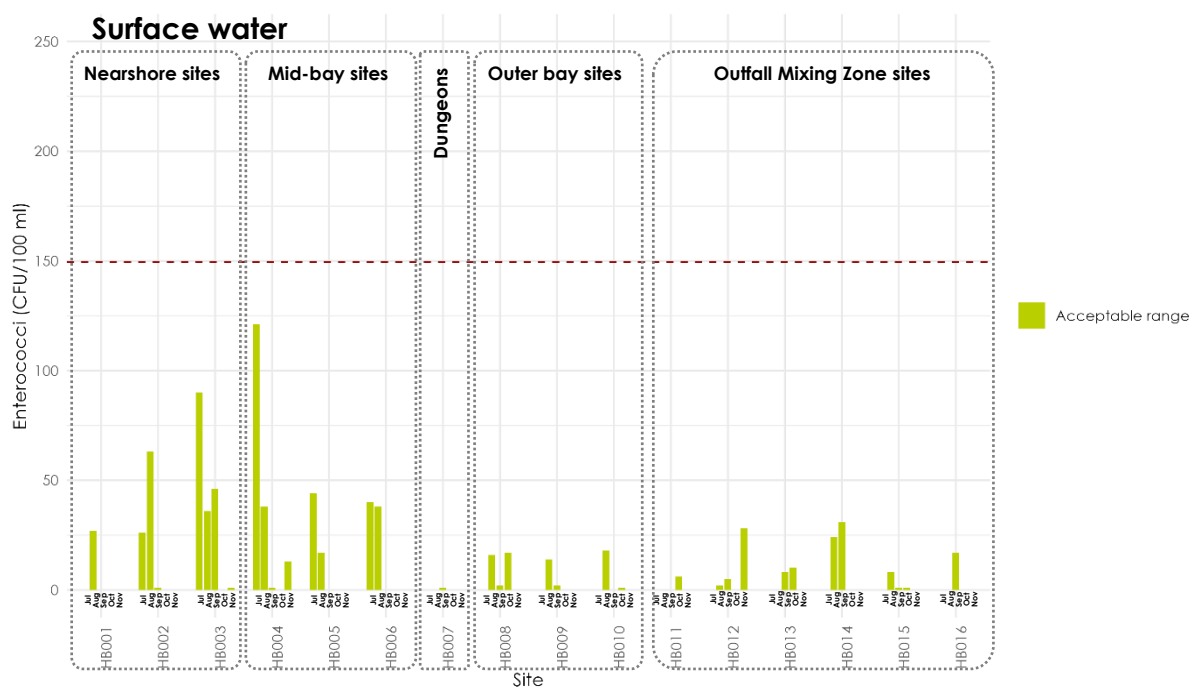


Figure 5. Enterococci sampling results at the sea surface, July 2024 to November 2024, from the Marine Outfalls Monitoring Programme. Results are grouped by sample site (Fig. 3), with nearshore sites HB001, HB002, and HB003 shown at left. Each bar represents a monthly sample. The dashed line indicates the 150 cfu threshold, and exceedances are highlighted in pink. No exceedances were recorded at the surface during the period.

