4.4.6 MKOMAZI REGION

The Mkomazi River has its source at an elevation of approximately 3000 m above seal level in the Drakensberg Mountains. The region encompasses the entire U10 tertiary catchment (**Figure 4.37**). The river flows in a south-easterly direction and enters the Indian Ocean near the town of Umkomaas about 40 km south of Durban. Several large tributaries, including the Loteni, Nzinga, Mkomazane, Elands and Xobho rivers flow into the Mkomazi River. The region includes the small towns of Bulwer, Impendle, Ixopo, Mkomazi, Craigieburn and Magabheni which have small water requirements. The main land use activities in the catchment are large industry (Sappi Saiccor) located at the mouth of the catchment, irrigation and afforestation.

Surface Water

The hydrological characteristics for this region are summarised in **Table 4.38**.

Table 4.38 Hydrological characteristics of the Mkomazi Region (Umgeni Water 2002).

Region	River (Catchment)	Area (km^2)	Annual Average			
			Evaporation (mm)	Rainfall (mm)	Natural Runoff (million m^3/yr)	Natural Runoff (mm)
Mkomazi	Impendle	1,422	1,200	1,068	567.9	399.4
	Smithfield	632	1,200	1,000	163.2	258.2
	Ngwadini	2,242	1,200	875	324.5	144.7
	Mkomazi Estuary	91	1,200	855	11.3	124.2
	Luhane	46.3	1361	980	7.5*	161.9

* Present day MAR

Groundwater

The Mkomazi Region occurs in the KwaZulu-Natal Coastal Foreland and Northwestern Middleveld Groundwater Regions (**Figure 4.10**).

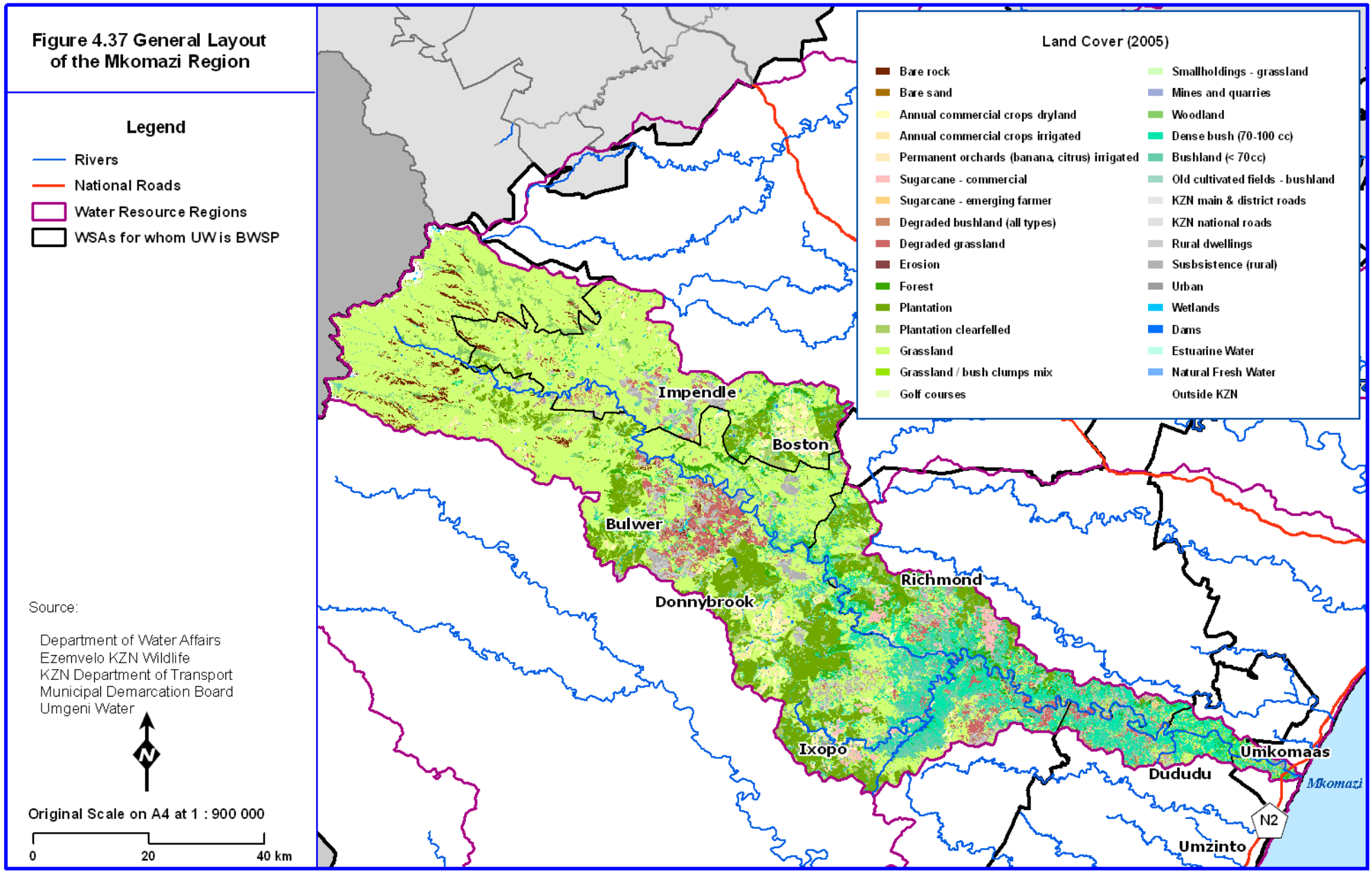
Figure 4.37 General Layout of the Mkomazi Region
Legend
Rivers
National Roads
Water Resource Regions
WSAs for whom UW is BWSP
Source:
Department of Water Affairs
Ezemvelo KZN Wildlife
KZN Department of Transport
Municipal Demarcation Board
Umgeni Water
N
Original Scale on A4 at 1 : 900 000
0
20
40 km
Land Cover (2005)
Bare rock
Bare sand
Annual commercial crops dryland
Annual commercial crops irrigated
Permanent orchards (banana, citrus) irrigated
Sugarcane - commercial
Sugarcane - emerging farmer
Degraded bushland (all types)
Degraded grassland
Erosion
Forest
Plantation
Plantation clearfelled
Grassland
Grassland / bush clumps mix
Golf courses
Smallholdings - grassland
Mines and quarries
Woodland
Dense bush (70-100 cc)
Bushland (< 70cc)
Old cultivated fields - bushland
KZN main & district roads
KZN national roads
Rural dwellings
Susbsistence (rural)
Urban
Wetlands
Dams
Estuarine Water
Natural Fresh Water
Outside KZN
Impendle
Boston
Bulwer
Donnybrook
Richmond
Ixopo
Umkomaas
Dududu
Mkomazi
N2
Umzinto

