RDMX100-03-CON-COMPR2-0303

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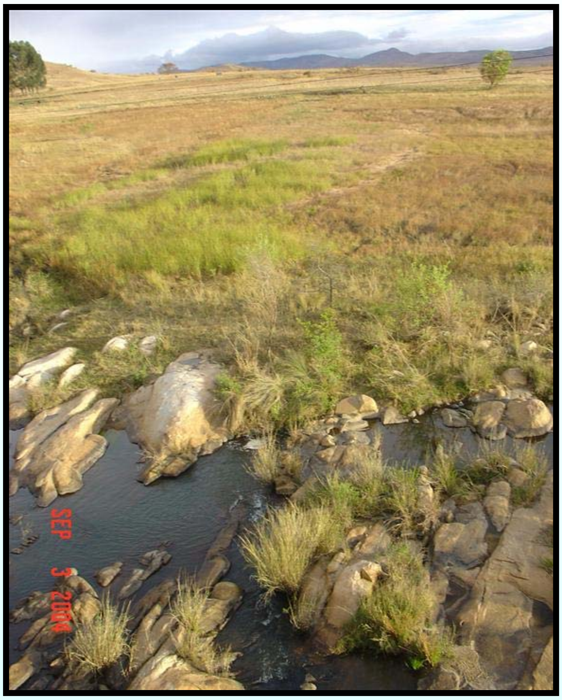

# KOMATI CATCHMENT ECOLOGICAL WATER REQUIREMENTS STUDY

# WETLANDS SCOPING REPORT

**May 2005**

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Water Affairs and Forestry
REPUBLIC OF SOUTH AFRICA

**DIRECTORATE: RESOURCE DIRECTED MEASURES**

# KOMATI CATCHMENT ECOLOGICAL WATER REQUIREMENTS STUDY

# WETLANDS SCOPING REPORT

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|---|---|
| **TITLE** | Wetlands Scoping Report |
| **AUTHOUR** | Jones I |
| **STUDY NAME** | Komati Catchment Ecological Water Requirements Study |
| **REPORT STATUS** | Final |
| **DATE** | 20.06.2005 |
| **DWAF REPORT NO.** | DWAF Report RDM X100-03-CON-COMPR2-0303 |

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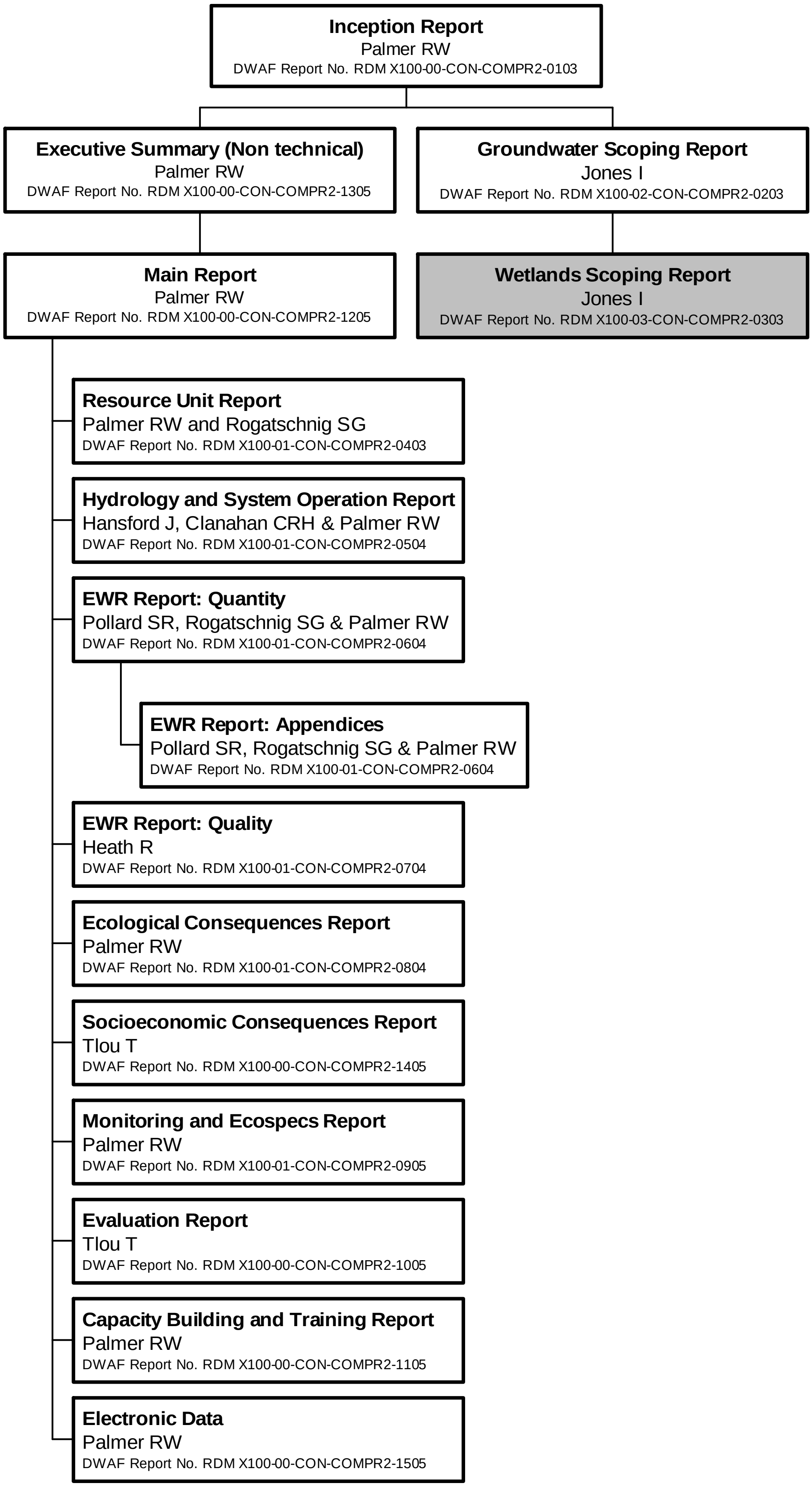
# Report Layout Diagram



# *EXECUTIVE SUMMARY*

## KOMATI CATCHMENT
## ECOLOGICAL WATER REQUIREMENTS STUDY –

## WETLANDS SCOPING REPORT


### *Background*

*The D-RDM has identified the Komati River Catchment as one of the primary catchments that requires a high confidence level assessment of Ecological Water Requirements. This study presents the results of a desktop scoping study intended to assess the need for a more detailed assessment of the wetland component of the Ecological Water Requirements within the catchment.*

### *Aims*

*The primary aim of this Scoping Study was to clarify the need for an assessment of the wetland component of the Ecological Water Requirement component of the Reserve for the Komati River Catchment within South Africa. The specific aims of the study were:*

- *to review and assess the availability and reliability of available relevant information on wetlands in the Study Area;*
- *to assess the distribution, diversity and function of wetlands in the catchment and the interaction between surface and groundwater resources;*
- *to assess the ecological importance and sensitivity of wetlands in the Study Area;*
- *to assess the social importance of wetlands in the Study Area;*
- *to delineate the Study Area into ecologically similar wetland zones (Wetland Ecotypes), and;*
- *To develop a Scope of Work for more detailed assessment, should this be necessary.*

### *Methods*

*The study was largely literature-based and shortfalls in the data were identified. The methods used to determine the wetland component of the catchment included:*

- *An assessment of available geological maps, hydrogeological maps, topographical maps and aerial photographs;*
- *An assessment of the National Groundwater Database, hydro-chemical data, aquifer parameters, recharge, base flow (ecological role) and wetland vulnerability.*

*Population census data and population density maps were reviewed. These gave an indication of the reliance of communities on groundwater, which will have an impact on the associated wetlands. Land-use information such as large-scale agricultural, industrial and mining related activities that rely on, or impact on wetlands, was sourced.*

### *Wetland Characteristics*

*The wetland characteristics of the catchment were investigated by reviewing aspects such as the different types and classes of wetlands present across the catchment from the 1:50 000 scale topocadastral maps and other existing projects, and analyzing the characteristics of each class within an identified geological unit. In addition, the interaction of the wetlands with the groundwater zone was noted. Water chemistry and potential impacts on wetlands by industry and/or mining were also noted.*

### *Importance of Wetlands in the Catchment*

*The general trend from the 1996 and 2001 census data was a decreased reliance on groundwater, and thus a lowering of the impact on wetlands though the groundwater systems. However, this does not relate to the surface runoff and impacts relating to increases in the population and the increase in industrial, mining and forestry undertakings. In the Nkomazi Local Municipality (Lebombo lithologies), the number of people involved in agriculture and forestry doubled between 1996 and 2001. The increased nitrate concentration in the groundwater for this part of the catchment can be related to the increased use of fertilizers and livestock grazing along riverbeds and wetland environments.*

*The coal mining areas around Carolina pose a serious threat to the water quality and surface water impacts on the pans and wetland environments and long-term effects on the baseflow could be severe.*

### *Interaction between Wetland and the Surface Water Resources*

*The results of a two-day field trip helped to delineate the processes involved in the interaction of the wetlands with the surface water regime. The sediments associated with the highveld area display perched water tables in the vadose zone, forming seeps that contribute to the formation of open plain wetlands. There is a direct contribution to surface water in this situation. The Lowveld granites are highly fractured and intruded by diabase/dolerite. This leads to the formation of underground dams, springs and large seep zones at the surface. There is a direct contribution to surface water. The Lebombo lithologies contribute directly through groundwater in the form of baseflow to rivers. The groundwater is intersected by the river and flows out on a rocky base. The groundwater to surface water relationship in the Barberton lithologies, gneiss, migmatite and granite in the west of the catchment is unknown and warrants further investigations.*

*The baseflow component of wetlands to the stream flow is negligible in the eastern part of the catchment associated with the Lebombo formations, as well as in the far western portion, were the area is dominated by endorheric pans. The central part of the catchment associated with wetlands derived from/sustained by the Barberton lithologies, the migmatites, gneisses and granites, and the Pretoria Group, show higher baseflow values than the Ecca Group lithologies. This implies (at this level of study) that the contribution of the groundwater to stream flow or surface flows though the wetland system is greatest for the Barberton lithologies.*

## *Wetland Classification*

*The Komati River Catchment has a number of differing wetland types that contribute to the system. These include the Palustrine class wetlands of the "Hillside Seepage" type, and some "Pans", typically associated with the sedimentary deposits that are underlain at shallow depths by ferricrete layers, "Drainage line" wetland types associated with the granite and meta-sediments within the lower lying areas of the catchment, and often associated with intrusive bodies within the host lithologies that force groundwater to surface as springs and day-lighting water within the drainage lines, and "Flood Plain" wetlands, associated with the areas within the river course associated with the river dynamics. There are also some very specific contributions from wetland environments that are specific to geological formations, such as the dolomites and basic intrusives.*

## *Preliminary Delineation of Wetland Ecotypes and level of EWR - Determination*

*A preliminary delineation of the Wetland Ecotypes was based on the geological formations underlying the catchment and their contribution to the surface water bodies. A geological classification is appropriate, due to the varying nature of the wetlands according to geologic formation and the observed interaction with the surface water bodies. Five Wetland Ecotypes were designated. These were:*

*A – Escarpment Complex (Ecca and Pretoria Groups and Dolomites);*
*B – Gneiss (Includes migmatite and granite);*
*C – Barberton Mountainland System;*
*D – Lowveld Granite; and*
*E – Lebombo Group (includes Karoo lithologies)*

## *Scope of Work*

*A Scope of Work for an intermediate level determination for the wetland investigation of the Komati Catchment was presented as a separate report.*

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# ABBREVIATIONS

| | |
|---|---|
| D: RDM | Directorate: Resource Directed Measures |
| DWAF | Department of Water Affairs & Forestry |
| EC | Ecological Category |
| EWR | Ecological Water Requirement |
| GCS | Groundwater Consulting Services |
| GIS | Geographical Information System |
| GPS | Geographical Positioning System |
| NGDB | National Groundwater Database |
| NWA | National Water Act |
| RQO | Resource Quality Objective |
| ToR | Terms of Reference |

# GLOSSARY

**Agglomorate:** A rock composed of sharp fragments set in a fine matrix.

**Andesitic:** An intermediate igneous rock.

**Basalt:** A very fine grained igneous rock derived from volcanic upwelling.

**Baseflow:** the component of river flow as mean annual flow in millimeters

**Basic:** In larv and rocks, dark, dense material containing 50% or less of silica.

**Delineation (of a wetland):** to determine the boundary of a wetland based on soil, vegetation and/or hydrological indicators (see definition of a wetland).

**Diabase:** a dark, grey-green, fine-grained gabbro with a characteristics texture, in which the interstices of tabular plagioclase crystals are filed by augite.

**Dolomite:** The mineral $CaMg(CO_3)_2$; also the rock that consists mainly of this mineral.

**Dyke:** a vertical or semi-vertical wall-like igneous intrusion which cuts across the bedding planes of a rock.

**Endorheic:** closed drainage e.g. a pan.

**Feldspar:** A white or pink crystalline mineral, largely formed of alumino-silicates of barium, calcium, potassium and sodium. Feldspars are abundant in metamorphic rocks.

**Ferricrete:** a very hard soil horizon made up of cementation of iron oxides at or near the land surface.

**Floodplain:** wetland inundated when a river overtops its banks during flood events resulting in the wetland soils being saturated for extended periods of time.

**Gabbro:** a group of dark-coloured, course-grained basic intrustive igneous rocks composed principally of calcium-rich basic plagioclase and pyroxene. Gabbro is formed through the crystalisation of basaltic magma, usually as large igneous intrusions deep within the earth’s crust.

**Gneiss:** A highly metamorphosed rock of a granular texture and with a banded appearance.

**Granite:** A course-grained igneous rock that consists largel;y of quartz, alkali feldspar, and plagioclase feldspar.

**Groundwater:** subsurface water in the zone in which permeable rocks, and often the overlying soil, are saturated under pressure equal to or greater than atmospheric.

