Information Sheet on Ramsar Wetlands (RIS) – 2006-2008 version

Available for download from http://www.ramsar.org/ris/key_ris_index.htm.

Categories approved by Recommendation 4.7 (1990), as amended by Resolution VIII.13 of the 8th Conference of the Contracting Parties (2002) and Resolutions IX.1 Annex B, IX.6, IX.21 and IX. 22 of the 9th Conference of the Contracting Parties (2005).

Notes for compilers:

1. The RIS should be completed in accordance with the attached *Explanatory Notes and Guidelines for completing the Information Sheet on Ramsar Wetlands*. Compilers are strongly advised to read this guidance before filling in the RIS.

2. Further information and guidance in support of Ramsar site designations are provided in the *Strategic Framework and guidelines for the future development of the List of Wetlands of International Importance* (Ramsar Wise Use Handbook 7, 2nd edition, as amended by COP9 Resolution IX.1 Annex B). A 3rd edition of the Handbook, incorporating these amendments, is in preparation and will be available in 2006.

3. Once completed, the RIS (and accompanying map(s)) should be submitted to the Ramsar Secretariat. Compilers should provide an electronic (MS Word) copy of the RIS and, where possible, digital copies of all maps.

1. Name and address of the compiler of this form:

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DD MM YY

Designation date | Site Reference Number

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2. Date this sheet was completed/updated:

Originally completed: August 2004
Updated: January 2007

3. Country:

South Africa

4. Name of the Ramsar site:

The precise name of the designated site in one of the three official languages (English, French or Spanish) of the Convention. Alternative names, including in local language(s), should be given in parentheses after the precise name.

Makuleke Wetlands

5. Designation of new Ramsar site or update of existing site:

This RIS is for (tick one box only)**:**
a) Designation of a new Ramsar site ☑; or
b) Updated information on an existing Ramsar site ❑

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6. For RIS updates only, changes to the site since its designation or earlier update:

a) Site boundary and area

The Ramsar site boundary and site area are unchanged: ❑

or
If the site boundary has changed:
i) the boundary has been delineated more accurately ❑; or
ii) the boundary has been extended ❑; or
iii) the boundary has been restricted** ❑

and/or

If the site area has changed:
i) the area has been measured more accurately ❑; or
ii) the area has been extended ❑; or
iii) the area has been reduced** ❑

** **Important note**: If the boundary and/or area of the designated site is being restricted/reduced, the Contracting Party should have followed the procedures established by the Conference of the Parties in the Annex to COP9 Resolution IX.6 and provided a report in line with paragraph 28 of that Annex, prior to the submission of an updated RIS.

b) Describe briefly any major changes to the ecological character of the Ramsar site, including in the application of the Criteria, since the previous RIS for the site:

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7. Map of site:
Refer to Annex III of the *Explanatory Note and Guidelines*, for detailed guidance on provision of suitable maps, including digital maps.

a) A map of the site, with clearly delineated boundaries, is included as:
i**) a hard copy** (required for inclusion of site in the Ramsar List): ☑;

ii**) an electronic format** (e.g. a JPEG or ArcView image) ☑ ✓;

iii) **a GIS file providing geo-referenced site boundary vectors and attribute tables** ❑.

b) Describe briefly the type of boundary delineation applied:
e.g. the boundary is the same as an existing protected area (nature reserve, national park, etc.), or follows a catchment boundary, or follows a geopolitical boundary such as a local government jurisdiction, follows physical boundaries such as roads, follows the shoreline of a waterbody, etc.

The boundary of the Ramsar site incorporates the area inside the flood level of the Limpopo and Luvuvhu rivers which consists of the pans and wetlands in the region explained below.

The northern boundary is the middle of the Limpopo River, which is the border between South Africa and Zimbabwe. To the east it ends at the border with Mozambique. To the west it ends with the inclusion of the Banyini Pan in the Makuleke Area (outside the Kruger National Park). In the Makuleke Area, Kruger National Park, it includes the floodplains and all the pans along the Limpopo

River, as well as floodplains and all the pans on both sides of the Luvuvhu River (Makuleke Area and Kruger National Park) downstream of Lanner Gorge. South of the Luvuvhu River it includes the Hapi drainage line.

8. Geographical coordinates (latitude/longitude, in degrees and minutes):
Provide the coordinates of the approximate centre of the site and/or the limits of the site. If the site is composed of more than one separate area, provide coordinates for each of these areas.

22°20'S 31°03'E
22°22'S 31°02'E
22°26'S 31°12'E
22°27'S 31°19'E

Since the shape of the proposed site is in the form of a skewed "J", the coordinates provide an area in which this site is situated.

9. General location:
Include in which part of the country and which large administrative region(s) the site lies and the location of the nearest large town.

The area is situated in the northeastern corner of South Africa, in the Limpopo Province. The wetland is bordered by Zimbabwe to the north and Mozambique to the east. The site is mostly located within the borders of the Kruger National Park, with only a small section of the Limpopo floodplain located in the Makuleke's portion of the Makuleke Property Area outside the Park's western border (Banyini Pan). The nearest town is Thoyandou, approximately 64 km to the southwest.

10. Elevation: (in metres: average and/or maximum & minimum)

Minimum elevation 190m asl at Limpopo-Luvuvhu confluence
Maximum elevation 235m asl at Banyini Pan

11. Area: (in hectares)

Ramsar site area: 7756 .98 ha. This comprises the following:

i. area of the pans in the Kruger National Park – 347.00 ha
ii. Makuleke – floodplains of the Limpopo and Luvuvhu Rivers - 7409.98 ha

12. General overview of the site:
Provide a short paragraph giving a summary description of the principal ecological characteristics and importance of the wetland.

This wetland, which is also referred to as a floodplain vlei, comprises a number of landscape features that include riverine forest, riparian floodplain forest, floodplain grassland, river channels and pans. The riverine forest is mostly confined to the banks of the Limpopo and Luvuvhu Rivers, and consists of large, broad canopied trees over 20m in height.

The proposed Ramsar site will form a continuous section from the Banyini Pan along the Limpopo River to the border of Mozambique, and from there on along the Luvuvhu River to the Lanner Gorge in a form of a skewed "J" (see maps).
This is a very important habitat for a large variety of biota that are dependant on this riparian zone in this dry landscape. Riparian floodplain woodlands comprising ana trees and fever

trees occur on waterlogged clays. In addition, floodplain grasslands communities occur on both the Limpopo and Luvuvhu floodplains (Venter, 1990). Thirty-one seasonally flooded pans are found in the floodplain. They provide important breeding and feeding habitats for a variety of animals and birds. The pans of the Limpopo River floodplain hold water well into the dry season, thereby creating important refuge areas for wildlife during the drier winter months. They also provide an important waterbird habitat during both summer and winter months in wet years and serve as a stopover for many migratory waterbirds. The Limpopo River is typically characterised by having a prominent levee on both banks. The floodplain forms depressions in places (pans), which are intermittently filled during flooding of the Limpopo River. Examples of these pans include Makwadzi and Manxeba, which are characterised by prominent floodplain vegetation, particularly emergent aquatic macrophytes. Mapimbi pan on the other hand appears to receive seepage water from Limpopo River and it is speculated that its hydrology may be related to fluctuations in the water table. The subsurface connection appears to be most evident when the river is full. It appears to receive surface water earlier during floods than the other floodplain pans, which fill predominantly from overtopping of the levee. The northern bank of the Luvuvhu River, on the other hand, shows no evidence of a prominent levee. As a result, Mabvubvanye pan, which occurs in this area, is shallower, has a more accessible connection to the river, and is flooded more regularly than those on the Limpopo floodplain. Another floodplain pan is Hapi, which occurs south of the Luvuvhu River in a depression running parallel to the river. During high flows (floods), the Luvuvhu River overflows its banks at the old Bobomene research station and campsite, where flow is obstructed by the low water approach to the Luvuvhu Bridge. The drainage line then runs parallel with the river well into Mozambique before the water reaches the Limpopo river (Van der Waal, 1996).

All of the above-mentioned pans, but especially Hapi, Makwadzi, Mapimbi and Mabvubvanye have substantial catchment areas and drainage lines of their own and may also fill completely as a result of runoff from these areas during normal rainfall years.

The Banyini pan is a 162 hectares pan with an 8 km perimeter in the newly declared area incorporated into the Makuleke area.

13. Ramsar Criteria:

Tick the box under each Criterion applied to the designation of the Ramsar site. See Annex II of the *Explanatory Notes and Guidelines* for the Criteria and guidelines for their application (adopted by Resolution VII.11). All Criteria which apply should be ticked.

1	2	3	4	5	6	7	8	9
☑	☑	☑	☑	☐	☐	☐	☑	☐

14. Justification for the application of each Criterion listed in 13 above:

Provide justification for each Criterion in turn, clearly identifying to which Criterion the justification applies (see Annex II for guidance on acceptable forms of justification).

Criterion 1

The proposed wetland is an excellent example of a floodplain vlei type characteristic of the northern part of South Africa and the eastern part of Mozambique.

Floodplain vleis comprise a riverine area (either a reedbed marsh or a reedswamp) and a grassy floodplain of varying width on either side. The riverine area may be permanently or

seasonally inundated but the grassy floodplain is only inundated by occasional floods. The floodplain plays an important role in attenuating floods, thereby reducing flood damage in the downstream areas of Mozambique. The floodplain and its associated pans also play an important role in recharging the groundwater levels and maintaining the riparian and floodplain vegetation (Rogers, 1995)

Although the flow in the Luvuvhu and Limpopo rivers has been reduced by human needs (49% in the Luvuvhu River) the floodplains are relatively unaffected by other human influences.

Criterion 2
High densities of Nyala occur here as well as the last remaining herd of Hippopotamus (*Hippopotamus amphibius*, VU) east of Beit Bridge on the Limpopo River in South Africa are found at Makwadzi pan.

The Nile crocodile (*Crocodylus niloticus*, CITES App. II; SA Red Data: Vulnerable) and African python (*Python sebae*, CITES App. II; SA Red Data: Vulnerable), which are both regarded as vulnerable also occur here. Mammals of ecological significance (Smithers, 1986) occurring in the area between the Luvuvhu and Limpopo Rivers, but not totally dependant on the wetland area, include the following:

1. Aardwolf (*Proteles cristatus cristatus*) – (South African Red List: Rare);
2. Brown hyaena (*Hyaena brunnea*) - (South African Red List: Near-threatened);
3. Serval (*Leptailurus serval*) - (South African Red List: Near-threatened);
4. Leopard (*Panthera pardus*) – (South African Red List: Rare, CITES App. I);
5. African wild dog (*Lycaon pictus)*– (South African Red List: Endangered, EN);

The critically endangered cycad (*Encephalartos hirsutus*, CR) is a plant species found in the Makuleke area.

A number of nationally threatened bird species is also present at the site. Please see Annex II for a table of South African Red-Listed bird species and section 22 for further information on other threatened species present at the site.

