

# SIYATHEMBA & DMA LOCAL MUNICIPALITY

## INTEGRATED ENVIRONMENTAL MANAGEMENT PROGRAM



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## **INDEX**

### **INTEGRATED ENVIRONMENTAL MANAGEMENT PROGRAM**

#### **SIYATHEMBA & DMA LOCAL MUNICIPALITY**

- 1. Executive Summary**
- 2. Institutional and Legal framework**
- 3. Siyathemba & DMA Municipality Issues, Strategies & Opportunities**
- 4. Urban Renewal Guideline Document**
- 5. Civil Works - Impacts & Mitigation Measures Matrix**

**- 1 -**

# **EXECUTIVE SUMMARY**

## **EXECUTIVE SUMMARY**

### **OVERVIEW**

African EPA was appointed to develop an Integrated Environmental Management Program (IEMP) for the Pixley Ka Seme District Municipality (PKSDM). A copy of the entire PKSDM IEMP was provided to **Siyathemba Local Municipality** via the District Municipality's office.

This document is a summary of information applicable to the **Siyathemba Local Municipality** only. It is believed that through the implementation of the guidelines in this document, a vast improvement will be seen from an environmental perspective on a local municipal level.

### **KEY OPPORTUNITIES**

#### **Tourism**

- Nature based tourism along the Orange River (Prieska specifically) and ridges.
- Route based tourism along the N-routes.

#### **Agribusiness**

- Fish farming

### **KEY ISSUES & THREATS**

#### **Salinity of the Orange River**

Water samples from the Vanderkloof, Lower Orange and Molopo areas indicate exceedances of irrigation guidelines over 35% of the time for levels of electrical conductivity (EC) and TDS. High levels of EC and TDS indicate increasing levels of salts, accumulation of salts in the soil, resulting in reduced yields of crops that are sensitive to soil salinity (DWAF, 1996b). (North Cape SOE Report 2004)

#### **Unrehabilitated Asbestos Mines**

In the Northern Cape asbestos is still perceived as an important issue because of the many unrehabilitated mine dumps that still have the potential to pollute the environment, and therefore cause asbestosis or mesothelioma. The public still has access to some of these dumps, and some individuals recover the asbestos for resale as there is apparently still a market for it (Du Plooy, pers comm., 2003). **In Prieska about 5 new cases (out of a population of about 15 000) of mesothelioma are diagnosed annually although the mines in the area have been closed since 1979 (Smith, pers comm., 2004).**

### **Land degradation**

Land use in the Karoo currently consist of sheep farming, some ostrich farming, game farming (that is currently on the increase), as well as crops farming that include lucerne, onions, garlic etc. Mining and development activities are likely to expand in the future.

One of the major threats to biodiversity in the Karoo is the long-term overgrazing by small livestock. This vast and open, semi arid rangeland covers a large part of South Africa and is impressively adapted to its climatic extremes. Evidence of degradation in these parts of the Karoo is clearly visible, mainly as a result of environmental (low and erratic rainfall) and anthropogenic factors (poor management practices).

The degradation is characterized by large bare and denuded areas and it seems these areas will not recover by natural succession processes alone. Some sort of **active intervention has therefore inevitably become necessary in order to avoid aridification and possibly also desertification.**

*(Source: Endangered Wildlife Trust, 2007)*

### **Loss of riverine habitat**

Only 5% of terrestrial ecosystems in South Africa are critically endangered, while 44% of river ecosystems are critically endangered. These river courses together with the riparian zones have an important biodiversity function as well as an economic value in the Karoo. These denser structures of vegetation are high in productivity and are

extremely important refuges for many animal species. The riparian zones are also very important to stock farmers as it provides grazing, especially during dryer seasons.

**The flagship species for this habitat is the Riverine Rabbit (*Bunolagus monticularis*), which is Critically Endangered. Today the population size is estimated to be just a view hundred animals.** At present, none of the Riverine Rabbit habitat is protected within a provincial nature reserve or national park and the species only occurs on private Karoo farmland (Ahlmann, Collins & Seal, 2000). In response to the rapidly declining populations, landowners in the Karoo have established Riverine Rabbit conservancies covering an area of approximately 350 000 ha of private farmland (*pers. comm.* Ahlmann, 2007<sup>1</sup>).

(Source: *Endangered Wildlife Trust, 2007*)

### **Need for Urban Renewal of Apartheid-Era Townships**

National Routes (or the main route through a town) was used in the previous regime to sever the townships from the white suburbs. There is a great lack of integration still today in many of the Karoo towns. Additional to this, many areas still have bucket system toilets or French drains, which prove a risk for the ground water source of the towns. Refuse and Landfill sites close to these areas also prove a human health risk. Lack of storm water systems means the occasional rain storms causes heavy erosion and flash floods. Most of these areas also do not have trees and open space and therefore the quality of life is perceived as low.

## **KEY SOLUTIONS**

### **Funding**

Although some funding such as MIG is available to the municipalities and departments, it is crucial to source more funding to speed up the progress of sustainable development for human settlements in the study area. Training is also required to improve the business plans which are being put forward to large funding agencies. Identification of specific projects are crucial.

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<sup>1</sup> Dr Vicky Ahlmann, Riverine Rabbit Working Group, PO Box 172, Loxton, 6985.

### **Participation & Communication**

In an area with little resources and people, co-operative governance and community participation in projects are crucial. As local municipalities does not have much capacity, they are largely dependent upon the District Municipality and State Departments. These relationships must be built and strengthened.

### **Training & Education**

Municipal and government officials can benefit enormously from training in their respective fields, and specifically regarding the environment. Environmental Awareness Training to land owners (farmers) and communities also become crucial for the sustainable management of the land.

### **Strategies / Initiatives / Projects**

- Environmental Education of Farmers and Communities
- Compliance & Enforcement of Illegal Water Uses
- Conservation Mapping & Initiatives
- Environmentally Responsible Development
- Urban Renewal Programmes

**- 2 -**

**INSTITUTIONAL AND LEGAL  
FRAMEWORK**



## **INSTITUTIONAL AND LEGAL FRAMEWORK**

In this section all legislation relevant to the environment has been listed and summarised. In the opportunities table for each municipality, the applicable legislation for each development category is indicated in the table next to each category. For further information pertaining the relevant legislation this section should be consulted. It is only a summary that will enable the user of this program to relate a development proposal to the applicable legislation. It is however important that a legal advisor be consulted if complicated issues arise which involves more than one act. It is also important to realise that legislation changes rapidly and that this section will be outdated quite soon.

This section also includes the result of an authority audit. The purpose and result of the audit was to indicate which department is responsible and accountable to apply certain legislation. For example, Department of Mineral and Energy (DME) is responsible to implement and police the Mineral and Petroleum Resources Development Act, no 28 of 2003. The user of the IEMP will be able to determine what legislation is applicable to a development category and who is the responsible department.

RELEVANT LEGISLATION	OBJECTIVES / PRINCIPLES
<p align="center"><b>CONSTITUTION OF THE REPUBLIC OF SOUTH AFRICA NO 108 OF 1998</b></p>	<p>Section 24: Everyone has the right to an environment that is not harmful to their health or well-being and to protect it for the benefit of present and future generations. Must take measures to prevent pollution and ecological degradation and promote conservation while promoting justifiable economic and social development</p>
<p align="center"><b>NATIONAL ENVIRONMENTAL MANAGEMENT ACT NO 107 OF 1998</b></p>	<p>Section 2: The principles set out in this section apply throughout the Republic to the actions of all organs of state that may significantly affect the environment. Environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably.</p> <p>Section 28: Duty of care and remediation of environmental damage</p> <p>Section 30: Control of emergency incidents</p> <p>Section 31: Access to environmental information and protection of whistle-blowers</p> <p>Regulations have been published in April 2006 that replaces the listed activities for EIA's as listed in ECA - these new regulations have impact on all kinds of infrastructure and other development.</p>
<p align="center"><b>BIODIVERSITY ACT</b></p>	<p>Act responsible to assist in management, conservation of biological diversity as well as ensuing sustainable use and equitable sharing of benefits derived.</p> <p>Section 40 allows MEC to establish a bioregional plan for a given area to align conservation strategies.</p> <p>Section 43 allows anybody who wishes to protect and indigenous species or ecosystem to set up a Biodiversity management plan. Although plans must be approved by the Minister.</p> <p>Section 52 allows MEC to publish provincial list of threatened ecosystems, local development plans should then take these into consideration.</p>

RELEVANT LEGISLATION	OBJECTIVES / PRINCIPLES
	<p>Minister can publish a threatened species list. Activities involving these species can then not be carried till a permit is obtained as per Section 57. Similar ruling applies for alien species as per Section 69.</p> <p>Chapter 6 deals with bio-prospecting, where a permit is required to undertake such an activity.</p>
<p><b>ENVIRONMENT CONSERVATION ACT NO 73 OF 1989</b></p>	<p>This Act deals with the effective protection of the environment and more specifically waste management (section 20), discarding of waste (section 20(6) and the prohibition of littering (section 19(1)).</p> <p>GN 1986 (GG 12703 of 24 August 1990): Identification of matter as waste</p> <p>GN 51 (GG 15428 of 24 January 1994) - General environmental policy which should be applied with any anticipated new activities</p> <p>GN R 1182, GN R 1183 and GN R 1184 (all promulgated into GG 18261 of 5 September 1997), stipulate EIA's to be done in terms of certain activities identified under section 21(1).</p> <p>GN R 1196 (GG 15832 of 8 July 1998): Application for disposal site procedure</p> <p>GN R 154 (GG 13717 of 10 January 1992): Noise control regulations in terms of section 25</p> <p>R.625 of 9 May 2003: Regulations regarding plastic carrier bags and plastic flat bags</p> <p>Section 31A: Powers of Minister, competent authority, local authority or government institution where environment is damaged, endangered or detrimentally affected.</p> <p>Proc R 29 (GG 16346 of 7 April 1995): Assignment of this act to the Provinces.</p>

RELEVANT LEGISLATION	OBJECTIVES / PRINCIPLES
<p><b>ATMOSPHERIC POLLUTION PREVENTION ACT NO 45 OF 1965 (Soon to be replaced by the current Air Quality Bill)</b></p>	<p>To provide for the prevention of the pollution of the atmosphere. It deals with the control of noxious or offensive gases (Part II) and the application of registration certificates where scheduled processes are carried on (section 9). Part III deals with atmospheric pollution by smoke and includes the installation of fuel burning appliances and smoke control regulations.</p> <p>Part IV: Dust control</p> <p>GN R 1387 (GG 22941 of 21 December 2001): Revised guidelines for sulphur dioxide</p> <p>Part V: Air pollution by fumes emitted by vehicles</p> <p>GN R 1651 (GG 4393 of 20 September 1974): Emission by diesel driven vehicles</p>
<p><b>CONSERVATION OF AGRICULTURAL RESOURCES ACT NO 43 OF 1983</b></p>	<p>This act provides for the control over utilization of natural agricultural resources, to promote the conservation of soil, water resources and vegetation and the combating of weeds and invader plants.</p> <p>Section 2 : Except for the provisions relating to invader plants and weeds, this Act shall <b>not</b> apply to any land situated in an <b>urban area</b> or to any area declared to be a <b>mountain catchment area</b> under the Mountain Catchment Area Act, 1970.</p> <p>GN R 1048 (GG 9238 of 25 May 1984): Regulations dealing with weeds and invader plants.</p>
<p><b>ADVERTISING ON ROADS AND RIBBON DEVELOPMENT ACT NO 21 OF 1940</b></p>	<p>The purpose of this act is to regulate the display of advertisements outside certain urban areas at places visible from public roads and the depositing or leaving disused machinery or refuse near certain public roads.</p>
<p><b>EXPLOSIVES ACT NO 26 OF 1956</b></p>	<p>The purpose of this act is to consolidate the laws relating to the manufacture, storage,</p>

RELEVANT LEGISLATION	OBJECTIVES / PRINCIPLES
	<p>sale transport, importation, exportation and the use of explosives.</p> <p>GN R 1604 (GG 3648 of 8 September 1972): Spillage of explosives, disposal of explosive waste.</p>
<p><b>FENCING ACT NO 31 OF 1963</b></p>	<p>The purpose of this act is to consolidate the laws relating to fences and the fencing of farms and other holdings and matters incidental thereto.</p> <p>Section 10: Repair of boundary fences</p>
<p><b>FERTILIZERS, FARM FEEDS, AGRICULTURAL REMEDIES AND STOCK REMEDIES ACT NO 36 OF 1947</b></p>	<p>The purpose of this act is to provide for the appointment of a registrar of fertilizers, farm feeds, agricultural remedies and stock remedies; for the registration of fertilizers, farm feeds, agricultural remedies, stock remedies, sterilizing plants and pest control operators; to regulate or prohibit the importation, sale, acquisition, disposal or use of fertilizers, farm feeds, agricultural remedies and stock remedies.</p> <p>Section 3 and 7(2)(a)(ii): Registration of fertilizers, farm feeds, agricultural remedies, stock remedies, sterilizing plants and pest control operators.</p> <p>Section 7: Sale of fertilizers, farm feeds, agricultural remedies and stock remedies.</p>
<p><b>FIRE BRIGADE SERVICES ACT NO 99 OF 1987</b></p>	<p>This act provides for the establishment, maintenance, employment, co-ordination and standardization of fire brigade services.</p>
<p><b>FOREST ACT NO 122 OF 1984</b></p>	<p>Most of the provisions of this act have been repealed by the National Forests Act, but the regulations relating to timber and protected trees remain.</p> <p>GN 1339 (GG 5242 of 6 August 1976): Protected trees</p>
<p><b>HAZARDOUS SUBSTANCES ACT NO 15 OF 1973</b></p>	<p>In general this act provides for the control of substances which may cause injury or ill-health to or death of human beings; it divides such substances or products into groups</p>

RELEVANT LEGISLATION	OBJECTIVES / PRINCIPLES
	in relation to the degree of danger. It also prohibits the dumping or disposal of such substances and products.
<b>HEALTH ACT NO 63 OF 1977</b>	<p>In general this act provides for measures to promote the health of inhabitants of the Republic and the rendering of health services.</p> <p>It also deals with nuisance which means anything which is offensive, injurious or dangerous to health and would include any stream, pool, marsh, urinal, drain, the accumulation of refuse, any industrial premises not kept in a cleanly state and free from offensive smells (section 1).</p>
<b>AGRICULTURAL PESTS ACT NO 36 OF 1983</b>	To provide for measures by which agricultural pests may be prevented and combated; and for matters connected therewith.
<b>MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT NO 28 OF 2003 (In force since 1 May 2004)</b>	<p>This Act makes provision for equitable access to and sustainable development of the nation's mineral and petroleum resources.</p> <p>This act together with the Mine Health and Safety act no 29 of 1996 and the regulations promulgated in terms of the Mines and Works act no 27 of 1956 apply only to mining areas.</p>
<b>NATIONAL BUILDING REGULATIONS AND BUILDING STANDARDS ACT NO 103 OF 1977</b>	<p>To provide for the promotion of uniformity in law relating to the erection of buildings in the areas of jurisdiction of local authorities and for the prescribing of building standards</p> <p>Any building, excluding a dwelling house, in which refuse is or will be generated shall be provided with an adequate storage area for refuse containers (Regulation U1)</p> <p>The location of any area contemplated in regulation u1 shall be such that access thereto from any street for the purposes of removing any refuse is to the satisfaction of the local authority (Regulation U2).</p>

RELEVANT LEGISLATION	OBJECTIVES / PRINCIPLES
<b>NATIONAL FORESTS ACT NO 84 OF 1998</b>	To reform the law on forests and in general to promote the sustainable management and development of forests for the benefit of all. It also includes measures for the protection of trees and emergency procedures therefore.
<b>NATIONAL HERITAGE RESOURCES ACT NO 25 of 1999</b>	<p>In general this act provides for an integrated and interactive system for the management of the national heritage resources and to empower civil society to nurture and conserve their heritage resources for future generations.</p> <p>It includes burial sites and graves and archeological sites, national monuments, etc.</p>
<b>NATIONAL ROAD TRAFFIC ACT NO 93 OF 1996</b>	Deals with road traffic matters, but as far as environmental matters are concerned, it deals with the transportation of certain dangerous goods. Regulations have been issued to this effect (GN R 225 (GG 20963 of 17 March 2000).
<b>NATIONAL VELD AND FIRE FOREST ACT NO 101 OF 1998</b>	Section 1 : The purpose of this Act is to prevent and combat veld, forest and mountain fires throughout the Republic and in this regard the Act provides for a variety of institutions, methods and practices for achieving the purpose. This includes the formation of fire protection associations (section3) and the duty to prepare and maintain fire breaks (section 12).
<b>GAME THEFT ACT NO 105 OF 1991</b>	To regulate the ownership of game in certain instances; to combat the theft and wrongful and unlawful hunting, catching and taking into possession of game; and to provide for matters connected therewith.
<b>NATIONAL WATER ACT NO 36 OF 1998</b>	<p>The purpose of this act is to protect water resources and the allocation of water.</p> <p>It deals with the protection of water resources (Chapter 3) and the prevention and the remedying of the effects of pollution (section 19) and the control of emergency incidents (section 20).</p> <p>Regulations have been promulgated on the use of water for mining and related activities aimed at the protection of water resources and includes the separation of clean and dirty</p>

RELEVANT LEGISLATION	OBJECTIVES / PRINCIPLES
	water systems.
<b>WATER SERVICES ACT NO 108 OF 1997</b>	The general purpose of this act is the provision for access to basic water supply and sanitation frameworks for water service institutions and water service providers and the monitoring of water service providers. It includes industrial use of water and the discharge of industrial effluent (section 7).
<b>WATER ACT NO 54 OF 1956</b>	<p>This Act has been repealed but the regulations promulgated in terms thereof still remain in force. These include:</p> <p>GN R 2834 (GG 10048 of 27 December 1985): Regulations for the erection, enlargement, operation and registration of water care works</p> <p>GN R 991 (GG 9225 of 18 May 1984): Requirements for the purification of waste water or effluent</p> <p>GN R 3208 of 29 August 1969: Regional standards for industrial effluent</p> <p>GN R 1560 (GG 10366 of 25 July 1986): Dams with a safety risk</p>
<b>NUCLEAR ENERGY ACT NO 46 OF 1999</b>	To regulate aspects of nuclear fuel and related matters.
<b>OCCUPATIONAL HEALTH AND SAFETY ACT NO 85 OF 1993</b>	<p>In general this act provides for the health and safety of persons at work. However, many regulations have been promulgated in terms of this act which are of an environmental nature.</p> <p>GN R 1179 (GG16596 of 25 August 1995): Hazardous chemical substances</p> <p>GN R 155 (GG 23108 of 10 February 2002): Asbestos regulations</p> <p>GN R 236 (GG 23175 of 28 February 2002): Lead regulations</p>



RELEVANT LEGISLATION	OBJECTIVES / PRINCIPLES
<b>PHYSICAL PLANNING ACT NO 125 OF 1991</b>	Relates to zoning, spatial and guide plans.
<b>LOCAL GOVERNMENT TRANSITION ACT NO 209 OF 1993</b>	Deals with Integrated Development Plans.
<b>DEVELOPMENT FACILITATION ACT NO 67 OF 1995</b>	Policy framework for land development, the so-called Local Development Objectives.
<b>PROMOTION OF ACCESS TO INFORMATION ACT NO 2 OF 2000</b>	This act gives effect to the constitutional right of access to any information held by the state and any information that is held by another person and that is required for the exercise or protection of any rights as provided for in section 32 of the Constitution. Any person whose environmental rights (as per section 24 of the Constitution) have been infringed, may request relevant information held by the state or private bodies.
<b>PROMOTION OF ADMINISTRATIVE JUSTICE ACT NO 3 OF 2000</b>	This act gives effect to the right to administrative action that is lawful, reasonable and procedurally fair and to the right to written reasons for administrative action as contemplated in section 33 of the Constitution.
<b>PROTECTED DISCLOSURES ACT NO 26 OF 2000</b>	This act makes provision for procedures in terms of which employees may disclose information regarding unlawful or irregular conduct by their employers or other employees and it provides for the protection of employees who make a disclosure which is protected in terms of this act.
<b>THE SOUTH AFRICAN NATIONAL ROADS AGENCY LIMITED AND NATIONAL ROADS ACT NO 7 OF 1998</b>	<p>This act provides for a national roads agency for the Republic to manage and control the Republic's national roads system and take charge of matters like development and maintenance within the framework of government policy.</p> <p>It also prohibits any person from depositing or leaving a disused vehicle or machine or a disused part of a vehicle or machine, or any rubbish or other refuse on a national road (section 51).</p>
<b>NORTHERN CAPE PLANNING AND DEVELOPMENT ACT NO 7 OF 1998</b>	This will be applicable to any planning and land development related activities and serves to guide the administration of any spatial plans, policies, etc.

RELEVANT LEGISLATION	OBJECTIVES / PRINCIPLES
<p align="center"><b>CAPE NATURE AND ENVIRONMENTAL CONSERVATION ORDINANCE NO 19 OF 1974</b></p>	<p>To consolidate and amend the laws relating to nature and environmental conservation.</p> <p>It includes provisions relating to the hunting or possession of endangered wild animals, the hunting of protected wild animals. It regulates the prohibition of killing or capturing of protected wild animals in excess of daily bag limit, the prohibition of the manipulation of boundary fences, laying of poison, possession of endangered flora and the picking of certain flora.</p>
<p align="center"><b>PN 955 OF 29 AUGUST 1975</b></p>	<p>These regulation were issued ito the aforesaid Ordinance and apply to, <i>inter alia</i>:</p> <ul style="list-style-type: none"> <li>• Wild animals</li> <li>• Fish in inland waters</li> <li>• Professional hunters, etc</li> </ul>
<p align="center"><b>PROC 1 OF 23 JANUARY 2002</b></p>	<p>This regulation was issued ito the same ordinance above.</p> <p>In this regulation the MEC determines that in the areas listed in Schedule 1 and in respect of the species of protected wild animals mentioned in the first and second columns, respectively, of Schedule 2, the hunting seasons and the daily bag limits as set out in the third and fourth columns, respectively, of the said Schedule 2.</p>
<p align="center"><b>CAPE ROADS ORDINANCE NO 19 OF 1976</b></p>	<p>The general purpose of this ordinance is to consolidate and amend the law relating to public roads and public paths.</p> <p>Any person who damages, destroys or defaces any public road or public path or places any obstruction or obstacle on, in over or under a public road, etc. will be guilty of an offence and upon conviction liable to a fine.</p>
<p align="center"><b>AN 575 OF 29 SEPTEMBER 1950</b></p>	<p>These are standard drainage regulations which were issued in terms of section 201 of Ordinance 10 of 1912 and they mainly deal with drainage systems, alterations thereto,</p>

RELEVANT LEGISLATION	OBJECTIVES / PRINCIPLES
	the local authority's approval, inspection, maintenance, etc
<b>CAPE LAND USE PLANNING ORDINANCE NO 15 OF 1985</b>	This ordinance will be applied if there is any change in land use. It stipulates that structure plans be prepared.
<b>PN 1050 OF 5 DECEMBER 1988</b>	This piece of legislation was promulgated in terms of the Land Use Ordinance No 15 of 1985 and sets out the administrative procedure regarding departure, zoning and subdivision.
<b>PN 527 OF 25 JULY 1952</b>	Cape standard sanitary regulation promulgated in terms of Ordinance no 19 of 1951. It deals with septic tanks, closets and urinals and domestic refuse.
<b>PN 504 OF 19 JUNE 1953</b>	Cape Local Authorities Standard Water regulations
<b>PN 416 OF 14 MAY 1954</b>	Regulations relating to inflammable liquids and substances.
<b>PN 504 of 12 AUGUST 1983</b>	Drainage by-law
<b>OTHER DOCUMENTS OF IMPORTANCE</b>	<p>Minimum requirements for classification, handling and disposal of hazardous waste, second edition, 1998 (issued by DWAF)</p> <p>Vienna Convention for the protection of the ozone layer</p> <p>Convention on Biological Diversity</p> <p>King report on corporate governance for South Africa, 2002</p> <p>Montreal Protocol on Substances that deplete the ozone layer, 1987</p> <p>Northern Cape Environmental Implementation Plan (GN 40 of 2003)</p> <p>World Heritage Convention Act no 49 OF 1999 (provides for the incorporation of the World Heritage Convention into South African law; the enforcement and implementation</p>

<b>RELEVANT LEGISLATION</b>	<b>OBJECTIVES / PRINCIPLES</b>
	of the World Heritage Convention in South Africa; the recognition and establishment of World Heritage Sites, etc)

**LEGAL OBLIGATIONS AS PER  
DTEC**

<b>International Obligations - Protocol &amp; Conventions</b>	
1	Lusaka Agreement on Co-operative Operations Directed at Illegal Trade in Wild Fauna & Flora (1974)
2	Convention on International Trade in Endangered Species of Fauna and Flora – CITES (1975)
3	Convention on Wetlands of International Importance (RAMSAR) (1975)
4	Convention on the Conservation of Migratory Species of Wild Animals (Bonn) (1991)
5	Convention on Biological Diversity (CBD) (1995)

<b>National Obligations - Biodiversity Legislation</b>	
1	National Environmental Management Act 107 of 1998 (NEMA)
2	National Environmental Management Biodiversity Act 10 of 2004 (NEMBA)
3	National Environmental Management Protected Areas Act 57 of 2003 (NEMPA)
4	National Environmental Management Protected Areas Amendment Act 31 of 2004 (NEMPAA)
5	Environment Conservation Act 73 of 1989 (ECA)
6	Game Theft Act 105 of 1991 (GTA)

<b>National Obligations - Policies / Procedures &amp; Guidelines</b>	
6	National Policy and Strategy for Problem Animal Control in South Africa
7	Red billed kwela
8	Cycad Policy
9	Locust control in South Africa
10	Opportunity Species
11	Ban on the importation of primates
12	Hunting of Leopard
13	Exotic parrots
14	Breeding in captivity of domesticated Guinea-fowl
15	Exotic Birds species
16	Exotic Fish species
17	National Policy and Strategy for Problem Animal Control in South Africa

<b>Provincial Ordinances</b>	
1	Nature and Environmental Conservation Ordinance 17 of 1974
2	Nature and Environmental Conservation Regulations - Provincial Notice PN 955 / 1975
3	Problem Animal Control Ordinance 26 of 1957

<b>Provincial Policies / Procedures &amp; Guidelines</b>	
18	A Freshwater Gill Net Fisheries Policy for the Northern Cape
19	Large Predator Policy
20	Keeping Blue Cranes in Captivity
21	Hunting of leopard Policy
22	Afrika Olifant – Merk van Ivoor
23	Inspection Services Policy
24	Guidelines for Bird Ringing Permits
25	Guidelines for Zoological Research Permits
26	Guidelines for Flora Research Permits
27	Falconry Policy
28	Birds of Prey Policy
29	Law Administration Policy
30	Policy on the trade and captivity of avifauna
31	Professional Hunting Policy
32	Wildlife Facilities Policy
33	Hippo policy

<b>Provincial Policies / Procedures &amp; Guidelines</b>	
<b>34</b>	<b>Adequate Enclosure Policy</b>
<b>35</b>	<b>Conservancy Policy</b>
<b>36</b>	<b>Hunt of Opportunity Species</b>
<b>37</b>	<b>Primate Policy</b>
<b>38</b>	<b>Policy for the establishment of Private Nature Reserves</b>
<b>39</b>	<b>Reptile Policy</b>
<b>40</b>	<b>Small Carnivore Policy</b>
<b>41</b>	<b>Translocation of game Policy</b>
<b>42</b>	<b>Transportation of game policy</b>
<b>43</b>	<b>Game exchange scheme policy</b>
<b>44</b>	<b>Policy on wildlife pet trade</b>

**- 3 -**

**LOCAL MUNICIPALITY  
ISSUES, STRATEGIES AND  
OPPORTUNITIES**



# ENVIRONMENTAL SUMMARY - SIYATHEMBA MUNICIPALITY

## 1. PRIORITY ENVIRONMENTAL ISSUES & STRATEGIES

<b>A – ISSUES IDENTIFIED FROM INTEGRATED DEVELOPMENT PLAN</b>		
<b>Specific Environmental Issues</b>	<b>Environmental Consequences</b>	<b>Strategies and legislation to address Issues for the Municipality</b>
<ol style="list-style-type: none"> <li>1. <i>Unrehabilitated Asbestos Mines north-west of Prieska.</i></li> <li>2. <i>Lack of Tourism to Prieska (not on Main Route).</i></li> <li>3. Salinity of the Orange River</li> <li>4. Incinerator not working</li> </ol> <p><b>Input from Intergrated Waste Management Plan for PKSDM (Kwezi V3):</b></p> <ol style="list-style-type: none"> <li>1. 3 Landfill sites – Niekerkshoop, Prieska, Marydale</li> <li>2. No authorizations for Niekerkshoop &amp; Marydale</li> <li>3. Upgrades and operation improvements required for all sites in terms of DWAF Minimum Requirements.</li> <li>4. Not sufficient equipment for effective refuse removal service</li> <li>5. No recycling</li> <li>6. Illegal Dumping</li> </ol>	<p>Human Health None River Ecosystem Human health</p> <p>Surface &amp; Ground Water</p>	<p>Rehabilitate with DME &amp; Land Owners Tourism Initiatives such as Die Bos DWAF Monitoring &amp; Compliance Infrastructure Development</p> <p>See IWMP</p>

### Summary of District Municipal Area

This is a rural area with no urban areas within its boundaries. The main economical activities in this area are agricultural of nature. There is also mining activities in this area but on a much smaller scale than agricultural activities. The DMA consist of three separate sections with a estimated total surface of 47 308ha. Only one worth-mentioning river flows through this area, namely the Orange River. Smaller non-permanent rivers like the Brakriver also appears here, but it does not really influence the economic activities of the DMA. There are scarcely mountains in this area but many hills. Mountain-ranges that can be recalled is the is the Asbesmountain and the Doringmountain. The climate of this area is mainly semi-desert with excessive temperature. Rainfall is low and normally during summer. Apart from the Orange River the inhabitants mostly in the Marydale and Niekershoop areas are making use of underground water to provide for their own needs and these of their livestock.

