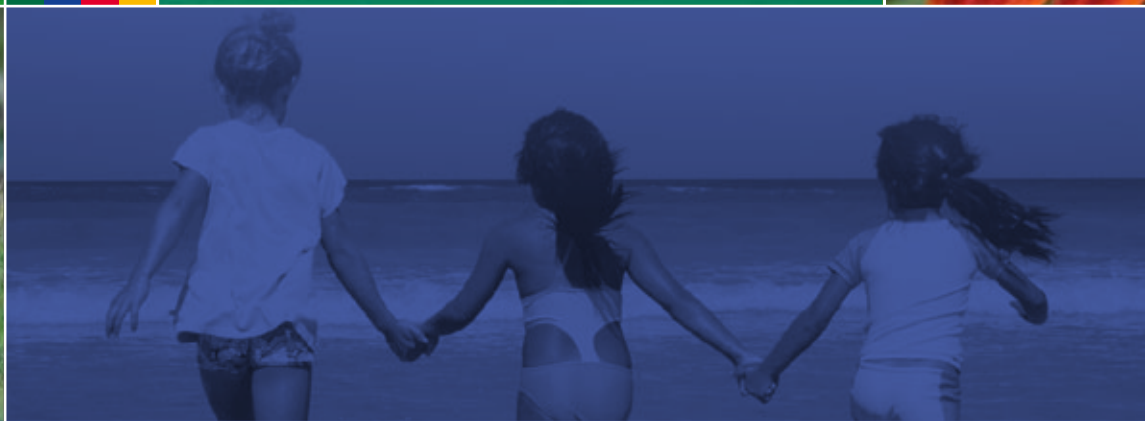
State of the Environment Report 2008



CITY OF CAPE TOWN | ISIXEKO SASEKAPA | STAD KAAPSTAD

THIS CITY WORKS FOR YOU

City of Cape Town State of the Environment Report 2007/8

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Dedicated to the memory of CRAIG HASKINS

On 3 February 2009 Craig Haskins was tragically killed in an accident while cycling on Ou Kaapseweg in Cape Town. At the time of his death he was Manager Strategic Information having been a committed member of staff in many areas during his nearly ten years of service with the City of Cape Town. Craig produced the first State of Environment Report for 1998 and was the initiator of the first State of Cape Town Report for 2006.

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FOREWORD

Executive Mayor Dan Plato

Cape Town is a city of contrasts. On the one hand, it is a city of outstanding natural beauty, with a rich environmental and cultural heritage, globally unique biodiversity, and a thriving local economy and tourist industry. On the other hand, the city faces the multiple environmental and social challenges of pollution, waste production, over-exploitation of resources, and urban sprawl.

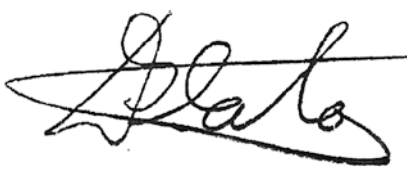
The City of Cape Town has committed itself to balancing the need for economic growth and development with environmental sustainability. The city's economic well being is closely linked to its natural beauty and natural assets, with tourism, the hospitality industry and location preference for homeowners and businesses forming a key pillar of its economy. Furthermore, it is important to remember that nearly every facet of human existence is dependent on the environment; a healthy environment promotes physical health as well as psychological well-being, and provides a range of important goods and services. It is also of significant heritage importance, and therefore we have a moral duty to preserve the environment for future generations.

In order to achieve the goal of environmental sustainability, hard work is required to improve environmental management in the city, and ensure conservation of the city's natural resources, whilst minimising waste and pollution. The 2007/8 State of the Environment Report provides insight into the condition of the physical environment, and provides guidance on the way forward to achieve a more sustainable city.

Unfortunately, after almost ten years of state-of-the-environment reporting, it is clear that the Cape Town urban region is falling short of certain goals it needs to meet in order to be truly sustainable. The report shows a picture of a city that is using more, disposing of more, and increasingly polluting the natural environment. Urban sprawl is also a key driver of environmental decline. It has a significant impact on the city's unique and rare biodiversity, and it places increasing pressure on the city's infrastructure – an already overburdened resource.

The value of this report lies in its ability to provide a core set of information for decision makers and the general public in an accessible and understandable manner. The main function of the publication is to show trends over time. In this way, it provides an important reference for decision makers, and allows City of Cape Town councillors and officials to work with a complete and integrated picture of the physical environment in Cape Town.

The City of Cape Town is committed to improving environmental sustainability in the city. However, it is impossible to achieve this alone. It is only through ongoing co-operation with Provincial and National Government, non-governmental and community-based organisations, the private sector and individual citizens that this goal can be achieved. I therefore urge you, the reader, to play your part in promoting environmental sustainability in Cape Town, and working towards securing a sustainable future for the city.



Dan Plato
Executive Mayor

INTRODUCTION

City Manager Achmat Ebrahim

This past year has been a significant one for environmental management in Cape Town. Along with the rest of the country, the city suffered from load-shedding due to insufficient electricity supply. The energy crisis highlighted the critical need for the City of Cape Town (City) to address the pressing issues of energy demand management, the implementation of renewable energy technologies, and the mitigation of and adaptation to climate change. As such, an additional strategic focus area was proposed for inclusion in the Integrated Development Plan (IDP) for 2008/9 and into the future. The strategic goals of the IDP can be found in Appendix B.

In 2001, the City adopted the Integrated Metropolitan Environmental Policy (IMEP) – the first local government environmental policy in the history of South Africa. In late 2006, a comprehensive review of this policy was launched, and was completed and submitted to Council for approval in early 2008. The outcomes of the review process were multiple, but chief among them was the renewed commitment by the political and administrative leadership of the City to put environmental sustainability at the top of its agenda, and the recognition that environmental management needs to be more fully integrated into mainstream City operations.

IMEP is due to be updated in early 2009 in order better to reflect the current administrative environment in the city. Public participation will be a key part of this process, and will take place in due course. For reference purposes, the current strategic goals of IMEP can be found in Appendix C.

The City is also committed to the implementation of a number of international conventions and pledges. Among these, the most significant is the United Nations Millennium Development Goals (UN MDGs), which provide a list of key actions that must be taken in order to ensure a more sustainable future in the developing world (Appendix D). Additionally, on World Environment Day 2005, the City pledged its commitment to the Urban Environmental Accords, a set of actions and targets for achieving a more sustainable city. These Accords can be read in detail in Appendix E.

Longtime readers of this report will notice a change in this year's reporting format. For the first time, the report focuses on the natural environment, and does not include details of socio-economic indicators. These indicators are now reported on by a team of specialists in the field of socio-economics, and are contained in the State of Cape Town Report. These two reports should thus be read together in order to gain a complete understanding of the dynamics of the city.

Achmat Ebrahim
City Manager

BACKGROUND

The first City of Cape Town State of the Environment Report (SoER) was published in 1998, and provided the City with a baseline from which to measure and record changes in Cape Town's environmental state. Since then, the report has been through a variety of incarnations, and has grown into a widely used and respected document.

This report focuses on the 2007/8 financial year, which ran from July 2007 to June 2008. This time period has been selected for better alignment with the City's internal reporting structures, which are all based on the financial year. All data presented are taken from this time period, unless stated otherwise.

The State of the Environment Report is designed to be responsive to the needs of its readers. New and improved indicators are therefore constantly being developed to enable the City to provide an increased level of insight into the natural environment.

INDICATORS

In order to report on the city's environment, it is necessary to have a set of common measurements that can be tracked over time. These measurements, more commonly known as 'indicators', allow us to quantify, monitor and report on changes in our city.[1]

Indicators have been chosen to provide a detailed overview of the state of the city's natural environment. The selected indicators are aligned with the IDP and IMEP, and represent issues that are relevant to the City and its residents.

The selection of indicators was also guided by international and local experience in this field, scientific research, and consultation with key stakeholders.

Data on each indicator are assessed and analysed to determine whether a positive or negative trend can be seen. Each indicator in the report is associated with an icon depicting the overall outcome of the analysis, thus:

+ SITUATION IMPROVING

! SITUATION DETERIORATING

? INSUFFICIENT DATA AVAILABLE TO DETERMINE TREND

It is important to remember that indicators provide a glimpse of a situation at a particular point in time, and do not necessarily tell the whole story. However, monitoring indicators over time allows one to draw fair and truthful conclusions about trends in the city, whilst working towards ensuring that necessary action is taken in a timely fashion.

Note: Throughout the document data references will appear within the text as end notes. Where these occur, please turn to page 63 for details.

AIR QUALITY

INDICATORS

Annual average levels for key atmospheric pollutants SO_2, NO_2 and PM_{10}

Number of instances when World Health Organisation (WHO) and United Kingdom (UK) guidelines for SO_2, NO_2 and PM_{10} are exceeded

Air pollution can be defined as the introduction of chemicals and other substances into the air that have a harmful effect on the environment and living creatures, including human beings. There are many different types of air pollution, but cities measure only certain key pollutants (criteria pollutants) for a number of reasons: Firstly, air pollution monitoring is expensive and highly technical; therefore only the criteria pollutants, as required by the National Environmental Management: Air Quality Act, are monitored. Secondly, it is unnecessary to measure every pollutant directly, as good indicator pollutants exist. In practice, this means that certain pollutants are often accompanied by other specific ones, and therefore the presence of one is an excellent indicator of the presence of the other. NO_2 is one such key indicator pollutant, as high levels of NO_2 in the air indicate that air quality in general is likely to be poor.

The City measures the following key pollutants:
PM_{10} – particulate matter smaller than ten microns in size
SO_2 – sulphur dioxide
NO_2 – nitrogen dioxide

Sources of pollution

PM_{10} pollution is a mixture of microscopic solid particles and liquid droplets, and could consist of a number of chemicals, soil, dust and pollen. PM_{10} could be the product of a large number of activities. In Cape Town, the most common sources of PM_{10} pollution are diesel vehicle emissions, wood and coal burning for fuel, and dust from construction and unpaved roads.

Sulphur dioxide is a colourless gas that is produced by industrial processes, burning fossil fuels, as well as motor vehicle emissions. In Cape Town, the most common source of SO_2 is likely to be vehicle emissions, as there is a limited number of large industries in the city.

Nitrogen dioxide is a reddish brown gas that is produced by fossil fuel burning. Similarly to SO_2, the main source of NO_2 in Cape Town is motor vehicle emissions, with limited industrial and domestic fossil fuel burning contributing to the problem.

Effects on human health

PM_{10} particles are microscopic, and are thus easily inhaled. PM_{10} could cause lung irritation, and exacerbate existing lung disorders and diseases, such as asthma and tuberculosis (TB). Long-term exposure has been associated with an increased incidence of chronic bronchitis as well as premature death.[2]

SO_2 and NO_2 form microscopic acid aerosols, which are harmful to human health when inhaled in high concentrations. These pollutants could cause lung irritations and wheezing, and could also exacerbate existing lung disorders and diseases.[3]

Air quality guidelines

The World Health Organisation has formulated air quality guidelines, which are intended to be used as a benchmark by governments around the world. These guidelines specify both the acceptable daily level of a pollutant, as well as the acceptable average annual level. This distinction is important, as both short-term exposure to high levels of pollutants, and long-term exposure to lower levels of pollutants are potentially harmful to human health. Selected guideline limits applicable to the Cape Town area are as follows:[4]

Annual average NO_2 level: 40 µg/m^3 (micrograms per cubic metre)

Annual average PM_{10} level: 20 µg/m^3

Daily average PM_{10} level: 50 µg/m^3

Effects on the natural environment

Both NO_2 and SO_2 represent a threat to the natural environment, as both these gases are precursor chemicals needed for the formation of acid rain. Acid rain has a damaging effect on the natural environment, as it changes the acidity (pH) of freshwater systems, thus reducing their ability to function as natural ecosystems. Acid rain is also harmful to plants through the increased acidification of soils, and physical damage to leaves.

Additionally, microscopic acid aerosols produced by the oxidation of SO_2 and NO_2 have been identified as possible contributors to global climate change.

Air quality guidelines

The United Kingdom Department of Environment, Food and Rural Affairs (DEFRA) has stipulated a number of guidelines[5] for air quality that need to be met in order to ensure the protection of the natural environment. These guidelines are used in many countries. The applicable guideline limits for Cape Town are:

Annual average NO_2 level: 30 µg/m^3

Annual average SO_2 level: 20 µg/m^3

State of the environment

Figures 1–4 present the measurements taken in Cape Town between 2003 and 2008. It is difficult to determine general trends for the city, as air pollution is often a localised event.

In general, average annual NO_2 measurements have remained at low levels across Cape Town. However, in 2003 and 2004, the Cape Town central city experienced levels in excess of both the WHO guideline value and the UK guideline limit for the protection of ecosystems. Encouragingly though, NO_2 levels have decreased steadily over time in Table View.

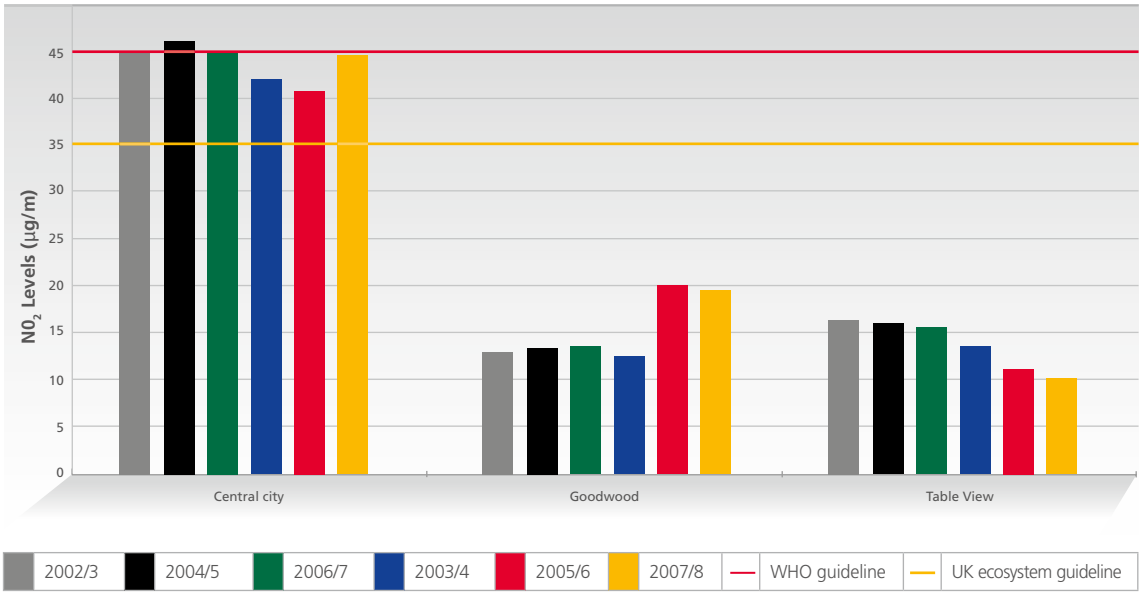


Figure 1 - Annual average N0$_2$ Levels (µg/m)

AIR QUALITY

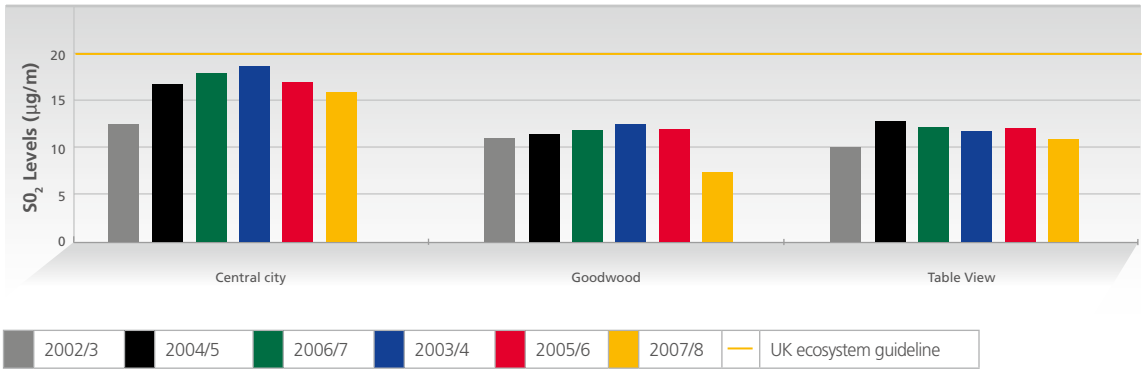


Figure 2 - Annual average $S0_2$ Levels (µg/m³)

It is encouraging to note that SO_2 emissions have consistently been well below the UK guideline value for ensuring ecosystem health. The WHO does not set an annual SO_2 guideline figure; however, a low annual figure indicates that daily limits are generally being met. A gradual decrease in SO_2 over the past three years may be due to the increased use of low-sulphur fuel products.

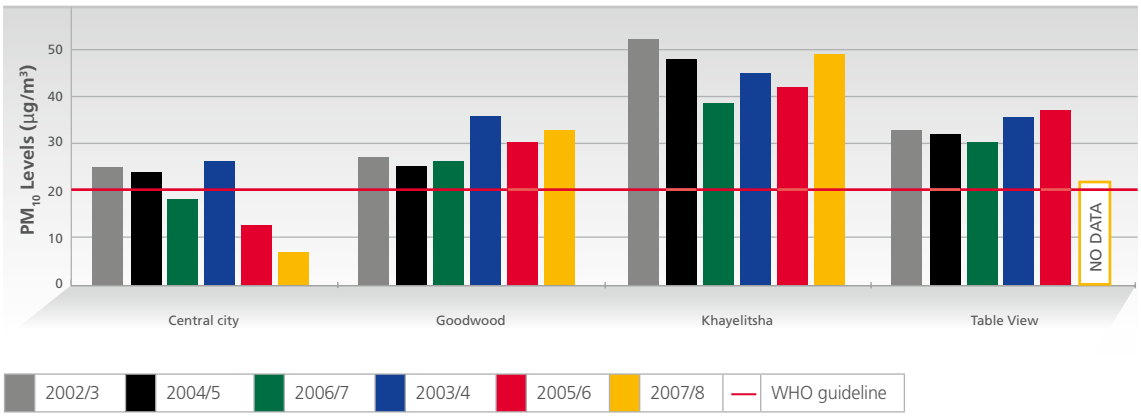


Figure 3 - Annual average PM_{10} Levels (µg/m³)

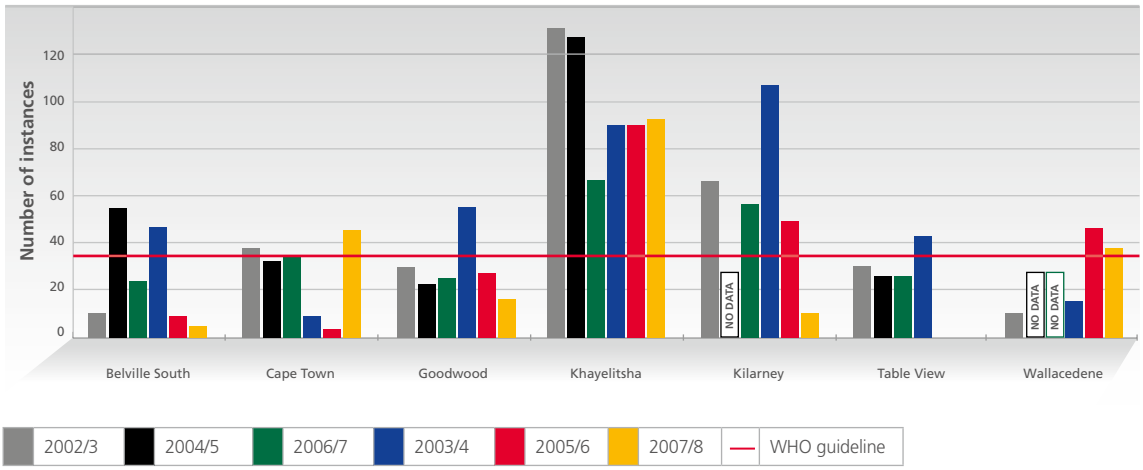


Figure 4 - **Instances of exceeding PM_{10} limits**

Figures 3 and 4 above clearly demonstrate the extent of PM_{10} pollution in Cape Town. Most sites have exceeded the recommended WHO annual average guideline of 20 µg/m3 for the period between 2003 and 2008, whilst almost all sites recorded at least ten annual instances of exceeding the daily guideline of 50 µg/m3. DEFRA recommends a limit of no more than 35 instances of exceeding the daily guideline per year. Many sites exceeded this limit at times, but only Khayelitsha has consistently done so. However, it is important to note that there have been sustained improvements in some areas, specifically Bellville South, Goodwood and Killarney.

Analysis

It is difficult to confirm whether pollution prevention efforts have been successful, as there have been both improvements and declines in air quality across the city. However, it does appear that there have been a greater number of improvements than declines. The City's Air Quality Management Plan (AQMP) provides a framework for managing and reducing air pollution in the city, and the success of this plan is monitored on an ongoing basis.

Air quality remains a matter of concern for the City, especially in poorer areas. For example, Khayelitsha has an above average incidence of TB,[6] which could be significantly exacerbated by air pollution. The Khayelitsha Air Pollution Strategy has therefore been established to address this very problem. Interventions that succeed in Khayelitsha could be extended and applied to other densely populated semi-informal settlements in the city. Sources of PM10 pollution in Khayelitsha have been determined to be dust, exacerbated by the presence of unpaved roads and large unplanted areas, as well as vehicle emissions and smoke from cooking fires.

