



CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

MARINE OUTFALLS: Environmental Monitoring Programme

Summary of Findings and Recommendations

Internal report

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REVISION	PREPARED BY	CHECKED BY
00	<p>Gregg Oelofse Manager: Coastal Management</p> <p>Signature</p>	<p>Maria Le Roux Pr Eng Head: Coastal Engineering & Optimisation</p> <p>Signature</p> <p>Darryl Colenbrander Head: Coastal Policy and Strategy</p> <p>Signature</p>

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1. INTRODUCTION

1.1 Background and Overview

In 2016 the Water and Waste Directorate requested the assistance of the Environmental Management Departments (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.

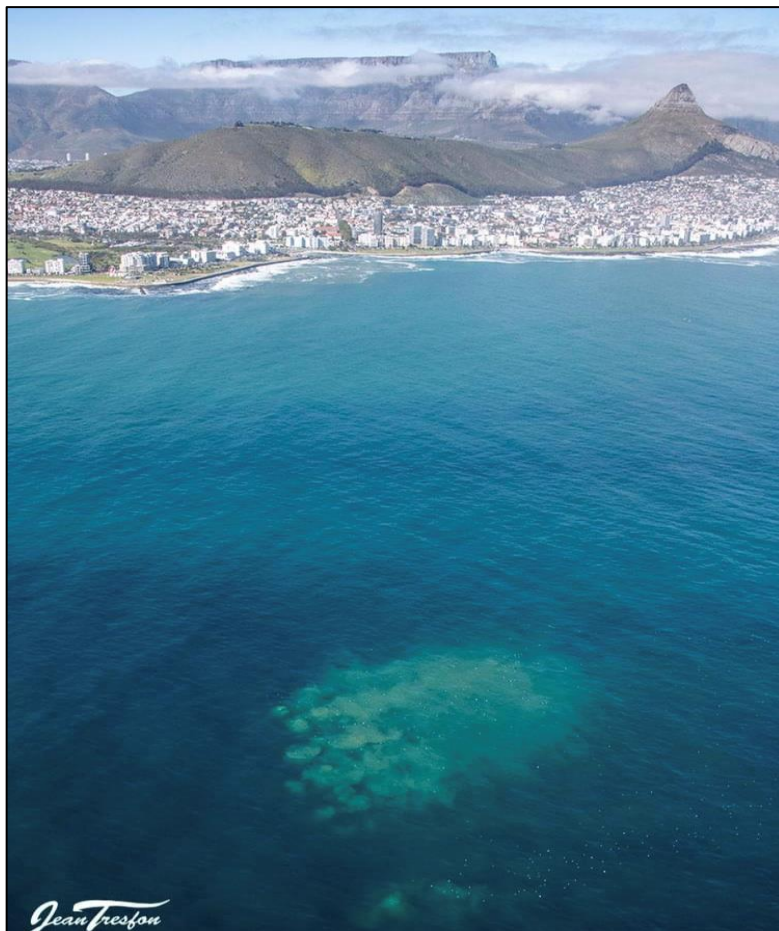


Figure 1: Green Point Outfall Plume Photographed by Jean Tresfon 2022

The Wastewater Department had at the time 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 (report attached as part of the Annexure). 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 was 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.

1.2 Objectives

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 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 2020/2021)
- 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)

Coastal Management, through the use of Term tender 375C, appointed PRDW and their sub consultants CLS to assemble a team of highly experienced and recognized 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 recognized and highly experienced 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 + marine chemist expertise)
- Stephen Luger (25+ years coastal engineering and modelling expertise)
- Independent Review: Dr Lynn Jackson (40+ years Marine Science expertise)

Attached as Annexures to this covering report by Coastal Management are the Environmental Summary Reports for each of the three outfalls, all the listed technical reports, as well as the final Independent Review statement by Dr Lynn Jackson.

The Covering 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.

2. DISCHARGING LAND-DERIVED WASTE VIA OFFSHORE OUTFALLS

2.1 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 is rapid and environmental impacts are therefore minimal and remain within "acceptable" levels.

Determining what are "acceptable" environmental levels/limits/impacts 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 recognized 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 removes individual or personal judgement/opinion from the assessment.

2.2 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 a particularly stark in Cape Town with our spectacular and globally recognized marine and coastal environment. There is also little doubt that the ocean outfalls are controversial, publically disliked and are focal points for controversy and activism.

