1. Introduction

The Department of Environmental Affairs and Tourism (DEAT), the Northern Cape Department of Tourism, Environment & Conservation (NCDTEC) and the Siyanda District Municipality (SDM) decided to jointly establish an Environmental Management Framework (EMF) for the Siyanda District municipal area to ensure that future development in the area occurs in a manner that is appropriate to the unique features and character of the area.

Environomics, leading a multi disciplinary team, was appointed to undertake the compilation of the EMF.

1.1 The purpose of the EMF

The purpose of the project is to develop an EMF that will integrate municipal and provincial decision-making and align different government mandates in a way that will put the area on a sustainable development path. The specific objectives of the EMF include:

- The provision of strategic guidance in the EMF area.
- Assisting in the identification of “identified geographical areas” in terms of NEMA.
- Assisting in the identification of “specified activities” within “identified geographical areas” in terms of NEMA.
- The provision of a decision support system in respect to environmental attributes, issues and priorities in the EMF area.

1.2 The project team

The project team consists of:

- Environomics
- Mosakong Management; and
- MetroGIS.

1.3 Location

The Siyanda District covers an area of 102,661.349km² in the Northern Cape Province. The location of the district in relation to the rest of the provinces in South Africa is indicated on Map1: Locality.
Abbreviated Status Quo and Desired State

The contents of this section have been abbreviated out of the Status Quo Report. For more detailed information please consult the Status Quo and Desired State Reports.

2.1 Physical environment

The description of the physical environment is divided into the following parts, which are discussed below:

- Geology and topography;
- soils;
- surface hydrology;
- groundwater; and
- climate

2.1.1 Geology and topography

The Siyanda District lies on the great African plateau which was uplifted during the great Mesozoic and Tertiary earth movements. This plateau forms the largest part of the ancient continent of Gondwanaland which formally included eastern Brazil, southern India, Western Australia and Antarctica. In each of these fragments the general foundation is the same with an ancient surface of old rocks which together form the “fundamental complex” of the ancient land-mass. Over time this surface was covered by sedimentary beds\(^1\) in a freshwater inland lake and by means of wind blown sand.

(a) The physical geography of the Siyanda District

The Siyanda district falls within four physical geographical regions namely:

- The Kalahari;
- Bushmanland;
- the Griqua fold belt; and
- the Ghaap Plateau.

The regions are depicted on Map 2: Physical Geographical Regions.

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\(^1\) Sedimentary beds refer to beds that formed from eroded material that weathered from existing surfaces that are deposited in a different place as a result of movement by water or wind (aeolian).
Map 2

Physical Geography
After JL Visser 1985 & JH Wellington 1985

Rivers
- Perennial
- Non-perennial
- Siyanda District Municipality

Major Roads
- Main road
- National road
- Secondary road

Physical Geography
1 - Kalahari
2 - Bushmenland
3 - Griqua Fold Belt
4 - Ghaap Plateau
The Kalahari basin stretches northwards from just north of the Orange River into Botswana and Namibia. It is a flat, sand covered, semi-desert area, on average between 900m to 1200m above sea-level. It is characterised by a number of large pans to the north of Upington, by dry river beds (such as the Kuruman, Nossob and Molopo Rivers) and by dunes which strike north-west to south-east. The region is underlain by Karoo rocks and rocks belonging to the tertiary Kalahari Group. Outcrops are rare.

Bushmanland is an arid, level sub-region of the Cape Middleveld to the east of the Namaqua Highlands. It is underlain by granitic Precambrian rocks on the western and northern sides and by Karoo rocks towards the south-east. It is characterised by numerous large pans and “vloers” and is on average between 900m to 1200m above sea-level.

The Griqua Fold Belt is a highveld sub-region that lies in a roughly triangular shape to the west of the Ghaap Plateau, to the south of the Kalahari Basin and to the east of Bushmanland. It includes the scenic Langberg/Korana Mountains. The low Gamagara ridge between Postmasburg and Sishen is economically important because of the rich iron and manganese deposits it contains.

A small portion of the south western corner of the Ghaap plateau occurs in the Siyanda District. The Ghaap plateau is a higher lying, pre-Karoo surface with its main physiographic element being the surface of dolomite that gives the form to the plateau. The plateau is separated from the Postmasburg plain by the Langeberg-Koranna ranges which are made up out of Matsap quartzites that forms the boundary of the Kalahari to the west. The Ghaap plateau is a roughly triangular limestone area. There are strong limestone springs on the western side of the plateau that surfaces as “eyes” in places.

(b) The terrain morphological classification

The terrain morphological classification (after G.P. Kruger, 1983 – but refined for Siyanda using an up to date relief model) is depicted in Map 3: Terrain Morphology. It gives a classification of the landforms that occur in Siyanda, irrespective of origin or geology. The details of the terrain morphology are provided in Table 1: Terrain Morphology.
Map 3
Terrain Morphology
After GP Kruger 1983

SIYANDA DISTRICT MUNICIPAL AREA
Table 1: Terrain Morphology

<table>
<thead>
<tr>
<th>Description</th>
<th>Area covered (km²)</th>
<th>% of Siyanda</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dune hills (parallel crests) and lowlands</td>
<td>47,142.467</td>
<td>45.935%</td>
</tr>
<tr>
<td>Extremely irregular plains</td>
<td>6,733.192</td>
<td>6.560%</td>
</tr>
<tr>
<td>Hills</td>
<td>5,849.351</td>
<td>5.699%</td>
</tr>
<tr>
<td>Hills and lowlands</td>
<td>2,304.084</td>
<td>2.245%</td>
</tr>
<tr>
<td>Low mountains</td>
<td>2,283.488</td>
<td>2.225%</td>
</tr>
<tr>
<td>Lowlands with hills</td>
<td>3,904.496</td>
<td>3.804%</td>
</tr>
<tr>
<td>Plains</td>
<td>16,126.101</td>
<td>15.713%</td>
</tr>
<tr>
<td>Plains and pans</td>
<td>2,481.322</td>
<td>2.417%</td>
</tr>
<tr>
<td>Slightly irregular plains</td>
<td>8,313.467</td>
<td>8.100%</td>
</tr>
<tr>
<td>Slightly irregular plains and pans</td>
<td>7,489.695</td>
<td>7.297%</td>
</tr>
</tbody>
</table>

(c) The surface geology

The surface geology of the area is displayed on Map 4: General Surface Geology, as a generalisation of the geology that occur in the area as well as on Map 5: Geology, which depicts the geology as it occurs on the 1:1,000,000 Geological Map of the Republic of South Africa and the Kingdoms of Lesotho and Swaziland, 1997.

A description of the Geology on Map 5 is contained in Table 2 of the Status Quo Report.

Kalahari landscapes
Map 4
General Surface Geology
After JL Visser 1989

SIYANDA DISTRICT MUNICIPAL AREA
Map 5
Geology
Source: Council for Geoscience
(d) **Mineral deposits and mining**

The Siyanda District is rich in minerals which has historically been the mainstay of the area’s economy. Minerals that occur, or used to occur, in the area are listed in Table 3: Minerals of the Siyanda District in the Status Quo Report.

The general locations of significant mineral deposit areas in Siyanda are depicted on Map 6: General Occurrence of Minerals. A more detailed information layer that indicates mines, minded-out areas and unexploited deposits will also be included in the EMF’s GIS.

Iron and manganese mining has in the past been an important activity in the economy of the area. Haematite deposits in the form of ferruginized banded ironstone occur as a cake or capping to the Gamagara Hills which lies between Postmasburg and Sishen. The ore is very pure and typically consist of 95% ferric oxide.

*Iron ore mining in the Langberg and a salt pan in the Kalahari*

The Department of Minerals and Energy (DME) must undertake and monitor diligence regarding the rehabilitation of mines and the Environmental Monitoring Progress Reports should be reviewed. Mine dumps should be rehabilitated and strict fines and penalties should be given if not adhered to.
(e) Opportunities

The varied landscape of the Siyanda District provides a unique and special character to the area that has the potential to contribute to a variety of local and international tourism opportunities, especially if scenic routes are developed that take these landscapes into account.

There are significant undeveloped mineral resources left in the area that can contribute to future economic growth in the area depending on the future viability of exploiting the minerals.

(f) Constraints

Large areas of un-rehabilitated or poorly rehabilitated mining activities (current and closed) have a significant negative effect on the scenic environment in the district, especially in the mountainous areas.

(g) Issues

The following are issues that need to be addressed in the EMF:

- The need to rehabilitate old mines properly; and
- the use of the landscape as a positively contributing asset in tourism related activities.

(h) Desired state

The following are the desired actions relating to the geology of the area:

- Mines need to be rehabilitated to the extent that their negative impact on the visual environment does not affect the tourism potential of the area negatively; and
- the landscape should be used as a positively contributing asset in tourism related activities, especially in the planning of tourism routes and destinations.

2.1.2 Soils

(a) Description

The following types of soils occur in Siyanda:
- Red, massive or weakly structured soils with high base status (association of well drained Lixisols, Cambisols, Luvisols);
- Red, yellow and greyish excessively drained sandy soils (Arenosols). These soils are also very prone to wind erosion;
- Rock with limited soils (association of Leptosols, Regosols, Durisols, Calsisols and Plinthosols);
- Soils with marked clay accumulation (association of Luvisols, Planosols and Solonetz. In addition one or more of Plinthosols, Vertisols and Cambisols may be present);
- Soils with minimal development, usually shallow on hard or weathering rock, with or without intermittent diverse soils (association of Leptosols, Regosols, Calsisols and Durisols. In addition one or more of Cambisols and Luvisols may be present);
- Soils with negligible to weak profile development usually occurring on recent flood plains (association of Fluvisols, Cambisols, Luvisols and Gleysols); and
- Strongly saline soils (association of Solonchacks and Arenosols).

The occurrence of the soils is depicted on Map 7: Soils. The soils in the district are not suitable for dry land crop production and the only area where agriculture is feasible is along the parts of the Orange River that can be irrigated.

Due to the sandy nature of much of the soil, a large part of the Syanda is susceptible to wind erosion if the natural vegetation cover is disturbed. Pure sands (material with 95% or more with a particle size of 0.05-2.00mm) are susceptible to being transported and re-deposited by strong winds whenever insufficiently protected by plant cover or windbreaks. Shifting sands tend to damage herbaceous, low-growing vegetation types and generate more shifting sands, starting a vicious circle.
Other general characteristics of soils in Siyanda include:

- Most of the soils drain perfectly;
- beneficial water retaining characteristics are scarce to absent;
- soils with structure favouring arable land use are scarce to absent;
- pH levels of soils vary between 7.5 and 8.4;
- very low cation exchange capacity occur in soils of between <3 to 6.0;
- the leaching status of soils is Eutrophic; and
- soil salination may be a problem in certain irrigated areas.

(b) Opportunities

In itself the soils of the Siyanda District has very little to no opportunities for productive use. Where soils can be irrigated along the Orange River, the land is suitable for a variety of crops.

(c) Constraints

There are extensive areas in the Kalahari where the sandy soils are of such a nature that it is prone to wind erosion if the vegetative cover is damaged. The two most significant impacting activities are overgrazing that has the potential to destroy the vegetation cover of vast areas and off-road recreational driving that has the potential to cause localised damage to the vegetative ground cover that can result in blowouts.

Dunes in general, but especially the Kgalagadi dunes, are heavily impacted on by the overexploitation of the off-road vehicle industry. These dunes need to be protected through better and stricter access and security control measures.

In places excessive irrigation, especially micro spray irrigation, causes leaching of soils that permeate to lower lying irrigation areas and accumulate as salts that destroy the continued potential of such lower lying areas (most often in the flood plain of the Orange River).

(d) Issues

The following are issues that need to be addressed in the EMF:
• The potential destabilisation of areas with a high susceptibility for erosion through the following activities:
  o Overgrazing;
  o 4x4 leisure activities; and
  o the creation of new irrigated fields in sandy areas.

• Excessive irrigation in places that causes excessive salination of soil.

(e) Desired state

The following are the desired actions relating to the soils of the area:

• The prevention of overgrazing by limiting further expansions in stock farming and tight controls over game farming/keeping;

• the control and restriction of 4X4 leisure activities to areas that are not sensitive to disturbance; and

• the control of irrigation activities to prevent excessive salination of soil.

2.1.3 Surface hydrology

(a) Description

The tertiary catchments of the area are depicted on Map 8: Tertiary Catchments and a broad image of the drainage patterns is given on Map 9: Hydrology. Detail of the Orange River is indicated on Maps 14-1 to 14-14 of this report (the delineation of features in the river is being further refined and will be indicated in the Status Quo Report).

The EMF area falls within the Lower Orange Water Management Area (LOWMA). The LOWMA’s natural environment is generally characterised by its arid climate with minimal rainfall and drought conditions, with occasional severe flooding. The evaporation (including evapotranspiration) is as high as 3000mm per annum, which is generally more than the Mean Annual Rainfall (MAR). As a result, little usable surface runoff is generated over most of the area as a result of the extremely low and infrequent rainfall.

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2 MS Basson and JD Rossow. Report number PMWA 14/000/00/0203, Lower Orange Water Management Area: Overview of water resources availability and utilization. Department of Water Affairs and Forestry (DWAF), South Africa, September 2003.
The surface hydrology of the EMF area is best characterised by the existing water catchment areas, pans and streams (i.e. perennial and non-perennial rivers). More than ninety percent of the surface water mainly comes from the Upper Orange Water Management Area (UOWMA) located south-west, outside the area.

There are six main catchment areas (in full or in part) in the EMF area, namely, the Lower Orange, the Klein-Boetsap, the Upper Orange, the Kuruman, the Nossob and the Molopo water catchment areas. The Molopo, Kuruman and Nossob water catchment areas are located in the northern part of the EMF area with the Nossob River forming the border between the area and Botswana. The well-known Hakskeenpan and Uitsakpan occur within the Molopo water catchment just a few kilometers away from the eastern border of Namibia.

The Lower Orange water catchment is the main water catchment in the EMF area. It covers the area from the Namibian border to some kilometers away from the Groblershoop. This catchment area also covers the south of the EMF area where it connects with the Klein-Boetsap water catchment and the Upper Orange water catchment in the west of the EMF area.

With the exception of the Orange River all the rivers in the EMF area are non-perennial rivers.

The Orange River, which forms the green strip through the dry landscape of the EMF area, is the main drainage channel in the area. It is the main source of surface water within the SDMA, and stretches for approximately 350 km through the area. The total length of the river from its origins in the highlands of Lesotho to the Orange River mouth at Alexander Bay where it discharges into the Atlantic Ocean is approximately 2300 km.