During 2005, industries in the Bellville South area also spent large amounts of money to improve the area's air quality by reducing their PM_{10} and SO_2 emissions. An improvement is clearly visible when comparing the number of instances when guideline levels were exceeded (and the concentration levels at such times) before and after the industries' intervention.

AIR QUALITY

It is important for prevention efforts to be maintained and stepped up in order to ensure a higher standard of air quality. PM_{10} pollution across the city, and NO_2 pollution in the city centre are of particular concern. PM_{10} pollution varies from one year to the next, and will often increase during periods of intense construction. NO_2 on the other hand, is closely linked to vehicle emissions, and therefore higher levels are to be expected in an area with high vehicle traffic such as the central city. This poses both a health and environmental risk, which will continue to be actively monitored. The City will also need to investigate the development of innovative methods for controlling NO_2 pollution in the central city. Other programmes that will reduce air pollution in the city are the promotion of non-motorised transport such as bicycles, and the upgrade of public transport systems, both aimed ultimately at having fewer vehicles on the road.

POLICY AND STRATEGY LINKAGES

IDP: Corporate objective 6A: Facilitating the development of a healthy and socially inclusive society

IMEP Goal 1: Commitment to reducing the incidence of all forms of air pollution

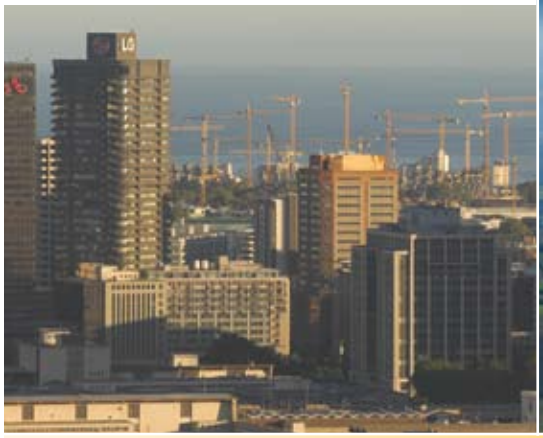
MDG Goal 7: Target 9 – Integrate the principles of sustainable development with country policies and programmes, and reverse the loss of environmental resources.

Urban Environmental Accord: Action 18 – Establish an Air Quality Index (AQI) to measure the level of air pollution, and set the goal of reducing by 10% in seven years the number of days categorised in the AQI range as 'unhealthy' or 'hazardous'.

AQMP: An integrated plan for managing air quality and reducing air pollution in the city

Khayelitsha Air Pollution Strategy: A specific plan to address the issue of high levels of air pollution in Khayelitsha

ALSO SEE
Carbon dioxide (CO_2) footprint (Page 12)



CARBON DIOXIDE (CO_2) FOOTPRINT

Indicators

The total amount of CO_2 and CO_2 equivalents produced per person through energy consumption in Cape Town

Carbon emissions by source

Sources of CO_2

Carbon dioxide (CO_2) – a colourless, odourless gas – is a by-product of numerous human activities, primarily the burning of fossil fuels for electricity generation and transport purposes (see Figure 5 for percentage breakdown of CO_2 production). In South Africa, over 95% of the main electricity supply is generated through coal burning. Coal is one of the dirtiest fuels, and produces massive amounts of pollutants as well as high levels of CO_2 when burned. In fact, burning 1 t of coal produces approximately 2,4 t of CO_2![7]

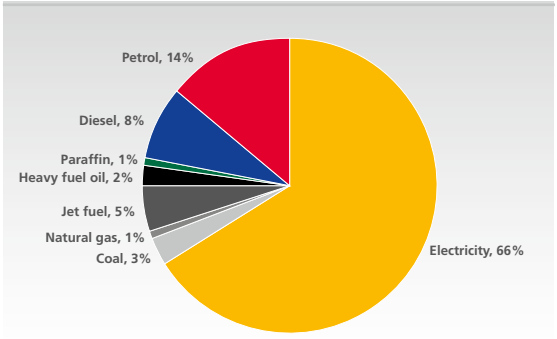


Figure 5 - Energy use by type

Similarly, petroleum and diesel fuels used in motor vehicles also produce CO_2, with 1 kl (1 000 l) of petrol producing 2,3 t of CO_2, and 1 kl of diesel producing 2,6 t of CO_2. By comparison, 1 kl of liquid petroleum gas (LPG, which can also be used to power motor vehicles) produces only 1,5 t of CO_2. A more important measure for motor vehicles, however, is the CO_2 produced per kilometre travelled, which provides an indication of engine efficiency. Newer, fuel-efficient cars, especially those with modern diesel engines, can emit as little as 98 g of CO_2 per kilometre, whilst sports utility vehicles (SUVs) and luxury cars can emit more than 230 g per kilometre. The average vehicle in the UK emits approximately 180 g of CO_2 per kilometre;[8] South African statistics are not available.

The problem with CO_2

CO_2 is a greenhouse gas. Greenhouse gases have a negative impact on the environment, as they artificially increase the ability of the atmosphere to retain the Earth's heat. This increases the energy available in the Earth's systems, and has been identified as the leading cause of anthropogenic (human-induced) climate change. Climate change is expected to have significant economic, social and environmental impacts, including sea-level rise, hotter average temperatures and an increase in extreme weather events.

Measuring the carbon footprint

Carbon footprint refers not only to the CO_2 that is produced in Cape Town through vehicle emissions and industry, but also the emissions produced elsewhere in South Africa to support the energy behavioural patterns of the citizens of Cape Town, in this case at the coal-burning power plants primarily in Mpumalanga. This indicator is updated every two years, as data are extremely difficult to obtain, and do not change quickly enough to warrant more regular updates.

The per capita CO_2 and CO_2 equivalent use was calculated by adding up the emissions produced through the use of electricity, petrol, diesel, paraffin, LPG, jet fuel, heavy fuel oil and coal in 2006. Additionally, emissions from landfills and wood burning account for approximately 1% of the total.

State of the environment

In 2006, Cape Town produced an average of **6,21 t of CO_2 equivalents per capita**, indicating an increase of 290 kg per capita since 2002. Figure 6 shows a trend of increasing per capita CO_2 emissions, although a smaller increase was experienced between 2004 and 2006 than between 2002 and 2004.

CO_2 FOOTPRINT

Analysis

Any increase in per capita CO_2 production – no matter how slight – is too much. Climate change has the potential to be the most devastating event of the 21st century, and therefore all citizens have a responsibility to reduce their CO_2 emissions. South Africa is one of the top twenty carbon polluters in the world, and it is therefore imperative that action is taken to reduce Cape Town's contribution to these emissions.

However, it is important to note that 2007 and 2008 saw a number of significant changes that may have reduced energy usage, and may thus have a positive impact on future measurements of CO_2 equivalent emissions. Perhaps most notable of these was the programme of pre-emptive load shedding initiated by Eskom. In addition, the City has embarked on a comprehensive education campaign aimed at raising awareness of CO_2 emissions, and encouraging more sustainable energy use, including the promotion of alternative technologies. Also, the City is busy developing a Solar Water Heater By-law, which seeks to make the installation of solar water heaters mandatory in all new and existing buildings with a floor area of more than 100 m^2. The City is committed to offset carbon emissions from significant once-off events, such as the 2010 FIFA World Cup™. These projects could have long-term environmental and social benefits for the City.

At the same time, rapid increases in both the petrol price and the general cost of living have occurred. Therefore, in an effort to try to reduce travel costs whilst also reducing CO_2 and other harmful emissions from private cars, the City is planning and implementing an integrated rapid transit system, which would promote the use of public transport in the city.

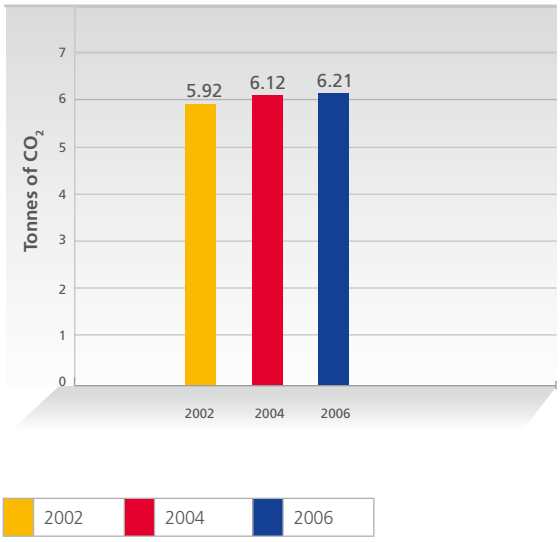
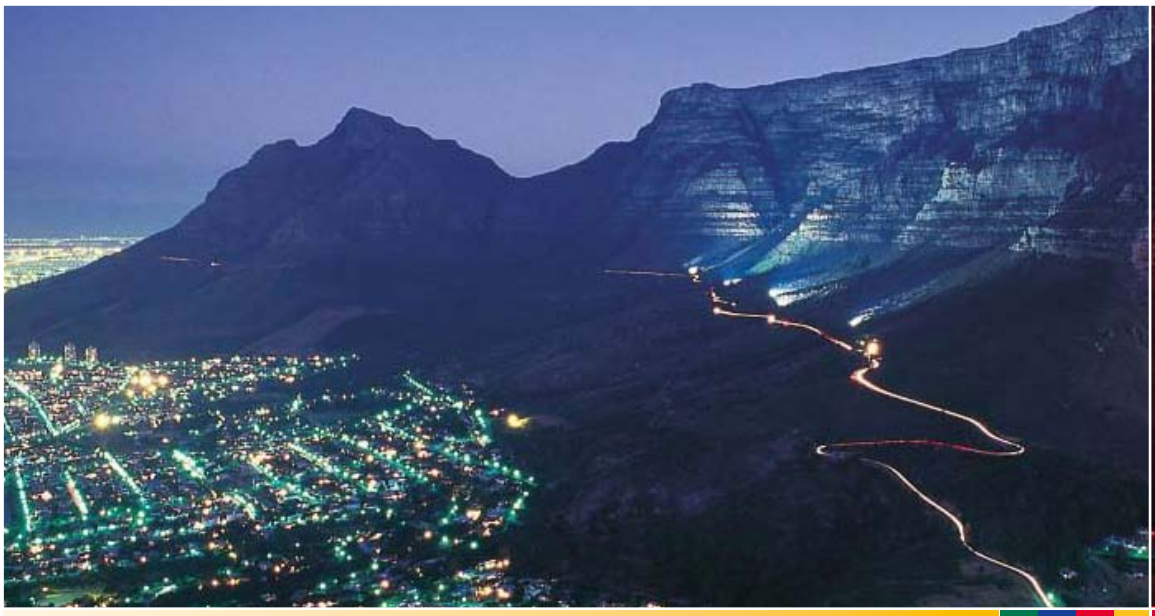


Figure 6 - Per capita $C0_2$ and $C0_2$ equivalents produced by Cape Town



POLICY AND STRATEGY LINKAGES

IMEP Goal 9: A commitment to sources of energy with the least impact on the environment and health of communities

MDG Goal 7: Target 9 – Integrate the principles of sustainable development with country policies and programmes, and reverse the loss of environmental resources.

Urban Environmental Accord: Action 3 – Adopt a city-wide greenhouse gas reduction plan that reduces the city's emissions by 25% by 2030, and which includes a system for accounting and auditing greenhouse gas emissions.

Energy and Climate Change Strategy: A city-wide strategy that sets goals and targets for climate change mitigation and adaptation measures

ALSO SEE

Air quality (Page 7)

BIODIVERSITY

Indicators
Percentage of natural vegetation remaining, by type

Cape Town is located in the heart of the Cape Floristic Region (CFR), the world's smallest and most diverse floral kingdom. As such, it is an area of high biodiversity and unique conservation value – a global urban biodiversity hot spot without parallel. Also, the CFR has one of the highest proportions of endemic species in the world, with over 70% of its approximately 9 600 species found nowhere else in the world.

The CFR has officially been identified as a 'global biodiversity hot spot', placing an international responsibility on Cape Town to ensure its adequate conservation. The City currently owns and operates 24 nature reserves; however, over two thirds of the city's natural vegetation, mostly occurring outside of formal reserves, is classified as 'endangered' or 'critically endangered', putting it on the brink of extinction. Indeed, Cape Town has the world's highest rate of plant extinctions in an urban area.

Vegetation types

Plants in the city are classified according to national vegetation types as well as regional sub-types that occur due to differing underlying soil conditions. Types and sub-types fall under one of the following general categories, although it is important to note that significant variations occur between the types within a specific category.

Mountain fynbos

As the name suggests, mountain fynbos tends to grow on both upper and lower mountain slopes. It is therefore largely isolated and protected from human development, and is as such generally well conserved.

Fynbos in general is characterised by its small and fine leaves, its bushy nature, and its ability to thrive in poor soils and hot, dry conditions. Mountain fynbos comprises seven types: Peninsula Sandstone Fynbos, Kogelberg Sandstone Fynbos, Cape Winelands Shale Fynbos, Elgin Shale Fynbos, Peninsula Granite Fynbos, Boland Granite Fynbos, and Cape Peninsula Shale Fynbos. The Peninsula vegetation types are endemic to the city, and can only be conserved here. Plants that characterise this type include proteas, such as the King Protea, Sunshine Conebush and Tree Pincushion, as well as Cape reeds (*Restionaceae*), and ericas and other fine-leaved shrubs.

Lowland fynbos

Lowland fynbos occurs in the parts of the city most affected by human settlement and agricultural development: the lowlands, flats and plains. Lowland fynbos is therefore highly threatened by extinction due to human intervention, and has more threatened species per area than anywhere else in the world. Lowland fynbos comprises five types: Cape Flats Sand Fynbos, Atlantis Sand Fynbos, Hangklip Sand Fynbos, Lourensford Alluvium Fynbos, and Swartland Alluvium Fynbos. Cape Flats Sand Fynbos and Lourensford Alluvium Fynbos are endemic to Cape Town, and can only be conserved here. Plants that characterise this type include numerous erica species, including the now extinct in the wild *Erica verticillata* and *Erica turgida*, proteas such as the Cape Flats Conebush, Cape reeds (*Restionaceae*) and bulbous plants of the lily and iris families.

Strandveld

As is evident from the name, strandveld grows along the coast, and is commonly found in sand dune systems. Strandveld has been significantly impacted by coastal development, and therefore only approximately 14% of its original extent is conserved or managed. Plants that characterise this type include Sea Guarrie (*Euclea racemosa*), Blombos (*Metalasia muricata*), Bietou (*Osteospermum monilifera*), annual daisies and numerous succulent vygie species.

Renosterveld

Literally translated, renosterveld means 'rhinoceros bush', and may have derived its name from the fact that in the past, rhinoceroses were commonly found in these areas of Cape Town. Another theory behind the name relates to the dark grey colouring of the plants in late summer, somewhat resembling the colour of a rhinoceros from a distance. Renosterveld on the West Coast is one of the most threatened vegetation types in South Africa, with less than 3% of its original extent remaining. In Cape Town, about 8% of all renosterveld vegetation types remain. Peninsula Renosterveld is endemic to Cape Town, and can only be conserved here. Renosterveld is dominated by the grey, low-growing Renosterbos (*Elytropappus rhinocerotis*), but in its natural state would be dominated by grass species, such as Rooigras (*Themeda triandra*). Renosterveld is rich in shrubs from the daisy family (*Asteraceae*) and bulbous plants, such as orchids, irises and lilies.

Causes of biodiversity loss

The primary reason for biodiversity loss in Cape Town is the destruction of indigenous vegetation by human development, including the construction of houses, commercial buildings and industry. Much of Cape Town's natural vegetation had been lost before it was widely recognised that it was unique (endemic) to Cape Town. Invasion by alien vegetation also causes biodiversity loss, as alien species crowd out indigenous ones, and eventually create a mono-culture of invasive plants.

State of the environment

Table 1 shows the current state of affairs with regard to biodiversity conservation in Cape Town. It is important to note the conservation status of each vegetation type, as well as the percentage remaining of these types. In some cases, almost nothing of the original extent of these vegetation types remains – these types are thus a critical priority for conservation efforts in Cape Town. Maps 2 and 3 show the likely historical distribution of vegetation types in Cape Town, and the current remaining fragments. The maps are classified according to national vegetation types. It is important to note that although some types may have experienced significant losses within the borders of the city, they are still conserved outside of Cape Town, and therefore the table provides the national ecosystem status.

BIODIVERSITY

Table 1

National vegetation type in Cape Town	Historical extent in Cape Town (ha)	Current area remaining in Cape Town (ha)	Percentage of historical area remaining	Target: (Percentage of original extent to be conserved)	Percentage lost	National ecosystem status	
						2004[9]	2008[10]
Swartland Alluvium Fynbos	1 742,41	87,94	5,05%	30%	94,95%	CR	CR
Swartland Shale Renosterveld	46 319,18	3 936,47	8,50%	26%	91,50%	CR	CR
Lourensford Alluvium Fynbos	4 819,25	558,48	11,59%	30%	88,41%	CR	CR
Peninsula Shale Renosterveld *	2 374,75	312,52	13,16%	26%	86,84%	CR	CR
Cape Flats Sand Fynbos *	54 447,98	8 342,33	15,32%	30%	84,68%	CR	CR
Swartland Silcrete Renosterveld	1 009,09	171,30	16,98%	26%	83,02%	CR	CR
Swartland Granite Renosterveld	5 911,56	1 509,51	25,53%	26%	74,47%	CR	CR
Elgin Shale Fynbos	841,01	256,51	30,50%	30%	69,50%	CR	CR
Swartland Alluvium Renosterveld	62,35	0,00	0,00%	26%	100,00%	EN	VU
Cape Flats Dune Strandveld	40 467,13	18 971,00	46,88%	24%	53,12%	EN	EN
Peninsula Granite Fynbos *	9 179,00	4 915,00	53,55%	30%	46,45%	EN	EN
Atlantis Sand Fynbos	27 769,72	16 274,35	58,60%	30%	41,40%	EN	CR
Cape Winelands Shale Fynbos	3 929,00	2 398,00	61,03%	30%	38,97%	EN	VU
Boland Granite Fynbos	9 575,44	5 992,00	62,58%	30%	37,42%	EN	VU
Hangklip Sand Fynbos	4 190,41	2 078,03	49,59%	30%	50,41%	VU	VU
Cape Lowland Freshwater Wetlands	1 450,30	1 005,16	69,31%	24%	30,69%	VU	CR
Western Shaleband Vegetation	328,60	328,58	99,99%	30%	0,01%	LT	LT
Kogelberg Sandstone Fynbos	9 499,87	9 234,41	97,21%	30%	2,79%	LT	CR
Peninsula Sandstone Fynbos *	21 495,87	20 857,04	97,03%	30%	2,97%	LT	EN
Southern Afrotemperate Forest	301,29	300,56	99,76%	34%	0,24%	LT	LT

* Endemic

CR	Critically endangered
EN	Endangered
VU	Vulnerable
LT	Least threatened

Analysis

Cape Town's natural and endemic vegetation, and the floral and faunal biodiversity it represents, is under severe threat. At this stage, it is not possible to determine losses from year to year. The Biodiversity Management Branch of the Environmental Resource Management Department recently completed a mapping exercise that has accurately determined the vegetation remnants in the city today. This data will be updated annually, which will enable the City to report on any changes.

It is however clear from the data that the city's biodiversity is severely threatened. Nearly 60% of the original extent of Cape Town's natural vegetation has been lost, mostly in the lowlands. Of those vegetation types that were historically most extensive, significant amounts have been lost: 85% of Cape Flats Sand Fynbos, 92% of Swartland Shale Renosterveld, and 53% of Cape Flats Dune Strandveld. It is important to note that Cape Town encompasses no fewer than six endemic national vegetation types: This means that these six types can only be conserved within the boundaries of Cape Town. Furthermore, three of these vegetation types are considered critically endangered, and remnants will need to be conserved both within and outside of the urban edge. Cape Town is perhaps the only city in the world where unique biodiversity can be conserved within the urban fabric.

In 2002, the conference of the parties to the Convention on Biological Diversity set a minimum target, which requires 10% of the historical extent of vegetation to be conserved. South Africa is one of the parties to the convention. It is clear that Cape Town will definitely not be able to meet the target for at least nine of its vegetation types, as there is already less than 10% of them remaining. Also, for another four types it seems unlikely that the target will be met. Furthermore, owing to the high levels of species endemism and high turn-over in species composition within vegetation types in the CFR, the 10% target mentioned above is considered hopelessly inadequate to conserve the region's biodiversity. Most CFR vegetation types require a conservation target of between 20% and 35% of the historical extent.

Conservation and rehabilitation of natural vegetation is ongoing throughout Cape Town, but requires significantly more resources – both financial and human – in order to ensure that the minimum targets are met. In order for this to be achieved, it is necessary for all levels of government as well as private enterprise and the citizens of Cape Town to understand the global significance of the city's biodiversity, and the pressing need for conservation before it is too late.

On a positive note, the City has signed the Durban Commitment and the Countdown 2010 Declaration, both of which represent a commitment of political leadership and support to the conservation and sustainable management of biodiversity in Cape Town. Cape Town is one of 21 cities from across the world taking part in the ICLEI-Local Governments for Sustainability project Local Action for Biodiversity (LAB), which aims to enhance and protect biodiversity in an urban context. The Durban Commitment is the second of the five steps in the LAB project, and commits the participants to regular biodiversity monitoring, assessment and reporting.