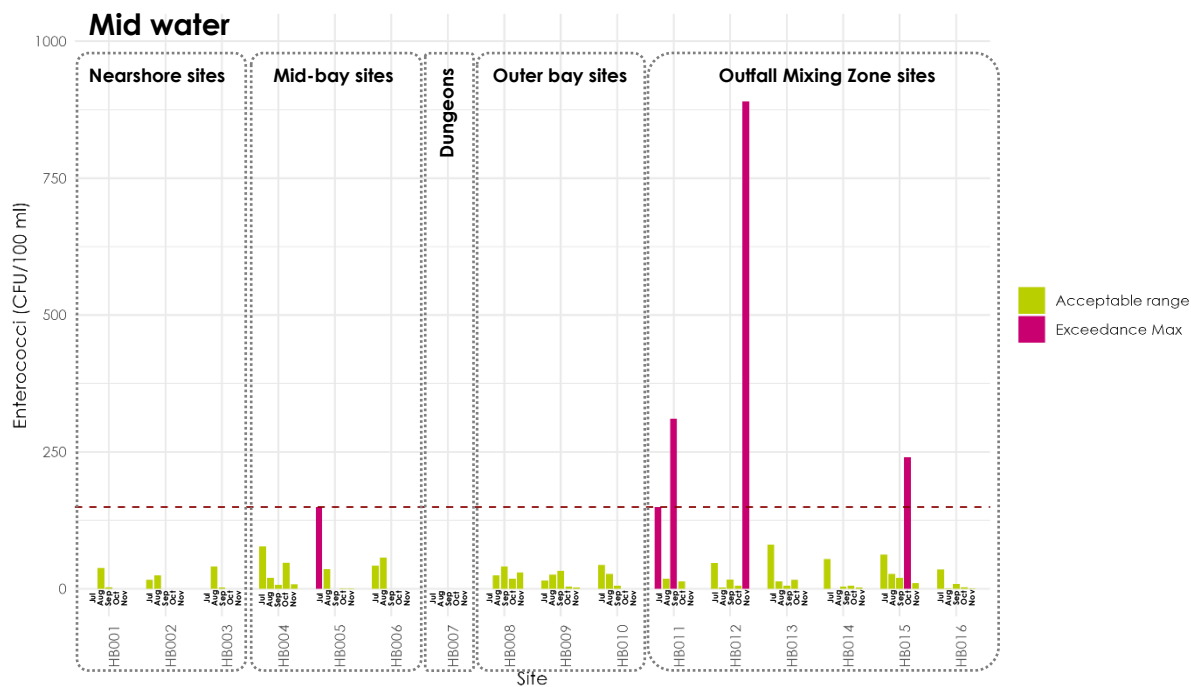


Figure 6. Enterococci sampling results at the mid-depth, July 2024 to November 2024, from the Marine Outfalls Monitoring Programme. Results are grouped by sample site (Fig. 3), with nearshore sites HB001, HB002, and HB003 shown at left. Each bar represents a monthly sample. The dashed line indicates the 150 cfu threshold, and exceedances are highlighted in pink: five were recorded, two in July 2024, one in September 2024, one in October 2024 and one in November 2024. No exceedances were recorded at the nearshore sites closest to the beach.