Criterion 3
The wetland system supports a high diversity of species, some of which have their centres of distribution in the area. Others have only been recorded from this area and it is therefore possible that they are confined to this area. Relevant to the Ramsar site or parts of the site only: The rare samango monkey (*Cercopithecus mitis erythrarchus*), four toed elephant-shrew (*Petrodromus tetradactylus*) and African civet (*Civettictis civetta*) occur in the riparian areas along the Luvuvhu and Limpopo Rivers. Rare bird species such as pygmy goose (*Nettapus auritus*), white crowned plover (*Vanellus albiceps*), and nesting white backed vultures (*Gyps africanus*) occur here, while the highest densities of Pel's Fishing owl (*Scotopelia peli*) in South Africa are found in the Luvuvhu River valley. The Böhm's (*Neafrapus boehmi*) and mottled spinetails (*Telacanthura ussheri*), which are rare in South Africa, occur along the lower reaches of the Ramsar site. This area also represent the south-western limits of the range of distribution for the Dune Squeaker *Artholeptis stenodactylus* Pféffer, and are the only records of their presence within the borders of the Transvaal. The Ramsar wetland site

has exceptional ecological features that are unique for South Africa as a country. A number of species occur here and nowhere else in the country. Bats like Rüppels bat (*Rhinolophus fumigatus*), Swinny's horseshoe bat (*Rhinolophus swinnyi*), the Madagascar large free-tailed bat (*Tadarida fulminans*) and Commerson's leaf-nosed bat (*Hipposideros commersoni*) are only known in the country from specimens collected in the areas adjacent to, and constituting, the Ramsar site.

Criterion 4

The floodplain and pans support both breeding and feeding populations of many terrestrial and aquatic animals such as numerous breeding wetland birds (Annex II) and rare bat species feeding in the riparian caopy. The pans also form an important refuge area for water dependent fauna such as, lowveld fish species, frogs and wading birds. Many rare mammals, reptiles, amphibians and birds that occur here are at some stage associated or dependent on the wetland.

The large diversity of habitats which occur in the area between the Luvuvhu and Limpopo Rivers supports a diversity of bird species. The riverine forest with its abundance of fruit trees, the floodplain pans, and the dense riverine bush provide food, shelter and nesting sites for the highest number of bird species found in the Kruger National Park (Newman, 1987). The area has a few scarce nesting records for waterbirds in South Africa, such as the black Stork (*Ciconia nigra*), yellowbilled Stork (*Mycteria ibis*), marabou (*Leptoptilos crumeniferus*) and openbilled storks (*Anastomus lamelligerus*), and three banded courser (*Rhinoptilus cinctus*) are from this site. The reserve also provides an important stopover and breeding and feeding site for migrating waterbirds along the north/south migration route in the eastern part of southern Africa, such as the lesser gallinule (*Porphyrula alleni*), green sandpiper (*Tringa ochropus*) and a number of more common waders. The area forms an important migration route for large animals such as elephant and antelope, linking the Kruger National Park with areas in Zimbabwe and Mozambique.

Criterion 8

The wetland acts as an important refuge for breeding stocks of fish which recolonise the floodplain by migrating upstream during flooding events. Stocks for the river are protected within the reserve.

During the events of flooding of the floodplains, huge numbers of fish will migrate into these flooded areas to feed and to breed. Since the southern African fish are well-adapted to erratic seasonal flows and no-flow situations, the cue to spawn during the short flood event is very strong. Huge spawning runs into these floodplain pans take place and large amounts of eggs are deposited in the pans. Adult fish returns to the main stem of the river as water recedes and the eggs get a chance to hatch while fry can grow without too much predation from adults. Follow-up floods see the repeat of spawning runs as well as the movement of juveniles from the pans into the main system.

Fish that use these floodplains extensively are the following groups:

Small minnow species that utilize the inundated grass and overhang to shelter and breed in: Hamilton's barb (*Barbus afrohamiltoni*), Straightfin barb (*Barbus paludinosus*) and East coast barb (*Barbus toppini*).

Tigerfish (*Hydrocynus vittatus*) and robbers (*Micralestes acutidens* and *Brycinus imberi*) that breed in the shallow backwaters and feed on the other fish and invertebrates present.

Fish that prefer to breed in shallower floodplains: *Labeo rosae, Labeo congoro* and *Labeo ruddi*. Other pool fish such as *Schilbe intermedius* and *Synodontis zambezense* also utilize these quiet waters to feed and breed.

In an event of no follow-up floods, these floodplain pans become an important food source for piscivorous animals as large numbers of birds, mammals and reptiles are attracted to the pans.

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15. Biogeography (required when Criteria 1 and/or 3 and /or certain applications of Criterion 2 are applied to the designation):
Name the relevant biogeographic region that includes the Ramsar site, and identify the biogeographic regionalisation system that has been applied.

a) biogeographic region:

- Limpopo plain.
- It is also classified as one of the Southern Temperate Biogeographical regions of the world, comprising of the Southern Temperate High Veld fresh water ecoregion (ERSI, 2001)

b) biogeographic regionalisation scheme (include reference citation):
Preliminary Level I River Ecoregion Classification System for South Africa. The Makuleke Wetlands are situated in the Limpopo Plain, an Ecoregion 1.01 classification (State of the River report, 2001).

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16. Physical features of the site:
Describe, as appropriate, the geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; downstream area; general climate, etc.

Geology and geomorphology

The northern sector of the Kruger National Park is known as the Punda Maria-Pafuri-Wambiya area. It is approximately 1830 km^2 in extent and is bordered to the north by the Limpopo River. It lies between 70 and 130 km north of the tropic of Capricorn. No other area of equivalent biogeographic importance in South Africa lies wholly within the tropics. The high biodiversity of the Punda Maria-Pafuri-Wambiya area can be attributed to its geographic location and diversity of landscape features (Tinley, 1978).

Nine geological features with contrasting rock types are responsible for the intrinsic heterogeneity of this junction area (Venter, 1990). The main rock types occurring in the area are quartzite, sandstone, mudstone, shale and basic lavas (Waterberg, Stormberg and Karoo sedimentary rocks and lavas). The marls, ferricrete, calcrete and unconsolidated sand and boulder beds towards the east were formed along the inland edge of the sediments which make up the Mozambique Plain. To the north, at the confluence of the Luvuvhu and Limpopo Rivers, extensive areas of floodplain alluvium occur. The area is characterised by flat to slightly undulating and concave land. The area along the Limpopo River is characterised by a well-developed levee and adjacent floodplains. Small, rounded, basaltic koppies sporadically protrude through the alluvium, and some of them (e.g. Timhisi) are capped by well-rounded, quartzitic boulders and cobblestones.

After cutting spectacular gorges through the cave sandstones of the Luvuvhu and Lanner Gorges (Venter, 1991), the Luvuvhu River exits abruptly from the Lanner gorge and flows onto a broad alluvial deposit which stretches north-east all the way to its confluence with the Limpopo River (Heritage, 1994). The confluence is about 190 m above sea level.

The Luvuvhu River differs from the other rivers draining the northeastern escarpment of South Africa because of the succession of rock types over which it flows (Tinley, 1978). This geological succession comprises quartzite and sandstone of the Soutpansberg Group on the western side, followed by sedimentary rocks of the Karoo sequence in the central area of the river (Madzaringwe vicinity) and basalt on the eastern side. The valley of the Luvuvhu River is usually steep and narrow where the river has incised into the resistant quartzite and sandstones as opposed to the relatively shallow and wide valley where the softer rocks like shale and basalt cross. As the river exits Lanner Gorge, much of the sediment load of the Luvuvhu River is deposited, forming the floodplain alluvium that underlies most of the Luvuvhu section of the Ramsar site. Here the altitude seldom varies by more than 50 metres (Venter, 1990).

Bordering on the Limpopo River and to the west of the Kruger National Park lays the Makuleke Property. The main rock types occurring in this area are gneisses, schist calc-silicate rocks, marble and metaquartzite of the Limpopo Metamorphic Complex. In the Mabiligwe area, undifferentiated volcanic rocks of the Karoo Super Group predominate. Less frequent occurrences (for example, around the Makuleke area) of red and pink conglomerates and sandstones of the Malvernia Formation are evident in the outcrops. Conglomerates, sandstones, shales and tuff of the Soutpansberg Group and Mabiligwe Formation also occur in this region. A major fault occurs in the area, namely the Bosbokspruit fault, which is suspected to have displaced the Limpopo River northwards over the last 180 million years. Between 140 and 180 million years ago, numerous kimberlite pipes intruded into this catchment area.

The topography is mostly undulating and incised by annual streams running northwards into the Limpopo River. The altitude varies from just below 190 m above mean sea level at the Limpopo-Luvuvhu confluence to 235 m at the Banyini pan. The Bosbokspruit fault has caused a noticeable change in the topography, which drops about 3 m from north to south across the fault.

Origins

The floodplains and pans of the Limpopo and Luvuvhu Rivers have developed as natural features in the ancient river courses (Tinley, 1978).

Hydrology

The Luvuvhu and Limpopo Rivers and their tributaries drain the Pafuri area in the Kruger National Park. As a result of resistance to weathering by the underlying geology, as well the erosive actions of the Luvuvhu River and its tributaries, the area is characterised and somewhat contrasted by high relief and steep gorges. Downstream of Lanner Gorge, the Luvuvhu River opens up to form a wide floodplain with several major ephemeral pans (Tinley, 1978). The Luvuvhu River with its deep hippo pools used to be perennial but recently agricultural, forestry and mining activities outside the Kruger National Park have caused the river to stop flowing during the winter months.

The Limpopo River is a seasonal river, characterised by a wide, sandy riverbed with several large pans on its floodplain. During summer months, when there is flow in the river, it can be a kilometre or so wide and spill over its banks to fill large pans on the floodplain.

The mean annual runoff (MAR) from the catchment of the Luvuvhu River (excluding the Mutale River tributary) for the undeveloped (virgin) condition is estimated to be 395 million m^3/a (DWAF, 1990). Runoff is unevenly distributed varying from 3% of mean annual precipitation (MAP) in the drier area of the catchment to 38% of MAP in the wetter areas along the Soutpansberg mountain range to the west. Some 38% of the total runoff is produced from 9% of the catchment. Both the Limpopo and Luvuvhu Rivers show high seasonal flow variation and upstream water abstraction occurs to various degrees. This results in a decrease of water flow and an increase of zero surface flow situations in the historically perennial Luvuvhu River.

The floodplain pans and underlying aquifer play an important role in providing ground and seepage water downstream, thereby maintaining the extensive riparian forests that are so prominent in the area. The Pafuri floodplain pans fill or are fed during three main events. The majority of pans have large enough individual catchment areas to fill during heavy local rain showers or high floods. It is also possible to have groundwater seepage into pans closest to the rivers (especially pans on the Limpopo River) when surface flow is high (Van der Waal, 1996).

The types of floods in the Luvuvhu River

Two types of floods have been identified in the Luvuvhu River (Bruwer, 1987). The first of these are high floods that overtop the banks of the river after it exits Lanner Gorge into the Pafuri floodplain area. Others are smaller floods of the lower floodplain when the river overtops its banks at the Luvuvhu/Limpopo confluence as a result of backflooding of the Limpopo River flood. This can happen even though the Luvuvhu River is not in flood.

The first type, or high floods, inundates the floodplains on either side of the Luvuvhu River, including the pans on the northern bank. The high floods also play an important role in the natural functioning of the whole floodplain system, especially with regard to maintaining the ecological integrity and functioning of the pan system. On the southern bank of the Luvuvhu River, this type of flood follows the Hapi/Fever tree floodplain system, a very important factor in the reduction of accumulated Anthrax spores in this system (De Vos, et al. 1996). This type of flood is associated with high rainfall cycles and therefore occurs roughly every 8-10 years. It also scours the main channel, especially when it does not coincide with a Limpopo flood.

The second type, backflooding by the Limpopo River of the pans between the Limpopo and Luvuvhu Rivers, occurs more frequently, on average every two to three years. For inundation of these pans from water flowing over the embankments of the river, the Luvuvhu need to be flowing strongly (but not necessary in flood), but a pre-requisite is a simultaneous high flow of the Limpopo. Silt is deposited and pans such as Gwalala, Mabvubvanye, Nyala, Nwambi, Hulukulu, Makwadzi, Shipokonyolo, Banyini and Dakamila pans, are filled. This pan veld is a unique characteristic of this landscape (Gertenbach, 1983).

