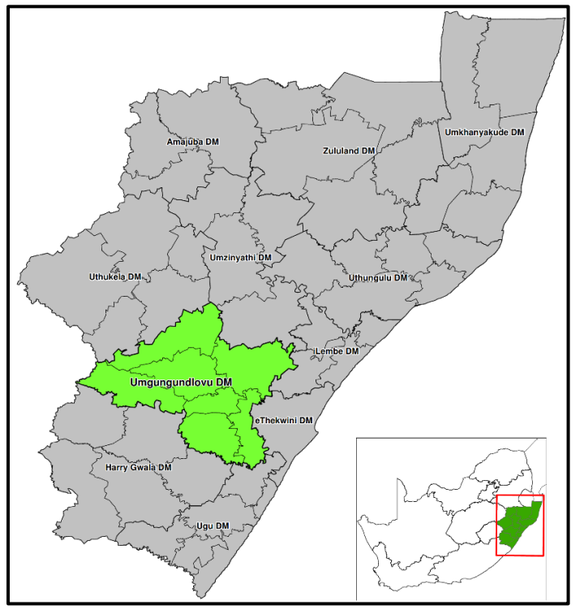
UNIVERSAL ACCESS PLAN (FOR WATER SERVICES) PHASE 2

PROGRESSIVE DEVELOPMENT OF A REGIONAL CONCEPT PLAN – UMGUNGUNDLOVU DISTRICT MUNICIPALITY

CONTRACT NO. 2015/178

RECONNAISSANCE STUDY
FINAL

JUNE 2016



Prepared for:

Umgeni Water
310 Burger Street, PMB
PO Box 9, PMB, 3200
Tel: (033) 341 1111
Fax: (033) 341 1084
Attention: Mr Vernon Perumal

Compiled by:

BIGEN AFRICA Services (Pty) Ltd
Block B, Bellevue Campus, 5 Bellevue Road,
Kloof, 3610
PO Box 1469, Kloof, 3640
Tel: +27(0) 31 717 2571
Fax: +27(0) 31 717 2572
e-mail: durban@bigenafrica.com
Enquiries: Mr Bart Oosthuizen
In Association with:
ZIYANDA consulting
Engineering Solutions through Sustainable Relationships

REPORT CONTROL PAGE

Client:	Umgeni Water
Project Name:	Universal Access Plan (For Water Services) Phase 2: Progressive Development of a Regional Concept Plan
Project Stage:	Reconnaissance Study
Report title:	Progressive Development of a Regional Concept Plan – UMDM: Reconnaissance Study
Report status:	Final
Project reference no:	2663-00-00
Report date:	June 2016

Quality Control

Written by:	Bart Oosthuizen
Reviewed by:	Robert Moffat – Bigen Africa
Approved by:	Robert Moffat – Bigen Africa
Date:	June 2016

Document Control

Version History:			
Version	Date changed	Changed by	Comments

EXECUTIVE SUMMARY

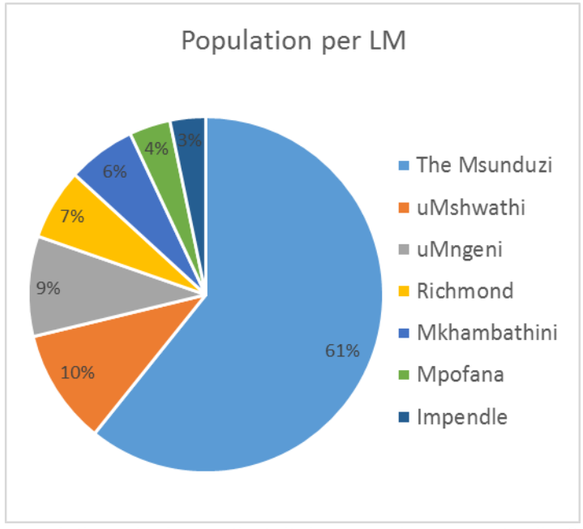
This report is the Reconnaissance Study for the Universal Access Plan Phase 2 – Progressive Development of a Regional Concept Plan for uMgungundlovu District Municipality (UMDM). The key objective of this study is to produce a concept plan for the Municipality that would address water backlogs in terms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

CONTEXT

UMDM is located in central KwaZulu-Natal, approximately 100km North-West of Durban. The provincial capital, Pietermaritzburg lies within UMDM. UMDM is made up of seven (7) local municipalities, namely: uMshwathi; uMngeni, Mpofana, Impendle, Msunduzi, Mkhambathini, Richmond, and Mkhambathini.

The UMDM is the Water Services Authority (WSA) for all LM's, except the Msunduzi. The Umgeni Water is the bulk water services provider (WSP) for large areas of the UMDM. The Msunduzi and the UMDM are the retail WSP for their areas of jurisdiction.

DEMOGRAPHICS AND SOCIO-ECONOMICS



According to Census 2011, UMDM recorded a total population of 1 017 763 and 272 666 households, resulting in an average of 3.73 persons per household. This population constitutes about 10% of the KZN provincial population.

Based on population growth rates provided by Umgeni Water (detailed further in **Section 3.5**), it is estimated that the total population for 2015 is 1 062 069. Based on an average of 3.75 persons per household, this equates to 283 218 households.

Nearly half of the economically active population declares that it has no income at all, 67% are most likely considered indigent, with an income of R1600 or less per month.

The district accounts for approximately 13.5% of the GDP of KZN, and 14.5% of the formal employment in the province (Isibuko se Africa, 2014). However, the economy of the UMDM is highly reliant on the Msunduzi, which according to Global Insight 2013, contributed 72% of the GDP for the district in 2012.

Region	Average Annual Growth Rate
UMgungundlovu	1.07%
The Msunduzi	1.05%
uMshwathi	1.13%
uMngeni	0.96%
Richmond	1.20%
Mkhambathini	1.13%
Mpofana	1.13%
Impendle	1.19%

WATER RESOURCES

The UMDM area is served by many different water resources. The Mooi and Mngeni River systems are the most important resources for a large proportion of the population. Other significant river systems are the uMkomazi, Lovu, and Mvoti, as well as some of their tributaries. Groundwater also plays an important role in the district, with rural villages, and large tracts of farmland being served via boreholes.

From a planning perspective, Umgeni Water must supply water at a 99% assurance of supply to the greater eThekwini-Msunduzi area (includes all of the Upper Mgeni system), and based on current yields and projected demands, the system is currently in a deficit with a worsening situation predicted in the future. Several years of good rainfall have masked the severity of the situation, but with current drought, and climate predictions, there is an increasing risk of shortfall. Despite the deficit, extensions to the system are currently under construction, and others are in the planning phase. Those in the Upper Mgeni System area are the Greater Mshwathi Water Supply System (demand projection 26Mℓ in 2012; 40Mℓ in 2027); and the Greater Mpofana Supply System (design demand 60Mℓ, for long term needs).

The most promising solution to resolve the deficit on the system is the augmentation from the proposed Mkomazi Water Project that will involve the construction of Smithfield and then Impendle Dams on the uMkhomazi River. This water will primarily serve eThekwini, but also to a lesser extent uMgungundlovu and Msunduzi. The augmentation will result in the deficit on the entire Mgeni System being resolved, resulting in 99% assurance of supply to all customers. However, the earliest possible commissioning of the system will be 2023, and thus water conservation and water demand management remain the top priority to try and ensure sufficient resources to supply the system.

EXISTING BULK WATER INFRASTRUCTURE

The uMgungundlovu DM water supply services are a mixture of individual schemes owned and operated by the DM, and areas served via the Upper Mgeni System owned and operated by Umgeni Water Board.

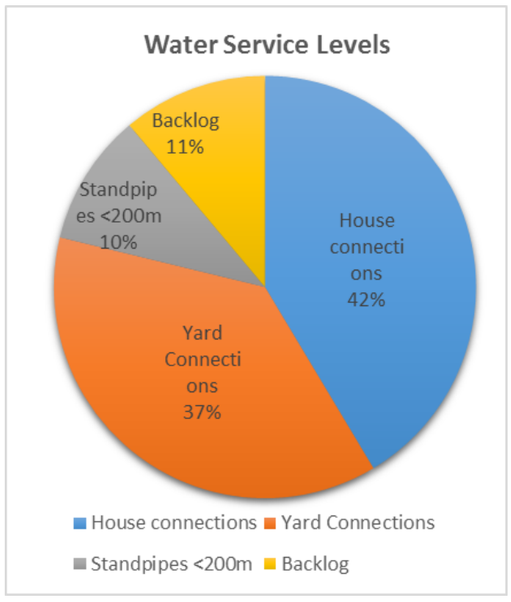
- **Msunduzi** comprises the urban areas of Pietermaritzburg and surrounds, and the rural area of Vulindlela. The entire municipality is supplied from the Upper Mgeni System.
- **Impendle** is categorised as mainly a deep rural area. The majority of the local municipal land is dedicated to forestry and agriculture. The municipality is supplied via stand-alone groundwater and surface water systems at present. The Greater Impendle Rural Water Supply Project is planned to supply some areas in the future. The remainder of the LM is private farmland, and no further bulk water supply projects are warranted.
- **Mkhambathini** is a largely rural area with Camperdown being the most urbanised area associated with light industries and distribution warehousing. Water is supplied to Mkhambathini by both UMDM stand-alone schemes, and the Upper Mgeni System.
- **Mpofana** is a deep rural area with one major town (Mooi River Town), and a few smaller towns. These urban areas have all historically been provided via stand-alone surface and ground water systems owned and operated by the UMDM. However, increasing demand raised concerns over

sustainability, and the Greater Mpofana Water Supply Scheme is being built in a phased approach from the Spring Grove Dam Water Treatment Works.

- **Richmond** is a mixture of urban and rural areas. Richmond Town/eNdaleni, located in central Richmond is the most densely populated region. This is followed by Hopewell, located in the North-East part of Richmond. The greater Richmond urban area has recently been connected to the Umgeni System via the Richmond pipeline. This pipeline also now supplies water to Hopewell, Thornville and Baynesfield. The rest of Richmond is served by boreholes and springs maintained by UMDM. The area is sparsely populated and the cost of supplying a Bulk Water Supply Scheme is high and renders a Regional Bulk Supply to the area not economically feasible.
- **uMshwathi** is a combination of rural and urban areas. Water is currently supplied to uMshwathi by UMDM stand-alone schemes and the Upper Mgeni System, but extensions are underway to cover the parts of the LM that are not private farmlands. No further bulk supply projects are required in this LM.
- **uMngeni** Municipality urban areas of Howick, Hilton, Merrivale and Mpophomeni are supplied from the Umgeni Water system. The remaining areas are primarily farmlands and are supplied by boreholes, and no further bulk supply projects are required.

WATER BACKLOG

The current estimated water supply backlog in UMDM is 11%.

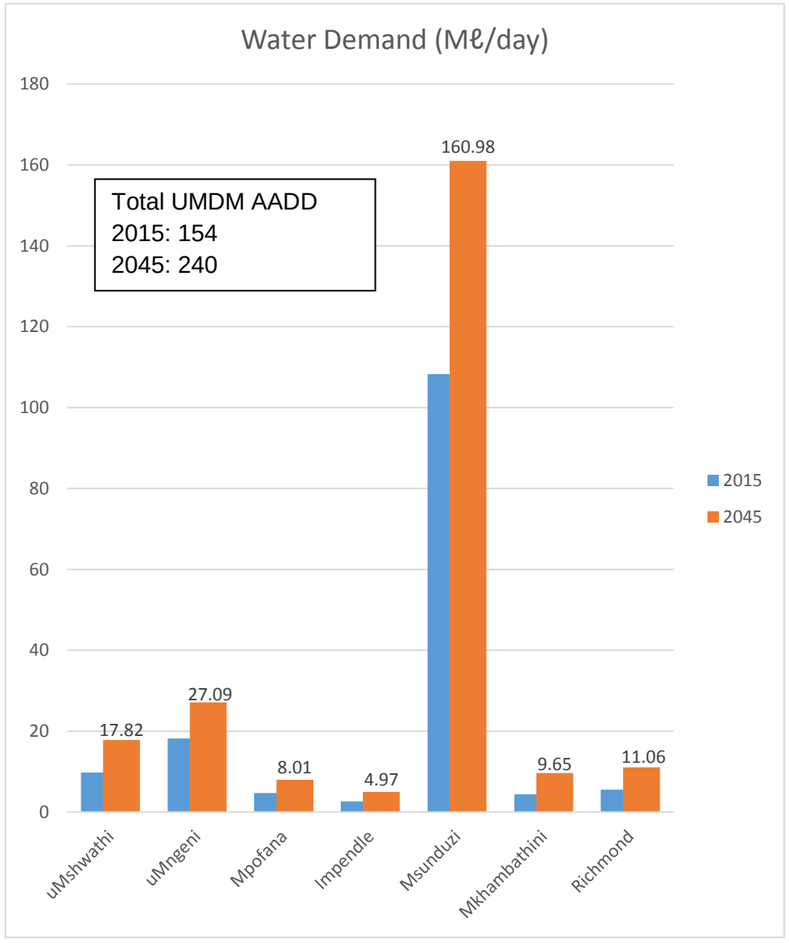


WATER DEMAND

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 UMDM. 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

Three (3) different scenarios were modelled. The scenario chosen for the gap analysis and intervention planning was the KZN Provincial Growth and Development Plan (PGDP) target to provide a minimum of 75ℓ/cap/day to all consumers in KZN by 2030. This has been interpreted as a level of service equivalent to a yard connection.



GAP ANALYSIS

Minor upgrades to existing/planned bulk infrastructure is recommended, based on the future demands calculated in this project:

1) Increased pipe size from Umlaas Road Reservoir to Lion Park / Manyavu (This pipeline is currently being constructed)
2) Additional storage at Howick West Reservoir
3) Additional storage at Wartburg Reservoir
4) Increased pipe size from Cool Air Pumpstation to Dalton
5) Increased pipe size from Table Mountain Pumpstation to Table Mountain Reservoir
   (Items 3 to 5 are being addressed in the proposed uMshwathi Bulk Water Supply project)

The areas not supplied by bulk water systems appear to be vast, yet, most of this land is private farmland, and therefore not considered for regional bulk projects. Only one (1) area - the Northern most section of Mpofana - warrants further investigation as to whether a bulk water supply system could be an option, as it is not currently served with a sustainable water supply, and the density of the population means that supply infrastructure can be distributed from one (1) command reservoir. Considering the future demand of the area is less than 1Mℓ/day, an extension of the Greater Mpofana Water Supply Scheme to this area is not considered feasible from a cost perspective. Instead, it is recommended that the areas be supplied from the Muden Regional Water Scheme in uMzinyathi DM because of the close proximity to Muden WTW. Under the planned Muden Regional Bulk Water Supply Scheme, the Muden WTW is to be expanded from 2,4Mℓ/day to 6,9Mℓ/day. The total future water demand for the Muden Regional Water Scheme is 4,5Mℓ/day, and the Northern Mpofana area requires less than 1Mℓ, from a cursory analysis, there will be sufficient capacity to supply this area.

COST OF INTERVENTIONS

A 14km length of 100Ø bulk pipeline from the Muden WTW to a 1Mℓ Reservoir is required. The cost for the proposed bulk water supply is estimated at R 55,8 million, excluding reticulation networks.

Costing of Proposed Northern Mpofana Infrastructure based on Probable Demands	
Consultants	R5 421 213
Construction	R29 882 298
Additional Studies etc	R20 527 024
Total	R55 830 535

Table of Contents

List of Tables

List of Figures

Annexures

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
UMDM	uMgungundlovu District Municipality
UW	Umgeni Water
WARMS	Water Authorisation 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 uMgungundlovu District Municipality.

1.1. Background to Study

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 in the KwaZulu-Natal province in 2013. The study focused on ten (10) WSA's 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 were however areas for improvement in the plan as per the following observations:

- The project focused on small localised schemes for universal access in the near future, 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 has appointed Bigen Africa Services (Pty) Ltd, in association with Ziyanda Consulting CC, to review the Phase 1 of the 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 City of uMhlathuze (CoU) all located in the KwaZulu-Natal province.

The development of the plan resulted in the following two (2) deliverables:

Deliverable 1: Status Quo Report

Deliverable 2: Reconnaissance Study Report and GIS data, namely an updated DWS Reference Framework Geodatabase for the study area; and maps to be published as part of an interactive mapping series.

This report serves as part of Deliverable 2.

1.2. Purpose of 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) definition:

> *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 5km;*
- *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

Figure 1 summarises the process followed for this reconnaissance study.

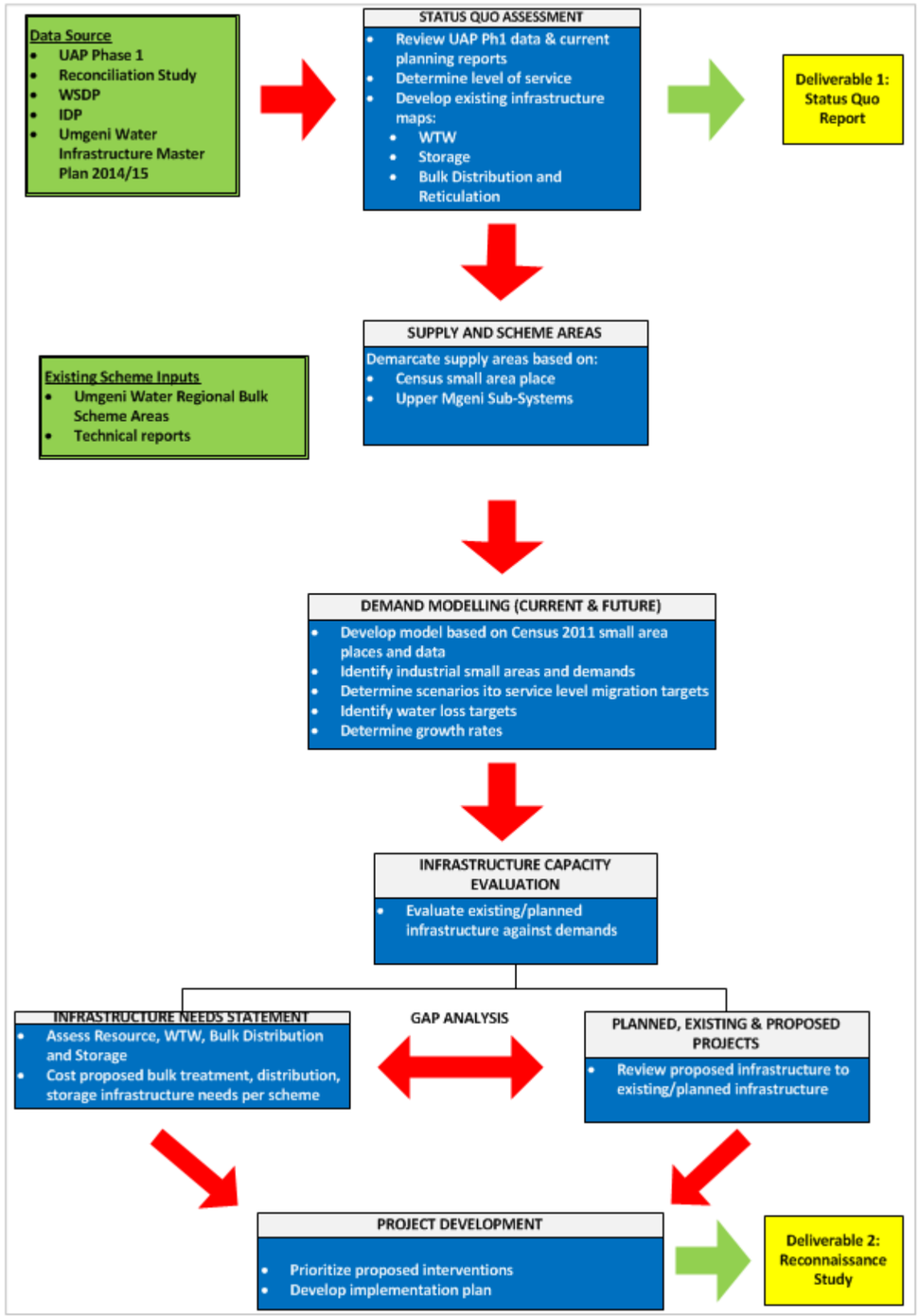


Figure 1: Study Process

- **Section 2 and 3** provides general background information on the study area.
- **Section 4** details the demand model methodology and summarises the demand projections for the WSA.
- **Section 5** provides a summary of water supply within the study area. An overview of areas provided with bulk and local schemes are provided. Details regarding local schemes are limited due to the scope of this study. Bulk water schemes are detailed further in Section 7.
- **Section 6** evaluates the water resources and availability for the study area.
- **Section 7** details the existing regional bulk schemes within the study area. Existing infrastructure is defined as either infrastructure in the ground, currently in construction or has committed funding. In the case of UMDM, all existing regional bulk infrastructure is owned and operated by Umgeni Water.
- **Section 8** highlights bulk infrastructure interventions / projects currently in planning either by the WSA or related institutions.
- **Section 9** is a gap analysis discussing the areas NOT currently provided with bulk water supply, and their potential to be linked into such a supply.
- **Section 10** details required interventions identified in **Section 9**.
- **Section 11** provides recommendations for actions going forward.

2. STUDY AREA

2.1. Context

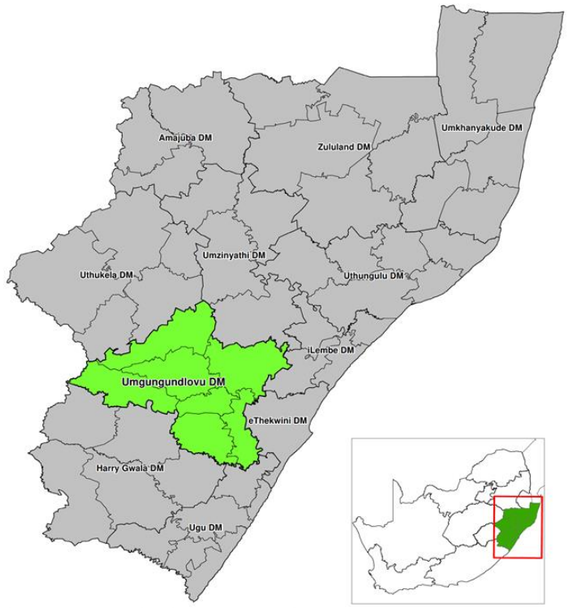


Figure 2: Provincial Perspective

uMgungundlovu District Municipality (UMDM) is located in central KwaZulu-Natal, approximately 100km North-West of Durban. The provincial capital, Pietermaritzburg lies within UMDM. Msunduzi, a local municipality within UMDM is the second (2nd) largest municipality in KZN. UMDM's vision is to evolve Msunduzi Local Municipality into a metropolitan municipality. UMDM serves as a Water Service Authority (WSA) for all local municipalities within its jurisdiction, except for Msunduzi Local Municipality, who has its own WSA status. Umgeni Water is the existing water board in this region and is fulfilling a WSP function on all bulk infrastructure. **Figure 2** provides a provincial perspective of UMDM's location within KZN.

2.2. Boundaries of Study Area

UMDM (DC22) is bounded by uThukela DM to the North-West, uMzinyathi DM in the North-East, iLembe DM in the East, eThekwini Metro in the South-East, Ugu DM in the South, and Harry Gwala DM in the South-West. A small part of the border of the Kingdom of Lesotho adjoins the DM in the West.

UMDM is made up of seven (7) local municipalities, namely:

- uMshwathi (KZN221)
- uMngeni (KZN222)
- Mpofana (KZN223)
- Impendle (KZN224)
- Msunduzi (KZN225)
- Mkhambathini (KZN226)
- Richmond (KZN227)
- Mkhambathini (KZN226)

Figure 3 provides a DM perspective.

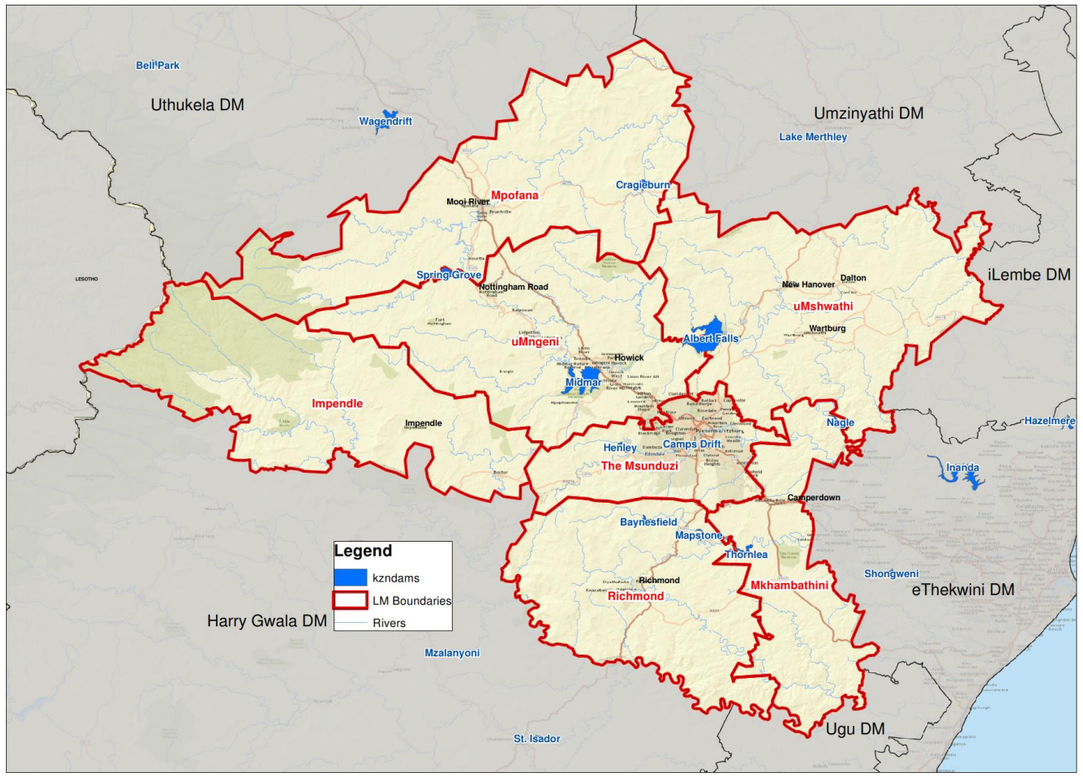


Figure 3: DM Perspective (Refer to **Annexure G** for an enlargement of this map)

Within its boundary are the Kamberg, Highmoor, Lotheni and Mkhomazi Nature Reserves, that are all a part of the uKhahlamba Drakensberg World Heritage Site, and are under the authority of Ezemvelo KZN Wildlife.

Figure 4 highlights the location of these conservation areas.

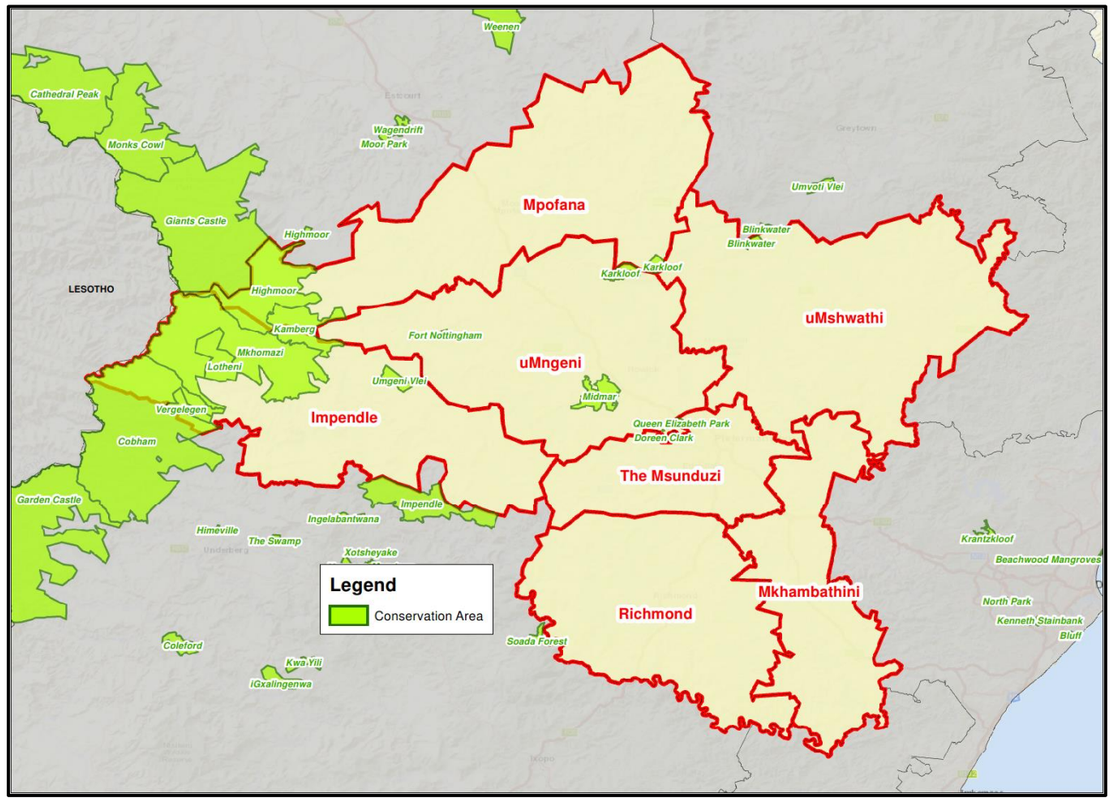


Figure 4: Conservation Areas (Refer to **Annexure G** for an enlargement of this map)

As noted in the previous section, UMDM is the Water Services Authority (WSA) for only six (6) of these municipalities, with The Msunduzi being its own WSA. From a regional planning perspective Msunduzi is included in this study, but it is acknowledged that legislative responsibility for the planning, authorisation, funding and implementation of the water services infrastructure will be separated according to the municipal boundaries.