Through the recognition of the Biodiversity Network, the City has taken a decisive step towards ensuring that its biodiversity is conserved in the future. The Biodiversity Network is a systematic fine-scale conservation plan for the City. It consists of a network of sites with significant biodiversity, including those that are formally declared as such, and those that must be formally conserved in the future. Where possible, the sites form corridors and links across the city, with the intention of ensuring that habitats do not become isolated. Ongoing commitment and allocation of resources will make a significant impact on the future of the city's natural environment.

POLICY AND STRATEGY LINKAGES

IDP: Corporate objective 2B: Conservation of natural resources

IMEP Goal 4: A commitment to the conservation of biodiversity in Cape Town

MDG Goal 7: Target 9 – Integrate the principles of sustainable development with country policies and programmes, and reverse the loss of environmental resources.

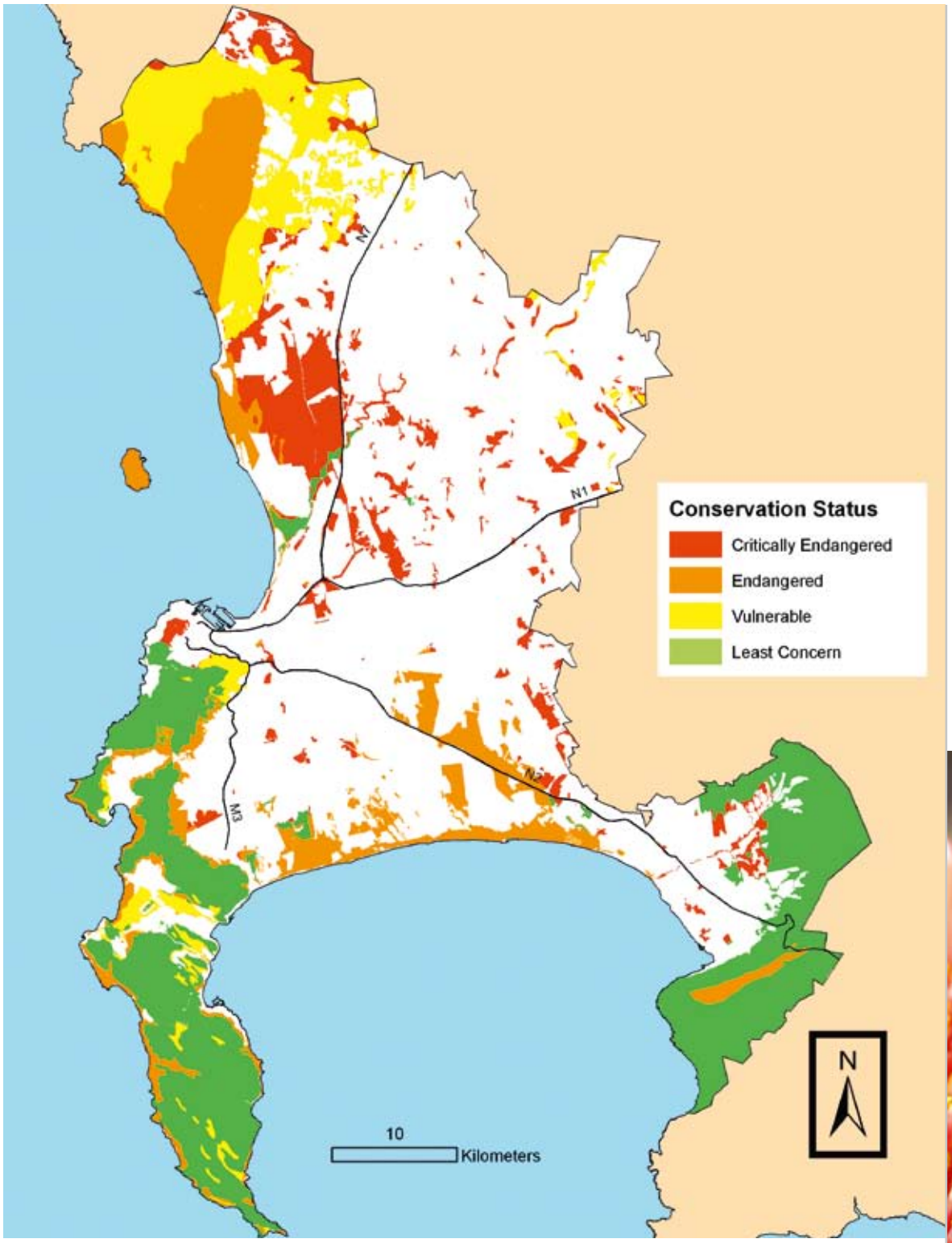
Biodiversity Strategy: A product of IMEP that provides a strategic framework for biodiversity management in the city

LAB Durban Commitment: A commitment to promoting, increasing and enhancing biodiversity within the City administrative area

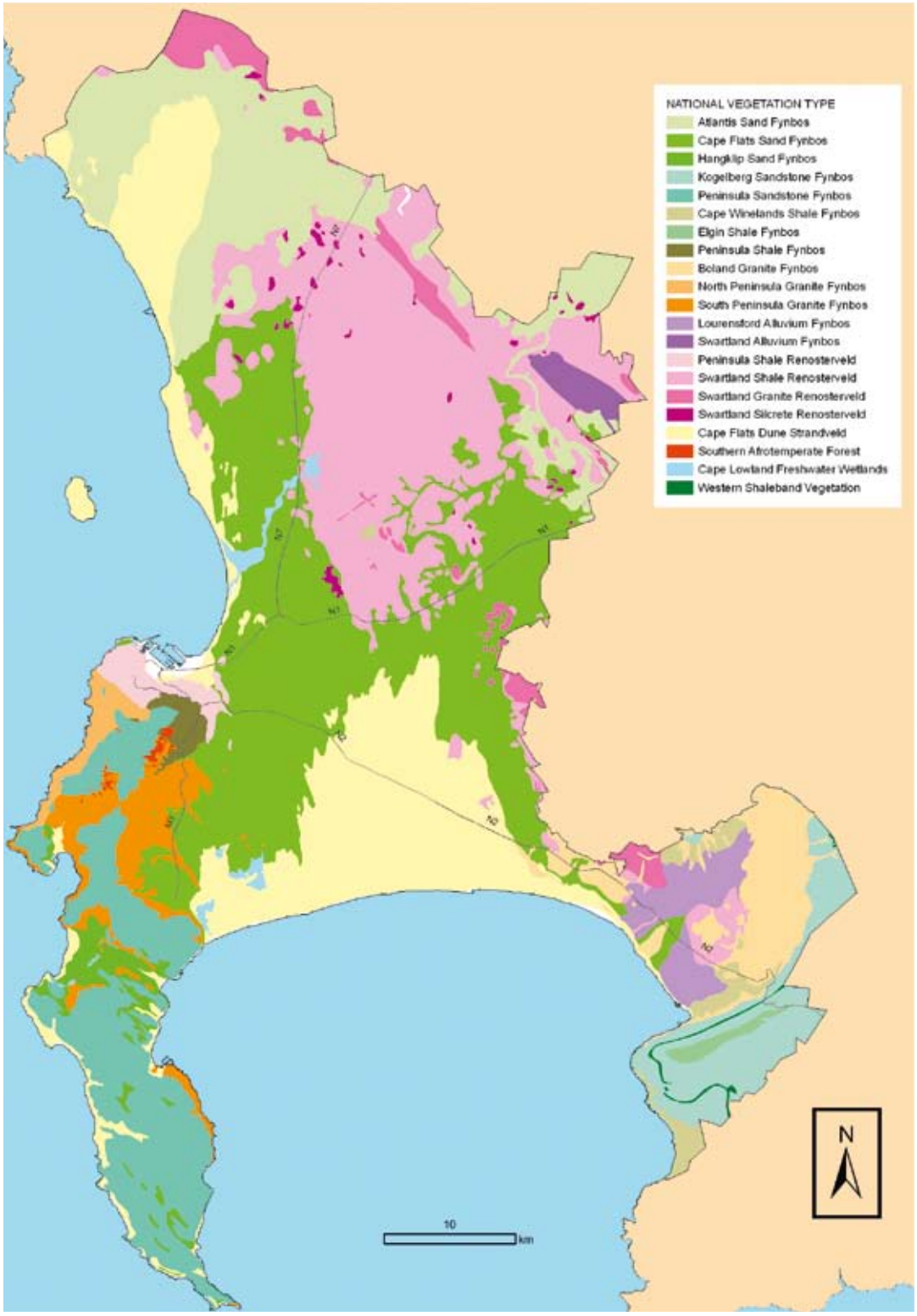
ALSO SEE

Invasive alien species (Page 22)
Urban sprawl (Page 49)

BIODIVERSITY

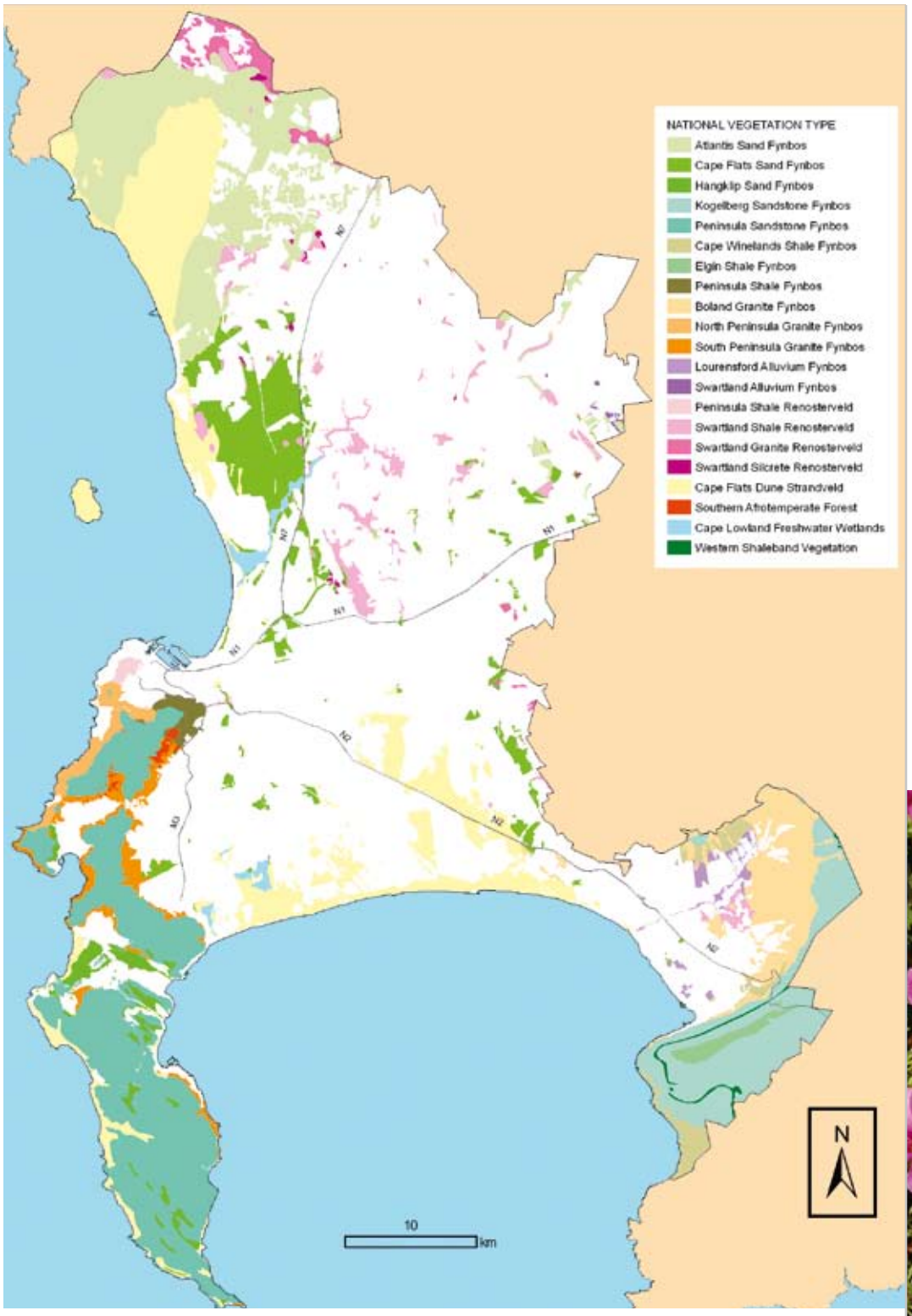


MAP 1 - VEGETATION TYPES IN CAPE TOWN
Conservation status



Map 2 - VEGETATION TYPES IN CAPE TOWN
Historical Extent

BIODIVERSITY



MAP 3 - VEGETATION TYPES IN CAPE TOWN
Remaining Extent

INVASIVE ALIEN SPECIES ?

Indicators

Proportion of land invaded by invasive alien plants

Occurrence of invasive alien animal populations

The Global Invasive Species Programme defines alien species as "non-native organisms that cause, or have the potential to cause, harm to the environment, economies or human health".[11] Invasive alien species are those that, through their establishment in natural or semi-natural habitats, reduce biological diversity, and crowd out or otherwise harm indigenous populations. Many alien plant species were brought to Cape Town by well-intentioned people, with the aim of stabilising sand dunes or providing shade. Alien species comprise both plants and animals.

The problem with invasive alien species

Invasive alien species are problematic for a number of reasons, including the following:

Alien plants grow rapidly, and out-compete and crowd out indigenous vegetation, thus changing habitats and causing biodiversity loss. Alien animals have a tendency to crowd out indigenous animals, thereby changing the balance of ecosystems.

When alien plants burn, they burn much hotter and much longer than indigenous plants. Although fynbos requires fire in order to germinate seeds, excessively hot and prolonged fires can destroy plants and seed banks.

Certain alien plants use significantly more water than indigenous species, thus reducing water supplies available to both ecosystems and humans.

Some alien plants are nitrogen-fixing, which means that they lock nutrients into the soil. This has a negative impact on indigenous plants, as fynbos grows best in nutrient poor soils.

Alien invasive species have a negative social impact: Dense stands of alien vegetation provide a screen for criminal activities; alien animals such as the house crow spread disease, while others out-compete indigenous species.

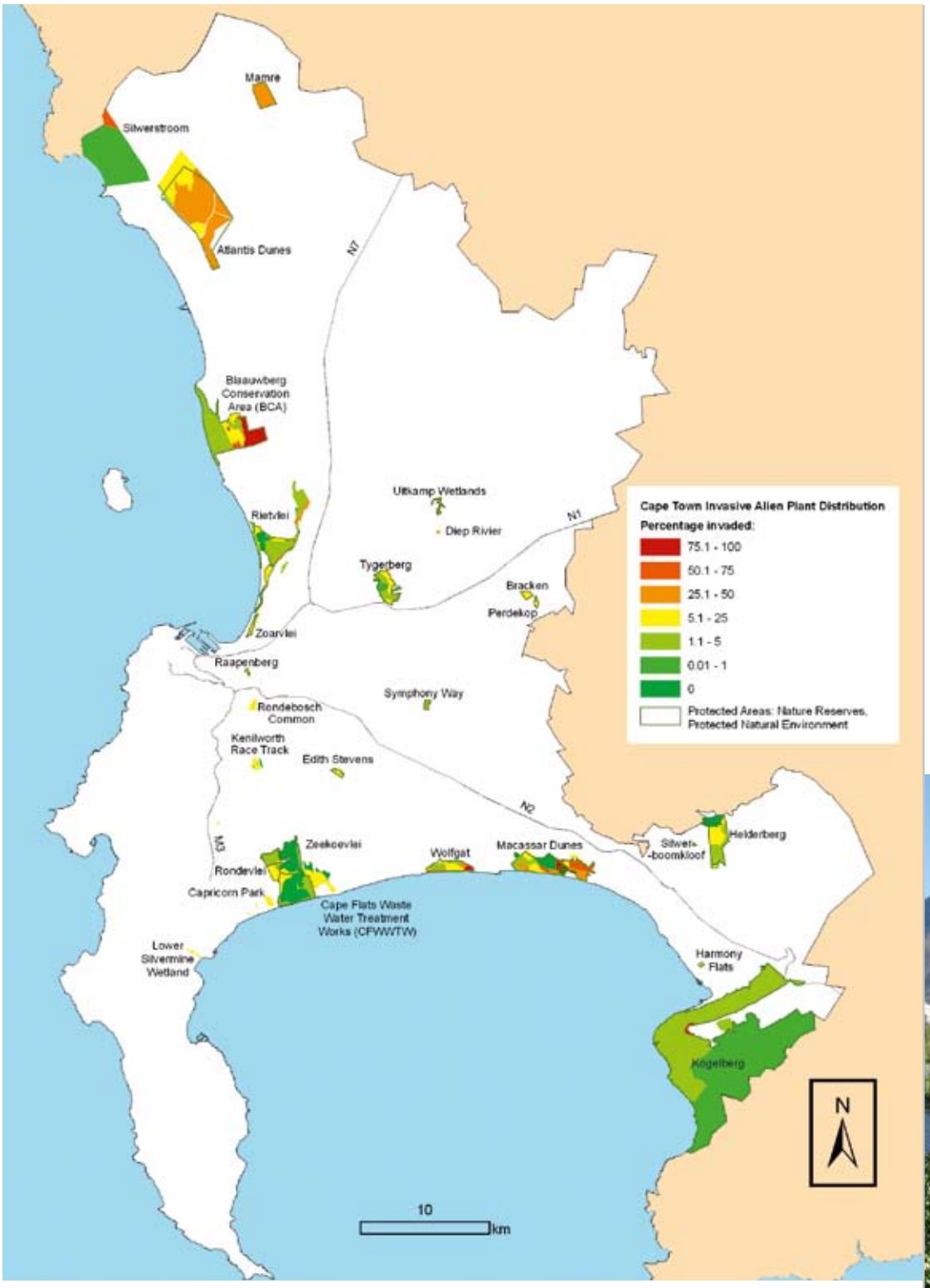
Alien aquatic plant species, which tend to proliferate in nutrient enriched waters, can block waterways and contribute to flooding, result in unnatural shading of the water column, and out-compete indigenous species.

State of the environment

The City has recently completed a mapping exercise to determine the extent of alien plant invasion in its protected areas. At this stage, it is not possible to determine accurately the extent of infestation outside of protected areas, but an extension of the mapping exercise to the rest of Cape Town is envisaged.

It is clear from Map 4 that significant proportions of the City's protected areas are infested with alien invasive plant species, and in some cases this infestation is severe (more than 50% invaded). Resources for alien plant clearing will first be allocated to those areas with mild to moderate infestation in order to prevent them from becoming severely invaded, after which the more challenging problem of severely invaded areas will be tackled.

INVASIVE ALIEN SPECIES



MAP 4 - INVASIVE ALIEN SPECIES

Prominent invasive alien plant species (terrestrial)

1. **Port Jackson** (*Acacia saligna*) – Originating from Australia, this highly flammable shrub/tree transforms landscapes, increases fire risk, and depletes water resources.
2. **Rooikrans** (*Acacia cyclops*) – Originating from Australia, this highly flammable shrub/tree transforms landscapes, increases fire risk, and depletes water resources.
3. **Kikuyu grass** (*Pennisetum clandestinum*) – This fast-growing turf grass displaces indigenous species, and depletes water supplies. It is commonly cultivated in gardens and on golf courses.
4. **Gum tree** (*Eucalyptus spp.*) – Originating from Australia, this highly flammable tree significantly increases fire risk, and depletes water resources.
5. **Pine** (*Pinus spp.*) – Pines invade mountain fynbos and forest ecosystems, out-compete indigenous plants, and increase fire risk.
6. **Manatoka** (*Myoporum tenuifolium monatum*) – This plant is toxic, and commonly invades dune systems and watercourses.
7. **Australian Myrtle** (*Leptospermum laevigatum*) – Invades sandy areas, forming dense stands that crowd out indigenous vegetation.
8. **Patterson's Curse** (*Echium plantagineum*) – A highly invasive flowering plant that crowds out indigenous vegetation.
9. **Black Wattle** (*Acacia mearnsii*) – A nitrogen-fixing tree that crowds out indigenous vegetation, increases fire risk, and depletes water resources.

Prominent invasive alien plant species (aquatic)

1. **Water Hyacinth** (*Eichhornia crassipes*) – This floating water weed displaces indigenous plant and animal species by habitat modification, and provides suitable breeding sites for vectors disease.
2. **Water Lettuce** (*Pistia stratiotes*) – Also a floating water weed, the water lettuce forms dense mats that impact on recreational activities, agriculture and the ecosystem, and decreases water quality.
3. **Red Water Fern** (*Azolla filiculoides*) – A floating water weed which forms dense mats. It is extremely fast-growing, and could cover a water body in a matter of months.
4. **Parrot's Feather** (*Myriophyllum aquaticum*) – This rooted water weed also forms dense mats. Particularly dense infestations of shallow water bodies have been known to cause flooding, and change draining patterns.
5. **Kariba Weed** (*Salvinia molesta*) – Another floating water weed, this species affects recreational activities and agriculture, decreases water quality, and displaces indigenous species through densification.

Prominent invasive alien animal species

Due to insufficient data on invasive animal species, it is impossible to map the distribution and severity of alien animal invasion accurately. However, these animals tend to be widespread, but especially in urban areas and where natural ecosystems have been disturbed.