Soil type and chemistry

The Pafuri land type in the KNP consists of the alluvial lowlands that flank the lower Luvuvhu River and the Limpopo River. The area is characterised by flat to slightly undulating and concave land. The area along the Limpopo River is characterised by a well-developed levee and adjacent floodplains. The floodplains of both the Luvuvhu and Limpopo rivers incorporate several large seasonal pans. Large areas of the land type are occasionally temporarily inundated by floodwater from either the Luvuvhu or the Limpopo rivers (or both), but pans are more often than not replenished by runoff water, after heavy rains in their immediate catchment areas. Small, rounded, basaltic koppies sporadically protrude through the alluvium, and some of them (e.g. Timhisi) are capped by well-rounded, quartzitic boulders and cobblestones.

Due to the geological differences between the catchment areas of the Luvuvhu and the Limpopo rivers (Sibasa basalt and granitoid rocks respectively), there is also a marked difference in the alluvial deposits that flank these two rivers (Tinley, 1978). The soils of the area, which flank the Luvuvhu River, consist mainly of very deep, red, occasionally calcareous, neocutanic clay of the Oakleaf form (frequently also with a high percentage of silt). The outer fringes of the Luvuvhu river floodplain are usually characterised by deep to moderately deep, red and brown, paraduplex, calcareous clay (Valsrivier form). On the other hand, the soils, which are associated with the levee of the Limpopo River, consist mainly of very deep brown, neocutanic and stratified, loam or fine sand (Oakleaf). The soils of the Limpopo floodplains are dominated by very deep, brown, calcareous and sodic, neocutanic and paraduplex clay (Oakleaf and Valsrivier forms) (Venter, 1990).

i. Alluvial soils

In the Makuleke area, just outside the Park's western border, alluvial soils occur adjacent to Banyini pan. Most of these soils were cultivated in the past. Surprisingly they are not calcareous, even though they occur in low-lying positions in the landscape. The pH is alkaline and they have a high phosphate and potassium content. They belong to the Dundee Form, Mtamvuna family. The dryland cropping potential of these soils is high due to their inherent fertility, good permeability, relatively high water table and their ease of tillage. This potential, however, is limited by low rainfall in the valley. The irrigation potential is good. The fine sand fraction and its relatively high silt fraction make these soils moderately erodible due to runoff and wind erosion when tilled. Deep red soils occur mainly in the flatter area in the Makuleke area. Large specimens of white syringa (*Kirkia accuminata*) are often associated with these soils. The nutrient status is high in the topsoil. They belong mainly to the Hutton Form, Lillieburn family, although a portion to the west is shallower and has calcareous subsoil that probably puts it into the Coega Form, Nabies family. The dryland cropping potential of these soils is high, again due to their inherently good topsoil fertility, good permeability and ease of tillage. However, the low rainfall and high evaporation as well as the low cation exchange capacity (C.E.C.) in the subsoil make the realisation of this potential unrealistic. The irrigation potential is good to excellent due to their depth and subsoil texture. Rapid permeability could be a limiting factor.

ii. Gravels and rocky soils

Gravels and rocky soils are also common in this area, with the gravel consisting mainly of rounded, pebble- and cobble-sized, particles from many different geological origins, although quartz seems to dominate the mineral type. Soil occurs between the gravel particles in

sufficient quantity to allow good plant growth. The chemistry shows that these soils are very fertile with generally high phosphate, potassium, calcium and magnesium levels. Most of the hills in the area have minimum soil cover with exposed rock being prominent. What little soil there is occurs in cracks and fissures between the rocks. These soils have no cropping or irrigation potential mainly because they are untillable. They are all suited only to the production of herbage for wildlife and domestic stock.

Water quality
Although no data are available concerning the water quality in the Limpopo River, it is well recognised that large amounts of sediment are transported during the bigger flooding events. The water column at this time is therefore expected to be high in suspended solids. After the floods have receded, some nutrient enrichment may be possible due to agricultural practices upstream. Mining and industrial activities are largely absent from the majority of the catchment, which tends to indicate that the quality of the water that reaches the Ramsar site is reasonably good. The water quality of the Luvuvhu River too can be considered good (DWAF, 1995), probably even better than that in the Limpopo River (**Annex IV**).

The water quality (Van der Waal, 1996) of the pans may be quite different to that of the rivers at times, particularly during the dry and hot summer months. Conductivity may range between 88 and 1249 mS/m in the pans, while the pH may range between 6.7 and 10.6. Water temperature in the pans is also variable, ranging from 13.5 to 33.3^{o} C, with a winter average of 17^{o} C and a summer average of 30^{o} C. Dissolved oxygen is normally less than 5 mg/l, according to Moore et al (1991). 6 mg/l-dissolved oxygen is the guideline value and 4 mg/l would be a critical value for key species such as invertebrates.

Depth, fluctuations and permanence
The Limpopo and the Luvuvhu Rivers show high seasonal variability in flow. Both the rivers have to rise a few metres to overspill their banks (the Luvuvhu, for example, needs to rise more than 7 m at the bridge in the Kruger National Park). The pans (Van der Waal, 1996) are generally shallow and can be alternatively dry or filled for more than one consecutive year. It is suggested that the pans could become dry once in three years in normal situations. Maximum depths (at overflow level either into the river or to the next pan) of some of the pans are recorded in Annex V. It is essential for the pans to be connected with the rivers in a flooding event in order to ensure recolonisation and exchange of fish and certain invertebrate species with the rivers.

The water table
The water table occurs just below the ground surface of both the Limpopo and Luvuvhu River floodplains. Measurements from boreholes (game rangers diaries) situated in the Limpopo floodplain indicate that the water table fluctuates quite considerably, depending on flooding and rainfall in the area. Depths tend to range from 2.4 to 6.86 metres below the ground surface. During extensive droughts, the water table has been known to drop as much as 4 metres in places. A similar scenario is expected on the floodplain of the Luvuvhu River.

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17. Physical features of the catchment area:
Describe the surface area, general geology and geomorphological features, general soil types, and climate (including climate type).

Catchment area
The Limpopo River catchment is large, approximately 109 604 km^2 in extent (Smit, D.W.J.

DEAT, 1996), and has a mean annual run-off (MAR) of 2 290 million m^3 (Pullen, 1994).

The relevant information so far gathered as given in Annex VI gives a preliminary overview of the water balance in the Limpopo River through estimated MAR (virgin and present) of the tributaries and their catchment sizes.

The Luvuvhu River is a tributary of the Limpopo River and covers 5956 km^2 (Smit, D.W.J. DEAT, 1996). It rises on the southern slopes of the Soutpansberg mountain range (Pullen, 1994). The Mutale and Mutshindudi rivers are two important tributaries of the Luvuvhu. The MAR of this river is approximately 528 million m^3, which constitutes about 12.2% of the mean annual rainfall of 731 mm (Pullen, 1994).

Downstream area

The Gaza Province in Mozambique lies downstream of the proposed site. A large area of this region becomes a Transfrontier Conservation Area (TFCA). This TFCA covers 20 700 km^2 of protected area in Gaza and Inhambane Provinces and already has two gazetted national parks: Bahine National Park (7 000 km^2) and Zinave National Park (3 700 km^2). Traditionally, animals have migrated through this area to the Limpopo River. Due to the close proximity to conservation areas in South Africa and Zimbabwe (Gona Re Zhou National Park), the potential for natural and artificial stocking is high.

Climate

The Luvuvhu/Limpopo region falls in the Tropical Premontane Arid Thorn Woodland climatic region according to the classification system of Holdridge et al. (1971) as reported by Schulze & McGee (1978). Climatic conditions vary from hot and humid during the summer months to mild and dry during winter months. The mean annual rainfall in the Kruger National Park decreases from south to north and from west to east. The rainfall in the Limpopo/Luvuvhu floodplains area is the lowest in the Kruger National Park and the mean for the last 66 years was 422 mm per annum with a low of only 98 mm during the 1982/83 season. Research has shown that the lower the mean annual rainfall, the more unpredictable and variable the annual rainfall (Gertenbach, 1980). The low and unpredictable rainfall renders this area unsuitable for livestock or crop farming and the only sustainable long-term use of this area is ecotourism.

On a transect from the Soutpansberg eastwards across the Pafuri area of the Limpopo Valley to the coast, the rainfall curve follows the relief and influence of the land-sea junction closely, with highest rainfall occurring at both ends (Tinley, 1978). The highest mean annual rainfall occurs in the Soutpansberg Mountains to the west (Sibasa, 1 963 mm) and at the coast (Massinga 1 172 mm) in the east. The lowest rainfall on this east-west transect is in the Limpopo Valley at Pafuri (362 mm). The rain falls mostly between November and March, with February being the wettest month. The combined rainfall for May to August makes up only 4% of the annual total (Tyson, 1978). On average, there are only 42 days in the year with rain. The average monthly rainfall at Tshipise can be viewed in Annex VII.

The average daily maximum temperature (Tinley, 1978) in January (hottest month) is 33.5^o C and in June and July (the coldest months) it is 24.9^{o}C. The highest temperatures that have been recorded for summer and winter respectively are 43.5^{o}C and 32.4^{o}C. The mean daily minimum in January is 21.3^{o}C, and 15.9^{o}C in June and July but extremes of 13^{o}C and -3.8^{o}C

have been recorded. The strongest winds blow during September and October, mainly from the east, which, together with winds from the northeast, constitute the prevailing wind directions. Evaporation is very high with an annual average of 2 682 mm which exceeds the rainfall by some 2 348 mm per year. On average, hail and fog only occur once a year, while snow has never been recorded.

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18. Hydrological values:

Describe the functions and values of the wetland in groundwater recharge, flood control, sediment trapping, shoreline stabilization, etc.

The floodplain plays an important role in attenuating floods, thereby reducing flood damage in the downstream areas of Mozambique. The floodplain and its associated pans also play an important role in recharging the groundwater levels and maintaining the riparian and floodplain vegetation (Rogers, 1995). Sediment retention also takes place during normal years. The physical resistance to flow of the landscape and its associated vegetation reduces flow velocities in the rivers, thus spreading flow laterally and increasing water retention times in any one area. The resulting reduced flows and the binding action of riparian plant roots in the soil also markedly reduces the erosion of riverbeds and banks. Riparian wetlands also act as natural filters of diffuse nutrient and pollution transfers between the terrestrial system and river via both surface run-off and subsurface flow. Similarly, the changes in flow characteristics caused by the riparian vegetation results in increased deposition of both organic and inorganic suspended materials within the wetland.

While many aquatic, aerial and terrestrial species utilise riparian wetlands during crucial parts of their life cycles, many other species are confined solely to these systems. Riparian wetlands therefore form centres of a very high biodiversity within the landscape (Naiman, Decamps & Pollock 1993). These types of wetlands also regulate nutrient movement from adjacent terrestrial systems (e g agricultural run-off), organic matter inputs (e g litter fall). The river corridor as a whole acts as an important migratory route for many species and forms an important biophysical link along the length of the catchment. The state of the riparian zone is a major determinant of the ability of the river corridor to provide this function.

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19. Wetland Types

a) presence:

Circle or underline the applicable codes for the wetland types of the Ramsar "Classification System for Wetland Type" present in the Ramsar site. Descriptions of each wetland type code are provided in Annex I of the *Explanatory Notes & Guidelines.*

Marine/coastal: A • B • C • D • E • F • G • H • I • J • K • Zk(a)

Inland: L • M • N • O • P • Q • R • Sp • Ss • Tp Ts • U • Va •
Vt • W • Xf • Xp • Y • Zg • Zk(b)

Human-made: 1 • 2 • 3 • 4 • 5 • 6 • 7 • 8 • 9 • Zk(c)

b) dominance:

List the wetland types identified in a) above in order of their dominance (by area) in the Ramsar site, starting with the wetland type with the largest area.

