

# NATIONAL CORE SET OF ENVIRONMENTAL INDICATORS

## PHASE 3 : SELECTION OF INDICATORS WASTE MANAGEMENT



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*National Environmental Indicators Programme  
Phase 3 : Indicator Selection*

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Specialist Report 3, Vol. 1: Inland Water  
Specialist Report 3, Vol. 2: Marine, Coastal & Estuarine  
Specialist Report 3, Vol. 3: Biodiversity & Natural Heritage  
Specialist Report 3, Vol. 4: Land Use  
Specialist Report 3, Vol. 5: Human Well-being  
Specialist Report 3, Vol. 6: Atmosphere & Climate  
**Specialist Report 3, Vol. 7: Waste Management**  
Specialist Report 3, Vol. 8: Integrated & Environmental Management

Cover picture: Mark Napier

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## BACKGROUND

This report is one in a series of 8 specialist reports produced as part of Phase 3 of the National Environmental Indicators Programme. This Programme was initiated by the South African national Department of Environmental Affairs and Tourism (DEA&T) to develop national environmental indicators for State of the Environment reporting in South Africa. Environmental indicators are described in Box 1 below.

The specialist reports contain information on the individual indicators selected for use in South Africa.

### BOX 1: ENVIRONMENTAL INDICATORS

The term “indicator” stems from the Latin verb “*indicare*” meaning to disclose or point out. Indicators provide a means of communicating information about progress towards sustainable development in a significant and simplified manner. They focus and condense information about complex issues for management, monitoring and reporting, principally for decision-making. An indicator will provide a signal to an issue of greater importance or make more evident a trend or phenomenon that is not immediately detectable. In this regard an indicator’s relevance extends beyond what is actually being reflected to a larger issue of interest.

An indicator set assists in understanding the current state of an environmental system and trends in that system. However, like any form of information, there are limitations to their use. The acceptability of any indicator depends on the availability and confidence of the data, as well as the interpretation of the indicator. Interpretation is particularly important as indicators tend to provide the essence of a situation rather than the whole picture. The establishment of thresholds can assist in interpretation, but only in cases where scientifically valid or legal thresholds exist.

The indicators presented here are grouped in the DPSIR framework. The definitions relating to the individual components of this framework are outlined in the box below.

### BOX 2: DPSIR DEFINITIONS

**Driving forces** are the human influences and activities that, when combined with environmental conditions, underpin environmental change. Indicators for driving forces describe the social, demographic and economic developments in societies and the corresponding changes in lifestyles, overall levels of consumption and production patterns.

**Pressures** are exerted on resources and ecosystems as a result of human activities (i.e. driving forces), and include consumption and waste generation patterns and trends.

**State** refers to the condition of the environment resulting from pressures (e.g. level of air pollution, land degradation or deforestation).

**Impacts** are the results of pressures on the current state of the environment, which occur in a certain sequence. For instance, air pollution may cause global warming (primary effect), which may in turn cause an increase in temperature (secondary effect), which may provoke a rise of sea level (tertiary impact), which could result in a loss of biodiversity and thus impact on human health and well-being.

**Responses** are the societal actions taken collectively or individually to ease or prevent negative environmental impacts, correct environmental damage or conserve natural resources. Responses may include regulatory action, environmental or research expenditure, public opinion and consumer preferences, changes in management strategy, and provision of environmental information.

## **INTRODUCTION**

Some people view waste as a manifestation of the inefficient use of resources, while others view it as the root cause of pollution and the associated environmental degradation. Whichever way one looks at it, increased waste generation is an inevitable consequence of development and must be systematically managed in order to conserve resources and protect the environment (DWAF, 1997b). An expanding economy, increased production of goods together with an expanding population are the main drivers for waste generation.

According to the White Paper on Integrated Pollution and Waste Management (IP&WM), the country is emerging from a period of unsustainable and inequitable development. One outcome of these unsustainable and inequitable development policies is environmental degradation, which has significant economic and social impacts. Part of effecting a transformation to sustainable development is to redefine the way in which pollution and waste is managed in South Africa (DEA&T, 2000).

International concern about increasing pollution has escalated over the past 20 years, particularly in the last decade. Many international protocols and conventions have arisen as a result. Many reports have also been written and conferences held as a result of concern about global environmental degradation. One of the most important of these conferences was the United Nations Conference on Environment and Development (UNCED), which was held in Rio De Janeiro in 1992. At this conference, 178 countries agreed on Agenda 21 as a blueprint for sustainable development. The White Paper on IP&WM is part of the South African government's efforts to meet the goals of Agenda 21 (DEA&T, 2000).

Certain international agreements (such as the UN Framework Convention on Climate Change, which deals with greenhouse gases, and the Basel Convention, which addresses trans-boundary movement of hazardous waste) impose specific requirements on South Africa. These requirements are also being addressed as part of the process of formulating South Africa's policy on IP&WM (DEA&T, 2000).

The indicators that are proposed in this report aim to address those aims and objectives of South Africa's National Waste Management Strategy, which is a follow up document to the White Paper on IP&WM (DEA&T and DWAF, 1999). The indicators are grouped according to the main issues surrounding waste management in South Africa. These issues were identified by specialists and stakeholders during Phase 2 of this project. They were then reviewed by officials from national and provincial government during Phase 3 of this project. The main issues were grouped under categories of waste generation and waste reduction. The waste reduction category as used here is broad and includes correct disposal and collection and expenditure indicators (see Summary of Indicators Table below).

## **DESCRIPTION OF ISSUES**

### *Waste Generation*

According to the 1999 State of the Environment Report for South Africa (DEA&T, 1999), the country generates over 42 million m<sup>3</sup> of solid waste every year. This is about 0.7 kg per person per day, which is more typical of developed countries than a developing country (by comparison the figure in the UK is 0.73 kg, 0.87 kg in Singapore and 0.3 kg

in Nepal). In addition, 5 million m<sup>3</sup> of hazardous waste are generated every year (DEA&T, 1999). Every day 2.6 million m<sup>3</sup> of domestic and commercial waste water is processed at treatment works. The last figure does not include agricultural and some industrial waste, which are the largest sources of water (DEA&T, 1999).

South Africa's capacity to treat, store and dispose of high volumes of waste are limited, and it is predicted that five of the nine provinces will have landfill shortages within the next decade (DEA&T, 1999). Further cause for concern is the low percentage of hazardous waste that is actually disposed of properly. It has been estimated that 5% of the 5 million m<sup>3</sup> produced every year was disposed of at designated sites.

#### *Waste Reduction*

In the past, the focus in South Africa has been on waste disposal and impact controls or "end of the pipe" treatment. Inadequacies of this focus include:

- Lack of waste avoidance, minimisation and cleaner production technology initiatives;
- Lack of regulatory initiatives to manage waste minimisation;
- Few incentives for reducing waste;
- Industries not required to submit plans for waste disposal when applying to establish new enterprises;
- Inadequate resource recovery and a general lack of commitment to recycling - no legislation, policy or waste management culture that promotes resource recovery or makes it financially viable; and
- Lack of a variety of appropriate waste treatment methods.

Some of the consequences of these policies are continued air and land pollution and the pollution of fresh and marine waters, resulting in the disruption of ecosystem processes, habitat destruction and species loss. The amount of waste produced also places increasing pressure on the country's landfills. Increasing amounts of land set aside for landfills could lead to habitat destruction and species loss. Lack of appropriate waste management strategies and treatment technologies associated with these policies also have a negative effect on people's health.

Appropriate measures to reduce and manage the amount of waste that is produced need to be put in place. The approach to integrated pollution and waste management spelled out in the White Paper (DEA&T, 2000) requires a shift from control to prevention. The shift to pollution prevention will:

- Minimise and/or avoid the creation of pollutants and waste;
- Minimise and/or avoid the transfer of pollutants from one medium to another;
- Accelerate the reduction and/or the elimination of pollutants;
- Minimise health risks and impact;
- Promote the development of pollution prevention technologies;
- Use energy, materials and resources more efficiently;
- Minimise the need for costly enforcement;
- Limit future liability with greater certainty;
- Limit costly clean-up practices;
- Promote a more competitive economy;
- Reduce human impact on the environment;

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- Enhance the quality of life, and
- Ensure intergenerational equity.

See Appendix 1 for Issues Diagrams based on the DPSIR framework.

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**SUMMARY TABLE OF INDICATORS**

<b>Issue</b>	<b>Indicator</b>	<b>Number</b>	<b>Type</b>	<b>Level</b>	<b>Frequency</b>
Waste generation	General waste produced per income group per year	WM01	S	2	Annual
	General waste produced per capita per year	WM02	S	2	Annual
	Hazardous waste produced per sector per year	WM03	S	2	Annual
Waste reduction	Waste recycling	WM04	R	2	Annual
	Value of waste recycled	WM05	R	2	Annual
	General waste correctly disposed through landfill	WM06	S	2	Annual
	Hazardous waste correctly disposed	WM07	S	2	Annual
	Available landfill lifespan	WM08	P/S	2	5-yearly
	Provincial expenditure on waste management	WM09	R	2	Annual
	Provincial waste collection capacity	WM10	R	2	Annual
Dormant Indicators	General landfill airspace supply vs. demand		P/S	2	5 yearly
	Hazardous waste landfill airspace supply vs. demand		P/S	2	5 yearly
	Percentage landfill permit applications and permits granted for operating and future landfills by class		S/R	1	Annual

Type: refers to the position of the indicator in the DPSIR framework. D: Driving Force, P: Pressure, S: State, I: Impact, R: Response. Level: refers to the availability of data. Level 1: adequate data available, Level 2: inadequate data available, Level 3: no data available. Frequency: refers to the desired frequency of reporting rather than the frequency of monitoring or measurement.

## **FACT SHEET DEFINITIONS**

The fact sheets contain certain terminology which requires clarification. The definitions for this terminology are provided below:

### *Indicator Levels*

Level 1: adequate data are available now for all components of the indicator and can be used to support the indicator without significant additional costs.

Level 2: the indicator is presently feasible, but cannot be provided without additional investment in the data collection process.

Level 3: no data currently exist for the indicator, and there is no immediate intention to collect the data.

### *Selection Criteria*

1. The indicator must be based on good quality data that are available at a reasonable cost.
2. The indicator should provide information that measures something that is important to decision makers.
3. The information can be presented in a way that is easily understood and appealing to the target audience.
4. The indicator must relate to goals, targets or objectives.
5. The indicator must provide timely information (to allow for response).
6. The indicator must be able to detect small changes in the system.
7. The indicator must be relevant to policy and management needs within the South African context. The indicator must therefore be associated with one or several environmental policy issues.
8. The indicator must be based on data that are accurate, reliable, statistically sound and scientifically valid. Metadata should define the quality of the data in the data set and includes information on sensitivity, uncertainty, variability, precision, accuracy and error
9. The data must be available and accessible, particularly in the long term.
10. The indicator must be based on data of the correct spatial and temporal extent. Sufficient historical data must be available to identify trends over time.
11. The data collection process should have minimal environmental impact.