2.3. Physical Characteristics of Study Area

The total extent of UMDM is approximately 9 189.53km$^{2.}$ It is located 85km from the country's busiest harbour – Durban – and is linked to the country's Industrial hub – Gauteng – by the N3 (IDP, 2015/16). Other larger urban towns include Richmond, Wartburg, Camperdown, Howick and Mooi River.

The UMDM is traversed by a good network of roads. The N3 is the National road that bisects the district from the South-East to the North-West. In addition some of the other major roads are– R103 as the old National road that is now a key tourist route; the R56 to Ixopo; the R617 to Bulwer; and the R33 and R622 to Greytown.

The Drakensberg Mountains cut across the Western section of Impendle and Mpofana LM's, with the foothills of the Drakensberg forming the rolling hills of the Midlands in the Central to North-Western areas of those LM's.

There are six (6) catchments in the UMDM – the Mooi, uMvoti, Mngeni, Ilovu, uMlazi and uMkomaas. The Mngeni catchment covers the largest area. The major dams are Midmar and Albert Falls on the Mngeni, and the Henley Dam on the Msunduzi. There are numerous farm dams in the area, used primarily for irrigation and livestock watering.

2.4. Climate

UMDM is a located in the sub-tropical latitudes and a summer rainfall area, with most of the rainfall occurring December and January. The climate varies with the change in altitude across the area – warm to hot and humid in the lower South-Eastern sub-tropical coastal region; and temperate in the North-Western escarpment region.

The Impendle Municipality has high rainfall areas in the mountains, with the mean annual precipitation (MAP) at 1324mm in those areas, but a reduced MAP of 986mm for the LM as a whole. Hilton through to Karkloof are also wet areas. Mooi River to Muden, and Eston to Camperdown areas are drier (SEA, 2012).

It is not possible to represent the general meteorology of the UMDM due to the significant diversities experienced. The mean average monthly temperatures and average monthly rainfall shown in **Figure** 5 is taken from the weather station at Cedara, and represents the central areas of the UMDM.

Figure 5: Monthly average temperatures and rainfall at Cedara for 1961-1990 as per the South African Weather Bereau (Isikhungesethu Environmental Services, 2012)

2.5. Topography

The Drakensberg escarpment in the West reaches heights of 3320m above sea level, contrasting with only 530m above sea level in the South East. The Impendle LM is characterised by steep slopes, with Mpofana and uMngeni having the gentler topography of the well-known "Natal Midlands" (Isikhungsethu Environmental Services, 2012). There is a clear West-East draining pattern in the area. **Figure 6** illustrates the topography of UMDM.

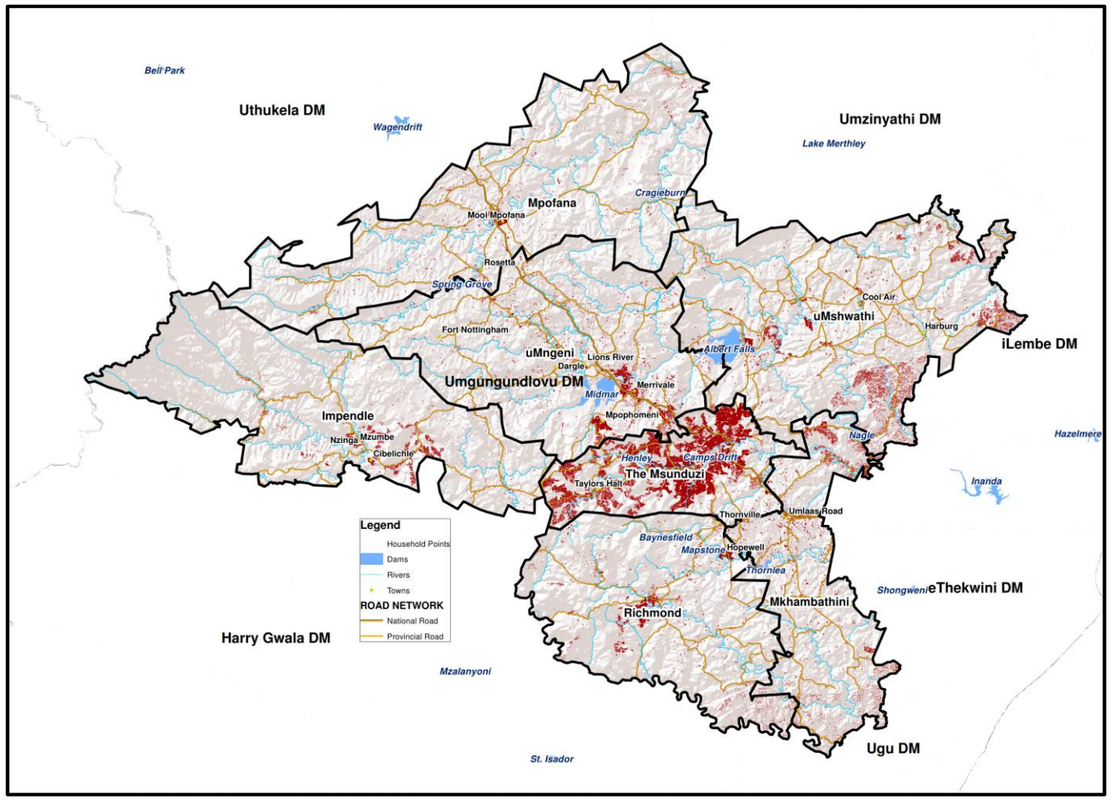


Figure 6: UMDM Topography (Refer to **Annexure G** for an enlargement of this map)

2.6. Environmental[1]

The topography of the area creates a range of habitats, ecosystems and biodiversity. The UMDM contains five (5) different biomes: Forest, Grassland (60%), Indian Ocean Coastal Belt, Savanna (38%) and Azonal Vegetation. These biomes define the habitat biodiversity. The warmer and drier North facing slopes support grasslands; while the cooler, wetter South facing slopes support indigenous forests. The UMDM has several formally protected areas and conservation areas. The uKhahlamba Drakensberg Park World Heritage Site, also a Ramsar site, has international recognition for its important biodiversity and ecosystem assets. The UMDM area has several priority wetland areas: uMngeni Vlei; Stillerust Vlei; and the Nyamvuba Vlei.

The area is known to support a number of endangered, and vulnerable floral (88 species) and faunal (95 species) species that are classified by the International Union for Conservation of Nature (IUCN) as species at risk of extinction and need to be protected.

A significant portion of the UMDM has been transformed from its indigenous vegetation type, and no longer provide the ecosystem services of the original land cover. The Mooi and uMngeni catchments have been significantly transformed, and as a result are now 'closed' catchments where new streamflow reduction activities (afforestation, irrigated agriculture, dams) are not allowed.

In terms of water resource quality, nutrients from agricultural activities in the uMngeni and Mooi River catchments have negatively affected the water quality in these rivers. In addition there are numerous farm dams on these rivers that reduce the flow volumes, and regulate the flow in the rivers, including delaying the summer flow response as they first successively fill with the first rains of the wet season. The reduced volumes have a negative impact on some physico-chemical water quality determinands. Informal settlements with no formal sewer infrastructure are expanding in the Mngeni catchment. This, coupled with defective sewer systems in Mpophomeni, have resulted in significant pollution of Midmar Dam. Downstream of the Dam, unregulated industrial effluent, informal settlements, WWTW overflows, and stormwater run-off from urban areas all negatively impact the water quality of the river.

[1] This section is sourced from the SEA 2012 Status Quo Report

3. DEMOGRAPHICS

3.1. Existing Population and Distribution

According to Census 2011, UMDM recorded a total population of 1 017 763 and 272 666 households, resulting in an average of 3.73 persons per household. This population constitutes about 10% of the KZN provincial population.

Based on population growth rates provided by Umgeni Water (detailed further in **Section 3.5**), it is estimated that the total population for 2015 is 1 062 069. Based on an average of 3.75 persons per household, this equates to 283 218 households. **Table 1** summarises the DM and LM population figures for 2011 and 2015.

Table 1: UMDM Population and Household Count

Region	2011		2015		Average Annual Growth Rate
	Pop	HH	Pop	HH	
UMgungundlovu	1 017 763	272 843	1 062 069	283 218	1.07%
The Msunduzi	618 536	165 817	644 899	171 973	1.05%
uMshwathi	106 374	28 514	111 243	29 665	1.13%
uMngeni	92 710	24 857	96 335	25 689	0.96%
Richmond	65 793	17 639	68 999	18 400	1.20%
Mkhambathini	63 142	16 928	66 039	17 610	1.13%
Mpofana	38 103	10 215	39 856	10 628	1.13%
Impendle	33 105	8 873	34 696	9 252	1.19%

The primary settlement areas are:

- Pietermaritzburg
- Richmond
- Wartburg
- Camperdown
- Howick
- Mooi River

Traditional areas are densely populated, especially those within Richmond, Impendle and uMshwathi. **Figure 7** illustrates the distribution of settlements within UMDM.

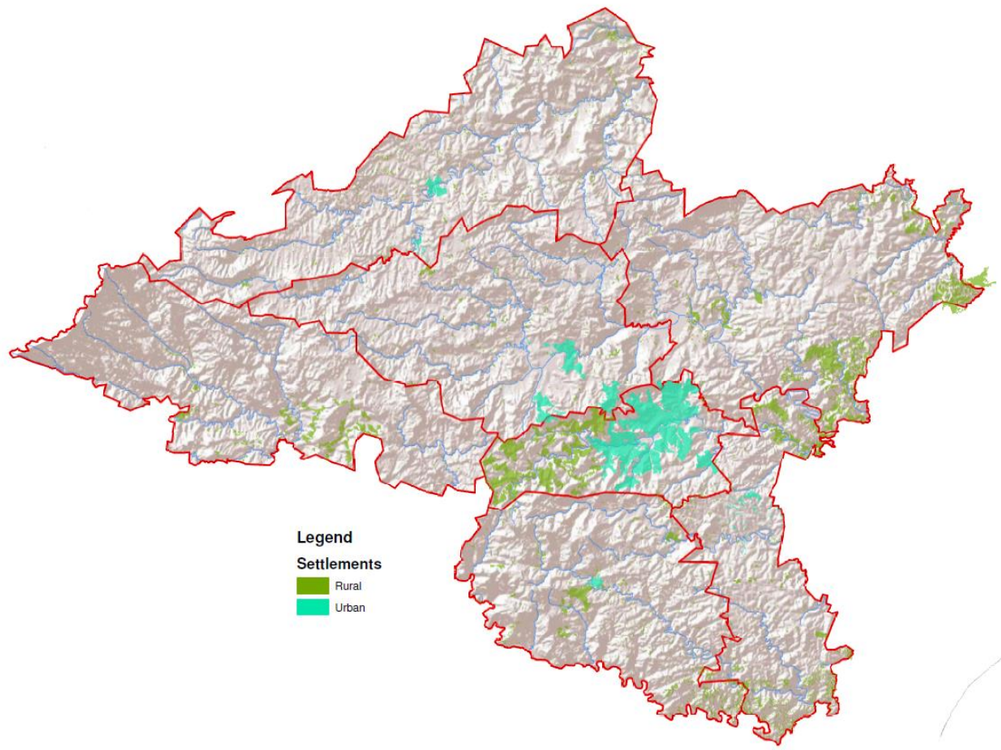


Figure 7: Distribution of Settlements within UMDM (Refer to **Annexure G** for an enlargement of this map)

3.2. Social and Economic Indicators

The unemployment rate in UMDM (as per 2011 Census) is estimated at 30.4%, which is slightly lower than the provincial rate of 33%. Of concern is the unemployment amongst the 25-34 age group is only 50% for males, and 41% for females. The employment varies across the different local municipalities, with uMngeni and Mpofana having the highest level of employment, and Impendle the lowest, as highlighted in **Figure 8** and **Figure 9** below.

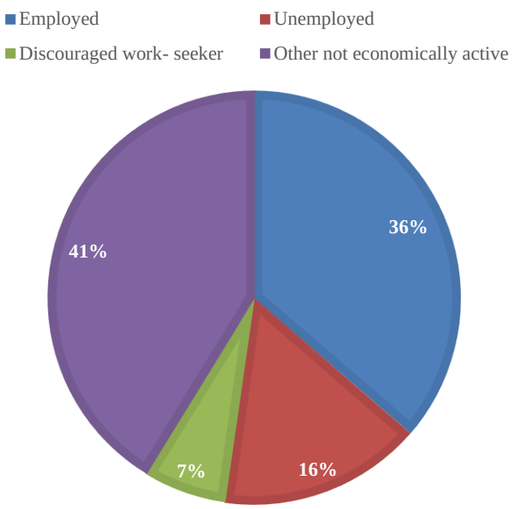


Figure 8: UMDM Employment Statistics (Census 2011)

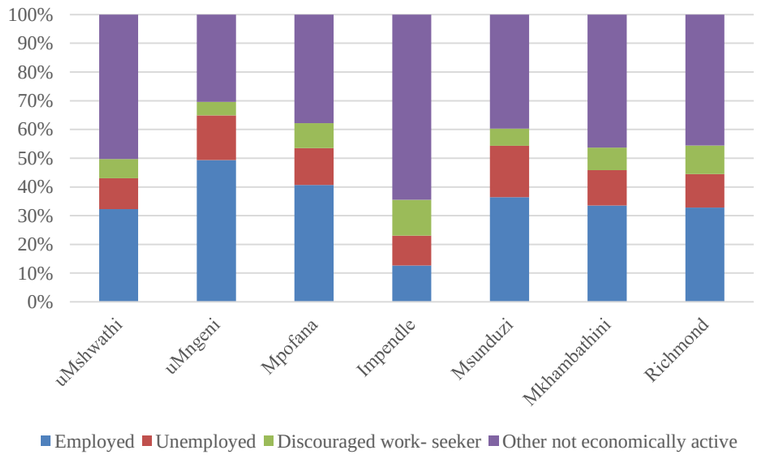
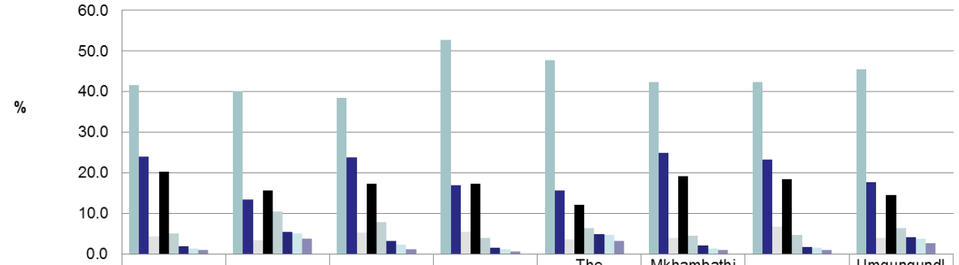


Figure 9: Employment statistics for each of the local municipalities (Census 2011)

Nearly half of the economically active population declares that it has no income at all, 67% are most likely considered indigent, with an income of R1600 or less per month. The average household income in UMDM in 2011 was R92 986 per annum, which is more than double the average in 2001. Although all the local municipal areas have seen a significant increase in average incomes, there is still a large disparity between the different areas, with the average in Impendle only R38 569 per annum, and a much higher R117 881 in uMngeni. The high average at uMngeni masks the reality that nearly 60% of the households earn at most R3000 per month.



	uMshwathi	uMngeni	Mpofana	Impendle	The Msunduzi	Mkhambathini	Richmond	Umgungundlovu
No income	41.7	40.2	38.4	52.8	47.8	42.3	42.3	45.6
R 1 - R 400	24.0	13.4	23.9	17.0	15.6	24.9	23.2	17.8
R 401 - R 800	4.4	3.5	5.2	5.4	3.6	4.0	6.7	4.0
R 801 - R 1 600	20.2	15.7	17.2	17.3	12.1	19.1	18.4	14.5
R 1 601 - R 3 200	5.1	10.4	7.9	3.9	6.3	4.5	4.7	6.3
R 3 201 - R 6 400	1.8	5.4	3.2	1.5	5.0	2.2	1.7	4.1
R 6 401 - R 12 800	1.4	5.0	2.2	1.1	4.8	1.4	1.5	3.8
R 12 801 - R 25 600	0.9	3.8	1.2	0.6	3.3	1.0	1.0	2.6
R 25 601 or more	0.5	2.7	0.7	0.4	1.6	0.6	0.5	1.4

Figure 10: Census 2011 Income levels of the economically active population in UMDM (IDP, 2015/16)

3.3. Commercial, Industrial and Institutional Development

UMDM is very strongly linked, economically, to Pietermaritzburg. The outlying areas all use the city as their primary shopping and service centre. There are good transport links from commercial farms and rural traditional settlements with the city for the movement of goods, services and people. UMDM is favourably located as an economic growth point on the national road (N3) between Durban and Johannesburg. As a result it has a diverse economic base, and is one of the more prosperous districts in the province. Education facilities, Government departments, the Provincial Legislature, historic sites and world class sporting events are all key economic attractions in Pietermaritzburg. The N3 has been earmarked for major corridor development, which should boost the economy and attract new players. In addition the district has good agriculture yield.

The economic strengths of the area are (IDP 2015/16):

- Industry – aluminium, footwear, textiles, furniture, wood products, electronics, motor components;
- Agriculture – timber, beef, dairy, sugarcane, citrus, exotic fruit, cut flowers;
- Business – major service centre for the entire Midlands area, legal services; and
- Tourism – parks and gardens, historical buildings and architecture, water sport, major international sporting events, and game viewing.

The district accounts for approximately 13.5% of the GDP of KZN, and 14.5% of the formal employment in the province (Isibuko se Africa, 2014). However, the economy of the UMDM is highly reliant on the Msunduzi, which according to Global Insight 2013, contributed 72% of the GDP for the district in 2012.

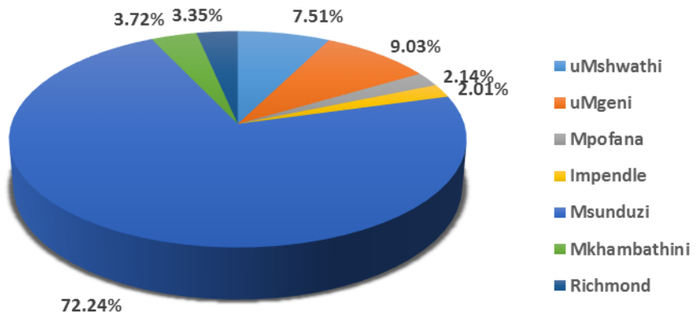


Figure 11: uMgungundlovu District Municipality's Gross Domestic Product (GDP) Contribution Rates (IDP, 2015/16)

For comparison purposes, **Table 2** shows the percentage contributions and top three (3) sectors per LM that were established in an economic scoping study of UMDM (Urban Econ, 2013).

Table 2: UMDM GDP Contribution and Top Three (3) Sectors

Local Municipality	% GDP Contribution to UMDM	Top 3 Sectors				
		Agriculture, forestry and fishing	General Government	Wholesale and retail trade, catering and accomodation	Manufacturing	Finance, Insurance, real estate and business services
The Msunduzi	70.6%					
uMngeni	11.6%					
uMshwathi	6.4%					
Richmond	4.5%					
Mkhambathini	2.9%					
Mpofana	2.9%					
Impendle	1.1%					

Highest ↓ Lowest

3.4. Population Growth

According to Census 2011, the total population was estimated at 1 017 763. In 2001, the population estimate was 932 121. Overall the UMDM has had a growth of 0.88% per annum from 2001-2011. This is lower than the national growth rate. uMngeni Municipality has experienced the highest growth with 2.27% from 2001-2011. Msunduzi in comparison had a growth of 1.12%. uMshwathi and Impendle, as primarily rural areas, experienced a decline in population size, with a 0.19% and 1.34% decline in growth, respectively.

From a water services perspective, UMDM are not responsible for the Msunduzi area. If the population for Msunduzi is excluded, the growth rate for the area is only 0.53%. **Table 3** shows the historic population count for UMDM.

Table 3: Historical population growth based on 1996, 2001 and 2011 Census (IDP 2015/16)

	Census 1996	Census 2001	Census 2011	% Change 1996-2001	% Change 2001-2011
uMshwathi	114,924	108,422	106,374	-5.7	-1.9
uMngeni	69,742	73,896	92,710	6.0	25.5
Mpofana	25,512	36,832	38,103	44.4	3.5
Impendle	39,957	37,844	33,105	-5.3	-12.5
The Msunduzi	524,266	552,837	618,536	5.4	11.9
Mkhambathini	45,174	59,067	63,142	30.8	6.9
Richmond	62,099	63,223	65,793	1.8	4.1
uMgungundlovu	**881,674**	**932,121**	**1,017,763**	**5.7**	**9.2**

3.5. Population Prediction Scenarios

Umgeni Water obtained information from Stats SA and under their guidance, estimated growth rates for each sub-place in KZN for each five (5) year period from 2011 to 2035. These growth rates have been adopted in the modelling process as the probable population growth rates per sub-place and take into account births, deaths and population migration. These predictions remain an estimate and have an associated level of accuracy, which accuracy deteriorates the longer into the future the prediction is made. For this reason, the model adopts an inaccuracy of 5% initially, growing to 15% by 2035 for the growth rates provided. These extremes are used for the determination of the low and high modelled estimates.

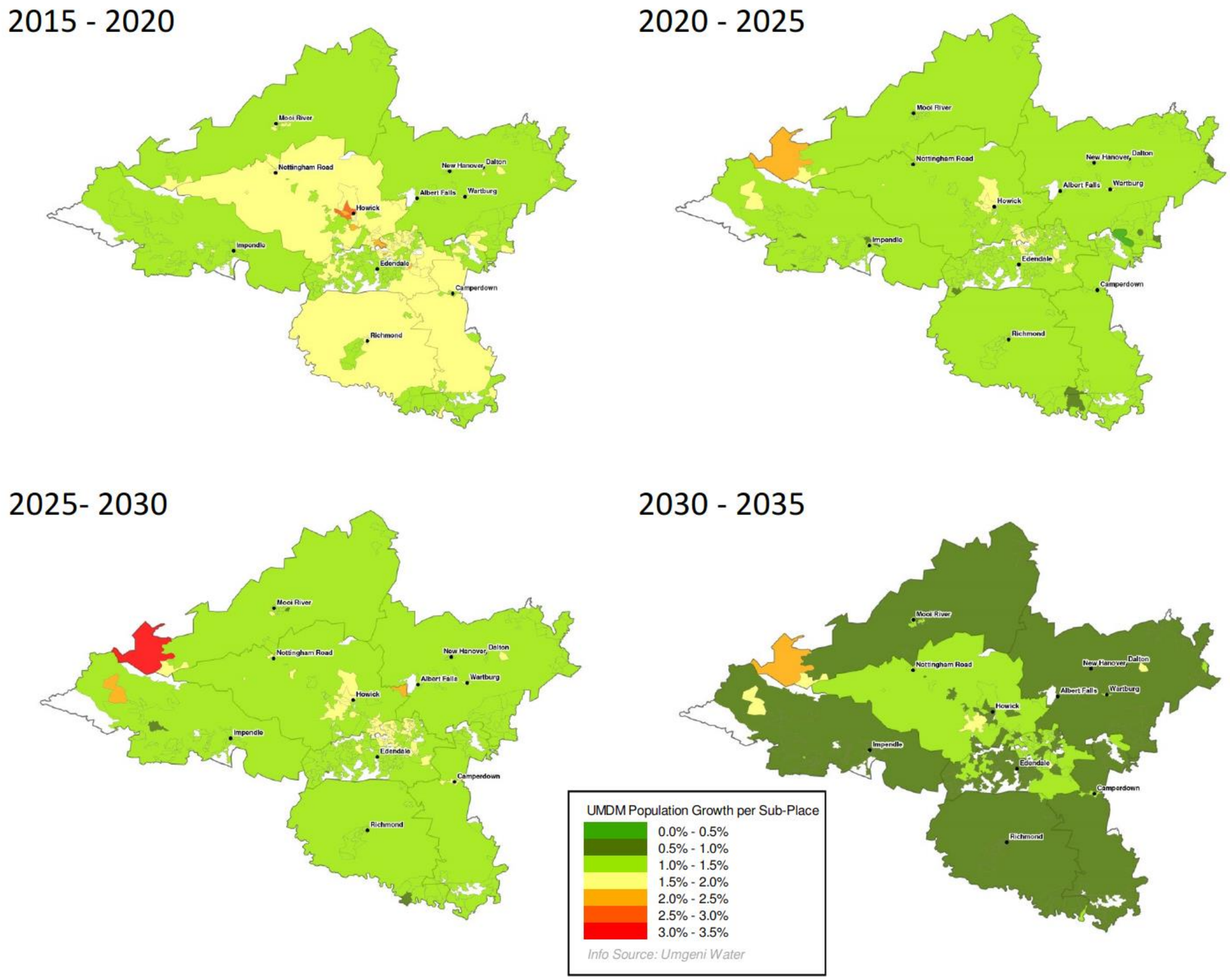


Figure 12: UMDM Population Growth Rates

4. WATER DEMANDS

4.1. Levels of Service

For the purpose of this study, the current level of water services was evaluated using the following data:

1. DWS Reference Framework Infrastructure Geodatabase
   Level of service was determined by growing the Census 2011 service levels to estimates for 2013. Growth rates utilised were obtained from the STATS SA website. These values were used as the basis of the service level analysis for this study.
2. UAP Phase 1
   SMEC, the PSP appointed on the UAP Phase 1 project, noted that an update to the level of water services could not be accurately determined. The only LoS update recorded by SMEC was the use of standpipes in Impendle. **Annexure F** maps the levels of service noted by SMEC.

Table 4: Levels of Water Service per LM in UMDM (SMEC – UAP Phase 1)

Access to Water	Standpipe	Private	Unable to Confirm	Grand Total
Impendle	5726	617	619	6962
Mkhambathini	0	3622	8872	12494
Mpofana	0	0	8364	8364
Richmond	0	2520	11650	14170
The Msunduzi	0	0	115845	115845
uMngeni	0	6595	17217	23813
uMshwathi	0	4996	14828	19824
Total	**5726**	**18350**	**177395**	**201472**
	3%	**9%**	**88%**	**100%**

3. DWS Project Geodatabase
   Project footprints were overlayed onto settlement data based on the project description and status.
4. UMDM Notes from Scoping Investigation
   In 2013/14 Bigen Africa conducted a scoping investigation for water and sanitation services in UMDM. During this engagement Bigen Africa engaged with technicians from the various local municipalities during Project Steering Committee meetings. Engagement involved marking up service levels of settlements on A0 maps. These notes were used to update the levels of service during this study. The map in **Annexure F** highlights some of the key areas marked up by UMDM.
5. Msunduzi Notes from Water Services Development Planning
   Bigen Africa is currently appointed by Msunduzi LM to complete the Municipality's Water Services Development Plan. During engagement with the WSA Manager, Mr Mike Greatwood, confirmation of the water service levels reflected by Bigen Africa was confirmed.

Through collective analysis of the aforementioned data sources and Bigen Africa's historic knowledge of areas within UMDM, **Table 5** summarises the levels of water service per LM in UMDM. The base date for the figures provided is 2013. This is the current base date utilised by DWS for the Reference Framework which is being used for all WSDP's on the DWS WSDP web-server.

Table 5: UMDM Existing Level of Service (LoS)

Households	House Connections		Yard Connections		Standpipes ≤ 200m		Above RDP		Below RDP (Backlog)		Total
Impendle	1 182	16%	2 659	36%	1 953	27%	5 794	79%	1 544	21%	7 338
Mkhambathini	3 691	19%	8 614	43%	4 752	24%	17 057	86%	2 892	14%	19 949
Mpofana	5 068	35%	5 403	38%	812	6%	11 283	79%	3 011	21%	14 294
Richmond	3 337	20%	4 989	30%	6 036	37%	14 362	87%	2 167	13%	16 529
uMngeni	19 963	57%	10 001	29%	1 655	5%	31 619	91%	3 196	9%	34 815
uMshwathi	5 467	20%	10 430	38%	3 860	14%	19 757	73%	7 378	27%	27 135
Msunduzi	78 585	48%	63 324	39%	9 348	6%	151 257	93%	11 775	7%	163 032
Total	**117 293**	**41%**	**105 420**	**37%**	**28 416**	**10%**	**251 129**	**89%**	**31 963**	**11%**	**283 092**

The map in **Annexure F** illustrates the water categories per settlement according to DWS's water service level categorisation standards.

