

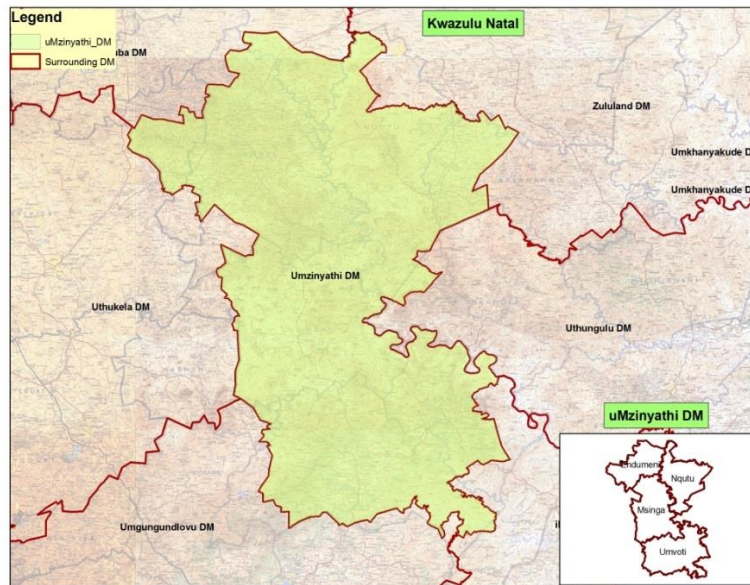
Umgeni Water



UNIVERSAL ACCESS PLAN FOR WATER SERVICES PHASE 2: PROGRESSIVE DEVELOPMENT OF A REGIONAL CONCEPT PLAN FOR BULK WATER SERVICES

REPORT
UMZINYATHI DISTRICT MUNICIPALITY

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LIST OF ABBREVIATIONS

Ave.	Average
CoGTA	Department of Cooperative Governance and Traditional Affairs
DM	District Municipality
DWS	Department of Water and Sanitation
GIS	Geographical Information System
GRIP	Groundwater Research Information Project
UZDM	Umzinyathi District Municipality
HFY	Historical Firm Yield
IDP	Integrated Development Plan
ILDM	iLembe District Municipality
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
UDM	uMzinyathi District Municipality
UTDM	uThungulu 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

EXECUTIVE SUMMARY

This report presents findings of the study: Universal Access Plan Phase 2 – Progressive Development of a Regional Concept Plan for Umzinyathi District Municipality (UZDM).

The municipality is bordered in the north by Amajuba District Municipality, in the west by uThukela District Municipality, in the south-west by uMgungundlovu District Municipality, in the south-east by iLembe District Municipality, and in the east by uThungulu District Municipality.

Umzinyathi District has a total area of 8 079 square kilometres and is located in the north central area of KwaZulu-Natal. The District lies between the main N3 corridor between Durban and Gauteng and the Coastal Corridor, running along the east coast. Umzinyathi includes some of the poorest and most underdeveloped rural areas of KwaZulu-Natal, most notably the Msinga and Nqutu Municipalities. The population of the region is approximately 456 454 people of which 93% are rurally located and 7% located in urban areas. The more developed urban areas include Dundee, which is the administrative seat of Umzinyathi District Municipality, and Greytown. Greytown can be viewed as a strong regional centre with substantial commercial and agricultural activity. In Nqutu and Msinga there is a dominance of the three peri-urban settlements of Tugela Ferry, Pomeroy and Keates Drift. The population densities of these three areas are higher than those of the rest of the area. The District has 17 Tribal Authorities. Endumeni is the only Municipality that does not have any tribal land. The majority of the land (60%) is under the control of the Ingonyama Trust situated mainly in Nqutu and Msinga.

The following schemes are existing and supply areas in UZDM

- Nqutu Scheme
- Jamesons Drift Scheme
- Sections of Muden Scheme
- Sampofu Scheme that is being upgraded and will supply Msinga Bulk Scheme mentioned below
- Matimatolo Scheme
- Bulk abstractions and treatment for the towns of Glencoe, Dundee and Greytown.

UZDM currently has three regional schemes in detailed planning and implementation, viz,

- Dundee Bulk Water Supply
- Msinga Bulk Water Supply

- Muden Bulk Water Supply

These schemes will supply the Endumeni and Nqutu Local Municipalities and well as the Msinga Local Municipality.

The possible Mvoti regional Scheme that will address bulk water supply in the Mvoti Local Municipality once water resources have been secured.

For the purposes of this UAP Phase 2 study, a water demand versus water resource availability was carried out and augmentation options that would address long term water resource availability to meet the projected demands have been assessed. The entire District Municipality has been divided into Bulk Water Supply Zones based on topography, existing scheme footprints and settlement densities. Bulk Supply command reservoirs were positioned to allow for links to existing and proposed bulk water infrastructure and allow distribution to the supply zone under gravity as far as possible.

In addition, the infrastructure requirements for bulk distribution of water was assessed and this is presented in Section 7 this report.

The water resource versus water demand balance is shown in **Table A** below. A discussion on the water balance (Yield versus Demand) for each proposed and existing Regional Scheme and well as the regional scheme details is discussed thereafter.

Table A: Water Balance

	Scheme	UAP Phase 2 Supply Zones	Existing Water Resource	Yield (Mℓ/day)	UAP Phase 2 : 30 Year Demand GAADD (Mℓ/day)	Resource Assessment	
						Water Surplus (Mℓ/day)	Water Deficit (Mℓ/day)
Existing	Msinga	0 to 6 & 21	Boreholes & Thukela	3	23.32	-	20.32
	Muden	8, 9 & 16 to 19	Mooi River	1.5	15.78	-	14.28
	Endumeni	23 & 28 to 30	Biggarsberg WTW	16	32.66	-	16.66
	Nquthu	20, 22 & 24 to 27	Vants Drift WTW	8.3	33.45	-	25.15
	Mvoti	7 & 10 to 14	Lake Merthley & Boreholes	4	14.42	-	10.42

	Scheme	UAP Phase 2 Supply Zones	Planned Water Resource / Scheme	Yield (Mℓ/day)	UAP Phase 2 : 30 Year Demand GAADD (Mℓ/day)	Resource Assessment		UAP Phase 2/UZDM Long Term Augmentation Option	Required Resource Yield (Mℓ/day)
						Water Surplus (Mℓ/day)	Water Deficit (Mℓ/day)		
In Planning / Implementation	Msinga	0 to 6 & 21	Msinga Bulk	14	23.32	-	9.32	Off Channel storage on Thukela	9.32
	Muden	8, 9 & 16 to 19	Mooi River	27.31	15.78	11.53	-	Dam - 49.85mcm or Releases from Spring Grove Dam	-
	Endumeni	23 & 28 to 30	Dundee Bulk	93.93	32.66	27.82	-	Dundee Bulk	-
	Nquthu	20, 22 & 24 to 27			33.45				
	Mvoti	7 & 10 to 14	Mvotipoort Dam uMshwati Bulk Craigieburn Dam	132	14.42	117.58	-	Mvotipoort Dam uMshwati Bulk Craigieburn Dam	-

References: All Town Recon Strategies of the respective Regional Schemes
Ibhongo Consulting

Msinga Regional Scheme

The existing Sampofu Scheme supplies Tugela Ferry and immediate surrounds with abstraction from the Thukela River and treatment at the Sampofu Water Treatment Works. This water works, together with the abstraction works, has recently been upgraded from 3 Ml/day to 14 Ml/day with the intention to supply bulk water to the north of Msinga Local Municipality up to Pomeroy and further to the west to an area called Douglas and east to Msinga Top Reservoir. This project has been named the Msinga Bulk Water Supply Scheme and is currently being implemented in four main phases with sub phases.

This project will ultimately supply Zones 0 to 6 and Zone 21 of this UAP Phase 2 Study (see **Figure 4**) with bulk water. From the hydrological assessment, it was established that the yield of the Thukela River at the abstraction point is 14 Ml/day at a 98% level of assurance (Bosch Stemele, 2012).

The projected long term demand for the Msinga Bulk Water Supply Scheme area is 23.32 Ml/day. There is therefore a water deficit of 9.32 Ml/day for the scheme as indicated in **Table A**. In order to meet the long term demand a storage facility will be required as indicated in the hydrology report.

The planned bulk water distribution infrastructure adequately covers Zones 0 to 6 and Zone 21 of this UAP Phase 2 Study and no further bulk distribution investigations are deemed necessary at this stage.

Dundee Bulk Regional Scheme

Water supply in the Endumeni Local Municipality for the towns of Dundee and Glencoe is from the existing Donald McHardy and Tom Worthington Dams in the Sterkstroom River, a tributary of the Buffalo River, as well as abstraction from Buffalo River at Tayside weir. The total available water including the historical firm yield of the small dams as well as the registered water use from Tayside weir is 11.5 Ml/day.

The long term water demand for the Glencoe, Dundee and surrounding areas is 32.66 Ml/day.

The Nqutu Local Municipality is supplied with water from the Vants Drift Water Treatment Works with abstraction from the Buffalo River. The yield at the abstraction point is 33 Ml/day. However, according to the 2014 upgrade to the All Towns Strategy for Nqutu Supply scheme pages 6–21;

“The water users rely on run-of-river abstraction. Therefore, the low flow duration of the Buffalo River is important for Nqutu, particularly with the increasing demands upstream of the abstraction works. From WR90 (1994), it has been estimated that the natural flow with a 1:50 year recurrence interval

being available at the Vants Drift abstraction works will be approximately 0.45 million m³ and 3.03 million m³ for the 1-month and 3 month durations respectively.”

The current demand for the Nqutu Supply area is 9.31 Mℓ/day (All Towns, 2014) and the long term water demand for the Nqutu Scheme is 33.45 Mℓ/day.

In order to secure the long term water supply to Endumeni and Nqutu LM's, the Umzinyathi DM intends implementing the Dundee Bulk Water Supply Project. This project involves the following:

- 40 km, 600mm diameter Raw Water Pipeline from Ntshingwayo Dam from the Buffalo River to Biggarsberg WTP to supply Glencoe and Dundee
- Upgrade of Biggarsberg WTP to 65 Mℓ/day
- 47 km, 450mm diameter Raw Water Pipeline from Biggarsberg to Vants Drift to supply Nqutu LM

(Ibhongo Consulting, Dundee Bulk Executive Summary, 2015).

The proposed Dundee Bulk project addresses the bulk water supply requirements from both a water resource and infrastructure point of view for the Endumeni and Nqutu Local Municipalities, Zones 20, 22, 24 to 27 and 29 and 30.

The option of extending the Dundee Scheme to cover Zone 23 was investigated (see Section 7.5). In addition a dam on the Buffalo River, just after the confluence of the Buffalo and Blood Rivers that was proposed in the uThukela Water masterplan is also presented in this UAP Phase 2 report as an option for bulk water supply to Nqutu LM.

Muden Water Supply Scheme

The Muden Water Supply Scheme covers the Umvoti and Umshwathi Local Municipalities in the Umzinyathi and uMgungundlovu District Municipalities respectively and Zones 8, 9 & 16-19 in Umzinyathi DM in this UAP Phase 2 Study.

The scheme is currently supplied from boreholes and abstractions from the Mooi River. The long term water demand for the Umzinyathi DM section of the Muden Water Supply Scheme is estimated at 15.78 Mℓ/day. The Mooi River remains the most viable source of water for the scheme. The MAR at the abstraction point was calculated at 49.85mcm, according to page 33 of the Muden All Town Recon Strategy. In order to secure the long term yield at this point for the scheme for both the Umzinyathi and uMgungundlovu District Municipalities, the development of a storage system in the form of a weir is recommended.

This storage facility together with possible releases from Spring Grove Dam in the long term, if necessary, will provide the water requirements for the scheme.

Plans are currently underway to upgrade the Muden WTP to 6.9 Mℓ/day (Umzinyathi DM, 2015) and to extend the bulk distribution system of the scheme to incorporate the Keates Drift and Ndaya Water supply schemes, thereby covering Zones 8, 9 & 16-19 of Umzinyathi DM in this UAP Phase 2 Study. Therefore no further bulk distribution investigations are deemed necessary. However, the possibility of extending supply from Greytown with supply from the future Mvotipoort Dam was investigated. This option is presented in **Appendix A**.

The option of supply to Zones 8, 9 & 10 to 16 from the Sampofu WTP was also investigated and this is presented in Section 7.2.

Mvoti Regional Scheme

The proposed Mvoti Regional Scheme involves bulk water supply to the Mvoti LM to supply areas east of Greytown including Matimatolo and Kranskop. However a water resource constraint currently affects the viability of this scheme. The possible sources of water viz, Lake Merthley that has a yield of 2.16 Mℓ/day and existing boreholes that yield 0.6 Mℓ/day (DWA, 2012), do not have sufficient yield to support this scheme. The estimated long term demand for this scheme developed in this UAP Phase 2 Study is 14.42 Mℓ/day and will cover Zones 7 & 10-14.

An intervention is underway to augment water supply to the Greytown WTP from Craigieburn Dam. The approved water use licence for this augmentation scheme of 12.3 Mℓ/day will only meet the long term needs of Greytown and as presented in Table A, there is a deficit of 10.42 Mℓ/day for the Mvoti Regional Scheme. In order to extend supply from Greytown WTP to the remainder of the Mvoti Regional Scheme, another water resource will be required. The two options that were investigated were:-

- Supply from the proposed Mvotipoort Dam (see section 7.3)
- Extension of the uMshwati Regional Water Supply Scheme (see Section 7.1)

From available existing information, it has been established that the Mvotipoort Dam will yield 120 Mℓ/day (Umgeni Water, 1998). Although indications are that this dam will also secure water supply to the upper areas in the Ilembe District Municipality. The possibility of a water use allocation of 14.42 Mℓ/day for the Mvoti Regional Scheme needs to be investigated in detail secured.

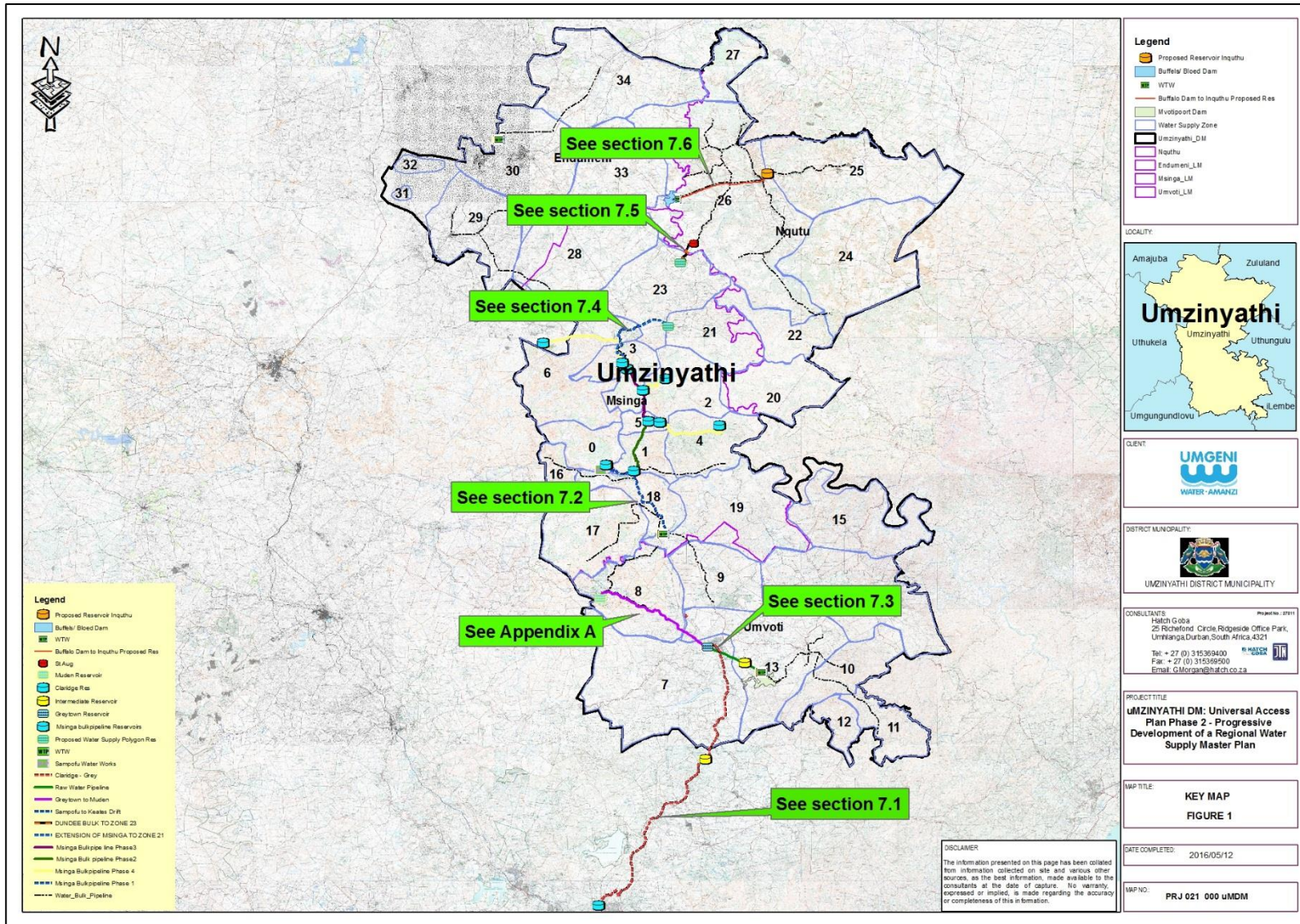
Another possibility of bulk water augmentation to the Greytown Supply node is the existing uMshwathi Regional Bulk Water Supply Scheme. The possibility of extending this pipeline along the R33/R614 junction was investigated. A 58 km pipeline will supply water to Greytown. It will be possible to supply water under gravity for approximately 20 km from the R33/R614 intersection where after a pumpstation will be required to pump water up a static lift of 200m to a reservoir at Seven Oaks. It will be possible to gravitate water from the Seven Oaks Reservoir to within 2 km of Greytown at an elevation of 1070m where another booster pumpstation will be required to pump water to Greytown reservoir.

Summary of Investigations in this Study

Six possible new regional scheme augmentation options were also investigated in the UAP Phase 2 Study as follows:

- Option 1: Proposed extensions of the Umshwathi Regional Scheme
- Option 2: Supply from the Sampofu WTW south of the Thukela
- Option 3: Proposed Mvotipoort Dam Regional Scheme
- Option 4: Extension of the Msinga Bulk Water Supply Scheme
- Option 5: Review and Extension of Dundee Bulk
- Option 6: Dam on the Buffalo River to Supply Nqutu LM
- Non-preferred Option: Greytown to Muden (Appendix A)

The above options are shown in the Overall Map in **Appendix E** and the relevant section in this report that each option is discussed in shown in the **Project Key Map - Figure 1**.



RECOMMENDATIONS:

- The Msinga Bulk Scheme is currently in implementation. This scheme will address bulk water supply requirements to the Msinga LM north of the Thukela River. The option of extending this scheme further north to supply Zone 21 was investigated. This option requires three stage pumping and thus not recommended for further investigation.
- The option of extending the Msinga Bulk Scheme south of the Thukela River towards Keates Drift will require pumping heads of over 500m. This will involve high capital and O&M costs. No further investigations into this option are thus recommended.
- The Umvoti LM requires a long term raw water resource augmentation that will support the Umvoti Regional Scheme that will supply Greytown, Matimatolo and Kranskop. It is recommended that a detailed feasibility study of the Mvotipoort Dam be undertaken to supply this scheme and to also provide downstream storage for the Ilembe DM
- The water resource availability in the Mgeni catchment will affect supply further to the Umvoti Catchment and Greytown. It is however recommended that a feasibility study be undertaken into the extension of the Umshwathi Regional scheme to supply the Umvoti Regional Scheme with the option of reverse flow at some point in the future when the development of the Mvotipoort Dam together with an upgraded treatment works at Greytown becomes feasible.
- The Dundee Bulk Scheme is in the detailed feasibility phase and the project business plan is due to be presented to DWS at the end of June 2016. The intention of the scheme is to supply the Endumeni and Nqutu LMs with bulk water. A dam on the Buffalo River has been proposed by uThukela Water as an option to supply the Nqutu LM with bulk water. It is recommended that this option be investigated in detail should the Dundee Bulk option to supply Nqutu LM not be approved by DWS.

1. OBJECTIVES AND METHODOLOGY

1.1. BACKGROUND

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 the ten 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.

Upon completion of UAP Phase 1, Umgeni Water (UW) initiated a second stage of the UAP project with the main objective being the progressive development of a regional bulk water supply concept plan for the Umzinyathi District Municipality that would address bulk water supply backlogs in the long term. The intention is to review existing and planned Bulk Water Supply Schemes and present other possible options for consideration in future detailed studies.

Umgeni Water has appointed Hatch Goba, in association with JTN Consulting (Pty) Ltd, to review the Phase 1 of UAP project in the form of developing UAP – Phase 2, for Harry Gwala District Municipality (HGDM), iLembe District Municipality (IDM), uMzinyathi District Municipality (UZDM), uThungulu District Municipality (UTDM) all located in the KwaZulu-Natal province.

1.2. PURPOSE AND OBJECTIVES

The purpose of this study is to investigate water demands, already proposed regional schemes as well as defining new possible schemes that could provide an integrated bulk water supply by linking into existing schemes and also provide water to areas that are not serviced thereby addressing backlogs.

The objective of this study which was carried out at a reconnaissance level of detail is to verify and validate the following:

- Identify existing water services backlogs
- Calculate water demands
- The identification and status of the existing bulk water supply infrastructure;
- The availability of sustainable water resources;
- The extent and status of existing and future regional bulk projects
- Investigate possible bulk water supply schemes
- Investigate augmentation schemes where possible
- Determine optional scheme configuration to allow bulk water supply to targeted areas.

SPECIFIC TARGETS OF THE INTERVENTION

The Specific Targets of the Intervention are summarised as follows:

- Promoting knowledge sharing between all stakeholders namely, the WSA's, the local municipalities within the WSA's area of jurisdiction, Department of Water and Sanitation (DWS) and Umgeni Water;
- Using existing information and comparing it as much as possible as a basis for current and future demand and infrastructure requirements;
- Identification of gaps in bulk water supply schemes.
- Determine possible options of bulk water scheme to supply the consumers in Umzinyathi DM and thereby address water services backlogs.

1.3. STUDY PROCESS

The study process involved the following steps

- Meetings with the Umzinyathi District Municipality to confirm information on the existing and planned schemes
- Gathering GIS information on existing and planned schemes from other service providers
- Determining water supply zones and calculating water demands,
 - Water supply zones were determined using the following:
 - Topography
 - Settlement densities,
 - Footprints of existing water supply schemes
 - Most suitable command reservoir positioning for maximum supply via gravity
- Investigating possible water resources
- Selecting the scheme options and suitable pipe routes and optimal configuration for lowest possible operation and maintenance costs.

1.4. DATA SOURCES

The background information pertinent to this report is presented in Table 1.

