CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

# THE FISH HOEK SEA-LEVEL RISE MURAL, CAPE TOWN

## Introduction

The City of Cape Town has the longest stretch of coastline in South Africa compared to any other coastal municipality, approximately 307km in length. Traditionally referred to as the "Cape of Storms" by seafarers past, Cape Town is exposed to big winter storms caused by cold fronts. It is anticipated that climate change induced pressures such as sea-level rise will exacerbate the pressure on Cape Town's coastline and may suffer impacts of increased erosion, localised periodic flooding and damage to coastal infrastructure from high seas.

## Background

The City of Cape Town's coastline is arguably one of its most important social-economic and environmental assets. An internet search for images of Cape Town typically results in images of Cape Town in relation to its beautiful coastline. An economic study in 2017 estimated that Cape Town's coastline contributes approximately 10% to its annual GDP (Urban-Econ, 2017), revealing its value in monetary terms. However, as much as Cape Town's coastline contributes in terms of economic opportunity, it may also present a source of risk. This is due to climate change induced coastal pressures, such as sea-level rise and coastal erosion, and the consequent impacts on the city's coastal communities, infrastructure, and opportunities.

The City acknowledges that delaying or failing to take the necessary action to adapt to these and other predicted impacts and to contribute to global efforts to mitigate climate change will lead to greater long-term impacts and result in missed opportunities. As a result, there is a long history of responding to climate change in the City through policy, planning and project implementation. With the increasing urgency over the last few years to combat climate change, the City, along with three other South African metropolitan municipalities and over 100 cities worldwide, has made the ambitious commitment to meet the goals of the Paris Agreement and achieve carbon neutrality[1] and climate resilience by 2050. Cape Town also has an important role to play in helping South Africa meets its Nationally Determined Contributions in terms of the Paris Agreement. Achieving this requires all government, residents, businesses and organisations to play their part. In the process, we become more competitive globally, embrace innovation and entrepreneurship, build more sustainable livelihoods, provide affordable and accessible services to our residents and protect our natural resources.

## What causes sea-level rise?

Sea level-rise is essentially caused by two phenomena: firstly, thermal expansion of the ocean due to warming seas, and secondly, the introduction of vast volumes of water into the ocean through the melting of the Greenland and Antarctic ice sheets as well as the melting of glaciers. Both the expanding seas as well as the melting of the polar ice sheets are a function of a warming climate caused by heat trapped in the atmosphere by excessive quantities of greenhouse gases (GHG) now present in the atmosphere. Examples of GHGs include carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O) and fluorinated gases. Many of these gases are produced naturally on Earth, but emissions have been accelerated by human activity since the beginning of the industrial revolution (Figure 1).

[1] Carbon neutrality means introducing new technologies to completely clean up the fuels and activities that currently cause greenhouse gas emissions, while enhancing our social, economic and environmental goals. To read more about the City's carbon neutral by 2050 commitment click here.