4.2. Water Losses and Demand Management

For purposes of this model, because it is required to quantify water demands that need to be satisfied over time, the term "Water Losses" is used to include the following factors:

- Physical losses
- Excessive water use / usage due to:
  - Unmetered connections
  - Inappropriate water tariffs
  - Inefficient invoicing or debt recovery
- Unauthorised water connections

4.2.1. Water Loss Inputs

For all three (3) service level migration scenarios to be detailed in the section to follow, the estimated existing water loss is reduced over a defined period down to an expected reasonable water loss. Such water losses differentiate between urban and rural areas due to the differing capacity and circumstances of local authorities to manage such losses.

Table 6 provides a summary of the water loss inputs utilised for UMDM.

Table 6: Summary of water loss inputs in UMDM

	Urban	Rural
Existing Real Water Loss	45%	60%
Target	20%	20%
Achieve By	2025	2035

These water loss values were estimated based on Bigen Africa's historic knowledge of UMDM's real water loss percentage. A target of 20% was utilised as this is seen as the lowest feasible real water loss that can be achieved by the majority of WSA's.

4.2.2. Water Treatment Losses

For purposes of this model, a fixed allowance of 10% is made for the water lost during water treatment.

4.3. Water Service Level Migration

Three (3) development scenarios are analysed in the modelling process. Each of these scenarios are defined by the change / improvement of the levels of service expected over differing time scales and differentiate between urban and rural areas, defined as per the DWS Infrastructure Reference Database.

The three (3) scenarios can be defined as follows:

Scenario 1: This scenario refers to the targets being aimed for by the Local Water Service Authority (WSA) for each area.

Scenario 2: This is the target scenario as per the KZN Provincial Growth and Development Plan (PGDP). The target as per the KZN PGDP is to provide a minimum of 75ℓ/cap/day to all consumers in KZN by 2030. This has been interpreted as a level of service equivalent to a yard connection.

Scenario 3: This is the expected, practical, implementable development scenario determined by Bigen Africa, taking into account historical knowledge of the study area.

For UMDM, Scenario 1 and 2 have identical inputs. UMDM's IDP refers directly to the KZN PGDP and does not explicitly note any other growth scenarios.

Figure 13 below provides the respective inputs utilised per scenario.

Scenario 2	Urban			Rural			KZN Prov Growth and Dev Plan (PGDP)
	Portion to Convert	Start Year	End Year	Portion to Convert	Start Year	End Year	
Convert from No Service to RDP LOS	100%	2015	2020	100%	2015	2020	All pop. without supply converted to RDP level of service by 2020
Convert from <RDP LOS to RDP LOS	100%	2015	2020	100%	2015	2020	All pop with <RDP LOS converted to RDP level of service by 2020
Convert from RDP LOS to Yard Conn.	100%	2015	2030	100%	2015	2030	100% of Pop with RDP LOS in converted to YC LOS by 2030
Convert from Yard Conn. to House Conn	30%	2020	2035	10%	2025	2035	30% of pop with YC LOS in Urban areas and 10% in Rural Areas converted to HC LOS between 2020 and 2035 for Urban and between 2025 and 2035 for Rural

Scenario 3	Urban			Rural			Realistic Achievable Estimate
	Portion to Convert	Start Year	End Year	Portion to Convert	Start Year	End Year	
Convert from No Service to RDP LOS	90%	2015	2035	85%	2015	2035	90% of Urban pop. and 85% of rural pop. without supply converted to RDP level of service by 2035
Convert from <RDP LOS to RDP LOS	90%	2015	2035	85%	2015	2035	90% of Urban pop and 85% of Rural pop with <RDP LOS converted to RDP level of service by 2035
Convert from RDP LOS to Yard Conn.	60%	2015	2035	40%	2015	2035	60% of Urban pop and 40% of Rural pop with RDP LOS converted to YC LOS by 2035
Convert from Yard Conn. to House Conn	20%	2020	2035	10%	2020	2035	20% of Urban pop and 10% of Rural pop with YC LOS converted to HC LOS between 2020 and 2035

Figure 13: Respective Inputs utilised per scenario

4.4. Water Demand Modelling

Bigen Africa developed a zero-based demand modelling tool that has been used to determine the projected demands over a 20 year period (2015 – 2035) for UMDM. The demand model is a Microsoft Excel application in which modelling is performed at Census "Small Area" Level.

The following sub-sections provide an overview of the source data, inputs and structure of the outputs from the model. The actual results from the demand model are presented in **Section 8** of this report.

4.4.1. Source Data

4.4.1.1. Boundary Definitions

Census 2011 was used to define the reference numbers, names and associations between small area, sub-places, Local Municipalities and District Municipalities.

4.4.1.2. Demographics

The Census 2011 data was used as the base data for the following:

- Population
- Households
- Heads per household
- Income level categories
- Existing levels of water supply services

The data provided has some level of accuracy and for purposes of this model it has been assumed that the true figures will fall within a 10% wide band around the data provided in the census. The definition of urban and rural areas used in the model is derived from the classification applied to sub-place areas by DWS National in the DWS Reference Framework Geodatabase.

4.4.1.3. Growth Rates

Population growth rates were derived by Umgeni Water, utilising algorithms provided by Statistics SA. The data utilised in the model was provided at sub-place level. These growth rates allow for migration into and out of sub-places as well as for births and deaths for the period 2011 to 2045.

The growth rates provided are estimates and a band width of 10% is allowed for the period 2011 – 2015, increasing linearly up to 30% for the period 2030-2035.

4.4.2. Inputs

The key inputs for the UMDM demand model included the following:

1) Unit Water Demands
2) Supply Areas
3) Quaternary Catchments
4) Water Loss Targets
5) WTW Losses

4.4.2.1. Unit Water Demands

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.

Table 7 indicates the unit domestic demands used in the model.

Table 7: Average Annual Daily Demands

Average Annual Daily Demands								
Category	Description of consumer category	Household Annual Income Range		Per capita cons (l/c/d)			Non Seasonal	Seasonal
		From	To	Low	Prob	High	SPF	SPF
1	Very High Income; villas, large detached house, large luxury flats HC	R1 228 001	R9 999 999	360	410	460	1.5	2.5
2	Upper middle income: detached houses, large flats HC	R153 601	R1 228 000	260	295	330	1.5	2.4
3	Average Middle Income: 2 - 3 bedroom houses or flats with 1 or 2 WC, kitchen, and one bathroom, shower HC	R38 401	R153 600	200	228	255	1.4	2.3
4	Low middle Income: Small houses or flats with WC, one kitchen, one bathroom HC	R9 601	R38 400	140	170	200	1.4	2.2
5	Low income: flatlets, bedsits with kitchen & bathroom, informal household HC	R1	R9 600	80	100	120	1.3	2.0
6	No income & informal supplies with Yard connections	R0	R0	70	80	90	1.2	1.5
7	Informal with no formal connection RDP LOS	R0	R0	40	50	60	1.1	1.1
8	Informal below 25 l/c/d <RDP	R0	R0	5	12	20	1.0	1.0

Further to the description of consumer categories presented in the table above:

- Informal below 25ℓ/c/d = “<RDP” or no formal supply
- Informal with no formal connections = “RDP LoS” or walking distance to water <200m and minimum supply of 25ℓ/c/d
- No income and informal supplies with yard connection = “YC” or water at yard boundary
- House connections = “HC” with sub-categories:
  - Low Income (R 1 to R 9,600): flatlets, bedsits with kitchen and bathroom, informal household
  - Low Middle Income (R 9,601 to R 38,400): small houses or flats with WC, one kitchen, one bathroom
  - Average Middle Income (R 38,401 to R 153,600): 2-3 bedroom houses or flats within 1 or 2 WC, kitchen and one bathroom, shower
  - Upper Middle Income (R 153,601 to R 1,228,000): detached houses, large flats
  - Very High Income (>R 1,228,000): villas, large detached house, large luxury flats

Table 8 indicates the Commercial / Institutional / Industrial (CII) norms.

Table 8: Commercial / Institutional / Industrial Norms

Commercial/Institutional/Industrial Norms					
Ref	Description	Units	Low	Probable	High
A	Comm/Inst/Indust Floor area per HH (Urban)	m2/HH	12.0	20.0	28.0
B	Comm/Inst/Indust Floor area per HH (Rural)	m2/HH	3.0	5.0	7.0
C	Comm/Inst/Indust Water Demand	kl/mnth /100m2	14.0	20.0	25.0
D	Equivalent Comm/Inst/Industrial Water Demand (Urban)	l/HH/d	55.2	131.5	230.1
E	Equivalent Comm/Inst/Industrial Water Demand (Rural)	l/HH/d	13.8	32.9	57.5
F	Comm/Inst/Indust Summer Peak Factor .	f		1.1	

The following is to be noted with regard to the CII inputs above:

- Ratios of Commercial, Institutional and Industrial roof areas to number of households exist for all small areas / settlements.
- These ratios will vary according to the formality of the small area / settlement. For the purpose of this model, two (2) categories of formality have been adopted as “Urban” and “Rural”.
- Typical ratios have been combined into a single weighted range of ratios for CII water demands expressed as kℓ/households per day for urban and rural settlements.
- There exists a large spread for these demands.
- Where a small area is mainly industrial of nature, these small areas are specifically defined and the water demands uniquely identified. The water demands for such small areas are populated in the model directly, using actual records where available.

The norms utilised list low, probable and high as the range of unit demands. For purposes of this model, the low and high have been adopted as the extreme low and extreme high respectively. These have been equated to the 0.1% and 99.9% probability. Using a normal distribution, the 5% and 95% probabilities have been interpolated and these figures have been used in the model for the low and high unit demands.

4.4.2.2. Supply Areas

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.

The supply areas for UMDM are illustrated in **Figure 14**.

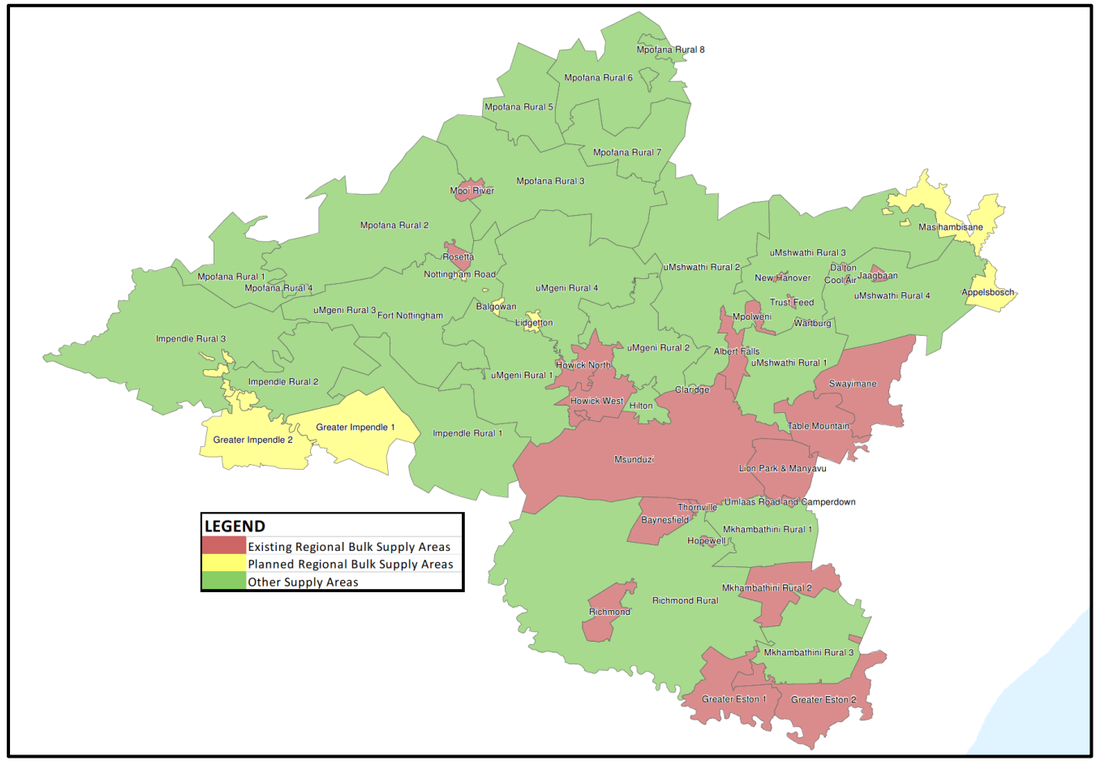


Figure 14: UMDM Supply Areas (Refer to **Annexure G** for an enlargement of this map)

4.4.2.3. Quaternary Catchments

The GIS database was utilised to determine which quaternary catchments each small area falls into. The results reflected in this report do not refer to the catchment demands, however, should this demand type be required for future use, it can be made available. (The Quaternary Catchment drawing is included in **Annexure G**).

4.4.3. Outputs

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

The predicted populations, AADD, GAADD and SDD are aggregated per:

- Small Area
- Sub-place
- Supply Area
- Local Municipality
- Quaternary Catchment
- Study Area

4.5. Reliability of Demand Modelling

The following limitations, constraints and definitions are to be noted with regard to the Census 2011 data used and the range of results produced:

- Although the Census 2011 data is considered the most reliable source of statistical data regarding demographics, this data should be seen in context when utilised in determining water demands. One should remember that Census data is obtained over a single week in a particular year and this data is not necessarily fully representative of the location where services are utilised throughout the year (e.g. holiday homes, people working in other places and returning home over holidays etc.).
- It can also be noted that some data obtained by the census is subjected to deceitful responses by the people being questioned with regard to issues like illegal immigrants, incomes, etc.
- The existing levels of service as reported by the census are also not as reliable as one would hope as the reporting is based on the experiences of the consumer according to his/her recent recollection/experience.
- The results reported as the probable are the results of adding/multiplying/dividing each of the average/probable input and Census 2011 data values. The results are only as accurate as the combined accuracy of the input values.

Demand model results are tabled in **Table 9** below:

Table 9: Demand Model Results for UMDM

Totals for District Council Area		Census	Low Population Estimates							Probable Population Estimates							High Population Estimates						
Area:	UMgungundlovu	2011 Pop	2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045
Scenario	2	1 017 706	1 059 816	1 134 285	1 198 376	1 269 049	1 317 440	1 360 194	1 393 918	1 062 069	1 142 926	1 214 862	1 297 024	1 355 380	1 408 869	1 452 685	1 064 325	1 151 625	1 231 558	1 325 584	1 394 372	1 459 240	1 513 889
	Heads per Household	3.75																					

Totals per Municipality																								
Mun Number	Municipality Name	Census 2011 Pop	Low Population Estimates							Probable Population Estimates							High Population Estimates						
			2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045
562	uMshwathi	106 359	110 995	118 575	124 954	131 948	136 757	140 947	144 199	111 243	119 474	126 632	134 759	140 553	145 788	150 004	111 492	120 378	128 331	137 627	144 450	150 789	156 038
563	uMngeni	92 715	96 151	103 635	110 027	116 989	121 613	125 743	129 204	96 335	104 461	111 640	119 744	125 330	130 507	135 015	96 519	105 293	113 275	122 562	129 157	135 448	141 085
564	Mpofana	38 101	39 767	42 502	44 824	47 365	49 117	50 672	51 905	39 856	42 826	45 432	48 385	50 496	52 440	54 040	39 946	43 153	46 047	49 426	51 913	54 268	56 260
565	Impendle	33 097	34 615	36 952	38 836	40 877	42 259	43 486	44 477	34 696	37 235	39 349	41 718	43 382	44 912	46 196	34 778	37 519	39 867	42 576	44 533	46 384	47 979
566	The Msunduzi	618 499	643 559	688 758	728 169	771 875	801 991	828 660	849 590	644 899	693 973	738 207	789 021	825 347	858 724	885 932	646 241	699 223	748 373	806 528	849 357	889 848	923 803
567	Mkhambathini	63 142	65 892	70 351	74 088	78 238	81 126	83 653	85 624	66 039	70 881	75 074	79 896	83 375	86 533	89 089	66 187	71 415	76 072	81 586	85 684	89 508	92 691
568	Richmond	65 793	68 836	73 511	77 478	81 757	84 576	87 033	88 919	68 999	74 076	78 528	83 501	86 897	89 965	92 409	69 163	74 644	79 592	85 280	89 279	92 993	96 033

Totals for District Council Area		Low Water Demand AADD (Ml/d)								ProbableWater Demand AADD (Ml/d)								High Water Demand AADD (Ml/d)							
Area:	UMgungundlovu	2011	2015	2020	2025	2030	2035	2040	2045	2011	2015	2020	2025	2030	2035	2040	2045	2011	2015	2020	2025	2030	2035	2040	2045
Scenario	2	115.6	120.2	138.0	151.0	167.4	178.4	184.5	189.3	147.6	153.6	175.4	191.2	211.3	225.3	233.2	239.6	183.8	191.7	217.9	237.2	261.8	279.4	289.8	298.2

Totals per Municipality																								
Mun Number	Municipality Name	Low Water Demand AADD (Ml/d)								ProbableWater Demand AADD (Ml/d)								High Water Demand AADD (Ml/d)							
		2011	2015	2020	2025	2030	2035	2040	2045	2011	2015	2020	2025	2030	2035	2040	2045	2011	2015	2020	2025	2030	2035	2040	2045
562	uMshwathi	7.43	7.75	10.06	11.16	12.76	13.69	14.11	14.45	9.40	9.81	12.56	13.83	15.69	16.86	17.40	17.82	11.60	12.11	15.33	16.79	18.97	20.39	21.08	21.62
563	uMngeni	13.60	14.09	15.83	17.16	18.73	19.77	20.45	21.04	17.55	18.21	20.38	22.07	24.05	25.39	26.30	27.09	22.04	22.90	25.59	27.71	30.21	31.94	33.17	34.24
564	Mpofana	3.48	3.63	4.51	4.99	5.60	5.96	6.15	6.30	4.53	4.73	5.80	6.37	7.10	7.56	7.81	8.01	5.73	5.98	7.26	7.94	8.81	9.39	9.72	9.98
565	Impendle	2.01	2.10	2.78	3.11	3.60	3.86	3.98	4.07	2.55	2.67	3.45	3.82	4.39	4.71	4.85	4.97	3.14	3.29	4.19	4.60	5.25	5.64	5.82	5.96
566	The Msunduzi	81.70	84.93	93.78	101.91	111.84	119.13	123.29	126.60	104.01	108.30	119.29	129.45	141.88	151.18	156.62	160.98	129.40	134.96	148.49	161.09	176.58	188.34	195.55	201.39
567	Mkhambathini	3.35	3.49	5.30	5.99	7.01	7.54	7.78	7.97	4.21	4.39	6.54	7.29	8.46	9.12	9.41	9.65	5.16	5.38	7.88	8.72	10.04	10.84	11.20	11.49
568	Richmond	4.02	4.20	5.78	6.67	7.85	8.44	8.69	8.88	5.30	5.55	7.38	8.39	9.75	10.50	10.82	11.06	6.76	7.08	9.19	10.34	11.91	12.82	13.23	13.55

5. DESCRIPTION OF SUPPLY TO STUDY AREA

The uMgungundlovu DM water supply services are a mixture of individual schemes owned and operated by the DM, and areas served via the Upper Mgeni System owned and operated by Umgeni Water Board.

Impendle is categorised as mainly a deep rural area. The majority of the local municipal land is dedicated to forestry and agriculture. The municipality is supplied via stand-alone groundwater and surface water systems at present. The Greater Impendle Rural Water Supply Project is planned to supply some areas in the future:

- Impendle Town, Enguga and Gomane are supplied from the Nzinga River, a spring and several boreholes.
- The Greater Stoffelton area is supplied by springs, boreholes and the Mkomazi River.
- The Kwanovuka area is supplied from springs and boreholes.
- The remainder of the municipality is supplied with private water supply systems.

Mkhambathini is a largely rural area with Camperdown being the most urbanised area associated with light industries and distribution warehousing. Water is supplied to Mkhambathini by both UMDM and Umgeni Water:

- Camperdown, Table Mountain and Emakholmeni are supplied with water from the Upper Umgeni Water Supply Scheme. This is by means of an off-take on the Umlaas Road Reservoir sub-system.
- The Mpangisa and Dwangu areas will be supplied from the Upper Mgeni System as of 2016.
- The remaining areas in Mkhambathini are supplied with water from boreholes. Large concentrations of boreholes are located in the south of Mkhambathini. Some of these areas include Gulube, Dwangu and Emzinoni.

Mpofana is a deep rural area with one major town (Mooi River Town), and a few smaller towns. Although these urban areas have all historically been provided via stand-alone surface and ground water systems owned and operated by the UMDM. However, increasing demand raised concerns over sustainability, and the Greater Mpofana Water Supply Scheme was planned to be implemented once the Spring Grove Dam was constructed. A phased supply system via the Spring Grove Water Treatment Works is currently being implemented:

- Mooi River, Bruntville, Rosetta and Nottingham Road are in the process of being connected to the Umgeni Water supply system
- Balgowan is supplied from a borehole scheme. The town will in future be supplied as part of Phase 2 of the Greater Mpofana Water Supply scheme
- Lions River and Lidgetton have supply systems that abstract from the Lions River. These towns will in future be supplied as part of Phase 2 of the Greater Mpofana Water Supply scheme
- Mount West and Curries Post all have borehole schemes. These communities may be connected as Phase 4 of the Greater Mpofana scheme via a pipeline from Nottingham Road.

Richmond is composed of urban and rural areas. Richmond Town/eNdaleni, located in Central Richmond is the most densely populated region. This is followed by Hopewell, located in the North-East part of Richmond:

- The greater Richmond urban area has recently been connected to the Umgeni System via the Richmond pipeline. This pipeline also now supplies water to Hopewell, Thornville and Baynesfield
- The rest of Richmond is served by boreholes and springs maintained by uMgungundlovu District Municipality.

uMshwathi is a combination of rural and urban areas. Water is supplied to uMshwathi by UMDM and Umgeni Water:

- The Wartburg Sub-System of the Upper Umgeni Water Supply Scheme provides water to Claridge, Wartburg, Cool Air, Dalton, Bruyns Hill, New Hanover, Swayimane, houses en route, Albert Falls, Mpolweni, Trustfeeds.
- Efaye, Ozwathini and Nadi are currently supplied by boreholes, but construction is underway to the Wartburg Sub-system as a part of the Greater Mshwathi Supply System.
- Hlatikulu is supplied from the Sikoto River and boreholes.
- Masihambisane is supplied from boreholes.

uMngeni Municipality urban areas of Howick, Hilton, Merrivale and Mpophomeni are supplied from the Umgeni Water system. The remaining areas are primarily farmlands and are supplied by boreholes.

6. WATER RESOURCES AND AVAILABILITY

The UMDM area is served by many different water resources. The Mooi/Mngeni catchment is the most important resources for a large proportion of the population. The other catchments in the area are the uMkomazi, Lovu, and Mvoti, Groundwater also plays an important role in the district, with rural villages, and large tracts of farmland being served via boreholes. A high level discussion on the catchments and their current contribution to the district as a potable resource is contained in this chapter.

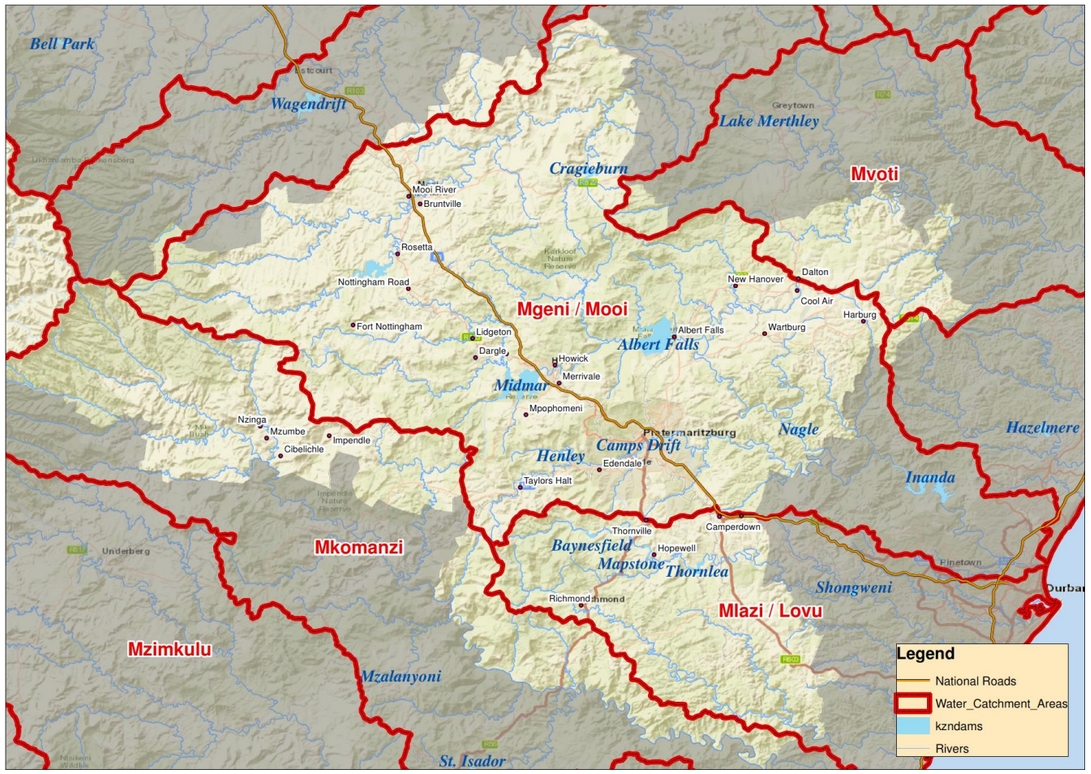


Figure 15: Catchments that fall within the UMDM boundaries (Refer to **Annexure G** for an enlargement of this map)

6.1. Mooi and Mngeni River systems

The Mgeni River rises in the uMngeni Vlei area in the KZN Midlands and flows Eastwards through the hills, where it is joined by the Lions River before flowing into the Midmar Dam. Below Midmar Dam, the River flows over the Howick Falls, and into the uMngeni Valley where the Karkloof River joins it, and then flows into the Albert Falls Dam. Below Albert Falls, the river cuts through deep valleys and then flows into the Nagle Dam. The uMsunduze tributary joins below Nagle Dam, and then the river flows into Inanda Dam and empties into the Indian Ocean in Durban North. The catchment is approximately 4 416km^2, with a river length of 255km (CSIR, 2002). The Mgeni River is a major source of water for Pietermaritzburg and Durban. The demand from the Mgeni River first exceeded the system yield in 2004.

The Mooi River (catchment V20) rises in the Drakensberg Mountains, and is a tributary of the Tugela, which it joins near Muden. The main water user in the two (2) upper catchments are agriculture and commercial forestry, with only 2.1% of the total registered water use for domestic purposes.

Table 10: Registered water users in the upper Mooi and Mgeni catchments (million m^3/annum) (DWA, 2011)

Sub-catchment	Irrigation	Industry	Forestry	Municipal	Total
Mooi River (V20A…C)	27.58	0.01	3.36	1.22	32.17
Mgeni River (U20A…C)	21.42	0.01	9.43	0.10	30.97
Total	49.00	0.02	12.80	1.32	63.13
% Total	77.6%	0.0%	20.3%	2.1%	100.0%

The upper Mooi River is unregulated with the users dependent on run-of-river abstraction. The mean annual runoff of the Mooi River is 385 million m^3/a. The gross available surface water in the Mooi River, is estimated at 73 million m^3/a. There are significant return flows from irrigation, but the total local yield after allowing for the Ecological Reserve is estimated to be in the order of 64 million m³/a. There are no transfers into the catchment. The total registered water use in the Mooi is 32.17 million m^3/a, but the abstraction during low flow periods is only 10.0 million m^3 or 114.0 Mℓ/d for three (3) months (taking into account a peaking factor in summer of 1.5). Therefore the available water cannot meet the low flow periods without sufficient storage capacity in the Mooi River, particularly for irrigators (DWA, 2011).

A Mooi-Mgeni Transfer system was initially set up during the 1983 drought to provide additional water into the Mgeni System. The scheme consisted of a 3m high weir and pumpstation at Mearns, just downstream of the confluence of the Mooi and Little Mooi Rivers, a 13.3km long 1400mm dia rising main to a break pressure tank situated at Nottingham Road and an 8.3km long 900mm diameter gravity main to an outfall structure on the Mpofana River. From here the water flows via the Mpofana, Lions and Mgeni rivers to Midmar Dam. The scheme has a maximum transfer capacity of 3.2m^3/s and was operated on a run-of-river basis due to the insignificant storage capacity. In 2002, the Mearns Weir was raised to 8m, increasing the storage to 4.9 million m^3, and Midmar Dam wall was raised an additional 3.5m. This was referred to as the Mooi-Mgeni Transfer Scheme 1 (MMTS-1), and was viewed as an interim solution whilst the feasibility of a dam on the Mooi was investigated.