Table 1: Source Documents

Document	Compiler(s)	Document Owner (Client)	Date
First Stage Reconciliation Strategy for All Towns in the Eastern Region uMzinyathi District Municipality <ul style="list-style-type: none"> • Dundee Glencoe Water Supply Scheme Area • Tugela Ferry Water Supply Scheme Area • Nqutu Water Supply Scheme Area • Greytown Water Supply Scheme Area • Kranskop Water Supply Scheme Area • Muden Water Supply Scheme Area 	<ul style="list-style-type: none"> • Water For Africa Environmental Engineering & Management Consultants (Pty) Ltd • Water Geosciences Consulting • Charles Sellick and Associates • Aurecon 	Department of Water & Sanitation	June 2011
The Development of Universal Access Plan for Water Services in uMzinyathi District Municipality	<ul style="list-style-type: none"> • LDM • SMEC South Africa (Pty) Ltd 	Co-operative Governance and Traditional Affairs	September 2014
Keates Drift Water Supply Project Phase 1, 2, 3 and 4	<ul style="list-style-type: none"> • Goba (Pty) Ltd 	Umzinyathi District Municipality	
Email Correspondence	<ul style="list-style-type: none"> • Ibhongo Consulting 	Umzinyathi District Municipality	May 2016
uThukela Water Bulk Water Services Masterplan	<ul style="list-style-type: none"> • Jeffares & Green 	uThukela Water	November 2011

2. STUDY AREA

2.1. CONTEXT

Umzinyathi District Municipality is located in the northern central areas of the KwaZulu-Natal province.

2.2. BOUNDARIES OF THE STUDY AREA

The municipality is bordered in the north by Amajuba Municipality, in the west by uThukela, the south-west by uMgungundlovu Municipality, in the south-east by iLembe Municipality and in the east by uThungulu Municipality. The district consists of four local municipalities namely, Endumeni, Nqutu, Msinga and Umvoti. The district lies between the main N3 Corridor between Durban and Gauteng and the Coastal Corridor, running along the east coast. The seat of uMzinyathi is Dundee. The more developed urban areas include Dundee and Greytown, which can be viewed as a strong regional centre with substantial commercial and agricultural activity. The DM covers an area of 8 589 km² with a population of 510 840 people (Statistics South Africa Census, 2011).

Figure 2 below illustrates the locality of uMzinyathi DM and neighbours as described above.

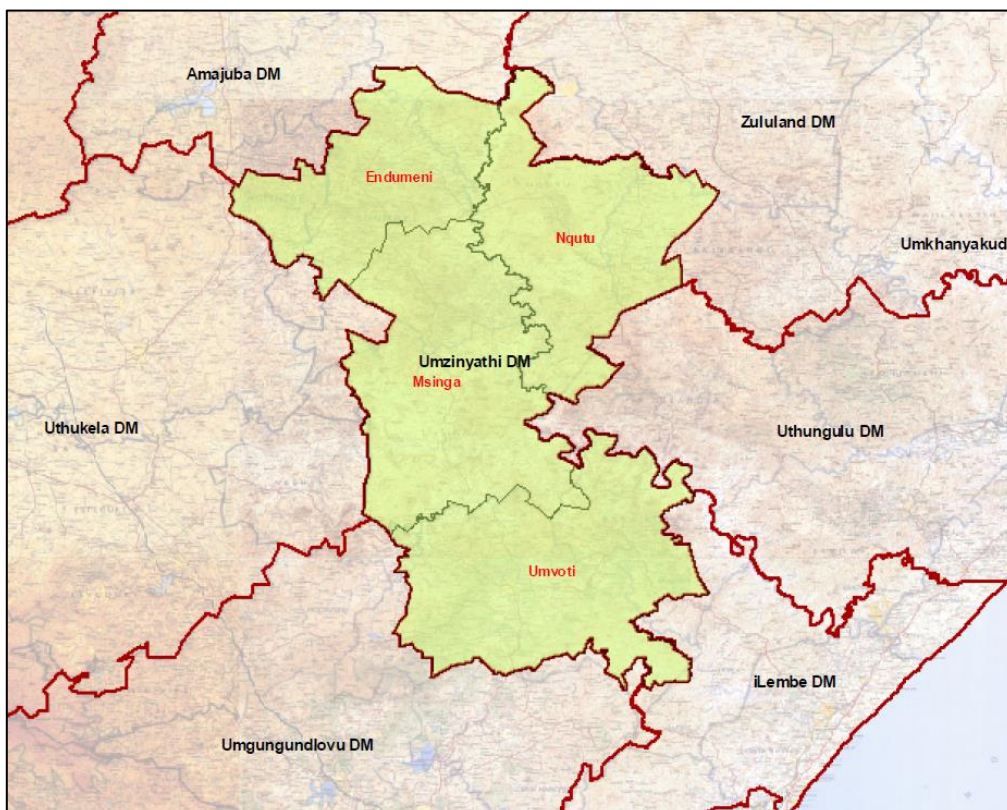


Figure 2: Locality of uMzinyathi District Municipality

2.3. PHYSICAL CHARACTERISTICS OF STUDY AREA

Umzinyathi District Municipality is located in the northern central areas of the KwaZulu-Natal province. The municipality is bordered in the north by Amajuba Municipality, in the west by uThukela Municipality, in the south-west by uMgungundlovu Municipality, in the south-east by iLembe Municipality and in the east by uThungulu Municipality (All Towns, 2014).

The district consists of four local municipalities namely Endumeni, Nqutu, Msinga and Umvoti. The district lies between the main N3 Corridor between Durban and Gauteng and the Coastal Corridor, running along the east coast. The seat of Umzinyathi is Dundee. The more developed urban areas include Dundee and Greytown, which can be viewed as a strong regional centre with substantial commercial and agricultural activity.

2.4. CLIMATE

In general, the District has a temperate climate. Frost occurs only in parts of Umzinyathi in winter. Rainfall varies throughout - from more than 800mm in Endumeni and Umvoti, to less than 400 mm in parts of Msinga. The topography is undulating, although some areas are steeper than others. Umzinyathi is bisected by several significant rivers, including the Tugela, Mooi, Umvoti, Blood and Buffalo Rivers (All Towns, 2014).

2.5. TOPOGRAPHY, GEOLOGY AND SOILS

Topography

Umzinyathi is deeply rural and has a mountainous topography with poor basic infrastructure. The topography of the area strongly influence the climate of certain places within the same area. The differences in elevation within these LM's, translates into noticeable differences in climate within the south, south central and north eastern areas which have more pleasant and warmer temperatures than the colder northern areas and rainfall which increases towards the south.

Soils

Most of the soils in the district consist of restricted depth and highly erodible soils. Msinga LM and Umvoti LM especially contain soils with high erodibility and low fertility, with rockiness being common. Endumeni LM, Nqutu LM and Msinga LM contain high fertility clay content soils with poor drainage and highly erodible soils. Umvoti LM also contains clayey soils with poor drainage.

2.6. ENVIRONMENTAL

Important areas of environmental significance need to be identified to protect and preserve valued ecosystems, natural habitats and special case areas in order to minimise negative impacts. In terms of land use management, the specific ecosystems and vegetation communities that require environmental management are wetlands, grasslands and indigenous forests that contain the habitats of important species. It should be noted that environmental management need not be limited to the protection/preservation but also areas may be identified for opportunities that a particular environment may provide such as the rehabilitation of wetlands, eco-tourism opportunities etc.

3. DEMOGRAPHICS

3.1. EXISTING POPULATION AND DISTRIBUTION

During the Professional Service Provider (PSP) Inception Meeting with Umgeni Water, it was proposed and accepted to standardise the data source and methodology to apply for the demographics and water requirements. The Census 2011 small areas layer will be used as base data for the demographics and water requirements/demand model with predefined classes for water consumption categories. The growth rates for each Local Municipality and water supply area would differ according to each Local Municipality's characteristics and settlement patterns as per Census 2011 figures. The population and number of households for each of the four local municipalities under UDM are presented in **Table 2**.

The UAP Phase 1 study used a low and high scenario for the population and household counts utilising the information at hand (see next section). The Integrated Development Plan (IDP) of 2014/2015 utilised the 2011 Census information for demographic analysis. The DWS RF Geodatabase (March 2014) utilised adjusted 2011 Census figures based on growth rates.

3.1.1. POPULATION SOURCES

UAP Phase 1

The UAP Phase 1 study utilised the following data sources in defining the demand areas:

- 2011 Census for population figures
- 2011 Eskom household counts
- 2001 Census for population growth analysis

However, the study did not specify the outcome of the low and high count scenario for each Local Municipality.

Census 2011

The demographics from the Census 2011 are presented in the **Table 2** below.

Table 2: Census Population and Households (2011)

Municipality	Population	Household size	PP/HH
Endumeni	64 863	16 851	3.8
Nqutu	165 309	31 614	5.2
Msinga	177 576	37 722	4.7
Umvoti	103 092	27 282	3.8
Total	510 840	113 469	4.5

Source: Census 2011

Population	510 838
Age Structure	
Population under 15	40.20%
Population 15 to 64	54.60%
Population over 65	5.20%
Dependency Ratio	
Per 100 (15-64)	83.10
Sex Ratio	
Males per 100 females	81.60
Population Growth	
Per annum	0.62%
Labour Market	
Unemployment rate (official)	36.60%
Youth unemployment rate (official) 15-34	45.60%
Education (aged 20 +)	
No schooling	25.60%
Higher education	4.90%
Matric	21.60%
Household Dynamics	
Households	113 469

Average household size	4.40
Female headed households	59.00%
Formal dwellings	54.20%
Housing owned	59.80%
Household Services	
Flush toilet connected to sewerage	18.90%
Weekly refuse removal	20.20%
Piped water inside dwelling	17.50%

DWS Reconciliation Strategy 2011

The DWS Reconciliation Strategy (2011) looked at high, medium and low population growth scenarios from 2008 to 2030. The findings from the analysis is summarised in **Table 3**.

Table 3: DWS Reconciliation strategy Population growth scenarios (2011)

Dundee Glencoe Water Supply Scheme (Endumeni LM)		2010	2015	2020	2025
Future requirements without WC/WDM	High growth (Mℓ/day)	6.52	8.04	9.77	11.79
	Low growth (Mℓ/day)	6.04	6.64	6.95	7.22
Future requirements with WC/WDM	High growth (Mℓ/day)	6.52	6.84	8.21	9.96
	Low growth (Mℓ/day)	6.04	5.65	5.65	6.10
Additional water required above registered water use (without WC/WDM)	High growth Scenario (Mℓ/day)	2.82	4.34	6.08	8.09
	Low growth Scenario (Mℓ/day)	2.34	2.94	3.25	3.52
Additional water required above registered water use (with WC/WDM)	High growth Scenario (Mℓ/day)	2.82	3.14	4.51	6.27
	Low growth Scenario (Mℓ/day)	2.34	1.96	1.96	2.41
Tugela Ferry Water Supply Scheme (Msinga LM)		2010	2015	2020	2025
Future requirements without WC/WDM	High growth (Mℓ/day)	3.04	3.40	3.77	4.17
	Low growth (Mℓ/day)	2.91	3.13	3.27	3.39
Future requirements with WC/WDM	High growth (Mℓ/day)	3.04	3.08	3.40	3.79
	Low growth (Mℓ/day)	2.91	2.83	2.83	3.08

Dundee Glencoe Water Supply Scheme (Endumeni LM)		2010	2015	2020	2025
Additional water required above registered water use (without WC/WDM)	High growth Scenario (Mℓ/day)	1.86	2.22	2.59	2.99
	Low growth Scenario (Mℓ/day)	1.73	1.95	2.09	2.22
Additional water required above registered water use (with WC/WDM)	High growth Scenario (Mℓ/day)	1.86	1.90	2.22	2.61
	Low growth Scenario (Mℓ/day)	1.73	1.65	1.65	1.91
Nqutu Water Supply Scheme		2010	2015	2020	2025
Future requirements without WC/WDM	High growth (Mℓ/day)	3.52	4.14	4.83	5.63
	Low growth (Mℓ/day)	3.31	3.55	3.65	3.78
Future requirements with WC/WDM	High growth (Mℓ/day)	3.52	3.29	3.75	4.39
	Low growth (Mℓ/day)	3.31	2.82	2.82	2.94
Additional water required above registered water use (without WC/WDM)	High growth Scenario (Mℓ/day)	1.52	2.15	2.84	3.63
	Low growth Scenario (Mℓ/day)	1.31	1.56	1.68	1.78
Additional water required above registered water use (with WC/WDM)	High growth Scenario (Mℓ/day)	1.52	1.29	1.76	2.39
	Low growth Scenario (Mℓ/day)	1.31	0.83	0.83	0.95

Umvoti LM					
Kranskop Water Supply Scheme		2010	2015	2020	2025
Future water requirements without WC/WDM	High growth (Mℓ/day)	0.20	0.24	0.28	0.33
	Low growth (Mℓ/day)	0.19	0.20	0.21	0.22
Future water requirements with WC/WDM	High growth (Mℓ/day)	0.20	0.19	0.22	0.25
	Low growth (Mℓ/day)	0.19	0.16	0.16	0.17
Additional water required above registered water use (without WC/WDM)	High growth Scenario (Mℓ/day)	0.20	0.24	0.28	0.33
	Low growth Scenario (Mℓ/day)	0.19	0.20	0.21	0.22
Additional water required above registered water use (with WC/WDM)	High growth Scenario (Mℓ/day)	0.20	0.19	0.22	0.25
	Low growth Scenario (Mℓ/day)	0.19	0.16	0.16	0.17
Muden Water Supply Scheme		2010	2015	2020	2025
Future water requirements without WC/WDM	High growth (Mℓ/day)	1.77	2.05	2.39	2.77
	Low growth (Mℓ/day)	1.69	1.82	1.88	1.93
Future water requirements with WC/WDM	High growth (Mℓ/day)	1.77	1.70	1.95	2.27
	Low growth (Mℓ/day)	1.69	1.51	1.51	1.58
Additional water required above registered water use (without WC/WDM)	High growth Scenario (Mℓ/day)	1.77	2.05	2.39	2.77
	Low growth Scenario (Mℓ/day)	1.69	1.82	1.88	1.93
Additional water required above registered water use (with WC/WDM)	High growth Scenario (Mℓ/day)	1.77	1.70	1.95	2.27
	Low growth Scenario (Mℓ/day)	1.69	1.51	1.51	1.58
Greytown Water Supply Scheme		2010	2015	2020	2025
Future water requirements	Low growth (Mℓ/day)	4.43	4.56	4.73	4.95
	High growth (Mℓ/day)	6.22	7.94	10.15	12.96
Additional water required	Low growth Scenario (Mℓ/day)	0.47	0.60	0.77	0.99
	High growth Scenario (Mℓ/day)	2.26	3.98	6.19	9.00

Source: DWS Reconciliation strategies 2011

It should be noted that these figures are based on populations supplied per water scheme (Supply Area) and therefore do not necessarily capture the entire population within the UMDM.

3.2. SOCIAL AND ECONOMIC INDICATORS

Economy

Most industries in the area are associated with agriculture or hand work (carpets, beadwork) by trained artisans. The use of natural products, water, by aQuellé, is a national brand. The municipal area has extensive grasslands in the north supporting the primary agricultural sector based on cattle ranching for beef, small scale sheep and mixed farming and maize cultivation. In the southern areas substantial forestry is prevalent. Sugar cane and smaller scale fruit farming such as avocado and kiwi fruit cultivation also occur. The area has high potential for growth in agricultural crop production (maize, soybean and sugar cane). In rural areas, particularly at Msinga and Nqutu, animals are not kept as farming commodities and are seldom slaughtered or sold. There is a need for farmer support programmes to improve stock management. It is important to broaden rural livelihoods through targeted agricultural production. There is very little product beneficiation with most products being exported to major markets for further processing and / or export.

Mining

Mineral deposits found in the District include coal and metal ores. Dundee and Glencoe forms part of the so called Coal Rim of KwaZulu-Natal, which have over the past decade been negatively affected by a substantial decline in the coal mining sector. However, the coal mining industry is undergoing a restructuring process and there is interest in the small scale regeneration of the coal belt for SMME development. A small amount of stone quarrying occurs in the District.

Tourism

Umzinyathi Municipality, in conjunction with its north-western neighbour Amajuba Municipality, is branded as the 'custodian' of the Battlefields region of the Zulu Kingdom. The District has in the past been the scene of fierce battles involving the British, Boers and Zulus. The ruins of several forts remain dotted throughout the District e.g. Fort Ahrens, Fort Liddle, Fort Mizpah.

The Battlefields form a vital role in the spatial economy of the Province from a tourism perspective. The revenue from tourism related to the Battlefields is contributing to the District economy, particularly at Endumeni. Visitors to the area are mainly domestic tourists, although some foreign tourists pass through the region en route to other attractions outside the node such as the Drakensburg, Swaziland or the Kruger National Park. The key challenge is to upgrade the economic node's tourism attractions and improve its accommodation facilities in order to retain a greater share of tourism activity.

At Isandlwana, in 1879, the Zulu army attacked a British regiment under Lord Chelmsford, resulting in heavy casualties. At Rorke's Drift, in 1879, a Zulu regiment tried to break through stone walls and makeshift barricades defended by British soldiers from Monmouthshire. In October 1899, Dundee was the scene of the first major engagement of the South African War, between Generals' Lucas Meyer and Penn Symons. The strong traditional culture prevalent particularly in Msinga and Nqutu is a valuable asset that must be preserved and valued. These traditional areas provide support mechanisms for the communities, as well as living custodians of the culture.

Other tourist sites include 13 private game reserves and one 18 000 ha proclaimed conservation area. There are two natural heritage sites: Fugitives Drift and Hlathikulu at Wasbank. Two wild cycad areas will be added to this list in the near future. Other significant sites include waterfalls, raptor breeding sites, a yellow wood forest and wetlands, including Paddavlei and Gladstone Vlei.

3.3. COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL DEVELOPMENT

The general government sector overtook the agricultural sector as the main source of employment in the district by 2010. This is the result of a substantial decrease in the number of employment opportunities in the agricultural sector from 13 867 to 5379 between 2000 and 2010, whilst the figures in the general government sector increased from 7126 to 10 258. The other main sources of employment in the district include the community and social services sector (8535), and the retail, catering and accommodation sector (6620). Despite the dominant role of manufacturing in the economic output of the district, it only provided 10.8% of the district formal sector employment. Apart from the general government sector, the only other sectors with notable increases in formal sector employment were the community and social services sector (increasing from 7272 to 8535) and the manufacturing sector (from 2698 to 4692). (Umzinyathi District Municipality District Growth and Development Plan)

3.4. POPULATION GROWTH SCENARIOS

The future population is envisaged to increase at a growth rate of 1% to 2.5% according to Stats SA. **Table 4** below sets out the growth assumptions for Umzinyathi DM.

Table 4: Population Projections (2015 – 2045)

Year	Endumeni	Nqutu	Msinga	Umvoti
2015	65 515	166 965	179 352	104 123
2020	68 857	175 482	188 501	109 434
2025	72 369	184 433	198 116	115 016
2030	76 060	193 841	208 222	120 883
2035	79 940	203 729	218 843	127 050
2040	84 858	214 121	230 006	133 531
2045	88 304	225 044	241 739	140 342

4. WATER DEMANDS

4.1. LEVEL OF SERVICE

Each of the previous studies adopted a different basis of unit consumption for the determination of water demands:

UAP Phase 1

The UAP Phase 1 study provided the following categories: of water service policy.

RDP and above – referring to the population or area that receives at least the minimum level of service or above

Dysfunctional Schemes – referring to the population or area that is covered by a scheme which is dysfunctional to an extent that even minimum RDP level of service is not achieved

Unreliable source – referring to the population or area that is covered under a scheme but sporadic, seasonal or experiences continuous failure of raw water source resulting in supply that is below the RDP level of service.

Table 5 below categorises the per capita demands for water supply as defined by DWS.

Table 5: Unit Demands

Category	Description of consumer category	Household Annual Income range	Per capita cons (ℓ/c/d)		
			Min	Ave.	Max.
1	Very High Income: villas, large detached house, large luxury flats	>R1 228 000	320	410	500
2	Upper middle income: detached houses, large flats	R153 601 – R1 228 000	240	295	350
3	Average Middle Income: 2 - 3 bedroom houses or flats with 1 or 2 WC, kitchen, and one bathroom, shower	R38 401 – R153 600	180	228	275
4	Low middle Income: Small houses or flats with WC, one kitchen, one bathroom	R9 601– R38 400	120	170	220
5	Low income: flatlets, bedsits with kitchen & bathroom, informal household	R1 - R9600	60	100	140
6	No income & informal supplies with yard connections		60	80	100
7	Informal with no formal connection		30	50	70
8	Informal below 25 l/c/d		25	25	25
9a	Non Residential - Rural		As per Red Book Guidelines		
9b	Non Residential - Urban		As per Red Book Guidelines		
9c	Non Residential - Industrial		As per Red Book Guidelines		

Census 2011

The water service levels (piped water) and water sources from Census 2011 are presented in **Table 6**.

Table 6: Water Service levels (piped water) per Local Municipality

Local Municipality	Piped (tap) water inside dwelling/institution	Piped (tap) water inside yard	Piped (tap) water on community stand: distance less than 200m from dwelling/institution	Piped (tap) water on community stand: distance between 200m and 500m from dwelling/institution	Piped (tap) water on community stand: distance between 500m and 1000m (1 km) from dwelling /institution	Piped (tap) water on community stand: distance greater than 1000m (1km) from dwelling/institution	No access to piped (tap) water	Number of Households
Endumeni	10434	3621	930	234	177	180	1281	16 851
Nqutu	2520	7605	9735	3183	1155	633	6783	31 614
Msinga	1404	3087	8322	2697	1005	693	20520	37 722
Umvoti	5520	4800	4074	1620	699	417	10152	27 282
Total	19878	19113	23061	7734	3036	1923	38736	113 469

Source: Census 2011

Further meetings and discussions with Umgeni Water during the course of the study resulted in three Scenarios being adopted for the purposes of water demand projections. These scenarios are presented in **Table 7**.

The levels of service will be dealt with in detail in the Water Master Plan and will be used as the information base for Phase 2 of this study.

Table 7: Water Demand Scenarios

Scenario 1	Urban			Rural			WSA Targets
	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.	50%	2020	2030	50%	2020	2030	50% of Pop with RDP LOS in 2020 converted to YC LOS between 2020 and 2030
Convert from Yard Conn. to House Conn.	10%	2020	2035	10%	2025	2035	10% of pop with YC LOS converted to HC LOS between 2020 and 2035 for urban and between 2025 and 2035 for Rural
Scenario 2	Portion to Convert	Start Year	End Year	Portion to Convert	Start Year	End Year	KZN Prov Growth and Dev Plan (PGDP)
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 Portion to Convert	Start Year	End Year	Portion to Convert	Start Year	End Year	Realistic Achievable Estimate	
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	90%	2015	2020	80%	2015	2020	90% of Urban pop and 80% of Rural pop with <RDP LOS converted to RDP level of service by 2020
Convert from RDP LOS to Yard Conn.	80%	2020	2035	50%	2020	2035	80% of Urban pop and 30% of Rural pop with RDP LOS converted to YC LOS by 2035
Convert from Yard Conn. to House Conn.	40%	2020	2035	20%	2025	2035	40% of Urban pop and 20% of Rural pop with YC LOS converted to HC LOS between 2020 and 2035 for Urban and between 2025 and 2035 for Rural

4.2. WATER DEMAND CALCULATION

For the purposes of water demand calculations, Scenario 3 which utilises the latest population figures from the updated Umzinyathi Masterplan with an allowance of 100ℓ/c/d and an allowance for 30% losses was deemed to be the most probable scenario in Umzinyathi District Municipality assuming that all households will eventually have a house connection. This equates to a category 5 level of service as indicated in **Table 6**. The water demand for each Local Municipality is presented in **Table 8**.