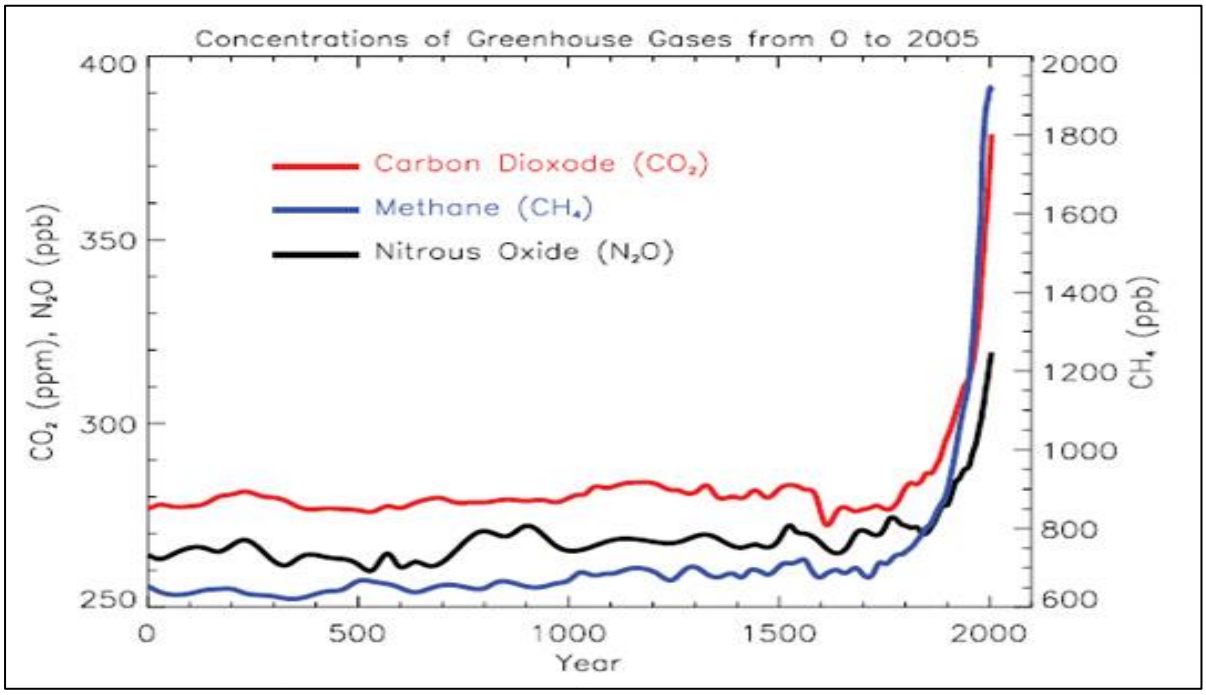


**Figure 1**: Atmosphere concentrations of important long lived greenhouse gases over the last 2000 years. Increases since about 1750 are attributed to human activities since the industrial era (Source: IPCC, 2007).

It is estimated that human activities have caused an approximate 1.0° C increase in temperature as a global average if compared to pre-industrial levels (IPCC, 2019). It is projected by the International Panel on Climate Change (IPCC) that global warming is likely to reach 1.5° C between 2030 and 2050 if the release of GHG emissions into the atmosphere continues at the current rate (IPCC, 2019). The IPCC is an intergovernmental body comprising, among others, globally renowned scientists that have the responsibility of assessing climate change predictions and impacts.

Closer to Cape Town, and in alignment with the projections of the IPCC, research conducted by the University of Cape Town's Climate Systems Analysis Group (CSAG) shows that while there may be some variability in Cape Town's climate up until the period 2030-2040, thereafter there is a high degree of confidence that there will be a shift to a drier and warmer future for Cape Town (CSAG, 2016; Petrie el al., 2019). It is this increase in the global temperature of the atmosphere that is the primary driver behind sea levels rising both globally and in Cape Town.

## Sea-level rise projections

The projections and estimates of sea-level rise determined by the IPCC are generally accepted globally as the benchmark. It is these predictions that are used by a wide range of institutions worldwide, including municipalities, to plan for sea-level rise and associated impacts into the future. The science produced and projections determined by the IPCC are therefore used by the City of Cape Town for its own coastal planning purposes.

The most recent report released by the IPCC (Special Report of the Ocean and Cryosphere in a Changing Climate (https://www.ipcc.ch/srocc/ ) in 2019 provides the most up-to date information on climate change including the latest science and predictions on sea-level rise. The projections shown in the mural at Fish Hoek are based on these.

The Special Report of the Ocean and Cryosphere in a Changing Climate (SROCC) by the IPCC determines a number of Global Mean Sea-level (GMSL) rise scenarios. These scenarios are based on the Representative Concentration Pathways (RCPs) identified by the IPCC which describe different possible climate futures. As such, these GMSL scenarios are effectively contingent upon our efforts at reducing GHG emissions, which is the key driver behind sea-level rise. These scenarios emphasise the idea that our climate future is in our hands, but this is dependent on our collective ability to curb GHG emissions.

In specific relation to sea-level rise, the IPCC focuses on two scenarios, representing both a "best case" and "worst case" scenario for GMSL. These scenarios are measured against a time-frame up to 2100 (Figure 2). These scenarios are as follows:

**Representation Concentration Pathway 2.6**

RCP 2.6 assumes that, globally, GHG emissions will peak between 2010-2020 with emissions declining substantially thereafter. Under this scenario GMSL is predicted to rise by approx. 0.43m by 2100.

**Representation Concentration Pathway 8.5**

RCP 8.5 assumes that, globally, GHG emissions will continue to rise throughout the 21st century. Under this scenario the upper limit of GMSL is estimated to be approx. 0.85m by 2100.