## 2. KEY PERFORMANCE (SUSTAINABILITY) INDICATORS FOR THE ENVIRONMENT

### FROM IDP

#### **The vision of the Environmental Management Plan is as follows:**

To manage the development of natural resources in such a way that there will be no negative influence on nature and the environment.

#### **Mission**

The mission of the Siyathemba Municipality focuses broadly on service delivery, utilisation of resources, economical development and job creation, a safe and healthy community as well as a friendly environment.

#### **With the above-mentioned in mind the mission of the Environmental Management Plan are as follows:**

- To deal with the disposal of waste in an acceptable way.
- To manage and rehabilitate the sites where disposal will take place, effectively.
- To control the exploitation of asbestos and other mining activities.
- To ensure the regulation of all land-uses in the MA
- To establish an effective monitoring- and record keeping programme.
- To secure and utilise the personnel of the Council the optimum
- To protect our on-surface water- and water supply; and
- To find a harmonious balance between economical development and -utilisation of the environment on the one side and the preservation and rehabilitation of the environment on the other side.

To promote sustainable environment in the region. The following environment programmes will be implemented in accordance with the framework of the IDP and relevant planning legislation:

- a. To return, strengthen or add to features, structures and design elements which enhance beauty, attractiveness and overall amenity in the environment of the region.
- b. Assist local municipalities in ensuring that relative proportions of physical development (e.g. buildings) are kept with desirable human scale.
- c. In all areas in towns, we shall also assist municipalities in encouraging high standards of cleanliness and ensure regular and efficient cleaning up and removal of refuse.
- d. Encourage in accordance with the MSA of 2000 and with all relevant enactments, on the creation, retention and proper maintenance of sites and structures of outstanding beauty and historic interest.
- e. In keeping with the need to preserve buildings and other features of historic significance as mentioned earlier in this report, the municipality together with local municipalities take all measures possible to ensure proper conservation and nurturing of any natural or man-made features/ structures within the district in terms of relevant legislation. In particular, we shall put into effect measures for conservation of building of architectural significance as laid down in the historic buildings regulation.

f. Compile a register/ list of historic buildings/ sites which require to be conserved.

## ALSO REFER TO GENERIC SUSTAINABILITY INDICATORS TABLE

### 3. SPECIFIC OPPORTUNITIES

- Die Bos Resort Upgrading.
- Orange River as Tourism Resource
- Fish Farming
- Nature Based Tourism Potential on Ridges and Orange River in DMA

#### TOURISM OPPORTUNITIES

Tourism	Crafts	Cultural	Nature reserve	Recreation Activities / 4 x 4	Birding	Lodges/ Game farming / Hunting	Heritage / Architecture	War	Other
<b>Prieska</b>	Tiger's eye fort Arts and Crafts Prieska Museum	Prieska Museum	Die bos Nature Reserve Hiking Trails Safari Ria Hysaman Aloe Garden Wonderdraai	Alongside the orange River at Die bos Nature Reserve	Die bos Nature Reserve Hiking trail Ria Hysaman Aloe Garden Wonderdraai	Die bos Nature Reserve Blaauwbosch Plaaswerf Herberg Preiskaspoort Hunting Farm Who can tell Ondraaivlei Nelspoortjie Karoo Guest House Wonderdraai Guest Farm.		Memorial Garden Fort on top of Prieska Koppie.	Ria Huisman Aloe Garden Die bos Nature reserve Wonderdraai land.
<b>Niekerkshoop</b>									
<b>Marydale</b>			Boegoeberg Dam Kokerboom forest		Boegoeberg Dam Kokerboom forest	Trans Boegoe Eco Resort			Quiver tree forest Rock Formations

## 4. IDENTIFICATION OF IMPLEMENTABLE PROJECTS

### FROM INTEGRATED WASTE MANAGEMENT PLAN

1. Authorise existing Niekerkshoop and Marydale for operations (2009) (R500 000)
2. Construction of guardhouse, ablution facilities & fencing at Phillipstown & Vanderkloof Landfill Sites up to 2010 (R465 000)
3. Audit Landfill Sites (twice yearly) (R50 000 per annum – add escalation)
4. Start recycling initiatives

### FROM IDP

#### 1. Asbestos Rehabilitation

##### Background

The Prieska Area in Siyathemba Municipal Area was richly settled with Asbestos. It was good for the Economy but not for socio-economy. As a result of the former mining of asbestos there is the \* of rehabilitating the asbestos areas.

##### LOGISTICAL FRAMEWORK

Priority	Objectives Verifiable Indicators	Means of Verification	Risks and Assumptions
Goal The rehabilitate the asbestos area for health reasons	To secure a safer environment for the people	Ground still a health threat	-Workers might get sick -Might distributed asbestos into the air/atmosphere Health hazards
Output A safer environment for Siyathemba Municipal community			
Activity The depositing of special sand over the	Responsibility Municipality Dept. of Health	Time Frames	Cost

infused ground	Contractor Consultant		
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## 2. Upgrading and Greening of Public Spaces. [chapter 4, p 83]

### Background

The Siyathemba Municipality is a very big Area. Most of the area is dusty and dry. Upgrading and greening of this spaces will only refresh the outlook of the area.

### LOGICAL FRAMEWORK

Priority	Objectives Verifiable Indicators	Means of Verification	Risks and Assumptions
Goal Upgrading and greening of public spaces	To attract tourists that passes by the area	Tourism development	Disturbing nature.
Outputs A more beautiful and refreshed Outlook over the area. Create jobs for the unemployed			
Activity Planting of grass and trees etc.	Responsibility Municipality Dept of Environmental Affairs and Tourism Consultants Contractors	Time Frame	Cost

## 3. Upgrading of Museum.

**Infrastructure improvement** (with implies environmental impact) [Chapter 4, p 1 and p 30-40))

- Sanitation - Changed from VIP to full borne systems

- Build Pipeline from Orange River to Niekerkshoop
- Build Pipeline from Orange River to Marydale
- Upgrading of Sewerage Infrastructure
- Upgrading of Landfill in Marydale to DWARF standards

***Socio-economi improvement*** with environmental implication

- Community food garden

**Background**

Poverty and unemployment brings a problem of food security which causes hunger to many households.

**Logical Framework**

Priority To address poverty and hunger through food garden	Objectives Verifiable Indicators Assist community to right hunger and poverty	Means of Verification	Risks and Assumptions
Goals To establish sustainable food gardens			
Outputs			
Activity 1. Identify land 2. Identify beneficiaries	Responsibility Municipality Department of Agriculture Social Development Health	Time Frame	Cost

- **Improvement of waste management in the Siyathemba Municipality**

**BACKGROUND**

The people of Siyathemba are currently in a culture to dump their waste in the streets and open areas.

**LOGICAL FRAMEWORK**

PRIORITY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	RISKS & ASSUMPTIONS
<u>Goal</u> To create a culture to recycle and reduce informal dumping	To reduce informal dumping		That people shall learn to recycle and stop dumping
<u>Activity</u> To held workshops with people in towns to explain to them to recycle and not dump waste in streets.	<u>Responsibility</u> Local Authority DWAF Karoo District Municipality	<u>Time Frame</u> 2007/08	<u>Cost</u> R1 021 500-00

***Economic development***

- Identify land suitable for Agriculture development
- Fish farming
- Tiger eye mining

**ALSO REFER TO GENERIC ISSUES, STRATEGIES AND OPPORTUNITIES TABLE**

## Generic Municipal Issues, Environmental Impacts, Strategies & Opportunities/Projects

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
<p><b>Informal Residential</b></p> <ul style="list-style-type: none"> <li>• Low density urban,</li> <li>• Informal, high density urban,</li> <li>• Informal, low density rural,</li> <li>• Informal, high density rural</li> </ul>	<ol style="list-style-type: none"> <li>1. Housing Backlog</li> <li>2. Lack of availability of land for settlements (most land privately owned).</li> <li>3. Housing projects</li> <li>4. Illegal evictions from farms – people move to settlements which can not accommodate them.</li> <li>5. Dumping due to insufficient refuse removal.</li> <li>6. Dust Pollution because of little vegetation cover.</li> <li>7. Burning of wood – removal of vegetation adjacent to informal settlements.</li> <li>8. Replacement of bucket system – technologies available is not viable &amp; appropriate.</li> </ol>	<ul style="list-style-type: none"> <li>• Destroy indigenous biodiversity; in gardens indigenous flora are substituted with exotic species.</li> <li>• Fragmentation of ecological area, subdividing large populations by causing a barrier.</li> <li>• Scenic impact.</li> <li>• Depletion and degradation of soils may lead to unproductive soils. Decrease of water infiltration and increase the water run-off (flood potential).</li> <li>• Pollution of air – due to open cooking fires</li> <li>• Flooding may occur due to no management of storm water runoff.</li> <li>• Water quality most adversely influenced</li> </ul>	<p><b>Strategies:</b></p> <ol style="list-style-type: none"> <li>1. Sewer system management.</li> <li>2. Consider soil conditions in particular – no septic system on slate, shale or clay soils.</li> <li>3. Storm water planning to make storm water available for urban agriculture.</li> <li>4. Formalize informal settlements.</li> <li>5. Labour intensive projects in informal settlements</li> </ol> <p><b>Legal requirements:</b></p> <ol style="list-style-type: none"> <li>1. Environmental and Heritage Impact Assessment (EIA and HIA) required for land use changes, under NEMA, ECA and NHRA</li> <li>2. Expansion and formalization of</li> </ol>	<ol style="list-style-type: none"> <li>1. Small contracts for SMME, regarding maintenance or small capital projects – training required.</li> <li>2. Urban agriculture such as olive and citrus, harvest on contract to distributors.</li> <li>3. Small scale urban agriculture production.</li> <li>4. Cleaning programme currently implemented must be continued and encouraged.</li> <li>5. Environmental education against wood collection in the adjacent veld to prevent degradation &amp; erosion.</li> <li>6. Urban renewal and greening for dust prevention. Soil stabilisers can be investigated in crucial areas.</li> <li>7. Investigation or project</li> </ol>



Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
		<p>by organic and microbiological pollution due to human activities.</p> <ul style="list-style-type: none"> <li>Overall very high impact on vegetation that usually result in the complete or partial destruction of both the vegetation and the top layers of soil often further exacerbated by inadequate rehabilitation.</li> </ul>	<p>settlements to be in accordance with IDP and SDF</p> <ol style="list-style-type: none"> <li>Water Services Act</li> </ol>	<p>to determine most suitable alternatives for bucket system that does not need lots of water.</p>
<p><b>Formal Residential</b></p> <ul style="list-style-type: none"> <li>Low density (plot sizes &gt; 1500m<sup>2</sup>),</li> <li>Formal, normal density (plot sizes 500m<sup>2</sup> - 1500m<sup>2</sup>),</li> <li>Formal, medium density (shared plots, single &amp; double storey),</li> <li>High density (multi storey units in complex)</li> </ul>	<ol style="list-style-type: none"> <li>No land available at this stage</li> </ol>	<ul style="list-style-type: none"> <li>Destroy indigenous biodiversity; in gardens indigenous flora are substituted with exotic species.</li> <li>Fragmentation of natural area, subdividing large populations by causing a barrier that is extremely difficult to cross, with genetic consequences.</li> <li>Scenic impact.</li> <li>Pollution of air.</li> <li>Flooding may occur in floodplains due to construction being too close to the stream or river edge.</li> <li>Water quality most</li> </ul>	<p><b>Strategy:</b></p> <ol style="list-style-type: none"> <li>Densification rather than expansion, development by subdivision of large residential plots.</li> <li>Strategic Environmental Plan for local Municipality.</li> </ol> <p><b>Legal requirements:</b></p> <ol style="list-style-type: none"> <li>EIA according to ECA.</li> <li>Physical Planning Act</li> <li>Development Facilitation Act</li> <li>Northern Cape Planning and Development Act</li> <li>Cape Land Use</li> </ol>	<ol style="list-style-type: none"> <li>SMME waste removal.</li> <li>Service and maintain areas through SMME's, side walks etc. in partnership with the municipality – work towards a municipal service contract.</li> <li>Survey on plot sizes and opportunities for development, densification</li> </ol>

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
		<p>adversely influenced by organic and microbiological pollution due to human activities.</p> <ul style="list-style-type: none"> <li>Overall very high impact on vegetation that usually result in the complete or partial destruction of both the vegetation and the top layers of soil often further exacerbated by inadequate rehabilitation.</li> </ul>	<p>Planning Ordinance.</p>	
<p><b>Open Space</b></p> <ol style="list-style-type: none"> <li>Most of the existing soft open spaces, especially in the informal residents areas, are unkempt and therefore creating an unsafe environment</li> <li>The park in the informal areas of the three towns are mostly overgrown and unkempt, making is attractive dumping sites that lead to unsafe and polluted areas within the residential areas.</li> </ol>	<ol style="list-style-type: none"> <li>Almost no open space planning has been done in most of the towns.</li> <li>Lack of Formal Sports field in many of these townships.</li> <li>Informal settlements in open areas (public open spaces)</li> <li>Floodplain areas cause a safety risk, as no detailed flood line determinations have been done in most towns. Informal settlement also takes place below the flood line.</li> </ol>	<ol style="list-style-type: none"> <li>Human Health</li> <li>Safety</li> </ol>		<p><b>Open Space and Landscape Plans (OSLP)</b></p> <p>- Decision support tool and a spatial planning tool that can assist in the promotion of sustainable management of open space within the area of each Municipality. <b>(This forms part of Urban Renewal. – Also refer to Urban Renewal Guidelines)</b></p>
<p><b>Commercial</b></p> <ol style="list-style-type: none"> <li>Free Trade Zones.</li> <li>Trade Zones.</li> <li>Shopping Centres.</li> <li>CBD Commercial</li> </ol>	<ol style="list-style-type: none"> <li>CBD Areas have no public toilets.</li> <li>CBD often lacks identity &amp; legibility</li> </ol>	<ol style="list-style-type: none"> <li>Destroy indigenous biodiversity; in gardens indigenous flora are substituted with exotic species.</li> <li>Fragmentation of natural area, subdividing large</li> </ol>	<p><b>Strategies:</b></p> <ol style="list-style-type: none"> <li>Healthy CBD stimulation against decentralization.</li> <li>Beautification by tree planting etc for</li> </ol>	<ol style="list-style-type: none"> <li>Olive oil industry, small scale farmers, joint ventures.</li> <li>Greening of town CBD, growing plants for side walks etc.</li> </ol>

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
5. Grain Silos		<p>populations by causing a barrier.</p> <p>9. Scenic impact.</p> <p>10. Pollution of air.</p> <p>11. Overall very high impact on vegetation that usually result in the complete or partial destruction of both the vegetation and the top layers of soil often further exacerbated by inadequate rehabilitation.</p>	<p>ecological disadvantages in CBD</p> <p>3. Spatial planning to make CBD attractive for tourists.</p> <p>4. Develop ablution facilities for CBD Areas.</p> <p><b>Legal requirements:</b></p> <p>1. Occupational Health and Safety Act</p> <p>2. EIA for new development</p> <p>3. Atmospheric Pollution Prevention Act.</p> <p>4. Hazardous Substances Act</p> <p>5. Health Act</p>	<p>3. Proper CBD Planning is part of Urban Renewal</p> <p>4. Manufacturing of street furniture banners and other image creating elements.</p> <p>5. Security contracts such as organised car protecting services.</p> <p>6. Link to other regional distribution centres</p> <p>7. Investigate establishment of free trade zones around airport in the district</p> <p>8. Continue to investigate re-use of buildings associated with airports for other types of facilities.</p>
<p><b>Leisure &amp; Tourism</b></p> <p>1. Hotel - large (more than 100 rooms),</p> <p>2. medium (30 - 100 rooms),</p> <p>3. small (less than 30 rooms),</p> <p>4. Guest house,</p> <p>5. Resort - detached units in a rural or natural setting outside urban areas,</p> <p>6. Caravan Park / Site, Casino,</p>	<p>1. Tourism information in the study area is not always accessible &amp; legible to a tourist moving through the area. Booklets of specific tourist attractions is not being distributed through the country</p>	<p>1. Destroy indigenous biodiversity; in gardens indigenous flora are substituted with exotic species.</p> <p>2. Trail and disruption caused by vehicles may functionally fragment populations especially insofar small-bodied, less mobile or cryptic species are concerned.</p>	<p><b>Strategies:</b></p> <p>1. Focus on agricultural tourism.</p> <p>2. Concentrate to conserve what is left,</p> <p>3. Combine conservation with development.</p> <p><b>Legal requirements:</b></p> <p>1. EIA for new development.</p>	<p>4. Audit L and T facilities – training required for SMME's</p> <p>5. Maintenance contracts for all monuments and sites.</p> <p>6. Food oriented tourism development</p> <p>7. Maintenance of resorts, planning and SMME opportunity.</p> <p>8. Tourism marketing</p>

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
Golf Course		<ol style="list-style-type: none"> <li>3. Scenic impact.</li> <li>4. Pollution of air.</li> <li>5. Overall very high impact on vegetation that usually result in the complete or partial destruction of both the vegetation and the top layers of soil often further exacerbated by inadequate rehabilitation</li> </ol>	<ol style="list-style-type: none"> <li>2. National Water Act</li> <li>3. Environmental Conservation Act.</li> </ol>	<p>exercise (to the entire country) is required.</p> <ol style="list-style-type: none"> <li>9. Gateway / entrance design for each town is required.</li> <li>10. Tourism info centre is required for each town.</li> <li>11. Signage must be improved for all tourism facilities.</li> <li>12. Ramble routes must be developed within each local municipality to link all tourism establishments with the info centre.</li> </ol>
<p><b>Game &amp; Hunting Lodges</b></p> <ol style="list-style-type: none"> <li>1. Game &amp; hunting lodges,</li> <li>2. Eco-lodge (low impact facilities in a natural environment)</li> </ol>	<ol style="list-style-type: none"> <li>1. Only 1,2% of land cover utilized for game farming.</li> <li>2. New developments to be done in consultation with IEMP</li> </ol>	<ol style="list-style-type: none"> <li>1. Destroy indigenous biodiversity.</li> <li>2. Selective hunting of target species alters genetic constitution of natural populations; non-target species may be affected by management practices that favour increased population numbers of charismatic and hunted species.</li> <li>3. Trail and disruption caused by vehicles may functionally fragment populations especially</li> </ol>	<p><b>Strategy:</b></p> <ol style="list-style-type: none"> <li>1. Not to be stimulated in this area.</li> </ol>	

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
		<p>insofar small-bodied, less mobile or cryptic species are concerned.</p> <p>4. Scenic impact.</p>		
<p><b>Trails</b></p> <ol style="list-style-type: none"> <li>1. 4x4Trail,</li> <li>2. Motorbike Trail,</li> <li>3. Equestrian Trail,</li> <li>4. Hiking Trail</li> </ol>	<ol style="list-style-type: none"> <li>1. Not present in this area.</li> <li>2. Potential for hiking trails.</li> </ol>	<ol style="list-style-type: none"> <li>3. Destroy indigenous biodiversity; in gardens indigenous flora are substituted with exotic species.</li> <li>4. Trail and disruption caused by vehicles may functionally fragment populations especially insofar small-bodied, less mobile or cryptic species are concerned.</li> <li>5. Scenic impact.</li> </ol>	<p><b>Strategy:</b></p> <ol style="list-style-type: none"> <li>1. Stimulate agricultural related trials, like olive and wine routes etc.</li> <li>2. Hiking trails within natural areas.</li> </ol> <p><b>Legal requirements:</b></p> <ol style="list-style-type: none"> <li>1. Conservation of Agricultural Resources Act.</li> <li>2. Environmental Conservation Act</li> </ol>	<ol style="list-style-type: none"> <li>1. Maintenance contracts</li> <li>2. Trial guides – training</li> <li>3. Trials linked to agriculture and related initiatives.</li> </ol>
<p><b>Animal Husbandry</b></p> <ol style="list-style-type: none"> <li>1. Cattle farming,</li> <li>2. Cattle, large (more than 1000ha),</li> <li>3. Cattle, medium (250ha - 1000ha),</li> <li>4. Cattle, small (less than 250ha),</li> <li>5. Cattle, high density feeding lots,</li> <li>6. Dairy Farming,</li> <li>7. Poultry farming,</li> <li>8. Ostrich farm,</li> <li>9. Sheep farming,</li> </ol>	<ol style="list-style-type: none"> <li>1. Of the total surface area, 29,6% is used for livestock.</li> <li>2. Informal settlements. Keeping of livestock in urban areas. Possibility of outbreak of pests or diseases.</li> <li>3. Low carrying capacity makes area extremely vulnerable to land degradation &amp; erosion.</li> </ol>	<ol style="list-style-type: none"> <li>1. Destroy indigenous biodiversity;</li> <li>2. Non-selective overgrazing and trampling causes the replacement of late successional grasses with less nutritional, early pioneer grasses, the loss of herbaceous annuals, exposure of bare soil and subsequent erosion.</li> <li>3. High density cattle farming leads to total destruction of indigenous vegetation that may result in subsequent erosion.</li> </ol>	<p><b>Strategies:</b></p> <ol style="list-style-type: none"> <li>1. Avoid ecological sensitive areas such as close to the river.</li> <li>4. Programs to monitor points of pollution.</li> <li>5. Stimulate farm labour ownership and/or partnerships.</li> <li>6. Encourage and provide farm labour training.</li> <li>7. Stimulate small scale economic viable business enterprises.</li> <li>8. Situation analyses,</li> </ol>	<ol style="list-style-type: none"> <li>1. Promote utilisation and co-operation with NC research institutes.</li> <li>2. Leather works from various skins.</li> <li>3. Small scale poultry farming</li> <li>4. Small scale breeding operations.</li> <li>5. Investigate aqua culture link to hydroponics.</li> <li>6. Broad Scale education on veld management – farmers, land owners and</li> </ol>

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
10. Sheep large (more than 1000ha), 11. Sheep medium (250ha - 1000ha) 12. Sheep small (less than 250ha) 13. Pig farm, 14. Crocodile farm, 15. All goats farming 16. Mixed grazing		4. The deposition of abnormal amounts of manure increase soil acidity and prohibits recovery of indigenous species for prolonged periods.  5. Water quality most adversely influenced by organic and microbiological pollution due to animal wastes or activities.	location of small farms, wind direction etc.  <b>Legal requirements:</b> 1. ECAct 2. Conservation of Agricultural Resources Act. 3. Fertilizers, Farm Feeds, Agricultural Remedies Act. 4. Health Act. 5. Agricultural Pests Act 6. National Water Act 7. Occupational Health and Safety Act	communities.
<b>Crop Farming Agriculture</b>  1. Irrigated agriculture (all farm sizes), 2. Mono-culture agriculture, large (more than 1000ha), 3. Mono-culture agriculture, medium (250ha - 1000ha), 4. Mono-culture agriculture, small (less than 250ha), 5. Mono-culture agriculture, subsistence. 6. Rain-fed crops. 7. Nurseries	1. throughout the area 2. Seasonal migrant workers working on farms. 3. High water table on farms. 4. Volatility of crop farming. (sudden climatic changes can destroy the whole industry)	1. Destroy indigenous biodiversity. 2. Area is homogenized and ecosystem functioning on cultivated land is essentially simplified to production of bio-mass. 3. Depletion and degradation of soils may lead to unproductive soils. Build up of salts. 4. Water quality most adversely influenced by the use of inorganic fertilizers or pesticides during the cultivation of	<b>Strategies:</b> 1. Do not stimulate water dependent farming. 2. Stimulate farming with indigenous crops such as Aloe. 3. Focus on new irrigation techniques. Water use efficiency.  <b>Legal requirements:</b> 1. Conservation of Agricultural Resources Act. 2. Fertilizers, Farm Feeds, Agricultural	1. Focus on dry land production and/or using recycled water in intensive crop production. 2. Encourage current research institutions to do appropriate research on dry land crop production. Make information available to the Municipalities 3. Establish: Medicinal plant, Aloe, Herb, essentials oil plants and cut flower nurseries. – bee (honey and wax)

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
		crops, leaching to underground water.	Remedies Act. 3. Agricultural Pests Act 4. National Water Act	industry link after establishment. 4. Investigate the alternatives of packaging such as making muslin bags for olive packaging 5. Develop policy framework for urban agriculture 6. Take educational programs to schools regarding farming in the area.
<b>Aquaculture</b>	1. Opportunity	1. Destroy indigenous biodiversity. 2. Area is homogenised and ecosystem functioning on cultivated land is essentially simplified to production of bio-mass. 3. Water quality most adversely influenced by either organic and microbiological wastes due to the raising of animals or the use of inorganic fertilizers or pesticides during the cultivation of crops.	<b>Strategy:</b> 1. Stimulate small scale aquaculture projects. 2. Stimulate water re-use projects	1. Aqua culture can be located in any municipality where waste water can be utilised

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
<p><b>Game Farming</b></p> <ol style="list-style-type: none"> <li>1. Game farming, large (more than 4000ha),</li> <li>2. Game, medium (600ha - 1000ha),</li> <li>3. Game, small (less than 600ha)</li> </ol>	<ol style="list-style-type: none"> <li>1. Game farming on small scale.</li> </ol>	<ol style="list-style-type: none"> <li>1. Destroy indigenous biodiversity.</li> <li>2. Selective hunting of target species alters genetic constitution of natural populations; non-target species may be affected by management practices that favour increased population numbers of charismatic and hunted species.</li> <li>3. Trails and disruption caused by vehicles may functionally fragment populations especially insofar small-bodied, less mobile or cryptic species are concerned.</li> </ol>	<p>Not to be encouraged.</p>	<ol style="list-style-type: none"> <li>1. Concentrate on domestic animals.</li> <li>2. Goat milk and meat production for small farmers.</li> </ol>
<p><b>Mixed Agriculture</b></p> <ol style="list-style-type: none"> <li>1. Mixed agriculture (livestock &amp; crops), large (more than 1000ha),</li> <li>2. medium (250ha - 1000ha),</li> <li>3. small (less than 250ha),</li> <li>4. subsistence,</li> <li>5. Communal Grazing system</li> </ol>	<ol style="list-style-type: none"> <li>1. Expansion of urban area could have impact on agricultural land bordering urban areas. See under informal and formal settlements.</li> </ol>	<ol style="list-style-type: none"> <li>1. Destroy indigenous biodiversity;</li> <li>2. Non-selective overgrazing and trampling causes the replacement of late successional grasses with less nutritional, early pioneer grasses, the loss of herbaceous annuals, exposure of bare soil and subsequent erosion.</li> <li>3. Area is homogenised and ecosystem functioning on cultivated land is essentially simplified to production</li> </ol>	<p><b>Strategy:</b></p> <ol style="list-style-type: none"> <li>1. Planning areas for communal use. (Permit system etc.)</li> <li>2. Stimulate small scale permaculture and vegetable production.</li> </ol> <p><b>Legal requirements:</b></p> <ol style="list-style-type: none"> <li>1. As with crop and animal farming</li> </ol>	<ol style="list-style-type: none"> <li>1. Establish local compost and organic soil industry linked to earth worms industries.</li> </ol>



Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
		<p>of bio-mass.</p> <p>4. Depletion and degradation of soils may lead to unproductive soils.</p>		
<p><b>Forestry</b></p> <p>1. Large scale forestry, 2. Small scale commercial forestry (less than 10ha), 3. Subsistence forestry (firewood etc.)</p>	<p>1. Although areas are electrified households still use wood fires for cooking and heating which leads to air pollution – subsistence forestry.</p> <p>2. Alien invader species along the riverine areas.</p>	<p>1. Destroy indigenous biodiversity.</p> <p>2. Scenic impact.</p> <p>3. Overall very high impact on vegetation that usually result in the complete or partial destruction of both the vegetation and the top layers of soil often further exacerbated by inadequate rehabilitation.</p>	<p><b>Strategy:</b></p> <p>1. Stimulate selective harvesting.</p> <p>2. Concentrate on exotic or invader plants.</p> <p>3. Stimulate small business ventures such as charcoal production and furniture industry.</p> <p>4. Link to “Working for water” program.</p> <p><b>Legal requirements:</b></p> <p>1. Nature and Environmental Ordinances.</p> <p>2. National Forest Act</p>	<p>1. Promote working for water programs.</p> <p>2. Promote removal of alien vegetation – link to fuel for cooking and heating, charcoal, furniture and basket weaving industries. Note - indicate the legislation requirements.</p> <p>3. Link up with Working for Water – DWAF initiative against alien species invasion.</p>
<p><b>Industrial</b></p> <p>1. Heavy industrial - metal smelting, 2. chemical processing, assembly plants, other, 3. Medium industrial- chemical processing, other, 4. Light industrial, Workshop, 5. Agricultural processing</p>	<p>1. Local communities partnerships lacking.</p>	<p>1. Destroy indigenous biodiversity.</p> <p>2. Fragmentation of natural area, subdividing large populations by causing a barrier that is difficult to cross.</p> <p>3. Scenic impact.</p> <p>4. Materials used may be toxic to fauna and flora</p>	<p><b>Strategy:</b></p> <p>1. Business plans for small enterprises.</p> <p>2. Environmental audit on all businesses. Compliance with legislation</p> <p>3. Capacity building programs.</p> <p>4. Investigate alternative</p>	<p>1. Investigate waste recycling for new innovative products.</p> <p>2. Promote collection of paper and cans for recycling.</p> <p>3. Manufacturing of ready-made furnishings and building elements from waste material.</p>

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
plants on agricultural land		<p>and may also induce genetic changes between generations.</p> <ol style="list-style-type: none"> <li>5. May lead to pollution caused by emission of by-products.</li> <li>6. Air and noise pollution.</li> <li>7. The possibility of leakage/ spillage may pollute the soil, surface and groundwater.</li> <li>8. Overall very high impact on vegetation that usually result in the complete or partial destruction of both the vegetation and the top layers of soil often further exacerbated by inadequate rehabilitation.</li> </ol>	<p>use of waste products.</p> <ol style="list-style-type: none"> <li>2. Infrastructure analyses to support industry.(e.g. roads, water etc.)</li> <li>3. Stimulate processing plants, e.g. olive and other oil plants etc.</li> </ol> <p><b>Legal requirements:</b></p> <ol style="list-style-type: none"> <li>1. ECAct</li> <li>2. Conservation of Agricultural Resources Act.</li> <li>3. Health Act.</li> <li>4. Agricultural Pests Act</li> <li>5. National Water Act</li> <li>6. Occupational Health and Safety Act</li> <li>7. Atmospheric Pollution Prevention Act.</li> </ol>	
<p><b>Mining</b></p> <ol style="list-style-type: none"> <li>1. Open cast mine,</li> <li>2. Open cast mine with drag line,</li> <li>3. Underground mine,</li> <li>4. Sand works,</li> <li>5. Clay quarry associated with brickworks,</li> <li>6. Other clay quarries,</li> <li>7. Gravel quarry for road fill,</li> </ol>	<ol style="list-style-type: none"> <li>1. Very little mining is being done although huge mineral resources exist.</li> </ol>			<ol style="list-style-type: none"> <li>1. A mining marketing study must be done to assess viability of mineral resources.</li> <li>2. These viable mining options must be further investigated and big mining houses invited for partnerships in the area.</li> <li>3. These mining opportunities will in turn offer opportunities in terms of beneficiation for of these</li> </ol>

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
8. Rock quarry for construction aggregate, 9. Rock quarry for blocks or slabs of rock, 10. Salt works				minerals, for example, cutting and polishing factories, jewellery manufacturing, tiger's eye processing plant, uranium as an alternative source of fuel; and table salt manufacturing.
<b>Airports</b>  1. International airports. 2. Regional airports, 3. Small airports. 4. Public and private landing strips	1. Air field at ammunition depot. Not utilized infrastructure. 2. Air field only used for private light aircraft.	1. Destroy indigenous biodiversity. 2. Fragmentation of natural area, subdividing large populations by causing a barrier that is extremely difficult to cross, with genetic consequences. 3. Cause increase mortality in birds of prey if incorrectly designed. 4. Pollution of air. 5. The possibility of leakage/ spillage may pollute the soil, surface and groundwater. 6. Overall very high impact on vegetation that usually result in the complete or partial destruction of both the vegetation and the top layers of soil often further exacerbated by inadequate rehabilitation.	<b>Strategy:</b> 1. Stimulate growth and market as tourism opportunity. 2. Stimulate as export opportunity for products such as flowers etc. 3. Avoid the destruction of high bio-diversity areas for new landing strips.  <b>Legal requirements:</b> 1. Environmental Conservation Act 2. Shipping and Civil Aviation Laws Rationalisation Act. 3. Airport Company Act. 4. South African Civil Aviation Authority Levies Act.	1. Investigate optimum utilisation of airports for tourism, export of products. 2. Promote fly in tourism linked to agri-tourism and scientific research. 3. Establish free trade zones around airport – link to other industries in the region – such as Upington.