There are no natural lakes in the area, although many large depressions or pans are found, the better known of which are Hakskeenpan, Uitsakpan, Tuinspan and Soutpan. Notable infestation of invading alien vegetation occurs at several places on the banks of the Orange River.

Alterations of the flow regime of the Orange River occurred mostly as a result of water resource development (e.g. dams and inter-catchments transfers) in the upstream areas.

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3 A.G Visser. Report number PMWA 13/00/00/0304, Internal Strategic Perspective for the Upper Orange Water Management Area. Department of Water Affairs and Forestry, South Africa, April 2004.

outside the EMF area. Occasional run-off occurs in the upper reaches of the Molopo River. There are, however, no records of volumes for occasional run-off reaching the Orange River. Last recordings of flows in the lower reaches of the Molopo and Kuraman Rivers were in 1933 and again in the 1974/5 and 1975/6 season. The total volumes of the Mean Annual Runoff (MAR) and Ecological Reserve (EC) are determined to be 181 million cubic metres and 49 million cubic metres, respectively.
Map 9

Hydrology

- Rivers
  - Perennial
  - Non-perennial
- Siyanda District Municipality
- Major Roads
- Main road
- National road
- Secondary road
- Hydrology
- 52m river buffer

Siyanda District Municipal Area
The UOWMA surface hydrology contributes almost all the flow of the Orange River in the EMF area. In 2000 the recorded natural MAR quantity of the Orange River and its tributaries (excluding the Orange Coastal sub-area, as this falls in water catchments that are located below the EMF area) was approximately 478 million cubic metres per annum. The total ER is calculated to be 67 million cubic metres per annum.

Surface water is mainly used for irrigated agriculture. The LOWMAR\textsuperscript{5} recorded irrigation as the dominant water use in the LOWMA sector representing a total of ninety-four percentage (94%), which is a total of 977 million cubic meter of water per annum of the total 1028 million cubic meter of water used per annum in the year 2000. Irrigation activities are mainly situated along the Orange River, which is the main source of surface water. Limited irrigation is also practiced along some of the main tributaries (Orange Tributaries sub-area).

The Boegoeberg Dam enables the irrigation of the alluvial soils between the river’s poort through the Ezel Rand (part of the Matsap quartzite) and the open granite country at Upington. The crops most suited to this part of the Orange River valley include lucerne, grapes and wheat, with subsidiary crops of vegetables, deciduous fruits and maize.

Between Upington and the Augrabies Falls irrigation is closely linked to river gradients and low flows. Flooding remains a danger especially to the numerous islands that occur in the river. Between Upington and the Friersdale rapids, the river valley and the islands, form a second distinct irrigation area. In this area the crops, in order of importance, include lucerne, grapes, wheat and much smaller crops of vegetables, cotton, deciduous fruits, maize and citrus.

The Kakamas area was originally settled with destitute farmers who were ruined by the drought of 1896 and the rinderpest of 1897. The Dutch Reformed Church recognised the general suitability of the soil on both sides of the river below the Neus rapids and in 1898 settlers began digging a canal from Neus Poort to the main irrigation area on the south bank. A canal to the north bank was later added.

The possibility of using the Augrabies Fall to generate hydo-electrical power has been mooted from time to time but although technically possible, it is unlikely that it would make enough of a contribution to justify the costs and impacts on the environment.

\textsuperscript{5} MS Basson and JD Rossow. Report number PMWA 14/000/00/0203, Lower Orange Water Management Area: Overview of water resources availability and utilization. Department of Water Affairs and Forestry (DWAF), South Africa, September 2003.
Significant other water requirements in the sub-area are for urban use (towns) as well as rural domestic supplies and stock watering. Urban, rural and bulk industrial activities use respectively 3%, 2% and less than 1% (excluding mining) of the water consumed.

Some of the water abstracted for irrigation from the Orange River drains back to the river as return flows, for potential use downstream (or as part of the freshwater requirements for the estuary at the Orange River mouth). A proportion of the water used in urban areas is also used non-consumptively and again becomes available as effluent. The potential negative impact of return flows from irrigated agriculture may have a long term impave and impact on the ecology of the Orange River over the long term and should be monitored.

At the larger centers in close proximity of the river, most or all of the effluent is discharged back into the river after appropriate treatment. Effluent from smaller towns typically evaporates from maturation ponds, or may be absorbed by irrigation and infiltration.

(b) Opportunities

The Orange River provides a significant source of water that is available for irrigation and the low population density results in a regime where even though it is arid area, water availability per capita is generally high.

(c) Constraints

The main constraints in respect to surface water include:

- Most of the water in the area originates in up-stream catchment over which there is little local control;
- the negative yield of the Orange River within the EMF area resulting from the high evaporation and evaportranspiration caused by the riparian vegetation along the reach of the river, which by far exceeds the run-off yield;
- the dependence of agriculture for irrigation on surface water, especially the Orange River;
- insufficient measurement, monitoring and control of water used for irrigation, which is the largest water use sector in the water management area; and
- inefficient management of releases from Vanderkloof Dam and the lack of control structures to facilitate this.
(d) **Issues**

The following are the main issues that should be taken into account in the EMF:

- The dry climate of the region and the limited potential of water resources which naturally occur in the water management area. Both surface and groundwater are already fully developed and utilised;\(^6\)
- The need for poverty relief and availability of water (approval in principle) for settlement of emerging irrigation farmers; and
- The need to implement efficient flood management measures in co-operation with upstream water management area.

(e) **Desired state**

The Orange River provides a significant source of water that is available for irrigation and the low population density results in a regime where even though it is an arid area water, availability per capita is generally high.

The desired actions in respect to surface water include:

- Better local control or participation in respect of water that originates in up-stream catchments needs to be negotiated with the relevant authorities;
- the dependence of agriculture on irrigation from the Orange River needs to be managed at a level that would be sustainable over the long term;
- the further development of activities that require the use of surface water should be limited to the extent that it is sustainable given the limited remaining potential of the resource.
- due to the limited economic opportunities in the area, available water resources should be allocated in a way that recognise the need for poverty relief and for the establishment of emerging irrigation farmers;
- flood management measures should be implemented for the Orange River in co-operation with upstream water management areas;

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\(^6\) MS Basson and JD Rossow. Report number PMWA 14/000/00/0203, Lower Orange Water Management Area: Overview of water resources availability and utilization. Department of Water Affairs and Forestry (DWAF), South Africa, September 2003.
measurement, monitoring and control of water used for irrigation should be improved in order to provide better information for planning and management; and

- water releases from the Vanderkloof Dam should be better managed and control systems that take the interests of all water users into account should be established.

2.1.4 Groundwater

(a) Description

Groundwater utilization is important in the area and constitutes the only source of water over much of the rural areas within the EMF area. As a result of the low rainfall over the area, the groundwater is mainly used for rural domestic water supplies, stock watering and water supplies to inland towns. Recharge of groundwater is limited and only small quantities can be abstracted on sustainable basis. Aquifer characteristics (borehole yields and storage of ground water) are also typically unfavourable because of the hard geological formation underlying most of the municipal area. The exception to this, is the western part of the area that are underlain by dolomitic Karst aquifers.

In the Orange River tributaries, more than fifty percent of the available water is supplied from groundwater sources. A very small component of the available water in the vicinity of the Orange River is groundwater. It, however, constitutes an important source of water for rural water supplies in this sub-area. A significant amount of groundwater is being abstracted near the river, where the ground water levels are replenished by means of induced recharge from the river.

In the year 2000, the utilization of groundwater in the area was approximately in balance with the sustainable yield from this source. No significant potential for further development exists. Over-exploitation of the groundwater has not been experienced in the EMF area. The quality of groundwater is in general appropriate for the uses which the water is applied to. Brackish (mineralized) water is, however, common in the drier areas.

The available water for the EMF area has been included in the LOWMAR.

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7 MS Basson and JD Rossow. Report number PWA 14/000/00/0203, Lower Orange Water Management Area: Overview of water resources availability and utilization. Department of Water Affairs and Forestry (DWAF), South Africa, September 2003.
The demand for water requirements has been included in the LOWMAR. The report states that in the year 2000 the LOWMA (inclusive of the EMF area) water requirements came to a total of 1028 million cubic metres per day (including the component of reserve for basic human needs at 25 litres per person per day). This volume is given by the demand of water for irrigation which is 977 million cubic metres per annum, 9 million cubic metres per annum of water for Mining and Bulk Industry, 25 million cubic meters of water per annum for urban and 17 million cubic meters per annum for the areas.

The expected groundwater demand for future use is provided in the LOWMAR.

The dolomite area that occurs in the eastern part of Siyanda holds significant groundwater in karst aquifers.

(b) Opportunities

There are no significant opportunities for the further utilization of groundwater in the area. With carefull planning the use of water from the karts systems in the east of the area can be further expanded and improved.

(c) Constraints

More than fifty percent of the rural water supply in the EMF area is dependent on groundwater for domestic use while the type of the geology in the area limits groundwater storage capacity.

The arid climate of the region and limited potential of water resources which naturally occur in the water management area will result in groundwater fully developed and utilised.

Rural users, which are by far the largest water use sector in the water management area, are meaures and controlled insufficiently. Water use efficiency of irrigation is also subject to improvement.

(d) Issues

The following issues affecting the ground water have been identified:

- Imbalance utilization of groundwater.
- Limited recharge of groundwater resulting in small quantities of groundwater that can be sustainably abstracted.

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9 MS Basson and JD Rossow. Report number PWA 14/000/00/0203, Lower Orange Water Management Area: Overview of water resources availability and utilization. Department of Water Affairs and Forestry (DWAF), South Africa, September 2003
The ground water in the karst systems are sensitive to overexploitation and pollution.

(e) Desired state

The desired actions relating to the groundwater of the area are:

- The allocation of groundwater should be based on the sustainable availability of groundwater;
- water extraction should be limited to amounts that equals the natural recharge of groundwater;
- additional groundwater extraction of water out of the karst systems should be investigated and strictly controlled before it is allowed to prevent the resource from being over utilised; and
- potentially polluting activities should not be allowed on the karst aquifer systems.

2.1.5 Climate

Note: All information in this section is derived from information that was purchased from the South African Weather Service.

(a) Description

- Temperature

The area is known for its hot days and cold nights. The summer days are hot and the winter nights very cold.

- Precipitation

The area is very dry with an average yearly rainfall of approximately 189mm per annum.

- Cloud cover and sunshine

The sunshine in the area is very suitable for solar energy generation.
- **Wind**

A summary of the winds that occur is contained in Figure 1: Windrose for Upington.

**Figure 1: Windrose for Upington**

![Windrose for Upington](image)

(b) **Opportunities**

The high level of sunshine in the area provides a significant opportunity for the generation of electricity using solar energy. A Concentrating Solar Power facility is currently being planned by Eskom a few kilometres outside Upington.

The relatively strong winds that blow in relatively well defined directions may also in future be utilised for electricity generating purposes.

(c) **Constraints**

The biggest climatic constraint is the low rainfall in the area.

(d) **Desired state**

The desired action relating to the climate of the area is:
The low rainfall in the area dictates that significant development away from the Orange River or areas on top of the karst aquifers in the dolomites in the eastern part of the area should not be allowed.

### 2.1.6 Climate change

The contents of this section are largely based on the source document indicated in footnote 10.

Climate change represents a change in climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability over comparable time periods.

In many parts South Africa, especially in the Northern Cape, variability in climatic conditions is already resulting in wide ranging impacts, specifically on water resources and agriculture. Water is a limiting resource for development in the Northern Cape and a change in water supply could have major implications in most sectors of the economy, especially in the agricultural sector. Factors include seasonal and inter-annual variations in rainfall, which are amplified by high run-off production and evaporation rates. There is clear evidence of climate change in South Africa, which will continue even if greenhouse gas concentrations were stabilised. Global warming is a threat to the country’s sustainable development.

According to the report “Climate variability, climate change and water resource strategies for small municipalities”\(^\text{10}\) there is also evidence that the increase in Green House Gasses (GHG’s) is having an effect on climatic conditions, which in turn can lead to biological impacts, such as impacts on agricultural development, specifically related to the Northern Cape. South Africa’s per capita contributions to GHG emissions is well above global averages and those of middle income developing countries. The greenhouse gasses that occur in the troposphere (or lower atmosphere) which are responsible for global warming include: ozone, methane, chlorofluorocarbons (CFC’s), carbon dioxide, water vapour and nitrous oxides.

Expanded desertification in semi-arid areas is already a feature of the South African landscape. There is also a demonstrated dieback of desert plants, such as the kokerboom, in the Northern Cape and southern Namibia. Bush encroachment into productive grasslands in summer rainfall regions and the destruction of natural indigenous vegetation has implications for

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agricultural activities such as cattle and sheep ranching, wildlife management and other ecosystem services.

Global warming models suggest a reduction of the area covered by the current biomes in South Africa by 35% to 55% in the next 50 years. In a hotter and drier climate maize production would decrease by up to 20%, mostly in the drier western regions of the country. Marginal areas of maize production might well fail, especially for resource-poor farmers unable to adapt rapidly.

South Africa’s vulnerability to the direct and indirect impacts of climate change, including the costs of mitigation and adaptation, the potential loss of markets, and the consequent impact on sustainable development and poverty alleviation underline the need to create a balance between adaptation, mitigation and managing the socio economic impacts of climate change response measures.

The effects of global climate change are likely to influence the availability of water and patterns of use during the next few decades.

Projections for the Northern Cape include an increase in temperature, which will lead to increased evaporation. Rainfall patterns are also likely to change and become more variable.

(a) Strategies

The following strategies have been identified as to accommodate the effects of future climate change:

- Supply management:
  - Reduction of leaks programmes
  - Regional water resource planning
  - Local municipalities water resource management and monitoring
  - Conjunctive use of surface and groundwater
  - Rainwater harvesting

- Demand management:
- Dry sanitation systems
- Education programmes
- Tariff structures
- Water restrictions

Human and financial resources are main challenges to the successful implementation of these strategies.

(b) Recommendations

- There is a need for proactive strategies at local and national level to deal with the impacts of drought and climate change on water resources rather than the current reactive strategies.

- Given the possible implications of climate change on local water resources, it is important that the impact be monitored as a precautionary measure.

- Strict groundwater management systems should be put in place, with early warning mechanisms to report depleted groundwater reserves. Continual monitoring of the aquifer against climate conditions will provide some knowledge of the future potential under projected climate conditions.