**Figure 2**: The Fish Hoek mural displaying projections of sea-level rise up to 2100.

## Understanding the context behind the sea-level rise projections

These two scenarios are internationally accepted best estimates for GMSL, and have been plotted on the mural at Fish Hoek. It is important to note that these estimates only reflect the estimated eustatic global average in sea-level rise. The term 'eustatic' is used to describe 'still water' rise. An analogy here to describe eustatic sea-level rise would be to compare it with water slowly rising in a bathtub. We do however know that the ocean is not 'still' as the ocean is characterised by having waves, tides, currents, and at times can be very stormy with high seas. These characteristics are all unique to different parts of the globe and may even differ regionally and/or locally. For example, the nature of the waves in Fish Hoek is very different to the nature of the waves Kommetjie. It is in this context that the following aspects must be considered when considering GMSL projections:

- There are regional differences in the rate of sea-level rise owing mainly to variations in ocean warming and circulation. The IPCC estimates that these regional differences may vary within ±30% of the mean global sea-level rise estimate.
- GMSL projections given by the IPCC are based on eustatic levels. They do not factor in aspects such as high tides, high waves, or combination of both high tides and high waves which may coincide at the same time. This would mean that the sea may reach further inland during discrete events such as during winter storms in Cape Town.
- Each projected scenario of GMSL given by the IPCC has a level of confidence associated with it. For example, the IPCC has a 'medium confidence' of the predicted GMSL trajectories under both RCP 2.6 and 8.5. The reason why the IPCC attaches a confidence level to the various estimates of GMSL is because of the sheer complexity of trying to understand the Earth's systems at a global scale, how our activities may be influence these systems and how this in return influences sea-level rise.
- Given this complexity, and our incomplete understanding of climate change and earth system dynamics, the IPCC has erred on the side of caution in that, and based on the latest SROCC report, indicated that there is a possibility (estimated at 17%) that GMSL projections under both RCP 2.6 and RCP 8.5 may be exceeded by 2100.

## What are the expected impacts of sea-level rise for Cape Town?

As is the case with many coastal cities, Cape Town is vulnerable to the projected impacts of sea-level rise. As an urban hub where much of the coastal environment has been 'fixed' through development, there is limited potential for the shoreline to naturally adjust and recede from erosion events as it has historically done pre-development. The largely fixed nature of our coastline presents a risk in the following ways:

- In such instances where the coastline is abutted by hard infrastructure, the recreational and amenity value of the beach as a public space may be increasingly impacted in the medium to long term due to a receding shoreline caused by sea-level rise
- This erosion and exposure to high tides and seas will present a threat to both private infrastructure (such as houses), and City infrastructure (roads, paving etc.) abutting the coast into the medium to long term.

## What is the City doing about sea-level rise?

In response to these projections by the IPCC and the associated impacts of climate change induced sea-level rise, the City has completed and executed a number of strategies which are geared to promoting coastal resilience and optimising the potential that Cape Town's coastline provides. It is important to note that such initiatives, irrespective of sea-level rise, are

critical and necessary for the sustainable and equitable development and utilisation of our coastline. This is because the coastline is a naturally dynamic and unpredictable space characterised by emergent risk properties and as such requires such interventions. These initiatives and interventions specifically as it relates to coastal management include the following:

## City of Cape Town Integrated Coastal Management Policy

The City of Cape Town Integrated Coastal Management Policy (ICM Policy) was formally adopted in 2014 and is Cape Town's first dedicated coastal policy. Considering the strategic importance that the coast offers from a socio-economic and livelihood perspective, and the potential risks the coast may pose to the City and its residents as a consequence of climate change, this policy provides a vital framework for effective coastal governance and decision making at the municipal level. The ICM Policy also meets the mandated responsibilities imposed on local municipalities by the National Integrated Coastal Management Act (Act 24 of 2008). The ICM Policy may be accessed from the following link:

View the Inegrated Coastal Management Policy

## City of Cape Town Integrated Coastal Management Programme

Key to giving effect to the vision determined in the ICM Policy is the City's Coastal Management Programme (CMP). The CMP, formally adopted in 2015, provides a wide range of operational management protocols, from managing kelp on Cape Town's beaches, responding to shark incidents to managing coastal erosion and the risks presented by climate change induced sea-level rise. These operational management protocols contained in the City's CMP are designed to provide an 'information bank' to ensure continuity and consistency in the management of the City's coastline and ultimately to ensure a sustainable and resilient coastal City. Access the Coastal Manangement Programme.

View the Coastal Management Programme

## City of Cape Town Coastal Management Line: method and process

Promoting risk adverse, equitable and sustainable coastal development is a priority for the City. The anticipated pressures associated with climate change and sea-level rise has necessitated that the City develop and formalise a Coastal Management Line. This process was completed in 2012 whereby the CML was formally included in the then Cape Town Spatial Development Framework as the Coastal Urban Edge. The Coastal Urban Edge/ Coastal Management Line effectively demarcates areas along the coast based on a range of informants and is used to guide coastal planning towards ensuring that all decisions relating to coastal development are risk averse.