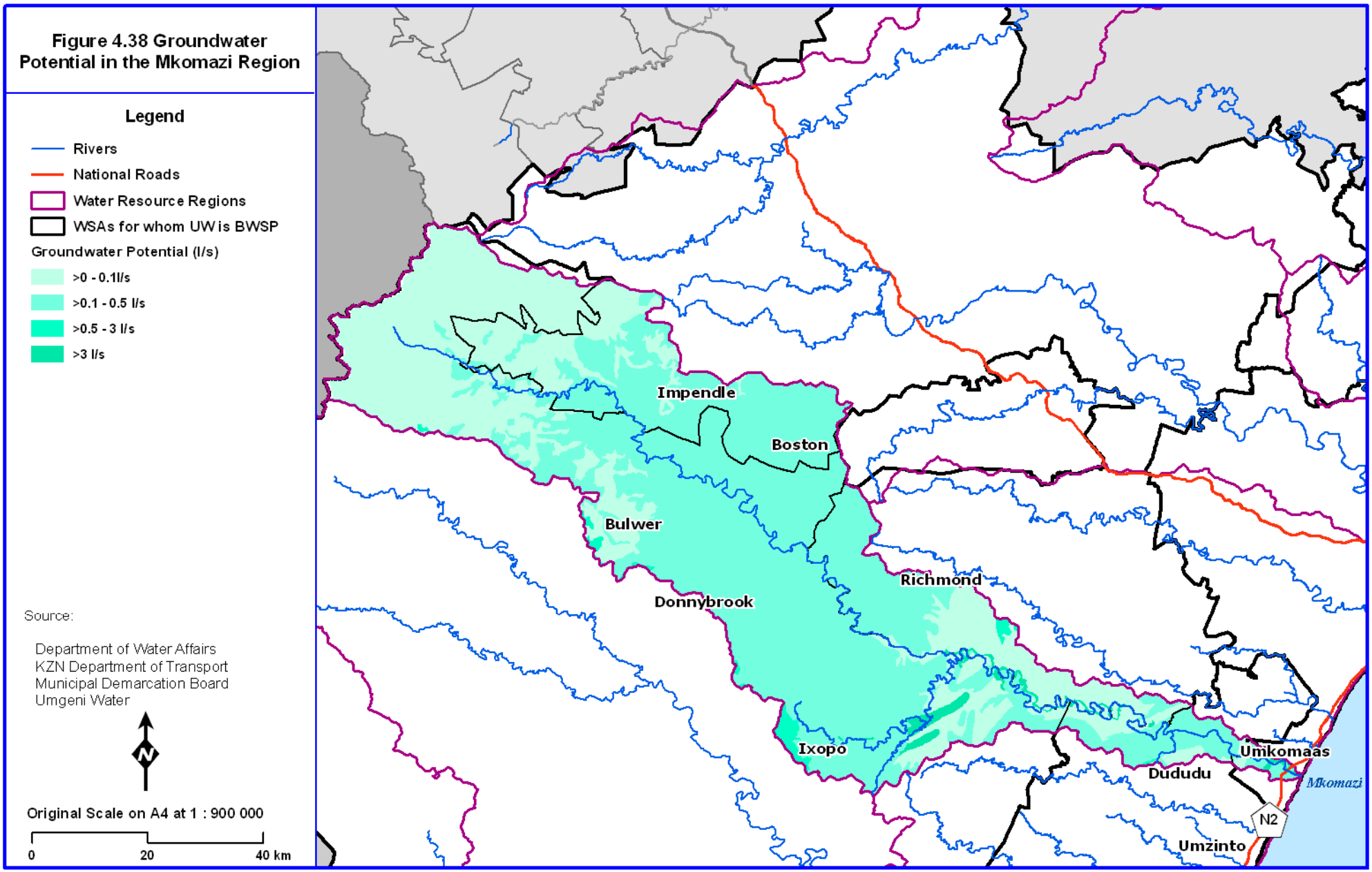
Figure 4.38 Groundwater Potential in the Mkomazi Region
Legend
Rivers
National Roads
Water Resource Regions
WSAs for whom UW is BWSP
Groundwater Potential (l/s)
>0 - 0.1l/s
>0.1 - 0.5 l/s
>0.5 - 3 l/s
>3 l/s
Source:
Department of Water Affairs
KZN Department of Transport
Municipal Demarcation Board
Umgeni Water
N
Original Scale on A4 at 1 : 900 000
0
20
40 km
Impendle
Boston
Bulwer
Donnybrook
Richmond
Ixopo
Umkomaas
Dududu
Mkomazi
N2
Umzinto

