UNIVERSAL ACCESS PLAN (FOR WATER SERVICES) PHASE 2

PROGRESSIVE DEVELOPMENT OF A REGIONAL CONCEPT PLAN - UMKHANYAKUDE DISTRICT MUNICIPALITY

CONTRACT NO. 2015/178

RECONNAISSANCE STUDY
FINAL

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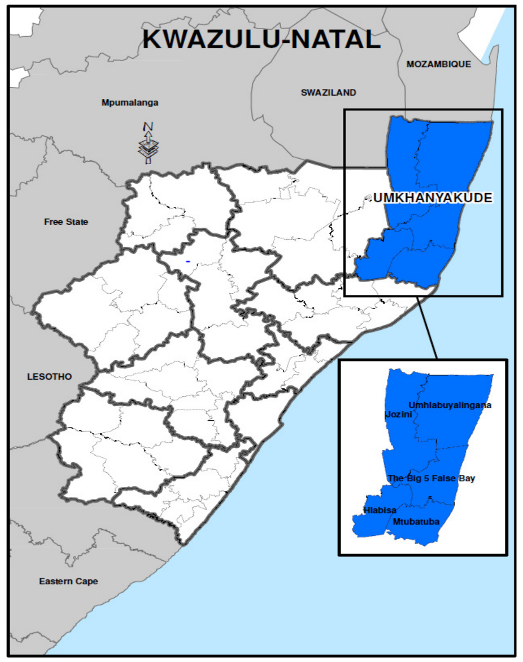

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EXECUTIVE SUMMARY

This report is the Reconnaissance Study for the Universal Access Plan Phase 2 – Progressive Development of a Regional Concept Plan for uMkhanyakude District Municipality (UKDM). The key objective of this study is to produce a concept plan for the municipality that would address water backlogs in terms of regional bulk water supply.

Context

The uMkhanyakude District Municipality is located in north-eastern corner of South Africa, in the province of KwaZulu-Natal (KZN). The area has five local municipalities (LMs), namely: uMhlabuyalingana, Jozini, Big Five False Bay, Hlabisa and Mtubatuba. The total extent of the UKDM is over 12 000km² - the second largest district municipality in KZN.

A high proportion of the UKDM is thicket, grassland, and wetland, with remaining areas as disturbed cultivation (farmland) and settlement. Large areas are traditional authority areas, under the jurisdiction of the Ingonyama Trust.The extent of natural land cover and the very small proportion of built up areas are what make UKDM unique.

The UKDM is known for is rich biodiversity, and scenic beauty. The UKDM area supports a wide diversity of faunal and floral species, due to its unique and widespread aquatic and wetland habitats. The continued protection of the wealth of natural resources in the area is essential to sustain the associated environmental goods and services that underpin the economy of the district

Demographics and Socio Economics

The population of UKDM as at Census 2011 was 625 846, with a growth rate of 0.88% overall. Over 86% of this population resides in rural areas. The striking feature is the sparse distribution of the households with 82% of the rural settlements having population density of less than 500 people per square kilometre.

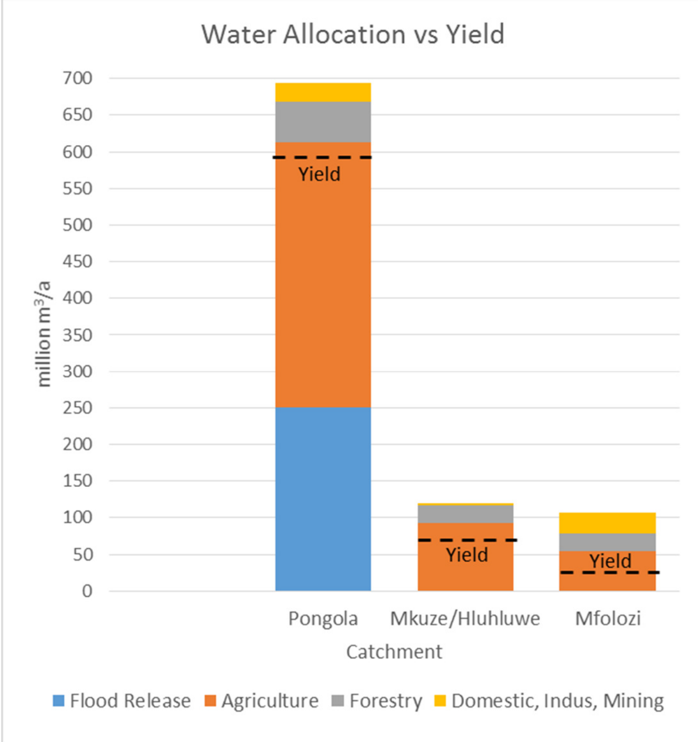
Census 2011 Statistics	
Population	625 846
% rural population	86,8%
% urban population	13,3%
Population Growth	
Per annum	0.88%
Labour Market	
Unemployment rate (official)	42.80%
Youth unemployment rate (official) 15-34	51.20%
Education (aged 20 +)	
No schooling	25.30%
Higher education	4.90%
Matric	25.40%
Household Dynamics	
Households	128 195
Average household size	4.70
Formal dwellings	71.70%

Overall household income patterns indicate that nearly 80% of households earn less than R38 200 per annum – significantly higher than the provincial figure of 68%.

The UKDM has a relatively small economic base, being only 5% of that of eThekwini Metropolitan municipality. However, the total size of the UKDM economy grew from R2.7 billion in 1995 to R7.1 billion in 2011, **which is a strong growth of over 9% per annum – over double the growth rate of eThekwini over this period.**

Water Availability

Water for domestic and commercial usage within the district is sourced from both surface and groundwater. Pongolapoort Dam is the most significant regional bulk source, supplying large areas of Jozini; parts of uMhlabuyalingana; and is planned to supply Hlabisa, and perhaps even northern sections of Hluhluwe. The Hluhluwe Dam and downstream river supplies the entire Hluhuwe LM at present. With specific intervention 58 mil m³/annum (158,9 Ml/day) can be freed for domestic use fot all these areas.

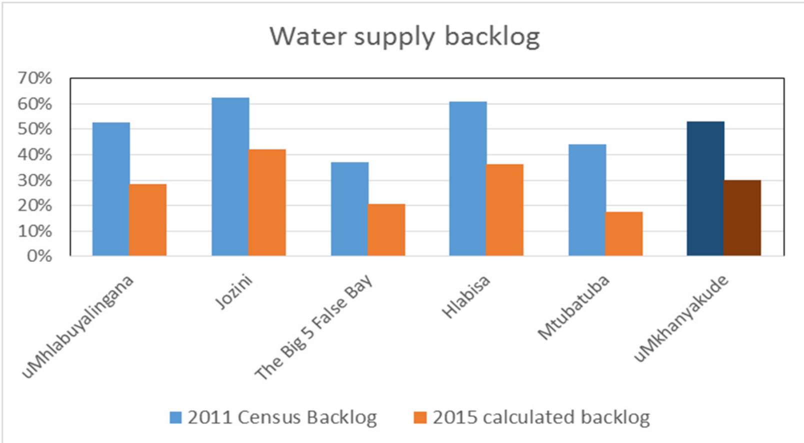


The Mfolozi River is the primary supply source for the Mtubatuba LM. uMhlabuyalingana is supplied primarily from groundwater, and Lake Sibaya. There are numerous stand-alone schemes in this area. Groundwater potential in the area is very high, and should be the first resource utilised for domestic and commercial use. Groundwater is also utilised in the south around Mtubatuba. The potential in this area is only recently been tapped for the urban areas.

The Pongola, Mkuze, and Mfolozi catchments are significantly over-allocated in terms of registered water use. The DWS needs to prioritise the validation and verification of water use, and find ways for more equitable allocation of resources. Protection of the environmental reserve is of paramount importance in the area, and abuse of the reserve could result in severe degradation of the natural economic infrastructure in the area which is key for the tourism trade in the area. A huge source deficit exists and various water resource interventions are considered to meet the deficit for both UMkhanyakude and the City of Mhlathuze, of which an off-channel storage dam on the Mfolozi has been identified to be the most viable source.

Backlog

The estimated backlog in water supply as at 2015 is approximately 30%. Jozini LM has the highest backlog. This is an improvement on the 2011 Census figure of 53% backlog.



Water Demand

Bigen Africa developed a zero-based demand modelling tool that has been used to determine the projected demands over a 30 year period (2015 – 2045) for the UKDM. The demand model is a Microsoft Excel application in which modelling is performed at Census "Small Area" Level. The predicted "zero based" water demands as derived through the model are calculated against time as:

- AADD (Average Annual Daily Demand): Average water demands excluding water losses
- GAADD (Gross Average Annual Daily Demand): AADD plus water losses
- SDD (Summer Daily Demand): GAADD x Summer Peak Factor

Unlike the other demand model used in the UAP 2 Reports for UMDM and CoU, the UKDM demand although it is based on the Census Small Area, the 2015 household count was determined through actual household roof counts using high resolution 2013 images. Using Census Small area information for Heads Per Household at a small area level, the population at each specific small area was calculated and a unit demand determined using demands from the engineering guidelines.

Institutional demands were calculated as follows;
Schools: No. of pupils and Teachers are assigned demands of 20litres per person per day and each school is located within a corresponding small area.

Hospitals: Similar to the method used for schools, however, No. of beds per hospital were used.

Commercial/Industrial: Industrial roofs were digitised and the roof area was calculated (m²) less overhang and the Commercial /Industrial floor area was calculated. A unit demand of 400litres per 100m² was used to determine the industrial demands.

The 2035 Max AADD has been calculated as being **114Ml/day and the SPD at 163Ml/day** for the district.

Water Supply Infrastructure and Gap Analysis

For each of the supply areas, infrastructure needs was determined using the projected demands.

UKDM has a large number of planned small to medium MIG and MWIG infrastructure projects that are implemented by UKDM as well as large MWIG and RBIG projects which are implemented on UKDM's behalf by Mhlathuze Water as contained in UKDM's planned project lists and The UKDM Accellatration Planned Compiled by Mhlathuze Water. These planned projects are anticipated to provide additional capacity to the existing infrastructure and are estimated to have a total cost in the region of R5.3billion. It is for this reason that the resulting infrastructure capacity from these planned projects had to be considered in the infrastructure assessment process.

Therefore a Gap Analysis was conducted by comparing the needs determined with the new or planned infrastructre to be bult under the planned infrastructure projects. The resulting shortfall in infrastructure capacity from this assessment was then consolidated as the Proposed Infrastructure for each supply area.

Shemula Scheme

Resource : The Phongola River as the main water resource for this bulk scheme. Current records are indicate an overallocation of water from this resource. A validation, verification, and equitable reallocation of water is urgently required from DWS.

Treatment Capacity : The Shemula WTW (27Ml/day capacity) was found to be adequate for the present and 2025 demands, however, additional capacity needs to be added in order for demand beyond this to be met. Based on these demands, an additional 13Ml/day treatment capacity as well as 16Ml storage are required for the year 2045.

Bulk Distribution and Storage: The proposed Shemula Bulk Water Supply Project will have sufficient capacity to supply future demand. As this project has been sub-divided into 6 Phases, it is recommended that the various phases be completed by 2030 to keep in line with the growing demands for the supply areas within the scheme.

Jozini Scheme

Resource : The Phongola River is the main water resource for this bulk scheme. As stated for the Shemula scheme, this reource is overallocated, and a resolution needs to be found by DWS. The eastern section, Mseleni and Mbazwana are supplied from Lake Sibaya and groundwater.

Treatment Capacity : The are is currently supplied by numerous water treatment works. A new Othobothini 40Ml/day treament works is under construction will have the capacity to supply the future demand for the scheme area including the proposal to supply Hluhluwe Phase 3. The 40 Ml/day extension would be adequate to beyond the year 2035)

Bulk Distribution and Storage: A regional bulk suply is proposed to Mbaswana in the East, and to Hluhluwe North via the Malobeni-Kwajobe supply line.
It is recommended that in future, Lake Sibaya only serve Mseleni, as current information suggests that the Lake cannot sustain increased abstraction levels. Yield should be sufficent to serve the future needs of this area.Therefore, the eastern extension of the planned Jozini Regional Bulk Water Supply Project must exclude the link to Mseleni.

Hlabisa

Resource: The Mandlakazi WTW in Zululand abstracts water from the Phongolapoort Dam via the private infastructure of Charl Senekal,and will in the near future supply to the whole of Hlabisa. The water is assumed to be a part of the existing agricultural allocation to Charl Senekal, which needs to be updated, as at present the allocation for domestic use is insuffient to supply the needs of Mandlakazi and Hlabisa.

Treatment Capacity : The Mandlakazi works has been found to require an additional 8Ml/day capacity for the Hlabisa portion of the works.

Bulk Distribution and Storage: From the assessment of the Hlabisa Scheme to Supply the future demand, it has been found that the scheme requires an additional 5.5Ml storage. The newly constructed bulk pipelines have been found to be adequate for the future demand requirements

Hluhluwe Scheme

Resource : The Hluhuwe supply areas are supplied from an abstaction point at the Hluhluwe Dam wall, and another downstream of the dam. The Hluhlowe catchment is noted as being over allocated. As mentioned earlier a Mfolozi Off-Channel storage dam and macro transfer to this supply areas is discussed as a potential water resource solution for Hluhluwe, Mpukunyoni and Mtubatuba Supply areas.

Treatment Capacity : The Hluhluwe 1 WTW requires an additional treatement capacity of 25Ml/day and Hluhluwe 1 WTW requires an additional 15Ml/day treatment capaciy.

Bulk Distribution and Storage : Overall additional storage required for the supply area is 53.5Ml (8.5Ml Hluhluwe 1 and 15Ml Hluhluwe 2). In terms of the bulk distribution. Bulk mains to Phase 1, Phase 2 and Phase 4 have been proposed as the exisitng has been found to be inadequate for the ultimate demand.

Mtubatuba Scheme

Resource: Mtubatuba abstracts from the Mfolozi River, and recently augmented with groundwater due to insufficient surface water availability. An Mfolozi Off-Channel storage dam is proposed as part of this report as a long term solution.

Treatment Capacity: The recently upgraded Mtubatuba WTW is adequate for the future demand.

Bulk Distribution and Storage: The existing infrastructure, as well as new infrastructure that will be constructed as part of the planned infrastructure projects has been found to be adequate for the future demands of this study.

Mpukunyoni Scheme

Resource: The Mfolozi Catchment is over-allocated. For a number of years, the DM has been battling to abstract sufficient water. A Mfolozi Off-Channel storage dam is proposed as part of this report as a long term solution.

Treatment Capacity: The Nkolokotho WTW capacity has been found as being inadequate for the future demands, an additional 15Ml/day treatment capacity is required.

Bulk Distribution and Storage: The Mpukunyoni scheme requires an additional 15Ml storage capacity to cater for the future demand. In addition, a cross boarder agreement with Uthungulu requires a bulk main of 250mm diameter.

Summary associated costs for total needs (Excluding planned interventions by UKDM)

Supply Area	Estimated Project Cost
Shemula	R 149 373 690.10
Jozini	R 1 128 137 000.00
Hluhluwe	R 1 412 325 391.00
Hlabisa	R 78 485 761.44
Mpukunyoni	R 338 106 897.80
Mtubatuba	R 276 923 076.90
Total Cost For Bulks	**R 3 383 351 817.00**

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LIST OF ABBREVIATIONS

Ave.	Average
CoGTA	Department of Cooperative Governance and Traditional Affairs
DM	District Municipality
DWS	Department of Water and Sanitation
GIS	Geographical Information System
GRIP	Groundwater Research Information Project
HFY	Historical Firm Yield
IDP	Integrated Development Plan
KZN	KwaZulu Natal
l/c/d	Litres per capita per day
LM	Local Municipality
LoS	Level of Service
Max.	Maximum
Min.	Minimum
m^3	Cubic meters
PSP	Professional Service Provider
RDP	Reconstruction and Development Plan
RF	Reference Framework
TBD	To be determined
UAP	Universal Access Plan
UKDM	uMkhanyakude District Municipality
UW	Umgeni Water
WARMS	Water Authorization and Registration Management System
WSA	Water Service Authority
WSDP	Water Services Development Plan
WSP	Water Service Provider
WSS	Water Supply Scheme
WTW	Water Treatment Works

1. OBJECTIVES AND METHODOLOGY

This report is the Reconnaissance Study for the Universal Access Plan Phase 2 – Progressive Development of a Regional Concept Plan for uMkhanyakude District Municipality (UKDM).

1.1. Background

In 2013 the Department of Cooperative Governance and Traditional Affairs (CoGTA), in association with Umgeni Water, initiated the development of a Universal Access Plan (UAP) for bulk water supply. The study focussed on the ten WSAs in the KwaZulu-Natal Province and constituted Phase 1 of the project. The outcome of this Phase 1 plan provided good base information in some of the WSA's with regards to water supply in KwaZulu-Natal. There are however areas for improvement in the plan as per the following observations:

- The project focussed on small localised schemes for universal access in the short term, however these proposed schemes are not necessarily sustainable;
- The proposed schemes were largely designed in isolation and took little cognisance of other water planning studies and recommendations;
- Many of the WSDP's and /or Water Master Plans were being updated during the course of the project, and need to be incorporated into UAP planning;
- The project did not go as far as Umgeni Water's extended area into the Eastern Cape; and
- The footprints did not take cognisance of town planning type information that would give an indication of future demands.

These gaps have resulted in Umgeni Water (UW) initiating a second stage of this UAP project with the main objective being the progressive development of a regional bulk water supply concept plan for the municipality that would address bulk water supply backlog.

Umgeni Water appointed Bigen Africa Services (Pty) Limited, in association with ZIYANDA Consulting cc , to review the Phase 1 of UAP project in the form of developing UAP – Phase 2, for Ugu District Municipality (UDM), uMgungundlovu District Municipality (UMDM), uMkhanyakude District Municipality (UKDM), Zululand District Municipality (ZDM) and the City of uMhlathuze (CoU).

The development of the plan was conducted in two (2) phases resulting in the following two (2) deliverables:

- ➢ Deliverable 1: Development of an Interim Regional Bulk Scheme Report (Status Quo Report); and
- ➢ Deliverable 2: Reconnaissance into the proposed Regional Bulk Schemes per Water Services Authority

This report serves as part of deliverable 2.

1.2. Purpose of the Report

A reconnaissance study refers to a preliminary feasibility study designed to ascertain whether a feasiblity study is warranted.

This report provides a concept plan for regional bulk water supply infrastructure that will address water backlogs in terms of regional bulk water supply.

In the context of this report, regional bulk is defined as per the Regional Bulk Infrastructure Grant (RBIG) Framework for Implementation (DWS, 2010):

The infrastructure required to connect the water resource, on a macro or sub-regional scale (over vast distances), with internal bulk and reticulation systems or any bulk supply infrastructure that may have a significant impact on water resources in terms of quantity and quality.

- **"Macro"** is defined as infrastructure serving extensive areas across multi-municipal boundaries;
- "**Sub-regional**" is defined as large regional bulk infrastructure serving numerous communities over a large area normally within a specific district or local municipal area;
- Over "**vast distances**" is considered as any distances greater than 5 km;
- Bulk infrastructure that has a "**significant impact on water resources**" includes:
  - Any bulk scheme or component that is designed for maximum demand of 2 Ml/day or more;
  - Any waste water treatment plant that discharges into a fresh water resource system, and
  - Any water treatment plant that is designed for a maximum demand of more than 2 Ml/day.

1.3. Specific Targets of the Study

The main outcomes as per agreement between the Client - Umgeni Water - and all professional service providers engaged in this study are as follows:

1) Supply areas are defined and prioritised based on agreed criteria including footprints (from UAP Ph1), needs, proximity to existing bulk schemes, financial viability, footprint density, DHS and land claim areas, proximity to development nodes, sustainable demands, etc.
2) Existing supply schemes (NB regional) are verified, quantified, documented and mapped.
3) Options of already proposed regional schemes are assessed and documented.
4) Perform high level assessment of demand/supply capability
5) Required new or existing water resource sources are determined and mapped.
6) Extensions to existing schemes and/or new regional schemes are documented in GIS and Visio
7) Key stakeholders are informed(UW, DWS, COGTA, SALGA)

1.4. Study Process

The methodology for Phase 2 consists of Tasks 3-5 of the project. **Figure 1** summarises the process followed for this reconnaissance study.

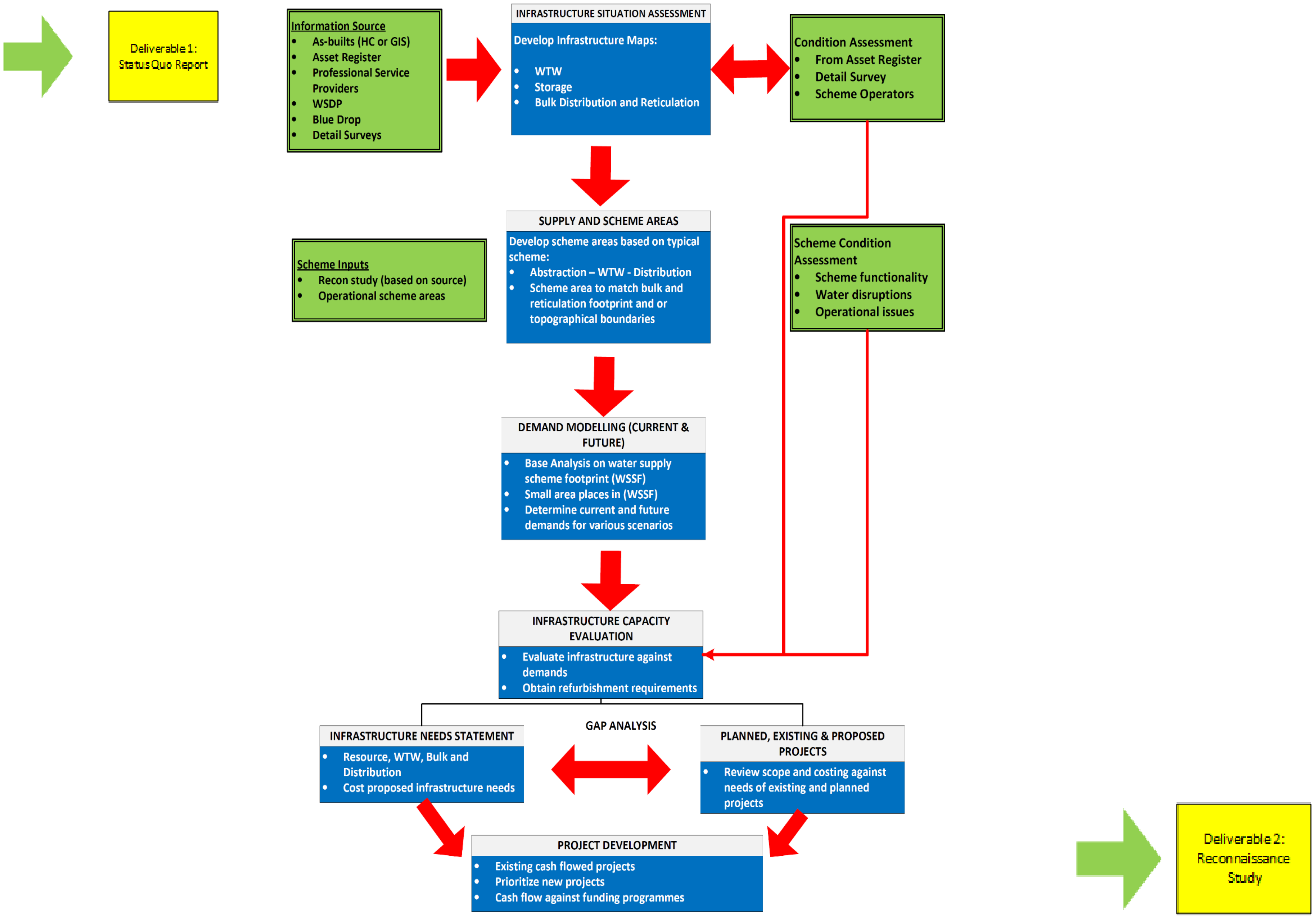


Figure 1: Reconnaissance Study Process

2. STUDY AREA

The uMkhanyakude District Municipality (UKDM) is located in north-eastern corner of South Africa, in the province of KwaZulu-Natal (KZN), as shown in **Figure 2**. The municipal seat is in Mkuze.

The northern boundary is the international border of Mozambique and Swaziland; the Mpumalanga Province and the Zululand District Municipality are in the west; and uThungulu in the south. The Indian Ocean forms the eastern boundary.

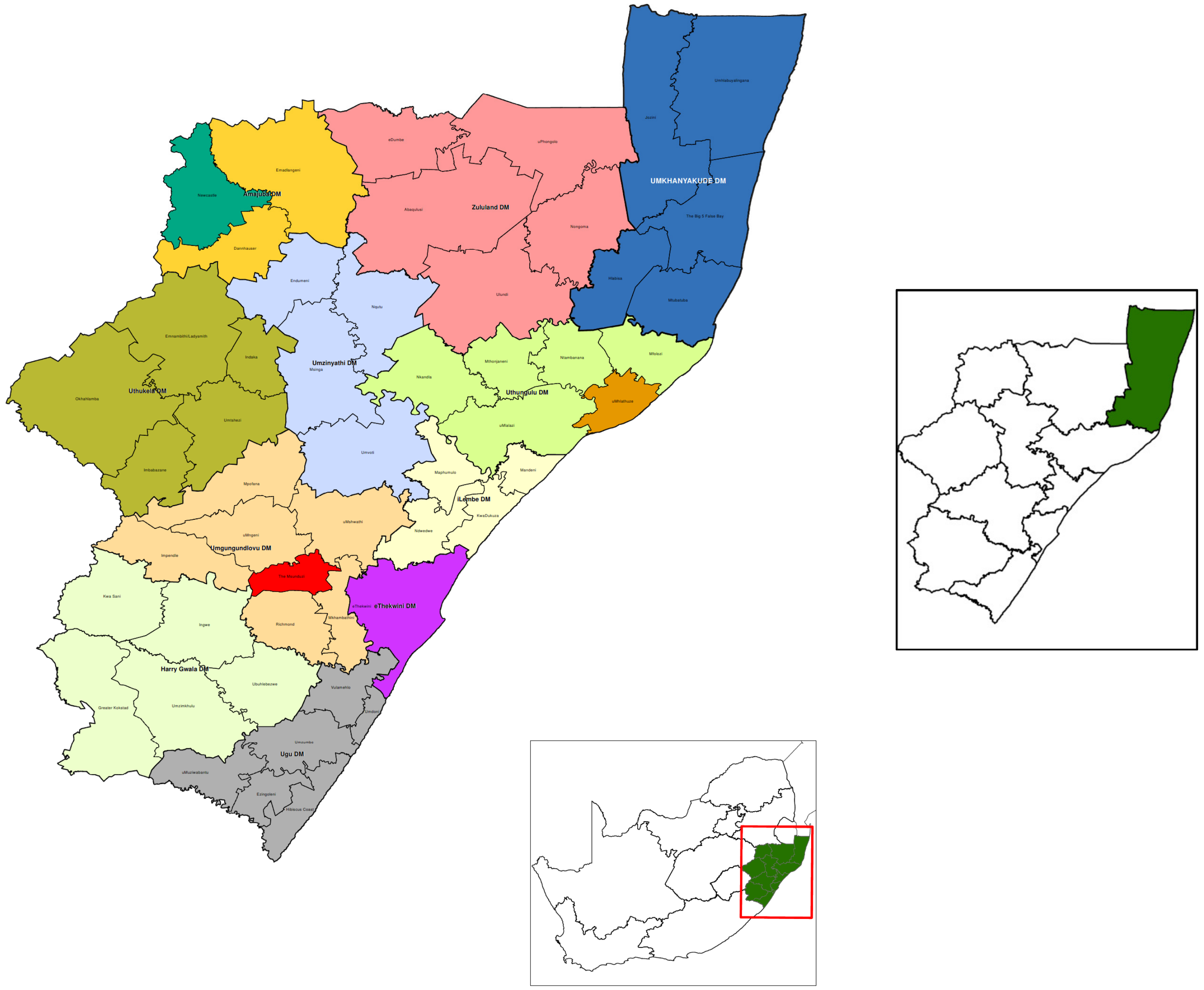


Figure 2: Provincial Perspective

The area has five local municipalities (LMs), namely: uMhlabuyalingana, Jozini, Big Five False Bay, Hlabisa and Mtubatuba. The main towns are Mtubatuba; Hlabisa, Hluhluwe, Manguzi, Mbazwana, Jozini and Mkuze.

There are large tracts of land that are conservation areas, including: Isimangaliso Wetland Park encompassing the entire coastline; Hluhluwe-Umfolozi Game Reserve in Hlabisa LM; Mkuze and Ndumo Game Reserves in Jozini LM, and Tembe Elephant Park in uMhlabuyalingana LM. The municipality falls within the Pongola-Mtamvuna water management area, and more specifically, the Mfolozi/Pongola catchment, which is shared with Swaziland and Mozambique.