1. **House Crow** (*Corvus splendens*) – This bird is an aggressive feeder that out-competes indigenous birds, and is a vector for diseases.
2. **Mallard duck** (*Anas platyrhynchos)* – This species out-competes and hybridises with indigenous species, posing a threat of genetic takeover.
3. **Argentine Ant** (*Linepithema humile*) - Alters fynbos ecosystems by out-competing indigenous ant species, on which many fynbos plants depend for seed dispersal. The Argentine Ant does not disperse seeds.
4. **Common Carp** (*Cyprinus carpio*) – This large species uproots plants and disturbs sediments, causing widespread habitat damage. It also out-competes indigenous fish species.
5. **Brown rat** (*Rattus norvegicus*) – This rat species impacts on biodiversity by out-competing and preying on indigenous species. They also spread disease, and feed on farmers' crops.

INVASIVE ALIEN SPECIES

Methods of control

By far the best method of controlling invasive alien species is preventing them from becoming established in a particular area. Therefore the City is currently working on an early detection and rapid response action plan aimed at preventing new invasions from taking place. For areas that are already invaded, there are a number of control methods:

- **Manual** – literally digging out or uprooting small plants by hand. Care must however be taken not to further disturb soils.
- **Mechanical** – cutting down larger plants with chain saws.
- **Chemical** – the application of registered herbicides to tree stumps and new growth; usually used in conjunction with other methods.
- **Fire** – considered the most successful control method of large stands of dense alien vegetation that is isolated from human settlements; followed by clearing in order to control regrowth.
- **Biocontrol** – the introduction of natural predators of alien species in order to reduce growth. Seed abundance is reduced, thus preventing plants from reproducing. This has been particularly successful in the control of Acacia saligna.
- **Restoration** – rehabilitation of indigenous plants following the clearing of an area, to allow indigenous species to re-establish and eventually out-compete alien plants.

Analysis

Infestation by alien invasive species is one of the biggest threats to Cape Town's globally unique and important biodiversity. The fact that many of the City's protected areas are experiencing significant invasive alien infestations even though they are actively managed, indicates that the problem outside of the protected areas is likely to be much more severe.

The City is currently working on the implementation of a co-ordinated Invasive Alien Species Strategy, which aims to improve coordination, integrate alien control efforts, and increase such efforts' efficiency and efficacy. Many different role players in Cape Town, including various City line functions, National Government, utility providers, non-governmental organisations and local communities, are engaged in clearing operations. The strategy will ensure that these different groups begin to operate with a common vision and plan, thus improving the success rate of control operations.

As of 2007/8, it is not possible to determine accurately how much land has been cleared of invasive species, and by what percentage the problem has been reduced. However, ongoing data capturing and management of a central City invasive alien species database will ensure that more up-to-date and accurate data are available for the 2008/9 State of the Environment Report.

It is extremely important to note that most areas of invaded land can never be considered completely 'cleared'. Although many or all adult plants may be removed in clearing operations, long-term follow-up is required in order to ensure that plants do not regrow. This requires a significant long-term commitment by the City and other key role players, as well as the allocation of substantial additional funding.

POLICY AND STRATEGY LINKAGES

IDP: Corporate objective 2B: Conservation of natural resources

IMEP Goal 4: A commitment to the conservation of biodiversity in Cape Town

MDG Goal 7: Target 9 – Integrate the principles of sustainable development with country policies and programmes, and reverse the loss of environmental resources.

Urban Environmental Accord: Action 12: Pass legislation that protects critical habitat corridors and other key habitat characteristics (e.g. water features, food-bearing plants, shelter for wildlife, use of native species, etc.) from unsustainable development.

Invasive Alien Species Strategy: A city-wide strategy to co-ordinate the various line functions that have responsibility for invasive alien species management, and ensure a holistic approach

ALSO SEE
Biodiversity (Page 15)

WASTEWATER !

Indicators

Percentage compliance with Department of Water Affairs and Forestry (DWAF) guidelines for wastewater treatment works (WWTWs)

Wastewater in an urban environment is defined as any water that enters the sewerage system, and is subsequently processed at a wastewater treatment plant. This includes wastewater produced by bathing and showering, washing clothes and dishes, and toilets. Also included are effluents from industries and commercial activities.

In Cape Town, wastewater is treated through a variety of processes. All of these processes however make use of physical screening, followed by a biological treatment process. Pollutants are removed from the wastewater, and are converted into a semi-solid sludge. After treatment, the resulting effluent is released into rivers or the ocean, where it is assimilated into the environment. Some treated effluent is re-used, and is particularly popular for the watering of golf courses and sports fields, as it is significantly cheaper and more environmentally sustainable than using potable water.

Also, an increasing quantity is being used in industrial processes, where a lower water quality than that of potable water is suitable. Beneficial uses of the waste sludge include composting, application to agricultural land, or as fuel.

The wastewater that is returned to the environment must meet the quality standards promulgated by DWAF in terms of the National Water Act of 1997. These prescribed standards are intended to ensure that the wastewater has a minimal impact on the natural environment as well as the health of anyone who may come into contact with it.

However, the reality is that in Cape Town and many cities in the developing world, many WWTWs operate beyond capacity, or use older technology, and do not have the ability to meet the required standards effectively. Furthermore, none of the City's WWTWs are currently equipped to remove phosphorus from effluent, and significant changes need to be made to most facilities in order to meet the proposed 1 mg/l phosphate standard. Phosphorus is a key pollutant of concern in receiving waters, as it contributes to eutrophication and associated prolific growth of problem aquatic plants and potentially harmful algal blooms.

Standards for treated wastewater discharge

The following pollutants are measured in the City's WWTWs:

Ammonia

Ammonia is produced by the interaction between bacteria and nitrogen compounds present in wastewater. This pollutant contributes to the eutrophication of receiving waters, and is toxic to both plant and animal life.

General standard: Not exceeding 10 mg/ℓ

Chemical oxygen demand (COD)

COD is the measure of the amount of oxygen in water that is consumed for the oxidation of organic compounds. COD provides a good indication of the amount of organic pollutants in water. Oxidation of large quantities of organic matter in water may result in significant reduction in dissolved oxygen levels, which could in turn result in respiratory distress in aquatic organisms.

General standard: Not exceeding 75 mg/ℓ

Escherichia coli (*E. coli*)

E. coli is a bacterium that is commonly found in the intestines of warm-blooded animals as well as humans. The presence of *E. coli* in water is indicative of pollution with faecal matter. Although *E. coli* itself is not necessarily harmful, it is used as an indicator of the presence of other pathogenic organisms in faecally contaminated water, and therefore is important in determining guidelines for recreational water quality.

General standard: No *E. coli* to be present, but most WWTWs allow a relaxation to 1 000 *E. coli*/100 mℓ

Suspended solids

This refers to any particles that are suspended or floating in wastewater. Suspended solids could comprise a range of particles, which include sediments, food particles, detergents and human waste. Water with a high suspended solids loading will tend to have a murky/turbid appearance, which in turn affects light penetration, and thus also photosynthesis. Suspended solids could negatively affect filter-feeding organisms, whereas solids that settle out may smother plants and animals.

General standard: *No more than 25 mg/ℓ*

State of the environment

Figures 7–10 show the percentage compliance with various DWAF general standards for 2007/8. The percentages are calculated on the basis of the number of times that effluent quality fails to meet the general standard in a year. For example, if the effluent fails ten times out of 100 measurements, it will have a 90% compliance rate. A compliance rate of over 95% is considered acceptable, between 95% and 75% is poor, and less than 75% is considered unacceptable.

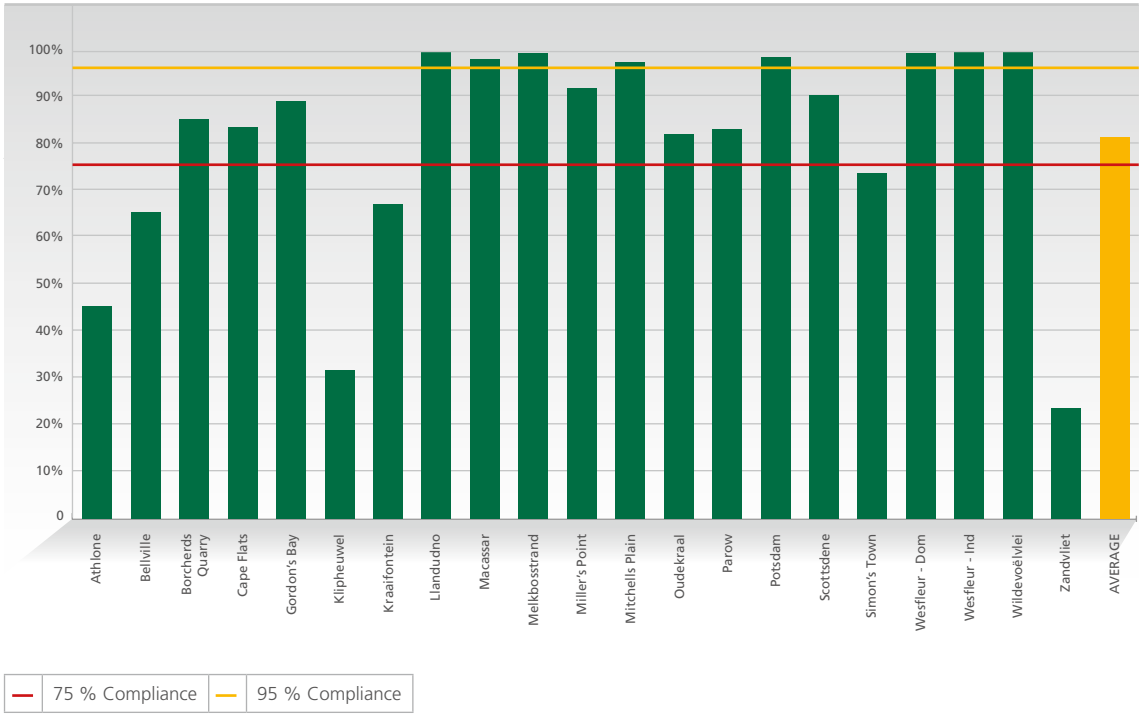
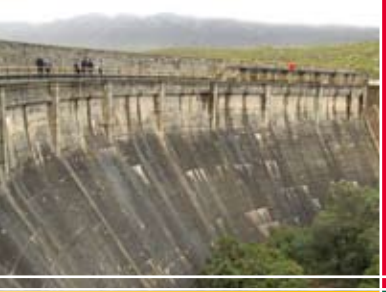


Figure 7 - **Percentage comliance with standard - ammonia**

Out of the 21 WWTWs, eight achieved over 95% compliance, while another two achieved over 90% compliance. Five sites were deemed unacceptable. On average, the compliance rate was 81,2%.



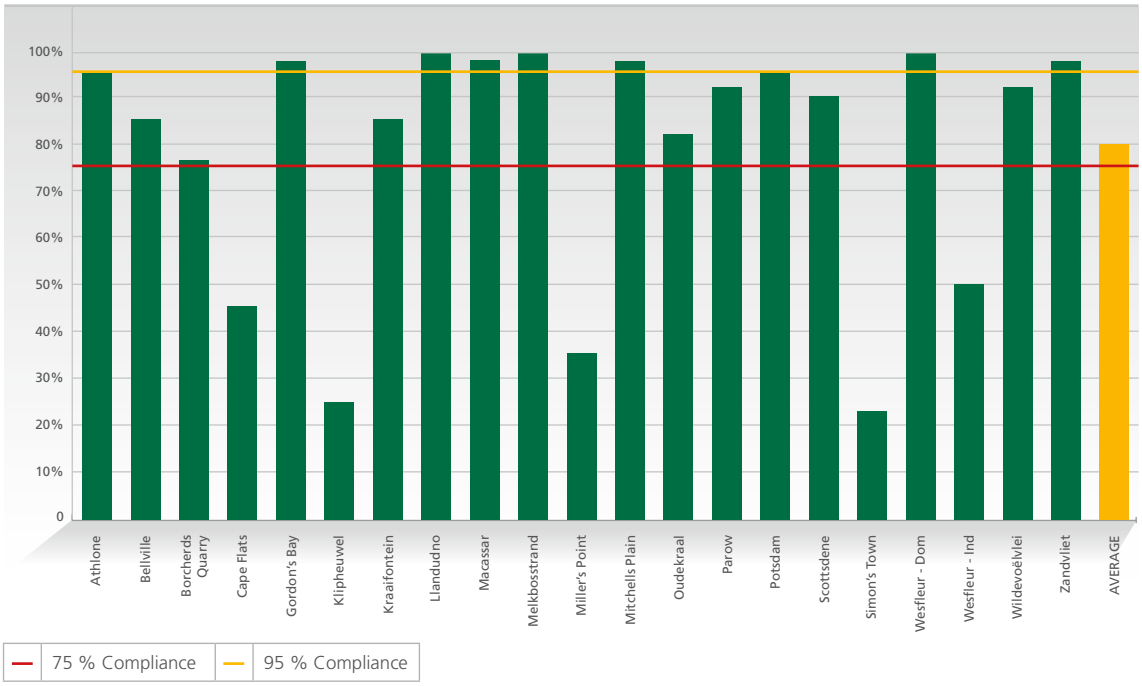


Figure 8 - **Percentage comliance with standard - COD**

Out of the 21 WWTWs, nine sites achieved over 95% compliance, while another three sites achieved over 90% compliance. Five sites were deemed unacceptable. On average, the compliance rate was 80,1%.

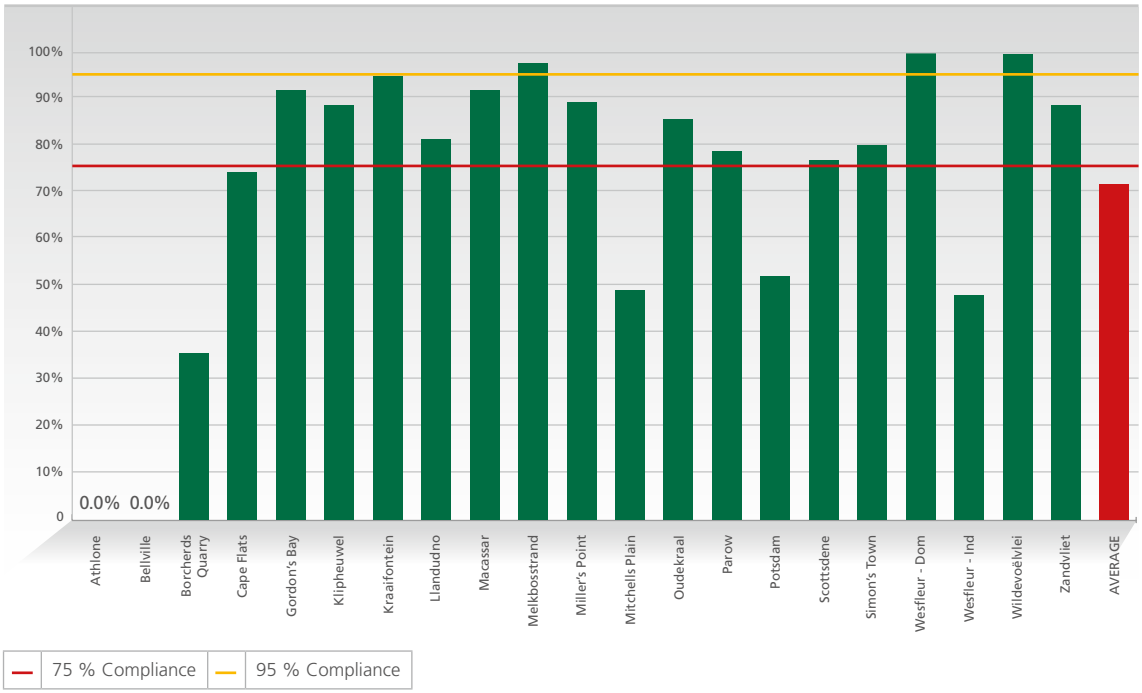


Figure 9 - **Percentage comliance with standard - E.coli**

Out of the 21 WWTWs, four sites achieved more than 95% compliance, while another two sites achieved 90% compliance. Eight sites were deemed unacceptable. On average, the compliance rate was 71,1%. Note that compliance at the Athlone and Bellville WWTWs was 0%.

WASTEWATER

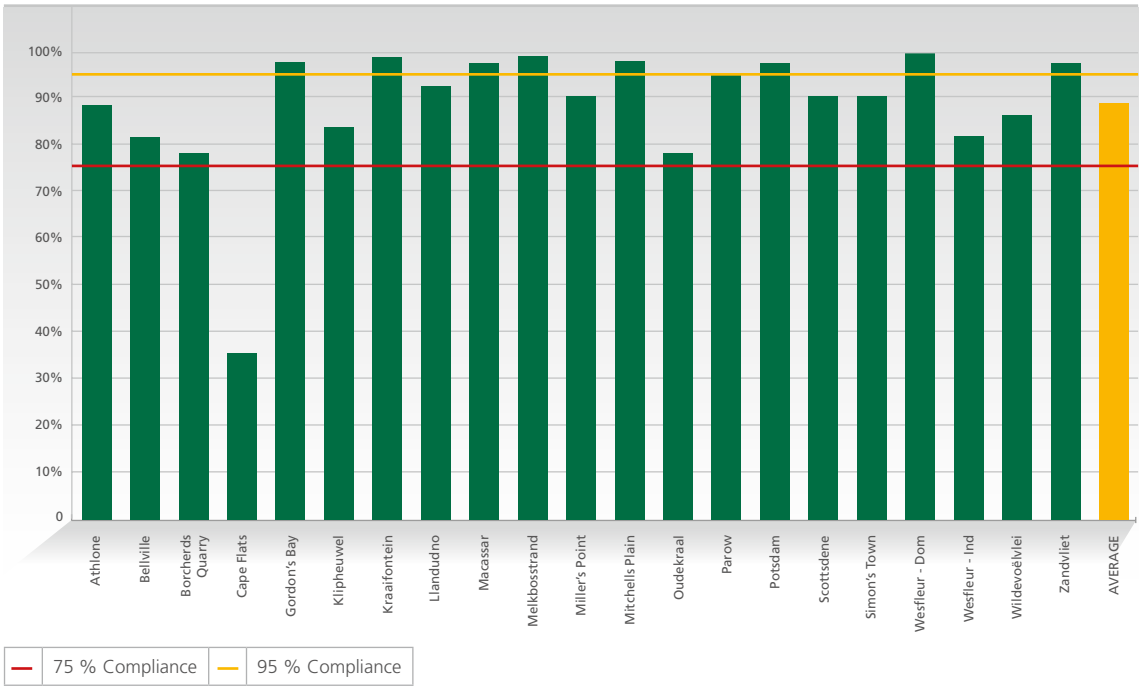


Figure 10 - **Percentage comliance with standard - suspended solids**

Out of the 21 WWTWs, eight sites achieved more than 95% compliance, while another five sites achieved 90% or better compliance. One site was deemed unacceptable. On average, the compliance rate was 88,5%.

Analysis

The significant growth in both residential and commercial development, coupled with the provision of sewered toilets for many informal settlement dwellers, has placed a great burden on the wastewater treatment system. This rapid growth was unfortunately not matched by an increase in the capacity of WWTWs, nor was it accompanied by the construction of new plants.

It is clear that some of the WWTWs in Cape Town simply operate beyond capacity, and that significant capital investment is required in order to upgrade existing plants, and build new ones where necessary. The City has allocated a sizeable portion of its capital budget for 2008/9 to the upgrade and extension of wastewater treatment capacity. Whilst this extension of capacity is under way, it is important that effluent quality is continually monitored in order to ensure that the public receives adequate warning and information. The Wastewater Department annually produces its ten-year capital plan highlighting the improvements and funding required. While it remains a challenge to secure sufficient funding, it should also be noted that significant improvements in wastewater treatment capacity and effluent quality have indeed taken place in the past few years.

The City is aiming for a higher standard for its wastewater effluent than what is currently legislated. The current ammonia limit, for example, is 10 mg/l, but new treatment works and extensions are designed to attain a level of 3 mg/l. For phosphate content, for which a target is not currently specified, a value of 1 mg/l is envisaged. These improved target values will play an important role in trying to minimise the impact of wastewater discharges in Cape Town. Also, the City is actively promoting the use of treated effluent, both to reduce the impact on the environment even further, and to save valuable potable water where possible.

Considerable opportunities exist for reducing the pressure on existing wastewater treatment systems through the use of alternative and sustainable technologies. On-site sewage treatment in the form of bio-digesters and artificial wetlands may offer a suitable alternative to traditional wastewater treatment, especially in areas where WWTWs are particularly overloaded, or where costs need to be kept to a minimum. The City needs to continue exploring alternative technologies in order to determine the most suitable applications, which should then be implemented where appropriate.