The Mooi-Mngeni Transfer Scheme 2 (MMTS-2) involved the construction of a dam, and bulk raw water infrastructure for inter-basin transfer. The Spring Grove Dam is located on the Mooi River approximately 2km South West of Rosetta, and 8km upstream of the Mearns Weir. It drains an area of 339km² and has a gross storage volume of 139.5 million m³. Water is released from Spring Grove Dam and is abstracted at the Mearns Weir on the Mooi River, and transferred into Midmar Dam to support supply in this system. In addition a new raw water pipeline from Spring Grove Dam to the uMngeni catchment has been completed, enabling a continuous transfer of water at a higher rate, and increasing the yield of the greater Mgeni System by 164Mℓ/day. In addition, a water treatment works

has been built at the dam to supply the Greater Mpofana Water Supply Scheme, with the ultimate capacity of 60Mℓ/day. Both the Mooi and the Mgeni catchments are now fully utilised, and no additional water use can be licensed (Umgeni Water, 2015).

Water is abstracted from Midmar Dam, treated and distributed via the Upper Mngeni Water Supply System. The current demand off the Upper Mgeni System is approximately 318Mℓ/day (95Mℓ/day for uMgungundlovu DM, 181Mℓ/day for Msunduzi, and the remainder for eThekwini) (Umgeni Water, 2015).

Table 11: Yield of the Mgeni System (Umgeni Water, 2015)

Phase	Historic Firm Yield	Stochastic Yield (1 in 50 years risk of failure)		Stochastic Yield (1 in 100 years risk of failure)	
	million m^3/annum	million m^3/annum	Mℓ/day	million m^3/annum	Mℓ/day
Mgeni System *(Initial)*	60.8	78.0	213.7	66.3	181.6
Mooi-Mgeni *(Previous)*	114.2	152.0	416.4	117.7	322.5
MMTS-2A *(Current)*	161.7	178.7	489.6	166.4	455.9
MMTS-2B (Proposed)	177.3	192.0	526.0	173.8	476.2

The groundwater has low to medium potential in the area. The quality of the groundwater is generally excellent. Groundwater is used by many private landowners for potable use. Groundwater is also used to supplement irrigation and for stock watering. The exception is Nottingham Road and Rosetta, which are supplied by very high yielding boreholes. Groundwater in the Howick area is bottled and sold commercially.

From a planning perspective, Umgeni Water must supply water at a 99% assurance of supply to the greater eThekwini-Msunduzi area (includes all of the Upper Mgeni system), and based on current yields and projected demands, the system is currently in a deficit with a worsening situation predicted in the future. Several years of good rainfall have masked the severity of the situation, but with current drought, and climate predictions, there is an increasing risk of shortfall (Umgeni Water, 2015). Despite the deficit, extensions to the system are currently under construction, and others are in the planning phase. Those in the Upper Mgeni System area are the Greater Mshwathi Water Supply System (demand projection 26Mℓ in 2012; 40Mℓ in 2027); and the Greater Mpofana Supply System (design demand 60Mℓ, for long term needs).

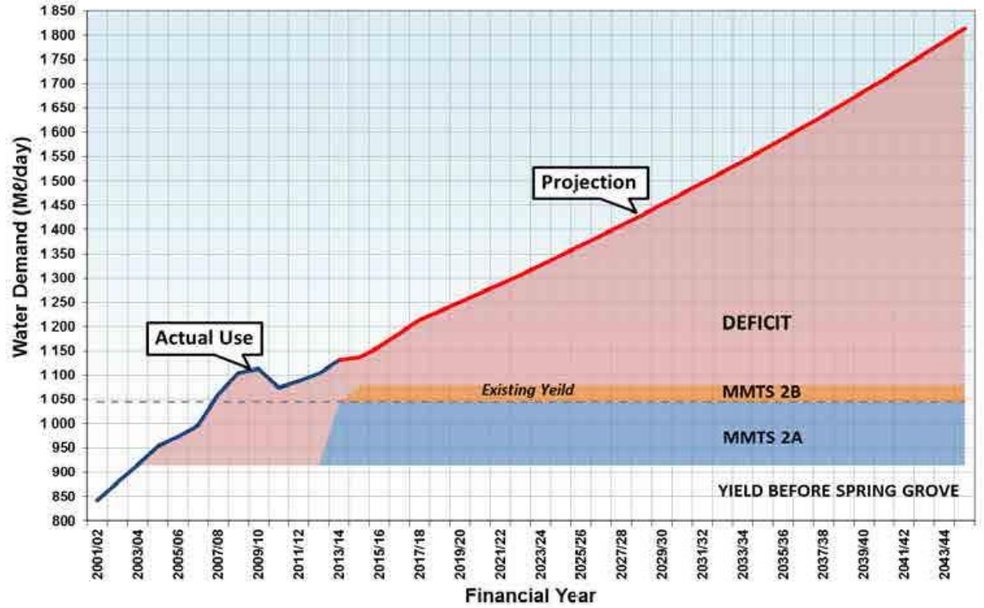


Figure 16: Mgeni System water balance with Spring Grove supplementation (Umgeni Water, 2015)

The most promising solution to resolve the deficit on the system is the augmentation from the proposed Mkomazi Water Project that will involve the construction of Smithfield and then Impendle Dams on the uMkhomazi River. This water will primarily serve eThekwini, but also to a lesser extent uMgungundlovu and Msunduzi. The augmentation will result in the deficit on the entire Mgeni System being resolved, resulting in 99% assurance of supply to all customers. However, the earliest possible commissioning of the system will be 2023, and thus water conservation and water demand management remain the top priority to try and ensure sufficient resources to supply the system (Umgeni Water, 2015).

Maps of current and planned areas served by Umgeni Water, showing the demand projections of each sub-system is attached as **Annexure C**.

6.2. Mkhomazi Catchment

The Mkhomazi River (tertiary catchment U10) rises in the Drakensberg Mountains and flows in a South-Easterly direction, entering the Indian Ocean near the town of Umkomaas. The river has several large tributaries including the Loteni, Nzinga, Nkomazane, Eland and Xobho. The river passes through the towns of Bulwer, Impendle, Ixopo, Mkomazi, Craigieburn and Magabheni. The catchment is primarily undeveloped with commercial forestry and irrigated agriculture around the towns of Bulwer, Richmond, Ixopo and Impendle. Sappi Saiccor has a large industrial abstraction near the coast. There are no significant water quality problems. A potential risk to the water quality could be due to agricultural activities and forestry taking place upstream.

The yield of the uMkhomazi River, with Sappi's allocation and the Reserve supplied, is 93 Mℓ/day. According to the Mvoti to Mzimkulu ISP (DWS, 2004) the water balance of this region is in deficit by 72 million m^3/annum. Sappi Saiccor has a daily demand of about 150 Mℓ/day supplied from a run-of-river system. Plans for the construction of Ngwadine Dam aim to mitigate the water availability during low flow periods.

Ixopo Dam is situated downstream of the UMDM boundaries at the town of Ixopo, and has a capacity of 0.55 million m^3, and a firm yield of 2.7Mℓ/day.

In order to relieve the stressed Mngeni catchment, the Smithfield Dam on the uMkhomazi River near Richmond is being planned. The water would be transferred via a balancing dam near Baynesfield in the uMlaza River Catchment and treated water transferred to the Mgeni Water Supply System. In addition to the Smithfield Dam, a second, large dam is planned upstream near Impendle. This would allow for regulation of flow and ensuring water is always available downstream at the Smithfield Dam.

Groundwater potential in the catchment is variable. The areas located in the Natal Group Sandstone have a high potential yields. Rural communities and farmlands utilise groundwater for drinking water and irrigation purposes.

6.3. Lovu River Catchments

Part of the Richmond and Mkhambathini LM areas are situated in the Lovu River (U70 Tertiary catchment). The catchment is dominated by irrigation and afforestation, with irrigation being by far the dominant water user. Much of this irrigation use is for intensive vegetable farming to supply Durban and Pietermaritzburg. This is important from a food supply perspective. The catchment is largely unregulated, however, large farm dams are present in the upper reaches of the Lovu River.

The significant dams in the catchment are Nungwane Dam situated on the Nungwane River (Quaternary U70D), which is a tributary of the Lovu River, Beaulieu Dam on the Lovu River (quaternary U70A), and Umgababa Dam situated on the Mgababa River within the U70 catchment. The Lovu River has a MAR of 26.64 million m^3/a, at the outlet of quaternary catchment U70B, at the confluence of Mkomazi and Lovu River; while the three (3) month low flow was determined to be 0.3 million m^3 (3.6 Mℓ/d). Compared with the current peak summer demand of 1.4 million m^3/a (3.8 Mℓ/d) (Recon Study, 2011). There is significant water use in the upper catchment of the Lovu, with agriculture accounting for approximately 30% of the total registered water use; and commercial forestry accounting for 67% of the total registered use. Only a small amount of water for domestic use – that for Richmond and Ndaleni – is registered.

Table 12: Registered water users in the Lovu catchment (million m^3/annum) (DWA, 2011)

Sub-catchment	Irrigation	Industry	Forestry	Municipal	Total
Upstream of Richmond (U70A)	0.36		5.48	0.02	5.86
Upper Lovu River (U70B)	4.12	-	4.67	0.43	9.22
Lovu River (U70C)	0.56		1.31	0.09	1.97
Total	**5.05**	**-**	**11.47**	**0.54**	**17.05**
% Total	**29.6%**	**0.0%**	**67.2%**	**3.2%**	**100.0%**

Most of the registered irrigation and municipal water requirement is in quaternary catchment U70B. Most of this water requirement must be supplied from the Beaulieu Dam. The Beaulieu Dam is situated near the town of Richmond. The dam is owned by the Upper Lovu Water User Association, and has a storage capacity of 2.4 million m^3. The net dam yield at 1:50 year, without reserve allowances, is 4.4 million m^3/annum. The dam was constructed to supply water for irrigation, but also supplied part of the water needs of Richmond town, eNdaleni and kwaCebelele until recently when supply switched to the Umgeni Water Richmond Pipeline. This switch has resolved the overuse of the Beaulieu Dam, which did not have sufficient capacity to supply both the agricultural and domestic/industrial demand.

Groundwater potential in the areas with Natal Group Sandstone is generally good, and there are numerous high yielding boreholes. The area around Richmond is noted for high groundwater potential. Other areas also have the potential to supply water at lower volumes.

6.4. The Mvoti Catchment

The Mvoti River Description. Land cover is primarily communal land and commercial timber inland, and sugarcane along the coast.

The Mvoti River does not at present supply water to UMDM residents, but there is a significant reliance on the groundwater within the catchment. The DWS Reconciliation Strategy highlights the potential of the uMvoti, and two (2) of its tributaries – the Sikoto, and the Pambanani Rivers – providing sustainable water to the area, and these are described below. **It should be noted that the UMDM, along with Umgeni Water, have decided to provide this area from the Greater Mshwathi Water Supply Scheme, which is an extension of the Upper Mgeni System. The sources are discussed nevertheless for completeness.**

The Greater Efaye, Nadi and Hlatikulu areas are currently being supplied from boreholes. The water quality from some boreholes is not good and some package treatments plants have been installed for treatment of the borehole water before being pumped to consumers. The 2011 DWS Reconciliation Strategy recommended that the area (including neighbouring Ozwathini outside the UMDM boundary) get all its future water supply from the Sikoto River in the Mvoti catchment. A review of the registered water use in the catchment upstream indicates that there are significant water uses in the upper catchments, other than domestic water use. Irrigation agriculture is the major water user which accounts for approximately 47% of the total registered water use. Commercial forestry is also a major upstream user, accounting for approximately 40% of the registered water use.

Table 13: Registered water use in the Sikoto and Mdloti Rivers upstream of Hlatihkulu and Ozwathini (million m^3/annum) (DWA, 2011)

Sub-catchment	Irrigation	Industry	Forestry	Municipal	Total
Sikoto River (U40E…H)	3.25		2.22	0.52	5.99
Mdloti River (U30A &C)	0.40		0.94	0.52	1.86
Total	3.65	-	3.16	1.04	7.85
% Total	46.6%	0.0%	40.3%	13.1%	100.0%

The Sikoto River has sufficient water available for development of a dam to supply the Hlatikhulu and Ozwathini Water Supply Scheme. A preliminary assessment of the potential yield of the dam was conducted by Umgeni Water. The proposed Sikoto Dam is located in the headwaters of the Sikoto River. The MAR at the dam site was determined to be 3.42 million m^3/a. A weir with a live storage capacity of 100% of the MAR at the proposed site has been proposed and will provide a firm yield of 2.3 million m^3/a (6.2 Mℓ/d). This, if used with the existing groundwater is more than sufficient to meet the future water requirements of Hlatikhulu and Ozwathini Water Supply Schemes.

The Masihambisane Water Supply Scheme area in Mshwathi is situated mainly in quaternary catchments U40D in the Mvoti River. A review of the registered water use in the catchments upstream and making up the Masihambisane Water Supply Scheme indicates that there are significant water uses in the upper catchments of the Mvoti River, other than domestic water use. Irrigation agriculture is a major water user which accounts for approximately 24% of the total registered water use upstream of the scheme area. The largest registered water use is commercial forestry which accounts for approximately 72% of the registered water use. The water use for domestic purposes in the upper catchments are registered according to the information from the latest WARMS database available at the time. The total registered water use is only 1.24 million m^3/a. This is mainly to supply the Greytown Water Supply Scheme area. There is no registered water use for Masihambisane.

Table 14: Registered water use in the Upper Mvoti River catchment (million m^3/a) (DWA, 2011)

Sub-catchment	Irrigation	Industry	Forestry	Municipal	Total
Upper Mvoti River (U40A…D)	10.41	0.59	30.79	1.24	43.03
Total	10.41	0.59	30.79	1.24	43.03
% Total	24.2%	1.4%	71.6%	2.9%	100.0%

The area is served by stand-alone groundwater supply schemes. The abstraction is estimated at 0.72Mℓ per day. The 2011 DWS Reconciliation Strategy states that the area is likely to get its future water supply either from Umgeni Water bulk scheme or the development of a weir or dam on the Pambanyoni River, a tributary of the Mvoti River system. The Pambanyoni River has a MAR of 33.2 million m^3/a, at the outlet of quaternary catchment U40C, at the confluence of Pambanyoni and Mvoti Rivers; while the three (3) month low flow was determined to be 0.6 million m^3 (6.1 Mℓ/d). Compared with the current three (3) month peak summer demand of 0.14 million m^3/a (1.5 Mℓ/d), there is therefore sufficient water available to meet the short term water requirements of Masihambisane Water Supply Scheme, if the groundwater is included. A proposed weir with a live storage capacity of 10% of the MAR at the proposed site would increase the yield and provide a historical firm yield of 2.2 million m^3/a (6.1 Mℓ/d).

The groundwater potential in the catchment is good, and there is widespread use of groundwater in rural areas and farming areas. The potential is particularly high in the upper catchment.

7. BULK WATER SUPPLY SCHEMES AND CONSTRAINTS

Much of the bulk water supply systems within the UMDM are owned, operated and maintained by Umgeni Water as part of the Upper Mgeni Supply System. The internal bulks and reticulation from the bulk infrastructure is the responsibility of the UMDM.

Until recently, UMDM was responsible for several bulk supply systems across the DM, but these are gradually being linked into larger regional bulk supplies owned and operated by Umgeni Water:

- In Mpofana, with the recent commissioning of the Spring Grove dam, and the phased implementation of the Greater Mpofana Supply System, urban areas will be fed from the WTW at Spring Grove Dam.
- The Richmond urban area has recently been linked up to the Mgeni System, replacing the bulk system from Beaulieu Dam.
- The urban areas of Mshwathi, and extending now into the rural areas, are now linking up to the Wartburg sub system of the Mgeni network.
- The densely populated areas of Southern Mkhambathini and Richmond that previously had numerous schemes, are now linked up to the Greater Eston Sub-System.
- The Greater Impendle Water Project, with water sourced from the Mkomazi and Nzinga rivers, is still in planning phases, and the existing schemes are run by UMDM. However, Umgeni Water has been tasked with the development of the regional bulk project.

This report is not intended to elaborate or discuss the current bulk water supply infrastructure but rather focus on the areas not being supplied by a bulk system. In this section, therefore, is a brief overview of the supply systems for contextual purposes, but for a detailed understanding, the reader should refer to the latest Umgeni Water Infrastructure Master Plan. The sections below were compiled from the 2015/16 version of this Plan.

7.1. Umgeni Water Upper Mgeni System

uMgungundlovu District Municipality falls within the Upper Mgeni System of Umgeni Water's service area and forms the heart of Umgeni Water's supply to uMgungundlovu District Municipality, Msunduzi Local Municipality and to a limited extent to eThekwini Metro (its Outer West supply area).

Raw water is pumped from the Mearns Weir in the Mooi River into the upper reaches of the Mgeni River to supplement the raw water supply into the Midmar Dam. The raw water is treated at the Midmar WTW at the dam and is also fed under gravity supply to the D.V Harris WTW, which respectively have a 250Mℓ/day and 110Mℓ/day treatment capacity. The system distributes potable water from the Midmar and D.V Harris Water Treatment Works to the various municipal areas and sub-supply areas as reflected in the General System Layout in **Figure 17**.

- Midmar to uMngeni LM (Howick Sub-Supply areas)
- Midmar to Umlaas Road Sub-Supply system
    - Umlaas to Msunduzi LM
    - Umlaas to Mkhambathini LM
    - Umlaas to Richmond LM
- D.V Harris to uMshwathi LM (Wartburg)
- D.V Harris to Msunduzi LM

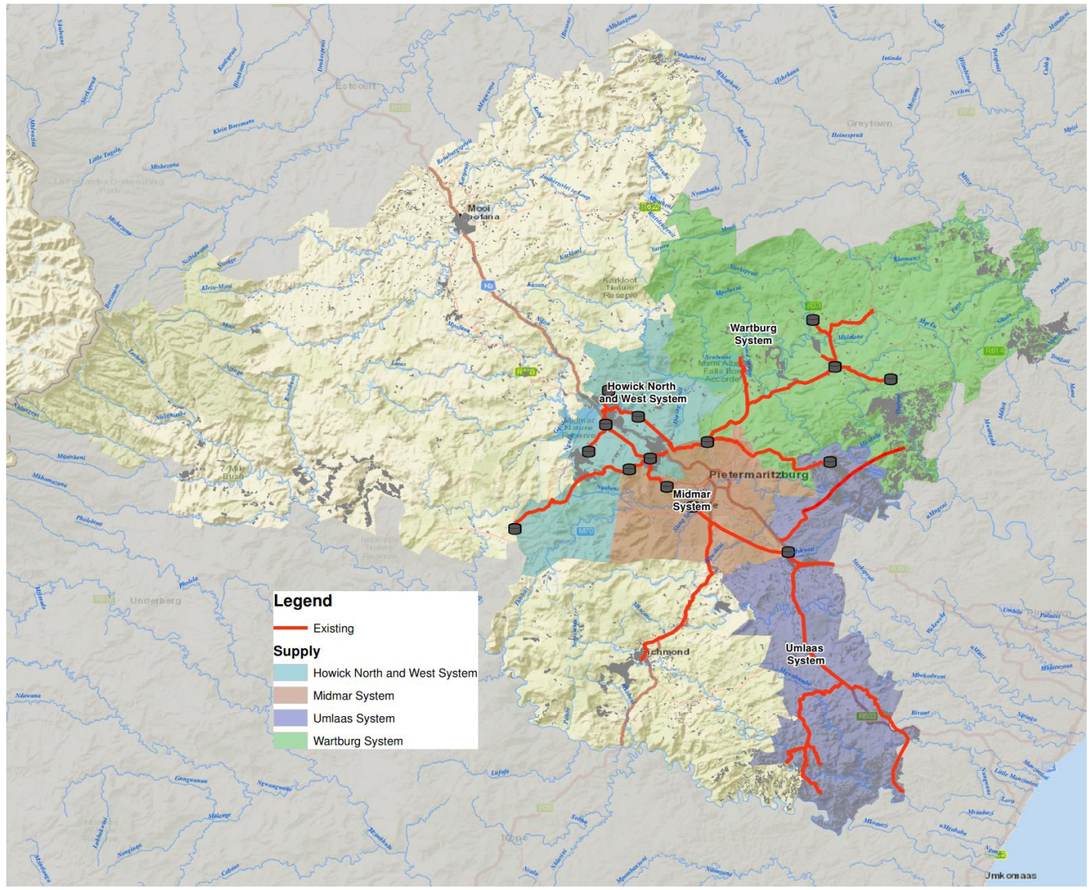


Figure 17: General Layout of Upper Mgeni Water Supply Sub-Systems

An overview of the bulk supply system is shown in **Figure 17.**

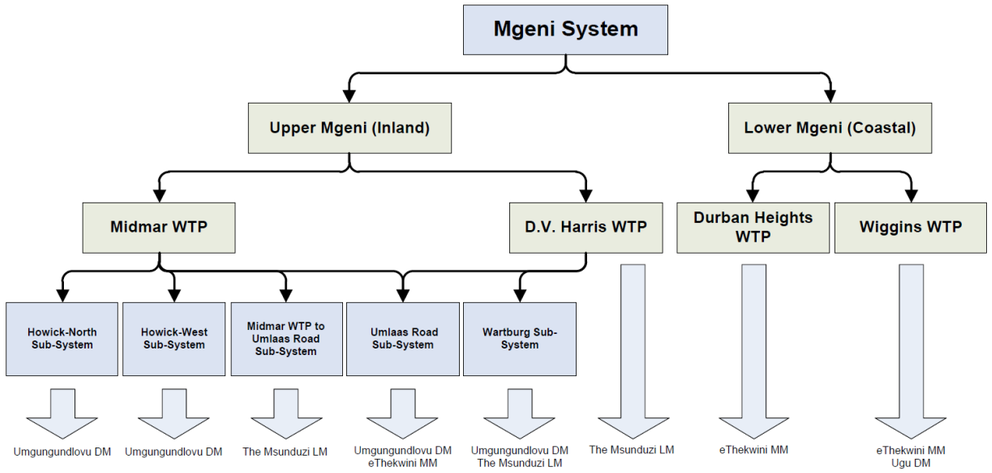


Figure 18: Network chart of the uMgeni Water Supply System

7.1.1. *Water Resource Consideration / Infrastructure*

The Midmar WTW draws raw water from Midmar Dam via a raw water pipeline to a pumpstation, and a rising main from the pumpstation to the treatment works.

Raw water is also conveyed under gravity to the DV Harris WTW.

The Midmar WTW has a design capacity of 250Mℓ/day, and is currently operating at 275Mℓ/day. An upgrade is planned towards the end of 2017 to 375Mℓ/day. The raw water supply capacity is already 375Mℓ/day.

The DV Harris WTW has a design capacity of 110Mℓ/day, with a current utilisation of 89Mℓ/day.

The yield of the Mooi/Mgeni System was 334 million m^3/annum (915Mℓ/day). The Spring Grove Dam Phase 2A, which has been completed, has improved the yield of the Mooi/Mgeni System to 381 million m^3/annum (1044 Mℓ/day).

When the construction of MMTS Phase 2B is complete, the yield of the Mooi/Mgeni System will increase to 394 million m^3/annum (1080Mℓ/day). Currently, the deficit is about 25 million m^3/annum (69Mℓ/day) and during the financial year 2013/14, Umgeni Water increased its water use registration with DWS from 397 to 406 million m^3/annum (1088 to 1112 Mℓ/day) for the entire Mgeni System. The licence application of 470 million m^3/annum (1288Mℓ/day), in anticipation of the support from Spring Grove Dam, was submitted to DWS in 2013.

The yield at a 99% assurance of supply at Midmar Dam, with MMTS 1 and MMTS 2, is 476Mℓ/day. Midmar WTP will treat 376Mℓ/day and the balance of 100Mℓ/day will be treated at D.V. Harris WTP. The current demand is 318Mℓ/day.

Table 15: Yield of the Mgeni System (Umgeni Water, 2015)

Phase	Historic Firm Yield	Stochastic Yield (1 in 50 years risk of failure)		Stochastic Yield (1 in 100 years risk of failure)	
	million m^3/annum	million m^3/annum	Mℓ/day	million m^3/annum	Mℓ/day
Mgeni System *(Initial)*	60.8	78.0	213.7	66.3	181.6
Mooi-Mgeni *(Previous)*	114.2	152.0	416.4	117.7	322.5
MMTS-2A *(Current)*	161.7	178.7	489.6	166.4	455.9
MMTS-2B (Proposed)	177.3	192.0	526.0	173.8	476.2

7.1.2. *Water Supply Infrastructure*

The Mgeni System water supply infrastructure is extensive. To give an overview of the supply infrastructure, the section starts with a schematic showing capacities and demands of the current (as at October 2015) system, followed by a schematic of the planned infrastructure and demands in 2045. Then, each of the five (5) Sub-Systems are discussed thereafter. A detailed description of the infrastructure can be found in Volume 2 of the latest Umgeni Water Infrastructure Master Plan, and is not repeated here.

