

5. ENVIRONMENTAL MANAGEMENT

The main environmental issues and features of the City of uMhlatuze are indicated on the **Environmental Plan** (see overleaf).

5.1 CLIMATE AND ATMOSPHERE

The climate of this sub-region is characterised by humid summers and hot winters. At Empangeni the average maximum temperature during summer is 28.4°C but can at times exceed 40°C. The average minimum temperature is also high, being 18.5°C in summer and 13.2°C in winter. Extreme minimum temperatures in winter seldom fall below 5°C and frost seldom occurs. At Richards Bay it is warm to hot for most of the year, with a mean summer temperature of 30°C. During winter temperatures are moderate, seldom falling below 11°C.

Humidity can reach very high levels in summer causing discomfort. Generally the climate in Empangeni is considered more moderate, due to its inland location, which is a positive aspect of the area and makes Empangeni an attractive residential area.

The prevailing winds in the study area are predominantly northeasterly, associated with high pressure systems and fine weather, and southwesterly winds that are associated with the ridging Indian Ocean Anticyclone, and to a lesser extent westerly waves and frontal weather. Those areas that is closer to the coastline (i.e. Richards Bay) experience north-northeast to northeasterly winds for nearly 28% of the time and south-southwest to southwesterly winds for nearly 20% of the time.

The long term average annual rainfall for the Richards Bay area is approximately 1 200mm decreasing to approximately 1 000mm inland towards Empangeni with most of the rainfall occurring between January and May. Winter rain is most often associated with frontal weather from the south or may result from the influx of moist air from the east associated with the ridging Indian Ocean Anticyclone. The study area has experienced two periods of prolonged drought (1981-1983) and (1992-1994) in the last 30 years. The area has also been subjected to the destruction of extreme floods generated by the cyclones Demoina and Mboa in 1984 followed by the flood disaster in 1987.

The state of the atmosphere within the City of uMhlatuze appears to be generally good. However some parts of the study area (e.g. Richards Bay) may not be able to tolerate increases in fluoride or SO₂. The Richards Bay Clean Air Association (RBCAA) monitored SO₂ and ozone for the year 2000. There were no exceedences of the national guidelines for SO₂ and ozone during the year 2002, i.e. there were no exceedences of the instantaneous hourly, daily, monthly or average SO₂ guidelines.

Taicor monitors dust and SO₂ at four stations near the Taicor site using the so-called CSIR bubbler method for SO₂. Hillside Aluminium monitors fluoride levels around Hillside Aluminium and Indian Ocean Fertilisers. In addition Mondi has conducted some air pollution monitoring.

5.1.1 RESOURCE OPPORTUNITIES AND CONSTRAINTS

5.1.1.1 Monitoring air quality in uMhlatuze

Ambient air quality monitoring is conducted for the Richards Bay area by Richards Bay Clean Air Association (RBCAA). The monitoring network has been in operation since 1997 and consists of SO₂ monitors situated in key receptor areas and these are complimented with meteorological stations. Recently an ozone (o₃) monitor together with a particulate

matter and smoke (PM₁₀) monitor have been added to the network. However, due to the malfunction of the PM₁₀ analyser PM₁₀ sampling is not longer being undertaken. In addition it is important that the current activities of RBCAA are expanded to include PM₁₀ monitoring and to quantify what the associated health effects of particulates are.

Ticor monitors dust and SO₂ at four stations near the Ticor site using the co-called CSIR bubbler method for SO₂. Hillside Aluminium monitors fluoride levels around Hillside Aluminium and Indian Ocean fertilisers (IOF). In addition Mondi Kraft has conducted some air pollution monitoring.

5.1.1.2 Recommendations

- ✍✍ It is strongly recommended that the ambient air quality programme be supported so that long term, scientifically valid data can be collected. Monitoring should be extended to other key pollutants, such as particulates.
- ✍✍ Although some meteorological data is collected by the uMhlathuze Municipality, the ambient air quality monitoring programmes needs to be augmented with a meteorological station that captures data that is representative of the entire area.
- ✍✍ Although industrial inventories have been established for the Richards Bay area there is a need for a comprehensive inventory which includes emissions from all air pollution sources for all pollutants to be compiled for the uMhlathuze Municipal area.
- ✍✍ There is a need for a cumulative effects study to be conducted for the area considering all emission sources and the impacts as a result of reactions between pollutants in the atmosphere. An example is the emission of SO₃ from IOF and its reaction with water vapour to potentially form acid rain or acid mist. Studies of this nature are critical in understanding the full impact posed by air pollution on the region.
- ✍✍ The current level of pollution must be considered in planning for additional industry i.e., new development will not be emitting into a pristine atmosphere.
- ✍✍ A comprehensive health study should be conducted to understand the impacts of current air pollution concentrations on human health.

5.1.1.3 Policy Considerations

- ✍✍ The Atmospheric Pollution Prevention Act (Act of 1965) provides a framework for air pollution control throughout South Africa addressing noxious and offensive gases, smoke, dust and fumes emitted by vehicles. The Act uses the standard of best practicable means rather than focussing on ambient air quality standards.
- ✍✍ The Department of Environmental Affairs and Tourism (DEAT) has a comprehensive set of guidelines for the common gaseous and particulate pollutants.

5.1.1.4 Key Issues and Information Gaps

Key Issues for Sustainable Environmental Management:

- ✍✍ The bio climatic profile is suitable for certain types of agricultural production, for example sugar cane and timber production.
- ✍✍ Poor atmospheric conditions may occur in the north and west, particularly at night when a high frequency of light winds and calm conditions occur. Here pollutants may

accumulate in low-lying areas. The area is best suited to development activities that are non-air polluting or have limited emission to the atmosphere.

Current SO₂ monitoring indicates that mean annual ambient concentrations in the Richards Bay area well within the DEAT guidelines. This suggests that the area may have the capacity to accommodate further industrial development however; any accidents that might occur imply that there may be health risks.

