

MBOMBELA STATE OF ENVIRONMENT 2003

Identification of Key Environmental Indicators



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Mpumalanga Province

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i EXECUTIVE SUMMARY

This report presents the Key Environmental Indicator (KEI) framework of the Mbombela State of Environment study, as prepared by Naidoo, Molobela & Partners, in association with Afridev and Woza Nawe, for the Mbombela Local Municipality.

Chapter 1 provides a background and introduction to the State of Environment study, the concept of indicators and the selection criteria for key environmental indicators. Chapter 2 provides the approach and methodology for KEI selection. Chapter 3 provides an overview of the key issues and the corresponding list of KEIs per reporting theme, while Chapter 4 provides additional information on the interpretation and use of the KEIs. Chapter 5 contains the conclusions and suggests the way forward to complete the Mbombela State of Environment Report.

ii ACRONYMS

AIDS	Acquired Immuno-Deficiency Syndrome
ARC	Agricultural Research Council
CARA	Conservation of Agricultural Resources Act
CMA	Catchment Management Association
CSIR	Council for Scientific and Industrial Research
DACE	Department of Agriculture, Conservation and Environment
DEAT	Department of Environment Affairs and Tourism
DWAF	Department of Water Affairs and Forestry
EIA	Environmental Impact Assessment
GRIP	Greater Nelspruit Rape Intervention Project
HIV	Human Immuno-deficiency Virus
IDP	Integrated Development Plan
KEI	Key Environmental Indicator
KMIA	Kruger Mpumalanga International Airport
KNP	Kruger National Park
LRAD	Land Reform for Agricultural Development
MMC	Manganese Metal Company
MPB	Mpumalanga Parks Board
NEMA	National Environmental Management Act
RDP	Reconstruction and Development programme
SAHRA	South African Heritage Resources Agency
SAPS	South African Police Services
SoER	State of Environment Report
TB	Tuberculosis
TRAC	The Rural Action Committee
TRAC (2)	Trans African Concessions
UNISA	University of South Africa
WfW	Working for Water

1. INTRODUCTION

1.1 Background to the Mbombela State of the Environment Report

A State of the Environment Report (SoER) is an environmental decision-making and reporting system, which provides concise and current information on the environmental state of a specific area or region. The Mbombela Local Municipality appointed Naidoo, Molobela and Partners in association with Africon, Afridev and Woza Nawe as environmental consultants to investigate the state of the environment in Mbombela. The goal of this project is to provide the basis for decision-making by the local authority, major industries, businesses and individuals regarding issues affecting the environment.

The Mbombela State of Environment Report is being undertaken in 3 phases:

Phase 1: The determination of Key environmental Issues and Concerns.

Phase 2: The determination of environmental Indicators associated with these issues.

Phase 3: The determination of the state of the environment in Mbombela using the Driving force–Pressure–State–Impact–Response (DPSIR) Framework.

This report represents the key environmental indicators for Mbombela, Mpumalanga Province, (i.e. Phase 2). The report follows on the recently completed Phase 1, during which the key environmental issues and concerns were determined. The indicators in this report were determined through a review of relevant information and stakeholder workshops held on 7 May and 5 June 2003.

1.2 What is an environmental indicator?

Indicators are part of our daily lives. Examples we regularly use include exam results to indicate a learner's knowledge of a subject and a doctor taking a patient's temperature to indicate whether the patient is ill or not.

Indicators can also be used to indicate the state of the environment to us. Environmental indicators, like any other, need detail and reliable data or statistics.

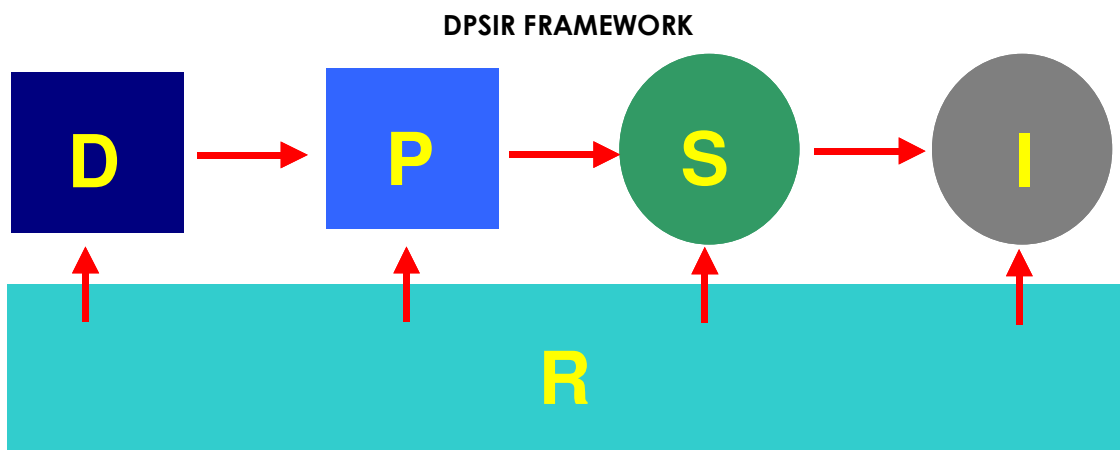
Factors that influence the state are identified and reported on in a State of the Environment report. This includes indicators, which are used to measure the environmental state. An environmental indicator indicates the status of the environment by providing detailed information on a specific environmental attribute. A set of environmental indicators is required to determine or measure the status or state of the environment.

It is imperative that indicators are simple and easy to interpret and understood and accepted by the community. Indicators monitor trends in environmental conditions, the pressures on the environment and causes of environmental change, the impacts of environmental change, and the effectiveness of existing and proposed response mechanisms (DEAT, 2002). In addition, indicators are used to compare situations, assess the effectiveness of policy-making and to measure progress against stated benchmarks (CSIR Environmentek, 2002).

The indicators listed in this report are linked to the issues and concerns identified in Phase 1 of the SoER process, and detailed in the Mbombela SoER Key Environmental Issues and Concerns Report.

1.3 The DPSIR model

The Driving force–Pressure–State–Impact–Response (DPSIR) Framework, used in the National SoER as well as the 2001 Mpumalanga SoER, was introduced and used to establish the key issues in each planning area for the Mbombela SoER. The DPSIR approach uses indicators to describe the pressures, state, impacts and responses on environmental issues. This model will be used to complete the Mbombela SoER, based on the set of indicators determined in this Phase 2 of the SoER process. A summary of the DPSIR framework model is described below.



Description of the components of the DPSIR framework:

(Source: National SOE: www.environment.gov.za)

- D – Driving Forces:** These are the underlying social and economic activities that lead to environmental change. Population growth, poverty, agriculture and industrial production are common examples.
- P – Pressures:** These are pressures on the environment which result from the driving forces, for examples pollution of air, water and soil from industrial production, or depletion of fish stocks through human consumption.
- S - State:** This component describes the current state of the environment and recent trends in environmental quality.
- I - Impacts:** These are the consequences of the pressures on the environment, for example reductions in biodiversity, soil degradation, poor human health, and lack of clean, safe water.
- R - Responses:** This component describes the human responses to environmental change, including policies and management strategies to reduce environmental damage, rehabilitate damaged environments and encourage sustainable development.

1.4 Environmental Indicator Selection Criteria

In general, selection criteria for environmental indicators are usually based on three overriding considerations: data reliability and analytical soundness, issue relevance, and usefulness to the user.

It is imperative that KEIs be selected based on the priority or significance of the environmental issue concerned. The most significant issues with the highest priority are those with the largest potential environmental impact. As mentioned in Section 1.2, it is imperative that indicators must be simple and easy to interpret and understood and accepted by the community.

2. APPROACH TO KEY ENVIRONMENTAL INDICATOR SELECTION

In Phase 1 of the SoER process a draft issues and concerns list was prepared by NM&P and distributed to stakeholders at an issues workshop held on 25 February 2003, public participation process in the nine planning regions from 12-19 March 2003 and through emails. This list formed the basis for discussion during the workshops. Environmental issues were discussed in a broad manner, but specific critical issues for certain areas of Mbombela were also highlighted. A draft Key Issues and Concerns Report was compiled and distributed for comments. In this report, the issues and concerns were grouped together in logical reporting themes. The Key Issues and Concerns Report was finalised, based on the comments received on the draft report.

The set of indicators proposed was compiled by specialists from the list of issues and concerns and is linked to the same reporting themes as the issues and concerns. Where appropriate, some of the core indicators contained in the DEAT set of indicators for national environmental reporting, and key indicators from the Mpumalanga SoER, were included. This combined set of draft indicators was workshopped with the stakeholders on 7 May 2003 at the Mbombela Council Chambers. Feedback from the stakeholders was used to compile the framework of key environmental indicators for the Mbombela SoER. This framework was discussed at a workshop on 5 June 2003 and thresholds were determined.

3. AN OVERVIEW OF THE KEY ISSUES AND THE CORRESPONDING INDICATORS

The key issues and concerns were verified by using the DPSIR framework, which distinguishes between key issues, drivers, pressures and impacts. Some of the issues were determined to be drivers of change or pressures that relate to a specific issue. The key issues were established and DPSI indicators determined to measure each issue.