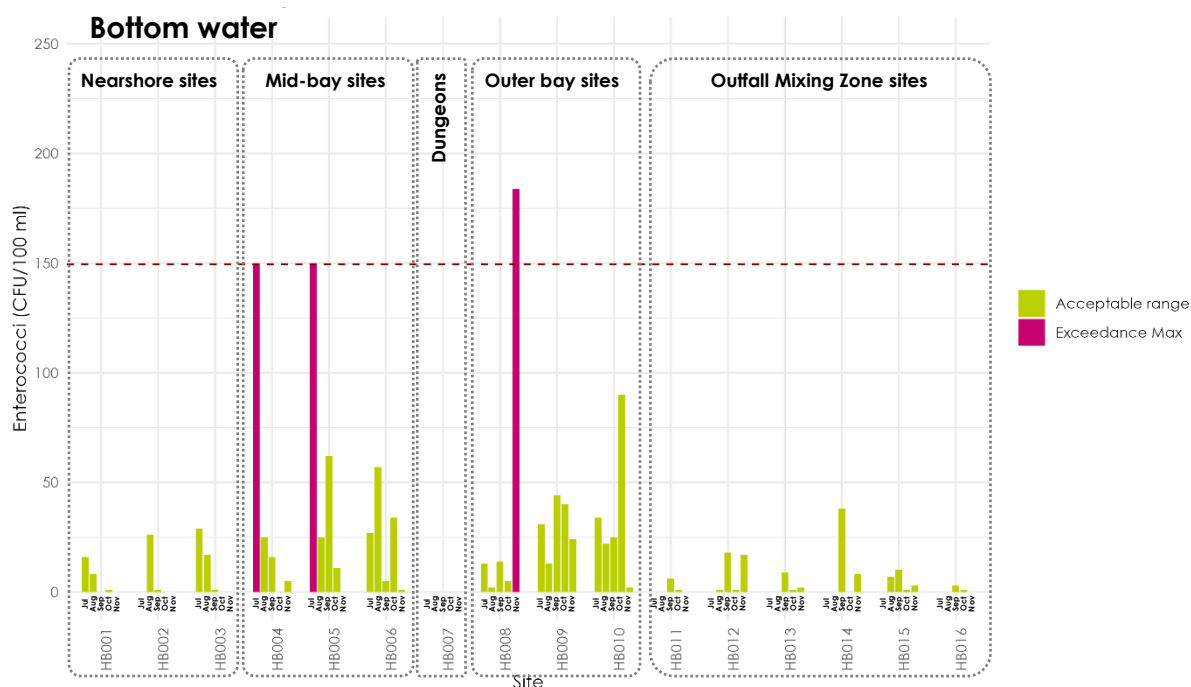


Figure 7. Enterococci sampling results at the sea bottom, July 2024 to November 2024, from the Marine Outfalls Monitoring Programme. Results are grouped by sample site (Fig. 3), with nearshore sites HB001, HB002, and HB003 shown at left. Each bar represents a monthly sample. The dashed line indicates the 150 cfu threshold, and exceedances are highlighted in pink: three were recorded, two in July 2024, one in September 2024 and one in November 2024. No exceedances were recorded at the nearshore sites closest to the beach.



Figure 8. Location of Hout Bay marine outfall relative to beach and monitoring sites

4.3 Coastal water quality 2014-2021

The City of Cape Town's Know Your Coast reports (available [online](#)) summarise the coastal water quality at various sites along the coast, including Hout Bay Beach. The data in Table 2 summarise the coastal water quality ratings for XCN10 at Leopard Rock, assigned per reporting year (1 December to 30 November annually). No ratings were assigned for the 2023 reporting year due to insufficient data, and the 2024 report has not yet been compiled.

Table 2. Coastal recreational water quality ratings for the Hout Bay sample location from Know Your Coast Reports (CCT 2019, 2020, 2021, 2022, 2023)

Historical Coastal Recreational Water Quality Rating for Hout Bay					
(National Water Quality Guidelines Hazen Method)					
2017	2018	2019	2020	2021	2022
Sufficient	Sufficient	Sufficient	Poor	Poor	Good

To further analyse coastal water quality data for this period, enterococci counts have been plotted with rainfall data (Figure 9), and on a logarithmic scale to more accurately depict variation as a result of the exponential nature of bacterial count data (Figure 10). The data show clear **seasonality in coastal water quality, with intestinal enterococci counts being notably higher during winter months**. During the summer months, there are very few exceedances of recreational water quality guidelines, with the 2020-2021 summer showing the most exceedances (just two exceedances over the six-month summer period). Whilst this suggest relatively good water quality at the Hout Bay monitoring site during summer, it also

illustrates the impact of winter rainfall: the winter exceedances are the primary driver of the **POOR** water quality rating for both 2020 and 2021.

Figure 10 highlights that bacterial contamination at the Hout Bay beach, though not typically at unsafe levels during the summer months, remains consistently above zero for most of the year. The Hout Bay River flows throughout the year, and its inputs of urban runoff and sewage-derived contamination are likely the most significant causes of poor coastal water quality in Hout Bay. No Hout Bay River samples during 2023 and 2024 were within the DWAF 1996 guidelines for full-contact recreation (Figure 3).