Hydrogeological Units

The hydrogeologically relevant lithologies recognised in the Mkomazi Region comprise sandstone, tillite and mudstone/shale supporting fractured groundwater regimes and dolerite intrusions and granite/gneiss supporting fractured and weathered groundwater regimes.

Geohydrology

The Dwyka Tillite formation has the smallest coverage in comparison to the other lithological units in the catchment. It occurs just south of Richmond where it lies exposed in the river banks of the Mkomazi. The Ecca Group is represented by the mudstones/shale of the Pietermaritzburg, Vryheid and Volksrust Formation. The foothills of the Drakensberg Mountains at the head of the EMkhomazi River and the central areas of the catchment are dominated by these lithologies. These lithologies support marginal to poor borehole yields (0.1 – 0.5 l/s). However the presence of extensive intrusive dolerite in the form of sheets and dykes has greatly enhanced the potential of the mudstones to store and yield groundwater.

Groundwater Potential

Primary groundwater supplies using boreholes fitted with handpumps, wind pumps or submersibles are obtainable in most of the lithological units. The exceptions are the Dwyka formation (tillites) or massive granites. In these areas groundwater supply could be obtained within an adjacent fault valley where the potential for high yielding boreholes is much enhanced.

The sandstone of the Natal Group represents the most productive groundwater-bearing lithology, followed by mudstone/shale lithologies, the granite/gneiss lithologies and the tillite sediments of the Dwyka Tillite Formation.