Planning for future industrial development needs to consider meteorological conditions, the cumulative effects of adding emissions and the assimilative capacity of the atmosphere for additional air pollution loading when selecting industry type and siting such as:

Future industry with high air pollution activities within the Richards Bay area could be located after appropriate impact assessment south of the John Ross Highway at the junction with the railway line, to the south of Lake Nsezi; immediately adjacent to the railway line to the east of the southern parts of Lake Nsezi; south of the railway marshalling yard; between Lake Nsezi and the N2, on the flat ground immediately east of the highway and between the N2, the John Ross Highway and the railway line.

Future industrial activities with low or no air pollution potential should be located as a 'buffer' between high pollution industries and sensitive areas, i.e. residential suburbs, nature reserves etc. e.g. between Lake Cubhu and the Mhlathuze River; south of the residential area of Arboretum and north of the Richards Bay harbour; between the railway line and northern parts of Lake Nsezi and south of Lake Nsezi on either side of the John Ross Highway before the junction with the railway line.

Within the Empangeni area generally good atmospheric dispersion conditions exist as a result of hot summer and warm winter days. Dispersion will be best in stronger wind conditions to the east and south of Empangeni where light industry is currently located. There is an opportunity to accommodate all levels of industry in these areas, as air pollutants will mostly disperse to the north and south along the coastal plain.

It is unlikely that the Richards Bay area would be able to cope with additional HF emissions.

The philosophy of minimizing air pollution should be emphasized as it underpins the concept of sustainable development

5.2 PHYSIOGRAPHY

5.2.1 TOPOGRAPHY, SOILS AND MINERAL POTENTIAL

Topography:

The regional geology has given rise to considerable diversity of relief. This includes horst and graben structures on a larger scale and an undulating landscape on a more localized scale. The altitude varies over the study area from approximately 20 meters above sea level.

The topography of Empangeni consist of gently rolling hills, whilst towards the coastal plain the dominant feature of the area is the low lying sandy coastal plain, and the broad alluvial plain of the Mhlathuze River and the former Richards bay estuary. The coastal dune barrier complex is very young, and its stability is due to vegetation cover. Steep basin shaped scars called 'cirques' form as a result of dune slumping. The narrow beach extent and local wind characteristics result in high susceptibility of beach and dune sands to scour by sea and wind erosion.

Soils:

Towards the coast the recent red, brown and grey sands that have covered the Port Durnford formation as a result of wind action are generally low to very low in natural fertility because of their high permeability, rapid leaching of nutrient and because they are so thin – maximum of 60cm. The soils have a low agricultural potential (<10% good soils) but the mild topography, high temperature and good rainfall favours the production of sugar cane and extensive areas are cultivated with this crop. In areas to the north-east timber is grown extensively. Some of the inter-dune hollows contain accumulations of peat up to several metres thick.

The Mhlathuze River flood plain and channels through which the river flowed at different times contain alluvial and estuarine sediments which range in texture from sands to clays. Soft, unconsolidated dark greys characterise the lower course of the Mhlathuze River including the harbour and the broader areas of the flood plain. The depth to suitable foundation material, about 65m in places has significant implications for construction costs. These areas also have an abnormally high water table with significant cost and technical implications for the provision of engineering services, waste water and sewerage disposal systems.

Weathered dolerite produces the red, apedal, silty clay soils of the Hutton Form which respond well to irrigation and, thus, the agricultural potential of these soils is good. Dolerite soils are mostly deeply weathered and the high plasticity and deep soil profiles offer good landfill development sites provided that the indurated contact zones are well covered by residual soils and the regional water table is deep. The clayey residual soil is very suitable as final cover and capping material.

Mineral Resources:

Towards the coast the area becomes rich in mineral resources, including ilmenite, rutile and zircon. The mining of these minerals allows uMhlathuze to meet 100% of South Africa's demand for titanium oxide and pig iron. The area is also rich in building sand and clay deposits (Strategic Environmental Assessment, 2002).

5.2.2 RESOURCE OPPORTUNITIES AND CONSTRAINTS**5.2.2.1 Legislative and Policy Considerations**

Kindly refer to the detailed discussion in the State of the Environment Report.

5.2.2.2 Recommendations

☞☞ Environmental awareness and training among different land users with regards to minimal impact on land is needed.

☞☞ The following issues of land degradation are prevalent in KwaZulu-Natal and should be monitored in the uMhlathuze Municipal area:

- ?? Soil erosion;
- ?? Mining degradation;
- ?? Flood plain and stream bank degradation;
- ?? Soil compaction; and
- ?? Estuarine siltation.

✍️ Appropriate engineering solutions must be implemented for areas with flood hazards (drainage channels) and steep slopes (greater than 1:3) as these areas are generally unsuitable for development if the appropriate engineering solutions are not considered (Strategic Environmental Assessment, 2002).

5.2.2.3 Key Issues and Information Gaps

Key Issues:

✍️ Soil stability together with local relief places a risk of some form on sustainable development in most parts of the area. Towards the interior most of the area is however, regarded as suitable for development provided caution is exercised and appropriate engineering solutions are implemented to ensure slope stability.

✍️ The varied topography increases the aesthetic appeal of the area and provides opportunities for a well-planned open space system. The abundance of rivers and streams also aids open space planning.

Information gaps:

✍️ There is a severe lack of information for the rural areas. These areas are probably most severely affected due to the poor sanitation practices, clearing of natural vegetation for subsistence farming etc. which can lead to erosion (Strategic Environmental Assessment, 2002).

5.2.3 HYDROLOGY AND DRAINAGE

The primary drainage system of the Empangeni area is the Mhlatuze River. The Mhlatuze River System, to the south of Empangeni enters the sea via the estuary at Richards Bay and drains the southern portion of Empangeni. Immediately north of Empangeni the N2 highway runs along a watershed, which separates streams draining to the east from those draining to the west. The latter cross the western portions of the study area and form part of the upper catchment of the Mhlatuze River. Drainage in the east joins the low reaches of the system. The catchment area of the Mhlatuze River is approximately 4 238km².