Table 1: Summary of key issues and drivers and their respective response indicators (pressure, state, impact and response indicators)

Key Issues	Driver	Pressure indicators	State indicators	Impact indicator	Response indicators
Reporting Theme: Terrestrial Resources					
<ul style="list-style-type: none"> Loss of natural habitats 	<ul style="list-style-type: none"> Economic pressures for agricultural expansion Increased need for housing development/urban sprawl Bush encroachment from overgrazing and poor fire management 	<ul style="list-style-type: none"> N/a 	<ul style="list-style-type: none"> Sensitive habitats Conservation areas 	<ul style="list-style-type: none"> Sensitive biota Alien vegetation Alien biota 	<ul style="list-style-type: none"> Number of hectares cleared of alien vegetation
<ul style="list-style-type: none"> Unsustainable harvesting of selected plants and animals 	<ul style="list-style-type: none"> Demands for medicinal plants and animals, Demands for firewood, curios, building and furniture Demands for collector species Poaching 	<ul style="list-style-type: none"> N/a 	<ul style="list-style-type: none"> N/a 	<ul style="list-style-type: none"> Target species 	<ul style="list-style-type: none"> N/a
<ul style="list-style-type: none"> Soil erosion 	<ul style="list-style-type: none"> Forestry and agricultural activities, Sand mining Culverts, bridges and roads Cemeteries leave the soil bare 	<ul style="list-style-type: none"> N/a 	<ul style="list-style-type: none"> N/a 	<ul style="list-style-type: none"> Sedimentation 	<ul style="list-style-type: none"> N/a
Reporting Theme: Water Resources					
<ul style="list-style-type: none"> Groundwater quality 	<ul style="list-style-type: none"> Contamination by pit toilets, industrial and domestic wastes, agricultural pesticides, cemeteries in unsuitable locations and solid waste dumping (both legal and illegal) Subdivision of agricultural land and illegal development with 	<ul style="list-style-type: none"> N/a 	<ul style="list-style-type: none"> % non-compliance with DWAF guidelines for selected groundwater water quality variables (total nitrogen, total phosphorus, conductivity and faecal coliforms) 	<ul style="list-style-type: none"> N/a 	<ul style="list-style-type: none"> Sanitation services

Key Environmental Indicators

Key Issues	Driver	Pressure indicators	State indicators	Impact indicator	Response indicators
	inadequate septic tanks				
<ul style="list-style-type: none"> • Surface water quality 	<ul style="list-style-type: none"> • Organic pollution from municipal treated sewage effluent entering Crocodile and White Rivers • Organic pollution from washing of clothes and cars in rivers and streams • Industrial pollution and periodic spills • Agricultural pollution entering the streams and rivers • Sawmills dumping sawdust, bark and other debris into rivers • Herbicides used in road maintenance entering streams and rivers 	<ul style="list-style-type: none"> • Accidental spills • Herbicidal use 	<ul style="list-style-type: none"> • % non-compliance with DWAF guidelines for selected surface water quality variables (total nitrogen, total phosphorus, conductivity and faecal coliforms) 	<ul style="list-style-type: none"> • River health • Aquatic weeds 	
Reporting Theme: Air Quality					
<ul style="list-style-type: none"> • Paper mills and sawmills cause odors and dust 	<ul style="list-style-type: none"> • Economic development • Demand for timber, pulp and wood products 		<ul style="list-style-type: none"> • Number of air quality complaints registered at Mbombela • Soiling index for suspended particles 	<ul style="list-style-type: none"> • Hospital admissions for respiratory diseases by type such as asthma and hay fever 	
<ul style="list-style-type: none"> • Veld fires and sugar cane burning during winter months 	<ul style="list-style-type: none"> • Negligence and lack of environmental awareness • Demand for agricultural products • Need for new green grazing 		<ul style="list-style-type: none"> • CO • PM₁₀ • NO₂ • SO₂ 	<ul style="list-style-type: none"> • Hospital admissions for respiratory diseases by type such as asthma and hay fever 	
<ul style="list-style-type: none"> • Pollen from citrus and other fruit trees during the flowering season 	<ul style="list-style-type: none"> • Demand for agricultural products 		<ul style="list-style-type: none"> • Number of air quality complaints registered at Mbombela 		

Key Environmental Indicators

Key Issues	Driver	Pressure indicators	State indicators	Impact indicator	Response indicators
<ul style="list-style-type: none"> Dust from dirt roads mainly in the rural areas 	<ul style="list-style-type: none"> Level of infrastructure provision Transportation need 		<ul style="list-style-type: none"> Soiling index for suspended particles 	<ul style="list-style-type: none"> Hospital admissions for respiratory diseases by type such as asthma and hay fever 	
<ul style="list-style-type: none"> Industrial processes causes air pollution 	<ul style="list-style-type: none"> Economic development Demand for industrial products 		<ul style="list-style-type: none"> Pb CO SO₂ O₃ NO₂ Benzene 	<ul style="list-style-type: none"> Hospital admissions for respiratory diseases by type such as asthma and hay fever 	
<ul style="list-style-type: none"> Emissions from vehicles traveling on the N4 highway 	<ul style="list-style-type: none"> Economic and Maputo corridor development resulting in traffic and traffic congestion 		<ul style="list-style-type: none"> CO O₃ NO₂ PM₁₀ Pb 		
<ul style="list-style-type: none"> Burning of waste in informal settlements causing smoke 	<ul style="list-style-type: none"> Lack of environmental awareness Service provision Population growth 		<ul style="list-style-type: none"> Pb CO PM₁₀ NO₂ 	<ul style="list-style-type: none"> Hospital admissions for respiratory diseases by type such as asthma and hay fever 	
<ul style="list-style-type: none"> Transboundary air pollution by smoke emanating from Highveld power stations 	<ul style="list-style-type: none"> Demand for electricity 		<ul style="list-style-type: none"> Pb CO SO₂ O₃ NO₂ 	<ul style="list-style-type: none"> Hospital admissions for respiratory diseases by type such as asthma and hay fever 	
<ul style="list-style-type: none"> Smoke from the use of fossil fuels and wood for cooking or heating 	<ul style="list-style-type: none"> Cost of electricity Poverty 	<ul style="list-style-type: none"> Distribution of household use per energy type (fossil fuels and wood) 	<ul style="list-style-type: none"> CO NO₂ SO₂ PM₁₀ 	<ul style="list-style-type: none"> Hospital admissions for respiratory diseases by type such as asthma and hay fever 	
Reporting Theme: Cultural Issues					

Key Environmental Indicators

Key Issues	Driver	Pressure indicators	State indicators	Impact indicator	Response indicators
<ul style="list-style-type: none"> Limited historical resources in Mbombela 	<ul style="list-style-type: none"> Rejuvenation of town Lack of cultural awareness 	<ul style="list-style-type: none"> Listed cultural resources 	<ul style="list-style-type: none"> Status of resources 		
<ul style="list-style-type: none"> Accessibility and conservation of cultural sites 	<ul style="list-style-type: none"> Increase in security limiting access Lack of awareness and funding 	<ul style="list-style-type: none"> No. of Rock Art sites 	<ul style="list-style-type: none"> Status of rock art sites 	<ul style="list-style-type: none"> Sources of cultural significance 	<ul style="list-style-type: none"> No. of sites restored No. of sites with accessibility
<ul style="list-style-type: none"> Lack of cultural awareness and implementation of legislation 			<ul style="list-style-type: none"> Expenditure at cultural resources 		<ul style="list-style-type: none"> Investment into cultural resources
Cemeteries					
<ul style="list-style-type: none"> Rural cemeteries not managed by Mbombela unplanned 	<ul style="list-style-type: none"> Inaccessibility of registered cemeteries 		<ul style="list-style-type: none"> No & status of cemeteries and their capacity in Mbombela. 		
<ul style="list-style-type: none"> Cemeteries have reached capacity 	<ul style="list-style-type: none"> High mortality rate No new registered cemeteries managed by Mbombela are developed Socio-economic reasons for preference of unregistered cemeteries not managed by Mbombela 	<ul style="list-style-type: none"> Mortality Rate 	<ul style="list-style-type: none"> Capacity Status Number of burials/year 		
<ul style="list-style-type: none"> Lack of services, fencing and maintenance at cemeteries 	<ul style="list-style-type: none"> Demand for cemeteries 			<ul style="list-style-type: none"> No & status of services at cemeteries and their capacity 	<ul style="list-style-type: none"> Investment into maintenance and services of cemeteries
<ul style="list-style-type: none"> Cemeteries inaccessible or located far from certain areas Distance to and number of cemeteries 	<ul style="list-style-type: none"> Lack of registered cemeteries in rural areas 		<ul style="list-style-type: none"> No. of cemeteries with capacity in Mbombela/planning or settlement area 		

Key Issues	Driver	Pressure indicators	State indicators	Impact indicator	Response indicators
Reporting theme: Landuse – Urbanisation					
<ul style="list-style-type: none"> Extension of major centra due to new urban developments 	<ul style="list-style-type: none"> Increasing urbanisation 	<ul style="list-style-type: none"> Land Use Change. 	<ul style="list-style-type: none"> Population density. Floor area per person. Derelict areas. 		<ul style="list-style-type: none"> Renewal areas. EIA procedures.
<ul style="list-style-type: none"> Uncontrolled low density urban sprawl and land invasion. Uncontrolled densification within existing settlements 	<ul style="list-style-type: none"> Land Invasion 	<ul style="list-style-type: none"> Land Use Change. 	<ul style="list-style-type: none"> Population density. Floor area per person. 		<ul style="list-style-type: none"> Formal & Informal settlements.
<ul style="list-style-type: none"> Long distances between live and work/shopping areas. 	<ul style="list-style-type: none"> Commuting distances 		<ul style="list-style-type: none"> Travel times. Daily average distance travelled. 		
<ul style="list-style-type: none"> Insecure land tenure. 	<ul style="list-style-type: none"> Insecure land tenure 		<ul style="list-style-type: none"> Formal and Informal settlements. 		
<ul style="list-style-type: none"> Informal, environmental unsafe cemeteries. Insufficient provision. Poor maintenance. No services. 	<ul style="list-style-type: none"> (See Cultural resources) 				
<ul style="list-style-type: none"> Development places a burden on the already stressed water sources. 	<ul style="list-style-type: none"> (See Terrestrial resources) 				
Industries					
<ul style="list-style-type: none"> Overprovision of industrial properties. Illegal industrial uses. 	<ul style="list-style-type: none"> Increasing industrialisation 	<ul style="list-style-type: none"> Land Use Change 	<ul style="list-style-type: none"> Derelict areas. 		<ul style="list-style-type: none"> Illegal industrial uses being formalised or closed.