M; P; R; Xf; N

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20. General ecological features:

Provide further description, as appropriate, of the main habitats, vegetation types, plant and animal communities present in the Ramsar site, and the ecosystem services of the site and the benefits derived from them.

The location of the wetland system together with the diverse landscape features in the vicinity, form the foundation for the high biodiversity, which is characteristic of the Limpopo/Luvuvhu floodplain and pan system. The diversity of landscape is depicted by the area the wetland system occurs in (Tinley, 1978):

- the continental old land and the young coastal plain meet;
- the mountains of the Soutpansberg and the Great Escarpment end;
- the north-south Lebombo Mountain range, which separates the Transvaal-Zululand Lowveld from the Mozambique coastal plain, ends;
- The north-south valley trough links the Transvaal and Zululand Lowveld; and
- The east-west valley trough of the Limpopo links the east coast with the continental interior (Kalahari-Mozambique).

This in turn is coupled with a high landscape and substrate diversity. In addition, the diverse topography provides a multiplicity of aspects open to or sheltered from aridity or moisture bearing winds. The presence of these landscapes and the contrasting moisture properties exhibited by the variety of substrates because of highly seasonal and erratic rainfall has resulted in a heterogeneous mosaic of plant communities in the vicinity of the Ramsar site. The major plant communities in the vicinity of the wetland and which are not found elsewhere in South Africa include (Tinley, 1978):

i. Lebombo ironwood forests;
ii. High mopane woodlands;
iii. Boabab "forests"; and
iv. Extensive areas of big timber riverine woodland.

In addition to number iv. above, there are a number of other more common wetland communities which constitute the Ramsar site. These include the following:

v. Riverine forest or thickets;
vi. Scrub-thicket on calcareous and brackish clays;
vii. Clayveld;
viii. Floodplain woodland;
ix. Dambo grassland;
x. Floodplain grassland; and
xi. Herbaceous aquatic communities.

The diversity of landscape features is matched by a great variety of soils and relief aspects which support exceptional vegetation diversity.

The Punda Maria-Pafuri-Wambiya area not only contains the most spectacular scenery in the Kruger National Park, but also has the richest variety of fauna and flora (Tinley, 1978). A large number of plant and animal species occur here nowhere else in South Africa. By far the most important of the unique features of this northern sector of the country, is the high biotic diversity formed by the overlapping elements of many biogeographic centres.

Van Rooyen (1978) and Gertenbach (1983) described the vegetation of this area in detail, and

only the major patterns are summarised here. The areas which occur immediately on either side of the Luvuvhu river, as well as the levee of the Limpopo river, are dominated by a tall and dense *Faidherbia albida / Ficus sycomorus* / *Xanthocercis zambesiaca* riverine forest. *A. xanthophloea* is often dominant on the edges of pans and in concave areas. The outer part of the Luvuvhu floodplain is dominated by *Sporobolus consimilis* grassland.

The Makuleke section of the Ramsar site outside of the Kruger National Park (to the west) is also a unique landscape with an accompanying wilderness character. The pans in this area, the Banyini Pan, together with the floodplain of the Limpopo River, make this area an important component of the Ramsar site. This area is also an historic migratory route for elephants and buffalo from Zimbabwe to the Transvaal Lowveld.

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21. Noteworthy flora:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 14, Justification for the application of the Criteria) indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

The vegetation of the area between the Luvuvhu and Limpopo rivers is characterised by a moderately dense to dense mopane (*Colophospermum mopane*)/tall common corkwood (*Commiphora pyracanthoides*) or bush savannah (Van Rooyen 1978), with large baobab trees (*Adansonia digitata*) often conspicuous. Lowveld cluster-leaf (*Terminalia pruniodes*) and Lebombo Euphorbia (*Euphorbia confinalis*) are locally dominant on very shallow, calcareous soils and rock outcrops. The areas which occur immediately on either side of the Luvuvhu and Limpopo Rivers are dominated by riverine forest, tall and dense ana tree (*Faidherbia albida*) / common cluster fig (*Ficus sycomorus*) / nyala tree (*Xanthocercis zambesiaca)* stands. Tall fever trees (*Acacia xanthophloea)* are often dominant on the edges of pans. More than 256 plant taxa have been recorded in the Luvuvhu/Limpopo region (Zambatis, et al. 1996), two of which are listed as threatened in the Red Data List (R.D.L.) of plants (see Annex I). Parts of this area, including the floodplain pans, have been poorly collected. Additional taxa can therefore be expected to be found here.

The diversity of landscape is matched by a great variety of soils and relief aspects which support an exceptionally high vegetation diversity - from floodplain grassland through many types of savannas and thickets to forest. Of the communities described by Van Rooyen (1978) and Bredenkamp (1993), the following are associated with the floodplain and riparian areas:

Acacia nigrescens-Sclerocarya birrea Savanna communities of dry sandy floodplains.

1. *Combretum hereroense-Acacia nigrescens* dense tree savanna
2. *Markhamia acuminata-Kirkia acuminata* open tree savanna
3. *Terminalia prunioides-Adansonia digitata* open tree savanna

Acacia tortilis-Acacia albida Flood Plains Savanna and Riparian Forest Communities

4. *Hyphaene coriacea-Acacia tortilis* floodplain Savanna
5. *Peuchel-loeschia leubnitziae-Acacia tortilis* pans and brackish plains savanna
6. *Acacia xanthophloea-Azima tetracantha* floodplain forest
7. *Faidherbia albida-Ficus sycomorus* riparian forest
8. *Setaria sagittifolia-Croton megalobotrys* riparian forest

Phragmites mauritianus-Breonadia salicina Reed Communities and Riparian Forest Communities
9. *Schotia brachypetala-Acacia robusta* Dry Riparian Forest
10. *Afzelia quanzensis-Combretum microphyllum* Riparian Forest
11. *Garcinia livingstonei-Phragmites mauritianus* Riparian Forest
12. *Pluchea dioscorides-Breonadia salicina* River bed community
13. *Phragmites mauritianus-Nuxia oppositifolia* River bed community

The *Colophospermum mopane / Acacia tortilis / Urochloa mossambicensis* savanna occurs on the basalt foot slopes adjacent to the river and pans in many places. It often forms the ecotone between the drier upslopes and the wetter bottom lands (Van Rooyen, 1978; Gertenbach, 1983). Other dominant woody species associated with this community include *Maerua parvifolia, Grewia bicolor, Azima tetracantha, Acacia senegal* var. *rostrata, Salvadora angustifolia, Hyphaene natalensis, Commiphora glandulosa, Thilachium africanum, Ximenia americana, Gardenia resiniflua, Maytenus heterophylla, Dalbergia melanoxylon, Acacia nigrescens, Gardenia spatulifolia, Zanthoxylum humilis, Boscia albitrunca* and *Adansonia digitata*. Almost homogeneous stands of baobabs *Adansonia digitata* occur in certain localities. The herb and grass layer includes a large variety of species such as the grasses *Tragus berteronianus, Aristida congesta* subsp. *barbicollis, Chloris virgata, Sporobolus smutsii, Enneapogon cenchroides* and *Dactyloctenium aegypteum*. Forbs include *Alternanthera pungens, Trianthema triquetra, Cyathula crispa, Corbichonia decumbens, Pupalia lappacea, Hibiscus micranthus, H. engleri, Indigofera rhytidocarpa, Boerhaavia diffusa, Ecbolium revolutum, Gisekia africana* and *Ipomoea obscura*.

A list of plant species that have only been collected from the area between the Luvuvhu and Limpopo Rivers as well as a list of the current red data taxa occurring in this region is available in Annex 1.

During an investigation of the conservation status of the riparian vegetation of the Luvuvhu River east of Makhado to the confluence with the Limpopo, assessment scores were given to different areas according to certain criteria such as removal of riparian vegetation, presence of weirs or impoundments, abundance of invasive plant species within the riparian zone, etc. The conservation status of the riparian vegetation starts out relatively high outside Makhado, but then scores drop off dramatically on entry into the former Gazankulu and remain so until the Kruger National Park boundary (DWAF, 1994). This clearly reflects a situation of high vegetation removal, and utilisation associated with bank erosion outside the Park. This is typical of the subsistence farming practices that are common in the catchment. On entry into the Kruger National Park, the situation and condition scores improved dramatically to attain nearly pristine status (Kemper, 1994), considering the damage done to the riparian zone due to the 1992-1993 drought and the simultaneous utilisation of the river upstream (Zambatis, et al. 1995).

The riverine vegetation along the Limpopo River in the Makuleke area is dominated by brack thorn (*Acacia robusta*), umbrella thorn (*Acacia tortilis*), fever tree (*Acacia xanthophloea*), sycamore fig (*Ficus sycomorus*), apple leaf (*Philenoptera violacea*) and in places in the pans, ilala palms (*Hyphaene coriacea*). The grasses include, among others, buffalo grass and

bushveld signal grass. The bottomlands and lower slopes are dominated by knob thorn (*Acacia nigrescens*), leadwood (*Combretum imberbe*) and gummy gardenia (*Gardenia resinflua*) and when calcareous, magic guarri trees (*Euclea divinorum*) and bushveld signal grass. The palaeogravels and shallow, rocky areas on the hilltops surrounding the Ramsar site are dominated by mopane, red bushwillow (*Combretum apiculatum*) and knob thorn trees (*Acacia nigrescens*). Grasses include nine-awned grass and spreading three-awn. The deep soils of the uplands are dominated by big and widely spaced trees that include mopane, white syringe (*Kirkia acuminata*), marula (*Sclerocarya birrea*) and shepherd's tree (*Boscia albitrunca*). The grasses include *Aristida congesta, Urochloa mosambicensis*, and *Digitaria* species. While baobab trees are prominent everywhere except in the pans, they do not dominate any of the vegetation associations. Sisal plants (*Agave sisalana*, originally from Mexico) are exotic to the area and were used in the past to create a security fence along the border between the Makuleke Property and Zimbabwe. The remains of the fence are still very evident in the Makuleke area.

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22. Noteworthy fauna:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 12. Justification for the application of the Criteria) indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc., including count data. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

The proposed Ramsar site area contains a considerable portion of the biodiversity of the lowveld in South Africa. A large number of species occur here and nowhere else in South Africa. The diversity of landscape is matched by a great variety of soils which support exceptional vegetation diversity and an unusually high number of habitats and wildlife.

Larger mammals

Although the area between the Luvuvhu and Limpopo Rivers in the KNP section of the proposed Ramsar wetland is not renowned for the big concentrations of large herbivores typical of the basalt plains further south, it does contain the highest density of nyala (*Tragelaphus angasii)* in the Transvaal. In the Transvaal the rare samango monkey (*Cercopithecus mitis erythrarchus*) has only been found in isolated forest patches in the Soutpansberg and Ohrigstad sector, and the riparian vegetation of the Luvuvhu and Limpopo rivers (Smithers, 1986). The last remaining herd of hippopotamus (*Hippopotamus amphibius*) east of Beit Bridge on the Limpopo River occurs at Makwadzi Pan. Due to the 1992/93 drought, the hippo numbers in the Luvuvhu and Limpopo rivers in the proposed Ramsar wetland, decreased from more than a hundred to only about 10 animals (Viljoen, 1995).