Table 8: Demand Calculation

Local Municipality	Households	Population	Demand (ℓ/day)	(ℓ/s)	m ³ /day	30%losses (m ³ /day)	30 Year Demand Mℓ/day
UMZINYATHI DISTRICT MUNICIPALITY							
ENDUMENI	10 811	64 866	6486600	75.08	6486.60	8432.58	10.60
NQUTU	27 552	165 312	16531200	191.33	16531.20	21490.56	27.01
UMSINGA	29 596	177 576	17757600	205.53	17757.6	23084.88	29.01
UMVOTI	17 182	103 092	10309200	119.32	10309.20	13401.96	16.84

5. EXISTING WATER SUPPLY INFRASTRUCTURE

5.1. WATER RESOURCES AND AVAILABILITY

The IDP and Reconciliation strategy studies further describe the status of the water sources found in the Municipality as follows:

5.1.1. ENDUMENI LM

The main surface water source of supply in the Endumeni LM is the Buffalo River at the Tayside Weir. There are other sources of supply consisting of four dams in the area; namely Tom Worthington Dam and Verdruk Dam located in the Ngobiya River, a tributary of the Sterkstroom River; Donald McHardy Dam and the Upper and Lower Mpati Dams which are located in the Sterkstroom River, a tributary of the Buffalo River. The dams are the source of water supply to the Biggarsberg Water Treatment Works (WTW) which has a design capacity of 16 Mℓ/day.

5.1.2. MSINGA LM

The main source of supply of the Msinga LM is the run-off-abstraction, yielding 3 Mℓ/day, from the Tugela River. The Tugela River is well regulated with a number of dams in the upstream catchment which are mainly for the pumped storage scheme and transfer of water to the Vaal River system with the exception of Spioenkop Dam.

5.1.3. NQUTU LM

The major source of supply is the raw water abstraction from the Buffalo River below the confluence of the Blood and Buffalo Rivers.

The cumulative natural Mean Annual Run-off (MAR) in the Buffalo River catchment system up to the last quaternary catchment V32F at the abstraction point at Vants Drift weir, but excluding the quaternary catchment upstream of Ntshingwayo Dam and Zaaihoek Dam is 505.25 million m³/a. This MAR was adopted to determine the available water at the abstraction point for the scheme. The MAR determined does not take into account the uptake of water by commercial forestry and alien vegetation as well as upstream abstraction by the agricultural sector. The irrigation agriculture upstream was found to be approximately 24.35 million m³/a, at low assurance of supply.

5.1.4. UMVOTI LM

The Umvoti LM consists of Greytown, Muden, Kranskop and Matimatolo towns. Greytown is supplied by Lake Merthley Dam and fifteen boreholes which have a combined yield of 4 Ml/day. Water is fed via gravity from Lake Merthley Dam to the Water Treatment Plant (WTP). This gravity main was upgraded in 2010. Water from the boreholes is fed directly to the WTP.

Muden is supplied by the Mooi River and boreholes where raw water is transferred to the Muden WTP. Kranskop is supplied by a number of boreholes which feed the Kranskop WTP.

5.2. BULK WATER SUPPLY SCHEMES AND AREAS

The existing schemes of Umzinyathi District Municipality are summarised in **Table 9** below showing the All Towns Reconciliation Study water supply scheme areas, treatment works and their capacity, abstraction sources and supply areas.

Table 9: Summary of Existing Infrastructure per Water Supply Scheme

Scheme Area	Source	WTW	Reservoir Capacity (MI)
Dundee Glencoe	Buffalo River	Biggarsberg WTW - 16.00 M ³ /day conventional plant	43.5
Tugela Ferry	Tugela River	Tugela Ferry WTW - 2.00 M ³ /day conventional plant	Unknown
	Borehole	Borehole – 1.42M ³ /day	Unknown
Nqutu	Buffalo River	Vants Drift WTW - 9.00M ³ /day conventional plant	9.0
Greytown	Lake Merthley	Greytown WTW - 7.00 M ³ /day, Conventional plant	Unknown
Kranskop	Groundwater	Kranskop WTW - 0.92M ³ /day, Conventional plant	0.60
Muden	Mooi River	Muden WTW – 1.00M ³ /day, Conventional plant	Unknown
	Boreholes	Borehole – 1.58M ³ /day	

Detailed audit reports have been undertaken at local municipal level within the uMzinyathi DM, which will be used to review the scheme requirements. As the quality of some of these audit reports are very poor, all the significant WTW's were visited as part of the Water sources master planning and the de facto plant capacities recorded, based on design flow parameters. This information will be used for infrastructure capacity review.

Matimatolo Regional Water Supply Scheme

There is currently no regional bulk water supply scheme in the proposed project area. The towns of Kranskop and Hermannsburg have existing water supplies, which require augmentation. Areas 1, 5 and 6 is currently served from boreholes and the residents of Areas 2, 3 and 4 are depending on water from springs and streams for domestic use. Individual schemes which operate hand pump boreholes and springs are in Areas 2, 3 and 4 but sometimes residents are forced to use water from stagnant water pools during the dry seasons of which the water quality varies from poor to too dangerous for human consumption. The quality will not pass the Blue Drop standards test.

The following bulk water source options were previously investigated (Concept and Viability Phase of previous project):

- Option 1 Groundwater Investigations
- Option 2 New Dam/Surface water investigations
- Option 3 Craigeburn/Greytown water supply schemes.

Ultimately the plan is to develop the proposed Mvotipoort Dam as a regional bulk water source, which will ultimately also include the Umzinyathi DM region. However, it is estimated that the dam will only become operational and service the area beyond the 30-year design period of this project.

The Umzinyathi DM therefore proposed the following interim to medium term bulk water supply approach:

- Interim supply Groundwater Development (5-10 years)
- Medium Term Proposed surface dam (10 -30 years)
- Long Term Proposed Mvotipoort Dam (>30 years)

Nqutu Water Supply Scheme

The Nqutu Water Supply Scheme comprises raw water abstraction from the Buffalo River downstream of the confluence with the Blood River.

The maximum capacity of the raw water abstraction works from the Buffalo River system is not well known. However, given the design capacity of the Vants Drift water treatment works of 8 Mℓ/day and the current abstraction of 11-12 Mℓ/day, the existing raw water pumping infrastructure appears to have insufficient capacity to meet the capacity of the existing water treatment works. An additional clarifier is needed, high lift pumps are required to pump extra water away and the rising main needs an upgrade.

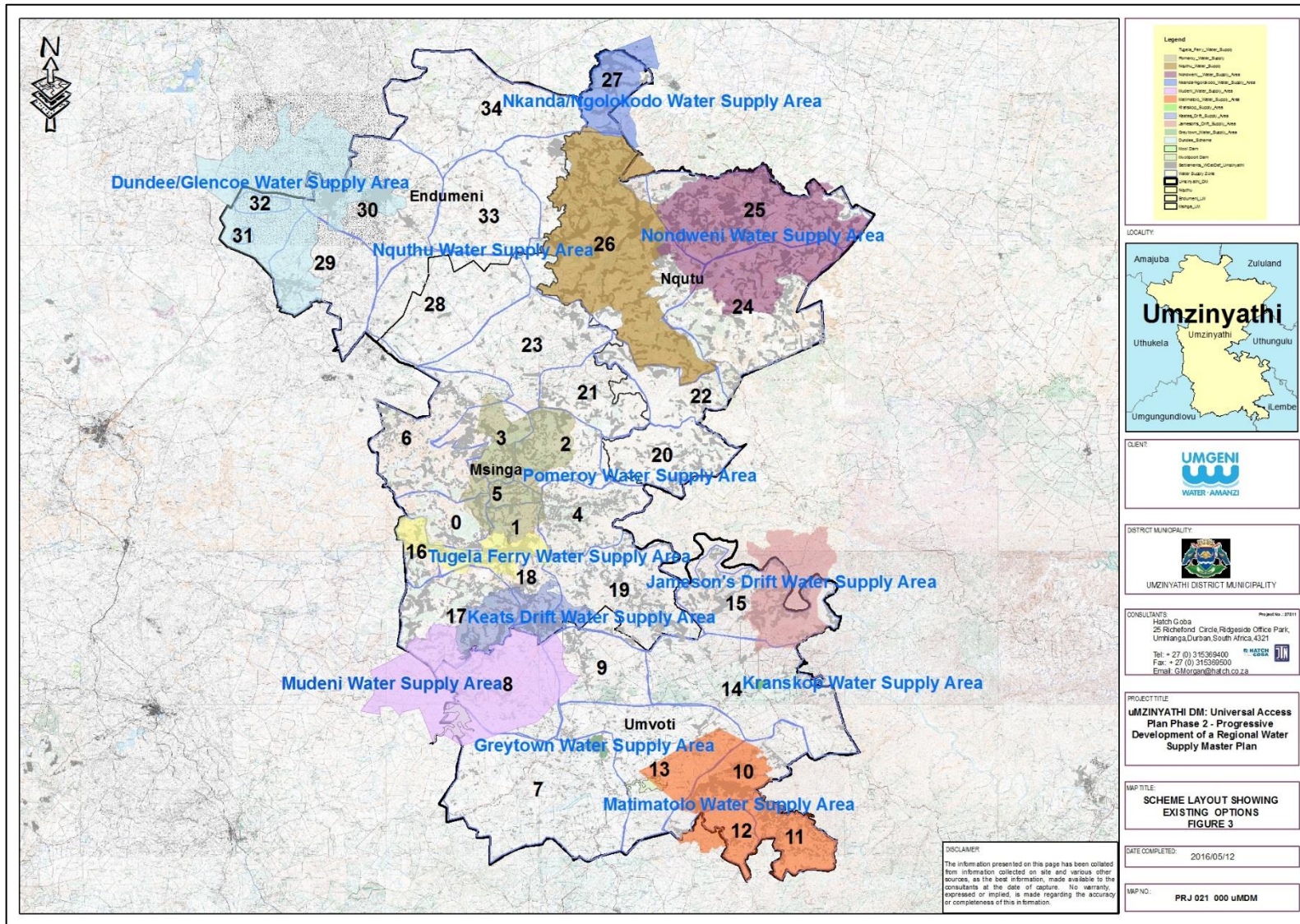
The raw water from the Buffalo River is delivered to Vants Drift WTW where it is treated to potable drinking water quality standards. This is the only treatment works that supplies the scheme area. The peak hydraulic design capacity of the water treatment works is 8 Mℓ/day or 2.9 million m³/a (WSDP, 2008).

The Vants Drift WTW is a conventional treatment plant. After treatment, the potable water is then pumped to the various command reservoirs in the supply area.

The current utilisation of the bulk water supply infrastructure is approximately 107%. The existing bulk water supply infrastructure does not have sufficient capacity to meet the current

water requirements of Nqutu Water Supply Scheme on a sustainable basis and does not have sufficient capacity to meet future water requirements on a long term sustainable basis.

A map showing the existing schemes is shown in **Figure 3** below.



6. BULK WATER SUPPLY INTERVENTIONS CURRENTLY IN PLANNING AND IMPLEMENTATION

The water supply for the Umzinyathi DM has been categorised into the proposed regional schemes to produce a more accurate analysis of the water supply. These regional bulk schemes are a long term solution to providing water to households in the Umzinyathi District Municipality. One cannot rely on these schemes to eradicate the current backlogs as these are large schemes.

Valuable existing infrastructure information have been collated from previous consultants in various drawing formats and transferred to GIS, further enhanced by recent asset register GIS and condition information that is being evaluated and interpreted in the Water Services Master Plan and will be used under Phase 2 of this assignment.

The perspective reflected below is as depicted in the All Towns Reconciliation Study (2011) and will be updated with the information referred to above. O&M arrangements have also changed. All the WTW's are currently being operated and maintained by WSSA acting as a WSP on behalf of UDM and are well maintained and operated and water quality and quantity information recorded.

6.1. MVOTI REGIONAL WATER SCHEME

The licensed raw water abstraction for Greytown waterworks from Lake Merthley and existing boreholes is 3 Ml/day. The current water demand exceeds the existing raw water allocation for the waterworks. A study was undertaken to augment the raw water supply to Greytown from the Craigieburn Dam. The approved water use from this dam for Greytown is 12.3 Ml/day. The construction of the pipeline from Craigieburn Dam to Greytown as well as the waterworks at Greytown is currently in progress. The Umvoti Regional Supply Scheme intends supplying water from Greytown through to Matimatolo, Ahrens and Kranskop. This option is currently under investigation.

As presented in Table 11 the water resource versus demand for the Mvoti Regional Scheme is summarised below.

30 Year Water Demand	14.42 Ml/day
Water Source	Lake Merthley Boreholes
Source Yield	4 Ml/day
Augmentation Required	Yes
Augmentation Option	Mvotipoort Dam uMshwati Bulk Craigieburn Dam

6.2. MUDEN REGIONAL WATER SCHEME

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 6.9 Ml/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 25 km 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 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, Nhlunga, Mkhuphula, Nhlesi and Ndaya.

The total water supply area covers an area of approximately 480 km². The total estimated population supplied by the existing scheme in Keates Drift is 11848 and approximately 59880 will benefit from this project after implementation and water supply from Mudén. The total water demand is estimated to be 4.5 Ml/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 a rationalisation/regionalisation was necessary for all areas under consideration.

Umzinyathi District Municipality commissioned three 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 Mudén. The canal's supply is from a weir constructed on the Mooi River, located approximately 7km from the existing Mudén Water Treatment Plant. The irrigation canal feeds water to the existing treatment plant via gravity, from where it is distributed to the Mudén 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 of 6.9 Ml/day for the regional scheme (which includes the daily demand for Mudén and Opathe) was discussed with Mr James Perkins of DWAF, in order to establish whether the Craigieburn Dam would be a sustainable supplementary source. Mr James Perkins confirmed this to be the case.

The Mudén Regional Bulk Water Supply Scheme comprises of the following infrastructure:

- The expansion of the existing Mudén Water Treatment Plant from a capacity of 2.4 Ml/day to a capacity of 6.9 Ml/day.
- The relocation of the portable 1 Ml/day Water Treatment Plant, located near Keates Drift abstraction works to Mudén to augment supply.
- The construction of approximately 150 km of bulk water pipelines ranging in diameter from 90mm to 315mm diameter pipelines.

- The construction of several bulk water reservoirs totalling approximately 15ML of storage, and distribution reservoirs totalling 0.3ML of storage.
- The construction of six bulk water pumpstations and two booster pumpstations to carry water to the high lying areas of the project area.
- The construction of approximately 77km of distribution water pipelines (including reticulation), ranging in diameter from 63mm to 90mm.
- The construction of approximately 410 standpipes which will provide water to the entire project area.

The aim of the Muden Bulk Water Supply Scheme is to:

- Consolidate water supply sources to achieve economy of scale.
- Provide safe and reliable source of potable water to promote health and hygiene and reduce the incidence of waterborne diseases for a population of 59,880 (7485 households) in the project area.
- Create employment opportunities for the community for the duration of the construction programme.
- Promote community awareness in terms of general health and hygiene issues.

In summary, the project is recommended for the following reasons:

- It is a cost effective solution yielding an initial per capita cost of R 3 160.54
- 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 Craigieburn Dam.
- Eliminates the operation of multiple Water Treatment Works situated at various places within the Municipal boundaries i.e. economy of scale.

(UMzinyathi DM, 2015)

As presented in Table 11 the water resource versus demand for the Muden Regional Scheme is summarised below.

30 Year Water demand :	15.78 Ml/day
Water Source :	Mooi River
Source Yield :	1.5 Ml/day
Augmentation Required :	Yes
Augmentation Option	49.85mcm Dam Releases from Spring Grove Dam (when needed)

6.3. NDAYA WATER SUPPLY SCHEME

The ultimate objectives of the project is to ensure that it provides enough supply to ensure at least RDP level of service for water for all the population in the target areas and also provide 48 hours of storage to ensure reasonable security of supply. While the target level of service for the Ndaya Water Supply Scheme is the minimum RDP planning purposes is 60 litres, as it has been found that consumers can use up to that amount of water per day.

The design criteria employed for sizing of elements and costing purposes are detailed below. It was noted that reservoir sizing was based on the current population. Should the population grow at say, 2.1% growth, the storage in the reservoirs will be approximately 30 hours in 20 years' time.

The present day total population for the area is 38,400. The present day demand based on a per capita consumption of 60 litres per day and 20% system losses is therefore 2,765 m³per day.

- Daily per capita consumption 60 litres
- Peak factor (bulk and reticulation) 3 Pipelines sized for 20 year projected demand at 2.1% growth
- Bulk Storage 48 hours; Reservoir sized for current demands
- System Losses 20%

Two possible sources of water were investigated; the first source considered was direct abstraction of water from UThukela River which as alluded to could reliably meet the 2.76

Ml/day required by Ndaya area. Second option was to link the Ndaya Water Scheme to Keates Drift Scheme. This option was chosen because it fulfilled the district municipality's objective of rationalizing the regional schemes in order to reduce capital and operational expenditure and improve efficiency.

6.4. DUNDEE/GLENCOE WATER SUPPLY SCHEME

The Dundee /Glencoe Water Supply Scheme comprises raw water abstraction from 6 dams and from the Buffalo River in quaternary catchment V32D, a balancing dam near the treatment works, a water treatment works and bulk service storage infrastructure and bulk distribution networks.

The Biggarsberg WTW abstracts raw water from four sources of supply which are on the Buffalo River catchment.

- **Dams in Ngobiya River**

The first source of supply for the Biggarsberg WTW is the two dams on the Ngobiya River, namely, Tom Worthington and Verdruk Dams. These dams are located in the Amajuba DM but are a source of supply for the Biggarsberg WTW. Water is pumped from the raw water pumping stations to a 1.3 MI capacity balancing dam from where it then gravitates to a balancing dam at the WTW.

- **Dams in Sterkstroom River**

The second source of supply is the dams on the Sterkstroom River; which include Donald McHardy Dam and the Preston Pan. It is estimated that the total available water from the Sterkstroom river is 3.34 Ml/day (1.2 million m³/a).

- **Mpati catchment**

There are two small dams located near the Biggarsberg WTW which are also supplying raw water. Raw water is gravitated from both the upper and lower Mpati Dam directly into the water treatment works. The capacity of the dams have been estimated to supply 0.26 million m³/a based on the live storage capacity of the dams.

- Mpati Dams 1.2 Ml/day
- Tom Worthington Dam 5.0 Ml/day
- Verdruk Dam 2.6 Ml/day

- **Buffalo River abstraction**

The main source of supply currently for the Biggarsberg WTW is the Buffalo River. Raw water is currently abstracted at Tayside where it is pumped approximately 20 km to the Biggarsberg water treatment works. The raw water pumping main is a 400mm diameter steel pipeline.

The Dundee Bulk Water Supply Scheme intends supplying bulk water from the Ntshingwayo dam to Endumeni, Nqutu and Danhauser. Ntshingwayo dam can yield 257 Ml/day for supply to these areas. (Ibhongo Consulting, 2015)

The Dundee bulk water supply scheme intends supplying bulk water to Dundee, Glencoe areas in Endumeni as well as communities in the Nqutu Local Municipality. An allocation of 32.66 Ml/day at Endumeni and 33.45 Ml/day for Nqutu has been made in the Dundee bulk scheme. A new treatment works will be built at the Ntshingwayo dam. The existing Biggarsburg WTW that supplies Glencoe and Dundee will be upgraded to supply the Endumeni and Nqutu LM's, Vants drift will be decommissioned. The project is currently in the design phase, a layout plan from Ibhongo Consulting of the option considered for the scheme and the final recommended option is attached in **Annexure A**.

The following is the scope of works for the Dundee Bulk Pipeline as outlined in the Dundee Bulk Business Plan Report by Ibhongo Consulting:

Construction of raw water conveyance pipeline (Ntshingwayo Dam to Biggarsberg WTP in Dundee):

- 600mm x 20000m steel pipeline raw water conveyance pipeline(forced main) to convey 40 Ml/day
- 700mm x 30000m steel pipeline raw water conveyance pipeline(gravity line) to convey 40 Ml/day
- 600mm x 30000m steel pipeline raw water conveyance pipeline(forced main) to convey 40 Ml/day
- 176Kw Intake pump station at Ntshingwayo Dam to pump 40 Ml/day
- 234 Kw Booster Pump station 1 to pump 40 Ml/day
- 199Kw Booster Pump station 2 to pump 40 Ml/day
- 200KL Pressure Break Tank
- 40ML Emergency Raw water Storage Reservoir at Biggarsberg Water Treatment Plant

- Installation of telemetry

Upgrade of Biggarsberg Water Treatment Plant–Dundee (Additional 40 Mℓ/day Treatment Capacity)

Conventional Water Treatment Capacity to consist the following components

- Receiving well volume: 50m³
- Mixing basin volume :68m³
- Flocculation basin volume:1000m³
- Sedimentation Basin volume :6000m³
- Rapid Sand filter filtration area : 308m²
- Clear Water Storage tank:1500m³
- 250Kw High lift Pump station – to pump 30 Mℓ/day of clear water from Biggarsberg WTP to Service reservoirs supplying Dundee.

As presented in Table 11 the water resource versus demand for the Endumeni/Nqutu Regional Scheme is summarised below.

30 Year Water demand :	32.66 Mℓ/day
Water Source :	Biggarsberg WTW Buffalo River
Source Yield :	16 Mℓ/day
Augmentation Required :	Yes
Augmentation Option	Dundee Bulk Pipeline

6.5. MSINGA BULK WATER SUPPLY SCHEME

The raw water from the Thukela River is delivered to Sampofu WTW where it is treated to potable drinking water quality standards. The Sampofu WTW is the only treatment works that supplies the scheme area besides boreholes supplying the outlying communities. The peak hydraulic design capacity of the water treatment works is only 3.1 Mℓ/day or 1.825 million m³/a (WSDP, 2008). The average annual flow rate of the treatment works is estimated to be 4.0 Mℓ/day or 1.5 million m³/a based on a peak factor of 1.5. The Sampofu WTW is currently being upgraded to 14 Mℓ/day.