Boreholes favourably located in the Natal Group Sandstone (NGS) provide good yields (Figure 4.38). Yields of 3 l/s (greater than 10 000 l/hr) are not uncommon where large scale fracturing/faulting provide conduits for groundwater movement

Boreholes located in metamorphic lithologies (gneisses) indicate yield characteristics in the range 0.1 to 0.5 l/s, with a median value of 0.3 l/s.

Water Quality

The Ixopo Dam inflow has shown increasing breaches of the RQO limit during the last year for the *E.coli*, algae turbidity. This is due to sewer problems with the main sewage delivery line running close to the dam inflow.

The ambient quality of groundwater in the study area is generally very good with only 3% of the recorded filed electrical conductivity (EC) values exceeding a value of 450 mg/l (70 mS/m).

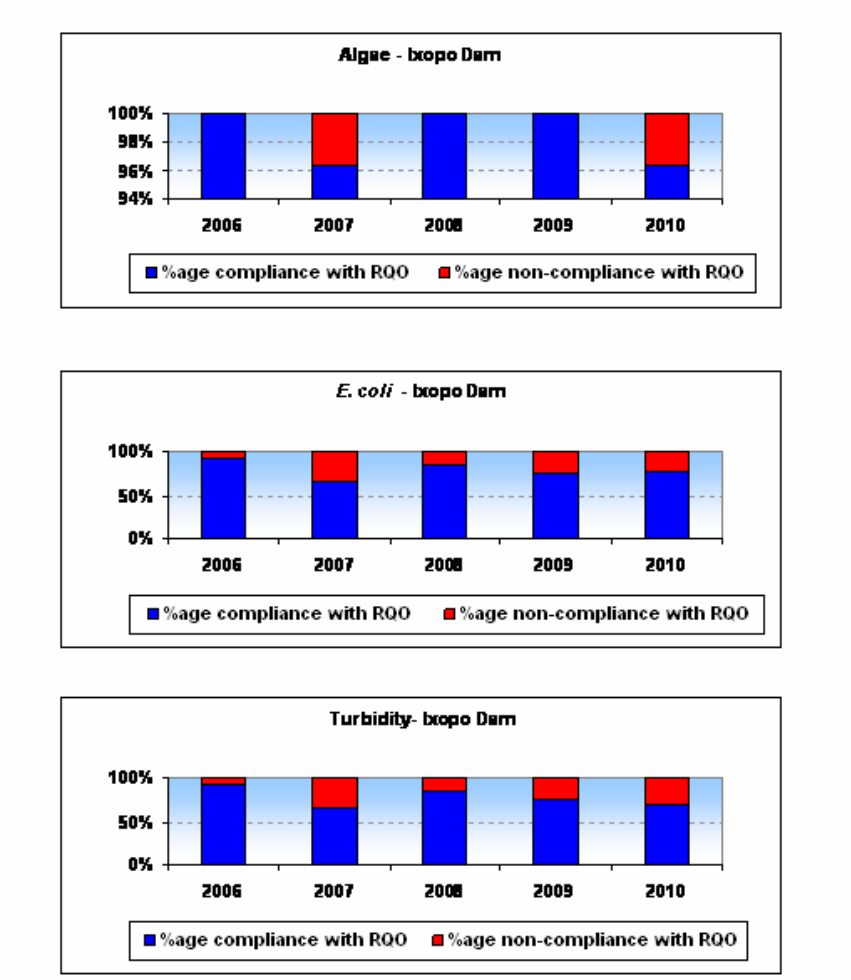

Figure 4.39 **Percentage compliance vs. non-compliance with the Resource Quality Objective for the Ixopo Dam.**

Existing Allocations

Table 4.39 indicates that even though the MAR for the Mkomazi catchment is relatively large, the available yield is minimal because there is no significant existing storage in the system.

Table 4.39 Surface water resources of the Mkomazi region at a 98% assurance (DWAF 2004).