2.1. Physical characteristics of Study Area

The total extent of the UKDM is over 12 000km^2 - the second largest district municipality in KZN A high proportion of the UKDM is thicket, grassland, and wetland, with remaining areas as disturbed cultivation (farmland) and settlement. Large areas are traditional authority areas, under the jurisdiction of the Ingonyama Trust.

The land cover[1] (**Figure 3**) in the district is dominated by natural vegetation, with agriculture and water features also having significant coverage. The extent of natural land cover and the very small proportion of built up areas are what make UKDM unique.

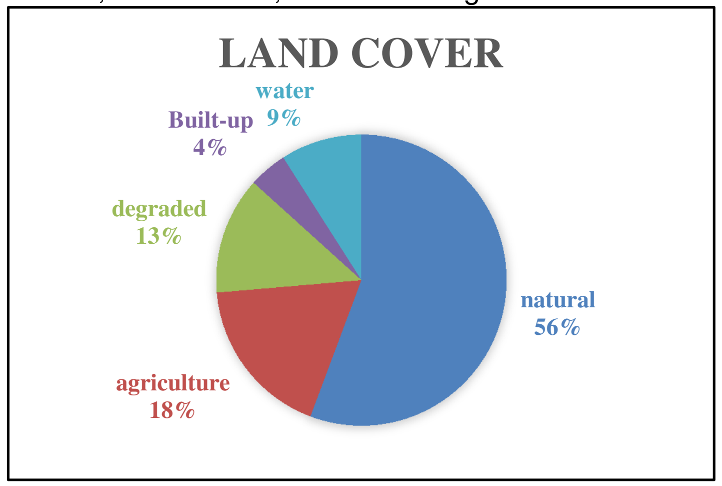


Figure 3: UKDM Land Cover

Land degradation is a concern, with the problem particularly severe in uMhlabuyalingana, Jozini and Big Five False Bay LM's. Agriculture activities are dominant in Mtubatuba, where 42.7% of the land is utilised for subsistence agriculture and plantations. Subsistence agriculture and plantations are also prominent in Jozini. Afforestation is considered one of the biggest water users in Jozini, removing a large proportion from the aquatic environments.

The major rivers in the area include the Pongola River in the north-west, which drains in a northerly direction into Mozambique; the Msunduzi River and the Mkuze Rivers draining the central areas; and the Hluhluwe, Nyalazi and Mfolozi Rivers in the south. Two of these major rivers have significant dams along their route - the Pongola River has the extensive Pongolapoort Dam; and the Hluhluwe River, the Hluhluwe Dam. The central and southern regions feed into the internationally recognised conservation area, the Isimangaliso Wetland Park. There are four other major conservation areas, namely the Hluhluwe-Umfolozi Game Reserve, the Ndumo Game Resource, the Mkuze Game Reserve, and the Tembe Elephant Park. In addition there are many smaller private conservation areas in the region.

[1] UKDM GDP (2013) uMkhanyakude GDP Status Quo Report

The N2 is a major transport route that runs from south to north through the UKDM, and is the only national road in the region. The R618 is the main road from the N2 to Hlabisa, and the R22 cuts through the coastal pain from Hluhluwe and Kwangwanase. The N2 and four other key corridors have been identified as the key routes in the area:

- NORTH - SOUTH CORRIDOR (N -2) (Richards Bay – Mtuba/Hlabisa – Hluhluwe – Mkhuze – Golela)
- CULTURAL HERITAGE CORRIDOR HLABISA NONGOMA (Gateway to the Kingdom)
- BORDER HERITAGE CORRIDOR (Cecil Mack Pass – Ingwavuma – Bambanani – Ngwanase - Kosi Bay)
- ZULU OCEAN CORRIDOR (Richards Bay – St Lucia – Hluhluwe – Kosi Bay to Maputo)
- AILE OF KINGS HERITAGE CORRIDOR (Liberation Route: Jozini/N2 Turnoff – Sikhandane – Kwaliweni – Ingwavuma – Cecil Mack Pass).

2.2. Topography, Geology and Soils

The UKDM area is characterised by a wide range of environments due to diverse underlying geological formations, and numerous incised river catchments. Low lying coastal plains in the east, and the low-lying plains to the west are separated by the Lebombo Mountains[2]. In the north-west the Lebombo Mountains form the border with Swaziland and the western slopes falling steeply to the coastal plain (**Figure 4**). The extensive coastal plains are largely sandy soils, and are known as the Makhathini Flats. These extend up as part of the Mozambique coastal plain. Block faulted upper Karro Supergroup rocks underlie the hilly terrain, and lower Karoo Supergroup underlie the Hluhluwe and Hlabisa area in the south west (EMF, 2012).

The *UKDM EMF SQ Report – Geology and Geohydrology* (2012, page 3) provides the following on the terrain: “The 1:250,000 Terrain Morphological Map of South Africa (Kruger, 1983) classifies the UMkhanyakude region into terrain morphological classes based on slope form, relief and drainage density. The low-lying Maputaland coastal plain east of the Lebombo Mountains are classified as “plains” with low relief and low drainage density. The eastern Lebombo mountain foothills extending south from Ndumo to Mkhuze are “moderately undulating plains” with variable relief (30-210m) underlain by the Cretaceous siltstones and influenced by the Neogene palaeo-dune ridge along the Phongola River valley. The Lebombo steep mountains are classified as “low mountains” with high relief. The characteristic steep western scarp and lower gradient, hill crest and eastern slopes are defined by the easterly dip of the Jozini rhyolite Formation. The “slightly undulating plains” west of the Lebombos are defined by the Letaba Formation basalts.

The undulating hills in the area around Hluhluwe-Imfolozi Park and Hlabisa town is underlain by the block faulted Karoo Supergroup rocks with large intrusive dolerite sills that juxtaposes the older Natal Group sandstone and the ancient Nseleni Gneiss complex”.

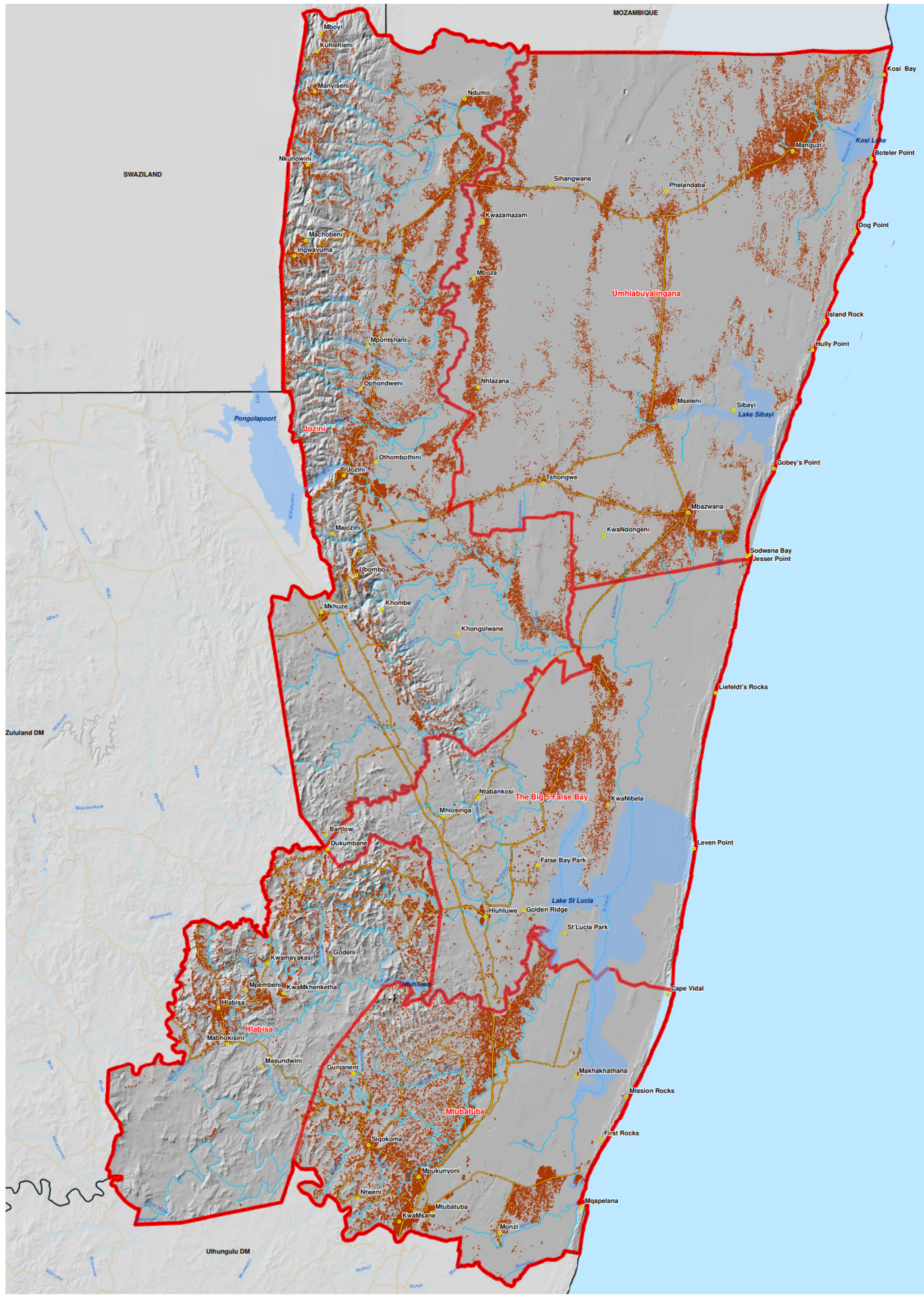


Figure 4: Topography Map (3D)

[2] UKDM EMF (2012) Geological, Geohydrological And Development Potential Zonation Influences; Environmental Management Framework For Umkhanyakude District, Kwazulu-Natal

2.3. Climate

The UKDM falls within the summer rainfall region. The region has a sub-tropical climate (**Figure 5**) with mild winters and very hot, humid summers. The coastal areas fall within the subtropical coast region, the northernmost area of the Makathini Flats falls within the subtropical Lowveld, and the Ubombo Mountains is part of the escarpment. Summer temperatures are usually around 30 degrees Celsius, with December to February rising to 40 degrees or over. Winters rarely see temperatures below 17 degrees Celsius. Rainfall occurs primarily between October and March, with highest rainfalls in January. Average rainfall ranges from 670mm- 950mm, however the area is prone to droughts once in seven years (visitelephantcoast.co.za)

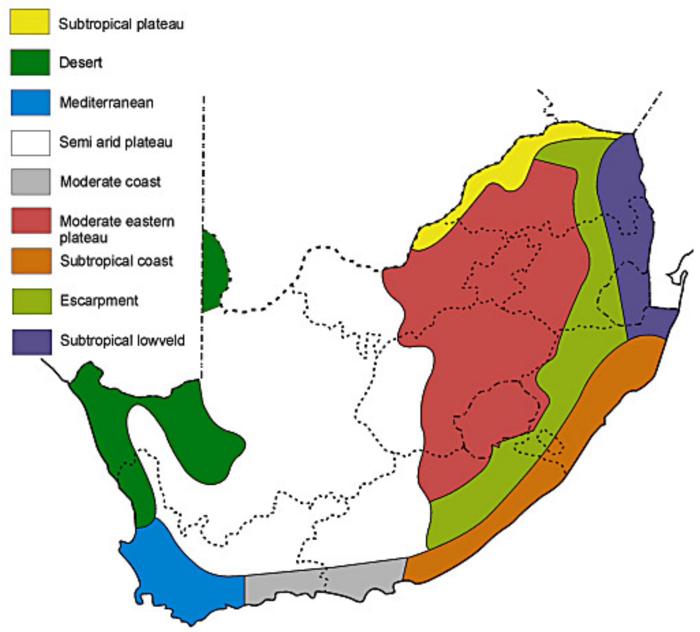


Figure 5: Climate Zones of South Africa (www.south-africa-tours-and-travel.com)

2.4. Environmental

The UKDM is known for is rich biodiversity, and scenic beauty. The UKDM area supports a wide diversity of faunal and floral species, due to its unique and widespread aquatic and wetland habitats; and the occurrence of both subtropical and temperate features due to the warm ocean currents offshore (EMF, 2012). The region has large tracts of conservation areas including private and state owned game reserves; and the Isimangaliso Wetland Park that stretches along the coast from Mapelane to Kosi Bay, incorporating Lake Sibaya, Sodwana Bay, Mkhuze Game Reserve, False Bay, Fanie's Island, Charters Creek, Lake St Lucia and Cape Vidal (IDP 2014/15).

The continued protection of the wealth of natural resources in the area is essential to sustain the associated environmental goods and services. The World Heritage Site, and each declared conservation area are to be managed according to their own integrated management plan. The areas that buffer and support these regulated conservation areas need to also be managed carefully so as not to negatively influence the biodiversity of the protected areas. A Strategic Environmental Management Plan has been adopted for the area, and a composite set of environmental management zones have been developed as per the National Environmental Management Act (Act No. 107 of 1998). From the composite map in **Figure 6**, it is clear that there is a significant portion of the UKDM that is environmentally sensitive, and needs to be managed properly. Considering the economic value of the associated ecosystem services, it is essential to the economy of the UKDM that the value is maintained.

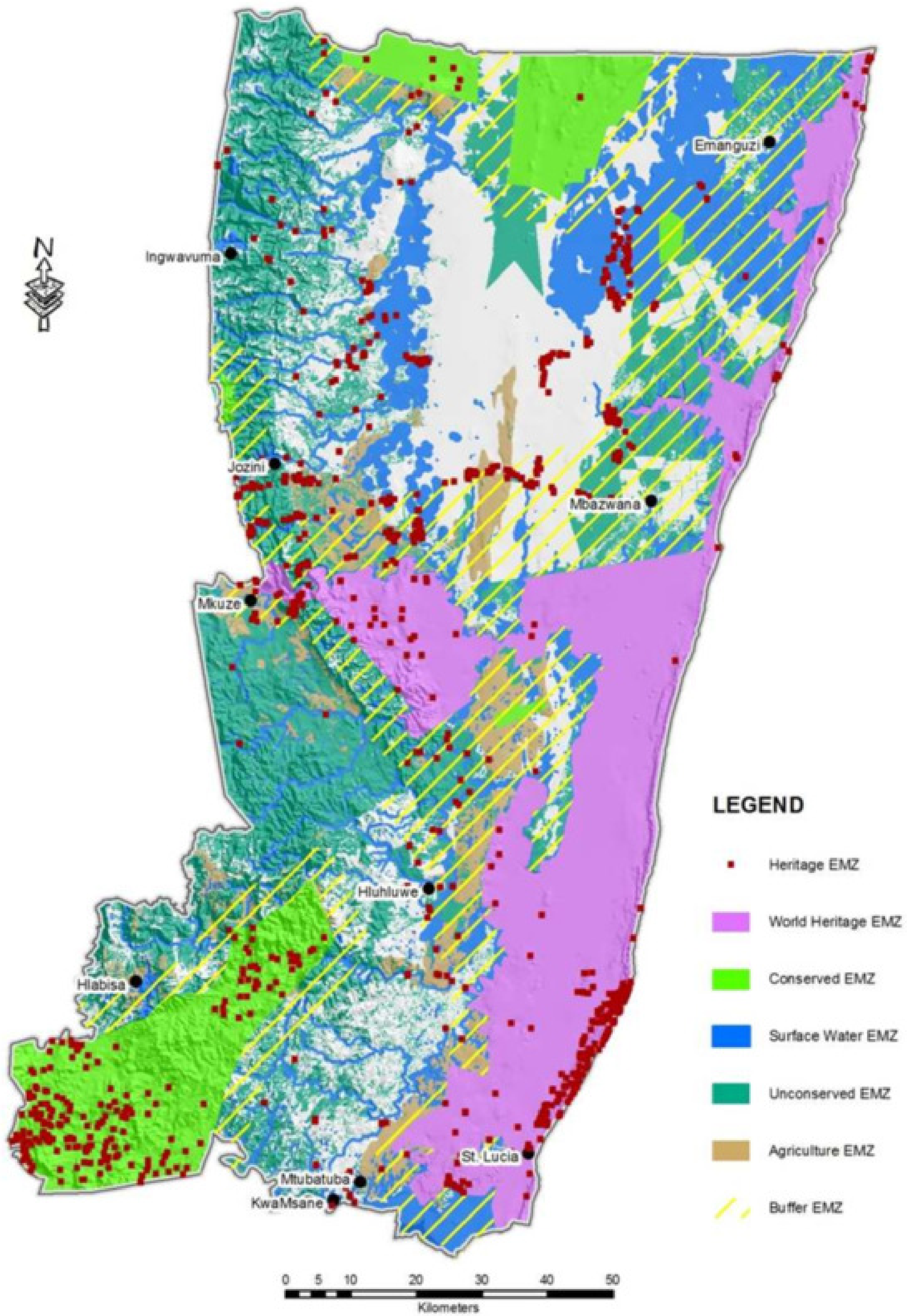


Figure 6: Composite Map of Environmental Management Zones (EMF, 2013)

3. DEMOGRAPHICS

Table 1: Census 2011 Statistics (www.stattsa.gov.za)

Population	625 846
% rural population	86,8%
% urban population	13,3%
Age Structure	
Population under 15	40.30%
Population 15 to 64	55.30%
Population over 65	4.50%
Dependency Ratio	
Per 100 (15-64)	81.00
Sex Ratio	
Males per 100 females	85.60
Population Growth	
Per annum	0.88%
Labour Market	
Unemployment rate (official)	42.80%
Youth unemployment rate (official) 15-34	51.20%
Education (aged 20 +)	
No schooling	25.30%
Higher education	4.90%
Matric	25.40%
Household Dynamics	
Households	128 195
Average household size	4.70
Female headed households	53.90%
Formal dwellings	71.70%
Housing owned	47.70%
Household Services	
Flush toilet connected to sewerage	9.90%
Weekly refuse removal	9.00%
Piped water inside dwelling	13.40%
Electricity for lighting	38.40%

3.1. Existing Population and Distribution

Table 1 is a summary of key demographic statistics.
The population of UKDM as at Census 2011 was 625 846. Over 86% of this population resides in rural areas.

The average household size is significantly larger than the rest of KZN, with 33% of households consisting of six or more people. The household size is similar across the district with the exception of Big 5 False Bay that has smaller household sizes. It is important to note that 53.9% of households are headed by females possibly due to large numbers of the male population seeking work outside of the UKDM.

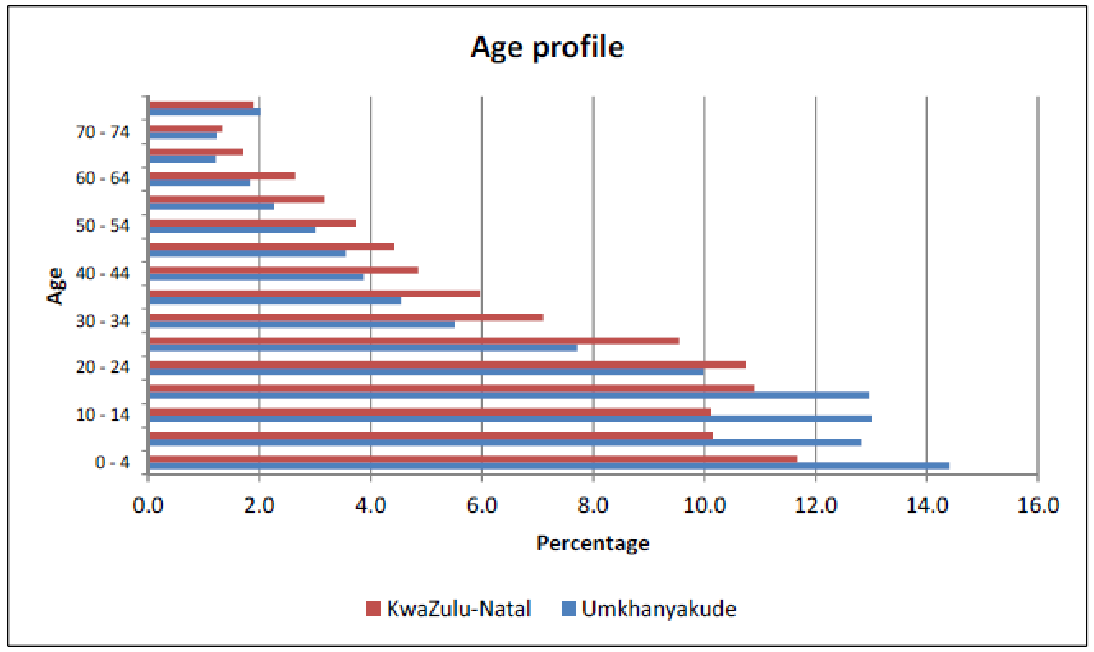
The age profile of the UKDM is dominated by its very youthful population, with 76% of the population under 35 (**Figure 7**). This is slightly higher than the provincial figure of 67%. However, the economically active age category from 20 to 65 is lower than the KZN average.

Land use is linked to tenure and the land with the highest agricultural potential is privately owned and predominately utilized for commercial farming, with low settlement densities. In contrast, the non-arable land and land with severe limitations to agriculture, fall into the tribal authority areas and are densely settled. Traditional land tenure is linked to the settlement pattern in the tribal authority areas where communities are not concentrated into "urbanised" centres. Instead, large rural populations are spread over the area in traditional family settlements.

There are 8 923 settlements or Community Planning Units the UKDM, of which 13 are classified as urban or towns with some urban characteristics; and 7 125 as scattered. The distribution of settlement types is shown in **Table 2**.

Table 2: Number of Community Planning Units per Settlement Type

Municipality	Urban	Rural High	Rural Medium	Rural Low	Scattered	Total
Hlabisa	1		20	242	509	772
Jozini	3	1	20	501	1928	2453
Mtubatuba	3	1	14	393	1059	1470
The Big 5 False Bay	1	1	2	205	519	728
Umhlabuyalingana	5	1	3	381	3110	3500
Total	13	4	59	1722	7125	8923



Data Source: Statistics SA, Census 2011

Figure 7: UKDM Age Profile

The settlement distribution can also be expressed in population figures. This shows that although 80% of the land is scattered rural (**Figure 8**), this represents only 9% of the population. Instead, 71% of the population resides in low density rural settlements, which cover 19% of the land (**Figure 9**).

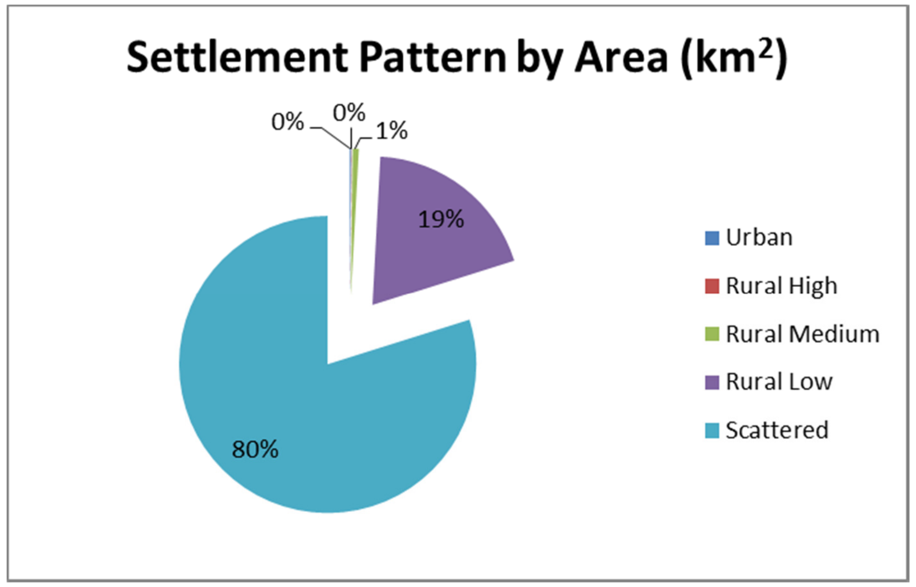


Figure 8: Settlement types by area

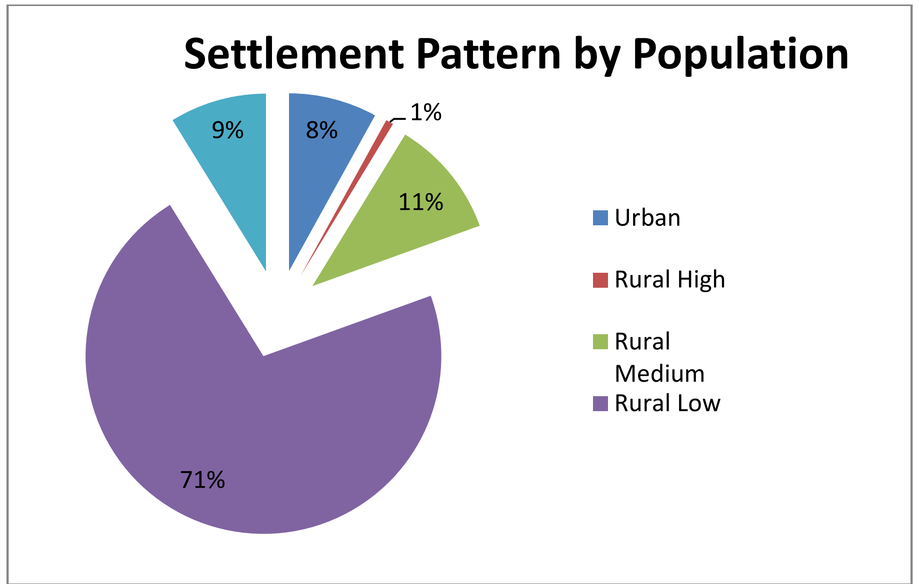


Figure 9: Settlement types by population

The distribution of types of settlement reveals that 92% of settlements fall into the non-urban category. The striking feature is the sparse distribution of the households with 82% of the settlements having population density of less than 500 people per square kilometre.

In terms of the size of these demographic clusters, the most are very small. **Table 4** indicates the size distribution of the demographic clusters and also the significantly different population distribution for settlement patterns among the local municipalities. Only 0.5% of the demographic clusters have populations in excess of 2000 while an overwhelming 97.0% of the clusters have less than 250 people.

Sparse and/or small settlement patterns impose high costs on service delivery, a factor that is exacerbated by the broken terrain and poor access roads. It also implies that many settlements lack adequate thresholds for economic development initiatives.

Table 3: Rural Demographics

Municipality	Population	Households
uMhlabuyalingana	151 579	32 417
Jozini	179 169	37 080
The Big 5 False Bay	31 848	9 979
Hlabisa	69 141	15 659
Mtubatuba	142 893	29 081
uMkhanyakude	574 629	124 216

Table 4: Settlement Sizes

Settlement size (pop)	uMhlabuyalingana	Jozini	The Big 5 False Bay	Hlabisa	Mtubatuba	uMkhanyakude	
						Total	%
0 - 250	3451	2352	719	713	1423	8658	97.0%
251- 500	21	42	1	31	25	120	1.3%
501 - 750	6	17	2	11	5	41	0.5%
751-1000	0	9	0	5	5	19	0.2%
1001-1500	6	15	0	2	5	28	0.3%
1501-2000	3	3	0	2	1	9	0.1%
2001-4000	8	8	4	7	1	28	0.3%
4001-6000	2	4	1	1	0	8	0.1%
6001+	3	3	1	0	5	12	0.1%
TOTALS	3500	2453	728	772	1470	8923	100.0%

Using the demographic data, population densities per municipal area are indicated in **Table 5** and are as follows:

Table 5: Population Density (Rural Population only)

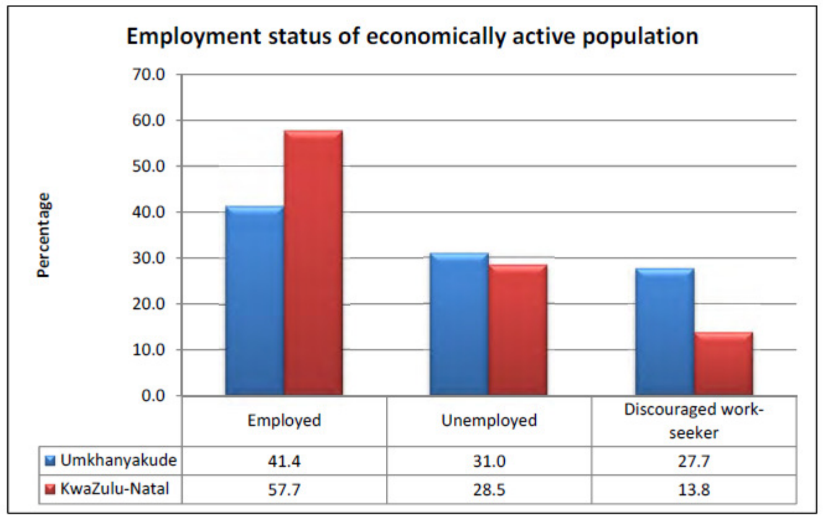
Local Municipality	Population	Area km²	Population / km²
Umhlabuyalingana	151579	3966.2	38.2
Jozini	179169	3443.3	52.0
The Big 5 False Bay	31848	2122.9	15.0
Hlabisa	69141	1555.4	44.5
Mtubatuba	142893	1738.6	82.2
Umkhanyakude	574,629	12826.4	44.8

In Mtubatuba, the concentration of people is much higher than the rest of the district at 82.2 people per square kilometre, which is double that of the average density for the district. The under-utilised areas are very sparsely populated. Generally the sparsely populated areas correspond to inaccessible areas with steep topographical conditions including a large number of rivers and valleys. The Big 5 False Bay municipality is by far the least densely populated at only 15 people per square kilometre, at a third of the average for the district.