The business plan and scope of works for the Msinga Bulk Pipeline according to Ibhongo Consulting is summarised hereunder:

Phase 1: Msinga Bulk Water Supply

Project Status: Construction complete

Scope of Work:

- 10.5km x 300mm diameter 25 bar galvanized steel bulk pipeline
- Construction of 1 x 1ML reinforced concrete service reservoir
- Construction of 1 x 0.5ML reinforced concrete service reservoir
- Construction of a high lift pump station

Phase 2A: Msinga Bulk Water Supply: Tugela Ferry-Cwaka Bulk Pipeline

Project Status: Active contract, construction on-going

Scope of Work:

- 9.5km x 300mm diameter 40 bar galvanized steel bulk pipeline
- Construction of 1 x 0.5ML reinforced concrete service reservoir
- Construction of a high lift pump station

Construction Phase: January 2014- November 2015

Phase 2B: Msinga Bulk Water Supply: Tugela River Abstraction Works

Project Status: Active contract, construction on-going

Scope of Work:

Construction of 14M³/day Tugela River Abstraction Works
Construction of a high lift pump station

Construction Phase: July 2015- April 2016

Phase 3A: Msinga Bulk Water Supply: Cwaka Bulk Pipeline

Project Status: Documentation and Procurement Phase

Procurement Phase: November 2015- January 2016

Construction Phase: February 2016- February 2017

- 21km x 150mm diameter 25 bar galvanized steel bulk pipeline
- Construction of 1 x 0.350 ML reinforced concrete reservoir
- Construction of a high lift pump station

Phase 3B: Msinga Bulk Water Supply: Cwaka- Pomeroy Bulk Pipeline

Project Status: Design development stage

Procurement Phase: November 2015- January 2016

Construction Phase: February 2016- November 2017

- 18km x 200mm diameter 25 bar galvanized steel bulk pipeline
- Construction of 1 x 0.5 and 1 x 1.0 ML reinforced concrete reservoirs
- Construction of 2 high lift pump stations

Phase 3C: Msinga Bulk Water Supply: Sampofu WTW Upgrade

Project Status: Design development stage

Scope of Work:

Construction of 14Mℓ/day Sampofu WTW

Construction of a high lift pump station

Procurement Phase: March 2016- May 2016

Construction Phase: June 2016 – November 2017

Phase 4A: Msinga Bulk Water Supply: Msinga Top Bulk Pipeline

Project Status: Planning stage

Procurement Phase: March 2016- May 2016

Construction Phase: June 2016- November 2017

- 18km x 150mm diameter 40 bar galvanized steel bulk pipeline
- Construction of 0.2ML and 1.0ML reinforced concrete reservoirs
- Construction of 2 high lift pump stations

Phase 4B: Msinga Bulk Water Supply: Mazabeko Bulk Pipeline

Project Status: Planning stage

Procurement Phase: June 2016- August 2016

Construction Phase: September 2016- September 2017

- 10km x 100mm diameter 25 bar galvanized steel bulk pipeline
- Construction of 1 x 0.5ML reinforced concrete reservoir
- Construction of a high lift pump station

Phase 4C: Msinga Bulk Water Supply: Douglas Bulk Pipeline

Project Status: Planning stage

Procurement Phase: June 2016- August 2016

Construction Phase: September 2016- September 2018

- 26km x 100mm diameter 25 bar galvanized steel bulk pipeline
- Construction of 2 x 0.5ML reinforced concrete reservoir
- Construction of 2 high lift pump station

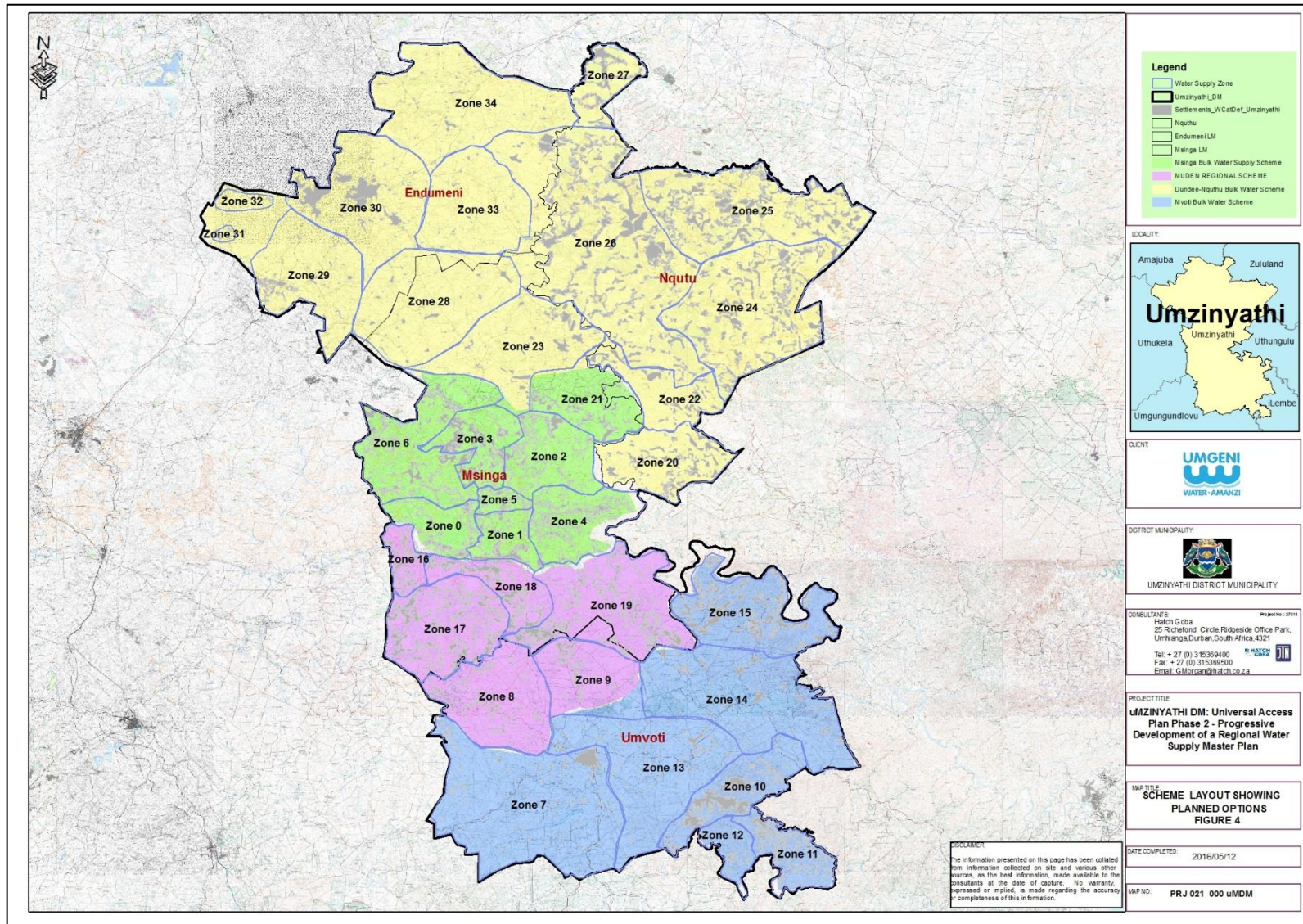
The planned Msinga Bulk Pipelines have been digitized by Ibhongo Consulting and is shown in Appendix C.

As presented in Table 11 the water resource versus demand for the Msinga Regional Scheme is summarised below.

30 Year Water demand :	23.32 Ml/day
Water Source :	Thukela River Boreholes
Source Yield :	3 Ml/day
Augmentation Required :	Yes
Augmentation Option	Thukela River via Msinga Bulk Pipeline

More details about the scheme associated with this works is discussed in Section 7.2 and 7.4.

A map showing the planned schemes are shown below in **Figure 4**.



7. BULK WATER SUPPLY INTERVENTIONS CONSIDERED IN THIS STUDY

Using available information regional scheme options have been investigated to augment existing schemes or to extend the footprint of existing and planned schemes to cover other areas in Umzinyathi District Municipality. It must be noted that viability of these options are dependent on many factors such as:

- Water resource availability
- Existing infrastructure availability
- Technical matters
- Environmental matters
- Financial, Economic and social matters

All options that were investigated are presented in this report and the viability and possible further investigation of each option is discussed after the option is presented.

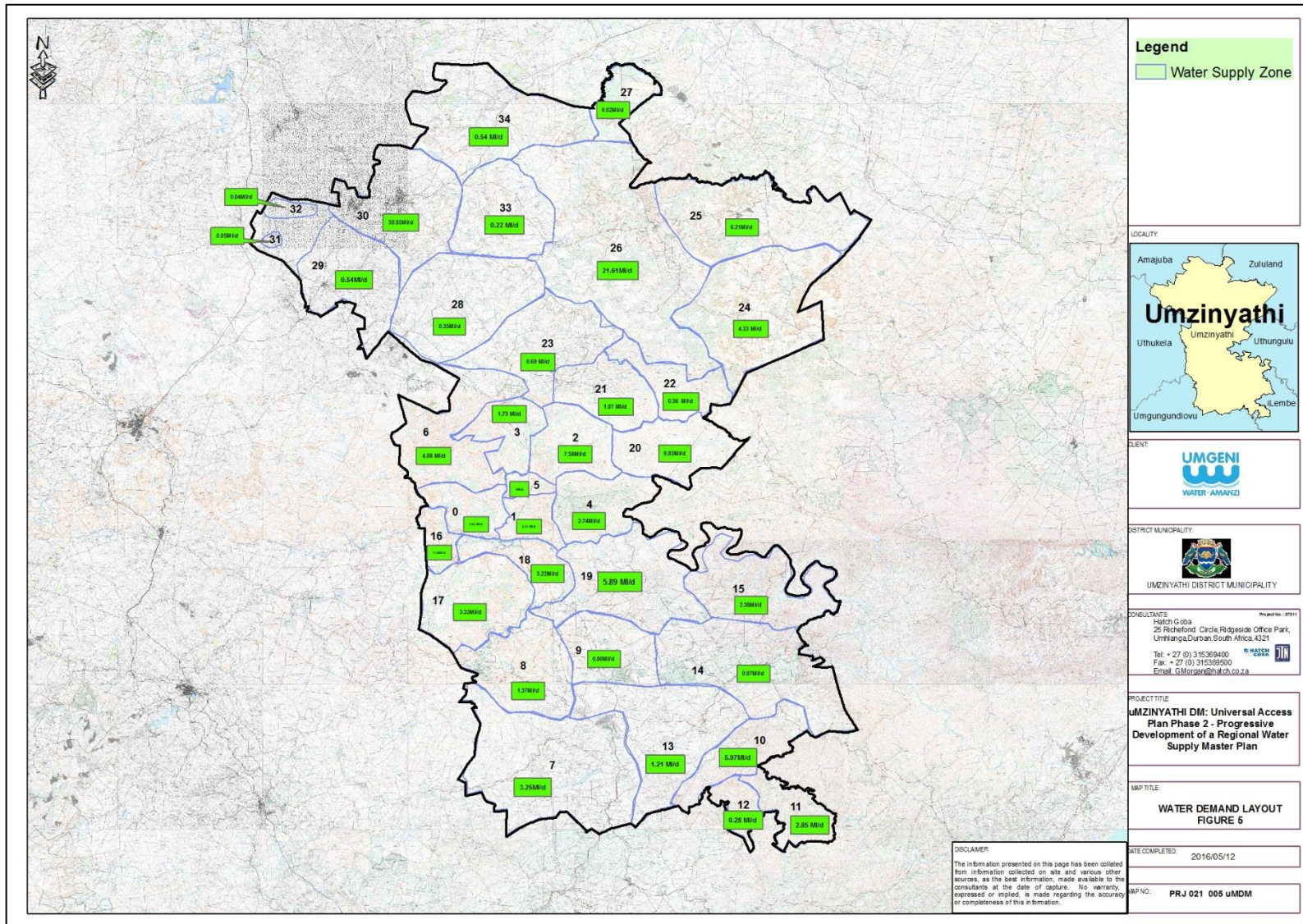
Using the methodology presented in section 1.3, the Umzinyathi District Municipality was broken up into 34 Bulk Supply Zones with possible command reservoir positions in each zone.

These zones together with the demand for each zone are shown in **Figure 5** and summarised in **Table 10**.

Areas which were not covered by regional schemes were deemed to be “stand-alone schemes” (Zones 15 and 31 - 34 in **Figure 5** below). It is recommended that these, predominantly farmland, stand-alone areas be supplied by localised schemes (boreholes etc.) due to the sparse population and the proximity of the area in relation to the other regional schemes, it would not be feasible to extend bulk regional schemes to supply this area.

Refer to the **Scheme Maps**, shown in **Figure 3 and 4**, in conjunction with the information below, where existing and planned supply is depicted within their respective regional schemes.

A water balance is presented in **Table 11** highlighting either the adequacy or need for augmentation of the water resources for each regional scheme.



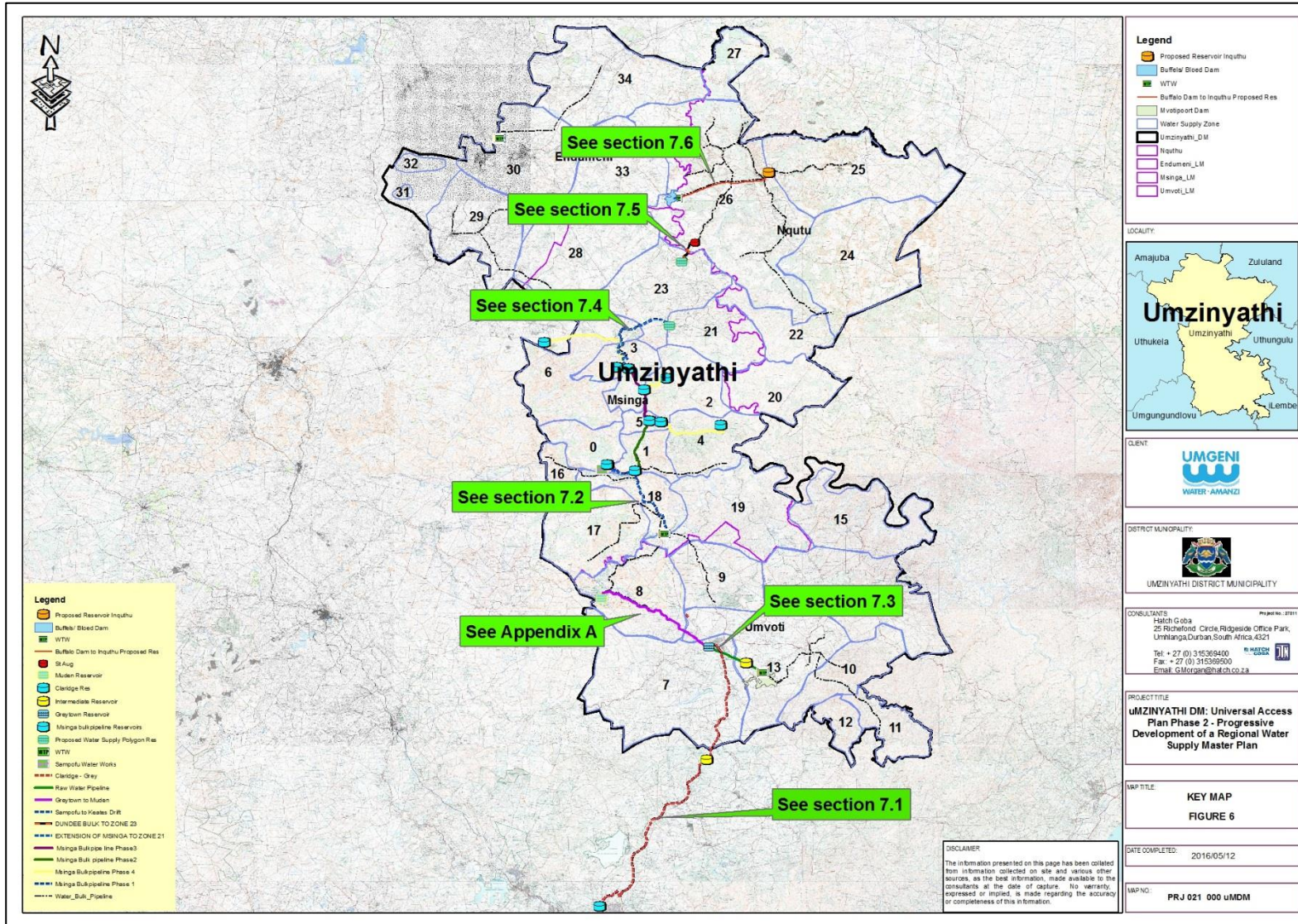


Table 10: Project Demands per Zone

Zone	Population 2015	Population 2045	Mℓ/day 2015	Mℓ/day 2045
0	9 431	12 712	1.23	1.65
1	13 951	18 804	1.81	2.44
2	43 288	58 346	5.63	7.58
3	10 011	13 493	1.30	1.75
4	21 338	28 760	2.77	3.74
5	5 729	7 722	0.74	1.00
6	23 260	31 351	3.02	4.08
7	18 522	24 965	2.41	3.25
8	7 800	10 513	1.01	1.37
9	4 581	6 174	0.60	0.80
10	34 063	45 912	4.43	5.97
11	16 272	21 932	2.12	2.85
12	1 572	2 119	0.20	0.28
13	6 885	9 280	0.90	1.21
14	4 955	6 679	0.64	0.87
15	14 718	19 838	1.91	2.58
16	6 730	9 071	0.87	1.18
17	18 991	25 597	2.47	3.33
18	18 349	24 732	2.39	3.22
19	33 605	45 294	4.37	5.89
20	6 646	8 958	0.69	0.93
21	6 101	8 223	0.79	1.07
22	6 374	3 430	0.26	0.36
23	3 640	6 593	0.38	0.69
24	27 283	41 677	3.22	4.33
25	44 310	59 723	4.61	6.21
26	101 865	142 460	24.73	21.60
27	14 301	13 643	0.01	0.02
28	2 490	3 356	0.26	0.35
29	3 882	5 232	0.40	0.54
30	86 612	116 740	27.02	30.93
31	290	391	0.04	0.05
32	217	292	0.03	0.04
33	1 230	1 658	0.16	0.22
34	3 086	3 014	0.29	0.39
TOTALS	622 378	833 329	103.21	122.75

Table 11: Water Balance

	Scheme	UAP Phase 2 Supply Zones	Existing Water Resource	Yield (Mℓ/day)	UAP Phase 2 : 30 Year Demand GAADD (Mℓ/day)	Resource Assessment	
						Water Surplus (Mℓ/day)	Water Deficit (Mℓ/day)
Existing	Msinga	0 to 6 & 21	Boreholes & Thukela	3	23.32	-	20.32
	Muden	8, 9 & 16 to 19	Mooi River	1.5	15.78	-	14.28
	Endumeni	23 & 28 to 30	Biggarsberg WTW	16	32.66	-	16.66
	Nquthu	20, 22 & 24 to 27	Vants Drift WTW	8.3	33.45	-	25.15
	Mvoti	7 & 10 to 14	Lake Merthley & Boreholes	4	14.42	-	10.42

	Scheme	UAP Phase 2 Supply Zones	Planned Water Resource / Scheme	Yield (Mℓ/day)	UAP Phase 2 : 30 Year Demand GAADD (Mℓ/day)	Resource Assessment		UAP Phase 2/UZDM Long Term Augmentation Option	Required Resource Yield (Mℓ/day)
						Water Surplus (Mℓ/day)	Water Deficit (Mℓ/day)		
In Planning / Implementation	Msinga	0 to 6 & 21	Msinga Bulk	14	23.32	-	9.32	Off Channel storage on Thukela	9.32
	Muden	8, 9 & 16 to 19	Mooi River	27.31	15.78	11.53	-	Dam - 49.85mcm or Releases from Spring Grove Dam	-
	Endumeni	23 & 28 to 30	Dundee Bulk	93.93	32.66	27.82	-	Dundee Bulk	-
	Nquthu	20, 22 & 24 to 27			33.45				
	Mvoti	7 & 10 to 14	Mvotipoort Dam uMshwati Bulk Craigieburn Dam	132	14.42	117.58	-	Mvotipoort Dam uMshwati Bulk Craigieburn Dam	-

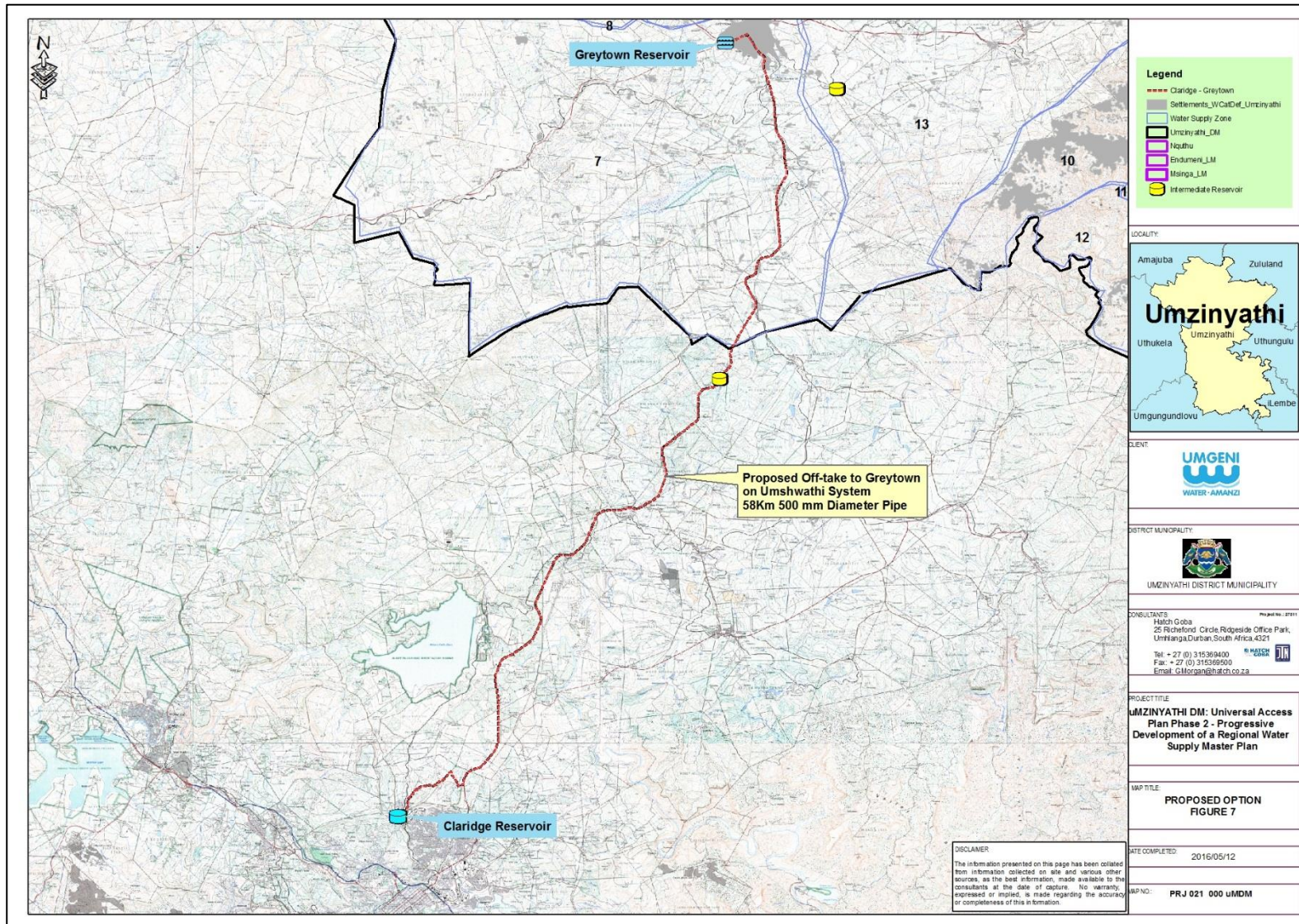
References: All Town Recon Strategies of the respective Regional Schemes
Ibhongo Consulting

7.1. PROPOSED EXTENSION OF THE UMSHWATHI REGIONAL SCHEME

The Umshwathi Regional Bulk Water Supply Scheme is currently in construction. The main supply from Claridge Reservoir to Wartburg is initially through sugar cane for a section and then follows the R33 and then the R614 towards Wartburg. The pipeline has a capacity of 50 Ml/day. This pipeline will supply the greater Umshwathi LM and also intends supplying the Ilembe DM in Ndwedwe.