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**FACT SHEETS**

<b>INDICATOR THEME</b>	Waste management
<b>INDICATOR ISSUE</b>	Waste generation
<b>INDICATOR NAME</b>	<b>WM01</b> General waste produced per income group per year

**Type:** Driving Force / Pressure / **State** / Impact / Response

**Linkages:** This indicator can be linked to the Human Well-being theme.

**Indicator Level**

Level 1	<b>Level 2 X</b>	Level 3
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**Selection Criteria met by the Indicator**

	1	2	3	4	5	6	7	8	9	10	11
Criteria met fully			<b>X</b>								<b>X</b>
Criteria met partially	<b>X</b>	<b>X</b>		<b>X</b>			<b>X</b>				
Criteria not met					<b>X</b>	<b>X</b>		<b>X</b>	<b>X</b>	<b>X</b>	

**Description of the Indicator**

This indicator will track the average annual amount of general waste produced per income group. General waste is waste that does not pose a significant threat to man and the environment if managed properly. It includes waste paper, metals, glass, plastic, organic and inert materials generated through domestic, commercial and industrial activities.

<b>Units</b>	m <sup>3</sup> /capita/year
<b>Spatial scale</b>	National
<b>Frequency</b>	Annual
<b>Confidence</b>	Medium

**Reason for Selecting the Indicator**

General waste production increases annually due to population growth, economic growth and unsustainable lifestyles. Waste that is not disposed of properly may have adverse effects on ecosystem functioning and human health. In South Africa there are huge disparities between higher income groups and lower income groups. In general, the higher income groups generate more waste per capita than the lower income groups. This indicator highlights the differences in the amount of waste generated for the different income groups. Due to problems with obtaining reliable data on volumes of waste produced from municipalities, alternative ways of determining general waste volumes are required. This approach determines the average volumes of general waste produced by different income groups and multiplies it with the population for each income group. Assessments should be on a national or provincial scale.

### Data Sources

- **Data acquisition:** Data can be obtained from DWAF regional offices, municipalities and from the national census.
- **Limitations:** Current data may not be available. The most recent data available can be found in the Baseline Studies that were published by DWAF in 1997 and 1998.

### Example

Trend lines or bar graphs can be used to represent this indicator. This graph was based on **estimated** data found in the document *Waste Generation in South Africa*, which formed part of the National Baseline Studies which were published by DWAF in 1997 and 1998.

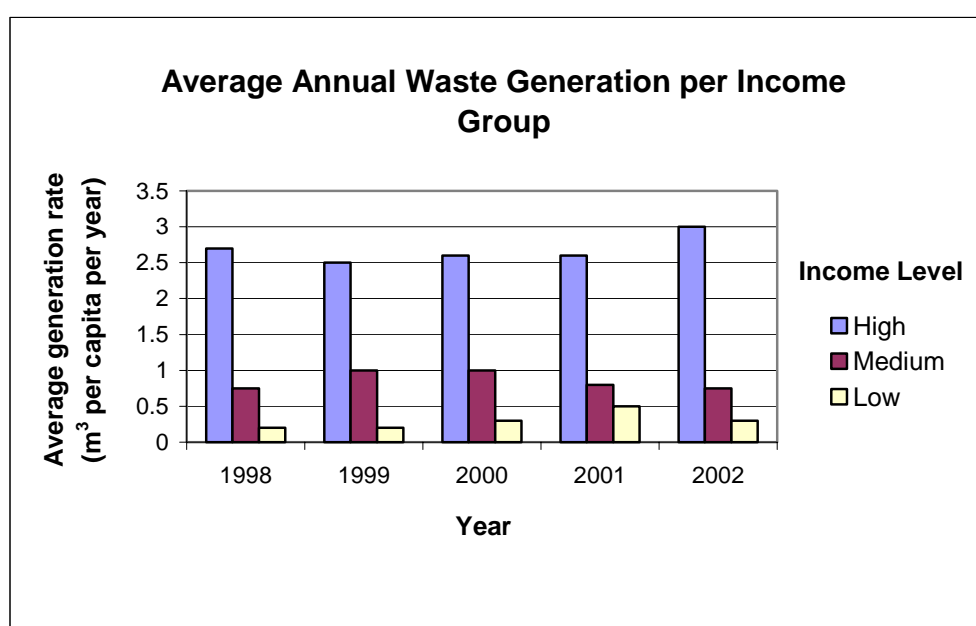


Figure WM1.1: **Fictitious** graph showing the average annual waste generation per income group, for illustrative purposes (DWAF, 1998a)

### Cost of implementation

According to DEA&T and DWAF (1999) the initial investment in capacity building and hardware and software for the implementation of the Waste Information System (WIS), which forms part of the NWMS, will cost an estimated R21 million. The operating costs are estimated at R57 million per year assuming that data will be collected every year and that the approximately 200 000 waste generators, transporters and disposers identified in related NWMS initiatives are required to report. See the table below for a breakdown of the Development, Investment and Operating costs. The information in this table also applies to Indicators **WM02**, **WM03**, **WM04**, **WM06**, **WM07** and **WM08**.

Development Costs	Million Rand
Development of WIS Database	5
Building Capacity in Government	5
Building Capacity in Data Suppliers	3
Building Capacity in Society, Promoting the WIS	2

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<b>Total Development Costs</b>	<b>15</b>
<b>Investment Costs</b>	<b>Million Rand</b>
Computer Hardware	5
New Personnel	1
<b>Total Investment Costs</b>	<b>6</b>
<b>Operating costs per year</b>	<b>Million Rand</b>
Salaries for Data Capture	50
Salaries for Quality Assurance	3
Salaries for WIS Management	0.5
Ongoing Advertising and Information Dissemination	2
Maintenance and Upgrading	1
<b>Total Operating Costs</b>	<b>57</b>

**Needs**

Few local authorities know how much waste is generated and how much is properly disposed of. Part of the problem is that waste volumes can be reported as compacted or non-compacted waste, which leads to apparent discrepancies. A national database of waste statistics is needed to make this information more accessible to the public and policy makers. A Waste Information System Action Plan was developed as part of the National Waste Management Strategy (DEA&T and DWAF, 1999). Once the Action Plan is implemented more reliable data will be generated.

**Reference List**

DEA&T, 2000. White paper on IP&WM for South Africa. Available at: <http://www.gov.za/gazette/whitepaper/2000/20978.pdf>

DEA&T and DWAF, 1999. National Waste Management Strategies and Action Plans for South Africa. Strategy Formulation Phase. PMG 130. DEA&T and DWAF, Pretoria.

Cities Environment Reports on the Internet (CEROI). City Environmental Indicators Encyclopedia. Available at: [http://ceroi.net/ind/all\\_ind.asp](http://ceroi.net/ind/all_ind.asp)

DWAF, 1997a. Waste Management Series. Disposal Sites for Hazardous and General Wastes in South Africa. Baseline Studies Second Draft, November 1997. DWAF, Pretoria.

DWAF, 1998a. Waste Management Series. Waste Generation in South Africa. Baseline Studies. DWAF, Pretoria.

Mr. Kobus Otto, Waste Consultant

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<b>INDICATOR THEME</b>	Waste management
<b>INDICATOR ISSUE</b>	Waste generation
<b>INDICATOR NAME</b>	<b>WM02</b> General waste produced per capita per year

**Type:** Driving Force / Pressure / **State** / Impact / Response

**Linkages:** This indicator can be linked to all the other themes. It is also linked to the Commission for Sustainable Development indicators 'Municipal waste disposal' and 'Generation of industrial and municipal solid waste'.

**Indicator Level**

Level 1	<b>Level 2 X</b>	Level 3
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**Selection Criteria met by the Indicator**

	1	2	3	4	5	6	7	8	9	10	11
Criteria met fully			<b>X</b>				<b>X</b>		<b>X</b>		<b>X</b>
Criteria met partially	<b>X</b>	<b>X</b>		<b>X</b>				<b>X</b>			
Criteria not met					<b>X</b>	<b>X</b>				<b>X</b>	

**Description of the Indicator**

This indicator measures the total annual amount of general waste produced per capita. General waste is waste that does not pose a significant threat to man and the environment if managed properly. It includes waste paper, metals, glass, plastic, organic and inert materials generated through domestic, commercial and industrial activities.

<b>Units</b>	kg/capita/year or m <sup>3</sup> /capita/year
<b>Spatial scale</b>	Provincial or National
<b>Frequency</b>	Annual
<b>Confidence</b>	Medium

**Reason for Selecting the Indicator**

Waste production increases annually due to population growth, economic growth, inadequate services and unsustainable lifestyles. Waste that is not disposed of properly may have adverse effects on ecosystem functioning and human health. The South African government has, through its White Paper on IP&WM, highlighted the need to minimise the amount of general waste generated.

**Data Sources**

- **Data acquisition:** Data can be obtained from DWAF regional offices, municipalities and the national census (obtainable from Statistics South Africa).
- **Limitations:** Current data may not be available. The latest data can be found in the national baseline assessment that was conducted by DWAF in 1998. This indicator will not give a true reflection of the amount of waste disposed to landfill per capita because it does not allow for recycling and recovery or private

dumping e.g. by the mining industry and other industries. It also does not take illegal dumping into account.

### Example

This indicator should be measured both in capacity and in weight units if possible. To calculate the amount of waste generated per person, the total number of inhabitants of the country are needed. Trend lines, bar graphs or maps can also be used to represent this indicator. **Fictitious** data have been used in the example below.

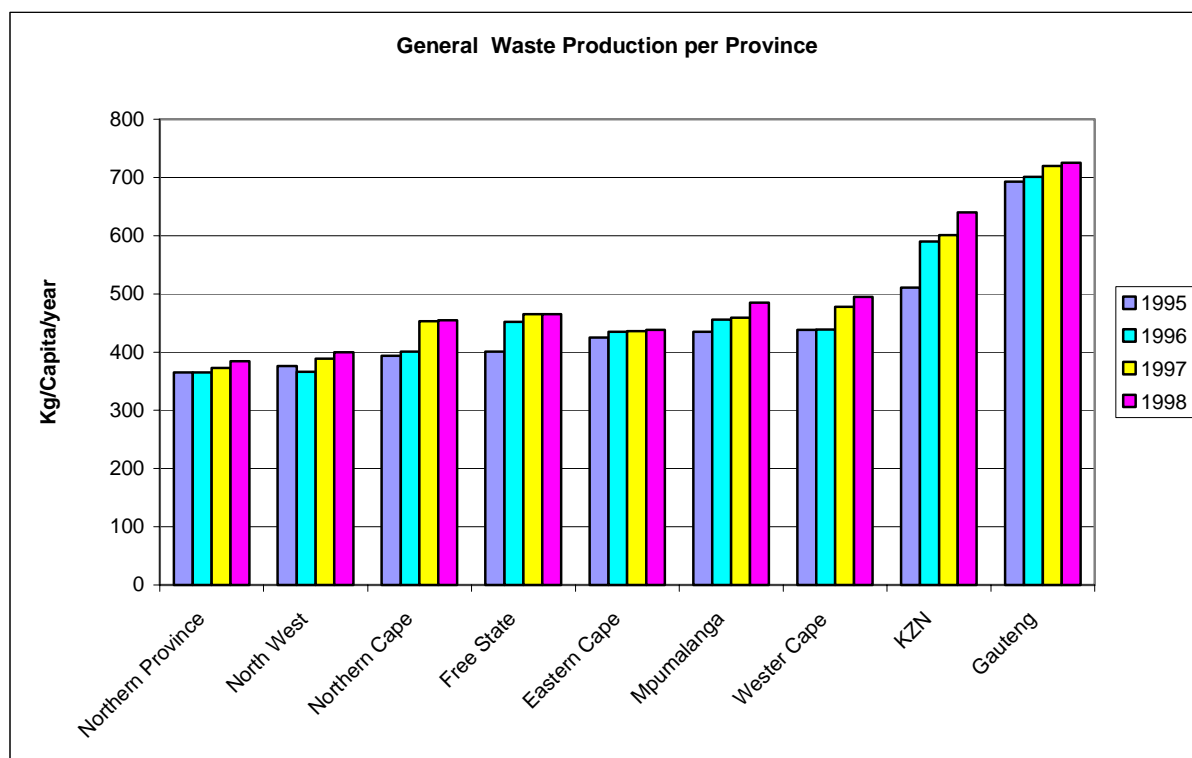


Figure WM2.1: **Fictitious** graph showing general waste production per province.