Resource Category	Available/Impact (Million m^3/annum)	Available/Impact (Ml/day)
Gross surface water resource	61	167
Subtract:		
▪ Ecological Reserve	32	88
▪ Invasive Alien Plants	1	3
▪ Dryland Sugar Cane	1	3
Net Surface Water Resource	27	74
Groundwater	1	3
Return Flows	3	8
Total Local Yield	31	85
Transfers In	0	0
Total	**31**	**85**

Reserve

No comprehensive assessment, using the accepted standardised methodology, has been undertaken of the Ecological Reserve of the Mkomazi River to date. A Reserve determination was undertaken in the late 1990's as part of the pre-feasibility investigations into a transfer scheme from the Mkomazi to the Mgeni catchment. An accepted comprehensive assessment will need to be undertaken as part of the detailed investigation of the Mkomazi-Mgeni Transfer Scheme, which is due to be undertaken by DWA, starting in 2011 (**Section 7.2**).

The current Sappi Saiccor abstraction during low flows impacts on the water availability at the estuary of the Mkomazi River and will need to be addressed as part of the future implementation of the Reserve. The pending construction of the Ngwadini Dam by Sappi Saiccor has been proposed to mitigate this concern.

Water Balance/Availability

The major water users in the catchment are Sappi Saiccor with a daily demand of about 120 Ml/day supplied from a run-of-river system, and widespread irrigation throughout the catchment. During the 2010/2011 financial year, Umgeni Water registered the amount of 0.84 million m^3/annum (2.3 Ml/day) with DWA for the Ixopo Dam abstraction. Abstraction no longer takes place for the Craigieburn WTP as the plant has been closed, since the supply to the area in now through the South Coast Pipeline (**Section 5.2**).

Table 4.40 Water requirements/allocations and the water resources in the Mkomazi Region (DWAF 2004).

Category	Volume (Million m^3/annum)	Volume (Ml/day)
Available Water		
Local Yield	31	85
Transfer In	0	0
Total	31	85
Water Requirements		
▪ Urban	1	3
▪ Industrial	44	120
▪ Rural	5	14
▪ Irrigation	43	118
▪ Afforestation	10	27
Transfers Out	0	0
Total	103	282
Balance	**-72**	**197**

Table 4.41 Water requirements/allocations and the water resources for the Ixopo Region.

Category	**Volume (Million m^3/annum)**	**Volume (Ml/day)**
Available Water		
Dam Yield	1	2.7
Borehole	0.15	0.4
Total	1.15	3.1
Water Requirements		
▪ Urban	0.91	2.5
Transfers Out	0	0
Total	0.91	2.5
Balance	**0.24**	**0.7**

Existing Infrastructure and Yields

Currently the region is unregulated and there is no major water resource infrastructure on the Mkomazi River or on any of its tributaries.

The Ixopo System lies within the Mkomazi catchment and is not connected to any of Umgeni Water's regional bulk systems. The Ixopo system is situated at the town of Ixopo within the Sisonke District Municipality area. Umgeni Water owns and operates the bulk supply system comprising of water resource infrastructure, raw water pipelines, and the WTP. Potable water is sold at the WTP to the uBuhlebezwe Local Municipality who is responsible for reticulation within the town of Ixopo and the adjacent peri-urban areas (**Section 5.3**).

Table 4.42 Characteristics of Ixopo Dam.

Catchment Details	
Incremental Catchment Area:	77.53 km^2
Total Catchment Area:	77.53 km^2
Mean Annual Precipitation:	793 mm
Mean Annual Runoff:	6.95 million m^3
Annual Evaporation:	1 200 mm
Dam Characteristics	
Gauge Plate Zero:	935.8 mASL
Full Supply Level:	939.8 mASL
Net Full Supply Capacity:	0.555 million m^3
Dead Storage:	0.0 million m^3
Total Capacity:	0.555 million m^3
Surface Area of Dam at Full Supply Level:	0.20 km^2
Dam Type:	Earth embankment
Crest Length:	Spillway Section: Not Available Non-Spillway Section: Not Available
Type of Spillway:	Uncontrolled
Capacity of Spillway:	Not Available

Figure 4.40 Ixopo Dam.

Table 4.43 Existing Dams in the Ixopo Region.

Impoundment	River	Capacity (million m^3)	Purpose
Ixopo (Homefarm) Dam	Xobho	0.55	Domestic

The water resources that support the Ixopo System comprise of the Ixopo Dam (**Table 4.42** and **Figure 4.40**) and a production borehole. These two sources are used conjunctively supply the current Ixopo town demand of 2.5 Ml/day. The dam has a full supply capacity of 0.55 million m^3 and a firm yield of 2.7 Ml/day. The production borehole is capable of a sustainable yield of about 400 kl/day using a pump cycle of 16 h/day at a rate of 25 kl/h.