The possibility of extending this pipeline along this pipeline along the R33/R614 junction was investigated. A 58km pipeline will supply water to Greytown. It will be possible to supply water under gravity for approximately 20km from the R33/R614 intersection where after a pumpstation will be required to pump water up a static lift of 200m to a reservoir at Seven Oaks. It will be possible to gravitate water from the Seven Oaks Reservoir to within 2km of Greytown at an elevation of 1070m where another booster pumpstation will be required to pump water to Greytown reservoir.

The long term demand of Greytown and Kranskop, zones 7 to 15 in the Mvoti Regional Scheme, is estimated at 24 Ml/day. Assuming that this demand could be supplied from Claridge Reservoir, a 550mm Ø pipeline will be required. The proposed pipeline route is shown in **Figure 7** and the longitudinal section is shown in **Figure 7a**. The estimated capital costs for this option is shown in **Table 12**.



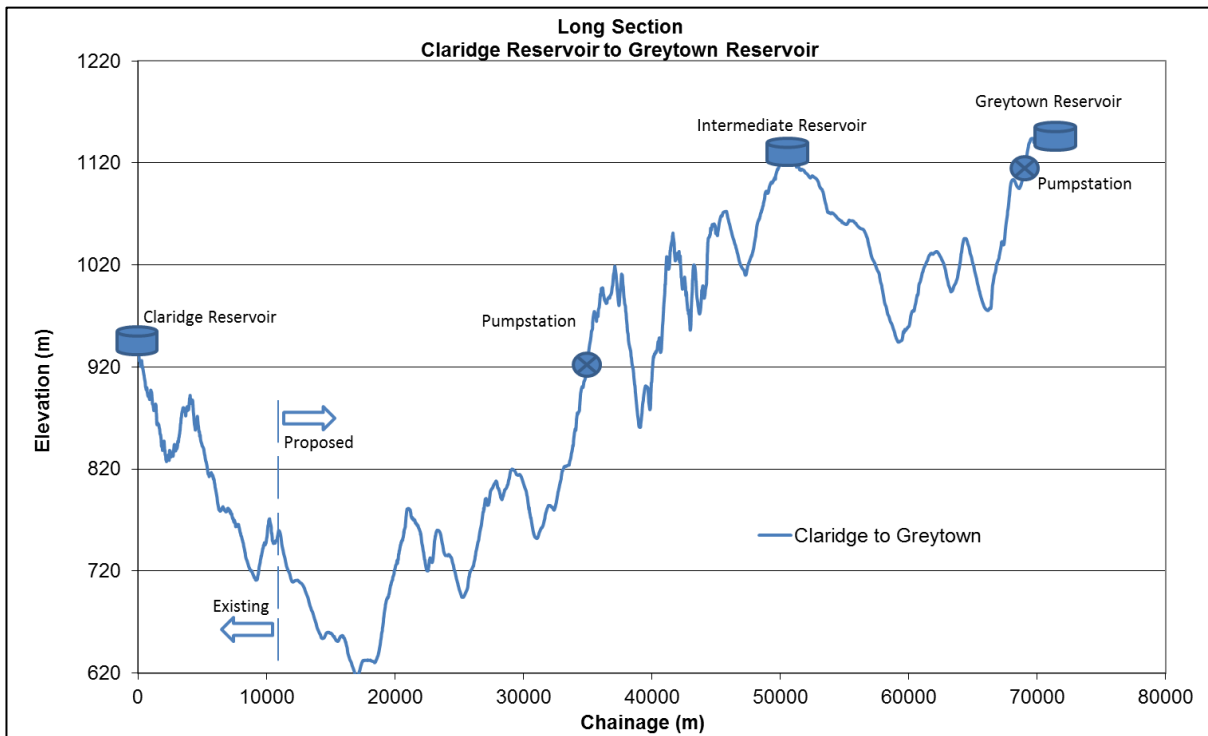


Figure 7a: Long Section – Claridge to Greytown

Table 12: Capital Costs – Claridge to Greytown

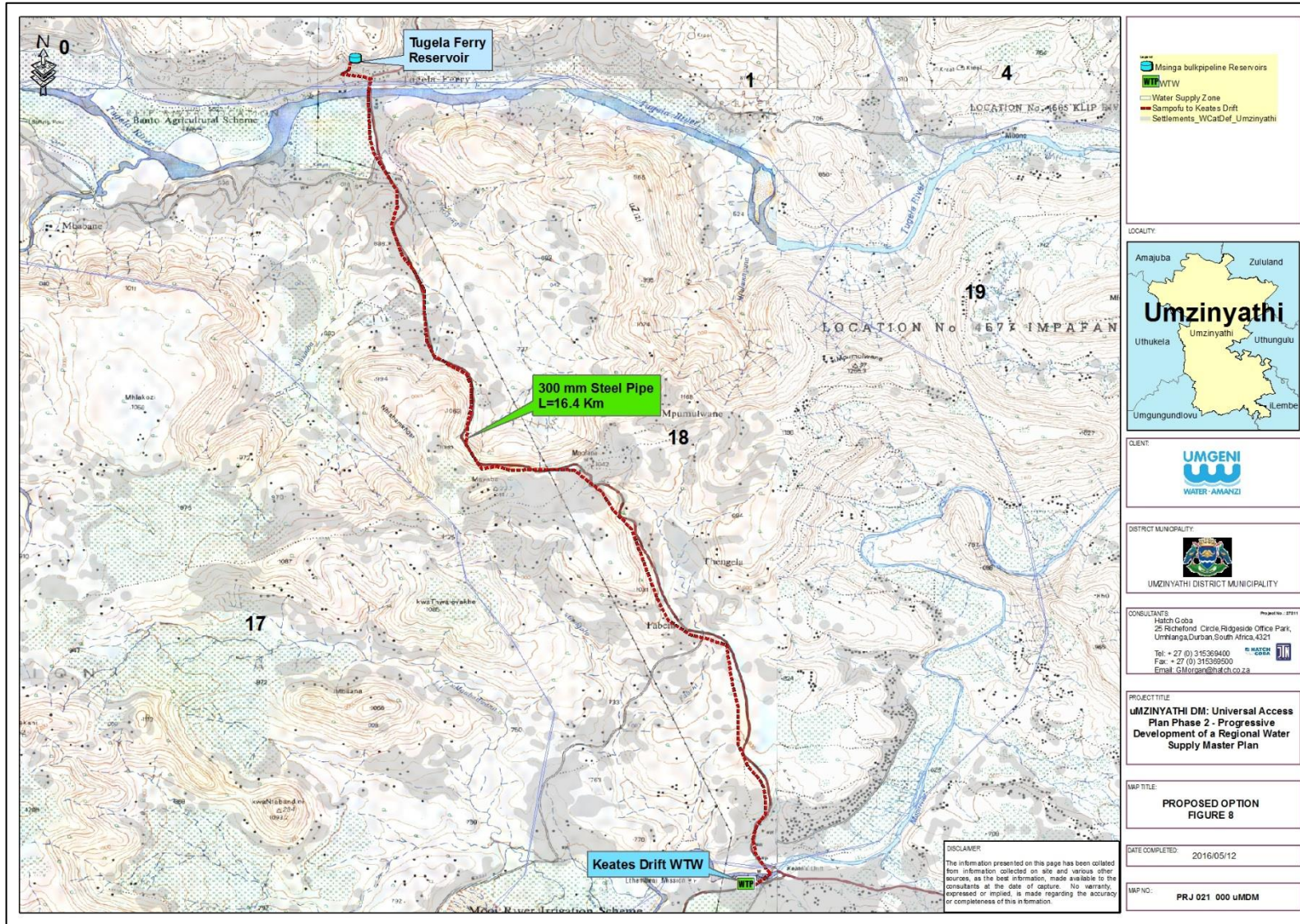
Consultants	
Design and Tender Documentation	R 52 316 752
Geotech Survey	R 3 000 000
Land Survey	R 465 102
Cathodic Protection	R 5 000 000
Construction Monitoring	R 10 852 380
Construction	
Pipe Supply	R 153 483 660
Pipeline Construction	R 273 513 684
Pipe Bridge/Jack	R 9 000 000
Pumpstation	R 100 237 500
Water Works	R 0
Reservoir	R 45 062 405
Dam	R 0
Abstraction	R 0
Land Acquisition - 7.5%	R 43 597 294
Environmental, Community Liaison	R 5 000 000
Health & Safety, Quality Assurance	R 5 812 972
Project Office	R 20 345 404
Contingencies	R 362 343 576
Sub total	R 1 087 030 729
VAT (14%)	R 152 184 302
Grand total	R 1 242 215 031

Electricity capital costs excluded

7.2. SUPPLY FROM THE SAMPOFU WTW SOUTH OF THE THUKELA RIVER

As there is potential for additional yield from the Thukela River after the allocation of 14 Ml/day for the Msinga Bulk Water Supply Scheme albeit with some off-channel storage facility, the option of supply to the area south of the Thukela River as far as Keates Drift to supply Zones 8, 9 and 10 to 16 in the Msinga Regional Scheme was investigated.

A 16.4 km long, 300mm Ø steel pipeline will be required. It will be necessary to pump up to a static head of 500m in at least two lifts to a command reservoir at elevation 1080m. It will thereafter be possible to supply water under gravity to Zones 8, 9 and 10 to 16. The proposed pipeline route is shown in **Figure 8** and the longitudinal section is shown in **Figure 8a**. The estimated capital costs for this option is shown in **Table 13**.



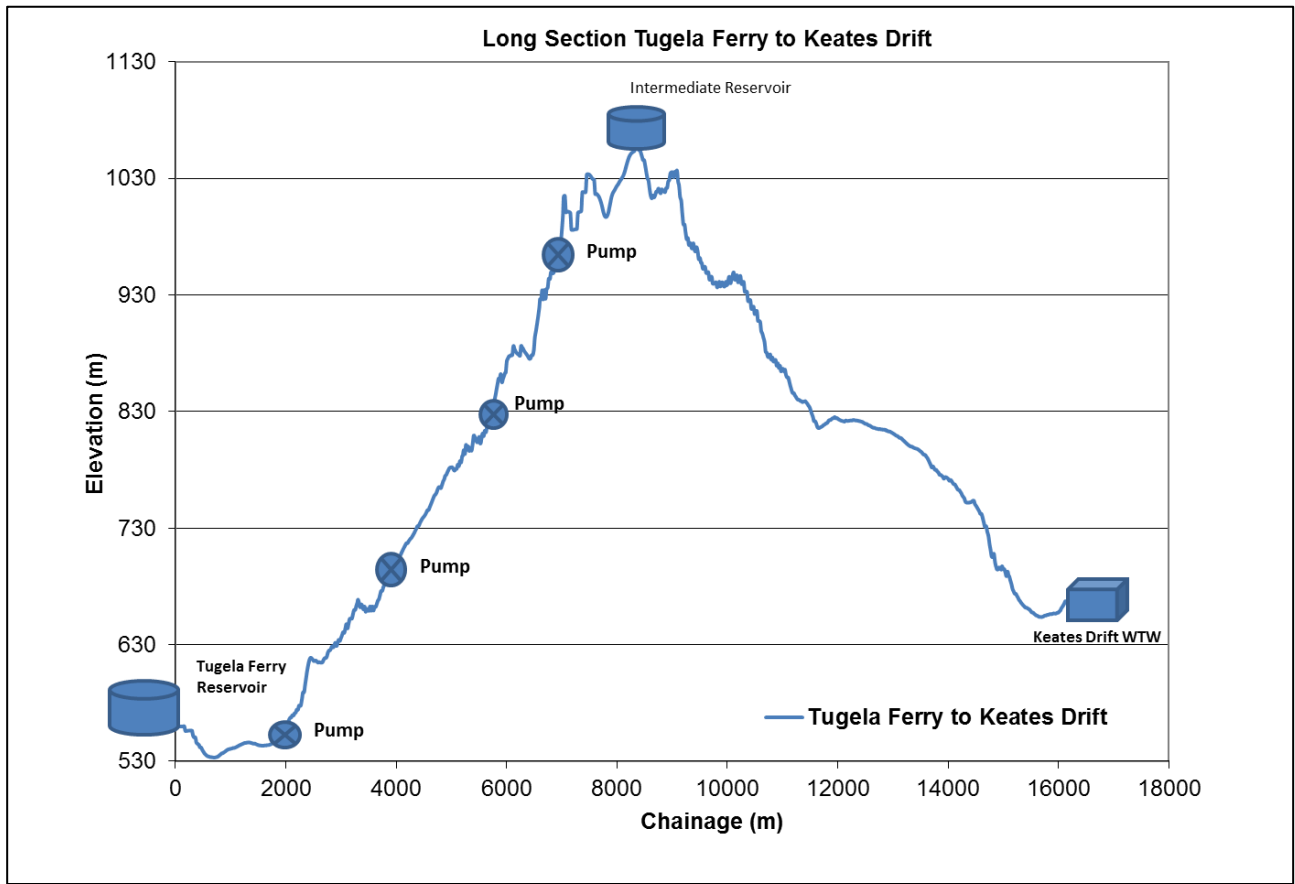


Figure 8a: Long Section - Sampofu to Keates Drift

Table 13: Capital Costs – Tugela Ferry to Keates Drift

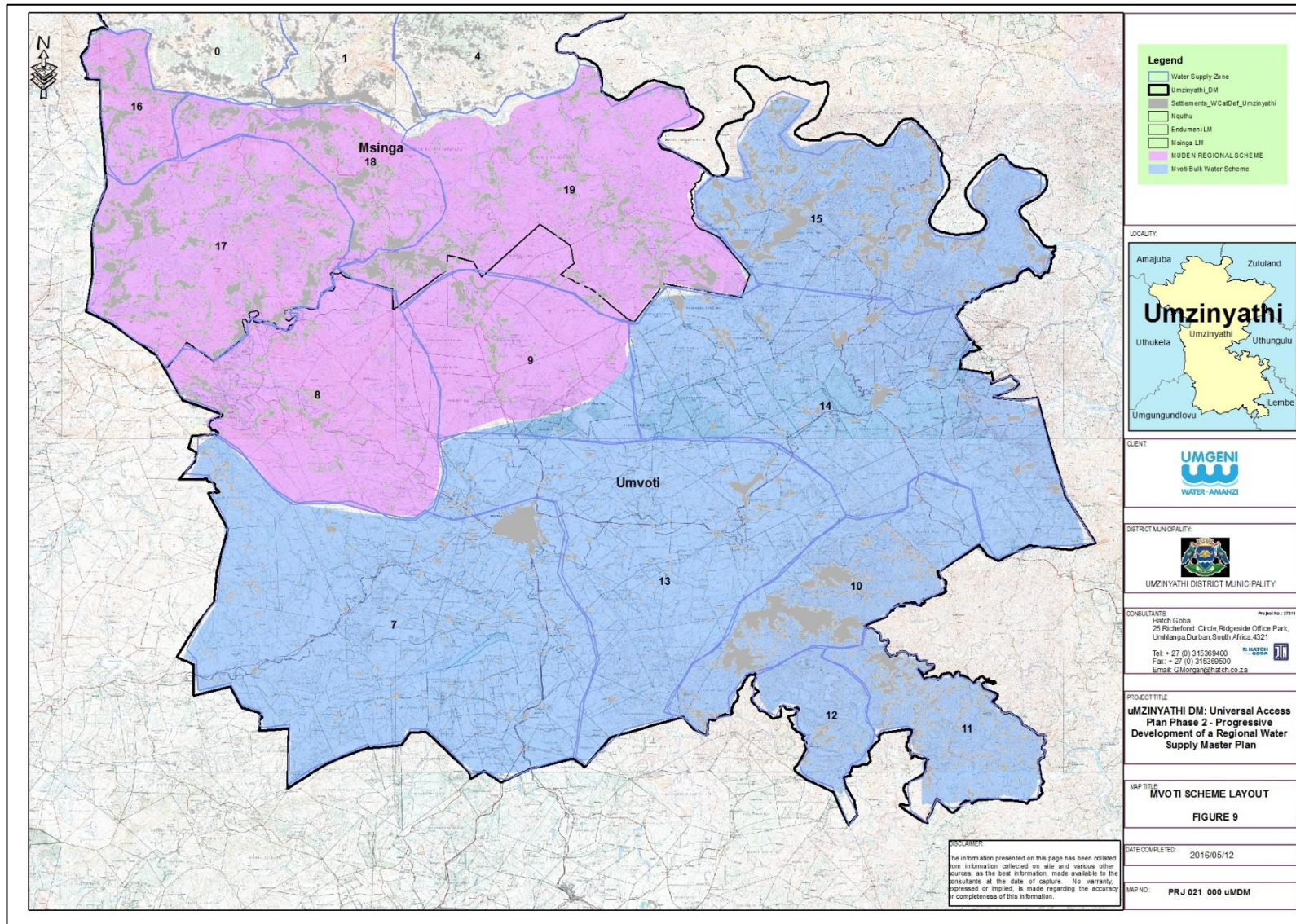
Consultants	
Design and Tender Documentation	R 21 269 390
Geotech Survey	R 3 000 000
Land Survey	R 131 512
Cathodic Protection	R 5 000 000
Construction Monitoring	R 3 068 604
Construction	
Pipe Supply	R 36 165 690
Pipeline Construction	R 64 448 627
Pipe Bridge/Jack	R 3 000 000
Pumpstation	R 96 228 000
Water Works	R 0
Reservoir	R 36 484 244
Dam	R 0
Abstraction	R 0
Land Acquisition - 7.5%	R 17 724 492
Environmental, Community Liaison	R 5 000 000
Health & Safety, Quality Assurance	R 2 363 266
Project Office	R 8 271 430
Contingencies	R 149 577 627
Sub total	R 448 732 880
VAT (14%)	R 62 822 603
Grand total	R 514 555 483

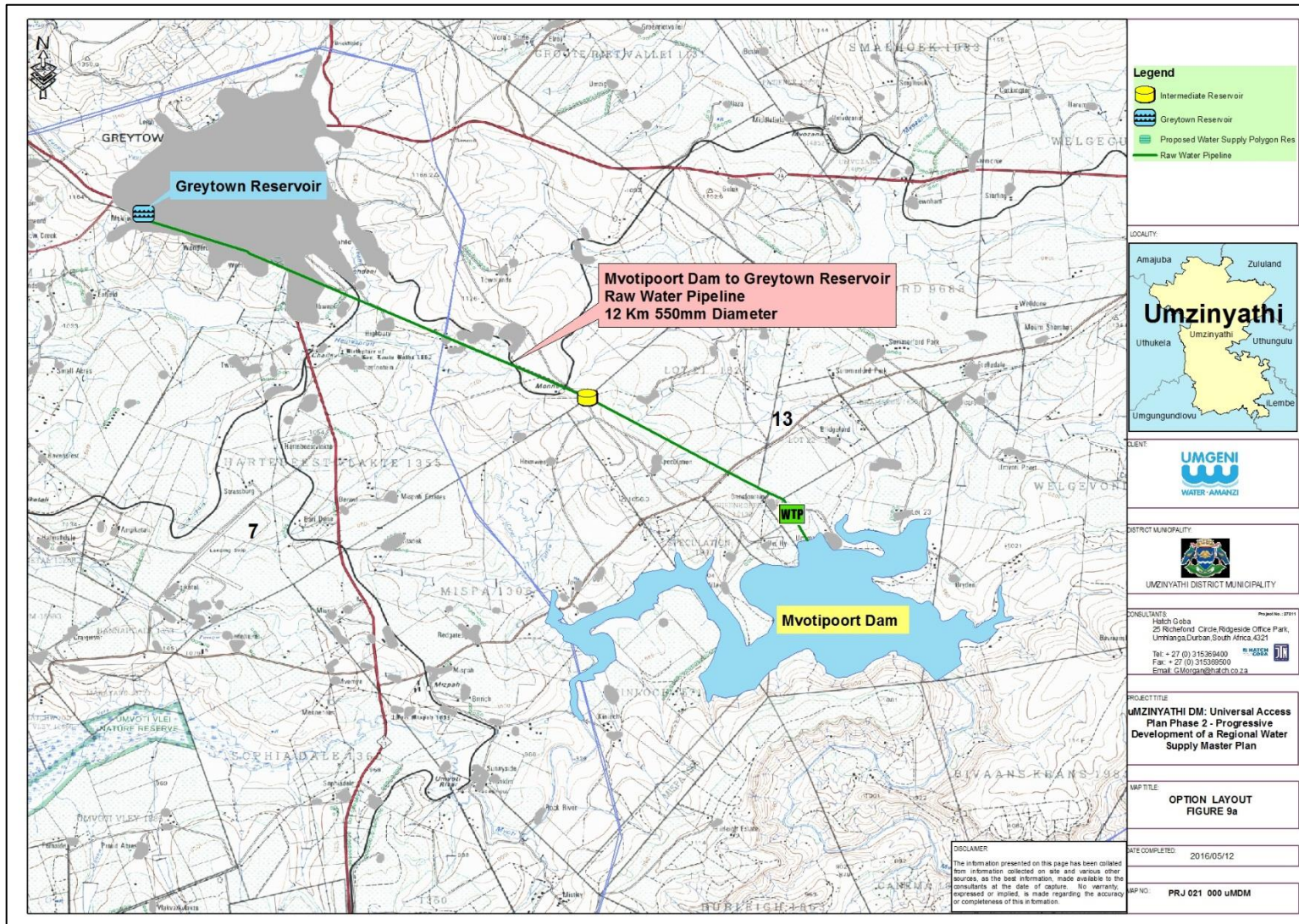
Electricity capital costs excluded

7.3. PROPOSED MVOTIPOORT DAM REGIONAL SCHEME

The long term plan for the Umvoti LM and the Msinga LM south of the Thukela, zones 7 to 15, are two regional schemes namely the proposed Umvoti and existing Muden regional schemes. These schemes are shown in **Figure 9**. The schemes currently use a combination of boreholes, Lake Merthley, Craigieburn Dam and the Mooi River as water sources. The long term plan is to extend the supply from the Greytown water works to supply areas such as Kranskop and Matimatolo, zones 10 to 15. These current water resources are under strain to meet the required water demands and a long term solution to the raw water needs of Umvoti LM is required to support the regional schemes.

The proposed Mvotipoort dam which lies south-east of Greytown at co-ordinates, -29.1409 S, 30.700 E, is one option. A 12 km long, 550mm Ø raw water pipeline will be required from the dam to Greytown Reservoir. The possible pipeline route is shown in **Figure 9a** and longitudinal section in **Figure 9b**. The capital costs for the supply is shown in **Table 14**.