Key Environmental Indicators

Key Issues	Driver	Pressure indicators	State indicators	Impact indicator	Response indicators
Parks and Open Space					
<ul style="list-style-type: none"> Lack of parks, open space and recreational land. Lack of control over open spaces. 	<ul style="list-style-type: none"> Insufficient Parks, Open Space and Recreational land. 		<ul style="list-style-type: none"> Green Areas. Access to green spaces. 		<ul style="list-style-type: none"> Investment in Green Areas.
Conservation					
<ul style="list-style-type: none"> Lack of control and regulation of sensitive areas with conservation value. Insufficient containment of wild animals in KNP. 	<ul style="list-style-type: none"> Degradation of conservation land. (See Terrestrial Resources) 	<ul style="list-style-type: none"> Land Use Change 			<ul style="list-style-type: none"> Protected area as percent of total area. (See Terrestrial Resources)
Agriculture					
<ul style="list-style-type: none"> New land for agricultural development. Subsistence farming within flood lines, stream banks and wetlands. Unproductive and unsustainable practices Free roaming livestock. 	<ul style="list-style-type: none"> Encroachment of agriculture onto natural land. 	<ul style="list-style-type: none"> Land Use Change. 	<ul style="list-style-type: none"> EIA procedures. 		<ul style="list-style-type: none"> Expenditure on agricultural training programmes.
<ul style="list-style-type: none"> Overgrazing 	(See Terrestrial resources)				
Forestry					
<ul style="list-style-type: none"> Extension of plantations. Deforestation. 	<ul style="list-style-type: none"> Afforestation 	<ul style="list-style-type: none"> Land Use Change 	<ul style="list-style-type: none"> EIA procedures. 		

Key Environmental Indicators

Key Issues	Driver	Pressure indicators	State indicators	Impact indicator	Response indicators
Mining					
<ul style="list-style-type: none"> Environmentally unsafe mining practices. Uncontrolled and illegal mining such as sand mining 	<ul style="list-style-type: none"> Unsustainable mining practices. 		<ul style="list-style-type: none"> Illegal mining activities. 		<ul style="list-style-type: none"> EIA procedures.
Infrastructure: Solid waste management					
<ul style="list-style-type: none"> Widespread illegal dumping of wastes in the area and in wetlands 	<ul style="list-style-type: none"> Mbombela's inability to cope with increasing service demands Safety & security at landfill sites 		<ul style="list-style-type: none"> Extent of illegal dumping sites 		
<ul style="list-style-type: none"> Lack of capacity in landfill sites managed by Mbombela 	<ul style="list-style-type: none"> Economic growth resulting in increased waste 	<ul style="list-style-type: none"> Volume of waste received at landfills vs. available landfill capacity 	<ul style="list-style-type: none"> Status of landfill sites (Number and position of landfill sites and projected life of each) managed by Mbombela 		
<ul style="list-style-type: none"> Land fill sites unsafe and not managed properly causing odors, litter and health problems due to spoilt goods 	<ul style="list-style-type: none"> Poverty Institutional Capacity Limited budget 	<ul style="list-style-type: none"> Staff complement on the different landfill sites Sites managed by Mbombela, registered and with or without EMP 			<ul style="list-style-type: none"> Compliance with registration permits
<ul style="list-style-type: none"> Lack of formal landfill sites in rural areas - Burning of waste, waste is buried anywhere 	<ul style="list-style-type: none"> Population growth resulting in increased waste production Mbombela's inability to cope with increasing service demands 	<ul style="list-style-type: none"> Volume of Waste generated by the municipality – Nelspruit, Hazyview and 			

Key Environmental Indicators

Key Issues	Driver	Pressure indicators	State indicators	Impact indicator	Response indicators
		White River • % Population without access to refuse removal / planning area			
• Closed landfill site is leaking hazardous substances into the groundwater	• Dumping of hazardous waste in a general landfill site		• Status of rehabilitated landfill sites		
• Limited recycling or reducing programmes in Mbombela	• Lack of knowledge and environmental education on hazard of solid waste in the area				• No of programs for recycling • Amount of waste recycled
• Lack of refuse removal in rural areas.	• Institutional • Population growth	• % Population without access to refuse removal / planning area			• Percentage of households receiving refuse removal services
Electricity:					
• Electricity too expensive	• Poverty • Cost of electricity generation and distribution	• History of payment in Mbombela			
• Inadequate electricity distribution	• Urbanization • Lack of funding	• Electricity provision			
• Limited development of alternative energy sources	• Funding • High dependency on Eskom • Capital investment required		• % of electricity generated by hydro electrical stations		
• Destruction of natural resources for energy	• Cost of electricity • Inadequate electricity distribution	• Wood use for energy	• % of electricity generated by hydro electrical stations		
Transport:					
• Inadequate maintenance of	• Lack of road maintenance and management	• Registered vehicles			

Key Environmental Indicators

Key Issues	Driver	Pressure indicators	State indicators	Impact indicator	Response indicators
roads with unsafe potholes.	programmes • Increased traffic	• Traffic volumes			
• Mostly dirt roads in rural areas	• Lack of infrastructure provision				
• Insufficient public transport facilities and status of existing facilities	• Lack of infrastructure provision • High number of commuters	• Access to public transport • Public and mass transport seats • Number of commuters using public transport	• Status of bus /taxi terminals • Total length of paved or unpaved roads		
• Increasing road infrastructure impacts negatively on natural drainage patterns	• Demand for transportation infrastructure			• Total length of paved or unpaved roads	
Water supply					
• Water shortages	• Limited storage • Over-abstraction, particularly by agriculture • Stream reduction activities • Limited reticulation • Water tanks not filled regularly • Illegal connections	• Population • Water used • Water lost • Water returned	• Water stored • Water treatment works		• Water services • Water pressure • Water price
• Quality of treated water	• Reticulated water quality highly variable, often carrying rust and usually turbid following heavy rains • Water tanks are dirty inside	• N/a	• % non-compliance with DWAF guidelines for potable water	• N/a	• N/a
• Water shortages	• Population increase • Illegal connections • Over-abstraction, particularly for agriculture. • Stream reduction activities	• Use of unsafe surface water or groundwater.	• Limited bulk water storage; • Limited potable water storage and reticulation;	• Increase in waterborne gastric diseases.	• Improved water services; • Water demand management • Water pricing

Key Environmental Indicators

Key Issues	Driver	Pressure indicators	State indicators	Impact indicator	Response indicators
			<ul style="list-style-type: none"> • Insufficient water treatment works capacity (output). • Water tanks not filled regularly 		
<ul style="list-style-type: none"> • Quality of treated water. 	<ul style="list-style-type: none"> • Poor service management. • Poor operation and maintenance of systems. 	<ul style="list-style-type: none"> • Reticulated water quality highly variable, often carrying rust and usually turbid following heavy rains • Water tanks are dirty inside 	<ul style="list-style-type: none"> • % non-compliance with DWAF guidelines for potable water 	<ul style="list-style-type: none"> • Increase in waterborne gastric diseases. 	<ul style="list-style-type: none"> • Improved water services management;
Reporting theme: Socio-Economic					
<ul style="list-style-type: none"> • Poverty and high levels of unemployment and lack of local job opportunities 	<ul style="list-style-type: none"> • Disparity between urban areas and outlying rural areas • Low levels of education and high adult illiteracy • Insufficient numbers of schools, particularly high schools • Limited tertiary education • Alcohol abuse • The lotto has had a major and detrimental impact on household economy and spending behavior, and has increased poverty levels 	<ul style="list-style-type: none"> • Population • Unemployment 	<ul style="list-style-type: none"> • Adult literacy rate • Household demographics • Prevalence of HIV/AIDS • Educators • Prevalence of communicable diseases 	<ul style="list-style-type: none"> • Household expenditure 	
<ul style="list-style-type: none"> • Uncertainty about land tenure 	<ul style="list-style-type: none"> • high level of land restitution claims • conflicting land claims • equitable redistribution of land not taking place at a 				<ul style="list-style-type: none"> • Land redistribution

Key Environmental Indicators

Key Issues	Driver	Pressure indicators	State indicators	Impact indicator	Response indicators
	<p>rate sufficiently fast to address the problem, leading to future problems of land invasions</p>				
<ul style="list-style-type: none"> • Health risks variable but generally high 	<ul style="list-style-type: none"> • High infant mortality • HIV/AIDS and sexually transmitted diseases very high • Associated disease, such as TB, also high • High numbers of AIDS orphans • Malaria incidence moderately high • Cholera - periodic outbreaks • Bilharzia incidence very high • Diarrhea a significant cause of death among <5yr olds • Lower respiratory infections • Bad hygiene practices and the consumption of food from diseased animals • Spraying of crops/trees • Asthma and respiratory problems caused by pollen in flowering season • Low respiratory infections 		<ul style="list-style-type: none"> • Status of Health Services • Prevalence of HIV/AIDS • Prevalence of communicable diseases 	<ul style="list-style-type: none"> • Household expenditure • Life expectancy 	
<ul style="list-style-type: none"> • Government health services are limited, particularly in rural areas 	<ul style="list-style-type: none"> • Hospitals and mobile clinics are inadequate • Inadequate numbers of doctors, nurses and Environmental Health Practitioners in rural areas 		<ul style="list-style-type: none"> • Status of Health Services 		

Key Environmental Indicators

Key Issues	Driver	Pressure indicators	State indicators	Impact indicator	Response indicators
	<ul style="list-style-type: none"> Inadequate emergency services Insufficient health programmes to educate people on disease Inadequate transport for health practitioners in rural areas Notifiable disease information is not standardized or available for all subdistricts Feeding schemes at schools inconsistent and not always enough Lack of registration of births and deaths 				
<ul style="list-style-type: none"> Education generally of low standard 	<ul style="list-style-type: none"> Schools have limited resources Limited tertiary education Impacts of HIV/AIDS on the number of teachers 		<ul style="list-style-type: none"> Adult literacy rate Educators Prevalence of HIV/AIDS Prevalence of communicable diseases 		<ul style="list-style-type: none"> Provision of Schools
<ul style="list-style-type: none"> Crime: Safety and security poor, including high levels of theft, hijacking, rape and murder 	<ul style="list-style-type: none"> Social inequity/anger Organised crime High numbers of immigrants from Mozambique, Swaziland, Zimbabwe, Malawi, Nigeria and elsewhere Unlit urban areas, inadequate street lighting 	<ul style="list-style-type: none"> Unemployment Urban/rural distribution 	<ul style="list-style-type: none"> Provision of Street lighting in planning areas 		<ul style="list-style-type: none"> Crime prevention
<ul style="list-style-type: none"> Economic development and growth 	<ul style="list-style-type: none"> Safety and security Macro-economic policies Policies on trade and immigration (eg border duties and visa costs) 	<ul style="list-style-type: none"> Population Unemployment 	<ul style="list-style-type: none"> Household demographics Adult literacy rate 	<ul style="list-style-type: none"> Economic growth Household expenditure Life expectancy 	