3.2. Social and Economic Indicators

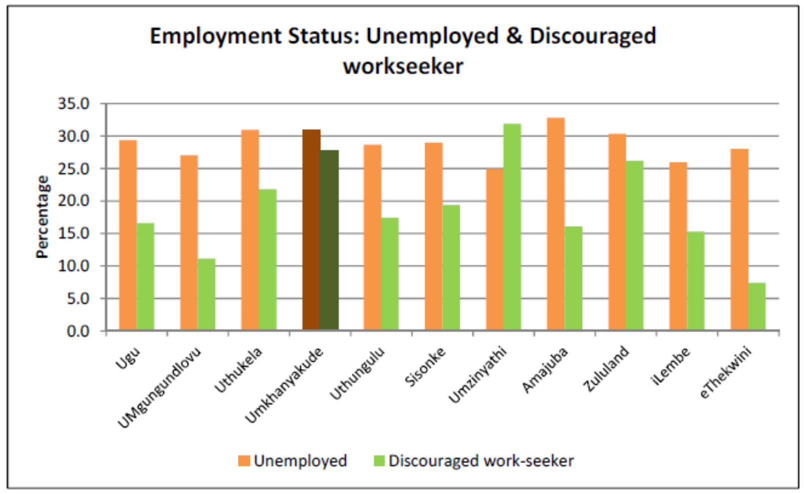
The unemployment rate **(Figure 10)** in UKDM (as per 2011 Census) is estimated at 31%, which is slightly lower than the provincial rate of 33%. Of concern is the very high proportion of the economically active population classified as discouraged work seekers (27.7%), a figure more than double the provincial average (**Figure 11**) of 13.8%. The age breakdown of the unemployed population in UKDM is very similar to the overall figures for KZN. As much as 35.2% of the unemployed population is younger than 25 years of age with a further 34.9% between 25 and 34 years. This implies that more than 70% of the unemployed population is younger than 35 years of age.

Also significant is that 30% of the unemployed population has completed their Grade 12 education. The implication of this is that completing secondary schooling has not provided much guarantee of finding employment, and tertiary education remains a key factor in entering the formal employment sector.



Data Source: Statistics SA, Census 2011

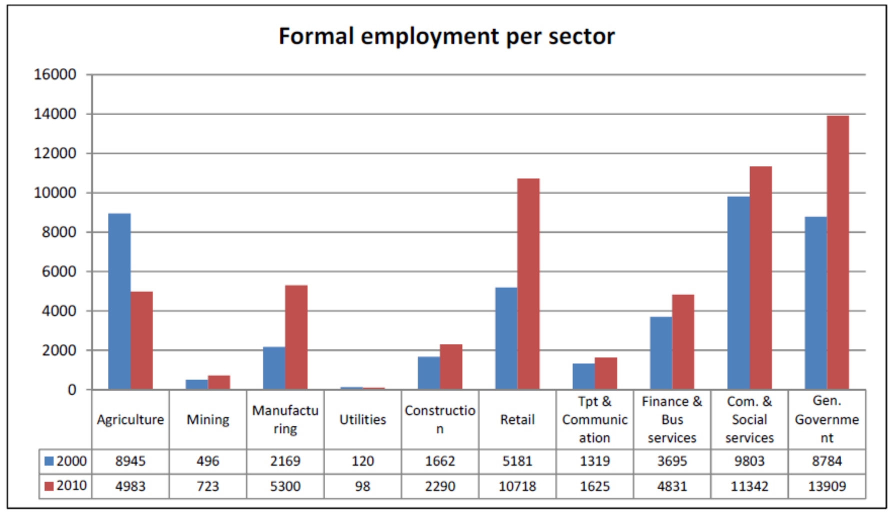
Figure 10: Percentage employed, unemployed, and discouraged



Data Source: Statistics SA, Census 2011

Figure 11: UKDM employment status within the KZN context

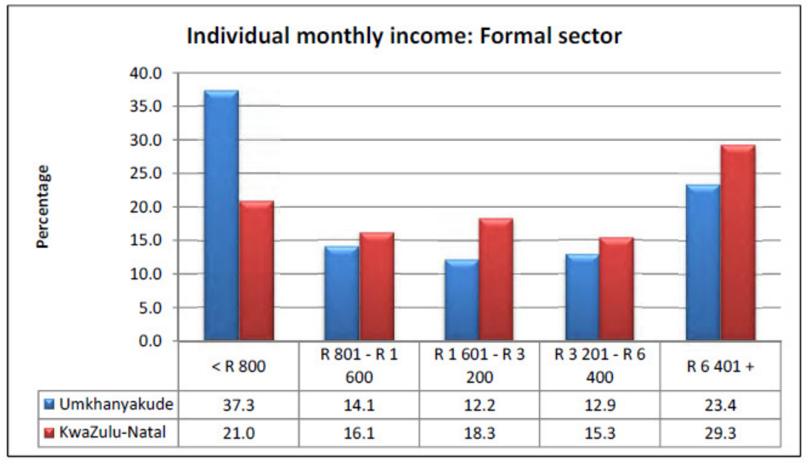
The formal sector (**Figure 12)** employs 71.8% of the employed population. Government, and community social and personal services are the main sources of formal employment in the UKDM. The retail, catering and accommodation sector more than doubled its employment opportunities between 2000 and 2011, as did those in the manufacturing sector. There is however, a substantial decrease in employment in the agricultural sector. Approximately 18% of those employed are in the informal sector, a notably higher percentage than the KZN average of 12.9%. The retail sector represents the largest informal employer. Employment in private households represents 9.3% of the employed population.



Data Source: Quantec, RSA Regional indicators (2011)

Figure 12: Formal employment per sector

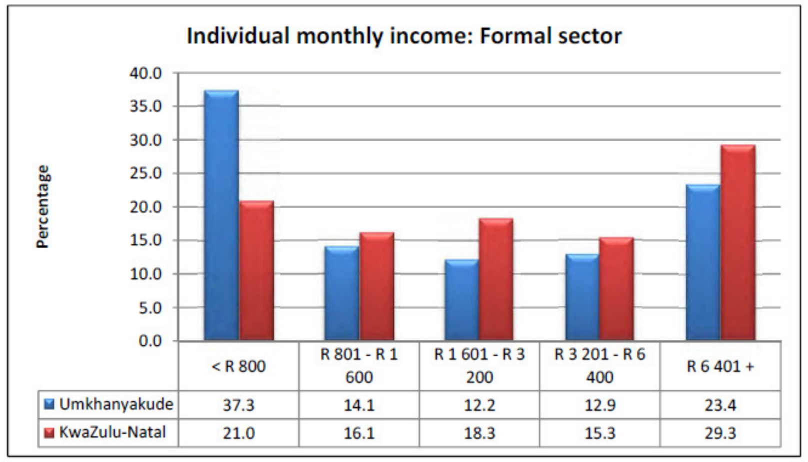
The individual monthly income of persons employed in UKDM varies between the formal (



Data Source: Statistics SA, Census 2011

), informal (**Figure 14**), and private household (**Figure 15**) sectors. Income levels are amongst the lowest in the province. The formal sector has 37.3% of individuals earning less than R800 per month at one end of the scale and 23.4% of people earning greater than R6400 per month. These extremes make up the majority of those in the formal sector. This contrasts with the informal sector where there is also a high percentage (39.4%) earning less than R800 per month, but thereafter there is a downward trend in the percentage of people earning higher incomes. The private household sector has 33% earning less than R800 per month (**Figure 17**), and a further 55% earning between R800 and R3200 per month.

Overall household income patterns **(Figure 16**) indicate that nearly 80% of households earn less than R38 200 per annum – significantly higher than the provincial figure of 68%. High income households make up only 5.5% in the UKDM compared to 11.9% in the province. Similar income patterns can be found across all five LMs. The internationally accepted threshold for what a household should pay for water and sanitation bill is a maximum of 5% of disposable household income. Considering the number of households that declare they have no income, and those that have an annual income of less than R38 200, affordability to pay is a significant issue for UKDM. For those 80%, a water and sanitation bill to the maximum of R100 per month may be affordable to some (R38 200 / 12 months * 5% = R159), but that is considering total income, not disposable income. In essence, with the tariff structure at the UKDM, these household would need to manage (or the DM control) their usage to only FBW, or for those with some ability to pay, limit use to 20kl/hh/month. Beyond that, it is likely the households would not be able to pay, and would fall into debt.



Data Source: Statistics SA, Census 2011

Figure 13: Individual monthly income in the formal sector

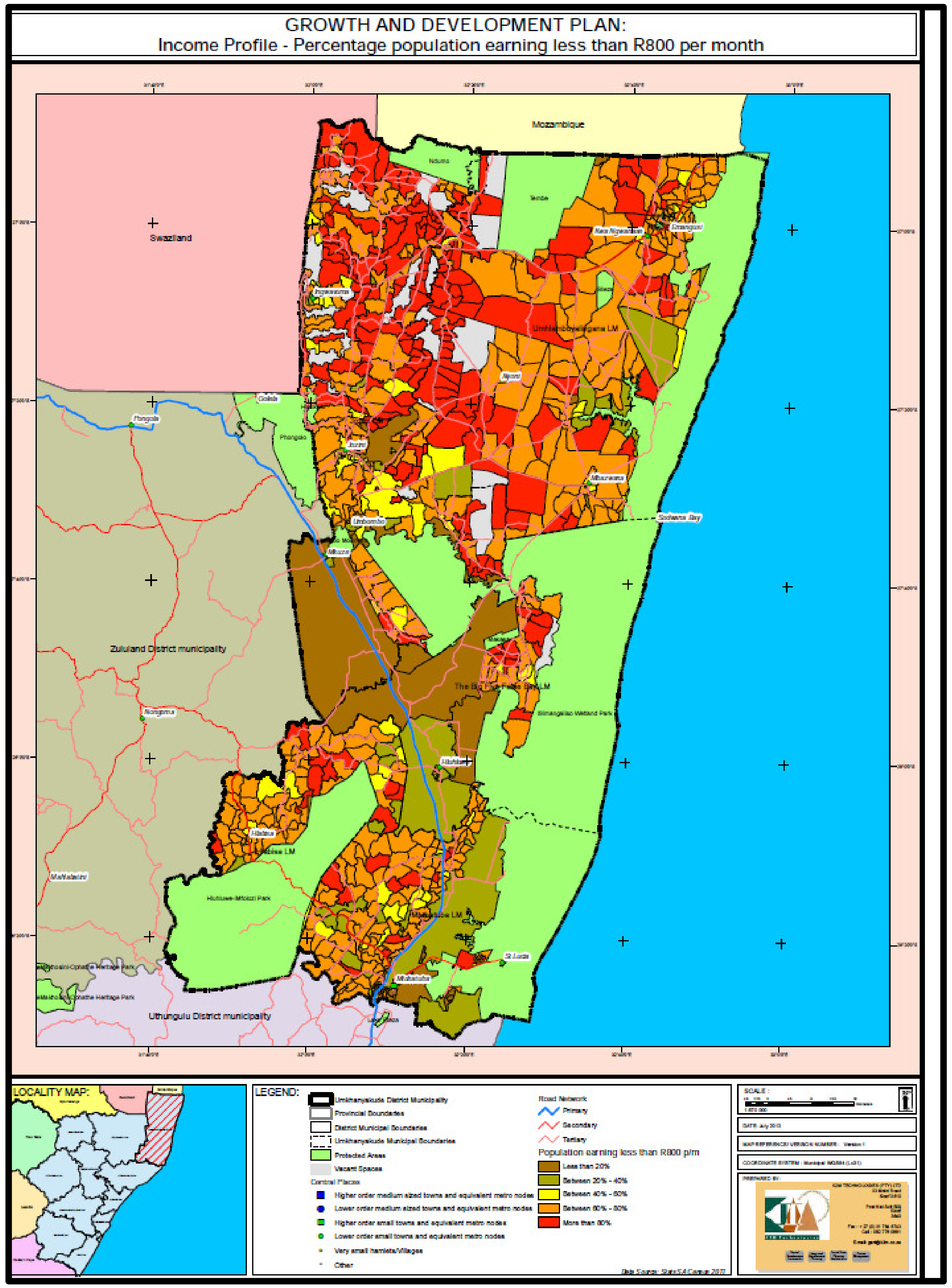
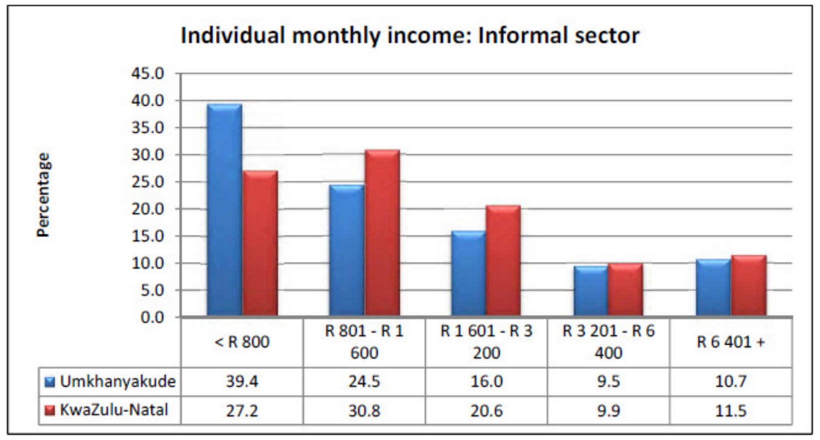
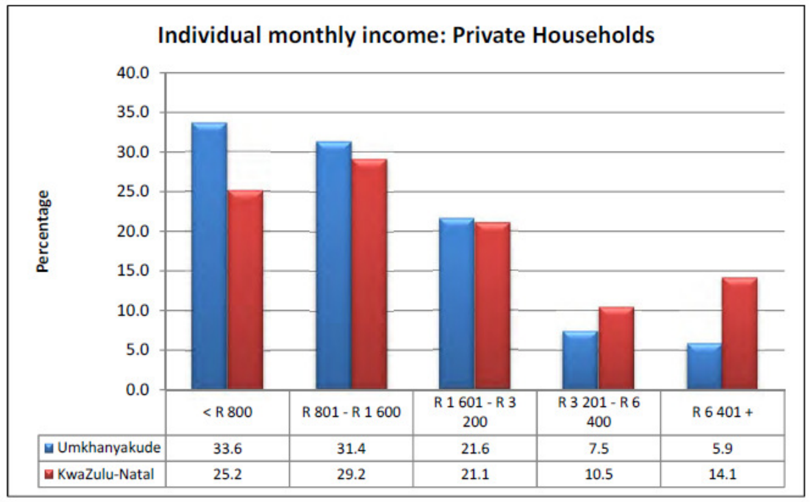


Figure 17: Income Profile – Percentage Population earning less than R800 per month



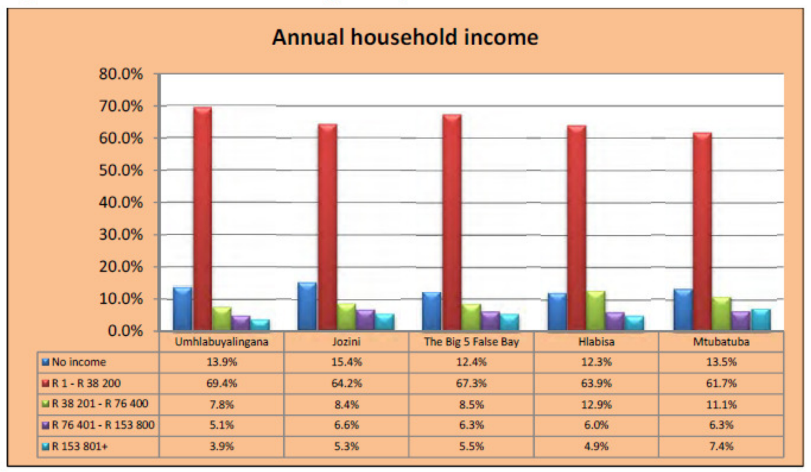
Data Source: Statistics SA, Census 2011

Figure 14: Individual monthly income in the informal sector



Data Source: Statistics SA, Census 2011

Figure 15: Individual monthly income from private household sector



Data Source: Statistics SA, Census 2011

Figure 16: Annual Household Income

3.3. Commercial, Industrial and Institutional Development[3]

The UKDM has a relatively small economic base, being only 5% of that of eThekwini Metropolitan municipality. However, the total size of the UKDM economy grew from R2.7 billion in 1995 to R7.1 billion in 2011 (**Figure 18**), **which is a strong growth of over 9% per annum – over double the growth rate of eThekwini over this period.**

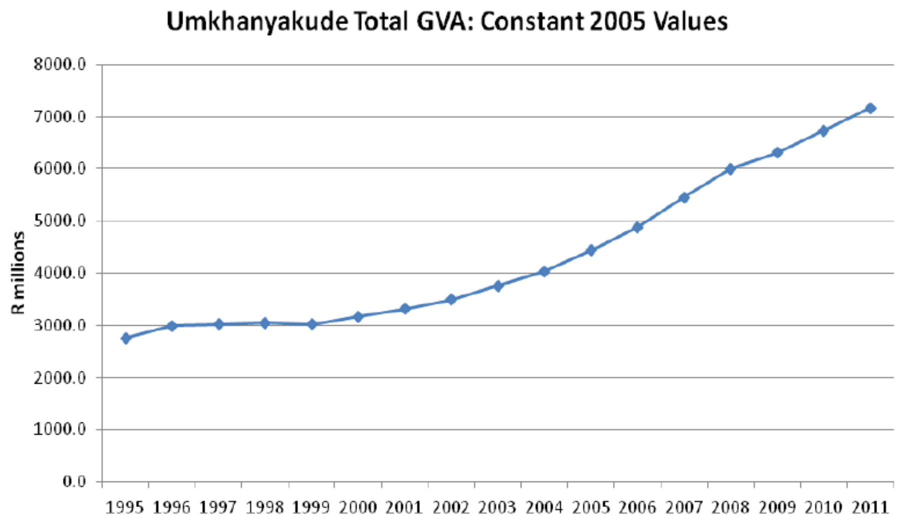


Figure 18: Growth of economy from 1995-2011

Lack of appropriate infrastructure to support economic development; land restitution; high levels of unemployment; and low education and skills levels are all challenges to a growing economy in the UKDM. In overall terms, the UKDM contributes to only 2.4% of the provincial economy.

The government sector is the largest contributor to the district economy. This is not viewed as a healthy situation, as it does not offer growth opportunity directly, and although it has resulted in a growth of commercial activity, it is still most common for many of the civil servants to reside elsewhere, and commute to work, so an increase in schools and social facilities does not occur.

Retail, catering and accommodation is the second largest contributor, due to the very significant tourism trade that emanates from the large conservation areas.

Manufacturing is also an important sector, but this is primarily due to the contribution of a sugar mill in Mtubatuba that has been around for over 100 years, and not due to a thriving manufacturing sector. The economy is still dependent on this, and a few other large, well-established manufacturers.

Agriculture is a critical sector in terms of food security from wide spread subsistence farming, but commercial farming is not a significant economic contributor, with only a narrow corridor of commercial farmland running alongside the N2.

[3] KZN PSEDS (2012) and UKDM GDP (2013)

The commercial sector has grown in recent years, with Jozini, Mbazwana, Manguzi and Mkuze all seeing growth in the number of businesses. This is primarily due to shopping centres being developed, and national chain stores entering these areas for the first time.

Mtubatuba is the oldest commercial town, and used to dominate this sector. However, despite the town being a prime industrial zone due to the Umfolozi Sugar Mill, Hluhluwe, Jozini, Mbaswana and KwaNgwanase are now also important commercial nodes.

According to the 2012 PSEDS: Profiling District Economic Drivers report, the following sectors have been identified as being the key economic drivers in the UKDM:

- Older more established companies with a sizeable number of employees and annual turnover in the uMkhanyakude context. These companies are located in the following sectors:
  - Agriculture: Farming relating to various agricultural commodities
  - Manufacturing: Processing of agricultural products
  - Tourism: Established large scale tourism facilities; and Many smaller tourism and accommodation facilities

The newer, smaller, perhaps more dynamic, companies having an impact include those in the following sectors:

- Services: Government
- Trade: Wholesale and retail; Tourism and hospitality

Considering the key drivers of the economy, it is important to contextualise these in relation to the planning of water services.

The manufacturing sector is well established, and primarily centred in Mtubatuba. These industries have water supply infrastructure, but of concern is surety of supply due to the significant water resource limitations in the area.

The significance of tourism in the area must not be underestimated. Problems with continuity of supply in the Mtubatuba and St Lucia areas are well known, and many establishments have had negative repercussions related to water quantity and quality, thus affecting trade. The game reserves have their own independent supplies.

3.4. Population Growth

The population for UKDM was 573 341 in 2001, (2001 Census, Statistics SA), this increased to 614 046 in 2007 (Statistics SA, Community Survey), and then to 625 846 in 2011 (2011 Census, Statistics SA). This represents an overall growth rate of 0.9% per annum (**Table 6).**

As at 2011, Jozini LM had the largest population, followed closely by Mtubatuba LM and uMhlabuyalingana LM. The most significant growth rate was experienced in Mtubatuba LM, with an average growth rate of 2%. Jozini showed the lowest growth rate at 0.1%.

Table 6: Population growth trends according to Statistics SA (2001-2011)

Municipality	Population			Households		
	2001	2007	2011	2001	2007	2011
uMhlabuyalingana	140 958	163 694	156 736	25 959	27 006	33 857
Jozini	184 052	207 250	186 502	33 534	38 530	38 849
The Big 5	31 291	34 991	35 258	33 534	6 657	7 998
Hlabisa*	176 890	150 557	71 925	6 183	29 260	12 586
Mtubatuba*	33 612	46 596	175 425	26 876	11 339	35 905
DMA	6 538	10 958	incorporated into LMs			
	573 341	614 046	625 846	126 086	112 792	129 195

*Note: Municipal boundary changes were implemented in 2011, with a significant proportion of land being reallocated from Hlabisa to Mtubatuba.

3.4.1. Growth Rates Used for future Population Estimates.

Table 7: Growth rates per LM

Growth Rates at LM	2001 - 2011	2009 - 2013 counts	Ave	2013-2015	2015-2020	2020-2025	2025-2030	2030-2035	2035 - 2040	2040 - 2045
Jozini	1.00%	4.13%	2.57%	1.5%	1.2%	1.1%	1.0%	0.9%	0.9%	0.8%
Hlabisa	0.40%	10.53%	5.47%	2.0%	1.5%	1.2%	1.0%	0.9%	0.8%	0.7%
Mtubatuba	2.00%	11.22%	6.61%	3.0%	2.5%	2.0%	1.8%	1.6%	1.5%	1.4%
The Big 5 False Bay	1.20%	19.23%	10.22%	3.5%	2.5%	1.5%	1.2%	1.1%	1.0%	0.9%
Umhlabuyalingana	1.00%	3.56%	2.28%	1.5%	1.2%	1.1%	1.0%	1.0%	1.0%	1.0%

Table 7 reflects the growth rates for the UKDM at a local municipality level. These were derived from the using the historic growth rates from Census 2001 to 2011 as well as household counts conducted on high resolution 2013 imagery.

The average growth resulting from the sets of information available was used as a starting point for the estimation of the future growth rates for the district.

4. WATER DEMANDS

4.1. Level of Service

To determine the municipality's water backlog two data sources have been used:-

1) Spatial Infrastructure Analysis

Scheme GIS coverages; utilising data from the UKDM asset register, and verified data from consultants; where the scheme/projects footprints are given a status of either served or unserved and calculating the associated status of the household falling within that footprint.

2) Status as per Census 2011 data

Table 8 reflects the primary source of water for all households within the UKDM, as per the Census 2011 database. The statistics that stand out are the large number of households that depend on "rivers and streams" for their source of water supply in the local municipalities of Jozini (29.8%), Hlabisa (40.4%) and Mtubatuba (21.2%).

Table 8: Sources of Water Supply (Census 2011

	Umhlabuyalingana	Jozini	The Big 5 False Bay	Hlabisa	Mtubatuba	Umkhanyakude
Regional/local water scheme	42.4%	38.1%	67.3%	22.1%	38.9%	39.2%
Borehole	28.8%	10.3%	7.8%	10.0%	7.7%	14.0%
Spring	1.5%	3.6%	1.3%	7.5%	1.9%	2.9%
Rain water tank	2.3%	1.7%	6.3%	1.7%	2.7%	2.4%
Dam/pool/stagnant water	2.7%	7.4%	5.7%	9.0%	13.3%	8.0%
River/stream	13.0%	29.8%	3.5%	40.4%	21.2%	22.9%
Water vendor	1.2%	1.2%	1.5%	1.0%	1.5%	1.3%
Water tanker	2.0%	3.1%	2.2%	3.0%	4.1%	3.0%
Other	5.8%	4.5%	3.7%	5.3%	8.4%	6.0%
Not applicable	0.1%	0.2%	0.8%	0.0%	0.2%	0.2%

Census 2011 also reports on the households receiving piped water. The pie graph illustrates that 46.6% of households report receiving water at the basic national standard or higher. 41% claim to have no access to piped water at all.

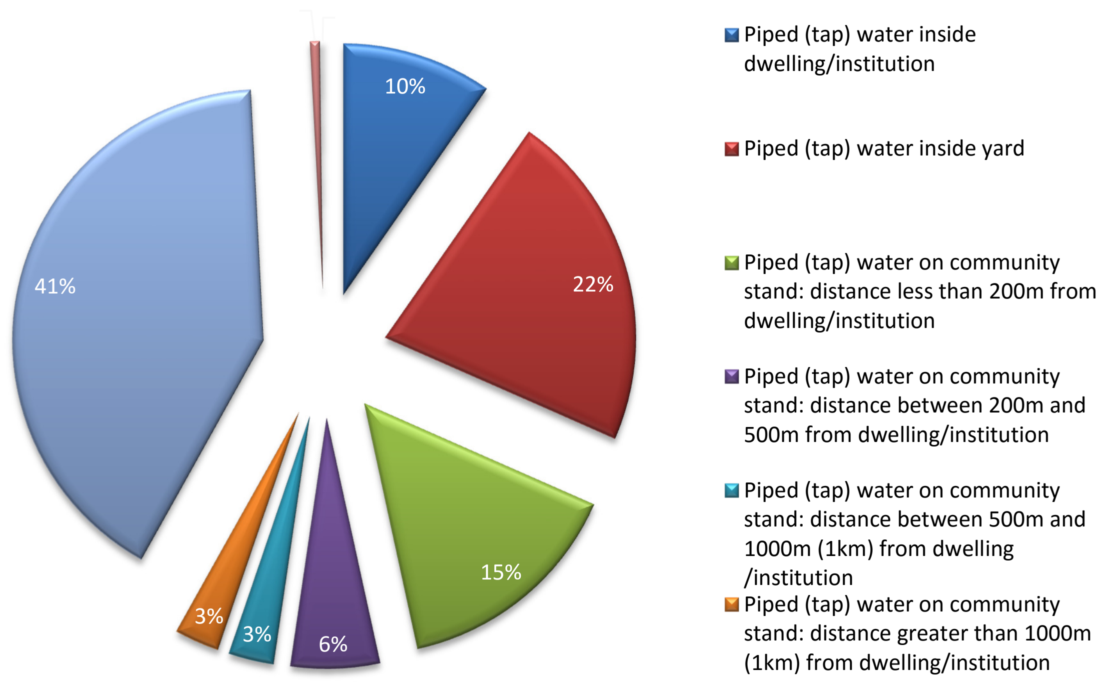


Figure 19: Households receiving piped water in UKDM (Census 2011)

Utilising these statistics, the percentage of the households served at the minimum level of service as per the Compulsory National Standards (Regulation 9 of Water Services Act of 1998), per LM are shown in **Figure 20** below.