In considering this key 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 shows 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, we are yet to show/demonstrate an equivalent environmental impact 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 all/most 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 that 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 nipper lifesaving training at Clifton 4th beach contacted Coastal Management, outraged that his young nipper 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 (perhaps deservedly) focal points for environmental activism. With that can come miss-information, exaggeration and myths that grow in stature and which 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 the laboratory analysis under a microscope or the weighing of the urchins 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. A screen grab below 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 miss-information 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 have 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 – why would they advocate any differently as it relates to the outfalls? 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. BROAD CONSIDERATIONS FOR THE OUTFALLS

3.1 Considerations Common to all three outfalls

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

3. It is important to recognise that in addition to (1) and (2) above, the outfalls are adding Suspended Solids (SS) and Chemicals of Emerging Concern (CEC's) to the wider ocean environment through dispersion and ocean distribution. The statement is therefore not that there is NO pollution.
4. While data indicates 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.
5. Although not yet measured or quantified, it is assumed that the outfalls are discharging microplastics into the marine environment.
6. 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 practise in its current form.
7. Coastal Management is not of the view that additional data or reports demonstrating low impact will meaningfully shift this public perception.
8. Water and Sanitation must confirm the status of the Coastal Waters Discharge Permits

3.2 Considerations Specific to the Hout Bay Marine Outfall

1. 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.
2. There may be some risk to human health for big wave surfing at Dungeons. Enterococci over 185/100ml is modelled to reach the area, although only very periodically. This concentration or anything that exceeds this are 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.
3. The model shows that surface enterococci does 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.
4. The scuba dive sites of Aster and Katsu Maru may be exposed to elevated enterococci at mid water depths in winter.
5. 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.
6. The 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 counter to marine conservation objectives embedded in the intention of MPA's
7. It is however 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/counter to the establishment, intention and management of the MPA.

8. 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 on the basis that popular dive sites such as Vulcan Rock, are reportedly healthy and rich in marine biodiversity.
9. 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, at Hout Bay due to higher sand substrate levels there is potential for greater accumulation of pollutants in the sediment. This should be investigated and reported on.
10. Accumulation of CEC's 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's 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's being released into the marine environment at Hout Bay would of course be locally reduced. Much of those CEC's 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.

3.3 Considerations Specific to the Camps Bay Marine Outfall

1. Risk to human health at the shoreline is possible for surfers at Glen Beach where for short periods elevated bacterial counts may occur. Water quality guidelines for recreational use are however not transgressed at any point on the shoreline (including at Glen Beach), however this risk must remain as an acknowledged health risk.
2. 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 Maidens Cove.
3. 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.
4. Preliminary and initial biodiversity assessment data shows little to no impact on marine biodiversity at Camps Bay.
5. 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 mono species environment or the presence of unexpected species in the benthos and is therefore not considered environmentally significant

6. 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.
7. 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 counter to marine conservation objectives embedded in the intention of MPA's and their establishment to discharge preliminary treated wastewater directly into the MPA.
8. 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/counter to the establishment, intention and management of the MPA.
9. Accumulation of CEC's 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's being released into the marine environment at Camps Bay would be substantially reduced. Other local sources of CEC's at Camps Bay are limited to urban run-off via the stormwater and the local stream more likely to be carrying herbicide/pesticide CEC's, while pump station failures at Bakoven and Maidens Cove will add pharmaceutical CEC's. Much of the CEC's 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 Considerations Specific to the Green Point Marine Outfall

1. Due to the volume of wastewater discharged at Green Point, the scale and geographic extent of the ZID and concentrated impacts is much larger than the other two outfalls.
2. Any risk to human health at the shoreline is likely for surfers at Moullie Point where for very short periods elevated bacterial counts may occur in summer. Water quality guidelines however for recreational use are not exceeded at any point on the shoreline.
3. 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 not hug the coastline. Health risk is considered negligible, while the negative visceral experience of confronting the plume is considered high.
4. There is 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.
5. 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.

6. Green Point does not discharge into a Marine Protected Area but operates adjacent to two MPA's.
7. It is important to note that the MPA declaration of both the TMNP and Robben Island MPA's occurred many years post outfall establishment and it would appear that the reports and documentation prepared in respect of establishing both the MPA's did not identify the marine outfall as an environmental concern, risk or as problematic/counter to the establishment, intention and management of either of the MPA's.
8. Accumulation of CEC's 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's 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.
9. 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.

4. 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 practise 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 MPA's. Reducing urban pollution to the MPA's 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 pre-discharge treatment levels will provide far greater public assurance of environmental

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 pre-treatment is increasingly unacceptable to the public and the City should begin proactive planning in response; and
- Global best practise for wastewater marine outfalls is a higher level of pre-discharge treatment to the benefit of the environment and the reduction of human health risks.

4.1 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 pre-treatment 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 shows 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 pre-treatment on land prior to discharge,
 - potential water re-use technology.
- Water and Sanitation should commit to implementing the most appropriate and cost achievable pollution minimisation option that emerges from the assessment/investigation and
- Water and Sanitation should review and optimise all three outfalls daily operational plans to ensure optimal and efficient operation;
- Given that the data indicates low impacts to date there is adequate time for proactive planning for the implementation in accordance with City 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 is 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 publically available;

- City Health should consider and determine based on the attached reports what level of additional health warning and information is 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 Moullie 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 CWDP and the regular reporting to DFFE;
- Coastal Management should complete a benthic macrofauna survey at Hout Bay and report publically on the findings;
- Coastal Management to continue with marine biodiversity and benthic macrofauna surveys at Camps Bay outfall;
- Coastal Management must undertake a micro plastics quantification exercise at all three outfalls and report in 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.