- Emphasis should be placed on demand management.

- In order to successfully implement any of these strategies, the lack of personnel and financial capacity at local level must be overcome.

- Strategies that are finally identified not only need to be social, environmentally and economically acceptable, but they need to have long term applicability if they are to provide adequate resilience to climate change impacts.

- A climate change awareness programme should be developed that is targeted at local government officials to equip them with the necessary tools to engage the issue and implement the strategies that are identified.

- Each local authority should develop a locally based strategy.
2.2 Biological environment

2.2.1 Vegetation

(a) Biomes

The biomes that occur in the area are depicted on Map 10: Biomes and in Table 2: Biomes.

<table>
<thead>
<tr>
<th>Biome</th>
<th>Area (km²)</th>
<th>% of total area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nama-karoo</td>
<td>40,822.066</td>
<td>39.763%</td>
</tr>
<tr>
<td>Desert</td>
<td>100.837</td>
<td>0.000%</td>
</tr>
<tr>
<td>Wetland</td>
<td>3,121.907</td>
<td>3.040%</td>
</tr>
<tr>
<td>Savanna</td>
<td>58,616.640</td>
<td>57.097%</td>
</tr>
</tbody>
</table>

(b) Vegetation types

The vegetation types of the area have been grouped into “vegetation combinations” which are displayed on Map 11: Vegetation Combinations. These combinations do not correspond with the biomes but were chosen for map display purposes. All the vegetation types have, however, been mapped and are included in the relevant GIS layer. The vegetation types that occur in the area are described below as adaptations out of Mucina. L and Rutherford. M.C. (eds) 2006. *The vegetation of South Africa, Lesotho and Swaziland*. Strelitzia 19. South African National Biodiversity Institute, Pretoria.
The following vegetation types occur in the Nama-karoo biome:

- Bluppies Karroid Thornveld
- Bushmanland Arid Grassland
- Bushmanland Basin Shrubland
- Bushmanland Sandy Grassland
- Kalahari Karroid Shrubland
- Lower Gariep Broken Veld
- Northern Upper Karoo

The following vegetation types occur in the desert biome:

- Bushmanland Inselberg Shrubland
- Eastern Gariep Plains Desert

The following vegetation types occur in the Wetland biome:

- Bushmanland Vloere (salt pans)
- Southern Kalahari Mekgacha
- Southern Kalahari Salt Pans
- Lower Gariep Alluvial Vegetation

The following vegetation types occur in the Savanna biome:

- Ghaap Plateau Vaalbosveld
- Gordonia Duneveld
- Gordonia Kameeldoring Bushveld
- Gordonia Plains Shrubland
- Kathu Bushveld
- Koranna-Langeberg Mountain Bushveld
- Kuruman Mountain Bushveld
Kuruman Thornveld
- Molopo Bushveld
- Nossob Bushveld
- Olifantshoek Plains Thornveld
- Postmasburg Thornveld
- Auob Duneveld

(c) Meeting national biodiversity targets in Siyanda

The targets for priority vegetation types indicated in Table 3 below were derived from the assessments that were undertaken as part of the Status Quo. These vegetation types are indicated on Map 11 and the colour of the boundary of each indicates its priority for conservation. Map 12 indicates areas that are proposed for the extension of conservation of land in the district. It is based on finding areas where the sensitive vegetation types are grouped together, thereby indicating areas where conservation can potentially be achieved relatively efficiently.

The conservation can be in the form of:

- Extensions to or the creation of new national parks or provincial reserves;
- the establishment of private protected natural areas;
- the establishment of conservancies; or
- the stricter control of activities on identified areas through the application of the EIA regulations.
Map 11

Vegetation Combinations

After L. Mucina & MC Rutherford 2006

SIYANDA ENVIRONMENTAL MANAGEMENT FRAMEWORK – EMF REPORT

SIYANDA DISTRICT MUNICIPAL AREA

35
Table 3: Priority vegetation types for conservation

<table>
<thead>
<tr>
<th>Vegetation name (biomes in capitals)</th>
<th>SIYANDA DISTRICT EMF AREA ASSESSMENT</th>
<th>Proposals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Area (sq km)</td>
<td>% of vegetation in Siyanda</td>
</tr>
<tr>
<td>NAMA-KAROO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bushmanland Arid Grassland</td>
<td>23894.280</td>
<td>23.275</td>
</tr>
<tr>
<td>Kalahari Karroid Shrubland</td>
<td>8291.594</td>
<td>8.077</td>
</tr>
<tr>
<td>Lower Gariep Broken Veld</td>
<td>2531.476</td>
<td>2.466</td>
</tr>
<tr>
<td></td>
<td>34717.350</td>
<td>33.818</td>
</tr>
<tr>
<td>WETLANDS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Southern Kalahari Salt Pans</td>
<td>807.531</td>
<td>0.787</td>
</tr>
<tr>
<td>Lower Gariep Alluvial Vegetation</td>
<td>550.238</td>
<td>0.536</td>
</tr>
<tr>
<td></td>
<td>1357.769</td>
<td>1.323</td>
</tr>
<tr>
<td>SAVANNA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gordonia Plains Shrubveld</td>
<td>6979.727</td>
<td>6.799</td>
</tr>
<tr>
<td>Koranna-Langeberg Mountain Bushveld</td>
<td>1131.219</td>
<td>1.102</td>
</tr>
<tr>
<td>Kuruman Mountain Bushveld</td>
<td>1490.203</td>
<td>1.452</td>
</tr>
<tr>
<td>Molopo River Duneveld</td>
<td>802.067</td>
<td>0.781</td>
</tr>
<tr>
<td>Olfantshoek Plains Thornveld</td>
<td>4014.247</td>
<td>3.91</td>
</tr>
<tr>
<td>Postmasburg Thornveld</td>
<td>929.252</td>
<td>0.905</td>
</tr>
<tr>
<td></td>
<td>15346.715</td>
<td>14.949</td>
</tr>
</tbody>
</table>

(d) Proposed priorities for conservation in the Siyanda District

The areas within which the proposed priority areas for conservation falls in the district is depicted on Maps 12a and 12b, based on local occurrence, the national conservation target, the national ecosystem status and the national protection level of the vegetation types. A proposal is made for the prioritisation of vegetation types in the Siyanda District.
Map 12a
Vegetation Assessment Conservation Priority

- Rivers
  - Perennial
  - Non-perennial
- Siyanda District Municipality
- Major Roads
  - Main road
  - National road
  - Secondary road

Conservation Priority
1 - Low
2 - Low (Transformed)
3 - Low (Well Protected)
4 - Medium
5 - High
6 - Very High

Siyanda District Municipal Area
Map 12b

Proposed Conservation Areas

- Kalahari Gemsbok National Park
- Augrabies Falls National Park
- Witsand Nature Reserve
(e) Protection and conservation of the Lower Gariep Alluvial Vegetation

A river classification in the form of a series of photo interpretation maps (see Appendix A) indicating the details of land use activities and the extent of remaining natural vegetation in the floodplain of the Orange River is contained in Appendix A.

The vegetation of the riparian habitats of the study area have been classified as Lower Gariep Alluvial Vegetation (Mucina et al. 2006) occurring between Groblershoop and the mouth of the river at the Atlantic Ocean. This vegetation type is considered to be Endangered with more than 50% transformed by agriculture and only 6% conserved (in Augrabies Falls National Park) of a target of 31%.

The Orange River in the study area consists of a wide floodplain. This usually has well-developed levees on both sides and, at low-level, extensive sand-banks occur in the channel. Where the river cuts steep valleys through dolerite dykes or other hard rock, these sand banks are absent and the river becomes faster-flowing and rocky. The levees may be up to 250 m wide and contain alluvial woodland, forest or scrub, also described as Riparian Thicket. The numerous small to extensive sand-banks in the river-bed may contain a number of temporary to semi-permanent plant communities. These habitats are characterised by regular seasonal flooding, silting and alternating dry and wet conditions. The substrate is dynamic and may shift to new positions on occasion. Submerged wetland plant communities are virtually absent from the Orange River due to the periodic sudden, large floods as well as the normally high silt-loads of the water. Where dolerite dykes cross the river, these may be exposed at low-level periods of flow. These rocky outcrops may contain sparse stands of the low shrub, *Gomphostigma virgata*.

Between Groblershoop and Augrabies Falls the habitats vary somewhat, with less alluvial deposits closer to the falls. Further upstream the typical pattern is a floodplain with terraces and vegetated sand-banks. Closer to Augrabies Falls the substrate becomes rockier and the sand-banks become rarer. Rocky islands occur where reedbeds are restricted to small marginal habitats and the river bed may be composed of bare rock or boulder beds.

Riparian thickets occur on the well-developed levees and terraces of the river margins. Common and dominant species in this habitat include the woody plants, *Acacia karroo*, *Asparagus laricinus*, *Diospyros lycioides*, *Euclea pseudobenus*, *Gymnosporia linearis*, *Prosopis glandulosa*, *Rhus lancea*, *Salix mucronata* subsp *mucronata*, *Schotia afra* var *angustifolia*, *Tamarix usneoides* and *Ziziphus mucronata*. This is the plant community that is most
vulnerable to human disturbance and therefore in greatest need of sensitive management and conservation. It consists of usually a narrow band of permanent woodland that is the major physical barrier to human movement into the floodplain. As such, it is often removed to improve access. It is also severely affected by regular burning of reedbeds and often invaded by alien plants.

The most obvious and dominant plant species in reed beds is the tall reed, \textit{Phragmites australis}. This is, however, often accompanied by the woody plants, \textit{Salix mucronata} subsp \textit{mucronata} and \textit{Rhus pendulina}, especially where the islands are slightly elevated above the waterline. The abundance of these woody plants appears to be directly related to the elevation of the islands, low islands being bare to fully-dominated by reeds and higher islands with an abundance of shrubs.

Temporary flooded grasslands and herblands plant communities may develop on sand-banks, especially soon after they have become exposed following flooding. These are characterised by a variety of grass and herb species, including \textit{Amaranthus praetermissus}, \textit{Cynodon dactylon}, \textit{Cenchrus ciliaris}, \textit{Cyperus laevigatus}, \textit{Eragrostis echinochloidea}, \textit{Polypogon montspeliensis}, \textit{Setaria verticillata}, \textit{Stipagrostis namaquensis}, \textit{Persicaria lapathifolia} and \textit{Tetragonia schenkii}. Sufficient time between flooding may result in these communities developing successionaly towards reed beds.

There are various impacts evident on vegetation of the floodplain due to existing land use practices. The most obvious and important of these is the widespread cultivation of alluvial soils. This has led to direct loss of alluvial habitat thus reducing the overall extent of the vegetation type. In addition, the cultivated areas are managed in such a way as to prevent damage to cultivated areas by flooding, e.g. embankments. This has the consequence of stabilising the alluvial substrates thus reducing the dynamic shifting of alluvial substrates within the river bed. Water extraction for cultivation is either via the canal system or directly by pumping. The canal system represents a permanent structure at approximately the floodline of the river, which is a direct loss of some habitat as well as a barrier to the movement of materials and organisms. The extraction of water may have an impact on water-flow levels in the river, but the significance of this is not known. More importantly, the large reservoirs along the Orange River, e.g. Gariep Dam, have modified the water-flow dynamics of the river. Water now flows more regularly and at a lower rate. The periodic extreme flooding events no longer occur resulting in the entire system being less dynamic.
Localised impacts are caused by the regular burning of the reeds along the river. This is having a severe impact on the woody vegetation, killing off trees and opening up the woodland. The long-term impact is the loss of alluvial woodland and probably a change of species composition to those that are favoured by regular burning.

Significant transformation of indigenous land is taking place in the Kakamas, Groblershoop and Upington areas. The indigenous vegetation is decreasing rapidly to make place for the establishment of irrigated agriculture, especially grapes. In the light of the sensitivity of the indigenous vegetation this is a matter of concern that requires stricter control measures by the responsible authorities.

The human disturbances along the river through cultivation, burning and domestic livestock trampling through the vegetation as well as vehicle tracks, infrastructure, etc. have resulted in localised disturbance to vegetation. Amongst other consequences, there is also the higher chance of alien invasive species becoming established in these disturbed areas. General disturbance of alluvial woodland is greatest closer to human settlements. It was an obvious feature along the river that alluvial woodland was less dense closer to settlements and was almost entirely absent adjacent to towns, such as Upington.

The following alien plant species were observed in the field:

<table>
<thead>
<tr>
<th>Table 4: Alien species observed in the area</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Species</td>
<td>Invasive status</td>
</tr>
<tr>
<td>Argemone ochroleuca</td>
<td>Declared weed</td>
</tr>
<tr>
<td>Casuarina equisetifolia</td>
<td>Declared invader category 2</td>
</tr>
<tr>
<td>Eucalyptus camaldulensis</td>
<td>Declared invader category 2</td>
</tr>
<tr>
<td>Melia azedarach</td>
<td>Declared invader category 3</td>
</tr>
<tr>
<td>Morus alba</td>
<td>Declared invader category 3</td>
</tr>
<tr>
<td>Nicotiana glauca</td>
<td>Declared weed</td>
</tr>
<tr>
<td>Opuntia ficus-indica</td>
<td>Declared weed</td>
</tr>
<tr>
<td>Prosopis glandulosa</td>
<td>Declared invader category 2</td>
</tr>
<tr>
<td>Populus deltoides</td>
<td>Proposed declared invader</td>
</tr>
</tbody>
</table>

In most cases, these occurred as single individuals or in planted groves close to human settlement with no major spreading. The exceptions were Prosopis glandulosa, which was widespread and common, and Eucalyptus camaldulensis, which was widespread in clumps (probably planted) and may be spreading on its own. It tended to occur higher up from the river. Two other more herbaceous species, Nicotiana glauca and Argemone ochroleuca, are also
commonly encountered. These four species constitute the primary alien threat to the alluvial habitat; *Prosopis glandulosa* is the priority plant to control.

