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**Application by the City of Cape Town for a permit for existing marine outfall sewers at Hout Bay, Camps Bay and Green Point**

Dear Mr Samson and the responsible officials at Western Cape Government Environmental Affairs and Development Planning

As invited in the public media and in terms of Section 17 of the Local Government Municipal Systems Act (Act 200 of 2000), I wish to comment on the application for a coastal waters permit for the existing marine outfall sewers situated in the jurisdiction area of the City of Cape Town at Hout Bay, Camps Bay and Green Point.

These marine outfall sewers have been in operation for more that two decades and have been designed by means of engineering modelling based on by now seriously outdated biological and physical assumptions. Green Point and Hout Bay sewer outfalls were commissioned in 1993 and Camps Bay in 1977.

***Principles on which sewage disposal at sea beyond the surf zone is based***

This short summary is not intended as a scientific exposition, but rather a quick overview of the assumptions that were in vogue at the time these marine outfall sewers were designed in



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contrast to our present knowledge of the biological and physical realities of such disposal methods. References can be provided should they be required.

There are several reasons why marine outfall disposal proved to be so popular over the centuries. There was an almost unshakeable faith in the ability of dilution/dispersion as a process to purify effluent or at least make it 'disappear'. The assumption was that if small amounts of heavily contaminated sewage effluent are introduced into the ocean, then the subsequent dispersal into such a large body of water will dilute the pollutants to such a low level that they will be harmless and thus over time their detrimental effect will be removed. Of late, the design calculations and computer models used to predict this dispersal and the dilution factors needed for it to operate safely have been severely criticised. There was an over-emphasis on dilution while processes with an opposing effect such as sedimentation and bioaccumulation, as well as the agglomeration of fat particles, were not even taken into account at the time.

The heavy reliance on dilution ignores the fact that continuous discharge will have an accumulative effect on a semi-restricted body of water such as Table Bay. Besides, dilution is not the only mechanism that operates in the sea. Various components of the effluent tend to accumulate or agglomerate in the marine environment while some organisms and chemical compounds will eventually bioaccumulate in the food chain. This process is not linear - it accelerates over time and thus its effects become more and more noticeable as the disposal process carried on unrelentingly.

Fat particles especially tend to agglomerate and form 'fat balls'. Disease-causing organisms such as viruses and bacteria tend to cling to the fat particles and can survive for much longer in these fat balls than previously thought. Grease of mineral origin is furthermore resistant to biodegradation and can linger in the environment for much longer than previously thought.

The other reasons why marine outfalls are so popular with municipal planners and engineers are that they require minimal labour and treatment and are thus cheaper to operate than conventional treatment. If the gradient is sufficient, then pumping is even minimised. In the case of the City of Cape Town, there is no pre-treatment of the sewage, only screening out of large objects such as plastic bags, etc. Thus minimal land is needed for the outfall sewer facilities. Pragmatic considerations therefore weighed heavily on the initial decision to construct such outfalls.

More recent studies on bioaccumulation and concentration of both disease-causing organisms and chemical pollutants present a different picture to the blithe assumptions of the past century. Since the effects of those processes are 'deferred' (showing up only after the outfall had been operating for some time), the association between marine sewage disposal and a variety of detrimental effects are denied for a long time.

### ***The importance of considering infective dose***

Faecally-associated bacteria and viruses capable of infecting humans and animals tend to clump together or onto solids in the water. These pathogens are also embedded in solid faecal matter and can thus disperse quite far from the diffuser at the end of the outfall pipe. In fact 'several kilometres' is quoted in the literature. Viruses do not usually replicate outside of their natural hosts but they can survive in seawater and accumulate in sediment. Bacteria can actually multiply in seawater if their nutrient material (sewage) is present in sufficient quantity. Even if they do not multiply, they certainly can survive in seawater and sediment for a certain time.

The usual indicator organisms used to determine the presence of sewage contamination are *Escherichia coli* and *Enterococcus* spp. *Enterococcus* is better suited to seawater since *E. coli* dies off in seawater faster, but neither survive as long as viruses and some parasites.

The result of the reliance on *E. coli* and *Enterococcus* sp. to assess infective potential of contaminated seawater are thus guaranteed to severely underestimate the health risks. The argument that viral determinations are too expensive means that the 'convenient' indicators are also those that deliver the lowest risk indication and that suits the position of local authorities who want to retain their marine outfall sewers at all costs.

Viruses can infect humans at very low numbers of organisms - in the case of some causes of serious diarrhoea it can be as low as one or two organisms. It is unlikely that the present guidelines are sensitive enough to adequately assess the risk of disease from contaminated seawater epidemiologically.