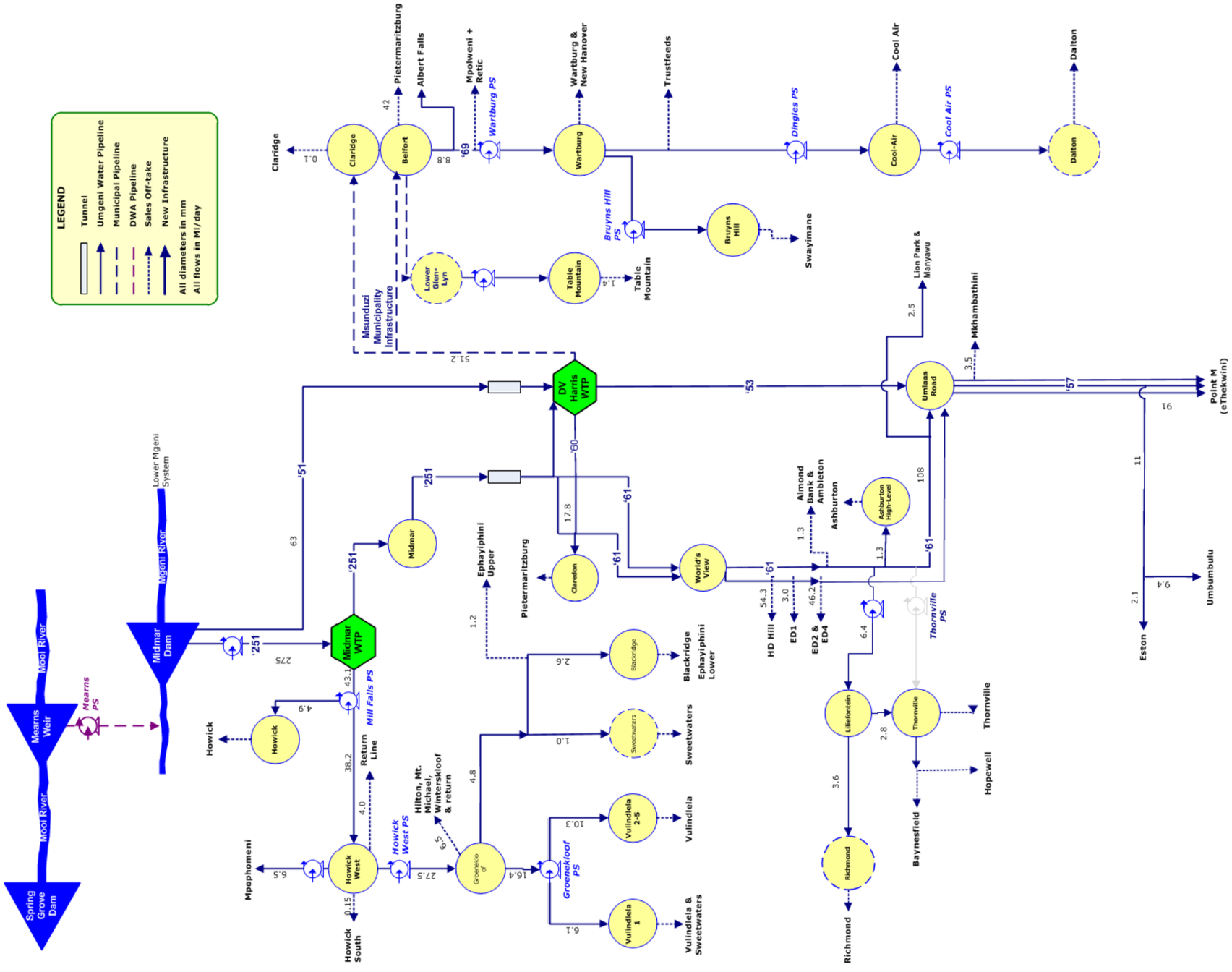


Figure 19: Upper Mgeni Schematic as at October 2014 (Umgeni Water, 2015)

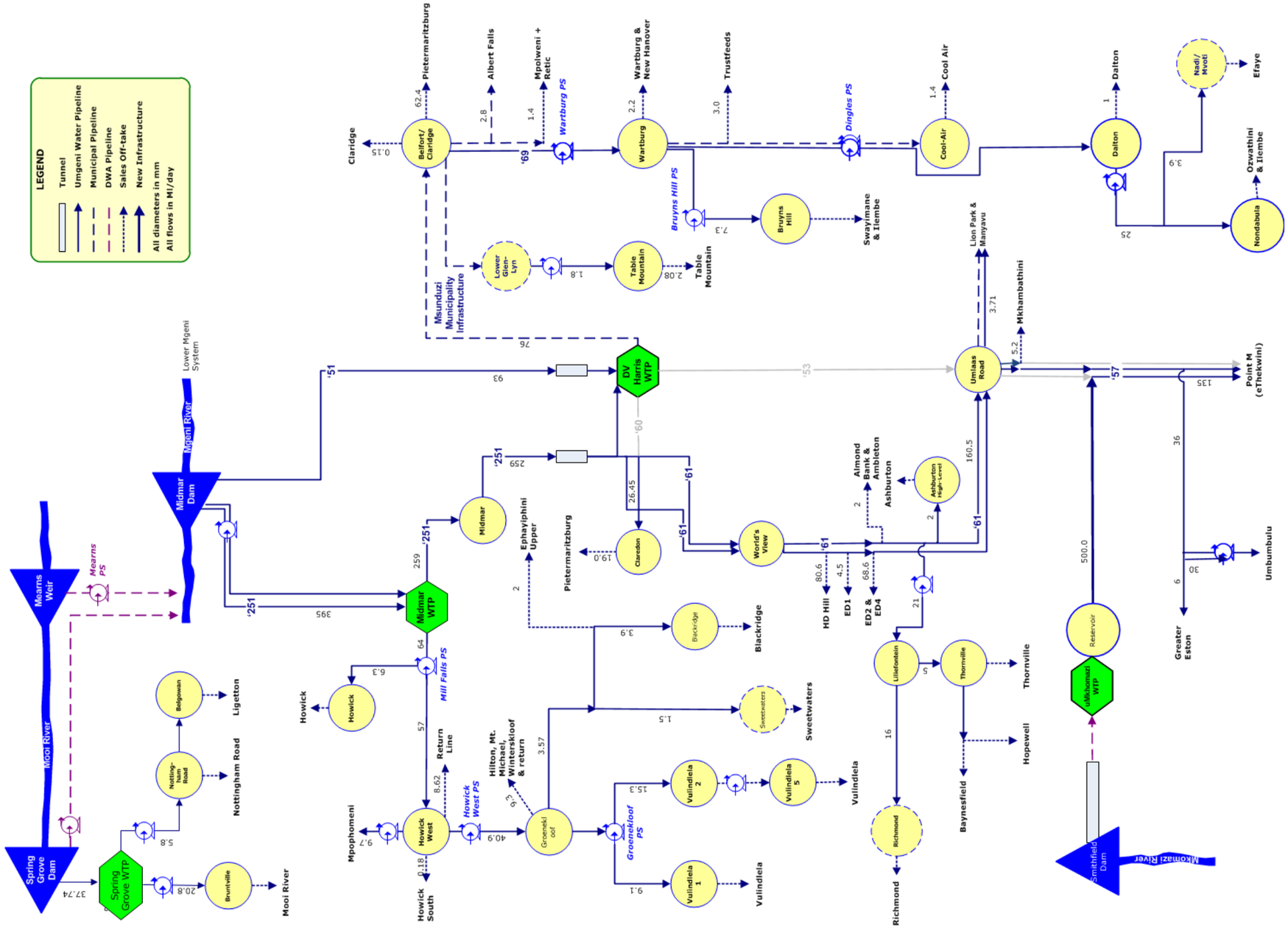


Figure 20: 30 Year Demand Projection for the Upper Mgeni System (Umgeni Water, 2015)

7.2. Howick-North Sub-System

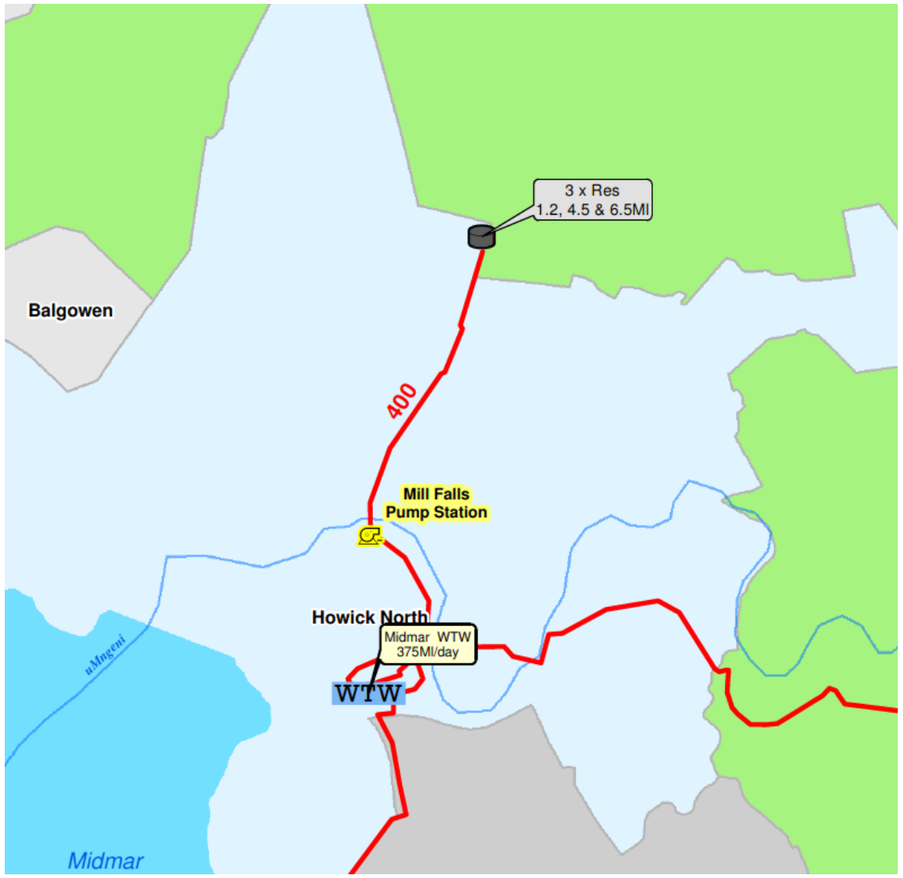


Figure 21: Existing Infrastructure – Howick-North Sub-System

The Howick North Sub-System consists of a bulk line from the Midmar WTW to a set of reservoirs to the north of Howick that serve the Howick CBD and surrounding suburbs. The Northern area has grown significantly in recent years, increasing the demand for water. Additional housing developments are still underway.

7.2.1. Existing Bulk Water Supply Infrastructure

The bulk water infrastructure description and capacity is summarised in **Figure 22** and **Table 16** below:

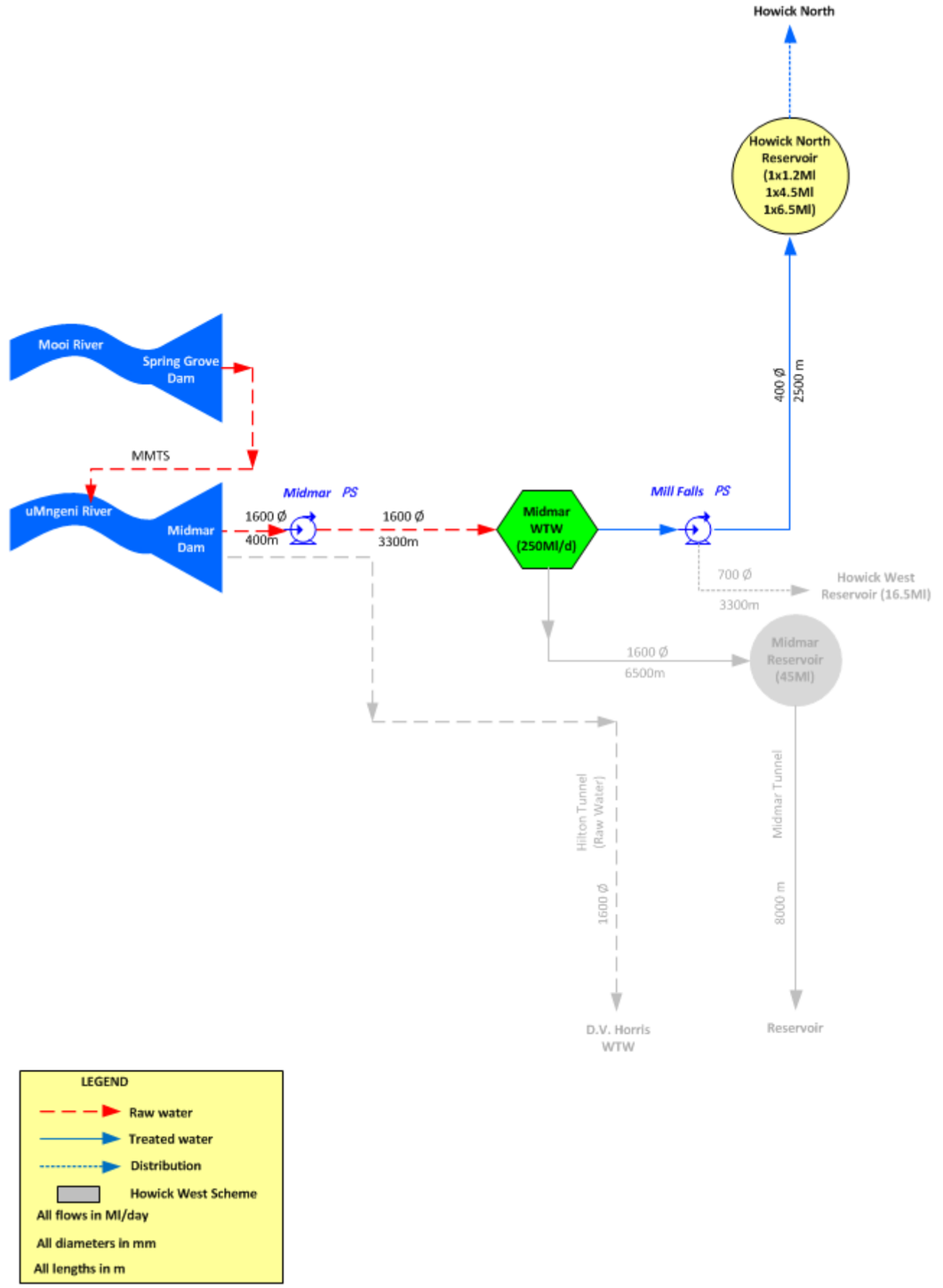


Figure 22: Schematic of Howick-North Sub-Scheme (Existing)

Table 16: Existing Bulk Water Supply Infrastructure – Howick-North Sub-Scheme

Bulk Supply Pipeline		Diameter (mm)	Length (km)
From	To		
Midmar Dam	Midmar Raw Water Pumpstation	1600	0.40
Midmar Raw Water Pumpstation	Midmar WTP	1600	3.30
Mill Falls Pumpstation	Howick-North Reservoir	400	2.5
Reservoir		**Storage (Mℓ)**	
Howick-North		12.2	
Pumpstation		**Design Capacity**	
Midmar Pumpstation		3 x 131Ml/day	
Mills Falls pumpstation		1 x 6.9 and 2 x 4.5Mℓ/day	

7.2.2. Condition of Bulk Supply Infrastructure

No condition issues were mentioned in the 2015 Umgeni Water Master Plan.

7.2.3. Planned Bulk Infrastructure upgrades

No other upgrades are planned for this Sub-System, as the reservoir capacity was recently upgraded to 12.2Mℓ. The pumps at Mill Falls and the pipeline to the reservoir were recently upgraded and hence there is sufficient capacity in this infrastructure for the foreseeable future.

7.2.4. Water Demand Issues to Consider

The current water demand for this system, as recorded by Umgeni Water is 4.3Mℓ/day, and the 2034 demand projection is 6.3Mℓ/day.

7.3. Howick-West Sub-System

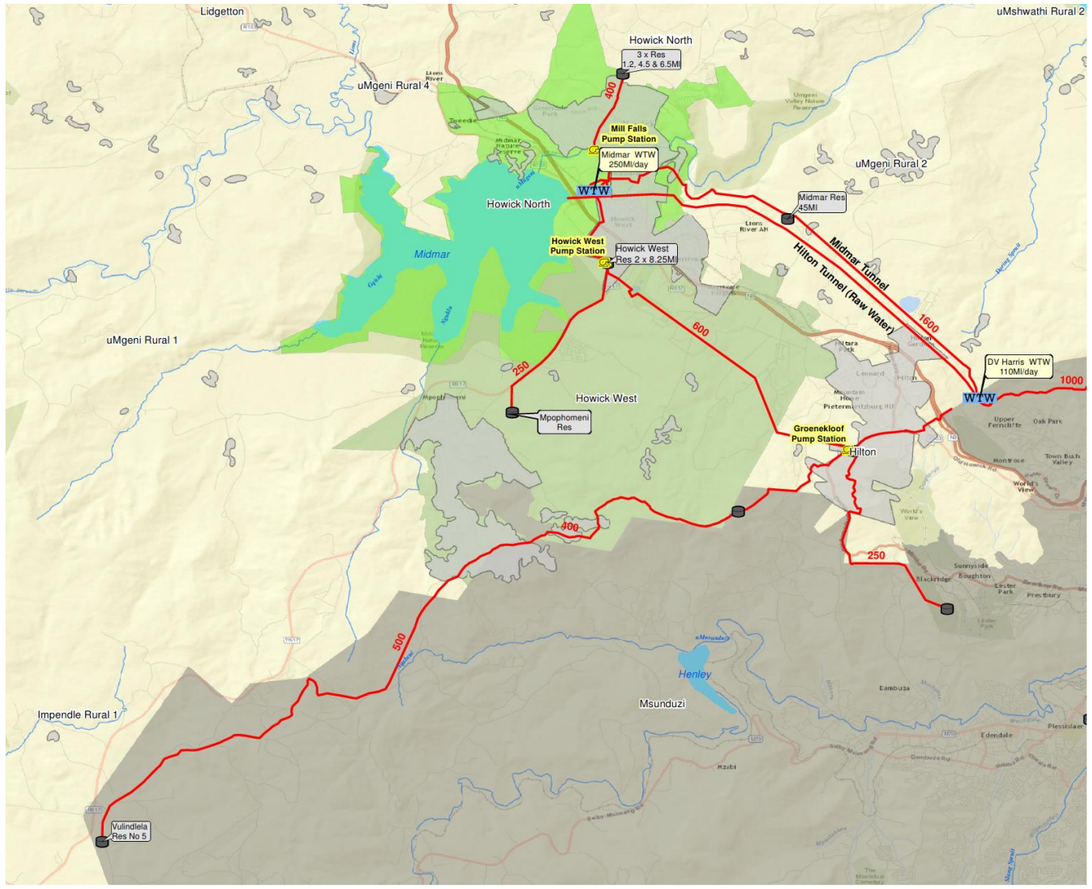


Figure 23: Existing Infrastructure – Howick-West (Refer to **Annexure D** for an enlargement of this map)

The Howick-West Sub-System serves the communities of Howick West, Merrivale, Mpophomeni, Cedara and Hilton in the uMngeni LM; and Vulindlela, Sweetwaters, and Blackridge in Msunduzi.

7.3.1. Existing Bulk Water Supply Infrastructure

The bulk water infrastructure description and capacity is summarised in **Table 17** and **Figure 24** below:

Table 17: Bulk Water Supply Infrastructure – Howick West Sub-Scheme

Bulk Supply Pipeline		Diameter (mm)	Length (km)
From	**To**		
Mill Falls Pumpstation	Howick-West Reservoir	700	3.30
Howick-West Reservoir	Midmar WTP (Backfeed)	375	3.40
Howick-West Pumpstation	Mpophomeni Reservoir	250	5.80
Howick-West Pumpstation	Groenekloof Reservoir	600	9.80
Groenekloof Reservoir	Howick-West Reservoir (Backfeed)	300	9.80
Groenekloof Pumpstation – Low-Lift Pumpstation	Vulindlela Reservoir 1	400	4.25
Groenekloof Pumpstation – High-Lift Pumpstation	Vulindlela Reservoir 2-5	500	27.90
Groenekloof Reservoir	Blackridge BPT	250	7.30
'56 Pipeline (Upstream of Blackridge BPT)	Sweetwaters Reservoir	250	4.40
Blackridge BPT	Blackridge Reservoir	250	3.30
Reservoir		**Storage (Mℓ)**	
Howick-West Reservoir 1		8,25	
Howick-West Reservoir 2		8,25	
Blackridge Reservoir		2,2	
Sweetwaters Reservoir		0,5	
Vulindlela Reservoir 1		16	
Vulindlela Reservoir 2		10	
Vulindlela Reservoir 3		0,6	
Vulindlela Reservoir 4		0,2	
Vulindlela Reservoir 5		9,2	
Groenekloof Reservoir 1		2,3	
Groenekloof Reservoir 2		5	
Groenekloof Reservoir 3		10	
Pumpstation		**Design Capacity (Mℓ/day)**	
Mills Falls (Howick West set)		2x25.1 (1 standby)	
Howick West (Mpophomeni)		2 x 6.1 (1 standby)	
Howick West (Groenekloof)		2 x 18 (1 standby)	
Low lift to Vulindlela 1		3 x 7.1 (1 standby)	
Highlift between Groenekloof and Vulindlela 2-5		3 x 13 (2 operating, 1 standby)	

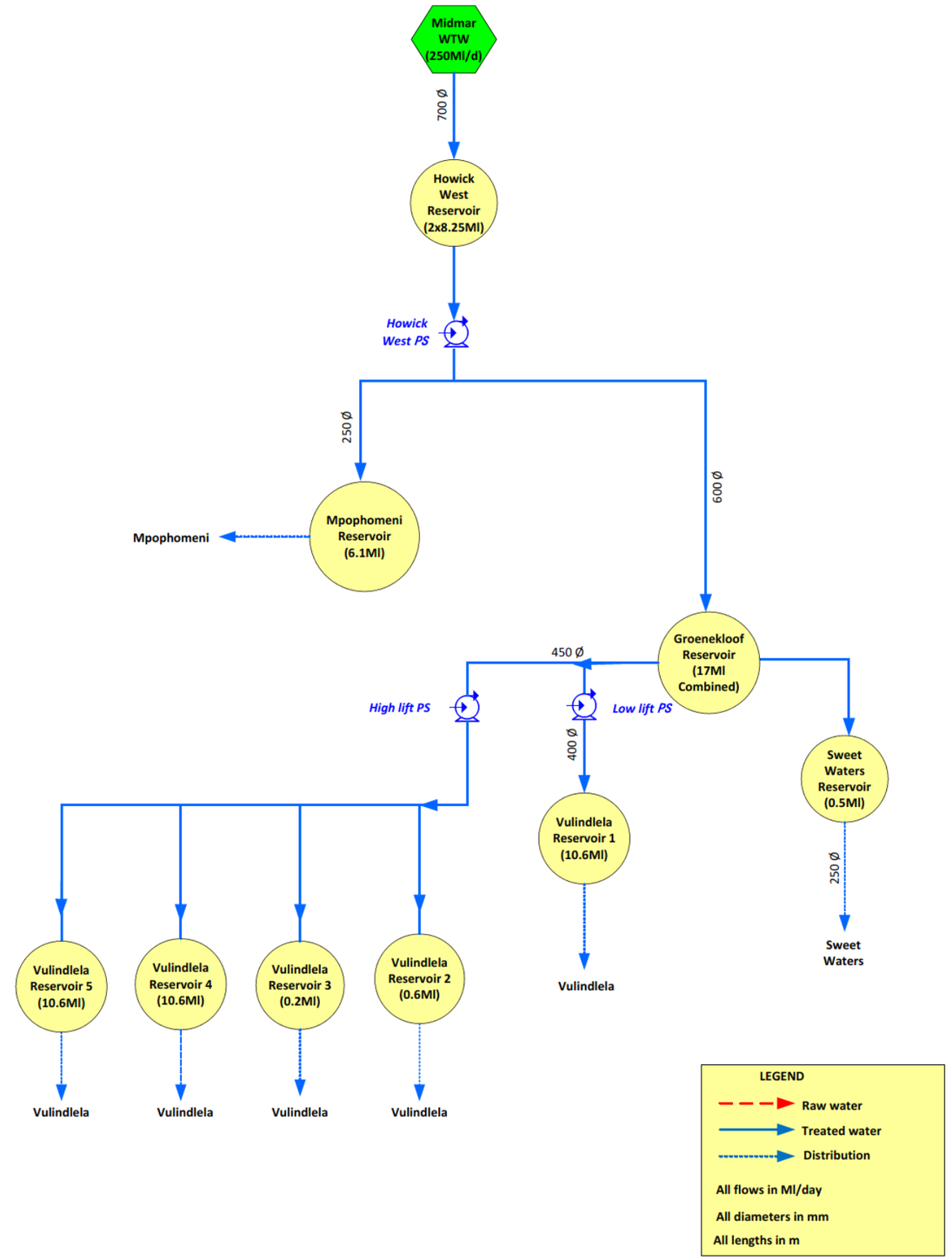


Figure 24: Schematic of Howick-West Sub-Scheme (Existing)

7.3.2. Condition of Bulk Supply Infrastructure

No condition issues were mentioned in the 2015 Umgeni Water Master Plan.

7.3.3. Planned Bulk Infrastructure Upgrades

The high lift pumps to Vulindlela Reservoirs 2-5 have a capacity of about 15 Mℓ/day which is not adequate to meet the current demand of 21 Mℓ/day mostly due to increase in demand as well as high water losses. Currently the high lift pump impellers are being upgraded to increase the capacity to meet the current demand. The high lift pumps will be upgraded to the ultimate capacity of the pipeline, this being 34Mℓ/day.

The uMngeni Local Municipality is in the process of implementing a low-cost housing development in the Mpophomeni supply area and middle to high-income residential development in the Garlington area. These proposed developments, combined with the natural growth of the Howick-West Supply System, will place undue stress on the Howick-West Reservoir Complex to sustain the projected demand.

To sustain the current and future demand off the Howick-West Reservoir Complex, it is necessary to augment the existing storage capacity at the Howick West Reservoir Complex. If projections materialise as expected, then the current storage of 16.5Mℓ should be increased by adding a new 16Mℓ reservoir in 2015/2016. This will bring the total storage up to 32.5Mℓ.

7.3.4. Water Demand Issues to Consider

The pumpstation and pipeline to Howick-West Reservoir have adequate capacity to serve the long-term demands on Howick-West Reservoir.

uMngeni Local Municipality has planned a 1500 unit low cost housing development adjacent to Mpophomeni. This development will be phased with the first 500 units occupied in late 2015. Phase 1 will result in a 300kℓ/day increase in demand which will cause the current demand to exceed the capacity of the Mpophomeni pipeline. New infrastructure will be required to meet the future demands.

The 17.3Mℓ Groenekloof Reservoir serves as a balancing reservoir for Vulindlela, Sweetwaters and Blackridge. The current demand out of Groenkloof Reservoir is 23 Mℓ/day. This demand is expected to increase to 34Mℓ/day by 2030 when 24Mℓ of storage will be required.

7.4. Midmar WTW to Umlaas Reservoir Sub-System

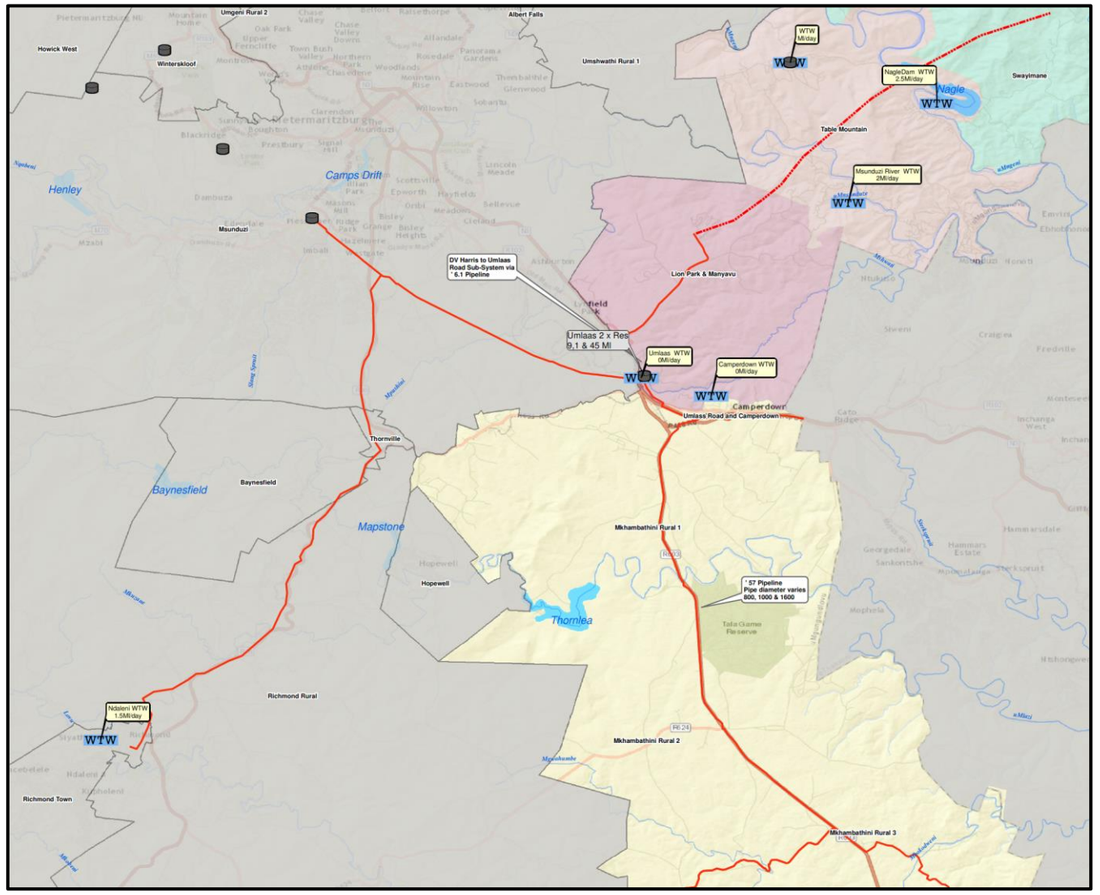


Figure 25: Existing Infrastructure – Midmar WTW to Umlaas Reservoir Sub-System (Refer to **Annexure D** for an enlargement of this map)

This Sub-System includes areas served by both the Midmar and DV Harris WTW. The areas fed from the Midmar WTW includes the ‘251, and ’61 pipelines and delivers water to Edendale, the Western suburbs of Pietermaritzburg, Ashburton, Thornville, Baynesfield, Hopewell and Richmond town. There is also an emergency feed that supplies the DV Harris WTW. The ’51 pipeline supplies raw water from Midmar under gravity to the DV Harris WTW, that supplies Claridge and the Northern and Eastern suburbs of Pietermaritzburg, the Wartburg-subsystem, and through to the Umlaas Road Reservoir.

The 2035 and 2045 probable Summer Daily Demands (SDD) for the current and planned Umgeni Water supply areas in UMDM is 321Mℓ/day and 342Mℓ/day respectively. Subtracting the supply from D.V Harris WTW at 100Mℓ/day the deficit that needs to be supplied from Midmar WTW is 221Mℓ/day and 242Mℓ/day for 2035 and 2045 respectively. The above figures do not include the supply to eThekwini as the uMkhomazi System is scheduled to supply the eThekwini’s Western aqueduct by 2024 (Umgeni Master Plan, Vol. 2).

7.4.1. Existing Bulk Water Supply Infrastructure

The bulk water infrastructure description and capacity is summarised in **Table 18** and **Figure 26** below.