To the west of Empangeni the Mpangeni, Laleni and Niwe Rivers drain the area surrounding Ngwelezane township. The Mpangeni stream feeds into the Mpangeni dam, before joining the Mhlatuze River. The area north and north-west of Empangeni is drained by the Enseleni River, and its main tributary, the Ukula River forms part of the northern boundary at the study area. The Enseleni River reaches the sea via Lake Nsezi and the lagoon at Richards Bay (Richards Bay Structure Plan, 1996 and Empangeni Local Development Plan, 2000).

The Richards Bay landscape historically comprised an enormous wetland environment, second only to the Greater St. Lucia Wetland Complex in size in KwaZulu-Natal. Today the wetland is a fraction of its former self, but notwithstanding its reduction over time, it remains an extensive wetland environment. The key features which directly impact on the understanding of this role, are the large water bodies that exist today. The position of and linkages between these bodies provide useful guides to planning and development initiatives.

There are three large water bodies which lie parallel in a row close to the coastline, namely Lake Mzingazi, the Harbour and the Sanctuary. These bodies collect runoff and subterranean water from the immediate drainage catchment of Richards Bay and from wider

afield via the two main rivers flowing into the bay, namely the Nseleni from the northeast and the Mhlathuze from the northwest.

The three water bodies are also linked to one another via channels so that Lake Mzingazi flows into the harbour and the Sanctuary and the harbour transfer water to and fro, depending on the tide and the runoff.

Inland of the harbour and Lake Mzingazi, abutting the first coastal ridgeline, is the fourth large water body of Lake Nsese, which drains to the Sanctuary. West of the Sanctuary is Lake Cubhu, a smaller water body which drains to the Sanctuary. These water bodies and their associated drainage systems play a key role in the functioning of the wetland environmental of Richards Bay. They should therefore obviously play a key role in the management of the town – particularly its open spaces and development areas. It is the open spaces that encompass the drainage system and the development areas that impact on the natural system and its ability to sustain itself.

A further large water body is envisioned when the harbour is extended inland to the N2 freeway. This also needs to be taken into consideration now so that the opportunities and problems associated with this development can be carefully assessed.

The water bodies and associated systems described above are enclosed within the local watershed of Richards Bay. To the north is the first coastal ridge, to the east a ridge not far beyond the former TLC boundary, to the south the coastal dune system and to the west a ridge just beyond Esikhawini. A final watershed runs inland perpendicular from the coast between the harbour/industrial areas and the residential areas to the north-east (Revised Open Space Framework and MOSS for the Richards Bay TLC, March 2000).

Over time, the major drainage channels of the study area have cut deep valleys, the floors of which have become covered with alluvium. The freshwater lakes on the coastal plain, such as Mzingazi, Nsese and Cubhu, are drowned valleys related to a former erosion cycle with a lower sea level.

The presence of rivers and streams within the study area provides opportunities for excellent drainage from urban development and well as open space and recreation planning. The 1:50 and 1:100 year floodlines applicable to these rivers however impose constraints on the development of urban areas, limiting the use of developable land. Urban development in turn has an impact on the quality of rivers and wetlands (Richards Bay Structure Plan, 1996 and Empangeni Local Development Plan, 2000).

5.2.4 RESOURCE OPPORTUNITIES AND CONSTRAINTS - MARINE AND COASTAL SYSTEM RESOURCES

5.2.4.1 Responses

Any activities on the continental shelf and inshore habitats must consider the influence on sand movement (large-scale and local), and the implications of any changes in this regime on functioning and biodiversity or intertidal ecosystems and biological communities.

Intertidal rocky shores habitats are sensitive and vulnerable to physical influences such as siltation, changes in sand movements and weather flow. Changes in these can affect the disturbance regime on the shore.

Biodiversity and resources on the shoreline are dependant on maintenance of natural processes such as larval supply, transport and settlement) and actions that may change

current or affect water quality could therefore have an impact. Other processes that may be vulnerable are that of migration of species such as east coast rock lobster across the inshore-offshore axis (Strategic Environmental Assessment, 2002).

5.2.4.2 Legislative and Policy Considerations

Please refer to the detailed discussion in the State of the Environment Report.

5.2.4.3 KEY ISSUES AND INFORMATION GAPS

Key Issues for Sustainable Environmental Management:

- ✘ Any activities on the continental shelf and inshore habitats must consider the influence on sand movement (large-scale and local), and the implications of any changes in this regime on functioning and biodiversity or intertidal ecosystems and biological communities.
- ✘ Intertidal rocky shores habitats are sensitive and vulnerable to physical influences such as siltation, changes in sand movements and weather flow. Changes in these can affect the disturbance regime on the shore.
- ✘ Biodiversity and resources on the shoreline are dependant on maintenance of natural processes such as larval supply, transport and settlement and actions that may change currents or affect water quality could therefore have an impact. Other processes that may be vulnerable are that of migration of species such as east coast rock lobster across the inshore-offshore axis (Strategic Environmental Assessment, 2002).

5.3 BIODIVERSITY

The study area is situated at the southern section of the East African Coastal Plain (a major biogeographical unit) and forms a transition zone, which is characterised by a rich mix of species of local and proximate biogeographical origin. As a consequence, the area is recognised as being of high conservation significance in terms of biodiversity which it supports within a range of habitats represented in the area. Several red data and endemic species occur here. In this respect, the significance of the uMhlathuze area may be regarded as indicative of greater significance of southern Africa in terms of the region's contribution to the global reservoir of biodiversity (Strategic Environmental Assessment, 2002).