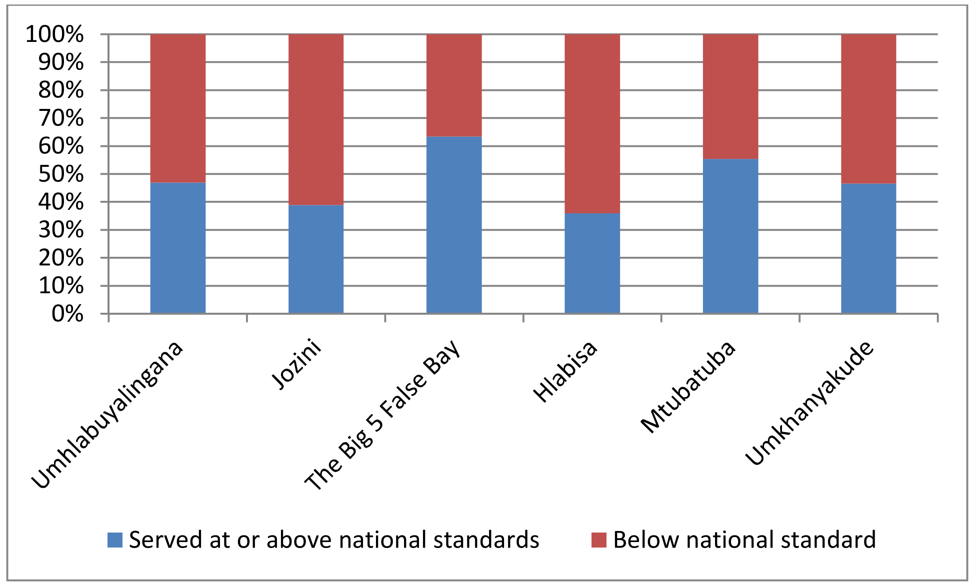


Figure 20: Households served with water above and below national minimum standards

Utilising these accepted levels of service as per settlement classification, the households have been separated into "at or above" and "below" the standard in order to represent the status as at 2011.

Figure 21 shows the results per local municipality using these statistics. Overall, 46.8% of the population receives water supply at or above the Compulsory National Standards. Overall, this is almost exactly the same as the percentage served to national standard although there are variations when the data is scrutinised at a settlement level.

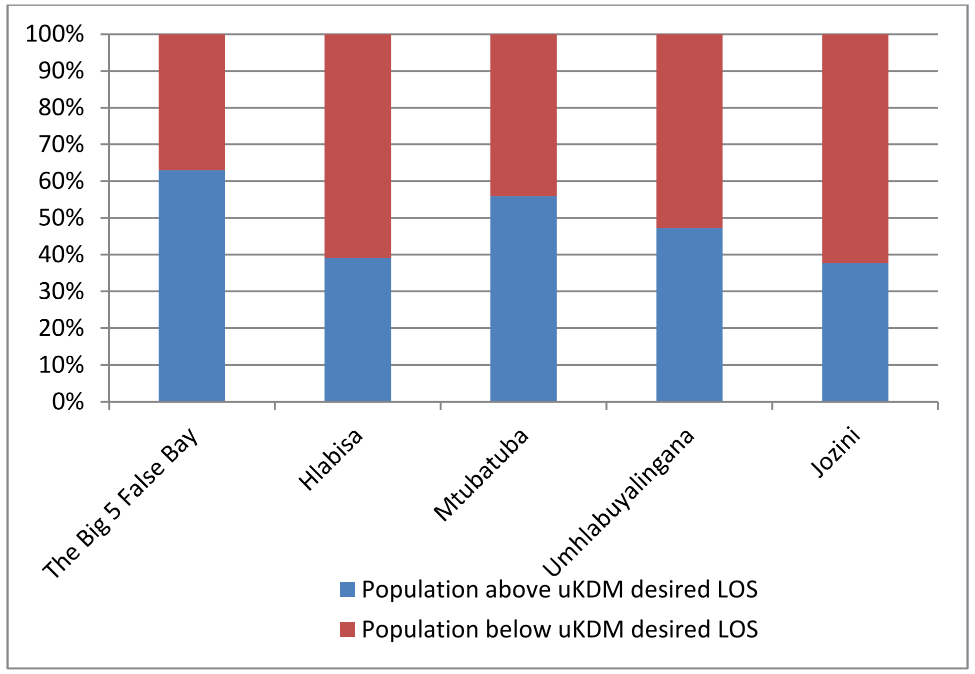


Figure 21: Population above and below UKDM accepted standard

Note: water service levels within town boundaries and private farmlands were all considered as served "at or above" the UKDM accepted standard.

4.1.1. <u>Level of service based on GIS data gathered</u>

As a part of the preparation for UKDM, available design data from consultants was obtained and verified. In addition, the asset register GIS database was obtained from PWC. These datasets were all combined, and then cleaned to produce the most comprehensive dataset of water supply infrastructure across the UKDM. These, combined with scheme footprints provided by the UKDM technical staff, were utilised to determine the served/unserved households across the district.

Table 9 and **Figure 22** show that there are significant differences in the datasets. However, combining the GIS datasets, should provide the most comprehensive coverage, and hopefully present the most accurate status as of 2015. This shows a significant improvement since the 2011 Census, with only 30% of the population still considered water services backlog. The data is also represented visually in the graph below.

Table 9: Comparison of data sets for the determination of population served and unserved in terms of level of water supply

Local Municipality	Percentage of the population with access BELOW National standard level of water service			
	Census 2011 Level of Water Services	Asset Register Infrastructure Data	Verified Consultants Infrastructure Data	Combined Infrastructure Data
uMhlabuyalinga na	52.7%	50.6%	60.2%	28.5%
Jozini	62.4%	67.4%	47.1%	42.3%
The Big 5 False Bay	37.0%	28.2%	32.5%	20.7%
Hlabisa	60.8%	48.7%	37.9%	36.4%
Mtubatuba	44.0%	50.3%	28.9%	17.6%
uMkhanyakude	53.2%	54.1%	43.3%	30.0%

Figure 22: Comparison of datasets to show the percentage of the population below national standard for water supply.

4.2. Water Conservation and Water Demand Management (WCWDM)

Non-revenue water is unacceptably high in the UKDM, with both real physical losses (due to poor O&M, ageing infrastructure and vandalism) and apparent losses (due to lack of metering, billing, and credit control). When compared to other water services institutions, the extent of the problem in UKDM is clear.

There are no pressure records, poor billing data, and no burst frequency records and as a result there is no baseline information, and no ability to measure improvements or worsening situation. The only water demand management initiative in the area is consumer metering to some of the residents in the towns and the use of water tariffs. There are extensive problems with the meters, meter reading and the billing process, and very little accurate usage information is available. The areas outside the towns have flat rate tariffs which do not encourage or reward the efficient use of the available water supplies. This is because of a lack of consumer metering for the outlying areas.

As per the strategy of national government, expressed in the National Water Resource Management Strategy 2 (2014), the development of new water resource infrastructure will not be approved by the Department of Water and Sanitation, if WCWDM measures are not first implemented. Considering (1) the considerable problem with water losses; and (2) the large scale plans for water resource infrastructure development, the need for WCWDM interventions needs to be prioritised.

JOAT undertook a Water Conservation Water Demand Management (WCWDM) 5-year strategic plan for the UKDM in 2014. There was very limited information for them to work with, but their key findings are outlined hereunder, and depicted in **Table 10**, and **Table 11**.

Table 10: Water balance indicators for UKDM (JOAT, 2014)

Key Performance Indicator	Result
Inefficiency of Use of Water Resources	35%
Total Water Losses	162 kl/service connection/year or 444 litres/service connection/day
Inefficiency of Use of Water Resources	3 583 kl/km/year
Current Annual Real Losses	338 litres/service connection/day 7 461 litres/km/day
Unavoidable Annual Real Losses	70 litres/service connection/day
Apparent Losses	107 litres/service connection/day
Non-Revenue Water by Volume	81%
Infrastructure Leakage Index (ILI)	5

If one converts these volumes to Rands, the losses for the 2012/13 financial year were as follows:

Table 11: Financial losses due to NRW in UKDM (JOAT, 2014)

Unbilled Authorised Consumption	R 23,592,391
Apparent Losses	R 7,178,441
Real Losses	R 22,731,730
Total Non-Revenue Water	R 53,502,562

The consolidated water balance for UKDM is shown in **Figure 23**. The level of confidence in data is not high, and there is a considerable allowance for error.

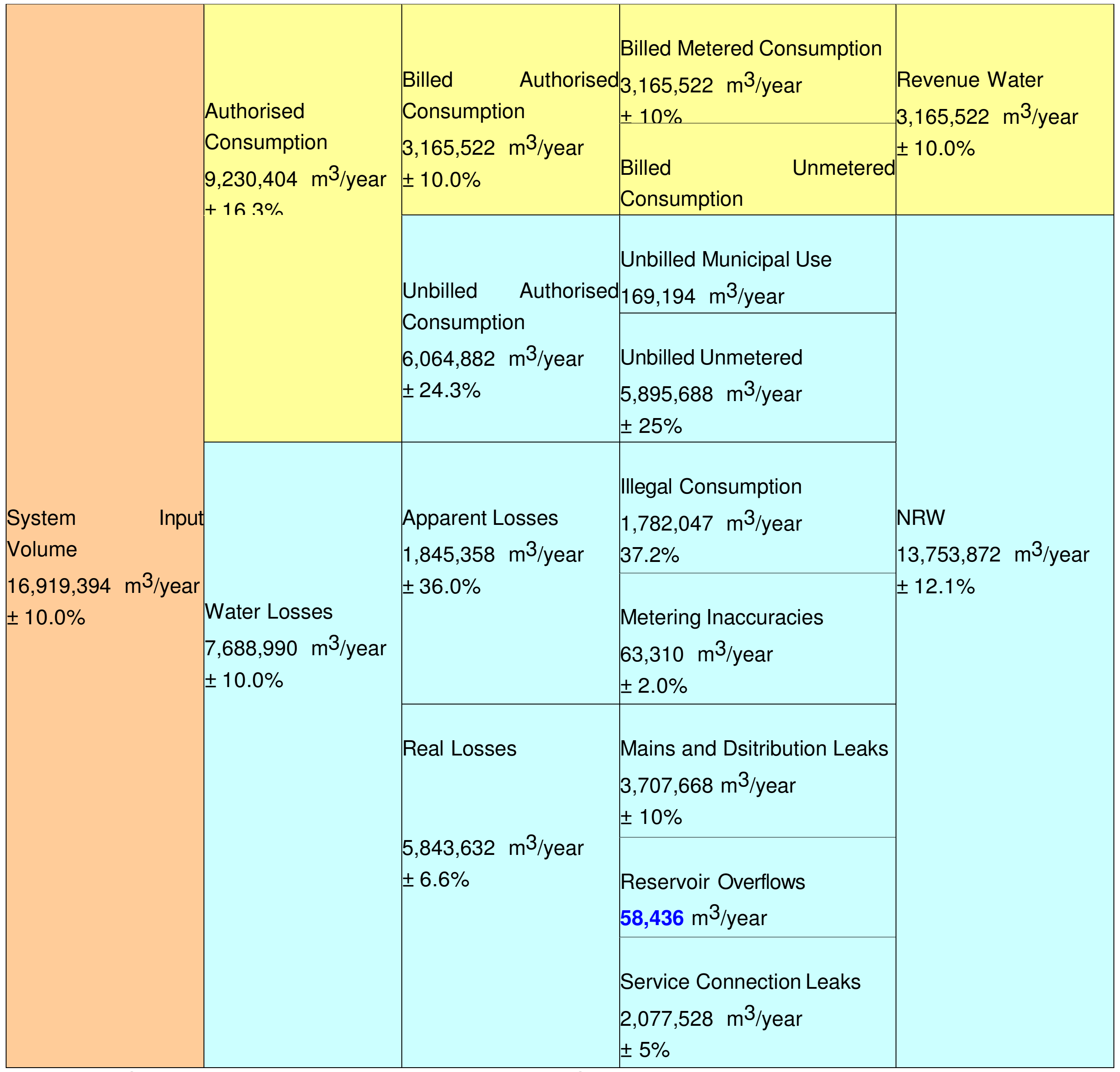


Figure 23: Consolidated water balance for UKDM (JOAT, 2014)

The 5-year strategic plan set KPIs for the DM to attain within five years, with Inefficiency of Use of Water Resources to reduce to 20.3%, and NRW by Volume to reduce to 59.7%. With these changes, the results would be:

- Decrease of System Input Volume by 14.5% over five years
- Reduction of Non-Revenue Water by 37.3% over five years
- Reduction in Unbilled Authorised Consumption by 19.7%
- Increase in Billed Authorised Consumption by 84.1%.

In order for this plan to be achievable, the UKDM has to recognise the importance of WCWDM, and ensure this is a major focus of the technicians, the financial staff, and the contracted service providers. In addition, funds must be put aside. The JOAT plan estimates approximately R80 million over the next 5 years is needed to meet the KPI targets, with a standard annual budget of R1 million for pressure management, and targeted leak detection. In addition, staff dedicated to WCWDM are required. Progress has been made in the latter, with WCWDM managers in the new proposed organogram for 2015/16. The technical priorities identified in the JOAT plan are:

- Investigate Top Consumers per Municipality --- ensure that meters are properly installed, registered in the Billing System and meter is read monthly.
- All unmetered connections must be metered and registered in the Billing Database as a matter of urgency.
- Appropriate metering, illegal connection and real loss reduction policies need to be developed and implemented.
- Water mains replacement has not been addressed in this study. Never the less this is an important part of any future program.
- The largest impact on WC/WDM is resolving the unregistered consumers in the billing database and implementing pressure management.
- An Infrastructure Information Office (CAD & GIS) must be set under the Technical Department. All Technical Data (drawings, plans, maps, etc.) should be captured as a matter of urgency.
- New design standards must be formalised and implemented (new pressure regimes, pipe material, etc.)
- Start an active leak detection program.
- Identify high burst area and high real loss to start a pressure management program.
- The recommendations as contained in this Master Plan for the roll---out of the WC/WDM interventions must be approved for implementation.

The DWS Reconciliation Strategies for some of the major schemes each contained a section on the WCWDM status and recommendations. These are summarised in **Table 12.**

Table 12: WCWDM indicators from the 2014 DWS Reconciliation Strategies for UKDM

Performance category	Measure	Shemula	Kwa-ngwanase	Mbazwana	Mseleni	Mtubatuba
Water resources performance indicator	Real losses/system input	29.20%	24.30%	30.20%	21.00%	52.60%
Operational performance indicator						
• Water losses total	Ml/d	2.98	1.35	1	0.48	8.75
• Apparent losses	Ml/d	0.75	0.32	0.28	0.18	2.11
• Real losses	Ml/d	2.22	1.03	0.73	0.3	6.64
Infrastructure Leakage Index (ILI)	Real losses/UARL	16	13	6.9	7.5	16
Financial performance indicators						
• Nonrevenue Water (NRW)	% of system input	40%	35%	44%	36%	70%

There were other areas that were included in the 2011 DWS Reconciliation Strategies for UKDM, but the reporting was not as detailed. The information from these is included here, as it is the latest available for the areas:

- The total 2008 system losses or NRW from the Jozini-Malobeni Water Supply Scheme were estimated at 2.36 Ml/d (0.86 million m^3/a), or 30%, based on the water use and operating practices.
- The total system losses or NRW in 2008 from the Mkuze Ubombo Water Supply Scheme area were estimated at 2.1 Ml/d (0.75 million m^3/a), or 66%, based on water use and operating practices. This estimate was based on the 2008 consumption figures. The high water losses are mainly due to the leakages at the service reservoirs. As the condition of the water infrastructure deteriorates due to a lack of proper maintenance, the water losses will continue to increase. It has been assumed that the losses will increase annually, reaching 69% of the raw water abstraction by 2030.
- The total 2008 system losses or NRW from the Hluhluwe Water Supply Scheme were estimated at 1.6 Ml/d (0.6 million m^3/a), or 38%, based on water use and operating practices.

4.3. Water Service Level Migration

The UKDM has adopted a desired level of service as per their District Growth and Development Plan. These were utilised to calculate the service level migration, and associated demands, over time.

Table 13: UKDM District Growth and Development Plan Target Level of Services

Indicator	Baseline Data		Proposed Targets		
			2020	2025	2030
% households with yard connections	21.9 (2001)	23.6 (2011)	35	42	50
% of households with access to 75l of water per person per day		TBD	100%	100%	100%
% WSA Blue Drop score	32.5 (2011)	77.8 (2012)			
Population density in identified development nodes (persons/ha)		15 (2011)	30	40	50
Grant income as a total % of municipal income	85.3 (2013)	90 (2014)	75%	70%	65%

Using **Table 13** as the ultimate target level of service(hence demand requirements), i.e. in the year 2030, ALL persons in the district must have access to 75l which is associated with RDP level of service and 50% of households to have a yard connection level of service.

The levels of service used as sourced from Census are:

- Piped (tap) water inside dwelling / institution
- Piped (tap) water inside yard
- Piped (tap) water on community stand: distance less than 200m from dwelling / institution(RDP)
- Piped (tap) water on community stand: distance between 200m and 500m from dwelling / institution
- Piped (tap) water on community stand: distance between 500m and 1000m (1km) from dwelling / institution
- No access to piped (tap) water
- Unspecified
- Not applicable

From the above list of levels of service, service levels a - to - c are currently considered as served to the national standard, with service levels d - to – h considered as below national standard /unserved and would constitute a backlog.

Furthermore, as per the Medium Term Strategic Framework(MTSF 2014-2019) that all households must be served to at least RDP level, i.e. service level C or above by 2019.

Using the two (2) service level targets stated above, migration of households to higher levels of service was done as follows:

- Current : The present levels of service were not amended:
- Year: 2020: All households that have a current level of service that is below RDP i.e below service level "c" were migrated to this level. 5% of households that fall in service level "c" was migrated service level b. Lastly 10% of households that fall in service level "b" were migrated to service level "a".
- Year: 2030 : 20% of households that currently have yard connections(service level "b") were migrated to house connections(service level "a"). As by this point in time, no household has a service level below RDP(service level "c"), households that have a service level as RDP level(service level "c") were migrated to yard connections(service level "b") such that 50% of the households in the district have yard connections, with the balance remaining in service level "c"

4.4. Water Demand Modelling

A zero base demand model based on Census demographics and levels of service (at smallest grouping) was adopted for the demand modelling. This was based on:

a) Using the Census Household size income levels and level of service (LoS) information at small area place level (smallest available demographic grouping) and by using;

b) New high quality 2013 imagery information to undertake a re-count and classify consumers into the following categories:
   - Urban
   - Rural
   - Commercial
   - Institutional
   - Tourism

   The 2009 household counts, 2011 Eskom and new 2013 set information was used to get an indication of household / community growth over time with inputs from the IDP and the provincial growth and development plan was used to adopt growth rates going forward.

   A sub-place area, which has a sub-place name attached to it, is broken down further into a small area place with only a small area code as identified, but perfect for spatial analysis. The sub-place names are used for map area / community identification.

   As indicated above each of these small area places provides the following information:

- The number of households and population within the small area footprint, which also includes / enables a heads / household count;
- All other demographics, such as income levels, age distribution, gender distribution etc.;
- Levels of service information, that is:
  - A number of households with **house connection**: water connection inside of dwelling;

- A number of households with **yard connections**: water connection (yard tap) inside the yard, not connected to the kitchen and ablution facilities;
- A number of households with **RDP supply** (shared service or standpipe at 200m walking distance);
- Various other levels of supply below RDP, where the standpipes are further than 200m walking distance; and
- A number of households with no formal supply.

By allocating or associating a specific demand to an individual (per capita) in each of these categories (**Table 14**) and then multiplying that unit demand with the number of people in each household, a current zero based demand has been developed.

Table 14: Demand Categories and Unit Demands

Category	Description of consumer category	Household Annual Income range	Per capita cons (l/c/d)		
			Min	Ave.	Max
1	Very High Income; villas, large detached house, large luxury flats	>R1 228 000	320	410	500
2	Upper middle income: detached houses, large flats	153 601 – 1 228 000	240	295	350
3	Average Middle Income: 2 - 3 bedroom houses or flats with 1 or 2 WC, kitchen, and one bathroom, shower	38 401 – 153 600	180	228	275
4	Low middle Income: Small houses or flats with WC, one kitchen, one bathroom	9 601– 38 400	120	170	220
5	Low income: flatlets, bedsits with kitchen & bathroom, informal household	1 - 9600	60	100	140
6	No income & informal supplies with yard connections		60	80	100
7	Informal with no formal connection (RDP supply)		30	50	70
8	Informal below 25 l/c/d (below RDP)		0	12	25

c) For commercial and Industrial, footprints for all roof structures that relate to floor space were digitized determine the number of equivalent demands for a 100m² gross floor area, and then applying the following demand to each point.

Commercial & dry industries = 400ℓ/day/100m² grass floor area

Various categories of unit water demands are used in the model. The basis of these unit demands are as indicated by DWS, Umgeni Water and as set out in UAP Phase 1.

For institutional sites (schools and hospitals) the demand was obtained from the number of pupils or beds at a unit demand as given by the Engineering guidelines. These facilities are located within a small place and its demand picked up at its exact location.

d) Agricultural demands were accounted for in the water source descriptions taken from the reconciliation study or the registered use, where such data was available.

e) Allowance was made for increasing demands associated with service level migration, which is for example from no service to RDP or yard connection, communal stand tap to yard connection or yard to house connections with its associated increase in unit consumptions.

f) Housing plans were obtained from the Department of Human Settlements and were evaluated against the potential LoS migration to house connections.

g) The demands for the various scenarios (low, average and maximum) were then calculated at a small-area level.

4.4.1. Demand Categories and Unit Demands

The demand table introduced above depicts the following:

Provides eight (8) categories or levels of service with associated minimum and maximum demands:

- The Census data provides the following demand categories:
  a. Piped (tap) water inside dwelling / institution
  b. Piped (tap) water inside yard
  c. Piped (tap) water on community stand: distance less than 200m from dwelling / institution
  d. Piped (tap) water on community stand: distance between 200m and 500m from dwelling / institution
  e. Piped (tap) water on community stand: distance between 500m and 1000m (1km) from dwelling / institution
  f. No access to piped (tap) water
  g. Unspecified
  h. Not applicable
- The categorisation is quite different while aligning as follows:
  - Piped water inside dwelling or institution relates to any of the first five (5) categories. The category 3 demand is used for critical LoS demand calculations.
  - Piped water inside yard: relates to category 6.
  - Piped water on community stand: distance less than 200m from dwelling / institution relates to category 7.
  - All lower levels: relate to either category 8 or is regarded as unserviced.

i. It associates a category of service with a specific household income, which does not necessarily reflect a level of affordability.

ii. These unit demands are annual average daily demands per capita (individual) and do not provide for any water losses.

4.4.2. Water Loss, Design and Peak Factors

4.4.2.1. Water Loss Factors

Although it is known that in 2014 the water losses were determined to be in the order of 45% and a total non-revenue water-NRW of 81% (JOAT, 2014), the schemes and infrastructure evaluations cannot be designed for these high losses and the following general norms subsequently adopted:

- Water Treatment Losses - 10%
- Water Distribution Losses -15% (with 50% reflected as a current high scenario in some instances for indicative purposes)

4.4.2.2. Peak Factors

The summer peak factor was associated with a specific level of service and the factors in **Table 15** that are in line with DWS design guidelines, were adopted.

Table 15: Summer Peak Factors

Category	Census Water Supply Categories	Per capita cons (l/c/d)			Dist. W. Loss	SPF
		Min	Ave	High		
1	Piped (tap) water inside dwelling/institution	180	228	275	15%	1.5
2	Piped (tap) water inside yard	60	80	100	15%	1.2
3	Piped (tap) water on community stand: distance less than 200m from dwelling/institution	30	50	70	15%	1.1
4	Piped (tap) water on community stand: distance between 200m and 500m from dwelling/institution	5	20	40	15%	1.1
5	Piped (tap) water on community stand: distance between 500m and 1000m (1km) from dwelling /institution	3.75	16	32.5	15%	1.1
6	Piped (tap) water on community stand: distance greater than 1000m (1km) from dwelling/institution	2.5	12	25	15%	1.1
7	No access to piped (tap) water	2.5	5	10	15%	1.1
8	Unspecified					

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For instantaneous peak demands or feed directly into a network, a 4.5 peak was adopted.

4.4.3. Design Norms

The design principal followed with the high order infrastructure review and scoping of new infrastructure needs to assume the following principals:

- 1,1 multiplied (10% allowance for treatment losses) with the summer peak demand abstracted
- Although the WTW would be able to hydraulically accept the 1,1 x SPD flow it is nominally sized for the SPD
- A high lift pump (referred to as a clear water pump in the diagram below) and rising or gravity main to accommodate the SPD flow
- Not shown, but the reservoir needs to have 48 hour AADD storage and provision for fire flow, although the latter was not provided for at this high level assessment and should be looked at in the preliminary or detail design stages

4.5. Reliability of Demand Modelling

Although the demand model is based on the official Census data and agreed unit demands, it is not a stochastic model involving random demographic and unit demand sampling and probability behaviour. It also does not allow for level of confidence or degree of accuracy calculations of the Census data, growth rates, nor of the unit demand values adopted.

4.6. Demand Figure

The demands (kl/day) generated from the demand model have been areas per the following demand table for each of the supply areas corresponding to the supply areas reflected in **Figure 27**.

	Sum of HH2015	Sum of HH2025	Sum of HH2035	Sum of Cur AADD(Rest LOS) Ave	Sum of Future AADD LOS 2025 Ave	Sum of Future AADD Trans 2035 Ave	Sum of Cur AADD (Rest LOS) Max	Sum of Future AADD LOS 2025 Max	Sum of Future AADD Trans 2035 Max	Sum of CurLOSSP DAverage	Sum of Future SPF LOS 2025 Ave	Sum of Future SPF LOS 2035 Ave	Sum of CurLOSSP DMax	Sum of Future SPF LOS 2025 Max	Sum of Future SPF LOS 2035 Max
Conservation	**413**	**472**	**519**	**137**	**184**	**210**	**162**	**219**	**250**	**200**	**403**	**311**	**239**	**489**	**374**
Conservation-UAP	413	472	519	137	184	210	162	219	250	200	403	311	239	489	374
Farm Land	**3 428**	**4 155**	**4 816**	**1 034**	**1 563**	**1 894**	**1 276**	**1 926**	**2 320**	**1 577**	**3 501**	**2 915**	**1 944**	**4 293**	**3 570**
Conservation-UAP	332	398	459	96	118	134	112	138	157	147	462	207	173	554	245
Farm Land-UAP	1 342	1 566	1 765	378	483	550	455	582	661	611	1 598	886	739	1 937	1 068
Kula Village-UAP	1 754	2 191	2 593	561	962	1 210	709	1 206	1 502	819	1 442	1 822	1 032	1 801	2 257
Hlabisa	**12 020**	**13 744**	**15 107**	**2 607**	**6 053**	**6 838**	**3 404**	**7 894**	**8 857**	**3 733**	**7 261**	**9 493**	**4 853**	**9 390**	**12 252**
Hlabisa-UAP	12 020	13 744	15 107	2 607	6 053	6 838	3 404	7 894	8 857	3 733	7 261	9 493	4 853	9 390	12 252
Hluhluwe	**28 495**	**34 821**	**39 956**	**10 965**	**19 102**	**23 466**	**14 125**	**24 138**	**29 397**	**16 015**	**25 165**	**34 662**	**20 514**	**31 533**	**43 290**
Hluhluwe Phase 1-UAP	4 058	4 640	5 100	2 127	3 240	3 739	2 628	4 022	4 625	3 264	4 170	5 758	4 025	5 153	7 104
Hluhluwe Phase 2-UAP	7 470	9 331	11 044	3 724	6 306	8 224	4 652	7 815	10 172	5 325	7 902	12 405	6 648	9 769	15 317
Hluhluwe Phase 3-UAP	7 807	9 516	10 668	2 876	4 953	6 079	4 010	6 420	7 706	4 083	5 561	8 715	5 618	7 145	11 007
Hluhluwe Phase 4A-UAP	2 670	3 336	3 948	230	1 199	1 411	352	1 632	1 908	307	1 299	1 828	467	1 762	2 470
Hluhluwe Phase 4B-UAP	2 915	3 642	4 310	682	1 615	1 965	898	2 109	2 540	968	1 896	2 736	1 267	2 461	3 524
Hluhluwe Town-UAP	1 099	1 340	1 502	786	1 015	1 139	918	1 192	1 336	1 218	1 990	1 764	1 440	2 369	2 092
Hluhluwe-UAP	2 476	3 017	3 383	540	774	909	666	948	1 110	852	2 347	1 457	1 048	2 874	1 777
Jozini	**34 317**	**38 474**	**42 372**	**9 589**	**17 081**	**19 999**	**12 220**	**21 648**	**25 112**	**13 182**	**22 906**	**28 125**	**16 836**	**28 898**	**35 322**
Jozini-UAP	2 886	3 235	3 556	1 079	1 553	1 786	1 293	1 880	2 151	1 508	2 657	2 562	1 826	3 232	3 108
Malobeni-UAP	8 023	8 995	9 895	1 655	3 643	4 163	2 162	4 728	5 355	2 249	4 460	5 681	2 943	5 760	7 300
Mbaswana-UAP	5 628	6 310	6 970	2 632	3 959	4 807	3 280	4 906	5 929	3 717	4 981	7 174	4 636	6 162	8 843
Mhlekazi-UAP	1 691	1 895	2 083	249	697	771	337	922	1 016	365	844	1 049	489	1 112	1 376
Mjindi-UAP	2 718	3 047	3 361	680	1 106	1 343	943	1 445	1 715	910	1 402	1 858	1 256	1 824	2 368
Mkuze-UAP	2 801	3 141	3 452	1 027	1 502	1 672	1 199	1 801	1 996	1 412	2 682	2 299	1 676	3 249	2 775
Mseleni-UAP	4 700	5 270	5 821	1 249	2 238	2 653	1 572	2 811	3 308	1 714	3 108	3 789	2 163	3 903	4 726
Nondabuya-UAP	2 722	3 052	3 354	490	1 077	1 280	696	1 429	1 661	610	1 229	1 665	875	1 628	2 165
Othobotini-UAP	3 148	3 530	3 880	528	1 306	1 523	738	1 726	1 981	697	1 542	2 048	973	2 028	2 660
Mpukunyoni	**10 937**	**13 662**	**16 170**	**2 592**	**6 053**	**7 413**	**3 479**	**7 924**	**9 582**	**3 657**	**7 018**	**10 298**	**4 874**	**9 129**	**13 262**
Mpukanyoni 1-UAP	6 551	8 183	9 686	1 378	3 550	4 288	1 856	4 670	5 583	2 000	4 141	5 970	2 667	5 410	7 736
Mpukanyoni 3-UAP	2 420	3 023	3 578	611	1 327	1 668	823	1 721	2 127	805	1 526	2 268	1 087	1 972	2 892
Mpukanyoni 2-UAP	1 966	2 456	2 907	603	1 176	1 458	799	1 533	1 872	851	1 350	2 060	1 120	1 747	2 634
Mtubatuba	**13 927**	**17 398**	**20 592**	**7 048**	**10 559**	**12 599**	**8 501**	**12 843**	**15 293**	**11 078**	**18 744**	**19 571**	**13 414**	**22 798**	**23 807**
Dukuduku-UAP	3 168	3 957	4 684	614	1 606	1 893	793	2 095	2 458	926	2 082	2 667	1 188	2 694	3 445
Honeydale-UAP	614	767	908	284	376	435	343	455	526	481	934	740	582	1 132	895
Kwamsane-UAP	7 082	8 846	10 470	3 603	5 318	6 445	4 437	6 536	7 910	5 832	9 355	10 387	7 156	11 451	12 713
Mozi-UAP	434	542	642	134	180	218	154	209	252	192	554	318	225	663	373
Mtuba Town-UAP	2 042	2 551	3 019	2 050	2 604	3 056	2 342	2 982	3 491	3 053	4 741	4 556	3 554	5 564	5 302
Uitkytoring-UAP	156	195	231	51	73	87	63	90	107	86	199	143	105	243	175
CapeVidal-UAP	432	539	638	312	402	466	369	476	551	509	879	759	606	1 051	904
Shemula	**37 764**	**42 339**	**46 662**	**7 961**	**15 690**	**18 255**	**10 413**	**20 232**	**23 252**	**10 629**	**20 364**	**24 847**	**13 942**	**26 210**	**31 665**
Conservation-UAP	69	77	85	14	19	22	17	22	26	19	56	32	23	67	38
Enkanyezini-UAP	1 712	1 920	2 120	311	690	797	399	891	1 021	428	922	1 111	549	1 187	1 421
Ingwavuma-UAP	4 596	5 153	5 664	848	1 897	2 142	1 080	2 437	2 730	1 100	2 455	2 806	1 416	3 153	3 592
Manguzi-UAP	2 743	3 076	3 398	762	1 342	1 528	885	1 628	1 846	947	1 868	1 984	1 120	2 294	2 424
Manyiseni-UAP	3 549	3 979	4 374	292	1 257	1 390	420	1 693	1 861	353	1 447	1 753	517	1 951	2 357
Mshudu-UAP	2 277	2 553	2 820	287	843	945	378	1 110	1 238	388	1 079	1 261	512	1 418	1 652
Ndumo-UAP	3 897	4 369	4 803	1 033	1 796	2 115	1 371	2 317	2 686	1 417	2 279	2 949	1 877	2 922	3 739
Phelandaba North-UAP	1 937	2 171	2 399	202	636	731	290	849	963	259	802	953	375	1 071	1 257
Phelandaba South-UAP	1 119	1 254	1 386	91	343	384	125	456	507	108	439	484	151	587	642
Thengane-UAP	4 231	4 744	5 240	408	1 328	1 476	551	1 769	1 958	553	1 792	1 945	747	2 385	2 577
Embonisweni 1-UAP	9 047	10 143	11 183	2 953	4 326	5 254	3 897	5 519	6 576	4 035	5 625	7 486	5 310	7 146	9 363
Embonisweni 2-UAP	1 627	1 824	2 005	512	812	976	658	1 021	1 214	701	1 099	1 406	900	1 380	1 748
Embonisweni 3-UAP	959	1 075	1 188	246	402	496	342	521	626	320	502	677	445	648	855
Grand Total	**141 301**	**165 065**	**186 196**	**41 933**	**76 285**	**90 673**	**53 580**	**96 824**	**114 063**	**60 071**	**105 363**	**130 222**	**76 617**	**132 741**	**163 542**