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
<p><b>Power Stations Alternative Power</b></p> <ol style="list-style-type: none"> <li>1. Electricity generation facilities,</li> <li>2. Coal powered stations,</li> <li>3. Hydro electricity generators,</li> <li>4. Wind electricity generators (commercial only),</li> <li>5. Bio-electricity generators (commercial only)</li> </ol>	<ol style="list-style-type: none"> <li>1. Not applicable to this municipality</li> </ol>			
<p><b>Parking, Related Structures &amp; Facilities</b></p> <ol style="list-style-type: none"> <li>1. Parking lot,</li> <li>2. Taxi rank,</li> <li>3. Bus or heavy vehicle depot,</li> <li>4. Filling station,</li> <li>5. Vehicle service facility,</li> <li>6. Traffic control centre,</li> <li>7. Dirt road with high traffic loads,</li> <li>8. Dirt road with low traffic loads.</li> </ol>	<ol style="list-style-type: none"> <li>1. Taxi ranks along the main roads.</li> </ol>	<ol style="list-style-type: none"> <li>1. Destroy indigenous biodiversity.</li> <li>2. Fragmentation of natural area, subdividing large populations by causing a barrier that is extremely difficult to cross, with genetic consequences.</li> <li>3. Roads and other tourism related structures may cause fragmentation of large populations (especially of cryptic animals) and behavioral changes induced by tourism activity.</li> <li>4. May lead to pollution caused by emission of by-products.</li> <li>5. Pollution of air</li> </ol>	<p><b>Strategy:</b></p> <ol style="list-style-type: none"> <li>1. Audit all taxi stands, upgrade facilities.</li> </ol>	<ol style="list-style-type: none"> <li>1. SMME contracts for the maintenance and construction of new facilities.</li> <li>2. Construction of labour intensive paving and roads</li> </ol>

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
<p><b>Roads</b></p> <ol style="list-style-type: none"> <li>1. Roads</li> <li>2. Double carriageway highway,</li> <li>3. Tared road with 120km/h speed limit,</li> <li>4. Tared road with 80km/h speed limit,</li> <li>5. Tared roads with speed limits below 80km/h</li> </ol>	<ol style="list-style-type: none"> <li>1. Road upgrade at other towns such as Pampierstad etc.</li> <li>2. Construction of roads necessitates gravel borrow pits.</li> <li>3. Road construction leads to deforestation.</li> <li>4. New roads lead to higher volume of storm water run off.</li> <li>5. Lack of integration between historically divided areas in settlements, normally transected by the N-routes.</li> <li>6. Storm Water Management not up to standard – risk for human health &amp; erosion.</li> </ol>	<ol style="list-style-type: none"> <li>1. Destroy indigenous biodiversity;</li> <li>2. Fragmentation of natural area, subdividing large populations by causing a barrier that is extremely difficult to cross, with genetic consequences.</li> <li>3. Roads and other tourism related structures may cause fragmentation of large populations (especially of cryptic animals) and behavioral changes induced by tourism activity.</li> <li>4. Prevention of natural floods leads to the alternation of natural flow of rivers that may cause deposition of silt that shallows river bed and may have consequences for aquatic species that are dependent on deep or fast flowing water.</li> <li>5. Scenic impact.</li> <li>6. May lead to pollution caused by emission of by-products.</li> <li>7. Pollution of air</li> </ol>	<p><b>Strategy:</b></p> <ol style="list-style-type: none"> <li>1. Road audit within the municipal area.</li> <li>2. Road upgrading by labor intensive methods.</li> </ol> <p><b>Legal requirements:</b></p> <ol style="list-style-type: none"> <li>1. Mineral and Petroleum Resources Development Act (quarries)</li> <li>2. Advertising on Roads and Ribbon Development Act.</li> <li>3. Environmental Conservation Act</li> </ol>	<ol style="list-style-type: none"> <li>1. Lack of integration should be addressed by urban renewal projects such as gateway design, signage, general upliftment of previously disadvantaged communities etc.</li> <li>2. Storm water management plans required for all towns.</li> </ol>

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
<p><b>Railways, Related Structures &amp; Facilities</b></p> <ol style="list-style-type: none"> <li>1. Railway structures,</li> <li>2. Railway lines,</li> <li>3. Stations,</li> <li>4. Shunt yards &amp; workshops,</li> <li>5. Railway bridges</li> </ol>	<ol style="list-style-type: none"> <li>1. Main railway line through Municipal area.</li> <li>2. Mainly used to transport cargo</li> </ol>	<ol style="list-style-type: none"> <li>1. Destroy indigenous biodiversity.</li> <li>2. Fragmentation of natural area, subdividing large populations by causing a barrier that is extremely difficult to cross, with genetic consequences.</li> <li>3. Roads and other tourism related structures may cause fragmentation of large populations (especially of cryptic animals) and behavioral changes induced by tourism activity.</li> <li>4. Prevention of natural floods leads to the alternation of natural flow of rivers that may cause deposition of silt that shallows river bed and may have consequences for aquatic species that are dependent on deep or fast flowing water.</li> <li>5. Scenic impact.</li> <li>6. May lead to pollution caused by emission of by-products.</li> <li>7. Pollution of air</li> </ol>	<p><b>Strategy:</b></p> <ol style="list-style-type: none"> <li>1. Make trains more user friendly.</li> <li>2. Link to tourism potential.</li> </ol>	<ol style="list-style-type: none"> <li>1. Servitude – investigate utilisation for biking, hiking and horse trials.</li> </ol>

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<p><b>Pipelines, Cable Networks</b></p> <ol style="list-style-type: none"> <li>1. Pipeline for the transportation of hazardous substances including petroleum products,</li> <li>2. Water bulk supply pipelines,</li> <li>3. Cable networks,</li> <li>4. Telephone lines and associated structures,</li> <li>5. Industrial cable way and associated structures,</li> <li>6. Tourism cable way and associated</li> </ol>	<ol style="list-style-type: none"> <li>1. Electrification of informal settlements/residential areas deforested for high voltage cables and servitudes</li> <li>2. Water pipes for bulk water old.</li> <li>3. Storage reservoirs needs attention, old and leaking.</li> </ol>	<ol style="list-style-type: none"> <li>1. Destroy indigenous biodiversity.</li> <li>2. Fragmentation of natural area, subdividing large populations by causing a barrier that is extremely difficult to cross, with genetic consequences.</li> <li>3. Prevention of natural floods leads to the alternation of natural flow of rivers that may cause deposition of silt that shallows river bed and may have consequences for aquatic species that are dependent on deep or fast flowing water.</li> <li>4. Scenic impact.</li> </ol>	<p><b>Strategy:</b></p> <ol style="list-style-type: none"> <li>1. Audit water and sewage networks and capacities.</li> <li>2. Demand and supply audit in co-operation with Eskom for the Municipality's future needs.</li> </ol> <p><b>Legal requirements:</b></p> <ol style="list-style-type: none"> <li>1. EIA's for new networks necessary.</li> </ol>	<ol style="list-style-type: none"> <li>1. SMME maintenance and installation contracts.</li> <li>2. Focus on extended DPW programmes.</li> </ol>
<p><b>Water storage</b></p> <ol style="list-style-type: none"> <li>1. Water storage and supply structures as well as structures affecting the flow of water in rivers,</li> <li>2. Bulk water supply/storage dam,</li> <li>3. Farm dam,</li> <li>4. Inter catchments water transfer scheme, Reservoirs for public water supply,</li> <li>5. Levees,</li> <li>6. Weirs</li> </ol>	<ol style="list-style-type: none"> <li>1. Upgrade bulk water at</li> <li>2. Canal leaking and very old</li> <li>3. All reservoirs are old and capacity not sufficient.</li> </ol>	<ol style="list-style-type: none"> <li>1. Destroy indigenous biodiversity.</li> <li>2. Prevention of natural floods leads to the alternation of natural flow of rivers that may cause deposition of silt that shallows river bed and may have consequences for aquatic species that are dependent on deep or fast flowing water.</li> <li>3. Scenic impact.</li> </ol>	<p><b>Strategy:</b></p> <ol style="list-style-type: none"> <li>1. Water audit and strategic plan in relation to Water Services Plan (WSDP)</li> <li>2. Small projects to repair canal and other bulk supply network.</li> <li>3. Audit all boreholes.</li> <li>4. Regular water testing from boreholes</li> </ol> <p><b>Legal requirements:</b></p> <ol style="list-style-type: none"> <li>1. National Water Act.</li> </ol>	<ol style="list-style-type: none"> <li>1. SMME maintenance and installation contracts.</li> <li>2. Focus on extended DPW programmes.</li> </ol>

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			2. Water Services Act. 3. Water Act.	
<b>Towers and masts, Conveyors</b> 1. Microwave towers (telecommunications), 2. Radio transmission towers and masts, 3. Cellular phone network masts, 4. Wireless loop telecommunication masts, 5. Radar masts, 6. Reception dishes and structures, Industrial conveyor - long distance (>1km), Industrial conveyor	1. Visual impact of cellular base stations is often negative. 2. By-laws and regulations required regarding positioning of base stations especially in rural areas.	1. Destroy indigenous biodiversity. 2. Cause increase mortality in birds of prey if incorrectly designed. 3. Scenic impact.	<b>Strategy:</b> 1. Strategic plan for site selection in and around towns. 2. Avoid natural areas such as ridges etc.  <b>Legal requirements:</b> 1. EIA assessments for cellular base stations.	1. Promote utilisation of masts for raptor and large bird nesting – artificial nesting.
<b>Conservation</b> 1. All conservation area, 2. National park, 3. Provincial nature reserve, 4. Regulated natural area, 5. Natural heritage site, 6. National monument, 7. Marine reserve, 8. Local authority conservation area, 9. Private nature reserve, 10. Urban open space area	1. No areas conserved. Game farming only 1,2% which can be seen as conservation of land.	1. Destroy indigenous biodiversity.. 2. Trail and disruption caused by vehicles may functionally fragment populations especially insofar small-bodied, less mobile or cryptic species are concerned.	<b>Strategy:</b> 1. Develop a conservation strategy for the municipal area. 2. Identify natural areas to be protected. 3. Identify no-go development areas.  <b>Legal requirements:</b> 1. All legislation as for Game farming etc. EIA's are important.	1. Conserve areas such as ridges and other sensitive areas. 2. Promote the conservation of all wetland areas.



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<p><b>Waste sites, Sewage treatment</b></p> <ol style="list-style-type: none"> <li>1. Household waste landfill,</li> <li>2. Class 2 waste landfill,</li> <li>3. Class 1 waste landfill,</li> <li>4. Waste indicator,</li> <li>5. Radioactive waste site,</li> <li>6. Sewage disposal structures,</li> <li>7. Sewage treatment plants,</li> <li>8. Off- shore disposal pipelines,</li> <li>9. Sewage pipelines (MAIN)</li> </ol>	<ol style="list-style-type: none"> <li>1. Waste management plan</li> <li>2. Upgrade bulk sewerage works</li> <li>3. Landfill Sites without approvals and in close proximity to human settlement.</li> <li>4. Littering has negative effect on tourism.</li> <li>5. Problems with the sewage treatment plant. reached its full capacity.</li> </ol>	<ol style="list-style-type: none"> <li>1. Destroy indigenous biodiversity..</li> <li>2. Prevention of natural floods leads to the alternation of natural flow of rivers that may cause deposition of silt that shallows river bed and may have consequences for aquatic species that are dependent on deep or fast flowing water.</li> <li>3. These materials may be toxic to fauna and flora and may also induce genetic changes between generations.</li> <li>4. May lead to pollution caused by emission of by-products.</li> <li>5. Pollution of air.</li> <li>6. The possibility of leakage/ spillage may pollute the soil, surface and groundwater.</li> </ol>	<p>Strategy:</p> <ol style="list-style-type: none"> <li>1. Investigation and viability study on the total sewage system.</li> <li>2. Refer to IWMP recently completed</li> </ol>	<ol style="list-style-type: none"> <li>1. Ongoing process of formalizing sanitation to include water borne systems and address the backlog that currently exists. The use of dual flush systems to conserve water should be implemented.</li> <li>2. Refer to IWMP recently completed.</li> </ol>
<p><b>Hazardous Materials Handling, and manufacturing</b></p> <ol style="list-style-type: none"> <li>1. Hazardous materials transportation route,</li> <li>2. Hazardous materials handling facility,</li> <li>3. Hazardous materials processing facility,</li> <li>4. Hazardous materials storage</li> </ol>	<ol style="list-style-type: none"> <li>1. Waste management plan.</li> <li>2. Hazardous waste being transported on N-Routes and spilled in towns.</li> </ol>	<ol style="list-style-type: none"> <li>1. Destroy indigenous biodiversity.</li> <li>2. Radioactive elements are carcinogenic and cause genetic mutations between generations.</li> <li>3. May lead to pollution caused by emission of by-products.</li> </ol>	<p>Strategy:</p> <ol style="list-style-type: none"> <li>1. Refer to integrated waste management plan just completed.</li> </ol>	<ol style="list-style-type: none"> <li>1. All hazardous waste spillages or emergencies must be properly documented before any action can be taken to determine the exact extent and frequency.</li> <li>2. Safe sleepover areas must be designed and built away from the residential</li> </ol>

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
facility, 5. Hazardous materials manufacturing facility		4. Pollution of air. 5. The possibility of leakage/ spillage may pollute the soil, surface and groundwater. 6. Overall very high impact on vegetation that usually result in the complete or partial destruction of both the vegetation and the top layers of soil often further exacerbated by inadequate rehabilitation. 7. Scenic value destroyed.		area of each town. 3. Determine the main companies transporting waste of this nature and do spot checks of their permits as they enter each town in liaison with Traffic Dept. 4. In serious instances whistle blowing to DTEC or even DEAT can become necessary.
<b>Advertisement</b> 1. All advertisement. 2. Posters and other general signs. 3. Signs on buildings, structures and premises. 4. Signs for the tourist and traveller. 5. Mobile signs, 6. Billboards and other high impact free standing structures	1. Not currently addressed in IDP or other policy statements	1. Destroy indigenous biodiversity. 2. Scenic impact.	<b>Strategy:</b> 1. Abide by the requirements; SA manual for outdoor advertising control (DEAT)	1. SMME manufacturing of unique, wood, fabric or painted local signs.
<b>Fuel Stations</b> 1. Petrol/Diesel Filling Stations, 2. Fuel Storage Facilities, 3. Fuel Refineries,	1. Full EIA assessment for new filling stations. 2. Location of new filling stations/ fuel storage facilities/refineries to be addressed in Spatial	1. Destroy indigenous biodiversity. 2. These materials may be toxic to fauna and flora and may also induce genetic changes	<b>Strategies:</b> 1. Storm water planning in all towns. 3. Oil handling and disposal audit needed.	

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
	Development Frameworks in conjunction with IEMP.	<p>between generations.</p> <ol style="list-style-type: none"> <li>3. May lead to pollution caused by emission of by-products.</li> <li>4. Pollution of air.</li> <li>5. The possibility of leakage/ spillage may pollute the soil, surface and groundwater.</li> </ol>	<ol style="list-style-type: none"> <li>4. Encourage recycling initiatives.</li> </ol> <p><b>Legal requirements:</b></p> <ol style="list-style-type: none"> <li>1. Full EIA assessment for new filling stations.</li> <li>2. Location of new filling stations/ fuel storage facilities/refineries to be addressed in Spatial Development Frameworks in conjunction with IEMP.</li> </ol>	
<p><b>Heritage</b></p> <ol style="list-style-type: none"> <li>1. Structures</li> <li>2. National Monuments</li> <li>3. Artifacts</li> <li>4. Rock Paintings</li> <li>5. Battlefields</li> <li>6. Museums</li> <li>7. Mission Stations</li> </ol>	<ol style="list-style-type: none"> <li>1. Historical sites</li> <li>2. Archaeological sites</li> <li>3. Cultural sites</li> <li>4. Scientific and ecological sites</li> </ol>	<ol style="list-style-type: none"> <li>1. Roads and other tourism related structures may cause fragmentation of large populations (especially of cryptic animals) and behavioral changes induced by tourism</li> <li>2. Destroy indigenous biodiversity.</li> <li>3. May cause pollution, littering etc by visitors.</li> </ol>	<p><b>Strategy:</b></p> <ol style="list-style-type: none"> <li>1. Assessment of all possible historic sites, ruins, structures and graves.</li> <li>2. Inventory of all archaeological artifacts in the area.</li> <li>3. Heritage site, such as bushman paintings, must be identified.</li> <li>4. Scientific important ecological sites must be identified and registered.</li> <li>5. Focus of above should be to link this with tourism exploitation possibilities.</li> </ol> <p><b>Legal requirements:</b></p>	<ol style="list-style-type: none"> <li>1. Complete audits as required – training.</li> <li>2. Liase with agriculture to develop strategy for agri-tourism, heritage sites.</li> <li>3. Promote links to tourism industry.</li> <li>4. Complete conservation plans as required.</li> <li>5. SMME's maintenance of monuments and sites.</li> <li>6. Identification of new sites to be listed under the NHRA.</li> </ol>

<b>Categories of Development</b>	<b>Some Specific Municipal Issues</b>	<b>General Environmental Consequences</b>	<b>Strategies and legislation to address environmental issues for the Municipality</b>	<b>Opportunities / Projects</b>
			<ol style="list-style-type: none"><li>1. National Heritage resources Act</li><li>2. Environmental Conservation Act</li><li>3. National Environmental Management Act</li></ol>	

**- 4 -**

**URBAN RENEWAL  
GUIDELINE DOCUMENT**

**PIXLEY KASEME INTEGRATED ENVIRONMENTAL MANAGEMENT PLAN:**

**URBAN RENEWAL PROJECTS AND PRINCIPLES FOR TOWNSHIPS AND HUMAN SETTLEMENTS**

TABLE OF CONTENTS

- 1 Specific project proposals: SMALL-SCALE INTERVENTIONS..... 2
  - 1.1 Children Play Areas ..... 2
  - 1.2 Sidewalk Improvements ..... 2
  - 1.3 Safe Road Crossings ..... 3
  - 1.4 Social Areas at Commercial Centres ..... 4
    - 1.4.1 Larger Towns and Urban Centruems ..... 4
    - 1.4.2 Township Areas..... 5
  - 1.5 Active recreation areas ..... 5
    - 1.5.1 Township Areas..... 5
    - 1.5.2 Picnic Areas ..... 6
    - 1.5.3 Social Facilities Such as Outdoor Performance Areas or Community Halls..... 7
  - 1.6 Urban Agriculture ..... 8
  - 1.7 Policing of Public Use Areas ..... 10
  - 1.8 Stream Rehabilitation and Channel Improvements ..... 11
  - 1.9 Hiking and Bicycling Trails ..... 11
  - 1.10 Street Furniture Design ..... 14
- 2 Specific project proposals: MEDIUM TO LARGE-SCALE INTERVENTIONS..... 15
  - 2.1 Pilot Project #1: Provision of Multi-functional Hall and Buildings and Upgrade of Existing Sport Facilities..... 15
  - 2.2 Pilot Project #2: Upgrade of Major Commercial Corridor..... 16
  - 2.3 Pilot Project #3: Upgrade and Expansion of Existing Community Service Building Grounds .... 17
  - 2.4 Pilot Project #4: Street Upgrades..... 18
- 3 Xerlscaping ..... 20
  - 3.1 Principles of Proper Site Planning..... 21
  - 3.2 Soil Analysis ..... 24
  - 3.3 Appropriate Plant Selection..... 25
  - 3.4 Practical Lawn Areas ..... 26
  - 3.5 Efficient Irrigation ..... 28
  - 3.6 Use of Mulches..... 30
  - 3.7 Appropriate Maintenance ..... 31

## 1 SPECIFIC PROJECT PROPOSALS: SMALL-SCALE INTERVENTIONS

The following small-scale interventions have been identified for implementation in public open spaces within towns and especially townships and informal settlements within the Pixley Ka Seme District Municipality (PKSDM). These projects have been selected based on past experience from open space development and urban renewal projects in Galeshewe in Kimberley and the PKSDM Local Municipality and have been developed in conjunction with both the relevant municipalities and communities and interest groups from both these areas. It is however important to note that these proposals are conceptual only and intended to guide thinking and design efforts for the remaining open spaces within the various settlements within PKSDM. Minimum and general guidelines for each project type are as follows:

### 1.1 CHILDREN PLAY AREAS

- A minimal area of paving of approximately 100 square metres of non-slip paving material with adequate drainage should be provided for general play and as a potential multi-purpose area where other recreational activities can take place.
- A minimal set of play equipment for pre-school children.
- A minimal set of play equipment for primary school children
- Two benches set on the paving and in close proximity and close to pre-school play areas for mothers to keep eye on their children.
- A minimum of three shade trees – one set in the paved area and two adjacent. Additional shade trees can be allowed along the periphery of larger spaces, which will help with spatial delineation. However care must be taken that sight lines around street corners, as well as to entrances to the park (both pedestrian and possibly vehicular) are not obscured.



### 1.2 SIDEWALK IMPROVEMENTS

- Due to the drought, harsh sunlight and lack of vegetation, shade trees should be provided wherever feasible, along all sidewalks along roads and streets – one approximately every 10 metres. Hardy species that are adapted to this region should be used and should preferably be indigenous, although non-invasive exotics such as *Schinus molle* may also be utilised. In urbanised areas it is beneficial if the trees are arranged in patterns and alternate with the

streetlights, however along larger roads or in more rural areas and where roads transect or border natural areas, trees should be irregularly spaced or clumped to simulate more natural groupings.

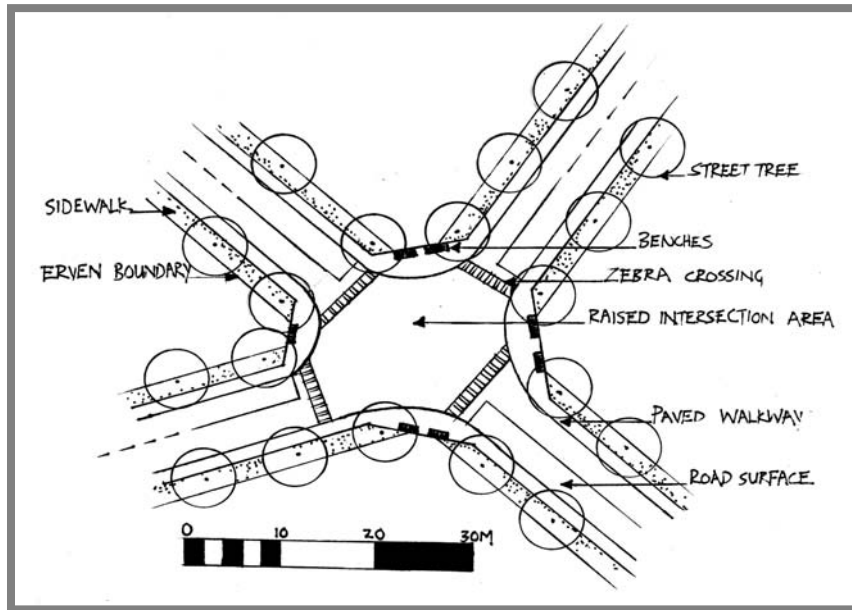
- Where financially feasible paved walkways should be provided along all streets and roads frequently used by pedestrians. This is specifically important within the rural township areas, since the streets are extremely dusty here and washed away due to bad storm water management programmes.
- One seating area should be provided every 200 meters along major pedestrian and vehicular routes.
- Adequate lighting for evening comfort and user safety is essential. Especially in the rural townships, adequate night time lighting is crucial as often informal settlements expand at a faster rate than at which services are implemented. In these areas high-mast lighting are effective at illuminating large areas, especially public areas. During a survey done for the Galeshewe Open Space and Landscape Plan (GOSLP; 2004) a significant number of residents indicated that although these lights are not particularly attractive, they prefer these lights to standard street lights, or a combination of standard and high mast lights to standard street lights only, as safety is often greater in such areas.

### **1.3 SAFE ROAD CROSSINGS**

- Road crossings can form an integral part of the open space network of any neighbourhood or city, especially in instances where pedestrian activity is prevalent. Often street corners are significant social interaction areas within townships and rural settlements. Street vendors use these spaces to peddle their wares, commuters wait for taxis and people meet each other here to go to mutual destinations. Subsequently these spaces should be both safe and accommodating to the needs of pedestrians and vehicle users.
- Sidewalks should ideally be provided on all four corners of intersections, to increase pedestrian safety and usability. These elements should be considered a minimum where high amounts of pedestrian and vehicular traffic have to interact.
- Signage that indicates to the drivers to stop at the stop sign must be provided.
- Seating areas should be provided near at least two sides of the intersection, with litterbins and adequate lighting.
- Raised areas should be created in the intersection of the two streets. This is again true where large amounts of pedestrian traffic must interact with vehicular traffic, such as busy streets in the rural townships.



- Zebra crossings should be painted on the road surface. In busy streets where vehicles travel at high speeds, the raised area can be created from another material, to enhance its visibility.