In addition to those species listed above, the following species (not seen during fieldwork) may occur in the alluvial vegetation of the study area:

<table>
<thead>
<tr>
<th>Species</th>
<th>Invasive status</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Arundo donax</em></td>
<td>Declared weed</td>
</tr>
<tr>
<td><em>Azolla filiculoides</em></td>
<td>Declared weed</td>
</tr>
<tr>
<td><em>Atriplex lindleyi</em></td>
<td>Declared invader category 3</td>
</tr>
<tr>
<td><em>Sesbania punicea</em></td>
<td>Declared weed</td>
</tr>
<tr>
<td><em>Tamarix ramosissima</em></td>
<td>Declared weed</td>
</tr>
</tbody>
</table>

From the more detailed survey it is clear that only 206.915 km$^2$ of the initially expected 550.238 km$^2$ (based on the SANBI delineation on the Vegetation Map of South Africa, Leshoto and Swaziland) Lower Gariep Alluvial Vegetation actually remains in a natural state. It is therefore imperative that all the remnants be protected against further degradation. This can be done in the following ways:

- Formally conserve appropriate areas, as on private land as protected natural environments, as provided for in the terms of the National Environmental Management Protected Areas Act, 2003. (Act No 57 of 2003);
- Identification of the remaining Lower Gariep Alluvial Vegetation as a geographical area based on environmental attributes in which specified activities may not commence without environmental authorisation from the competent authority in terms of Section 24(2)(b) of the National Environmental management Act, 1998 (Act no 107 of 1998) – as amended;
- By adopting a policy that only rocky outcrops within the river system should be considered for development provided that they can be reached without causing significant environmental impacts and that they are not sensitive in terms of their aesthetic value.
2.2.2 Fauna

Siyanda has a rich variety that is described in the Status Quo Report.

2.2.3 The blackfly problem

Blackflies are major pests of especially livestock farming along the Ornage River in the Siyanda District. Females of some species need a blood-meal to produce eggs. They feed on sheep, cattle, horses, ostriches, poultry, wildlife and humans. Their bites are painful and itchy which leads to swelling, secondary infection and sometimes even death. Blackflies are estimated to cause tens of millions of rands of losses in animal production. Other activities that are negatively affected include irrigation farming, tourism and recreation. In addition to the biting of the blackflies they are also a nuisance because of their high numbers and their habit of flying around ones head and crawling into ones hair, nose, ears and eyes. *Guidelines for Integrated Control of Pest Blackflies Along the Orange River* (a report by the Water Research Commission – Report NO 1558/1/07/) was completed in May 2007. The report concluded that the blackfly control programme should actively engage an integrated approach comprising of preventative and symptomatic measures. The preventative measures entail the reduction of high blackfly populations by reducing winter flows through flow manipulation, especially at the Vanderkloof Dam. Symptomatic measures entail the traditional approach of treating the consequences of high water flows (increased larval activity) by applying larvicides. These measures are supported although it is important to also monitor the impacts of the programme on the ecology of the Orange River.

2.3. State of development of the Siyanda District

2.3.1 The landcover of the Siyanda District

The landcover of the Siyanda district reflects the results of the 2000 national landcover determination and is depicted on Map 13: Landcover. It shows the type of surface that covers the area.

It is evident that most of the area is in a natural state and the most significant spatial impact on the environment has come from mining which occupies an area of almost 7% of the total area. The landcover data unfortunately does not give a proper evaluation of the agricultural use along the Orange River.
<table>
<thead>
<tr>
<th>Type of landcover</th>
<th>Area in Km²</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bare rock and soil</td>
<td>0.351</td>
<td>0.000341%</td>
</tr>
<tr>
<td>Degraded land</td>
<td>336.565</td>
<td>0.328%</td>
</tr>
<tr>
<td>Grassland</td>
<td>312.431</td>
<td>0.304%</td>
</tr>
<tr>
<td>Mines and quarries</td>
<td>7,125,710</td>
<td>6.940%</td>
</tr>
<tr>
<td>Plantation (exotic trees)</td>
<td>42.076</td>
<td>0.041%</td>
</tr>
<tr>
<td>Planted grass</td>
<td>2.480</td>
<td>0.002%</td>
</tr>
<tr>
<td>Shrubland</td>
<td>59,127.737</td>
<td>57.588%</td>
</tr>
<tr>
<td>Thicket, bushland, bush clumps</td>
<td>26,371.503</td>
<td>25.685%</td>
</tr>
<tr>
<td>Urban/built-up commercial</td>
<td>1.185</td>
<td>0.001%</td>
</tr>
<tr>
<td>Urban/built-up industrial</td>
<td>15.401</td>
<td>0.015%</td>
</tr>
<tr>
<td>Urban/built-up residential</td>
<td>37.132</td>
<td>0.036%</td>
</tr>
<tr>
<td>Waterbodies</td>
<td>88.181</td>
<td>0.086%</td>
</tr>
<tr>
<td>Wetlands</td>
<td>2,202.201</td>
<td>2.145%</td>
</tr>
<tr>
<td>Woodland</td>
<td>7,011.125</td>
<td>6.829%</td>
</tr>
<tr>
<td></td>
<td>102,674.399</td>
<td></td>
</tr>
</tbody>
</table>
2.3.2 The Orange River Valley

The Orange River Valley forms a development spine that runs through the area. Development of towns and agriculture is possible due to the water that is available from the river. Towns and other places along the river developed during the late 19th century and early 20th century.

Irrigated agriculture is the mainstay of the economic activity along the river. In order to assess the extent of this, the irrigation maps of the National Department of Agriculture were obtained and verified using the 2006 Landsat 5 Satellite images at a scale of 1:10,000. For display purposes a map of the Orange River Valley has been clipped into sub-maps. These are indicated on the maps in Appendix A: Orange River Classification. These maps indicate the following:

- Areas that are currently being utilised for irrigated agriculture;
- airports/airfields;
- golf courses;
- mines and quarries;
- land which is currently not classified (especially on some of the islands which are currently being investigated further);
- urban residential areas;
- rural residential areas and/or smallholdings;
- commercial areas;
- industrial and or military areas; and
- waterbodies.

These have been overlain over the SANBI delineation of the sensitive Lower Gariep Alluvial Vegetation. This starts to give an indication of where remnants of the vegetation may still occur. It is, however, evident that the scale of data capture in the Vegetation Map is inadequate (e.g. steep rocky areas such as Tierberg at Keimoes is also indicated as Lower Gariep Alluvial Vegetation) and therefore the distribution of remaining vegetation in the area is in the process of being reassessed. This assessment will be completed during the course of the EMF project.
The Siyanda District is characterised by vast open space with scattered human settlement throughout the area. Many of the towns are located in the proximity of the Orange River (e.g. Upington, Groblershoop, Keimoes, Kakemas, Marchant and Augrabies). Other town originated due to the exploitation of minerals (e.g. Postmasburg, Danielskuil and Lime Acres), administrative outposts (e.g. Kenhardt) and settlements with regional rural support functions (e.g. Askham, Rietfontein and Riemvasmaak).

The “urban boundaries” of the more prominent towns and settlements have been demarcated from the 2006, Spot 5 satellite images at a captured scale of at least 1:10 000 to indicate areas which can be considered as transformed for the purpose of identifying activities that may be excluded from environmental impact assessments in terms of section 24(2)(c) in the National Environmental Management Act 1998, (Act No. 107 of 1998). The towns and settlements in the vicinity of the Orange River are indicated in Appendix B. The rest of the towns are indicated in Appendix A.

2.3.3 Transportation infrastructure

(a) Roads

The Siyanda district has a good primary tarred road network that links the major towns with each other and to areas outside the area. The major road network consists of:

- The N14 highway that links Upington to the east with Kuruman and to the west with Springbok, passing through Keimoes and Kakamas on the way;
- the N10 highway that links Upington to the South with Britstown (passing through Groblershoop along the way) and the N12 and to the north-west and with the Namibian border at Nakop/Ariamsvlei;
- the R31 that links Danielskuil with the N14 at Kuruman;
- the R385 that links Danielskuil with Postmasburg and the N14 just east of Olifantshoek;
- the R64 that provides a direct link between Groblershoop and Kimberley;
- the R27 that links Kenhardt with Keimoes;
- the R359 that links Augrabies with the N14; and
- the R360 that provides access to the Kalahari and northern towns of Askham and Andriesvale.
These roads are all in a good condition and are currently being upgraded (widening of the tarred surfaces).

The secondary network is less developed and vast areas with sparse populations are served only by means of a vast network of dirt roads of varying quality. Many of these roads are in such a bad state that it is an impediment to the development of the tourism potential of the area.

(b) Railways

The Shishen/Saldanha railway line which was built to transport iron ore from Shishen to the iron works at Saldanha passes through an area and crosses the N10 highway and the Orange River just north of Groblershoop at a settlement called Wegdraai, from where it continues in a south-westerly direction past Kenhardt towards the coast. Stations and sidings in the area along this line include Langberg, Vrolik, Witpan, Rooilyf, Oorkruis, Rugseer and Kenhart.

Postmasburg and Lime Acres are linked to Kimberley in the south-east and Shishen in the north. Stations and sidings in the area include Mookaneng, Lohatha, Glosam, Palingpan, Bokkoppie, Beeshoek, Blinkklip, Silver Streams, Lime Acres and Ariesfontein.

A third Railway line links Upington with De Aar to the south-east and splits just to the north of Upington with the one line going to the border of Namibia at Nakop and the other following a route along the Orange River to Kakamas. Stations and sidings on these lines include Nakop, Langklip, Toeslaan, Lutzputs, Colston, Hondejaag, Kakamas, Neushek, Friesdale, Keimoes, Currie’s Camp, Klippunt, Upington, Sprigg, Trooilapspan, Josling, Kleinbegin, Boksputs and Koegrabie.

(c) Upington Airport

With the fall of the Portuguese regime in Angola, South African Airways (SAA) lost its landing rights in Luanda. The restrictions on flying over African states were compounded by concern that the country would lose its landing rights in the Ivory Coast and Isle de Sol.

As a result, Upington Airport's runway was built to accommodate a Boeing 747 with a full load of passengers, cargo and fuel – allowing planes to take off for Europe without having to stop along the way. Upington was chosen because of its height above sea-level, position and available land. The airport's 4 900m-long runway, the longest in Africa, was built in a record seven months in 1975.

From August 1976 to December 1996, SAA used Upington as a refueling station for two weekly scheduled Boeing 747 flights to London and Zurich.
In 1996 the original fire station was converted into offices for airport management and other administrative staff.

The SA Air Force (SAAF) and SAA use the airport to train 747 and 707 pilots. The SAAF also used the airport to train pilots for the South African presidential jet. The runway is also long enough to land a space shuttle.

About 78 tons of cargo a week is flown from Upington during the busiest months of November, December and January. Cars, fish and courier parcels head for Cape Town, Kimberley and Johannesburg, as well as England, Germany and Spain. Mining equipment leaves Upington for other African countries.

A whopping one million tons of grapes are flown from Upington every year and live sheep and goats pass through the airport on their way to Saudi-Arabia.

A number of smaller airports (e.g. Postmasburg), airfields and landing strips occur in the area, and are mostly used for local access.

(d) Opportunities and constraints

The transport infrastructure in the district is well positioned to deal with increased people and commercial traffic and should be regarded as one the area’s comparative advantages.

(e) Constraints

Large parts of the rural areas does not have well developed transport infrastructure and it is also unlikely that such infrastructure will developed due to the very space populations that occur in these areas.

(f) Desired state

The desired actions relating to the transportation infrastructure of the area are:

- The relatively well developed transport infrastructure including the Upington Airport, the major roads as well as the railway lines should be used optimally to develop the area with particular focus on the tourism industry; and

- rural roads that are in a bad state should be upgraded to a level that would contribute positively to tourism development in the area.

The transport infrastructure including the Upington Airport, the major roads as well as the railway lines should be used as a positive factor in the economic development of the area.
2.3.4 Waste management

(a) Description

Both general and hazardous wastes are produced in the area. Waste in the “garden waste” classification originating from households and agriculture is the biggest contributor to the waste stream.

The IDPs of the District and Local Municipalities do not give clear indications of the systems that are in place or of efforts that are being made to ensure waste prevention and/or avoidance. In the EMF area refuse removal services are provided by either the municipalities or private contractors. This includes recycling initiatives and disposal sites.

In the EMF area, most households are provided with plastic bags and containers for temporary storage of waste. Waste is collected on a weekly basis from households in established residential areas. Waste collection of waste that is dumped in unauthorized places also takes place regularly. Special removals are also done on request.

Waste from newly incorporated residential areas is removed every second week in certain instances. Waste from business premises is removed weekly or more often where necessary. Business premises must provide their own waste holders.

(b) Specific waste management in certain areas

In the //Khara Hais municipal area, the waste disposal is done at the Dunes Landfill Site, situated on the road to Keimoes and at a smaller site at Leerkrans, which caters mostly for the rural area outside Upington. The waste disposed at the Dunes Landfill Site is compacted daily and covered with sand in accordance with permit conditions. It has adequate airspace for at least another 20 years.11

In the Kgatelopele local municipality waste is removed by a private contractor.12 A new landfill site has been in operation since November 2006. In the Siyanda District Municipal Area (SDMA), the individual landowners organize their own refuse removal.13

In the Riemvasmaak region, at Vredesvallei and Sending, there is at present no formal refuse disposal area. The SDM currently renders a service of refuse removal to the residents for the removal of their household refuse.14

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12 Integrated Development Plan of Kgatelopele Municipality (5 year plan), 2007/8 to 20011/12
13 Integrated Development Plan of the Siyanda District Municipality, 2004
The waste disposal management practices of abattoirs and farms are important to ensure sustainable waste management in the Siyanda District over time. It is therefore important that the waste generation and disposal activities of these sectors be monitored on an ongoing basis and that appropriate management practices are continually developed to facilitate ever-more effective waste disposal.

(c) Recycling

Waste prevention and minimisation are generally not practiced in the area. Recycling is concentrated in the Upington area due to the availability of adequate quantities of recyclable material. Recycling focuses mainly on cardboard and paper. All local municipalities have plans for future recycling projects. There are a number of private companies involved in waste minimization initiatives in the EMF area.

(d) Needs in respect to landfill sites

The IDPs indicates that there is currently a need across all the local municipalities to develop and upgrade landfill sites in Siyanda in order to prevent environmental degradation and meet the needs of the community.

The following objectives have been set in the local municipalities in order to improve the status quo of waste management in the area:

- Upgrading of existing landfill sites;
- provision of new landfill sites;
- upgrading and improvement of current waste management services rendered by the municipalities;
- initiate recycling projects; and
- extent services in un-serviced areas.

(e) Opportunities

Growth in waste management industry, particularly in recycling is envisaged. This could contribute to poverty alleviation by providing sustainable employment opportunities.

The large quantity of bio-degradable waste may hold possibilities for composting and even biogas generation in future.

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14 Integrated Development Plan of the Siyanda District Municipality, 2004
(f) Constraints

The current lack of resources, especially financial and human resources puts pressure on the municipalities to render adequate waste management services.