5. Water Resources and Availability

Figure 24: Catchments in the UKDM area

The UKDM falls within the Mfolozi/Pongola Primary Catchment, containing the Pongla, SIbaya, Mkuze/Hluhluwe, and the Mfolozi catchments (Figure 24. The area has a wide diversity of aquatic and wetland habitats, and supports many faunal and floral species, due to the area having both subtropical and temperate features, and mountainous and flat areas.

5.1. The Pongola River Catchment

The Pongola River is very important from an environmental flow requirements perspective because of the floodplains downstream of the Pongolapoort (Jozini) dam. The water quality in the Pongolapoort Dam catchment is good. The quality of the resource along the lower reaches of the Pongola River upstream of the Pongolapoort Dam is, however, significantly affected during periods of low flow through saline and nutrient enriched return flows from the large irrigation areas.

The gross available water from the Pongola catchment is estimated at 818 million m^3/annum. The Ecological Reserve has been calculated as 172 million m^3/a, and this volume is therefore not available for allocation. The estimate of the impact of alien invasive plants in the catchment is noted as 30 million m^3/a. However, groundwater and return flows from agriculture add another estimated 29 million m^3/a (DWAF, 2004). In addition, the dam releases water to maintain the Makhatini floodplains reducing the available yield by approximately 250 million m^3/a. The Ecological Reserve, and Flood Releases are calculated independently at present, although there is most likely overlap between the two. Besides meeting the water requirements of South Africa, the Pongola River catchment is part of an international shared watercourse and some of the water released from the Pongolapoort Dam is also required to meet the international obligations in accordance with the Interim Inco-Maputo Agreement (IIMA). Presently the water requirement of 66 million m^3/a for the Maputo River, is met from the constant low flow and ecological releases for the floodplains. The agreement also allows for an additional allocation of 87 million m^3/a for Maputo in the future. This does not have to be met by the Pongola River. The MAR into the Pongolapoort Dam is estimated to be 1 293 million m^3/a (DWA, 2004) while the historical firm yield of the dam, which has a storage capacity of 2 445 million m3, is estimated at 530 million m3/a. Assessment of the safety of the Pongolapoort Dam by the Dam Safety Office after the 2004 floods indicated that the spillway capacity was not sufficient, and therefore the recommendations are to operate the dam at 80% of its storage capacity. This has an impact on the reduction in yield of 49 million m^3/a, reducing the yield to 481 million m^3/a.

The dam level as from October 2014 until February 2016 has steadily decreased, with the level in February 2016 being 47%, compared to the same time the previous year being 62%. It should be noted, that flood releases cannot be done if the dam level drops below 60%, as the required m^3/s cannot be attained.

The registered water users upstream of the dam in the Pongola River system are important as impact the quantity and quality of water entering the dam. Water use is irrigation agriculture which is mainly the Impala Irrigation Scheme which has a scheduled quota of over 160 million m^3/a. The rest of the irrigated agriculture is diffuse irrigation from run-of-river abstraction. Commercial forestry is also significant. There are also transfers out of the catchment from the dam of 32.6 million m3/annum to the Mkuze River, registered to Charl Senekal, and 5 million m3/annum to Swaziland. The total registered use has increased more than 50 million m^3/a since 2008 when the DWS Reconciliation Strategies were first undertaken. The total registration for the W41, 42 and 44 sub-catchments, including extraction from the dam is 337.3 million m^3/a.

As per the DWS WARMS database (December 2015), the total registered use downstream of the Pongolapoort Dam is 83.27 million m^3/a, and increase of nearly 10 million m^3/a since 2008 (see **Table 16**.and **Table 17**). The major water users (within SA borders) are irrigation agriculture, which has a registered water use of 69.33 million m^3/a. The main crops being irrigated are cotton, sugar and maize. Water use for the domestic sector is registered at 13.94 million m^3/a (13.5 for Jozini, and 0.44 for Shemula), but is in fact higher than this, as many of the small schemes are not registered (total of about 1.1 million m^3/a), and Shemula has a much higher use. A 40Ml/day water treatment works is also under construction in Jozini, and will abstract from the Pongola River, adding another 14.6 million m^3/a. In 2007 the then Minister of Water Affairs and Forestry announced an allocation of 60 million m^3/a for a joint Sugar Project between Tongaat-Hulett Sugar and Irrimec (this is not on the WARMS database). In addition there has been increase in domestic registrations, and other agricultural registrations.

Table 16: Registered water use in the Pongola River catchment as at 2008 (DWS Recon Study)

Sub-catchment	Irrigation	Forestry	Municipal	Total
Bivane Catchment (W41)	4.52	18.17	0.11	22.80
Pongola River W42	12.55	35.83	2.54	50.92
Pongolo River (W44A to W44E)	168.58	-0	4.56	173.14
Phongolo River d/s	70.23		4.34²	74.57
Total	255.88	53.99	11.55	321.43

Table 17: Registered water use in the Pongola River catchment as at Dec 2015 (DWS WARMS Database)

Sub-catchment	Agriculture (Irrigation & livestock)	Forestry	Domestic (incl Schedule 1 use) & Industrial	Total
Bivane Catchment (W41)	6.30	18.99	0.04	25.33
Pongola River W42	15.43	36.01	5.33	56.77
Pongolo River (W44A to W44E)	176.67		4.92	217.6
Transfers from the Pongolapoort Dam	35		2.6	37.6
Phongolo River W45 (downstream of dam)	69.33		13.94	83.27
Total	302.73	55.00	26.83	420.87

The relatively small water uses in Swaziland from the Phongolo River catchment upstream of the Pongolapoort Dam are not included in the uses given in the Tables above.

If one works on the methodology and assumptions as per the 2004 DWAF *Internal Strategic Perspective: Usuthu to Mhlathuze Water Management Area* - still considered the most reliable water balance calculation – the current water balance is as calculated in **Table 18**.

Table 18: Pongola River Catchment Water Balance

Resource Category	Available/Impact (million m3/a)
Gross Surface water resource	818
Ecological Reserve	-172
Alien Invasives	-30
Net surface water resource	616
Ground water	8
Agricultural Return Flows	21
Total local Yield	645
Registered Use above and from Pongolapoort Dam	-337.3
Reduction in yield due to dam safety	-48
Flood Release (currently sufficient for Moz license)	-250
Registered Use downstream of the Pongolapoort Dam	-83.27
Tongaat-Irrimec	-60
Deficit	-133.57

This would suggest that the catchment yield is already oversubscribed by 133 million m^3/a. However, it is recognised that there is most likely overlap between the Ecological Reserve and Flood Release allocations, and so additional water could be available. This must be confirmed through a thorough study of the basin. In addition, the repair of the dam wall will make water available; as will the review/retraction of large licences (Makhathini Cotton and Tongaat Irrimec) that have not yet been used. There are several large known applications for water from Pongolapoort Dam, and a solution to the oversubscription is urgent, especially in the light of the significant growth in this as a source for domestic water for a large proportion of the DM.

5.2. Mkuze Catchment (W30)

The Mkuze Catchment includes the drainage areas of both the Mkuze (W31) and the Hluhluwe (W32) as detailed in **Figure 25**. The catchment is 9 545km^2, and the rivers end in Lake St Lucia which then drains into the Indian Ocean. The catchment is very important for the environmental flow requirements of Lake St Lucia and other areas east of the Lebombo Mountains. Lake St Lucia is an ecologically sensitive area and World Heritage Site. Because of its importance there is a strong need to ensure that the ecological water requirements of the whole Mkuze catchment are met.

The total water resource available in the Mkuze Hluhluwe catchment is approximately 74 million m^3/a, after the allowance for the ecological reserve, irrigation return flows, the contribution of groundwater, and the transfer of water from the Pongolapoort Dam for the Charl Senekal Trust.

Figure 25: Hluhluwe Mkuze Catchment, with quaternary detail

The registered water use per sector is shown in **Table 19**. The largest water user in the Mkuze catchment is irrigation. Irrigators abstract from run-of-river flows or farm dams. In addition the Senekal Trust transfers up to 32.6 million m^3/annum, of which 2.6 is registered for domestic use. There is also significant afforestation in the catchment, although a large portion of it is in the more coastal region and does not impact the yield upstream. However, considering the ecological importance of Lake St Lucia, the impact of the stream flow reduction activities on the lake is significant. The future domestic use from the Mkuze catchment needs to be resolved from this transfer from the Pongolapoort Dam.

Table 19: Registered Water Use in the Mkuze/Hluhluwe Catchment (WARMS December 2015)

Sub-catchment	Agriculture (Mℓ m³/a)	Forestry (Mℓ m³/a)	Domestic & Industrial (Mℓ m³/a)	Total (Mℓ m³/a)
Mkuze River catchment (W31)	78.08	8.36	3.05	89.49
Hluhluwe River Catchment (W32)	14.16	16.28	4.3	34.74
Total	92.24	24.64	7.35	124.23

The Hluhluwe Dam is the only significant dam in the catchment. It has a storage capacity of 25.89 million m^3 and estimates of the historical firm yield range from 8.5 million m^3/a to 23 million m^3/a based on differing reports (Department of Water Affairs, 2004). A yield of 13.5 million m^3/a is adopted for this study, as per the 2011 Recon Study.

Table 20: Registered water use downstream of Hluhluwe Dam (W32F)

Agriculture (Mℓ m³/a)	Domestic and Industrial (Mℓ m³/a)	Total (Mℓ m³/a)
11.2	3.6	14.8

A total of 14.8Ml m^3/a is registered below Hlhluwe Dam (**Table 20**).The major water user downstream of the Hluhluwe Dam is irrigation agriculture. The main crops being irrigated are sugarcane and pineapples. Domestic water use is the other significant water user which includes the Hluhluwe Water Supply Scheme whose abstraction is directly from the Hluhluwe Dam. There is also 0.8million m^3/a of forestry in the W32F catchment, but this will have limited impact on the available water from the river. Based on the available information, the future water requirements for domestic water use from the Hluhluwe Dam cannot be met at the required levels of assurance of supply and without curtailment of existing water uses. Further assessments of the actual registered users, revised firm yields and actual water availability is needed.

The geology and the topography of the Mbazwana area are such that there is potential for significant groundwater development. Although the rainfall in the catchment is relatively high (769 mm/a), the surface runoff is limited due to the very flat terrain. The KwaZulu-Natal coastal aquifer underlies much of this catchment and the potential for groundwater use is therefore high.

The geology and the topography of the Hluhluwe area are such that there is limited potential for significant groundwater development. Currently four boreholes with a combined yield 115000 m^3/a (0,315Mℓ/day) have been registered within a 5 km radius of the town Hluhluwe. However, there are unregistered boreholes that are supplying water to a number of the villages in the Hluhluwe Supply Area. There are reports of poor groundwater quality in the water supply scheme area, especially groundwater hosted within the Lebombo and Zululand Group rocks that are characterized by high total dissolved solids (TDS) and high specific electrical conductivity (EC).

The water balance for the catchment, based on the net surface water resources as calculated in the DWAF 2004 *Internal Strategic Perspective: Usuthu to Mhlathuze Water Management Area,* and using current registered use and return flows (WARMS December 2015) shows a deficit of 50.39 million m^3/a (**Table 21**).

Table 21: Mkuze/Hluhluwe Catchment Water Balance

Mkuze/Hluhluwe catchment	Available/Impact (million m^3/a)
Gross surface water resource	71
Ecological Reserve	-54
Invasive alien plants	-2
Net surface water resource	15
Groundwater	12
Agriculture return flow	6
Mining Return Flow W31	7.12
Urban Return Flow W31	0.26
Urban Return Flow W32	0.46
Transfer from Pongola	33
Total Available	73.84
Total Registered water use W31	-89.49
Total Registered Water Use W32	-34.74
Water Balance	-50.39

Considering the World Heritage Site located as the last downstream “user” of water, a careful consideration of the current registrations should be undertaken, and no further allocations allowed.

This deficit has an impact on the domestic requirements in the catchment:

- The domestic requirements from the Mkuze catchment are met via the transfer from the Pongolapoort Dam, and the allocation to meet future needs to be planned from the Pongola catchment, as it is clear that the Mkuze River is not able to support additional use.
- In the Hluhluwe catchment, all municipal domestic abstraction is located downstream of the Hluhluwe Dam, which regulates the availability of water, and improves assurance of supply. Based on current WARMS registrations, the full firm yield of the dam is allocated, and there is insufficient water to meet any growing future domestic demands. A reallocation of some agricultural use, or the increased yield of the Hluhluwe Dam should be considered to meet this demand.

5.3. Lake Sibayi Catchment (W70A)

The Lake Sibayi Catchment (in quaternary W70A.) covers the coastal areas from the border with Mozambique in the north to St Lucia Wetlands in the south. The area is ecologically sensitive and there are a number of conservation areas in the catchment. This catchment ends up in the Kosi Bay which is a group of wetlands and freshwater lakes. Lake Sibayi is the largest of the lakes, but Lake Shengeze and Lake Nhlange are also notable.

The surface hydrology in this catchment has not been studied in detail, but a current DWS reserve determination project (WP 10544) due to be completed July 2016 includes this catchment, and results from this should be referred to in future. The best known statistics are included here, but should be utilised with caution.

The natural MAR quaternary catchment W70A is estimated to be 111 million m^3 (WR90, 1994). This includes several small coastal rivers such as Gezisa, Futi and Mlangeni situated in the northern parts near Mozambique down to Muzi River, which flows into the Mkuze River in the south. The W90 hydrology of the catchment suggests a 25.5 million m^3/a run-of-river yield, but may be much lower due to the flat terrain and low surface runoff. However, there are significant groundwater resources in the catchment, estimated at 98 million m^3/annum (DWA, 2004). According to the CSIR report of 1995, the recharge of groundwater was calculated at between 5% and 18% of mean annual rainfall (EMATEK-CSIR, 1995). With the MAP of the W70A quaternary catchment being 718.88 mm, the recharge potential for an area of 47.2853 km^2 where groundwater can be developed, is between 1.82 million m^3/a to 6.5 million m^3/a for the area, with the potential to develop boreholes with safe yields of more than 3 l/s. (DWA, 2014).

Lake Sibayi is one of the largest freshwater lakes in South Africa. It is part of the Greater St. Lucia Wetland Park and is recognised under the Ramsar Convention as a "Wetland of International Importance" on 28 June 1991. In December 1999 The Greater St. Lucia Wetland Park was declared a UNESCO World Heritage Site. It is estimated that Lake Sibayi has a storage capacity of 700 million m^3. Historically, the surface run off, groundwater recharge and precipitation have matched the evaporation from the lake and groundwater outflow to the sea, resulting in fairly consistent lake levels. However, there has been significant development around the lake in the non-conservation areas, and there has been an increase in both ground water and surface water abstraction for supply to Manguzi, Mbazwana and Mseleni communities.

A recent study[4] confirmed a direct hydraulic link between the groundwater in the catchment and the lake surface water. In the west, groundwater flows to the lake, and to the east the lake recharges the aquifer (**Figure 26**). In addition, the lake water moves beneath the coastal dune cordon, which eventually discharges into the ocean.

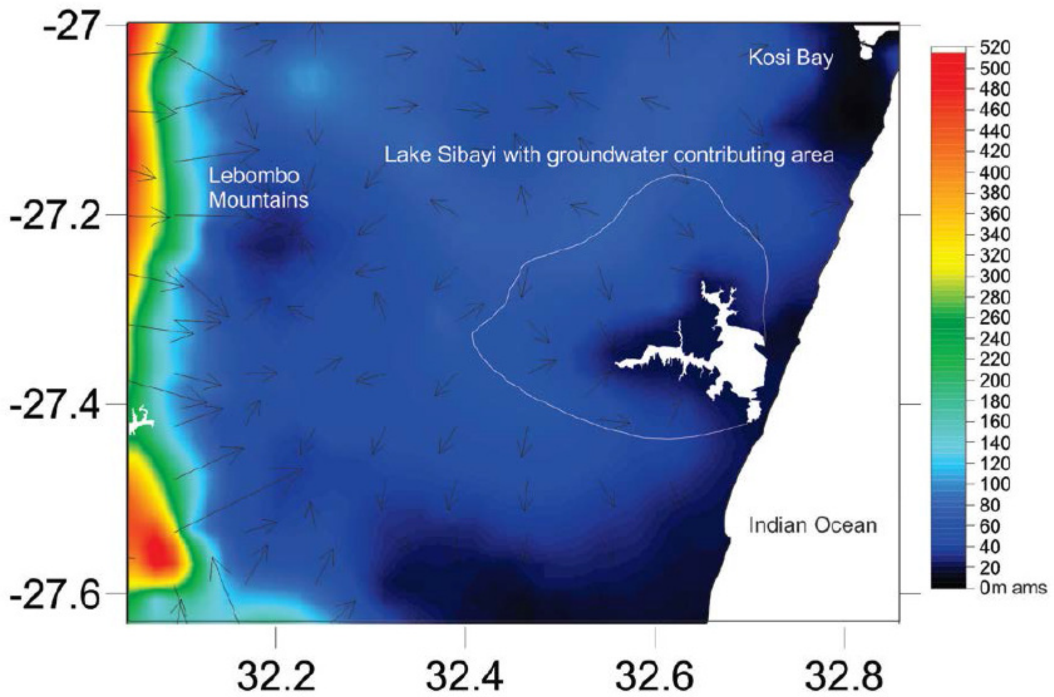


Figure 26: Groundwater distribution and flow direction showing groundwater contributing to Lake Sibayi (Wietz, 2012, pg 6)

Artificial abstraction from the lake and/or groundwater, coupled with drought conditions, appears to have impacted lake levels, and if levels drop further, may reverse the hydraulic gradient around the lake and result in saltwater migration from the ocean into the lake, and severely impact the local ecosystems. At present a fine balance exists between the lake and groundwater regime, but any further developments should take the water balance components into account (Weitz, 2012).

The major current water use is commercial forestry which is mainly located in the northern parts of the quaternary catchment. The other significant registered water use is domestic water use.

Table 22: Registered water users in the Lake Sibayi catchment (million m³/a) (WARMS, Dec 2015)

Sub-catchment	Irrigation	Forestry	Domestic & Industrial	Total
Sibayi catchment (W70A)	0.11	12.20	4.79 (13,1Mℓ/d)	17.10

[4] Weitz, J and Demlie, M (2012) Conceptual Modelling of Lake-Groundwater Interactions for the Lake Sibayi Catchment, North Eastern South Africa

The domestic registrations can be further broken down into the sources within this catchment as detailed in **Table 23**.

Table 23: Domestic water use registrations for W70 Catchment (WARMS, Dec 2015)

Sub-catchment	Domestic & Industrial Million m³/a	
Futi River Catchment	1.01 (2,77Mℓ/d)	Borehole registrations for Manguzi
Gezisa Stream	0.18 (0,49Mℓ/d	Surface water abstraction for Manguzi
Kunkanini River Catchment	0.75 (2,05Mℓ/d)	0.26 river abstraction; 0.49 borehole
Lake Sibayi	2.47 (6.8Mℓ/d)	0.5 Mbazwana; 0.15 Mseleni; 1.83 Manguzi (from the lake)
Shengeza Lake	0.28	Manguzi town (not utilized)
Mgoboseleni Lake	0.09	Sodwana National Park

As mentioned earlier, the groundwater potential for this catchment is somewhere between 1.82 million m³/a to 6.5 million m³/a. At present there is only 1.65 million m³/a registered use from borehole in this catchment.

5.4. Mfolozi Catchment (W20)

The Mfolozi catchment consists of the Black and White Mfoloze tributaries that rise in the eastern Drakensberg and flow across the Zululand coastal plain and into the Indian Ocean. Mfolozi Game Reserve lies in the central part of the catchment. The towns of Vryheid, Ulundi, Babanango, Nongoma and Mtubatuba fall within the catchment. Klipfontein Dam is the only major dam in the catchment, situated in the upper part of the White Mfolozi, although there are several farm dams that reduce the streamflow, especially in the low flow months. There is a large potential for groundwater use along the coast. The primary uses in the catchment are communal land stock farming, irrigation, forestry and dryland sugarcane. Most of the water demand is near the coast, including a transfer to the Mhlathuze catchment. The MAR is estimated to be 962 million m³/a. The Ecological Reserve is estimated to be 19 million m3/a.

The Mtubatuba area is found within the Mfolozi catchment (W23D).The registered water users in the two upstream tertiary catchments as well as the third tertiary catchment which feed the Mfolozi are primarily irrigation, and forestry with significant use from domestic and industrial users. Umfolozi Sugar Mill has a water allocation of 2 million m³/a for sugarcane processing. In addition, there is an allocation of 9 million m³/a that is transferred out of the catchment to Richards Bay Minerals.

Table 24: Water use registrations in the Mfolozi Catchment (WARMS, Dec, 2015)

River	Agriculture	Forestry	Industry	Mining	Domestic	Total
White Mfolozi	9.98	13.42	0.04	0.09	11.67	35.2
Black Mfolozi	5.67	10.62	0.06	0.52	3.76	20.63
Mfolozi	38.69	0	2.01	9.78	7.3	57.78
Total	54.34	24.04	2.11	10.39	22.73	113.61

The domestic allocations on the Mfolozi are for the Mpukonyoni and Mtubatuba schemes, that each have an allocation of 3.65 million m^3/a (10 Ml/day). The available yield at the Mpukonyoni abstraction site is not known, but regular operational issues due to low river levels indicates that there is limited availability on a consistent basis.

Of greatest significance to uMkhanyakude DM is the yield of the Mfolozi at the point of abstraction for Mtubatuba. For this, the low flow run off is most significant in terms of reliability of supply throughout the year. The low flow runoff of the Mfolozi River with a 1:50 year recurrence interval being available at the Mtubatuba abstraction works will be approximately 5.26 million m^3 and 8.09 million m^3 for the 1-month and 3 month durations respectively. This translates to approximately 7.39 million m^3/a (20,24 Mℓ/day). However because of the sandy nature of the Mfolozi River, only 50% (3.7 million m^3/a) (10,14Mℓ/day) of this low flow is available over the whole year (DWA, 2014).

The groundwater quality in quaternary catchment W23D around Mtubatuba falls in Class 0 of the DWS water quality classification, representing an ideal quality for long term domestic use.The groundwater development potential of the area around Mtubatuba is very high. The quaternary (Pleistocene and Holocene) inter-granular formations and late Miocene Uloa formations are potential productive aquifers. Groundwater levels are generally shallow with 50 % of boreholes having a water level less than 25m below ground level (bgl). The highest yielding borehole in the Maputaland Group is in the Uloa Formation, with yields of 15 l/s easily obtained. The potential for drilling a successful borehole in the region is 95 % (King 2003). The utilisable groundwater exploitation potential for quaternary catchment W23D during the dry season was estimated to be 18 Ml/d (6.59 million m^3/a) while the annual utilisable groundwater exploitation potential based on GRDM evaluations was estimated at 17.78 million m^3/a, for quaternary catchment W23D (DWA, 2014).

Table 25: Mfolozi Catchment Water Balance

Gross Water Resource	57
Ecological Reserve	-19
Invasive Alien Plants	-1
Dryland Sugarcane	-1
Net surface water resource	36
Groundwater	5
Irrigation Return flow	5
Urban Return Flow	4
Industrial Return Flow	1
Water Available	51
Agriculture Use	-54.34
Industrial Use	-2.11
Mining Use	-1.39
Forestry Use	-24.04
Domestic Use	-22.73
Transfer out	-9
Water Balance	-62.61

The water balance, based on the determination of available water in the 2004 DWAF *Internal Strategic Perspective: usuthu to Mhlathuze Water Management Area;* and the registered water use as per WARMS December 2015, shows a deficit of 63 million m^3/a.

An off channel dam is currently being investigated as a means to improve the yield of the Umfolozi, and improve the assurance of supply to the users in the lower catchment. This dam will take many years until it is built and commissioned, and an interim solution is required. The groundwater potential in the W32D area needs to be further explored, and the curtailment of the upstream agricultural and forestry allocations should be investigated by DWS.

6. Bulk Water Supply Infrastructure

For the purpose of analysis, WSA's were demarcated into supply areas based on existing regional schemes / infrastructure, planned schemes and then on areas currently being served by local solutions. This provided wall-to-wall coverage of the WSA. All supply areas align with Census Small Area Places. In UKDM, supply areas were demarcated as sub-areas of the six (6) major schemes in the area (Figure 27).