Key Environmental Indicators

Key Issues	Driver	Pressure indicators	State indicators	Impact indicator	Response indicators
	<ul style="list-style-type: none"> impacting negatively on the area) Supplies and demands Education 				
Reporting theme: Tourism					
<ul style="list-style-type: none"> Tourism resources underdeveloped and cultural tourism very limited in Mbombela Destruction of natural vegetation for curios Safety and security at tourism sites 	<ul style="list-style-type: none"> Increasing tourism potential Demand for traditional curios Poverty Poverty Lack of law enforcement 	<ul style="list-style-type: none"> Vegetation used for making curios 	<ul style="list-style-type: none"> Status of tourism resources Economic statistics on tourism 		<ul style="list-style-type: none"> Crime incidents reported by tourists
Reporting theme: Environmental Governance					
<ul style="list-style-type: none"> Depletion of resources Lack of compliance with environmental legislation requirements. Lack of environmental awareness and environmental education 	<ul style="list-style-type: none"> Lack of Environmental governance No monitoring due to lack of capacity Lack of environmental awareness programs 	<ul style="list-style-type: none"> % new developments which are listed activities with approved EIA & EMPs vs. none. % new developments which are listed activities with approved EIA & EMPs vs. none. IDP commitment to environment and environmental policies. 	<ul style="list-style-type: none"> Conditions of approval of EIAs implemented 		<ul style="list-style-type: none"> Mbombela Local Municipality: Compliance to environmental strategies and policies Environmental education programs

Key Environmental Indicators

Key Issues	Driver	Pressure indicators	State indicators	Impact indicator	Response indicators
<ul style="list-style-type: none"> Mbombela lacks capacity to implement environmental legislation and policies 	<ul style="list-style-type: none"> Lack of environmental education Financial restrictions 		<ul style="list-style-type: none"> Mbombela Local Municipality: Trained personnel in environmental management 		<ul style="list-style-type: none"> Budgetary allocation to management and training, education and awareness.

4. AN OVERVIEW OF THE KEY ENVIRONMENTAL INDICATORS IN MBOMBELA

The list of indicators below was determined through the review of relevant information and the stakeholder workshops held in Mbombela. The summary contains the key indicators for the SoER as determined at the workshop. Indicators are grouped per reporting theme and are linked to the relevant sections in the Key Environmental Issues and Concerns report.

The main reporting themes are:

- 4.1 Terrestrial Resources
- 4.2 Water Resources
- 4.3 Air quality
- 4.4 Cultural Resources
- 4.5 Land use
- 4.6 Socio-Economics
- 4.7 Infrastructure
- 4.8 Tourism
- 4.9 Environmental Governance

Table 2: Summary of key indicators and their unit of measurement

Reporting Theme	Key indicators	Unit of measurement
4.1 Terrestrial Resources	Sensitive habitats	<ul style="list-style-type: none"> • Area and status of large habitat units linked to sensitive biota, including natural forests, wetlands, riparian zones and natural grassland (in ha and as % of total area)
	Conservation areas	<ul style="list-style-type: none"> • Area of land with formal conservation status (in ha) • Conserved areas expressed as a % of total area
	Sensitive biota	<ul style="list-style-type: none"> • Number of locally threatened, vulnerable, endangered and extinct species per taxonomic group (Invertebrates, Plants, Fish, Birds, Reptiles, Amphibians, Mammals), • Population status of selected flagship species, such as blue swallow
	Alien vegetation	<ul style="list-style-type: none"> • Condensed Area (ha) occupied by selected alien vegetation species (Category 1), particularly <i>Chromoleana</i>, <i>Lantana</i>, <i>Solanum</i>, guava, <i>Seringa</i>, pine, eucalyptus, and Mauritius thorn • Area (ha) occupied by alien vegetation expressed as a %

Key Environmental Indicators

		<p>of total area</p> <ul style="list-style-type: none"> • Areas (ha) cleared of alien vegetation
	Alien biota	<ul style="list-style-type: none"> • Indian Mynhas: Number, distribution and size of roosting flocks
	Target species	<ul style="list-style-type: none"> • Population status (locally extinct, endangered, vulnerable, rare, indeterminate) and, where possible age structure of selected target species (e.g. pepper bark tree (<i>Warbergia salutaris</i>), wild ginger, Kiaat, Red ivory, cycads and tree ferns • Number of convictions
	Sedimentation	<ul style="list-style-type: none"> • Reduced capacity of reservoirs (m³)
4.2 Water Resources	Water stored	<ul style="list-style-type: none"> • Total maximum water storage capacity within Mbombela (m³) • Total water storage capacity per capita (m³/1000 c) • Percentage of full supply capacity of the dams supplying Mbombela at end April (for planning) and October (critical low-flow period) each year
	Water used	<ul style="list-style-type: none"> • Total water used per sector per annum (m³/sector/a) • Total water used per capita per annum (m³/c/a) • Total annual demand as % of available resources
	Groundwater quality	<ul style="list-style-type: none"> • % non-compliance with DWAF guidelines for selected groundwater water quality variables (total nitrogen, total phosphorus, sulphates, conductivity and faecal coliforms) per main user sectors (irrigation and domestic)
	Surface water quality	<ul style="list-style-type: none"> • % non-compliance with DWAF guidelines for selected surface water quality variables at selected sites (total nitrogen, total phosphorus, conductivity and faecal coliforms) Accidental spills: Number,

		<p>locality, duration, extent, material, cause and impacts of point source pollution episodes (industrial spills, fish kills etc) per annum</p> <ul style="list-style-type: none"> • Herbicide use: total volumes of each herbicide applied by Mbombela, and for what purpose
	River health	<ul style="list-style-type: none"> • SASS monitoring during the dry period (Sept) • Ecological Category A-F (DWA RDM method)
	Aquatic weeds	<ul style="list-style-type: none"> • Location and length (km) of rivers and streams infested with invasive aquatic pest plants, and the type (<i>Azolla</i>, <i>Lemna</i>, <i>Eichhornia</i> etc) • % river length within Mbombela affected by aquatic weeds
4.3 Air quality	Hospital admissions for respiratory diseases by type such as asthma and hay fever	Number /type
	<p>Measurement of:</p> <ul style="list-style-type: none"> • SO₂ • NO₂ • CO • PM₁₀ • O₃ • Pb • Benzene 	See attached schedule
	Soiling Index from 3 stations in Nelspruit (<i>Proxy indicator to be replaced with the one above</i>)	Can be converted into TSP – Total suspended particles
	No. of air quality complaints registered at Mbombela	Number of complaints
	Distribution of household use per energy type	<p>Number of households using:</p> <ul style="list-style-type: none"> • Electricity • Wood • Coal • Paraffin etc.
4.4 Cultural resources	List and determine status of cultural buildings, rock art sites or other resources	<p>Number of cultural resources</p> <p>Status depicted in: conserved, what condition, budget or visitors to the site</p>
	Expenditure and investment into cultural resources excluding cemeteries	Amount spent per planning area

	List Sources of cultural significance (champion trees etc.)	Number of and type.
4.4.1 Cemeteries	No and status of cemeteries and their capacity in Mbombela <ul style="list-style-type: none"> • Managed by Mbombela • Not managed by Mbombela 	Number of graves / planning area Status of services at cemeteries: condition of fences, number of toilets etc.
	Mortality Rate	Amount of funerals held per month/year
	Investment into maintenance and services of cemeteries	Budget for management and maintenance of cemeteries in Mbombela
4.5 Land use:	Land use change.	Hectares per land use per annum.
4.5.1 Urbanisation	Population density	Persons per hectare settled area.
	Floor area/person	Square meters per person.
	Derelict areas	Hectares per previous land use.
	Renewal areas.	Hectares
	Formal and informal settlements.	Extent of settlement (ha) and occupants for both formal and informal.
	Travel times	Average travel time in minutes. Number of buses and taxis.
	Daily average distance travelled	Average travel distance in km. Number of buses and taxis.
4.5.2 Industrial	Illegal industrial uses being formalised or closed.	Number of illegal uses being addressed
4.5.3 Open areas / parks	Green areas	Number and extent per settlement
	Access to green spaces	Square meters per capita.
	Investment in green areas	R expenditure on green spaces as a percentage of total expenditure pa
	Protected area as percent of total (See Terrestrial resources)	Percentage of total area.
4.5.4 Agriculture	Expenditure on agricultural training programmes	R expenditure per annum
4.5.5 Mining	Illegal mining activities.	Number of activities identified.
4.5.6 Forestry	Land use change (Already above)	
4.6 Socio-economics	Population	<ul style="list-style-type: none"> • Total population • Growth rate (%/a) • Ratio of urban population to rural population • Residential density / area <ul style="list-style-type: none"> ○ Formal housing ○ Informal areas
	Life expectancy	<ul style="list-style-type: none"> • Life expectancy – female - male
	Household demographics	<ul style="list-style-type: none"> • Dependency ratio - dependents / earner • Number and % female

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		<ul style="list-style-type: none"> headed households • Number and % child headed (under 18) • Teenage pregnancy/1000 (under 18)
	Poverty / Household Expenditure	<ul style="list-style-type: none"> • Household expenditure R/a /area • Age, weight (kg) height and upper arm (mm) measurement on school children • Number and % households living below the breadline (PDL poverty datum line) / area
	Unemployment	<ul style="list-style-type: none"> • Number and % unemployed and underemployed, formal and informal • Skills levels –no. tertiary graduates per 1000 capita • Employment Market - number. of jobs per sector <ul style="list-style-type: none"> ○ Professional / managerial ○ Technical/skilled ○ Semi- and unskilled
	Economic growth	<p>Per Planning Area -</p> <ul style="list-style-type: none"> • Value of new housing and industrial development p.a. • No. new businesses registered • No. business liquidations • No. insolvencies • No.& value of house repossessions
	Provision of schools	<ul style="list-style-type: none"> • Number and location of primary and secondary schools and tertiary facilities (private and public). per 1000 capita/area
	Number of educators	<ul style="list-style-type: none"> • Educator/learner ratio / area
	Adult literacy rate	<ul style="list-style-type: none"> • % / planning area
	Status of health services	<p>Per Planning Area -</p> <ul style="list-style-type: none"> • No. state hospitals, clinics, ambulances, doctors, nurses per 1000 capita • Distance (km) to nearest hospital/clinic. • Private health institutions • Traditional Healers
	Mortality Rates	<ul style="list-style-type: none"> • Mortality rates per 1000 <ul style="list-style-type: none"> ○ Infant ○ Under 5 ○ Maternity
	Prevalence of communicable	Communicable diseases -