POLICY AND STRATEGY LINKAGES

IDP: Corporate objective 2B: Conservation of natural resources

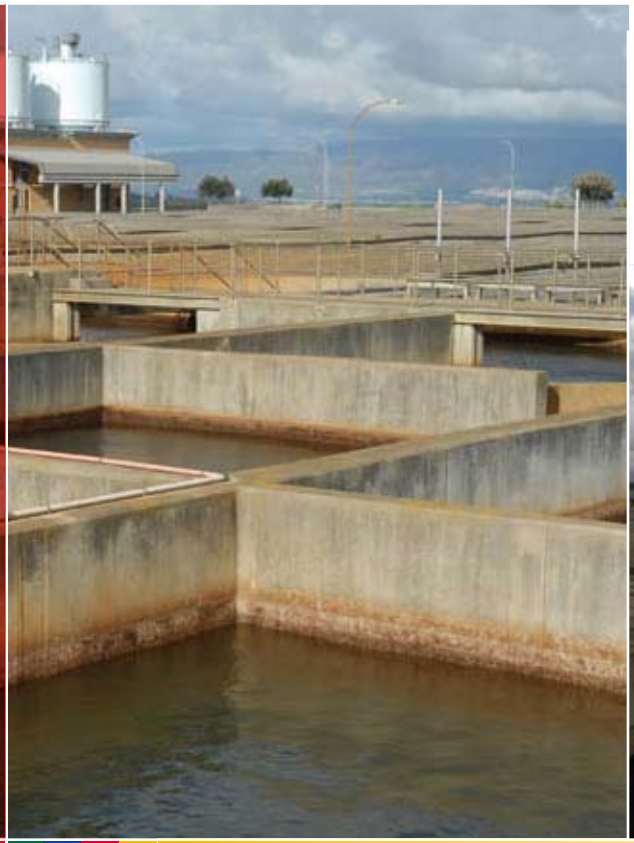
IMEP Goal 2: A commitment to ensuring that the quality of coastal, marine and inland waters of Cape Town is suitable for the maintenance of biodiversity, and the protection of human health

MDG Goal 7: Target 9 – Integrate the principles of sustainable development with country policies and programmes, and reverse the loss of environmental resources.

Urban Environmental Accord: Action 21 – Adopt municipal wastewater management guidelines, and reduce the volume of untreated wastewater discharges by 10% in seven years, through the expanded use of recycled water, and the implementation of a sustainable urban watershed planning process, which includes participants of all affected communities, and is based on sound economic, social and environmental principles.

ALSO SEE

Freshwater quality (Page 31)
Coastal water quality (Page 36)
Water use (Page 43)
Urban sprawl (Page 49)



FRESHWATER QUALITY !

Indicators

River health, as determined by the River Health Programme

Ecosystem status based on trophic state

Percentage compliance with DWAF public health guidelines

Cape Town is home to an extensive network of rivers and vleis. These freshwater systems fulfil a dual function: they serve as havens for plant and animal life, and as infrastructure networks for the management of stormwater and treated effluent. However, the ongoing organic pollution of Cape Town's freshwater systems poses a threat to both biodiversity and human health.

Guidelines for freshwater quality

Three sets of guidelines are used to assess freshwater quality in Cape Town.

River Health Programme[12]

Cape Town is a participant in the national River Health Programme, which uses a range of biological indices for determining the ecological health of rivers. The SASS5 index (South African Scoring System) uses an assessment of aquatic invertebrate communities to determine ecological river health. This is usually combined with an assessment of in-stream and riverine habitat conditions to provide an overall measure of river health on the descriptive scale below. The results obtained during SASS5 surveys thus provide an indication of the degree of disturbance due to affected water quality and/or habitats.

SASS5 CATEGORIES

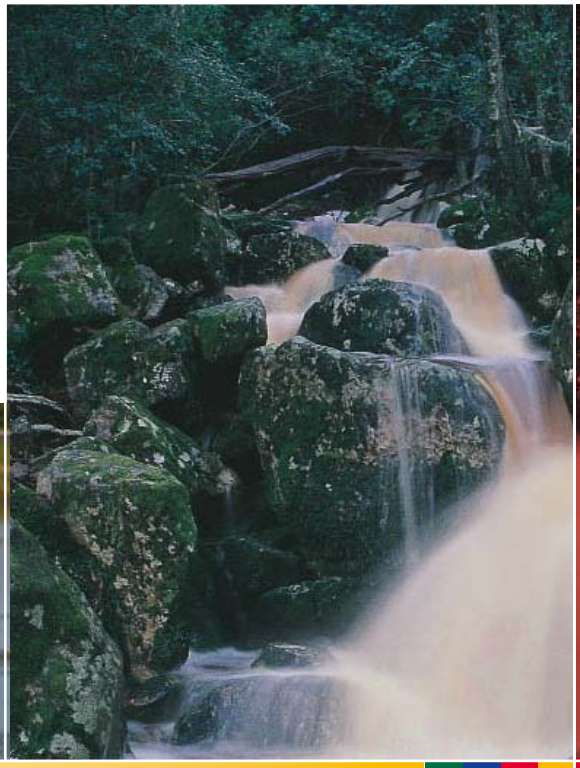
Natural – no or negligible modification

Good – biodiversity and integrity largely intact

Fair – sensitive species may be lost, with tolerant or opportunistic species dominating

Poor – mostly only tolerant species present; alien species invasion; disrupted population dynamics; species often diseased

Unacceptable – river has undergone critical modification; almost complete loss of natural habitat and indigenous species, with severe alien invasion



Trophic state

Phosphorus provides an excellent proxy measurement of the state of an aquatic system, as it is commonly identified as a key pollutant in urban and peri-urban areas. Too much phosphorus in a freshwater system leads to a process known as eutrophication, in which excessive (often alien) plant and algae growth leads to the degradation of the natural ecosystem. As plant material grows denser, or algal blooms develop, this may prevent light from reaching the lower levels of rivers and lakes. Large-scale die-off and subsequent decomposition of algae may reduce the oxygen content of the water, thus leading to the death of fish and aquatic invertebrates. Table 2 describes trophic tendencies and conditions that typically exist under various phosphorus concentrations.[13]

Table 2

Trophic tendency	Phosphorus range (mg/l)	State and typical conditions
Oligotrophic Very low nutrient level	< 0,005	Excellent. Usually moderate levels of species diversity; usually low productivity systems, with rapid nutrient cycling; no nuisance growth of aquatic plants or blue-green algae.
Mesotrophic Moderate nutrient level	0,005–0,025	Good. Usually high levels of species diversity; usually productive systems; nuisance growth of aquatic plants and blooms of blue-green algae; algal blooms seldom toxic.
Eutrophic High nutrient level	0,025–0,125	Fair to poor. Usually low levels of species diversity; usually highly productive systems, with nuisance growth of aquatic plants and blooms of blue-green algae; algal blooms may include species that are toxic to humans, wildlife and livestock.
	0,125–0,25	
Hypertrophic Excessive nutrient level	> 0,25	Bad. Usually very low levels of species diversity; usually very highly productive systems; nuisance growth of aquatic plants and blooms of blue-green algae, often including species that are toxic to humans, wildlife and livestock.

DWAF public health guidelines

DWAF sets guidelines for various degrees of contact with freshwater systems. The guidelines commonly used for assessing freshwater systems are the intermediate and full-contact guidelines, which set safe standards for the limits of pollutants in water that may be used for water sports, boating, swimming and other recreational activities. These guidelines set upper limits on the amount of indicator organisms, such as *E. coli* bacteria, which may be present in a water sample. The intermediate contact guideline stipulates that samples should not exceed 1 000 indicator organisms per 100 ml.

Sources of pollution

The primary sources of pollution of Cape Town's freshwater systems are unsatisfactorily treated wastewater effluent, overflows from sewer systems and pump stations, and contaminated stormwater. Additionally, the dumping of human waste (in the form of toilet buckets from informal settlements) directly into rivers adds to the organic load of the system. In urban areas, rainwater picks up a range of contaminants as it makes its way towards rivers and the sea. Stormwater can therefore include oil, petrol and diesel from roads and other paved areas; fertiliser from suburban gardens, sports fields and golf estates; silt from eroding areas, and general litter and pet waste.

The fact that some of Cape Town's rivers have been canalised adds to the problem. Concrete canals are essentially biologically sterile, which leaves little in-stream habitat suitable for plants and other biota. These river systems therefore have no ability to assimilate and treat pollutants.

State of the environment

River Health Programme

Table 3

Natural	Good	Fair	Poor	Unacceptable
2 (5%)	3 (8%)	8 (22%)	18 (49%)	6 (16%)

The last River Health Programme survey of Cape Town rivers was conducted in 2006/7. The results, presented in Table 3, showed that 24 out of 37 rivers monitored fell into the poor and unacceptable categories – therefore approximately 65% of the rivers are moderately to severely disturbed.

Trophic state

In 2007/8, nine out of 13 vleis (or 69%), and six out of 14 rivers (or 42%) were classified as eutrophic or hypertrophic, indicating poor to bad water quality (see Figures 11 and 12). It is important to note that only two rivers were classified as mesotrophic, indicating a good level of ecosystem health, while none of Cape Town's freshwater systems were classified as oligotrophic (excellent ecosystem health).

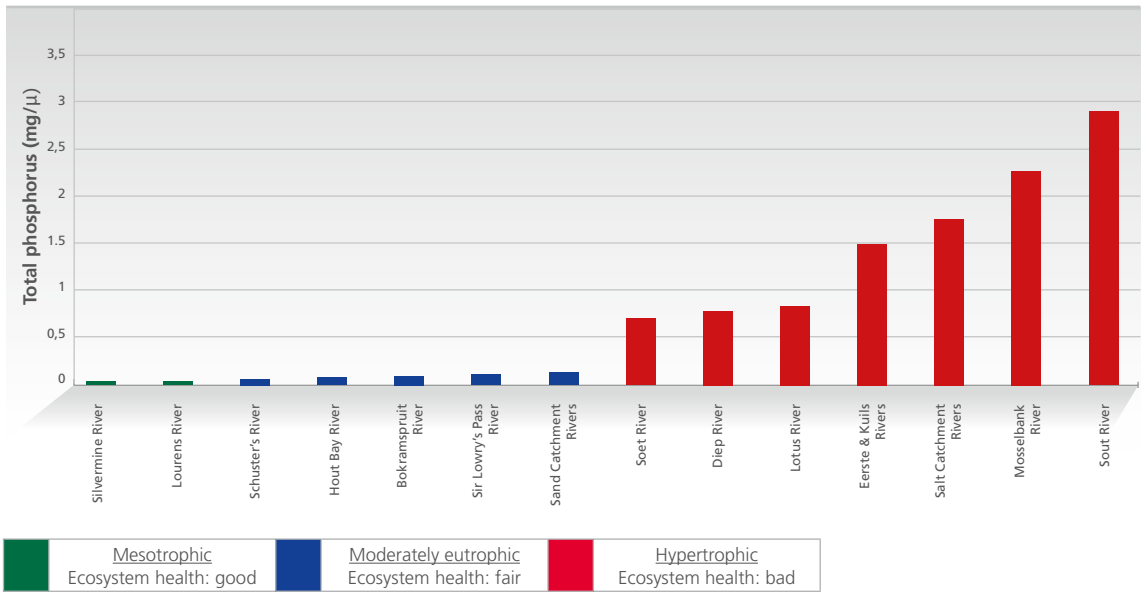


Figure 11 - Phosphorus in rivers

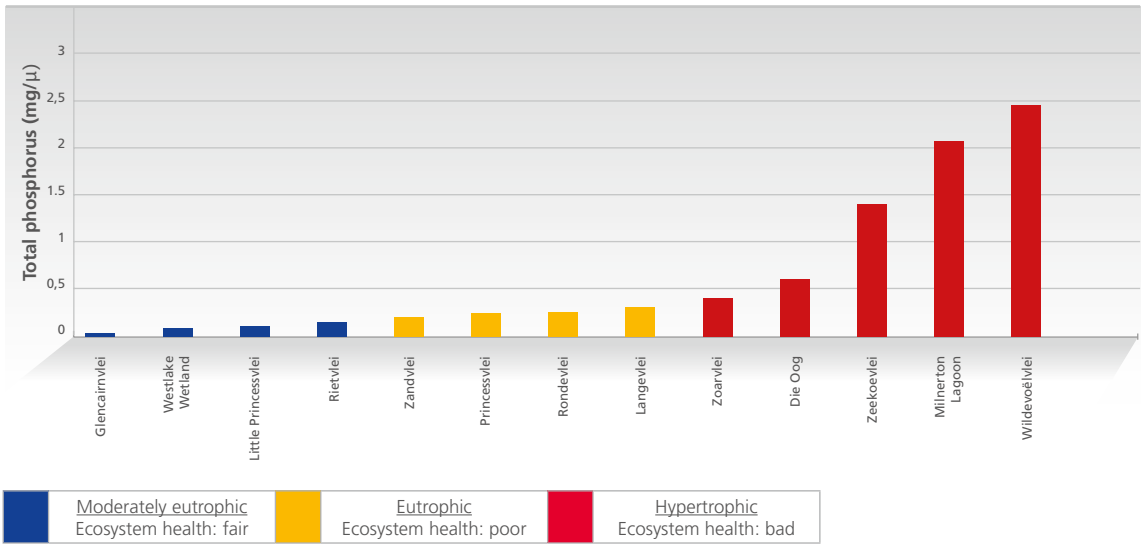


Figure 12 - **Phosphorus in vleis**

DWAF public health guidelines

When measured in 2007/8, compliance with the DWAF intermediate contact recreational guideline had generally declined slightly since 2006/7, indicating increased levels of *E. coli* pollution in Cape Town's freshwater systems. It is important to note that nine out of 13 vleis (or 69%), and 10 out of 14 rivers (71%) showed compliance levels of less than 80% for both 2006/7 and 2007/8 (see Figures 13 and 14), indicating that pollution in these systems is a long-term and serious problem.

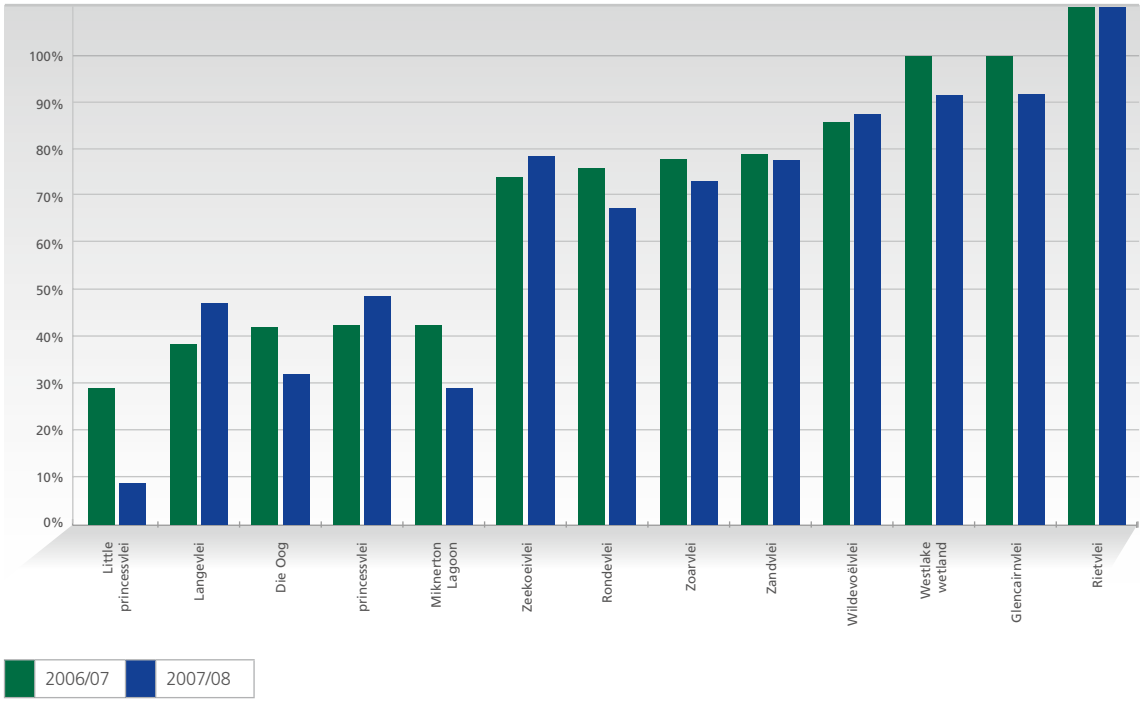
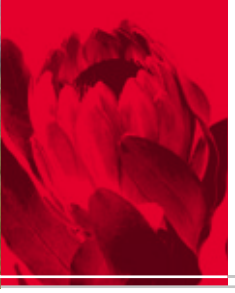


Figure 13 - **Percentage compliance with DWAF intermediate contact recreational guideline - vleis**



FRESHWATER QUALITY

Analysis

The poor quality of virtually all of Cape Town's freshwater systems is a serious concern. Rivers and vleis are important recreational areas, as well as critical habitats for aquatic vertebrates, invertebrates and birds.

As discussed previously (see 'Wastewater'), the primary sources of contamination of Cape Town's freshwater systems are poorly treated wastewater effluent, contaminated urban stormwater, raw sewage from informal settlements, and leaking sewers and pump stations. Rapid urbanisation without simultaneous infrastructure expansion is another major cause. In order to resolve these long-standing issues, the City needs to prioritise the upgrade and expansion of WWTWs, the provision of effective sewerage infrastructure in informal areas, as well as the repair and replacement of ageing sewer systems.

Furthermore, serious consideration needs to be given to the rehabilitation of Cape Town's rivers and wetlands, where feasible, in order to promote a return to functional aquatic ecosystems. This might include the rehabilitation of canalised rivers to ensure a diversity of in-stream habitats and a suitable canal shape (as the steep sides of a canal are inhospitable to plant growth), and the restoration of indigenous riparian and aquatic vegetation. Maintenance of buffer areas adjacent to freshwater systems is also important, as these protect the receiving environment from polluted runoff, and could provide valuable habitat as well as recreational space.

Another key initiative, which also forms a new focus area of the City's Catchment, Stormwater and River Management Branch, involves the implementation of environmentally sensitive urban stormwater management through the promotion of sustainable urban drainage systems (SUDS). This requires widespread support and commitment by many role players in both government and civil society in order to achieve real improvements in the state of receiving aquatic environments in the long term.

POLICY AND STRATEGY LINKAGES

IDP: Corporate objective 2B: Conservation of natural resources

IMEP Goal 2: A commitment to ensuring that the quality of coastal, marine and inland waters of Cape Town is suitable for the maintenance of biodiversity, and the protection of human health

MDG Goal 7: Target 9 – Integrate the principles of sustainable development with country policies and programmes, and reverse the loss of environmental resources.

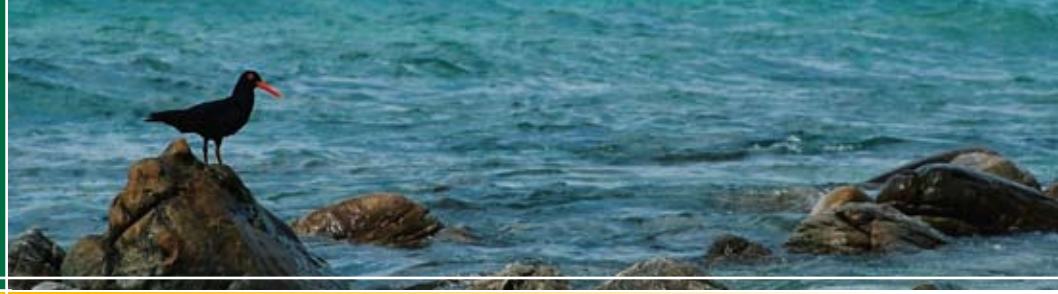
Urban Environmental Accord: Action 20: Protect the ecological integrity of the city's primary drinking water sources (i.e. aquifers, rivers, lakes, wetlands and associated ecosystems).

Catchment, Stormwater and River Management Strategy: Aims to safeguard human health, protect natural aquatic environments, and improve recreational water quality.

Catchment, Stormwater and River Management Draft Policies, including a Floodplain Management Policy and a Policy to Minimise the Impact of Stormwater from Urban Development on Receiving Waters

ALSO SEE

Coastal water quality (Page 36)
Wastewater (Page 26)
Water use (Page 43)



COASTAL WATER QUALITY

(Atlantic Coast) (False Bay Coast)

Indicators

Number of instances when water quality guidelines are exceeded (False Bay and Atlantic coasts)

Percentage compliance with water quality guidelines (trend)

Cape Town is bounded by approximately 308 km of coastline – a considerable asset in terms of both tourism and recreation, and the natural environment. Cape Town's beaches are a significant driver of tourism, and provide all citizens with the opportunity to spend their leisure time in an accessible yet natural environment.

Measurement and monitoring of coastal water quality is therefore extremely important, as it is necessary to protect the public from possible pollution of the coastal environment. Beaches are therefore monitored throughout the year in order to ensure that public health guidelines are met.

Guidelines

Coastal water quality is measured fortnightly on both the Atlantic and False Bay coasts, and assessed according to the South African Water Quality Guidelines for Coastal Marine Waters (Volume 2: Recreational Use). This guideline includes a dual target for faecal coliform counts. However, in order for a beach to comply, it must meet both targets indicated below.

80th percentile standard: 80% of samples must contain no more than 100 faecal coliform bacteria per 100 ml

AND

95th percentile standard: 95% of samples must contain no more than 2 000 faecal coliform bacteria per 100 ml

The City is a participant in the Blue Flag programme, which provides an internationally recognised 'eco-label' to beaches around the world. Blue Flag beach status is awarded based on compliance with 29 criteria covering all aspects from environmental education and information, and water quality, to environmental management, safety and services. All Blue Flag beaches must have an Environmental Management Plan in place, and are required to meet the standards for water quality.

Blue Flag beaches are evaluated based on water quality measurements taken only over the six-month summer season (November to April). In 2007/8, three beaches in the City area were awarded Blue Flag status, namely Clifton Fourth Beach, Mnandi Beach and Bikini Beach.