## 1.4 SOCIAL AREAS AT COMMERCIAL CENTRES

### 1.4.1 Larger Towns and Urban Centurms

- Ideally commercial centres and shopping complexes should be placed in close proximity to public parks, so that people have the option of enjoying lunch, strolling or recreating in other ways before or after they go shopping. It is much more likely that especially larger parks or passive recreation places will be more frequently used if they are associated with activity centres, than if they are located far from public amenities. It is therefore crucial that the remaining public parks or open spaces within all towns within PKSDM be retained and properly maintained and that where feasible, small retail outlets or other attractions be provided close to these spaces.
- All remaining indigenous trees and larger non-invasive exotic trees should be retained in these spaces however invader species, vegetation that excessively obscure views through these spaces and may potentially pose hiding places for criminals, should be removed. Furthermore small, secluded pockets of planting that attract littering should be avoided.

## 1.4.2 Township Areas

- In rural townships social areas at commercial centres are particularly important as they often play a significant role in communal life, and should be within walking distance of the commercial centre.
- A minimal area of paving of approximately 100 square metres should be provided at an open area close to the shops, to allow for a variety of different social activities. If feasible small lawn areas should be provided adjacent to the paved sections, to facilitate mothers and children, or more leisurely recreation. Where lawn cannot be established due to lack of irrigation water, small areas of synthetic playing surfaces or sandpits may be considered.
- Vehicular access to such spaces should be restricted by bollards or non-mountable kerbs, in order to prevent misuse as taxi ranks or washing areas. However adequate provision for taxis should be made in close proximity to such areas.
- Adequate seating should be set on the paving areas of smaller spaces and should be provided with litterbins and adequate lighting.
- At least one shade tree should be provided per seating area.
- Larger open areas close to significant commercial centres are often used for informal vending, sport, performances and playing music from car stereos. These activities should be catered for by providing adequately paved surfaces. Where vehicular access is required or desirable the areas used by vehicles should be clearly demarcated and separated from areas that may be used by children or for sports activities, with bollards. The distinction between adjoining hard and soft surfaced spaces can be further reinforced by using trees along the periphery, which will increase their appeal.

## 1.5 ACTIVE RECREATION AREAS

### 1.5.1 Township Areas

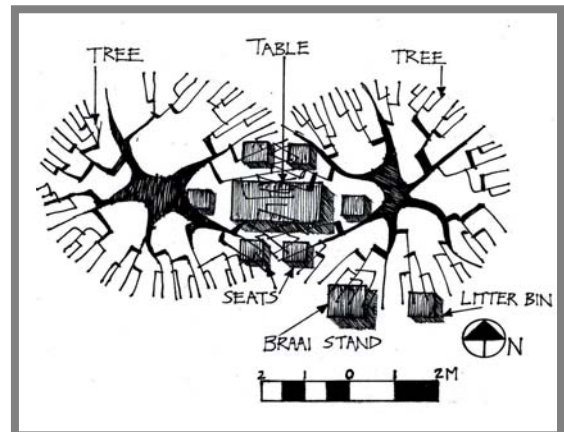
- **Informal soccer field:** The site surveys of some of the township areas within the study area revealed that soccer fields within most of these townships are often in a poor condition and lack lawn, due to a lack of irrigation water and poor soil conditions. Construction of these fields should therefore be of levelled, rolled dirt with a curb installed all around the play area but set back from the play area. Shade trees just outside of the playing area are essential.
- **Netball court with hoops:** Wherever there is space, netball courts should be provided adjacent to or near soccer fields, as often there are very few areas that cater for female sports.

Construction of court should be of rolled dirt with a curb installed all around the play area but set back from the play area.

- A spectator area with adequate trees for shading should be provided at all sports venues. A maximum of approximately fifty spectators must be accommodated at all soccer fields and ten to twenty spectators at netball fields.
- One tree per ten spectators or part thereof must be provided.
- Water facilities such as basins and drinking fountains are important at public sport facilities. These should be designed as robust as possible and all pipes and other working parts must not be accessible by users, save for the fountain nozzle and button.
- Where more frequently used sports facilities are concerned, provision should be made for informal vending. This should be in the form of an appropriately placed hard-surfaced area and possibly permanent vending stands. However these structures should be designed to be robust, vandal proof and must not be removable.
- Benches must be grouped under shade trees.
- Paving areas at the street curb to link with public transportation.
- Trash receptacles should be provided at the seating areas.
- Lighting should also be provided along walkways where possible. High-mast lighting will be particularly effective at larger sports complexes or multiple sports fields.

## 1.5.2 Picnic Areas

- Picnic areas are essential to any sizeable public park as this is one of the main activities that will ideally take place here. Such areas should be incorporated into all existing parks within the PKSDM and planned for all new parks.
- Larger public parks should have a covered structure of a minimum size of five by eight metres to allow for a variety of uses. Ideally such a structure should also have, or be directly adjacent to, seats and tables.
- The structure should be so located that prevailing cross-winds ventilate it and it should be fully shaded by trees, especially during mid-day and afternoons. Failure to do so will result in uncomfortably hot places that will not be used.
- Where such structures occur in parks / public areas close to centres of significant commercial activity, these structures should be provided with an electricity point, with pay-by-the-minute meters. These must be locked inside a vandal proof box. Keys for these are to be obtained from



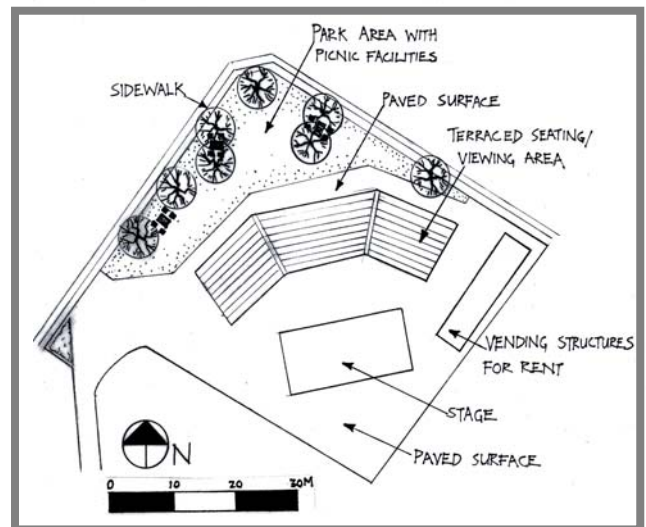
municipal representative or park attendants, after payment has been made for use. In this fashion the park can generate a small amount of revenue, which may help to subsidise maintenance.

- Water point with a lockable tap can also be provided. Keys are to be obtained from a municipal representative or park attendant after payment has been made for use.
- Trees should be scattered throughout the space and should have lawn in at least some locations for informal seating on blankets.
- In larger parks a shaded lawn area to allow for large group gatherings should be provided. Trees are to be planted in the lawn areas to prevent informal soccer activities from destroying lawn. In very large parks several spaces of this size can be created, by separating them with rows of trees and other planting. However care should be taken to preserve sufficient visibility to ensure the safety of users.
- Braai areas should be provided on the edge of the lawn areas under the trees to accommodate approximately ten groups of five to ten people.
- For larger parks, a paved road surface should ideally be provided all around the lawn area to allow access to braai facilities. A curb or low fence must be provided to prevent cars from driving onto the lawn.
- Trash receptacles must be provided at every braai stand.

### **1.5.3 Social Facilities Such as Outdoor Performance Areas or Community Halls**

- The versatility and robustness of most large parks can be significantly increased if they are provided with facilities to accommodate ancillary activities, such as performances or gathering areas. This is particularly true for most rural townships, as often there are few structured venues where events such as performances, community gatherings, meetings and larger parties can be facilitated. By providing such facilities in larger parks or near sports venues, the potential uses of the open space are greatly increased.
- A roofed stage area should be provided to accommodate approximately twenty people. For larger facilities electricity points should be provided, for which access can be obtained from a central office, for a refundable deposit. Well-known venues such as a local Tourism Office or Information Centre can provide such services, to avoid the need for additional offices to be built.
- A raised seating area should be provided, to allow for viewing access to the stage area. These structures can be built to accommodate approximately 200 people, although for smaller stages a maximum of approximately 50 people should be catered for.
- A paved area should be created around the stage and seating area to prevent erosion and to provide informal vending and entertainment activities.
- Informal vending stalls should be available to rent for specific events.

- Picnic areas should be created under trees, to allow for multiple uses of the space.
- Safe access routes for pedestrian, cyclists and vehicles are essential and places should be provided where cyclists can secure their bicycles.
- Fencing must be provided around the stage facility area, to allow for the safe locking of the facility when not in use.
- Safe off-street parking areas must be provided where possible.
- An access point on all street intersections must also be provided to allow access to public transportation systems.



## 1.6 URBAN AGRICULTURE

- Often in townships and rural areas urban agriculture is practiced by individuals in a corner of their yard. Due to the very low average arability of the soil in the region, large scale crop production is not feasible and thus small-scale subsistence and commercial farming should be encourage. Thus the opportunity exists for greater communal urban agriculture and greater co-operation between individual residents.
- Fertilized soil areas that can accommodate approximately five to ten people working on plots of approximately ten by ten metres can be established between two or three individual homes. Thus an area of approximately 100 square metres can be established that are managed and maintained by two or three households. Produce can be grown for own consumption and the surplus sold at local markets or at vendor stands.
- It is essential that urban farmers be assisted financially and in terms of experience in order for organised urban agriculture projects to succeed. Where new townships or extensions of existing ones area planned, the municipality should allocate areas for urban agriculture as described above and provide subsidies to farmers willing to utilise and care for these plots. Subsidies should ideally be in the form of seed and fertiliser with inputs from trained persons, to assist the



farmers in establishing the plots. These patches of farmland will form an integral part of the open or “green” space network within townships and contribute to making them more sustainable.

- Communal water points will be required for successful urban agriculture to take place. Treated effluent water should not be used for the production of crops that will be consumed, as it is very difficult to ensure that the water is properly treated, especially in rural townships where quality control and maintenance cannot be ensured. Instead fresh municipal water must be provided, or grey water from kitchens must be filtered and cleaned. Water from roof collection points can also be utilised and stored in large containers. These containers can be located next to each residence or at a central position serving several residences.

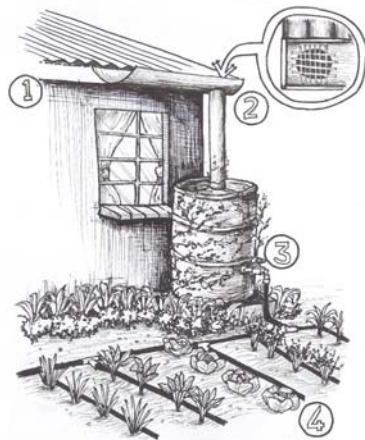


FIGURE 1

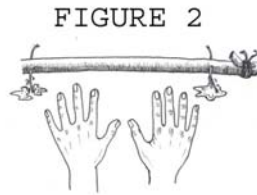


FIGURE 2

FIGURE 4

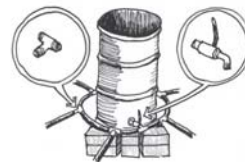


FIGURE 3

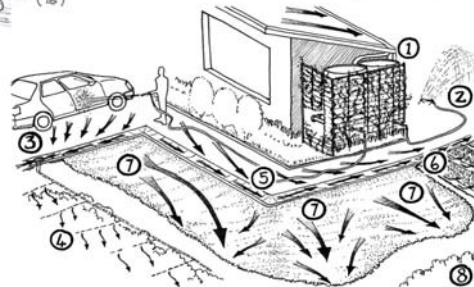


FIGURE 6



FIGURE 5

FIGURE 5

- Trees for shading of workers should be planted at intervals of approximately twenty meters on the periphery or close to the farm plots, thus at least one tree per plot. These trees could be fruit-bearing trees such as Olives or Oranges. However care must be taken to ensure that the trees do not shade the crops, which will hamper their growth and result in a lower yield.
- Permanent seating areas and structures could be provided under the trees to increase the usability of these spaces.
- Secure, vandal proof, lockable sheds should also be provided for each plot, for storage of tools and equipment.

## 1.7 POLICING OF PUBLIC USE AREAS

In order for public open space to be viable and useful to the communities that they intend to serve, it is of paramount importance that these spaces are made safe. Even the most attractive and well cared for park will eventually fall into disrepair, if criminal or unsavoury elements are not kept out of them. Often parks that are otherwise appealing and functional, are not used by the public as they are perceived as unsafe, which eventually leads to them falling into disrepair. It is therefore crucial that the public open spaces in the greater PKSDM be made safe for the people that are to use them. The following steps, where appropriate, should be employed:

- Visibility through and into any park is of crucial importance. Thus dense vegetation along the border of any park or public open space should be avoided, especially at entrance points.
- Tree species that have canopies that are well clear of the ground should be selected. Low, dense, multi-stemmed species should be avoided or pruned, and should not be used with clumps of smaller shrubs, as these pockets of vegetation may afford ill doers hiding places.
- It is important that access into especially larger parks or open areas occur only at certain entry points specifically created for that purpose. However the method of enclosure selected should be as opaque as possible, to allow ample visual penetration.
- Access to large nature areas or conservation nodes, should be controlled and monitored by security personnel. Several successful examples of this method of public open space security are found in larger cities such as Pretoria, where security guards keep a logbook of people entering and exiting public hiking trails or conservation areas. If all people are not accounted for by closing time, they know to inform the police or at least search for the missing person/s. This method of public open space policing also has the benefit of job creation and the wages of the guards and any required infrastructure such as guard huts etc. can be partially subsidised by local interest groups, or homeowners associations in the area.
- The municipality must investigate the potential of establishing a park police corps that are responsible for patrolling public open space areas and relaying all necessary information to

the police. This unit can also work in collaboration with neighbourhood watch organisations, to ensure a more effective and integrated approach to safeguarding public open spaces.

## 1.8 STREAM REHABILITATION AND CHANNEL IMPROVEMENTS

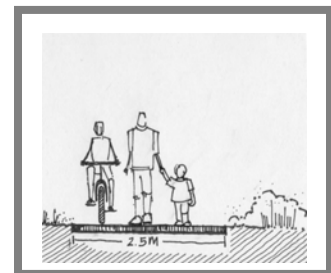
The study area is characterised by a great abundance of streams and waterways, which contribute greatly to its scenic quality and appeal. However unfortunately rivers and streams are often some of the most infested habitats and are clogged with alien vegetation and littered with debris and household rubbish. It is very important that these habitats be protected and rehabilitated wherever possible as they form a vital part of any open space or ecological framework.

Generally river courses and riparian habitat in conservation and remaining natural or rural areas are in a more pristine condition than water bodies within urban and settled areas. Here invader species such as *Melia azedarach*, *Arundo donax*, *Lantana camara*, *Eucalyptus* species and exotic *Acacia* species have often along many river courses. Heavy littering also usually occurs along and in streams in the vicinity of residential and urbanised areas. Unlicensed (and therefore illegal) farm dams in larger rivers are a common occurrence and have serious detrimental environmental consequences.

The National Environmental Management Act (NEMA), the National Water Act and the Biodiversity Bill require the responsible management of ecological and biophysical resources of the country. Urban ecological areas are also of concern in the acts and must be managed in a responsible manner. It is therefore essential that stream, wetland and ground water management and rehabilitation programmes be established.

## 1.9 HIKING AND BICYCLING TRAILS

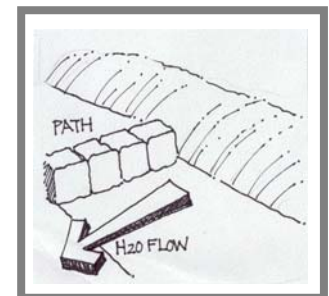
Apart from passive recreation and sports, many of the open spaces within PKSDM itself require well-established hiking and biking trails running throughout towns. These activities should be facilitated by providing paved walkways that connect the various green / open spaces throughout the city, in order for users to be able to commute on foot from one such area to the next with ease. In this fashion a series of interlinking “meanders” can be created, which will greatly improve the potential for these places to be experienced as being integral to a town and not merely a random collection of isolated spaces that do not form a part of the larger planned structure. The following guidelines should be followed wherever





walkways and cycle routes are established:

- Sightlines – ensure that paths have good longitudinal visibility, avoiding sharp bends.
- Margins – paths should have open space to both sides. Where the vegetation comes up to the path it should be opened to allow visibility through it. Where feasible open verges are also recommended for habitat creation and visual variation.
- Lighting – adequate lighting is appropriate in some areas, especially where there is high activity after hours. Lamp poles should be of a human scale but high enough that the light fittings are out of reach of ill doers, thus approximately 4.5 meters high. In order for the various pedestrian/ cycle routes or meanders to be visually recognisable, it is suggested that slightly different lamp-poles, litterbins and other street furniture be used along each route. This will heighten the degree of visual variation within the city and help to create visually recognisable routes.
- Path widths – they should be wide enough or have passing places so that people can pass comfortably, 2 to 2.5 metres.
- Thinning – Where space is sufficient, differentially thin treed areas can be created, and provided with seated rest areas and possibly tables for picnicking. However these spaces must have low stem densities and good visibility to the pathway to ensure safety.
- Undergrowth – shrubs and tall herbaceous vegetation are viewed with great suspicion by many townspeople. Mown verges and low vegetation is preferred close to activity areas. Keep areas specifically designed for wildlife away from high activity areas.
- Concentrate uses – active areas are safe areas. Group activities of similar nature and provide short distances from access roads to these activities.
- Patrol the area – neighbourhood watches on foot, or better yet, on bicycles, mounted police, or environmental wardens provide a presence that deter vagrants and that ensure surveillance and monitoring. Also areas where vagrants tend to congregate must be mowed continuously and planted with tall trees only, to ensure clean views and sight lines into these sites.
- Slope – to accommodate elderly people, wheelchairs and small children on bicycles, the pathways should not be steeper than 5%.
- Drainage – Drainage is of the utmost importance in all trail and walkway construction. Dispose of water to the side of the walkway without causing erosion. Where required construct water diversion bars into the longitudinal section of the walkway.



- Surface material – all surface material must be of a rough texture to prevent slippage. High traffic areas must have a durable paving material, such as interlocking blocks, rough finished concrete, or broken brick paving.
- Informal crossings of the stream should not be removed, but should be made safe for crossing. An elementary steel or timber bridge could be installed that is made of flat timber poles covered with chicken wire to prevent people from slipping. Handrails must be provided at all stream crossings. This type of construction must be low in the stream bed as to not be an obstruction during flooding conditions. The flood will pass over the bridge.
- Handrails – in areas where the walkways may be treacherous a single handrail should be installed. The handrail must be approximately 900 mm high.
- Interpretative signage – Where ecological features are located, or where bird nesting sights or indigenous trees are growing, informative signage could be installed. The signage must be weather proof, vandal proof, durable and display information in an easily understood manner. It is especially important that signage such as this should be introduced within town areas, in order for its residents and visitors to realise that nature is not confined to areas outside of the city and that by conserving and highlighting these areas within cities, their appeal is greatly enhanced.
- Resting areas – provide resting areas along the pedestrian meanders at intervals of approximately 200 metres, or closer if affordable. The seating could be in the form of benches or seating walls. Along pedestrian routes within urban conservation areas or larger parks, large rocks that fit into the environment more readily should be considered. Rocks are also less easily vandalised. Provide trash receptacles and a light post at the seating or resting areas.
- Links – provide links with public transportation routes, and public facilities such as clinics, commercial centres, sports centres, and institutions such as schools.
- Vehicle access – prevent vehicle access into resting areas along the meanders in all cases. In most cities and densely populated areas, pedestrians are being ostracised by city planning that is almost exclusively planned to accommodate vehicular traffic. This results in pedestrians feeling unsafe, especially along very busy roads, where sidewalks are often included as an afterthought, or are completely insufficient to accommodate the amount of pedestrian traffic that it must. It is thus vitally important that vehicles area kept out of public areas that are intended for pedestrian use.



Within the townships the guidelines mentioned above are also especially significant as a large percentage of the population commute by foot or cycle. Especially women, children and older people use such routes increasingly as the townships expand. Under the current conditions of unpaved surfaces, lack of shading,

vast open areas, and illegal dumping, these users are most likely to feel uncomfortable in most of the areas. Thus it is of the utmost importance to design the facilities to alleviate the anxieties of users and to provide a safe environment for all user groups.

## **1.10 STREET FURNITURE DESIGN**

Street furniture and small projects must be constructed and completed by the people of PKSDM and especially the townships and rural settlements. Significant skills are available within the townships to ensure that most of the project could successfully be completed by the residents. The project manager and the project Co-ordinator can identify the persons to be employed as SMME contractors to be trained for the execution of specific projects.

## **2 SPECIFIC PROJECT PROPOSALS: MEDIUM TO LARGE-SCALE INTERVENTIONS**

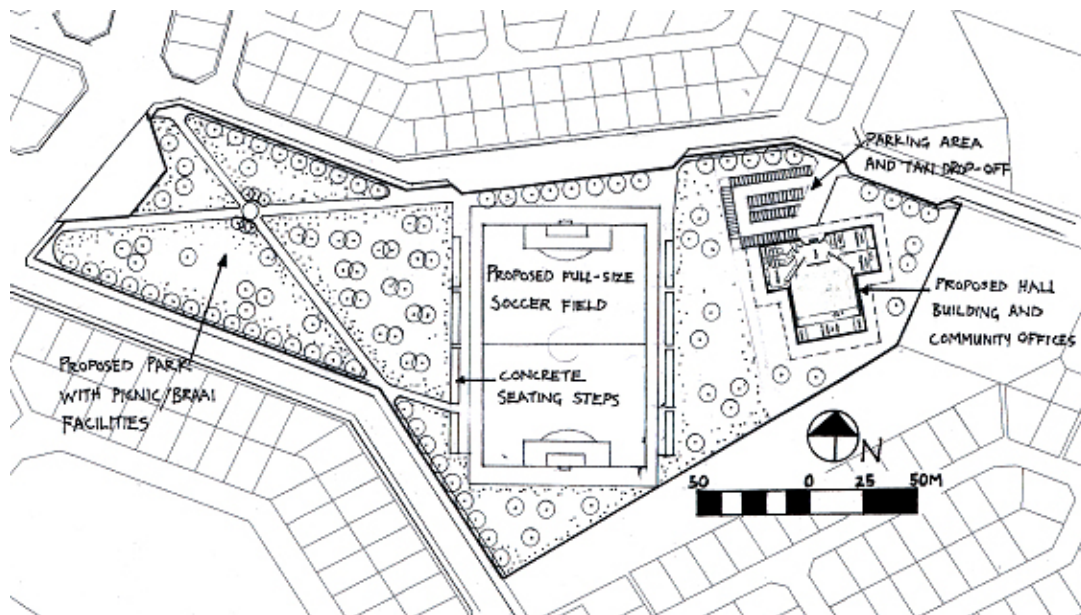
In this section written and sketch plan descriptions are presented for several concept developments as examples of possible improvements to existing open spaces within the townships within the PKSDM. It is important to note that these conceptual improvement plans are intended as guidelines only, based on past experiences and the wishes of community members interviewed during other similar projects. Detailed plans and designs have to be created for each individual project, based on its specific requirements and for the circumstances within which it occurs.

### **2.1 PILOT PROJECT #1: PROVISION OF MULTI-FUNCTIONAL HALL AND BUILDINGS AND UPGRADE OF EXISTING SPORT FACILITIES**

During the field survey it was established that there are many open spaces within the townships that currently have a rudimentary soccer field consisting only of two goal posts and a level playing-surface, with no other facilities or amenities that will stimulate more intensive use of the spaces within which they are situated. In especially larger lots of approximately 2 to 3 hectares, this is not effective use of land yet such spaces are not uncommon. Subsequently the following upgrades are suggested for relatively large open spaces that have little else than a basic soccer field to offer users. A similar layout can also be adapted for parks planned as part of the open space network of new extensions or suburbs of PKSDM, in which case the soccer field should be substituted for a rugby field or tennis and netball courts:

- Provision of the following buildings should be considered for such spaces:
  - Recreational centre and community hall, probably as one multi-functional and multi-spaced building, with community offices and electricity vending facilities. This should be situated opposite the soccer field and other sport facilities with enough distance between them that both facilities can be utilised simultaneously without disturbing each other, yet close enough that during larger sports events use can also be made of the building:
  - Provision of a separate clinic and crèche building can also be considered in such spaces.
- Provision of the following support infrastructure for this building complex:
  - Parking with trees for about 10 to 15 vehicles and safe access to the parking areas situated close to the complex so that possible deliveries can be made. Overflow parking must also be provided for spectators at the soccer field,
  - A taxi stop with a shelter and adequate lighting so that spectators have access to public transport,
  - Adequate pedestrian circulation provision to and around the complex,

- Additionally vending facilities may be provided near the taxi stop, or alternatively they may be located in the adjacent park area mentioned below.
- Upgrade the soccer field by providing a decent playing surface and nets, flood lighting around it, seating structures or well-tended lawn viewing areas and pedestrian circulation to these areas. Trees can also be placed intermittently between the seating structures for shade.
- Where irrigation water is available provision of a park area adjacent to the soccer field, consisting of paved pedestrian circulation routes, high-branching trees, a small lawn area and several benches. A market area can also be considered as part of the park area.



## 2.2 PILOT PROJECT #2: UPGRADE OF MAJOR COMMERCIAL CORRIDOR

Public spaces become more frequently used if they are associated with other attractions such as commercial corridors or shopping complexes. Furthermore especially in communities where pedestrian commuting is predominant, such as the townships and rural settlements, streets become significant open spaces in themselves. Taxi stops become social gathering places, parking lots may serve as vending areas or playing fields, and sidewalks may become impromptu performance areas. Thus it is important that these linear spaces be viewed as part of the open space framework of a city and upgraded as and when required:

- Creation of speed bumps or other traffic calming devices along the entire length of the commercial corridor,
- Upgrade of existing taxi stop inlets by providing a shelter structure, seating, street lights and litterbins,

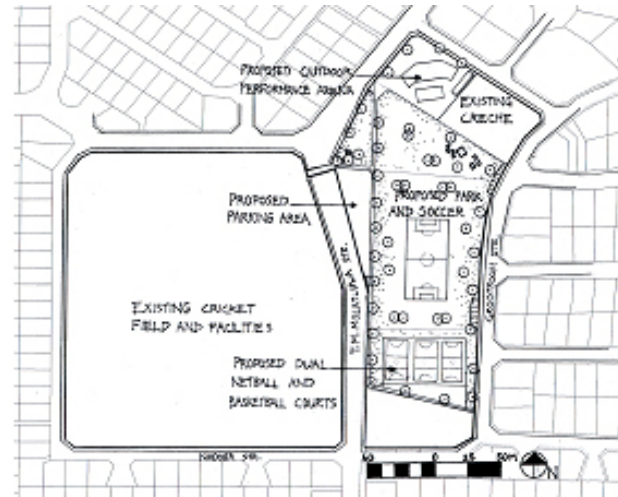
- Provision of at least one more fully facilitated taxi/bus stops on both sides of the main road, in front of the shop buildings, and a raised pedestrian crossing from one side to the other,
- Provision of paved parking with trees, safe entry/exit points, lighting, and a pedestrian walkway on both sides of the road.
- Storm water management system for the entire parking area through a channel and/or pipe system, to a suited of-site location, where infiltration trenches are to be constructed.



### **2.3 PILOT PROJECT #3: UPGRADE AND EXPANSION OF EXISTING COMMUNITY SERVICE BUILDING GROUNDS**

- Provision of paved/tar parking space serving both the clinic and recreation hall. Physical barriers, e.g. a low fence, should be erected between the waiting/play area (see below) and parking area to prevent accidents.
- Outdoor waiting and play area for the clinic on one section of the property, in front of the clinic entrance. This should include seating structures, tables, litterbins, trees and lawn. Paved pedestrian areas should also be provided around the entire building, serving the entrances on both sides.
- Pedestrian access linking the clinic/recreation centre with the street.

- The remainder portion of the property aside of the clinic/hall building should also be planted with trees and lawn.
- A focal feature, in the form of a sculptural name structure or signage device should be erected on the corner in front of the property. This structure and associated landscaping must integrate with the existing paved walkway and should not hinder pedestrian circulation.



## 2.4 PILOT PROJECT #4: STREET UPGRADES

- Upgrade of existing road surfacing by providing a tarred surface. Adequate streetlights and signage should also be provided.
- Provision of a paved pedestrian walkway alongside, with clear distinction between it and the vehicular entrance.
- Paved parking in front of any existing shop building located along the street.
- Provision of concrete drainage channels alongside the streets to manage rainwater. These channels should join the drainage swale in adjacent parks where possible or lead to infiltration trenches created in suitable locations.
- Stabilisation of sidewalks, through planting, paving or combinations of both.
- Planting of additional trees, and provision of lights in these areas. Robust seating structures should also be provided under the trees.





### **3 XERISCAPING**

A successful open space system is dependant both on sound planning and appropriate design and maintenance principles. In this respect landscaping choices are an important part of any city's greening programme. By making good planting choices and using appropriate management and maintenance principles, time and money are saved and the beautiful natural environment of PKSDM is protected.

The PKSDM region consists of several soil and climate combinations which mean that landscape decisions should be specific to each site. Each area has different soil types with different planting requirements. The native and adaptive plants (adaptive plants are non-native plants that thrive in this climate) that will thrive on these soils are also very different. Before planting, test the soil type and choose the landscape to fit. Each improvement area should be evaluated for the dominant soil type, and in this respect it should be considered obtaining a soil analysis from a specialist.