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	diseases	<ul style="list-style-type: none"> • Cases per 1000 capita/a <ul style="list-style-type: none"> ○ TB, ○ Malaria, ○ Bilharzia, ○ Cholera, ○ Meningococcal meningitis, ○ Gastro enteritis /Dysentery
	Prevalence of HIV/AIDS,	<ul style="list-style-type: none"> • % infection for age groups <ul style="list-style-type: none"> ○ under 18 ○ 18-24 ○ 24-32 ○ over
	Land redistribution	<ul style="list-style-type: none"> • Area (in ha) of land within Mbombela that is redistributed per annum, • Total area of land redistributed as a % of total area earmarked for redistribution
	Crime prevention	<p>Per Planning Area</p> <ul style="list-style-type: none"> • % settlement areas with street/security lighting; • Location of areas with no lighting. • Number of reported cases <ul style="list-style-type: none"> ○ Serious social crimes (murder, rape etc) ○ Property crimes • Numbers of policemen and police stations /area /1000 • Distance to nearest station (community service centre) • Community police forums (areas) • Correlation between street lighting and crimes
	Emergency Services	Locations of emergency services (fire etc.) and distances to nearest station
4.7 Infrastructure: 4.7.1 Solid waste management	Extent of illegal dumping sites	Rand expenditure (budget) to clean illegal dumping/year Volume of waste cleaned, time period and location occurrence.
	Status of Landfill sites managed by Mbombela (compliance to permits)	<p>Status:</p> <ul style="list-style-type: none"> • Registered • With or without EMP • Number and position of landfill sites and projected life of each • Capacity

		<ul style="list-style-type: none"> • Volume of waste received
	Staff complement to manage the different landfill sites	Number of staff/landfill site
	Waste generated by the municipality – Nelspruit, Hazyview and White River	Volume of waste generated / household/annum
	Recycling of waste	No of programs for recycling No of waste recycled
	% Population without access to refuse removal / planning area	Percentage of households receiving refuse removal services/planning area
4.7.2 Electricity	History of payment in Mbombela	% people paying for electricity
	Electricity provision	% households with reticulation and without
	Electricity generated by Hydro-electrical stations	% of all electricity sold
	Wood use for energy	Loss of Vegetation cover
4.7.3 Transport	Registered vehicles	Number and Number/ capita
	Traffic volumes	Total vehicles/km, N4 traffic counts: light/heavy
	Status of Bus/Taxi terminals	Number Type (terminus, rank or holding) Status: <ul style="list-style-type: none"> • Formal or informal • Paved or unpaved • On or off street • Average passenger waiting times • Electricity/ telephones/ ablutions/ shelters • No of loading bays/type
	Access to public transport routes	% people having access to public transport route within 1km walking distance
	Commuters using public transport	Number of
	Public and mass transport seats	No. of public transport seats per 1000 people
	Total length paved or unpaved roads	Km
4.7.4 Water supply & Sanitation	Water price	<ul style="list-style-type: none"> • Price of water per sector (R/kl)
	Water Treatment Works	<ul style="list-style-type: none"> • No. potable water treatment works, and maximum capacity of each (Ml/d) • Average spare capacity or shortfall (Ml/d)
	Water cost recovery	<ul style="list-style-type: none"> • Ratio of water billed to water paid per sector per annum • Distribution losses %

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	Treatment Process Waste	<ul style="list-style-type: none"> • Water losses • Sludge produced <ul style="list-style-type: none"> ○ reusable (tons/a) ○ non reusable (tons/a)
	Licensing of water treatment services	<ul style="list-style-type: none"> • No. of registered water treatment works failing license requirements
	Quality of reticulated water	<ul style="list-style-type: none"> • No. and % non-compliance with DWAF requirements for potable water selected variables at treatment works and selected sites (faecal coliforms, conductivity, turbidity, pH, arsenic, cadmium, calcium, sodium, chloride, fluoride, iron, manganese, total hardness, magnesium, nitrate, nitrite, potassium and zinc)
	Water distribution services	<ul style="list-style-type: none"> • % of households with reticulated treated water to <ul style="list-style-type: none"> ○ house or yard, ○ communal standpipe, • Number and locality of people without access to reticulated potable water using <ul style="list-style-type: none"> ○ borehole, ○ tank delivery, ○ river, spring or dam
	Sanitation Services	<ul style="list-style-type: none"> • % of households with <ul style="list-style-type: none"> ○ water borne sewerage ○ septic tanks, ○ conservancy tanks, ○ pit latrines (including VIP) and cess-pits ○ none.
	Wastewater Treatment Works	<ul style="list-style-type: none"> • No of waste water treatment works, and maximum capacity of each (MI/d) • Average spare capacity or shortfall (MI/d) • % reuse of effluent (MI/d) • Sludge produced <ul style="list-style-type: none"> ○ reusable (tons/a) ○ non reusable (tons/a)
	Water returned to catchment	<ul style="list-style-type: none"> • Total controlled effluent discharged per sector per annum (m³/sector/a) • Total effluent discharged per capita per annum (m³/c/a) • Proportion of treated effluent reused (%)

4.8 Tourism	Status of tourism resources	<ul style="list-style-type: none"> • Number of Tourists • Tourism attractions • List of accommodation and available beds
	Vegetation used for making curios	Loss of indigenous vegetation
	Economic statistics on Tourism	Numbers
	Crime incidents reported by tourists	Number of tourist crime incidents
4.9 Environmental Governance	Mbombela Local Municipality: Compliance to environmental strategy / policies	Audits
	Mbombela Local Municipality: Trained personnel in environmental management	Numbers
	Budgetary allocation to environmental management, training, education & awareness	Budgetary allocation per capita
	% New Developments which are listed activities with approved EIA, EMP & EMPRs vs none	%
	Conditions of approval of EIAs implemented	Monitoring of implementation & compliance
	Environmental education programs	Number of.
	IDP commitment to environment and environmental policies	Compliance monitoring

Section 5 provides additional background on the specific indicators, as well as information on the interpretation and use of these indicators.

5. INTERPRETATION & USE OF MBOMBELA KEY ENVIRONMENTAL INDICATORS

5.1 Terrestrial Resources

The core indicators for Terrestrial Resources are:

- Sensitive habitats and conservation areas
- Sensitive biota
- Target species
- Alien vegetation and biota
- Sedimentation

Landuse activities over most of the Mbombela region have transformed most areas, and few habitats remain in their natural or near-natural state. Those that do, provide important areas of refuge for biota, particularly sensitive species. Some of these areas are formally conserved, while others remain vulnerable to further development, particularly large-scale clearing of bush for agricultural development, which is transforming remaining pockets of natural habitats at a high rate. Remaining natural habitats have effectively become "islands", and the theory of island biogeography predicts that as habitats shrink in size, so too do the numbers of species that they are able to support. Many species that once inhabited Mbombela are no longer found in the area, or are restricted to isolated "islands" of suitable habitat. These ecologically important "islands" include natural forests, wetlands, riparian zones and natural

grasslands, which are critical for the continued survival of many species in the region. The size, shape, distribution and connectivity between the remaining "islands" are all important factors in determining their ability to support viable populations of biota. Most of these factors are difficult to measure, but size is fairly easy to measure. It is for this reason that the total area of remaining **sensitive habitats**, as well as the size of formally **conserved areas**, provide practical indicators of the state of remaining natural habitats, and by implication, the biota that they support. This information can be measured from Landsat imagery.

The status of **sensitive biota** also provides a measure of environmental degradation. Each species has specific environmental requirements, so the more species that are included in such an index, the more the index will reflect the overall health or condition of the environment. The total number of locally threatened, vulnerable, endangered and extinct species for each major taxonomic group (invertebrates, plants, fish, birds, amphibians and mammals) has therefore been chosen as an appropriate indicator of overall environmental degradation. The population status of selected flagship species, such as blue swallow (endangered), are also included. This information can be obtained from interest groups, such as bird clubs, the Plant Specialist Group etc, as well as specialists at the Mpumalanga Parks Board.

Areas that have been disturbed by development are highly susceptible to invasion by exotic vegetation, and in Mbombela the main invaders are *Chromolaena*, *Lantana*, *Solanum*, guava, *Seringa*, pine, eucalyptus and Mauritius thorn. The area occupied by these invader species provides a simple index of their severity. Some areas are more invaded than others, so it is necessary to convert the area coverage to assume 100% cover for each species. In other words, if there are 10ha invaded with 50% cover of *Lantana*, then the condensed area would be 5ha. This information is captured by the Working for Water (WfW) Programme, which has been active in clearing **alien vegetation** from the region. The annual monies spent on alien control by WfW provide a simple indicator of the management response to the problem of alien vegetation.

Mbombela is endowed with a wealth of natural resources, some of which are highly sought after, both locally and regionally. These include medicinal plants and animals, collector species such as cycads and tree ferns, as well as indigenous hardwoods that are used for firewood, furniture, building and curios. It is not practical or cost-effective to monitor the harvesting of all these resources, so we suggest monitoring the population status of **key target species** only (ie pepper bark tree, wild ginger, Kiaat, Red ivory, cycads and tree ferns). This information may be difficult to source, but the Mpumalanga Parks Board do have some relevant data that could be used.

One of the key environmental issues in Mbombela is soil erosion, attributed to poor land management and agricultural practises, and poorly constructed stream crossings, inter alia. This has resulted in many of the rivers and streams, which were formerly cobble-bed streams with riffle and deep pools, becoming highly silted, shallow, and overgrown with reeds. Erosion is difficult to quantify, and most of the transport of **sediments** takes place during short storm or flood events. Much of the sediment lands up in dams and weirs, where it reduces the much needed storage capacity of these facilities. Periodic measurement of the storage capacity of the main reservoirs therefore provides an indication of the extent of soil erosion in the catchment upstream of the dam, and also provides useful information for water management planning. A limitation of this index is that it does not provide information

on soil loss in those catchments that have no dams, such as the Nsikazi area, where soil erosion is a key feature of the landscape. The storage capacity of DWAF-owned reservoirs is measured periodically, but the frequency of these measurements may need to be increased to be of value to Mbombela.