Apart from the mammals conserved in the KNP, the Makuleke area supports numerous large mammals. Nyala (*Tragelaphus angasii)* and waterbuck (*Kobus ellipsiprymnus*) are commonly associated with the riverine areas and floodplains respectively. Warthog (*Phacochoerus aethiopicus*) are common, as are vervet monkeys (*Chlorocebus aethiops*). Two herds of buffalo (*Syncerus caffer*) totalling about 70 animals, and elephants appear to be resident in the area, both of which utilise the floodplain and riparian habitats extensively. The African civet (*Civettictis civetta),* aardwolf (*Proteles cristatus cristatus*), brown hyena (*Hyaena brunnea*), serval (*Leptailurus serval*), leopard (*Panthera pardus*) and Sharpe's grysbok (*Raphicerus sharpei*), although not wetland species, also occur in the area. The aquatic ecotones and drainage lines are probably extensively traversed by these species and it is envisaged that the riverine areas are utilised by them at some stages. The hippopotamus (*Hippopotamus*

amphibious), which is also regarded as rare, is still found in the few more permanent pools along the Limpopo River in the Makuleke Property.

Large mammals of ecological significance (Smithers, 1986) depending on the existence of the proposed Ramsar wetland include the following:

1. Samango monkey (*Cercopithecus mitis erythrarchus*) - In the Transvaal these animals these monkeys have only been found in isolated forest patches and the riparian vegetation of the Luvuvhu and Limpopo Rivers. SA Red data status - vulnerable;
2. Bushpig (*Potamochoerus porcus*) - The highest concentration of these animals in the KNP (and thus protected) is found in the riparian vegetation of the Pafuri region;
3. Hippopotamus (*Hippopotamus amphibious)* - In the northern region and along the Limpopo River, this is the last remaining herd east of Beit Bridge. There are 22 animals in Makwadzi pan and 8 in the Luvuvhu River (1996 hippo census). IUCN Red data status - Vulnerable;
4. Nyala (*Tragelaphus angasii)* - The highest density of nyala (*Tragelaphus angasii)* in the Transvaal occurs in the proposed Ramsar wetland riparian zone;

Small mammals

Numerous species of bats and small rodents are known to occur only in proposed Ramsar wetland area between the Luvuvhu and Limpopo Rivers and nowhere else in South Africa (Pienaar, 1987). The colony of several thousand Egyptian fruit bats (*Rousettus aegyptiacus*) roosting in a cave in Lanner Gorge is one of only about seven such colonies known in South Africa. Other bats like the Rüppels bat (*Rhinolophus fumigatus*), Swinny's horseshoe bat (*Rhinolophus swinnyi*), the Madagascar large free-tailed bat (*Tadarida fulminans*) and Commerson's leaf-nosed bat (*Hipposideros commersoni*) are only known in South Africa from specimens collected at Pafuri. These species probably also use the riparian areas to forage.

Small mammals of ecological significance (Smithers, 1986) depending on the existence of the proposed Ramsar wetland include the following:

1. Suni (*Neotragus moschatus*) – SA Red Data: vulnerable;
2. Four toed elephant-shrew (*Petrodromus tetradactylus*) - – SA Red Data: endangered; restricted to the riparian forests of the Limpopo and Luvuvhu rivers and extreme northeast parts of KwaZulu-Natal.
3. African civet (*Civettictis civetta)* - prefer areas with riverine underbush, thickets and reed beds where trees and shrubs provide wild fruits.
4. Lesser grey-brown musk shrew (*Crocidura silacea*) - This shrew has a only been found on the banks of the Sabie River in the southern area of the Park, from the Mashicindzudzi area south of Pafuri, and from the banks of the Luvuvhu River;
5. Egyptian fruit bat (*Rousettus aegyptiacus*) - This bat has only been recorded along the Luvuvhu and Limpopo rivers in the proposed Ramsar wetland area, they utilize the caves at Lanner Gorge. These bats are also rare in the rest of the old Transvaal. The riverine forests are important foraging areas for the bats;
6. Commerson's leaf-nosed bat (*Hipposideros commersoni*) - The only area where these bats have been encountered in South Africa is from the riverine forests of the Pafuri area.

7. Rufous hairy bat (*Myotis bocagei*) - This extremely rare species in South Africa has only been collected from Skukuza and in the Pafuri area along the Luvuvhu river, this bat appears to prefer forests. Red data status – data deficient;
8. Rüppell's bat (*Rhinolophus fumigatus*) - Within the borders of South Africa the only area where these bats have been encountered is in association with the riverine forests of Pafuri.
9. Butterfly bat (*Chalinolobus variegatus*) - In South Africa these bats have only been recorded from the Soutpansberg and from Pafuri where it is associated with riverine forest.
10 Long-tailed Serotine bat (*Eptesicus hottentotus*) - In the former Transvaal this uncommon bat has only been collected from the riverine area at Pafuri;
11. Damara woolly bat (*Kerivoula argentata*) - In the Park this bat has only been collected from the Pafuri riverine forest. These bats appear to be confined to well watered areas and riparian forests. SA Red data status - Endangered;
12. Lesser woolly bat (*Kerivoula lanosa*) - This bat has only been collected from the Pafuri area in the Park. In the former Transvaal they have only been collected from the Soutpansberg along the Njelele River and in the riparian vegetation at Pafuri; SA Red data status – Near-threatened
13. Woodland mouse (*Grammomys dolichurus*) - These mice have a limited distribution in the Transvaal and have only been collected from the riverine forest area of the Limpopo and Luvuvhu areas;

Small mammals of ecological significance (Smithers, 1986) occurring in the area between the Luvuvhu and Limpopo Rivers, but not totally dependant on the wetland area, include the following:

1. African wild cat (*Felis silvestris*)
2. Ant bear (*Orycteropus afer*)
3. Pangolin (*Manis temminckii*) - SA Red Data -Vulnerable
4. Wahlberg's epauletted fruit bat (*Epomophorus wahlbergi*) - Occurs along the Limpopo River. They appear to be dependent on evergreen forest;
5. Swinny's horseshoe bat (*Rhinolophus swinnyi*) - The only known records of these bats in the former Transvaal come from the Pafuri region. These bats have a limited distribution throughout the Subregion of Southern Africa. At night they frequent well wooded area in search of prey. SA Red Data -status - Endangered;
6. Ansorge's free-tailed bat (*Chaerephon ansorgei*) - In South Africa this bat is only known from two localities in the Park, namely Pafuri and Nwanetsi, and from Mkuzi Game reserve in Natal. These bats require rock clefts and caves for shelter.
7. Madagascar large free-tailed bat (*Tadarida fulminans*) - The only records of these bats in South Africa is from the Pafuri area. They appear to be dependent on a rocky terrain for their roosts.
8. Yellow golden mole (*Calcochloris obtusirostris*). SA Red Data -status -.Vulnerable
9. Honey badger (*Mellivora capensis*): SA Red Data -status -.Near-threatened.

Birds

From an avifaunal point of view, Pafuri is strategically situated for many species. From a subregional perspective, the ecology of the area has been influenced by a mesic temperate regime from the south and west, an arid climatic regime from the northwest and more

tropical, humid influences from the north (Hurford, 1993). This has given rise to a wide diversity of bird species in the Pafuri area which is situated in the centre of this region. Some of the birds which occur in the area are tropical species which reach the southern limit of their ranges here and thus only just occur within the boundaries of South Africa. Others are generally rare and their conservation is of importance not just within the Kruger National Park, but wherever they may occur.

A total of over 450 bird species have been identified in the Pafuri area and 34 are restricted to this northern area (Sinclair, et al. 1992). The highest densities in South Africa of the scarce, nocturnal Pel's fishing owl (*Scotopelia peli*), occur along the Luvuvhu River. The rare pygmy goose (*Nettapus auritus*) also occurs here. Sparse, but localised populations of Böhm's (*Neafrapus boehmi*) and mottled spinetails (*Telacanthura ussheri*), which are rare in South Africa, occur along the lower reaches of the Ramsar site. The long-tailed wagtail (*Motacilla clara*) is common along the well-wooded, rocky stretches of the Luvuvhu River. The Basra reed warbler (*Acrocephalus griseldis*), which is a very rare non-breeding palaearctic migrant, reaches the southern edge of its range in this area where it feeds in the tall weedy growth in the riparian forest. The European sedge warbler, also a palaearctic migrant, occurs here. The Luvuvhu/Limpopo region is widely acknowledged amongst bird watching enthusiasts as one of the top birding areas in the country.

Annex II (a) and (b) show lists of uncommon birds found in the proposed Ramsar site and surrounding area (Maclean, 1993; Newman, 1987; Sinclair, et al. 1992; Tarboton, et al. 1987). Since the birds in the surrounding area are closely linked with processes in the Ramsar site, it seems logical to include them in the list.

Reptiles

The Pafuri area is unrivalled in most parts of southern Africa in terms of its abundance and diversity of reptiles (Jacobsen, et al. 1994; Jacobsen, et al. 1989; Pienaar, et al. 1983). Of the 108 recorded species in the Kruger National Park, no fewer than 90 have been collected in some or other part of the Pafuri area. Several species are more or less restricted in their respective distributional ranges within the Park to this area, and two species i.e. Lang's round-snouted amphisbaenian (*Chirindia langi langi*) and the golden blind skink (*Typhlosaurus aurantiacus fitzsimonsi*) have their centres of distribution here.

The Limpopo-Luvuvhu area is where the only specimens of the Pafuri flat gecko (*Afroedura pondolia* subsp. *nov*), the Transvaal flat gecko (*Afroedura transvaalica transvaalica*), Stevenson's/Khami dwarf gecko (*Lygodactylus stevensoni*), the Limpopo dwarf burrowing skink (*Scelotes limpopoensis limpopoensis*) and Kalahari wedge-snouted amphisbaenian (*Monopeltis leonhardi*) have been collected (Jacobsen, et al. 1994). Recently, several specimens of the Horned adder (*Bitis caudalis*) were found on Mabyeni hill which lies adjacent to the Ramsar site. This provides evidence of a zoogeographic link between this area and the more arid western regions of southern Africa. A list of reptiles which are found in the area adjacent to the rivers and floodplains is provided in appendix 2.

Reptiles occurring in the floodplains and the Luvuvhu and Limpopo Rivers include the following:

1. Peter's Flat Skink (*Mabuya homalocephala depressa*) - In the Transvaal these skinks have a limited distribution. In the Park, the species has been recorded at the confluence of the Luvuvhu and Limpopo Rivers, the eastern boundary between the Mathlakuza pan and Saselandonga gorge and the eastern boundary north of Nwanetsi. The status of this species is only regarded as secure in the former Transvaal because it occurs in the Park;
2. Slender Wedge-snouted Amphisbaenian (*Monopeltis sphenorhynchus sphenorhynchus*) - The distribution of this Amphisbaenian is along the Limpopo River (Branch, 1988). In the Park they have only recorded from the far northern sections where there is a substrate of deep sand (Pienaar et al, 1983).
3. Common African Python (*Python sebae natalensis*). SA Red Data status - Vulnerable
4. Nile crocodile *(Crocodylus niloticus)* SA Red Data status: - Vulnerable

Crocodile *(Crocodylus niloticus)* counts in the Luvuvhu and Limpopo rivers in the Kruger National Park are summarized in Annex VIII.

Amphibians

Of the 33 amphibian species indigenous to the Ramsar Site, 28 are tropical forms (Passmore, et al. 1995). These areas also represent the south-western limits of the range of distribution of the Dune Squeakers (*Arthroleptis stenodactylus*) .The Dune Squeaker is an inhabitant of Northern Zululand, Mozambique and Zimbabwe. It was not known to occur in the former Transvaal until very recently when it was discovered in the riverine forest of the Luvuvhu River near Bobomene Drift in the Pafuri area of the Kruger National Park. This frog has a limited distribution in South Africa and only occurs in the coastal dune forest at Cape Vidal and in the far northern areas of the Park where it has been collected from Shipudza spring and from Bobomene.