The six (6) major schemes are:

1) Shemula (Blue): covering the northern region
2) Jozini (pink/purple): covering the major portion of Jozini LM to Mseleni and Mbazwana in Umhlabuyalingana LM.
3) Hluhluwe (brown): This covers the local municipality of The Big 5 False Bay.
4) Hlabisa (red) : Covering the area of Hlabisa LM that falls outside of the Hluhluwe Game Reserve.
5) Mpukunyoni (Yellow)
6) Mtubatuba (Cyan)

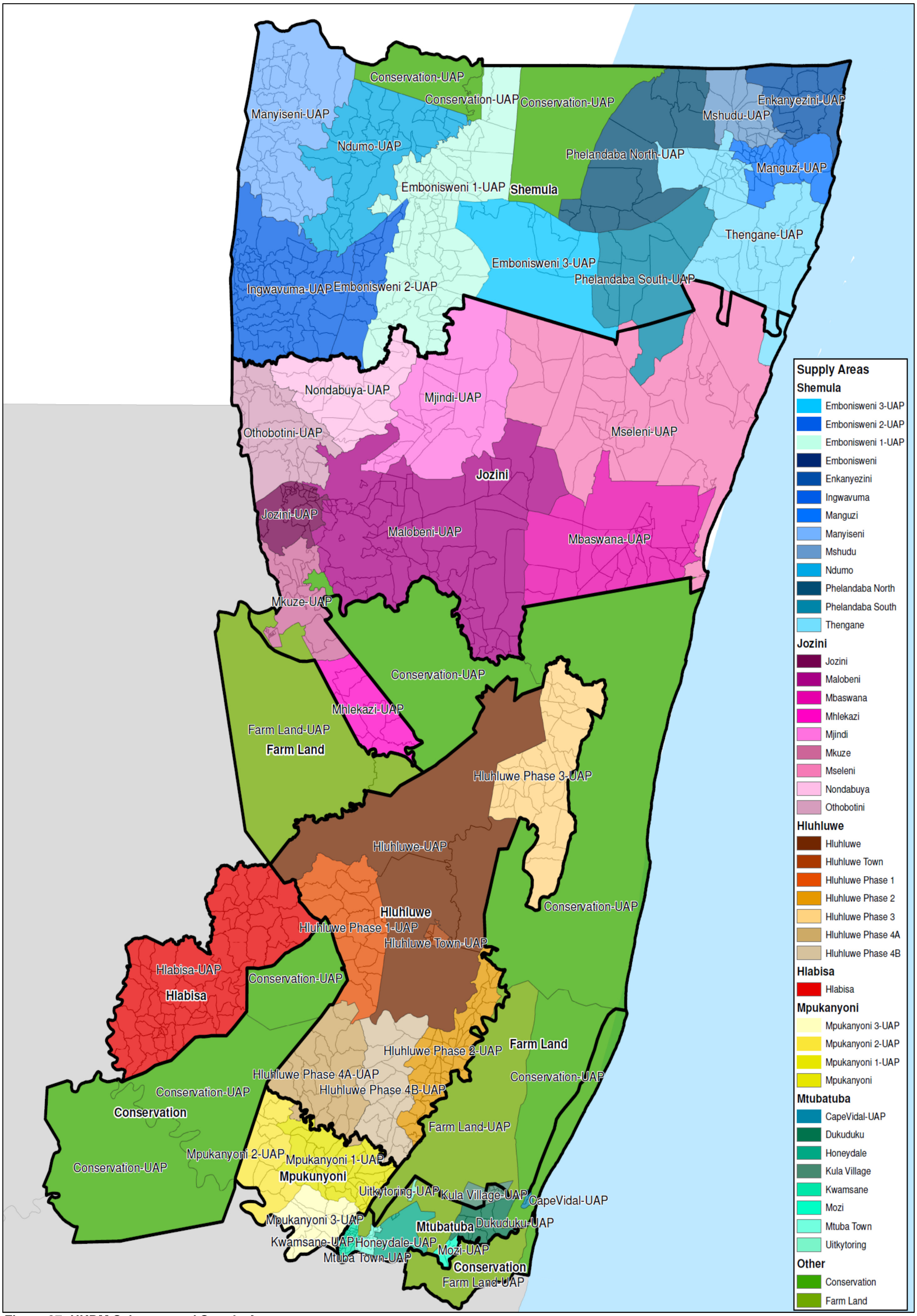
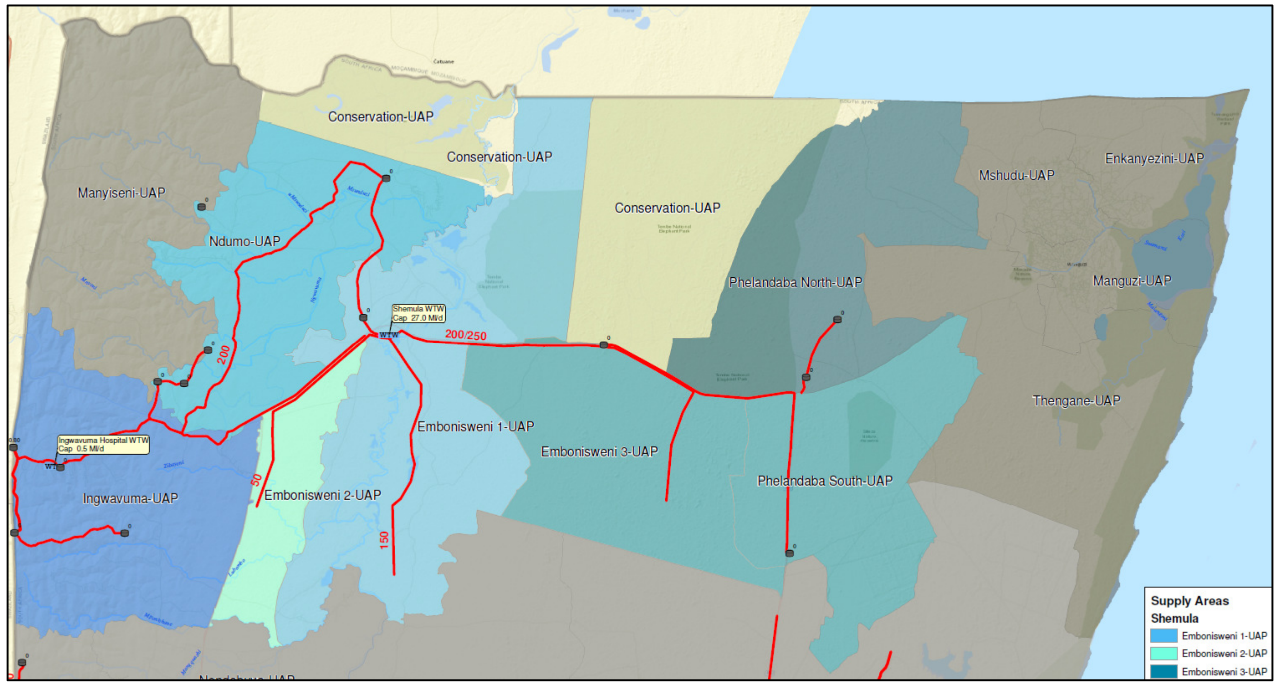
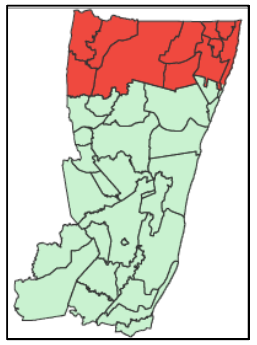


Figure 27: UKDM Schemes and Supply Areas

6.1. Shemula Supply Area





The Shemula Scheme currently abstracts water from the Pongola River and is treated at the Shemula WTW which has been recently upgraded from 7Ml/day to 27Ml/day capacity (**Table 26**). The scheme has 13.5 million m^3/a (37 Ml/day) registered on WARMS (as at December 2015), which is significantly higher than the current use of 5.46 Ml per day, more than the capacity of the Shemula WTWs.

Table 26: Shemula Regional Bulk Water Treatment Works Details

LM	Regional Scheme	Sub-Scheme	Source	Water Treatment Works	Design Capacity	Current Operating Capacity	Works Classification
				Plant Names	(Ml/Day)	(Ml/Day)	
uMhlabuy	Shemula	Shemula	Pongola River	Shemula (old)	7	5.46	E
	Shemula	Shemula	Pongola River	Shemula (new)	20	0.00	C

Treated water is pumped from the Shemula works to the Shemula command/balancing reservoir. From here water flows North, towards Ndumo, West towards Ingwavuma and East towards Shongwe.

North, from the Shemula reservoir, water is pumped to the Ndumo reservoir and is distributed in the rural area of Ndumo. West, from the Shemula reservoir, water gravitates along the newly constructed 400mm diameter bulk main to the Ingwavuma pump station in the Siweni Area, from here, water is then pumped mountain ridge to the Ingwavuma Reservoir where it is then distributed in to Ingwavuma town and surrounding areas. East, again from the Shemula reservoir, water now gravitates East along the exsiting 250mm diameter main to the Shongwe Reservoir, with off-takes along the way feeding the area of Emboniswen. From the Shongwe reservoir, water gravitates further to the Phelandaba Booster pump Station where it is pumped North to Phelandaba North reservoir and also gravitates South to Phelandaba South.

Although the Shemula scheme is very large, it however, does not cover the entire Shemula Supply area as can be seen from the map and key above. Out of the present reach of the Shemula scheme are five (5) stand-alone schemes which are supplied by boreholes. These schemes are Manyiseni, Manguzi, Thengane, Mshudu and Enkanyezini, each supplied by small WTW (**Table 27**).

Manyiseni - There is no existing bulk supply in Manyiseni, however there is a proposed bulk supply line that is planned to branch from a bulk supply pipeline supplying water to Ingwavuma from the Shemula WTW. This proposed bulk pipeline will extend from Manyiseni Town and its diameter ranges from 200mm to 250mm diameter.

Manguzi - This sub-scheme draws water from Gezisa stream, and several boreholes. The details of the airfield wellfield are: Airfield 1 and Airfield 1a with each yielding 10l/s that amounts to a daily Table 26delivery of 633m^3/day; Airfield 2 and Airfield 2a – each yielding 12l/s amounting to a daily delivery of 875m^3/day; Airfield 3 – Airfield 3a each yielding 8l/s with a daily delivery amounting to 644m^3/day and eManguzi 1 – yielding 5l/s with a daily delivery of 454 m^3/day.

Thengane - This sub-scheme draws water from a wellfield of five boreholes; and is treated at a package treatment works. The details of the 5 boreholes as per the *Water project Feasibility report Shemula Water Supply Scheme-upgrade, February 2014* report are: BOM 12 -12l/s, LIBUYILE – 5.3l/s, BOM 10A – 3l/s, THENGANI- 5.4l/s, and THENGANI B- 2.1l/s

Mshudu - scheme draws water from a Mshudu borehole of 3l/s where it is treated at Mshudu WTW (1Ml/day). It is also supplied with treated water from Thengane Reservoir 6 located in Thandizwe. The reservoir is supplied with water drawn from the Thengane well field and treated at the Thengane WTW.

Enkanyezini – The sub-scheme gets its water from Kanini Stream and Tshong 4 borehole. The Tshong 4 borehole yields 10.5l/s amounting to a daily delivery of 781.92 m^3/day. The raw water abstracted from the two sources is treated at the Enkanyezini WTW (1Ml/day).

Table 27: Summary of existing small treatment works within Shemula-Supply Area.

LM	Sub-Scheme	Source	Water Treatment Works	Design Capacity	Current Operating Capacity	Works Classification
			Plant Names	(Ml/Day)	(Ml/Day)	
uMhlabuyalingana	Enkhanyezini	Borehole	Kwangwanase -Enkhanyezini	1	0.72	D
	Thengane	Boreholes x 5	Kwangwanase -Thengane	1	0.90	D
	Manguze	Borehole	Kwangwanase - Manguzi	1.5	1.57	D
	Manguzi	Boreholes x 4	Kwangwanase - Manguzi Airfield	1	0.39	D
	Mshudu	Borehole	Kwangwanase - Mshudu	1	0.00	D
	Manguzi	Kanini Stream	Kwangwanase - Kanini	0.3	0.05	
	Manguzi	Gezisa Stream	Kwangwanase - Gezisa	1	0.30	
Total				6.8	3.93	

6.1.1. Demographics and water demands for the Shemula Supply Area

Table 28 summarizes the demographics and water demands for the Shemula Supply Area.

Table 28: Demographics and Demands for the Shemula Supply area.

Shemula			
Probable	2015	2025	2035
HH	38 027	42 659	47 036
Pop	185 189	207 650	228 850
AADD (Ml/d)	8	16	18
SDD (Ml/d)	11	21	25
High	2015	2025	2035
AADD (Ml/d)	10.5	20.3	23.4
SDD (Ml/d)	14.1	26.7	31.9

Demands reflected above indicated that the present high demand is 10.5 Ml/d with the probable being 8Ml/d. The ultimate 2035 High demand has been calculated as being 23.4 Ml/d and the probable is 18Ml/d. These demands have been used to assess the capacity of the existing infrastructure to supply the noted demands.

6.1.2. Backlogs and Cost for upgrade

The current level of service has indicated that the overall backlog in the area is 58% of the population which is served below the minimum standard.

Table 29: Cost estimate of addressing the present backlogs as well as the upgrade requirements of the existing infrastructure

Consultants Fees	R 63 456 821.10
Design and Tender Documentation	R 50 222 133.71
Geotech Survey	R 0.00
Land Survey	R 541 282.50
Cathodic Protection	R 0.00
Construction Monitoring	R 25 859 812.41
Construction	R 614 225 861.06
Pipe Supply (Bulk)	R 0.00
P&G	Included in Works Costs
Pipeline Construction (Bulk)	R 265 047 542.88
Pipe Bridge/Jack	R 0.00
Pumpstation	R 0.00
Water Works	R 155 836 877.88
Storage (Reservoir)	R 83 193 221.82
Dam	R 0.00
Abstraction	R 0.00
Land Acquisition - 7.5%	R 11 394 643.29
Environmental, Community Liaison	R 5 697 321.65
Health & Safety, Quality Assurance	R 3 798 214.43
Project Office	R 13 293 750.51
Contingencies	R 75 964 288.60
TOTAL	R 787 830 900.63

Table 29 provides an overall cost estimate of addressing the present backlogs as well as the upgrade requirements of the **EXISTING** infrastructure (i.e. basic needs assessment without taking into consideration planned infrastructure projects) associated with future demand increases as a result of level of service migration.

Following the results of the findings in the assessment of the existing infrastructure as well as the resulting needs identified, it is important to consider "potentially new" infrastructure which will result from planned infrastructure projects.

6.1.3. Planned Infrastructure Projects

Table 30: Planned Infrastructure Projects

Planned/Existing Infrastructure Project Description	Cost	Comments
Kwazibi Community Water Supply	R 24 999 903	Partially addresses the upgrade of bulk and reticulation to 11 Ml/day. 4 Ml/day source increase not addressed. An amount of R41mil is a provision for 48 hour storage, which is not feasible due to it having to be provided on elevated stands. Provision is therefore only made for R38 mil for network upgrades
Kwangwanase Phase 3:	R 102 657 991	
Manguzi Star of the Sea	R 173 658 613.00	Ground Water Development Project
Shemula Bulk Water Project-Upgrade Phase 1	R 174 515 569	Phase 1 is complete, the overall capacity of Shemula WTW is 27Ml/day. Additional 12.5 Ml/day WTW is not addressed by this project
Shemula Water Project-Upgrade Phase2	R 154 902 087	Upgrade of Ingwavuma 400mm diameter gravity main recently complete, and it is sufficient for 2035 demand.
Shemula Bulk Water Project -Upgrade Phase 4	R 73 157 583	Addresses the upgrade requirement of bulk line from Sihangwane/Embonisweni to Phelandaba
Shemula Bulk Water Project -Upgrade Phase 5:	R 77 172 905	Addresses the upgrade requirements of bulk line to Phelandaba South and bulk line from Phelandaba to Manguzi
Shemula Bulk Water Project -Upgrade Phase6:	R 80 744 533	Addresses the upgrade requirements on bulk line to Phelandaba North
Total Cost	R 986 704 055	

Table 30 presents a summary of the planned infrastructure projects and comments are made on the impact the new infrastructure will have in addressing the needs identified as a result of the demands and existing infrastructure.

In order for the full needs to be addressed, the resulting short comings of the planned infrastructure projects above were identified and grouped into projects; the results have been tabulated below.

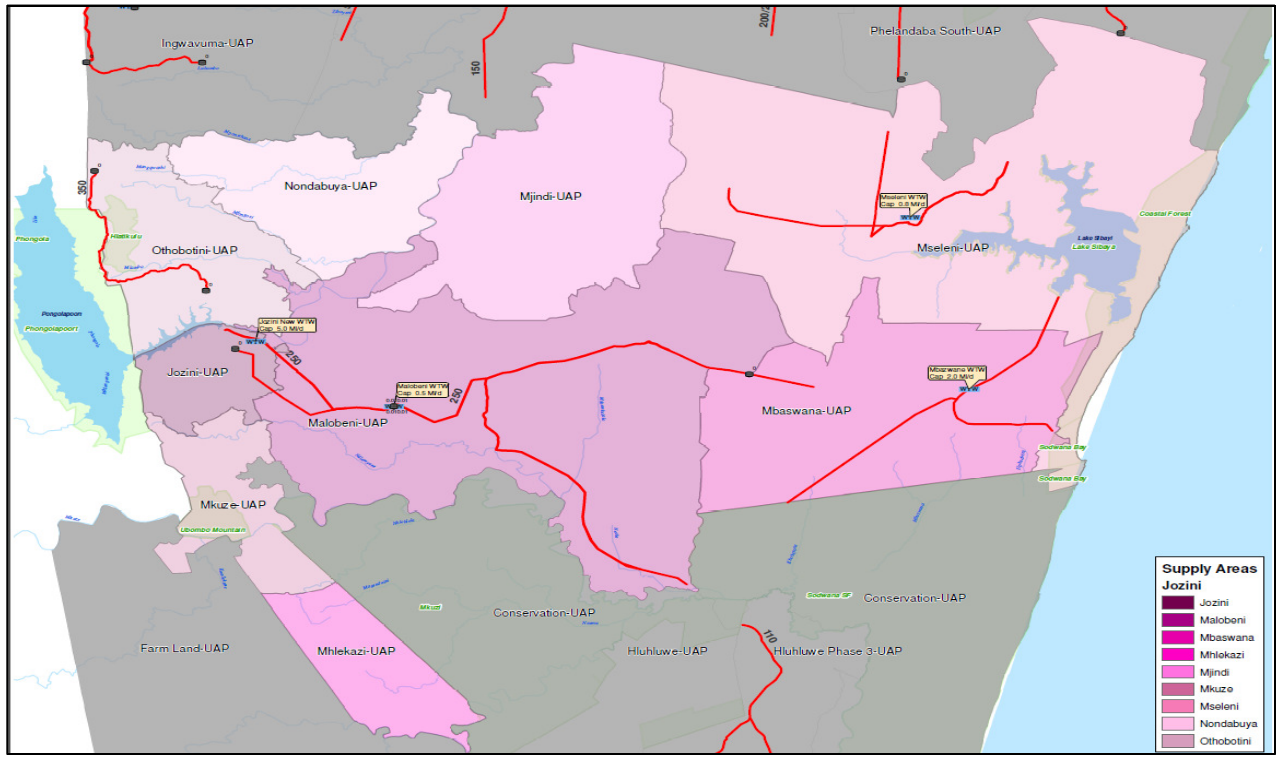
6.1.4. Proposed Infrastructure

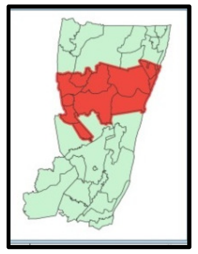
Table 31 shows the proposed infrastructure for this area.

Table 31: Proposed Infrastructure Projects

LM	Supply Area	Proposed Project Name	Proposed New Infrastructure		Cost Per Component	Overall Project Cost
			Component	Quantity		
Jozini	Shemula	Shemula Infrastructure Upgrade	Upgrading Shemula WTW	13Ml/d	R 89 373 690.07	R 149 373 690.10
			Additional Storage	16 Ml	R 60 000 000.00	
Total Cost						R 149 373 690.10

6.2. Jozini Supply Area





The Jozini Supply Area is in the northern half of the UKDM, cutting across the southern parts of Jozini and uMhlabuyalinga LMs.

The Jozini Supply Area depicted in the above map was made up of a combination of the Recon Study, small scheme areas provided by UKDM and our interpretation of the current supply scheme as well as small area boundaries, extent of the bulk distribution infrastructure and topographical boundaries such as rivers or watersheds.

The UAP has identified a larger supply area which encloses three (3) recon scheme areas and is subdivided in the following 9 sub schemes:

- Tshongwe Malobeni
- Othobothini
- Nondabuya
- Mjindini
- Jozini
- Mkuze
- Mhlekazi
- Mseleni
- Mbazwana

The main source of supply of these sub-schemes (Jozini, Malobeni, Mjindi, Nondabuyo, Mkuze and Othobothini) currently is the Phongola River. Although Mkuze abstracts from the Mkuze River, their allocation is from a transfer of water from the Pongolapoort Dam via the Charl Senekal Trust infrastructure. The schemes are primarily supplied by small package treatment works (**Table 32**)

An allocation of 2.6 million m^3/a is registered on WARMS for the UKDM. The UKDM has registered a water allocation of 0.4 million m^3/a at the weir where the Jozini New WTW abstracts water. This is the equivalent of only 1.2Mℓ/day. The river's current water allocations and registered water users are discussed in Section 5 which shows that the Pongola catchment is significantly oversubscribed and a solution needs to be found.

Table 32: Summary of water treatment works in the Jozini Supply Area

LM	Regional Scheme	Sub-Scheme	Source	Water Treatment Works	Design Capacity	Current Operating Capacity	Works Classification
				Plant Names	(Ml/Day)	(Ml/Day)	
Jozini	Jozini	Jozini	Pongola River	Jozini Old	2.5	2.45	C
	Jozini	Jozini	Pongola River	Jozini New	5	4.99	
	Jozini	Malobeni	Pongola River	Malobeni old	0.5	0.31	D
	Jozini	Malobeni	Pongola River	Malobeni New			
	Jozini	Nondabuyo	Pongola River	Nondubuya	0.3	0.31	D
	Jozini	Mkuze	Pongolapoort Dam via Blackie Dam into Mkuze River	Mkuze	1.5	1.90	C
	Jozini		Not operational	Mkuze River	1	0.00	
	Jozini	Mkuze	Pongolapoort Dam via Blackie Dam into Mkuze River	Ubombo	0.3	0.55	
	Jozini	Othobothini	Pongola River	Block 6 Package	0.8	0.35	D
	Jozini	Mjindi	Pongola River	Mjindi	0.35	0.27	D
	?	?	Pongola River	Makhonyeni	0.8	0.58	D
	Jozini	Othobothini	Pongola River	Othobothini Old	0.5	0.44	D
	Jozini	Othobothini	Pongola River	Othobothini New	20		
	Shemula	Ingwavuma	Phophopho dam	Ingwavuma	0.5	0.00	
Total					**34.05**	**12.15**	

The bulk distribution and reticulation of each scheme is summarised as follows:

- **Jozini Old/New** - The bulk pipeline extends from Mseleni Town to the north west towards KwaMlamula, to the north east towards KwaSonto and its diameter ranges from 200mm to 250 diameter over some sections, where known, but the diameter for the full extent of the line / nor connectivity to reservoirs is not known.
- ***Othobothini***- The bulk backbone extends from Othobothini rural area towards Hlatikula and Mombeni along road D 1837, north of Othobothini rural towards Ophondweni and its diameter

ranges from 250 to 320 mm dia for Hlatikhulu/ Mombeni section and 220 to 350 mm dia for the Ophondweni.

- ***Nondabuyo*** - Reticulation extends from a water treatment plant towards Nondabuya rural, North towards Kwashukela and north west towards Ophondweni. The diameter for the full extent of the line / nor connectivity to reservoirs is not known.
- ***Tshongwe/Malobeni*** - The bulk backbone extends from Jozini Town towards Tshongwe branching off to Kwajibe and its diameter ranges from 250 to 200mm dia over some sections, where known, but the diameter for the full extent of the line is not known, which makes a firm evaluation of the capacities impossible.
- ***Mjindi*** – The bulk pipeline extends from Mjindi WTW to the north towards Mafefe along road S 1834bulk pipe line branches to road D21 towards Biva community and also branches on A1188 road towards Maputaland. The diameter of the bulk line is not known.
- ***Mkhuze Ubombo***– The bulk pipeline extends from outskirt of Mkuze towards Mkuze town, Potable water bulk line from Mkuze WTW towards Ubombo reservoir crossing Mkuze River. Bulk line from Ubombo WTW extends to Town supplying the hospital and commercial/residence settlement and a limited supply is extended beyond the rural town. Pipe sizes are unknown.
- **Mbazwana -** The bulk backbone extends from Mbazwana Town towards Shazibe and Qondweni, to the west towards Monzi, south west towards KwaJozana and its diameter ranges from 90mm to 200 dia over some sections. Because of the Ultimate demands for this sub-supply area exceeding the available yield from Lake Sibaya it is recommended that Lake Sibaya be dedicated to the Mseleni Subsupply area **ONLY** and Mbazwana be supplied from Pongolapoort Dam via the Jozini Regional bulk scheme.
- **Mseleni -** The bulk pipeline extends from Mseleni Town to the north west towards KwaMlamula, to the north east towards KwaSonto and its diameter of the sections are unknown.

6.2.1. Demographics and water demand for the Jozini Supply Area

Table 33 summarizes the demographics and water demands for the Jozini Supply Area.

Table 33: Summary of Demographics and Water Demands for the Jozini Supply Area

Probable	2015	2025	2035
HH	34 317	38 474	42 372
Pop	175 951	197 266	217 262
AADD (Ml/d)	10	17	20
SDD (Ml/d)	13	23	28
GAADD(Ml/d)	11.5	19.55	23
High	2015	2025	2035
AADD (Ml/d)	12.2	21.6	25.1
SDD (Ml/d)	16.8	28.9	35.3
GAADD(Ml/d)	14	24.8	28.8

Demands reflected above indicated that the present high demand is 12.2 Ml/d with the probable being 10Ml/d. The 2035 High demand has been calculated as being 25.1 Ml/d and the probable is 20Ml/d. These demands have been used to assess the capacity of the existing infrastructure to supply the noted demands.

NB: These demands include the demand components for Hluhluwe Phase 3 which is currently served from Hluhluwe Dam, however is planned to be supplied from the Jozini Regional Scheme by UKDM.

6.2.2. Backlogs and Cost for upgrade

The current level of service has indicated that the overall backlog in the area is 49% of the population which is served below the national standard.

Table 34: Cost estimate of addressing the present backlogs as well as the upgrade requirements of the existing infrastructure

Consultants Fees	R 150 006 073.15
Design and Tender Documentation	R 97 860 129.81
Geotech Survey	R 0.00
Land Survey	R 1 588 570.00
Cathodic Protection	R 0.00
Construction Monitoring	R 48 930 064.91
Construction	R 1 332 516 245.58
Pipe Supply (Bulk)	R 136 446 425.00
P&G	Included in Works Costs
Pipeline Construction (Bulk)	R 544 219 785.69
Pipe Bridge/Jack	R 0.00
Pumpstation	R 10 996 722.00
Water Works	R 161 375 646.77
Storage (Reservoir)	R 124 734 695.55
Dam	R 0.00
Abstraction	R 0.00
Land Acquisition - 7.5%	R 36 697 548.68
Environmental, Community Liaison	R 18 348 774.34
Health & Safety, Quality Assurance	R 12 232 516.23
Project Office	R 42 813 806.79
Contingencies	R 244 650 324.53
TOTAL	R 1 482 522 318.74

Table 34 provides an overall cost estimate of addressing the present backlogs as well as the upgrade requirements of the **EXISTING** infrastructure (i.e. basic needs assessment without taking into consideration planned infrastructure projects) associated with future demand increases as a result of level of service migration.

Following the results of the findings in the assessment of the existing infrastructure as well as the resulting needs identified, it is important to consider "potentially new" infrastructure which will result from planned infrastructure projects.