*Cost of Implementation:*  
Refer to Indicator **WM01**.

### Needs

Few local authorities know how much waste is generated and how much is properly disposed of. Part of the problem is that waste volumes can be reported as compacted or non-compacted waste, which leads to apparent discrepancies. A national database of waste statistics is needed to make this information more accessible to the public and policy makers. A Waste Information System Action Plan was developed as part of the National Waste Management Strategy (DEA&T and DWAF, 1999). Once the Action Plan is implemented more reliable data will be generated.

### Reference List

DEA&T 2000. White paper on IP&WM for South Africa, 2000. DEA&T, Pretoria. Available at: <http://www.gov.za/gazette/whitepaper/2000/20978.pdf>

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DEA&T and DWAF, 1999. National Waste Management Strategies and Action Plans for South Africa. Strategy Formulation Phase. PMG 130. DEA&T and DWAF, Pretoria.

Cities Environment Reports on the Internet (CEROI). City Environmental Indicators Encyclopedia. Available at: [http://ceroi.net/ind/all\\_ind.asp](http://ceroi.net/ind/all_ind.asp)

DWAF, 1997a. Waste Management Series. Disposal Sites for Hazardous and General Wastes in South Africa. Baseline Studies Second Draft, November 1997. DWAF, Pretoria.

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<b>INDICATOR THEME</b>	Waste management
<b>INDICATOR ISSUE</b>	Waste generation
<b>INDICATOR NAME</b>	<b>WM03</b> Hazardous waste produced per sector per year

**Type:** Driving Force / Pressure / **State** / Impact / Response

**Linkages:** This indicator can be linked to all the other themes. It is linked to the Commission for Sustainable Development indicators 'Generation of hazardous wastes' and 'Generation of industrial and municipal solid waste'. It is also linked to the Basel Convention.

**Indicator Level**

Level 1	<b>Level 2 X</b>	Level 3
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**Selection Criteria met by the Indicator**

	1	2	3	4	5	6	7	8	9	10	11
Criteria met fully			X	X			X				X
Criteria met partially		X			X			X	X		
Criteria not met	X					X				X	

**Description of the Indicator**

This indicator describes the annual amount of hazardous waste produced per sector. Hazardous waste is defined in the National Waste Management Strategy as '*waste that has potential even in low concentrations, to have a significant adverse effect on the public health or the environment*'. It is categorised according to the nine classes and four hazardous ratings, as described in the *Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste* (DWAF, 1998b). Industries that should be reporting on the amount of hazardous waste produced are mining, non-metallurgical, metallurgical and metals, services, health care, power generation, water treatment and supply and agriculture.

<b>Units</b>	m <sup>3</sup> or tonnes per sector per year
<b>Spatial scale</b>	National
<b>Frequency</b>	Annual
<b>Confidence</b>	Low

**Reason for Selecting the Indicator**

Run off and seepage from hazardous waste sites may pollute land resources, inland water resources and the marine and coastal environment. This may lead to habitat fragmentation and the disruption of ecosystem functioning. This in turn may lead to species loss and the decreased ability of ecosystems to support human livelihoods and commercial activities. Exposure to certain hazardous wastes may also lead to disease in humans and animals.

### Data Sources

- **Data acquisition:** Some of the data for this indicator may be obtained from the Baseline Studies which were published by DWAF in 1997 and 1998. Additional data can be obtained from DWAF, Enviroserve, and DEA&T.
- **Limitations:** Reliable and recent data for this indicator are not readily available, but data should become available from the provincial authorities as the National Waste Management Strategy is implemented.

### Example

Waste can be differentiated into broad categories e.g. mining, non-metallurgical, metallurgical, metallurgical and metals, services, health care, power generation, water treatment and supply and agriculture. The amount of hazardous waste produced for each of these categories can be represented in the form of a bar graph as shown in the graph below. **Fictitious** data were used in this example.

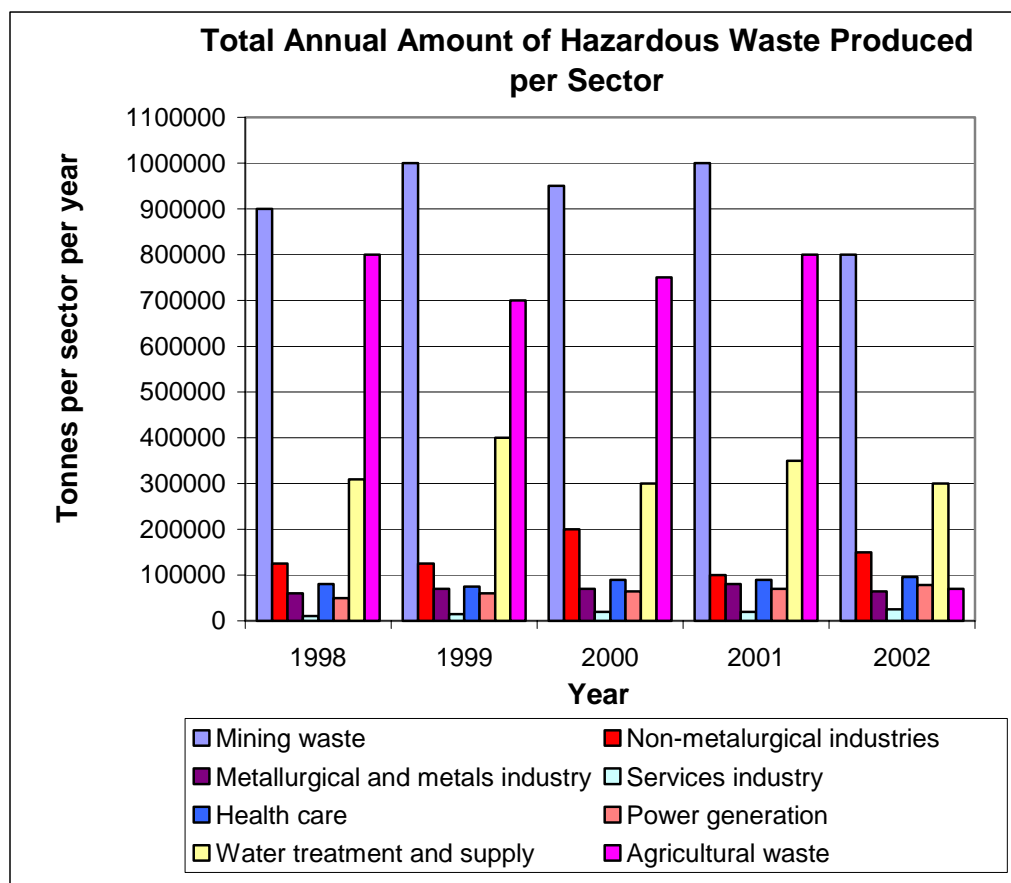


Figure WM3.1: **Fictitious** graph showing the total annual amount of hazardous waste produced per sector.

*Cost of Implementation:*  
Refer to Indicator **WM01**.

**Needs**

A new survey is needed to obtain the latest data on the amount of hazardous waste produced per year on a national scale. Very few local authorities know how much hazardous waste is generated and how much is properly disposed of. DEA&T is required in terms of the Basel Convention to report on the amounts of hazardous and other wastes generated. The development of the Waste Information System as part of the National Waste Management Strategy is crucial to ensure that adequate data are obtained.

**Reference List**

DEA&T and DWAF, 1999. National Waste Management Strategies and Action Plans for South Africa. Strategy Formulation Phase. PMG 130. DEA&T and DWAF, Pretoria.

DWAF, 1998a. Waste Management Series. Waste Generation in South Africa. Baseline Studies. DWAF, Pretoria.

DWAF, 1998b. Waste Management Series. Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste.

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<b>INDICATOR THEME</b>	Waste management
<b>INDICATOR ISSUE</b>	Waste reduction
<b>INDICATOR NAME</b>	<b>WM04</b> Waste recycling

**Type:** Driving Force / Pressure / State / Impact / **Response**

**Linkages:** This indicator can be linked to the Inland Water, Biodiversity & Natural Heritage, Land Use, and Marine, Coastal & Estuarine themes. This indicator is linked to the Commission for Sustainable Development indicator 'Waste recycling and re-use'.

**Indicator Level**

Level 1	<b>Level 2 X</b>	Level 3
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**Selection Criteria met by the Indicator**

	1	2	3	4	5	6	7	8	9	10	11
Criteria met fully		X	X	X			X		X		X
Criteria met partially	X				X	X		X		X	
Criteria not met											

**Description of the Indicator**

Total annual amount of waste recycled per material type – reported as m<sup>3</sup> or tonnes and percentage.

<b>Units</b>	m <sup>3</sup> or tonnes per year and percentage
<b>Spatial scale</b>	Provincial or National
<b>Frequency</b>	Annual
<b>Confidence</b>	Medium

**Reason for Selecting the Indicator**

Recycling is an alternative to disposing of waste in landfills, thereby reducing pressure on the available space in landfills. The creation of new landfills may lead to disruption in ecosystem functioning, and habitat and species loss. Recycling of waste may also reduce the amount of land, air and water pollution as well as reduce pressure on natural resources. Recycling is also a means of job creation and generation of income, especially among low income groups.

**Data Sources**

- **Data acquisition:** The Packaging Council of South Africa (PACSA) annually publishes best industry estimates of recycling activities within the packaging and related industries. Data can be obtained from PACSA. PACSA has been collecting and reporting on recycling statistics since 1984.
- **Limitations:** The data which are collected by PACSA relate only to the packaging industry and may not be a true representation of the total amount of materials that are recycled annually. A national database of recycling statistics is needed. There is no international standard methodology for calculating the

amount and percentages of waste recycled per material type. It is therefore difficult to compare the amount of waste recycled for different countries.

**Example**

This indicator can be represented in the form of a stacked bar graph indicating the percentage of each material type that is recycled per year, as shown in Figure WM4.1 below. **Fictitious** data were used to draw this graph.

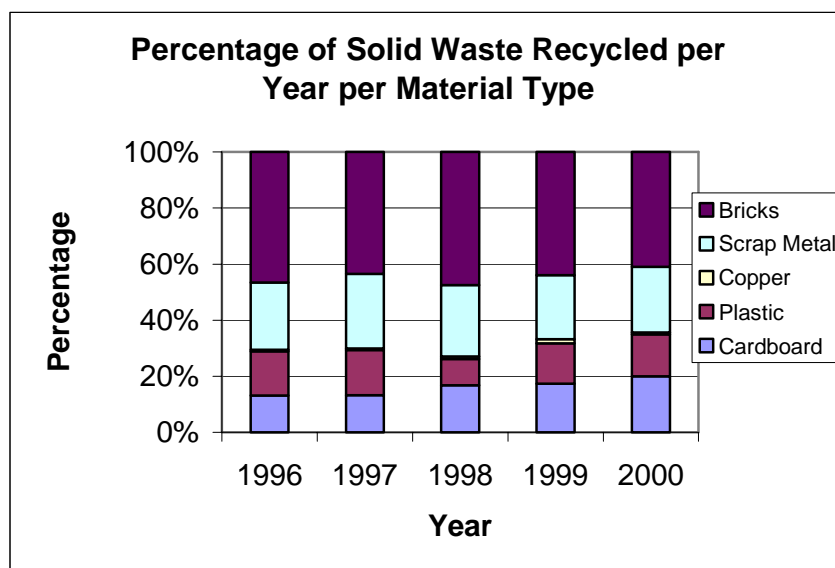


Figure WM4.1: **Fictitious** graph showing the percentage of solid waste recycled per year per material type.