(g) Desired state

The desired actions relating to the waste management infrastructure of the area are:

- An Integrated Waste Management Plan (IWM) must be developed for the EMF area to ensure a holistic approach to waste management;
- the potential presence of asbestos in the environment must be investigated and uncontrolled illegal dumping of asbestos should be prevented through strict law enforcement; and
- illegal dumping must be controlled through law enforcement in order to prevent its huge negative impact on sensitive economic sectors such as tourism.

2.3.5 Water supply

(a) Description

Water is the main source of life and the most important natural resource that determines sustainable population settlement in the EMF area. Different sources of water supply to communities are used in the area. Most of the surface water is used by the agricultural sector for irrigation purposes and as drinking water for livestock. The towns and settlements along the Orange River also utilised this source extensively. Water is also widely used for sanitation throughout the area and most communities have flush toilets. In the Mier area for example, underground water drawn from boreholes is used. Water is pumped from boreholes to reservoirs or pressure towers from where it is distributed.\(^{15}\)

There are three water supply schemes in the EMF area. They are the Kalahari West Water Board, the Kalahari East Water Board and the Karos Geelkoppan Water Board. The Kalahari West Scheme’s water is pumped from the Orange River in Upington and then purified mainly for livestock and human consumption. The average water requirements recorded in 2004 amounted to approximately 1545m\(^3\)/day. The scheme provides purified water to farms in the West Kalahari with a total area of approximately 600 000 hectares.\(^{16}\)

\(^{15}\) Integrated Development Plan for Mier Municipality (reviewed), 2005  
\(^{16}\) Integrated Development Plan for the Siyanda District Municipality, 2004
The Vaal-Gamagara Government Water Scheme, provide the Kalahari East Scheme with water that is purified in order to supply 256 livestock farms and settlements, with a total surface area of 1,4 million hectares. This water is sourced from Vaal River. Another 11 farms with a total surface area of 65000 hectares are supplied with water from the Karos Geelkoppan Water Board. The scheme gets its water from the Orange River.17

<table>
<thead>
<tr>
<th>Piped water</th>
<th>African/Black</th>
<th>Coloured</th>
<th>Indian/Asian</th>
<th>White</th>
<th>Not applicable</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No access to piped (tap) water</td>
<td>492</td>
<td>1905</td>
<td>3</td>
<td>131</td>
<td>0</td>
<td>2531</td>
</tr>
<tr>
<td>Piped (tap) water to community stand: distance greater than 200m from dwelling</td>
<td>1039</td>
<td>2181</td>
<td>2</td>
<td>453</td>
<td>4</td>
<td>3679</td>
</tr>
<tr>
<td>Piped (tap) water to community stand: distance less than 200m from dwelling</td>
<td>1863</td>
<td>2579</td>
<td>2</td>
<td>80</td>
<td>3</td>
<td>4527</td>
</tr>
<tr>
<td>Piped (tap) water inside yard</td>
<td>8778</td>
<td>13334</td>
<td>10</td>
<td>1232</td>
<td>24</td>
<td>23378</td>
</tr>
<tr>
<td>Piped (tap) water inside dwelling</td>
<td>5855</td>
<td>7974</td>
<td>27</td>
<td>6224</td>
<td>98</td>
<td>20178</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>54293</td>
</tr>
</tbody>
</table>

The onsite water supplied to the residents is supplied by the municipalities in the form of a prepaid service. In the Mier area, water networks have been installed since 1996, except in Noenieput. Households are mostly services with onsite metered water except for Groot Mier and Klein Mier18.

The Riemvasmaak community at Vredesvallei, in the SDMA, gets their water from the Orange River while the community at the Mission station (Sending) is dependent on water from boreholes near the settlement. The water pumped out of the Orange River is purified at the purification plant at the foot of a hill near the village before it reaches the community. Water from the Orange River is also used for irrigation at Vredesvallei, while livestock farmers further inland and in the area of Sending are dependent on water pumped from the two boreholes in the area.19

Most of the private farm properties in the area are self-sufficient in respect to water and most of these owners make use of borehole water.

(b) Opportunities

There are relatively few households without piped water.

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17 Integrated Development Plan for the Siyanda District Municipality, 2004
18 Integrated Development Plan for the Mier Municipality (reviewed), 2005
19 Integrated Development Plan for the Siyanda District Municipality, 2004
(c) **Constraints**

Some of the poorer households in the area cannot afford water despite water being generally available.

(d) **Desired state**

The following is the main issues (desired state) relating to the water supply infrastructure of the area:

- The risk of the high dependency on groundwater in many places should be reduced by ensuring that extraction does not exceed the natural recharge rate of groundwater resources and by developing alternative means of supply;
- the generally poor quality (the water is very brackish) and unreliable supply of water in the Mier area should be alleviated by importation of water; and
- access to clean drinking water in some informal settlements and on some privately owned land should be improved through subsidised water schemes.

2.3.6 **Energy use**

(a) **Description**

An estimated 73% of households in the EMF area have access to electricity. Electricity is distributed to most areas. The distribution is done by ESKOM Bulk Electricity services. In the Mier area, including all the towns in the area, electricity is supplied from Namibia (Nampower), except for Noenieput. According to the Siyanda IDP, a six-year programme to restructure the distribution of electricity in six independent regional distributors has been approved and is being managed by the Department of Minerals and Energy.

Most people use electricity for lighting which is followed by candles. Tables 8 and Tables 9 gives the statistics on sources for lightning for the Siyanda District and the local municipalities respectively.

<table>
<thead>
<tr>
<th>Energy source for lighting</th>
<th>African/Black</th>
<th>Coloured</th>
<th>Indian/Asian</th>
<th>White</th>
<th>Not applicable</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>13621</td>
<td>18581</td>
<td>37</td>
<td>7556</td>
<td>123</td>
<td>39918</td>
</tr>
<tr>
<td>Gas</td>
<td>38</td>
<td>77</td>
<td>0</td>
<td>27</td>
<td>0</td>
<td>142</td>
</tr>
<tr>
<td>Paraffin</td>
<td>942</td>
<td>1141</td>
<td>1</td>
<td>35</td>
<td>0</td>
<td>2119</td>
</tr>
</tbody>
</table>

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20 Integrated Development Plan for the Mier local municipality (reviewed), 2005.
21 Integrated Development Plan for the Siyanda District Municipality, 2004
While most households use electricity for heating and cooking, approximately 35% still use wood.

Table 9: Siyanda District, energy source for heating and population group of head of household (Census 2001)

<table>
<thead>
<tr>
<th>Energy source for heating</th>
<th>African/Black</th>
<th>Coloured</th>
<th>Indian/Asian</th>
<th>White</th>
<th>Not applicable</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>9140</td>
<td>13816</td>
<td>30</td>
<td>7200</td>
<td>113</td>
<td>30299</td>
</tr>
<tr>
<td>Gas</td>
<td>175</td>
<td>366</td>
<td>1</td>
<td>281</td>
<td>3</td>
<td>826</td>
</tr>
<tr>
<td>Paraffin</td>
<td>1372</td>
<td>675</td>
<td>1</td>
<td>65</td>
<td>0</td>
<td>2113</td>
</tr>
<tr>
<td>Wood</td>
<td>6755</td>
<td>12306</td>
<td>10</td>
<td>268</td>
<td>8</td>
<td>19347</td>
</tr>
<tr>
<td>Coal</td>
<td>154</td>
<td>92</td>
<td>1</td>
<td>16</td>
<td>1</td>
<td>264</td>
</tr>
<tr>
<td>Animal dung</td>
<td>31</td>
<td>25</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>62</td>
</tr>
<tr>
<td>Solar</td>
<td>0</td>
<td>16</td>
<td>0</td>
<td>36</td>
<td>0</td>
<td>52</td>
</tr>
<tr>
<td>Other</td>
<td>401</td>
<td>678</td>
<td>1</td>
<td>248</td>
<td>4</td>
<td>1332</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>54298</td>
</tr>
</tbody>
</table>

(b) Opportunities

Due to the climate of the area there is huge potential to utilise solar energy more widely, especially in the remote areas of the district.

(c) Constraints

The small communities in sparsely populated areas make effective distribution of electricity very difficult in some areas.

(d) Desired state

The desired actions relating to energy supply in the area:

- Electricity provision should be extended to all areas in order to reduce the dependency on candles and wood as the main energy sources (the strong reliance on wood is not sustainable over the long term and can lead to the overexploitation of especially Camel Thorn trees in the area); and
- the excellent potential for the utilisation of alternative energy sources should be optimised by a sponsored programme to introduce alternative energy on a large scale to remote communities.
2.3.7 Sanitation

(a) Description

The number of the households receiving sanitary services increased dramatically in 2001 in the EMF area. The Census data of 2001 indicates an improvement sanitation service of the EMF area with major increases in chemical toilets, septic tanks, VIP and flush toilets. Bucket latrine systems are being phased out across the area.

<table>
<thead>
<tr>
<th>Toilet facilities</th>
<th>African/Black</th>
<th>Coloured</th>
<th>Indian/Asian</th>
<th>White</th>
<th>Not applicable</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flush toilet (connected to sewerage system)</td>
<td>11028</td>
<td>14174</td>
<td>35</td>
<td>6223</td>
<td>108</td>
<td>31568</td>
</tr>
<tr>
<td>Flush toilet (with septic tank)</td>
<td>1005</td>
<td>2854</td>
<td>3</td>
<td>1766</td>
<td>16</td>
<td>5644</td>
</tr>
<tr>
<td>Chemical toilet</td>
<td>54</td>
<td>362</td>
<td>0</td>
<td>6</td>
<td>1</td>
<td>423</td>
</tr>
<tr>
<td>Pit latrine with ventilation (VIP)</td>
<td>1090</td>
<td>2129</td>
<td>1</td>
<td>39</td>
<td>1</td>
<td>3260</td>
</tr>
<tr>
<td>Pit latrine without ventilation</td>
<td>1425</td>
<td>1737</td>
<td>2</td>
<td>10</td>
<td>0</td>
<td>3174</td>
</tr>
<tr>
<td>Bucket latrine</td>
<td>1476</td>
<td>1767</td>
<td>2</td>
<td>7</td>
<td>0</td>
<td>3252</td>
</tr>
<tr>
<td>None</td>
<td>1950</td>
<td>4951</td>
<td>3</td>
<td>70</td>
<td>3</td>
<td>6977</td>
</tr>
</tbody>
</table>

Universe: All households. (Including collective living quarters)

The cumulative effects of sewage disposal in the Vaal and Orange River systems is regarded as problematic but there is currently insufficient information available to confirm the extent of the problem.

(b) Opportunities

The climate of the area lends itself to cost efficient sanitation systems (high evaporation and low humidity).

(c) Constraints

The improvement of sanitation systems to waterborne systems increases the pressure on scarce water resources, especially in remote areas.

(d) Desired state

The desired actions relating to the sanitation infrastructure in the area are:

- Reduce the reliance on water borne sanitation systems;
– explore and implement alternative dry technologies for which the climate of the area is ideally suited; and
– Monitor and record the cumulative effects of sewage disposal in the Vaal and Orange River systems.

2.4 Population characteristics

2.4.1 Population size, distribution, age and gender

(a) Description

The Siyanda District Municipality’s Integrated Developmental Plan has documented the statistics of the population as contained in Census 2001 and Census 1996 respectively. The statistics indicates that the EMF area experienced a marginal decrease in population between 1996 and 2001 but with an increase of 6749 African people\textsuperscript{22}. All the population and household related tables used in this document, however, reflect the Census 2001 information in terms of the new 2005 Municipal Demarcations and, therefore, differs from the information contained in the IDP documents.

According to Census 2001 Siyanda has a population of 202161 persons as depicted in the 2005 Municipal Demarcation. Approximately 49% of the population is male while 51% is female.

The population of the area is young, with 59% of persons younger than 30 years old and 73% of persons younger than 40 years old. Less than 8% of persons are older than 60 years old, which indicates a low life expectancy for the region.

Coloured persons makes up 64.36% of the population, African persons makes up 23.65% (mostly in the Tsantsabane and Kgotelopele municipal areas) and Whites makes up 11.88%. Indian/Asian persons make up less than 0.1% of the population.

\textit{Table 11: Siyanda District, age group, population group, gender and group totals (Census 2001)}

<table>
<thead>
<tr>
<th>Age groups</th>
<th>African/Black</th>
<th>Coloured</th>
<th>Indian/Asian</th>
<th>White</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M  F</td>
<td>M  F</td>
<td>M  F</td>
<td>M  F</td>
<td></td>
</tr>
<tr>
<td>0 - 4</td>
<td>2065</td>
<td>1991</td>
<td>7856</td>
<td>7756</td>
<td>11</td>
</tr>
<tr>
<td>5-9</td>
<td>2006</td>
<td>1998</td>
<td>7606</td>
<td>7606</td>
<td>14</td>
</tr>
<tr>
<td>10-14</td>
<td>1868</td>
<td>1930</td>
<td>7238</td>
<td>7330</td>
<td>7</td>
</tr>
<tr>
<td>15 - 19</td>
<td>2407</td>
<td>2554</td>
<td>6803</td>
<td>6986</td>
<td>10</td>
</tr>
<tr>
<td>20 - 24</td>
<td>3165</td>
<td>2900</td>
<td>5380</td>
<td>5743</td>
<td>10</td>
</tr>
<tr>
<td>25 - 29</td>
<td>3027</td>
<td>2664</td>
<td>4797</td>
<td>5399</td>
<td>12</td>
</tr>
<tr>
<td>30 - 34</td>
<td>2370</td>
<td>2104</td>
<td>4565</td>
<td>4941</td>
<td>12</td>
</tr>
</tbody>
</table>

### Opportunities

The low and relatively stable population provides an opportunity for effective basic service delivery.

### Constraints

The wide and low density distribution of the population makes service delivery expensive and in places even unsustainable over the long term.

The large agricultural sector induces a seasonal trend to the labour market that results in a fluctuating population in some areas throughout the course of a year.

### Desired state

The desired actions relating to population of the area:

- The long term sustainability of service delivery to isolated small populations is an issue that will have to be dealt with at some point.; and

- substance abuse, especially alcohol abuse, is a major debilitating factor in the population amongst all age groups that has to be addressed as a priority on every level.

### Language

#### (a) Description

Afrikaans is the dominant language in the area and is spoken by almost 82% of the population. Setswana is spoken by almost 13.5% of the population. Less than 5% of the population speak...
other languages. The language profiles are provided for the Siyanda District and the local municipal area in the table below.