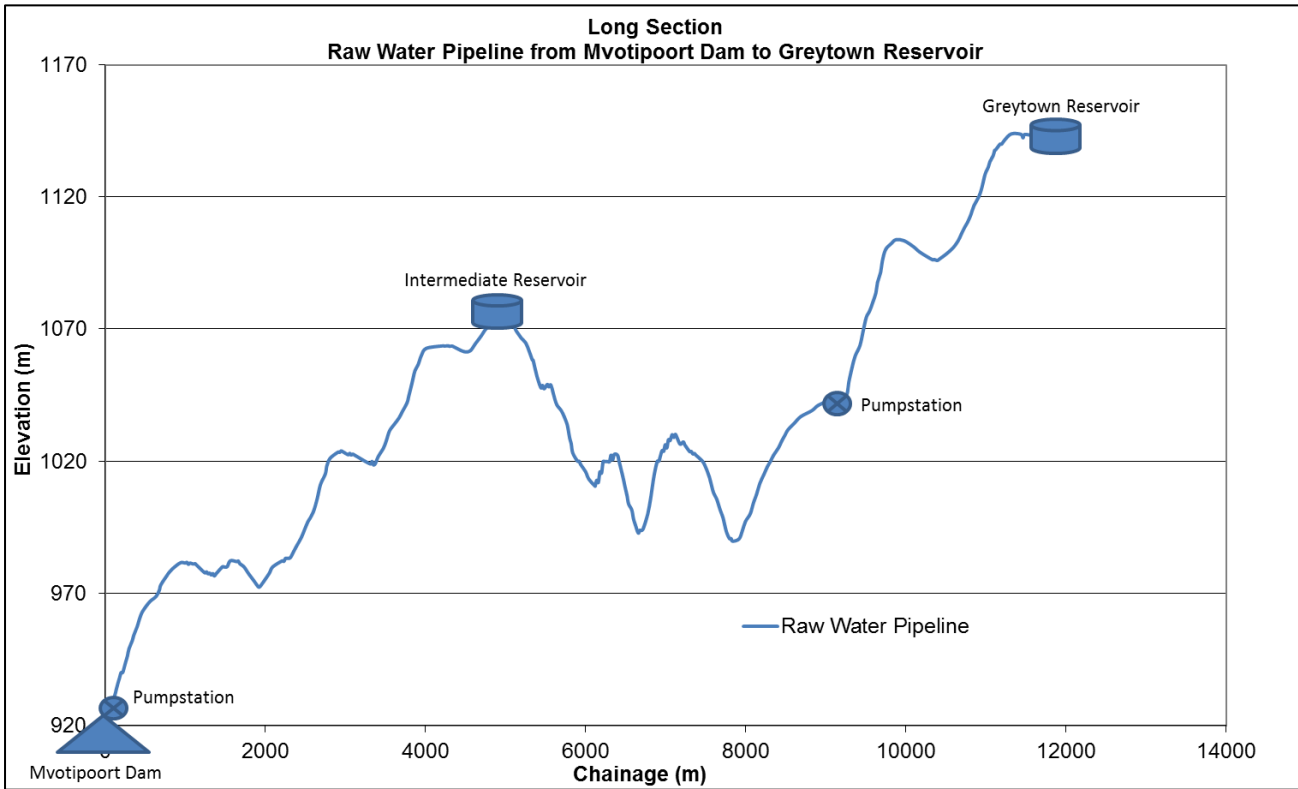


Figure 9b: Long Section – Mvotipoort Dam to Greytown Reservoir

Table 14: Capital Costs - Mvotipoort Dam to Greytown

Consultants	
Design and Tender Documentation	R 81 046 375
Geotech Survey	R 3 000 000
Land Survey	R 96 228
Cathodic Protection	R 5 000 000
Construction Monitoring	R 2 245 320
Construction	
Pipe Supply	R 31 755 240
Pipeline Construction	R 56 589 038
Pipe Bridge/Jack	R 0
Pumpstation	R 66 825 000
Water Works	R 5 346 000
Reservoir	R 0
Dam	R 1 500 000 000
Abstraction	R 40 000 000
Land Acquisition - 7.5%	R 67 538 646
Environmental, Community Liaison	R 10 000 000
Health & Safety, Quality Assurance	R 9 005 153
Project Office	R 31 518 035
Contingencies	R 550 982 517
Sub total	R 1 652 947 552
VAT (14%)	R 231 412 657
Grand total	R 2 692 360 209

Electricity capital costs excluded

7.4. REVIEW OF THE MSINGA BULK WATER SUPPLY SCHEME

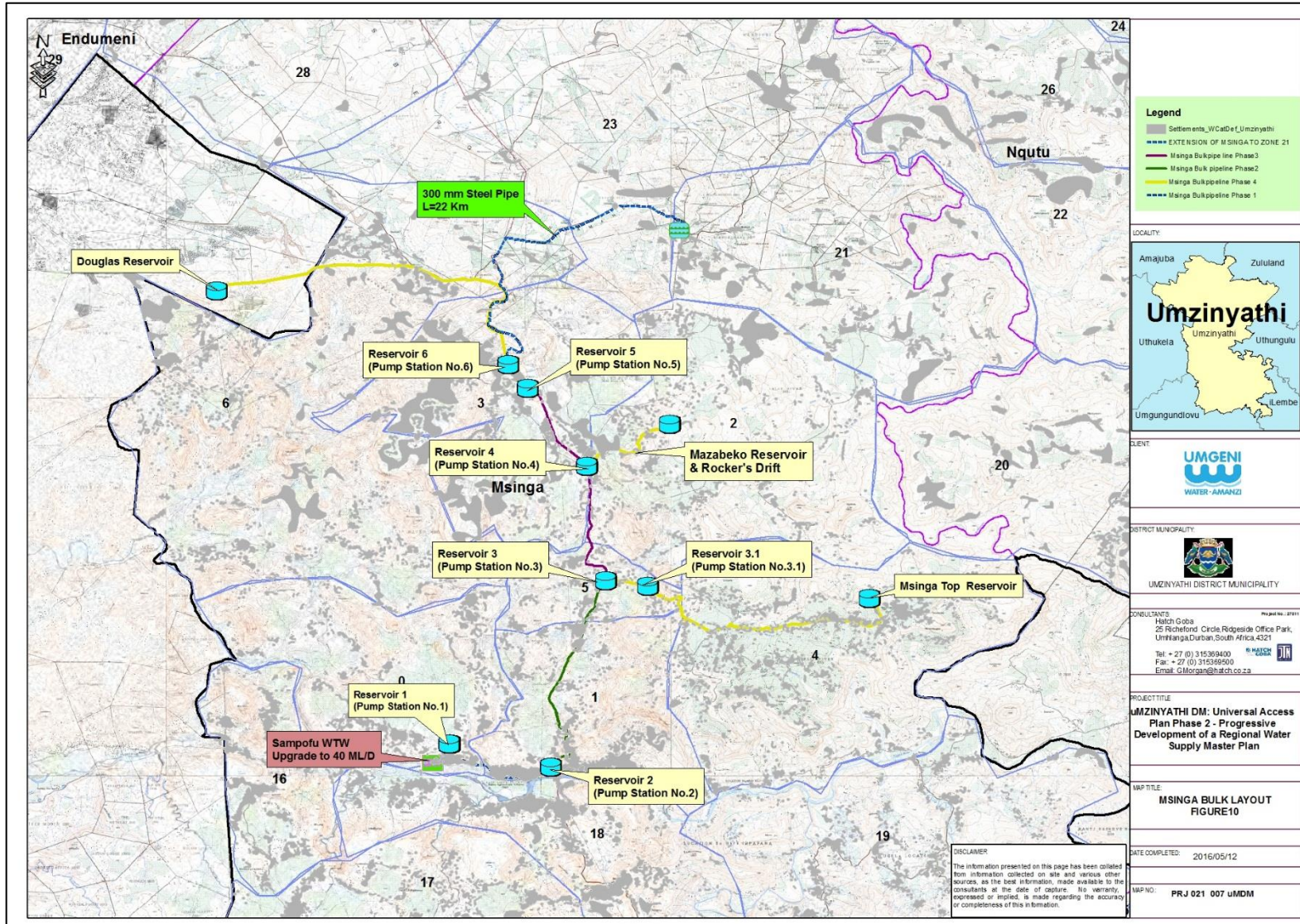
The Sampofu Water Treatment Works (SWTW) is situated at position, -28.7445 S; 30.3822 E, alongside the Thukela River at Tugela Ferry. The works has a capacity of 3 Ml/day. Water is abstracted from the Thukela River and treated at SWTW. Tugela Ferry and areas immediately adjacent to it are supplied from this works.

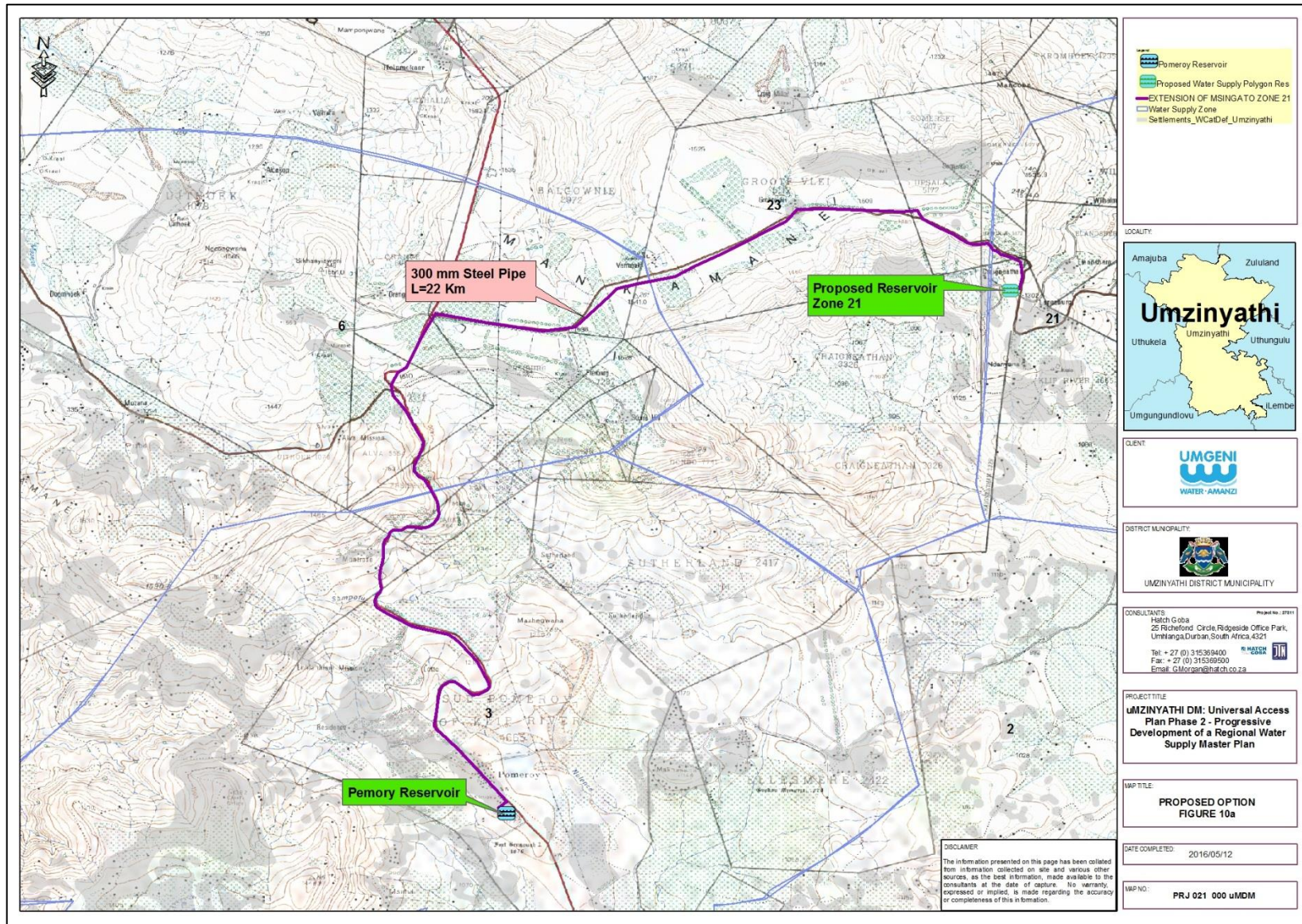
A water resources investigation was carried out by Ibhongo to confirm the yield of the Thukela River at the current abstraction point and to determine the possibility of abstracting additional water. The results of the investigation indicated that 22 Ml/day could be abstracted from the river although this will be at a reduced level of assurance of 97.7%. This is without any raw water storage facility.

The abstraction works and SWTW is currently being upgraded to 14 Ml/day. The intention is to utilise the SWTW to supply the entire of the Msinga LM north of the Thukela River by means of the Msinga Bulk Water Supply Scheme. A layout of the scheme that was received from Ibhongo Consulting is attached in **Annexure A**.

The information from this map was digitised in GIS to confirm the Msinga Bulk Water Supply Scheme footprint to determine whether the entire Msinga LM could be supplied. This is shown in **Figure 10**.

The Msinga Bulk Water Scheme covers Zones 0 to 6 as determined in this UAP Phase 2 study. The total demand of these zones is 20.54 Ml/day. From the layout received from Ibhongo Engineers, it appears that the entire Msinga LM north of the Thukela River will be covered by this scheme which is currently in construction. The 14 Ml/day abstraction works and treatment plan will have to be upgraded at some point in the future, to allow for the long term demand of 22 Ml/day to be met. It will not be possible to supply Zone 20 at Msinga from the Msinga Bulk Scheme due to the topography of this area. The option of extending the Msinga Bulk water supply scheme to cover Zone 21 was investigated and is shown in **Figure 10a**, the longitudinal section is shown in **Figure 10b** and the Capital Costs are presented in **Table 15**. Zones 23 and 28 are relatively sparsely populated and may not be feasible from an economic point of view due to extending the regional schemes to these areas, localised schemes are thus recommended. An option of supply to the northern sections of Zone 23 (Rorkes Drift) from the Dundee Bulk Supply Scheme to Nqutu was investigated and is presented in Section 7.5.





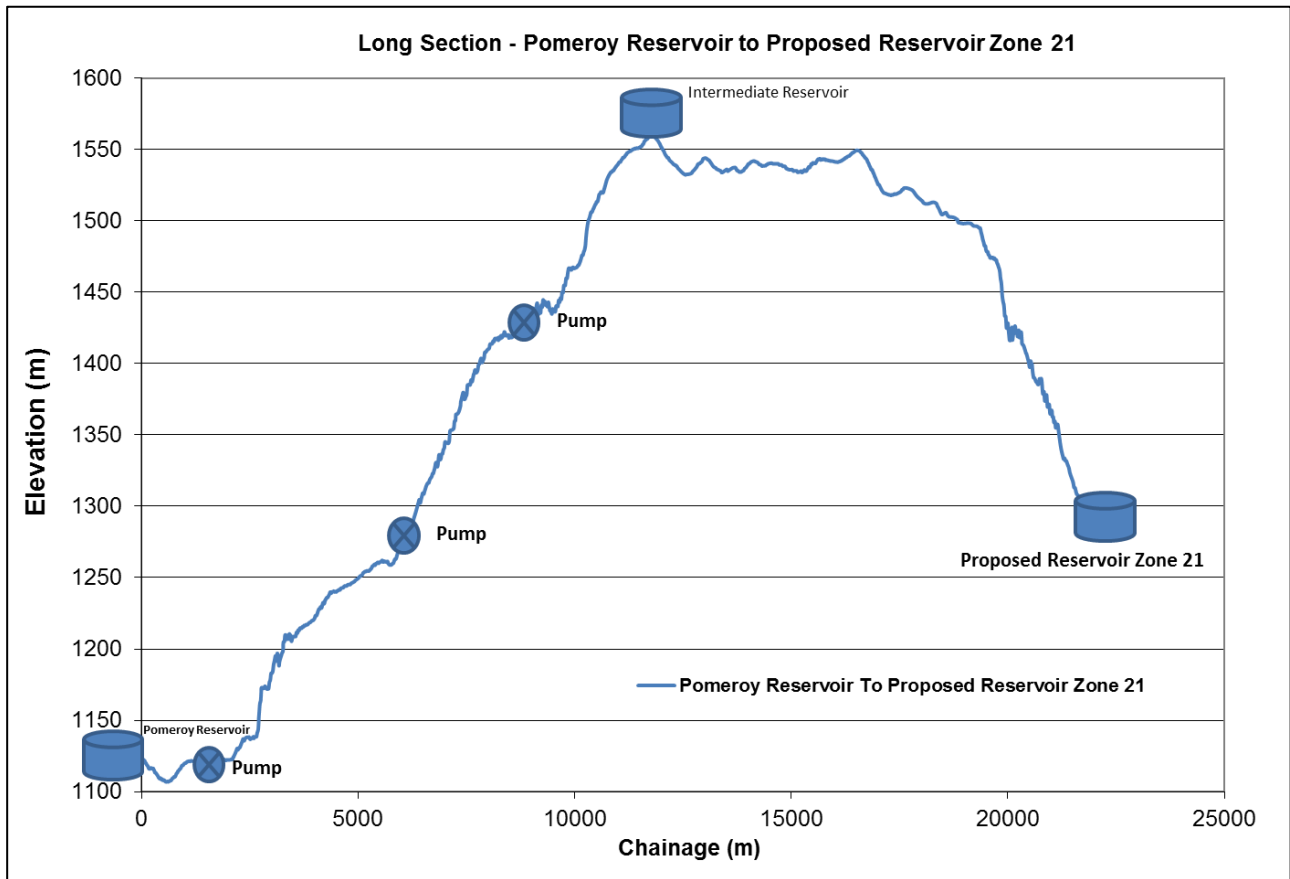


Figure 10b: Long section – Extension to Zone 21

Table 15: Capital Costs – Extension to Zone 21

Consultants	
Design and Tender Documentation	R 11 498 518
Geotech Survey	R 3 000 000
Land Survey	R 176 418
Cathodic Protection	R 5 000 000
Construction Monitoring	R 4 116 420
Construction	
Pipe Supply	R 20 582 100
Pipeline Construction	R 36 678 080
Pipe Bridge/Jack	R 6 000 000
Pumpstation	R 58 806 000
Water Works	R 0
Reservoir	R 5 695 128
Dam	R 0
Abstraction	R 0
Land Acquisition - 7.5%	R 9 582 098
Environmental, Community Liaison	R 5 000 000
Health & Safety, Quality Assurance	R 1 277 613
Project Office	R 4 471 646
Contingencies	R 84 442 011
Sub total	R 253 326 032
VAT (14%)	R 35 465 644
Grand total	R 291 791 676

Electricity capital costs excluded

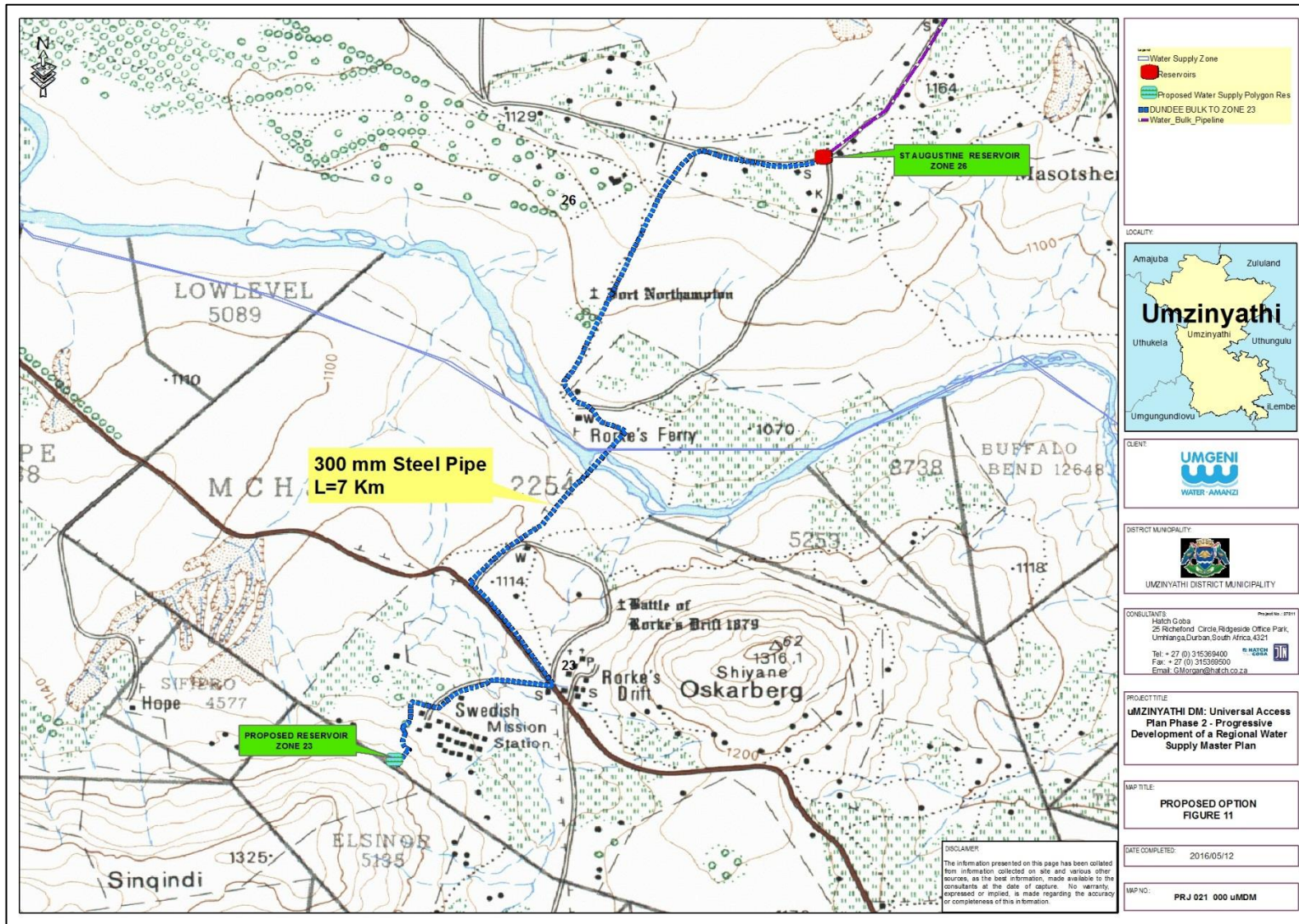
7.5. EXTENSION OF DUNDEE BULK

The Dundee Bulk Water Supply Scheme intends supplying bulk water from the Ntshingwayo dam to Endumeni, Nqutu and Danhauser. Ntshingwayo dam can yield 257 Mℓ/day for supply to these areas (Ibhongo Consulting, 2015).

The Dundee bulk water supply scheme intends supplying bulk water to Dundee, Glencoe areas in Endumeni as well as communities in the Nqutu Local Municipality. An allocation of 32.66 Mℓ/day at Endumeni and 33.45 Mℓ/day for Nqutu has been made in the Dundee bulk scheme. A new treatment works will be built at the Ntshingwayo dam. The existing Biggarsburg WTW that supplies Glencoe and Dundee will be upgraded to supply the Endumeni and Nqutu LM's, Vants drift will be decommissioned. The project is currently in the design phase, a layout plan from Ibhongo Consulting of the option considered for the scheme and the final recommended option is attached in **Annexure A**.

The Dundee bulk scheme adequately covers both Dundee and Nqutu LM's, supply zones 28, 29, 30, 20, 22 and 24 to 27. No further bulk water schemes are thus required.

The extension to zone 23 is shown in **Figure 11** and the longitudinal section is shown in **Figure 11a**. The capital cost for the raw water and potable water supply are shown in **Table 16**.