Operating Rules

The two water resources at Ixopo are used in a conjunctive manner. During times when Ixopo Dam (surface water supply) is spilling the borehole abstraction rate is reduced. If there are operational problems at the WTP the borehole is often used to make up shortfalls during shutdowns or reduced production.

Ixopo Dam supplies its own demand without the support of the two upstream farm dams until the dam storage has dropped to 20%. A 20% storage level at Ixopo Dam triggers the need for support from both the farm dams. These dams continue to support Ixopo Dam until they reach dead storage. Restrictions are imposed in the system when the farm dams have reached their dead storage level.

Proposed Water Resource Infrastructure

The current water resources of the Mgeni System are insufficient to meet the long-term water demands of its own system. Past investigations have indicated that, possibly, the most suitable long-term solution would be to develop a scheme that transfers raw water from the still undeveloped Mkomazi River to the Mgeni catchment. Water resources development options on the Mkomazi River have already been investigated at a pre-feasibility level of detail with the view to augmenting the supply in the Mgeni catchment through an inter-basin transfer scheme. Various potential sites and transfer options were assessed in this investigation. The recommended scheme, known as the Mkomazi Water Project (MWP) comprised of two phases.

The first phase (MWP-1) would consist of a once-off constructed 58 m high (FSL to RBL) Smithfield Dam on the Mkomazi River near Richmond from where water would be pumped into a 33 km long free surface flow tunnel to deliver raw water to a new water treatment plant at Baynesfield in the Mlazi River catchment. Treatment water would be transferred to an appropriate delivery node within the Mgeni catchment.

The second phase (MWP-2) would comprise of the construction of a large dam at Impendle further upstream on the Mkomazi River. Once in place, water would be released from the Impendle Dam down the Mkomazi River for abstraction and transfer at Smithfield Dam. The Impendle Dam could be built either in two phases or as a once-off constructed scheme component. The MWP-2 would only be implemented at a future date when needed.

Table 4.44 Proposed water resource infrastructure for the Mkomazi Region.

Impoundment	River	Capacity (million m^3)	Yield (million m^3/year)	Stochastic Yield (million m^3/year)
			Historical	1:100
Smithfield Dam	Mkomazi	137	131 (359 Ml/day)	177 (485 Ml/day)
Impendle Dam	Mkomazi	270	204 (559 Ml/day)	228 (625 Ml/day)
Ngwadini Dam	Mkomazi (Off-channel)	10	Not Available	16.4* (45 Ml/day)
Temple Dam	Mkomazi (Off-channel)	6.7	10.5 (29 Ml/day)	Not Available
Bulwer Dam	Luhane	9.8	Not Available	3.4* (9.3 Ml/day)

* 98% assurance level

In the late 1990's Umgeni Water, together with Sappi Saiccor, conducted an investigation into the water resource options in the lower reaches of the Mkomazi River in order to support growing water demands in the Upper and Middle South Coast regions, and to also to provide an assured supply of water to the mill. Two possible sites for off-channel storage were identified in the lower reaches of the Mkomazi River, namely the Ngwadini and Temple dams. The Ngwadini option was preferred due to the more positive social and bio-physical aspects of the development, and the larger storage volume. This water resource would support the proposed Hull Valley WTP to be situated close to the decommissioned Craigieburn WTP to then feed into the South Coast Pipeline.

This project was not taken forward to implementation by Umgeni Water due to the predicted growth in demands not materialising as rapidly as was anticipated at the time, and lack of joint commitment from Sappi Saiccor. They had also decided not to pursue this option at that time due to financial/operational reasons. Subsequently, Sappi Saiccor has decided to continue with the construction of Ngwadini Dam, with revised calculations indicating that they require the entire storage available in the dam to meet their own requirements. To date, they have completed the detailed design and obtained the environmental RoD approval. Construction was scheduled to have commenced in 2009, but this has been delayed due to the recent downturn in the economy (**Section 2.5**).

In order to develop a sustainable water resource to support the long-term supply of water to the upper and middle south coast regions it is now necessary to reassess the water availability in the lower reaches of the Mkomazi River, both with and without the proposed Mkomazi Water Project (**Section 7.2**) in place. This assessment will confirm whether storage is required in the lower reaches. If positive, then potential dam sites will need to be investigated.