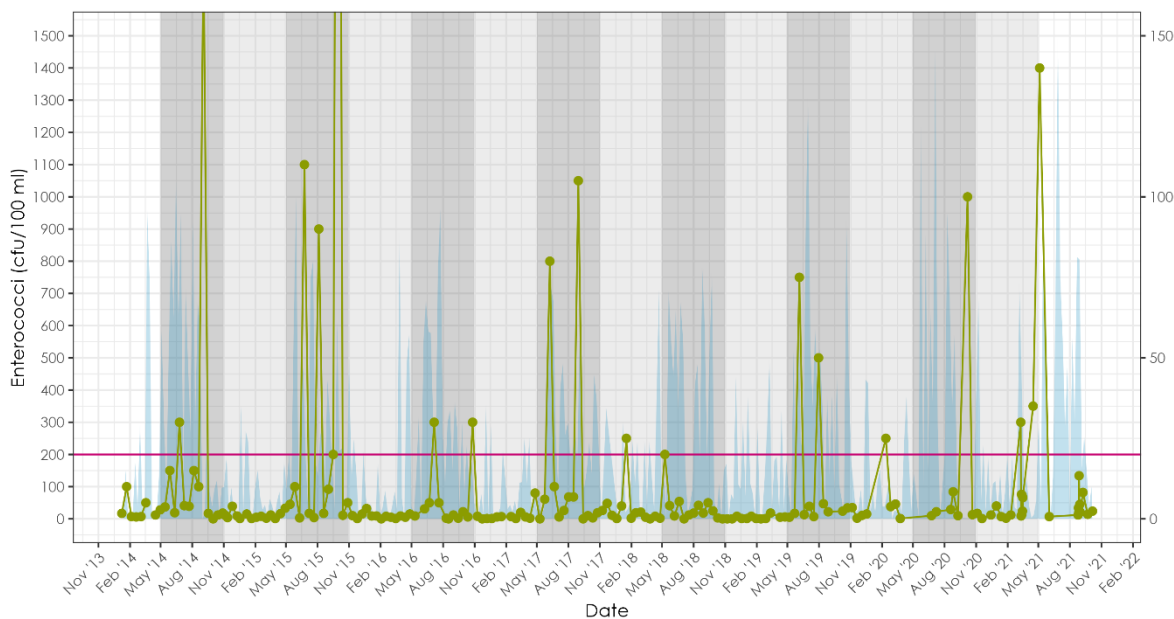


Figure 9. Plot showing historic trends of Enterococci counts at XCN10 – the eastern side of Hout Bay beach. Rainfall is depicted on the secondary axis as total weekly rainfall (mm). The grey banding represents summer and winter, with dark grey being winter and light grey being summer. The red line indicates the target enterococci threshold for recreational water use (200 cfu/100ml)

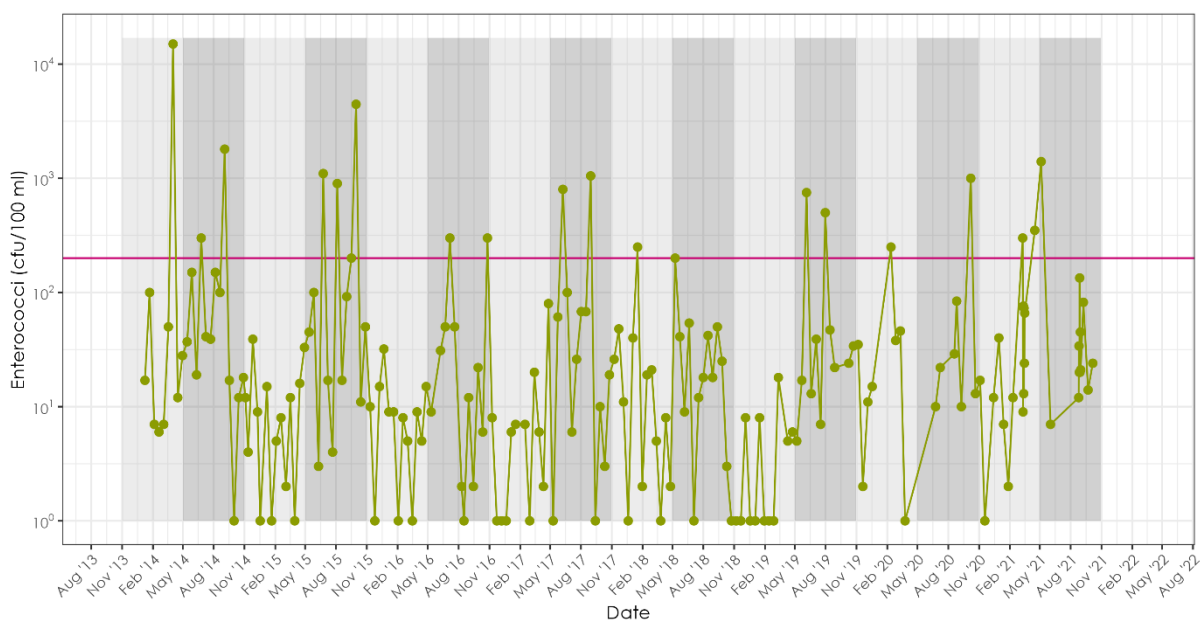


Figure 10. Plot showing historic trends of Enterococci counts on a logarithmic scale at XCN10 Hout Bay Beach. Grey banding represents summer and winter: dark grey being winter and light grey summer