Where public use areas, especially parks and rehabilitated natural areas are designed and implemented, it is important to consider site-specific conditions related to soil and climate. Planting zones should be created in the landscape according to the various existing or improved soil conditions found over the site. Plants that have similar soil and water needs should be grouped together. For instance sites along moderately sloping areas, are likely to have shallower and possibly poorer soils than sites situated near streams or lower-lying areas.

Considering the prevailing climatic conditions in the PKSDM area, which can be especially dry during the winter, it is important to create public spaces that do not require much water to remain attractive and appealing to users. Often public parks fail to attract people simply because they do not look attractive and inviting. Plant species that require significantly more water than that which is provided by rain will not grow well, unless they are frequently watered. When this does not happen (due to financial and ecological considerations) the park will eventually appear neglected and unattractive and will eventually become disused. Therefore it is important to keep high water use plants to a minimum and group these together to make miniature "oasis" areas.

It is also beneficial to be aware of different microclimates that exist even on a single site. For example, reflected heat from walls or patios can create pockets of warmer temperatures for more tender plants, while plants exposed to cold winds need to tolerate colder winter temperatures. Native and adaptive plants thrive the best to the conditions found locally, and are low maintenance. Low maintenance alternatives to traditional landscaping are becoming the norm. In the PKSDM area, with its hot, mostly dry summers and predominantly dry winters, native and adaptive plants require very little water to thrive.

In the 1980's, the word Xeriscape was coined from the Greek word "xeros" for dry. Xeriscape is defined as "quality landscaping that conserves water and protects the environment." It is not a style of gardening, but a method of gardening. It is based on the following seven principles:

Developing a plan is the first and most important step in a successful low water, low maintenance park or urban green space. Consider the regional and microclimatic conditions of the site; existing vegetation and topographical conditions; how you intend to use your landscape; and the zoning or grouping of plants by their water needs.

The Xeriscape landscape takes into account the regional and microclimatic conditions of the site, existing vegetation and topographical conditions, the intended use and desires of the owner, and the zoning of plant materials according to their water needs. The landscape plan should allow the landscaping to be phased in, with initial phase installation and a future phasing-plan as part of the process. For instance where funds to fully implement a design for a park are not immediately available, trees, seating, braai structures and lighting should initially be installed. This will immediately create a space that is useable and appealing. Other elements such as play structures, paving areas and shrubs or lawn can be added as funds become available and a sufficient tree canopy has been established. Furthermore if trees are allowed to mature somewhat they can protect smaller, frost tender plants from frost when they are eventually planted.

### **3.1 PRINCIPLES OF PROPER SITE PLANNING**

- Design of floor plans and foundations of public use buildings and structures should reflect the site topography.
- Split level plans, terracing, and decks can help integrate built features into site conditions and minimize the cost and effects of grading.
- Building orientation on an east-west axis with glass area minimized on walls with maximum solar exposure will decrease energy demands for cooling, particularly when combined with proper placement of shade producing plants.

#### **Preserve and Protect as Much Existing Vegetation as Possible**

- Incorporate existing trees when locating structures and power lines, allowing room for them to grow if they are not at mature size. If retained where possible, trees help to establish a strongly recognisable character for the city. Furthermore by retaining larger trees, a landscape can immediately attain a well-established look, which is not financially feasible if all the existing

vegetation on site is removed and replaced with new plants. According to several surveys conducted, retaining large trees can increase the value of a property by up to 15 %.

- Protect trees from damage during construction with clearly visible fencing located below the outermost branches (see Figures 1 & 2) and flags in overhanging branches. See illustrations for where to locate fences. Much of the damage that occurs to trees during the construction process is due to soil compaction from heavy equipment and materials being driven or stored under trees.
- Roots, which extend out far beyond the trunk are damaged when soil becomes compacted. This will cause trees to go into a gradual decline, and eventually die.
- Filling or cutting in tree root areas will also kill trees. Use tree wells or decks to work around tree trunks, roots and slopes.

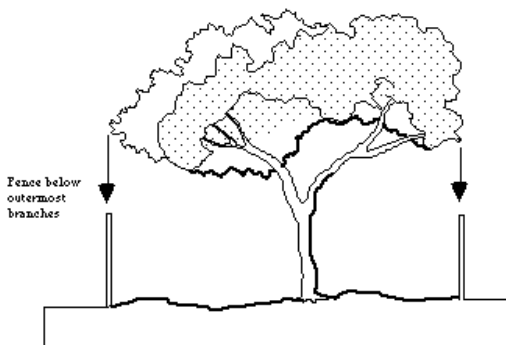


Figure #1 Tree Protection Fencing

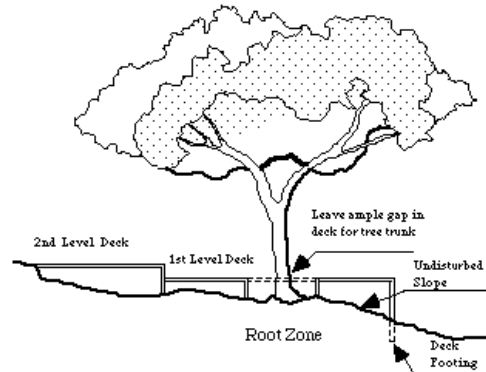


Figure #3 Terraced Deck on Slope with Tree

- Avoid trenching in tree root zones; try tunnelling instead to locate buried utility lines.
- If areas around trees must be paved, use pervious materials or, at a minimum, leave large holes spaced at regular intervals in the tree's root zone (openings will help give trees needed air and water). Never dump paints or solvents near trees. These cause plant death and soil contamination. Dispose of all waste materials properly.

### Preserve and Protect Topsoil on Construction Sites

- Topsoil is a valuable resource, which can only be replaced with expensive hauling from other sites, or with many years of the natural process of soil formation. In areas where topsoil must be stripped, collect and stockpile the topsoil for future use on the site.
- Place erosion control devices such as hay bales or erosion control fencing in all areas where construction disturbs the soil. (Such devices will help prevent the loss of topsoil during rainfall, when soil can be washed downstream causing site losses and non-point-source pollution.

### **Stabilize or Cover all Bare Soil Areas by the Time Construction is Completed**

- Extreme slopes, hillsides, and stream banks can be stabilized with vegetation, terracing, dry stack limestone, rubble, or rip-rap.
- In landscaped areas, a thick layer of organic mulch should be applied to planting beds.
- Planted slopes can be covered with erosion control fabrics or jute netting before groundcover or other plantings are added. This will help hold soil in place during the plant establishment period. Shredded mulch, which tends to form a mat should be used in sloping areas, as it tends to wash out less than other types.

### **Landscaping for Energy Conservation Should be an Integral Part of any Landscape Design**

- Plant deciduous trees on the west and northwest sides of structures. Such trees can create enough shade to lower roof and wall temperatures of buildings by up to 10 degrees. This factor can be effectively utilised in public open spaces that have function halls, recreation centres or institutional buildings.
- Deciduous trees that lose their leaves in winter will create summer shade and allow sunlight through open branches to warm and light the home during winter. Even when bare, there can still be significant shading from the branches of large trees.
- Shade can also be created by using a combination of landscape features, such as shrubs and vines on arbours or trellises.
- Shade the outdoor compressor unit of an air conditioning system. This can help save up to 10% on summer cooling bills. Be sure to leave room (at least 1 metre) for airflow and service access.
- Natural cooling without air conditioning can be enhanced, by locating trees and shrubs to channel summer breezes. Cooling breezes will be able to pass through the trunks of trees placed for shading. For this technique to be effective it is crucial to establish the prevailing wind directions for that space. This factor can be utilised to control the climate of buildings located in public open spaces, but can also ameliorate temperatures within the spaces themselves. By situating rest areas so that breezes are channelled through them they can provide respite from hot summer conditions. If deciduous trees are used, these spaces can still be pleasantly warm in winter, as sunlight will reach them for most of the day.
- Living windbreaks can be created to block cold winter winds. By placing dense strips of vegetation perpendicular to prevailing wind directions during winter and locating recreation spaces downwind of these windbreak, they can provide recreation areas in the winter, provided that they receive enough sunlight.
- Public buildings can also be screened from cold winds during winter. Plant evergreen shrubs and/or trees on the north and northwest sides of a building. Varieties that branch all the way to the ground are most effective. Several staggered rows of plantings should be located on the

leeward side of the wind. For best wind protection, plant windbreak trees a distance from the building equal to 5 to 7 times the height the trees will be when mature.

### **3.2 SOIL ANALYSIS**

- Soils will vary from site to site and even within a given site. Be aware of the acid/alkaline state of soils on site and what nutrients are lacking, a condition which can generally be expected throughout most of PKSDM. Soils should be analysed to help determine suitable plants and the need for any soil amendments.
- Add organic matter to planting soil to enhance plant health. This improves soil texture and moisture retention. (Soil rich in organic matter provides nutrients and micro-organisms beneficial to plants.) For planting beds, spread 5 mm of organic matter and mix it in 150mm deep. For soil to fill a hole for planting shrubs or trees, mix 1/3 organic matter into the soil. (Some native plants may not require this, as they are well adapted to poor soils.) Compost and composted sludge products such as excellent sources of nutrients for ornamental landscapes. Such products release nutrients slowly to the plants, making frequent fertilizing unnecessary and minimizing the risk of fertilizer washing out of sites and becoming non-point source pollution.
- Add other amendments as necessary. A soil test is an important first step in determining whether fertilizer is needed, and if so, what type.
- To reduce the need for fertilizer on established turf, use the "Don't Bag It" program: leave clippings in place to decompose after mowing. This recycles important nutrients back into the soil.
- The addition of gypsum and sand can improve the workability and drainage capacity of soil. Soils with large amounts of clay and stones are difficult to work with. If little soil is available and bedrock is in evidence on the site, planting holes are sometimes dug in solid rock. If this occurs, be sure all planting holes drain thoroughly before planting. Standing water on plant roots can be lethal.
- Choose topsoil wisely. If topsoil is imported from off-site, be sure it is of high quality. (There are many grades of topsoil, and the end use will determine what type of topsoil to use. For example, the best material for grading and filling may not be good for planting.)
- The locally occurring soils are suitable for many native plantings. (Native plants are naturally adapted to such soils, and may not thrive on soil blends, which don't mimic the natural conditions.)

### **3.3 APPROPRIATE PLANT SELECTION**

The design will determine the overall effect of the landscape. The actual selection of plants should come from those species that are native or adaptive to the site. Deviation from the appropriate selections creates the need for more soil amendments, more maintenance, and different watering schedules. In any public open spaces for which funds to maintain are usually limited, choices have to be made that ensure maintenance is kept to the minimum. A significant part of the success of low-maintenance gardens is choosing the correct species for the situation and location.

#### **Select Plants that Require a Minimal Amount of Supplemental Watering**

- Use plants that will need no supplemental watering after an establishment period, unless there is an extreme drought. The establishment period after installation may require from 18 to 24 months.
- Almost any plant can be used if grouped according to its water needs. Annual and exotic plantings can be located in small, easily accessible areas to make maintenance easier. Irrigation can then be zoned according to plant water needs to make efficient irrigation possible.
- Many native plants are well adapted to the natural soil and rainfall conditions of the area. They have protection mechanisms that cause them to go dormant during periods of stress. They may appear brown, but will turn green again when temperatures improve and it rains.

#### **Choose a Diversity of Plant Species**

- Avoid planting large numbers of only one plant species, which can create a monoculture susceptible to pest or insect problems. (A variety of plant species occurs in nature, making more stable and diverse plant populations.)
- The abundance of local – or endemic plants - trees, shrubs, perennials, groundcovers, vines and grasses make it possible to choose plantings which give colour and interest (flowers, fruits, berries, and foliage) year-round.

#### **Buy from Reputable Suppliers and Nurseries**

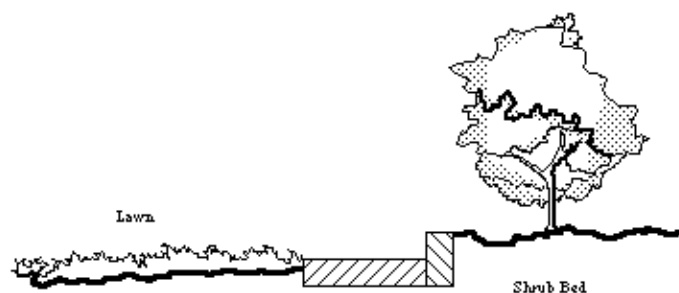
- Well-established plant suppliers know the exact sources of their plant materials. Information on where plants are nursery-grown or field-dug should be available.
- For field collected specimens, environmentally sound collection techniques should be used and permission of the landowner obtained. Rare plants should never be collected from the wild.
- Where locally indigenous species have to be removed from a site due to construction, an attempt should be made to re-locate these specimens to another suitable location on site. If handled and stored properly, these plants should re-establish relatively quickly and without excessive care and maintenance.

### **Use Locally Grown or Sourced Plants if Possible**

- Using plants that have been grown by nurseries within the PKSDM cuts down on transportation costs and increases the viability of plant materials.
- By encouraging the local nurseries to adopt a consumer awareness program, which labels plants "Locally Grown" with a special tag, the local economy may benefit significantly. If trade agreements are established between the municipality and local nurseries, especially ones owned by previously disadvantaged individuals, the landscaping industry could play a significant role in economic development in the area.
- A list of plants suitable to the PKSDM climatic region should be compiled and made available at Local Municipal Offices, participating nurseries and other selected institutions.
- It is furthermore suggested that a list of preferred plant species for all open spaces, which form part of private residential estates, resorts and other developments, be compiled and kept at the Municipal Offices. Such a list will not be enforceable save for instances where specifications of a project-specific EMP, conducted as part of the EIA process, require the use of selected indigenous species. However by establishing awareness programs that seek to educate developers on the benefits of using locally indigenous plants, it is possible to retain and enhance the indigenous character of PKSDM. By possibly coupling such programs with a nominal incentive program for the use of preferred tree species, the effectiveness of the program can be significantly increased.

### **3.4 PRACTICAL LAWN AREAS**

Practical lawn areas mean lawn areas, which have sizes suited to the intended uses. Lawn grass usually covers more of the landscape than is needed for entertaining or recreation. Huge lawns of exotic grasses will require more maintenance and care than any other type of landscape plant and excessive amounts of water. Lawns may be needed as children's play areas, for pets, sports, or simply for the aesthetic appeal of turf, which some people prefer. For more interesting and manageable landscapes, use lawn only as a fill-in plant. Increase the area of decks, porous paving, paths, indigenous grass areas and mulched planting beds to reduce lawn. Be sure to select drought-tolerant grass varieties such as *Cynodon* sp., in the sunny lawn areas.



### **Design Lawn Areas Appropriate to their Function**

- The maintenance needs of lawn can be minimized by the design of the area, the irrigation equipment used, and the turf type selected.
- Design turf areas in rounded, compact shapes to water and mow more efficiently.
- Curving borders of plant beds around turf areas and the use of mowing strips can make mowing and edging easier.
- Avoid long narrow areas of turf, which are difficult to water efficiently.
- Locate turf areas close to associated structures and public buildings such as libraries, clinics, multi-purpose centres, entertainment venues and performance stages, and lower-maintenance areas near the edges or rear of the open space.
- Design turf areas so they can be watered separately from other landscape plants.
- If using an automatic irrigation system, the grass areas can be zoned in order to be watered according to the needs of the grass type.
- For non-automatic systems, use hose-end efficient sprinklers for grass areas and soaker hoses for beds. Watering times will vary by plant type.

### **Avoid Planting Grass on Slopes**

- Sloping areas are difficult to mow and difficult to water without runoff.
- Terracing of slopes can help slow down water. Plant groundcovers, shrubs, and perennials to minimize the maintenance problems of slopes. Alternatively planted retaining walls can be created.
- Many slopes can be left in their natural state. This is especially true in public areas that are adjacent to or within natural areas. Alternatively sloped areas, which usually are not high-use areas, can be rehabilitated to the expected natural condition if they occur on transformed sites. This will both decrease maintenance costs and increase the ecological value of the site, as well as its aesthetic appeal.

### **Minimize Grass Areas by Using Alternatives**

- There are many alternatives to grass lawn areas, which are aesthetically pleasing and low-maintenance.
- Planting beds are a logical alternative to grass if the appealing green and “soft” appearance of plants is still desired.
- Wild flowers can be incorporated into native groundcovers and grasses.
- Mulch beds of bark, stone or gravel can be used as pathways, or around driveways and utility areas. Currently some landscape designers are creating highly aesthetic landscapes for private developments such as shopping complexes and office parks, by replacing excessive areas of



lawn with beds of rocks and gravel, interspersed with indigenous flowering bulbs and shrubs, attractive tree species and accent plants such as Aloes. Such landscapes require far less water than conventional lawn areas and are an attractive alternative to utilise in areas that are not frequently used.

- Children's play areas can be covered with sand or bark mulch to create inexpensive "safety" zones. Paving products made of recycled tires are available to create a ground surface that minimizes injuries.

### **3.5 EFFICIENT IRRIGATION**

Water infrequently, but when you do, water deeply. Plants and grasses develop deeper, drought-tolerant roots when forced to find deeper moisture. Frequent, light watering results in shallow roots, leading to water stress during periods of drought.

#### **Use an Efficient Irrigation System Designed by a Licensed Irrigator**

- The type of watering equipment best suited to the situation depends on the landscape, design, layout and budget. The irrigation design should be integrated with the design of the landscape. A simple hose and sprinkler system with a few soaker hoses, or simple sprayer system may be the best way to water landscapes that can be more closely monitored and where theft or vandalism is less likely, such as open areas associated with multi-function halls, libraries, clinics, crèches or small public performance areas. These facilities usually have smaller public spaces associated with them and can be maintained and irrigated by a few persons. Underground drip irrigation and pop-up systems may be more appropriate for larger landscapes such as sports facilities. Larger public parks and landscapes of civic centres. However in such landscapes the design should be such that only frequently used and highly visible or prominent areas require frequent watering.
- It is important to note that a newly installed landscape will require more water during an establishment period of one to two years. After this time, the landscape may require no irrigation except during a drought period.

#### **Install a Water Efficient Automatic Irrigation System, this Includes:**

- A timer that allows for scheduling every 5-7 days (14 or 15-day programming) and independent zone programming capability.
- Features such as multi-cycling (or multiple start times) will help in watering areas which may need several short irrigation cycles to avoid runoff.
- An inexpensive rain shut-off device, which will prevent unnecessary irrigation during rain.

- A soil moisture sensor. Unlike the rain shut-off device, the soil moisture sensor actually measures soil moisture, and overrides programmed irrigation when the soil moisture level is adequate.
- Non-mist type low trajectory nozzles and pressure-compensating devices for spray systems in turf areas. Alternatively micro-spray heads should be used for spray systems in turf areas.
- A zoned approach whereby plants of similar water requirements are grouped together in the same zone capable of independent station programming (i.e. turf areas separate from shrub areas, sunny areas separate from shady areas).

### **Use Low-flow Irrigation Equipment**

- Evaporation losses can be minimized by drip irrigation, soaker hoses, or bubblers.
- Drip irrigation systems are ideal for watering plants in beds and garden areas.
- Drip lines require no expensive underground trenching, and are easy to utilize in a retrofit of an existing landscape.
- Drip irrigation uses a flexible hose system, which can be easily modified, to apply water at the ground surface to individual plants. Emitters are punched into the supply line where they are needed. A variety of types and flow rates for emitters are available.
- If water pressure at the source exceeds pre-determined pressure levels, a pressure regulator may be necessary. Filters to remove sediment should be installed at the water source. Flush caps should be installed at the ends of the drip supply lines so that the entire system can occasionally be flushed of contaminants.
- Drip lines should be secured to the soil surface and covered with organic mulch to improve appearance and protect them from sunlight.

### **Water Only When Plants Need It and Water Deeply**

- Deep, more drought tolerant root systems will develop from a weekly deep soaking.
- Irrigate in the coolest part of the day (early mornings and evenings) to avoid evaporation loss and wind drift.
- Night time watering can encourage diseases in plants and during the winter, excess water in the ground may freeze overnight, damaging root systems and killing more tender plants.
- Wet the soil to a depth of fifteen or twenty centimetres, and allow it to dry out between watering events.
- As a general rule, during the growing season most grass needs about 25mm of water per week. This will vary depending on soil type and depth, sun, plant conditions, and rainfall occurrence.
- Watering can taper off gradually as autumn arrives and can gradually increase again in spring.
- Plants don't need as much water in winter, but will still benefit from monthly irrigation if there is no rainfall.

### **Maintain the System**

- Irrigation systems need regular maintenance to ensure proper working order and to adjust irrigation scheduling.
- A complete system audit should be conducted annually, and irrigation schedules adjusted quarterly at a minimum. (A training program for Irrigation Auditors should be offered by the Parks Department of the PKSDM or alternatively by an outside appointed specialist or consultant.)
- Irrigation lines should be flushed and all stations, heads, nozzles, and/or emitters checked for proper functioning.

### **Staff Should be Trained**

- Copy and file a plan with the project file at the Municipality of how the system is built, and instructions for use of the system.
- Post the current irrigation schedule inside the controller box. (Be sure to note that seasonal adjustments to the irrigation schedule will be necessary.)
- Give the operators and maintenance staff an orientation session on how to operate the system. Many irrigation systems that are efficiently designed are never used efficiently because the owner is unaware of the importance of his/her role in scheduling and maintenance after the system is installed.

## **3.6 USE OF MULCHES**

- A 150 to 200 mm layer of organic material should cover all exposed soil areas. Replenish it twice a year. Mulch retains moisture, controls soil temperature, discourages weeds, and prevents erosion.
- Use a deep layer of mulch in planting beds to help retain moisture, slow weed growth, and prevent erosion.
- The use of mulches on sloped areas along with terracing and plantings can help prevent runoff and erosion problems.
- Examples of organic mulch material include: shredded bark, wood chips, pine needles, straw, nut hulls, olive seeds, composted leaves, shredded exotic plants without the seedpods or other reproductive matter.
- The depth of mulch needed will depend on the type used. As a general rule, the coarser the material, the deeper it should be applied. A 150 to 200 mm layer of bark mulch should be sufficient. Mulch needs to be reapplied as it decomposes.
- Use inorganic mulches such as gravel, crushed granite or pebbles in unplanted areas.
- Such areas can become inexpensive pathways, utility areas, or decorative border strips.

- Don't use stone mulches in areas immediately adjacent to buildings, as they can heat up and cause glare.
- Brown or grey coloured stone is preferred over white for use as mulch, as very light colours cause glare. Conversely dark colours or black absorb heat, which may damage less robust plants and groundcovers.
- Use mulches from locally or regionally derived materials. This decreases transportation costs, and utilizes local resources.
- Organic mulches can be the by-product of local tree trimming, land clearing or agricultural activity. Agriculture is a significant industry in parts of the PKSDM, especially to the south, and farmers can sell by-products, which aren't used for other purposes to the municipality or private maintenance contractors. Urban agriculturalists within the townships can also benefit in this fashion.
- Stone mulches can be produced from regional quarries. Mining which is the primary industry in the PKSDM, produces vast quantities of material, which may be suitable for this purpose. Aggregate and crusher run produced by granite mines in the area may also be used for ornamental xeriscaping of public spaces.

### **3.7 APPROPRIATE MAINTENANCE**

Even in the most self-sustaining landscapes maintenance cannot be totally eliminated, especially where people frequently use these places. However by following the first six principles of xeriscaping, it is possible to reduce manpower and cost spent on maintaining public landscapes. After they are established, xeriscapes require less fertilizer, chemicals, and less water than conventional landscaped areas. This is due to a reduction in lawn area and un-adapted plants that might have more diseases and require insect control, more watering and have higher fertilizer demands. However, there is no such thing as a maintenance-free constructed landscape. In general, a properly maintained landscape is hardier and better able to withstand drought, freezing and pest problems. Obviously, landscape maintenance is up to the owner or custodian of that space. However, there are things that can be done during installation to make maintenance easier.

#### **Provide a Composting Area and Encourage Its Use**

- Garden waste can be recycled into high-quality compost. This minimizes the load on landfills and encourages wise resource use. Large composting facilities can be operated as a SMME venture and can generate an income for several people. If the garden refuse and clippings (which are not used as mulches) from several parks are taken to a central facility and converted into compost, it

may be possible to cut down on some of the maintenance costs of public parks by producing the compost for the parks from its own garden refuse.

- A well-drained area on the site should be chosen to locate the composting facility – it can be utilized by the entire community for garden and kitchen waste composting. Make sure to clear the area to expose the soil prior to dumping composting materials.
- Smaller compost bins are easy to build and can be effectively utilized in township areas, to improve the quality of soil used for urban agriculture. Remember to use inexpensive materials, allow for air circulation and make the bin wide enough to turn and lift compost. For individual house use by the community, they could use chicken wire, woven wire, or inexpensive fencing to build a bin. Wood stakes, wire, or chain snaps to support and fasten the bin. Discarded wood pallets can be put together with wire to make an inexpensive rectangular bin. A portable bin can be built of wood slats and wire mesh. Cinder blocks or brick can be used if gaps are left to allow air circulation.

### **Mow Correctly**

- Mow the grass when it is about 1/3 higher than the desired height.
- Clippings can be left where they fall, recycling nutrients into the soil.
- If clippings are collected, compost them with raked leaves and organic waste.
- Never mow lawns too short. (Proper mowing heights can help lawns use less water. Grass cut too short is stressed and dries out quickly.)

### **Fertilize Wisely**

- Many native plants do not need fertilizer since they are adapted to natural soil conditions.
- Other plants, such as non-native grasses, need additional nutrients for healthy growth.
- Use recycled lawn clippings, compost, or slow-release encapsulated nitrogen on lawns.

### **Use Least-toxic Methods of Insect and Disease Control**

- Such techniques, otherwise known as Integrated Pest Management (IPM), take advantage of natural methods of control. This protects soil from contamination, inhabitant wildlife from harm, and waterways from being polluted with non-point source pollution.
- Old-fashioned methods such as installing a birdhouse can help encourage natural insect control.
- Chemical controls will destroy beneficial insects as well as harmful ones and should only be considered in instances of serious infestation.
- Organic pest control such as insecticide soaps and manual methods such as pulling weeds or using sand barriers will usually be sufficient and has little or no impact on the environment.
- Beneficial insects such as ladybugs and beetles should be encouraged and can even be introduced into a landscape.

- Over watering and night-time watering may actually cause some diseases such as brown patch on lawns.

## HOW TO USE THIS DOCUMENT

The document set is comprised of two separate document types:

The **first is a set of three matrixes** for the Construction, Operation and Maintenance for the various municipal infrastructure types. The main column headings identify the various aspects relating to the construction, operation and maintenance of various types of municipal infrastructure respectively, whilst the impacts appear on the left-hand side of each table. These are grouped into the various categories Air, Earth, Surface Water, Ground Water, and Fauna and Flora, and indicate the types of impacts that the construction, operation and maintenance of infrastructure may have on these various natural elements. Where a specific activity, or infrastructural component may potentially have a specific environmental impact, this impact is then identified within the matrix with a code. By way of example, as illustrated in the “**Civil Municipal Infrastructure Construction Potential Impacts Relational Matrix**”, cooking fires may potentially cause chemical or smoke pollution and this impact is identified in the matrix with the code CAa-4. The code is a reference to the matrix on which it is identified (Construction –C, the category of infrastructure or activity (in this case Construction Camp –A), and the cross reference between the specific activity / item (cooking, fires –a) and the specific (air chemical/smoke pollution -4) – CAa-4.

This code then refers to the impacts in the **second** document set, namely the detailed “**EMP Masters**”. There is a specific EMP Master for each of the various categories of environmental impacts, i.e. Air Impacts, Earth Impacts, Surface Water Impacts, Ground Water Impacts, and Fauna and Flora Impacts (with an additional EMP for diverse additional impacts which does not refer to any of the Impact Matrixes).

The “EMP Masters” documents list, in order from left to right:

- The Specific Impacts identified in the matrix. Thus by way of example Smoke/chemical pollution during construction, potentially caused by cooking fires (derived from the Impact Matrix Tables) is listed with the reference code from the Impact Matrix – CAa-4. All impacts are further separated into construction, operation maintenance and overall design parameters.
- Photo/s of the impact where available,
- Potential mitigation measures that may be applicable,
- Photo/s of the mitigation measure/s where available, performance indicators to verify whether the desired results are being achieved,

- Whose responsibility the mitigation measures are,
- And other notes if applicable.
- Additional columns that also appear allow for relevant legislation/standards, and reference to project drawings to be captured, and successful implementation to be checked and signed off.

Many of the activities and components of both the construction and maintenance phases are similar for the different infrastructure categories, therefore the impact matrixes for the construction and maintenance phases are generic and can be applied to any of the different infrastructure categories.

However the different construction and maintenance activities or aspects will be of differing relevance to different infrastructure categories according to the scale and nature of the project. For instance even though both an electrical substation and sewage treatment plant may require a construction camp, the construction camp for a sewage treatment plant will be much more extensive than for the substation. Thus the impact matrix for the construction phase must be interpreted within the context of each specific project.

The same applies to the maintenance impact matrix. No municipal infrastructure project would include all the issues addressed in this guideline document and each project must be evaluated within its specific context and the requirements presented by the brief, or terms of reference.

This system allows each environmental impact to be viewed separately in terms of its potential causes, and then evaluated in terms of a set of proposed mitigation measures. It must however be kept in mind that the success of any mitigation measure is dependant on the quality of the workmanship and the adherence to the EMP as a whole. Often negative environmental impacts arise from sufficient and appropriate designs that are simply not executed well.