6.2.3. Planned Infrastructure Projects

Table 35: Planned projects in Jozini supply area

Existing/Planned Project Description	Cost	Comments
Greater Mseleni Water supply scheme refurbishment.	R 309 899 200	Yard connections, future demands have been assessed based on the design criteria and have been found to be in line with those of the UAP Demands. **Lake Sibaya to be dedicated source to Mseleni only**
Include WTW only for Mbazwane, for total cost comparison	R 55 068 537	Orthobothini upgraded to 40 Ml/day. A total WTW capacity of 24 Ml/day is required should groundwater for Mseleni and Mabibi be developed, Mkuze old and New be retained, however providing 10 Ml/day for Hluhluwe North.
Jozini Regional Community Water supply **Phase 1 A.**	R 255 877 298	A 63 km main line from Jozini to Mbazwana diameter 150-350mm, Bulk Storage 5Ml (under Jozini Regional Community Water supply)
Jozini RCWS Phase 1 B; Line to Mseleni & 6,5 Ml bulk storage **Jozini RCWS Phase 1 C**; Line to to Kwa Jobe & 1,5Ml storage	R 365 410 700	Scope and status reviewed against Kwajobe Project
Kwajobe Community Water Supply	R 160 194 179	Water source from the Pongola Canal where a packaged treatment plant will be located. 2 Ml Package WTW at Pongola Canal. This is 2 Ml/day smaller than required.
Jozini Regional Community Water Supply: Phase 2 : Connection to Hluhluwe Phase 3	**R 62 946 388.85** (Estimated as % of overall R 1 220 400 000)	This project will provide relief to Hluhluwe 1 by addressing part of the demand from Phase 3 (**10Ml/d** from the 12Ml/d demand for Phase 3). Hluhluwe 1 WTW thefore need only capacity to deliver the remaining 2Ml/d. Also 30Ml less 6.5Ml storage to be catered for under Hluhluwe 1. It must be noted that the Othobothini WTW must be sized to include this additional demand.
Mkuze WTW Upgrade	R 25 115 551	4,5 Ml/day could serve Mkuze and Mhlekazi, need for Jozini Phase 1D; and Phase 3 to be evaluated further
Jozini Phase 1D: Line from Orthobothini to Mkuze	R 503 800 000	
Jozini Ingwavuma Water Supply Project	R 1 021 566 878	Multiphased RBIG and MIG project : Bulk water supply to Ingwavuma.
Total Cost	R 2 759 878 732.85	

Table 35 presents a summary of the planned infrastructure projects and comments are made on the impact the new infrastructure will have in addressing the needs identified as a result of the demands and existing infrastructure.

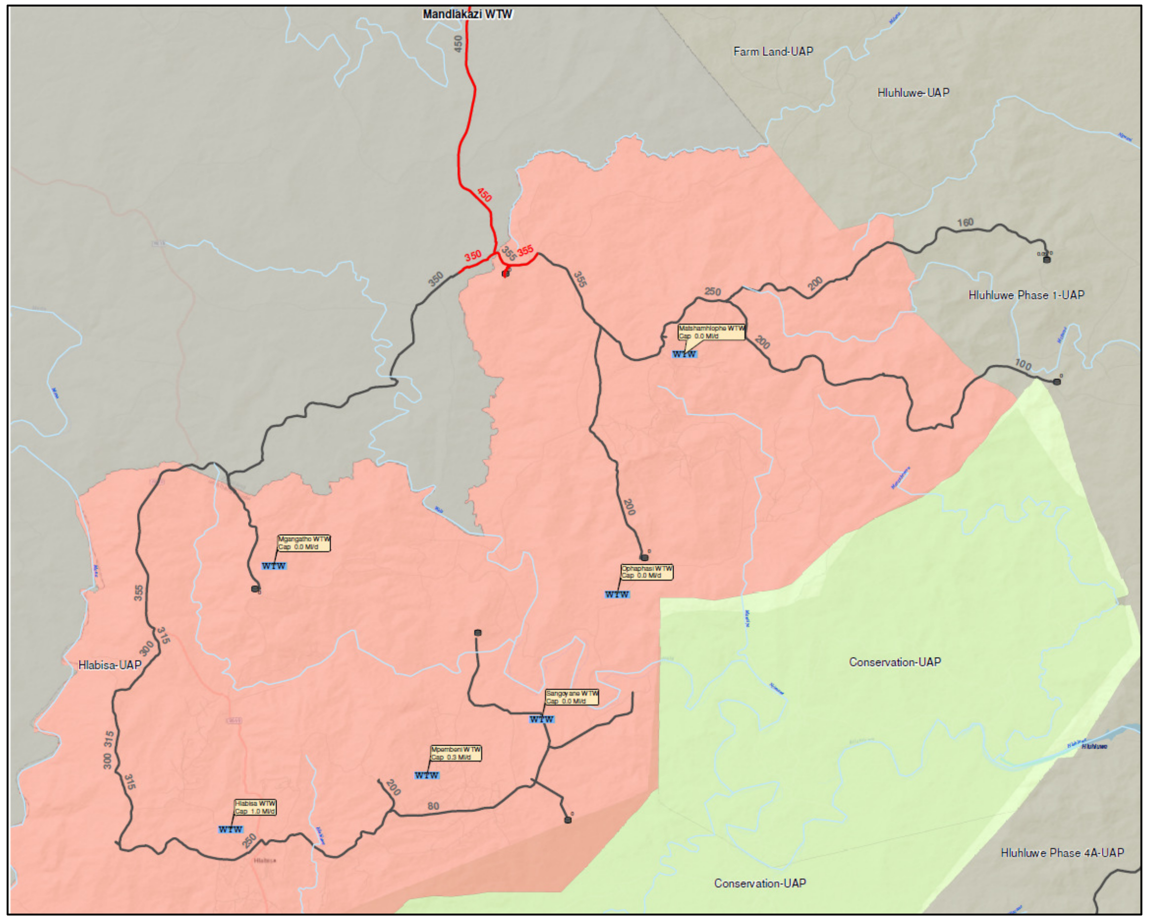
6.2.4. Proposed Infrastructure

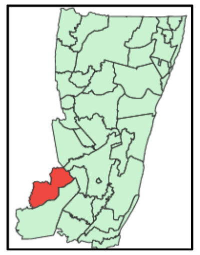
In order for the full needs to be addressed, the resulting short comings of the planned infrastructure projects above were identified and grouped into projects; the results are in **Table 36.**

Table 36: Proposed infrastructure in the Jozini supply area

LM	Supply Area	Proposed Project Name	Proposed New Infrastructure		Overall Project Cost
			Component	Quantity	
Umhlabuyalingana	Jozini	Mbazwana Bulk Water Supply Project	Bulk water supply from Othobothini or Malobeni	-	R 444 112 000.00
			Mbazwana Bulk Reinforcement,Storage	-	
Jozini	Jozini	Jozini Bulk Storage and Reticulation Upgrade	Storage and Reticulation Upgrade	-	R 40 489 000.00
Jozini	Jozini	Mkuze Bulk Water Supply Project	Additional Upgrade to Mkuze WTW	-	R 130 530 000.00
			Bulk Pipeline to Mkhuze		
Jozini	Jozini	Mhlekazi Water Supply Project	Bulk Water Supply from Mkhuze Sub Scheme + Bulk Storage	-	R 106 408 000.00
Umhlabuyalingana	Jozini	Nondabuya Water Supply Project	Bulk Water Supply from Othobothini	-	R 166 623 000.00
			Bulk Storage		
Jozini	Jozini	Mjindi Water Supply Project	Bulk Water Supply from Othbothini	-	R 150 375 000.00
			Provision for Additional Storage		
Jozini	Jozini	Othobothini Water Supply Project	Othobothini Bulk Water Supply,Storage	-	R 89 600 000.00
					R 1 128 137 000.00

6.3. Hlabisa Supply Area





The Hlabisa Supply Area covers the Hlabisa Local Municipality. The supply area depicted on the large supply area key map above show the footprint which exclude a large area that is occupied by the Hluhluwe Game Reserve. Hlabisa was also made up of eight (8) stand-alone small scheme areas provided by UKDM and our interpretation of the current supply scheme dictated by existing water sources, extent of the bulk distribution infrastructure and topographical boundaries such as rivers or watersheds.

Currently the southern Hlabisa Scheme abstracts water from a small stream east of Hlabisa town as well a borehole with the premises of the Hlabisa WTW and the northern Hlabisa Scheme being served by the Mpembheni WTW which abstracts water from a single borehole (**Table 37**). Hlabisa is further served by numerous stand-alone boreholes, some equipped with hand pumps with relatively low yield capacities.

The existing Hlabisa WTW has a capacity of 3Ml/day. The plant has been operating at very low flows with the earliest figures from the Operation and Maintenance Report from July 2014 indicating that the Plant has been unable to even produce 0.5 Ml/day(as slow as 0 flows for the month of February 2015). This is unfortunately due to existing source problems from the stream and borehole. The Mpembheni WTW has a capacity of 0.3Ml/day and is not operational with the last actual production figure of 0.2 Ml/d being in April 2015. (A more recent Operation and Maintenance Report was not available to indicate any changes to this situation). These two works will be subsequently decommissioned upon the full operation of the new Hlabisa Water Scheme Infrastructure, and therefore treatment of water will be from the Mandlakazi WTW in Zululand District.

The Hlabisa Bulk Water Supply Preliminary Engineering Design Report Dated February 2008 by Bigen Africa refers to a project which is currently at construction hand over stage for the bulk water supply mains and storage reservoirs already complete. The Hlabisa scheme will therefore be considered and evaluated as per the new infrastructure i.e. complete and currently in construction.

This new Hlabisa scheme draws water via a cross-district agreement with Zululand District Municipality from the Mandlakazi Water Scheme. Raw Water from the Senekal Boerdery, who in turn source water via a license from Pongola Poort Dam. The Charl Senekal is noted to have a license for abstraction of 32.6mil m^3/a, of which 2.6 million m^3/a (7.1Ml/day) is registered for domestic use to share between the Mkuze and Mandlakazi (and therefore Hlabisa) schemes. It should be noted that the Pongolapoort Dam is already over allocated, and an increase in the allocation from the Charl Senekal Trust should be confirmed.

Table 37: Water Treatment Works in Hlabisa

LM	Regional Scheme	Sub-Scheme	Source	Water Treatment Works	Design Capacity	Current Operating Capacity	Works Classification
				Plant Names	(Ml/Day)	(Ml/Day)	
Hlabisa	Hlabisa	Hlabisa	Borehole	Mpembeni	0.3	no meters	D
	Hlabisa	Hlabisa	stream + 3 Boreholes	Hlabisa	1	0.05 No water	
					1.3	0.05	

From the Hlabisa Bulk Water Supply Preliminary Engineering Design Report, it's noted that the overall capacity of the new Mandlakazi WTW was to be upgraded to 20 Ml/d, which would comprise of 10.6 Ml/d for the Mandlakazi scheme area and 9.3 Ml/d would be reserved to be supplied to the Hlabisa Supply Area. It is noted that the raw water supply line has a capacity of only 10Ml/day, so in order for the plant to operate at full capacity once the upgrade is completed. This needs to be discussed with Zululand District Municipality.

After treatment at the Mandlakazi WTW, portable water "gravitates" into two(2) Hlabisa Scheme connection nodes H (Northern Area) and A (Southern Area) which comprise of 245KVA and 55KVA pump stations respectively. Water from each node is pumped via 250mm diameter rising mains into storage reservoirs and then into secondary distribution mains (see **Table 38** for details). This marks the end of the recently completed Hlabisa Bulk Water Supply Scheme Project. The distribution/reticulation networks for the Hlabisa Scheme are currently not commissioned, however construction of the reticulation is underway.

Table 38: Hlabisa Bulk Distribution and Reticulation

Diameter	Length	Condition
250	25 660 m	Good (New Infrastructure)
200	13 580 m	Good (New Infrastructure)
140	2 850 m	Good (New Infrastructure)
125	11 250 m	Good (New Infrastructure)
110	5 950 m	Good (New Infrastructure)
90	14 050 m	Good (New Infrastructure)
75	12 980 m	Good (New Infrastructure)
50	1 400 m	Good (New Infrastructure)

6.3.1. *Demographics and water demand for the Hlabisa Supply Area*

Table 39 summarizes the demographics and water demands for the Hlabisa Supply Area.

Table 39: Demographics and Water Demands for the Hlabisa Supply Area

Probable	2015	2025	2035
HH	12 020	13 744	15 107
Pop	71 570	81 839	89 955
AADD (Ml/d)	2.6	6.1	6.8
SDD (Ml/d)	3.7	7.3	9.5
GAADD(Ml/d)	3	7	7.8
High	**2015**	**2025**	**2035**
AADD (Ml/d)	3.4	7.9	8.9
SDD (Ml/d)	4.9	9.4	12.3
GAADD(Ml/d)	3.9	9.1	10.2

Demands reflected above indicated that the present high demand is 3.4 Ml/d with the probable being 2.6Ml/d. The ultimate 2035 High demand has been calculated as being 8.9 Ml/d and the probable is 6.8Ml/d. These demands have been used to assess the capacity of the existing infrastructure to supply the noted demands.

6.3.2. *Backlogs and Cost for upgrade*

The current level of service has indicated that the overall backlog in the area is 36% of the population which is served below the national standard.

Table 40 provides an overall cost estimate of addressing the present backlogs as well as the upgrade requirements of the **EXISTING** infrastructure (i.e. basic needs assessment without taking into consideration planned infrastructure projects) associated with future demand increases as a result of level of service migration.

Table 40: Overall cost estimate of addressing the backlogs and upgrade of the existing infrastructure

Consultant Fees	R 7 051 539.00
Design and Tender Documentation	R 4 568 956.00
Geotech Survey	R 0.00
Land Survey	R 123 589.00
Cathodic Protection	R 0.00
Construction Monitoring	R 2 358 994.00
Construction	R 57 947 466.95
Pipe Supply (Bulk)	
P&G	Included in Works Costs
Water Works	R 41 881 000.24
Storage (Reservoir)	R 16 066 466.71
Dam	R 0.00
Abstraction	R 0.00
Environmental, Community Liaison	R 869 212.00
Health & Safety, Quality Assurance	R 579 474.67
Project Office	R 2 028 161.34
Contingencies	R 11 589 493.39
TOTAL	R 80 065 347.36

6.3.3. Planned Infrastructure

The planned infrastructure for the area is limited to just one project as shown in **Table 41**.

Table 41: Planned infrastructure in Hlabisa

Existing/Planned Project Description	Cost	Comments
Hlabisa-Mandlakazi Water Supply: Secondary Bulk and Reticulation	113 823 000.00	Reticulation and yard connections to ALL households. No need for further upgrades

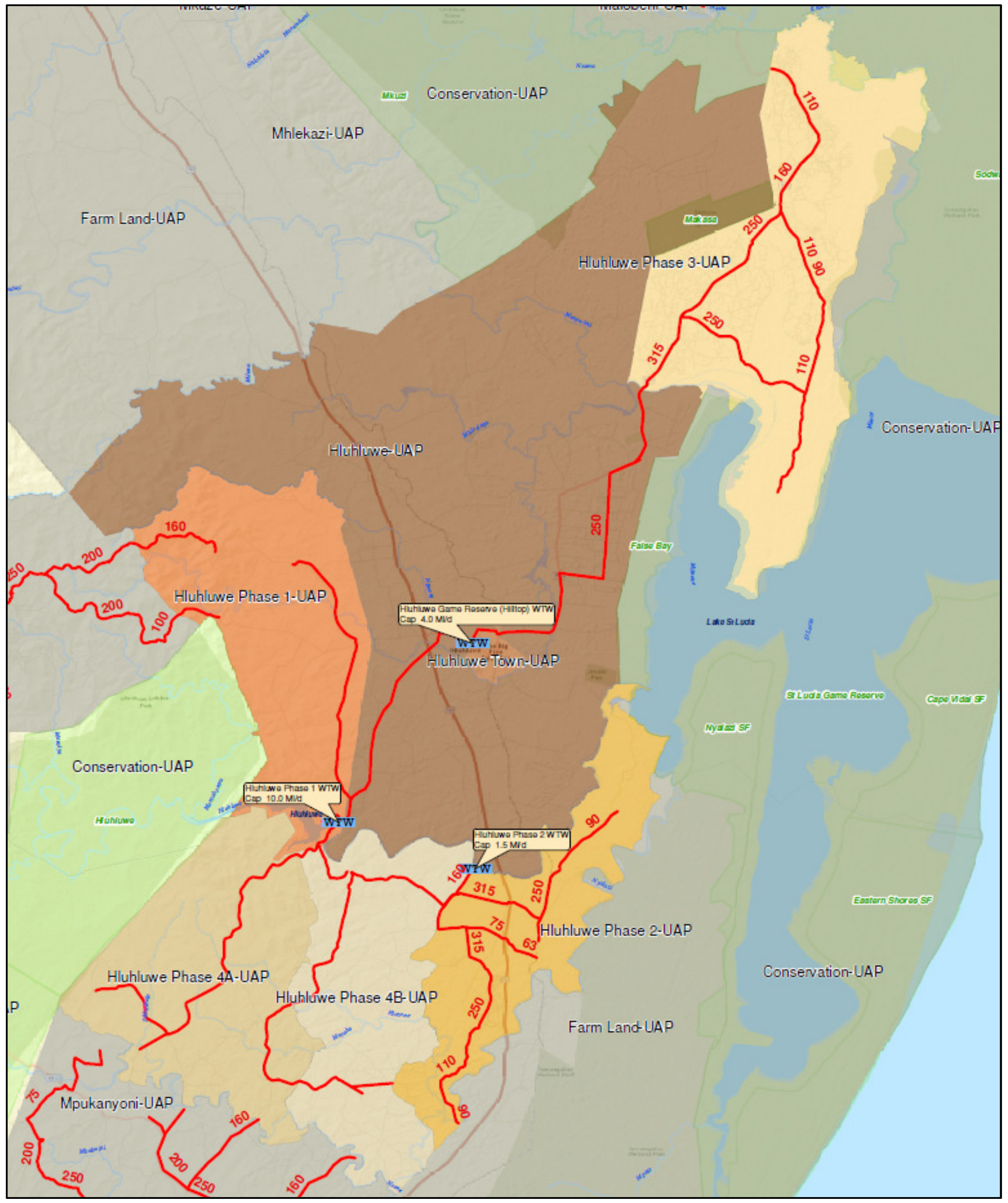
6.3.4. Proposed Infrastructure

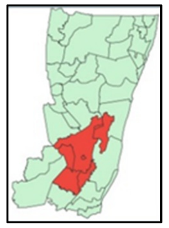
The WTW as well as storage will need upgrades in the future as per the summary in **Table 42**.

Table 42: Proposed Infrastructure in Hlabisa

Proposed Project Name	Proposed New Infrastructure Component	Quantity	Cost per component	Overall Project Cost
Hlabisa Infrastructure Upgrade	Mandlakazi WTW	8Ml/day	R 56 724 864.21	R 78 485 761.44
	Additional Storage in supply area.	5.5 Ml	R 21 760 897.23	

6.4. Hluhluwe Supply Area





The Hluhluwe Supply Area covers The Big 5 False Bay Local Municipality. The scheme area depicted on the scheme map above for Hluhluwe was made up of a combination of the Recon Study, small scheme areas provided by UKDM and our interpretation of the current supply schemes dictated by existing sources, the extent of the bulk distribution infrastructure and topographical boundaries such as rivers or watersheds.

There have been six (6) sub-supply areas identified:

- Hluhluwe Phase 1
- Hluhluwe Farms
- Hluhluwe Town
- Hluhluwe Phase 3
- Hluhluwe Phase 2
- Hluhluwe Phase 4

The entire Hluhuwe Supply area sources water from the Hluhluwe River, downstream of the Hluhluwe Dam. The Hluhluwe River is part of the Hluhluwe/Mkuze Catchment (W30), which is currently oversubscribed, primarily due to overuse in the Mkuze sub-catchment. The rivers flow into the Isimangaliso Wetland Park, and therefore protection of the Environmental Reserve is very important.

The Hluhluwe Dam has a storage capacity of 25.89 million m^3 and estimates of the historical firm yield range from 8.5 million m^3/a to 23 million m3/a based on differing reports. For this report, the yield of 13.5 million m^3/a is utilised as determined by the 2004 ISP study (Department of Water Affairs, 2004). UKDM has two water use registrations from W32F for the Hluhluwe Scheme totalling 9.8Ml/d. Hluhluwe 1 WTW has an allocation of 2.8 million m^3/a (7.6Ml/day) and Hluhluwe 2 WTW has an allocation of 0.79 million m3/a (2.16 Ml/day).

There are two water treatment works supplying the area (**Table 43**). Hluhluwe 1 WTW is located at Hluhluwe Dam and currently supplies Hluhluwe Phase 1, Hluhluwe Farms, Hluhluwe Town, and Hluhluwe Phase 3 and Hluhluwe Phase 4. Potable water is pumped through a 300mm rising main to a 5000kl reservoir located in the Mdlesthe area. From Mdlesthe water is transferred to Hluhluwe town and Phase 3. Water is also being pumped South into Phase 4 via a 250mm diameter rising main.

Bulk consumers include:

- Mdlesthe rural: ±360kl/d
- Commercial farmers
- (19) and a game ranch:±130kl/d
- Hluhluwe town: ±880kl/d

The Hluhluwe 2 WTW is located downstream of Hluhluwe Dam and supplies Hluhluwe Phase 2. From the treatment plant potable water is supplied to rural communities to the south (Ophondweni region) at approximately 650kl/d and communities towards False Bay in the north at approximately 650kl/d.

Table 43: Water Treatment Works in the Hluhluwe Supply area

LM	Regional Scheme	Sub-Scheme	Source	Water Treatment Works	Design Capacity	Current Operating Capacity	Works Classification
				Plant Names	(Ml/Day)	(Ml/Day)	
Hluhluwe	Hluhluwe	Hluhluwe	Hluhluwe River	Hluhluwe Phase1 (Dam)	10	6.3	B
	Hluhluwe	Hluhluwe	Hluhluwe River	Hluhluwe Phase 2	1.5	1.46	B
Total					**11.5**	**7.76**	

The bulk distribution and reticulation of each sub-scheme is summarised as follows:

Hluhluwe Phase 1 - The bulk backbone extends from Hluhluwe 1 WTW to the north east towards Bartown or Hluhluwe Town passing Sikwakwaneni towards Njiya, branching after Sikwakwaneni to the south towards Nqutsheni and its diameter ranges from 315mm to 110mm dia over some sections, where known, but the diameter for the full extent of the line / nor connectivity to reservoirs is not known, which makes a firm evaluation of the capacities impossible. From available information from GIS collected from PSP and UKDM, the total storage in the Hluhluwe Supply area is 12 Ml.

Hluhluwe Phase 3: *It should be noted that although Hluhluwe Phase 3 is currently served from the Hluhluwe 1 WTW under the Hluhluwe Supply Area, UKDM have a planned project which is Phase 2 of the Jozini Regional Community Water Supply Project which is aiming to extend the Jozini Regional Supply scheme to cater for Hluhluwe Phase 3 demands. Therefore, hence forth the future demands and infrastructure requirements for Hluhluwe Phase 3 have not been included in the assessment of this supply area as it was added as part of the requirement sand assessment of the Jozini Supply area*

6.4.1. *Demographics and water demand for the Hlabisa Supply Area*

Table 44 shows the demands identified for the Hluhluwe Supply area.

Table 44: Demographics and demands for the Hluhluwe area

Probable	2015	2025	2035
HH	28 495	34 821	39 956
Pop	165 463	202 212	232 302
AADD (Ml/d)	11	19	23
SDD (Ml/d)	16	25	35
GAADD(Ml/d)	12.6	21.8	26.4
High	2015	2025	2035
AADD (Ml/d)	14.1	24.1	29.4
SDD (Ml/d)	20.5	31.5	43.3
GAADD(Ml/d)	16.2	27.7	33.8

Note: These demands do not include Hluhluwe Phase 3, as these are catered for under the Jozini Supply area.

Demands reflected above indicated that the present high demand is 14.1 Ml/d with the probable being 11Ml/d. The ultimate 2035 High demand has been calculated as being 29.4 Ml/d and the probable is 23Ml/d. These demands have been used to assess the capacity of the existing infrastructure to supply the noted demands. The GAADD has been used to determine the required water resource for the area which is 2015 12.6Ml/d(probable) 16.2Ml/d(high) and the ultimate 2035 being 26.4Ml/d(probable) and 33.8Ml/d(high)..

6.4.2. Backlogs and Cost for Upgrade

The current level of service has indicated that the overall backlog in the area is 36% of the population which is served below the national standard, with the majority of households served with yard connections.

Table 45: Cost estimate of addressing the backlogs and upgrade of the existing infrastructure

Consultant Fees	R 61 916 426.47
Design and Tender Documentation	R 39 250 823.80
Geotech Survey	R 0.00
Land Survey	R 236 560.50
Cathodic Protection	R 0.00
Construction Monitoring	R 22 429 042.17
Construction	R 535 601 902.79
Pipe Supply (Bulk)	
P&G	Included in Works Costs
Pipeline Construction (Bulk)	R 77 448 800.00
Pipe Bridge/Jack	R 0.00
Pumpstation	R 0.00
Water Works	R 188 151 246.79
Storage (Reservoir)	R 107 391 300.27
Dam	R 0.00
Abstraction	R 0.00
Land Acquisition - 7.5%	R 16 821 781.63
Environmental, Community Liaison	R 8 410 890.81
Health & Safety, Quality Assurance	R 5 607 260.54
Project Office	R 19 625 411.90
Contingencies	R 112 145 210.85
TOTAL	R 597 518 329.26

Table 45 provides an overall cost estimate of addressing the present backlogs as well as the upgrade requirements of the **EXISTING** infrastructure (i.e. basic needs assessment without taking into consideration planned infrastructure projects) associated with future demand increases as a result of level of service migration.

Following the results of the findings in the assessment of the existing infrastructure as well as the resulting needs identified, it is important to consider “potentially new” infrastructure which will result from planned infrastructure projects

6.4.3. *Planned Infrastructure Projects.*

Table 46: Planned infrastructure in Hluhluwe

Existing/Planned Project Description	Cost	Comments
Hluhluwe Phase 1	R 38 867 955.00	Additional infrastructure upgrades required for future demands and level of service upgrade as this project was for the provision of community standtaps.
Nkunduzi Interim Water Supply	R 2 687 127.00	Project will assist in identifying additional water sources.
Hluhluwe Community Water Supply Scheme: Phase 4	R 150 000 000.00	99% Complete as at February 2016. Additional upgrade requirements has taken new infrastructure into consideration
Total Cost	R 192 055 081.20	

Table 46 presents a summary of the planned infrastructure projects and comments are made on the impact the new infrastructure will have in addressing the needs identified as a result of the demands and existing infrastructure.

6.4.4. *Proposed Infrastructure*

The resulting proposed projects to address the ultimate needs for Hluhluwe are summarised in **Table 47**.

Table 47: Proposed infrastructure in Hluhluwe

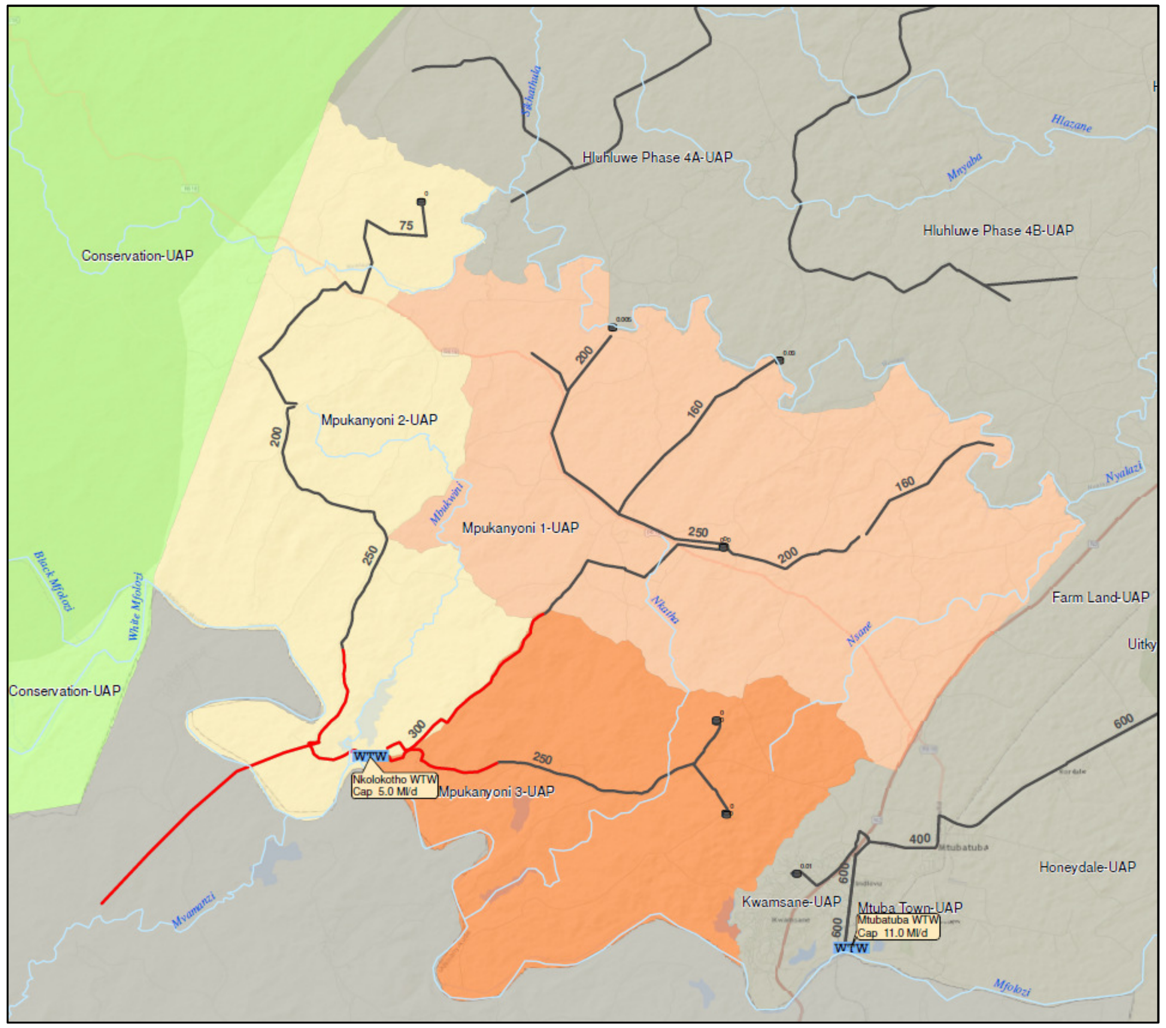
LM	Supply Area	Proposed Project Name	Proposed New Infrastructure Component	Quantity	Cost Per Component	Overall Project Cost
The Big 5 False Bay	Hluhluwe	Hluhluwe 1 Infrastructure Upgrade Project	Upgrade Hluhluwe 1 WTW	25Ml/day	R 182 586 540.80	R 328 237 280.90
			450mm Diameter bulk to Phase 4	3km	R 21 341 744.88	
			Additional Storage at Command Res.	38.5 Ml	R 91 945 347.21	
			315mm diameter bulk to Phase 1	8 km	R 32 363 648.00	
The Big 5 False Bay	Hluhluwe	Hluhluwe 2 Infrastructure Upgrade Project	Upgrade Hluhluwe 2 WTW	15Ml/day	R 101 607 727.90	R 182 916 341.90
			Additional Storage at Command Res.	15Ml	R 34 663 938.21	
			500mm Diameter bulk to Phase 2	6km	R 46 644 675.74	

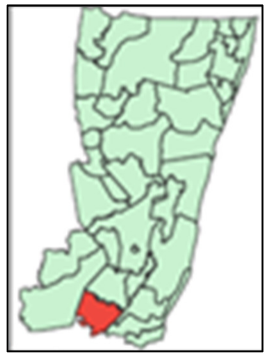
Water Resources Problem.