Fish

A total of 38 fish species have been recorded in the Luvuvhu and Limpopo Rivers in the proposed Ramsar wetland area. The eastern part of the Luvuvhu River in the area is also the transitional zone between the foothill bio-region and the tropical bio-region, resulting in some cool water species such as the mountain catfish (*Amphilius uranoscopus*), and shortspine rock catlet (*Chiloglanis pretoriae*) entering the warm Lowveld region (Pienaar, 1978). In 1950 a Zambezi shark (*Carcharhinus leucas*) was also collected at the Luvuvhu/Limpopo confluence. These sharks are common in the coastal waters off Mozambique and northern Kwazulu-Natal. With the Luvuvhu River having changed from a perennial to a seasonal river by activities outside the Park, the habitats of fish species such as the rock catlets (*Chiloglanis pretoriae*) and the mountain catfish (*Amphilius uranoscopus*) which need flowing water to survive, are being threatened (Pienaar, 1978; Skelton, 1987).

Deterioration of the Lowveld Rivers due to water abstraction, siltation and pollution, causes that the environmental conditions for sensitive fish species are becoming less suitable. The Luvuvhu River is still in a relatively acceptable state, although it stopped flowing in recent years during the low rainfall periods in the winter. Fish, sensitive to changes in quality and quantity fluctuations that can still be found in the Luvuvhu River, but become rare or absent in the other tributaries of the Limpopo River (including the Olifants and Letaba Rivers in the Kruger National Park), are listed in Annex III.

Table 1: Fish species rare to the Lowveld area, found in the proposed Ramsar site.

Name	Status
Amphilius uranoscopus Stargazer mountain catfish	Rare in the Ramsar area: only in the western section of the Luvuvhu River; constitutes the eastern-most limit of the distribution of this species.
Aplocheilichthys johnstonii Johnston's topminnow	Rare in the Ramsar area; has only been recorded from the Luvuvhu River, in the Pafuri area.
Awaous aeneofuscus Freshwater gobi	Rare in the Ramsar area; found in the Pafuri area of the Luvuvhu River.

Invertebrates

A total of 28 taxa representing 18 genera have been recorded exclusively in the Luvuvhu River (Moore & Chutter, 1988). Limited sampling has been done in the pans along the Limpopo floodplain and many more species are bound to still be discovered in this area. Most of the species occurring in the Pafuri/Limpopo area, would most probably also occur in the Makuleke Property section of the Ramsar site.

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23. Social and cultural values:

a) Describe if the site has any general social and/or cultural values e.g., fisheries production, forestry, religious importance, archaeological sites, social relations with the wetland, etc. Distinguish between historical/archaeological/religious significance and current socio-economic values:

In 1969 some 3000 people belonging to the Makuleke clan were removed from a 25 000 hectares of land between the Luvuvhu and Limpopo Rivers so that the boundaries of the Kruger National Park could be expanded to the Limpopo. The Makuleke livelihoods and cultural systems on the land between the rivers were adapted to the abundance of natural wealth that surrounded them. The soil on the river was fertile, nourished by nutrients carried in the waters of the Luvuvhu when it flooded. People could eat figs, maroela and jackal berries that grow wild in the bush.

People used xirongos – cylindrical baskets from reeds – to trap fish. Other fishing methods included using traps that were set in the water in a way that allowed fish to enter but not escape. Spears carved with a barded hook on the end were also used. In summer when the rivers were full, people used locally-made nets. Different species of fish provided a vital source of protein especially in the months of food scarcity – the agricultural off-season - when cultivated crops and wild fruits were scarce.

Hunting was an important element in their subsistence methods. The Makuleke operated with traps, snares, bows and arrows, and occasionally with rifles. Ivory and the skins of civet cats were sold, but meat, as the main source of protein was the main product of the hunt. Hunting also had socially important role as the distribution of venison cemented kinship links and solidarity. Chiefs were also recognised through gifts of lion and leopard skins.
The villagers made a wine called Vuchemas from the Malala palms that grow in few other parts of the country that had a high nutritional value.

After the removal, the Makuleke were resettled in the southwest of the Punda Maria entrance of the Kruger National Park in the area called Ntlhaveni. The conditions at Ntlhaveni did not have the rich mix of natural resources that existed on the floodplains of the rivers. The Makuleke community associates their removal with a sharp decline of livelihoods.

Ntlhaveni falls within Malamulele region of the Limpopo Province. According to the Development Bank of Southern Africa's 1998 Development profile, the Limpopo Province is amongst the poorest provinces in the country. The Malamulele region in turn is amongst the poorest in the province. The following are some of its characteristics:

- Unemployment is around 60% and out-migration is very high. The average increase in unemployment since 1980 is more than 20%.
- Pensions, remittances, occasional selling of agricultural surpluses and infringement informal activity are the main sources of income.
- More than one in four people live more than 5 kilometres from medical facility
- Infant mortality is 57 per 1000 births. The countries average is 41.8 per 1000. In 1994, 35.6% of the children between four and five years were stunted due to poor nutrition.
- Residents rely primarily on communal taps and only 7% of the dwellings have water-borne sewerage.
- Electricity and communal telephones have recently been installed – including cell phone masts. However, there is still extensive reliance on fuelwood for cooking and heating.

b) Is the site considered of international importance for holding, in addition to relevant ecological values, examples of significant cultural values, whether material or non-material, linked to its origin, conservation and/or ecological functioning?

If Yes, tick the box **X** and describe this importance under one or more of the following categories:

i) sites which provide a model of wetland wise use, demonstrating the application of traditional knowledge and methods of management and use that maintain the ecological character of the wetland:

ii) sites which have exceptional cultural traditions or records of former civilizations that have influenced the ecological character of the wetland:

The area is well known for its archaeological sites and extensive excavations are still being undertaken in the area. More than 30 archaeological sites of continuous human settlement dating back to the first century AD have been identified. The area is very historically significant to the Makuleke Community. It has several sites illustrating their traditional ways of living, such as hunting, fishing and ploughing. The Makuleke Royal family graveyard is valuable for the Makuleke community. Every year on the 24th of September they visit the site to perform "the ancestral calling and thanks giving" ceremony. There is an old store at the Crook's Corner built by a Portuguese, Fernandez, from Mozambique. The Crook's Corner was used for trade to people from Mozambique, Zimbabwe and South Africa. Closer to it there is a grave for the famous hunter, Vekenya, well known for hunting in all three countries sides, South Africa Zimbabwe and Mozambique. All pans still have good memories to the Makuleke elders. Some of pans were named after the people living close to them.

iii) sites where the ecological character of the wetland depends on the interaction with local communities or indigenous peoples:

In 1996, Makuleke community created the Community Property Association (CPA), through which they gained ownership of 22,000 hectares of the northernmost part of the KNP between the Limpopo and Luvhuvu rivers. The land was returned to them after they reached a mediated settlement with many government departments and with South African National Parks Board (SANParks) and the new democratic government.

This accomplishment returned full ownership and title to a piece of land that contains by far the richest combination of wild plants, animals and stunning landscapes in the entire park, along with a host of tangible rights. In return for these rights they guaranteed to use the land in a way that is compatible with the protection of wildlife. The Makuleke Region of the Kruger National Park (KNP) is an attempt to harmonise the protection of biological diversity with their interests as rural people.

To give effect to this agreement, some 24,000 hectares of land within the KNP between the Luvhuvu and Limpopo Rivers was transferred from the State and returned to the community. It was then reproclaimed as a contractual park, effectively reincorporating it back into a national park. Although ownership changed hands, the land effectively remained within the same ecological management system.

iv) sites where relevant non-material values such as sacred sites are present and their existence is strongly linked with the maintenance of the ecological character of the wetland:

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24. Land tenure/ownership:

a) within the Ramsar site:

The Banyini Pan and the rest of the wetland system in the Makuleke's portion of the Madimbo Corridor are, for the first time, under effective conservation management. The Makuleke will participate in a Joint Management Board that will control the Pafuri Triangle as a Schedule 2b National Park, while the day-to-day management will continue to be done by the KNP as an agent of the Board. The commercial rights obtained by the Makuleke will be exercised exclusively, but within a pre-negotiated environmental framework, and subject to Environmental Impact Assessments. A sophisticated system of checks and balances will govern the relationship between SANP and the Makuleke.

The majority of the Ramsar site falls within the boundary of the Kruger National Park and therefore falls under the jurisdiction of the Joint Management Board. The Ramsar site is a tribal land that belongs to Makuleke Communal Property Association. The Government of South Africa established a Communal Property Association in 1996 to enable tribal authorities to own pieces of land. The Makuleke Tribal Authority got their land, which used to be in the Kruger National Park. The title deed was obtained in 1999 through the Constitutional Court. Presently the Joint Management Board, comprising members of Makuleke Communal Property Association and South African National Parks, is managing the land as a contractual park. The Makuleke Communal Property Association has full rights and the Joint Management Board is responsible for conservation and management of the area.

The portion of the Ramsar site outside of the Kruger National Park is state land. Since 1968, the land use and access has been restricted for military purposes. As such, the South African National Defence Force (SANDF.) manages the area.

b) in the surrounding area:
On 9 December 2002, the Great Limpopo Transfrontier Park (GLTP) was proclaimed with the signing of an international treaty at Xai-Xai, Mozambique by the heads of state of Mozambique, South Africa and Zimbabwe. The Great Limpopo Transfrontier Park will link the Limpopo National Park in Mozambique; Kruger National Park in South Africa; Gonarezhou National Park, Manjinji Pan Sanctuary and Malipati Safari Area in Zimbabwe, as well as two areas between Kruger and Gonarezhou, namely the Sengwe communal land in Zimbabwe and the Makuleke region in South Africa into one huge conservation area of 35 000 km² (SANParks Official Website).

Thus the Ramsar Site will be bordered by the GLTP in Mozambique in the east, a portion of the area north of the Limpopo River in Zimbabwe will be GLTP and the rest will be the Sengwe communal land, and to the west it will be Maluluke property between the Ramsar Site and the Matshakatini Nature Reserve. To the south it is protected by the Kruger National Park in South Africa and as part of the Makuleke region of the park.

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25. Current land (including water) use:

a) within the Ramsar site:
The major portion of the Ramsar site is conserved within the borders of the Kruger National Park. It is thus managed by the Joint Management Board for nature conservation. The Luvuvhu/Limpopo region represents one of the major biodiversity "hotspots" in South Africa (Tinley, 1978), with many species of a wide range of animal groups occurring only in this very small area of the country. Given the arid nature of the region, the low potential for agricultural yield and animal husbandry, together with the fact that anthrax is endemic in the area, the most suited land-uses are nature conservation and ecotourism. Ecotourism currently represents the only viable option for sustainable, long-term use of this area, with a good potential for generating revenue without impacting on the unique biodiversity present here (Venter, et al. 1994).