5.3.1 FAUNA AND FLORA

The uMhlathuze area is characterised by a diversity and quality of plant communities. The diversity of vegetation types at uMhlathuze is primarily a function of the region's biogeographical position, its topographic and climo-edaphic variability and, these factors, as well as secondary anthropogenic effects, create the conditions which give rise to the complex mosaic of the different plant communities, which occur, in the area.

The dune cordon, which extends along the uMhlathuze coast in the vicinity of Richards Bay provides a particularly important corridor for genetic exchange between certain species from different biogeographical units and regions. Inland of this cordon, however, most of the terrestrial environment has been transformed through human development, and the vectors controlling genetic exchange no longer operate effectively. Some examples of human developments which have contributed historically to the major loss of natural plant communities in the area include:

- ✘ Destruction of the Mhlathuze reed-marsh and wetland in the mid-1930s and reclamation for sugar cane production;
- ✘ Construction of the port and town of Richards Bay in 1960 which destroyed extensive areas of coastal forest;
- ✘ Harbour construction which has impacted on the natural functioning of the Mhlathuze estuary; and
- ✘ Timber production and other agricultural activities.

Within the Empangeni area the only vegetation communities occur in and around drainage lines viz. the Empangeni stream, the Ukula River, the Mkumbane stream, and the Odakeneni and Ngweni streams that extend into Ngwelezane. These communities range from a narrow riparian belt consisting of reeds and/or trees to slightly broader marshy areas dominated by the reed *Phragmites australis*. In certain areas on the Empangeni stream the natural vegetation has been altered by the cutting of reeds to allow for pedestrian movement.

In the surrounding sugar cane areas riparian vegetation has been impacted by cultivation right up to the stream banks. Vegetation in this area is dominated by reed *Phragmites australis* and the bulrush *Typha capensis* while typical riparian trees would include *Ficus trichopoda*, *ficus sur*, *bridelia micrantha* and *Syzygium caudatum*.

There are no coastal forest, swamp forest and grassland communities remaining within the Empangeni area making it poor when it comes to habitat availability when compared to neighbouring Richards Bay. However, low habitat diversity would not preclude the possible occurrence of rare and endangered species within the available habitats, e.g. certain small sedges (Cyperaceae).

5.3.1.1 Faunal Types and Conservation Importance

The Preliminary Environmental Scan for the Richards Bay SDI (Steffen, Robertson & Kirsten, 1998) identified the following fauna likely to occur in the uMhlathuze area:

- ✘ 35 species of fish including Red Data species;
- ✘ 36 species and subspecies of amphibians including 5 taxa endemic to KwaZulu-Natal and 2 South African Red Data species;
- ✘ 59 reptile species including 47 that require specialized habitats and 4 Red Data species;
- ✘ 350 species of birds including at least 23 and possibly 31 Red Data species; and
- ✘ 69 species of mammals including 12 Red Data species (Strategic Environmental Assessment, 2002).

5.3.2 AGRICULTURE

The natural conditions of the study area (climate and soils) provide very high potential for crop farming, although it is not suitable for cattle farming. The uMhlathuze area is characterised by intensive agricultural activities, in particular the growing of sugar cane as well as timber. Sugar cane has been intensively farmed in the Empangeni/Richards Bay sub region since the end of the last century and has formed the economic backbone of Empangeni and the sub-region.

The Zululand Region has produced approximately 30% of the country's sugar cane, with approximately 40% thereof being produced by the now closed Empangeni Mills as well as the Felixton Mills. This contribution of this area's sugar cane production to the country's production as a whole indicates the dominant role this industry plays in this sub-region. The expansion of the Empangeni urban area is however limited, due to the high potential agricultural land surrounding the urban area. Urban expansion requires a sacrifice of

valuable agricultural land, therefore it is extremely important that urban development takes place in a coordinated and planned manner in order to achieve a balance with agricultural development (Richards Bay Structure Plan, 1996 and Empangeni Local Development Plan, 2000).

Commercial forestry in South Africa occupies approximately 1.44 million ha of land, about 3.5% of the total area of the country. This is all plantation forestry resulting from planting of areas of natural grassland or shrub land to pine, eucalypt or wattle species. Forestry is a dry-land cropping practice and is most successful if it receives at least 800mm of rainfall per annum (DWAF, 2000). The uMhlathuze area has favourable climatic and soil conditions for the growing of forests, since the area receives rainfall in the region of 1 000 to 1 200mm of rainfall/annum (Draft Resource Opportunities and Constraints Report, 2001).

Sugar is a well-established industry in South Africa, with an annual production of 2.6 million tonnes. A total area of 424,000 hectares is currently under sugar. Sixty percent of this is in the coastal area of KwaZulu-Natal, 20% in the KwaZulu-Natal midlands and 20% in Mpumalanga/Pongola (Schmidt, 2000).

Sugar is by far the most important agricultural crop in the Mhlathuze catchment in terms of area, employment and water use. As can be seen from Figure 4.2, this holds true for the uMhlathuze Municipal area as well (Draft Resource Opportunities and Constraints Report, 2001).

5.3.3 SENSITIVE ENVIRONMENTS

Some of the sensitive environments identified within the area include:

- The primary coastal dunes;
- The fragile strand vegetation between the dunes and the sea;
- Fresh water lakes (particularly Nseze and Mzingazi);
- The Sanctuary;
- Enseleni Nature Reserve;
- "The Ridge" between Alkantstrand and Greenhill;
- Sensitive habitats within the harbour including mangrove swamps and wetlands;
- The Manzamnyana and Bhizolo canals;
- The seepage pans, such as Thulazihleka and Magongdo;
- The area between Ngodweni Canal and John Ross Parkway;
- Alusaf Reedmarsh; and
- Lake Cubhu is also considered to be of high conservation significance (Strategic Environmental Assessment, 2002).