5.2 Water Resources

The core indicators for Water Resources are:

- Water stored
- Water used
- Groundwater and surface water quality
- River health
- Aquatic weeds

The rate and type of future development in Mbombela is strongly linked to the quantity and quality of available water supplies. Storage of surface waters provides the bulk of the water used in the area, and so it is crucial to monitor how much is **stored (supply) in relation to how much is used (demand)**. The storage capacity at the end of the rainy season (April), provides useful information for water resource planning for the following dry season. The storage capacity at the end of the dry season (October) monitors the low-flow period, which is critical for assessing the assurance of available supplies. These indicators provide essential tools for planning water augmentation and/or demand management strategies, particularly when the information has been collected over a number of years, and trends are evident. The trends should indicate when augmentation is needed, and how much is needed, or what restrictions on use need to be implemented.

Water users have different water quality requirements, so we suggest that the % non-compliance to the standard DWAF guidelines for each user sector, for both surface and **groundwater**, should be used as a simple measure to indicate the type and extent of **water quality** problems in the area. The variables monitored are restricted to key variables only. Water quality variables are monitored routinely at selected stations by the DWAF.

Mbombela has witnessed a number of accidental spills of polluting materials, which may be toxic per se or have a high oxygen demand when degrading and so remove oxygen from water. Usually the spills are associated with transporting toxic materials or accidental releases of industrial process waste. The toxins usually end up in a watercourse, and can have detrimental impacts on the downstream ecosystem and economic activities alike. It is therefore suggested that the annual number of toxic spills should be recorded, together with their locality, duration, extent, type of toxin, cause and their impacts. This information would be useful for introducing measures to curb such spills.

Large volumes of herbicides and other pesticides are applied within Mbombela each year and not all of these break down rapidly on contact with soil or water. This could be causing slow but long-lasting changes to soil properties, groundwater quality and aquatic biota in particular. It would be impossible to monitor the use of all the pesticides within the region, but we suggest that a record be kept of the volumes of each herbicide used by the council, and for what purpose.

The composition of aquatic biota provides a useful index of the overall health of an aquatic ecosystem. A standard method of assessing river health, based on the composition of aquatic invertebrates, has been developed specifically for rivers and streams in South Africa. The method is referred to as the South African Scoring System (SASS), and has been widely applied by industry and government agencies alike. The method forms a key component of the National **River Health** Programme, which has monitored the state of rivers throughout the country, including various rivers within Mbombela. The results are routinely converted to a Present State Ecological Category, ranging from Category A (pristine) to Class F (critically degraded). It is suggested that the method should be applied to strategically selected sites throughout Mbombela. Best results are usually obtained during low-flow conditions, when the rivers and streams are accessible, and when water pollution problems are most severe.

Invasive **aquatic weeds** are a serious problem on some of the rivers in Mbombela, the Crocodile in particular. The main pest species are water hyacinth (*Eichhornia crassipes*), duck weed (*Lemna gibba*), Parrot's feather (*Myriophyllum aquaticum*), and Kariba weed (*Salvinia molesta*). These weeds have a detrimental impact on most aquatic biota, mainly because they reduce oxygen levels. They also provide habitat for bilharzia snails and malaria mosquitoes, and significantly increase evaporative losses. It is for these reasons that the abundance and distribution of these weeds should be monitored on the main rivers and streams in the area (ie, Crocodile, Elands, White River, Nels, Gutshwa etc). The % of river length infested with these weeds provides a simple measure of the extent of the problem. The best way to do this is with a low-level aerial survey.

5.3 Air quality

The core indicators for the air quality reporting theme are:

- Exceedances of WHO guidelines for SO₂, NO₂, CO, PM₁₀, O₃, Pb and Benzene
- Soiling Index from 3 stations in Nelspruit (*Proxy indicator to be replaced with the one above*)
- Number of air quality complaints registered at Mbombela
- Number of hospital admissions for respiratory diseases by type such as asthma and hay fever
- Distribution of energy household use (electricity, fossil fuels and wood)

Air pollution is caused by the emissions of gas, liquid vapor, or solid particulate matter into the atmosphere as a result of human activity. Apart from the impact on the natural environment, air pollution can adversely affect human health and well-being. Sufficient increases in the concentrations of various ambient air-pollutant can cause increased mortality, morbidity and deficits in pulmonary function as well as cardiovascular and neurobehavioral effects.

Continuous air quality monitoring is needed to determine the **exceedances of SO₂, NO₂, CO, PM₁₀, O₃, Pb and Benzene** as determined by the World Health Organisation (WHO) guidelines. These guidelines will be followed in the proposed new National Environmental Management: Air Quality Bill, 2003 developed by DEAT. This indicator should be reported on annually.

The Mbombela Local Municipality has not measured air quality, in terms of the constituents mentioned above, in the past and monitoring will have to be instituted. A **Proxy indicator** will be used for the first SoER to show trends over the last couple of years by the conversion of the **soiling index** measured at 3 stations in Nelspruit to a Total suspended Solids (TSP) value. The **number of air quality complaints registered** at the Mbombela Local Municipality will show a trend in air quality variations and the associated human well being will be measured by the number of **hospital admissions for respiratory diseases by type such as asthma and hay fever**.

Another indicator for air quality is connected to energy use in Mbombela, as burning of fossil fuels and wood causes air pollution. Potential trends in air quality variations could be determined by analyzing household energy use by type (Electricity, fossil fuels, coal or wood), as a percentage or the total.

5.4 Cultural Resources and cemeteries

Cemeteries are included as part of this reporting theme. The core indicators for the Cultural Resources reporting theme are:

- List and determine status of cultural buildings, rock art sites or other resources
- Expenditure and investment into cultural resources excluding cemeteries
- List Sources of cultural significance (champion trees etc.)
- No and status of cemeteries and their capacity in Mbombela
 - Managed by Mbombela
 - Not managed by Mbombela
- Mortality Rate
- Investment into maintenance and services of cemeteries

Nelspruit is a young city and is the capital of the Mpumalanga Province. With the exception of a few attractions namely, the Nelspruit Library, the Lowveld National Botanical Gardens, the Civic Centre and the Mpumalanga Legislative Building, the city lacks notable cultural/heritage resources. With the increase in capital influx and international tourism and the lack of proper cultural destination points for these visitors and the local people, it has become essential to **list and determine the status of all cultural buildings, rock art sites or other cultural resources** in the province. The data will be presented by trend charts, reports and maps. Data collection and updating is an ongoing process. As new rock art sites are discovered the condition and conservation status and location will be recorded. The objective of the indicator is to conserve the cultural resources in the Mbombela area and to thereby promote tourism in the area.

The **expenditure and investment into cultural resources** by Mbombela Local Municipality will indicate the priority status of cultural resources. Investment into cultural resources demonstrates action to conserve the heritage of Mbombela. The objective of this indicator is to prevent the loss of heritage and to increase public access and tourism in Mbombela. This data will be measured annually and can be presented by pie charts, graphs or trend charts.

In Mbombela cemeteries is a very important cultural asset especially in the rural areas. It is a place visited regularly requiring maintenance, toilet facilities and must be safe. **Investment into maintenance and services of cemeteries** will determine why the status of cemeteries is deteriorating and how much budget will be needed to maintain a standard. The **number and status of cemeteries and their capacity in Mbombela** is a

very important indicator. Most of the statistics are only available for the cemeteries managed by Mbombela, but initiatives will have to be developed in the next five years to gather information on the rural cemeteries. These cemeteries impact negatively on the environment, since they are mostly situated in environmentally sensitive areas. To determine the impact it is important to establish the location and status of these cemeteries. The **mortality rate** with the prevalence of HIV/Aids is also a factor that is decreasing the capacity of cemeteries in the area. Planning will have to be done in advance if an environmental disaster is to be prevented.

5.5 Land use:

5.5.1 Urbanisation

The core indicators for the land use reporting theme are:

- Land use change.
- Population density
- Floor area per person
- Derelict areas
- Renewal areas.
- Formal and informal settlements.
- Travel times
- Daily average distance travelled.

By measuring **land use change**, be it urban, industrial, forestry or agricultural, one will obtain an indication of the extent of natural environment being taken up by the extension of other uses. The use of land and the way it is managed affects the environment. It is therefore important to monitor changes in land use and the extent thereof. It is essential that the continual demand for land be reconciled with the desire to protect natural habitats.

The **population density** within settlements gives an indication of the pressures on the environment including the exploitation of natural resources and the pollution of the soil, air and water sources. The density of human settlement also affects human health and the quality of life.

In compact high-density settlements the **floor area per person** is higher than in lower-density settlements. Human health and quality of life is usually affected adversely in high-density settlements. When the floor area per person becomes too large it indicates that unnecessary use of resources such as electricity, land and water is taking place.

Derelict areas include land that was developed for some specific purpose but now remain unutilised. They represent wastage of resources as the land is designated for a specific use but is not optimally utilised. Duplication might be a result, which places unnecessary pressure on the environment. The derelict areas are often unsightly and present opportunities for unhealthy activities.

Renewal areas refer to land that was derelict but has been developed for another use. Utilisation of derelict areas reduces pressure on other areas, minimises the need for the development of green areas, removes unsightly developments, removes the opportunity for unhealthy activities and provides land suitable for housing, leisure or other uses.

The indicator of **formal and informal settlements** focuses on the marginality of human living conditions. Settlements characterised by informal tenure are generally marginal and precarious and do not cater for basic human needs and socio-economic development. Informal settlement of people does not take into consideration the effect that the use will have on the environment.

Travel times and **daily average distance travelled** gives an indication of the functionality of the built environment. Long travel times and large distances covered will indicate a dysfunctional system, represented by living and working areas far removed from each other. Mobility is an essential part of daily life and is the only access to economic and social opportunities. The level of mobility determines the ease of access to employment and social integration and the lack thereof promotes economic and social discrimination.

5.5.2 Industrial

The core indicators for the industrial reporting theme are:

- Illegal industrial uses being formalised or closed.

Illegal industrial uses being formalised or closed will give an indication of the extent of such activities as well as the success in monitoring such uses. Illegal uses do not take into consideration the effect on the environment or built area and could result in negative impacts.