**- 5 -**

**CIVIL WORKS – IMPACTS  
AND MITIGATION  
MEASURES MATRIX**







**PIXLEY KA SEME DISTRICT MUNICIPALITY - MUNICIPAL INFRASTRUCTURE GUIDELINES**  
**CIVIL MUNICIPAL INFRASTRUCTURE MAINTENANCE POTENTIAL IMPACTS RELATIONAL MATRIX**

Date: 2007-12-14      Project No: A1289      Consultant: African EPA      Client: PKSDM

Final






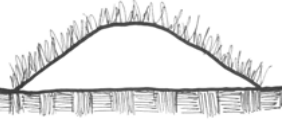

IMPACTS OF MAINTENANCE (either by direct cause or by significantly promoting thereto)	INFRASTRUCTURE MAINTENANCE											
	A Mowing	B Pruning	C Weeding	D Alien Vegetation Clearance	E Re-Planting	F Watering/ Irrigation	G Sediment Removal	H Litter/ Refuse Removal	I Embankment Structural Maintenance	J Road Resurfacing	K Trenching/ Pipe Repairs	L Sewage Spill Cleanup
<b>Air</b>												
1) Dust Pollution	MA-1			MD-1			MG-1			MJ-1		
2) Noise Pollution	MA-2	MB-2		MD-2			MG-2			MJ-2		
3) Odours						MF-3	MG-3			MJ-3		ML-3
4) Air Chemical/ Smoke Pollution				MD-4						MJ-4		
<b>Earth</b>												
5) Erosion/ Topsoil Loss	MA-5			MD-5		MF-5					MK-5	
6) Significant Sedimentation				MD-6						MJ-6	MK-6	
7) Soil Compaction/ Impermeability				MD-7			MG-7			MJ-7	MK-7	
8) Soil Contamination	MA-8			MD-8			MG-8			MJ-8	MK-8	ML-8
9) Slope Collapse									MI-9			
<b>Surface Water</b>												
10) Surface Water Physical Pollution (Litter, Refuse, Rubble)	MA-10	MB-10	MC-10				MG-10	MH-10				
11) Surface Water Sewage Pollution												
12) Surface Water Biological Pollution (Pathogens, Organic Solvents)												
13) Surface Water Chemical Pollution			MC-13	MD-13				MH-13		MJ-13		
14) Drainage Problems						MF-14					MK-14	
15) Anaerobic Conditions							MG-15					ML-15
16) Increased Runoff Rate										MJ-16		
<b>Ground Water</b>												
17) Ground Water Biological Pollution												ML-17
18) Ground Water Chemical Pollution			MC-18	MD-18				MH-18		MJ-18		
<b>Fauna and Flora</b>												
19) Habitat and Vegetation Loss	MA-19	MB-19		MD-19								
20) Habitat Fragmentation												
21) Habitat Degradation/ Disturbance			MC-21	MD-21	ME-21		MG-21		MI-21	MJ-21	MK-21	
22) Poaching							MG-22					










**PIXLEY KA SEME DISTRICT MUNICIPALITY - MUNICIPAL INFRASTRUCTURE GUIDELINES**  
**MUNICIPAL CIVIL INFRASTRUCTURE: AIR IMPACTS - EMP MASTER**





Date: 2007-12-14	Project No: A1289	Consultant: African EPA	Client: PKSDM
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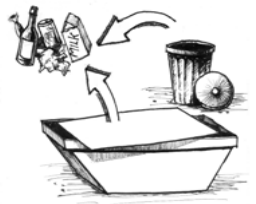



RELEVANT LEGISLATION/ STANDARDS	REFERENCE DRAWING/ SHEET NO.	SPECIFIC IMPACTS	POTENTIAL CAUSE	IMPACT PHOTO/ DRAWING EXAMPLE	MITIGATION MEASURE	MITIGATION PHOTO/ DRAWING EXAMPLE	PERFORMANCE INDICATOR/ VERIFICATION	RESPONSIBILITY	NOTES/ GENERAL	SIGN. + DATE
		1 Dust Pollution (Construction)	Access roads to/from/on the site (CAAd-1; CBf-1; CCf-1; CDc-1) Excavation of material (CCa-1) Mixing of materials (CDa-1) Refuse / Rubble removal (CDb-1) Borrow pits (CCe-1)	  	<p>Roads: All access roads and other roads on the site are to be wet with water dowsers as and when the need arises. Caution is to be taken by the operator not to wet surfaces excessively.</p> <p>Stockpiling of soil: If the material is to be stockpiled for a period longer than 6 months, the stockpile is to be vegetated. When the soil is being moved from the stockpile, water dowsers are to wet the area where vehicular access occurs.</p> <p>General: Large areas of the site that have been stripped of vegetation are to be avoided. If this cannot be avoided dust suppression is to be undertaken by water dowsers. The operator of the water truck is to wear the correct PPE.</p>	    	<p>Successful dust suppression i.e. limited dust in the air.</p> <p>Planting in the vicinity of the construction activities is not covered in dust.</p> <p>No run-off from the dust suppression activities is evident.</p> <p>Stockpiles are vegetated if material is to be stockpiled for longer than 6 months.</p> <p>No dust pollution from stockpiled soil or material.</p> <p>No dust pollution from unavoidable bare or unvegetated areas.</p>	<p>Contractor</p> <p>Contractor</p> <p>Contractor</p>	<p>Precautions are to be undertaken to the satisfaction of the PM, the Environmental Health Division and Environmental Management Division of the PKSDM.</p>	
		1 Dust Pollution (Operations)	Borrow Pits (DCe-1)		<p>Roads: All access roads and other roads on the site are to be wet with water dowsers as and when the need arises. Caution is to be taken by the operator not to wet surfaces excessively.</p>		<p>Successful dust suppression i.e. limited dust in the air.</p> <p>Planting in the vicinity of the construction activities is not covered in dust.</p> <p>No run-off from the dust suppression activities is evident.</p> <p>Successful revegetation of areas where alien species have been removed.</p>	Operator	<p>Precautions are to be undertaken to the satisfaction of the PM, the Environmental Health Division and Environmental Management Division of the PKSDM.</p> <p>Further site specific conditions according to the EMP are to be noted.</p>	

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					<p>Stockpiling of soil: If the material is to be stockpiled for a period longer than 6 months, the stockpile is to be vegetated. When the soil is being moved from the stockpile, water dowsers are to wet the area where vehicular access occurs.</p> <p>General: Large areas of the site that have been stripped of vegetation are to be avoided. If this cannot be avoided dust suppression is to be undertaken by water dowser. The operator of the water truck is to wear the correct PPE.</p>		<p>No dust pollution from stockpiled soil or material.</p> <p>No dust pollution from unavoidable bare or unvegetated areas.</p> <p>Planting in the vicinity of the construction activities is not covered in dust.</p> <p>No run-off from the dust suppression activities is evident.</p>	<p>Contractor</p> <p>Contractor</p>		
		<b>1 Dust Pollution (Maintenance)</b>	<p>Mowing (MA-1)</p> <p>Alien Vegetation Clearance (MD-1)</p> <p>Sediment Removal (MG-1)</p> <p>Road Resurfacing (MJ-1)</p>		<p>Roads: Where appropriate, the areas that are being re-surfaced can be wet with water dowsers as and when the need arises. Caution is to be taken by the operator not to wet surfaces excessively.</p> <p>Vegetation clearing: In areas where alien vegetation is to be removed, the area is to be revegetated as quickly as possible with indigenous grass and tree species (which ever is most appropriate).</p> <p>General: Large areas where vegetation has been removed or has died are to be identified and revegetated with indigenous trees and grasses (as appropriate).</p>		<p>Successful dust suppression i.e. limited dust in the air.</p> <p>Planting in the vicinity of the construction activities is not covered in dust.</p> <p>No run-off from the dust suppression activities is evident.</p> <p>Successful revegetation of areas where alien species have been removed.</p> <p>Successful revegetation of areas where alien species have been removed.</p> <p>Successful revegetation of unvegetated areas.</p>	<p>PKSDM personnel</p> <p>Contractor/ maintenance personnel</p> <p>Contractor</p>	<p>Precautions are to be undertaken to the satisfaction of the PM, the Environmental Health Division and Environmental Management Division of the PKSDM.</p>	
		<b>1 Dust Pollution (Design)</b>	<p>Lack of sufficient roadside planting (DAb-1)</p> <p>Roadside edges (DAc-1)</p> <p>Landfill sites (DEb-1)</p>		<p>Establish the location of the site and accordingly determine the site specific mitigation measures that are to be adhered to in the construction phase.</p> <p>Ensure that the aspect of dust pollution is addressed in the tender documents and state the requirements.</p>		<p>Appropriate mitigation measures in relation to the context.</p> <p>Dust pollution addressed in the tender documents.</p>	Engineers	<p>Precautions are to be undertaken to the satisfaction of the PM, the Environmental Health Division and Environmental Management Division of the PKSDM.</p>	

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					<p>Sufficient planting of all roadside embankments, medians and sidewalks are to be done to prevent dust pollution. Species with sufficiently strong roots should be used, that provide coverage throughout the year. Preferably indigenous species should be used.</p> <p>Where possible unused sections of landfill sites should be re-vegetated with indigenous veld grass species, or alternatively dust suppression by water dowsers should be done when appropriate.</p>		<p>No dust pollution from roadside edges, embankments or medians.</p> <p>Limited dust from landfill sites.</p>	<p>Contractor</p> <p>Contractor/ maintenance personnel</p>		
		<b>2 Noise Pollution (Construction)</b>	<p>Worker activity at the construction camp (CAb-2)</p> <p>Heavy vehicles on access roads (CAAd-2; CBf-2; CCf-2; CDc-2)</p> <p>Mixing of materials (CDA-2)</p>		<p>Ensure that the contractor adheres to the construction times as stated in the contract documents or EMP (usually 7:00 - 18:00).</p> <p>Where applicable all equipment must be SABS approved and use of noise generating equipment shall take place in accordance with the Gauteng Noise Regulations.</p> <p>Silencers must be fitted on all construction machinery. All construction vehicles must have baffled exhaust systems and comply to national noise regulations.</p>	 	<p>Construction hours are in accordance with the EMP.</p> <p>Maintenance logs of the plant and equipment are to be available on request.</p> <p>Suitable location for the Construction Camp.</p> <p>Noise levels are within acceptable limits.</p>	<p>Contractor</p> <p>Contractor</p>	<p>Precautions are to be undertaken to the satisfaction of the PM, the Environmental Health Division and Environmental Management Division of the PKSDM.</p>	
					<p>Ensure that all plant, vehicles and equipment is regularly maintained.</p> <p>Locate the construction camp in such a position that it does not interfere with residential areas.</p> <p>The contractor is required to adhere to SABS 1200 safety measures during construction.</p> <p>Loud noise and yelling will not be tolerated.</p>		<p>No noise pollution caused due to faulty or poorly maintained equipment or machinery.</p> <p>No complaints received about noise from adjacent or affected persons.</p>	<p>Contractor</p> <p>Contractor</p>		

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		<b>2 Noise Pollution (Operations)</b>	Bulk water pump stations (DDb-2) Water purification works (DDe-2) Substations (DFa-2)		Ensure that the contractor adheres to the operation times as stated in the contract documents or EMP (usually 7:00 - 18:00).  Ensure that all plant and equipment is to be regularly maintained.  Where applicable all equipment must be SABS approved and use of noise generating equipment shall take place in accordance with the Gauteng Noise Regulations.		Operation hours are in accordance with the EMP.  Maintenance logs of the plant and equipment are to be available on request.  No complaints received about noise from adjacent or affected persons.  No noise pollution caused due to faulty or poorly maintained equipment or machinery.  Noise levels are within acceptable limits.	Operator  Contractor  Contractor	Precautions are to be undertaken to the satisfaction of the PM, the Environmental Health Division and Environmental Management Division of the PKSDM.	
		<b>2 Noise Pollution (Maintenance)</b>	Mowing (MA-2) Pruning (MB-2) Alien vegetation Clearing (MD-2) Sediment removal (MG-2) Road resurfacing (MJ-2)		Ensure that the contractor adheres to the maintenance times as stated in the contract documents or EMP (usually 7:00 - 18:00).  Ensure that all plant and equipment is to be regularly maintained.  Where applicable all equipment must be SABS approved and use of noise generating equipment shall take place in accordance with the Gauteng Noise Regulations.		Maintenance hours are in accordance with the EMP.  Maintenance logs of the plant and equipment are to be available on request.  Noise levels are within acceptable limits.	Maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM, the Environmental Health Division and Environmental Management Division of the PKSDM.	
		<b>2 Noise Pollution (Design)</b>	General location of facilities - bulk water pump stations, purification works, landfill sites, substations (DDb-2; DDe-2; DEb-2; DFa-2)		Establish the location of the site and accordingly determine the site specific mitigation measures that are to be adhered to in the construction phase.  Ensure that the aspect of noise pollution is addressed in the tender documents and state the requirements.		Appropriate mitigation measures in relation to the context.  Noise pollution addressed in the tender documents.	Engineers	Precautions are to be undertaken to the satisfaction of the PM, the Environmental Health Division and Environmental Management Division of the PKSDM.	



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		<b>3 Odours (Construction)</b>	Cleaning, sanitation, worker activity at construction camp (CAb-3)		Construction Camp: Ensure that the dustbins are cleaned out on a regular basis.  Ensure that the chemical toilets are sufficient and maintained as stated by the supplier. If a French drain and septic tank system is utilized, ensure that anaerobic conditions do not arise. If pit latrines are used, ensure that the hole is deep enough and situated in a suitable location.	  	Dustbins are not overflowing with refuse.  Chemical toilets are clean.  No smells emanating from the septic tank and French drains.	Contractor  Contractor	Precautions are to be undertaken to the satisfaction of the PM, the Environmental Health Division and Environmental Management Division of the PKSDM.	
		<b>3 Odours (Operations)</b>	Waste Water Treatment (DCb-3) Refuse Removal (DEa-3)		Landfills: Ensure that the refuse that is disposed of on a daily basis at the waste disposal site is covered with a layer of soil daily.  In areas where refuse is removed, the operator is to ensure that all the refuse is collected. Where spillage of refuse has occurred, it is to be collected and disposed of accordingly.		No refuse remaining at the collection point once the operator has collected the material.  Verify that the daily arisings are covered with a layer of soil.	Operator  Operator/ maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM, the Environmental Health Division and Environmental Management Division of the PKSDM.  Precautions are to be undertaken to the satisfaction of the PM, the Environmental Health Division and Environmental Management Division of the PKSDM.	
		<b>3 Odours (Maintenance)</b>	Irrigation (MF-3) Sediment Removal (MG-3) Road resurfacing (MJ-3) Sewage spill clean - up (ML-3)		Irrigation: Irrigation is to be undertaken in a controlled manner to ensure that no areas of stagnant water are created.		No stagnant water.	Operator/ maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM, the Environmental Health Division and Environmental Management Division of the PKSDM.	





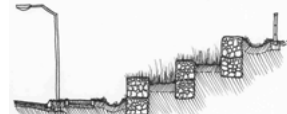
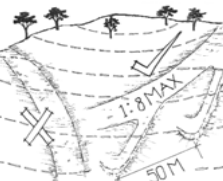




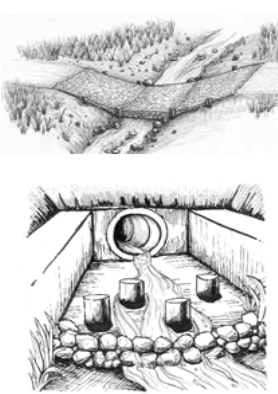



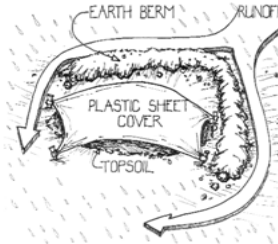


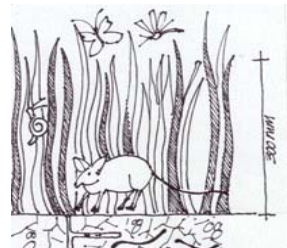


**PIXLEY KA SEME DISTRICT MUNICIPALITY - MUNICIPAL INFRASTRUCTURE GUIDELINES**  
**MUNICIPAL CIVIL INFRASTRUCTURE: EARTH IMPACTS - EMP MASTER**

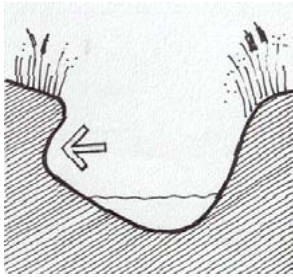
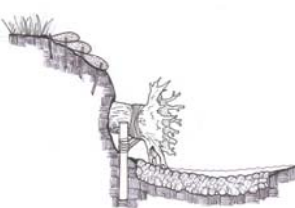


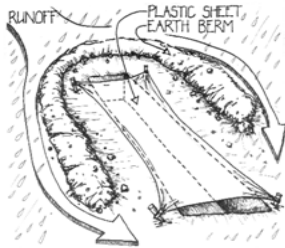



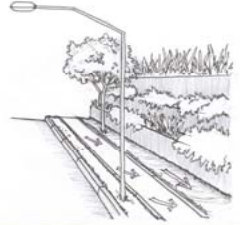





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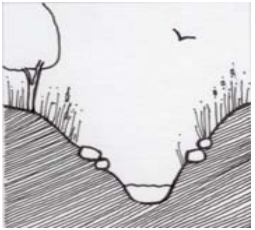
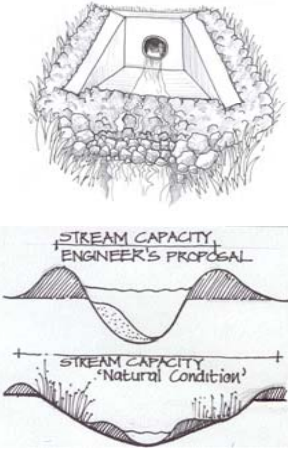





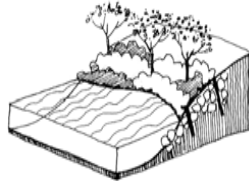

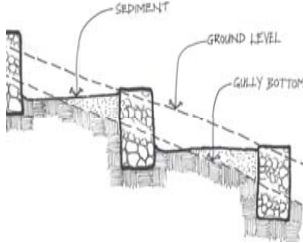
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		5 Erosion/ Topsoil Loss (Construction)	<p>Clearing of the building footprint area (CAc-5)</p> <p>Grading and construction of the access roads (CAAd-5; CDf-5; CCf-5; CDc-5)</p> <p>Excavation of trenches, foundations etc (CCa-5)</p> <p>Steep un stabilised slopes (CCb-5)</p> <p>Cut &amp; fill activities/ leveling (CDd-5)</p>	    	<p>Cut &amp; Fill: Cut slope gradients to not exceed the natural angle of repose for the particular soil type.</p> <p>In areas that are steep, measures are to be undertaken to limit erosion of the banks such as constructing a retaining wall.</p> <p>Roads: Gradients of road alignments to be minimal, aligning the road obliquely across contours and not perpendicularly.</p> <p>Where steep access roads are necessitated due to the general topography of the site, swales alongside the roads and cut-off drains with appropriate sand traps or sedimentation and infiltration areas are to be provided at appropriate intervals.</p>	      	<p>Cut and fill operations do not exceed the natural angle of repose of the particular soil. The embankments are sufficiently stabilised so as to prevent erosion.</p> <p>Steep roadside embankments do not erode.</p> <p>The road alignment is not perpendicular to the contours, but as oblique as possible.</p> <p>Drainage channels have been addressed sufficiently so as not to cause erosion.</p> <p>Steep access roads on site do not erode. Sediment accumulates in the desired locations and is effectively removed.</p>	<p>Contractor</p> <p>Contractor</p> <p>Contractor</p> <p>Contractor</p>		

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					<p>Crossing of drainage channels by site access roads and all permanent roads is to include culverts / pipes with energy dissipation / dispersion mechanisms integral to the design of the crossing.</p> <p>Stormwater: Storm water control during construction to be in terms of a submitted stormwater management plan submitted to PM for approval. Stormwater shall, where possible not be allowed to be concentrate and flow down cut or fill slopes or along pipeline routes without erosion protection measures in place.</p>		<p>Temporary drainage channels do not erode or degrade due to vehicles crossing over it.</p> <p>Storm water management plan has been drafted, is approved and being adhered to.</p>	<p>Contractor</p> <p>Contractor</p>		
					<p>Overflow channels shall be lined with stone pitching along the length and at the points of discharge.</p> <p>Stormwater channels shall not discharge straight down the contours but shall be aligned at such an angle to ensure that erosion does not take place.</p> <p>In the discharge area dense natural vegetation is to be planted where appropriate. Furthermore where appropriate all sections of the channel should be vegetated with indigenous, riverine vegetation.</p> <p>Excavations: Excavate, close, compact and rehabilitate trenches as soon as possible after the pipes have been installed. Avoid any open trenches for any extended period of time. If the excavation should be filled with water, this water is to be pumped from the trench in the appropriate manner and discharged in a responsible manner. Excavations and stored topsoil or other excavated material should be protected from heavy rain and runoff by means of cut-off berms and/ or sheet covering.</p>	  	<p>No erosion of channel or discharge point occurs.</p> <p>Storm water discharges oblique to contours in steep areas and do not erode laterally or overflow.</p> <p>Drainage channels remain vegetated with indigenous vegetation. Stormwater attenuation occurs through vegetation at discharge points.</p> <p>Trenches are not left open for extended periods of time. Trenches are properly back filled, compacted and revegetated. Stockpiled material for the purpose of backfilling trenches is properly protected against erosion from rain and runoff.</p>	<p>Contractor</p> <p>Contractor</p> <p>Contractor</p>		


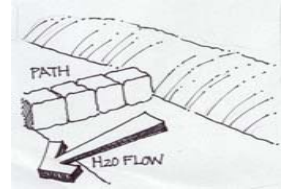
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					<p>General: Erosion caused by severe rain storms must be rehabilitated as soon as possible after the damage has occurred. Limit the extent of the vegetation removal on a site. Re-vegetate all exposed surfaces as soon as is practically possible with indigenous grasses, shrubs and trees (which ever is most appropriate). Water usage during construction is to be closely monitored, especially for leaking pipes, taps etc. Where roots can act as erosion protection, tress should be cut as close as possible to the ground level and the rootball retained.</p>		<p>Areas where erosion is taking place are being rehabilitated.</p> <p>No extensive areas of exposed soil. Revegetation is successful.</p> <p>Water usage on site is closely monitored i.e. no leaking pipes etc.</p> <p>Root ball retained where appropriate.</p>	Contractor		
		<b>5 Erosion/ Topsoil Loss (Operations)</b>	<p>Landfill sites (DEb-5)</p> <p>Powerlines servitudes (DFd-5)</p> <p>Reservoir sites (DDg-5)</p>		<p>All exposed areas are to be revegetated as soon as practicably possible. Areas where erosion is evident are to be repaired as soon as erosion problems are evident. All access roads are to be of such a nature that run-off will not cause erosion. Drainage channels are to be constructed in appropriate locations and kept unblocked. A storm water management plan is to be established for the site and approved bu the PKSDM.</p>		<p>Limited areas of exposed soils.</p> <p>Remediation and maintenance of areas affected by erosion.</p> <p>Access roads aligned in such a manner as not to contribute to erosion.</p> <p>Sufficient drains are installed and maintained as necessary.</p>	Operator/ maintenance personnel		
		<b>5 Erosion/ Topsoil loss (Maintenance)</b>	<p>Mowing (MA-5)</p> <p>Alien Vegetation clearing (MD-5)</p> <p>Irrigation (MF-5)</p> <p>Trenching associated with pipe repairs (MK-5)</p>		<p>Mowing: The blades of the mowers are to be set at the appropriate height to ensure that the grass is not cut too short.</p>		<p>No exposed soil resulting from vegetation being mowed too short.</p>	Contractor / maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
					<p>Alien vegetation clearing: A rehabilitation plan is to be established and approved by the Environmental Planning Section prior to the eradication of the alien vegetation. Extensive areas of exposed soil are to be avoided. The area where the alien vegetation has been removed is to be re-vegetated with the appropriate grass, shrub and tree species as soon as possible.</p>		<p>Approved rehabilitation plan.</p> <p>No extensive areas of exposed soil.</p> <p>Re-vegetation of area that has been cleared.</p>	Contractor / maintenance personnel		

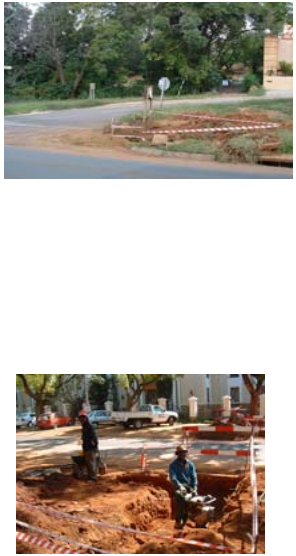
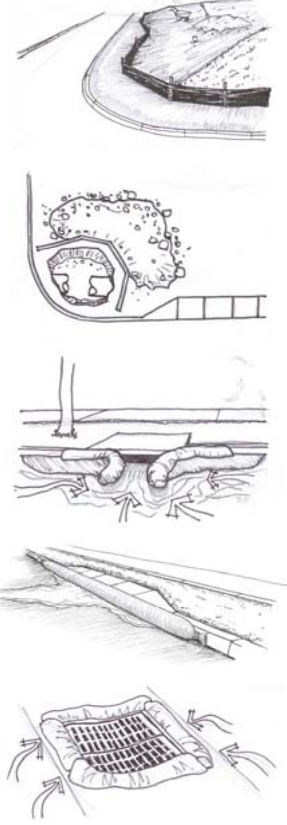
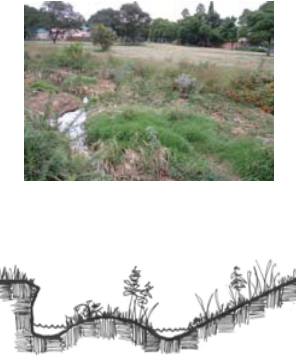
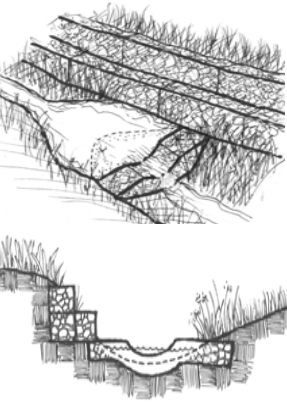
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					<p>Where the removal of alien vegetation within stream channels is causing or may potentially lead to soil erosion, The stumps and root balls of trees and larger shrubs should be left in-situ to act as soil stabilisation and treated for coppicing. Large root balls can also be used as energy dissipaters alongside steeper embankments. Additional soil stabilisation with earth-filled hessian bags containing a mix of indigenous pioneer grass species seeds, securely staked into the earth, can also be used.</p>		<p>Alien vegetation removal is not causing erosion of the stream bank. Retained root balls do not propagate or cause recurrence of alien plants.</p>	Contractor / maintenance personnel		
					<p>Trenches: All trenches are to be backfilled, compacted and re-vegetated as soon as possible after the pipes have been repaired.</p> <p>Topsoil is not to be used for the purposes of backfilling of any trenches or temporary excavations. Only subgrade or other excavated material as approved is to be used for the purpose of backfilling.</p>		<p>No sagging of areas where pipes have been repaired. No evidence of soil erosion where water has been pumped from the trenches. Topsoil is not being used for backfilling.</p>	Contractor / maintenance personnel Contractor		
					<p>Trenches that must be left open for extended periods of time, must be protected from surface runoff and rain by cut off berms and/ or sheet covering as approved by the PL. If the trenches should be filled with water, this water is to be pumped from the trench in the appropriate manner and discharged in a responsible manner.</p>		<p>No erosion of trenches or excessive ponding occurs.</p>	Contractor		
					<p>Irrigation points are not to be located in positions where they cause excessive runoff along steep embankments, especially where such slopes are being vegetated and do not yet have sufficient vegetation cover to prevent soil erosion.</p>		<p>Irrigation activities are not causing erosion.</p>	Contractor / maintenance personnel		
		<b>5 Erosion/ Topsoil loss (Design)</b>	<p>Cut/ fill slopes (DAa-5)</p> <p>Roadside planting (DAb-5)</p> <p>Roadside edges (DAC-5)</p> <p>Outlets (DBb-5)</p> <p>Drainage channels (DBh-5)</p> <p>Any structures with large foot-prints</p>		<p>All cut and fill slopes adjacent to roads are to be properly stabilised and where possible vegetated, as soon after construction has been completed as possible. Where steep slopes are required, plant species with strong root systems which will anchor the soil are to be used.</p>		<p>Speed of run-off is controlled in an appropriate manner so as not to result in erosion downstream of the the inlet / outlet.</p> <p>Appropriate road alignment.</p> <p>Appropriate footprints for the extent of the proposed development.</p> <p>Erosion control is addressed in the tender document.</p>	Engineers	<p>Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.</p>	