A trend line indicating the percentage of solid waste that is recycled per year can also be used to represent this indicator (See Figure WM4.2). **Fictitious** data were used to compile this graph.

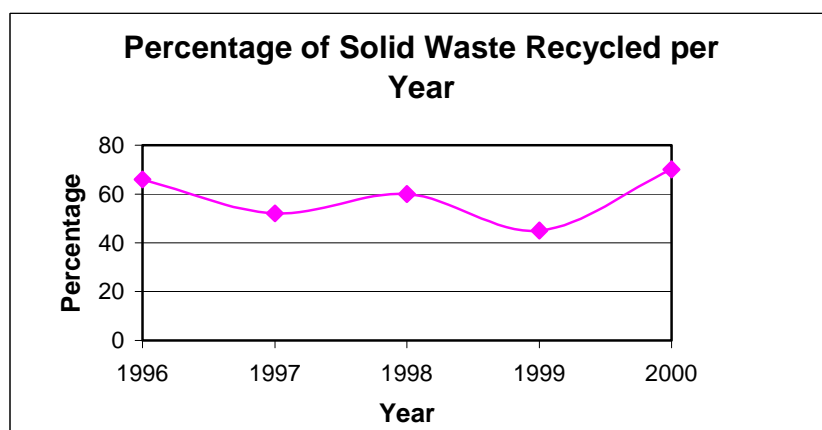


Figure WM4.2: **Fictitious** graph showing the percentage of solid waste recycled per year.

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*Cost of Implementation:*

Data are already collected by PACSA. Data for this indicator may also be available from the WIS when it is implemented, refer to Indicator **WM01** for the costs of implementing the WIS.

**Needs**

A national database of waste and recycling statistics is needed. The Waste Information System, which forms part of the National Waste Management Strategy, may provide some of the data for this indicator when it is implemented and enforced.

**Reference List**

Cities Environment Reports on the Internet (CEROI). City Environmental Indicators Encyclopedia. Available at: [http://ceroi.net/ind/all\\_ind.asp](http://ceroi.net/ind/all_ind.asp)

DEA&T, 2000. White paper on IP&WM for South Africa, 2000. DEA&T, Pretoria. Available at: <http://www.gov.za/gazette/whitepaper/2000/20978.pdf>

DEA&T and DWAF, 1999. National Waste Management Strategies and Action Plans for South Africa. Strategy Formulation Phase. PMG 130. DEA&T and DWAF, Pretoria.

Packaging Council of South Africa, Mr. Owen Bruyns

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<b>INDICATOR THEME</b>	Waste management
<b>INDICATOR ISSUE</b>	Waste reduction
<b>INDICATOR NAME</b>	<b>WM05</b> Value of waste recycled

**Type:** Driving Force / Pressure / State / Impact / **Response**

**Linkages:** This indicator has economic implications and is linked to the Land Use study.

**Indicator Level**

Level 1	<b>Level 2 X</b>	Level 3
---------	------------------	---------

**Selection Criteria met by the Indicator**

	1	2	3	4	5	6	7	8	9	10	11
Criteria met fully		<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>		<b>X</b>				<b>X</b>
Criteria met partially	<b>X</b>					<b>X</b>		<b>X</b>	<b>X</b>	<b>X</b>	
Criteria not met											

**Description of the Indicator**

The indicator shows the annual value of total recycling that takes place per material type. The tonnage of each type of waste material recycled will be adjusted by the market price of that type of recycled waste to determine the Rand value of the waste. This will be reported as a provincial aggregate.

<b>Units</b>	Rand value per province per year
<b>Spatial scale</b>	Provincial or National
<b>Frequency</b>	Annual
<b>Confidence</b>	Medium to High

**Reason for Selecting the Indicator**

The indicator measures the value of recycled waste in the country. As the value of recycled materials increases it will become more lucrative for individuals to begin recycling their own waste. Individuals who may previously have not recycled waste materials because they did not benefit in any way may show a change in behaviour.

**Data Sources**

- **Data acquisition:** Data can be obtained from provincial and local authorities, and waste technology management institutes. Turnover statistics can be obtained from recognised recycling industries. WASTE-TECH collects information on the international prices of waste. Data are also available from PACSA.
- **Limitations:** Prices collected are subject to international standards and may not specifically relate to South Africa.

**Example**

Pie charts can be used to indicate the economic value of different waste materials recycled per region (See Figure WM5.1). A country map could also be developed

depicting the zones of highest values recycled and highest volumes recycled, this could be developed using GIS technology.

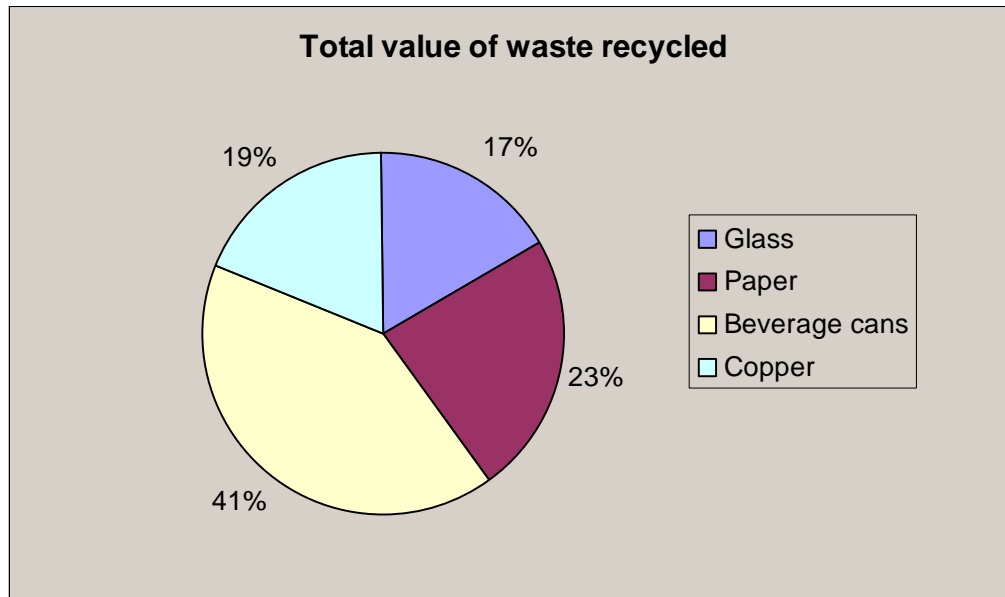


Figure WM5.1: **Fictitious** graph showing the total value of waste recycled.

The *costs* associated with this indicator include the following:

1. Costs of data acquisition (UNKNOWN)
2. Human resource costs for calculations

### Needs

Data on the volumes and types of wastes recycled in the respective provinces needs to be collected, along with the data on international prices of recycled waste. Annual calculations need to be done multiplying the volume of waste by the respective price in order to determine the value of recycled waste.

For example:

$$\text{value of recycled waste} = \text{quantity}_{\text{type}} * \text{price}_{\text{type}}$$

### Reference List

Packaging Council of South Africa, Mr. Owen Bruyns.

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<b>INDICATOR THEME</b>	Waste management
<b>INDICATOR ISSUE</b>	Waste reduction
<b>INDICATOR NAME</b>	<b>WM06</b> General waste correctly disposed through landfill

**Type:** Driving Force / Pressure / **State** / Impact / Response

**Linkages:** This indicator can be linked to the Biodiversity & Natural Heritage, Land Use and Marine, Coastal & Estuarine themes.

**Indicator Level**

Level 1	<b>Level 2 X</b>	Level 3
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**Selection Criteria met by the Indicator**

	1	2	3	4	5	6	7	8	9	10	11
Criteria met fully		X	X	X			X				X
Criteria met partially	X				X						
Criteria not met						X		X	X	X	

**Description of the Indicator**

The indicator reports on the total annual amount of general waste disposed of at landfill sites. General waste is waste that does not pose a significant threat to man and the environment if managed properly. It includes waste paper, metals, glass, plastic, organic and inert materials generated through domestic, commercial and industrial activities.

<b>Units</b>	Tonnes per year
<b>Spatial scale</b>	Provincial or National
<b>Frequency</b>	Annual
<b>Confidence</b>	Medium

**Reason for Selecting the Indicator**

General waste production increases annually due to population growth, economic growth, inadequate services and unsustainable lifestyles. Waste that is not disposed of properly may have adverse effects on ecosystem functioning and human health. The South African government has, through its White Paper on Integrated Pollution & Waste Management, highlighted the need to minimise the amount of general waste generated.

**Data Sources**

- **Data acquisition:** Data can be obtained from DWAF regional offices and municipalities.
- **Limitations:** Current data may not be available. The latest data can be found in the Baseline Studies that were published by DWAF in 1997 and 1998.

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**Example**

This indicator can be represented in the form of a bar graph or a trend line. Refer to Indicator **WM02** for an example of how this indicator can be represented.

*Cost of Implementation*

Refer to Indicator **WM01**.

**Needs**

Few local authorities know how much waste is generated and how much is properly disposed of. Part of the problem is that waste volumes can be reported as compacted or non-compacted waste, which leads to apparent discrepancies. A national database of waste statistics is needed to make this information more accessible to the public and policy makers. A Waste Information System Action Plan was developed as part of the National Waste Management Strategy (DEA&T and DWAF, 1999). Once the Action Plan is implemented more reliable data will be generated.

**Reference List**

DEA&T and DWAF, 1999. National Waste Management Strategies and Action Plans for South Africa. Strategy Formulation Phase. PMG 130. DEA&T and DWAF, Pretoria.

DWAF, 1997a. Waste Management Series. Disposal Sites for Hazardous and General Wastes in South Africa. Baseline Studies Second Draft, November 1997. DWAF, Pretoria.

Mr. Kobus Otto, Waste Consultant

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<b>INDICATOR THEME</b>	Waste Management
<b>INDICATOR ISSUE</b>	Waste reduction
<b>INDICATOR NAME</b>	<b>WM07</b> Hazardous waste correctly disposed

**Type:** Driving Force / Pressure / **State** / Impact / Response

**Linkages:** This indicator can be linked to the Biodiversity & Natural Heritage theme. It can also be linked to the Basel Convention.

**Indicator Level**

Level 1	<b>Level 2 X</b>	Level 3
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**Selection Criteria met by the Indicator**

	1	2	3	4	5	6	7	8	9	10	11
Criteria met fully		X					X				X
Criteria met partially			X	X							
Criteria not met	X				X	X		X	X	X	

**Description of the Indicator**

This indicator reports on the total annual amount of hazardous waste correctly disposed – reported as percentage and volume correctly disposed together with the total volume of hazardous waste produced per year.