What constitutes an infectious dose obviously varies depending on the pathogen involved, but also with the route of exposure (ingestion, inhalation, through broken skin etc.), the immune status and the susceptibility of the individual. For some viruses and protozoa the infectious dose may be as low as one or two organisms, but the infectious dose for bacteria vary widely. For *Shigella* spp., (the cause of bacillary dysentery) the infectious dose can be only a few organisms, but at the other end of the spectrum it can be as high as  $10^8$  for *Vibrio cholerae* (causing cholera). It is important to remember that pathogens do not occur homogeneously in a water body but clump together on other particles such as fat globules where they are somewhat protected. This clumping may make the ingestion of an infectious dose much easier to occur.

The only water quality guidelines (please note - not enforceable limits) in force in South Africa have been under revision by the Department of Water Affairs and Sanitation since the 1990's. No usable results have yet appeared from the revision process and it is unlikely that the new target values, when they appear, will be anything other than 'guidelines' and thus unenforceable. The Department of Environmental Affairs is urged to pay serious attention to the standards which these marine outfall disposal processes should meet.

Another crucial point in determining the health risks associated with water contamination is that average or smoothed mean values of repeated surveillance measurements are meaningless. The risk lies at the peak values and smoothing them out (as the City of Cape Town regularly does when releasing test results) presents a serious underestimation of the risks.

If a person acquires an infection from recreational exposure to contaminated seawater, the symptoms may only appear hours or even days after infection. Such an infected person may spread this infection to others, with the original seawater as the source of infection not realised. Infections acquired in the environment are poorly documented and seriously undercounted. This is another source of underestimation by the authorities, who argue that people do not get sick from the environmental pollution and that there is no reason not to continue to dispose of the sewage in such a manner.

### ***Components of sewage - now and in the future***

The World Health Organisation published a report on emerging issues in water and infection disease in 2003. The report stated, inter alia, "Infectious, water-related diseases are a major cause of morbidity and mortality worldwide. Although a significant proportion of this immense burden of disease is caused by 'classical' water-related pathogens such as typhoid and cholera, newly recognized pathogens and new strains of established pathogens are being discovered that present important additional challenges to both the water and public health sectors. Between 1972 and 1999, 35 new agents of disease were discovered and many more have re-emerged after long periods of inactivity or are expanding into areas where they have not previously been reported. ... The perceived severity of risk and significance of an emerging infectious disease may be so far removed from reality that there is potential for

inappropriate allocation of resources. This can have repercussions for countries at all stages of development."

"Worldwide, wastewater treatment is failing. ... As a result the majority of wastewaters, septage and faecal sludges are discharged without any form of treatment into the environment ... spreading disease to humans and damaging key ecosystems such as coral reefs and fisheries. Dirty water is a key factor in the rise of de-oxygenated dead zones that have been emerging in the seas and oceans across the globe. This is becoming increasingly a global problem as urban populations are projected to nearly double in the next 40 years ... already most cities lack adequate wastewater management due to aging, absent or inadequate sewage infrastructure." (World Water Council, 2012 as quoted in Wastewater Management - A UN-Water Analytical Brief, 2015).

The development of antibiotic resistance - as indeed the increase in number of cases of infection - are examples of how the repercussions of the disposal of sewage at sea can impact financially on organisations outside the municipal structures responsible for the disposal of the sewage. No municipal budget provides a share of their budget to hospitals such as Tygerberg and Groote Schuur who have to cope with some of the serious cases originating from this environmental contamination. It means that the true financial impact of their method of disposal is not felt by the municipal authorities and they can therefore do their calculations of the costs involved on only the costs involving operating their service.

There are numerous compounds present in sewage that were not of concern two decades ago when these outfall sewers were designed and built. According to the Environmental Protection Agency, chemicals are being discovered in water that previously had not been detected or are being detected at levels that may be significantly different than expected. These are often generally referred to as "contaminants of emerging concern" (CECs) because the risk to human health and the environment associated with their presence, frequency of occurrence, or source may not be known. Compounds such as caffeine, hormones, illicit drugs, over-the-counter medicines, personal care products such as shampoos, deodorants, etc., household chemicals, all contain products with unknown effects on the marine environment, especially in ever increasing concentrations.