View the Coastal Management Line: Method and process

## City of Cape Town Dune and Beach Maintenance Management Programme

The City of Cape Town has a dynamic coastline subject to various coastal processes including, *inter alia*, erosion, accretion and wind-blown sand. Due to the nature of Cape Town's coastline, public infrastructure such as roads and walkways in close proximity to the coastline are frequently either smothered with wind-blown sand, undercut by erosion and/or exposed to high seas. Given the dynamic nature of the City's coastline and the need to maintain infrastructure and provide access to the beachfront for members of the public at all times, a Maintenance Management Plan (MMP) was prepared and formally adopted in 2017. The Dune and Beach MMP enables the City to undertake immediate and ongoing management of beaches and dune systems (which also act as valuable natural buffers against high seas) in compliance with the requirements of the National Environmental Management Act (NEMA) and the Environmental Impact Assessment (EIA) Regulations. The City of Cape Town Dune and Beach MMP may be accessible from the following link:

View the Cape Town Dune and Beach Maintenance Management Programme

## Milnerton Erosion Response Forum and Guideline

The stretch of coastline from the northern boundary of the Cape Town Port up to and including the Milnerton Golf Course in the North is one of Cape Town's greatest 'hotspots' in terms of exposure to coastal erosion. Having receded by approximately 100m over the last century, and bounded by both City and private infrastructure, this stretch of coastline has required special focus in respect of addressing the challenges associated with coastal erosion. The vulnerability of this stretch of coastline is likely to escalate given the projections of sea-level rise. In response to this, the City established the Milnerton Coastal Erosion Response Forum. The convening of the forum led to the development of the Milnerton Coastal Erosion Response Guideline. Both the Terms of Reference and the Milnerton Erosion Response Guideline are available from the following link:

View the Milnerton Erosion Response Forum and Guideline

## Adopting an ecosystems based approach in response to climate change induced coastal risks such as sea-level rise

Ecosystems Based Adaption (EBA) essentially focuses on the use of biodiversity and ecosystems services as a means to more sustainably adapt to the impacts of climate change induced coastal pressures such as sea-level rise. This is as opposed to traditional and/or conventional approaches that have typically responded to such risks with hard engineering interventions, such as sea-walls. For the City, the restoration and protection of its various dune systems as natural 'buffers' against coastal hazards is a key part of promoting EBA. The City also recognises the value of kelp in its role of maintaining functional coastal ecosystems and the buffer that such ecosystems provide. An example of Cape Town's EBA approach through dune restoration as well as Cape Town's Kelp Management Protocol may be accessed from the following links:

View the City of Cape Town Kelp Management Pamphlet

## City of Cape Town Coastal By-law

The Coastal By-law will assist the City to better manage the coastline; take appropriate action during emergencies in the interest of public safety; and enable law enforcement of activities that may have a damaging impact on the coastal environment. There are also provisions in the Coastal By-law that regulate the development and erection of sea-fence and anti-erosion interventions. The intent of these provisions is to ensure that initiatives undertaken by private property owners to protect their own properties are well informed and do not compound risk and vulnerability. The Coastal By-law is available from the following link:

View the Coastal By-law

## Wider Climate Change initiatives and strategies developed for the City

In addition to those coastal management initiatives intended to respond to climate change induced sea-level rise and the dynamics and unpredictability inherent to coastline as listed above, the City has a range of strategies in place which are designed to address the impacts of climate change more broadly for the City. Some of these initiatives and strategies include the following:

## Cape Town Resilience Strategy

The City of Cape Town has developed, and formally adopted, the Resilience Strategy. This strategy will be used to ensure that the City survives and thrives in the event of possible challenges, including those climate change induced impacts. The strategy recognises Cape Town's interdependencies on systems in other parts of the country and the rest of the world. The Resilience Strategy will allow the City to better prepare for risks and understand how stresses impact on the ability of the city to thrive in moments of shock. The resilience strategy may be accessible from the following link:

View the Resilience Strategy

## City of Cape Town Climate Change Strategy

The City of Cape Town Climate Change Strategy recognises that responding to climate change and dealing with its impacts is both urgent and essential for building both resilience and a city that is able to prosper in an increasingly carbon-neutral focused world. Significant changes will be necessary to achieve this. As such, the strategy provides a framework for the City to transform the way it engages and operates and to ensure alignment of key City policies, strategies and plans with effective climate change responses. The strategy is currently a draft and will be made available on this site after it is approved by Council; it will replace the existing Climate Change Policy. The Climate Change Policy is available from the following link:

View the Climate Change Policy

## City of Cape Town Climate Action Plan

The Climate Change Action Plan includes details of a range of actions across all ten strategic focus areas and five cross-cutting work areas, which have been designed as thematic action areas for climate change response implementation. The actions are programmatic in nature and contain many sub-actions which take the form of projects, detailed plans of action, and operating procedures. The action plan is currently a draft and is anticipated to be available in June 2021.