**Units**                    m<sup>3</sup> / year and percentage  
**Spatial scale**        National  
**Frequency**            Annual  
**Confidence**            Low

**Reason for Selecting the Indicator**

Hazardous waste is defined in the National Waste Management Strategy as '*waste that has potential even in low concentrations, to have a significant adverse effect on the public health or the environment*'. Hazardous waste that is not disposed of properly may pollute land resources, inland water resources and the marine and coastal environment. This may lead to habitat fragmentation and the disruption of ecosystem functioning. This in turn may lead to species loss and the decreased ability of ecosystems to support human livelihoods and commercial activities. Exposure to certain hazardous wastes may also lead to disease in humans and animals.

**Data Sources**

- **Data acquisition:** The latest data can be obtained from the Baseline Studies which were published by DWAF in 1997 and 1998. Data can be obtained from DWAF and Enviroserve.
- **Limitations:** Reliable and recent data for this indicator are not readily available, but data should become available as the National Waste Management Strategy is implemented.

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**Example**

This indicator can be reported through the use of bar graphs indicating the total amount of hazardous waste correctly disposed and the percentage of hazardous waste that is correctly disposed of.

*Cost of Implementation*

Refer to Indicator **WM01**.

**Needs**

A new survey is needed to obtain the latest data on the amount of hazardous waste produced per year on a national scale. Very few local authorities know how much waste is generated and how much is properly disposed of. A national database of waste statistics is needed to make this information more accessible to the public and policy makers. The government has proposed legislation to create a National Waste Information System that will allow public access to pollution and waste management information.

**Reference List**

DEA&T and DWAF, 1999. National Waste Management Strategies and Action Plans for South Africa. Strategy Formulation Phase. PMG 130. DEA&T and DWAF, Pretoria.

Mr. Kobus Otto, Waste Consultant.

Mr. Gerrie Le Roux, DWAF.

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<b>INDICATOR THEME</b>	Waste management
<b>INDICATOR ISSUE</b>	Waste reduction
<b>INDICATOR NAME</b>	<b>WM08</b> Available landfill lifespan

**Type:** Driving Force / Pressure / **State** / Impact / Response

**Linkages:** This indicator can be linked to the Biodiversity & Natural Heritage, Marine, Coastal & Estuarine, Inland Water, Human Well-Being and Land Use themes. The indicator is partially related to the Human Rights Commission reporting requirement of "Number and percentage of communities with inadequate dumping sites".

**Indicator Level**

Level 1	<b>Level 2 X</b>	Level 3
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**Selection Criteria met by the Indicator**

	1	2	3	4	5	6	7	8	9	10	11
Criteria met fully		X		X			X				X
Criteria met partially	X		X		X						
Criteria not met						X		X	X	X	

**Description of the Indicator**

This indicator will report on the available landfill lifespan, however the following information should be provided for each landfill site: site name, location, classification, permit granted or not, available airspace (m<sup>3</sup>), incoming volume per annum (m<sup>3</sup>), lifespan (available airspace/incoming volume per annum)

<b>Units</b>	Years
<b>Spatial scale</b>	Provincial
<b>Frequency</b>	5 Yearly
<b>Confidence</b>	Medium

**Reason for Selecting the Indicator**

South Africa's population is placing increasing pressure on existing landfills through the increasing amount of waste that is produced. It is important to know whether the available landfills can meet the demand for airspace and whether these landfills are environmentally acceptable and comply with the minimum requirements as set by DWAF. These requirements are set out in DWAF's document on the Minimum Requirements for Waste Disposal by Landfill (DWAF, 1998c). Creating more landfills may lead to a disruption in ecosystem process, habitat loss or species loss.

**Data Sources**

- **Data acquisition:** Data for this indicator can be obtained from the Baseline Studies which were published by DWAF in 1997 and 1998. Some information may also be obtained from local authorities.
- **Limitations:** The latest available data were published in 1997 and 1998. A major research project is needed to determine the exact amount of waste

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produced per municipality and at a national scale. The proposed National Waste Information System will be able to provide this kind of information.

**Example**

This indicator can be reported as landfill lifespan in years – this value can be calculated as follows: available airspace / incoming volume per annum (m<sup>3</sup> / m<sup>3</sup> per year)

This indicator is best represented in a table (see Table 8.1 below). Data for this table were based on data for the Eastern Cape Province found in DWAF (1997a). Data for the rest of the landfill sites in the Eastern Cape and the country can be found in the same document, and a summary table is provided below in Table 8.3.

Table 8.1: Landfill sites in the Eastern Cape Province (DWAF, 1997a)

Site name	Location	Classification	Permit granted	Available airspace (m <sup>3</sup> )	Incoming volume per year (m <sup>3</sup> /annum)	Lifespan (years)
Boesmansriviermond	EC	GSB-	Yes	6500	1040	6
Boknes	EC	GCB-	No	2700	100	27
Cannon Rocks	EC	GCB-	No	2700	100	27
Colchester	EC	GCB-	Yes	2000	75	27
Cookhouse	EC	GSB-	Yes	40000	560	71
Graaf Reinet	EC	GMB-	Yes	108000	7500	14

Landfills are classified according to the classification system provided in Table 8.2 below (from DWAF, 1997a).

Table 8.2: Landfill Classification System (DWAF, 1997a)

WASTE TYPE	G General Waste								H Hazardous Waste	
	C Communal Landfill		S Small Landfill		M Medium Landfill		L Large Landfill		H:h Hazard Rating 3&4	H:H Hazard Rating 1-4
SIZE OF LANDFILL OPERATION										
SITE WATER BALANCE	B <sup>-</sup>	B <sup>+</sup>	B <sup>-</sup>	B <sup>+</sup>	B <sup>-</sup>	B <sup>+</sup>	B <sup>-</sup>	B <sup>+</sup>		
MINIMUM REQUIREMENTS										
<b>NOTES</b>										
B <sup>-</sup> = No significant leachate will be generated in terms of the Site Water Balance (Climatic Water Balance calculation plus Site Specific Factors), so that a leachate management system is not required.										
B <sup>+</sup> = Significant leachate will be generated in terms of the Site Water Balance (Climatic Water Balance calculation and Site Specific Factors) so that a leachate management system is required.										

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<b>h</b>	= A Containment landfill which accepts Hazardous waste with Hazard Ratings 3 and 4.
<b>H</b>	= A containment landfill which accepts all Hazardous waste, i.e., with Hazard Ratings 1,2,3 and 4.

Table 8.3: Collated Regional Data for each Province (DWAF, 1997a)

Regional Authority	Classification	No. of Sites	Sum of Incoming General Waste [Tpa]	Sum of Incoming Hazardous Waste [Tpa]	Sum of Remaining General Airspace [m <sup>3</sup> ]	Sum of Remaining Hazardous Airspace [m <sup>3</sup> ]
<b>NORTH WEST PROVINCE</b>						
Bophirima	GCB-	5	540	0	11200	0
Bophirima	GSB-	7	6171	0	227990	0
Bophirima	GMB-	1	7800	0	85200	0
Central	GSB-	9	17661	0	641127	0
Central	GCB-	2	145	0	31000	0
Central	GMB-	3	38540	0	983000	0
Eastern	GMB-	2	43100	130	628000	0
Eastern	GSB-	2	7170	0	23600	0
Rustenburg Regional	GCB-	2	270	0	40900	0
Rustenburg Regional	GSB-	5	9660	0	74400	0
Rustenburg Regional	GMB-	3	73100	0	305447	0
Southern	GSB-	15	81890	3354	1778804	0
Southern	GMB-	6	99650	0	704500	0
Southern	GCB-	1	260	0	36000	0
<b>NORTHERN PROVINCE</b>						
Bushveld	GSB-	8	22952	0	607860	0
Bushveld	GMB-	4	36750	0	651391	0
Northern	GCB-	4	564	4	10663	0
Northern	GSB+	6	17394	0	196334	0
Northern	GSB-	12	22808	0	413741	0
Northern	GCB+	1	160	0	37500	0
Northern	GMB-	6	92344	0	1043016	0
Northern	GMB+	1	8748	0	90000	0
<b>WESTERN CAPE</b>						
Breede River	GCB-	1	195	0	1000	0
Breede River	GMB+	2	19664	0	1584000	0
Breede River	GMB-	1	13000	0	30000	0
Breede River	GSB+	2	3362	0	95343	0
Breede River	GSB-	8	22887	0	1817440	0
Cape Metro	GLB+	3	588700	0	6905000	0
Cape Metro	GMB+	3	60625	0	3447200	0
Cape Metro	GSB+	4	1979	0	18889	0
Cape Metro	GSB-	5	7215	0	27200	0
Cape Metro	H:H	2	444200	111000	9070762	3529238
Central Karoo	GCB-	6	460	0	3000	0
Central Karoo	GSB-	5	10883	0	104600	0
Klein Karoo	GCB-	2	252	0	4552	0
Klein Karoo	GMB-	1	15000	0	50000	0
Klein Karoo	GSB-	4	3750	0	34455	0
Overberg	GCB-	3	217	0	5600	0
Overberg	GMB+	1	9594	0	93600	0
Overberg	GMB-	1	8192	0	20000	0
Overberg	GSB+	8	21674	0	200220	0
Overberg	GSB-	6	8338	0	49933	0
South Cape	GCB+	1	167	0	1596	0
South Cape	GCB-	1	86	0	100	0
South Cape	GMB+	2	31120	0	93234	0
South Cape	GMB-	4	38695	0	232000	0
South Cape	GSB+	1		0		0

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South Cape	GSB-	10	17810	0	181100	0
South Cape	H:H	1	34060	19770	569459	330541
West Coast	GCB-	5	564	0	44300	0
West Coast	GMB+	1	6930	0	140000	0
West Coast	GMB-	2	31707	0	1425000	0
West Coast	GSB+	1	1040	0	16000	0
West Coast	GSB-	19	28396	0	1204420	0
Winelands	GMB+	3	61815	0	2389400	0
Winelands	GSB+	3	5107	0	82000	0
<b>NORTHERN CAPE</b>						
Diamond Fields	GCB-	4	464	0	5111	0
Diamond Fields	GMB-	2	260000	0	5710715	0
Diamond Fields	GSB-	8	19392	0	296500	0
Hantam	GCB-	1	111	0	2009	0
Hantam	GSB-	8	8053	0	143957	0
Kalahari	GMB-	3	29102	0	507185	0
Kalahari	GSB-	8	17577	0	1226100	0
Lower Orange	GMB-	1	30000	0	3100000	0
Lower Orange	GSB-	7	12200	0	131670	0
Namakwaland	GCB-	4	675	0	93640	0
Namakwaland	GSB-	7	11360	10	242573	0
Upper Karoo	GCB-	2	311	0	4677	0
Upper Karoo	GMB-	1	9319	0	110000	0
Upper Karoo	GSB-	16	13395	31	302564	0
<b>EASTERN CAPE</b>						
Amatola	GCB+	2	234	0	4226	0
Amatola	GCB-	5	794	0	7495	0
Amatola	GMB+	2	77000	0	227000	0
Amatola	GMB-	2	42000	1	1210000	0
Amatola	GSB+	6	20860	0	39900	0
Amatola	GSB-	6	7503	0	71368	0
Drakensberg	GCB-	3	295	0	4516	0
Drakensberg	GMB-	1	11000	0	300000	0
Drakensberg	GSB-	7	7360	0	82808	0
Kei	GMB-	2	16500	0	80600	0
Kei	GSB+	3	1670	0	25650	0
Kei	GSB-	4	5800	0	29382	0
Stormberg	GCB-	1	30	0	456	0
Stormberg	GLB-	1	5635	0	21000	0
Stormberg	GMB-	3	30100	0	524267	0
Stormberg	GSB+	2	2600	0	150710	0
Stormberg	GSB-	7	17448	0	312961	0
Western	GCB+	4	470	0	13200	0
Western	GCB-	10	1174	0	26112	0
Western	GLB-	1	150020	0	3500000	0
Western	GMB+	2	25000	0	285200	0
Western	GMB-	4	87500	0	375000	0
Western	GSB+	3	4000	0	71200	0
Western	GSB-	18	31911	0	745798	0
Western	H:H	2	86654	81100	1646478	791022
Wild Coast	GCB-	3	328	0	5024	0
Wild Coast	GSB+	4	4100	0	26511	0
Wild Coast	GSB-	2	1664	0	4045	0
<b>MPUMALANGA</b>						
Highveld	GCB+	3	410	0	2800	0
Highveld	GCB-	3	260	0	5349	0
Highveld	GMB-	9	86500	0	2711000	0
Highveld	GSB+	7	16743	13	217400	0
Highveld	GSB-	11	16855	0	731378	0
Highveld	GMB+	1	9400	0		0
Highveld	GMB-	7	192300	0	6229000	0
Highveld	GSB+	2	2580	0	11000	0
Highveld	GSB-	2	4500	0	210000	0
Lowveld & Escarpment	GCB+	1	104	0	40000	0
Lowveld &	GCB-	9	1134	0	11450	0