5.5.3 Open areas / parks

The core indicators for the open spaces reporting theme are :

- Green areas
- Access to green spaces
- Investment in green areas

Parks, green lands, open areas and playgrounds play an important role in human settlement. **Green areas** symbolise peace, minimum stress and a cleaner environment. A quality provision of green areas enhances the quality of life.

The **access to green spaces** influences the quality of life in settlements and contributes to the aesthetics of the environment.

Investment in green areas is necessary for the maintenance, improving and regulation/monitoring of the areas. It is an important indicator for areas that suffer from a backlog in the provision of such facilities.

5.5.4 Agriculture

The core indicators for the agricultural reporting theme are:

- Expenditure on agricultural training programmes

In addition to the extent of new agricultural developments the environment is also severely impacted on by unsustainable farming practices. By maximising the expenditure on agricultural training and assistance programmes the extent of unsustainable farming practices can be lessened and a positive effect on the environment achieved.

5.5.5 Mining

The core indicators for the mining reporting theme are:

- Illegal mining activities

The identification of **illegal mining activities** will give an indication of the extent of such uses as well as the success of current regulation strategies by authorities.

5.5.6 Forestry

The core indicators for the forestry reporting theme are:

- Land use change (Included under land use change indicator)

The extent of new forestry development impacts on the environment by the destruction of natural habitats.

5.6 Socio-economics

The core indicators for Socio-Economics are:

- Population
- Life expectancy
- Household demographics
- Household expenditure
- Unemployment
- Economic growth
- Provision of schools
- Number of educators
- Adult literacy rate
- Status of health services
- Mortality rates
- Prevalence of communicable diseases
- Prevalence of HIV/AIDS
- Urban-rural distribution
- Land redistribution
- Crime prevention

Population increases, urbanisation and the provision of housing are prime factors influencing the state of the environment. The indicators suggested are important in the planning and management of urban areas as well as the use and direction of development resources. Apart from the total population and rate of increase of the population, it is important to know the distribution of that population and the density of housing in formal or informal settlements, for planning of formal housing and extension of services.

The **life expectancy** for females and males in different sectors of the community are important indicators of the state of community health and the adverse effects of poverty. The prevalence of HIV/AIDS will be reflected in the overall life expectancy.

Household demographics indicators are necessary for the planning and provision for social services and assistance, as well as understanding probable changes in social dynamics arising from an increasing number of female- and child-headed households. The expected increase in child-headed households, from AIDS/HIV attrition, will probably also see an increase in teenage pregnancies. The planning for provision of social services, by NGOs, state or municipal departments, will need such indicators.

Poverty levels may be quantified through estimates of **household expenditure** and child growth, as simply quantified by a school or clinic record of each child's age, weight and upper arm measurement. The data for both of these indicators are not easy to collect or maintain, but they do provide information on economic trends within communities and an estimate of the number of households living below the poverty datum line.

Unemployment statistics are an essential part of poverty alleviation, with a breakdown of skills available as well as an assessment of underemployment, due either to part time employment only or under-utilising trained personnel. Employment, or income earning, in the informal sector needs to be assessed as well, since this may contribute as much as the formal sector in particular areas.

Economic growth in the area may be best measured by the value of new housing plans passed and the development in the industrial and agricultural sectors. Economic "health" can be assessed from the number of business liquidations, insolvencies and house repossessions by mortgagors, where these show an upward or downward trend.

The **provision of education facilities** – primary and secondary schools as well as tertiary facilities – has to keep pace with the population increase and demand for schooling. The distribution of schools must be in line with population concentrations and this indicator is an essential tool for education planning in each area. Equally important is the number of educators in the schooling system, where it is important that each educator is not required to teach more learners than is reasonable. The adult literacy rate indicates the need for adult education, to provide at least reading, writing and basic arithmetic skills.

The **status of health services** must be quantified by the number of hospitals and clinics, both state and private, in the area, the staffing of each, and the availability of ambulances. Traditional healers should also be included in this evaluation. The location of each hospital or clinic should be determined, to assess distances to the nearest health service (not including doctors' surgeries or traditional healers' receptions). Although this would be a direct distance indicator and not road route, the information would still be indicative of areas poorly served by health institutions.

The **mortality rates** in different sectors of the community and in different age groups are important indicators of the state of community health and the adverse effects of poverty. The prevalence of HIV/AIDS will also be reflected in the infant and under 5 statistics.

The **prevalence of communicable diseases** is an indicator of a number of core issues, such as poverty levels, quality of water used in the households, general sanitation levels and general health awareness. This set of indicators is also linked to the need for health services in each area.

Estimates of the **prevalence of HIV/AIDS** are important in evaluating the need for support systems for households with AIDS sufferers and the increasing burden on health and social services. Other linked issues are the increasing number of AIDS orphans, child headed households, reduced household incomes and increased demands on those incomes, as well as the need for cemetery facilities.

Changes in demographics and household expenditure will take place through **land redistribution**, which will increase population densities in areas currently with low densities. This will influence the planning of all services, which may have to be provided with little time for implementation, as particular areas are settled.

Statistics on crime are currently not available, but should be seen as a future indicator in the **prevention of crime**. Indicators that are available are the numbers of community service centers (police stations) and their locations, distances to the nearest community service centre and the increase in areas being covered by community police fora (CPF), which are currently being initiated. The provision of street and security lighting is seen as being associated with crime and is a key issue in the areas not provided with public lighting.

The provision of **emergency services** – more particularly fire brigade services – will most probably be extended in future and the locations and levels of service need to be known, with the area served by each station. The distance to the nearest emergency service station will be an indicator of areas in need of additional services.

5.7 Infrastructure:

5.7.1 Solid waste management

The core indicators for the solid waste management theme are:

- Extent of illegal dumping sites
- Status of Landfill sites managed by Mbombela (compliance to permits)
- Staff complement to manage the different landfill sites
- Waste generated by the municipality – Nelspruit, Hazyview and White River
- Recycling of waste
- % Population without access to refuse removal / planning area

Many cities generate more solid waste than they can collect or dispose of. Even when municipal budgets are adequate for collection, the safe disposal of collected wastes often remains a problem. Dumping and uncollected landfills are sometimes the main disposal methods in many developing countries, sanitary landfills are the norm in only a handful of cities. Inadequate collection and unmanaged disposal present a number of problems for human health and productivity. Uncollected refuse dumped in public areas or in waterways contribute to the spread of diseases. (Ceroi) The **extent of illegal dumping** will be determined through the budget expenditure to clean illegal dumping and by measuring the volume of waste cleaned and taken to landfill sites.

Waste management and disposal must be well-planned to reduce the risk of handling and disposing of waste so that it is acceptable to man and the environment. Section 20 of the Environment Conservation Act, 1989 (Act 73 of 1989), states that “waste can only be disposed of at a waste disposal facility”. Waste prevention and minimization are therefore the best options to manage waste problems. **Recycling programs** and the **volume of waste recycled** in Mbombela are indicators to show how wastes minimisation is handled in Mbombela. To determine the efficiency of waste management in Mbombela the following indicators were identified:

The management of waste in townships and informal settlements is one of the main issues of waste disposal for local governments. The pressure indicator **% Population without access to refuse removal / planning area** will show the level of service provision in Mbombela in terms of solid waste management.

The status of Landfill sites managed by Mbombela as well as hazardous landfill sites will be determined through the compliance with permits. Part of the registration entails the management of the landfill site with an approved EMP. The number and position of landfill sites and projected life (Capacity) of each landfill site, together with the above registration requirements will be used to determine the status of the different landfill sites managed by Mbombela. The information will be represented on maps and charts and linked to the **staff complement for the landfill sites** to determine if it correlates.

Waste generated in the area increases annually due to population growth, inadequate services and unsustainable lifestyles. Solid wastes are generated by domestic, agricultural, tourism, transport, health care and economic sectors while chemical wastes are generated by industry and agriculture. The unit of measurement is both capacity and weight. The units are total Volume of waste generated / household/annum. The total number of households is needed to calculate the amount of waste generated per household. This indicator will be measured annually and can be presented by trend charts and maps. The objective of the indicator is to reduce the amount of waste disposal. Community participation in waste management produces health and social benefits.

All these indicators will be used to determine the % of waste disposed.

5.7.2 Electricity

The core indicators for the electricity theme are:

- Electricity provision
- % of electricity generated by Hydro electrical stations
- Wood use for energy
- History of payment in Mbombela

The energy sector has numerous points of interface with the environment, many of which suffer severe environmental degradation. Energy is often produced through the burning of fossil fuels and **wood** or the harnessing of **hydroelectric power**. Electricity generation produces emissions of carbon dioxide (CO₂). The burning of fossil fuels and wood for energy is an additional source of CO₂. By reducing electricity consumed, we can reduce the emissions of greenhouse gases and help control global warming. **Households without** electricity rely mainly on liquid fuels or the burning of **wood and**

biomass as energy sources for heating and cooking. By determining the vegetation reduction (Deforestation) we could form an idea of how much wood is burned.

By analysing the **history of payment for electricity in Mbombela** we could indicate the affordability of electricity and the attitude change of electricity users.

5.7.3 Transport

The core indicators for the transport theme are:

- Registered vehicles
- Traffic volumes
- Status of Bus/Taxi terminals
- Access to public transport routes
- Commuters using public transport
- Public and mass transport seats
- Total length paved or unpaved roads

Due to the rapid urbanization of Mbombela and the increase in population of the area it is important to upgrade and maintain the transportation infrastructure. By determining the number of **registered vehicles** in Mbombela, it is possible to determine the potential for congestion. N4 traffic counts will provide an indication of through traffic on this national road, affecting Mbombela.

The roads in the rural areas are not adequately maintained and have potholes resulting in unsafe conditions. With the increased urbanization occurring in the rural areas and the increase in job opportunities in the urban centres of Mbombela, it is essential that existing roads be maintained and/or new roads be established and maintained. By determining the **traffic volume** of the area it is possible to determine what the need for new roads and the maintenance for existing roads are. This indicator is also used to measure the pressure on the physical environment as well on the human environment. The ideal is to reduce the number of vehicles on the main routes.

The traffic volumes are measured as a number of vehicles/km (a manipulation of other indicators) and the number of vehicles on main routes (CEROI, City Environmental Indicators Encyclopedia).