There has been no agricultural production in the Madimbo area since the SANDF took over in 1968. However, there used to be subsistence cropping in the alluvial soils along the Limpopo and in a few lands on the flat, red-soils of the area. Cattle were also grazed in the area at that time. Towards the end of 1995, cattle were allowed to graze in the Corridor because there was no grazing left outside the area. The carrying capacity of the veld (grass and trees) is said to be about 18 ha per large stock unit on average, but this can drop to 30 ha per large stock unit during a drought. There is no resident population in the Corridor except for the military and their personnel who are not stationed there permanently.

b) in the surroundings/catchment:
The Limpopo River basin is extremely large and at this stage it is not possible to quantify the different land uses. It is reasonable to estimate that commercial and subsistence agriculture, together with cattle and game farming probably constitute the major land uses along this river. A few small towns do occur along the river and its tributaries. The area that bounds the southern border of the Makuleke Property is sparsely populated and is mainly used for grazing. The Chickwarakwara irrigation project is situated in Zimbabwe, opposite Mabiligwe, north of the Limpopo River. The rest of the area in Zimbabwe is tribal land and is

utilised by the local population for small-scale agriculture and stock farming, as well as a concession area for trophy hunting. The predominant current land uses in the Luvuvhu River basin are natural veld (51%) and national parks / nature reserves (30%). Cultivated lands comprise 13% (including irrigated lands which occupy 3% of the catchment). Afforestation comprises 4% of the catchment. Urban development comprises 3% of the basin area. The land use therefore ranges from commercial farms and forestry estates in the higher lying southwestern parts of the basin, to predominantly subsistence agriculture and grazing lands in the central basin. The lower lying northeastern part of the catchment is dominated by protected game reserve areas. A trend towards more intensive land uses (urban, irrigation and afforestation) can be expected outside the Kruger National Park.

Small-scale agriculture (maize) and stock farming (cattle and goats) are the main agriculture activities taking place in the area immediate adjacent to the Parks border. Game farming are also found in the region.

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26. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land (including water) use and development projects:

a) within the Ramsar site:

The low flows, which have and still continue to be experienced in the lower Luvuvhu River in the Kruger National Park, have resulted from water abstractions upstream. This has had the effect of changing a perennial river to one with a seasonal flow (Venter, et al. 1994). This has led to undesirable changes in the natural environment of this river system. Along the downstream reaches of the river, such as in the Kruger National Park and adjacent to some irrigation schemes outside of the Park, there have in recent years been noticeable periods of low river flows and the death of river bank vegetation. In recent years, the water table in the Luvuvhu floodplain has lowered beyond the reach of roots of well-established fig trees. The result was that large stands of old fig tree forests died. In addition, the bedrock-"pockets" where *Syzygium* and *Breonadia* trees were abundant, also dried out and many of these trees also died (Deacon, pers. comm.). It is unclear to what extent the low flows were attributable to development in the upper reaches of the river and to what extent due to climate changes. What is clear however, is that the reduced flows simply exacerbated the effects of the drought. The indirect water requirements for maintaining the ecological balance in the Kruger National Park is a major component (estimated at 42%) of the total current requirements. Increasing usage of water by other sectors will affect the water available for the Park (particularly low flows), unless steps are taken to provide this from storage. There is already full use of the river base flows by upstream users during low rainfall periods. The consequences of a reduction in flow in the Luvuvhu River have caused:

- extended periods of no flows in the river;
- receding ground-water levels;
- extensive stretches of river bed (channel) and pools or refugia to dry up; and
- The accretion of sediment.

In addition, there is an increase in total dissolved solids (TDS) along the lowest reaches of the Luvuvhu River which is probably due to an increased proportional contribution from the drier sub-catchments as well as the geology of the lower basin. Whilst the river was reported to run clear in winter in the past, nowadays it is turbid throughout the year.

Realising the importance of the Luvuvhu River, its floodplain, pans and associated riparian corridor, as a unique ecological entity, and its value for the ecotourism sector, the Department of Water Affairs and Forestry launched an instream flow requirement study to determine the ecological needs of the river and associated floodplain system (DWAF, 1990). The resulting information will hopefully be used to release flows from a newly proposed dam in the Luvuvhu River in order to try and maintain the ecological integrity of the system. If a dam is to be built, then it is essential that dam storage and releases are managed in order to restore at least the base flows of the Luvuvhu River. There is however no guarantee of such releases should the dam be built, and it is likely that a negotiated compromise may be necessary. Of concern with any such proposal is the effect of a dam on the sediment movement onto and through the floodplain system (trapping of sediment and the dampening effect of the dam on floods).

Exotic aquatic plants such as *Pistia* and *Azolla* also pose a threat to the ecological integrity of the system.

A large threat to the integrity of the Ramsar site as well the adjacent ecotones and terrestrial area is mining. A recent permit to prospect for diamonds in the Mashakatini Nature Reserve was approved by the Department of Mineral and Energy Affairs and should diamonds be found, this area will face the threat of full-scale mining. Rehabilitation in this low rainfall area is extremely difficult and some argue that it is not possible. Mining is therefore a very large threat that will have long-term detrimental consequences for conservation in the area.

While there is no population growth within the Makuleke Property, the population of the local people living outside of it is growing which is threatening the sustainable use of the natural resources in the area.

Redistribution of state-owned land for other purposes besides conservation and sustainable ecotourism also poses a threat.

Land claim by Makuleke community living southwest of Punda Maria entrance gate to Kruger National Park, in an area called Ntlhaveni, resulted in the restitution of land but not on main land use of the proposed Ramsar site. The Makuleke community decided to retain the conservation status of the area when it was returned to them, with the aim of practising ecotourism. At present there are formal or accepted plans for development projects as listed below:

1. Building of three lodges to accommodate 200 beds.
2. Building of museum and interpretation centre
3. Building of tented camp for tour guides training
4. Hunting Safaris

All these projects will promote the sustainable utilization of natural resources.

b) In the surrounding area:

A number of water supply schemes currently exist in the Luvuvhu River (DWAF, 1990) basin and existing dams regulate 55 million m^3 of the 395 million m^3 mean annual runoff (MAR). The total water requirement in 1985 was estimated to have been 192 million m^3/a

(49% of Virgin MAR), including both consumptive and non-consumptive uses. The number of people dependent on the basin for water during 1983 was 317 100. An increasing trend towards urbanization within the basin is occurring and is expected to continue. Urban and industrial use is 6% of the total use at present and could grow to 13% over the corresponding period to 2010. A trend towards more intensive land uses (urban, irrigation and afforestation) can be expected outside the Kruger National Park. Irrigation demand comprises some 43% of the water requirements of the basin at present. The total amount of water required by forestry (10%) and necessary ecological purposes (42%) are unlikely to change significantly but the proportion of total demand (versus irrigation) will decrease. In 1987, planted afforestation reduced the MAR to 376 million m^3/a, while runoff at the river outlet under 1987 conditions of development and abstraction averaged approximately 315 million m^3/a.

The potential for further irrigation development in the Luvuvhu Basin is high (DWAF, 1990). Within the central basin area, most schemes utilize river flow directly and do not have any impounded water supply. Their combined abstractions utilize all the low flows in the river, particularly during the critical period of August to November. Downstream in Mozambique, redevelopment of old irrigation schemes is also in progress.

The projected water requirements in 2010 based on a low-, and high-growth rate scenario is likely to be in the order of 222 million m^3/a (56% MAR) and 246 million m^3/a (63% MAR) respectively (DWAF, 1990). The total water demand and requirements of all the sectors and users will thus increase by between 16% and 28% over the period of 25 years from 1985 to 2010.

If increased growth is going to result in a decrease in allocation for ecological purposes (likely scenario) over the next 12 years, there will be between 38% (low growth rate) and 67% (high growth rate) reduction in allocation of MAR to lower Luvuvhu valley.

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27. Conservation measures taken:

a) List national and/or international category and legal status of protected areas, including boundary relationships with the Ramsar site:

In particular, if the site is partly or wholly a World Heritage Site and/or a UNESCO Biosphere Reserve, please give the names of the site under these designations.

On 9 December 2002, the Great Limpopo Transfrontier Park (GLTP) was proclaimed with the signing of an international treaty at Xai-Xai, Mozambique by the heads of state of Mozambique, South Africa and Zimbabwe. The Great Limpopo Transfrontier Park will link the Limpopo National Park in Mozambique; Kruger National Park in South Africa; Gonarezhou National Park, Manjinji Pan Sanctuary and Malipati Safari Area in Zimbabwe, as well as two areas between Kruger and Gonarezhou, namely the Sengwe communal land in Zimbabwe and the Makuleke region in South Africa into one huge conservation area of 35 000 km² (SANParks Official Website).

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b) If appropriate, list the IUCN (1994) protected areas category/ies which apply to the site (tick the box or boxes as appropriate):

Ia ❑;Ib ❑; II ☑; III ❑; IV ❑; V ❑; VI ❑

c) Does an officially approved management plan exist; and is it being implemented?
A Management and Development plan was developed, which is not in conflict with the Kruger National Parks Management plan, and that provides the framework for decisions in the Joint Management Board.

d) Describe any other current management practices:
In accordance with the National Parks Act (1976, as amended) the primary objective in the management of the Kruger National Park is to maintain the area as intact and as natural as possible and to utilize the Park for the educational and spiritual benefit of visitors. Maintaining the full spectrum of species in the various biotic communities of the Park is of the highest priority.

Co-management happens through the Joint Management Board, which is made up of representatives of the Makuleke CPA and SANParks (South African NationalParks) on a 50/50 basis.

The proposed area also borders the Limpopo Transfrontier Conservation Area (TFCA) with Mozambique and Zimbabwe.

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28. Conservation measures proposed but not yet implemented:
e.g. management plan in preparation; official proposal as a legally protected area, etc.

The National Parks Board has an imaginative proposal to recreate the Limpopo Valley as a wildlife area and develop its potential as a major ecotourism destination, linking the protected areas of four countries in a trans-frontier park (Dongola Park). As yet, there is still no clarity on further conservation measures in the Makuleke Property to the west.

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29. Current scientific research and facilities:
e.g., details of current research projects, including biodiversity monitoring; existence of a field research station, etc.

The Scientific Services department of the Kruger National Park coordinate a large number of projects that covers the entire Park, including the wetland areas.

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30. Current communications, education and public awareness (CEPA) activities related to or benefiting the site:
e.g. visitors' centre, observation hides and nature trails, information booklets, facilities for school visits, etc.
None

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31. Current recreation and tourism:
State if the wetland is used for recreation/tourism; indicate type(s) and their frequency/intensity.

Day visitors, game drives and picnic site. Please provide some detail on visitation rates: how many tourists go to the site per year? Are they local or foreign? How many days do they spend on average visiting the site? Etc.

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32. Jurisdiction:
Include territorial, e.g. state/region, and functional/sectoral, e.g. Dept of Agriculture/Dept. of Environment, etc.

Makuleke Communal Property Association
PO Box 305
SASELAMANI
0928

The department responsible for the jurisdiction of the site is Department of Environmental Affairs and Toursim.

In terms of the territorial jurisdiction, the area belong to the Makuleke Community after the land has been restituted in terms of the Restitution of Land Rights Act (Act no 22 of 1994)

Makuleke Community decided to retain the conservation status of the land i.e. the land is a Contractual National Park and the functional jurisdiction is held jointly by the Makuleke Communal Property Association and South African National Parks (SANPARKS) in particular Kruger National Park in a form of a Joint Management Board.

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33. Management authority:
Provide the name and address of the local office(s) of the agency(ies) or organisation(s) directly responsible for managing the wetland. Wherever possible provide also the title and/or name of the person or persons in this office with responsibility for the wetland.

Joint Management Board
C/o: Punda Maria Camp
Kruger National Park
Private Bag X402
Skukuza
1350

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Scientific/technical references only. If biogeographic regionalisation scheme applied (see 15 above), list full reference citation for the scheme.