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Escarpment						
Lowveld & Escarpment	GLB-	1	152000	0	1910000	0
Lowveld & Escarpment	GMB+	4	56460	0	974000	0
Lowveld & Escarpment	GMB-	1	11200	0	75000	0
Lowveld & Escarpment	GSB+	7	20963	0	311682	0
Lowveld & Escarpment	GSB-	4	9020	0	728800	0
<b>KWAZULU-NATAL</b>						
Durban Metro	GLB+	3	598000	0	15440000	0
Durban Metro	GMB+	5	228100	0	514244	0
Durban Metro	GSB+	1	3900	0	4500	0
Durban Metro	GSB-	1	2600	0	3250	0
Durban Metro	H:hs	3	538655	115125	9235602	1864398
Ilembe	GMB+	4	99300	0	2103689	0
Ilembe	GSB+	1	597	0	10786	0
Ilembe	GSB-	1	1100	0	6000	0
Indlovu/Natal/ Midlands	GCB+	3	495	0	31000	0
Indlovu/Natal/ Midlands	GCB-	2	190	0	3936	0
Indlovu/Natal/ Midlands	GLB-	1	140000	0	2300000	0
Indlovu/Natal/ Midlands	GMB-	2	24600	0	203000	0
Indlovu/Natal/ Midlands	GSB+	5	10600	7	195710	0
Indlovu/Natal/ Midlands	GSB-	10	12930	0	234248	0
Mzinyata	GMB-	2	28400	0	541600	0
Mzinyata	GSB-	4	8750	0	270252	0
Ugu	GMB+	4	38900	0	2120000	0
Ugu	GSB+	4	9295	0	295136	0
Ugu	GSB-	1	2700	0	200000	0
UThukela	GMB-	3	70000	2	552484	0
UThukela	GSB-	3	7663	0	120044	0
UThugulu	GCB+	3	452	0	124500	0
UThugulu	GLB+	2	180000	0	500000	0
UThugulu	GMB+	2	208000	0	10900000	0
UThugulu	GSB+	6	11549	0	605904	0
UThugulu	GSB-	2	6760	0	442925	0
Zululand	GCB+	1	150	0	11250	0
Zululand	GMB-	2	19300	0	320000	0
Zululand	GSB+	3	5900	2	37000	0
Zululand	GSB-	1	3000	0	115000	0
<b>GAUTENG</b>						
Eastern Gauteng	GLB+	1	163000	7800	77000	0
Eastern Gauteng	GLB-	5	895000	120	43100000	0
Eastern Gauteng	GMB+	1	80300	0	587000	0
Eastern Gauteng	GMB-	5	890200	0	1928000	0
Eastern Gauteng	GSB+	1	2400	0	45000	0
Eastern Gauteng	GSB-	4	4210	0	210100	0
Eastern Gauteng	H:H	1	117260	132080	2116267	2383733
Greater Jhb Metro	GLB+	1	372000	0	9300000	0
Greater Jhb Metro	GLB-	5	1539000	0	29830000	0

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Greater Jhb Metro	GMB-	1	65000	0	1300000	0
Greater Pta Metro	GLB-	1	140400	0	4000000	0
Greater Pta Metro	GMB+	1	32000	10600	350000	0
Greater Pta Metro	GMB-	7	389766	0	4642000	0
Kyalami Metro	GLB+	1		0	3000000	0
Kyalami Metro	GMB-	3	118800	0	33000	0
Lekoa Vaal Metro	GLB-	1	160000	0	1800000	0
Lekoa Vaal Metro	GMB-	6	214000	0	2684000	0
Lekoa Vaal Metro	H:H	1	20000	80000	52000	208000
Western Gauteng	GCB-	1	80	0	471	0
Western Gauteng	GLB-	2	468000	0	2917000	0
Western Gauteng	GMB-	5	80600	1560	1640000	0
Western Gauteng	GSB-	1	840	0	5300	0
<b>FREE STATE</b>						
Bloem-Area	GCB-	3	180	0	114630	0
Bloem-Area	GLB-	2	210200	0	500000	0
Bloem-Area	GSB-	22	34007	0	1306546	0
Eastern Free State	GCB-	2	337	0	7500	0
Eastern Free State	GMB-	4	73460	5200	1466600	0
Eastern Free State	GSB-	22	35952	0	726269	0
Goldfields	GCB-	1	156	0	25550	0
Goldfields	GLB-	1	1177762	0	225578	0
Goldfields	GMB-	5	138566	0	5074593	0
Goldfields	GSB-	12	28677	0	810331	0
Northern Free State	GMB-	4	105975	0	1010500	0
Northern Free State	GSB-	10	14282	0	317964	0

*Cost of Implementation*

Refer to Indicator **W01**.

**Needs**

Much research is needed to determine the exact amount of waste produced per municipality and at a national scale. A national database of waste statistics is needed. The proposed National Waste Information System, which forms part of the government's National Waste Management Strategy, will supply these type of data.

**Reference List**

DWAF, 1997a. Waste Management Series. Disposal Sites for Hazardous and General Wastes in South Africa. Baseline Studies Second Draft.

DWAF, 1998c. Waste Management Series. Minimum Requirements for Waste Disposal by Landfill. Second Edition.

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<b>INDICATOR THEME</b>	Waste management
<b>INDICATOR ISSUE</b>	Waste reduction
<b>INDICATOR NAME</b>	<b>WM09</b> Provincial expenditure on waste management

**Type:** Driving Force / Pressure / State / Impact / **Response**

**Linkages:** This indicator is linked to the Land Use study; the Inland Water study; and the Marine, Coastal & Estuarine study. The indicator is linked to the Commission for Sustainable Development indicator 'Expenditure on waste management', and can also be linked to the DPLG KPI QU3. Section 6.4 of the reporting requirements of the Human Rights Commission relates to this indicator as well.

**Indicator Level**

Level 1	<b>Level 2 X</b>	Level 3
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**Selection Criteria met by the Indicator**

	1	2	3	4	5	6	7	8	9	10	11
Criteria met fully		X	X	X	X		X				X
Criteria met partially	X					X		X	X	X	
Criteria not met											

**Description of the Indicator**

The indicator will report on the total annual provincial budget spent on waste management (including waste collection, litter collection, waste disposal etc).

<b>Units</b>	Rand value per year
<b>Spatial scale</b>	Provincial
<b>Frequency</b>	Annual
<b>Confidence</b>	Medium to High

**Reason for Selecting the Indicator**

The indicator measures the municipal response to waste management. Indirectly, one could infer the amount of waste in municipal areas based on how much money is spent each year to clean it up. However, those provinces where little money is spent do not necessarily have small amounts of waste to collect.

**Data Sources**

- **Data acquisition:** Data can be obtained from local authorities throughout the country. These data link closely with that collected for the DPLG Key Performance Indicators, specifically indicator QU3.
- **Limitations:** The data must actually be collected from each local authority. This is a time consuming exercise. These budgets in an aggregated form will not tell us the extent to which waste is recycled or disposed.

### Example

This indicator can be reported using pie charts indicating expenditure shifts and budgetary discrepancies between provinces. Figure WM9.1 shows an example reporting format. The percentage calculated here reflects the contribution of each province to the total amount paid for waste treatment across all provinces. This total amount will be determined as an aggregate of their individual expenditures on waste management.

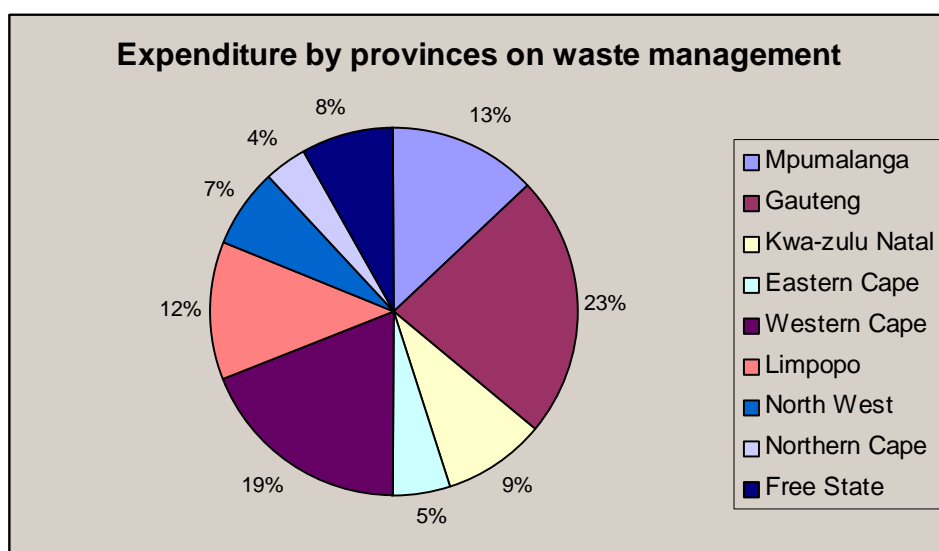


Figure WM9.1: **Fictitious** graph showing expenditure per province on waste management.

### Costs of implementation

1. There are no costs for data acquisition as this will be the responsibility of each local authority
2. Human resource costs will be involved to inform the local authorities
3. Human resource costs will be involved to collate and aggregate the data.

### Needs

The local authorities need to be encouraged to collect this information while collecting the information that relates to indicator WM10. Local authority budgets also need to be set up in such a way that they report on this expenditure.

### Reference List

DEA&T and DWAF, 1999. National Waste Management Strategies and Action Plans for South Africa. Strategy Formulation Phase. PMG 130. DEA&T and DWAF, Pretoria.

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<b>INDICATOR THEME</b>	Waste management
<b>INDICATOR ISSUE</b>	Waste reduction
<b>INDICATOR NAME</b>	<b>WM10</b> Provincial waste collection capacity

**Type:** Driving Force / Pressure / State / Impact / **Response**

**Linkages:** . This indicator is linked to the Commission for Sustainable Development indicator 'Municipal waste disposal', and the DPLG KPI SWU1. The information collected for this indicator can inform the reporting requirement of the Human Rights Commission on "Number and percentage of communities with ineffective refuse removal".