5.3.3.1 Wetlands

A special feature of the environment within the study area is the interlinkage, which exists between aquatic ecosystems which grade from marine to freshwater dominance. The freshwater wetlands range from seeps, to marshes, and swamps. Wetlands perform many vital ecological functions including:

- Control of runoff and recharge of groundwater reserves (water retention during floods and water release during dry periods). Wetlands assist in controlling flood damage and prevent soil erosion;
- Water purification (eg. removal of nutrients and suspended solids);
- Breeding grounds;
- Unique habitats for flora and fauna, such as waterfowl (Strategic Environmental Assessment, 2002).

5.3.3.2 Lakes

Lake Mzingazi is a vital source of potable water and is important for conservation *per se*. The lake has aesthetic appeal, and contains many plant and animal species, including fish, hippopotami and breeding populations of crocodiles. Raal and Burns (1993) confirm development and conservation zones around the lake identified in earlier studies. Lake Cubhu is also considered to have high conservation significance, and should be managed with similar caution. Lake Nsezi has aesthetic appeal, botanical importance, and conservation value. The southern-most extensive area of papyrus (*Cyperus papyrus*) in Africa dominates here and continues into the lower section of the Mhlathuze floodplain. It is now a permanent, non-mobile community, and is considered to be extremely worthy of conservation. There are four main forest areas fringing the lake, three of which are considered to be among the best examples of riverine forest in South Africa. Lake Nsezi harbours crocodile, hippopotami, fish, and abundant bird life different from that found in the Sanctuary. The lake is also a source of potable water for Empangeni. Nsezi canal, together with the Okula River, and the banks of the Mhlathuze River, is designated as an open space area, linking the two lakes with the Sanctuary area (Strategic Environmental Assessment, 2002).

5.3.3.3 Estuaries

Estuaries provide nursery sites for fish, crabs, and prawns; provide habitats; allow enriching organic nutrients to reach the sea; and are areas of scenic attraction. Up to 40% of the Tugela Bank prawn stock spend their juvenile stage in the Port of Richards Bay. Mangroves are associated with estuaries. They provide breeding grounds for fish and other marine life; trap silt; and protect the bay's shoreline from erosion (Strategic Environmental Assessment, 2002).

5.3.3.4 The Sanctuary

The southern Sanctuary area has been conserved as a bird sanctuary and breeding/nursery area for fish. The most important plant species in the Sanctuary are *Cyperus papyrus*, *Rhizophora mucronata* (red mangrove), *Bruguiera gymnorrhiza* (black mangrove), *Avicennia marina* (white mangrove) and *Phragmites* (reeds). MOSS (1994) recommends that the Sanctuary be enlarged to form a continuous protected zone with recreational use that should include the Richards Bay Peninsula, the Menywa and Sontwayo Pans, and northwards, including the Magongdo Pan (Strategic Environmental Assessment, 2002).

5.3.3.5 Canals and Pans

Manzamyama and Bhizolo Canal areas could serve as a green link between the Municipal area and the Sanctuary. Marine prawns (*Penaeus* spp.), which form the base of a local prawn fishery, use these canals and the Sanctuary area as nursery habitat. Losses of this habitat type could have a significant impact on the prawn trawling industry. Thulazihleka Pan, together with a second adjacent pan in the Portnet area, has the richest bird density per kilometer of shoreline in KwaZulu-Natal. Several rare and endangered birds have been recorded in the area. Crocodiles have also been sighted. It is thus considered a critical area and worthy of conservation. Despite this pan being man-made and its highly eutrophic state (a result of direct and indirect groundwater pollution), it has attracted unique bird life. Although under increasing pressure for in-fill and development, the Thulazihleka Pan should be protected. It is unlikely that such an important conservation feature could be recreated elsewhere. The pan could serve as a link through the harbour area to the Sanctuary. Currently the Pan is zoned "undetermined". This designation should be upgraded to a permanent conservation status (Strategic Environmental Assessment, 2002).

5.3.4 PRESSURES

- ✘ The value of the wetlands as areas which support a diversity of species can be seriously compromised by trans-boundary water pollution (Archibald *et al.*, 1998).
- ✘ Alien plant invasion is a serious problem in the uMhlatuze area.
- ✘ Most of the terrestrial environment has been transformed by development.
- ✘ In the surrounding sugarcane areas riparian vegetation has been impacted by cultivation right up to the stream banks.
- ✘ Other general pressures include:
 - ✘ Agriculture, in particular the need for land for small scale farming;
 - ✘ The establishment of timber plantations;
 - ✘ Infrastructure needs;
 - ✘ Rapid urbanisation in urban, peri-urban and rural areas;
 - ✘ Un-rehabilitated mining land;
 - ✘ Clearing up of natural vegetation for immediate and short-term commercial gain; and
 - ✘ Depletion of traders of indigenous trees and plants for medicinal purposes (KZN, 1998).

5.3.5 RESPONSES

- ✘ There is a need to implement MOSS fully, and these plans should upgrade conservation status of areas within MOSS. Very sensitive areas should have very limited disturbance.
- ✘ Avoid canalisation of waterways especially with regard to hard engineering structures e.g. the Bhizolo canal.
- ✘ Indigenous plants and medicinal plant nurseries should be promoted.
- ✘ Rehabilitation of degraded areas and alien-clearing programmes must be addressed. The spin-off from alien clearing programmes is job creation.
- ✘ Adjacent agricultural land should be considered for future development rather than destroying natural areas of high conservation
- ✘ Riparian vegetation and wetlands should be maintained for both the conservation of biodiversity and for their ecological functioning in water quality improvement and flood control.
- ✘ The use of indigenous vegetation for landscaping of industrial properties, private gardens, formal parks, golf courses, and road and freeway verges should be encouraged and implemented. These would add to the linking corridors necessary for long-term sustainability of core areas of habitat types.

5.3.6 LEGISLATIVE AND POLICY CONSIDERATIONS

Please refer to the detailed section in the State of the Environment Report.