**Hydrology:** the study of water, particularly the factors affecting its movement on land.

**Karst:** A type of topography that is formed over limestone, dolomite or gypsum by dissolution and which is dominated by underground streams, caves and hollows.

**Komatiites:** An ultramafic volcanic rock with >18% MgO composed of olivine and pyroxene in a glassy groundmass. Characteristic of archaean terrains.

**Lithology:** the character of a rock; its composition, structure, texture and hardness.

**Mafic:** Pertaining to or composed predominantly of magnesium rock-forming silicates. In general, synonymous with “dark minerals”.

**Migmatite:** A metamorphic rock injected with igneous material.

**Palustrine (wetland):** non-tidal wetlands dominated by persistent emergent plants (e.g. reeds) emergent mosses or lichens, or shrubs or trees.

**Perched water table:** the upper limit of a zone of saturation in soil, separated by a relatively impermeable unsaturated zone from the main body of groundwater.

**Periodotite:** An ultamafic rock with 40-90% olivine and pyroxene.

**Permanently wet soil:** soil, which is flooded or waterlogged to the soil surface throughout the year, in most years.

**Pluton:** A mass of igneous rock which has solidified underground. Plutons vary in size from batholiths, sills and dykes.

**Porphytic:** A textual term for those igneous rocks in which larger crystals are set in a finer groundmass.

**Quartzite:** A rock comprised essentially of quartz.

**Rhyolite:** The extrusive equivalent of granite with quartz and alkali feldspar in a glassy groundmass.

**Riparian:** the area of land adjacent to a stream or river that is influenced by stream-induced or related processes. Riparian areas, which are saturated or flooded for prolonged periods, would be considered wetlands and could be described as riparian wetlands. However, some riparian areas are not wetlands (e.g. an area where alluvium is periodically deposited by a stream during floods but which is well drained).

**Runoff:** total water yield from a catchment including surface and subsurface flow.

**Schist:** A strongly foliated crystalline rock formed by dynamic metamorphism whuich can be readily spilt into thin flakes or slabs due to well-developed parallelism of more than 50% of the minerals present.

**Seasonally wet soil:** soil which is flooded or waterlogged to the soil surface for extended periods (>1 month) during the wet season, but is predominantly dry during the dry season.

**Sedges:** Grass-like plants belonging to the family Cyperaceae sometimes referred to as nutgrasses. Papyrus is a member of this family.

**Sill:** An intrusion of igneous rock which spreads along bedding planes in a nearly horizontal layer.

**Syenite:** A group of plutonic igneous rocks consisting principally of alkali feldspar, usually with one or more mafic minerals such as hornblende or biotite.

**Tuff:** Volcanic sediment.

**Ultramafic:** A rock comprising >90% ferromagnesian minerals.

**Vadose Zone:** unsaturated zone – zone of oxidation between the surface and the groundwater interface.

**Value (soil colour):** the relative lightness or intensity of colour.

**Vlei:** a colloquial South African term for wetland.

**Water regime:** when and for how long the soil is flooded or saturated.

**Wetland catchment:** the area up-slope of the wetland from which water flows into the wetland and including the wetland itself.

**Wetland delineation:** the determination and marking of the boundary of a wetland on a map.

**Wetland:** land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which under normal circumstances supports or would support vegetation typically adapted to life in saturated soil.

# 1. INTRODUCTION

The National Water Act (Act No. 36 of 1998) (NWA) is founded on the principle that National Government has overall responsibility for and authority over water resource management for the benefit of the public without seriously affecting the functioning of the natural environment. In order to achieve this objective, Chapter 3 of the NWA provides for the protection of water resources through the Reserve for water resources.

The Reserve is defined as the quantity and quality of water required (a) to satisfy basic human needs and (b) to protect aquatic ecosystems. The basic human needs component of the Reserve is fairly easy to quantify as it is based on average water consumption per capita and standard drinking water standards. The quantity and quality of water needed to protect aquatic ecosystems is more difficult to quantify and the methods of doing so are under continual development and improvement.

The Directorate: Resource Directed Measures (D: RDM) is tasked with the responsibility of ensuring that the Reserve requirements, which have priority over other uses in terms of the Act, are determined before license applications are processed. Water resources in the Komati River Catchment (Water Management Area 5) are fully allocated, and the full implementation of the Reserve will almost certainly result in curtailment of water allocations once the compulsory licensing process is implemented. This highlights the need for an accurate assessment of the Reserve Requirements.

This report forms part of a comprehensive assessment of the Ecological Water Requirements (EWR) component of the Reserve that was commissioned by the D: RDM and undertaken by AfriDev Consultants. Groundwater Consulting Services CC (GCS) was appointed by AfriDev Consultants to compile a Scoping Report of the nature, function and importance of the wetland component of the Komati River Catchment.

## 1.1 AIMS

The primary aim of this Scoping Study was to clarify the need for an assessment of the wetland component of the Ecological Water Requirement component of the Reserve for the Komati River Catchment within South Africa. The specific aims of the study were:

- to review and assess the availability and reliability of available relevant information on wetlands in the Study Area;
- to assess the distribution, diversity and function of wetlands in the catchment and the interaction between surface and groundwater resources;
- to assess the ecological importance and sensitivity of wetlands in the Study Area;
- to assess the social importance of wetlands in the Study Area;
- to delineate the Study Area into ecologically similar wetland zones;
- to develop a Scope of Work for more detailed assessment, should this be necessary.

# 2. STUDY AREA

The Study Area for this report was defined by the D: RDM as the Komati River Catchment (X1) within South Africa (Figure 2-1). This area comprises two distinct sections: Komati West, comprising the area upstream of Swaziland, and Komati North, comprising the area downstream of Swaziland. The main tributaries are the Lomati, Teespruit, Gladdespruit and Seekoeispruit. The area includes the towns of Carolina, Silobela, Badplaas, Nhlaba, Kranskop, Driekoppies, Jeppes Reef and Komatipoort. The total area of the catchment, excluding Swaziland, is estimated at 12 360 $km^2$.

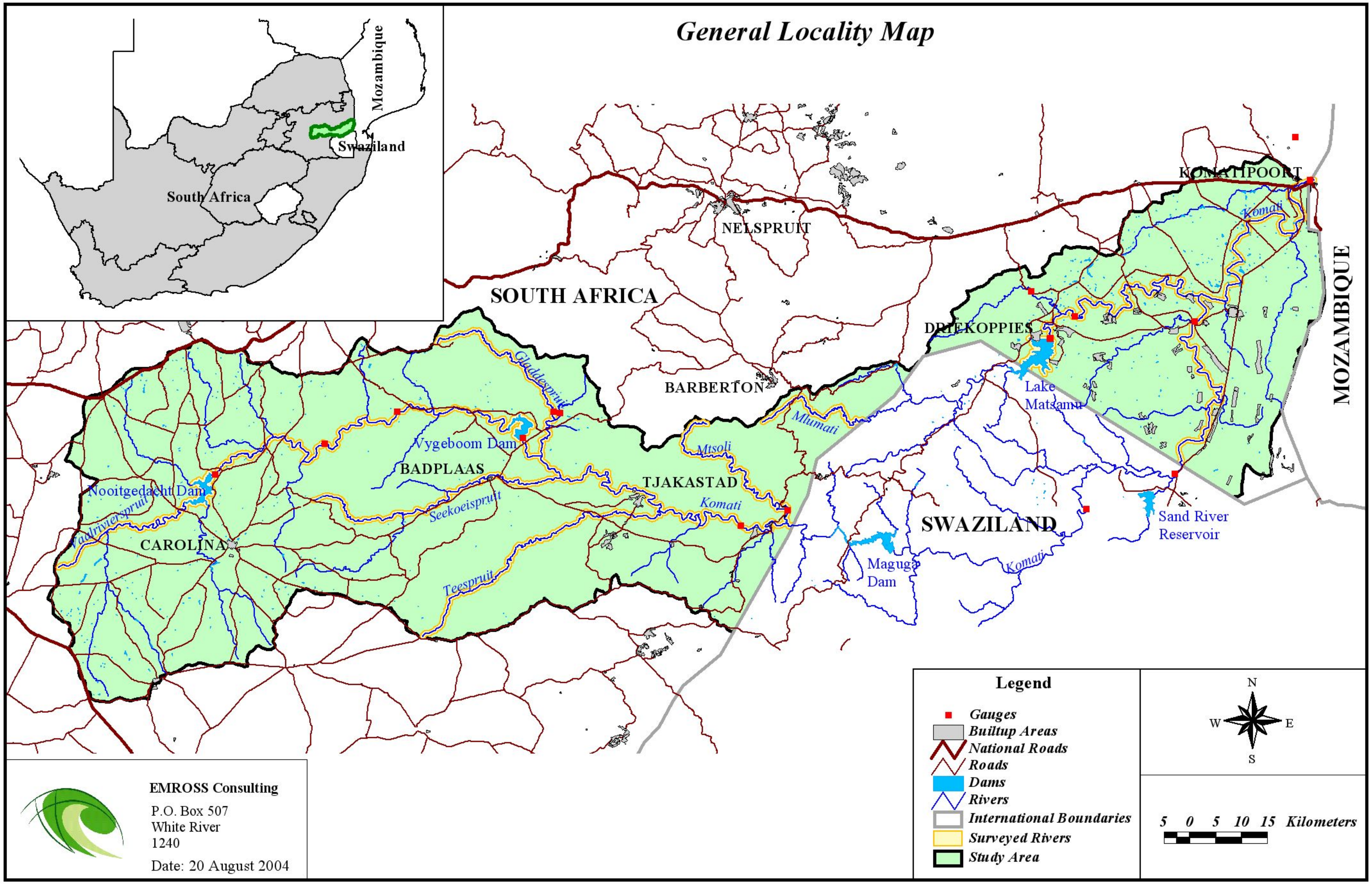


**Figure 2-1. General locality map of the Komati River Catchment, showing the main towns, rivers, dams and gauging weirs.**

# 3. METHODS

## 3.1 LEVEL OF INVESTIGATION

This study was largely literature-based and shortfalls in the available data were identified as part of the additional work that is needed. Visits to various centres and institutions were undertaken and a two-day field trip was undertaken to obtain a general overview of the catchment in August 2003.

## 3.2 SOURCES OF INFORMATION

The study relied largely on information sourced from government departments and verbal communications with the "Working for Water" and “Working for Wetlands” Programmes that are active in the area as well as local knowledge of aquatic specialists (Drs Rob Palmer and Johan Engelbrecht). The most important sources of information included the following:

- Geological maps and literature, topographical maps, hydrological maps, and aerial photographs (where available);
- National Groundwater database (NGDB);
- Hydrochemical database and baseflow contribution map, obtained from DWAF;
- Population census data for 1996 and 2001, obtained from Stats-SA (website address: www.*demarcation.co.za.)*

The relevant geological and hydrological maps, aerial photos and satellite images were obtained from the DWAF and other institutions, assessed and compiled into usable maps. Existing hydro geological information for the area were sourced and assessed. Population census data and population density maps for 1996 and 2001 were reviewed. These data gave an indication of the reliance of the communities on wetlands. Land-use information, such as large-scale agricultural, industrial and mining related activities reliant on wetlands, were obtained from available landuse coverages. This information provided insight to the predicted stresses on the wetlands systems.

# 4. OVERVIEW OF THE KOMATI RIVER CATCHMENT

## 4.1 PHYSICAL FEATURES OF THE CATCHMENT

### 4.1.1 Topography

The topography of the Komati River Catchment is highly variable, with the catchment rising in the west at an elevation of about 1,850m in the Carolina area on the Highveld to a minimum of about 170m near Komatipoort (Map 1). The western extent of the catchment is dominated by the flat to undulating topography of the Highveld plains, which give way to the steep to very steep contours of the escarpment, typified in the Badplaas area. These contours form a horse-shoe to the southeast, the escarpment continuing to the east along the Barberton Mountain Lands, which terminates near Malelane and forms a finger of high ground at 1100m that extends into the Lowveld. The Lowveld continues to the east at an elevation of 496m, falling to an elevation of 170m at Komatipoort. The northsouth trending Lebombo Range rises to an elevation of about 600m at the Mozambique Border and truncates the eastern border of the catchment.

### 4.1.2 Geology

The geological formations underlying the Komati Catchment have a chrono-stratigraphic age that ranges from the Triassic (250 Ma) to the Swazian (3850 Ma). Map 2 shows the underlying geology for the Komati Catchment which is broadly delineated into five distinct zones as follows:

***a) Escarpment Complex***

The geology in the western portion of the catchment, in the vicinity of Carolina, is typically represented by the Ecca Group consisting of the Dwyka and Vryheid formations. These formations consist mainly of shales, sandstones and coal beds. Dolerite sills intrude these formations. The Pretoria Group of the Transvaal Sequence underlies the area to the northeast of Carolina. The Pretoria Group consists of formations of quartzite, mudstone, shales and agglomerate, along with basic and andesitic lavas. The dolomites of Malmani Subgroup of the Chuniespoort Group, occurs at the base of the Pretoria Group. Some quaternary sediments cover sequences of the Pretoria Group. Dolomites form interfingering outcrops on the contacts between the Pretoria Group and the Nelshoogte Pluton (Gneiss).

***b) Gneiss***

The gneisses (Nelshoogte and Stolzburg Plutons) and granites occur immediately to the east of the dolomites.

***c) Barberton Mountainland System***

The Barberton Sequence occupies most of the central areas and the northeastern parts of the catchment. The sequence consists of the Moodies, FigTree and Onverwacht Groups. The Moodies Group consists of shale, sandstone, quartzite, conglomerate and basaltic lavas. The Fig Tree Group consists of tuff, siltstones, shales and greywacke. The Onverwacht Group is made up of the Geluk and Tjakastad Sub Groups. These consist of mafic and felsic lavas and volcanics, undifferentiated rocks, mafic and ultramafic schist's and basaltic and peridotitic komatiites. Some quaternary deposits are scattered across the Barberton Sequence.