Table 18: Bulk Water Supply Infrastructure – Midmar WTP to Umlaas Reservoir

Bulk Supply Pipeline		Diameter (mm)	Length (km)
From	To		
Midmar WTP	Midmar Reservoir	1600	6.50
Midmar Tunnel Outlet	D.V. Harris WTP	1600	8.06
'251 Pipeline	St. Josephs Tank		
D.V. Harris WTP	World's View Reservoir	1000, 900 and 800	6.20
World's View Reservoir	H.D. Hill	1000 and 1000	29.60
H.D. Hill	ED2 (Duplication)	1000 and 1000	8.90
ED2	Richmond P/L off-take	800	4.0
ED2	Richmond P/L off-take (Augmentation)	1300	4
Richmond P/L off- take	Umlaas Road	800	13.00
ED4 to Umlaas Road	Umlaas Road	1100	13.00
Off-Take from '61 Pipeline	Ambleton Reservoir	160	2.00
Off-Take from '61 Pipeline	Ashburton Reservoir	160	2.70
Off-Take from '61 Pipeline	Thornville Reservoir	160 and 200	7.90
Thornville Reservoir	Hopewell Reservoir	200	4.91
Thornville Reservoir	Hopewell Reservoir	300	4.95
Thornville Reservoir	Baynesfield	200	4.95
D.V. Harris WTP	Umlaas Road	762	26.60
Thornville Reservoir	Richmond	600	20
Reservoir		**Storage (Mℓ)**	
Midmar Reservoir		45.0	
Clarendon Reservoir		25.0	
World's View Reservoir		80.0	
Thornville Reservoir		2.0	
Hopewell Reservoir		0.5	
Ashburton High-Level Reservoir		0.5	
D.V. Harris Clearwells		4.1	
H.D. Hill (Balancing 1)		22.4	
H.D. Hill (Balancing 2)		22.3	
St. Josephs Reservoir		0.1	
Pumpstation		**Design Capacity (Mℓ/day)**	
Thornville		3 x 1.5 (1 standby)	

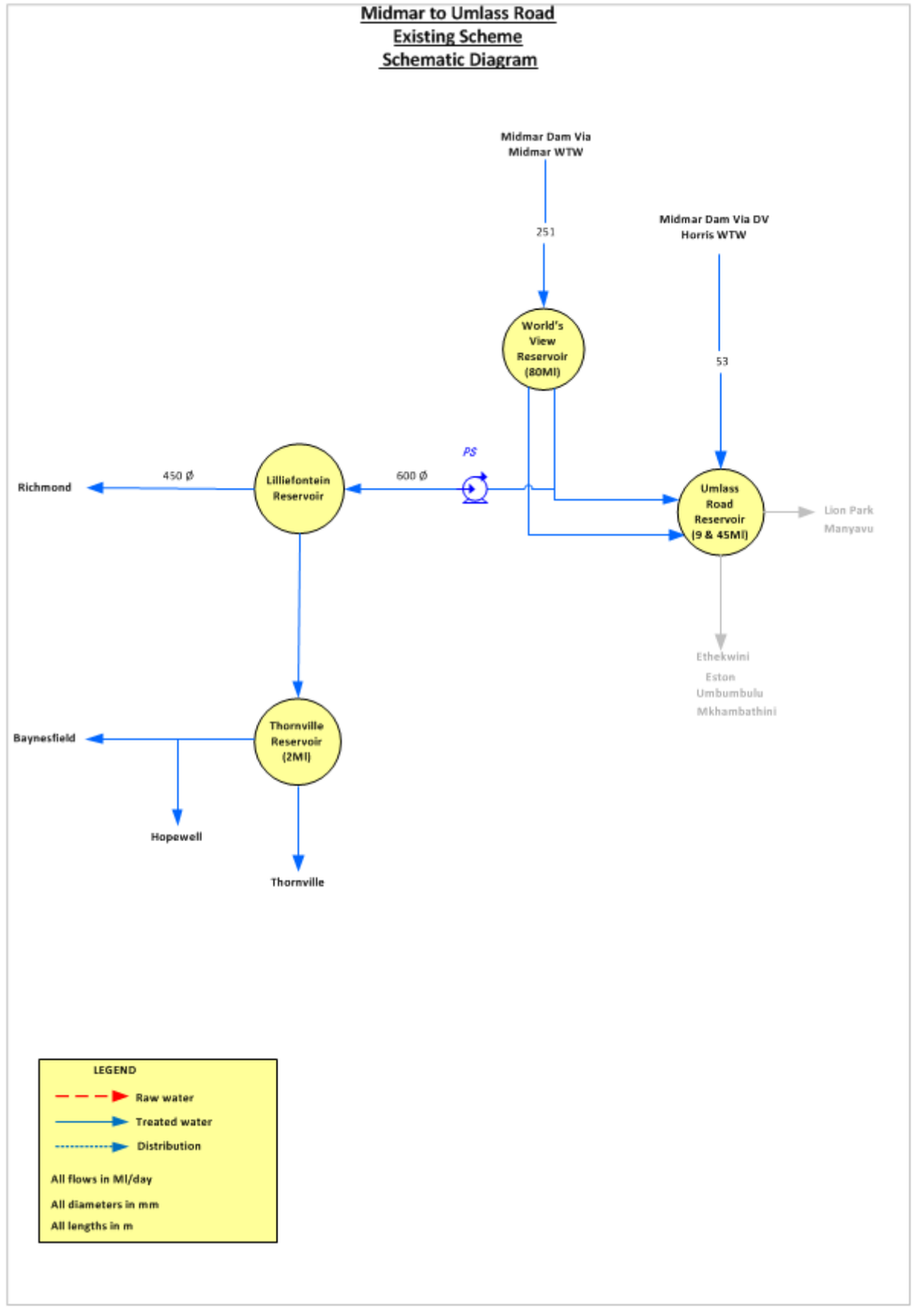


Figure 26: Schematic of Richmond Existing Scheme

7.4.2. Planned Bulk Water Infrastructure Upgrades

No planned upgrades at present.

7.4.3. Condition of Bulk Supply Infrastructure

The ’53 pipeline from DV Harris WTW to Umlaas Road currently supplies about 35Mℓ/day to Umlaas Road Reservoir. This ageing pipeline has an operational history of frequent bursts and caution has to be taken to not exceed the “safe load carrying capacity” of 45Mℓ/day. It is planned to take the ’53 pipeline out of commissioning once the UMWP is commissioned.

7.4.4. Water Demand Issues to Consider

When the demand downstream of World’s View Reservoir reaches 245Mℓ/day, the 800mm diameter ’60 Pipeline will have to be utilised to augment the supply from Midmar WTP into World’s View Reservoir. This will mean that Clarendon Reservoir will then have to be fed from Midmar WTP.

The current demand from Clarendon Reservoir is about 18Mℓ/day. The capacity of the reservoir is 25Mℓ. The reservoir functions as a terminal reservoir which should have 48 hours of storage. The reservoir should therefore be upgraded to minimise risk. This is a reticulation requirement and the responsibility to provide this storage requirement lies with the Municipality. Due to limiting head conditions in the upper portion of the ‘251 Pipeline, the maximum flow obtainable through this pipeline is 330Mℓ/day. Augmentation of all pipeline elements downstream of the ‘251 Pipeline should therefore be based on a maximum available flow of 330Mℓ/day.

The dedicated ’61 pipeline from the Worlds View Reservoir serving The Msunduzi Municipality has sufficient capacity to satisfy the growing annual average daily demand (AADD). For a peak flow of 1.3 x AADD the pipeline could reach its capacity by 2030. However, with the proposed interlinking of the two (2) ’61 pipelines and the anticipated relief from the ’61 Pipeline of the WA demand in 2023 (once the uMWP is commissioned), the current pipeline capacity is considered adequate.

The demand on the DV Harris WTW is made up of supply to the Msunduzi and uMshwathi Municipalities, as well as a supply to the Umlaas Road Reservoir via the ’53 Pipeline. The supply through the ’53 Pipeline varies between 25 to 35Mℓ/day depending on the operational requirements at Umlaas Road Reservoir. While Clarendon can be supplied from the Midmar WTP, the current operating rule is to supply Clarendon Reservoir from D.V Harris WTP to maximise the availability on the ‘251 Pipeline to serve the Umlaas Road Sub-System.

Due to the configuration of the ’61 Pipeline between D.V Harris WTP and Clarendon Reservoir, it is expected that Clarendon Reservoir will have to be fed from Midmar WTP in 2016. This will relieve the demand placed on D.V Harris WTP. The demand on the plant will be reduced further when the ’53 Pipeline is decommissioned, which will occur with the commissioning of the uMWP. D.V Harris WTP will therefore not have to be upgraded within this 30 year horizon. The current production at the plant is approximately 92Mℓ/day.

The Msunduzi Municipality intends expanding its low income housing in the Shenstone/Ambleton area. These developments will be supplied with potable water from the ED4 off-take. It is therefore expected that the increase in demand at this point will be in the region of 3% annually over the next ten (10) years. Further downstream of the ED4 off-take is the tie-in to the Richmond Pipeline. Which places a further demand of 11Mℓ/day (year 2020) on this section of pipeline to Richmond.

The average flow in Ashburton pipeline is currently 2.4Mℓ/day. This system has sufficient capacity for the foreseeable future.

7.5. Umlaas Road Sub-System

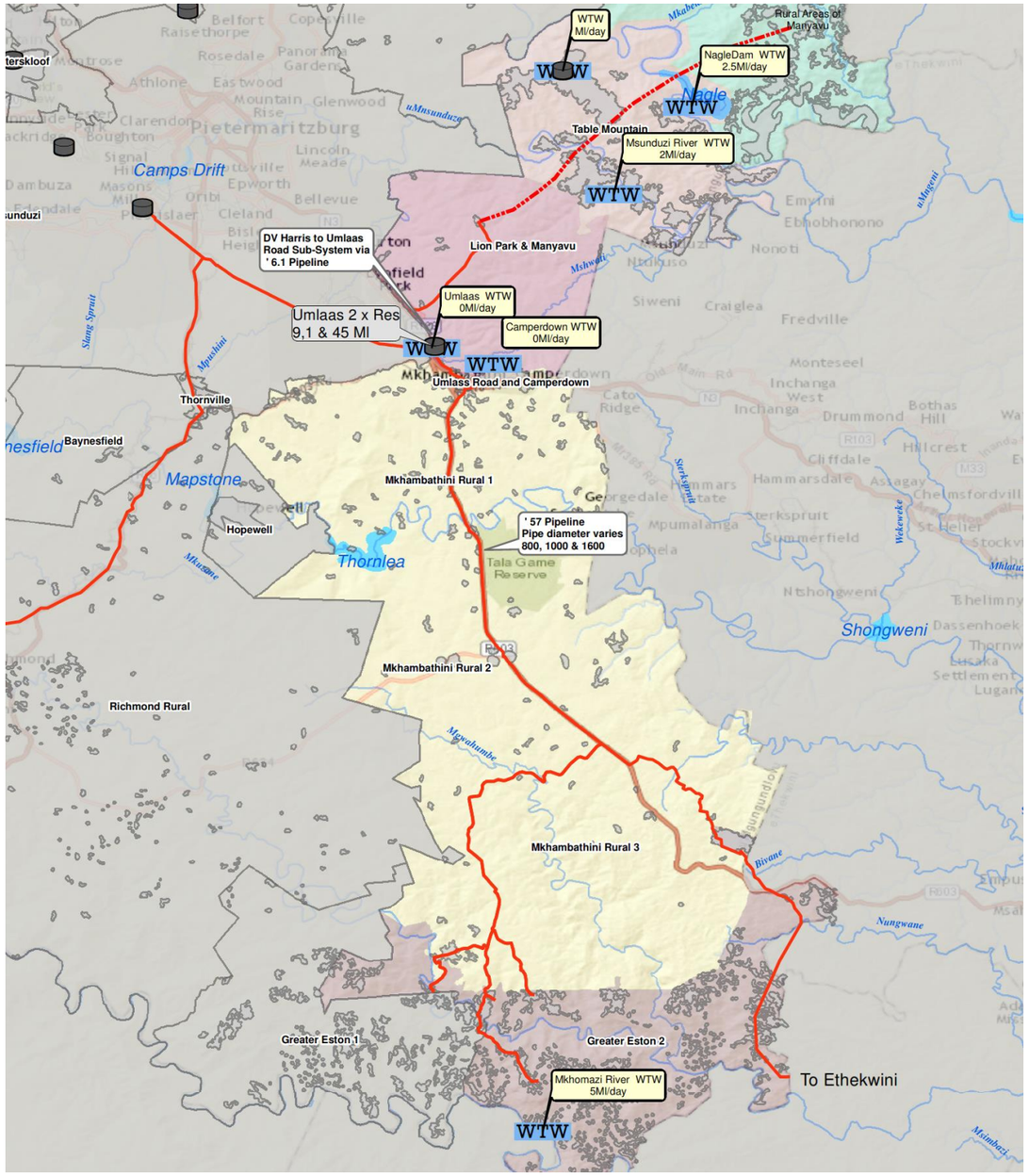


Figure 27: Umlaas Road Sub-System (Refer to **Annexure D** for an enlargement of this map)

The Umlaas Road Sub-System feeds the Greater Eston Water Supply Area, Camperdown, eThekwini, Lion Park, Manyavu and areas of Mkhambathini.

7.5.1. *Existing Bulk Water Supply Infrastructure*

The bulk water infrastructure description and capacity is summarised in **Table 19** and **Figure 28** below:

Table 19: Bulk Water Supply Infrastructure – Umlaas Road Sub-System

Bulk Supply Pipeline		Diameter (mm)	Length (km)
From	**To**		
Umlaas Road	Cato Ridge Bifurcation	800	8.60
Umlaas Road (Phase 3)	Cato Ridge Bifurcation	1000	8.50
Umlaas Road	Point M (eThekwini)	1600	8.10
'57 Pipeline (Phase 3)	Eston Reservoir	600	16.10
Eston Reservoir	Umbumbulu	450	13.10
Umlaas Road Reservoir	Lion Park	160	8.60
Lion Park	Consumers along the '53 Pipeline	90	4.60
Lion Park	Manyavu	250 160 150	1.00 2.00 13.00
Reservoir		**Storage (Mℓ)**	
Umlaas Road Reservoir 1		9.10	
Umlaas Road Reservoir 2		45.00	
Eston Reservoir 1		2.50	
Eston Reservoir 2		2.50	
Pumpstation		**Design Capacity (Mℓ/day)**	

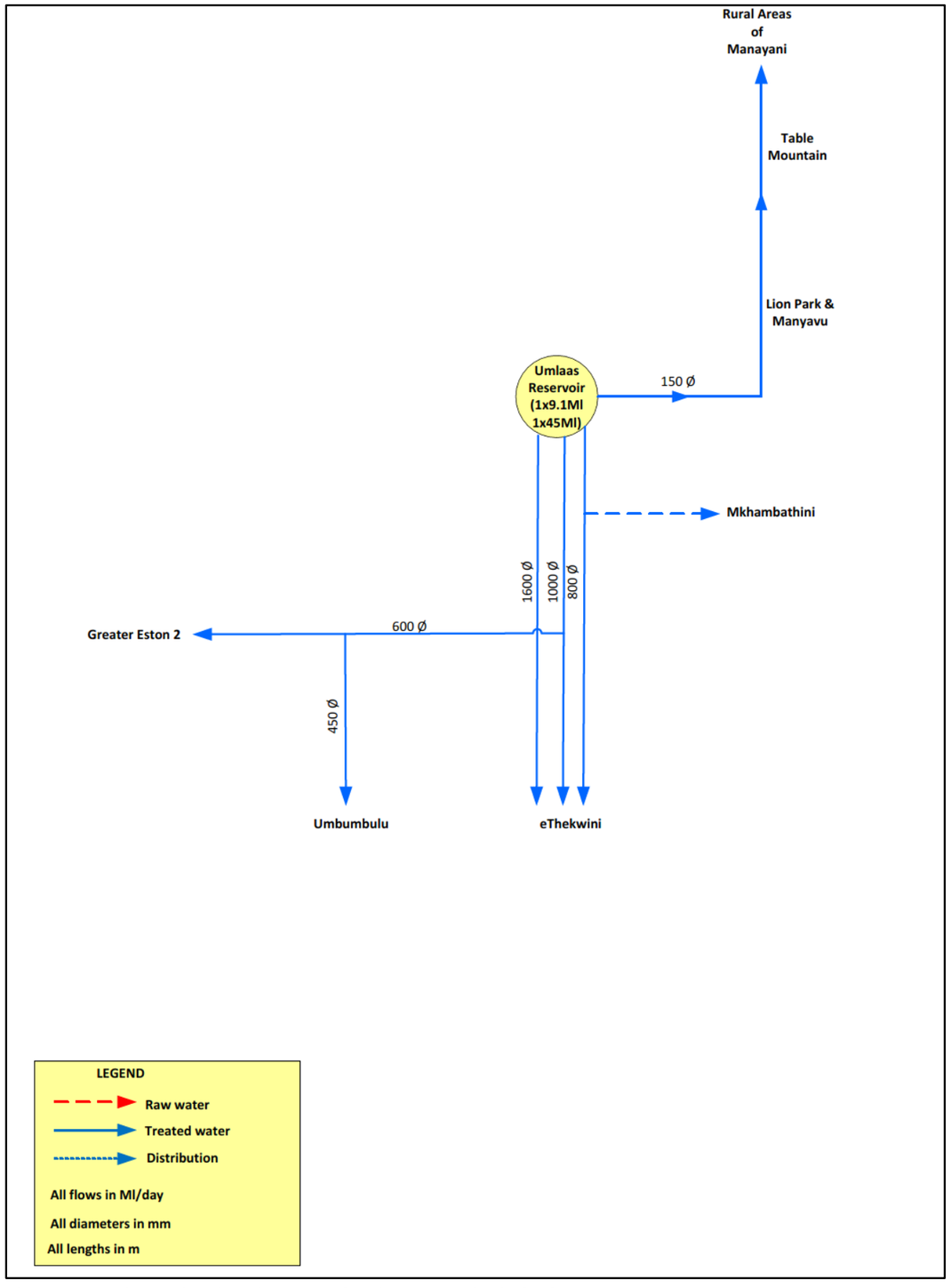


Figure 28: Schematic of Umlaas Road Sub-System (Existing)

7.5.2. Condition of Bulk Supply Infrastructure

The existing 800mm diameter ’57 pipeline serves a minimal demand in Camperdown. The pipeline was subjected to high velocities which resulted in the delamination of the bitumen lining along sections of the pipeline. This impacted on the quality of the water supplied to eThekwini Municipality.

7.5.2.1. Water Demand issues to consider

The current demand at Umlaas Road Reservoir is 95Mℓ/day. The reservoir serves primarily as a distribution reservoir, supplying reservoirs in Mkhambathini and eThekwini.

The inlet configuration at the reservoir needs to be upgraded to ensure that the maximum volume that will become available from the augmented ’61 Pipeline can be transferred into the Umlaas Road Reservoir. Limited inflow to the reservoir means that peak outflow demands currently cause the reservoir level to decrease to low levels. Once the inlet constrictions are removed and the ’61 Pipeline is augmented all the way to Umlaas Road, then those low level conditions will no longer be experienced. The ’61 Pipeline has been completed (2014) but the restriction removal is still to be completed.

The combined capacity of the 1000mm diameter and the new 1600mm diameter ’57 pipeline is 485Mℓ/day which is sufficient to satisfy the future demands of the WS.

The current supply to Msunduzi from the Claridge reservoir is approximately 31Mℓ/day. Besides infill residential development, no major developments are planned that will impact substantially on the storage requirement at Claridge Reservoir.

The capacity of the Eston/Umbumbulu pipeline is restricted to 15Mℓ/day due to the ground level profile along the pipeline route. The flow is restricted to ensure that the hydraulic grade line is at least 20m above a high point at Stoney Ridge. The current flow in this pipeline is 11Mℓ/day. UMDM plans to supply the Greater Eston area with potable water from this pipeline. This, together with the natural growth in Umbumbulu, will mean that the flow in this pipeline could reach capacity in 2015.

The current demand on the Lion Park pipeline is in the order of 2.3Mℓ/day. Umgeni Water has constructed a new pipeline from an off-take on the Lion Park Pipeline to serve the Manyavu community. This will place an additional demand on the system. The Manyavu demand is expected to grow to about 6Mℓ/day by 2040. As a result, the Lion Park Pipeline has to be augmented.

7.6. Wartburg Sub-System

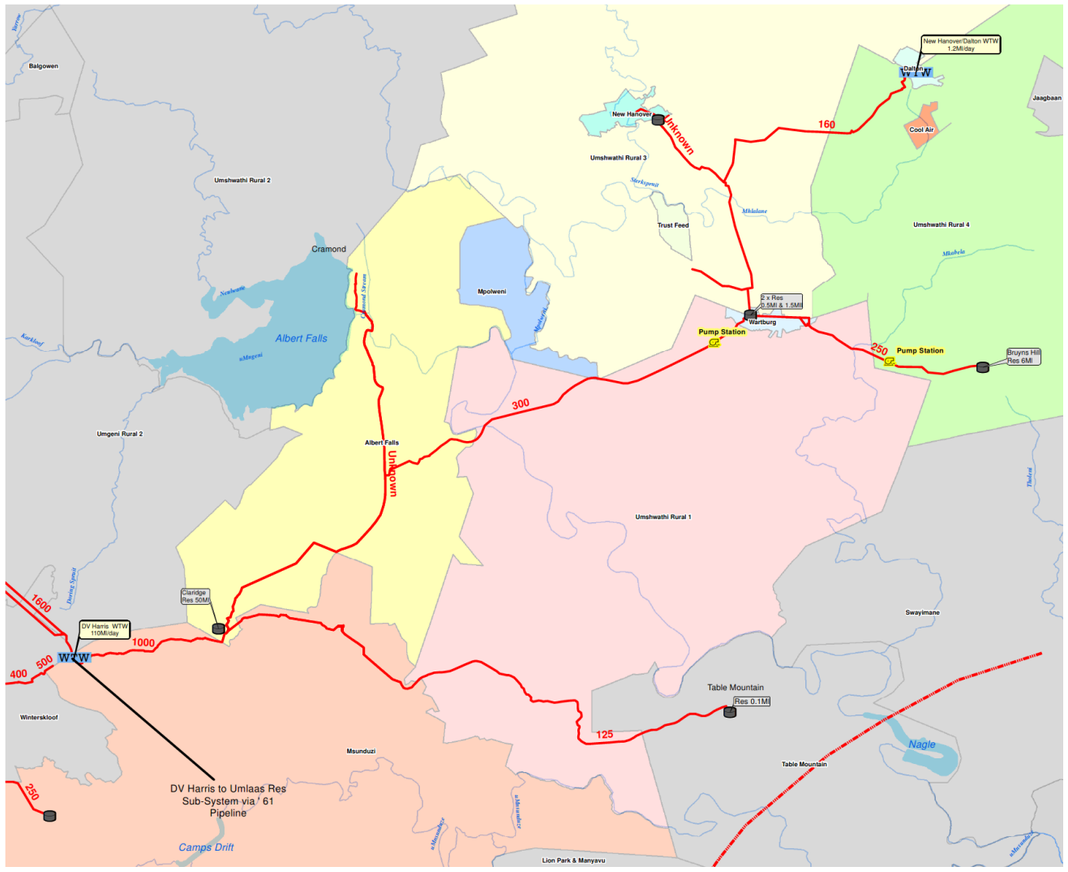


Figure 29: Existing Infrastructure – Wartburg Sub-System (Refer to **Annexure D** for an enlargement of this map)

The Wartburg Sub-System is supplied from the DV Harris WTW via the Claridge Reservoir. The Sub-System supplies Table Mountain, Albert Falls, Mpolweni, Wartburg, New Hanover, Swayimane, individual households en route, Trustfeeds, Cool Air, and Dalton. The Greater Mshwathi Regional Supply System is under construction as an extension to the Wartburg Sub-System and will supply the areas of Efaye, Nadi and Ekhamanzi.

7.6.1. *Existing Bulk Water Supply Infrastructure*

The bulk water infrastructure description and capacity is summarised in **Figure 30** and **Table 20** below:

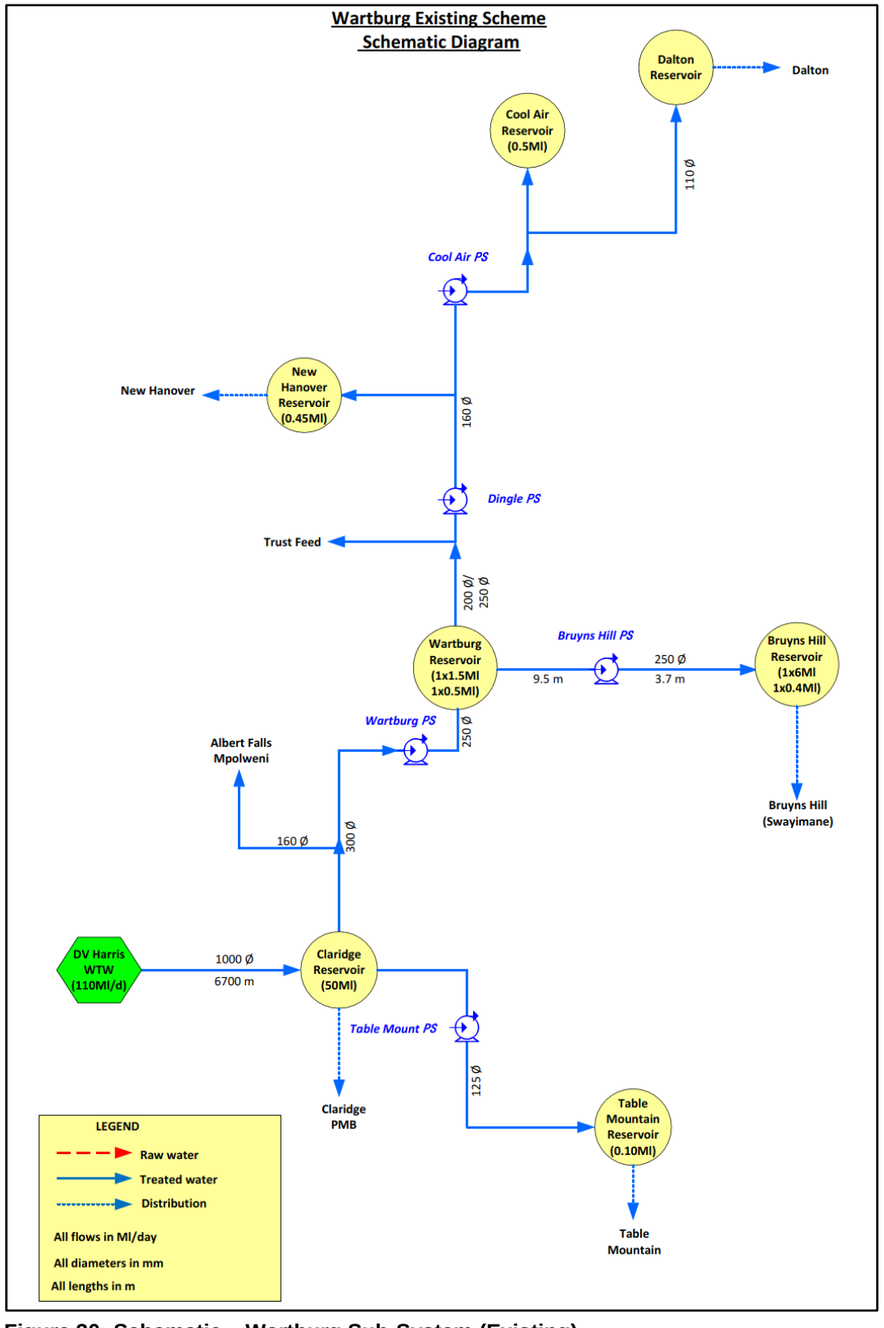


Figure 30: Schematic – Wartburg Sub-System (Existing)

Table 20: Bulk Water Supply Infrastructure – Wartburg Sub-System

Bulk Supply Pipeline		Diameter (mm)	Length (km)
From	**To**		
Lower Glen Lyn BPT	Table Mountain Reservoir	125	14.80
Claridge Reservoir/Belfort Reservoir	Wartburg Break Pressure Tank and Pumpstation	300	19.30
Wartburg Break Pressure Tank and Pumpstation	Wartburg Reservoir	250	6.80
Wartburg Reservoir	Dingle Break Pressure Tank and Pumpstation	250/200	9.50
Dingle Break Pressure Tank and Pumpstation	Cool Air Reservoir	160	13.90
Cool Air Reservoir	Dalton Pumpstation and Reservoir	110	1.30
Wartburg Reservoir	Bruyns Hill Pumpstation	250	9.50
Bruyns Hill Pumpstation	Bruyns Hill Reservoir (decommissioned in 2012)	250	3.69
Reservoir		**Storage (Mℓ)**	
Wartburg Reservoir 1		0.50	
Wartburg Reservoir 2		1.50	
Claridge Reservoir		50.00	
Bruyns Hill Reservoir 1		0.40	
Bruyns Hill Reservoir 2		6.00	
Cool Air Reservoir		0.50	
Table Mountain (Int)		0.10	
Pumpstation		**Design Capacity**	
Cool Air		2 x 0.46 (1 standby)	
Bruyns Hill			
Dingle			
Table Mountain		3 x 1.3 (1 standby)	
Old Wartburg		2 x 0.52 (1 standby)	
New Wartburg		2 x 3.24 (1 standby)	

7.6.2. Condition of Bulk Supply Infrastructure

No condition issues were mentioned in the 2015 Umgeni Water Master Plan.

7.6.3. Planned Bulk Infrastructure

The planned Wartburg system upgrade is shown in **Annexure E**.

7.6.4. Water Demand Issues to Consider

'69 Pipeline: Claridge Reservoir to Wartburg Reservoir

In 2008, planning was undertaken to supply Efaye and Ozwathini from the Wartburg system. UMDM has implemented a project to conduct further planning to supply the uMshwathi region through the D.V Harris WTP. This is a high priority project and, subject to funding, could be implemented within the next three (3) to five (5) years. The '69 Pipeline needs to be upgraded to supply the uMshwathi region and the Eastern areas of iLembe District Municipality.