5.3.7 KEY ISSUES AND INFORMATION GAPS

Key issues for Sustainable Environmental Development:

- ✍ Riparian vegetation and wetlands should be maintained for both the conservation of biodiversity and for their ecological functioning in water quality improvement and flood control.
- ✍ The use of indigenous vegetation for landscaping of industrial properties, private gardens, formal parks, golf courses, and road and freeway verges should be encouraged and implemented. These would add to the linking corridors necessary for long-term sustainability of core areas of habitat types.

Information Gaps:

- ✍ There is a lack of knowledge regarding ecological thresholds and incomplete inventories of biodiversity specific to the study area.
- ✍ There is a scarcity of information for the rural and tribal areas (Strategic Environmental Assessment, 2002).

5.4 GEOLOGY AND MINERAL POTENTIAL

Granite and basic rocks of the Tugela Complex underlie the largest part of the uMhlatuze area. There is a major northeast trending fault northwest of Empangeni which separates the older Tugela Complex from the younger Letaba Formation. Two formations of the Ecca Group are present, the Vryheid Formation consisting of sandstone, shale and coals and the Volksrust Formation consisting of shale, siltstone and thin sandstone bands. The Emakwezini Formation of the Beaufort Group is also present, consisting of sandstone, shale and coal.

The northern and northwestern part of the Empangeni area is underlain by basalt of the Letaba Formation, Lebombo Group. Quaternary deposits consisting of red clayey sand of the Berea member and recent sedimentary deposits cover the eastern margins of the area. The latter consists of alluvial sand, silt and clay and associated with the paleo river channels. These sands give rise to some of the finest agricultural soils in the area.

From an economic geological point of view, there is an extensive area of fault Breccia along the Empangeni Fault to the west of the N2, northeast of Empangeni. This is a commercially useable resource and important in the manufacturing of scouring agents. A further more limited area is found in Reserve No. 78, south of Ngwelezane.

The coastal dunes to the north and south of the harbour entrance contain rich deposits of heavy minerals, such as illmenite, Rutile, Zircon and, currently, these deposits are being mined to the north of Richards Bay in Reserve No. 4. The sub-region is richly endowed with building and stone (the latter south-west of Empangeni on Old Main Road) and sand resources occur in the coastal dunes, on the coastal plain and in the bay and beach areas. Course sand for concrete is mainly confined to the bed of the Mhlatuze River, while mortar sand and binder material are rare, confined to isolated deposits in the Berea Red sands and shale deposits near Mtunzini and Empangeni. Limited clay deposits, suitable for brick making, are also confined to the Empangeni area (Richards Bay Structure Plan, 1996 and Empangeni Local Development Plan, 2000).

5.5 MARINE AND COASTAL SYSTEM RESOURCES

The coastal and marine resources provide opportunities for economic and social activities that include: fisheries, agriculture, mineral resource exploitation and a range of development opportunities. The coast and its many estuaries are also highly valued for recreation.

The coastline of KwaZulu-Natal, in common with the rest of South Africa's coastline, is exposed to strong wave action. Consequently the few sheltered beaches are confined to estuary mouths and embayments (bay created by rocky outcrops in the surf zone). The proportion of fine sand in beach sediments is low: grain sizes on the open shore range from about 200 to 1 000 μ m with increasing wave action. The coastline between Cape St Lucia and the Tugela River Mouth, those trends in a southwesterly direction, consists mainly of sandy beaches backed by high-vegetated dunes. There are seven estuaries of which the Nhlabane and Siyaya are generally closed by a sandbar; the Matigulu/Nyoni is seldom closed; and the Mhlathuze, Mhlalazi and Tugela are permanently open. The Mhlathuze opens to the sea via an artificial mouth excavated at the time of construction of the harbour at Richards Bay.

5.5.1 OCEANOGRAPHIC FEATURES

The most important large-scale oceanographic feature affecting the coastal environment on this stretch of coast is the Agulhas Current that flows southwards bringing warm water from the tropics (Martin & Flemming, 1998). The continental shelf is very narrow in northern Zululand and widens to the south of Richards Bay. The Agulhas Current following the edge of the narrow continental shelf flows relatively close inshore along the coast north of Richards Bay. Factors controlling sediment dispersal include the morphology of the shelf, the wave and swell regime, the influence of the Agulhas current and sediment supply.

5.5.2 SANDY SHORE

Both ghost crabs and mole crabs are important components of the sandy beach macro fauna in the study area, ghost crabs occur inter-tidally and supra-tidally whereas mole crabs are found in the surf zone. Limited data exists on the numbers of birds on this stretch of shorelines.

5.5.3 UTILISATION OF THE SHORELINE

Except for the beaches close to Richards Bay the shoreline is accessible only by 4x4 off-road vehicles or by foot over the dune cordon. Nevertheless this stretch of coast is utilised by a number of user groups both recreational and subsistence. There is no commercial use along the shore.

5.5.5.3.1 Recreational use of resources

Recreational activities include shore angling, spear fishing, Cray fishing and mussel gathering, the intertidal rocky shores also provide low impact recreational activities including snorkelling in rock pools. In addition, the stretch of coast between South Flat Ledges and Cape St Lucia is popular for illegal camping behind the dunes over weekend and holiday periods.

KZN Wildlife conduct regular patrols and record the catches of both invertebrate species and fish caught along this stretch. These data are analysed by the Oceanographic Research Institute and provide information on the usage patterns and limited insight into the status of the stocks.

5.5.3.2 Subsistence fisher dependence

The study area incorporates a stretch of shoreline that has been utilised historically for subsistence harvest of intertidal mussels and shore angling by some of the Tribal Authority community residents. In addition, nyangas from these communities have a history of collection of marine products for traditional medicines from this area

5.5.4 RARE, VULNERABLE, SENSITIVE AND/OR ENDANGERED SPECIES/ ECOSYSTEMS

The following ecosystems and /or biota are vulnerable:

- ☒☒Turtles; and
- ☒☒Shore birds.