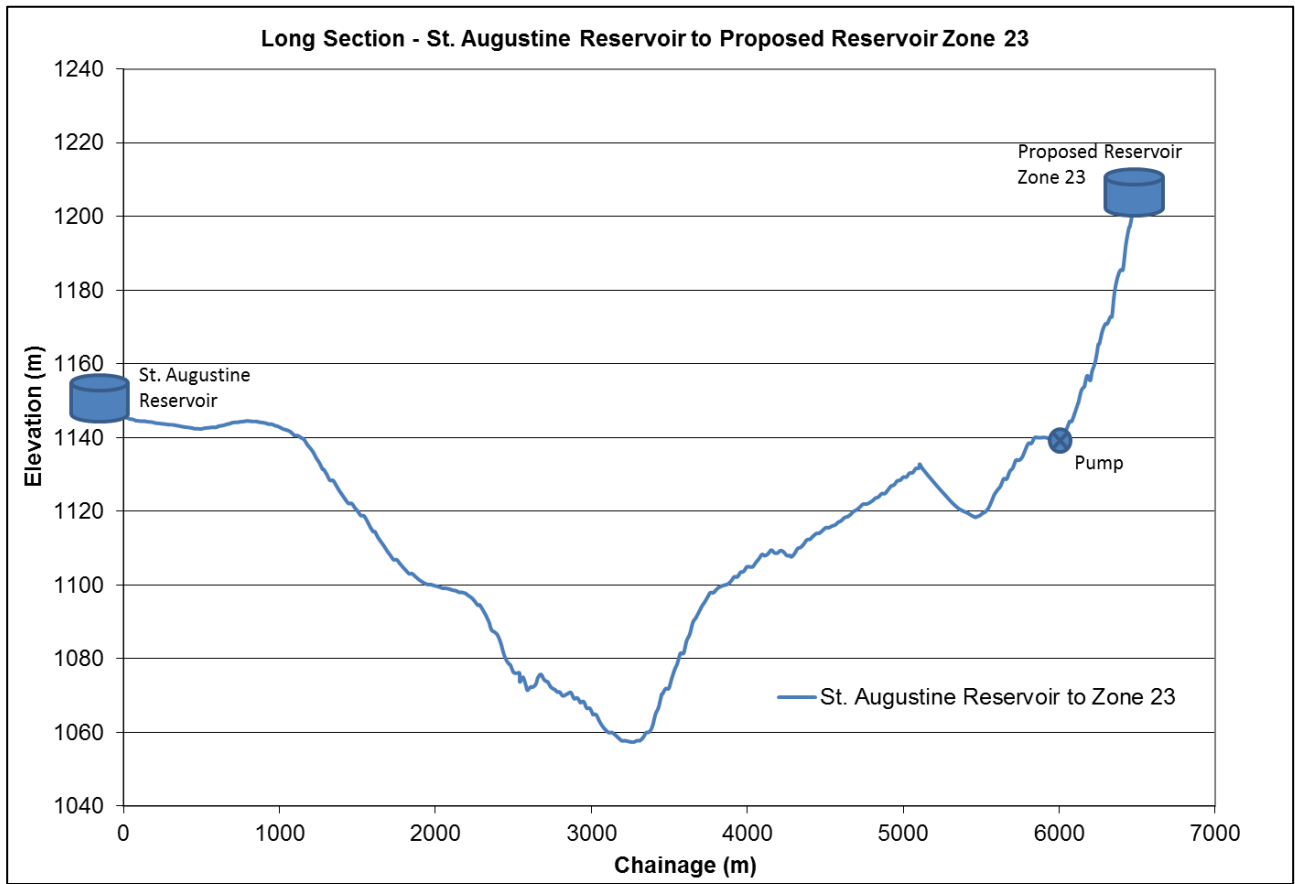


Figure 11a: Long section – Extension to Zone 23

Table 16: Capital Costs – Extension to Zone 23

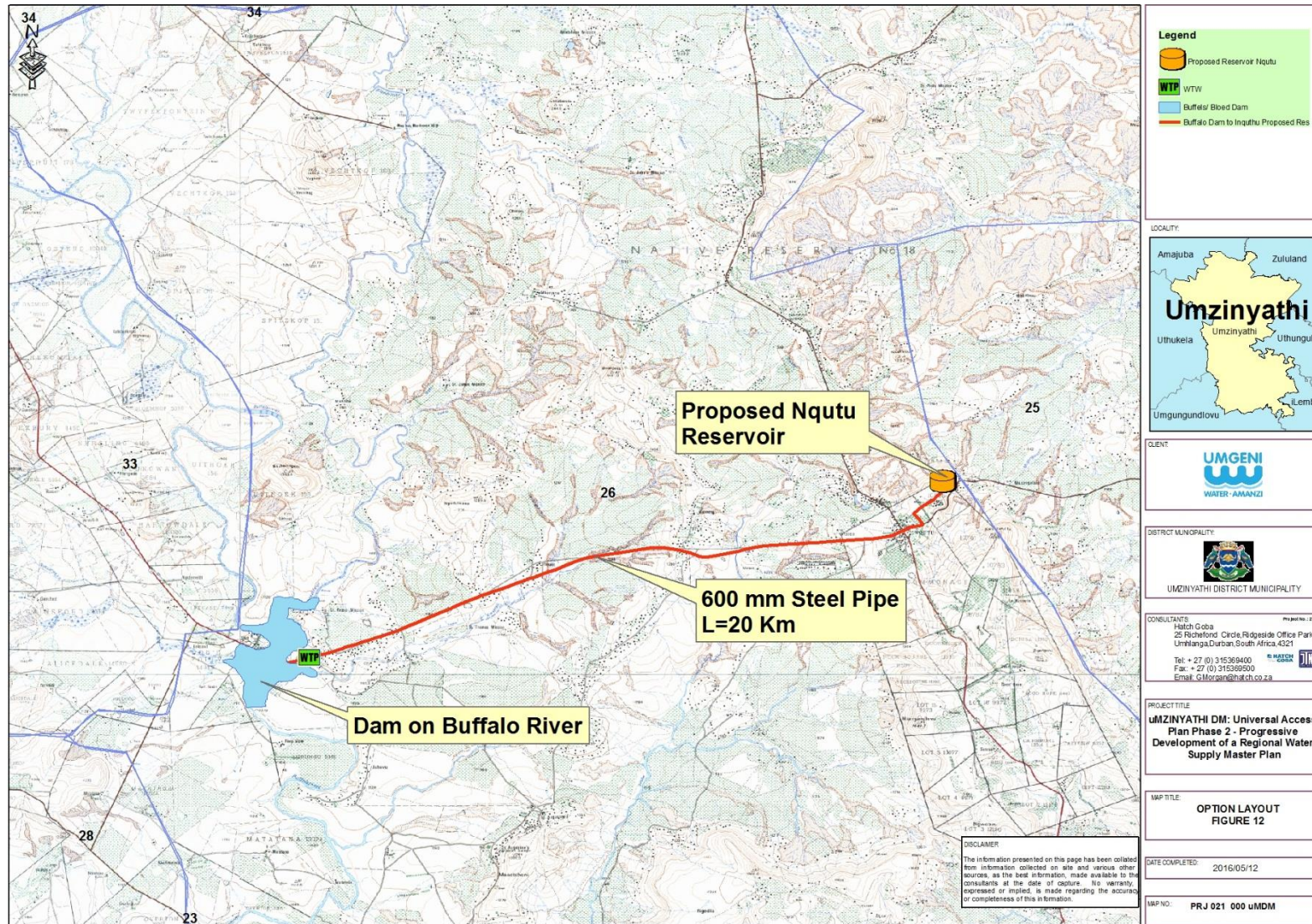
Consultants	
Design and Tender Documentation	R 4 276 316
Geotech Survey	R 3 000 000
Land Survey	R 56 133
Cathodic Protection	R 5 000 000
Construction Monitoring	R 1 309 770
Construction	
Pipe Supply	R 6 548 850
Pipeline Construction	R 11 670 298
Pipe Bridge/Jack	R 6 000 000
Pumpstation	R 14 701 500
Water Works	R 0
Reservoir	R 8 593 978
Dam	R 0
Abstraction	R 0
Land Acquisition - 7.5%	R 3 563 597
Environmental, Community Liaison	R 5 000 000
Health & Safety, Quality Assurance	R 475 146
Project Office	R 1 663 012
Contingencies	R 34 429 301
Sub total	R 103 287 902
VAT (14%)	R 14 460 306
Grand total	R 120 748 208

Electricity capital costs excluded

7.6. DAM ON THE BUFFALO RIVER

A proposed dam downstream of the confluence of the Buffalo and Blood Rivers that will supply the entire Nqutu LM (Zones 20, 22, 24 to 27). This dam is at position -28.2591 S; 30.5048 E.

A 20 km long, 600mm Ø raw water pipeline will be required from the dam to Nqutu Proposed Reservoir. The possible pipeline route and position of the dam is shown in **Figure 12**. The longitudinal section of the raw water pipeline to the proposed reservoir at Nqutu is shown in **Figure 12a** and the capital costs for this option are shown in **Table 17**.



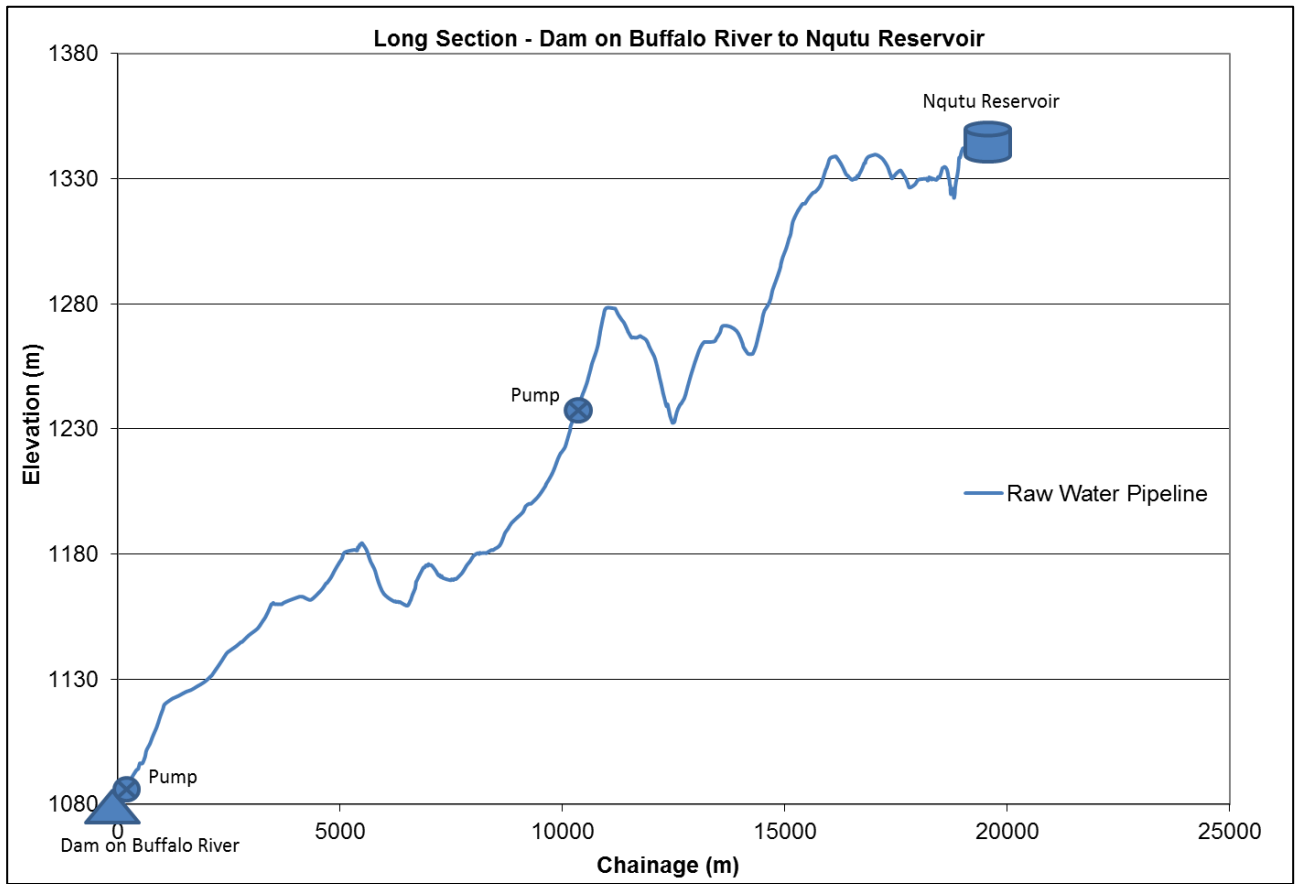


Figure 12a: Long section – Dam on the Buffalo River

Table 17: Capital Costs – Dam on the Buffalo River

Consultants	
Design and Tender Documentation	R 77 493 273
Geotech Survey	R 3 000 000
Land Survey	R 160 380
Cathodic Protection	R 5 000 000
Construction Monitoring	R 3 742 200
Construction	
Pipe Supply	R 52 925 400
Pipeline Construction	R 94 315 063
Pipe Bridge/Jack	R 120 000 000
Pumpstation	R 88 209 000
Water Works	R 5 346 000
Reservoir	R 70 240 907
Dam	R 350 000 000
Abstraction	R 80 000 000
Land Acquisition - 7.5%	R 64 577 728
Environmental, Community Liaison	R 5 000 000
Health & Safety, Quality Assurance	R 8 610 364
Project Office	R 30 136 273
Contingencies	R 529 378 294
Sub total	R 1 588 134 882
VAT (14%)	R 222 338 884
Grand total	R 1 810 473 766

Electricity capital costs excluded

RECOMMENDATIONS

- The Msinga Bulk Scheme is currently in implementation. This scheme will address bulk water supply requirements to the Msinga LM north of the Thukela River. The option of extending this scheme further north to supply Zone 21 was investigated. This option requires three stage pumping and thus not recommended for further investigation.
- The option of extending the Msinga Bulk Scheme south of the Thukela River towards Keates Drift will require pumping heads of over 500m. This will involve high capital and O&M costs. No further investigations into this option are thus recommended.
- The Umvoti LM requires a long term raw water resource augmentation that will support the Umvoti Regional Scheme that will supply Greytown, Matimatolo and Kranskop. It is recommended that a detailed feasibility study of the Mvotipoort Dam be undertaken to supply this scheme and to also provide downstream storage for the Ilembe DM
- The water resource availability in the Mgeni catchment will affect supply further to the Umvoti Catchment and Greytown. It is however recommended that a feasibility study be undertaken into the extension of the Umshwathi Regional scheme to supply the Umvoti Regional Scheme with the option of reverse flow at some point in the future when the development of the Mvotipoort Dam together with an upgraded treatment works at Greytown becomes feasible.
- The Dundee Bulk Scheme is in the detailed feasibility phase and the project business plan is due to be presented to DWS at the end of June 2016. The intention of the scheme is to supply the Endumeni and Nqutu LMs with bulk water. A dam on the Buffalo River has been proposed by uThukela Water as an option to supply the Nqutu LM with bulk water. It is recommended that this option be investigated in detail should the Dundee Bulk option to supply Nqutu LM not be approved by DWS.

REFERENCES

- Affairs, D. o. (2011). *First Stage Reconciliation Strategy for Kranskop Water Supply Scheme Area - uMvoti LM*. Pretoria: Department of Water Affairs.
- Affairs, D. o. (2011). *First Stage Reconciliation Strategy for Muden Water Supply Scheme Area - uMvoti LM*. Pretoria: Department of Water Affairs.
- Affairs, D. o. (2011). *First Stage Reconciliation Strategy for Nqutu Water Supply Scheme Area - Nquthu LM*. Pretoria: Department of Water Affairs.
- Affairs, D. o. (2011). *First Stage Reconciliation Strategy for Tugela Ferry Water Supply Scheme Area - Masinga LM*. Pretoria: Department of Water Affairs.
- Affairs, D. o. (2011). *Reconciliation Strategy for Greytown Water Supply Scheme Area - uMvoti LM*. Pretoria: Department of Water Affairs.
- Affairs, D. o. (2012). *Greytown Water Supply Scheme: Lake Merthley and Boreholes Decision Support System*. Pretoria: Department of Water Affairs.
- Affairs, D. o. (2014). *Update of the Water Reconciliation Strategy of the Dundee/Glencoe Supply Area - 2012 to 2040*. Pretoria: Department of Water Affairs.
- Affairs, D. o. (2014). *Update of the Water Reconciliation Strategy of the Greytown Supply Area - 2012 to 2040*. Pretoria: Department of Water Affairs.
- Affairs, D. o. (2014). *Update of the Water Reconciliation Strategy of the Nqutu Supply Area - 2012 to 2040*. Pretoria: Department of Water Affairs.
- Affairs, D. o. (2014). *Update of the Water Reconciliation Strategy of the Pomeroy Supply Area - 2012 to 2040*. Pretoria: Department of Water Affairs.
- Affairs, D. o. (2014). *Update of the Water Reconciliation Strategy of the Sampofu Supply Area - 2012 to 2040*. Pretoria: Department of Water Affairs.
- Consulting, I. (2015). *Dundee Bulk Water Supply Scheme*. Durban: Ibhongo Consulting.
- Consulting, I. (2015). *Msinga Bulk Water Supply Scheme*. Durban: Ibhongo Consulting.
- Consulting, Z. (2008). *Ndaya Bulk Water Supply Scheme*. Pietermaritzburg: Umzinyathi District Municipality.
- Department of Water Affairs. (2011). *First Stage Reconciliation Strategy for Dundee/Glencoe Water Supply Scheme Area - Endumeni LM*. Pretoria: Department of Water Affairs.
- Engineers, S. C. (2011). *uMvoti/Craigieburn Business Plan*. Pietermaritzburg: Municipality, Umzinyathi District.
- Municipality, U. D. (2007). *Keates Drift Feasibility Report*. Pietermaritzburg: Umzinyathi District Municipality.
- Municipality, U. D. (2015). *Muden Regional Water Supply Scheme*. Dundee: Umzinyathi District Municipality.

Sektor. (2013). *Matimatolo Regional Water Supply Scheme*. Westville: Municipality, Umzinyathi District.

Statistics South Africa Census. (2011). *Household Services_Small Areas*.

uThukela Water. (2011). *uThukela Water Bulk Water Services Masterplan*. Jeffares & Green.

APPROVAL

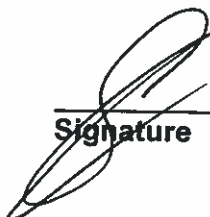
Approval of report:

P. S. MATHANAJ
JTN Consulting representative


Signature

24/06/2016
Date

G. Morgan
Hatch Goba representative


Signature

24/06/2016
Date

Umgeni Water representative

Signature

Date

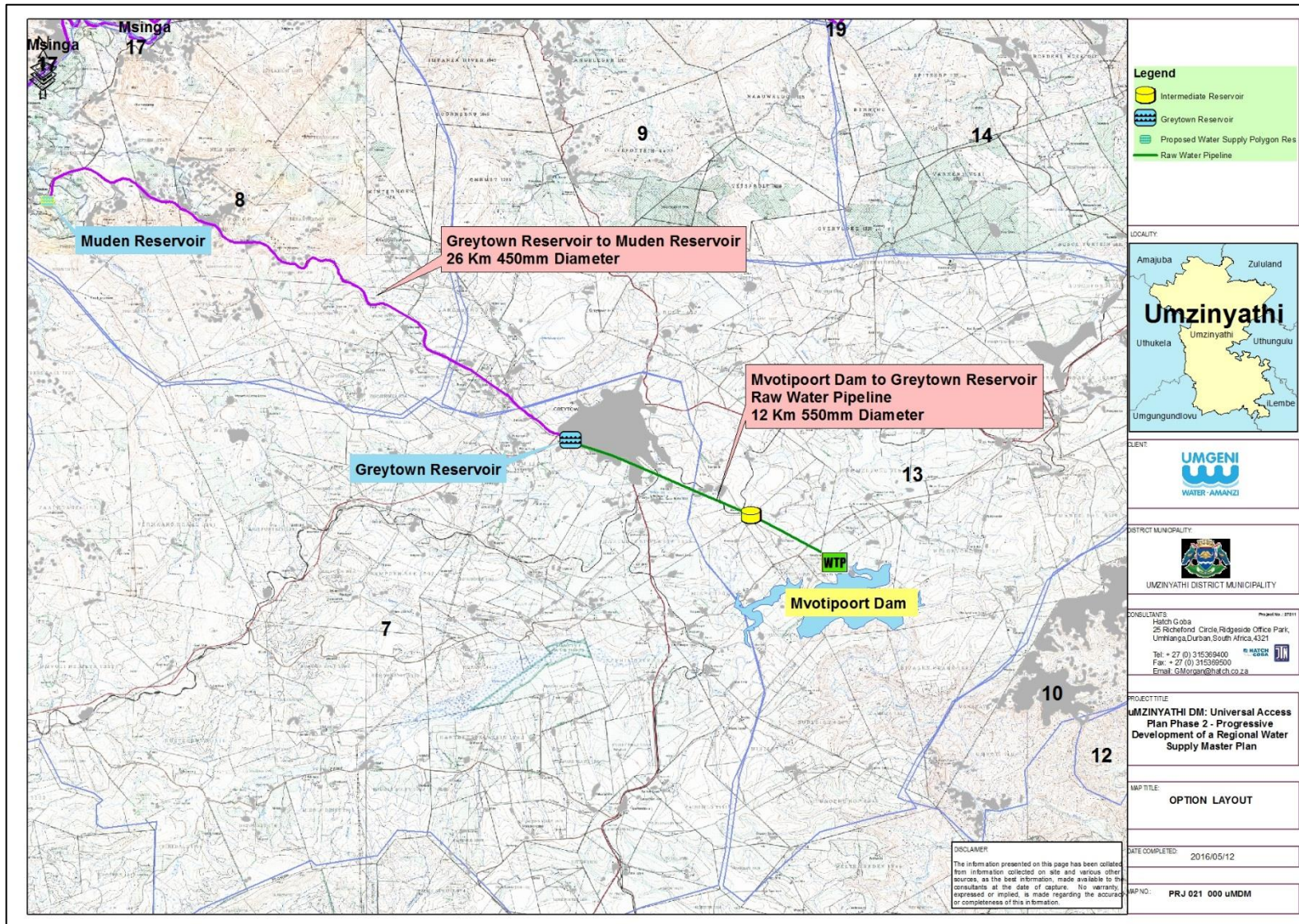


APPENDICES

ANNEXURE A: NON-PREFERRED OPTION

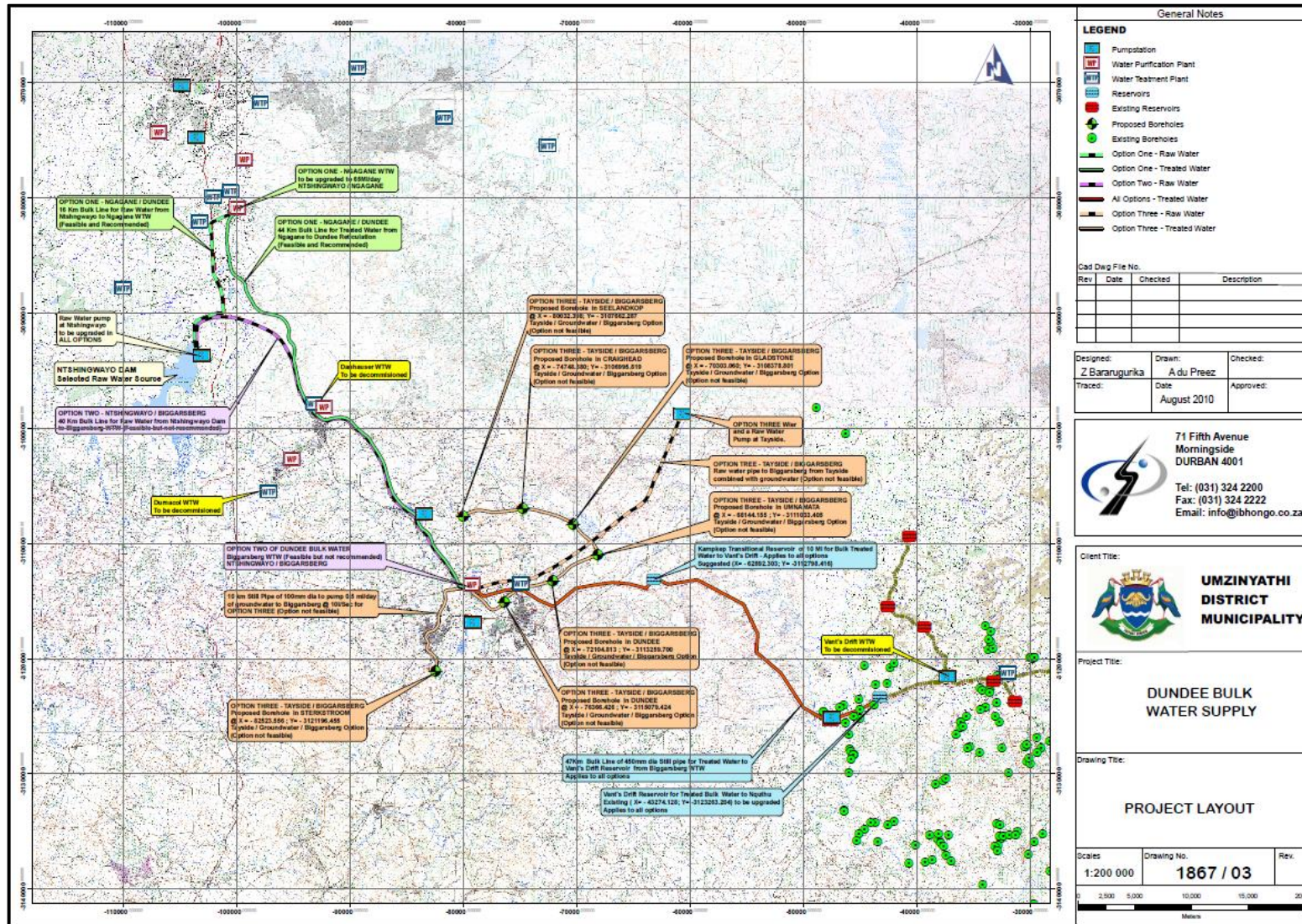
As an extension to section 7.3 where the proposed Mvotipoort Dam supplies the Greytown Reservoir within the Mvoti Regional Scheme, a 26 km long, 450 Ø from Greytown Reservoir to Muden WTW will allow bulk water supply to the Muden Regional Water Supply Scheme. See figure below.