4.4 Coastal Water Quality – October 2023 to November Weekly monitoring 2024

Weekly water samples collected from Hout Bay Beach Chapmans Peak side (XCN10) have consistently recorded high bacterial pollution levels during the 13-month sampling period. The overall coastal water quality rating during this period was **POOR**, indicating a large proportion of samples with unacceptably high concentrations of enterococci for recreational purposes.

Figure 9 shows a concerning state of water quality at Hout Bay beach for 2024, with what appears to be a clear association between rainfall events and a decline in coastal water quality. This trend was apparent for both summer and winter. During the monitoring period from 01 October 2023 to 15 November 2024 there were 18 exceedances of guidelines out of a total of 53 weekly samples. Between 06 June 2024 and 05 August 2024, not a single weekly sample from the Chapmans Peak side (XCN10) met the recreational guideline value for enterococci. This clearly demonstrates the effect of increased rainfall on coastal water quality at beaches near river inflows.

Table 3 highlights the seasonal difference in water quality at Hout Bay beach – with guideline values exceeded 2.8 times more frequently in winter 2024 than in summer 2023/2024.

The Mariners Wharf site was introduced in August 2024 to provide additional insight into water quality across the entire Hout Bay beach. Although it was not yet being monitored during the worst of the 2024 winter apparent pollution events, it did have one exceedance in late August 2024. This site generally showed slightly lower levels of faecal contamination compared to the Chapmans Peak (XCN10) side, although it generally exhibited similar trends (in both the daily and weekly monitoring).

Daily water quality sampling was undertaken for a period of 12 days in November 2024 at Hout Bay Beach in response to public concern. Figure 12 shows the results, with no exceedances of recreational guidelines detected during this period. These data are limited to a short period of relatively low rainfall during the summer months, and cannot necessarily be generalised.

Table 3. Comparison of exceedances of the 200 cfu/100ml threshold value for intestinal enterococci on the eastern side of Hout Bay beach (XCN10) over a full seasonal cycle (1 Nov 2023 to 31 Oct 2024).

Season	Total Exceedances	Total Records	Exceedance Rate
Summer	4	23	17.4 %
Winter	13	26	50 %