**Indicator Level**

Level 1	<b>Level 2 X</b>	Level 3
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**Selection Criteria met by the Indicator**

	1	2	3	4	5	6	7	8	9	10	11
Criteria met fully	X	X	X	X			X		X	X	X
Criteria met partially					X	X		X			
Criteria not met											

**Description of the Indicator**

The indicator shows the number and percentage of households with access to weekly curb-side waste collection services.

<b>Units</b>	Number and percent
<b>Spatial scale</b>	Provincial
<b>Frequency</b>	Annual
<b>Confidence</b>	Medium to High

**Reason for Selecting the Indicator**

The indicator measures the number of households within local authorities (and therefore also in provinces) that have waste collected from their house. This gives an indication of the number of provinces that are actively involved in waste collection and management. This also gives an indication of where potential shortfalls in waste management could be found, assuming a lack of collection capacity results in excessive waste.

**Data Sources**

- **Data acquisition:** Local authorities based on the DPLG Key Performance Indicators, indicator code SWU1.
- **Limitations:** The indicator does not allow for information on waste services development that may be pending. It also fails to account for the rate at which waste is collected and processed.

### Example

The indicator can be reported on using pie charts indicating areas with the greatest percentage of households with access to curb-side waste collection (See Figure WM10.1).

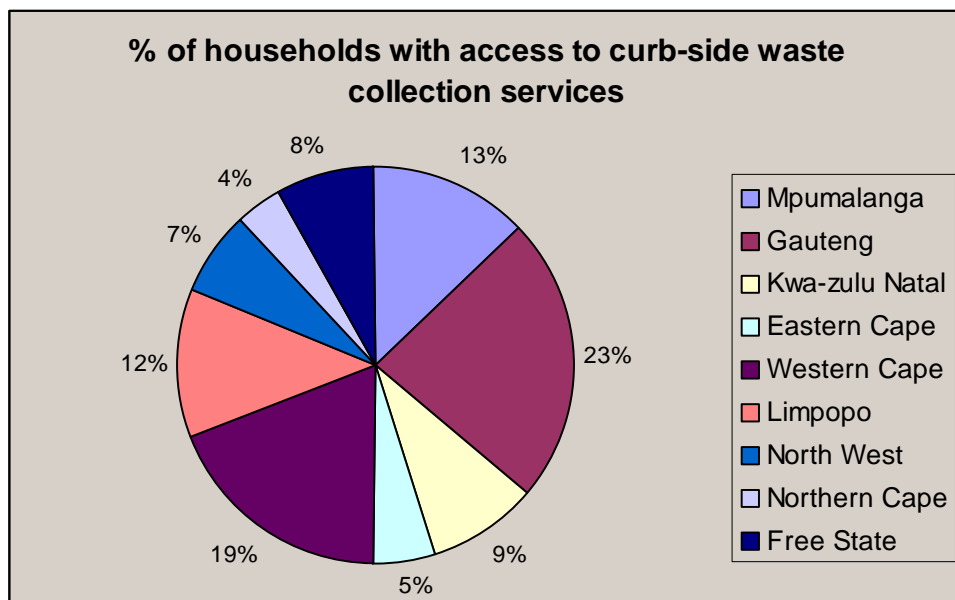


Figure WM10.1: **Fictitious** graph showing the percentage of households with access to curb-side waste collection services.

### Cost of implementation

1. There is no cost of data acquisition as this is governmental reporting.
2. Human resource costs are required to format and aggregate data.

### Needs

Data needs to be collected from the local authorities and aggregated to a provincial level. This collection process is dependent on the local authorities implementing their responsibilities according to the DPLG Key Performance Indicators.

### Reference List

DEA&T and DWAF, 1999. National Waste Management Strategies and Action Plans for South Africa. Strategy Formulation Phase. PMG 130. DEA&T and DWAF, Pretoria.

## DORMANT INDICATORS

Dormant indicators are those indicators that were identified during the indicator development process as indicators that should be included in the set of National Environmental Indicators, but due to lack of data or knowledge with regard to how to implement or calculate the indicators accurately, have been excluded from the current set of indicators. It is envisaged that some of the dormant indicators will be included in the set once more information becomes available.

<b>INDICATOR THEME</b>	
<b>INDICATOR ISSUE</b>	
<b>INDICATOR NAME</b>	<b>DORMANT</b> General landfill airspace supply versus demand

**Type:** Driving Force / **Pressure** / **State** / Impact / Response

**Linkages:** This indicator can be linked to the Land and Biodiversity themes.

### Indicator Level

Level 1	<b>Level 2 X</b>	Level 3
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### Selection Criteria met by the Indicator

	1	2	3	4	5	6	7	8	9	10	11
Criteria met fully		<b>X</b>		<b>X</b>			<b>X</b>				<b>X</b>
Criteria met partially	<b>X</b>		<b>X</b>		<b>X</b>			<b>X</b>	<b>X</b>		
Criteria not met						<b>X</b>				<b>X</b>	

### Description of the Indicator

This indicator illustrates whether the available general waste airspace in landfills in South Africa is sufficient to meet the demand for airspace by the growing amount of waste generated by South Africa's population. It can be reported as landfill lifespan (years).

<b>Units</b>	Years
<b>Spatial scale</b>	Provincial
<b>Frequency</b>	5 Yearly
<b>Confidence</b>	Medium

### Reason for Selecting the Indicator

South Africa's population is placing increasing pressure on existing landfills through the increasing amount of waste that is produced. It is important to know whether the available landfills can meet the demand for airspace and whether these landfills are environmentally acceptable and comply with the minimum requirements as set by DWAF. These requirements are set out in DWAF's document on the Minimum Requirements for Waste Disposal by Landfill (DWAF, 1998c). Creating more landfills may lead to a disruption in ecosystem process, habitat loss or species loss.

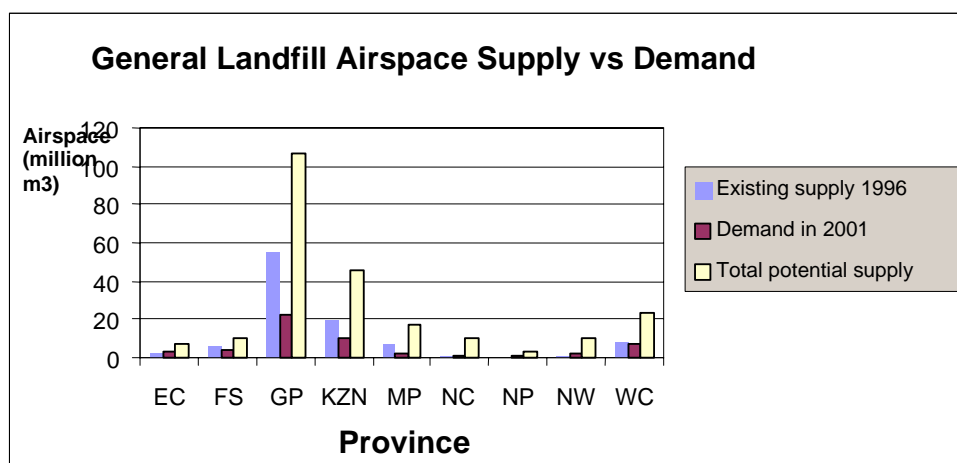
### Data Sources

- **Data acquisition:** Data for this indicator can be obtained from the Baseline Assessment which was published by DWAF in 1997 and 1998. Some information may also be obtained from local authorities.
- **Limitations:** The latest available data were published in 1997 and 1998. A major research project is needed to determine the exact amount of waste produced per municipality and at a national scale. The proposed National Waste Information System will be able to provide this kind of information.

### Example

This indicator can be reported as landfill lifespan in years – this value can be calculated as follows: available airspace / disposal volume per annum (million m<sup>3</sup> / million m<sup>3</sup> per year)

This indicator can also be represented in the form of a graph (refer to the graph below) indicating the existing supply, five years demand and the total potential supply of general landfill airspace per province. This graph was based on data from DWAF (1997a).



### Needs

Much research is needed to determine the exact amount of waste produced per municipality and at a national scale. A national database of waste statistics is needed. The proposed National Waste Information System, which forms part of the government's National Waste Management Strategy, will supply this type of data.

### Reference List

DWAF, 1997a. Disposal Sites for Hazardous and General Wastes in South Africa. Baseline Studies Second Draft. Waste Management Series. DWAF, Pretoria.

DWAF, 1998c. Waste Management Series. Minimum Requirements for Waste Disposal by Landfill. Second Edition.

National Environmental Indicators Programme  
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<b>INDICATOR THEME</b>	
<b>INDICATOR ISSUE</b>	
<b>INDICATOR NAME</b>	<b>DORMANT</b> Hazardous waste landfill airspace supply versus demand

**Type:** Driving Force / **Pressure** / **State** / Impact / Response

**Linkages:** This indicator can be linked to the themes on Inland Water, Biodiversity, Atmosphere and Climate, Land Use, Marine and Coastal issues, and the theme dealing with the cross-cutting issues.

**Indicator Level**

Level 1	<b>Level 2 X</b>	Level 3
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**Selection Criteria met by the Indicator**

	1	2	3	4	5	6	7	8	9	10	11
Criteria met fully		<b>X</b>					<b>X</b>				<b>X</b>
Criteria met partially	<b>X</b>		<b>X</b>	<b>X</b>	<b>X</b>				<b>X</b>	<b>X</b>	
Criteria not met						<b>X</b>		<b>X</b>			

**Description of the Indicator**

This indicator illustrates whether the hazardous waste airspace in landfills in South Africa is sufficient to meet the demand. It can be reported as landfill lifespan (years). Hazardous waste is defined in the Integrated Pollution and Waste Management White Paper (No 20978, March 2000) as *waste, including radioactive waste, which is legally defined as "hazardous" in the state in which it is generated*. The definition is based on the chemical reactivity or toxic, explosive, corrosive or other characteristics that cause, or are likely to cause, danger to health or to the environment, whether by itself or when in contact with other waste.

<b>Units</b>	Years
<b>Spatial scale</b>	Provincial
<b>Frequency</b>	5 Yearly
<b>Confidence</b>	Low

**Reason for Selecting the Indicator**

Run off and seepage from hazardous waste sites may pollute land resources, inland water resources and the marine and coastal environment. This may lead to habitat fragmentation and the disruption of ecosystem functioning. This in turn may lead to species loss and the decreased ability of ecosystems to support human livelihoods and commercial activities. It is also important to know whether the available landfills can meet the demand for airspace and whether these landfills are environmentally acceptable and comply with the minimum requirements as set by DWAF. These requirements are set out in DWAF's document on the Minimum Requirements for Waste Disposal by Landfill (DWAF, 1994).

### **Data Sources**

- **Data acquisition:** Data can be obtained from DWAF and Enviroserve. These data sources still have to be verified.
- **Limitations:** Reliable and recent data for this indicator are not readily available, but data should become available as the National Waste Management Strategy is implemented.

### **Example**

This indicator can be reported as landfill lifespan i.e. how long the existing hazardous landfill available airspace will last considering the volume of hazardous waste produced per year. The lifespan can be calculated by dividing the volume of the existing available landfill space by the volume of waste that is produced per year (million m<sup>3</sup> / million m<sup>3</sup> per year).

### **Needs**

The South Africa government has formulated a National Waste Management Strategy with the aim of addressing the fragmented and uncoordinated way in which pollution and waste is currently been dealt with. Part of this strategy is the development and implementation of a Waste Information System. The information for this indicator should be contained in this system. Data for this indicator will therefore not be readily available until such time as this system is properly implemented and enforced.