The '69 Pipeline currently runs at close to its capacity of 9Mℓ/day. In an attempt to increase throughput in this pipeline, the Claridge Reservoir was by-passed in 2012. This resulted in an increased head and consequent increased flow. The governing head in the pipe is now from D.V Harris WTP. This is considered a short-term solution and there remains an urgent need to augment this pipeline. Current demand in this pipeline is driven primarily by the growth in demand at Bruyns Hill Reservoir which serves Swayimane.

The Wartburg Reservoir functions primarily as a bulk reservoir for Bruyns Hill and Cool Air Reservoirs. To function as a bulk reservoir, it should have 15 hours of the AADD supply to Cool Air and Bruyns Hill Reservoirs.

Water demands from the Swayimane area have consistently increased over the years. This growth is expected to continue with the planning of further low cost housing in the area. iLembe District Municipality has also requested a supply to its Southern Ndwedwe region from Bruyns Hill.

The pipeline from Bruyns Hill Pumpstation to Bruyns Hill Reservoir has been upgraded to a 250mm diameter steel pipe which has a capacity of 8.5Mℓ/day. There is, however, a hydraulic constraint between Wartburg Reservoir and Bruyns Hill Pumpstation. The supply from Wartburg Reservoir to Bruyns Hill Pumpstation needs to be augmented to support this new demand node. The storage capacity at Bruyns Hill Reservoir has recently been increased and should be adequate for the next 20 years.

Wartburg Reservoir to Dalton Reservoir

The supply pipelines from Wartburg Reservoir to Dalton are adequate for the current demand. The pipeline will need to be augmented as and when Efaye, Ozwathini and Ndwedwe are supplied from the Wartburg System.

7.7. Greater Mpofana Water Supply Scheme Phase 1

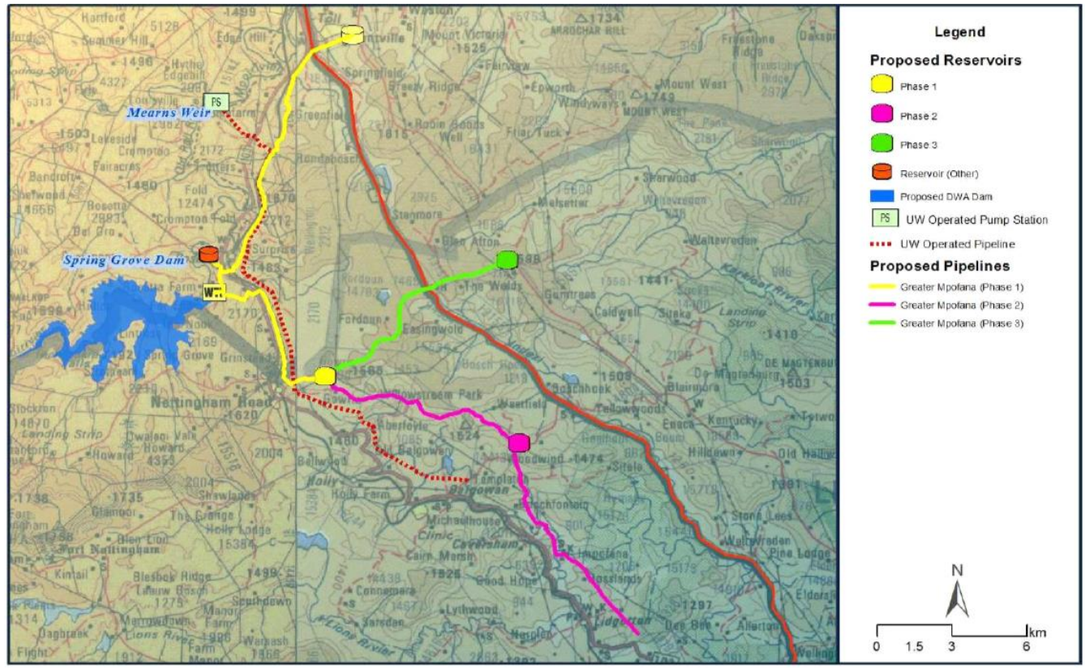


Figure 31: Greater Mpofana Water Supply Scheme

Several towns along the R103 in between Lions River and Mooi River have seen increasing water demand due to housing and tourism development. The growth has stressed local water resources and water infrastructure, and a regional bulk water supply scheme was identified as the solution to provide sustainable water supply into the future.

Phase 1 of the scheme involved the construction of a Water Treatment works and bulk infrastructure to supply the Mooi River, Bruntville and Nottingham Road areas. This Phase is nearing completion, and replaces the abstraction from the Little Mooi and groundwater in the area. Phases two and three are discussed under the Planned Infrastructure section of this report.

7.7.1. Existing Water Supply Infrastructure

Phase 1: 20Mℓ/day Water Treatment Works, associated pump-stations, 400mm diameter pipeline to Nottingham Road and 10Mℓ reservoir, and 500mm diameter pipeline to Rosetta and Bruntville in Mooi River with a 12Mℓ reservoir at Bruntville.

7.7.1. Condition of Bulk Supply Infrastructure

The infrastructure is newly constructed and therefore assumed to be in excellent condition.

7.7.1. Planned Infrastructure

Please refer to **Section 8**.

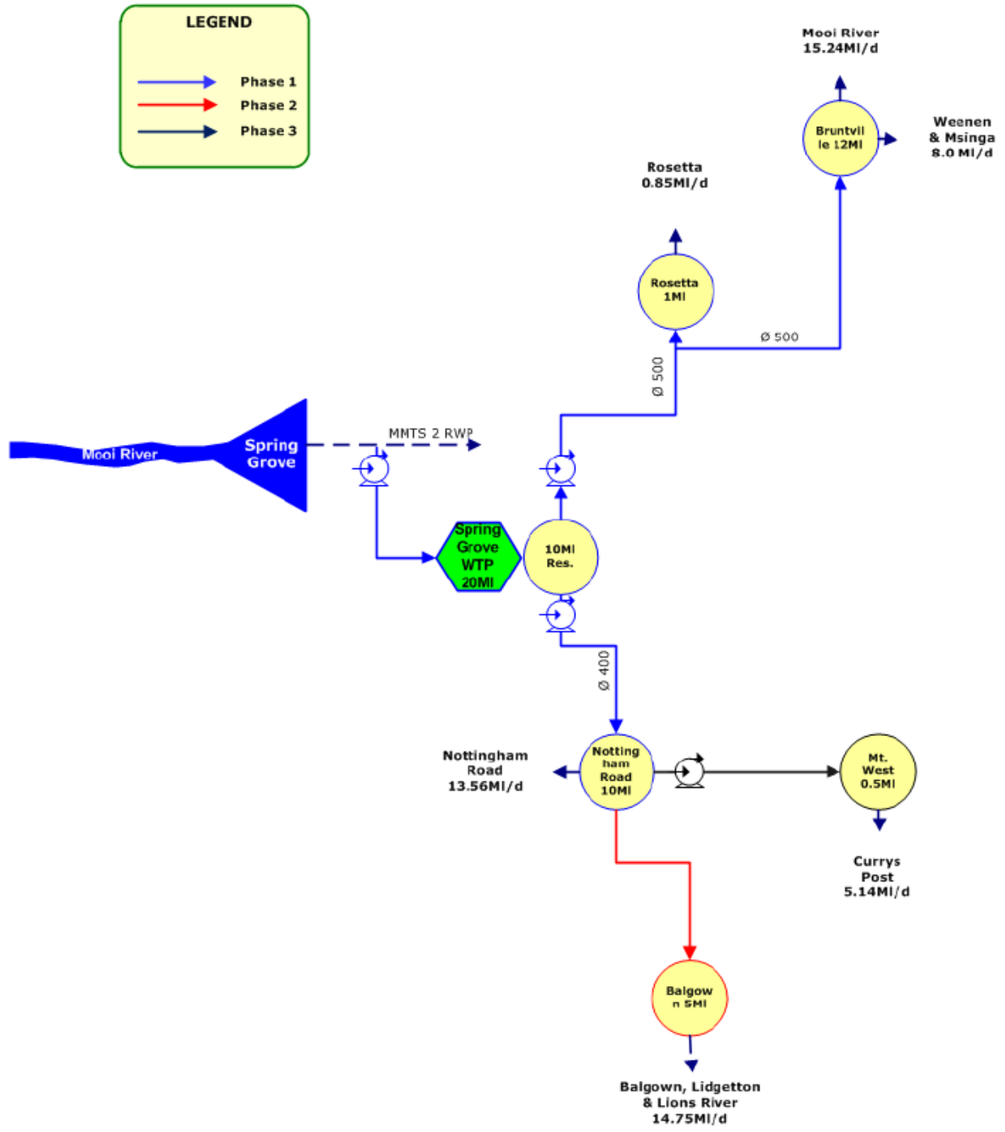


Figure 32: Schematic of Greater Mpofana Water Supply Scheme

7.7.2. Water Demand Issues to Consider

The construction of the Spring Grove Dam in Mooi River has been recently completed. The storage capacity and yield of the dam was designed to take into account the demands of the surrounding area which includes the whole of the Greater Mpofana Water Supply Scheme. (Reconciliation Strategy Report for Greater Mpofana, 2011).

8. BULK WATER SUPPLY INTERVENTIONS CURRENTLY IN PLANNING

Several bulk water supply projects are currently in planning by the UMDM and Umgeni Water. The details in this section are taken from Umgeni Water's 2016/17 Infrastructure Master Plan.

8.1. uMkhomazi System

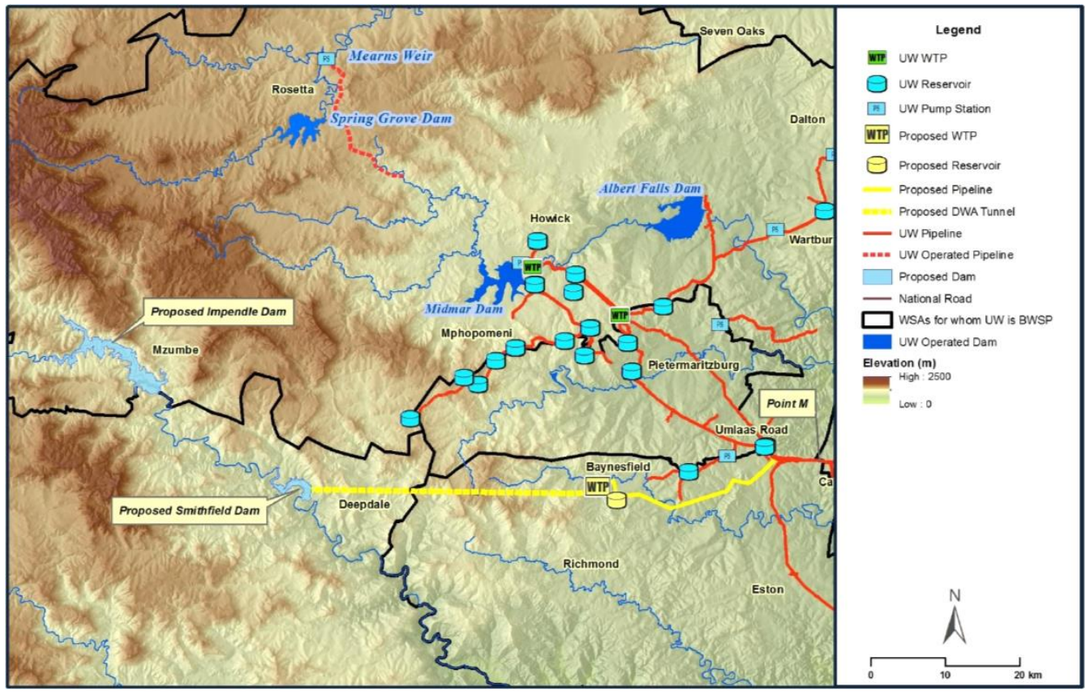


Figure 33: Planned Mkhomazi System (Umgeni Water, 2015)

The proposed uMkhomazi System will have the following Project Components:

Water Resource Components (to be developed by DWS):

- Smithfield Dam – having a storage capacity 251 million m³ (31% of MAR), earth core rockfill dam.
- A transfer tunnel – 3.5m bored diameter (3.0m lined diameter), concrete-lined (where necessary), overall length of 32km.
- Balancing Dam – located at the outlet portal of the tunnel in the vicinity of Baynesfield Estate.
- 3km of 3 000mm Raw Water Pipeline.

Potable Water Supply Components (to be developed by Umgeni Water):

- Water Treatment Plant (WTP) – to be located near Baynesfield Estate with an initial capacity of 500Mℓ/day and allowance for another module to increase capacity to 625Mℓ/day.
- 170Mℓ potable water storage reservoir at WTP.
- Bulk Potable Water Pipelines – 2 820mm diameter (15.1km) and 2 540mm diameter (4.6km) gravity mains from the WTP to '57 pipeline.

8.1.1. Financial Implications and Implementation Programme

The project needs to be implemented by 2018 in order to achieve a 99% level of assurance of supply to the Mgeni System. However, the earliest possible commissioning of this scheme is 2024. The estimated cost of the entire project (of both the water resource and water supply infrastructure for both phases) is in the order of R 18 billion at 2015 prices. This is made up of R 13.5 billion for the raw water component to be implemented by DWS and R 4.5 billion (Excl. VAT) for the potable component to be implemented by Umgeni Water.

8.2. Greater Mpofana Bulk Water Supply Phases 2-4 (Mooi System)

The project is separated into the following phases:

Phase 1: Nearing completion. 20Mℓ/day Water Treatment Works, associated pumpstations, 400mm diameter pipeline to Nottingham Road and 10Mℓ Reservoir, and 500mm diameter pipeline to Rosetta and Bruntville in Mooi River with a 12Mℓ Reservoir at Bruntville.

Phase 2: Pipeline from Nottingham Road Reservoir to Balgowan and then Lidgetton including the Balgowan Reservoir.

Phase 3: Pipeline from Nottingham Road to Mount West including a reservoir at Mount West. A pipeline from Mount West to Lion's River including a reservoir at the termination point.

Phase 4: Possible pipeline to Msinga

8.2.1. Financial Implications and Implementation Programme

The cost estimations are R76 million for Phase 2 and R110 million for Phase 3. Phase 4 has only been investigated at a pre-feasibility level of detail and hence the full capital cost of this phase is yet to be determined. Timeframes for implementation are not available as yet.

8.3. Impendle Bulk Water Supply Scheme

The area of Impendle has unreliable sources of water and many small run-off-river abstraction and borehole schemes. This project will increase the level of assurance of supply to the community of Impendle as requested by UMDM.

8.3.1. Water Resource Consideration/Infrastructure

The Mkomazi and Nzinga rivers will be the resources utilised for this project. The existing Nzinga abstraction and two (2) new abstractions on the Mkomazi are proposed. The Nzinga River has a minimum daily flow during the dry months of 105kℓ/hr, at the existing abstraction point, with approximately 74kℓ/hr available after allowing for EWR. The existing abstraction is already 68kℓ/hr,

leaving very little extra available capacity, and additional source is required. A hydrological analysis at the proposed abstraction point on the Mkomazi River showed a minimum average flow of 1.8 million m³/month, after allowance for the EWR. This is sufficient to provide the required water for the scheme. Boreholes in Stepmore could provide an additional 250kℓ/day if required (SSI Feasibility Report, 2011).

8.3.2. Planned Water Supply Infrastructure

The project is focused on bulk supply only. It will include the following:

- **Nzinga Waterworks -** The proposed plant has a capacity of 5.76 Mℓ/day with an abstraction capacity of 6.6 Mℓ/day.
- **Stepmore Waterworks -** The proposed plant has a capacity of 1.66 Mℓ/day with an abstraction capacity of 1.78 Mℓ/day

8.3.3. Financial Implications and Implementation Programme

The construction duration of this project is anticipated to be six (6) years. The total cost is estimated to be R200 million at 2015 prices.

8.4. uMshwathi Regional Bulk Water Supply Scheme

8.4.1. Project Description

The new pipeline 850mm diameter steel pipe from Claridge Reservoir to Wartburg Reservoir has now been constructed under Phase 1. The components of the project included a 26km pipeline, a booster pumpstation and 8Mℓ reservoir at Wartburg. The new Wartburg pipeline would tie into the outlet of the existing 50Mℓ Claridge Reservoir. In addition this pipeline will supply the rural areas of Efaye, Ozwathini and Ndwedwe.

In order to meet the projected demands for both existing consumers as well as the areas of greater Efaye, Ozwathini and Central Ndwedwe, new infrastructure will have to be constructed under the future phases.

8.4.2. Financial Implications and Implementation Programme

The phases of the project are anticipated to be completed as follows:

- Phase 1: December 2016
- Phase 2: August 2017
- Phase 3: May 2018

The total cost is estimated to be R 1.1 billion at 2016 prices.

9. GAP ANALYSIS

Chapters 5 and 6 give a basic overview of the existing and committed bulk schemes. The planning, operation and maintenance of these schemes is well covered by Umgeni Water, and elaboration and analysis of these schemes is not warranted as a part of this project. Of interest, however is the areas NOT served by bulk schemes, and the identification of possible areas where bulk infrastructure may be feasible.

The areas NOT served by bulk schemes are currently small stand-alone schemes, some operated and maintained by UMDM, and others are privately owned and maintained. This is a significant proportion of the UMDM, but the bulk of the areas are farmland as shown on the Key Map in **Annexure A**.

Removing all the privately owned farmland, and the conservation areas, one can see a more accurate picture of the areas that are supplied with local schemes. By excluding these areas, it is not stating that the UMDM should ignore workers who may live in such areas, but it is acknowledging that the number of households, and therefore water demand, are not high enough to warrant the development of a bulk water supply scheme. The unit cost per household would be too high, for both the capital and the O&M, and therefore are not viable. These areas should continue to be served by either private supplies, or small stand-alone schemes managed by the UMDM.

9.1. Richmond Rural

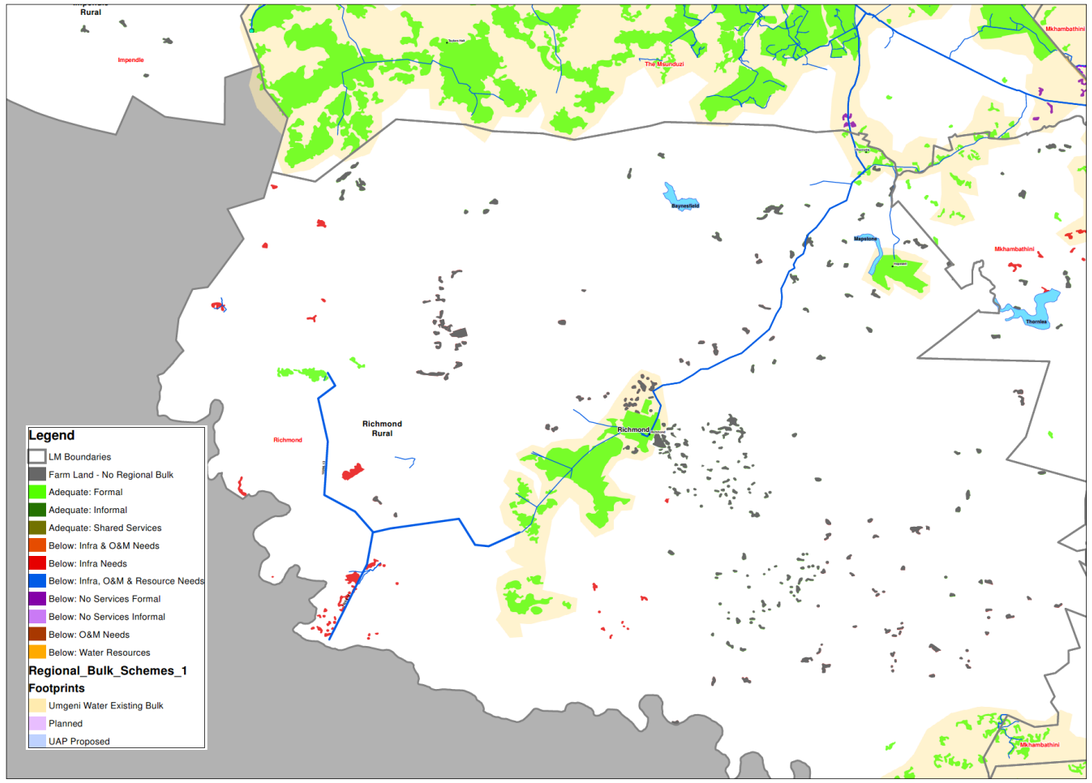


Figure 34: Layout – Richmond LM

To test the feasibility of a bulk supply system to Richmond Rural, pipelines were extended from Richmond to the rural areas, as shown in **Figure 34** above and was inserted into the demand / cost model as a stand-alone scheme. An extract of the model and the cost for this hypothetical scenario is shown in the table in **Annexure B**. The per household cost amounts to approximately R43 000/household for the high demand scenario and the 2011 population figures for the area served only by the proposed extended pipeline. This figure however is deceptive as the costs are based on a 24,5km bulk supply line, a single 6Mℓ reservoir and establishment of 3Mℓ/day boreholes. Should the entire Richmond Rural be supplied by bulk supply, excessively more length of pipeline needs to be allowed for, the scope of which is beyond the deliverables of this report. The SDF of UMDM shows the bulk of the Richmond Rural area to be earmarked as agricultural priority which in itself renders a bulk water supply system to the area unfeasible.

The rural pipeline analysis, as shown in the Mpofana map in **Section 9.4**, was also done to Mpofana rural areas with a similar outcome as indicated in **Table 21** below. (Refer to **Annexure B** for demand model results and cost estimate).

Table 21: Summary Table of Hypothetical Analysis

Rural Area	2011 Population	Cost	Cost/HH
Richmond	767	R132 million	R 172 000
Mpofana	1 478	R284 million	R 192 000

9.2. Umlaas Road Sub-System (Mkhambathini)

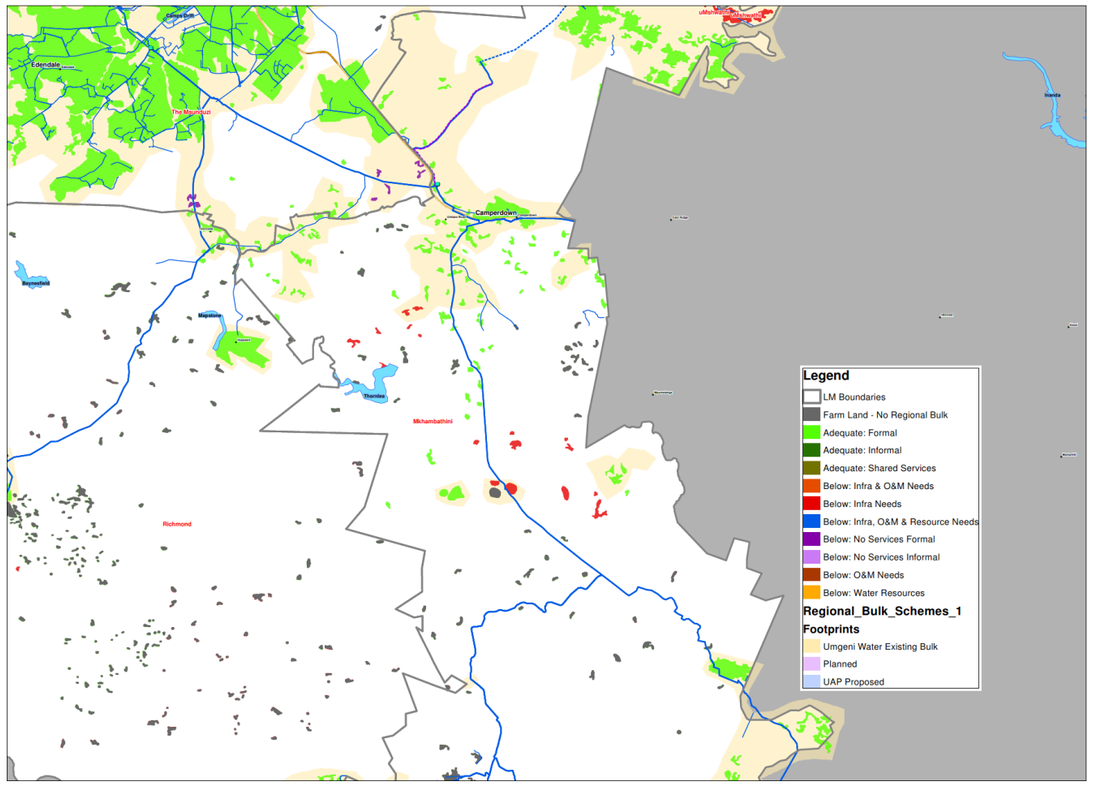


Figure 35: Layout – Mkhambathini LM

Demand figures of the Umlaas Road Sub-System are shown in the demand table in **Annexure B**. The capacity of the bulk distribution systems of certain supply areas is also shown. The Umlaas Road Reservoir to Lion Park and Manyavu shows an upgrade of the existing 150Ø pipeline is required, i.e. an additional 250Ø and 200Ø respectively for the high and probable 2035 demands.

9.3. Impendle

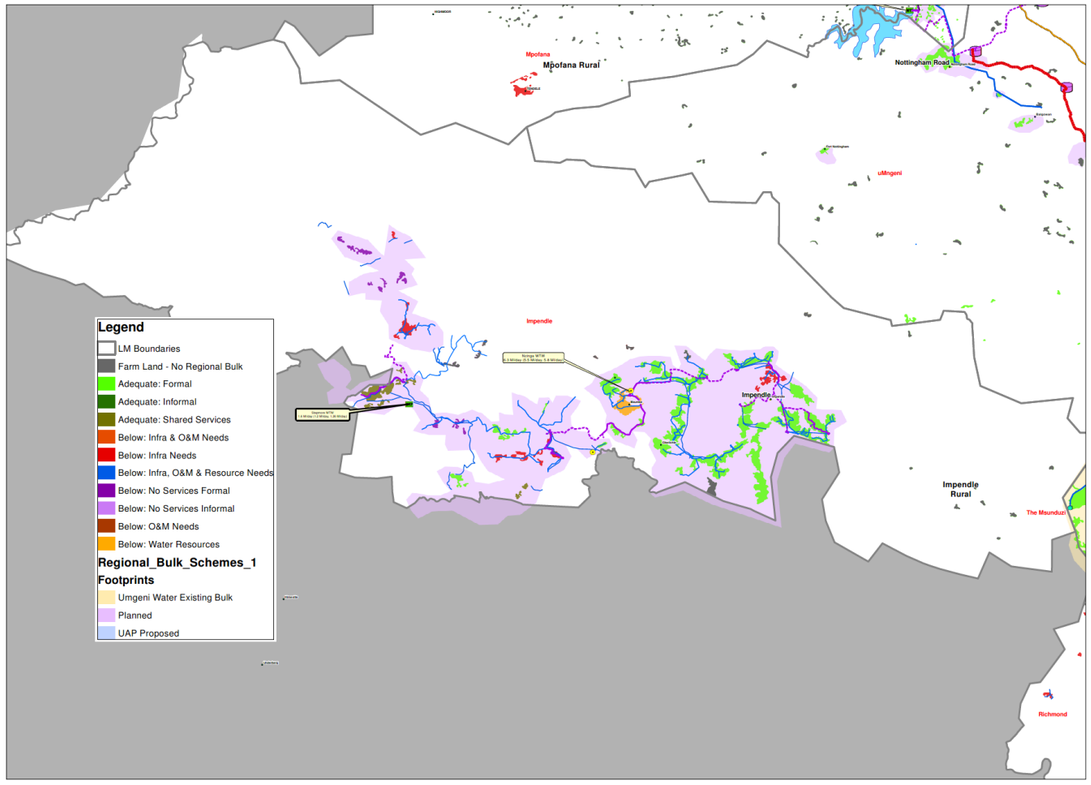


Figure 36: Layout – Impendle LM

The Impendle LM is divided into five (5) supply areas, as shown in the Demand Projection map in **Annexure C**. Greater Impendle is the most densely populated with the highest water demands. The current water supply to Impendle is described in **Section 5** of this report. The Impendle Rural Bulk Water Supply Scheme is currently being constructed. Raw Water is abstracted from both the Umkomazi and Nzinga Rivers. The scheme involves two (2) WTW's with 1,6Mℓ/day and 6,3Mℓ/day capacity respectively in the Umkomaas and Nzinga Rivers. From the treatment works, potable water is supplied via pumpstations, bulk reticulation pipelines and reservoirs to communal standpipes.

The 2035 and 2045 Summer Daily Demands (SDD) of the Greater Impendle areas are shown on the Key Map in **Annexure A** and the current combined water treatment capacity of 7,9Mℓ/day is adequate. The planned construction of the Impendle Dam in future will probably allow for the decommissioning of the smaller WTW with a single, larger WTW at the dam.

The total demographics and demands for the current and future years of the combined Impendle Municipality is shown under the "Demand Model Summary" in the demand table in **Annexure B**. Should the Impendle Municipal areas be supplied from the proposed Impendle Dam, the probable and high upgrade requirements for the WTW and reservoir is given. The estimated cost for this

infrastructure (WTW and reservoir) is also shown. No costing for distribution pipework is included as the extent of such is outside the scope of this report.