This option was not preferred due to the Muden Regional Scheme having sufficient yield at the abstraction point on the Mooi River with a storage facility. In addition, releases from Spring Grove Dam will supplement the scheme when required in the long term.



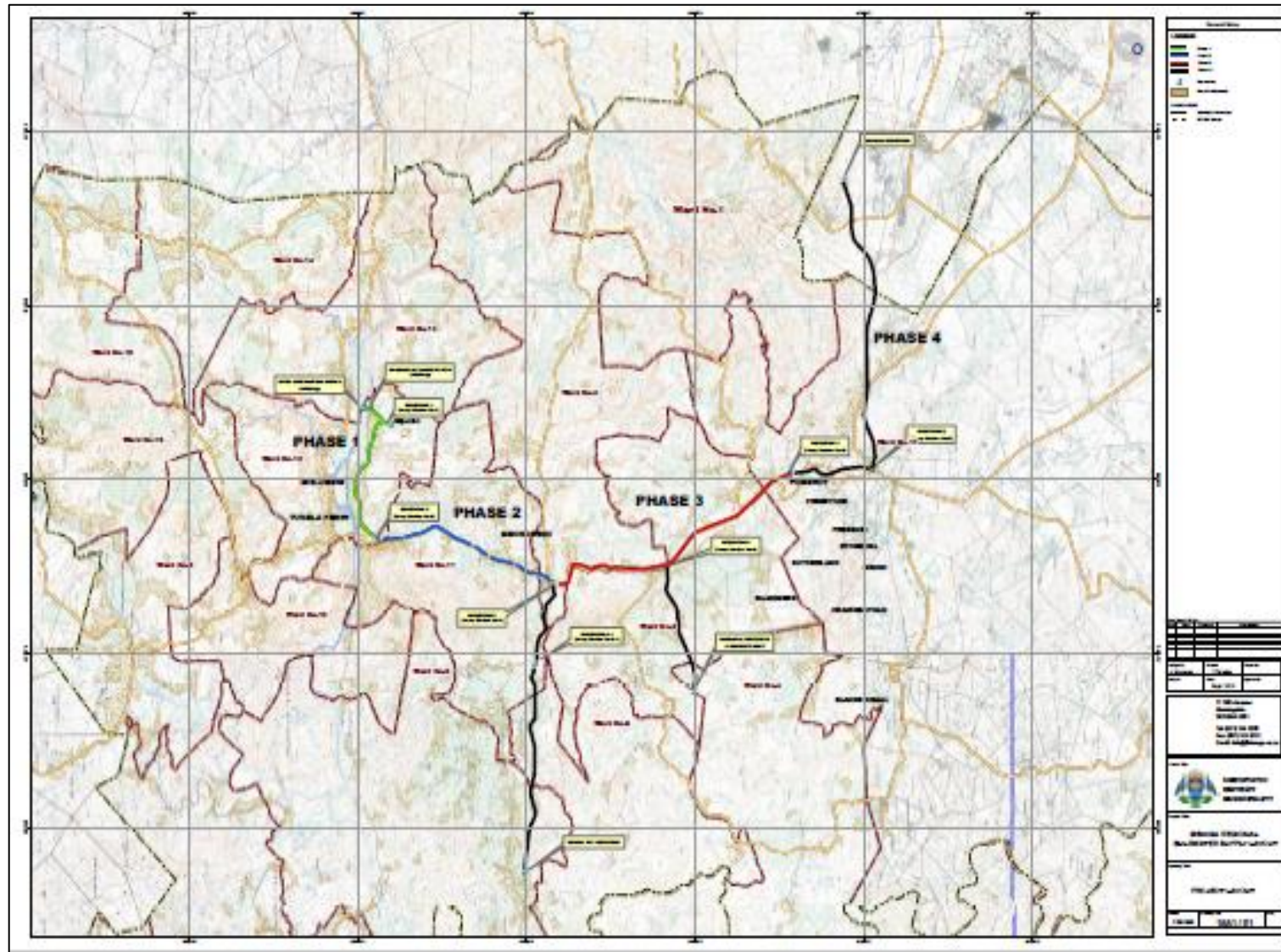


ANNEXURE B: DUNDEE BULK LAYOUT





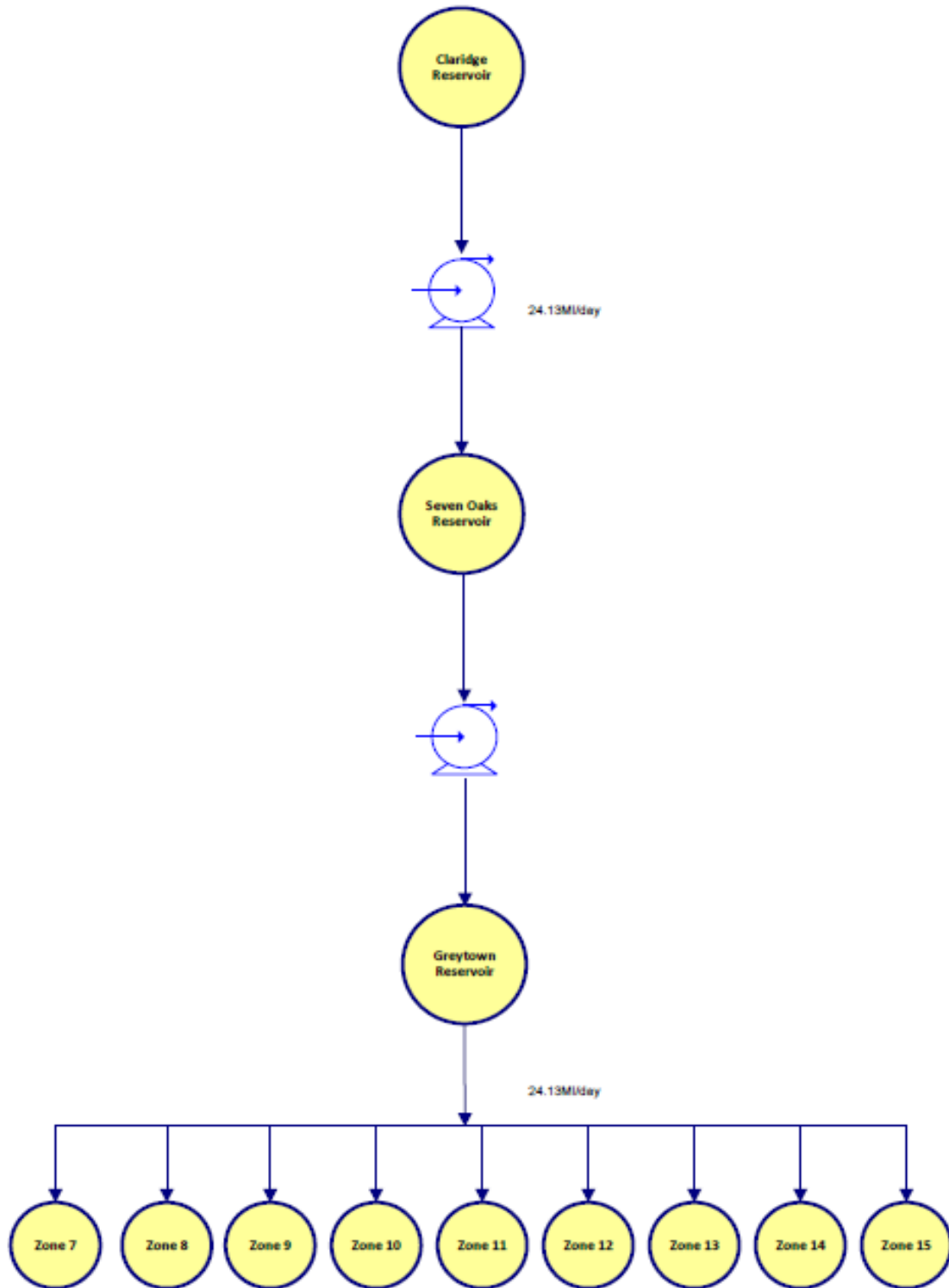
ANNEXURE C: MSINGA LAYOUT





ANNEXURE D: OPTIONS SCHEMATICS

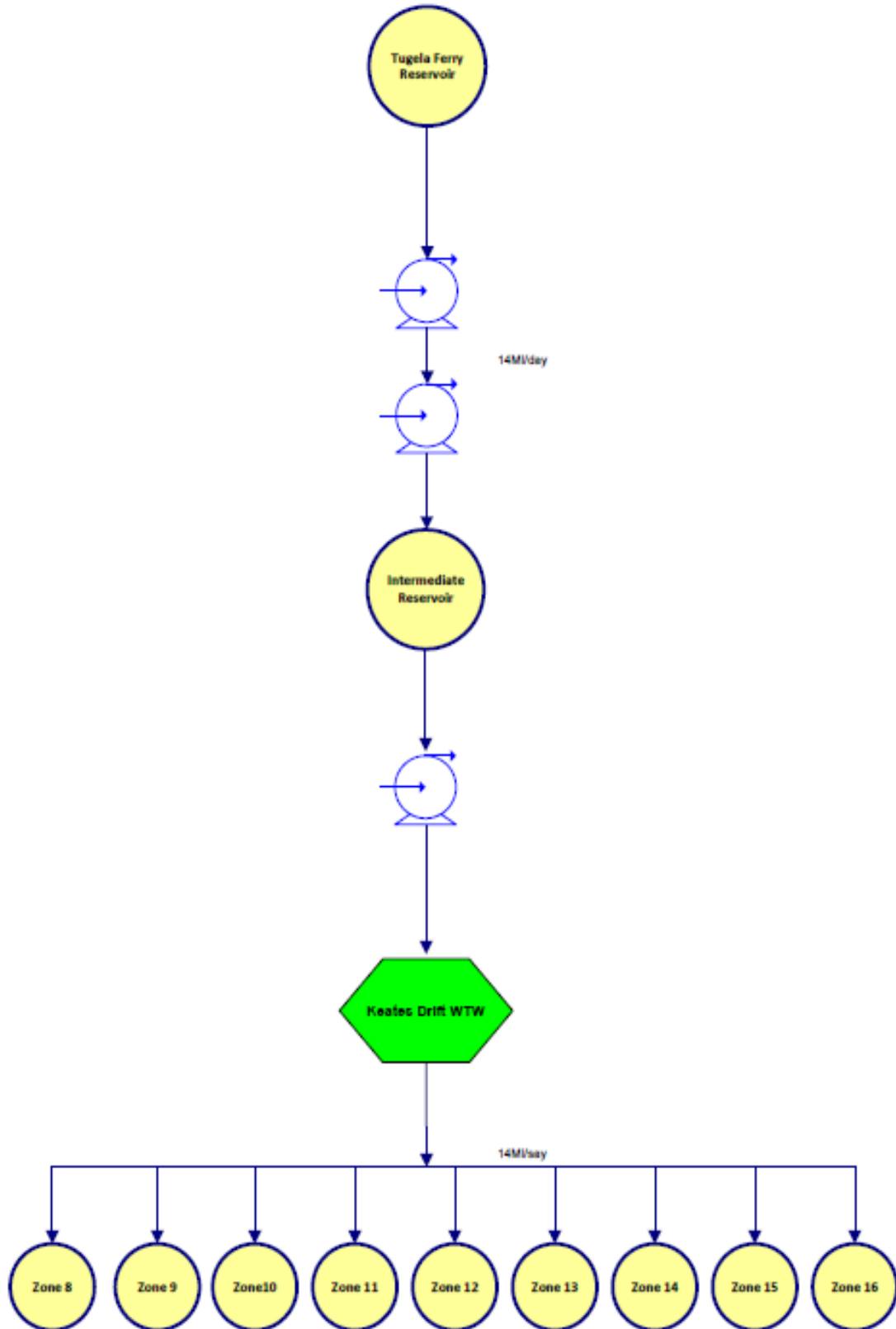
**Universal Access Plan for Water Services Phase 2: Umzinyathi District Municipality
UMZINYATHI: OPTION 1**



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Universal Access Plan for Water Services Phase 2: Umzinyathi District Municipality

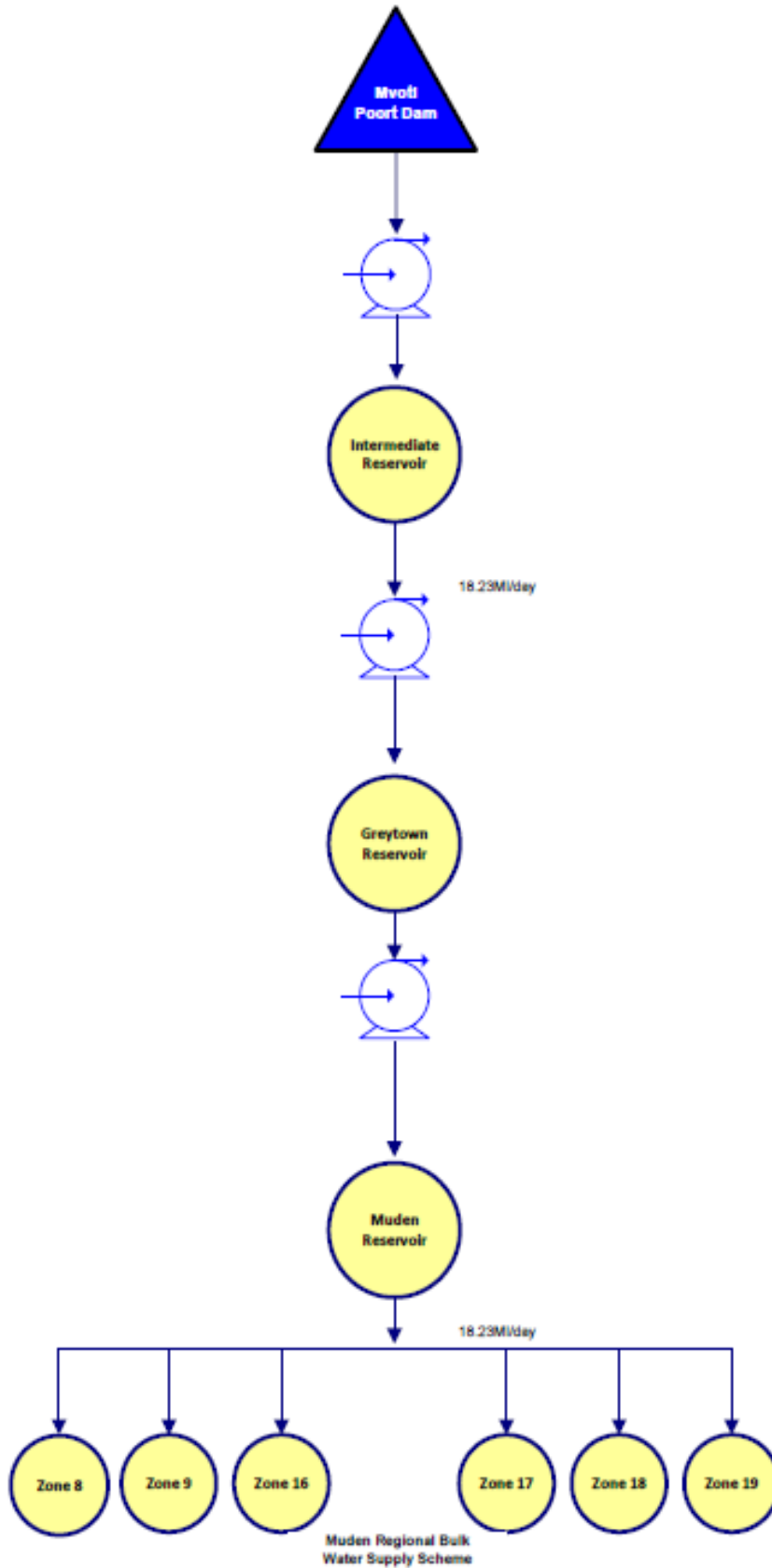
UMZINYATHI: OPTION 2



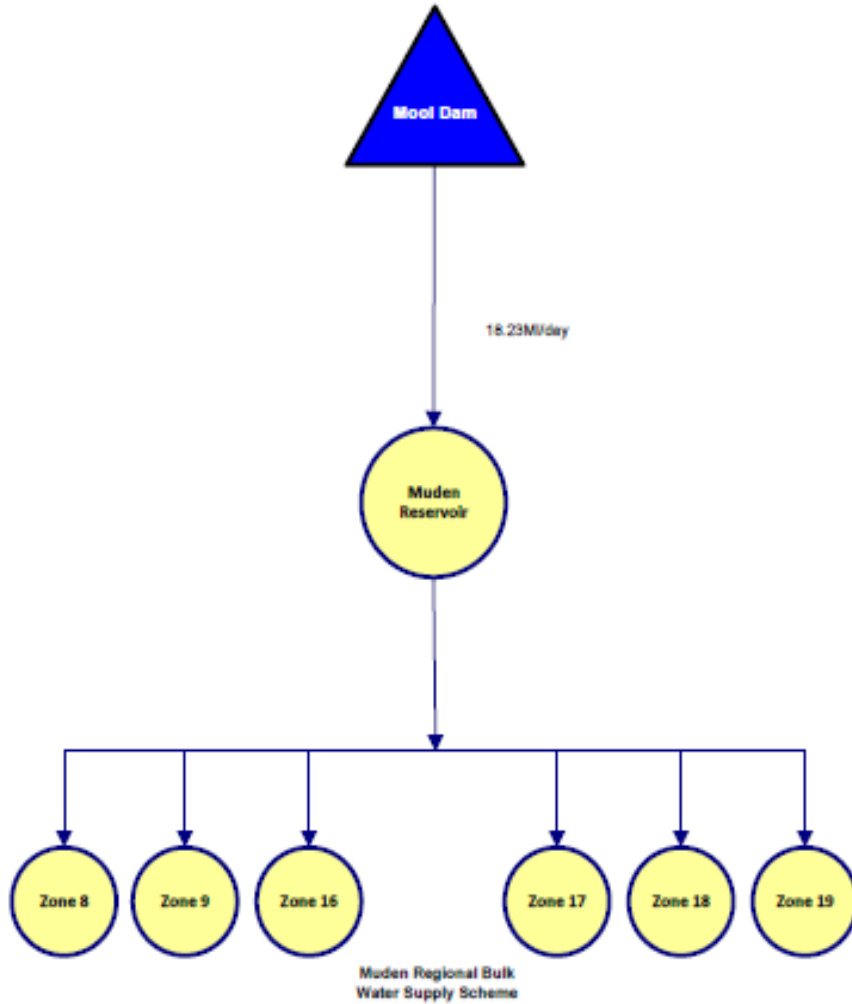
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Universal Access Plan for Water Services Phase 2: Umzinyathi District Municipality

UMZINYATHI: OPTION 3

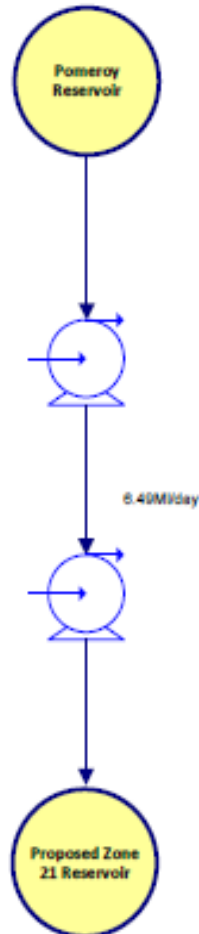


Universal Access Plan for Water Services Phase 2: Umzinyathi District Municipality
UMZINYATHI: OPTION 4



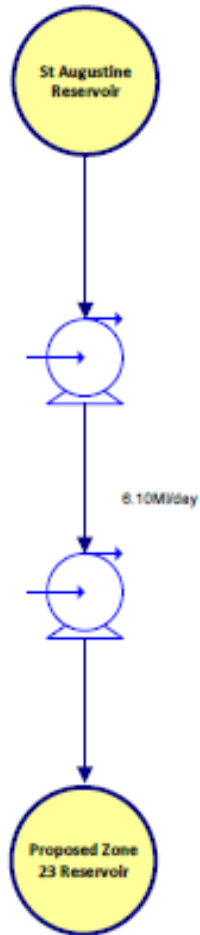
Universal Access Plan for Water Services Phase 2: Umzinyathi District Municipality

UMZINYATHI: OPTION 5



Universal Access Plan for Water Services Phase 2: Umzinyathi District Municipality

UMZINYATHI: OPTION 6





ANNEXURE E: OVERALL LAYOUT PLAN OF OPTIONS