<table>
<thead>
<tr>
<th>Language</th>
<th>African/Black</th>
<th>Coloured</th>
<th>Indian/Asian</th>
<th>White</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M  F</td>
<td>M  F</td>
<td>M  F</td>
<td>M  F</td>
<td></td>
</tr>
<tr>
<td>Afrikaans</td>
<td>6654 6460</td>
<td>62000 66906</td>
<td>73 67</td>
<td>11416 11920</td>
<td>80143 85353</td>
</tr>
<tr>
<td>English</td>
<td>184 177</td>
<td>289 287</td>
<td>21 21</td>
<td>336 276</td>
<td>830 761</td>
</tr>
<tr>
<td>IsiNdebele</td>
<td>35 39</td>
<td>8 12</td>
<td>0 0</td>
<td>0</td>
<td>43 51</td>
</tr>
<tr>
<td>IsiXhosa</td>
<td>2717 2532</td>
<td>35 34</td>
<td>0 0</td>
<td>3</td>
<td>2752 2569</td>
</tr>
<tr>
<td>IsiZulu</td>
<td>152 97</td>
<td>3 3</td>
<td>0 0</td>
<td>0</td>
<td>155 100</td>
</tr>
<tr>
<td>Sepedi</td>
<td>48 40</td>
<td>6 0</td>
<td>0 0</td>
<td>0</td>
<td>54 40</td>
</tr>
<tr>
<td>Sesotho</td>
<td>658 676</td>
<td>5 14</td>
<td>0 0</td>
<td>0</td>
<td>663 690</td>
</tr>
<tr>
<td>Setswana</td>
<td>13662 13218</td>
<td>193 191</td>
<td>4 0</td>
<td>4</td>
<td>13863 13413</td>
</tr>
<tr>
<td>SiSwati</td>
<td>38 33</td>
<td>3 0</td>
<td>0 0</td>
<td>5</td>
<td>46 33</td>
</tr>
<tr>
<td>Tshivenda</td>
<td>39 22</td>
<td>4 10</td>
<td>0 0</td>
<td>3</td>
<td>46 32</td>
</tr>
<tr>
<td>Tshivenda</td>
<td>31 25</td>
<td>7 6</td>
<td>0 0</td>
<td>3</td>
<td>38 34</td>
</tr>
<tr>
<td>Other</td>
<td>150 131</td>
<td>63 44</td>
<td>7 0</td>
<td>29 27</td>
<td>249 202</td>
</tr>
<tr>
<td></td>
<td>24368 23450</td>
<td>62616 67507</td>
<td>105 88</td>
<td>11793 12233</td>
<td>98882 103278</td>
</tr>
</tbody>
</table>

(b) Opportunities

The language distribution in the area does not provide any specific opportunities.

(c) Constraints

The language distribution in the area does not result in any specific constraints.

2.4.3 Education and literacy

(a) Description

There is a high illiteracy rate in the EMF area with more than 21105 persons over the age of 20 who have never been to school.

According to the IDP the population of the District has low educational levels with 49, 9% of the population over 20 years old with no schooling or only up to the level of primary education. According to Census 2001 information, only 15, 7% obtained grade 12, while 4, 7% undertook higher education. Table 13 provides information on persons between the ages of 5 and 24 that attend educational institutions.

<table>
<thead>
<tr>
<th>School attendance</th>
<th>African/Black</th>
<th>Coloured</th>
<th>Indian/Asian</th>
<th>White</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M  F</td>
<td>M  F</td>
<td>M  F</td>
<td>M  F</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>4551 4495</td>
<td>10517 11064</td>
<td>20 8</td>
<td>928 823</td>
<td>16016 16390</td>
</tr>
<tr>
<td>Pre-school</td>
<td>260 222</td>
<td>675 669</td>
<td>3 3</td>
<td>134 145</td>
<td>1072 1039</td>
</tr>
<tr>
<td>School</td>
<td>4577 4597</td>
<td>15717 15757</td>
<td>18 25</td>
<td>2352 2278</td>
<td>22664 22657</td>
</tr>
<tr>
<td>College</td>
<td>19 23</td>
<td>36 81</td>
<td>0 3</td>
<td>37 50</td>
<td>92 157</td>
</tr>
</tbody>
</table>

Table 13: Education institution attendance, persons between 5 years old and 24 years old (Census 2001)
(b) Opportunity

The low population makes the attainment of high school attendance possible.

(c) Constraints

The current low number of schools and institutions in the area are low in comparison with other areas. This makes it difficult to alleviate the high illiteracy rate.

(d) Desired state

The illiteracy rate in the area is high and many literate and skilled persons leave the area due to better offers in the surrounding areas and provinces.

The desired actions relating to education, illiteracy, employment and personal income in the area are:

- A concerted effort needs to be made to improve the literacy rate in the area and to retain skilled persons by improving the education system in the area; and

- there is a strong need to develop the economy of the area in a manner that will address the low level of skills and personal income that is partly due to the type of current occupational activities in mainly the agricultural and mining sectors that exist in the area which means that expansion and diversification of the employment sectors into industries and other sectors that require better skilled workers is imperative to create a market for such jobs.

2.4.4 Employment and personal income

(a) Description

The employment by occupational categories for the Siyanda District and the local municipalities are provided in Tables 14 and 15 respectively. Most employees work in elementary occupations while very few people perform professional work.

According to the Census 2001 figures, the majority of income earning persons in the area earned less than R800.00 per month. High incomes (above R50,000.00 per month) were also

<table>
<thead>
<tr>
<th></th>
<th>5</th>
<th>14</th>
<th>37</th>
<th>39</th>
<th>0</th>
<th>0</th>
<th>26</th>
<th>47</th>
<th>68</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technikon</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>23</td>
<td>0</td>
<td>0</td>
<td>21</td>
<td>25</td>
<td>24</td>
<td>48</td>
</tr>
<tr>
<td>Adult education centre</td>
<td>13</td>
<td>9</td>
<td>11</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>24</td>
<td>19</td>
</tr>
<tr>
<td>Other</td>
<td>17</td>
<td>21</td>
<td>35</td>
<td>26</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>6</td>
<td>62</td>
<td>53</td>
</tr>
<tr>
<td>Older than 24 years (N/A)</td>
<td>14922</td>
<td>14069</td>
<td>35590</td>
<td>39840</td>
<td>65</td>
<td>52</td>
<td>8282</td>
<td>8856</td>
<td>58859</td>
<td>62817</td>
</tr>
<tr>
<td>Totals</td>
<td>24364</td>
<td>23450</td>
<td>62621</td>
<td>67505</td>
<td>106</td>
<td>91</td>
<td>11790</td>
<td>12234</td>
<td>98881</td>
<td>103280</td>
</tr>
</tbody>
</table>
limited to less than 200 people. The individual monthly incomes for Siyanda District and the local municipalities are displayed in the tables below.

**Table 14: Siyanda District occupation amongst the employed aged 15 to 65 years (Census 2001)**

<table>
<thead>
<tr>
<th>Occupation</th>
<th>African/Black</th>
<th>Coloured</th>
<th>Indian/Asian</th>
<th>White</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M  F</td>
<td>M  F</td>
<td>M  F</td>
<td>M  F</td>
<td>Total</td>
</tr>
<tr>
<td>Legislators, senior officials and managers</td>
<td>116 35</td>
<td>340 137</td>
<td>3 0</td>
<td>1017 350</td>
<td>1476 522 1998</td>
</tr>
<tr>
<td>Professionals</td>
<td>171 53</td>
<td>302 236</td>
<td>6 3</td>
<td>604 385</td>
<td>1083 677 1760</td>
</tr>
<tr>
<td>Technicians and associate professionals</td>
<td>197 193</td>
<td>696 1006</td>
<td>3 4</td>
<td>526 567</td>
<td>1422 1770 3192</td>
</tr>
<tr>
<td>Clerks</td>
<td>280 261</td>
<td>742 1186</td>
<td>0 7</td>
<td>349 1446</td>
<td>1371 2900 4271</td>
</tr>
<tr>
<td>Service workers, shop and market sales workers</td>
<td>666 247</td>
<td>1133 849</td>
<td>9 0</td>
<td>864 387</td>
<td>2672 1483 4155</td>
</tr>
<tr>
<td>Skilled agricultural and fishery workers</td>
<td>1311 881</td>
<td>1595 415</td>
<td>5 0</td>
<td>1269 114</td>
<td>4180 1410 5590</td>
</tr>
<tr>
<td>Craft and related trades workers</td>
<td>1019 98</td>
<td>1836 307</td>
<td>3 0</td>
<td>800 48</td>
<td>3658 453 4111</td>
</tr>
<tr>
<td>Plant and machine operators and assemblers</td>
<td>867 37</td>
<td>1214 64</td>
<td>0 0</td>
<td>234 16</td>
<td>2315 117 2432</td>
</tr>
<tr>
<td>Elementary occupations</td>
<td>5883 5387</td>
<td>8771 8004</td>
<td>11 9</td>
<td>224 97</td>
<td>14889 13497 26386</td>
</tr>
<tr>
<td>Undetermined</td>
<td>757 615</td>
<td>752 604</td>
<td>0 0</td>
<td>259 258</td>
<td>1768 1477 3245</td>
</tr>
<tr>
<td>Not applicable</td>
<td>6443 8954</td>
<td>20331 28995</td>
<td>30 35</td>
<td>1967 4587</td>
<td>28771 42571 71342</td>
</tr>
<tr>
<td>Totals</td>
<td>17710 16761</td>
<td>37712 41803</td>
<td>70 58</td>
<td>8113 8255</td>
<td>63605 66877 130482</td>
</tr>
</tbody>
</table>

**Table 15: Siyanda District, individual monthly income for the employed aged 15 to 65 years (Census 2001)**

<table>
<thead>
<tr>
<th>Individual monthly income</th>
<th>African/Black</th>
<th>Coloured</th>
<th>Indian/Asian</th>
<th>White</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M  F</td>
<td>M  F</td>
<td>M  F</td>
<td>M  F</td>
<td>Total</td>
</tr>
<tr>
<td>No income</td>
<td>111 106</td>
<td>271 247</td>
<td>0 0</td>
<td>202 158</td>
<td>584 511 1095</td>
</tr>
<tr>
<td>R 1 - R 400</td>
<td>2461 2480</td>
<td>3756 4373</td>
<td>3 8</td>
<td>101 64</td>
<td>6321 6925 13246</td>
</tr>
<tr>
<td>R 401 - R 800</td>
<td>5027 4228</td>
<td>5982 4328</td>
<td>11 3</td>
<td>147 139</td>
<td>11167 8698 19865</td>
</tr>
<tr>
<td>R 801 - R 1600</td>
<td>1546 438</td>
<td>3437 1572</td>
<td>6 3</td>
<td>464 542</td>
<td>5453 2555 8008</td>
</tr>
<tr>
<td>R 1601 - R 3200</td>
<td>1347 291</td>
<td>2252 1214</td>
<td>3 3</td>
<td>1083 1131</td>
<td>4685 2639 7324</td>
</tr>
<tr>
<td>R 3201 - R 6400</td>
<td>550 185</td>
<td>1075 869</td>
<td>5 3</td>
<td>1716 1160</td>
<td>3346 2217 5563</td>
</tr>
<tr>
<td>R 6401 - R 12800</td>
<td>159 59</td>
<td>515 173</td>
<td>8 3</td>
<td>1470 353</td>
<td>2152 588 2740</td>
</tr>
<tr>
<td>R 12801 - R 25600</td>
<td>31 17</td>
<td>58 9</td>
<td>3 0</td>
<td>657 71</td>
<td>749 97 846</td>
</tr>
<tr>
<td>R 25601 - R 51200</td>
<td>7 0</td>
<td>19 12</td>
<td>0 0</td>
<td>186 24</td>
<td>212 36 248</td>
</tr>
</tbody>
</table>
Opportunities
There are significant opportunities for professional experts and skilled persons, especially those with entrepreneurial skills to find work in the area.

Constraints
The literacy rate and personal income in the area is low. Poverty is a major debilitating factor in the population.

2.5 Economy
2.5.1 Economic sectors
Siyanda District Municipality accounts for about 30% of the Northern Cape economy. Siyanda's economy is dominated by mining and agriculture. The share of agriculture in the economy is slowly gaining ground while it seems as if the contribution of mining is in decline. Tourism, while small, is the fastest growing sector.

Mining activity occurs mostly in the local municipalities of Tsantsabane and Kgatelopele, where manganese, diamonds and lime (for producing cement) are found. Agriculture occurs almost exclusively along the Orange River.

Tourism is already an important contributor to the Siyanda economy. If the latest growing trends in this sector continue, it is foreseen that in 10 years' time it can be the third largest sector after mining and agriculture.

Poverty is a tremendous problem with a high number of households living below the poverty line. The income per capita is lower than the provincial level in each one of the economic sectors.

The main sectors in the economy of the region are:

- Irrigated agriculture
Irrigated Agriculture is the most important economic activity in the area, especially in terms of employment. Its real value lies in the wider socio economic benefit and stability that it generates for a large part of the local communities as an employment provider. Modern irrigation techniques have improved the efficiency of water use which means that the irrigated areas are expanding well beyond the traditional areas that used to occur directly along the Orange River. Major horticulture crops produced in the area include, table grapes, raisins, dates, pistachio nuts and vegetables. Field crops include wheat, cotton and lucerne. Other smaller crops include groundnuts, citrus, onions, potatoes, peaches, apricots, melons, mangoes, flower bulbs and dried peas.

- **Agro-processing**

The largest dried vine fruit processing and packaging plant (SAD Vine Fruit (Pty) Ltd) in South Africa is based in Upington which is served by six intake depots located in Groblershoop, Mylpaal, Louisvaleweg, Keimoes, Kakamas and Vredendal.

The Orange River Wine Cellars Co-Op which is based in Upington is the second largest wine making co-operative in the world and has wine cellars in Groblershoop, Grootdrink, Upington, Keimoes and Kakamas. The co-operative was established in 1965 and has over 740 members who produce wine grapes and 445 members who produce grape juice. At present most of the wine is produced for the local South African market.

Expansion of agro-processing is regarded as an activity with significant future growth potential.

- **Livestock farming**

Livestock farming is an important activity in the dry semi-desert areas of the area and provides a livelihood to many small rural communities. Due to the generally low carrying capacity of the veld in the area livestock farming is, however, not as important as in the rest of the province. Growth in this sector is also unlikely due to the environmental limitations and the fact that the carrying capacity of the veld has in most cases already been reached.