***d) Lowveld Granites***

The area to the north of the South African-Swaziland border forming the lower-lying topography is underlain by the Nelspruit Suite of rocks. These consist mainly of potassic gneiss and migmatites. Intrusives include diabase sills and dykes as well as micro granite and syenite.

***e) Lebombo Group***

The area to the far east of the catchment, forming the Lebombo Range, is underlain by lithologies of the Ecca and Lebombo Groups. The Ecca Group consists of undifferentiated Karoo Sequence, predominantly sediments (red beds), while the Lebombo Group consists of the Letaba and Jozini formations. These formations consist of mafic and rhyolitic lavas respectively.

### 4.1.3 Climate

Records of rainfall, temperature and humidity were obtained from the South African Weather Bureau for the period between 1980 and 2002. Very large variations in the climatic variables from the highveld to the lowveld regions were noted. In the east of the catchment the town of Carolina had a mean annual rainfall of 637mm. Badplaas (central location in catchment) had a mean annual rainfall of 808 mm/annum. In the northeast of the region at Tunzini and Border Gate the average rainfall was 718mm/annum. A strong relation was found between elevation and rainfall: mountain areas were classified as "wet", the Highveld areas were generally classified as "moist", whereas the Lowveld areas were classified as "dry" (Map 1).

Air temperatures were given as average daily minimum and maximum values. Data were only available for the town of Carolina within the catchment. For the summer season the minimum temperature was 13.4$^{o}$C and the maximum 25.1 $^{o}$C. The winter months had an average daily minimum of 1.4 $^{o}$C and an average daily maximum of 24.8 $^{o}$C. The data for the Komatipoort area will yield significantly lower rainfall figures and much higher temperatures.

Humidity readings were available for the town of Carolina only. The readings taken at 14h00 are considered. During the summer the average humidity was 52.8% and in the winter the average humidity was 28.8%.

### 4.1.4 Vegetation

Vegetation cover gives an indication of the soils present and hence the nature of the unsaturated (vadose) zone. In addition, an understanding of the potential recharge from the surface features, including wetlands, can be obtained from the vegetation cover and nature of the soil and weathered rock profile. No interpretation was attempted in this study and this aspect should be assessed in detail when conducting an Intermediate level EWR assessment. Two broad categories of vegetation are found in the Study Area: Sweet Grassveld and Bushveld, and these can be further divided into eight vegetation types *sensu* Acocks (1975), as shown in Map 3.

## 4.2 WETLANDS OF THE KOMATI CATCHMENT

### 4.2.1 Wetlands Distribution

The distribution of some wetlands within the Komati Basin have been mapped using aerial photography as part of the 1:50,000 scale topocadastral map series (Map 4). The map distinguishes between "wetlands, perennial pans, non-perennial pans, dams and rivers". This level of classification is of limited use in assessing EWR requirements as it does not distinguish functional or ecological attributes of different wetland types, such as seepage wetlands and floodplain wetlands.

### 4.2.2 Wetland Classification

The Komati River Catchment is characterized by a wide diversity of wetland types due to the complex and changing geological environments and the variable topography that make up the area. A schematic diagram of the main wetland types that are found in the catchment is shown in Figure 4-1. It is possible that sufficient data are available within each geological defined unit (aquifer type) for the wetlands to be classified on the basis of the geology, and only limited field assessments will be needed to verify this assumption. If a correlation between geology/aquifer type and wetland classification (even on a broad scale) can be achieved, then the system can be refined and enhanced with more detailed field assessment. The collaboration with Working for Water Programme would aid in the success of this proposed method. The wetlands are generally associated with and structurally controlled by the geological formations on which they occur and the topography that they occur in. A summary of the differing wetland types found within the Komati Catchment is given below:

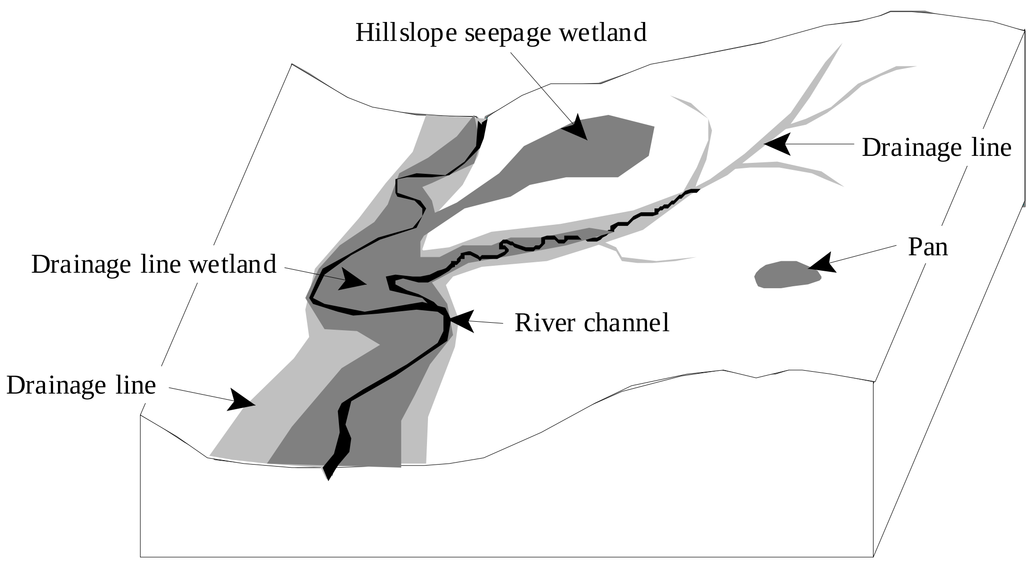


**Figure 4-1. Schematic of the wetlands in the Study Area showing the general relationship of wetland types to topography.**

***a) Pans***

Pans in the Highveld region are typically associated with the sedimentary deposits that are underlain at shallow depths by ferricrete layers. These pans are generally associated with the Karoo Sediments that form the majority of the highveld geology, and are typified by horizontally bedded sandstones, shales and mudstones. These lithologies are prone to the formation of ferricrete layers that are highly impermeable and result in perched water tables that contribute to the development of wetlands in the form of pans. Endorheic pans in the upper Komati River Catchment have been mapped by the Surveyor General. These data are comprehensive and classify the Highveld pans as either perennial or non-perennial. The confidence in available information on the Highveld pans is moderate to high.

Another distinct type of pan has been identified in the Lebombo Mountains in Swaziland (Watson 1986). These pans are typically 50 to 400m in diameter and up to 5m deep, and are thought to have been created in tuffaceous horizons within acid volcanic sequences (Watson 1986). The presence of thick ferricrete suggests that these pans are very old, possibly more than one million years. These pans are also likely to occur on the South African side of the Lubombo Mountains, but this remains unconfirmed.

The contribution to the surface flow from the Highveld pans and Lubombo depressions is generally small, and wetlands associated with these topographic and lithological types are generally not directly connected to the groundwater system and do not contribute in any significant way to the winter flows of the river system. These wetlands do not contribute large quantities of water to the surface water system, but form valuable resources both from an agricultural, as well as an ecological and geological perspective.

The water quality associated with the differing wetland classes and systems is dependent on the mechanisms involved in their origination and sustainability. In general, the water quality of the endorheric class wetlands will be moderate to poor, the concentration of salts, and toxic/pollution being more prevalent due to their closed, or semi closed nature, and the lack of any groundwater contribution (total dependent on rainfall for dilution).

***b) Hillside Seepage Wetlands***

Hillside seepage wetlands are typified by wetland sponge zones found in upper and midslope positions and are generally associated with a sub-surface hindrance to vertical movement of water. These seeps are often mistaken for pans, but have a distinctly different mechanism for formation, and are some of the prime contributors of dry season flow within the Komati Catchment. They are typically associated with sedimentary deposits that are underlain at shallow depths by ferricrete layers. These are generally associated with the Karoo Sediments that form the majority of the Highveld geology, and are typified by horizontally bedded sandstones, shales and mudstones. The sediments that occur along the contact with the Lebombo Range in the east portion of the catchment comprise the Clarens Sandstone Formation. Wetlands associated with this zone are uncommon, and were present as seasonal systems only. The distribution and abundance of Hillslope Seepage Wetland types is unknown. Hillside Seepage Wetlands generally have good quality water due to the constant recharge by groundwater.

***b) Drainage Line Wetlands – Structurally Controlled***

Wetlands associated with the granite lithologies are found predominantly in the south and central portion of the catchment as well as the eastern Lowveld. Granitic lithologies have variable depths of weathering, from shallow depths of weathering on the more porphyritic granites that form granite plutons, to deep weathering within the more feldspathic granites. The highly fractured nature of the granites results in the intrusion of younger cross-cutting dolerite and diabase dykes and sills. It is these intrusions that form the underground dams that bring the groundwater to surface along the fractures and faults. These waters form springs on the up gradient side of the intrusive bodies and result in the formation of drainage line wetlands. The distribution and abundance of these wetland types is unknown. Perhaps the largest and most well-known system of this type is the Masibekela Wetland System in the lowveld near Border Gate. This wetland receives irrigation return flow from Swaziland and remains perennial up to the Masibekela Dam. This area was historically an important area for biodiversity, but has become degraded through impoundment and irrigation activities. The intrusive lithologies of the Lebombo and the young dolerites and diabase intrusives return moderate to poor water qualities.

***c) Dolomite Associated Wetlands***

Dolomites occur at the base of the Pretoria Group in the chrono-stratigraphic sequence. They occur as the Malmani Subgroup of the larger Chuniespoort Group within a small area of the catchment. Solution cavities/caverns occur through karstification creating large groundwater reservoirs. The intersection of the dolomites by the Komati River has resulted in a direct contribution via groundwater to the surface system in the form of drainage line wetlands and a number of hillside wetlands. There is little to no reliable information within the Study Area relating to the contribution of dolomites to the wetland environment. Additional studies will be needed in understanding the mechanisms involved and the hydraulics that are associated with the groundwater from the limestone karsts, through the wetlands to the surface hydrology. Dolomitic associated wetlands generally have good quality water due to the constant recharge by groundwater, although levels of calcium carbonate can be high.

***d) Flood Plain Wetlands***

Flood plain wetlands consist of alluvial deposits of unconsolidated clayey silts to coarse gravels and boulders that are associated with watercourses, within valleys and in open river plains. These wetlands are recharged during high flows and do not contribute significant quantities to stream baseflows.

## 4.3 BENEFITS OF KOMATI WETLANDS

There was very little information available on wetland use in the Komati River Catchment. The available information suggests that wetlands in the Komati River Catchment are not generally targeted for use by large industries or municipalities, but they have come under increasing pressure due to mining, irrigation farming, domestic use and natural resource harvesting.

### *a) Mining*

Coal seams associated with the Karoo sediments in the upper reaches of the catchment are being mined over some areas. Pans are convenient to the mining industry for either the storage of water that has been removed from the groundwater system while mining is in progress (dewatering), or as systems from which water can be abstracted for use in the washing and processing plants associated with the beneficiation of the coal.

### *b) Irrigation Water*

The use of wetlands for water abstraction for irrigation within the agricultural industry has become necessary.

### *c) Domestic and Livestock Water*

The use of wetlands in the Komati River Catchment for domestic and livestock supplies is limited, but the potential for further use, particularly in the middle catchment, is high (Jones, per obs). Isolated springs that occur along the contact between sandstone and with the Lebombo Rhyolites provide rural populations with domestic water, but supplies are unreliable and water quality is poor. Water from these aquifers is not suitable for domestic or irrigation water supply and are only occasionally associated with major wetland development of any significance.

### *d) Natural Resource Harvesting*

Information relating to the use of wetlands associated with the in-stream and floodplain systems along the river courses within the catchment is scarce, and additional fieldwork and detailed studies will be needed to better understand the situation. However, it is suspected that significant quantities of medical plants are harvested from riparian and seepage zone wetlands.

## 4.4 THREATS TO WETLANDS

Census data for 1996 and 2001, as well as previous studies undertaken by Groundwater Consulting Services for a reconnaissance sanitation survey in December 2001, were used to provide a first approximation of the potential impacts of population and landuse on wetlands in the Komati River Catchment. The Komati River Catchment within South Africa includes three municipal districts and six local municipalities as follows (Map 7):

| | |
|---|---|
| A. EHLANZENI (DC32): | 1. Nkomazi (MP 324),<br>2. Umjindi (MP 323) |
| B. NGANKALA (DC31): | 1. Highlands (MP 314) |
| C. EASTVAAL (DC30): | 1. Carolina (MP 301),<br>2. Msukaligwa (MP 302) |

The distribution of the population in the Komati River Catchment is illustrated in Map 8, and the statistics for each of the local municipalities in terms of the industry, sanitation and water use is provided in Tables 4.1 and 4.2. The figures for the different sectors are given as percentages of the total population of the local districts. The population employed by the agriculture and forestry and mining sectors gives a first approximation of the type of land-use for a particular area. In many cases the area of employment of the population may be located in a different area from the area of residence of an employee, which will render the data unusable for the purpose intended. It is therefore assumed that the employing sector is located within the local municipality for the purpose of this study. The sectors chosen for investigation indicate that there is a potential threat to the groundwater system, and therefore to the associated wetlands. The manufacturing and industrial sectors may also impact on the groundwater system but these are too varied and need to be assessed individually.

The impacts on the wetlands were assessed in relation to the groundwater and surface water utilization within the catchment as these appear to be linked. The figures quoted are general for the catchment, and may differ from area to area.

***Groundwater Abstraction***: From the census data there was a clear decreased reliance on groundwater from 1996 to 2001. However, this does not specifically relate to quantities abstracted by the existing users, as not much information was available on abstraction volumes in the different aquifers. Additional information will be needed to clarity this situation.