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ANNEXES

Annex I: List of plant species that have only been collected from the area between the Luvuvhu and Limpopo Rivers as well as a list of the current red data taxa occurring in this region (Zambatis, 1996)

Common plant species	**Common plant species**
Adiantum capillus-veneris	*Commiphora merkeri*
Urochloa brichopus	*C. tenuipetiolata*
Echinochloa crus-galli	*Polygala schinziana*
Panicum heterostachyum	*P. wilmsii*
Panicum repens	*Phyllanthus burchelli*
Stipagrostis uniplumis var. neesii	*Maytenus putterlickoides*
Aristida stipitata subsp. spicata	*Allophyllus alnifolius*
Eragrostis crassinervis	*Corchorus kirkii*
Cyperus articulatus	*Grewia inaequilatera*
C. imbricatus	*G. retinervis*
C. pygmaeus	*G. rogersii*
Commelina petersii	*Abutilon englerianum*
Aloe littoralis	*Dombeya kirkii*
Dipcadi glaucum	*Ochna arborea var. arborea*
Sansevieria aethiopica	*Combretum collinum subsp. taborense*
Xerophyta equisetoides var. pauciramosa	*Stomatostemma monteroae*
Ficus craterostoma	*Stapelia gettelfii*
Ficus natalensis	*Stapelia kwebensis*
Tapinanthus ceciliae	*Huernia kirkii*
Helixanthera garciana	*Turbina schirensis*
Cyathula orthacantha	*Stenodiopsis humilis*
Gisekia Africana	*Dyschoriste depressa*
Potulaca collina	*Barleria crossandriformis*
Ranunculus multifidus	*B. lugardii*
Crotalaria distans subsp. mediocris	*B. matopensis*
Ptycholobium contortum	*Canthium setiflorum subsp. setiflorum*
Tephrosia virgata	*Senecio inaequidens*

T. zoutpansbergensis	*Stadmannia oppositifolia subsp. rhodesica*
Barleria matopensis	*Loudetia filifolia*
Boscia angustifolia var. corymbosa	*Heteropogon melanocarpus*
Combretum collinum subsp. toborensis	*Tetrapogon tenellus*
Euphorbia rowlandii	
Current Red Data plant taxa	**Current Red Data plant taxa**
Rhynchosia vendae	*Encephalartos hirsutus*

Annex II (a): Uncommon South African birds recorded in the Ramsar wetland area, which existence depend on the proposed wetland

Scientific name	**Common name**	**Status in South Africa - Barnes, 2000**
Pelecanus onocrotalus	White pelican	Near-threatened.
Pelecanus rufescens	Pink-backed pelican	Vulnerable.
Ciconia nigra	Black Stork	Breed on cliffs of Pafuri region, very few nests in S.A. Near-threatened.
Mycteria ibis	Yellowbilled Stork	Near-threatened
Anastomus lamelligerus	Openbilled Stork	One of two breeding colonies in S.A. and the largest breeding colony. Near-threatened.
Ciconia episcopus	Woollynecked stork	Near-threatened.
Ephippiorhynchus senegalensis	Saddlebilled stork	Endangered.
Leptoptilos crumeniferus	Marabou stork	One of two breeding sites in S.A. Near-threatened
Nettapus auritus	Pygmy Goose	Mostly in the pans of floodplains of the Limpopo and Luvuvhu Rivers. Near-threatened.
Vanellus albiceps	Whitecrowned Plover	Highest density in S.A. on the Luvuvhu River. Near-threatened.
Charadrius marginatus	Whitefronted Plover	Rare, but common on the Limpopo River. Peripheral.
Gyps africanus	Whitebacked Vultures	High densities in the K.N.P. on the Limpopo and Luvuvhu Rivers - breeding in riparian zone. Vulnerable.

Motacilla clara	Longtailed Wagtail	Only common along Mutale and Luvuvhu Rivers in the K.N.P.

Annex II (b): Uncommon South African birds not totally dependent on the wetland and which are recorded in the Ramsar wetland area

Scientific name	**Common name**	**Status in south africa (s.a.) - SA Red Data Book (Siegfried, et al 1976) and SA Red Data Book (Brooke, 1984).**
Rhinoptilus cinctus	Threebanded Courser	Only sightings in SA and the only breeding site in SA..
Stephanoaetus coronatus	Crowned Eagle	Uncommon in K.N.P., but localised at Pafuri. Near-threatened.
Falco peregrinus	Peregrine Falcon	Scarce or rare visitor that breeds in the Luvuvhu gorge just upstream of the Ramsar site. Near-threatened breeding resident race.
Aplopelia larvata	Cinnamon Dove	Rare in K.N.P., but localized at Pafuri.
Scotopelia peli	Pel's Fishing Owl	Uncommon resident in S.A. - highest densities on the Luvuvhu River. Vulnerable.
Neafrapus boehmi	Böhm's Spinetail	Uncommon. Resident at Pafuri. Nests inside hollow baobabs. Rare and local.
Telacanthura ussheri	Mottled Spinetail	Uncommon, only resident at Pafuri.
Merops hirundineus	Swallowtailed Bee-eater	Rare in the K.N.P. and only recorded along the Limpopo River
Coracias spatulata	Racket-tailed Roller	Uncommon in S.A. - resident at Pafuri
Coracina caesia	Grey Cuckooshrike	Uncommon resident in S.A. Resident in small numbers on the Luvuvhu River
Oriolus auratus	African Golden Oriole	Uncommon visitor to SA. Restricted to the north of the K.N.P.
Erythropygia leucophrys	Bearded Robin	Resident in riverine forests of the northern K.N.P.
Acrocephalus schoenobaenus	European Sedge Warbler	Uncommon in the K.N.P. where it has only been recorded from the north
Malaenornis mariquensis	Marico Flycatcher	Uncommon in the K.N.P. where it has only been recorded from the north
Platysteira peltata	Wattle-eyed	Uncommon localised resident to S.A.

	Flycatcher	Only seen in Pafuri. Peripheral.
Laniarius aethiopicus	Tropical Boubou	Occurs only in the north of the K.N.P.
Laniarius atrococcineus	Crimsonbreasted Shrike	Rare in K.N.P. with sightings only in the north
Telophorus nigrifrons	Blackfronted Bush Shrike	Scarce in KNP.
Telophorus olivaceus	Olive Bush Shrike	Rare in K.N.P. where it has only been recorded from the north
Lamprotornis mevesii	Longtailed Starling	Uncommon resident in S.A. Only resident in the Limpopo/Luvuvhu River valley.
Nectarinia venusta	Yellowbellied Sunbird	Uncommon in S.A.
Zosterops senegalensis	Yellow White-eye	Uncommon in S.A. where it has only been recorded from the Limpopo/Luvuvhu region
Acrocephalus griseldis	Basra Reed Warbler	Third sighting in S.A. along the Luvuvhu River

Annex III: Fish, sensitive to changes in quality and quantity fluctuations that can still be found in the Luvuvhu River, but become rare or absent in the other Limpopo tributaries.

Scientific name	**Common name**
Anguilla marmorata	Madagascar mottled eel
Anguilla mossambica	Longfin eel
Chiloglanis pretoriae	Limpopo or Dwarf rock catlet
Chiloglanis swierstrai	Lowveld of Bearded catlet
Hydrocinus vittatus	Tigerfish
Labeo congoro	Purple labeo
Marcusenius macrolepidotus	Bulldog
Micralestes acutidens	Silver robber
Petrocephalus catostoma	Churchill
Tilapia rendalli	Southern redbreast tilapia
Barbus afrohamiltoni	Hamiton's Barb
Total number of species in the Ramsar wetland section of the Luvuvhu and Limpopo Rivers is 38.	

Annex IV: Summary of water quality data in the Luvuvhu River. Site: Luvuvhu river down stream of the Mutale confluence (Department of Water Affairs and Forestry, 1995). Hydrological Station No: A9H010Q01. Dates: November 1983 to October 1991

	Min.	25%	Mean	75%	90%	Max	N*
EC mS/m	6.1	12	16.8	16.8	21.9	130	226
pH	5.8	7.1	7.4	7.9	8.2	8.6	226
Na	5	8	13.4	13	19	188	221
Mg	2	4	6.5	6	9	74	221
Ca	4	6	8.6	10	13	53	221
Cl	9	14	20.2	21	26	221	211
NO3+ NO2	0.04	0.04	0.15	0.14	0.36	1.59	211
SO4	4	4	6.9	5	8	367	211
PO4	0.005	0.009	0.030	0.026	0.039	1.025	211
TAL	13	29	44.2	48	63	456	211
NH4	0.04	0.04	0.06	0.07	0.09	0.23	211

* Number of samples

Annex V: Maximum depths of a few of the pans in the system

Name of pan	Depth (cm)	Name of pan	Depth (cm)
Mabvubvanye	215	Manxeba	180
Hapi	320	Gila	170
Makwadzi	255	Mapimbi	310
Nyavadi	160	Shipokonyolo	60

Annex VI: Limpopo tributaries: catchment sizes: naturalised and denaturalised MAR's.

Tributary	**Catchment area (km^2)**	**Naturalised MAR ($10^6 m^2$)**	**Denaturalised MAR ($10^6 m^2$) for 1990**	**Source**
Marico	13208	134.3	49.8	MSC. 1991
Crocodile	29572	442.4	204.8	MSC. 1991
Matlabas	3448	27.4	20.8	MSC. 1991
Mokolo	7616	207.2	116.9	MSC. 1991

Lephalala	4868	119.9	98.7	MSC. 1991
Mogalakwena	20248	178.0	79.3	MSC. 1991
Sand River	15630	80.44	37.6	MSC. 1991
Nzhelele	3426	109.52	89.4	De Wet Shand.1992
Luvuvhu	4826	573	492	WSM. 1993
Notwane	18053	54.7	24.3	HKS. 1993
Bonwapirse	9904	14.8	14.8	MSC. 1991
Mahalapswo	3385	13.2	13.2	MSC. 1991
Lorsane	9748	62.3	62.3	MSC. 1991
Motlouise	19053	11.1	111.1	MSC. 1991
Shashe	18991		462(*)	ME & WRD. Zimbabwe
Lower Shashe	4160		154	BNWMPS. 1990
Tuli	7910		281	ME & WRD. Zimbabwe
Umzingwani	15695		350(*)	ME & WRD. Zimbabwe
Bubi	8140		53(*)	ME & WRD. Zimbabwe
Mwenezi (Nuanetzi)	14759		256(*)	ME & WRD. Zimbabwe

(*) From the Zimbabwe National Master Plan for Rural Water Supply and Sanitation (1986)

Annex VII: The average monthly rainfall at Tshipise.

Month	**Rainfall (mm)**	**Rain days**
January	49.4	3.6
February	61.2	4.2
March	35.9	2.4
April	25.0	1,6
May	9.2	0.8
June	1.5	0.2
July	0.4	0.1
August	2.3	0.2
September	10.7	0.8
October	34.2	2.6
November	50.5	3.7
December	53.8	4.0
Total	334.1	24.3

Annex VIII: Crocodile *(Crocodylus niloticus)* counts in the Luvuvhu and Limpopo rivers in the Kruger National Park (Viljoen, 1991; Viljoen, 1993; Viljoen, 1995).

Size class	**Year (1984-1995)**											
	84	**85**	**86**	**87**	**88**	**89**	**90**	**91**	**92**	**93**	**94**	**95**
Very big	*	11	17	35	2	4	9	12	*	5	2	5
Big	81	72	80	68	47	25	73	77	44	94	90	76
Medium	132	118	154	103	75	98	210	160	52	73	86	75
Small	91	79	82	31	64	54	89	64	39	66	42	49
Unclassified	135	126	159	329	46	154	41	31	63	9	62	13
Total	439	406	492	566	234	335	422	344	198	247	282	218

* Not differentiated

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