### **Reference List**

Kobus Otto, Waste Consultant.

Linda Godfrey, CSIR Environmentek.

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<b>INDICATOR THEME</b>	
<b>INDICATOR ISSUE</b>	
<b>INDICATOR NAME</b>	<b>DORMANT</b> Percentage landfill permit applications and permits granted for operating and future landfills by class

**Type:** Driving Force / Pressure / **State** / Impact / **Response**

**Linkages:** This indicator can be linked to the Inland Water, Biodiversity, Land and Human Settlements themes.

**Indicator Level**

<b>Level 1 X</b>	Level 2	Level 3
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**Selection Criteria met by the Indicator**

	1	2	3	4	5	6	7	8	9	10	11
Criteria met fully	X		X	X			X	X	X		X
Criteria met partially		X			?	X				X	
Criteria not met											

**Description of the Indicator**

Indicates the percentage of permit applications and permits granted by landfill class. The landfill classes which should be reported on include: Containment landfill which accepts all hazardous waste; General waste large landfill; General waste medium landfill; General waste small landfill; and General waste communal landfill.

<b>Units</b>	Percentage
<b>Spatial scale</b>	Provincial
<b>Frequency</b>	Annual
<b>Confidence</b>	High

**Reason for Selecting the Indicator**

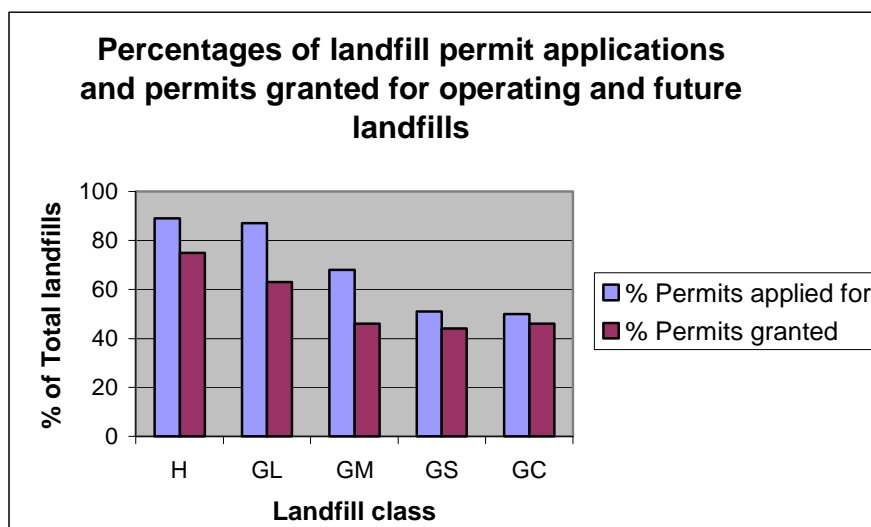
This indicator gives an indication of the percentage of landfills in the country that are environmentally acceptable and are managed properly. It also gives an indication of how effectively policy is being implemented.

**Data Sources**

- **Data acquisition:** Data can be obtained from Baseline Studies which were published by DWAF in 1997 and 1998.
- **Limitations:** The Baseline Studies were published in 1997 and 1998 – more recent data is now needed.

**Example**

This indicator can be reported in the form of a bar graph (refer to the graph below). Data for the compilation of this graph were taken from the Baseline Studies done by DWAF (DWAF, 1997a).



Explanation of landfill classes:

- H A containment landfill which accepts all hazardous waste
- GL General waste large landfill
- GM General waste medium landfill
- GS General waste small landfill
- GC General waste communal landfill

#### Needs

Unknown.

#### Reference List

DWAF, 1997a. Disposal Sites for Hazardous and General Wastes in South Africa. Baseline Studies Second Draft. Waste Management Series. DWAF, Pretoria.

### **ADDITIONAL INDICATORS WHICH WERE CONSIDERED**

<b>Indicator Name</b>	<b>Reason for Rejection at this Stage</b>
Access to refuse removal per capita	Rejected. This indicator does not fall within the two issues covered in this report.
Sanitation levels per capita	Addressed in the Human Well-being through the indicator HW14.
Percentage of population that have access to water-borne sewage	Addressed in the Human Well-being through the indicator HW14.
Number of landfills per city	Municipalities lack capacity to collect these data continually. The indicator WM08 is considered more important.
Charges for waste disposal	Municipalities lack capacity to collect these data, charges differ between municipalities, legacy of non-payment.
Expenditure on waste collection and treatment per capita	It is difficult to obtain standard information on this from different municipalities.
No of recycling plants	Recycling is not a well-organised activity in South Africa. Data would need to be sourced from too many small operators. The indicator WM04 addresses this issue in a better way.
No. of recycling plants per material type	Recycling is not a well-organised activity in South Africa. Data would need to be sourced from too many small operators. The indicator WM04 addresses this issue in a better way.
Amount of solid waste treated per year	Lack of municipal capacity and resources to collect these data. This issue is addressed in a slightly different way through WM06.
Amount of solid waste produced per municipality	Lack of municipal capacity and resources to collect these data. The indicator WM02 addresses this issue in a similar way.
No. or percentage of companies per sector implementing ISO 14001 environmental management systems	The indicator EM07 addresses this issue in a similar way.
No. of hazardous waste sites that are managed properly	The indicator WM07 addresses this issue in a different way.

### **LIST OF STAKEHOLDERS**

<b>Name</b>	<b>Organisation</b>
Kobus Otto	Waste Consultant
Ike Ndlovu	DEA&T
Gerrie Le Roux	DWAF

### **LIST OF ACRONYMS**

DEA&T	Department of Environmental Affairs and Tourism
DPSIR	Driving Forces, Pressure, State, Impact and Response Framework
DWAF	Department of Water Affairs and Forestry

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IP&WM	Integrated Pollution and Waste Management
NWMS	National Waste Management Strategy
PACSA	Packaging Council of South Africa
UNCED	United Nations Conference on Environment and Development
WIS	Waste Information System

## REFERENCES

Cities Environment Reports on the Internet (CEROI). City Environmental Indicators Encyclopedia. Available at: [http://ceroi.net/ind/all\\_ind.asp](http://ceroi.net/ind/all_ind.asp)

DEA&T, 1999. *State of the Environment South Africa*. Department of Environmental Affairs and Tourism, Pretoria. <http://www.environment.gov.za>.

DEA&T 2000. White paper on IP&WM for South Africa, 2000. DEA&T, Pretoria. Available at: <http://www.gov.za/gazette/whitepaper/2000/20978.pdf>

DEA&T and DWAF, 1999. National Waste Management Strategies and Action Plans for South Africa. Strategy Formulation Phase. PMG 130. DEA&T and DWAF, Pretoria.

DWAF, 1994. Waste Management Series Volume 1. Minimum Requirements for Waste Disposal by Landfill. CTP Book Printers.

DWAF, 1997a. Waste Management Series. Disposal Sites for Hazardous and General Wastes in South Africa. Baseline Studies Second Draft, November 1997. DWAF, Pretoria.

DWAF, 1997b. Waste Management Series. Towards Formulation of a Waste Management Strategy for South Africa Second Draft, November 1997. DWAF, Pretoria.

DWAF, 1998a. Waste Management Series. Waste Generation in South Africa. Baseline Studies. DWAF, Pretoria.

DWAF, 1998b. Waste Management Series. Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste. Second Edition.

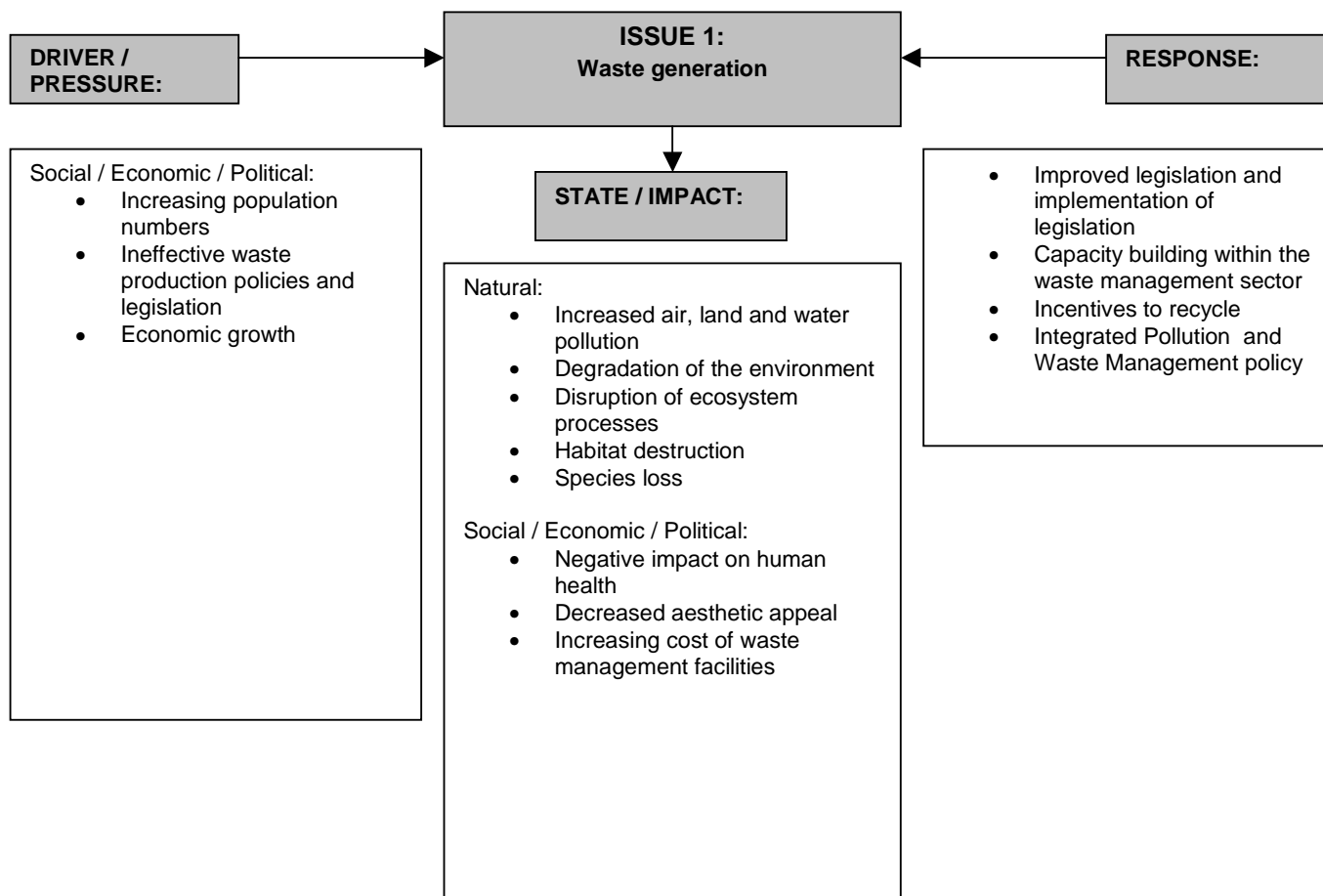
DWAF, 1998c. Waste Management Series. Minimum Requirements for Waste Disposal by Landfill. Second Edition.

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PACSA, Packaging Council of South Africa.

**APPENDIX 1: ISSUES DIAGRAMS**



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