***Agriculture and Forestry:*** In the Nkomazi Local Municipality (Lebombo lithologies), the number of people involved in agriculture and forestry doubled between 1996 and 2001. Increased nitrate concentration in groundwater for this part of the catchment can be related to the increased use of fertilizers and livestock grazing along riverbeds. The remainder of the catchment shows a decreasing number of people employed in the agriculture, forestry and mining sectors. The impact on the wetland systems of this area is confined to the increase in agricultural cultivation, the development of new farming areas, and the expansion low-cost housing within the rural areas. Wetlands in the lower reaches, particularly the Masibekela Wetland System, are particularly threatened by draining for agricultural expansion and inundation from impoundments.

***Sanitation:*** The use of flush and chemical toilets increased across the catchment between 1996 and 2001. Increasing trends in the use of septic tanks, bucket and pit latrines and no sanitation was observed for three local municipalities (Nkomazi, Umjindi and Carolina). This can account for the increased nitrate concentrations in the groundwater in the east of the catchment. There were no data available to evaluate the affect of the increase population trends on the wetland environs. Sanitation statistics give an indication of the potential stresses that could be imposed on the environment with the use of septic tanks, pit and bucket latrines. Rural communities and informal settlements (Mpumalanga Lowveld) would have an impact on the groundwater system in terms of elevated nitrate and organic compound concentrations if there were no management systems in place.

***Mining:*** There is a substantial amount of coal mining around Carolina and on the Highveld in general. An estimated 85% of the recorded boreholes in this area had water levels shallower than 15m. The coal mining areas and their use of the surface and groundwater resource pose a serious threat to the water quality in the area, and its relationship to the wetlands. The utilization of pans by mining and industry as potential waste water receptacles is under consideration. This threat is lessened by slow migration rates and low aquifer permeability. The loss of wetlands due to mining will need to be quantified through the DWAF licensing system, Environmental Management Plan documents and Water Use Licence applications.

The current and future status of mining activities within the catchment can be determined through a detailed and extensive desk study that will form part of the methodology used for the Intermediate EWR assessment. The information can also be obtained from the DWAF through the licensing of water utilization by the mines.

***Alien Vegetation:*** Encroachment of alien vegetation, particularly within Swaziland, is a concern that needs to be addressed in further studies.

## Table 4-1. Census data 1996.

| **DISTRICT MUNICIPALITY** | ***EHLANZENI (DC32)*** | | | | ***NGANKALA (DC31)*** | | ***EASTVAAL (DC30)*** | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **LOCAL MUNICIPALITY** | *NKOMAZI MP324* | | *UMJINDI MP323* | | *HIGHLANDS MP314* | | *CAROLINA MP301* | | *MSUKALIGWA MP302* | |
| | | % | | % | | % | | % | | % |
| **POPULATION** | **277967** | | **48577** | | **37012** | | **182348** | | **106017** | |
| | | | | | | | | | | |
| **INDUSTRY**[1] | | | | | | | | | | |
| **Agric./Forestry** | 14758 | 5.3 | 6312 | 12.9 | 2858 | 7.72 | 5540 | 3.03 | 7704 | 7.26 |
| **Mining** | 1414 | 0.50 | 2059 | 4.2 | 644 | 1.73 | 1964 | 1.07 | 2576 | 2.43 |
| | | | | | | | | | | |
| **SANITATION** | | | | | | | | | | |
| **Flush &Chem. Toilet** | 4070 | 1.46 | 6125 | 12.6 | 5259 | 14.2 | 4496 | 2.46 | 15354 | 14.48 |
| **Other**[2] | 48813 | 17.5 | 5474 | 11.2 | 3933 | 10.6 | 30781 | 16.8 | 9568 | 9.02 |
| | | | | | | | | | | |
| **WATER** | | | | | | | | | | |
| **Borehole** | 2456 | 0.88 | 262 | 0.54 | 432 | 1.17 | 2230 | 1.22 | 2284 | 2.15 |
| **Spring** | 5532 | 1.99 | 1231 | 2.53 | 1549 | 4.18 | 7697 | 4.22 | 1709 | 1.6 |
| **Dam** | - | | | | | | | | | |
| **River** | - | | | | | | | | | |

[1] Sectors in which people are employed the fishing sector has been included with agriculture and forestry to maintain the integrity of the statistics. Fishing however will not be assigned any importance in this discussion.
[2] Septic tanks, pit and bucket latrines and no sanitation.

## Table 4-2. Census data 2001.

| **DISTRICT MUNICIPALITY** | ***EHLANZENI (DC32)*** | | | | ***NGANKALA (DC31)*** | | ***EASTVAAL (DC30)*** | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **LOCAL MUNICIPALITY** | *NKOMAZI MP324* | | *UMJINDI MP323* | | *HIGHLANDS MP314* | | *CAROLINA MP301* | | *MSUKALIGWA MP302* | |
| | | % | | % | | % | | % | | % |
| **POPULATION** | **334416** | | **53743** | | **43007** | | **187936** | | **124812** | |
| | | | | | | | | | | |
| **INDUSTRY** | | | | | | | | | | |
| **Agric./Forestry** | 25678 | 7.67 | 5329 | 9.9 | 3023 | 7.02 | 5556 | 2.9 | 7285 | 5.8 |
| **Mining** | 999 | 0.29 | 1013 | 1.88 | 624 | 1.45 | 685 | 0.36 | 1845 | 1.48 |
| | | | | | | | | | | |
| **SANITATION** | | | | | | | | | | |
| **Flush &Chem. Toilet** | 7717 | 2.3 | 8275 | 15.3 | 6794 | 15.79 | 6100 | 3.2 | 19260 | 15.43 |
| **Other** | 64054 | 19.2 | 6183 | 11.5 | 2929 | 6.8 | 33575 | 17.87 | 10429 | 8.35 |
| | | | | | | | | | | |
| **WATER** | | | | | | | | | | |
| **Borehole** | 498 | 0.14 | 109 | 0.2 | 193 | 0.45 | 1554 | 0.82 | 369 | 0.29 |
| **Spring** | 583 | 0.17 | 40 | | 24 | 0.05 | 1708 | 0.91 | 425 | 0.34 |
| **Dam** | 545 | 0.16 | 145 | 0.26 | 291 | 0.67 | 657 | 0.34 | 828 | 0.66 |
| **River** | 2520 | 0.75 | 1184 | 2.2 | 271 | 0.63 | 3409 | 1.81 | 610 | 0.49 |

***Nkomazi Local Municipality***

The general trends in the Nkomazi Local Municipality between 1996 and 2001 were an increase in the number of people employed by the agriculture/forestry sectors and a decrease by the mining sector. There was an increase in the use of flush and chemical toilets as well as septic tanks, pit and bucket latrines. There was a decrease in the use of groundwater (i.e. boreholes and springs). No data were available for surface water (dams and rivers) use for 1996. However for 2001, 0.75% (2520 people) relied on water from rivers, and 0.16% (545 people) relied on water from dams. There were no figures relating to the use of, or impact on wetlands, for this area.

***Umjindi Local Municipality***

The general trends in the Umjindi Local Municipality between 1996 and 2001 were a decrease in the agriculture/forestry and mining sectors for the number employed and an increase in sanitation statistics. There was a decrease in the use of borehole water. There were no data for the use of springs in 2001. In 2001, 0.26% (145 people) relied on water from dams and 2.2% (1184 people) relied on water from the rivers.

***Highlands Local Municipality***

The general trends in the Highlands Local Municipality between 1996 and 2001 were a decrease in the population employed by industry and an increase in the number of people using flush and chemical toilets. There was a decrease in the use of septic tanks, pit and bucket latrines, and there was a decrease in the reliance on groundwater. There were no data for surface water use for 1996. In 2001, 0.67% (291 people) relied on dams and 0.63% (271 people) on rivers for water.

***Carolina Local Municipality***

The general trends in the Carolina Local Municipality between 1996 and 2001 were a decrease in the population employed by industry, and an increase in the use of flush and chemical toilets. There was also an increase in the use of septic tanks, pit and bucket latrines and a decreased reliance on groundwater. No data were available for surface water use in 1996. For 2001, 0.34% (657 people) used water from dams and 1.81% (3409 people) used water from rivers. This applies to wetlands as well.

***Msukaligwa Local Municipality***

The general trends in the Msukaligwa Local Municipality between 1996 and 2001 were a decrease in the population employed by industry and an increase in the use of flush and chemical toilets. A decrease in the use of septic tanks, pit and bucket latrines was noted, and groundwater use decreased. Data were only available for surface water use for 2001. Here, the reliance on dams was 0.66% (828 people) and on rivers 0.49% (610 people). No figures were available for the wetlands.

## 4.5 INTERACTION BETWEEN WETLANDS AND GROUNDWATER/SURFACE RESOURCES

The following section highlights our understanding of groundwater and surface interactions for the various wetland types found in the Komati River Catchment.

### 4.5.1 Highveld Pans

Highveld sediments (Ecca and Pretoria Groups) in the west, have horizontal bedding with impervious sediments that result in perched water within the unsaturated zone, forming seeps, and low-yielding groundwater within the saturated fractured rock aquifer. The end result is the formation of pans that form due to the impervious nature of the ferricrete layers within the sedimentary profile. These systems are directly feed by rainfall and are subject to seasonal fluctuations. They tend to dry up during the dry season, thus contributing very little to the overall system during the dryer months of the year.

### 4.5.2 Granites

The highly fractured nature of the Lowveld granites (includes gneiss and migmatites), and the prevalence of intrusive lithologies (dolerite dykes and sills), results in the formation of underground dams and the development of springs and large seep zones at surface were the groundwater is dammed and forced to surface. These waters have a direct contribution of groundwater to the surface water system and are observed to carry on contributing to the stream flows well into the dry months of the season. These systems do not dry out unless subjected to extended drought conditions. Although this may not be considered to be a direct groundwater to surface water contribution in the true sense of baseflow, it is a significant contribution and is readily used by the rural and farming populations as a reliable source of water for domestic and livestock use. In addition, these granites have a greater storage capability due to the nature of weathering and therefore have a greater utilization potential for domestic supply.

### 4.5.3 Lebombo Lithologies

The Lebombo lithologies are generally poor reservoirs of groundwater and the basic nature of the geology results in poor quality water. Observations in this area are that any baseflow contribution to the system from groundwater is one of a direct nature, where groundwater is noted to be intersected by the river and water flows out on a rocky base. Evidence of seepage zones, or wetland contributions to the surface system, are minimal and are only observed within the Red Bed Formations that occur at the contact between the Lebombo intrusives and the granites of the Lowveld.

### 4.5.4 Barberton Mountainland Lithologies

The Barberton Mountainland lithologies and the lower portion of the escarpment are highly structurally bound and are characterised by steeply inclined meta-sediments, with deep structurally controlled valleys that have been intruded by diabase dykes. The result of these features is two fold. The metamorphic nature of the geology has resulted in only moderate groundwater reservoirs within the meta-sediments. However, the fractured nature of the geology and the amount of faulting present allows for good groundwater conduits.

Consequently, the groundwater contributions are large, with good quality water. The contribution of groundwater to the surface water system is not well known in this area. This will need to be investigated further, as part of the proposed study.

#### 4.5.5 Gneiss

The area underlain by gneiss, migmatites and granite to the west of the Barberton Mountainland Sequence is another area that will need to be investigated in a fair amount of detail. All indications from the field inspection during this study are that the hard rock nature of the streams and rivers result in the groundwater portion of the base flow being contributed directly into the waterways. There is potential for Hillslope Seepage Wetlands and drainage line wetlands or flood plain deposits that could potentially contribute to river flows. The groundwater contribution does not appear to be structurally influenced. In addition to the lithological differences associated with these zones or groups, there are distinct differences in the structure associated with these groups and it is often this that is determining how the groundwater – wetland/surface water interaction is occurring.

# 5. CONCLUSIONS

## 5.1 AVAILABLE DATA

There is no published information on wetlands in the Study Area, with the notable exception of the birdlife and general ecology of endorheic pans on the Highveld (Allan 1988; Allan and Brown 1991). The Mpumalanga Parks Board has mapped some all the wetlands delineated on the 1:50,000 scale map sheets for the Komati River Catchment, but the information is patchy. The available maps show very few of the existing wetlands, with no consistency in the size or type of wetland mapped. Furthermore, the data available from the National Groundwater Database and the GIS Data are not consistent.

## 5.2 DISTRIBUTION, DIVERSITY AND FUNCTION

The limited information available indicates that the Komati River Catchment displays a number of different types of wetlands. These wetlands can be grouped according to the geology in which they occur and the topographic situation in which they are found. Endorheric pans are common in Highveld sedimentary formations and the distribution of these pans is well covered by available mapping. By contrast, very little is known about the distribution and characteristics of endorheic pans found in the Lebombo Mountains. Pans are independent of the groundwater system and are therefore unlikely to contribute significantly to stream baseflows.

Palustrine wetlands are associated with granites, igneous and metamorphic rocks, and are in contact with the groundwater system. Very little information is available on these systems in the Komati River Catchment. The relative contribution of groundwater to the wetlands associated with these geological formations is unknown and will need to be investigated in more detail.

Recharge to the differing systems is variable, with pans entirely dependent on rainfall for their recharge, while the Palustrine systems vary depending on the contribution of surface (flood plain wetlands) and groundwater that is associated with the system. On average the contribution of rainfall to the groundwater system varies between 5 and 10% of the mean annual rainfall for the area. However not all of this will re-appear as a contribution to the wetland environment.

The dolomites that occur between the gneiss, migmatites and granites and the Pretoria Group lithologies are important aquifers in terms of future use.

## 5.3 ECOLOGICAL IMPORTANCE AND SENSITIVITY

No data are available on the Ecological Importance and Sensitivity of wetlands in the Komati River Catchment.

### 5.4 SOCIAL IMPORTANCE

The available data indicate that wetlands in the Komati River Catchment, particularly upstream of Swaziland, play an important role in the provision of water for livestock and domestic supplies.