- **Game farming**

Game farming is well established and contributes significantly to the economy of the area. Game farming products include eco-tourism, hunting, rearing of game for the production of venison and game breeding for the sale of live animals. In places game farms occur in large-scale conservancies. There is significant potential to expand the tourism potential that is
created by game farming especially if it is focussed on the development of high quality specialised niche markets.

- Mining

Mining has traditionally been the mainstay of the economy of the area and contributed significantly to the historic settlement pattern in the area. As illustrated in section 2.1.1(d) of the report, it seems as if mining is past its peak and is currently, in a relatively steep decline as an economic contributor in the area, mainly due to the depletion of the best mineral reserves. Significant untapped and dormant mineral reserves of lesser quality, however, remain in the area. With the right market conditions, sometime in the future, mining could very well once again become a strong growth sector.

- Manufacturing

Manufacturing in the areas is currently limited. Given the comparative advantage in respect to transportation, there is great potential to increase the contribution from manufacturing, especially for export markets in the northern hemisphere.

- Tourism

The semi-desert landscape with its contrasts and relative accessibility attracts a lot of tourists each year. In addition, Kgalagadi Transfrontier Park and Augrabies Falls National Park are important draw cards for tourism. Visitors to these parks also generate a positive spillover effect on other small-scale tourist activities in the district.

- Transport

The national and other major roads that pass through the area are an important factor in generating income from those who use the routes. These routes include links to Namibia and with the careful placement of amenities along the routes there is significant potential to capture value from road users.

Upington Airport is a major resource especially for the export of locally produced products. It also has significant latent potential to serve as a major transportation/import/export hub, especially if it is linked with the railway network in the area.
Table 16: Siyanda District, economic sectors amongst the employed aged 15 to 65 years (Census 2001)

<table>
<thead>
<tr>
<th>Economic sector</th>
<th>African/Black</th>
<th>Coloured</th>
<th>Indian/Asian</th>
<th>White</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>F</td>
<td>M</td>
<td>F</td>
<td>M</td>
</tr>
<tr>
<td>Agriculture, hunting, forestry and fishing</td>
<td>6,224</td>
<td>4,791</td>
<td>7,744</td>
<td>4,022</td>
<td>8</td>
</tr>
<tr>
<td>Mining and quarrying</td>
<td>723</td>
<td>57</td>
<td>380</td>
<td>50</td>
<td>3</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>823</td>
<td>109</td>
<td>907</td>
<td>358</td>
<td>5</td>
</tr>
<tr>
<td>Electricity; gas and water supply</td>
<td>52</td>
<td>8</td>
<td>138</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>Construction</td>
<td>438</td>
<td>22</td>
<td>1,293</td>
<td>83</td>
<td>0</td>
</tr>
<tr>
<td>Wholesale and retail trade; repairs, hotels and restaurants</td>
<td>623</td>
<td>400</td>
<td>1,483</td>
<td>1,765</td>
<td>4</td>
</tr>
<tr>
<td>Transport, storage and communication</td>
<td>235</td>
<td>24</td>
<td>556</td>
<td>102</td>
<td>3</td>
</tr>
<tr>
<td>Financial; insurance; real estate business etc</td>
<td>264</td>
<td>82</td>
<td>704</td>
<td>460</td>
<td>6</td>
</tr>
<tr>
<td>Community; social and personal services</td>
<td>943</td>
<td>543</td>
<td>2,299</td>
<td>2,209</td>
<td>6</td>
</tr>
<tr>
<td>Private households</td>
<td>166</td>
<td>1,013</td>
<td>794</td>
<td>3,026</td>
<td>0</td>
</tr>
<tr>
<td>Other and not adequately defined</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Undetermined</td>
<td>774</td>
<td>758</td>
<td>1,082</td>
<td>714</td>
<td>6</td>
</tr>
<tr>
<td>Not applicable</td>
<td>6,443</td>
<td>8,956</td>
<td>20,331</td>
<td>28,996</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>17,708</td>
<td>16,763</td>
<td>37,711</td>
<td>41,805</td>
<td>71</td>
</tr>
</tbody>
</table>

2.5.2 Potential economic drivers

Economic drivers are the influences and activities that underpin economic growth and development. There are two kinds of drivers, namely external drivers (legislation and policy) and internal drivers (economic activities).

In respect to external drivers it is important that government (at all levels) create a legislative and policy environment that is conducive to quality sustainable economic growth in the area. Potential internal drivers include:

- The expansion, diversification and refinement of irrigated agricultural crops as well as associated agro-industrial processing, with an emphasis on high value crops and especially those that serve the export market.
- The marketing and use of the transportation infrastructure, especially Upington Airport and the major road, to create a regional and even international hub for imports, exports and cargo handling/distribution.
The development of niche tourism markets that capture full value out of the special attributes of the area.

The exploitation of the climate of the area for energy generation (sunshine).

Increased mineral beneficiation that unlocks manufacturing opportunities.

### 2.6 Land use and planning

#### 2.6.1 Integrated Development Plans

All municipalities are obliged to undertake an Integrated Development Planning (IDP) process to produce Integrated Development Plans (IDPs) in terms of the Municipal Systems Act, Act 32 of 2000 (MSA).

The EMF area has gone through the process of developing IDPs at both local and district levels. Each local municipality in the district has its own IDP that meets the legal requirements. The reviewed IDP of the Siyanda District EMF area was submitted to the MEC, as required by chapter five of the MSA for approval in the 2002/3 period. The EMF area’s local municipalities also produced their own IDPs after undergoing the reviewing process as required.

Various development plans in the EMF area are in process. Most of them are, however, still in the planning phase.

There are no additional issues in the IDP’s that have to be covered in the Status Quo Report.

#### 2.6.2 Spatial Development Framework (SDFs)

Spatial Development Frameworks for the EMF area have not yet been developed. The //Khara Hais municipality is the only municipality that has begun with the development process of the SDF. A service provider has been appointed to develop the SDF for the area.

### 2.7 Conclusion

#### 2.7.1 Sensitivity index

The sensitivity index is shown on Map 14: Sensitivity Index. The main factors that were used to compile the index include the following:

- The erosion potential of soil where soils with a high erosion potential were awarded a sensitivity of 1;
The conservation priority of veld types for veld types with a medium conservation priority were awarded a sensitivity count of 1; those with a high conservation priority were awarded a count of 2; and those with a very high conservation priority were awarded a count of 3;

- Topographical areas with a high variance in shape and form were awarded a sensitivity count of 1;
- All watercourses, drainage lines, and pans (including a 32m buffer on either side) were awarded a sensitivity count of 2; and
- All transformed areas were awarded a sensitivity count of -1.

It must be noted that conserved areas were not taken into account as their sensitivity to development activities are already catered for in their management plans.

The sensitivity of especially the vegetation along the Orange River will be refined further during the course of the EMF. It has, however, already been established to be the most critical element in the area.

### 2.7.2 Key issues

The issues relating to each section of the report are described at the end of each section. The following are, however, considered to be the main environmental issues that may cause negative impacts and have to be addressed in the EMF:

- The conservation of the remaining Lower Gariep Alluvial Vegetation along the Orange River;
- The protection of vegetative groundcover across the area against overgrazing and other activities such as 4x4 and quad bike driving;
- The effect that inappropriate irrigation may have on the salination of soil in places;
- The provision of services, especially water to small populations in remote areas that may be unsustainable over the long term;
- The extensive use of firewood for cooking and heating that may be a threat to especially the protected Camel Thorn trees in places; and
- The rehabilitation of mining areas, especially along scenic routes that may have potential for further tourism development.
Due to the nature of the vast area with a low population there are no significant landuse conflicts in the area that need to be addressed in the EMF with the exception of activities within the Orange River floodplain.
Map 14

Environmental Sensitivity Index

Rivers
- Perennial
- Non-perennial
- Siyanda District Municipality

Environmental Sensitivity Index
- Transformed
- 0 - Lower
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8 - Higher

Siyanda District Municipal Area
3. **Environmental control zones**

The purpose of environmental control zones is to indicate areas that require a specific type or regime of control due to unique environmental elements that occur in these areas. It may or may not be linked to the application of EIA legislation and should be dealt with at a more strategic level where it should serve as a guide for decision-making and planning.

3.1 **Siyanda district as a whole**

In respect to the Siyanda district as a whole the following specific environmental control areas have been identified:

- Zone 1: Potential sensitive groundwater resources (4.2% of the total area);
- Zone 2: Potential wind erosion areas (47.1% of the total area);
- Zone 3: Potential high to very high vegetation conservation areas (8.0% of the total area);
- Zone 4: Potential sensitive groundwater resources and potential wind erosion areas (0.04% of the total area);
- Zone 5: Potential sensitive groundwater resources and potential high to very high vegetation conservation areas (0.1% of the total area);
- Zone 6: Potential wind erosion areas and potential high to very high vegetation conservation areas (3.0% of the total area); and
- Zone 7: Low control zone (37.0% of the total area).

These zones are depicted on Map 15: Environmental Control Zones.

**Zone 1: Potential sensitive groundwater resources**

The karst aquifers that occur in the dolomite and lime stone rocks in the area represent a major strategic water resource. It is sensitive both in respect to the abstraction and potential pollution of groundwater.

The following management parameters are suggested for the zone:

- Land uses and activities that are compatible with the zone and may be allowed without further assessment:
  - Nature conservation;
  - Stock farming that does not exceed the carrying capacity of the veld; and
- game farming that does not exceed the carrying capacity of the veld.

- Land uses and activities that may be compatible (depending on the specific nature of land use or activity) and that may be considered in the zone after an appropriate level of impact assessment (as required by law) has been conducted:
  - Irrigated agriculture;
  - establishment of towns or settlements (including components thereof) and related infrastructure;
  - extraction of groundwater;
  - mining and quarrying;
  - decanting of water from mines;
  - bulk sewer and storm water infrastructure; and
  - new roads, railways, pipelines and cables.

- Land uses and activities that are not appropriate for this zone:
  - The bulk storage of hazardous substances; and
  - unrehabilitated spoil heaps and mine dumps.

- General parameters for the zone:
  - Relatively small facilities that store hazardous materials such as filling stations should be limited to the minimum necessary in the area in order keep the risk of polluting the aquifers in the area to the minimum possible; and
  - geohydrological investigations should be a standard requirement for all impact assessments of activities that relates to the storage of hazardous materials and the abstraction of groundwater.

**Zone 2: Potential wind erosion areas**

Due to the sandy nature and the grain size of the sand that occur in the area, the area is prone to severe wind erosion if the groundcover that acts as a protective layer is disturbed over large areas or in exposed places.

The following management parameters are suggested for the zone:
• Land uses and activities that are compatible with the zone and may be allowed without further assessment:
  o Nature conservation;
  o stock farming that does not exceed the carrying capacity of the veld, provided that the veld has not been overgrazed already; and
  o game farming that does not exceed the carrying capacity of the veld provided that the veld has not been overgrazed already.

• Land uses and activities that may be compatible (depending on the specific nature of land use or activity) and that may be considered in the zone after an appropriate level of impact assessment (as required by law) has been conducted:
  o Agriculture of any kind;
  o establishment of towns or settlements (including components thereof) and related infrastructure;
  o opencast mining and quarrying; and
  o new tracks, roads, railways, pipelines and cables.

• Land uses and activities that are not appropriate for this zone:
  o Stock farming on land that has already been overgrazed; and
  o game farming on land that has already been overgrazed;
  o off-road vehicle driving except where it is done under the supervision of a recognized suitably qualified person.

• General parameters for the zone:
  o The creation of unnecessary bare earth areas should be avoided at all cost;
  o new roads and tracks should be kept to the minimum necessary;
  o exposed bare areas should be paved or be rehabilitated with vegetation cover whenever feasible; and
  o over stocking with domestic animals or game must be prevented at all cost.
DESCRIPTION OF THE ENVIRONMENTAL CONTROL ZONES

Zone 1
- Potential sensitive groundwater resources

Zone 2
- Potential wind erosion areas

Zone 3
- Potential high to very high vegetation conservation areas

Zone 4
- Potential sensitive groundwater resources and
- Potential wind erosion areas

Zone 5
- Potential sensitive groundwater resources and
- Potential high to very high vegetation conservation areas

Zone 6
- Potential wind erosion areas and
- Potential high to very high vegetation conservation areas

Zone 7
- Low control zone
Zone 3: Potential high to very high vegetation conservation areas

The area covered by this zone has the potential to become core parts of conservation areas that may be necessary in order to meet national conservation targets. It is therefore important that the potential is maintained by keeping these areas as natural as possible.

Due to the sandy nature and the grain size of the sand that occur in the area, the area is prone to severe wind erosion if the groundcover that acts as a protective layer is disturbed over large areas or in exposed places.

The following management parameters are suggested for the zone:

- Land uses and activities that are compatible with the zone and may be allowed without further assessment:
  - Nature conservation.

- Land uses and activities that may be compatible (depending on the specific nature of land use or activity) and that may be considered in the zone after an appropriate level of impact assessment (as required by law) has been conducted:
  - Stock farming that does not exceed the carrying capacity of the veld; and
  - Game farming that does not exceed the carrying capacity of the veld.

- Land uses and activities that are not appropriate for this zone:
  - Agriculture of any kind;
  - Establishment of towns or settlements (including components thereof) and related infrastructure;
  - Opencast mining and quarrying;
  - New tracks, roads, railways, pipelines and cables; and
  - All off-road vehicle driving.

- General parameters for the zone:
  - The creation of unnecessary bare earth areas should be avoided at all cost;
  - The construction or creation of new roads and tracks should be avoided;
  - Exposed bare areas should be paved or be rehabilitated with vegetation cover whenever feasible; and
o over stocking with domestic animals or game must be prevented at all cost.

Zone 4: Potential sensitive groundwater resources and potential wind erosion areas
The parameters of both zones 1 and 2 apply in this zone.

Zone 5: Potential sensitive groundwater resources and potential high to very high vegetation conservation areas
The parameters of both zones 1 and 3 apply in this zone.

Zone 6: Potential wind erosion areas and potential high to very high vegetation conservation areas
The parameters of both zones 2 and 3 apply in this zone.

Zone 7: Low control zone
This zone has relatively less sensitivity than the other zones and no special parameters, except those already implemented or required by law, are proposed for this zone.