Sources of pollution

The primary source of bacterial pollution in coastal waters is the release of stormwater containing a variety of urban pollutants as well as treated sewage effluent into the marine environment. This could happen for a number of reasons. Often stormwater originating in partially serviced or unserviced informal settlements contains untreated sewage as a result of residents emptying toilet buckets into the open environment or the stormwater system. Stormwater may also often contain a significant amount of pet waste, which has been improperly disposed of and washes into the system during heavy rains. Treated sewage effluent is another significant contributor to poor coastal water quality in Cape Town.

It is very important to note that coastal water quality may deteriorate significantly in winter due to pollution that is washed off urban areas during heavy rainfall. Figures 14 and 15 however show an average for the entire 12-month winter and summer cycle.

Effects of pollution

Pollution of the coastal zone with contaminated water could have a detrimental effect on the health of both humans and marine ecosystems. DWAF has set guidelines in order to safeguard human health, as contact with *E. coli* and other pathogenic organisms present in the water could lead to the development of gastrointestinal illnesses and skin and eye conditions. Additionally, such water is likely to be higher in a range of other potentially harmful pollutants, which could upset the delicate balance of coastal ecosystems.

COASTAL WATER QUALITY

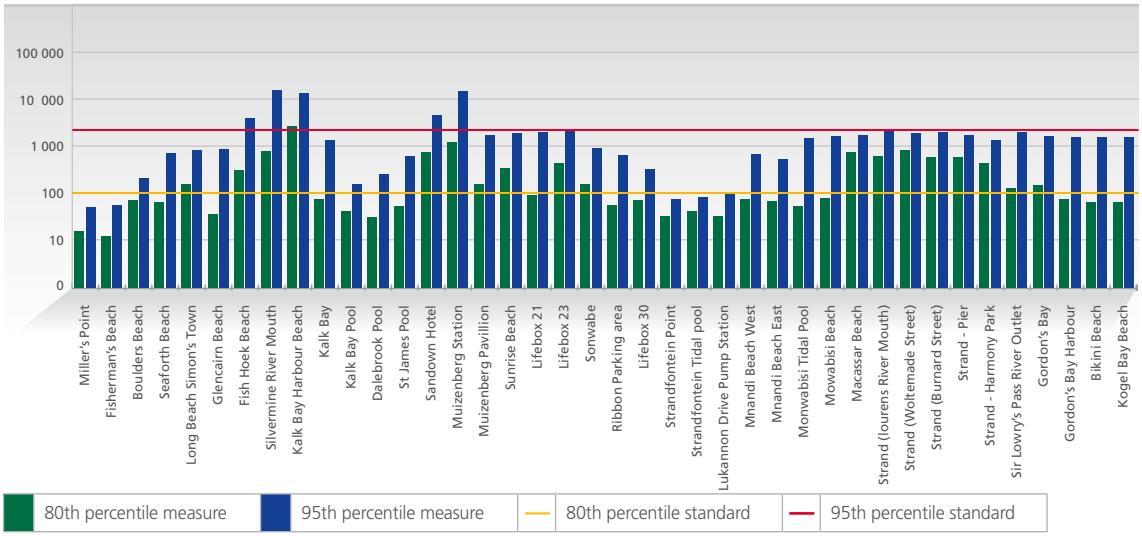


Figure 14 - **Compliance with DWAF guidelines, False Bay coast**

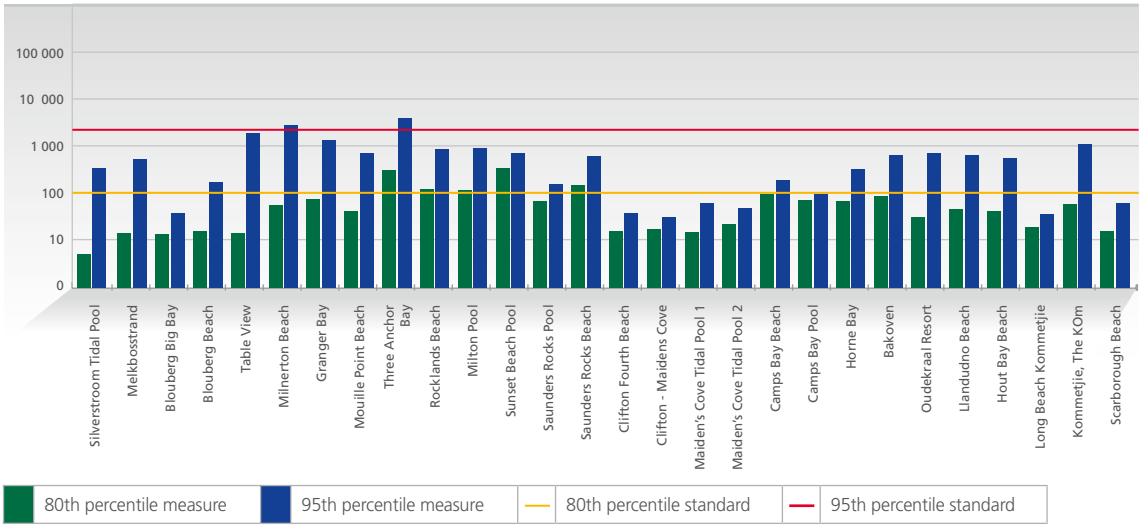


Figure 15 - **Compliance with DWAF guidelines, Atlantic coast**

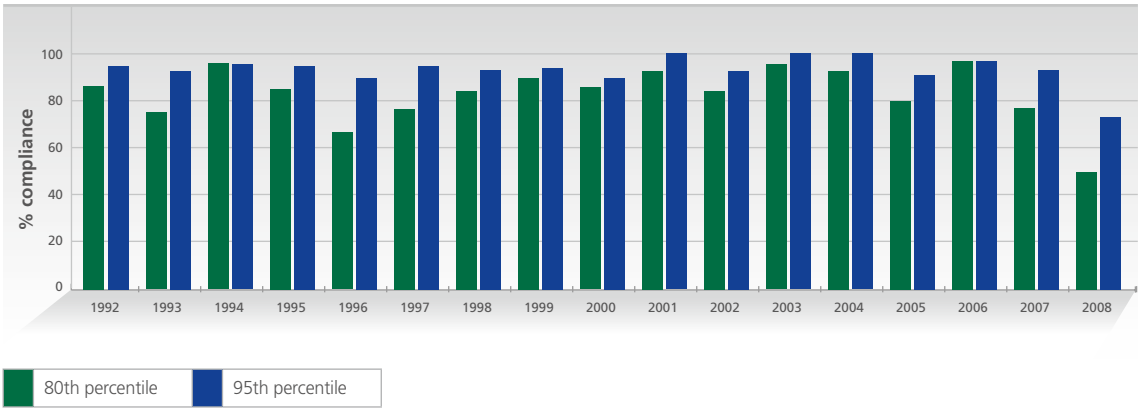


Figure 16 - False Bay coast - percentage compliance with the recreational water quality guideline

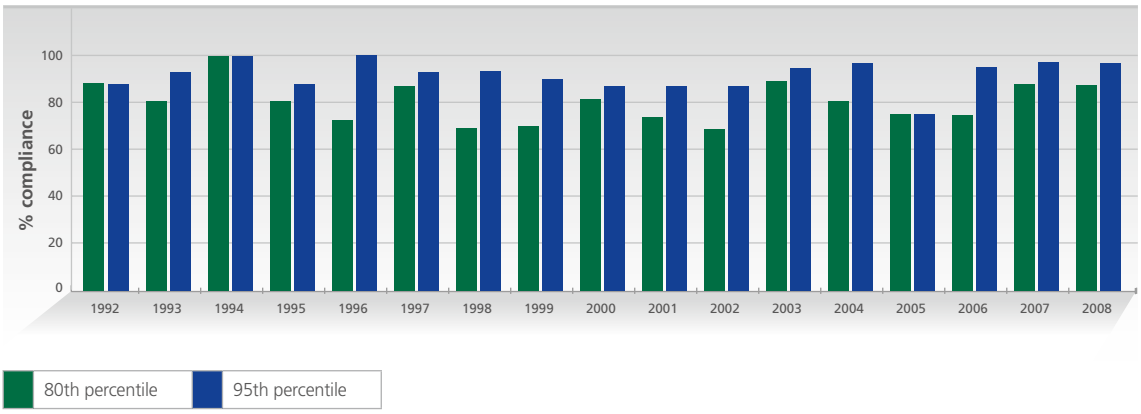


Figure 17 - Atlantic coast - percentage compliance with the recreational water quality guideline

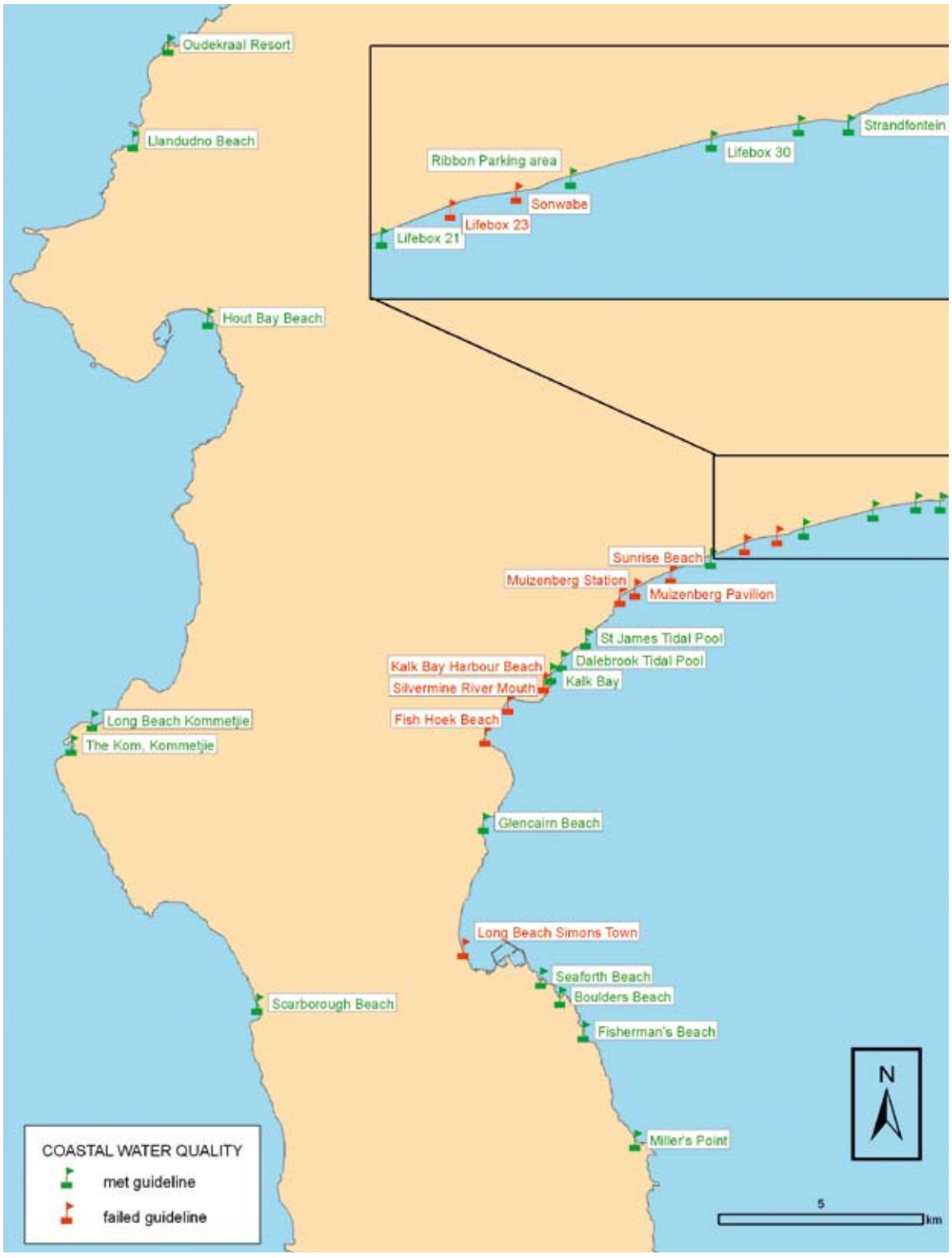
State of the environment

As is evident from Figure 16 and 17, during the 2007/8 reporting period 18 out of 40 points measured on the False Bay coast failed to comply with guidelines. On the Atlantic coast six out of 28 points measured failed to comply. Over time, the percentage of samples from the Atlantic coast complying with the 80th percentile standard has gradually increased, and currently stands at 89%. This (along with 2007 and 2003) is the highest percentage compliance it has shown since 1994, when 100% compliance was reached. Unfortunately, the percentage compliance in False Bay has dropped dramatically over the past two years. From a high of 98% compliance in 2006, False Bay measured a compliance rate of only 80% in 2007, and a dismal 50% in 2008 – the lowest to date.

Maps 5–7 depict those monitoring points that met the guideline (shown in green), as well as those that failed to comply (shown in red). The maps also show Cape Town's three 2007/8 Blue Flag beaches, all of which met the required guidelines in order to carry this prestigious label.

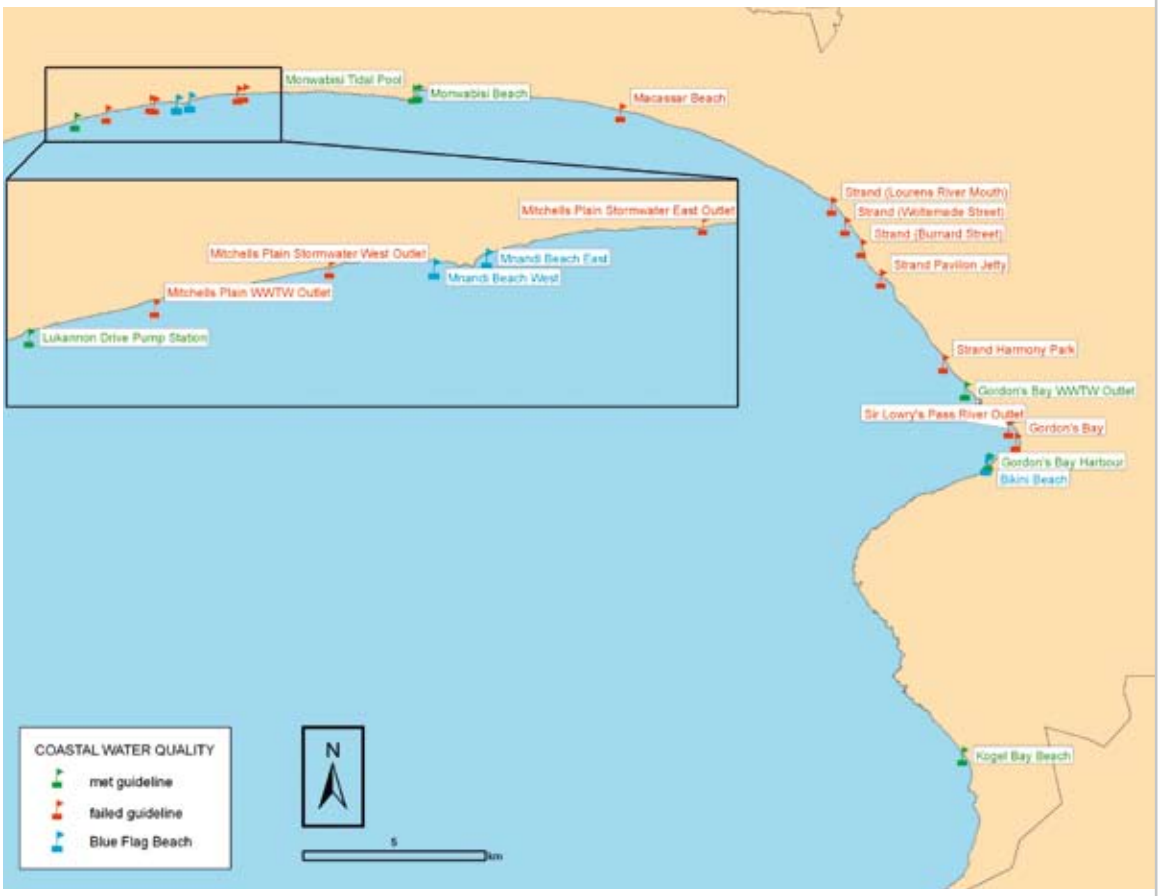
COASTAL WATER QUALITY

MAP 5 - COASTAL WATER QUALITY



MAP 6 - COASTAL WATER QUALITY

COASTAL WATER QUALITY



MAP 7 - COASTAL WATER QUALITY

Analysis

Poor coastal water quality tends to occur in clusters of monitoring points, indicating that pollution is relatively localised. The occurrence of poor water quality concentrations around stormwater and wastewater outlets and river mouths indicates that these are the major sources of coastal pollution, and a result of polluted stormwater and treated wastewater release into Cape Town's freshwater systems.

The reasons for the marked decline in water quality in False Bay are unclear at this time. What is evident, though, is that a significant change or event has taken place in this area. The City's Catchment, Stormwater and River Management, and Scientific Services Branches are currently engaged in research to determine the source of this pollution, so that it can be addressed.

The coastal zone is one of Cape Town's greatest economic assets, as it is an important drawcard for international and local tourists. Additionally, coastal property is highly priced and sought after, further stimulating the local economy. It is of the utmost importance that the City protects this asset by addressing the root causes of poor coastal water quality.

In order to address the state of coastal waters, it is necessary to address the underlying reasons for stormwater contamination, as well as improve the quality of wastewater effluent. This should include measures to address faecal contamination of stormwater, such as the installation of additional sewerage infrastructure in informal areas, and the ongoing upgrade and extension of WWTWs in order to improve the quality of effluent. Private residents also have a part to play by ensuring that litter and pet waste are adequately disposed of, and not allowed to run off into the stormwater system.

POLICY AND STRATEGY LINKAGES

IDP: Corporate objective 2B: Conservation of natural resources

IMEP Goal 2: A commitment to ensuring that the quality of coastal, marine and inland waters of Cape Town is suitable for the maintenance of biodiversity, and the protection of human health

MDG Goal 7: Target 9 – Integrate the principles of sustainable development with country policies and programmes, and reverse the loss of environmental resources.

ALSO SEE

Freshwater quality (Page 31)
Wastewater (Page 26)
Water use (Page 43)

WATER USE

INDICATORS

Water treated and sold annually (billions of litres)

Daily water use per capita (ℓ)

South Africa is a water-scarce country, and Cape Town particularly tends to experience periods of severe water shortages. The region's long, hot and dry summers cause demand for water to be highest when supply is most limited.

Guidelines for water use

The World Health Organisation recommends a per capita minimum of 50 ℓ of water per day for basic cooking, drinking and hygiene requirements. However, it is important to note that this is a basic level of service. The City provides 6 000 ℓ of free water to all households; at an average household size of four people, this works out at 50 ℓ per person per day. The Urban Environmental Accord recommends that cities with a consumption of more than 100 ℓ per capita per day implement measures to reduce consumption by at least 10%.

State of the environment

Since 1995, annual water use (including domestic, commercial and industrial use) has remained at fairly stable levels of between 240 and 290 billion litres per year, rising to a high of 288 billion litres in 1999/2000 (see Figure 18). Water restrictions were first introduced in 2001, and again in 2004, and saw a dramatic decrease in the amount of water used in Cape Town. It is therefore evident that the implementation of water restrictions does have a significant effect on water use levels, and demonstrates residents' willingness to contribute to their city's environmental sustainability.

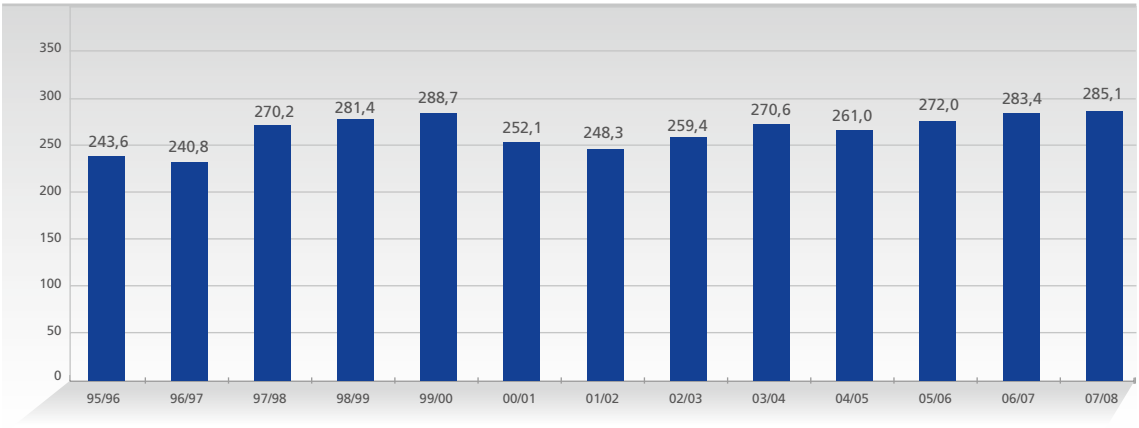


Figure 18 - **Annual water use (billions of litres)**

From Figure 19 it is however clear that water use per capita has dropped, and is at its second lowest level since 1995 at 223 ℓ per day. Therefore, although water use overall has increased, this is likely due to population growth in Cape Town, and not due to increased water use by individuals. This is an encouraging trend, as in order to ensure a future sustainable supply of water to Cape Town, water use needs to remain at relatively low levels.