### 5.5 WETLAND DELINEATION

Five preliminary Wetland Ecotypes were identified during this study (Map 5). The units were delineated on the basis of geology, topography and likely contributions to surface flows. The divides are closely related to the chronological divides, with the Highveld Sediments tying up very closely with the Palaeozoic, the Mountainland lithologies with the Swazian, etc. The five proposed Wetland Ecotypes were broadly delineated as follows:

A – Escarpment Complex
B – Gneiss
C – Barberton Mountainland System
D – Lowveld Granite Suite
E – Lebombo Group

## 6. RECOMMENDATIONS

The lack of sufficient and reliable data is the main reason for the additional investigations proposed, and in particular, the mapping of the wetlands and the designation of the specific wetland types. A proposed Scope of Work for further investigation of the wetland component of the EWR is detailed in Annexure A. The methods for wetland EWR assessment are not available for all wetland types but are under development, so the proposed Scope of Work is divided into two phases: Phase I will focus on delineation, classification, ecostatus assessment, the recommended Ecological Categories, and developing a Scope of Work for the second phase. Phase II will include the EWR assessment, ecological and socio-economic implications, monitoring and implementation.

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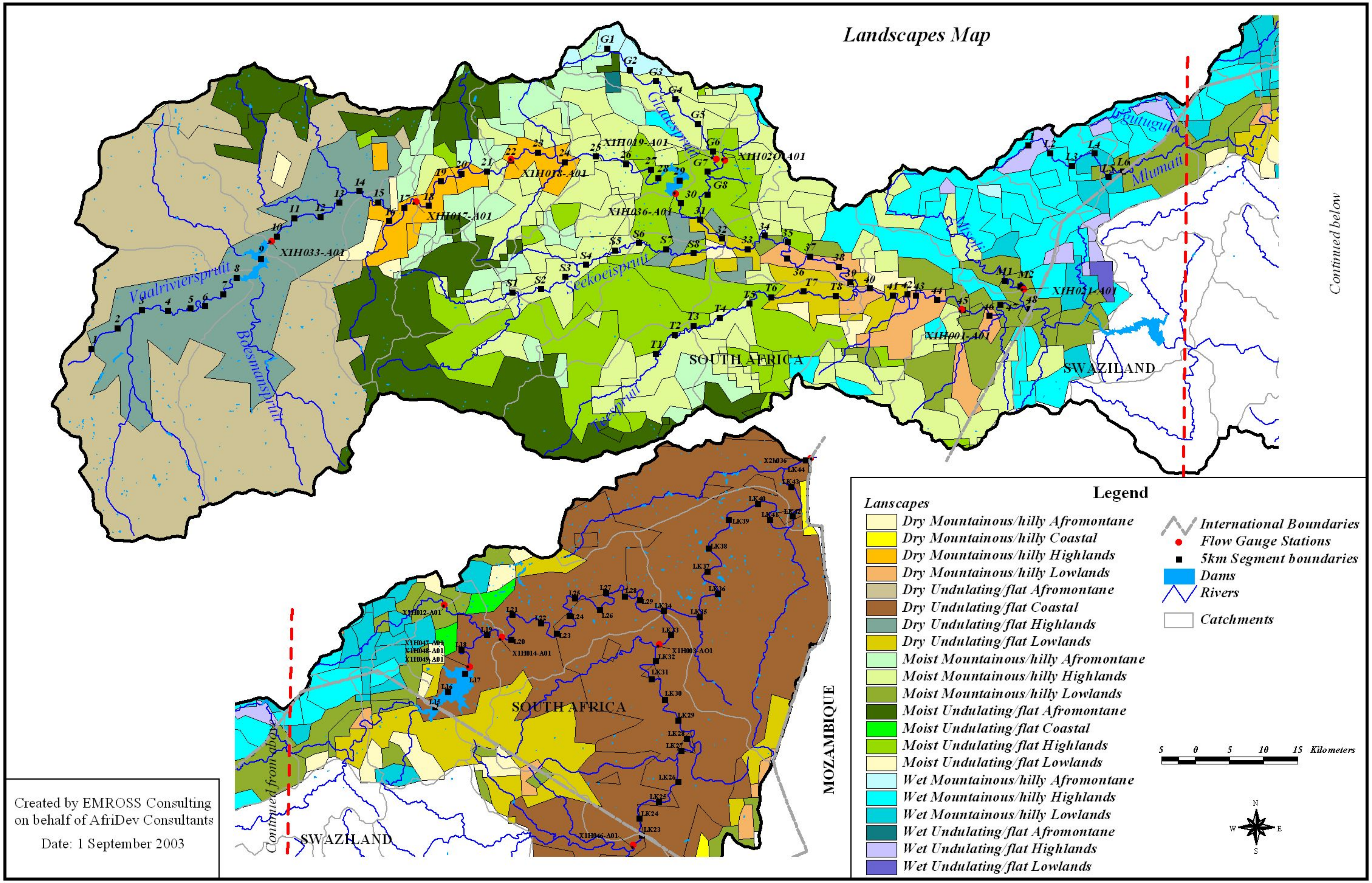
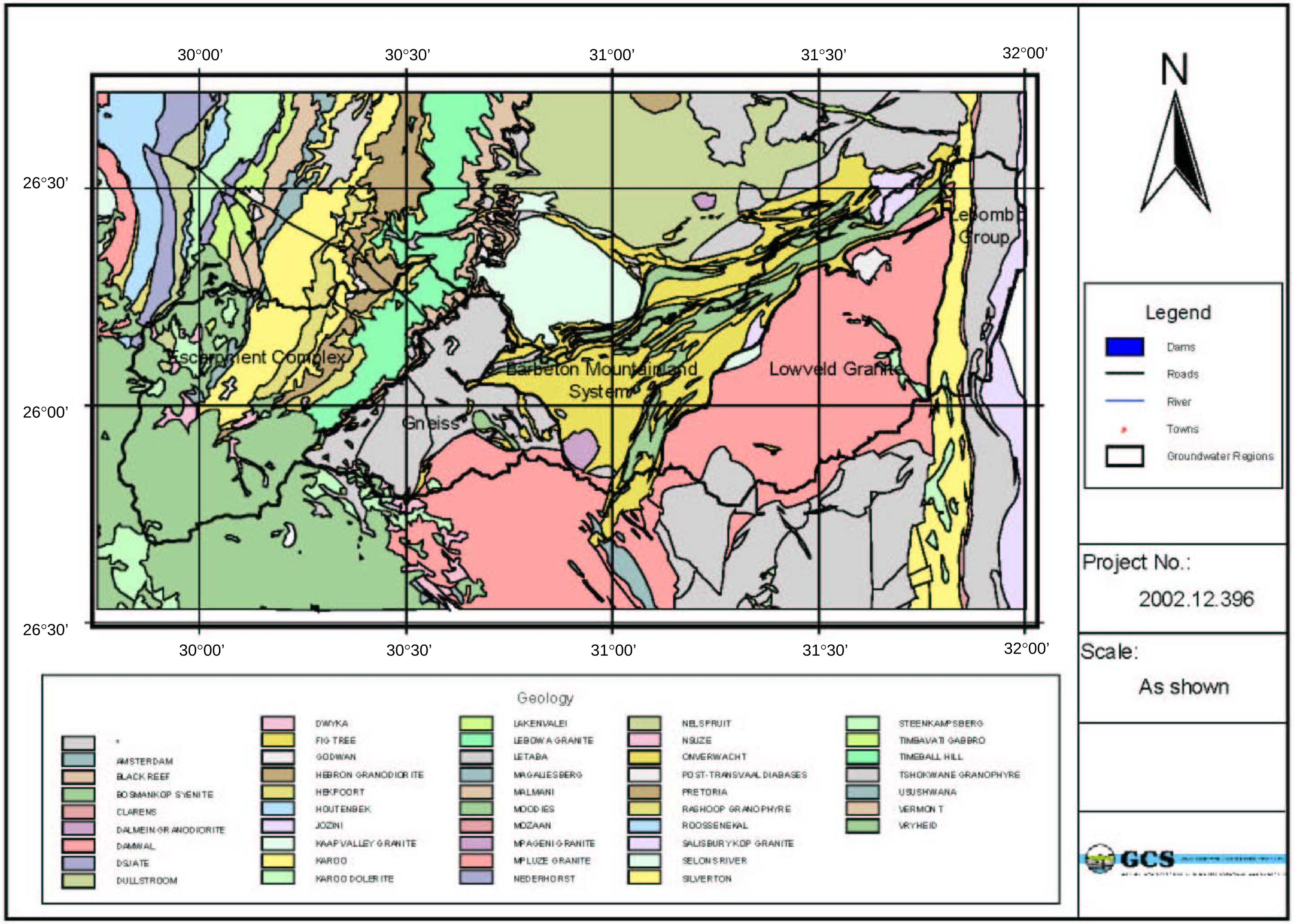
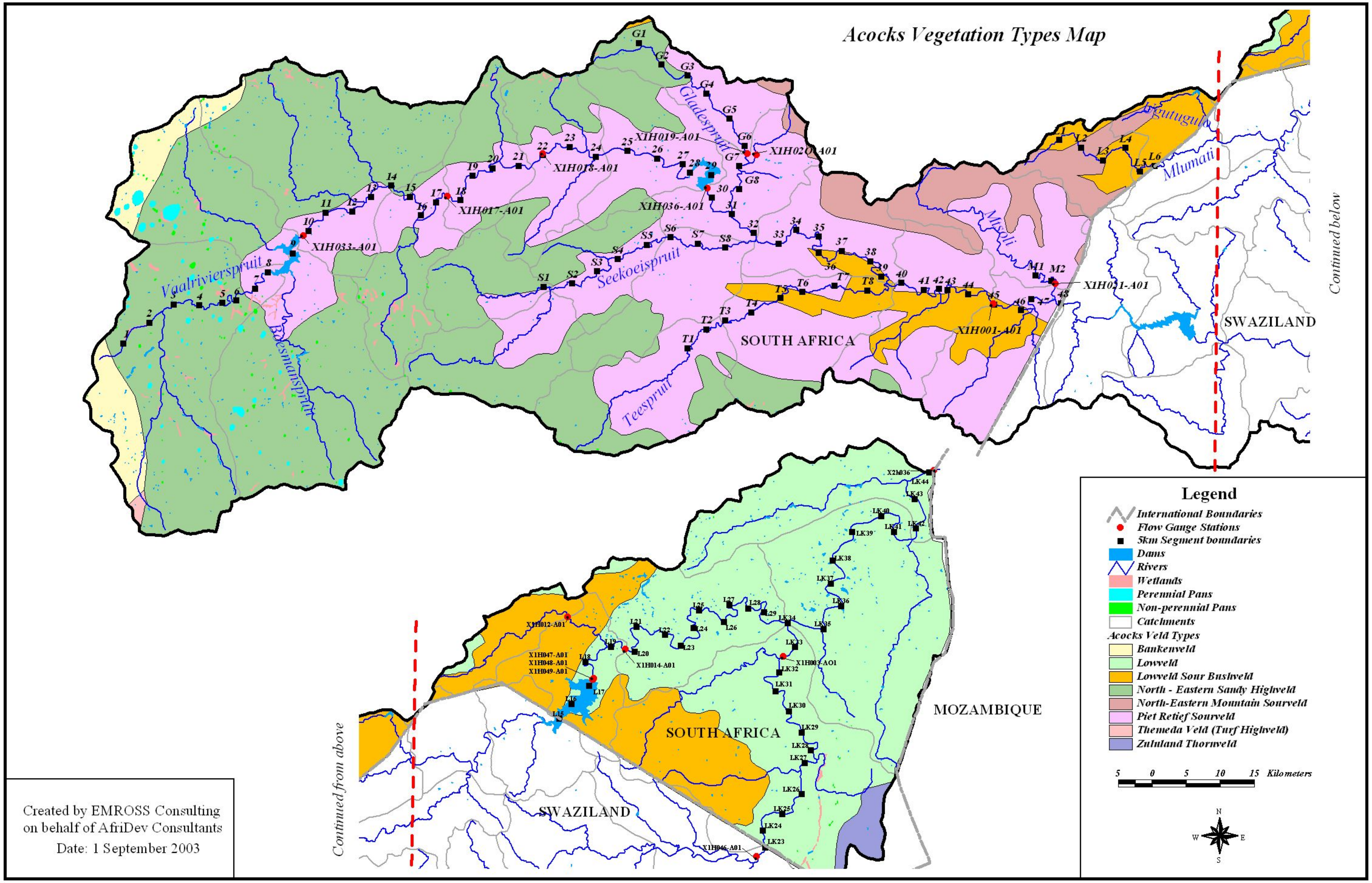
# 8. MAPS