3.2 General parameters for tourism development that should apply across Siyanda

Toursim in Siyanda is dependent on the maintenance of a high quality environment. The character of Siyanda, strengthened by special features such as the national parks and the Witsand Reserve (that is on the border of Siyanda) together with landscape features such as the Langberg / Koranaberge Ranges, the Orange River and its intricate web of islands, the Kalahari sands and the textured Karoo landscapes to the south, represents a particular sense of place with a special value for visitors. It is important that this value is protected from any influence that may detract from its positive attributes. The aesthetic nature of the area as a whole should therefore be a consideration in any large scale development in the area. There is a significant road network in the area that together with the character of the area makes a unique brand and mix of tourism viable in the area. The maximisation of this tourism as an economic activity in the area must be maximised. It may also be advantageous to upgrade some of the lower order roads in order to improve accessibility for tourists to some of the more remote areas.

3.3 The Orange River Area

In terms of environmental control, two aspects have been identified in the Orange River area that require specific attention namely areas covered by the Lower Gariep Alluvial Vegetation
and areas that consist of the water body of the river. These areas are depicted on the photo interpretation maps in Appendix A to this report.

In the instance of the Lower Gariep Alluvial Vegetation, conservation is the only acceptable use of the area because it represents:

- an endangered vegetation type with a conservation target that can already not be attained anymore due to the extent of transformation that has already occurred; and
- natural floodplain areas in the river system that is dynamic and subject to natural physical change over time due to the interaction between the alluvial nature of the area and flood events.

The water body of the Orange River is the most important element in the area in terms of natural and economic services that depend on it. It is a dynamic and complex system. Any activity that will affect the functioning of the water body should be subjected to an appropriate environmental impact assessment. From a strategic long perspective such activities should be limited to the minimum.

4. The identification of Geographical areas in terms of NEMA

4.1 The identification of geographical areas in terms of NEMA 24(2)(b)

This section deals with the identification of areas and the specification of activities in terms of section 24(2)(b) of NEMA. The identification of geographical areas was based on environmental attributes of the areas, which means that different types of areas based on different environmental attributes are identified. Identified areas also overlap with other identified areas in some instances and some areas are wholly contained within other areas. The approach adopted consists of a matrix of identified geographical areas within which the areas are defined according to their environmental attributes that are linked to specified activities. The end result will be a spatial data layer that consists of facets that are each made up of one or more identified areas as displayed on Map 16. Each facet type (each possible combination of identified geographical areas) will be linked to a unique list of specified activities.

A matrix that shows the relationship between identified geographical areas and specified activities is provided in Appendix C.
4.1.1 Siyanda District (excluding the Orange River area)

Four geographical areas have been identified in the Siyanda district where it is proposed that additional activities should be listed in order to achieve the management controls as explained in the previous section and are indicated on Map 16. These areas are:

- **Area A:** where activities may affect groundwater negatively (4.2% of the total area);
- **Area B:** where activities may affect vegetation cover negatively that could lead to significant impacts on the environment (58.1% of the total area);
- **Areas C:** where activities may affect both groundwater and vegetation negatively that could lead to significant impacts on the environment (0.5% of the total area); and
- **Area D:** where no additional activities are proposed (37.0% of the total area).

4.1.2 The Orange River area

In the Orange River area two geographical areas, based on environmental attributes have been identified where it is proposed that additional activities should be listed in order to achieve the management controls as explained in the previous section and are indicated on the photo interpretation maps in Appendix A to this report. The areas correspond to the environmental control zones discussed in the previous section. They are:

- **Area E:** where the Lower Gariep Alluvial Vegetation occurs and where activities that may alter it in any way, should be subjected to an appropriate level of EIA;
- **Area F:** which is occupied by the water body of the Orange River and where activities that may alter it in any way, should be subjected to an appropriate level of EIA;
- **Area G:** which is occupied with existing agriculture and where the national lists of activities should apply in its totality; and
- **Area H:** which is occupied by higher lying outcrops within the wider floodplain of the Orange River where the national list of activities should apply in its totality.

4.2 The identification of geographical areas in terms of NEMA 24(2)(c)

This section deals with the identification of areas and the specification of activities in terms of sections 24(2)(c) of the Act. The specified activities on the national lists are excluded from Basic Assessment (Government Notice R. 386) or Scoping and EIA (Government Notice R. 387), as the case may be within the indicated identified geographical areas as represented on the photo interpretation maps in Appendixes A and B to this report.
The approach adopted consists of a matrix of identified geographical areas within which the areas are defined according to their environmental attributes that are linked to specified activities. The end result will be a spatial data layer that consists of facets that are each made up of one or more identified areas as displayed on Map 16. Each facet type (each possible combination of identified geographical areas) is linked to a unique list of specified activities, as proposed in Appendix C.

4.2.1 Siyanda District (excluding the Orange River area)

For the Siyanda District an urban development boundary has been established and has been indicated on the photo interpretation maps in Appendix B. These areas are collectively identified as Area I (for the purposes of the matrix that will be established). It is proposed that any activities that relates to the provision of basic infrastructure or to the normal development of these towns or settlements that occur within the delineated boundaries be excluded in terms of section 24(2)(c). The types of activities that should not be excluded are facilities for the bulk treatment or disposal of waste, sewage and effluent.

4.2.2 The Orange River area

For the Orange River area the following geographical areas have been identified within which specified activities can be excluded:

- Area J: Airport/airfield;
- Area K: Commercial areas;
- Area L: Golf courses;
- Area M: Industrial and military areas;
- Area N: Mines and quarries;
- Area O: Rural residential areas and smallholdings; and
- Area P: which consist of urban residential areas.

It is proposed that any activities that relates to the provision of basic infrastructure or to the normal development of these towns or settlements that occur within the delineated boundaries be excluded in terms of section 24(2)(c). Once the revised EIA regulations and accompanying lists are available, further specific appropriate activities will be specified for exclusion from the lists for Areas H to P above. The types of activities that should not be excluded are facilities for the bulk treatment or disposal of waste, sewage and effluent.
Map 16: Geographical Areas

GEOGRAPHICAL AREAS WHERE ADDITIONAL EIA ACTIVITIES ARE TO BE SPECIFIED

Area A
Activities that may affect groundwater

Area B
Activities that may affect vegetation cover

Area C
Activities that may affect groundwater and vegetation cover

Area D
No additional activities
5. Strategies

5.1 Introduction

The purpose of strategies is to create a mechanism for implementing action to address some of the most pertinent issues that came out of the EMF. The strategies discussed in this section are focused on the alleviation of potential key development/environment friction areas by providing direction in respect to how these friction areas should be dealt with.

5.2 The role of the EMF in strategies

The EMF should form the basis for the strategy and should be used in the following ways:

- Inform policy and strategic decisions in respect of key government priorities such as provision for low cost housing;
- inform local authority planning;
- serve as a decision aid in the evaluation of impact assessments;
- inform decisions in respect to poverty alleviation and job creation; and
- serve as a guide to developers.

5.3 Strategy for the protection and conservation of high quality natural vegetation across the Siyanda District

5.3.1 Problem statement

The EMF identifies areas that should be considered for the expansion of nature conservation in order to help meet the conservation targets for certain vegetation types as expressed earlier in this report. The identification of the areas is, however, only a start and there is a need for a strategy to make the conservation of the areas a reality. The priority issues that were identified include:

- The need to increase the extent of formally conserved areas;
- the majority of potential properties are privately owned therefore complicating the conservation of these areas; and
- inadequate funds are available at provincial and local level to buy out the required area.
5.3.2 Intent of strategy

The strategy is intended to set a process in motion that can eventually lead to the conservation of adequate portions of the indicated areas.

5.3.3 Strategy parameters and guidelines

This strategy relies on actions to be taken by the provincial and local authorities. The necessary actions have been divided into primary strategic priority actions that have to be taken in order to make the strategy work and secondary strategic priority actions that should be taken if possible. The primary strategic priorities include:

- Clarify roles of provincial and local authorities;
- Timely and accurate reporting should be done by all sectors (government) on their activities that have an effect on the environment;
- Categorise areas in terms of ownership;
- Prioritise and categorise areas in terms of sensitivity/conservation value;
- Prioritise and categorise areas in terms of current threats;
- Compile a conservation plan;
- Secure and formally conserve areas that belong to the government;
- Monitor and conduct compliance audits in conservation;
- Implement environmental education programmes – “duty of care” message;
- Enter into public/private partnerships for the conservation of land; and
- Negotiate conservation / development compromises where appropriate or where it is the last resort.

Secondary strategic priority actions (that should be taken if and when capacity and funding allow) include:

- Acquire land for conservation according to priority where appropriate;
- Manage conservation areas;
- Conceptualise, explain and make guidelines and policies accessible to the public in a user-friendly format;
- Promote and ensure compliance and enforcement; and
• promote conservancies and other initiatives promoting conservation on private land.

5.3.4 Implementation

The strategy should be implemented using the available legal and other means including:

• The National Environmental Management: Protected Areas Act, 2004 (Act 57 of 2003);
• The National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004);
• Spatial Development Frameworks (SDFs); and
• The National Protected Area Expansion Strategy (NPAES).

5.3.5 Scope of application

This strategy should be applied in terms of the areas that have been identified as priority areas for conservation in this EMF.

5.4 Strategy for development on sensitive areas in the Orange River floodplain

5.4.1 Problem statement

There is pressure on environmental authorities to take a proactive approach on sacrificing high quality environmental resources (especially high quality endangered vegetation, along the Orange River – see Appendix A) in order to ensure that there is enough land to meet the “development” needs of the area. There is however significant “vacant” land in the area that falls outside of these high quality environmental areas. This means that for the foreseeable future there is enough spatial capacity to accommodate the anticipated growth and densification needs in the area on land that has low environmental sensitivity (see Appendix A). The strategy is simple and is based on the premise that there is no need for development on sensitive areas while there is currently adequate space available on land that is not sensitive.

5.4.2 Intent of strategy

The intent of the strategy is to prevent inappropriate development on sensitive land in the Orange River floodplain while allowing development on less sensitive part which would contribute to the conservation of the sensitive areas.

5.4.3 Strategy parameters and guidelines

The floodplain areas of the Orange River that consist of Lower Gariep Alluvial Vegetation, the water body as well as agricultural fields that are irrigated through flood irrigation systems should not be developed at all due to its sensitivity.
Higher lying rocky outcrops in the Orange River System or higher lying riverbank areas may be developed in instances where the protection of the resource value of the areas is comprehensively incorporated into developments that integrate its protection within a wider spatial development context (e.g. the substantial inclusion of a Lower Gariep Alluvial Vegetation area as the protected natural component of a nature estate or resort).

5.4.4 Implementation

The strategy should be implemented through the normal land use decision-making processes by adopting the above parameters and guidelines as local authority policy for the area.

5.4.5 Scope of application

The scope of application of this strategy does not include the planning and development of linear infrastructure (roads, bulk pipelines, electricity cables, etc.)

5.5 Protection of sensitive environmental features on large properties across Siyanda

5.5.1 Problem statement

Large properties in general often present good or at least better opportunities than small properties for integrated planning and development. Landowners of large properties often, and for various reasons (including risk management, cash flow, and market conditions), develop their properties incrementally without a long term plan for the development of the whole site, thereby reducing the potential of the site as a whole to accommodate more environmentally appropriate development on a larger scale.

5.5.2 Intent of strategy

The intent of the strategy is to prevent piecemeal development of large properties outside the context of a development plan for the property as a whole.

5.5.3 Strategy parameters and guidelines

Whenever development is proposed on any part of a property which is 2.5ha or larger, it must be done in the context of a development plan for the property as a whole.

5.5.4 Implementation

The strategy should be implemented through the normal land use decision-making processes by adopting the above parameters and guidelines as local authority policy for the area.
5.5.5  Scope of application

The scope of application of this strategy does not include the planning and development of linear infrastructure (roads, bulk pipelines, electricity cables, etc.).

5.6  Strategy for the protection of sensitive environmental features on, surrounded or abutted by small properties

5.6.1  Problem statement

In especially the rural residential and smallholding areas (Appendix A), sensitive elements are often surrounded or bordered on by a number of relatively small properties. If these properties are developed individually outside the context of a larger area development plan, such developments tend to result in a series of small walled, inward looking security developments next to each other with little or no relationship with each other or the natural open space. In this type of scenario the natural open space often becomes surrounded by the back walls of developments that do not make use of the open space values that are present. The open spaces then also become vacant pieces of land that are regarded as hindrances rather than assets.

5.6.2  Intent of strategy

The strategy intends to facilitate a condition where it is possible to incorporate natural open space features as positive land use elements into the development pattern that evolves on adjoining small properties.

5.6.3  Strategy parameters and guidelines

All properties smaller than 10ha that contain or border onto a sensitive natural area can only be developed if it is done within the context of a development plan that incorporates the sensitive area and other similar properties.

The development plans for such areas should be formulated by the local authorities in consultation with the landowners of such areas.

5.6.4  Implementation

The strategy should be implemented through the normal land use decision-making processes by adopting the above parameters and guidelines as local authority policy for the area.
5.6.5 Scope of application

The scope of application of this strategy does not include the planning and development of linear infrastructure (roads, bulk pipelines, electricity cables, etc.).


6.1 Key actions

The Draft National Biodiversity Framework includes the key actions listed below (grouped):

a) Enabling policy and legislative framework
   - Make the case for the value of biodiversity as a cornerstone of sustainable development;

b) Enhanced institutional effectiveness and efficiency
   - Establish and implement a human capital development strategy for the biodiversity sector to address transformation and scarce skills;

c) Integrated management of terrestrial and aquatic ecosystems
   - Develop and implement an integrated programme for ecosystem adaptation to climate change, with an emphasis on ecosystems vulnerable to climate change impacts;

d) Expanded network of protected areas and conservation areas
   - Establish and strengthen provincial stewardship programmes; and

6.2 Implementation, Monitoring and Review of the National Biodiversity Framework (NBF)

The priority actions identified are lead by DEAT and SANBI. These two organisations have a vital role to play and will be responsible for certain mandates and responsibilities regarding the driving of the implementation of the NBF by co-ordinating and catalysing the actions of other lead agents, especially those whose core business is not biodiversity but whose active collaboration is required in order to achieve targets, be it national, provincial or municipal. The Northern Cape Province must develop a provincial biodiversity plan.

Monitoring the implementation of the National Biodiversity Framework is primarily the responsibility of DEAT, although SANBI may be delegated to assist. The intention is not to create new, onerous reporting responsibilities. Reporting requirements will therefore be kept to a minimum.
These actions and responsibilities will influence activities in the Siyanda District and it is expected that the provincial authority will take a leading role in the implementation and execution of these key actions.
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