## Reducing our carbon footprint and 'living lightly': what can you do?

As indicated earlier, the IPCC has identified sea-level rise scenarios that are contingent upon our efforts to mitigate climate change over the medium to long term. Our ability to slow the rate at which the climate is warming, and to curb sea-level rise, is therefore dependant on our ability to reduce our carbon footprint and slow the release of GHG's into the atmosphere.

Our carbon footprint is a measure of how much carbon dioxide, methane and other greenhouse gases we create through our lifestyles. It is directly linked to what you buy, how much you travel, and the amount of waste you generate. The more waste you generate, the bigger your carbon footprint is, as the manufacturing, packaging, transport and disposal of the products you use all generate greenhouse gases.

Thus we all have a role to play in meeting our climate change goal of being carbon neutral by 2050. The change that is needed comes when making smarter choices. The good news is that as individuals, we can all make basic lifestyle changes that will drastically reduce our carbon footprint. This could be through choosing more energy-efficient appliances, responsible travel, getting into the habit of recycling, and also advocacy and consumer action. Here are some examples of where you can start to reduce your carbon footprint and contribute to our climate neutral journey:

- Turn off lights when you leave a room and limit the amount of electrical heating and cooling you use in your house.
- Replace incandescent light bulbs with LEDS as they save 80-90% on the amount of electricity used, and pay for themselves in less than a year.
- Turn your geyser down to 60 °C to reduce your electricity consumption and a 5% decrease in your hot water electricity bill.
- When buying new appliances, invest in energy efficient ones as they use much less electricity and as electricity tariffs rise, they will pay back in cost savings quicker than before.
- Consider investing in a solar PV system to generate your own electricity or a solar water heater to heat water directly from the sun and save on your electricity bill.
- Reducing waste production. Products that can help reduce your waste production include:
    - Non-disposable grocery bags, razers, nappies, travel coffee mugs etc.
    - Taking reusable containers when collecting takeaways
    - Buying second hand clothing

- Methane gas is produced during the decomposition of organic waste at landfill sites and is 25 times stronger than carbon dioxide as a greenhouse gas. By composting organic waste (e.g. fruit and vegetable scraps and garden clippings) you can reduce your carbon footprint
- Reusing items in their current state or recycling waste into useful items if avoidance and reduction are impossible
- Shop local and seasonal: transporting food and other products across the globe or even across the country contributes to fuel and energy consumption
- Find a local farm that provides a vegetable box option: this reduces plastic waste and supports local farmers
- Be thrifty: if an item you own breaks, think twice before you buy a new one, as it may be simple to fix
- Grow your own herbs or vegetables: this can reduce the plastic packaging should you purchase such products at a grocery store
- Use public transport or lift clubs where possible
- Reduce idling and turn off your car's engine if stopping for more than 60 seconds. Idling is wasteful and does not benefit your car, except perhaps in extreme cold. Only five minutes of idling can emit half a kilo of greenhouse gas into the air. In fact, anything more than 10 seconds of idling generates more global-warming pollution than stopping and restarting
- Avoid speeding and drive smoothly. Increasing your speed from 100 km/h to 120 km/h can increase your fuel consumption by 20%. The most fuel-efficient driving speed is 80 km/h
- Transitioning from a heavy meat diet (more than 100g per day) to a low meat diet (less than 50g per day) can reduce your dietary greenhouse gas emissions by 35% (Scarborough et al., 2014)
- Keep air travel to a minimum
- Where possible, make the most of online meetings instead of physically traveling to meetings

For further information on how you can reduce your carbon footprint and other smart living and working choices, please refer to the City's Smarter Living portal from the following link:

Go to Smart Living Choices.

**Acknowledgments**

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- The C40 Cities Network, especially via the C40 Connecting Delta Cities Network for facilitating linkages between Cape Town and other coastal cities, such as Vancouver, in order to share learning experiences and best practice as it relates to climate change adaptation, governance and communication.
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