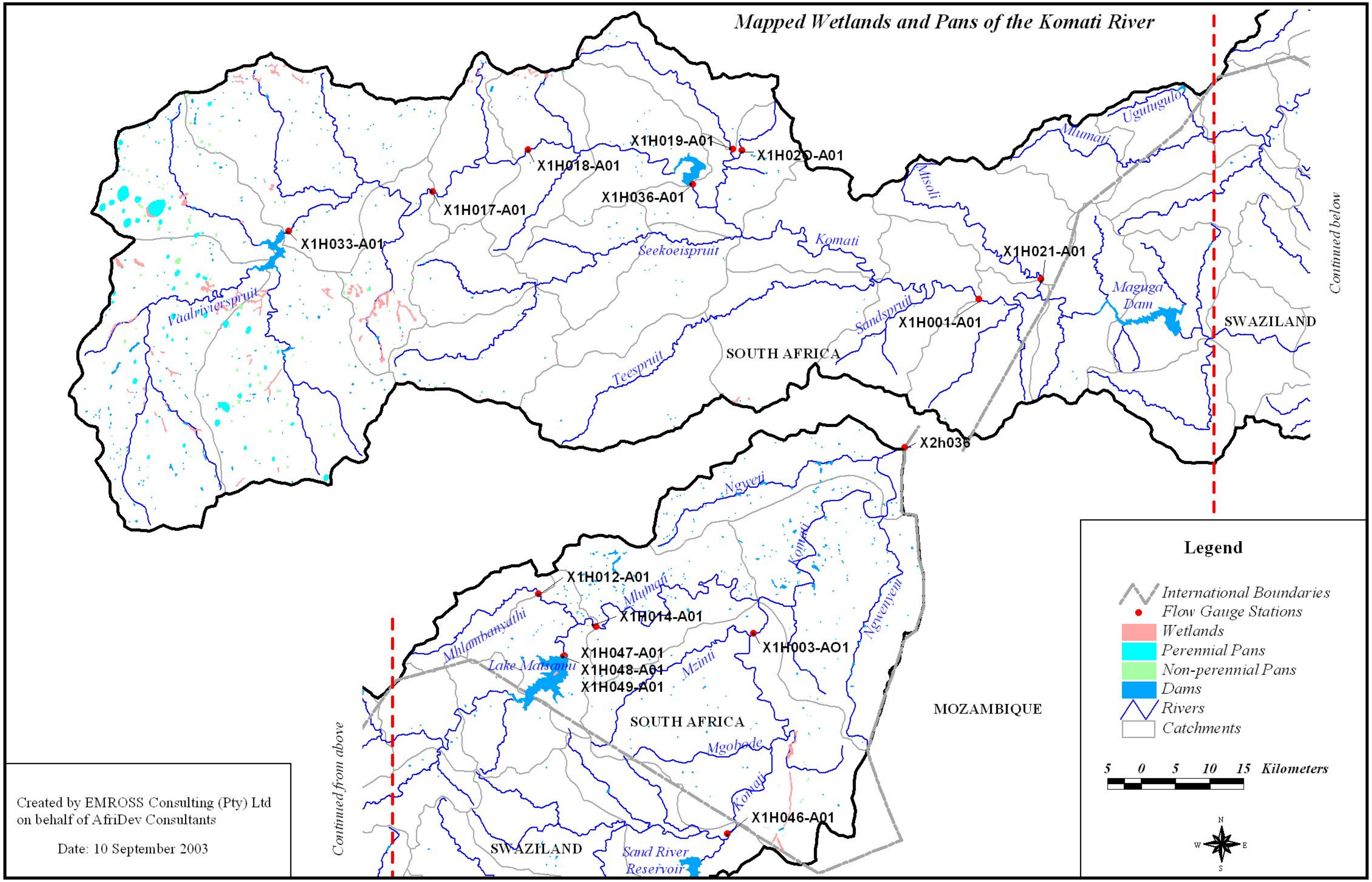

**Map 1: Map of the Komati River Basin, showing delineation of landscape units, comprising topography and moisture classification.**