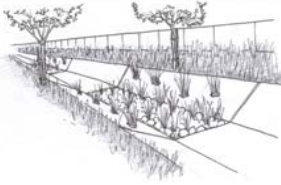
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					<p>Where embankments alongside roads have to be steep, measures are to be undertaken to limit erosion of the banks, such as constructing a retaining wall. These structures are to be planted where possible.</p>		<p>Steep embankments do not erode or collapse.</p>	Engineers		
					<p>In instances where the construction of retaining walls are not necessary, plantable concrete blocks should be used to stabilise slopes. These should be planted with indigenous veld grass species where appropriate or otherwise with indigenous lawn species.</p>		<p>Embankments do not erode.</p>	Engineers		
					<p>Roadside edges are to be so designed that they do not canalise water unnecessarily. Where steeper gradients occur, roadside edges must be designed and constructed so as to prevent erosion. Energy dissipation/ dispersion mechanisms are to be provided at all outflow points or where roadside edges end.</p> <p>Where roads are required along steep slopes, roadside edges must be protected from erosion by means of drainage channels with appropriately designed energy dissipating devices. Outlet points must be protected against erosion by means of energy dissipating structures and proper surface treatment.</p>		<p>Roadside edges do not erode and accumulated sediment is removed effectively.</p>	Engineers		
					<p>Crossing of drainage channels to include culverts/pipes with energy dissipation/dispersion mechanisms integral to the design of the crossing.</p>		<p>Drainage channel crossings cause the minimum possible disturbance to runoff. Erosion is prevented at outlets.</p>	Engineers		
					<p>Roads are to be aligned in such a manner as to avoid crossing the contours at acute angles, the road should cross contours as obliquely as possible.</p> <p>The footprint for any proposed development is to be kept to a minimum to limit the extent of exposed soil that could result in erosion.</p> <p>Erosion control is to be included in the tender documentation.</p>		<p>Road alignment does not unnecessarily cause increased runoff rates. Erosion is avoided.</p> <p>Minimal erosion of soil due to the extent of the building footprint.</p>	Engineers Engineers Contractor		

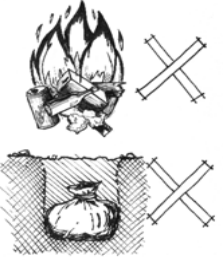

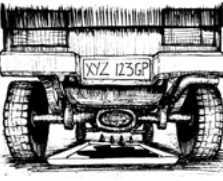

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				 	<p>Ensure that the edges surrounding the stormwater structure are detailed in the appropriate manner to ensure that erosion does not take place e.g. floor, embankments etc.</p> <p>Where feasible stream channels should be re-shaped to have as natural a profile as possible. A shallower profile is less likely to erode and greatly reduces the channeling effect caused by a narrow, deeper profile, decreasing the risk of flooding. The sectional volume of the channel should be calculated by a hydrological engineer.</p>		<p>Erosion does not occur around storm water outlet structures.</p> <p>Shallower stream channel profiles are maintained where possible, reducing runoff rates.</p>	<p>Engineers</p> <p>Engineers</p>	<p>Hydrological engineer design to ensure that flooding or erosion of stream channel does not occur.</p>	
				   	<p>Where stormwater channels are being eroded due to heavy runoff and/ or steep embankments, appropriate mitigation measures such as gabion reinforcing should be installed.</p> <p>In areas where stream channels are being eroded due to a loss of vegetation, slope stabilisation and re-vegetation should be done. Soil-filled hessian bags containing a mix of indigenous pioneer grass species seeds, securely staked into the earth, can be used. Where appropriate, riverine tree species should also be planted.</p> <p>In instances where large volumes of water must be accommodated stream channels should, where appropriate, be properly stabilised and protected from erosion by means of plantable concrete unit pavers or gabion mattresses.</p> <p>Where appropriate, severe gully erosion must be rehabilitated through the introduction of successive gabion sedimentation devices, to create a terraced longitudinal stream profile. These structures must however not restrict the flow of runoff or reduce the stream capacity. Accumulated sediment must be used in the rehabilitation of the stream channel. The design of these devices must be undertaken by a hydrological engineer.</p>	   	<p>Erosion of storm water channel is halted and successful mitigation occurs.</p> <p>Erosion of storm water channel is halted and successful mitigation occurs.</p> <p>Erosion of storm water channel does not occur and stabilisation structures remain intact in heavy runoff conditions.</p> <p>Erosion of storm water channel is halted. Stabilisation structures remain intact in heavy runoff conditions. Sediment can be easily and effectively removed and is applied during rehabilitation.</p>	<p>Engineer / Contractor</p> <p>Contractor</p> <p>Engineer</p> <p>Engineer / contractor</p>		





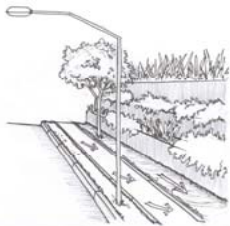
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		<b>6 Significant Sedimentation (Construction)</b>	Access roads (CAAd-6; CBf-6; CCf-6; CDc-6)  Sedimentation as a result of erosion e.g. building footprints, vegetation loss		Ensure that a stormwater management plan is adhered to.  Prevent extensive areas of exposed soil. Where soil is exposed, ensure that it is revegetated as soon as possible.  Where soil will be stockpiled for more than one season, the stockpile is to be located in an appropriate place, vegetated and haybales placed along the perimeter of the stockpile.  To reduce sedimentation of water courses or streets adjacent to the site place hay bales or earth-filled sand bags at the lowest point to trap the sediment.		Approved Stormwater management plan & compliance thereto.  Limited areas of exposed soil.  Successful re-vegetation.  Hay bales or sand-filled bags placed at the lowest point, sediments regularly removed.	Contractor          Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		<b>6 Significant Sedimentation (Operations)</b>	Sedimentation as a result of erosion e.g. building footprints, vegetation loss		Prevent extensive areas of exposed soil in the vicinity of the stormwater management structures.  Where soil is exposed in the vicinity of the exposed stormwater management structures, ensure that it is revegetated as soon as possible.		Limited areas of exposed soil.  Successful re-vegetation.	Maintenance Personnel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		<b>6 Significant Sedimentation (Maintenance)</b>	Sedimentation as a result of erosion caused by maintenance activities e.g.  Alien vegetation clearance (MD-6)  Resurfacing of roads (MJ-6)  Trenching and pipe repairs (MK-6)		Prevent extensive areas of exposed soil in the vicinity of the stormwater management structures. Where soil is exposed in the vicinity of the exposed stormwater management structures, ensure that it is revegetated as soon as possible.  The maintenance of stormwater structures, particularly with regard to sediment removal is to be undertaken at regular intervals to prevent blockage.  Where resurfacing of roads is taking place, install hay bales at the lowest point to trap the sediments.		Limited areas of exposed soil.  Successful re-vegetation.  Stormwater infrastructure is free of significant sediment that would obstruct the effective functioning of the structure.  Hay bales are in place.	Maintenance Personnel    Maintenance Personnel  Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

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					<p>Where significant sedimentation and washing away of soil may occur during trenching and pipe repairs, sufficient measures are to be taken to retain soil deposits as close to the point of origin as possible.</p> <p>Storm water inlets situated near maintenance sites that may lead to sedimentation, are to be protected from sediment blockage by sand filled bags placed alongside the inlets. Accumulated sediment should be regularly removed.</p>		<p>Sediment does not enter inlet structures or exposed pipes during maintenance/ repairs operations.</p> <p>Sediment does not enter inlet structures or exposed pipes during maintenance/ repairs or construction operations.</p>	<p>Contractor / maintenance personnel</p> <p>Contractor / maintenance personnel</p>		
		<b>6 Significant Sedimentation (Design)</b>	<p>Design aspects relating to:</p> <ul style="list-style-type: none"> <li>Cut &amp; fill (DAa-6)</li> <li>Inlets (Dba-6)</li> <li>Outlets (DBb-6)</li> <li>Detention Structures (DBc-6)</li> <li>Retention structures (DBd-6)</li> <li>Artificial Wetlands (DBf-6)</li> <li>Stream channels (DBh-6)</li> </ul>		<p>Ensure that all stormwater structures that may be influenced by sedimentation are designed in such a manner as to accommodate the settling of sediments and easy access for sedimentation removal activities.</p>		<p>Stormwater structures that remain free of significant sediment that would obstruct the effective functioning of the structure.</p> <p>Specifications are in place and activities scheduled by the maintenance personnel.</p> <p>The hydrological functioning of the structure is approved.</p>	<p>Engineers</p>	<p>Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.</p>	
					<p>Where heavy sedimentation continuously occurs in a stream channel, sedimentation devices should be created in the channel, at intervals as determined by a hydrological engineer. These should be provided with a spillway or overflow that allows continuous runoff past the structure, but retaining sediment behind it. Accumulated sediment should be used for stream rehabilitation purposes, unless it is heavily polluted or laden with weed/ alien plant seeds.</p>		<p>Obstruction of stream channels due to accumulated sediment is prevented. Sediment can effectively and easily be removed.</p>	<p>Contractor</p>		

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					<p>The maintenance specifications for these structures are to be written and communicated to the personnel responsible for maintenance.</p> <p>The proposed stormwater structures are to be approved by a hydrological engineer.</p>		<p>Maintenance specifications are understood and adhered to.</p>	<p>Maintenance Personnel</p> <p>Engineer</p>		
		<b>7 Soil Compaction/ Impermeability (Construction)</b>	<p>Compaction of the areas where the following temporary functions are situated:</p> <p>Temporary buildings (CAc-7)</p> <p>Materials and building rubble storage areas (CBa-7; CBc-7)</p> <p>Access roads (CAAd-7; CBf-7; CCf-7; CDc-7)</p>		<p>Areas that have been compacted are to be ripped and scarified to a depth of 300mm. Remove all rubble such as concrete slabs, bricks, etc. and dispose thereof appropriately.</p> <p>The prepared area is to be re-vegetated with indigenous grasses, trees, or shrubs (which ever is most appropriate)</p>		<p>Successful revegetation of the compacted area.</p>	Contractor	<p>Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.</p>	
		<b>7 Soil Compaction/ Impermeability (Operations)</b>								
		<b>7 Soil compaction/ Impermeability (Maintenance)</b>	<p>Compaction of the areas such as maintenance camps, temporary access roads to maintenance areas e.g.</p> <p>Alien vegetation removal (MD-7)</p> <p>Sediment removal (MG-7)</p> <p>Road resurfacing (MJ-7)</p> <p>Trenching and pipe repairs (MK-7)</p>		<p>Areas that have been compacted are to be ripped and scarified to a depth of 300mm. Remove all rubble such as concrete slabs, bricks, etc. and dispose thereof appropriately.</p> <p>The prepared area is to be re-vegetated with indigenous grasses, trees, or shrubs (which ever is most appropriate)</p>		<p>Successful revegetation of the compacted area.</p>	Maintenance personel	<p>Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.</p>	
		<b>7 Soil Compaction/ Impermeability (Design)</b>	<p>Design aspects of:</p> <p>Roadside edges (DAc-7)</p> <p>Stormwater channel design (DAh-7)</p>		<p>Limit the areas that will be compacted by the construction activities.</p> <p>Locate the areas that will be compacted in an appropriate place, i.e. not at the lowest section of the site where revegetation may be problematic.</p> <p>Ensure that the tender document addresses the requirements for the remediation of compacted areas.</p> <p>Where feasible and appropriate, sections of existing concrete drainage channels should be replaced with gabion mattresses or plantable concrete blocks. This should only be done where slopes are gentle and the design of these structures should be carried out by a hydrological engineer.</p>		<p>Limited compaction areas.</p> <p>Logical location for areas that will be compacted.</p> <p>Soil compaction addressed in tender documentation.</p> <p>Where feasible the impermeability of existing concrete storm water channels is reduced. These areas do not deteriorate or erode from heavy runoff.</p>	<p>Engineer</p> <p>Engineer</p>	<p>Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.</p>	

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		<b>8 Soil Contamination (Construction)</b>	<p>Cleaning, sanitation &amp; worker activity (CAb-8)</p> <p>Storage of:</p> <p>Chemicals and fuels (CBb-8)</p> <p>Wastes and refuse (CBd-8)</p> <p>Plant &amp; equipment (CBe-8)</p>		<p>Refuse collection and removal: Dustbins and proper refuse area must be designated in the construction camp. NO containers or refuse storage areas will be permitted on other areas of the construction site. Refuse is not to be buried or burnt on site.</p> <p>Chemical storage: All chemical storage i.e. paint, solvents, fuel etc. is to be stored in a lockable area, on a concrete slab with a 500mm bund wall. The structure is to have a roof. Where applicable the appropriate authorisations from DTEC are to be obtained.</p> <p>Spillages: Spillages are to be reported to the environmental officer on site or to the foreman, the appropriate clean up is to take place and be approved by the environmental officer. The resulting contaminated soil / absorbtion material is to be disposed of in the appropriate manner.</p> <p>Vehicle &amp; plant maintenance: No vehicle or plant maintainace is to take place on site. All vehciles and equipment that have oil leaks are to be reported to the environmental officer on site and repaired as a matter of urgency. If the project requires such repairs on site, a designated area is to be established and managed accordingly. Drip trays must be placed under each contruccion vehcile when it is not in operation at all times.</p>	  	<p>Absence of waste stockpiling on site.</p> <p>Storage of chemical is undertaken in the appropriate manner. Authorisation has been granted by DTEC.</p> <p>Record of spillages and the remediation is kept.</p> <p>No repairs to vehicles and plant is evident on site or only taking place in designated areas. Soil contamination does not occur from unavoidable repairs on site.</p>	<p>Contractor</p> <p>Contractor</p> <p>Contractor</p> <p>Contractor</p>	<p>Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.</p>	
		<b>8 Soil Contamination (Operations)</b>	<p>Could result from negligence or operational problems, at the following:</p> <p>Waste water treatment site (DCb-8)</p> <p>Basic sanitation provision (DCc-8)</p> <p>Storage dumps/ landfill sites (DEb-8)</p>		<p>Chemical storage: All chemical storage i.e. paint, solvents, fuel etc. is to be stored in a lockable area, on a concrete slab with a 500mm bund wall. The structure is to have a roof. Where applicable the appropriate authorisations from DTEC are to be obtained.</p> <p>Spillages: Spillages are to be reported to the environmental officer on site or to the foreman, the appropriate clean up is to take place and be approved by the environmental officer. The resulting contaminated soil / absorbtion material is to be disposed of in the appropriate manner.</p>		<p>Storage of chemical is undertaken in the appropriate manner. Authrisation has been obtained from DTEC.</p> <p>Record of spillages and the remediation is kept.</p>	<p>Contractor</p> <p>Contractor</p>	<p>Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.</p>	

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					Vehicle and plant maintenance: No vehicle or plant maintenance is to take place on site. All vehicles and equipment that have oil leaks are to be reported to the environmental officer on site and repaired as a matter of urgency. If the project requires such repairs on site, a designated area is to be established and managed accordingly. Drip trays are to be placed under all vehicles and plant when not in operation.		No repairs to vehicles and plant is evident on site or only taking place in designated areas. Soil contamination does not occur from unavoidable repairs on site.	Contractor		
		<b>8 Soil Contamination (Maintenance)</b>	Could result from the following activities:  Mowing (MA-8)  Alien vegetation clearing (MD-8)  Sediment removal (MG-8)  Road resurfacing (MJ-8)  Trenching (MK-8)  Sewage spill clean-up (ML-8)		Refueling of vehicles and plant: Where the refueling of the vehicles and plant is to take place on site, the appropriate measures are to be taken to reduce soil contamination. Fuel tanks and refueling areas are to be on a concrete slab, with a 500mm bund wall or cut-off drain which prevents spillage from contaminating the surrounding soil.  Chemical storage: All chemical storage i.e. paint, solvents, fuel etc. is to be stored in a lockable area, on a concrete slab with a 500mm bund wall. The structure is to have a roof. Where applicable the appropriate authorisations from DTEC are to be obtained.  Spillages: Spillages are to be reported to the environmental officer on site or to the foreman, the appropriate clean up is to take place and be approved by the environmental officer. The resulting contaminated soil / absorption material is to be disposed of in the appropriate manner.  Vehicle and plant maintenance: No vehicle or plant maintenance is to take place on site. All vehicles and equipment that have oil leaks are to be reported to the environmental officer on site and repaired as a matter of urgency. If the project requires such repairs on site, a designated area is to be established and managed accordingly. Drip trays must be placed under each construction vehicle when it is not in operation.		Refueling on site is being addressed in the appropriate manner.  Storage of chemical is undertaken in the appropriate manner. Authorisation has been obtained from DTEC.  Record of spillages and the remediation is kept.  No repairs to vehicles and plant is evident on site or only taking place in designated areas.	Contractor  Contractor  Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

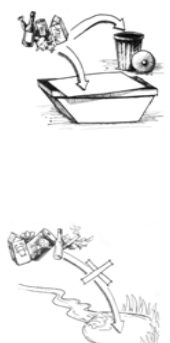
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		<b>8 Soil Contamination (Design)</b>	Landfill sites (DEb-8)		Ensure that the appropriate structures are accommodated on site to mitigate the contamination of soil by chemicals.  Ensure that the requirements for the prevention of soil contamination are included in the tender documents.  Ensure that the landfill sites have the correct classification and that the appropriate liners, as required by DWAf are in place.		Soil pollution is addressed in the design and planning stage of the project.	Engineers	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		<b>9 Slope Collapse (Construction)</b>	Insufficient support of excavations (CCb-9)  This aspect may lead to significant sedimentation, refer to relevant section.		Ensure that excavations are sufficiently supported at all times.		No soil collapse on the construction site.	Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		<b>9 Slope Collapse (Operations)</b>								
		<b>9 Slope Collapse (Maintenance)</b>	Maintenance of retaining structures (MI-9)		Ensure that the integrity of the retaining structures is not undermined by erosion. This includes: * ensuring positive, controlled drainage behind retaining walls * ensuring that fill behind the retaining walls remains in place.		Retaining structures do not fail.		Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		<b>9 Slope Collapse (Design)</b>	Cut and fill slopes along roads (DAa-9)  Storm water inlets (DBa-9)  Storm water outlets (DBb-9)  Detention structures (DBc-9)  Retention Structures (DBd-9)  Channels (DBh-9)  Storage dumps/ landfill sites (DEb-9)		Ensure that the retaining structures that are designed are appropriate for the function that is to be fulfilled.  Where embankments alongside roads have to be steep, measures are to be undertaken to prevent collapse of the embankments, such as constructing a retaining wall. These structures are to be designed by an engineer and planted where possible.		Approved building plans.  No collapse of embankments along steep sections of road,	Engineer	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	




**PIXLEY KA SEME DISTRICT MUNICIPALITY - MUNICIPAL INFRASTRUCTURE GUIDELINES**  
**MUNICIPAL CIVIL INFRASTRUCTURE: SURFACE WATER IMPACTS - EMP MASTER**



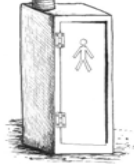

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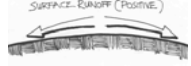
RELEVANT LEGISLATION/ STANDARDS	REFERENCE DRAWING/ SHEET NO.	SPECIFIC IMPACTS	POSSIBLE CAUSE	IMPACT PHOTO / DRAWING EXAMPLE	MITIGATION MEASURE	MITIGATION PHOTO / DRAWING EXAMPLE	PERFORMANCE INDICATOR/ VERIFICATION	RESPONSIBILITY	NOTES/ GENERAL	SIGN. + DATE
		<b>10 Surface Water Physical Pollution (Construction)</b>	Cleaning, sanitation & worker activity (CAb-10) Storage or dumping of building rubble (CBc-10) Storage of general refuse (CBd-10) Refuse/ rubble removal from site (CDb-10)		All litter and building rubble is to be collected, stored in a central place within the construction camp and disposed of in the appropriate manner.  Waste collection is to be undertaken on a regular basis, all weigh bills are to be filed.  Litter and refuse are not to be dumped in or stored near any watercourses or water bodies and preventative measures are to be taken to ensure that refuse does not wash out of designated storage areas during heavy rains.		Litter and rubble free site.  Weigh bills of the waste disposed should be available on request.	Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		<b>10 Surface Water Physical Pollution (Operations)</b>			All sites that are operational should ensure that no litter is present on site. Any litter is to be collected, stored and disposed of in the appropriate manner.		Litter free site.	Operator	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		<b>10 Surface Water Physical Pollution (Maintenance)</b>	Following activities may result in pollution: Mowing (MA-10) Pruning (MB-10) Weeding (MC-10) Sediment removal (MG-10) Refuse removal (MH-10)		Litter and waste removal: All litter and building rubble is to be collected, stored in a central place and disposed of in the appropriate manner.  Waste collection is to be undertaken on a regular basis, all weigh bills are to be filed.  Sediment removal: The material that is to be removed is to be removed and transported in such a manner that it does not pollute the surrounding surface water.  The detailed EMP for this activity is to be adhered to.  Organic waste removal: All plant cuttings and remains are to be taken to a registered garden refuse drop off point and compost made from the material.		Litter and rubble free site.  Weigh bills of the waste disposed should be available on request.  No pollution of surface water resources in the vicinity of the sediment removal activities.  Compost for use by PKSDM.	Maintenance personnel  Contractor  Maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.  Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.  Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	



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		10 Surface Water Physical Pollution (Design)	Following infrastructure requires physical pollution control: Roadside edges (DAc-10) Inlets (DBa-10) Outlets (DBb-10) Detention & retention structures (DBc-10, DBd-10) Channels (DBh-10) Landfill sites (DEb-10)		Where required & appropriate litter traps are to be incorporated in the design of certain stormwater management infrastructure.  Mitigation measures relating to surface water pollution are to be incorporated in the tender documents.		Reduced litter in surface water resources.	Engineer	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		11 Surface Water Sewage Pollution (Construction)	Sanitation and worker activity at the construction camp (CAb-11)		Shower or washing facilities, when provided, must be linked to the existing sewer system or the runoff must be drained to a soak-away system as approved by the ECO or project manager.		Positive drainage of all amenities.	Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		11 Surface Water Sewage Pollution (Operations)	Sewage treatment works (DCb-11) Basic sanitation provision (DCc-11)		Any spillages that may occur in the sewage treatment works are to be cleaned up in the appropriate manner. The site supervisor is to be notified as soon as a problem has arisen.  All monitoring as stated in the EMP and DWAF water use license are to be adhered to.		Incident & accident reporting of the event as well as the action taken.  Monitoring results are to be made available on request.	Operator	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		11 Surface Water Sewage Pollution (Maintenance)								
		11 Surface Water Sewage Pollution (Design)	Sewage treatment works (DCb-11) Basic sanitation provision (DCc-11)		Ensure that the operation of the facility is taken into account in the design process and the precautionary principle taken for the design of sewage treatment works.  Ensure that the facility has sufficient capacity and does not operate beyond its capacity.		Design that addresses environmental impacts holistically.	Engineer	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

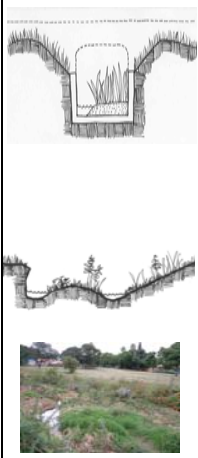
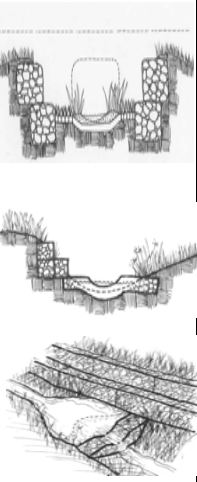



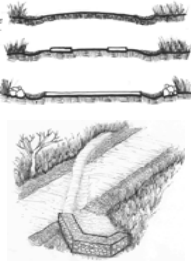



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					Provision should be made in the design of additional infrastructure or new treatment plants, for the mitigation of potential spills. This could include a concrete slab around aeration dams with a cut off drain, or emergency overflow. These systems should release excess sewage into the dry beds. However said measures should only be for emergency use, until the capacity of the treatment works has been sufficiently increased.			Engineer		
		12 Surface Water Biological Pollution (Construction)	Cleaning, sanitation and general worker activity at the construction camp (CAB-12)		Ensure that no raw sewage enters any water resources. VIP latrines should be provided in the construction camp. Pit latrines and soakaways should only be used if the geo-hydrological assessment indicates that it is acceptable to do so. Said structures should be located outside any flood lines or as indicated by a specialist.  Only ablution facilities provided in the construction camp may be used for this purpose. Non-compliance or using the rest of the site as latrine must be fined.	 	Monitoring the water quality data. No pollution of water due to worker activities.  No human waste or unauthorised abluion on site.	Contractor  Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		12 Surface Water Biological Pollution (Operations)	Sewage Treatment works (CCb-12)		Ensure that no raw sewage enters any water resources.		Monitoring the water quality data.	Operator	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		12 Surface Water Biological Pollution (Maintenance)								
		12 Surface Water Biological Pollution (Design)	Sewage Treatment works (CCb-12)		Ensure that the operation of the facility is taken into account in the design process and the precautionary principle taken for the design of sewage treatment works.  Ensure that the facility has sufficient capacity and does not operate beyond its capacity.		Design that addresses environmental impacts holistically.	Engineer	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	


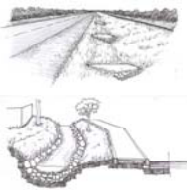
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		13 Surface Water Chemical Pollution (Construction)	Fuel storage (CBb-13) Mixing of materials (CDa-13)		Mixing of materials: Run-off produced by aggregate washing, concrete mixing and curing should be regulated by erosion control measures.  All mixing of materials should take place at a suitable distance from the any water resources.  Concrete mixing shall only take place within the designated areas on site.  Refueling: Where the refueling of the vehicles and plant is to take place on site, the appropriate measures are to be taken to reduce the potential of surface water contamination. Fuel tanks and refueling areas are to be on a concrete slab, with a 500mm bund wall or cut-off drain which prevents spillage from contaminating the surrounding soil.  Chemical storage: All chemical storage i.e. paint, solvents, fuel etc. is to be stored in a lockable area, on a concrete slab with a 500mm bund wall. The structure is to have a roof. Where applicable the appropriate authorisations from DTEC are to be obtained.	    	No evidence of run-off into the surrounding water courses.  Mixing takes place at a reasonable distance from water courses.  Designated areas for concrete mixing.  Refueling on site is being addressed in the appropriate manner.  Storage of chemical is undertaken in the appropriate manner. Authorisation has been obtained from DTEC.	Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
					Chemical spillages: Spillages are to be reported to the environmental officer on site or to the foreman, the appropriate clean up is to take place and be approved by the environmental officer.		Record of spillages and the remediation is kept.			
		13 Surface Water Chemical Pollution (Operations)	Waste water treatment works (DCb-13) Chemical & Fuel storage		Refueling: Where the refueling of the vehicles and plant is to take place on site, the appropriate measures are to be taken to reduce the potential of surface water contamination.  Chemical storage: All chemical storage i.e. paint, solvents, fuel etc. is to be stored in a lockable area, on a concrete slab with a 500mm bund wall. The structure is to have a roof. Where applicable the appropriate authorisations from DTEC are to be obtained.  Chemical spillages: Spillages are to be reported to the environmental officer on site or to the foreman, the appropriate clean up is to take place and be approved by the environmental officer.		Refueling on site is being addressed in the appropriate manner.  Storage of chemical is undertaken in the appropriate manner. Authorisation has been obtained from DTEC.  Record of spillages and the remediation is kept.	Operator	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

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		13 Surface Water Chemical Pollution (Maintenance)	Treating of weeds with pesticides (MC-13) Chemical treatment of alien invader plant species (MD-13) Careless litter and refuse removal (MH-13) Road resurfacing (MJ-13)		Refueling: Where the refueling of the vehicles and plant is to take place on site, the appropriate measures are to be taken to reduce the potential of surface water contamination.  In areas where refuse is removed, the operator is to ensure that all the refuse is collected. Where spillage of refuse has occurred, it is to be collected and disposed of accordingly.  Chemical spillages: Spillages are to be reported to the environmental officer on site or to the foreman, the appropriate clean up is to take place and be approved by the environmental officer.		Refueling on site is being addressed in the appropriate manner.  No sign of spillage or litter pollution.  Record of spillages and the remediation is kept.	Maintenance personnel  Maintenance personnel  Maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.  Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
					Ensure that the requirements for the prevention of soil contamination are included in the tender documents.  Ensure that the landfill sites have the correct classification and that the appropriate liners, as required by DWAF are in place.		Soil pollution is addressed in the design and planning stage of the project.	Engineer	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
					Access roads: Ensure that the roads are slightly above the natural ground level to ensure positive drainage.  Along temporary roads, water drainage channels are to be constructed in the appropriate manner to prevent erosion.  Backfilling: All excavated areas are to be backfilled in layers of 150mm and compacted prior to the placement of the next layer.  Positive drainage on site: All levels on the site are to be in accordance with the design drawings. Ponding is to be prevented by ensuring positive drainage in all areas of the site.		Access roads above natural ground level.  Appropriate drainage channels along temporary roads.  No sagging / settling of compacted areas occurs.  No ponding is evident on site.	Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