The following ecosystems are sensitive:

- ☒☒Rocky shores biological communities; and
- ☒☒Foredune systems.

5.5.5 THE MARINE ENVIRONMENT OFF RICHARDS BAY

5.5.5.1 Description of the twin pipelines at Richards Bay

The marine section of the pipeline begins at the pump station located in the north east corner of the harbour, where there is seawater intake facility to provide make-up water to allow the pipelines to operate at full volume. There are two pipes side by side, entering and leaving the pump station, one to dispose of so-called buoyant effluents, i.e. essentially freshwater-based effluents.

The CSIR undertakes two offshore sampling trips each year, one in May and the other in October or November. The seabed and water column are sampled at a number of fixed stations (Strategic Environmental Assessment, 2002).

5.5.6 RESOURCE OPPORTUNITIES AND CONSTRAINTS

5.5.6.1 Legislative And Policy Considerations

Discussed in detail in the State of the Environment Report.

5.5.6.2 Key Issues And Information Gaps

Key issues for sustainable environmental management

- ☒☒Any activities on the continental shelf and inshore habitats must consider the influence on sand movement (large-scale and local), and the implications of any changes in this regime on functioning and biodiversity or inter-tidal ecosystems and biological communities.
- ☒☒Inter-tidal rocky shores habitats are sensitive and vulnerable to physical influences such as siltation, and changes in sand movements.
- ☒☒Biodiversity and resources on the shoreline is dependant on maintenance of natural processes (such as larval supply, transport and settlement) and actions that may change the current status or affect water quality could therefore have an impact.
- ☒☒Offshore mining must be properly assessed and monitored.

- ✍✍ The proper functioning of the B-line at Richards Bay, designed to discharge gypsum slurry from IOF, is vital. Both the pumping and dispersion have to be maintained in peak order to adequately disperse this complex effluent.
- ✍✍ Beach replenishment is essential. Beach erosion has been prevalent north of Richards Bay since before harbour construction. The harbour has exacerbated this; therefore the beaches to the south of the harbour need to be artificially replenished.
- ✍✍ Increase formal, well-planned beach access and prevent informal access routes from being created. Informal routes result in erosion, blowouts, damage to the dune ecosystem, species loss, decrease in the aesthetics of the area etc (Strategic Environmental Assessment).

5.6 ENVIRONMENTAL ASSETS, PROBLEMS, RISKS AND THREATS

The conclusions and recommendations of the study are based on a technical analysis of the environmental opportunities and constraints of sustainable development in the uMhlathuze Municipal area. This is a summary of the conclusions and recommendations of the biophysical environment and presents a summary of the conclusions and recommendations elaborated on more fully in the Draft Resource Opportunities and Constraints Report.

5.6.1 AIR QUALITY

- ✍✍ It is strongly recommended that the ambient air quality programme be supported so that long term, scientifically valid data can be collected. Monitoring should be extended to other key pollutants, such as particulates.
- ✍✍ Although some meteorological data is collected by the uMhlathuze Municipality, the ambient air quality monitoring programmes needs to be augmented with a meteorological station that captures data that is representative of the entire area.
- ✍✍ Although industrial inventories have been established for the Richards Bay area there is a need for a comprehensive inventory which includes emissions from all air pollution sources for all pollutants to be compiled for the uMhlathuze Municipal area.
- ✍✍ There is a need for a cumulative effects study to be conducted for the area considering all emission sources and the impacts as a result of reactions between pollutants in the atmosphere. An example is the emission of SO₃ from IOF and its reaction with water vapour to potentially form acid rain or acid mist. Studies of this nature are critical in understanding the full impact posed by air pollution on the region.
- ✍✍ The current level of pollution must be considered in planning for additional industry i.e., new development will not be emitting into a pristine atmosphere.
- ✍✍ A comprehensive health study should be conducted to understand the impacts of current air pollution concentrations on human health.
- ✍✍ The bio climatic profile is suitable for certain types of agricultural production, for example sugar cane and timber production.
- ✍✍ Poor atmospheric conditions may occur in the north and west, particularly at night when a high frequency of light winds and calm conditions occur. Here pollutants may accumulate in low-lying areas. The area is best suited to development activities that are non-air polluting or have limited emission to the atmosphere.

- ✍✍ Current SO₂ monitoring indicates that mean annual ambient concentrations in the Richards Bay area are well within the DEAT guidelines. This suggests that the area may have the capacity to accommodate further industrial development. However, excessive development may incur health risks.
- ✍✍ Planning for future industrial development needs to consider meteorological conditions, the cumulative effects of adding emissions and the assimilative capacity of the atmosphere for additional air pollution loading when selecting industry type and siting such as:
 - ✍✍ Future industry with high air pollution activities within the Richards Bay area could be located after appropriate impact assessment south of the John Ross Highway at the junction with the railway line, to the south of Lake Nsezi; immediately adjacent to the railway line to the east of the southern parts of Lake Nsezi; south of the railway marshalling yard; between Lake Nsezi and the N2, on the flat ground immediately east of the highway and between the N2, the John Ross Highway and the railway line (CSIR, 2000).
 - ✍✍ Future industrial activities with low or no air pollution potential should be located as a 'buffer' between high pollution industries and sensitive areas, i.e. residential suburbs, nature reserves etc. e.g. between Lake Cubhu and the Mhlatuze River; south of the residential area of Arboretum and north of the Richards Bay harbour; between the railway line and northern parts of Lake Nsezi and south of Lake Nsezi on either side of the John Ross Highway before the junction with the railway line (CSIR, 2000).
 - ✍✍ Within the Empangeni area generally good atmospheric dispersion conditions exist as a result of hot summer and warm winter days. Dispersion will be best in stronger wind conditions to the east and south of Empangeni where light industry is currently located. There is an opportunity to accommodate all levels of industry in these areas, as air pollutants will mostly disperse to the north and south along the coastal plain (CSIR, 2001).
 - ✍✍ It is unlikely that the Richards Bay area would be able to cope with additional HF emissions (CSIR, 2000).
- ✍✍ The philosophy of minimizing air pollution should be emphasized as it underpins the concept of sustainable development.