In the water resources discussion in Section 5,it was noted that the Hluhluwe Dam has a yield of 13.5 mil m^3/a. The total registered use from the Dam is at a total of 14.8 mil m^3/a(40.5Ml/d) of which Domestic use is registered at 3.6 mil m^3/a(9.86 Ml/day). With the current high demand being 16.2Ml/day, the domestic component of the dam allocation is already exceeded by demand (shortfall of 6.3 Ml/day). Considering that the future domestic consumption is expected to be 33.8 Ml/d(high) (short fall with current registered of -23.94Ml/d), without considering increases in the agricultural demands (which is quite unlikely) the total future demand from the Hluhluwe Dam will be 64.4Ml/d (2035) which means the present yield will be exceeded by 24Ml/d.

A possible solution for this shortfall could be the increase in dam capacity by increasing the height of the dam resulting in a more adequate yield, however more detailed studies need to be done for this option. Another possibility is a transfer from the Mfolozi River which is discussed later in the document under Mtubatuba Supply Area(**Section 6.6.4**).

6.5. Mpukunyoni Supply Area





The scheme area depicted on the scheme map above for Mpukunyoni was made up of a combination of the Recon Study, small scheme areas provided by UKDM[5] and our interpretation of the current supply schemes dictated by existing sources, the extent of the bulk distribution infrastructure and topographical boundaries such as rivers or watersheds. Furthermore, the supply area boundary is in line with the census small area boundaries.

There is one prominent water treatment works (Nkolokotho) supplying the entire area, with distinct bulk pipelines and storage reservoirs. For this reason, the Mpukunyoni Supply area was **NOT** divided into sub-supply areas. For the purpose of evaluation of the bulk pipelines, several sub-zones were identified although not shown on the map

Water Resource

This scheme draws raw water from the Mfolozi River with some raw water stored in the Mbukwini off channel storage pond. The yield in the Mfolozi River at the Nkolokoto WTW abstraction point is not known as studies of this area were not available. The Mpukunyoni Scheme shares the Mfolozi River as a water resource with the Mtubatuba Supply area. Due to the low flows in the Mfolozi River a potential long term water resource solution affecting the Hluhluwe, Mpukunyoni and Mtubatuba Supply Areas is discussed later in this document under the Mtubatuba Supply Area(**Section 6.6.4**).

Water Treatment

The abstraction point located on (X 32.033 : Y -28.396) is currently not functioning under optimal capacity due to the low flow levels on the Mfolozi River.

The abstracted raw water is transported from the abstraction point and pumped into a raw water channel and then gravitates into a raw water sump located in the vicinity of the Nkolokoto Water Treatment Works (**Table 48**).

From the raw water sump, the water then gravitates into the Nkolokotho WTW inlet, any surplus water entering the sump overflows directly into the Mbukweni of channel storage dam which also has an independent gravity connection with the Nkolokotho WTW inlet as a reserve should the primary source be interrupted. There was unfortunately very little information pertaining to the capacity of the Mbukweni off channel storage pond for comments to be made on the storage capacity of the pond.

The Nkolokotho WTW is registered on WARMS for an abstraction of 10 Ml/d.

Table 48: Water treatment works in Mpukonyoni

LM	Regional Scheme	Sub-Scheme	Source	Water Treatment Works	Design Capacity	Current Operating Capacity	Works Classification
				Plant Names	(Ml/Day)	(Ml/Day)	
Mtubatuba	Mpukunyoni	Mpukonyoni	Mfolozi	Nkolokoto	5	4.5	C

This plant is currently being operated and maintained by WSSA and is generally in a good condition as preventative maintenance is being undertaken. No major refurbishment work is however undertaken currently.

The bulk distribution and reticulation of the supply area is summarised in **Table 49**:

Table 49: Summary of Bulk Distribution Mains

Diameter	Length	Condition
300mm Rising Main	11 km	Good
250mm Rising Main	18 km	Good
250mm Gravity Main	1.4 km	Good
200mm Rising Main	5.5	Good
200mm Gravity Main	8 km	Good
160mm Gravity Main	11 km	Good
110mm Rising Main	2 km	Good
100mm Gravity Main	1.4 Km	Good
75mm Gravity Main	7 km	Good

Potable water is pumped from the WTW in 3 directions:

1. West, to the Nkumbaningi Reservoir and PumpStation. The Nkumbaningi Pumpstation pumps water South across the Mfoloi Res to the Fuleni in uThungulu and North to Mahaye Reservoir and Pump Station. The Mahaye Reservoir distributes to its supply zone (Esiyembeni SP) and the Pump Station pumps water further North to the Dlokodlo Reservoir which then distributes in and around the Machibini SP.
2. East to the Phaphasi and KwaMshaye Reservoirs which then distribute to the areas of Nkatha SP,Nkombose SP and Nkatha 2 SP.
3. North-East to the Nomatiya Pump Station, from here water is pumped to 1; the Ebaswazini Reservoir which then distributes to its supply zone. 2; the Dolombo Reservoir which in term distributes West to the Manyoni and Alex RC Reservoirs (distributing to Gunjaneni SP and Myeki SP Respectively), and East to the Mapeleni Reservoir (distributing to the Ogengele SP and Makhabane SP).

6.5.1. *Demographics and Water Demand for Mpukunyoni*

Table 50 represents the demographics and demands for Mpukunyoni.

Table 50: Demographics and water demand for Mpukonyoni

Probable	2015	2025	2035
HH	10 937	13 662	16 170
Pop	66 474	83 037	98 283
AADD (Ml/d)	3	6	7
SDD (Ml/d)	4	7	10
GAADD(Ml/d)	3.45	6.9	8.05
High	**2015**	**2025**	**2035**
AADD (Ml/d)	3.5	7.9	9.6
SDD (Ml/d)	4.9	9.1	13.3
GAADD(Ml/d)	4.	9	11

Demands reflected above indicated that the present high demand is 3.5 Ml/d with the probable being 3Ml/d. The ultimate 2035 High demand has been calculated as being 9.6 Ml/d and the probable is 7Ml/d. These demands have been used to assess the capacity of the existing infrastructure to supply the noted demands.

6.5.2. *Backlogs and Cost to Upgrade*

The current level of service has indicated that the overall backlog in the area is 67.5% of the population which is served below the national standard.

Table 51: overall cost estimate of addressing the present backlogs as well as the upgrade requirements of the existing infrastructure

Consultants Fees	R 19 777 147.08
Design and Tender Documentation	R 13 158 098.05
Geotech Survey	R 0.00
Land Survey	R 40 000.00
Cathodic Protection	R 0.00
Construction Monitoring	R 6 579 049.03
Construction	R 171 979 579.71
Pipe Supply (Bulk)	
P&G	Included in Works Costs
Pipeline Construction (Bulk)	R 12 042 000.00
Pipe Bridge/Jack	R 0.00
Pumpstation	R 0.00
Water Works	R 80 190 000.00
Storage (Reservoir)	R 32 049 474.28
Dam	R 0.00
Abstraction	R 0.00
Land Acquisition - 7.5%	R 4 934 286.77
Environmental, Community Liaison	R 2 467 143.38
Health & Safety, Quality Assurance	R 1 644 762.26
Project Office	R 5 756 667.90
Contingencies	R 32 895 245.13
TOTAL	R 191 756 726.79

Table 51 provides an overall cost estimate of addressing the present backlogs as well as the upgrade requirements of the **EXISTING** infrastructure (i.e. basic needs assessment without taking into consideration planned infrastructure projects) associated with future demand increases as a result of level of service migration.

6.5.3. *Planned Infrastructure Projects*

Currently there is only one (1) planned project in the Mpukunyoni Supply area.

Project Name : Mpukunyoni CWSS: Remedial Works & Upgrade
Project Cost : R 90 949 048.00
Needs Addressed : The project excluded WTW upgrade and only provides bulk and network upgrade to RDP level. The existing project is also at an advanced stage of construction, hence all infrastructure capacity assessments have been conducted inclusive of the new infrastructure.

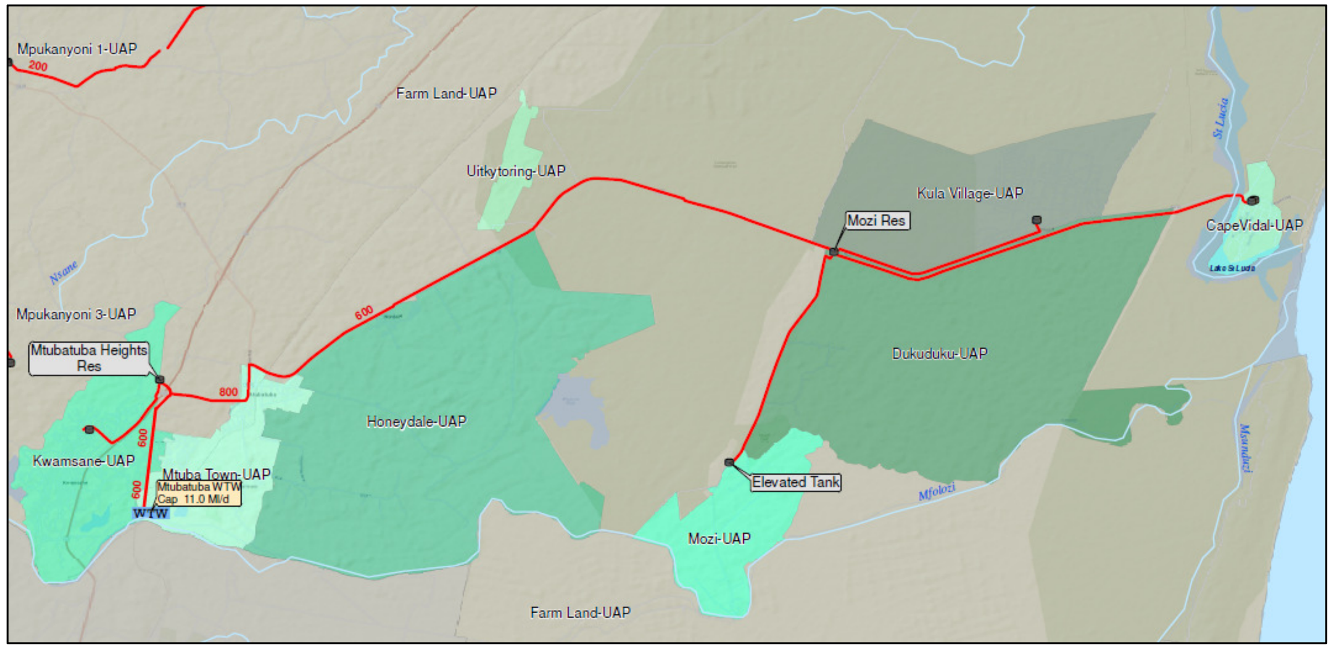
6.5.4. Proposed Infrastructure

The summary of proposed projects is found in **Table 52**.

Table 52: Proposed infrastructure in Mpukonyoni

LM	Supply Area	Proposed Project Name	Proposed New Infrastructure		Cost Per Component	Overall Project Cost
			Component	Quantity		
Mtubatuba	Mpukunyoni	Mpukunyoni Infrastructure Upgrade	Upgrade Nkolokotho WTW	15Ml/day	R 118 890 358.71	R 184 260 744.00
			Additional Storage in supply area	15 Ml	R 47 516 816.23	
			250mm diameter bulk to uThungulu	5 km	R 17 853 569.02	

6.6. Mtubatuba



The scheme area depicted on the scheme map above was made up of a combination of the Recon Study, small scheme areas provided by UKDM and our interpretation of the current supply schemes dictated by existing sources, the extent of the bulk distribution infrastructure and topographical boundaries such as rivers or watersheds.

There is one prominent water treatment works supplying the entire area, with distinct bulk pipelines and storage reservoirs. For this reason, the Mtubatuba Supply area was **NOT** divided into sub-schemes.

The Mtubatuba Supply area sources water from the Mfolozi River as well as from production boreholes. Water is treated at the newly upgraded 20Ml/day Mtubatuba WTW. The WTW is registered on WARMS for a total of 10Ml/day abstraction. The current safe yield for the Mfolozi River at this point, according to the DWS 2014 Recon Study, is at 10.1 Mℓ/d. It is not at present clearly defined as to what percentage of the overall abstraction is from ground water although it is understood that the production boreholes being used are of a high yield.

The bulk distribution and reticulation of each sub-scheme is summarised in **Table 53** and described as follows:

- Potable water is pumped Northwards through a 600mm diameter steel rising main to the 25Ml Mtuba Heights Reservoirs.
- From the Mtuba Heights Reservoirs, water then gravitates South Westerly to the KwaMsane 2Ml reservoir to supply the KwaMsane Township. Another 600mm dimeter steel gravity main (currently being upgraded to 813mm diameter) transports portable water from the Mtuba Heights reservoirs East towards Mtubatuba Town.
- An off-take from this gravity main ties into the distribution system in Mtubatuba town and the 600mm diameter gravity main continues 16 km East along the R618 main road to the 5Ml Mozi Reservoir. From the Mozi Reservoir, a 375 AC main gravitates 10km East to St. Lucia to tie into the 1.5Ml Reservoir.

Table 53: Summary of bulk distribution

Diameter	Length	Condition
813mm Gravity	3 km	Good
600mm Steel Rising Main	4 km	Fair
600mm Gravity	15.5 km	Good
375mm Gravity	11 km	Poor
200mm Gravity	3 km	Poor

The overall available storage in the Mtubatuba Supply area is 35.15 Mℓ. This total storage will be evaluated against the 48 hour storage requirement from the demand model.

6.6.1. Demographics and Water Demand for Mtubatuba

Table 54 represents the demographics and demands for the Mtubatuba Supply Area.

Table 54: Demographics and Demands for the Mtubatuba Supply Area

Probable	2015	2025	2035
HH	15 681	19 588	23 185
Pop	63 964	79 902	94 573
AADD (Ml/d)	8	12	14
SDD (Ml/d)	12	20	21
GAADD(Ml/d)	9.2	13.8	16.1
High	**2015**	**2025**	**2035**
AADD (Ml/d)	9.2	14.0	16.8
SDD (Ml/d)	14.4	24.6	26.1
GAADD(Ml/d)	10.6	16.1	19

Demands reflected above indicated that the present high demand is 9.2 Ml/d with the probable being 8Ml/d. The 2035 High demand has been calculated as being 16.8 Ml/d and the probable is 14Ml/d. These demands have been used to assess the capacity of the existing infrastructure to supply the noted demands

. It should be noted that by the addition of the demands from both the Mpukunyoni and Mtubatuba Schemes Max 35.6Ml/d and Average 28.1Ml/d, the available yield from the river will **NOT** meet the required demands. It is therefore important that the potential ground water sources as mentioned in the 2014 Recon Study are investigated and a thorough assessment is conducted.

6.6.2. Backlogs and Cost to Upgrade

The current level of service has indicated that the overall backlog in the area is 24% of the population which is served below the national standard.

Table 55: overall cost estimate of addressing the present backlogs as well as the upgrade requirements of the existing infrastructure

Consultants Fees	R 24 527 457.97
Design and Tender Documentation	R 15 450 564.17
Geotech Survey	R 0.00
Land Survey	R 248 000.00
Cathodic Protection	R 0.00
Construction Monitoring	R 8 828 893.81
Construction	R 201 976 180.11
Pipe Supply (Bulk)	
P&G	Included in Works Costs
Pipeline Construction (Bulk)	R 137 966 700.00
Pipe Bridge/Jack	R 0.00
Pumpstation	R 0.00
Water Works	R 0.00
Storage (Reservoir)	R 0.00
Dam	R 0.00
Abstraction	R 0.00
Land Acquisition - 7.5%	R 6 621 670.36
Environmental, Community Liaison	R 3 310 835.18
Health & Safety, Quality Assurance	R 2 207 223.45
Project Office	R 7 725 282.08
Contingencies	R 44 144 469.04
TOTAL	R 226 503 638.09

Table 55 provides an overall cost estimate of addressing the present backlogs as well as the upgrade requirements of the **EXISTING** infrastructure (i.e. basic needs assessment without taking into consideration planned infrastructure projects) associated with future demand increases as a result of level of service migration.

Following the results of the findings in the assessment of the existing infrastructure as well as the resulting needs identified, it is important to consider “potentially new” infrastructure which will result from planned infrastructure projects.

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6.6.3. *Planned infrastructure Projects*

Table 56 presents a summary of the planned infrastructure projects and comments are made on the impact the new infrastructure will have in addressing the needs identified as a result of the demands and existing infrastructure.

Table 56: Planned projects in Mtubatuba

Existing Project Description	Cost	Comments
Nsezi to Mfolozi Regional Bulk Water Supply	R 1 100 000 000.00	This project seeks to provide 69.2 Ml/day ("2040 Peak demand) of potable water from the Nsezi WTW to Mtubatuba and Mpukunyoni Schemes. This is not considered to be a viable option as the City of Mhlathuze UAP indicates and water resource shortage already from Nsezi and there is a need to provide a reliable water resource for the that area.
Kwamsane Bulk Supply : Provision of a 300mm diameter bulk pipeline to Kwamsane Reservoirs.	R 22 766 508.00	The 300mm bulk that is at present being constructed will be sufficient to supply the 2030 demand for KwaMsane, however, further evaluations will need to be conducted for beyond 2030 demands. No project provision will be made for this
Dukuduku on site resettlement project: Phase 1 Mtuba WTW Upgrade. Phase 2: 813mm bulk to Mtuba Town and 600mm to Mozi Reservoir, Phase 3 : 450 bulk to St. Lucia	R 777 101 338.87	Phase 1 complete WTW upgraded adequately for future demands Phase 2 proposed infrastructure adequate for future demands. Phase 3 Existing infrastructure, although adequate, condition of existing 375 AC to St. Lucia is very poor . Proposed 450 upgrade will be adequate for this section of the Mtubatuba Scheme.
Total Cost	R 1 899 867 846.87	

6.6.4. *Proposed Infrastructure Projects*

Due to the high demands in the Hluhluwe Supply area which exceed the existing dam yield, as well as the low flows in the Mfolozi River resulting in intermittent supplies for the Mpukunyoni and Mtubatuba Supply Areas, it is important to consider a regional water resources solution that can potentially address the issue for the 3 supply areas on a regional scale.

Off Channel Storage Dam at Mfolozi River: The potential of this option is quite significant in addressing the water resource need for the areas identified. Although not studied in detail, it is important that this option be looked into at a feasibility level such that it caters for the demands of the 3 supply areas in UKDM as well as the water supply shortfall of The City Of uMhlathuze which are:

- Hluhluwe Supply Area: 2035 High Demand 33.8 Ml/day less 9.86Ml/day(available from Hluhluwe Dam) results in an additional need of 23.94Ml/day
- Mpukunyoni Supply Area: 2035 High demand 11Ml/day
- Mtubatuba Supply Area : 2035 High demand 19Ml/day
- The City Of uMhlathuze : Demand 50-60 Ml/day

The firm yield of this off channel dam will provide 155 Ml/day which is the full demand for all the areas to be served plus an additional provision for future demand .increases thereafter. The costing model provided by Umeni Water does not include cost associated with Dams, however, the Reconciliation Strategy for The City of Umhlathuze dated December 2015 has indicated the off-channel dam on the Mfolozi River as a possible solution to the water resource shortage for that area and a cost estimate of R1.6 billion has been made. This estimate has therefore been adopted to form part of the overall cost estimate for addressing needs in the two (areas) and divided according to each areas demands contribution. In addition for UKDM provision will be made for a 600mm bulk pipeline transfer and pump station to supply the Hluhluwe Supply area's shortfall from its local water resource from the dam.

Table 57: Proposed infrastructure in Mtubatuba

Proposed Project Description	Cost	Comments
Mfolozi Off-Channel Dam	R 276 923 076.90	This off Channel Dam is aimed at providing the 2035 demands for Hluhluwe, Mpukunyoni and Mtubatuba Supply Areas in UKDM as well as a demand of 256 ML/day demand for The City of uMhlathuze.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1. Shemula Scheme

Resource : The Phongola River as the main water resource for this bulk scheme, current records are indicate a lack of available water in the river and Phongolapoort Dam, this is unfortunatley not clear, it is therefore recommended that a detail assessment of the actual registered users with the respective allocations and actual usage be conducted.

Treatment Capacity : The Shemula WTW(27Ml/day capacity) was found to be adequate for the present and 2025 demands, however, additional capacity needs to be added inorder for the ultimate demands to be met. Based on these demands, an additional 13Ml/day treatment capacity as well as 16Ml storage are required for the ultimate demands to be supplied.

Bulk Distribution and Storage: The results of the assessment conducted for this scheme has indicated that the proposed Shemula Bulk Water Supply Project will have suffecient capacity to supply the ultimate future demand. As this project has been sub-divided into 6 Phases, it is recommended that the various phases be inline with the growing demands for the supply areas within the scheme I.e the scheme to be completed by 2030.

7.2. Jozini Scheme

Resource : The Phongola River as the main water resource for this bulk scheme, current records are indicate a lack of available water in the river and Phongolapoort Dam, this is unfortunatley not clear, it is therefore recommended that a detail assessment of the actual registered users with the respective allocations and actual usage be conducted.

Treatment Capacity : The new upgrades underway as part of the Jozini Regional Bulk Water Supply Project have been found to be inline with the ultimate future demands. The new Othobothini 40Ml/day treament works have the capacity to supply the ultimate future demand for the scheme area includeing the propoal to supply Hluhluwe Phase 3.

Bulk Distribution and Storage: The actual scope of works is unfotrunately not clear in terms of pipeline capacities and storage reservoir locations for the planned Jozini Regional Bulk Water Supply Project. This information could not be acquired in time for the inclussion of a more acturate judgement to be done.

It is recommended that the Jozini Regional Bulk Water Supply Project be further assessed to ensure adequate capacity to meet the future demands for each supply area to be served. Provisions have been made based on required infrastructure capacities where these are unknown.

The Mseleni Supply are is to be served only from Lake Sibaya as the capacity of the lake can be able to supply the full ultimate demand of this supply are ONLY. Therefore, theeastern section of the Jozsini Regional Bulk Water Supply Project must exclude the link to Mseleni.

7.3. Hlabisa

Resource: The Mandlakazi WTW in Zululand abstracts water from the Phongolapoort Dam via the Charl Sienekal Trust. In addition to the Shemula and Jozini Regional Schemes, the availability of water from the Phongola River and Dam needs to be verified as part of the recommendation

Treatment Capacity : The madlakazi works has been found to require an additional 8Ml/day capacity for the Hlabisa portion of the works allocation.

Bulk Distribution and Storage: From the assessment of the Hlabisa Scheme to Supply the ultimate demand, it has been found that the scheme requires an additional 5.5Ml storage. The newly constructed bulk pipelines have been found to be adequate for the future demand requirements.

7.4. Hluhluwe Scheme

Resource : The Hluhluwe Dam and River are noted as being over commited interms of capacity and allocations. The acuracy of this information is however not validated as these are based on registered water user and environmental commitments. A more detailed assessment has to be done in order for the actual water allocations and availability to be confirmed. Proir to any neigbouring alternate major source to be considered. The potential for an Off-Channel Dam on the Mfolozi River and a bulk pipeline to this supply area is a possible solution to the huge shortfall which the local water resource is currently experiencing. The Hluhluwe Supply area's shortfall from its local water resource contributes 23.94Ml/day of the total 114.94Ml/day demand for the Off-Channel dam proposed on the Mfolozi River. This therefore means the Hluhluwe Supply areas will have an additionl needs cost of R338 461 538.50 of the R1.6Billion cost of the Dam. In addition the required 49km 600mm diameter bulk pipeline, pupstation and comand reservoir required for the Macro Transfer will add an additional cost of R 562 710 236.00. This added to the local infrstructure need of R 511 153 622.80 as mentioned under **Section 6.4.4** brings to total needs for the supply area to **R 1 412 325 391.00**

Treatment Capacity : The Hluhluwe 1 WTW requires an additional treatement capacity of 25Ml/day and Hluhluwe 1 WTW requires an additional 15Ml/day treatment capaciy.

Bulk Distribution and Storage : Overall additional storage required for the supply area is 53.5Ml(38.5Ml Hluhluwe 1 and 15Ml Hluhluwe 2). In terms of the bulk distribution
Bulk mains to Phase 1, Phase 2 and Phase 4 have been proposed as the exisitng has been found to be inadequate for the ultimate demand.

7.5. Mpukunyoni Scheme

Resource: The Mfolozi River, similar to the majority of the water resources in the district, records show it to be over committed, in addition to this, the district has been for some time, battling to abstract sufficient water as the Mfolozi river is lacking in terms of yield capacity.

The Mfolozi Off-Channel Storage: The Mpukunyoni Supply Are contributes 11Ml/day to the overall demand of 114.94Ml/day demand from the dam, which is equivalent to R 153 846 153.80 of the R1.6Billion total cost of the dam. Adding the local infrastructure cost of R 184 260 744.00(**Section 6.5.4)** brings the total needs for the areas to **R 338 106 897.80**

Treatment Capacity: The Nkolokotho WTW capacity has been found as being inadequate for the future demands, an additional 15Ml/day treatment capacity is required.

Bulk Distribution and Storage: The Mpukunyoni scheme requires an additional 15Ml storage capacity to cater for the ultimate future demand. In addition, a cross boarder agreement with Uthungulu requires a bulk main of 250mm diameter.

7.6. Mtubatuba Supply Area.

Resource: Similar to the Mpukunyoni Scheme, the Mtubatuba Scheme shares the same issues with regards to resources as abstraction is downstream of the Mpukunyoni's abstraction point.

The Planned infrastructure projects by UKDM have been found to be adequate to provide the projected demands, however, the water resource proposal of the ochnnel dam is a recommendation that should be considered as a potential long term water resource solution.

Treatment Capacity: The recently upgraded Mtubatuba WTW has been found to be adequate for the ultimate future demand of this study.

Bulk Distribution and Storage: The existing infrastructure, as well as new infrastructure that will be constructed as part of the planned infrastructure projects has been found to be adequate for the ultimate future demands of this study.

7.7. Cost Summary

The total estimated costs for the proposed infrastructure projects is summarized in **Table 58** , it should be noted that this does not include currently planned interventions by UKDM. In addition, there may be scenarios that are costed, but would not occur should another proposition be decided upon. For example, a WTW upgrade may not occur, if instead another source is utilised.

Table 58: Cost Estimates for proposed projects across the district

Supply Area	Estimated Project Cost
Shemula	R 149 373 690.10
Jozini	R 1 128 137 000.00
Hluhluwe	R 1 412 325 391.00
Hlabisa	R 78 485 761.44
Mpukunyoni	R 338 106 897.80
Mtubatuba	R 276 923 076.90
Total Cost For Bulks	**R 3 383 351 817.00**

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ANNEXURE A

UKDM CONTEXT MAPS

ANNEXURE B

DEMAND INPUTS AND RESULTS

ANNEXURE C

DEMAND PROJECTION MAPS

ANNEXURE D

EXISTING INFRASTRUCTURE MAPS

ANNEXURE E

UKDM PLANNED INFRASTRUCTURE MAPS

ANNEXURE F

UAP PROPOSED INFRASTRUCTURE MAPS

ANNEXURE G

UKDM KEY MAP