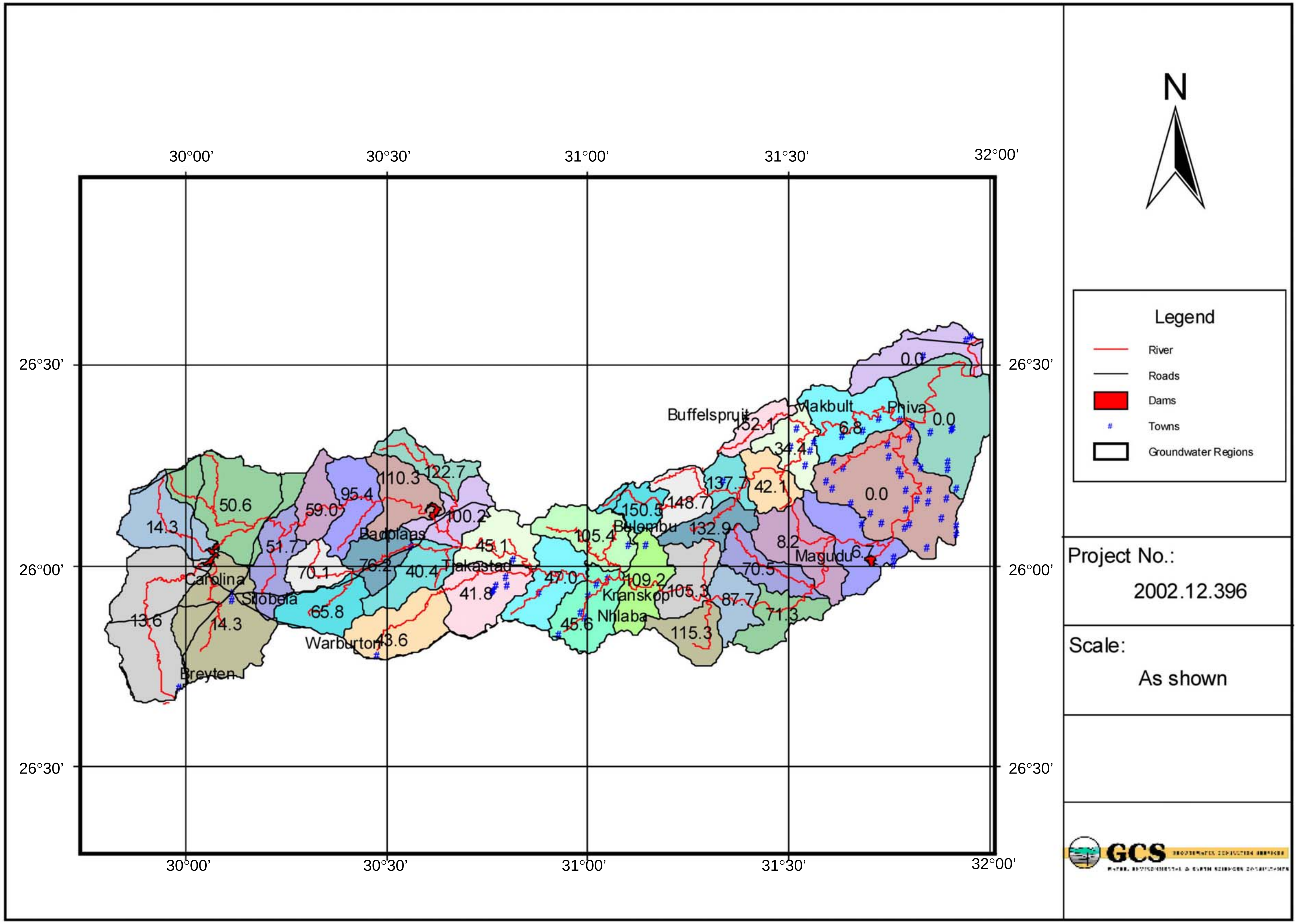

**Map 2: Geological map of the Komati River Basin.**



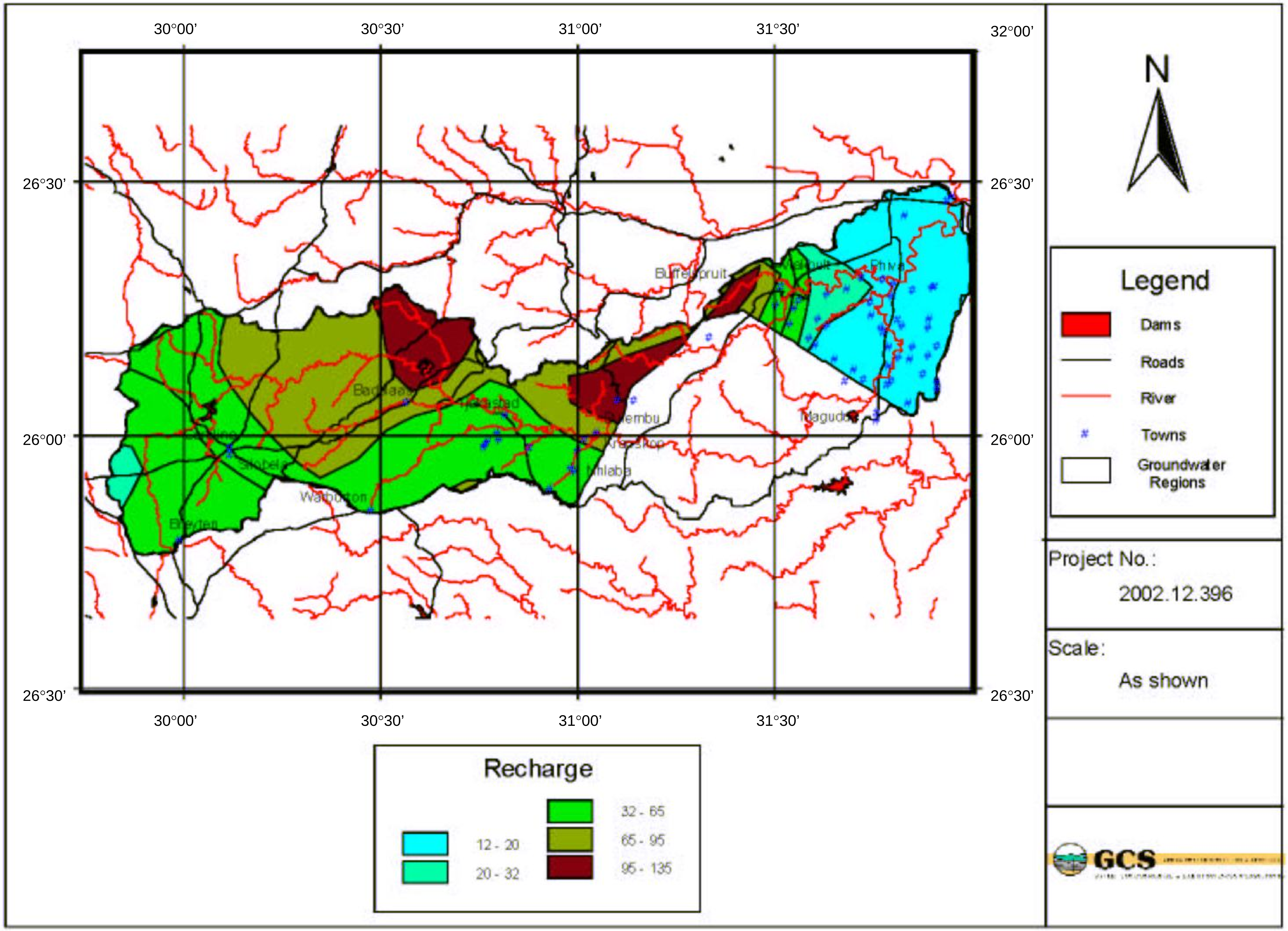

**Map 3: Vegetation map of the Komati River Basin (*sensu* Acocks 1975).**



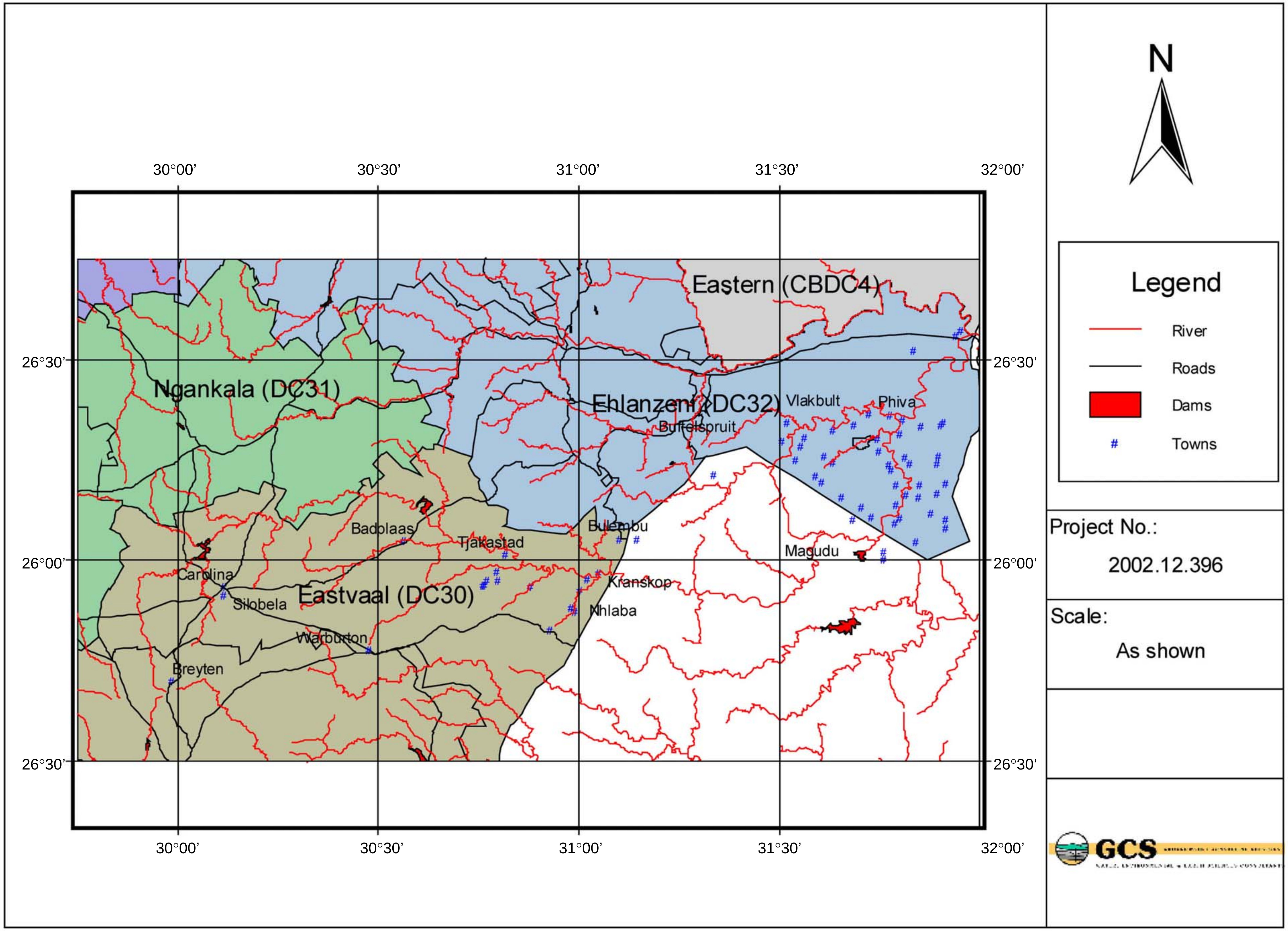

**Map 4: Map of the Komati River Basin, showing the distribution of pans and dams.**



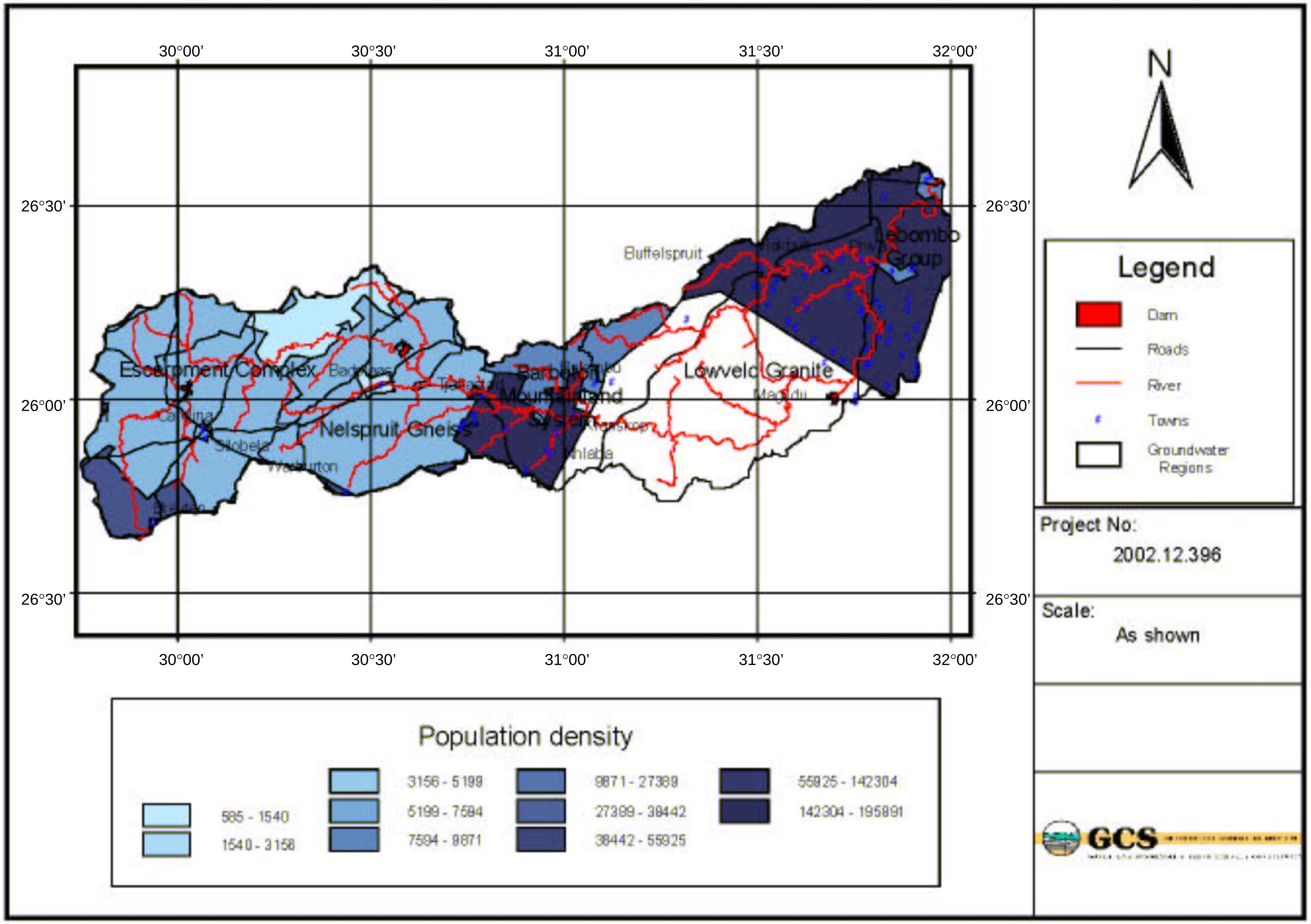

**Map 5: Map of the Komati River Basin, showing the contribution of each quaternary catchment to baseflows, expressed in mm/a.**



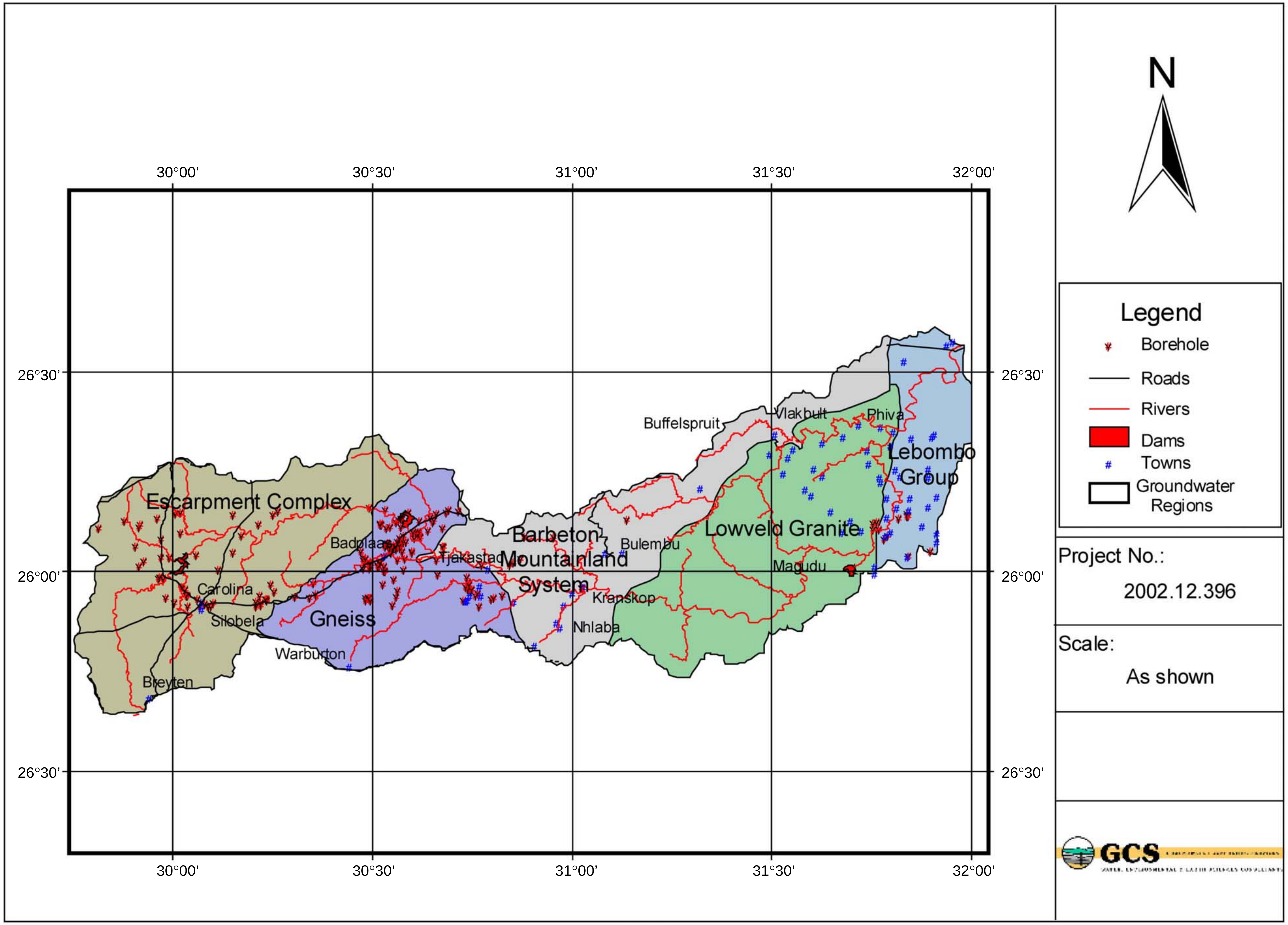

**Map 6: Map of the Komati River Basin, showing the recharge.**




**Map 7: Map of the Komati River Basin, showing the municipal districts.**




**Map 8: Map of the Komati River Basin, showing the population density.**




**Map 9: Map of the Komati River Basin, showing delineation of preliminary Wetland Ecotypes (Level 1).**

water & forestry

Department:
Water Affairs and Forestry
REPUBLIC OF SOUTH AFRICA

**DIRECTORATE: RESOURCE DIRECTED MEASURES**

# KOMATI CATCHMENT ECOLOGICAL WATER REQUIREMENTS STUDY

# WETLANDS SCOPING REPORT

# ANNEXURE A

# SCOPE OF WORK: PHASE I

# KOMATI CATCHMENT WETLANDS ECOLOGICAL WATER REQUIREMENTS STUDY

# TABLE OF CONTENTS

# GLOSSARY

| | |
|---|---|
| RESOURCE UNIT | Stretches of water resource that are sufficiently ecologically distinct to warrant their own specification of Ecological Water Requirements. |
| ECOTYPE | A wetland ecotype refers to wetlands with similar physical, chemical and biological characteristics for the purposes of comparison and extrapolation. Ecotyping of the wetlands provides the basis for deciding which components of the Reserve should be integrated with the wetland reserve and the methodology to be followed. |
| WETLAND | For the purposes of this report, “wetlands” refer to land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which under normal circumstances supports or would support vegetation typically adapted to life in saturated soil, but <u>excludes</u> perennial rivers and dams. |

# ABBREVIATIONS

| | |
|---|---|
| D: RDM | Directorate: Resource Directed Measures |
| DWAF | Department of Water Affairs and Forestry |
| EWR | Ecological Water Requirement |
| PSP | Professional Service Provider |

# 1. INTRODUCTION

The South African National Water Act (Act No. 36 of 1998) (NWA) is founded on the principle that National Government has overall responsibility for and authority over water resource management for the benefit of the public without seriously affecting the functioning of the natural environment. In order to achieve this objective, Chapter 3 of the Act provides for the protection of water resources through the Reserve for water resources. In 2003 the Department of Water Affairs ands Forestry Directorate: Resource Directed Measures (D: RDM), initiated a comprehensive assessment of the ecological component of the Reserve, referred to as the Ecological Water Requirements (EWR), for the Komati River Catchment within South Africa. Two desktop Scoping Studies were undertaken as part of the comprehensive assessment: one on wetlands (AfriDev 2005a) and one on groundwater (AfriDev 2005b). The aim of these Scoping Studies was to assess the need for more detailed studies, and if needed, to develop a Scope of Work for such studies. Both studies concluded that more detailed studies were needed. This document describes the Scope of Work for the wetlands component.

## 1.1 OBJECTIVES

The objectives of the proposed wetlands study are:

- **Delineation and Classification:** to delineate (map) wetlands in the Study Area and to classify the wetlands in terms of hydro-geomorphic functions;
- **Ecostatus**: to determine the Present Ecological State of the various wetland types within each of the Wetland Ecotypes in the Study Area;
- **Recommended Ecological Category:** to recommend an Ecological Category and feasible alternative categories, where appropriate, for the various wetland types within each of the wetland ecotypes in the Study Area, based on an assessment of Ecostatus, Ecological Importance and Sensitivity and Social Importance;
- **Capacity Building:** to train selected DWAF personnel in the methods used for wetland EWR assessment and monitoring.
- **Scope of Work - Phase II**: to prepare a Scope of Work for Phase II, including an assessment of Ecological Water Requirements, for water quality and quantity, for various wetland types within each of the Wetland Ecotypes in the Study Area, and the development of a monitoring and implementation plan.

# 2. STUDY AREA

The Study Area comprises the Komati River Catchment (X1) within South Africa and Swaziland (Figure 2-1). The main tributaries are the Lomati, Teespruit, Gladdespruit and Seekoeispruit. The area includes the towns of Carolina, Silobela, Badplaas, Nhlaba, Piggs Peak, Kranskop, Driekoppies, Jeppes Reef and Komatipoort. The Scoping Report delineated wetlands in the Study Area into five preliminary Wetland Ecotypes (Level I), based on underlying geology (Figure 2-2).