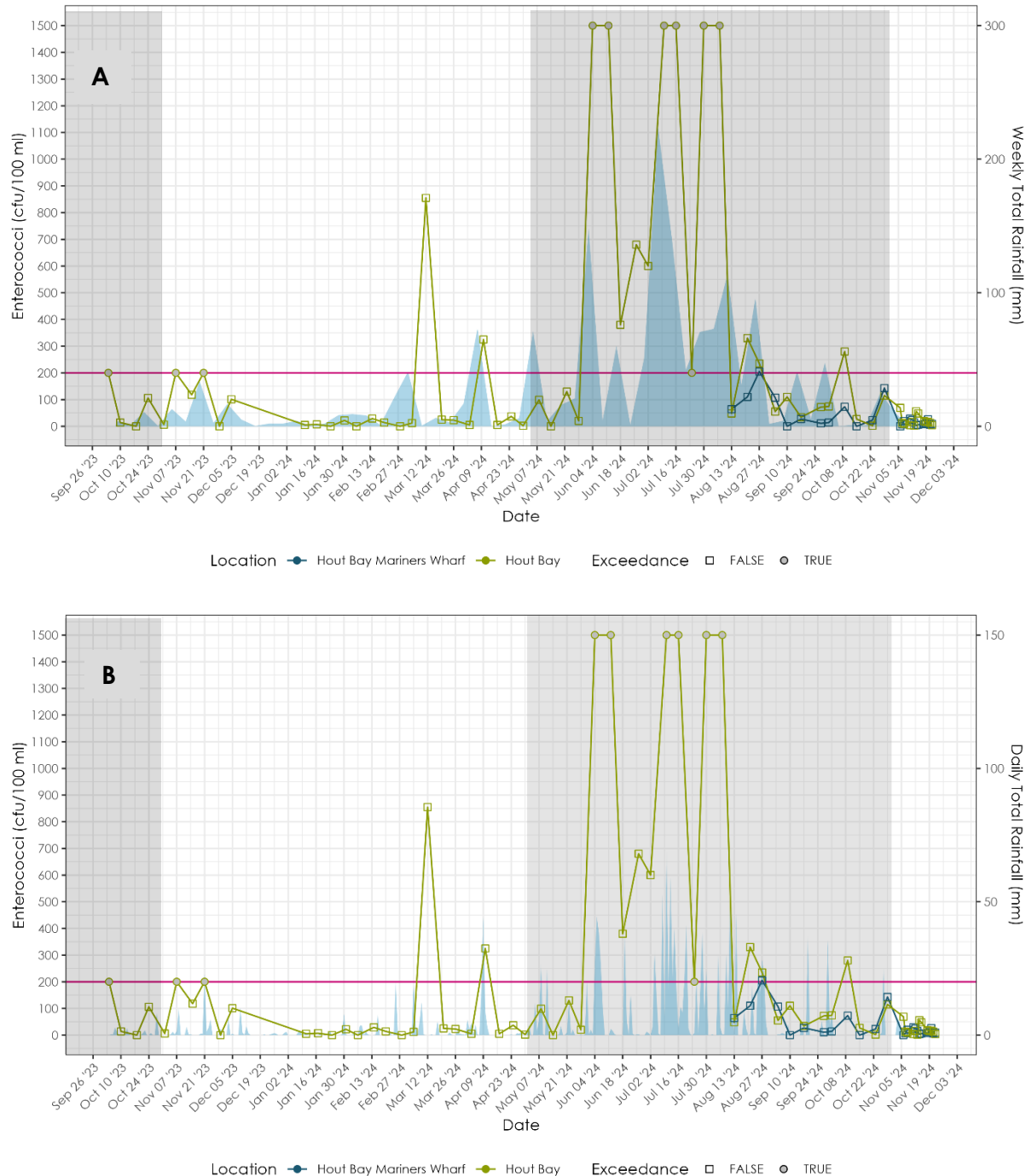


Figure 11. All enterococci data collected at the Hout Bay Beach since October 2023 (including daily samples undertaken in Nov 2024). Note Mariners Wharf was only introduced as a site in August 2024. Grey shading depicts winter months. A) Depicts enterococci counts with weekly total rainfall overlaid B) depicts enterococci counts with daily total rainfall