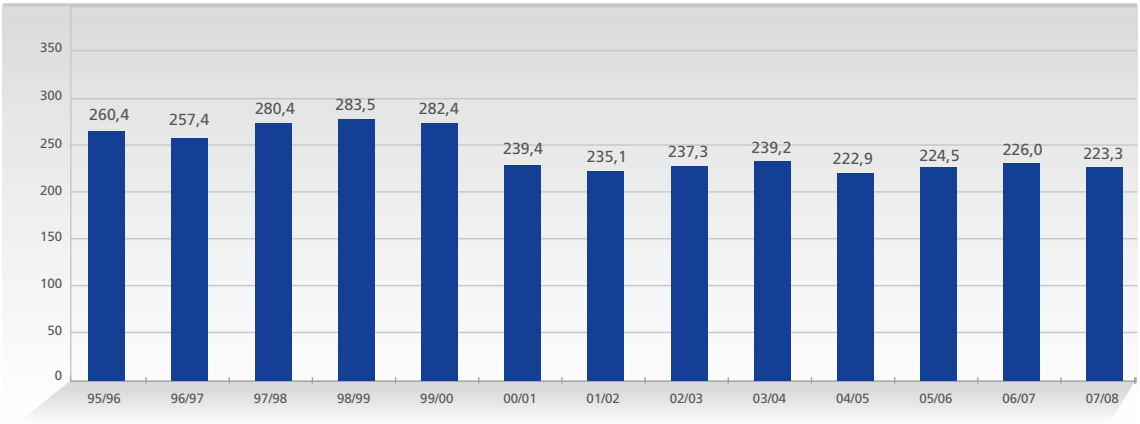


Figure 19 - **Daily water use per capita**

Analysis

It appears that even though water use per capita has decreased, this does not indicate a lack of sufficient water to meet Capetonians' optimum health and sanitation requirements. However, it must be noted that the varying levels of use by different socio-economic groups in the city have not been taken into account.

Whilst some wealthy citizens likely use significantly more than 223 ℓ per day for watering their gardens or topping up swimming pools, many poorer citizens may only just be meeting their basic needs. On average, European countries use approximately 200–300 ℓ per person per day. However, water use in the United States of America (USA) is as high as 575 ℓ per capita daily, whilst Norway, Spain, Mexico, Japan, Italy and Australia all use more than 300 ℓ per capita per day.[14] It is therefore reasonable to assume that water usage amongst the richer sectors of Cape Town's population is substantially more than 300 ℓ per person per day, and may be as high as the USA average.

A recent trend in wealthier areas of Cape Town is the installation of well points and boreholes to provide a non-potable water supply, especially for watering gardens. Whilst this reduces the pressure on dams and the City's treated water supply, it is important that it be monitored in order to ensure that Cape Town's groundwater does not end up depleted.

It is not possible at this stage to map accurately the average water use by district or suburb due to technical limitations. It is hoped that this will be reported on in the future in order to provide a more detailed analysis of discrepancies in water use between rich and poor suburbs, and to account for commercial and industrial water use more accurately.

The City has had significant success with its Integrated Water Leaks project, which has been ongoing since 2005. The goal of this project is to reduce plumbing leaks in households, especially poorer communities, thus reducing the amount of water wasted, and cutting down on water bills for those affected. During this project, local community members are trained in basic plumbing, and taught how to identify and repair leaks. These trainees are then able to offer their services to the community, who have been educated about the importance of repairing leaks.

Water demand management strategies have been extremely successful to date, and these interventions must continue into the future. The reduction of water use in Cape Town proves that citizens are willing and able to make changes when so required due to environmental constraints, and this success therefore could and needs to be extended to other aspects of resource conservation across the city.

WATER USE

POLICY AND STRATEGY LINKAGES

IDP: Corporate objective 2B: Conservation of natural resources

IMEP Goal 2: – A commitment to the principle that all Cape Town inhabitants have the right to clean, potable and adequate water sources

MDG Goal 7: Target 9 – Integrate the principles of sustainable development with country policies and programmes, and reverse the loss of environmental resources.

Urban Environmental Accord: Action 19: Develop policies to increase adequate access to safe drinking water, aiming at access for all by 2015. For cities with potable water consumption greater than 100 ℓ per capita per day, adopt and implement policies to reduce consumption by 10% by 2015.

ALSO SEE

Coastal water quality (Page 36)
Freshwater quality (Page 31)
Wastewater (Page 27)

SOLID WASTE

INDICATORS

Waste disposed of annually and per capita

Landfill lifespan remaining

Solid waste consists of the waste products generated by households, businesses and industry, and includes general waste, builder's rubble and hazardous waste. Much of the solid waste that is currently disposed of in Cape Town could be recycled.

Impacts of waste disposal

Many aspects of life in a modern city are extremely wasteful – every day, Capetonians throw away tons of paper, plastic, glass, metal and food. It has been estimated that up to 60% of household solid waste generated in South Africa is organic, consisting largely of food scraps and food waste.

The impact of waste disposal is two-fold. Firstly, waste disposal in landfills requires that large pockets of land be dedicated to this single land use. Currently, Cape Town's active landfills cover almost 300 ha of land. Landfill sites can eventually be rehabilitated and used for limited human activities or nature conservation purposes; however, this is a lengthy and expensive process. Secondly, disposing of waste in landfills removes a considerable quantity of useful products from circulation. Large amounts of plastic, metal, glass and paper are landfilled each year; many of these products could be recycled, thereby reducing the need for the further consumption of raw materials needed to create new products. The manufacturing of plastic is especially dependent on the availability of petrochemicals, which is a rapidly dwindling resource.

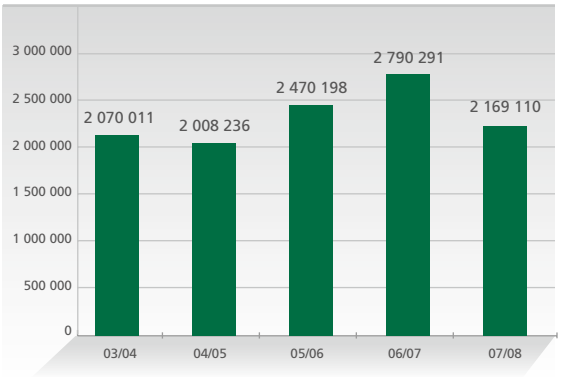


Figure 20 - Waste disposed of annually (t)

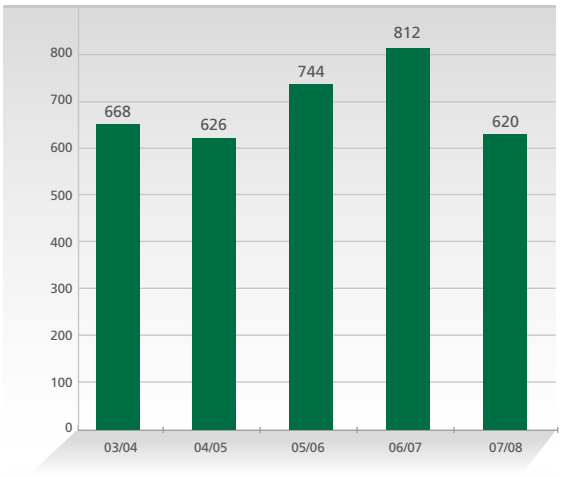


Figure 21 - Waste disposed of per capita annually (kg)

SOLID WASTE

State of the environment

NB: It has come to light that data from 2006/7 may be inaccurate, as some double-counting may have occurred. Readers should therefore treat data from 2006/7 with caution.

Figures 20 and 21 show a dramatic drop in the levels of waste disposed of in 2007/8, with 2,1 million tonnes, or approximately 620 kg per person, being disposed of during the year. In terms of per capita waste disposal, this is the lowest amount recorded since co-ordinated monitoring began in 2003/4.

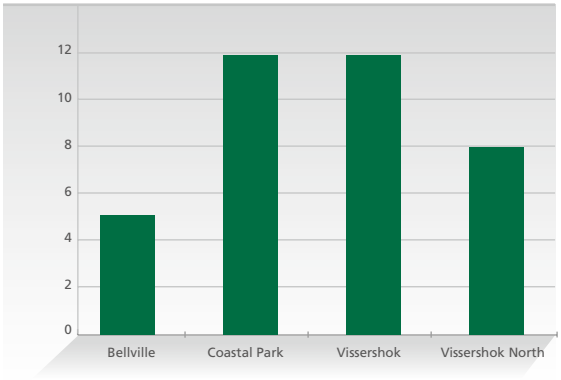


Figure 22 - **Landfills - projected lifespan (years)**

In general, the lifespan of existing landfills in Cape Town is low – the longest being only twelve years (see Figure 22). It is important to note that these projected lifespans are not cumulative (i.e. they cannot be added together) and that the projections do not take into account the knock-on effect of landfill closures. In the past few years, three of the City's landfills had to be closed. Whilst twelve years may seem like a long time, in terms of city planning it is a comparatively short timeframe in which to implement additional measures.

Analysis

It is unclear at this time what has caused the drop in waste disposal, and whether this will be sustained; however, a few reasons can be postulated. Firstly, rising interest rates in 2007, accompanied by global shocks in oil and food prices, have forced many citizens to become more frugal in their habits. This may have caused wastage, especially food wastage, to reduce as people attempt to save money.

Secondly, many large retailers have become aware of the impact of over-packaging of food, and are thus making an effort to reduce packaging material. Also, people are becoming more aware of the need to recycle, partly due to the City's environmental education and communication programmes, and voluntary recycling may therefore account for a portion of the reduction.

Finally, in 2007/8, the City started a pilot project, providing certain areas of Cape Town with a split-bag collection service, with one bag allocated for recyclables, and the other for general waste. This has increased the amount of recyclable material diverted away from landfills.

It is critical that the City investigates and implements methods for further reducing the amount of waste to landfill in order to both extend the projected lifespan of existing sites, and delay the need for construction of additional sites. The most important intervention that the City could implement is the extension of split-bag waste collection to the entire city, although this will no doubt be a slow process. Additionally, the City needs to investigate the possibility of large-scale composting of household food waste. This would produce significant amounts of compost, which the City could then effectively utilise for, for example, vegetation maintenance in parks and public spaces, or the establishment of more widespread urban agriculture.

POLICY LINKAGES

IDP: Corporate objective 2B: Conservation of natural resources

IMEP Goal 10: A commitment to the need for an integrated waste management strategy that addresses both the production and disposal of solid and liquid wastes, as well as the safe collection, transport and disposal thereof, and the reduction of illegal dumping

MDG Goal 7: Target 9 – Integrate the principles of sustainable development with country policies and programmes, and reverse the loss of environmental resources.

Urban Environmental Accord: Action 4 – Establish a policy to achieve zero waste to landfills and incinerators by 2040.

Urban Environmental Accord: Action 6 – Implement 'user-friendly' recycling and composting programmes, with the goal of reducing per capita solid waste disposal to landfill and incineration by 20% in seven years.

Waste Minimisation Policy: The City's Integrated Waste Management Policy fully supports the conservation of resources, and is linked to the waste hierarchy as described in the National Waste Management Strategy. The aim of the policy is to minimise waste to landfill by avoiding and reducing waste generation, and reusing and recycling waste, while incorporating landfill as a final option.

ALSO SEE
Urban sprawl (Page 49)

URBAN SPRAWL ?

Indicators
Number and type of residential building plans approved

Urban sprawl can be loosely defined as the tendency for cities to spread outwards instead of upwards, growing in size but not in density. Cape Town is a good example of a low-density city – most of its residents live in single residential dwellings on separate stands. In wealthier suburbs, large gardens are common, and even low-cost housing is generally built along the principle of one plot, one dwelling.

It is difficult to measure the rate of urban sprawl; however, one measure that provides a good idea is the number and type of building plans approved. The more low-density building types a city contains, the more urban sprawl there tends to be.

The problem with urban sprawl

Urban sprawl is problematic for two reasons. Firstly, sprawl of residential and commercial areas into existing natural areas leads to a loss of land for biodiversity conservation and agriculture. Secondly, sprawl is highly resource inefficient, as it increases the cost of services, such as electricity, water and waste removal, which must be supplied to increasingly outlying and peripheral areas, whilst it also significantly increases travel costs for residents as well as emissions from their vehicles. Adding to this problem is the fact that it is often the poorest members of society who are forced to locate on the periphery, thus placing an unfair travel cost burden on them. Increasing the density of urban settlements, especially around business and shopping hubs, will begin to address this problem.

State of the environment

The data (Figure 23 and 24) show that, in general, the number of residential building plans approved fell in 2007/8, although the largest drop was in the number of full-sized, detached residential dwellings. What is more important to note though, is that although the number of approvals for blocks of flats dropped, the area to be occupied by such structures grew significantly in 2007/8. This indicates that although there were fewer blocks, there are probably considerably more units per block.

Seen in conjunction, these results could indicate a shift to higher-density living. While it is too early at this stage to determine if this trend will be sustained, it is an encouraging sign.

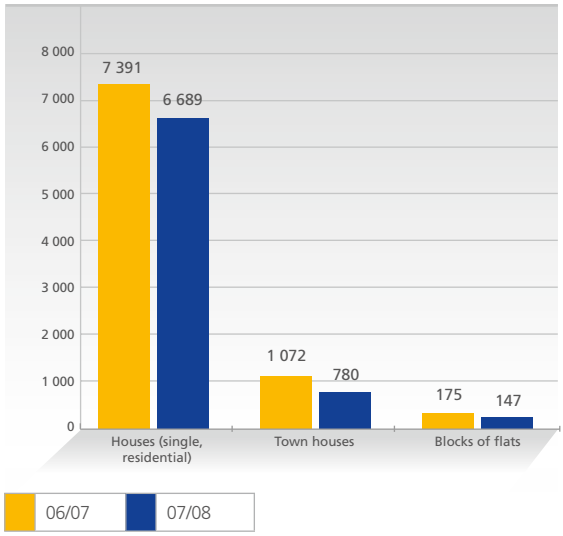


Figure 23 - Number of residential building plans approved

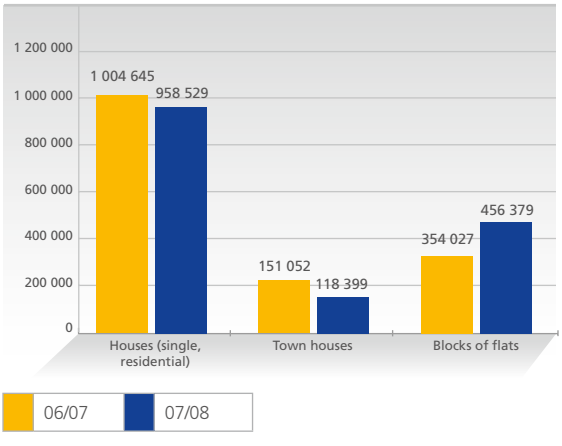


Figure 24 - Area of residential building plans approved (m^2)

Analysis

It is unclear whether the trend towards higher-density living will be sustained into the future. However, rising property prices in conjunction with high interest rates suggest that Cape Town may start to see a greater shift towards the development of apartments and town houses as opposed to single residential, detached dwellings.

Urban sprawl is not only resource inefficient and destructive in terms of biodiversity; it is a driver of social inequality, and places an unfair travel burden on those least able to afford it.

In order to reduce the problems associated with urban sprawl, the City needs to focus on increasing residential density. The development of nodes, and the densification of existing urban centres are key strategies that are being explored by the City as part of its City Development Strategy. Nodal development is aimed at concentrating residential growth around new or existing business and shopping areas, transport interchanges and community facilities. This will reduce travel times, and increase people's ability to access services.

POLICY LINKAGES

IDP: Corporate objective 2B: Conservation of natural resources

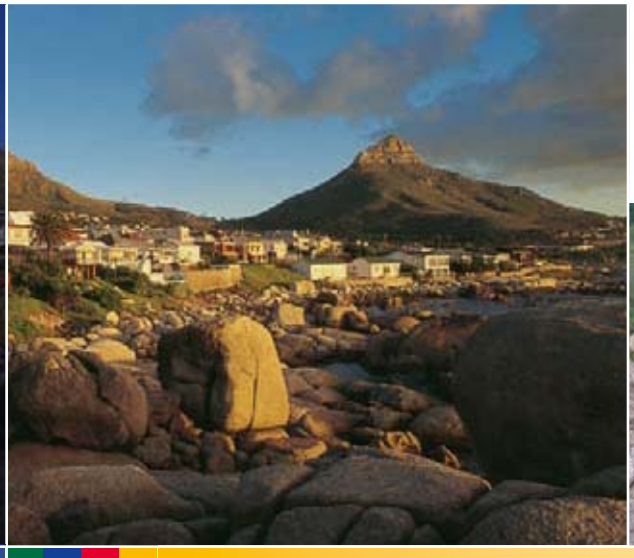
IMEP Goal 7: The recognition that the supply and delivery of infrastructure can both improve our living conditions, and cause environmental impacts

MDG Goal 7: Target 9 – Integrate the principles of sustainable development with country policies and programmes, and reverse the loss of environmental resources.

Urban Environmental Accord: Action 8: Adopt urban planning principles and practices that advance higher-density, mixed-use, walkable, bikeable and disabled-accessible neighbourhoods, which co-ordinate land use and transportation with open space systems for recreation and ecological restoration.

ALSO SEE

Biodiversity (Page 15)
Wastewater (Page 26)
Solid waste (Page 46)



ACCESS TO NATURE

Indicators
Residential proximity to nature reserves

Accessibility of managed natural green space and nature reserves is a key measure of a healthy city. However, this is often neglected due to rapid urbanisation. Internationally, city planners have recognised this, and as a result, English Nature (a UK conservation body) has established guidelines for the provision of natural green space. Currently, there are no South African guidelines for the provision of nature reserves as part of open space standards; however, research into determining standards is currently under way. Additionally, research is under way to determine accessibility standards for smaller local parks, and it is hoped that these standards will be available for the 2008/9 State of the Environment Report.

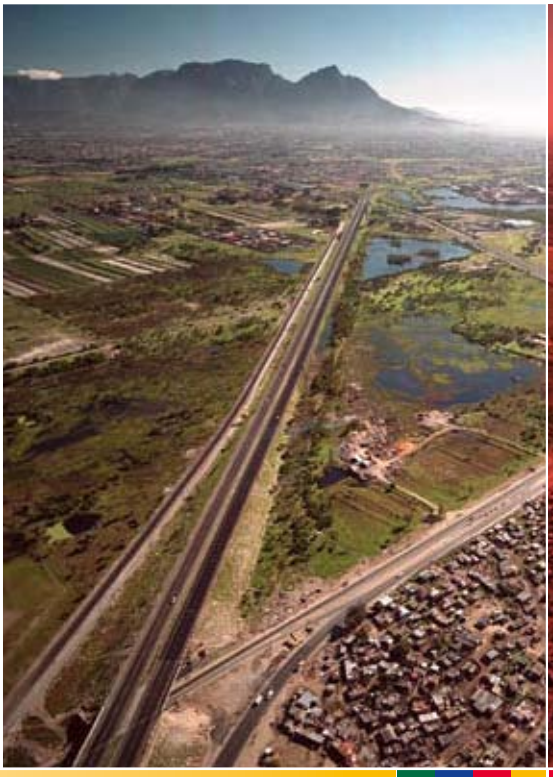
The applicable guidelines are as follows:[15]

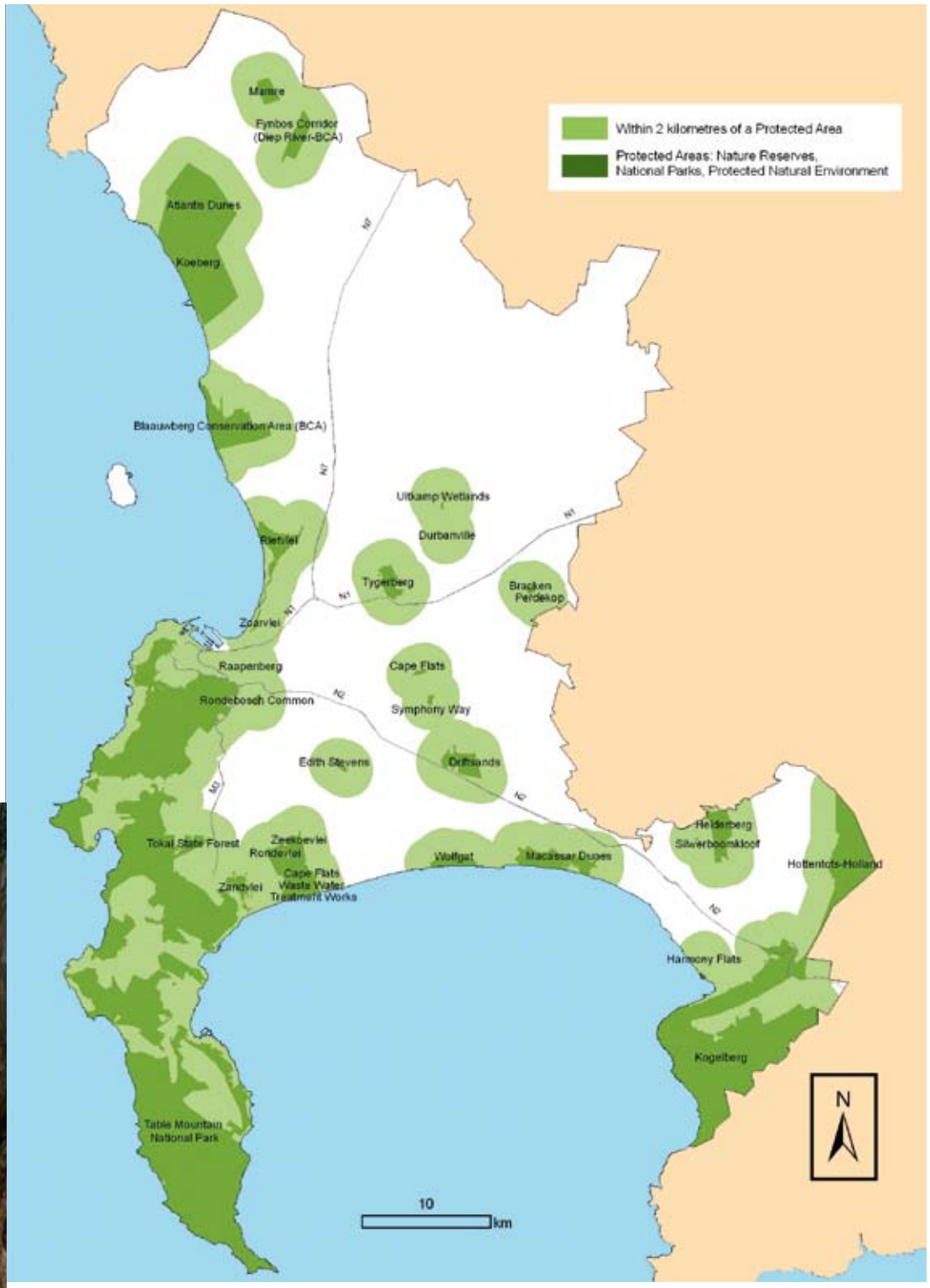
1. Statutory local nature reserves at a minimum level of 1 ha per 1 000 population
2. At least one accessible 20 ha site within 2 km of home, one accessible 100 ha site within 5 km of home, and one accessible 500 ha site within 10 km of home

State of the environment

Currently, English Nature recommends a minimum of 1 ha of land under formal conservation per 1 000 population. Cape Town has over 43 980 ha of land under formal conservation, including the Table Mountain National Park. This works out at approximately 12,5 ha per 1 000 population – well above the recommended standard.