To indicate the provision of road transportation infrastructure, the **total length of paved or unpaved roads** will be measured. To determine the trend, the data must be measured over several years. The data can be presented in the form of trend charts or maps.

The status of bus/taxi terminals in Mbombela is an important issue. Insufficient bus/taxi terminals and facilities at terminals have an impact on human health and human safety. The insufficiency is due to the increase in commuters and a lack of infrastructure provision. There is an increase of people in the rural areas employed in the urban centres like Nelspruit, White River and Hazyview, who do not have private transport. It is essential to provide adequate public transport facilities between these areas. The data required to measure this indicator includes the following:

Number, Type (terminus, rank or holding) and Status:

- Formal or informal
- Paved or unpaved
- On or off street
- Average passenger waiting times
- Electricity/ telephones/ ablutions/ shelters
- No of loading bays/type

This indicator can be spatially represented by a map and a table.

Access to public transport routes determines the potential usage of the transport systems in an urbanized area. The data needed is the percentage of people who live within 1 km walking distance of a public transport route. A map illustrating the location of all the bus/taxi terminals and public transport routes will be compiled to present the data. This indicator will represent accessibility to public transport routes.

Since there is an increased influx of people to the urban centres of Mbombela (Nelspruit, White River and Hazyview), it is important that transport and transport policies be reviewed as they play an important role in the economy and the quality of life. Efficient public transport ensures a cleaner urban environment by improving air quality. It also supports economic growth and stimulates tourism in the area as international tourists have access to more destinations. The indicator number of **public and mass transport seats** will provide insight into public transportation capacity in Mbombela.

This indicator will be measured annually and it can be “defined as the number of public seats per 1000 people” (CEROI). The data will be presented in the form of trend charts. No target references or benchmarks are known.

By measuring the **total length of the paved or unpaved roads** in Mbombela, the approximate surface of the paved areas will be known. This is important as paved areas cause an increase in runoff and runoff velocity and increases potential impacts on the natural drainage patterns. This indicator will provide insight into transportation infrastructure provision in Mbombela.

5.7.4 Water supply & Sanitation

The core indicators for the water supply theme are:

- Water price
- Water treatment works
- Water cost recovery
- Treatment process waste
- Quality of water treatment services
- Quality of reticulated water
- Water distribution services
- Sanitation services
- Wastewater treatment works
- Water returned

The **price of water**, both potable and bulk supply, for industry or agriculture, is indicative of water affordability and should also be influenced by scarcity and reflect

true economic value. Sliding tariff scales for domestic use are important indicators of induced demand management.

The capacity of **water treatment works**, supplying potable water, must be sufficient for both peak demand periods in summer and for demand growth through improved services and population increases. Reduction in spare capacity is an important indicator of when existing facilities will no longer cope with demands and when additional water treatment facilities should be put into service. In the long term, it is essential to have full cost recovery for potable water delivered, including maintenance of reticulation systems. The level of current cost recovery is important for long-term economic projections. Distribution losses play a major role, in both water demand management and economics of water supply, and should be reduced at an acceptable minimum. Treatment process waste production – sludge and non-reusable waste water – can be problematic, taking up solid waste disposal capacity or reducing receiving water quality, and also have economic implications.

The licensing of water treatment works and services is required under the Water Services Act (Act 108 of 1997) and any effluent discharge has to be licensed under the National Water Act (Act 36 of 1998). Both Acts are administered by the DWAF and any transgressions or failures to adhere to licensing requirements should be monitored. Maintenance of quality of reticulated water is essential and non-compliance with DWAF requirements should be monitored.

The extent and levels of water distribution services are improving steadily and indicators are suggested to monitor this improvement. The number of people without access to potable water or drawing water from surface water sources is an important indicator of the population at risk of waterborne diseases and of serious water shortages in drought periods.

Sanitation services are as important as the provision of potable water in the reduction in waterborne diseases, especially cholera. Monitoring the levels of sanitation is therefore important for planning both improved sanitation and community health services.

Wastewater treatment works are similarly as important as potable water treatment works, for the maintenance of river health, unpolluted groundwater and general sanitary conditions. As for water treatment works, the spare capacity available for increase in service demand is an important indicator, as are the reuse of treated effluent, either into reticulated systems or into rivers, and the production of usable and non-usable sludges.

All **wastewater** should be **returned** to the catchment of origin, as required by the National Water Act, and water returned to the rivers is an important part of the overall resource. However, returns may indicate inadequate water demand management and monitoring these returns will indicate the potential for water demand reduction. On the other hand, returns of good quality effluent from industry or wastewater treatment works usually indicates good water management.

5.8 Tourism

The core indicators for the Tourism reporting theme are:

- Status of tourism resources
- Vegetation used for making curios
- Economic statistics on Tourism
- Crime incidents reported by tourists

Mbombela contains many prime tourist destinations in the country. Mbombela forms a link to the Kruger National Park and the rest of Mpumalanga Province. The new Kruger Mpumalanga International Airport forms a gateway to many international destinations while Maputo is only three hours drive away by road. Many people flock to the area to experience outdoor adventure, waterfalls and forests.

The **status of tourism resources** can be measured by recording the number of tourists that visit the area, the **number of tourism attractions** and by listing the **accommodation** and the **number of available beds** in the area. The data can be presented by a map and by graphs. The objective of the indicator is to increase tourism in the area and thus also increase economic growth. The indicator also illustrates the adequacy of tourism facilities.

Due to the influx of tourists in the area there is a demand for traditional curios. The curios are made and sold by members of the lower income groups of society. These curios are made from natural resources such as indigenous vegetation as these materials are the cheapest to use. The indicator on **Vegetation cover** can be used to determine the extent of indigenous vegetation, which is lost in the process of producing traditional curios. The objective of this indicator is to prevent the destruction of indigenous vegetation and to promote the use of exotic invasive species for the production of curios. This data can be presented on a map.

The **economic statistic on tourism** in Mbombela will indicate whether the influx of tourists to the area have increased or decreased over a period. The issue that will be addressed is the safety and security of tourists at tourism sites. The objective of the indicator is to prevent crime and to increase economic growth. By measuring the **crime incidents reported by tourists** a trend could be determined. The data will be presented by trend charts and graphs.

5.9 Environmental Governance

The core indicators for the environmental Governance reporting theme are:

- Capacity of environmental staff compliment
- Trained personnel in environmental management
- Budgetary allocation to management, training, education and awareness
- Percentage new developments which are listed activities with approved EIAs, EMPRs & EMPs vs. none
- Conditions of approval of EIAs implemented
- Environmental education programs
- IDP commitment to environment and environmental policies.

The **capacity for environmental staff compliment** measures the capacity of Mbombela to implement environmental management. The data will be collected by monitoring the number of environmental management posts. The pressure placed on human resources and Mbombela's capacity to realize their results in inefficient

implementation and monitoring of environmental management. The results of the indicator will be presented by tables and measured annually. Together with this indicator it must be determined if these environmental staff members have been sufficiently **trained in environmental management** to fulfil their environmental responsibilities.

The financial commitment of Mbombela to encourage environmental management, education and awareness is indicated by the **budgetary allocation to environmental management, education and awareness**. This is a response indicator and is presented annually by tables. The degree of commitment is shown by the financial provision. If environmental education and awareness is promoted, it may result in increased involvement and empowerment of people in the environmental issues. This indicator will also measure the efficiency of Mbombela. The objective of the indicator is to establish a strategy to guide expenditure resulting in patterns that will highlight the presence, absence and efficiency of a strategy.

The **percentage of new developments, which are listed activities with approved EIAs and EMPs vs. none** indicates the efficiency of the local government to control development in the area. **Environmental education programs** in Mbombela will not only show commitment from the Municipality but will also increase environmental awareness at public level resulting in decreasing environmental degradation.

The **condition of approval of EIAs implemented is** an indicator measured by monitoring of implementation and compliance. This indicator will monitor the implementation of environmental management plans approved through the EIA approval process. The objective of the indicator is to address the developments that do not adhere to the specifications laid out in the environmental management plan after an Environmental Impact Assessment (EIA) has been conducted and approved.

The **IDP commitment to environment and environmental policies** is a state indicator that measures the commitment to environmental management on the local level. This commitment will be tracked in the IDP documents produced by the local authorities. By asking the following questions the indicator will measure the commitment to the environment (Mpumalanga Key Environmental Indicators):

- Does the IDP show an understanding of the policy and legislative framework surrounding the environment?
- Does the IDP show an understanding of the implications of the above policy and legislative framework for the municipality and their day-to-day operations?
- Does the IDP provide a structure and mechanisms for the responsibility and accountability of environmental issues?
- Does the IDP provide an understanding of the environmental issues in the municipality, and the opportunities and constraints those issues may present?
- Does the IDP provide Localised Strategic Environmental Guidelines for the development strategies?
- Is there an Integrated Environmental Program (IEP)?
- Does the Medium Term Expenditure Framework (MTEF) provide a budget for the IEP?
- Is there an integrated Waste Management Plan (IWMP)?
- Have any projects related to the following been identified?
 - Sanitation and water
 - Energy

- Integrated land and human settlement planning
- Environmental health
- Integrated pollution and waste management
- Biodiversity and sensitive areas
- Parks and open space
- Community based natural resource management
- Does the MTEF provide budgets for the above projects?
- Does the IDP specify how the EIA legislation will be complied with during the lifetime of the projects listed?
- Throughout the IDP, is the environment considered in a holistic manner, or does it merely relate to conservation or “green” issues?

Another objective of this indicator is to provide information on the transparency of the local government planning process, and the presence of an environmentally related strategic vision (Mpumalanga KEI).

6. CONCLUSION

This report presents an overview of the key environmental indicators in Mbombela, linked to the key environmental issues and concerns raised in Phase 1 of the SoER process.

These indicators were established through review of relevant information and a stakeholder workshop in Mbombela. They are appropriate for future monitoring of the state of the environment and determining trends in environmental change, and will now be used for state of environment reporting. Comments on this framework report will be included in the final list of key indicators. The list will then be measured against the issues and concerns.

The way forward in completing the SoER in Phase 3 of the SoER development process, includes the determination and reporting of the state of the environment in Mbombela using the Driving force–Pressure-State-Impact-Response (DPSIR) framework, based on the issues, concerns and indicators identified in the process to date.

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