5.6.2 LAND

- ✍✍ Environmental awareness and training among different land users with regards to minimal impact on land is needed. Public and commercial pressure against development activities that may lead to land degradation.
- ✍✍ The following issues of land degradation are prevalent in KwaZulu-Natal and should be monitored in the uMhlatuze Municipal area:
 - ✍✍ Soil erosion;
 - ✍✍ Mining degradation;
 - ✍✍ Flood plain and stream bank degradation;
 - ✍✍ Soil compaction;
 - ✍✍ Estuarine siltation; and
 - ✍✍ Coastal dune and beach erosion (KZN, 1998).
- ✍✍ Appropriate engineering solutions must be implemented for areas with flood hazards (drainage channels) and steep slopes (greater than 1:3) as these areas are generally unsuitable for development if the appropriate engineering solutions are not considered.

- ✍✍ Soil stability together with local relief places a risk of some form on sustainable development in most parts of the area. Towards the interior most of the area is however, regarded as suitable for development provided caution is exercised and appropriate engineering solutions are implemented to ensure slope stability.
- ✍✍ The varied topography however, increases the aesthetic appeal of the area and provides opportunities for a well-planned open space system. The abundance of rivers and streams also aids open space planning.

5.6.3 WATER RESOURCES

- ✍✍ Although not comprehensive some monitoring is being undertaken for some of the water resources within the area, a comprehensive monitoring programme is needed.
- ✍✍ The Department of Water Affairs and Forestry have recently completed a Strategic Environment Assessment for water use within the Mhlathuze catchment. This report contains information on water resources which is important for future planning in this area.
- ✍✍ The uses of the inland lakes in the area are becoming increasingly multi-purpose as the demands of industrial and urban development increase. The biotic diversity, limited area coverage, and their generally pristine state means that these lakes and wetlands are extremely valuable assets in terms of their recreational / tourist potential in addition to their critical ecological role within a river basin.
- ✍✍ Surface water resources within the area appear to be very limited, increased demands on the natural resources may not be possible.
- ✍✍ Legal issues will have a major impact on the way industrial pollution is controlled and managed in the area. The Water Act (1998) regulates the way in which municipalities and industries operate. Other agencies, such as the Water Boards, are empowered to enforce monitoring programmes in the application of the “polluter pays principle”.
- ✍✍ Catastrophic events such as droughts and floods will affect the sustainable supply of water.

5.6.4 BIODIVERSITY

- ✍✍ There is a need to implement MOSS fully, and these plans should upgrade conservation status of areas within MOSS. Very sensitive areas should have very limited disturbance.
- ✍✍ Avoid canalisation of waterways especially with regard to hard engineering structures e.g. the Bhizolo canal.
- ✍✍ Indigenous plants and medicinal plant nurseries should be promoted.
- ✍✍ Rehabilitation of degraded areas and alien-clearing programmes must be addressed. The spin-off from alien clearing programmes is job creation.
- ✍✍ Adjacent agricultural land should be considered for future development rather than destroying natural areas of high conservation
- ✍✍ Riparian vegetation and wetlands should be maintained for both the conservation of biodiversity and for their ecological functioning in water quality improvement and flood control.

✎ The use of indigenous vegetation for landscaping of industrial properties, private gardens, formal parks, golf courses, and road and freeway verges should be encouraged and implemented. These would add to the linking corridors necessary for long-term sustainability of core areas of habitat types.

5.6.5 MARINE ENVIRONMENT

✎ Any activities on the continental shelf and inshore habitats must consider the influence on sand movement (large-scale and local), and the implications of any changes in this regime on functioning and biodiversity or intertidal ecosystems and biological communities.

✎ Intertidal rocky shores habitats are sensitive and vulnerable to physical influences such as siltation, changes in sand movements and weather flow. Changes in these can affect the disturbance regime on the shore.

✎ Biodiversity and resources on the shoreline are dependant on maintenance of natural processes such as larval supply, transport and settlement) and actions that may change current or affect water quality could therefore have an impact. Other processes that may be vulnerable are that of migration of species such as east coast rock lobster across the inshore-offshore axis.

5.6.6 WASTE MANAGEMENT

✎ The 13 waste disposal sites in within the municipal area all have the potential to pollute ground and surface water through an increase in electrical conductivity as result of anions and cations leached from the waste.

✎ The Zululand Coastal Aquifer is a strategic fresh water resource that requires protection. In a letter written by Geomeasure Services (Pty) Ltd expressing the views of the Groundwater Association of KwaZulu-Natal and the Borehole Water Association of South Africa, these organisations believe that this important resource has already experienced some environmental damage due to poor waste management practices and requires rigorous protection to preserve its utility for the future. Solid waste disposal sites and tailing dams should not be located over, or adjacent to the aquifer, where there is a potential risk of polluting the resource. This should also be taken into account when siting any new landfill sites.

✎ The existing Empangeni landfill site can only accommodate general (G) waste. There is inadequate disposal capacity for the industrial waste (both low and high hazard) disposal needs in the broader uMhlatuze Municipal area.

✎ There is very limited capacity in the uMhlatuze Municipal area, and in fact in the entire province, for the disposal of health care wastes in an environmentally appropriate

✎ The current management of hazardous waste in the area with regards to stockpiling, transporting waste long distances to other areas and even provinces, is not sustainable.

✎ The issue of waste minimization is not being adequately addressed and needs coordination and concerted effort to be effective in the longer term.

✎ Concerted efforts are needed to increase people's awareness of good waste management practices (Strategic Environmental Assessment, 2002).