However, accessibility remains the key challenge. Many of Cape Town's natural areas are internationally renowned tourist destinations, but are inaccessible to the greater portion of the population due to the distance people are required to travel to reach these areas. Map 8 shows those areas of Cape Town (marked in green) within 2 km of a nature reserve over 20 ha in size.





MAP 8 - PROXIMITY TO NATURE RESERVES

ACCESS TO NATURE

Analysis

It is clear from Map 8 that people in many parts of Cape Town have no access to a nature reserve within a radius of 2 km, thus making it more difficult for them to access good quality natural open space. Additionally, the poorer areas of Cape Town seem to be those with the least direct access to nature reserves, and therefore also the least ability to travel long distances in order to access good quality natural green spaces in which to relax and enjoy recreational activities.

While on the face of it this may seem a solely environmental issue, it is in fact a critical social issue. The provision of good quality natural environments promotes health and well-being by encouraging residents to exercise, and has the potential to reduce stress among adults by providing a natural space in which to relax. It has also shown to improve mental well-being, and increase feelings of health,[16] especially among those of a lower socio-economic status. Additionally, it is important for children's development to have access to natural areas in which to play freely, and not be limited to organised sports activities or playgrounds.

The use of open space standards in city planning is a best practice that has been implemented in Cape Town. The City must however make an increased effort to incorporate the provision of natural green space and nature reserves into city planning. This is a particularly important part of any densification strategy in order to avoid a sterile urban landscape.

POLICY LINKAGES

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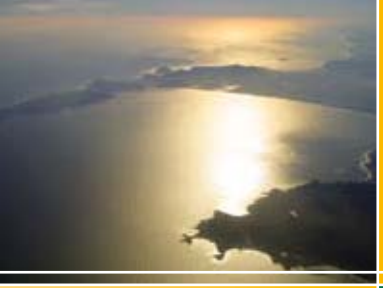


SUMMARY OF RESULTS

The 2007/8 State of the Environment Report has identified a number of key indicator trends, providing an insight into the state of Cape Town's natural environment. The following summary provides an overview of the report.

Indicators that show improvement are:

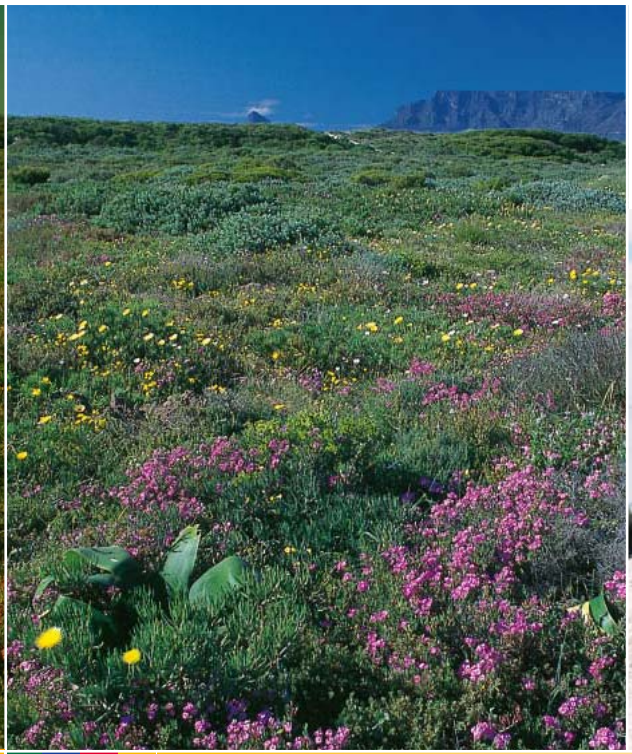
- Air quality;
- Coastal water quality (Atlantic coast);
- Water use; and
- Solid waste.

Indicators that show decline are:

- Carbon dioxide footprint;
- Biodiversity;
- Freshwater quality;
- Coastal water quality (False Bay coast);
- Wastewater quality; and
- Access to nature.

Indicators for which there are insufficient data to show trends are:

- Invasive alien species; and
- Urban sprawl.



CONCLUSION

The overall picture of Cape Town presented in this report is less than favourable. The city's natural environment underpins its economy by attracting tourists, and encouraging businesses to locate in Cape Town. However, the statistics reveal that Cape Town is facing increasing environmental challenges, and is not yet able to address them adequately, thus effectively undermining the foundation on which the city's economy is built.

Paramount among these challenges is the pollution of both Cape Town's freshwater and coastal ecosystems, largely as a result of unsatisfactorily treated wastewater and polluted urban stormwater runoff. This in itself is symptomatic of a larger problem – the rapid expansion of the urban environment without an associated expansion of critical city infrastructure, and the lack of access to critical sanitation services due to widespread poverty. It is clear from the statistics provided that the situation has become untenable, and that rapid action is required in order to prevent further deterioration of water quality. Although the City has allocated a significant portion of its capital budget to the expansion of wastewater treatment infrastructure, the time has come to start investing in alternative sustainable technologies, especially where costs must be kept to a minimum.

Biodiversity in Cape Town is also in a poor state, with over 60% of the extent of the city's original vegetation having been lost due to human activities, and 30% of the remaining vegetation considered as endangered or critically endangered. Cape Town is home to globally unique and important biodiversity that is found nowhere else in the country or the world, and therefore it is vital that the City acts now to limit the ongoing destruction of natural areas, and conserve biodiversity for both the good of Cape Town, and the benefit of future generations. Infestation by invasive alien species is another critical threat to both Cape Town's biodiversity and water resources, and must be acted upon as a matter of urgency.

It is important to note that two of the areas in which the biggest improvements have been observed – water use and solid waste disposal – are largely determined by the actions of individuals who make an effort to use less water, create less waste, and recycle more. It is the citizens of Cape Town that must be commended for striving to achieve sustainability in their lives, and choosing to limit their impact on Cape Town's resources. This is no small achievement; it is only with the co-operation of Capetonians, and a commitment to reducing environmental impacts, that the City can achieve a more environmentally sustainable future. It is therefore vital to incorporate the lessons learned in these two areas, and apply them where appropriate, especially in terms of pollution reduction.

The City is committed to creating a better, more environmentally sustainable city through the application of its IDP and IMEP, and its commitment to the implementation of the UN MDGs and Urban Environmental Accords. As these policies and goals have a medium to long-term view, it is important to acknowledge that many changes may take some time to manifest themselves. However, the City is confident that despite the challenges that will have to be met, the ultimate goal of creating a more environmentally sustainable city is an achievable one.

APPENDIX A

Full list of data sources

Indicator	Sources	Organisation
Air quality (all)	Sally Benson	City: Scientific Services
CO_2 emissions	Sustainability Report 2006	City: Environmental Resource Management
	State of Energy Report 2007	City: Environmental Resource Management
Biodiversity	Patricia Holmes	City: Environmental Resource Management
	City of Cape Town Nature Reserves booklet	City: Environmental Resource Management
Coastal water quality	Candice Haskins	City: Catchment, Rivers and Stormwater Management
Freshwater quality	Candice Haskins	City: Catchment, Rivers and Stormwater Management
Wastewater	Peter King	City: Water and Sanitation
Solid waste	Peter Novella and Deon Rhode	City: Solid Waste Management
Alien invasive species	Louise Stafford	City: Environmental Resource Management
	City of Cape Town Invasive Species Playing Cards	City: Environmental Resource Management
Water use	Masande Goniwe	City: Water and Sanitation
Urban sprawl	Marius Crous	City: Planning and Building Development Management

APPENDIX

APPENDIX B

Goals of the City's IDP 2007/8–2011/12

See website: www.capetown.gov.za/IDP

OUR VISION

The political leadership elected for Cape Town in March 2006 envisages:

- a prosperous city, in which city government creates an enabling environment for shared growth and economic development;
- a City known for its effective and equitable service delivery; and
- a City that distinguishes itself as a well-governed and efficiently run administration.

In order to achieve this vision, the City must:

- contribute actively to the development of its environmental, human and social capital;
- offer high quality services to all who live in it, do business in it or visit it as tourists or holiday makers; and
- be known for its efficiency, effectiveness and clean and caring government.

OUR IDP GOALS:

Strategic focus area 1: Shared economic growth and development

Corporate objectives:

1A Creating an enabling environment for the economy to grow and become globally competitive

1B Preparations for hosting the FIFA 2010 World Cup in Cape Town in accordance with FIFA's requirements, and the City's developmental objectives

Strategic focus area 2: Sustainable urban infrastructure and services

Corporate objectives:

2A Universal access to basic services

2B Conservation of natural resources

2C Effective management of the City's infrastructure and resources

Strategic Focus Area 3: Energy Efficiency for a Sustainable Future

Corporate objectives:

3A Climate Change Adaptation and Energy Efficiency for a Sustainable Future

Strategic focus area 4: Public transport systems

Corporate objectives:

4A Improve public transport system and services

Strategic focus area 5: Integrated human settlements

Corporate objectives:

5A Improve and develop integrated human settlements

5B Delivery of housing opportunities

5C Provision of equitable community facilities and services across the city

Strategic focus area 6: Safety and security

Corporate objectives:

6A Foster a safe and secure environment

Strategic focus area 7: Health, social and community development

Corporate objectives:

7A Facilitating the development of a healthy and socially inclusive society

Strategic focus area 8: Good governance and regulatory reform

Corporate objectives:

8A Ensuring enhanced service delivery, with efficient institutional arrangements

8B Management of key financial areas, such as income control, cash flow, indigent support, alternative income opportunities, asset management and risk management

8C Establishing effective community engagement channels

APPENDIX C

Goals of the Cape Town IMEP

Goal	Description
1. Air	A commitment to reducing the incidence of all forms of air pollution, and the potential environmental health risks associated with air pollution
2. Water resources	A commitment to ensuring that the quality of coastal, marine and inland waters of Cape Town is suitable for the maintenance of biodiversity, and the protection of human health, and a commitment to the principle that all Cape Town inhabitants have the right to clean, potable and adequate water sources
3. Landforms & soils	A commitment that recognises that the conservation and enhancement of landforms and soils in Cape Town is essential
4. Fauna & flora	A commitment to the conservation of biodiversity in Cape Town
5. Cultural heritage	A commitment to ensuring that the diverse cultural heritage of Cape Town is preserved, protected and enhanced
6. Urbanisation & housing	A commitment to recognising that shelter and services are needed for a growing population, while at the same time recognising that environmental features and systems need protection
7. Infrastructure	The recognition that the supply and delivery of infrastructure can both improve our living conditions, and cause environmental impacts
8. Transportation	A commitment to the recognition that transportation is needed for access to facilities and work opportunities, but consumes valuable resources and contributes to environmental degradation
9. Energy	Recognising the importance of energy and its role in development, and the negative effects that energy production may have on the environment; a commitment to sources of energy with the least impact on the environment and health of communities.
10. Waste	A commitment to the need for an integrated waste management strategy that addresses both the production and disposal of solid and liquid wastes, as well as the safe collection, transport and disposal thereof, as well as the reduction of illegal dumping
11. Economy	A commitment to the recognition that the environment of Cape Town is its greatest asset, and that sustainable development requires economic growth, the creation of jobs, and the reduction of currently high levels of poverty in Cape Town
12. Environmental health	A commitment to the Constitution of South Africa, which guarantees the right of all South Africans to an environment which is not detrimental to their health and well-being
13. Environmental education	A commitment to supporting and promoting appropriate environmental education and awareness throughout Cape Town, and within local government structures
14. Safety & security	A commitment to supporting crime prevention and the reduction of crime, recognising that many communities in Cape Town experience an unacceptable incidence of crime
15. Environmental governance	Recognising that effective environmental governance in Cape Town is in the process of being established, and a commitment to this establishment

APPENDIX

APPENDIX D

Goals and targets of the UN Millennium Declaration

See website: www.mdg.un.org

Goal	Goals and targets
Goal 1	**Eradicate extreme poverty and hunger.**
	Halve between 1990 and 2015 the proportion of people whose income is less than $1 a day.
	Halve between 1990 and 2015 the proportion of people who suffer from hunger.
Goal 2	**Achieve universal primary education.**
	Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling.
Goal 3	**Promote gender equality, and empower women.**
	Eliminate gender disparity in primary and secondary education preferably by 2005, and in all levels of education no later than 2015.
Goal 4	**Reduce child mortality.**
	Reduce by two thirds between 1990 and 2015 the under-five mortality rate.
Goal 5	**Improve maternal health.**
	Reduce by three quarters between 1990 and 2015 the maternal mortality ratio.
Goal 6	**Combat HIV/Aids, malaria and other diseases.**
	Have halted by 2015, and begun to reduce the spread of HIV/Aids.
	Have halted by 2015, and begun to reverse the incidence of malaria and other major diseases.
Goal 7	**Ensure environmental sustainability.**
	Integrate the principles of sustainable development with country policies and programmes, and reverse the loss of environmental resources.
	Halve by 2015 the proportion of people with sustainable access to safe drinking water.
	Have achieved by 2020 a significant improvement in the lives of at least 100 million slum dwellers.
Goal 8	**Develop a global partnership for development.**
	Develop further an open, rule-based, predictable, non-discriminatory trading and financial system (includes a commitment to good governance, development and poverty reduction – both nationally and internationally).
	Address the special needs of the least developed countries (includes tariff and quota-free access for exports, enhanced programme of debt relief for and cancellation of official bilateral debt, and more generous official donor assistance (ODA) for countries committed to poverty reduction).
	Address the special needs of landlocked countries and small island developing states (through the Programme of Action for the Sustainable Development of Small Island Developing States and 22nd General Assembly provisions).
	Deal comprehensively with the debt problems of developing countries through national and international measures in order to make debt sustainable in the long term.
	In co-operation with developing countries, develop and implement strategies for decent and productive work for youth.
	In co-operation with pharmaceutical companies, provide access to affordable essential drugs in developing countries.
	In co-operation with the private sector, make available the benefits of new technologies, especially information and communications technologies.

APPENDIX E

Green Cities Declaration

United Nations Environment Programme

Signed by World Mayors on World Environment Day, 5 June 2005, in San Francisco

Vision and implementation

The 21 actions that comprise the Urban Environmental Accords are organised by urban environmental themes. They are proven first steps toward environmental sustainability. However, to achieve long-term sustainability, cities will have to progressively improve performance in all thematic areas.

Implementing the Urban Environmental Accords will require an open, transparent and participatory dialogue between government, community groups, businesses, academic institutions and other key partners. Accords implementation will benefit where decisions are made on the basis of a careful assessment of available alternatives, using the best available science.

The call to action set forth in the Accords will most often result in cost savings as a result of diminished resource consumption, and improvements in the health and general well-being of city residents. Implementation of the Accords can leverage each city's purchasing power to promote and even require responsible environmental, labour and human rights practices from vendors.

Between now and World Environment Day 2012, cities shall work to implement as many of the 21 Actions as possible. The ability of cities to enact local environmental laws and policies differs greatly. However, the success of the Accords will ultimately be judged on the basis of actions taken. Therefore, the Accords can be implemented through programmes and activities, even where cities lack the requisite legislative authority to adopt laws.

The goal is for cities to pick three actions to adopt each year. In order to recognise the progress of cities to implement the Accords, a City Green Star Programme shall be created. At the end of the seven years, a city that has implemented:

19 to 21 actions shall be recognised as a ☆ ☆ ☆ ☆ city

15 to 18 actions shall be recognised as a ☆ ☆ ☆ city

12 to 17 actions shall be recognised as a ☆ ☆ city

8 to 11 actions shall be recognised as a ☆ city

APPENDIX

Green Cities Declaration (CONTINUED)

Urban Environmental Accords

Energy

Action 1: Adopt and implement a policy to increase the use of renewable energy to meet 10% of the city's peak electric load within seven years.

Action 2: Adopt and implement a policy to reduce the city's peak electricity load by 10% within seven years through energy efficiency, shifting the timing of energy demands and conservation measures.

Action 3: Adopt a city-wide greenhouse gas reduction plan that reduces the city's emissions by 25% by 2030, and which includes a system for accounting and auditing greenhouse gas emissions.

Waste reduction

Action 4: Establish a policy to achieve zero waste to landfills and incinerators by 2040.

Action 5: Adopt a city-wide law that reduces the use of a disposable, toxic or non-renewable product category by at least 50% in seven years.

Action 6: Implement 'user-friendly' recycling and composting programmes, with the goal of reducing per capita solid waste disposal to landfill and incineration by 20% in seven years.

Urban design

Action 7: Adopt a policy that mandates a green building rating system standard that applies to all new municipal buildings.

Action 8: Adopt urban planning principles and practices that advance higher-density, mixed-use, walkable, bikeable and disabled-accessible neighbourhoods, which co-ordinate land use and transportation with open space systems for recreation and ecological restoration.

Action 9: Adopt a policy or implement a programme that creates environmentally beneficial jobs in slums and/or low-income neighbourhoods.

Urban nature

Action 10: Ensure that there is an accessible public park or recreational open space within half a kilometre of every city resident by 2015.

Action 11: Conduct an inventory of existing canopy coverage in the city, and then establish a goal based on ecological and community considerations to plant and maintain canopy coverage in no less than 50% of all available sidewalk planting sites.

Action 12: Pass legislation that protects critical habitat corridors and other key habitat characteristics (e.g. water features, food-bearing plants, shelter for wildlife, use of native species, etc.) from unsustainable development.

Green Cities Declaration (CONTINUED)

Transportation

Action 13: Develop and implement a policy that expands affordable public transportation coverage to within half a kilometre of all city residents in ten years.

Action 14: Pass a law or implement a programme that eliminates leaded gasoline (where it is still used), and, phases down sulphur levels in diesel and gasoline fuels, concurrent with using advanced emission controls on all buses, taxis and public fleets to reduce particulate matter and smog-forming emissions from those fleets by 50% in seven years.

Action 15: Implement a policy to reduce the percentage of commuter trips by single-occupancy vehicles by 10% in seven years.

Environmental health

Action 16: Every year, identify one product, chemical or compound that is used within the city that represents the greatest risk to human health, and adopt a law and provide incentives to reduce or eliminate its use by the municipal government.

Action 17: Promote the public health and environmental benefits of supporting locally grown organic foods. Ensure that 20% of all city facilities (including schools) serve locally grown and organic food within seven years.

Action 18: Establish an Air Quality Index (AQI) to measure the level of air pollution, and set the goal of reducing by 10% in seven years the number of days categorised in the AQI range as 'unhealthy' or 'hazardous'.

Water

Action 19: Develop policies to increase adequate access to safe drinking water, aiming at access for all by 2015. For cities with potable water consumption greater than 100 ℓ per capita per day, adopt and implement policies to reduce consumption by 10% by 2015.

Action 20: Protect the ecological integrity of the city's primary drinking water sources (i.e. aquifers, rivers, lakes, wetlands and associated ecosystems).

Action 21: Adopt municipal wastewater management guidelines, and reduce the volume of untreated wastewater discharges by 10% in seven years, through the expanded use of recycled water, and the implementation of a sustainable urban watershed planning process, which includes participants of all affected communities, and is based on sound economic, social and environmental principles.

APPENDIX

END NOTES

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Acknowledgements

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A full list of data sources is included as Appendix A.

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