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		14 Drainage Problems (Operations)			<p>Positive drainage on site: All levels on the site are to be such that positive drainage can take place. Ponding is to be prevented by ensuring positive drainage in all areas of the site.</p> <p>Stormwater management: All inlets, outlets, detention and retention structures are to be maintained in such a manner that the flow of water is not obstructed in any manner to ensure effective functioning of the structure. The material that is removed from these structures is to be disposed of in the appropriate manner.</p>		<p>No ponding is evident on site.</p> <p>No indications of stormwater ponding or causing flooding of any areas. Free-flowing inlets outlets and pipes.</p>	Operator	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		14 Drainage Problems (Maintenance)	<p>Poor irrigation practice which leads to ponding (MF-14)</p> <p>Trenching/ pipe repairs (MK-14)</p>		<p>Irrigation points/ sprinklers should be so positioned that they do not cause runoff to accumulate in low-lying areas; and positive site leveling should be ensured to prevent ponding from occurring. Irrigation programs and timing should be based on the requirements of the landscape planting design and unnecessary irrigation is to be avoided.</p>		No ponding due to excessive or inappropriate irrigation practices evident on site.	Contractor/ Maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
					<p>Stormwater management: All inlets, outlets, detention and retention structures are to be maintained in such a manner that the flow of water is not obstructed in any manner to ensure effective functioning of the structure. The material that is removed from these structures is to be disposed of in the appropriate manner.</p>		No indications of stormwater ponding or causing flooding of any areas.			
		14 Drainage Problems (Design)	<p>Stormwater considerations relating to the design of the following:</p> <p>Roadside edges (DAc-14)</p> <p>Inlets (DBa-14)</p> <p>Outlets (DBb-14)</p> <p>Detention structures (DBc-14)</p> <p>Retention structures (DBd-14)</p> <p>Artificial wetlands (DBf-14)</p> <p>Pipes (DBg-14)</p> <p>Channels (DBh-14)</p>		<p>Positive drainage on site: All levels on the site are to be such that positive drainage can take place. Ponding is to be prevented by ensuring positive drainage in all areas of the site.</p> <p>General: Ensure that the aspects of drainage are adequately addressed in the tender document as well as how drainage problems are to be resolved.</p>		Resolved levels prior to construction commencing.	Engineer	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

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					<p>Stormwater management: All inlets, outlets, detention and retention structures are to be maintained in such a manner that the flow of water is not obstructed in any manner to ensure effective functioning of the structure. The design is to accommodate easy access and cleaning of these structures and not cause excessive sedimentation or collection of debris.</p>		Effectively functioning stormwater structures.			
		15 Anaerobic Conditions (Construction)								
		15 Anaerobic Conditions (Operations)	Waste water treatment works (DCb-15)		Should anaerobic conditions arise, a specialist is to be consulted.		Specialist consulted and condition resolved.		Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		15 Anaerobic Conditions (Maintenance)	Detention & retention structures - 14 sediment removal (MG-15)		Should anaerobic conditions arise, a specialist is to be consulted.		Specialist consulted and condition resolved.		Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		15 Anaerobic Conditions (Design)	Detention & retention structures, artificial wetlands (DBc-15; DBd-15; DBf-15)		Designs should ensure that anaerobic conditions will not operate in the plants unless so intended.		Specialist consulted and condition resolved.		Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

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		<b>16 Increased Runoff Rate (Construction)</b>	Access roads with steep slopes which increases the speed of run-off (CAD-16; CBH-16; CCI-26; CDc-16)  Levels on site which do not adequately direct storm water runoff or are to steep (CDd-16)		Where increased run-off is evident on the site, measures are to be taken to reduce the speed of run-off. This can be accomplished by placing gravel or establishing cut-off mounds that drain the water to a designated area where the speed of flow is retarded as the water flows over the grassed areas. Sheetflow from the site is to be directed into the stormwater structures that are to be established on site.		No erosion, as a result of increased runoff rate visible on site.	Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		<b>16 Increased Runoff Rate (Operations)</b>	All sites		Where increased run-off is evident on the site, measures are to be taken to reduce the speed of run-off. This can be accomplished by placing gravel or establishing cut-off mounds that drain the water to a designated area where the speed of flow is retarded as the water flows over the grassed areas.		No erosion, as a result of increased runoff rate visible on site.	Operator	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		<b>16 Increased Runoff Rate (Maintenance)</b>	Steep slopes increase the speed of runoff  Compacted Areas arising from road resurfacing (MU-16) and any other maintenance requiring heavy vehicles		Where increased run-off is evident on the site, measures are to be taken to reduce the speed of run-off. This can be accomplished by placing gravel or establishing cut-off mounds that drain the water to a designated area where the speed of flow is retarded as the water flows over the grassed areas.		No erosion, as a result of increased runoff rate visible on site.	Maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		<b>16 Increased Runoff Rate (Design)</b>	Design aspects relating to:  Roadside edges (DAC-16)  Channels (DBh-16)	  	Slopes along roads, and channel embankments are not to exceed a 1:3 gradient. Where this is not feasible such embankments shall be stabilised with plantable concrete blocks, gabions or retention walls, as appropriate.		No erosion taking place on site due to the establishment of structures that assist in the reduction of stormwater flow.	Engineer	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

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					<p>Where feasible, vegetated swales are to be used to channel stormwater run-off alongside roads. Alternatively packed stone is to be used, where runoff rates will allow it.</p> <p>Retention and detention structures can be designed into the stormwater management plan of the site.</p>					




**PIXLEY KA SEME DISTRICT MUNICIPALITY - MUNICIPAL INFRASTRUCTURE GUIDELINES**  
**MUNICIPAL CIVIL INFRASTRUCTURE: GROUND WATER IMPACTS - EMP MASTER**



Date: 2007-12-14	Project No: A1289	Consultant: African EPA	Client: PKSMD
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		17 Ground Water Biological Pollution (Construction)								
		17 Ground Water Biological Pollution (Operations)	Waste water collection (DCa-17) Waste water treatment (DCb-17) Basic sanitation provision (DCC-17) Landfill sites (DEb-17)		Should such a condition arise, a specialist is to be consulted.		Specialist consulted and condition resolved.	Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSMD.	
		17 Ground Water Biological Pollution (Maintenance)	Negligent or insufficient sewage spill cleanup (ML-17)		Should such a condition arise, a specialist is to be consulted.		Specialist consulted and condition resolved.	Maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSMD.	
		17 Ground Water Biological Pollution (Design)	Waste water collection (DCa-17) Waste water treatment (DCb-17) Basic sanitation provision (DCC-17) Landfill sites (DEb-17)		Designs should ensure that biological pollution of the ground water is prevented.		Specialist appointed to verify designs.	Engineer	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSMD.	
		18 Ground Water Chemical Pollution (Construction)	On site storage of chemicals and fuels (CBb-18)		Should such a condition arise, a specialist is to be consulted.		Incident report which states cause of the spill as well as how the situation was remediated.	Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSMD.	
		18 Ground Water Chemical Pollution (Operations)	Waste water treatment works (DCb-18) Negligent or inappropriate operational procedures at landfill sites and storage dumps (DEb-18)		Should such a condition arise, a specialist is to be consulted.		Specialist consulted and condition resolved.	Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSMD.	



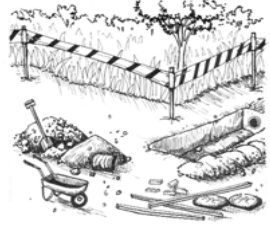

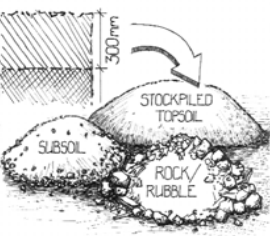


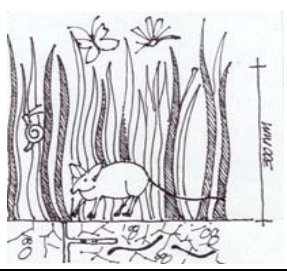
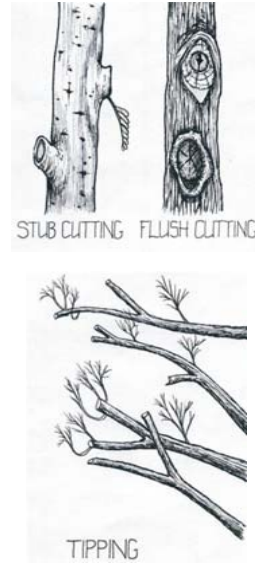
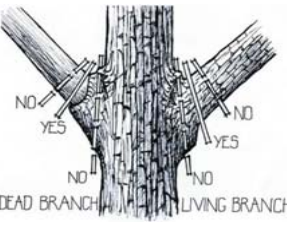
		<b>18 Ground Water Chemical Pollution (Maintenance)</b>	<p>Treating of weeds with pesticides (MC-18)</p> <p>Chemical treatment of alien invader plant species (MD-18)</p> <p>Careless litter and refuse removal (MH-18)</p> <p>Road resurfacing (MJ-18)</p>		Should such a condition arise, a specialist is to be consulted.		Specialist consulted and condition resolved.	Maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		<b>18 Ground Water Chemical Pollution (Design)</b>	<p>Waste water treatment works (DCb-18)</p> <p>Insufficient landfill sites and storage dumps design (DEb-18)</p>		Designs should ensure that chemical pollution of the ground water is prevented.		Specialist appointed to verify designs.	Engineer	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	






**PIXLEY KA SEME DISTRICT MUNICIPALITY - MUNICIPAL INFRASTRUCTURE GUIDELINES**  
**MUNICIPAL CIVIL INFRASTRUCTURE: FAUNA AND FLORA IMPACTS - EMP MASTER**

Date: 2007-12-14	Project No: A1289	Consultant: African EPA	Client: PKSDM
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		<b>19 Habitat &amp; vegetation loss (Construction)</b>	<p>Cooking areas and fires (CAa-19)</p> <p>Cleaning, sanitation worker activities on site (CAb-19)</p> <p>Temporary and permanent buildings on site (CAc-19)</p> <p>Access Roads (CAAd-19; CBF-19; CCf-19; CDc-19)</p>		<p>Access &amp; construction roads must be established in areas that are already disturbed, e.g. where alien vegetation has been removed, tracks exist etc.</p> <p>Loss of habitat and vegetation as a result of the construction activities is to be minimised as far as possible.</p> <p>Trees that have been identified by a suitably qualified person are to be retained as best possible during the construction phase.</p> <p>Areas where vegetation loss has occurred as a result of construction activities are to be rehabilitated as per the site specific EMP.</p> <p>Topsoil is to be stripped in such a manner that the seed bank is contained therein (first 300mm of soil). This topsoil is to be stockpiled separately and utilized specifically for rehabilitation purposes.</p> <p>The site specific EMP is to be adhered to.</p>	   	<p>Access roads and other infrastructure located in disturbed areas.</p> <p>Few areas of habitat and vegetation loss.</p> <p>Marked trees on site that are protected e.g. fenced).</p> <p>Areas being rehabilitated successfully.</p> <p>Topsoil (first 300mm) separately stockpiled.</p> <p>Site specific EMP being adhered to.</p>	<p>Contractor</p> <p>Contractor</p> <p>Contractor</p>	<p>Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.</p>	
		<b>19 Habitat &amp; vegetation loss (Operations)</b>			<p>Rehabilitated areas are to be maintained and where rehabilitation is not successful are to be reinstated.</p> <p>The site specific EMP is to be adhered to.</p>			Contractor	<p>Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.</p>	

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		<b>19 Habitat &amp; vegetation loss (Maintenance)</b>	Careless or inappropriate mowing (MA-19)  Careless or inappropriate pruning (MB-19)  Alien vegetation clearance (MD-19)		No vegetation is to be removed arbitrarily unless it is interfering with the operation of the facility. Weeds and alien invader vegetation should be removed in all instances.  The blades of the mowers are to be set at the appropriate height to ensure that the grass is not cut too short.		Retained habitats on site.	Operator/ Maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
					When pruning trees and larger shrubs, care should be taken to avoid stub-and flush cutting, or merely "tipping" (removing the ends of branches) as these practices may lead to distressed or diseased vegetation, which may eventually die.		No damage to plants from pruning activities	Operator/ Maintenance personnel		
		<b>19 Habitat &amp; vegetation Loss (Design)</b>	Positioning and specific design of the following facilities and infrastructure could lead to habitat and vegetation loss:  Cut and fill slopes along roads (DAa-19)  Stormwater inlets and outlets (DBa-19; DBb-19)  Waste water treatment facilities (DCb-19)  Water purification works (DDe-19)  Reservoir sites (DDg-19)  Landfill and dumping sites (DEb-19)  Powerlines servitudes (DFb-19)		No vegetation is to be removed arbitrarily unless it is interfering with the operation of the facility. Weeds and alien invader vegetation should be removed in all instances and these areas rehabilitated with indigenous vegetation.  Where possible buildings, facilities and structures should be located to avoid the loss of areas of indigenous vegetation.		Retained habitats on site.	Maintenance Personnel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

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			Loss of potential habitat areas arising from the extensive use of exotic, water-consuming plant species (DAb-19)		Where possible roadside planting should be indigenous species that require limited irrigation.		Roadside planting offers habitat and is a source of food to bird species.	Contractor		
		<b>20 Habitat Fragmentation (Construction)</b>	Positioning of access roads on site (CAAd-20; CBf-21; CCf-20; CDc-20)		Construction activities are to avoid breaking up clumps of vegetation for access purposes. Construction vehicles are to move around these clumps.		No fragmentation of habitats unless unavoidable.	Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		<b>20 Habitat Fragmentation (Operations)</b>	Operational actions at the following facilities and structures: Waste water treatment facilities (DCb-20) Water purification works (DDe-20) Reservoir sites (DDg-20) Landfill and dumping sites (DEb-20) Powerlines servitudes (DFb-20)		The activities associated with the operation of the plant should avoid breaking up clumps of vegetation for access purposes. Alternative routes are to be used.  Only the minimum amount of vegetation around facilities must be removed to maintain safety and operational requirements and allow maintenance personnel access to facilities.		No fragmentation of habitats unless unavoidable.	operator/ maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		<b>20 Habitat Fragmentation (Maintenance)</b>								
		<b>20 Habitat Fragmentation (Design)</b>	Design and positioning of the following facilities and structures: Waste water treatment facilities (DCb-20) Water purification works (DDe-20) Reservoir sites (DDg-20) Landfill and dumping sites (DEb-20) Powerlines servitudes (DFb-20)		Layout of the proposed development is to take cognizance of habitats.  The recommendations stated in the ecological report, undertaken as part of the EIA are to be incorporated in the design process.		Ecologically sensitive design.	Engineer	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

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		<b>21 Habitat Degradation/ Disturbance (Construction)</b>	Inappropriate location of access roads could lead to environmental degradation or disturbance - including weed growth and alien invader plant species proliferation (CAAd-20; CBf-21; CCf-21; CDc-21)		Access & construction roads must be established in areas that are already disturbed, e.g. where alien vegetation has been removed, tracks exist etc.  The site specific EMP is to be adhered to in this regard.		No sign of disturbed areas on site.  Compliance with EMP	Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		<b>21 Habitat Degradation/ Disturbance (Operations)</b>	Operational actions at the following facilities and structures:  Waste water treatment facilities (DCb-21)  Bulk water lines (DDc-21)  Water purification works (DDe-21)  Reservoir sites (DDg-21)  Landfill and dumping sites (DEb-21)  Powerlines servitudes (DFb-21)		Cognizance is to be taken of ecologically important areas. Where possible operational movement around plant and facilities is to be limited, to avoid disturbance of remaining habitat areas.  The site specific EMP is to be adhered to in this regard.		No sign of disturbed areas on site.  Compliance with EMP	Operator	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		<b>21 Habitat Degradation/ Disturbance (Maintenance)</b>	Carelessness during weeding/ alien plant clearance activities (MC-21; MC-22)  Inadequate re-planting of embankments, slopes or rehabilitated areas (ME-21)  Sediment removal (MG-21)  Embankment structural maintenance (MI-21)  Road resurfacing (MJ-21)  Trenching/ pipe repairs (MK-21)		Cognizance is to be taken of ecologically important areas.  Weeds and alien invader plant species removed from any area should be disposed off at a garden refuse site or as specified in the EMP. Care must be taken to prevent propagative material from getting into watercourses or ecologically sensitive areas during weeding/ alien vegetation clearance.  Adequate measures should be taken during site rehabilitation activities, to prevent the spread of weeds or possible alien invader plant species. Stored topsoil should be used for this purpose and continued weeding must be done during the initial establishment of the planted vegetation, as required.  The site specific EMP is to be adhered to in this regard.		No sign of disturbed areas on site.  Compliance with EMP	Maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

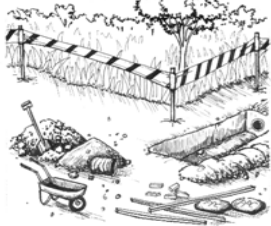





**PIXLEY KA SEME DISTRICT MUNICIPALITY - MUNICIPAL INFRASTRUCTURE GUIDELINES**  
**MUNICIPAL CIVIL INFRASTRUCTURE: OTHER IMPACTS - EMP MASTER**

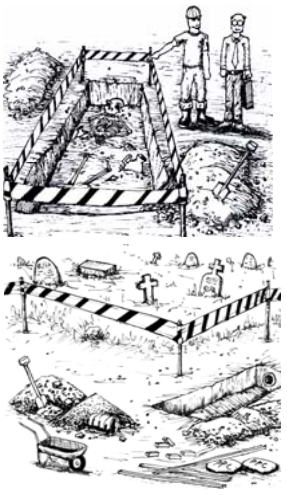
Date: 2007-12-14	Project No: A1289	Consultant: African EPA	Client: PKSDM
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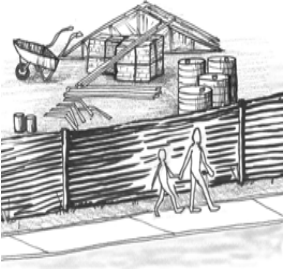


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		23 Other impacts - Sensitive areas (construction)			Sensitive areas are to be fenced and include an appropriate buffer zone.  Ensure that no building activity takes place in the demarcated sensitive areas.  Measures stated in the site specific EMP are adhered to.		Fenced sensitive areas.  No building activities in sensitive areas.  Compliance with site specific EMP	Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		23 Other impacts - Sensitive areas (operation)			Ensure that no activities associated with the operation of the facility are taking place in the sensitive areas.  Measures stated in the site specific EMP are to be adhered to.		No sign of operation activities taking place in sensitive areas.  Compliance with site specific EMP	Operator	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		23 Other impacts - Sensitive areas (maintenance)			Ensure that no activities associated with the maintenance of the facility are taking place in the sensitive areas.  Measures stated in the site specific EMP are to be adhered to.		No sign of inappropriate maintenance activities taking place in sensitive areas.  Compliance with site specific EMP	Maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		23 Other impacts - Sensitive areas (design)			Ensure that all building footprints are outside any sensitive areas e.g. ridges, flood plains etc.  Ensure that mitigation measures are proposed in the EMP for the environmental management of these areas.		No buildings in sensitive areas.  Management of sensitive areas included in EMP.	Engineer	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

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		23 Other impacts - Topsoil management (construction)			<p>The contractor is to strip topsoil from the relevant areas as identified and stockpile the material prior to the commencement of the construction activities. Topsoil should be stored separately from other excavated material and building rubble.</p> <p>Topsoil stockpiles are not to exceed 1.5m in height, and placed in locations that will not interfere with building activities. Topsoil is only to be handled twice - once to strip and stockpile and secondly to replace where required.</p> <p>Topsoil should be stockpiled in the appropriate manner to prevent erosion and compaction of the stockpiled soil.</p> <p>If the stockpile is remain on site for more than one season it is to be vegetated.</p>		<p>Stockpile of topsoil in the agreed position.</p> <p>Stockpiles are not higher than 1.5m.</p> <p>Stockpiles have hay bales on the perimeter and are not situated in drainage channels.</p> <p>Vegetated stockpile (if required).</p>	Contractor	<p>Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.</p>	
		23 Other impacts - Topsoil management (operation)			<p>Conditions stipulated in the site specific EMP are to be adhered to.</p> <p>Stockpile should be vegetated, and vegetation maintained.</p>		<p>Compliance with site specific EMP.</p> <p>No erosion of stockpile evident.</p>	Operator	<p>Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.</p>	
		23 Other impacts - Topsoil management (maintenance)			<p>Conditions stipulated in the site specific EMP are to be adhered to.</p> <p>Stockpile should be vegetated, and vegetation maintained.</p>		<p>Compliance with site specific EMP.</p> <p>No erosion of stockpile evident.</p>	Maintenance personnel	<p>Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.</p>	
		23 Other impacts - Topsoil management (design)			<p>Areas that are to be stripped of topsoil for the building and infrastructure is to be limited.</p> <p>Ensure that the aspect of topsoil management is addressed in the EMP.</p>		<p>Limited areas requiring topsoil stripping.</p> <p>Inclusion of topsoil management in EMP.</p>	Engineers	<p>Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.</p>	
		23 Other impacts - Alien vegetation (Construction)			<p>Eradication of alien invasives is to be supervised by persons that have a fundamental knowledge of such activities.</p> <p>In the event of alien invasives being eradicated using chemicals, the manufacturers application specifications area to be adhered to.</p> <p>Clearing of alien vegetation is to be undertaken by using best practice principles or as stated in the site specific EMP.</p>			Contractor	<p>Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.</p>	



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		23 Other impacts - Alien vegetation (operation)			Undertake follow up treatment of the areas that were cleared during the construction phase as required.  Adhere to the measures stated in the site specific EMP.		Alien vegetation free site.  Compliance with EMP.	Operator	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		23 Other impacts - Alien vegetation (maintenance)			Undertake follow up treatment of the areas that were cleared during the construction phase as required.  Adhere to the measures stated in the site specific EMP.		Alien vegetation free site.  Compliance with EMP.	Maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		23 Other impacts - Alien vegetation (design)			When designing new facilities or infrastructure, ensure that a programme is developed for the removal of alien vegetation.  Try to locate building or infrastructure footprints in these disturbed areas.		Management of alien vegetation from the outset of project.  Building and infrastructure footprints in disturbed areas.	Engineer, project manager	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		23 Other impacts - Protection of cultural & historical features (construction)			Cultural and Historic features are to be fenced. An appropriate buffer is to be established within the fence line.  If any other archaeological findings are made during the excavation process e.g. graves, artefacts etc. the project leader and SAHRA is to be notified immediately.  All measures stated in the site specific EMP are to be adhered to.		Fenced historical and cultural features.  Notification to and from SAHRA if artefacts etc. are found.  Compliance with EMP.	Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		23 Other impacts - Protection of cultural & historical features (operation)			Follow the measures stipulated in the EMP.		Adherence to the EMP.	Operator	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		23 Other impacts - Protection of cultural & historical features (maintenance)			Follow the measures stipulated in the EMP.		Adherence to the EMP.	Maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		23 Other impacts - Protection of cultural & historical features (design)			Identify all cultural and historical features.  Determine the importance of these features by consulting SAHRA.  Undertake the necessary action to include these features in the design of the new facility or infrastructure.		Plan indicating the position (where possible) of historical / cultural features  Correspondence from SAHRA.  Design that takes cognizance of the features.	Engineer	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

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		23 Other impacts - Visual Impact of proposed development (construction)			All materials are to be stored in such a manner and location that it does not cause a visual impact. Construction rubble is to be removed from site on a regular basis. Areas that are disturbed are to be rehabilitated in the appropriate manner.		Neat site.  No stockpiling of rubble.  Successful rehabilitation of disturbed areas.	Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		23 Other impacts - Visual Impact of proposed development (operation)			Should an operation be expanded, the structures are to be constructed with materials that are similar in nature to the existing infrastructure.		No unsightly additions.	Operator	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		23 Other impacts - Visual Impact of proposed development (maintenance)			All maintenance activities are to take cognizance of the original aesthetic of the structure and use the same material where possible.		No unsightly maintenance.	Maintenance personnel.	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		23 Other impacts - Visual Impact of proposed development (design)			Height restrictions and no-building zones may have been identified in the EIA process, these are to be adhered to.				Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		23 Other impacts - Development on Dolomitic Areas (construction)			Trenches and excavation works should be opened and closed as rapidly as possible. All trenches and excavation works must be properly backfilled and compacted. Once services/cables are installed and backfilling is completed, it must be ensured that ground surface is graded to match the slope of the surrounding area. No rocks should be placed in the top layer.  Berms should be constructed on the up-slope side of trenches to prevent the inflow of water during storms.  The fall of trenches shall be away from buildings.  No ponding of surface water is to be permitted over, in or in the vicinity of trenches and excavations.  Preparation of the site must ensure adequate sloping to facilitate drainage of storm water. The slope must be according to the recommendations of the engineer.  Water leakage detection must be done after the installation of services. All wet services pipes must be water tight and pressure tested for leakages.		No ponding of surface runoff water occurs in trenches. Final levels after construction is complete match the surrounding natural ground levels.  Inflow of storm water into trenches during storms is averted.  No ponding occurs where such ponding may be detrimental due to the presence of trenches.  Positive drainage away from undesired locations occurs.  Regular leak detection is done, which prevents the occurrence of leaks.		General compliance with NHBC Standard is required. Furthermore precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

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		23 Other impacts - Development on Dolomitic Areas (operation)			<p>Water leakage detection must be done after the installation of services. Furthermore water leakage testing should be conducted at least every two years.</p> <p>No ponding of surface water is to be permitted over, in or in the vicinity of wet service servitudes or pipes.</p> <p>Owners or operation personnel should be informed where services traverse so that accidental puncturing of pipes does not occur.</p>		<p>Regular leak detection is done, which prevents the occurrence of leaks.</p> <p>No ponding occurs where such ponding may be detrimental due to the presence of trenches.</p> <p>Accidental damage to pipes does not occur.</p>		<p>General compliance with NHBRC Standard is required. Furthermore precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.</p>	
		23 Other impacts - Development on Dolomitic Areas (maintenance)			<p>Water leakage detection must be done after the installation of services. Furthermore water leakage testing should be conducted at least every two years.</p> <p>No ponding of surface water is to be permitted over, in or in the vicinity of wet service servitudes or pipes.</p> <p>Owners or operation personnel should be informed where services traverse so that accidental puncturing of pipes does not occur.</p>		<p>Regular leak detection is done, which prevents the occurrence of leaks.</p> <p>No ponding occurs where such ponding may be detrimental due to the presence of trenches.</p> <p>Accidental damage to pipes does not occur.</p>		<p>General compliance with NHBRC Standard is required. Furthermore precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.</p>	
		23 Other impacts - Development on Dolomitic Areas (design)			<p>Brick and precast concrete walls must be so designed as to provide drainage ports at ground level permitting passage of maximum probable volumes of water.</p> <p>The free flow of surface water should be ensured where the layout of the design may cause runoff to be trapped in low-lying areas. A lined canal should permit passage of water into a drain or onto a lawn some distance away from structures.</p> <p>Piping materials selected should be appropriate to local subsurface conditions. Clay pipes are not recommended. Some soils may have low pH values which will render the use of ferrous material for underground services unsuitable. In such instances High impact PVC or other flexible pipes as required shall be used.</p> <p>Pipes should be flexible where possible, while joints should be minimised. Differential movement must also be accommodated without causing the pipes to break.</p>		<p>The maximum volumes of surface runoff is allowed to pass concrete precast and brick walls.</p> <p>Adequate positive drainage occurs on the entire site.</p> <p>Clay pipes are not used unless specifically required. Deterioration or corrosion of pipes does not occur due to inappropriate material or pipe selection.</p> <p>Pipes do not break, crack or leak due to insufficient differential movement.</p>		<p>General compliance with NHBRC Standard is required. Furthermore precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.</p> <p>Chapter II in "A Technical Guide to Good House Construction" NBRI of the CSIR (July 1984) should be consulted in areas where soils with low pH values are encountered. General compliance with NHBRC Standard is required. Furthermore precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.</p>	

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					<p>Water reticulation to buildings should be kept at a minimum depth of 500mm up to the structure. As many services as possible should also be accommodated in the same trench.</p> <p>Encasement of pipes in concrete or soilcrete should be avoided. Preferably place pipes in sleeves. If this cannot be achieved, care must be taken to ensure that differential movement can still be accommodated without the pipe breaking.</p> <p>Placement of wet services below the footprint of structures must be avoided. No plumbing and drainage pipes should be placed under floor slabs. Wherever practical, service trenches shall not be excavated along the length of structures or buildings within the first 3m beyond the perimeter of such units.</p> <p>Rodding eyes or similar access to the sewer connection should be provided in addition to the inspection eye/s.</p> <p>The roots of trees planted in close proximity to the line of water-bearing services often cause leaks in or malfunctioning of the services. Care should therefore be taken to avoid the unfortunate positioning of trees and other plants.</p> <p>No trees should be planted within 1.5 times their mature height from the line of storm water services.</p> <p>No accumulation of surface water is to be permitted and the entire development must be properly drained. Surface run-off must not be allowed to pond on the up-slope side of the development. A minimum gradient of 1:150 should be maintained along storm water systems.</p> <p>All ponds and water courses should be rendered impervious.</p> <p>The storm water drainage shall incorporate measures to ensure water tightness of conduits. Whenever possible, storm water should be channeled in lined, surface canals.</p> <p>Where relevant all street levels are to be sufficiently lower than the stand or facilities to ensure easy drainage to storm water management systems.</p>		<p>The amount of trenches for service provision is minimised.</p> <p>Where possible pipes are not placed in concrete or soilcrete and in all instances adequate differential movement is accommodated.</p> <p>Wet services are not placed below building footprints and disturbance or damage for servicing and repair purposes is kept to a minimum.</p> <p>Sufficient access for inspection and maintenance of sewerage and wet systems is provided.</p> <p>Tree roots do not cause damage to services or trenches.</p> <p>Tree roots do not cause damage to services or trenches.</p> <p>Effective drainage of the site is achieved.</p> <p>No erosion or infiltration along watercourses or ponds occurs.</p> <p>Effective drainage from the site to the street and storm water management system occurs.</p>			