In discussion with UMDM, they expressed their concern with water supply to the neighbouring Sisonke areas that are to be incorporated into the UMDM area. The investigation into this supply area is outside the scope of this report and can be addressed when the incorporation takes place.

9.4. Mpofana

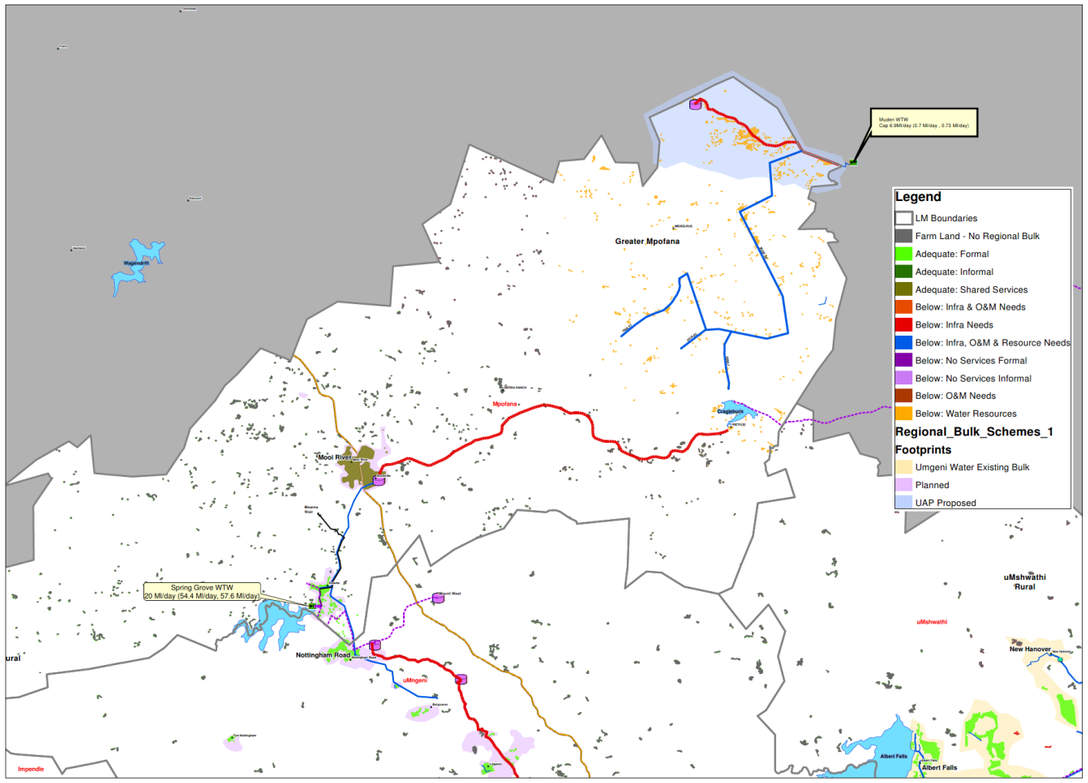


Figure 37: Layout – Mpofana LM

The Mpofana LM is divided into eight (8) supply areas. The supply areas and the demands are shown on the demand drawings included in **Annexure C**. The water demands for the individual supply areas are low and does not warrant a bulk supply system. The population densities occur around the town of Mooi River, which is currently fed from the Umgeni Water bulk water system. Another area of concentration that deems further investigation is the Greater Mpofana 4 area, or otherwise the Northern Mpofana area. The distance from the existing Umgeni Water bulk water system at Mooi River renders a bulk supply to it unfeasible, however a cross border supply from Muden might be considered.

Under the Muden Regional Bulk Water Supply Scheme, the Muden WTW is to be expanded from 2,4Mℓ/day to 6,9Mℓ/day. The total water demand for the Muden Regional Water Scheme is 4,5Mℓ/day (Umzinyathi UAP 2, March 2016). It is recommended that the Greater Mpofana areas be supplied from the Muden WTW because of the close vicinity to Muden WTW, as well as the 2045 SDD is lower than 1Mℓ/day. Considering the low SDD of the Greater Mpofana area and the great distance to the Mooi Water Scheme, a bulk water connection is not considered feasible.

The Hatch Goba UAP Phase 2 report states that the Muden WTP is supplemented from the Craigieburn Dam. A WTW at Craigieburn Dam is proposed to feed the surrounding areas and might also feed the Mpofana Northern areas. After discussions with UMDM it is evident that the Craigieburn Dam catchment is not very big and a pipeline from the Bruntville Reservoir is proposed to augment the supply. A take-off from this pipeline to Wenen is mentioned in the Umgeni Water Infrastructure Master Plan Report. This take-off can also supply the Northern Mpofana areas. The cost of the WTW at Craigieburn Dam and a 350mm diameter pipeline from Bruntville to Craigieburn Dam is estimated at R120 million.

9.5. uMshwathi

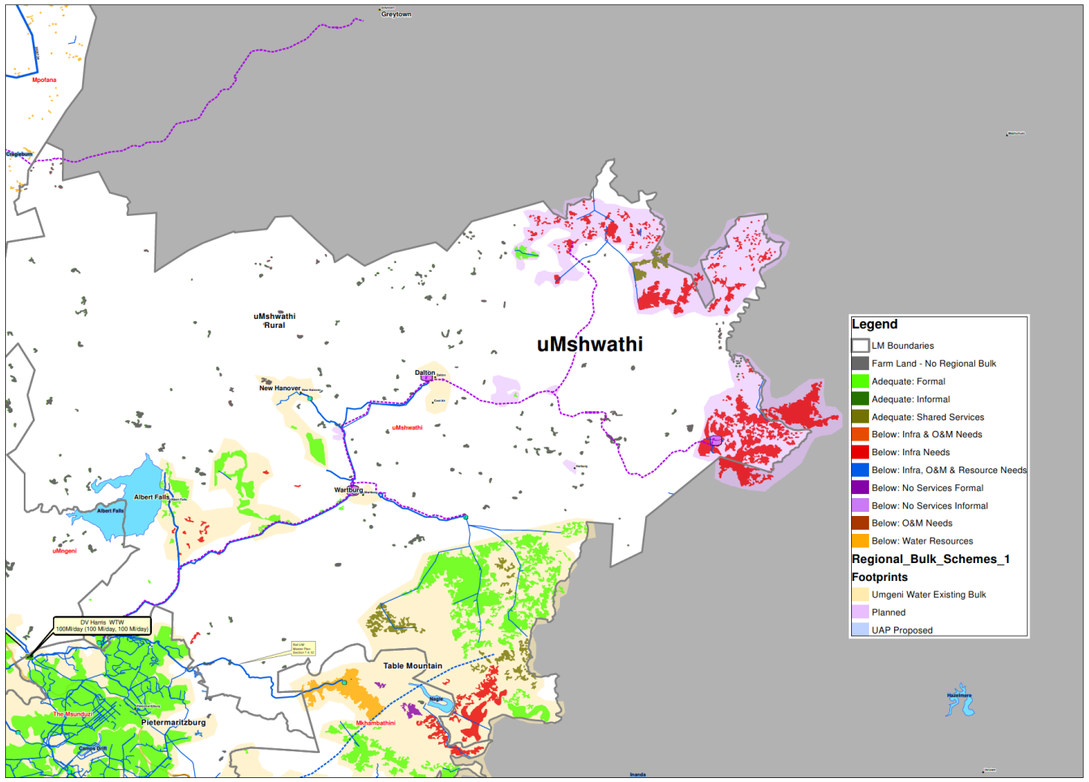


Figure 38: Layout – uMshwathi LM

The bulk of the uMshwathi rural areas are earmarked as agricultural priority and Traditional Authority areas. The central area is supplied by the Wartburg Bulk Water Supply Sub-System that is to be extended to serve the Eastern areas of uMshwathi under the uMshwathi Regional Bulk Water Supply Scheme.

9.6. Umgeni Rural

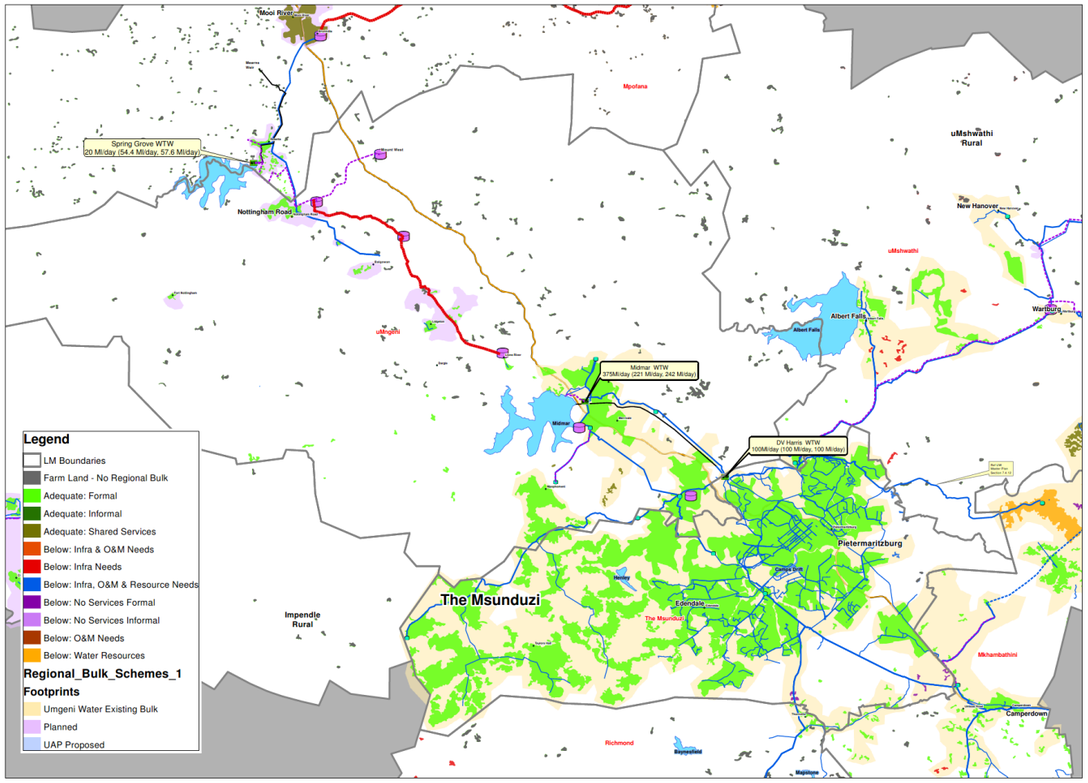


Figure 39: Layout – uMgeni LM

The Mgeni backlog as indicated in **Table 5** of **Section 4**, of 9% is low and mainly for the rural areas that are not supplied from the Upper Mgeni System. The Umgeni rural areas are sparsely populated and mostly farmland and the future low demands do not warrant a Bulk Water Supply Scheme.

9.7. Msunduzi

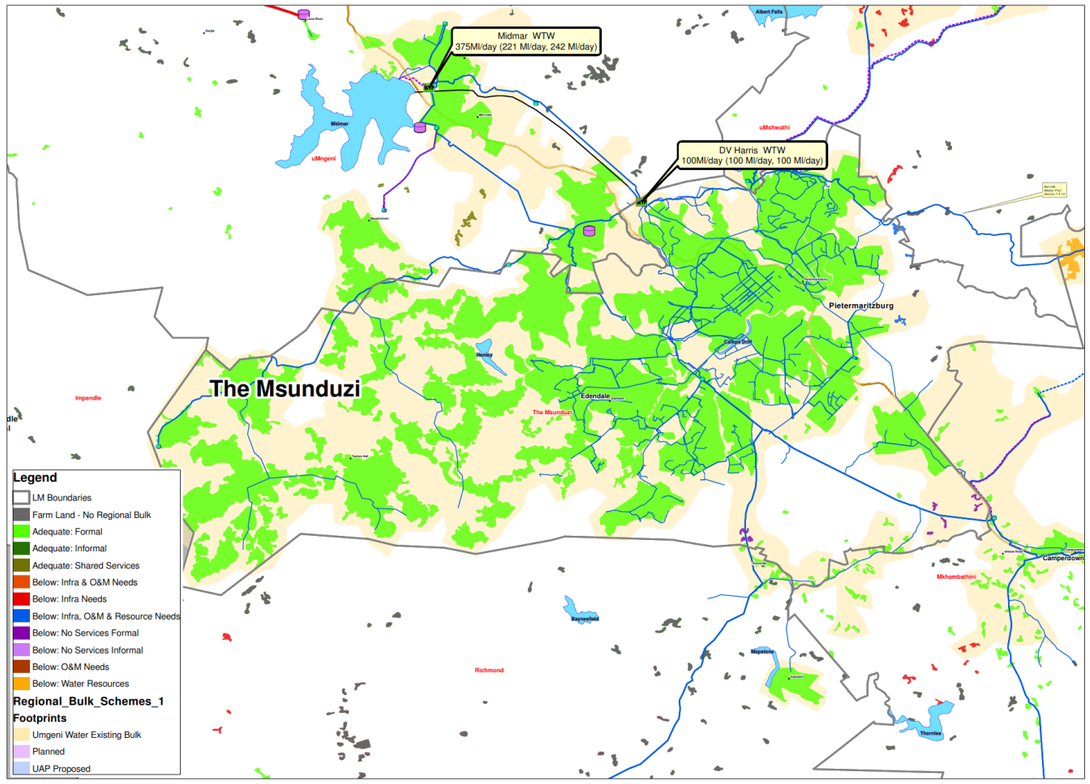


Figure 40: Layout – Msunduzi LM

The proposed Vulindlela upgrade as per the Umgeni Water Master Plan will address water supply restriction to the Vulindlela areas. GLS Consulting has also recently compiled a Master Plan for the Vulindlela area and the plan proposes a cost estimate of R 484 million to address water supply restrictions.

10. BULK WATER SUPPLY INTERVENTIONS CONSIDERED IN THIS STUDY

10.1. Northern Mpofana – Cross Border Augmentation

Based on the gap analysis, the Northern Mpofana area warrants further investigation as to whether a bulk water supply system could be an option. This is discussed below:

Cross border supply from the Muden Bulk Water Supply Scheme to Northern Mpofana is proposed. The UAP Phase 2 Report of Umzinyathi DM, March 2016, by Hatch Goba reports on the Muden Scheme as follows:

"*The Muden Regional Water Scheme will comprise of the following infrastructure:*

- *The extension of the Muden Water Treatment Plant*
- *The extension of the Keates Drift Water Supply Scheme*
- *The development of the Ndaya Water Supply Scheme*

These three components are collectively known as the Muden Regional Water Supply Scheme. The water supply schemes for Keates Drift and Ndaya are situated North to North-East of Muden. The Muden Water Treatment Plant, situated to the South-East of Keates Drift is to be upgraded to 6.9Mℓ/day and will be the primary source of treated water to the Ndaya and Keates Drift Schemes.

The Keates Drift supply area falls within the Umvoti Local Municipality in the uMzinyathi region, for which the uMzinyathi District Municipality is the Water Services Authority (WSA) and Uthukela Water Pty Ltd is the appointed Water Services Provider (WSP). Keates Drift is located on the Mooi River approximately 25km North of Greytown on the Main Road, R33, towards Dundee. Situated centrally in District Council 24, the Keates Drift Water Supply project area currently serves six (6) sub-wards viz. Ethembeni, Emvundlweni, Nxamalala, Emazoweni, Latha and Thengela.

Ngome and Ndaya are additional sub-wards that will be served by the scheme. The Ndaya area falls under the Msinga Local Municipality consisting of Ward 7 and 8 which cover the rural areas of Phakwe, Nhlonga, Nhlesi and Ndaya.

The total water supply area covers an area of approximately 480km². The total estimated population supplied by the existing scheme in Keates Drift in 11 848 and approximately 59 880 will benefit from this project after implementation and water supply from Muden. The total water demand is estimated to be 4.5Mℓ/day.

The current water sources at Keates Drift and Ndaya schemes are inadequate and unsustainable to meet the water demand for the area. The community of Ndaya currently obtains water supplies from streams, rivers and springs in the area for domestic purposes. In most instances these rivers and streams are located more than two kilometres from households and water quality is poor. It was clear that rationalisation/regionalisation was necessary for all areas under consider.

uMzinyathi District Municipality commissioned three (3) Consulting Engineering Firms viz. Ilifa, Goba (Pty) Ltd, and Ziyanda Consulting to investigate and report on the feasibility of developing a Regional Water Supply Scheme.

The primary water source for the regional scheme is the Mooi River. Abstraction from the Mooi River takes place at several locations, however the ideal abstraction position for the regional scheme is at an existing irrigation canal in Muden. The canal's supply is from a weir constructed on the Mooi River, located approximately 7km from the existing Muden Water Treatment Plant. The irrigation canal feeds water to the existing treatment plant via gravity, from where it is distributed to the Muden and Opathe areas. The Craigieburn Dam, which is situated between Mooi River and Greytown, augments the above mentioned weir as and when required.

The total daily demand for the regional scheme (which includes the daily demand for Muden and Opathe) was discussed with Mr James Perkins of DWS, who confirmed that the Cragieburn Dam would be a sustainable supplementary source".

10.1.1. Water Demand and Projections

A summary of the Northern Mpofana current and future water demands and population figures are shown in **Table 22** below. The 2045 SDD of 0,73Mℓ/day is less than the available supply at the Muden WTW of 2,4Mℓ/day (6,9Mℓ/day – 4,5Mℓ/day).

Table 22: Summary of Northern Mpofana Current and Future Water Demands and Population Figures

Greater Mpofana 4				
Probable	**2015**	**2025**	**2035**	**2045**
HH	1 110	1 260	1 385	1 461
Population	4 156	4 719	5 189	5 472
AADD (Mℓ/d)	0.07	0.36	0.48	0.50
GAADD (Mℓ/d)	0.12	0.50	0.58	0.60
SDD (Mℓ/d)	0.13	0.58	0.70	0.73
Density (Pop/km²)	172	196	215	227
High	**2015**	**2025**	**2035**	**2045**
HH	1 112	1 277	1 422	1 514
Population	4 166	4 783	5 326	5 672
AADD (Mℓ/d)	0.10	0.43	0.57	0.59
GAADD (Mℓ/d)	0.16	0.60	0.68	0.71
SDD (Mℓ/d)	0.18	0.70	0.82	0.86
Density (Pop/km²)	173	198	221	235

10.1.2. Water Resource Consideration/Infrastructure

The Muden WTW is recommended for the following reasons:

- It makes use of existing infrastructure most effectively.
- Operation and Maintenance activities at the Muden Abstraction Works and Water Treatment Plant are already in place, and therefore pose no new challenge to the operating authority.
- There is a guaranteed assurance of supply from the Muden irrigation canal which is supplied via the existing Cragieburn Dam.
- Eliminates the operation of multiple Water Treatment Works situated at various places within the Municipal boundaries i.e. economy of scale.

Discussions and negotiations will be required between Umgeni Water and uMzinyathi District Municipality for the cross border supply from Muden to the Northern Mpofana area.

10.2. Financial Implications

The cost for the proposed bulk water supply to the Northern Mpofana area is R 55,8 million, excluding reticulation networks. The project cost for the proposed new 1Mℓ Reservoir and 14km of 100Ø bulk pipeline is summarised in **Table 23** below.

Table 23: Project Cost for Proposed New 1Mℓ Reservoir and 14km of 100Ø Bulk Pipeline

Costing of Proposed Infrastructure	Based on Probable Demands
	New Work
Consultants	**R 5 421 213**
Design and Tender Documentation	R 2 689 407
Geotech Survey	R 0
Land Survey	R 112 266
Cathodic Protection	R 0
Construction Monitoring	R 2 619 540
Construction	**R 29 882 298**
Pipelines	R 25 010 755
P&G	R 0
Pipeline Construction (Bulk)	R 0
Pipe Bridge/Jack	R 0
Pumpstation	R 0
Water Works	R 0
Storage (Reservoir)	R 4 871 543
Dam	R 0
Abstraction	R 0
Additional	**R 20 527 024**
Land Acquisition - 7.5%	R 2 241 172
Environmental, Community Liaison	R 2 000 000
Health & Safety, Quality Assurance	R 298 823
Project Office	R 1 045 880
Contingencies	R 14 941 149
TOTAL	**R 55 830 535**

10.3. Northern Mpofana Supply Augmentation

The Hatch Goba UAP Phase 2 report states that the Muden WTP is supplemented from the Craigieburn Dam. A WTW at Craigieburn Dam is proposed to feed the surrounding areas and might also feed the Mpofana Northern areas. After discussions with UMDM it is evident that the Craigieburn Dam catchment is not very big and a pipeline from the Bruntville Reservoir is proposed to augment the supply. A take-off from this pipeline to Wenen is mentioned in the Umgeni Water Infrastructure Master Plan Report. This take-off can also supply the Northern Mpofana areas. The cost of the WTW at Craigieburn Dam and a 350mm diameter pipeline from Bruntville to Craigieburn Dam is estimated at R186 million.

The above augmentation proposal to the Northern Mpofana area is a result of discussions with UMDM. Further investigation of this proposal should be considered when the UAP proposals for the surrounding areas have been submitted and scheme or across border supply options are investigated.

11. RECOMMENDATIONS

The following upgrades are recommended:

11.1. From the Demand Model (*Annexure B*)

1) Increased pipe size from Umlaas Road Reservoir to Lion Park / Manyavu (This pipeline is currently being constructed).
2) Additional storage at Howick West Reservoir.
3) Additional storage at Wartburg Reservoir.
4) Increased pipe size from Cool Air Pumpstation to Dalton.
5) Increased pipe size from Table Mountain Pumpstation to Table Mountain Reservoir.
6) Items 3 to 5 are being addressed in the proposed uMshwathi Bulk Water Supply project.

11.2. From Gap Analysis

The rural areas depicted as "other" on the Demand Projection Maps in **Annexure C** does not warrant a bulk water supply. It is recommended that the cross border supply to Greater Mpofana 2 for the Muden Bulk Water Supply Scheme be investigated.

Further Conclusions and Recommendations for the "so called" "other" areas are as follows:

11.2.1. Impendle

The Impendle rural areas are very sparsely populated with very low water demands. The Impendle Rural Area 3 is a conservation area and no bulk water supply is required. The low water demands of the other two (2) rural areas also makes the provision of a bulk supply not feasible and the status quo supply is recommended.

The two (2) Greater Impendle areas are a bit more densely populated with higher water demands. This is mainly due to the existence of water from the Nzinga and uMkhomazi Rivers, around which the population is concentrated. The Greater Impendle Bulk Water Supply Scheme is currently under construction to address the backlog in water supply.

11.2.2. Mkhambathini

According to the Umgeni Water Report – 2016, the bulk water supply to the Mkhambathini area will increase from the 3,5Mℓ/day 2015 supply to 5,2Mℓ/day for 2045. The Bigen Demand Model reflects the 2045 high water demand of Mkhambathini as 4,4Mℓ/day. The 800Ø of Umgeni Water Pipeline that runs from the Umlaas Road Reservoir to the eThekwini take-off feeds the Mkhambathini area and especially those areas in close vicinity to the bulk pipeline.

11.2.3. Mpofana

The Mpofana LM is divided into eight (8) supply areas. The water demands for the individual supply areas are low and does not warrant a bulk supply system. The population densities occur around the town of Mooi River, which is currently fed from the Umgeni Water Bulk Water System. Another area of concentration that deems further investigation is the Greater Mpofana 2 area. The distance from the existing Umgeni Water bulk water system at Mooi River renders a bulk supply to it unfeasible, however a cross border supply from Muden might be considered.

Under the Muden Regional Bulk Water Supply Scheme the Muden WTW is to be expanded from 2,4Mℓ/day to 6,9Mℓ/day. The total water demand for the Muden Regional Water Scheme is 4,5Mℓ/day (uMzinyathi UAP Phase 2, March 2016). It is recommended that the Greater Mpofana areas be supplied from the Muden WTW because of the close vicinity to Muden WTW as well as the 2045 SDD is lower than 1Mℓ/day. Considering the low SDD of the Greater Mpofana area and the great distance to the Mooi Water Scheme, a bulk water connection is not considered feasible.

11.2.4. Richmond Rural

The bulk of the Richmond Rural areas in farmland and is categorised as Agricultural Priority in the SDF. The area is sparsely populated and the cost of supplying a Bulk Water Supply Scheme is high (refer to **Section 9.1**), which renders a Regional Bulk Supply to the area non-feasible.

11.2.5. Umgeni

The Mgeni backlog as indicated in **Table 5** of **Section 4**, of 9% is low and mainly for the rural areas that is not supplied from the Upper Mgeni System. The Umgeni rural areas are sparsely populated and mostly farmland and the future low demands do not warrant a Bulk Water Supply Scheme.

11.2.6. uMshwathi

The bulk of the uMshwathi rural areas are earmarked as agricultural priority and Traditional Authority areas. The central area is supplied by the Wartburg bulk water supply sub-system that is to be extended to serve the Eastern areas of uMshwathi under the uMshwathi Regional Bulk Water Supply Scheme.

LIST OF REFERENCES

Bigen Africa (2014) uMgungundlovu District Municipality, February 2014, Water and Sanitation Scoping Investigation.

CoGTA (2014) uMgungundlovu District Municipality: Development of Universal Access Plan for Water & Sanitation in KwaZulu-Natal, Phase 1.

Department of Water Affairs. (2011). First Stage Reconciliation Strategy for Impendle Town Water Supply Scheme Area - Impendle Local Municipality.

Department of Water Affairs. (2011). First Stage Reconciliation Strategy for Greater Stoffleton Water Supply. Supply Scheme Area - Impendle Local Municipality.

Department of Water Affairs. (2011). First Stage Reconciliation Strategy for Embuthweni Water Supply. Supply Scheme Area -Mkhambathini Local Municipality.

Department of Water Affairs. (2011). First Stage Reconciliation Strategy for Ogagwini Water Supply. Supply Scheme Area - Mkhambathini Local Municipality.

Department of Water Affairs. (2011). First Stage Reconciliation Strategy for Greater Mpofana Water Supply Scheme Area -Mpofana Local Municipality.

Department of Water Affairs. (2011). First Stage Reconciliation Strategy for Richmond Water Supply Scheme Area - Richmond Local Municipality.

Department of Water affairs. (2011). First Stage Reconciliation Strategy for Mhlatikhulu Water Supply. Supply Scheme Area - uMshwati Local Municipality.

Department of Water Affairs. (2011). First Stage Reconciliation Strategy for Ozwathini Water Supply. Supply Scheme Area - uMshwati Local Municipality.

Department of Water Affairs. (2011). First Stage Reconciliation Strategy for Masihambisane Water Supply. Supply Scheme Area - uMshwati Local Municipality.

Department of Water Affairs. (2011). First Stage Reconciliation Strategy for Ntazi Water Supply Supply Scheme Area - uMshwati Local Municipality.

Department of Water Affairs and Forestry, South Africa. 2004. Internal Strategic Perspective: Mvoti to Mzimkulu Water Management Area : Prepared by Tlou & Matji (Pty) Ltd, WRP (Pty) Ltd, and DMM cc on behalf of the Directorate: National Water Resource Planning (East). DWAF Report No. P WMA 11/000/00/0304

GroundTruth (2011) uMgungundlovu DM Biodiversity Sector Plan

Isibuko se Africa (2014) uMgungundlovu DM District Growth and Development Plan

Isikhungesethu Environmental Services (2012) uMgungundlovu District Municipality Strategic Environmental Assessment and Strategic Environmental Management Plan – STATUS QUO REPORT

SAICOG (2004) uMgungundlovu DM Water Services Development Plan

Statistics SA Census 2011 data, accessed at http://www.statssa.gov.za/?page_id=964

Udidi Consulting (2013) uMgungundlovu DM Spatial Development Framework Volume 2 Review for 2013/14- draft

Umgeni Water (2015) Infrastructure Master Plan 2015/2016- 2045/2046, volume 1 and 2

Umgeni Water (2016) Infrastructure Master Plan 2016/2017 – 2046/2047, volume 2 (Draft)

Umgeni Water (2016) Umzinyathi DM Development of Universal Access Plan for Water and Sanitation, Phase 2.

uMgungundlovu Draft IDP 2015/16 March 2015

uMgungundlovu DM Service Delivery and Budget Implementation Plan 2015/16

Urban Econ (2013) Umgungundlovu Economic Scoping Report

Annexure A: UMDM Key Map

ANNEXURE A

UMDM KEY MAP

ANNEXURE B

DEMAND INPUTS AND RESULTS

ANNEXURE C

DEMAND PROJECTION MAPS

ANNEXURE D

EXISTING INFRASTRUCTURE MAPS

Annexure E: Umgeni Planned Infrastructure Maps

ANNEXURE E

UMGENI PLANNED INFRASTRUCTURE MAPS

Annexure F: Level of Service (LoS) Maps

ANNEXURE F

LEVEL OF SERVICE (LOS) MAPS

ANNEXURE G

REPORT MAPS