The present area being served by the Green Point outfall sewer contains at least one large private hospital and several other health service points. No doubt the others also serve health practices and clinics. The sewage originating from hospitals contains many serious pathogens as well as other chemical compounds that one would not want to release into the environment. Apart from a disturbing array of infectious agents, such sewage also contains e.g. X-ray contrast medium, large quantities of different antiseptics, many drugs and pharmaceuticals. The issue of antibiotic resistance building up in the environment has received almost no attention and should be a top priority as therapeutic intervention is running out of drugs to treat a large number of diseases because of resistance to existing drugs. The remaining effective drugs often have troubling side-effects and almost all add considerably to the cost of treatment.

### ***Adequate monitoring of the marine outfall disposal system***

There is a lamentable lack of information of exactly how the day-to-day operations of the marine outfalls are monitored and what indicators this monitoring uses. There are concerns about the poor microbiological monitoring system already in place although this is difficult to pinpoint because the monitoring plan is hidden from public scrutiny in the application. No addenda can be accessed and almost all details of importance are in the addenda.

What is visible in the completed forms that are available in the public domain, gives rise for concern. The 'average discharge concentration per year' [whatever that may mean] for coliforms (entero written in by hand) are given as 59 organisms per 100 ml for Camps Bay

and 245 organisms per 100 ml for Green Point. The application for Hout Bay simply states 'see attached - various points'. The 'maximum anticipated discharge concentration' for Camps Bay is given as 2150 organisms per 100 ml and for Green Point as 3300 organisms per 100 ml. This is for untreated sewage! In fact, many of the rivers in the Cape Town metropolitan area are orders of magnitude higher than the maximum anticipated for these outfall sewers! Some of the stormwater drains I analysed at the request of the City of Cape Town measured millions of *E. coli* last year. What exactly is going on with these figures and why are they stated to be so low? If these values are correct for the quality of the outfall effluent, it would serve the City of Cape Town better to reroute the effluent to their dirty rivers!

I have noted on several occasions that the City of Cape Town provides analytical data on the state of the environment that are very much lower than anybody else had measured. At least once I noticed that the sampling point in a river utilised by the City water-sampler was directly in the path of clean stormwater entering the river from a pristine mountain area, thus lowering the measured contamination level considerably. A colleague from the University of Cape Town also noted this. Whether this was by omission, commission or long-time habit I cannot say. But it does underscore for me that using the scientific analytical services of the City to oversee the City's compliance with standards cannot be condoned. The Dept. of Environmental Affairs will have to design and carry out a transparent and credible surveillance programme or otherwise their oversight role means nothing at all.

### ***The ethical considerations of this untransparent public participation process***

I have had experience of the operations of various municipalities and the effects of their wastewater treatment systems on the environment. In my experience all the municipal engineers and other staff involved know that very little will happen to them should their treatment works not comply even with minimum safety standards. There is no Facility B to divert the sewage to when the works fail even rudimentary standards. The sewage streams in relentlessly and has no place to go. A number of unlicensed works are operating as I write this. The Dept. of Water and Sanitation sends directives, but nothing more, while the municipalities just shrug them off. So why are we trying to improve the situation by even commenting on this undesirable marine outfall disposal when the reality is that licences will be issued without fail?

As I have noted above, the information that an informed member of the public who wishes to contribute to this process are allowed to see is unsatisfactory and makes a mockery of asking for input. It has become habit for absurd routine public participation processes to be carried out where there is clearly no intention of taking note (let alone implementing remedial steps) of any concerns raised.

The Parliamentary Monitoring Group Water and Sanitation (meeting of 25 June 2015, taken from the records) noted that "the National Environmental Management Act (Act 107 of 1998) states clearly that the costs of remedying pollution, environmental degradation and consequent adverse health effects must be paid for by those responsible for harming the environment. The polluters pay principle had also been accepted in the international environmental policy, principle 16 of the United Nations conference on Environment and Development (Rio Declaration), which states that national authorities should endeavour to promote the internalisation of environmental costs. This was the principle that the DWS was applying, and it applied to both the government and private sector, so the onus was on the polluter to make amends and minimize pollution as much as possible. There had been a case where Earthlife Africa had gone to court with the Department of Environmental Affairs and Tourism, and the court had held that the *polluter pays principle applied to both the private sector and the state. If the State failed to address the issue of reducing potential environmental harm, it would be the one that would be liable for the pollution cost.* [my emphasis]."

It may be in the interests of the Dept. of Environmental Affairs as well as the City of Cape Town to note that, in the face of this obviously unsatisfactory public participation process with its hidden crucial information, both organisations will share the ethical blame in the event that environmental damage occurs, if not the legal liability.

I trust that the above information will receive the serious attention of the Western Cape Government Environmental Affairs and Development Planning. More in-depth information will be gladly supplied.

Yours sincerely



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