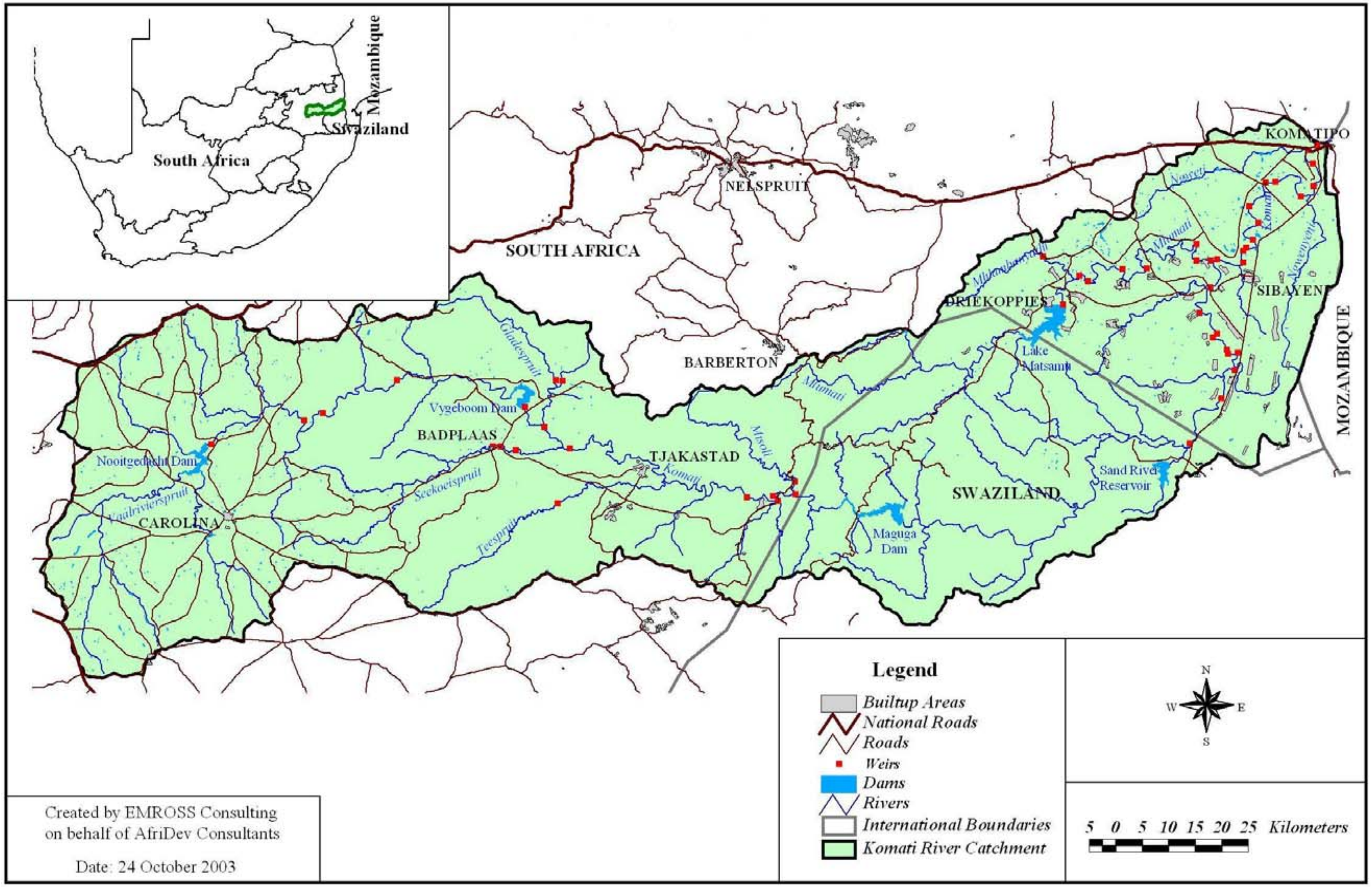



**Figure 2-1. General locality map of the Komati River Catchment within South Africa and Swaziland, showing the main towns, rivers and dams.**

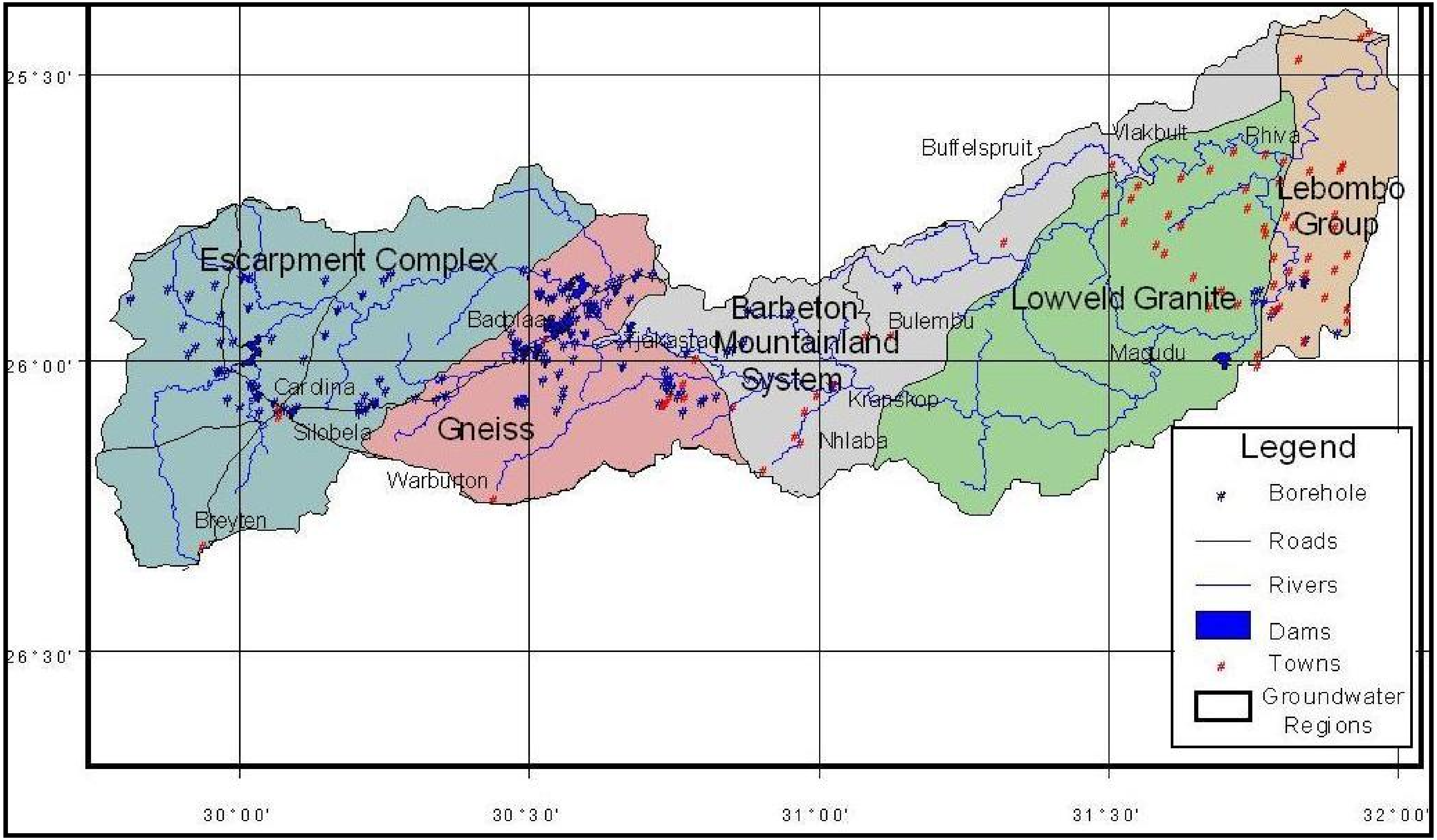



**Figure 2-2. Delineation of the Komati River Catchment into five preliminary Wetland Ecotypes (Level 1).**

# 3. RELEVENT INFORMATION

The Scoping Study on wetlands found that there was a high diversity of wetlands in the Komati River Catchment, reflecting the high diversity of underlying geology, topography, climate and altitude (AfriDev 2005a). The study highlighted the lack of reliable information on wetlands and recommended that a more detailed study be undertaken. There have been no detailed studies of wetlands in the Komati River Catchment, but there is a number of reports, listed in the bibliography, that are relevant to the current study. The birdlife and general ecology of endorheic pans in the upper Komati Catchment were evaluated by Allan (1988) and Allan and Brown (1991). The Mpumalanga Parks Board has mapped all the wetlands delineated on the 1:50,000 scale map sheets for the Komati River Catchment, but the information is patchy. The maps show very few of the existing wetlands, with no consistency in the size or type of wetland mapped. All the endorheic pans for the Komati Catchment have been mapped by the Surveyor General and classified as either "perennial" or "non-perennial". The Mpumalanga Working for Wetlands Programme has mapped wetlands in some areas and has recent aerial photographs that could be used in the proposed study. However, most palustrine wetlands in the catchment remain unmapped.

# 4. APPROACH

## 4.1 GENERAL

The Consultant shall use available methods for wetland Reserve determination, as approved by D: RDM. These methods are fairly well-developed for wetland delineation, classification and ecostatus determination, but there are few methods available for quantifying water requirements, particularly for different wetland types. The study is therefore divided into two phases: the first phase will focus on delineation, classification and ecoclassification, based on the methods described by DWAF (1999), or otherwise updated. The second phase will focus on the quantification of the EWR, monitoring and implementation, once appropriate methods have been decided upon. This scope of work is for the first phase only.

## 4.2 USE OF AVAILABLE INFORMATION

The study should incorporate all relevant and reliable information available on wetlands in the Study Area to ensure that duplication of effort is avoided. Potential sources of information include the Department of Water Affairs and Forestry, Working for Wetlands Programme, the forestry industry, coal mines, gold mines, district Municipalities, the Mpumalanga Parks Board, Environmental Management Program reports, Environmental Impact Assessments and Stats-SA.

## 4.3 LIAISON

The study should liaise closely with other related studies and initiatives in the Study Area, particular the Working for Wetlands Programme, consultants undertaking the comprehensive assessment of Ecological Water Requirement Study and other institutes involved in the management of water resources in the catchment.

### 4.4 LEVEL OF DETAIL

The level of detail required in this assignment should be appropriate to:

a) map all the wetlands in the Study Area at an appropriate scale (1:50,000 or other scale as agreed to by the Client during the Inception phase);
b) ground-truth the draft map, with particular focus on wetland types that are likely to contribute significantly to stream baseflows. The ground-truthing should aim to ensure that the larger and more significant wetland types are correctly classified. It is not the intention to accurately delineate wetland types. Ground-truthing of endorheic pans is not considered necessary;
c) select sites for detailed assessment at no more than two wetland types per Wetland Ecotype. This means that no more than ten sites should be selected for detailed assessment;
d) A comprehensive inventory of wetland resource utilisation is not considered necessary;
e) assess the Present Ecological State of each wetland type within each of the five Wetland Ecotypes, based on a once-off ecological survey. (This survey to be conducted at the same time as the ground-truthing of the draft map).

## 5. SCOPE OF WORK: PHASE I

### 5.1 TASK 1: INCEPTION

The study should incorporate all available data that could provide additional and relevant information, including the latest methods recommended for wetland delineation and classification, as recommended or approved by DWAF. The outcome of this Task will be an Inception Report for Phase I that must detail what will be done, where, why, when and at what cost. The Inception Report will provide the basis for project evaluation. The expected duration of this task is two months.

### 5.2 TASK 2: DELINEATION AND CLASSIFICATION

The main purpose of the delineation and classification task is to delineate the Study Area into homogenous zones in terms of wetland function (ie to delineate Wetland Ecotypes). The task should also evaluate the preliminary Wetland Ecotypes (Level I) that were delineated as part of the Desktop Study (Figure 2-2), and revise these units if necessary. The study should map the present distribution of all significant wetlands in the Study Area, based on an evaluation of the most recent and available aerial photographs and subsequent field verification. The study should classify the wetlands in the Study Area into functional types according to the method of Dini *et al.* (1999). The task should also evaluate the wetland classification presented in the Desktop Study (AfriDev 2005b), and revise if necessary. Appropriate monitoring sites within each wetland type within each Wetland Ecotype should be selected and mapped according to the methods of Marneweck (1999). The outcome of this task will be a report on Wetland Delineation and Classification, including a ground-truthed map that shows the distribution of different types of wetlands in the catchment and a description of the sites selected for detailed data collection and monitoring. The expected duration of this task is six months.

## 5.3 TASK 3: ECOSTATUS

The purpose of the Ecostatus task is to describe reference conditions and assess the Present Ecological State of each wetland type within each Wetland Ecotype. Reference conditions and Present Ecological State for the following components must be evaluated for key ecological drivers (hydrology, geomorphology and water quality) and response indicators (vegetation and aquatic invertebrates). An overall assessment of ecological state, or Ecostatus, should be based on the rule-based model developed by the Directorate of Resource Quality Services for river systems, but modified for wetlands. Detailed information needed from the sites selected should include, but not be restricted, to the following:

- Once-off cross-sectional survey to determine geomorphology and hydraulics, including surface flow volumes (if relevant) and the delineation of inundation zones, saturation and vegetation zones, to be conducted during the dry season;
- Detailed photographs of key habitats;
- Appropriate once-off studies of wetland plants and aquatic invertebrates, and;
- Assessment of the anthropogenic impacts and trends.

The outcome of this task will be a report on the Ecostatus of the Wetlands in the Study Area. The expected duration of this task is two months.

## 5.4 TASK 4: MANAGEMENT CATEGORY

The purpose of this task is to recommend an Ecological Category and feasible alternative categories, where appropriate, for the various wetland types within each of the Wetland Ecotypes in the Study Area, based on an assessment of Ecostatus, Ecological Importance and Sensitivity and Social Importance. The assessment of Social Importance should identify the <u>users</u> and quantify the <u>uses</u> of each wetland type within each Ecotype, based on focus interviews with selected individuals and organisations. The expected duration of this task is two months, to be conducted concurrently with Task 3.

## 5.5 TASK 5: CAPACITY BUILDING

The Consultant shall identify training needs and propose and present a training programme for three selected DWAF staff in relevant fields, including hydraulic assessment of wetlands, biological surveys and methods of wetland EWR assessment. The Consultant shall make provision for all training necessary to impart the skills needed to undertake monitoring and future surveys. The training should include, but not be restricted to, the following:

- Conceptual principles of wetland structure and function;
- Hydraulic surveys of wetlands;
- Biological surveys, including the identification of flora and fauna;
- Data analysis and presentation, and;
- Project Management.

The training should include regular assessments of progress and a final evaluation. The outcome of this task will be a Training Report. This task is expected to run concurrently with the other tasks.

## 5.6 TASK 6: SCOPE OF WORK – PHASE II

The Consultant shall develop a Scope of Work for the second phase of the study, based on close liaison with D: RDM office and other initiatives investigating methods for wetland EWR assessment. The Scope of Work shall include, but not be limited to the following:

- Quantification of the EWR;
- Assessment of ecological and socioeconomic implications;
- Monitoring and Implementation Plan, and;
- Capacity Building.

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