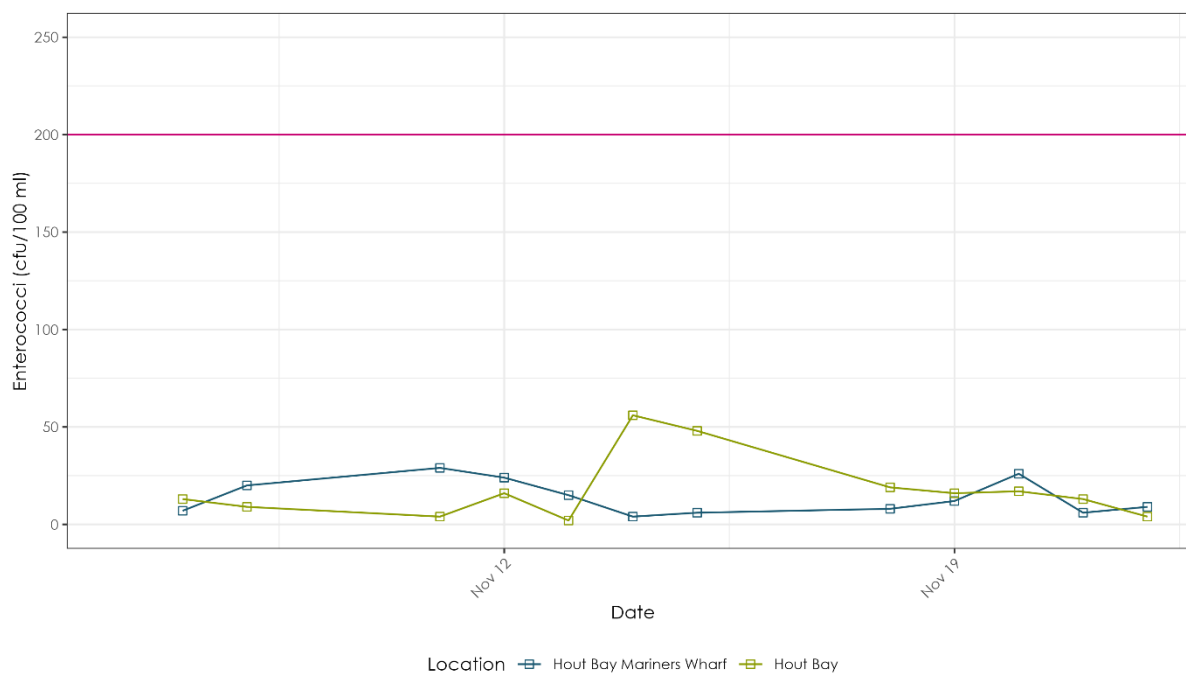


Figure 12. Daily enterococci counts collected at two sites at Hout Bay Beach for a two-week period in November 2024).

5 Overall Findings

- Long-term coastal water quality monitoring in Hout Bay has showed a decline in annually-determined water quality ratings over time, with **SUFFICIENT** ratings between 2017 and 2019 and **POOR** ratings from 2020 to 2021. A **GOOD** rating was achieved in 2022, and 2023 data is insufficient to allow for a rating to be assigned.
- Interim data for the 2024 reporting period, including weekly sampling between December 2023 and mid-November 2024, suggests that the 2024 reporting period may again have a **POOR** rating. This will be confirmed in a final report to be compiled after the end of the reporting period.
- Intestinal enterococci counts in coastal waters showed a clear seasonal trend in the 2014 – 2021 dataset with notably higher counts in winter, and very few individual guidelines exceedances during summer.
- Weekly and daily sampling undertaken by the Coastal Management Branch in 2023-2024 demonstrates that significant rainfall events in the catchment impact negatively on coastal water quality at Hout Bay, with a clear link between higher weekly rainfall and higher enterococci counts in coastal waters. During the monitoring period from 01 October 2023 to 15 November 2024 there were 18 exceedances out of a total of 53 weekly samples.
- It is notable that while in the historical record coastal water quality was highly variable, during the 2024 winter period (June to August 2024) there were no periods during which bacterial counts detected less than 200 cfu/100ml in the Hout Bay samples. This trend toward chronic pollution is a concern.
- Significant rainfall events in the catchment impact negatively on coastal water quality at Hout Bay, with a link between higher weekly rainfall and higher enterococci counts in coastal waters.

- The Hout Bay River and surface stormwater system are vectors for sewage-derived bacterial pollution from the catchment, including sewage from spills and overflows, from direct runoff in unserviced and underserviced areas of Hout Bay, and where pump station failures discharge directly to the river.
- The marine outfall monitoring data for 2024 do not appear to show any influence on water quality at the beach deriving from the marine outfall. Nearshore water quality at sites just beyond the surf zone was within the **EXCELLENT** range during all sampling events.
- Improvement to recreational water quality at the Hout Bay beach to consistently acceptable levels is dependent on:
 - a. Significantly reducing and preventing wastewater contamination of the Hout Bay (Disa) River from all sources
 - b. Significant reduction in pump station and sewer failures
 - c. The effective daily functioning of the Low Flow Diversions on Victoria Road
 - d. Expanded services in Imizamo Yethu
 - e. Reduction in misuse of the sewer infrastructure (80% of failures are attributed to foreign objects in the sewer system)
- The City should consider a formal advisory for beachgoers not to swim in the sea within 150 metres on either side of a river mouth, due to the high pollutant loading associated with urban rivers – this guidance is supported by the analysis of data for the Hout Bay beach.
- Similarly, the City should consider a formal advisory to full-contact users to avoid the ocean for 24 hours after heavy rainfall events.

6 Next Steps

The following recommendations are made based on the findings above:

- 1) Standard coastal water quality sampling frequency at recreational nodes (conducted by CCT) such as Hout Bay should be increased to weekly sampling at both locations.
- 2) Statistical analyses should be conducted as part of the standard annual reporting process to validate the preliminary findings in this study.
- 3) The potential health risks associated with swimming in the sea near river mouths or stormwater outflows, even in summer and especially after rainfall events, should continue to be clearly communicated to the public and beach users.
- 4) Consider a short daily sampling research project during peak rainfall season.

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8 ANNEXURE A: RAW COASTAL WATER QUALITY DATA ACROSS TWO LOCATIONS OF HOUT BAY BEACH

Table 1: Weekly data Hout Bay

Date	Hout Bay Chapman's Peak side	Hout Bay Beach Harbour side
Tuesday, 03 October 2023	450	***
Tuesday, 10 October 2023	14	***
Tuesday, 17 October 2023	<1	***
Tuesday, 24 October 2023	106	***
Tuesday, 31 October 2023	6	***
Wednesday, 08 November 2023	>150	***
Wednesday, 15 November 2023	118	***
Tuesday, 21 November 2023	>150	***
Wednesday, 29 November 2023	<1	***
Tuesday, 05 December 2023	101	***
Wednesday, 10 January 2024	5	***
Wednesday, 17 January 2024	7	***
Tuesday, 23 January 2024	<1	***
Tuesday, 30 January 2024	22	***
Tuesday, 06 February 2024	<1	***
Tuesday, 13 February 2024	29	***
Tuesday, 20 February 2024	14	***
Tuesday, 27 February 2024	<1	***
Tuesday, 05 March 2024	12	***
Tuesday, 12 March 2024	855	***
Wednesday, 20 March 2024	25	***
Tuesday, 26 March 2024	23	***
Tuesday, 02 April 2024	5	***
Tuesday, 09 April 2024	325	***
Wednesday, 17 April 2024	5	***
Tuesday, 23 April 2024	37	***
Tuesday, 30 April 2024	2	***
Tuesday, 07 May 2024	99	***
Tuesday, 14 May 2024	<1	***
Tuesday, 21 May 2024	130	***
Tuesday, 28 May 2024	20	***
Tuesday, 04 June 2024	>1500	***
Tuesday, 11 June 2024	>1500	***
Tuesday, 18 June 2024	380	***
Tuesday, 25 June 2024	680	***

Tuesday, 02 July 2024	600	***
Tuesday, 09 July 2024	>1500	***
Tuesday, 16 July 2024	0	***
Tuesday, 23 July 2024	>150	***
Tuesday, 30 July 2024	>1500	***
Tuesday, 06 August 2024	>1500	***
Monday, 12 August 2024	48	64
Tuesday, 20 August 2024	330	110
Tuesday, 27 August 2024	235	205
Tuesday, 03 September 2024	55	107
Wednesday, 11 September 2024	110	0
Wednesday, 18 September 2024	34	27
Thursday, 26 September 2024	72	11
Tuesday, 01 October 2024	74	14
Wednesday, 09 October 2024	280	73
Wednesday, 16 October 2024	27	0
Tuesday, 22 October 2024	2	23
Tuesday, 29 October 2024	115	143
Tuesday, 05 November 2024	69	0
Tuesday, 12 November 2024	9	26

*No data. **Research at this site temporarily suspended. ***Not yet monitored

Table 2: Daily data Hout Bay

Date	Hout Bay Chapman's Peak side	Hout Bay Beach Harbour side
Thursday, 07 November 2024	13	7
Friday, 08 November 2024	9	20
Monday, 11 November 2024	4	29
Tuesday, 12 November 2024	16	24
Wednesday, 13 November 2024	2	15
Thursday, 14 November 2024	56	4
Friday, 15 November 2024	48	6
Monday, 18 November 2024	19	8
Tuesday, 19 November 2024	16	12
Wednesday, 20 November 2024	17	26
Thursday, 21 November 2024	13	6
Friday, 22 November 2024	4	9
Monday, 25 November 2024	171	*

*No data. **Research at this site temporarily suspended. ***Not yet monitored