CITY OF UMHLATHUZE

UPGRADE OF WATER SUPPLY INFRASTRUCTURE FOR NTAMBANANA SUPPLY AREA (UPPER NSELENI SUPPLY)

FEASIBILITY REPORT (REV 1)

MARCH 2022

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UPGRADE OF WATER SUPPLY INFRASTRUCTURE FOR NTAMBANANA SUPPLY AREA

FEASIBILITY REPORT

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UPGRADE OF WATER SUPPLY INFRASTRUCTURE FOR NTAMBANANA SUPPLY AREA

FEASIBILITY REPORT (REV 1)

EXECUTIVE SUMMARY

This project is for an extension of the existing water supply scheme originally named Khoza Water Supply. This project is now called Upgrade of Water Supply Infrastructure for Ntambanana Water Supply Area. The project is located in the north west part of City of uMhlathuze which is approximately 5km form Empangeni town and can be accessed via R34 and through Nseleni township. This project will serve council wards 24, 31, 31 and 33.

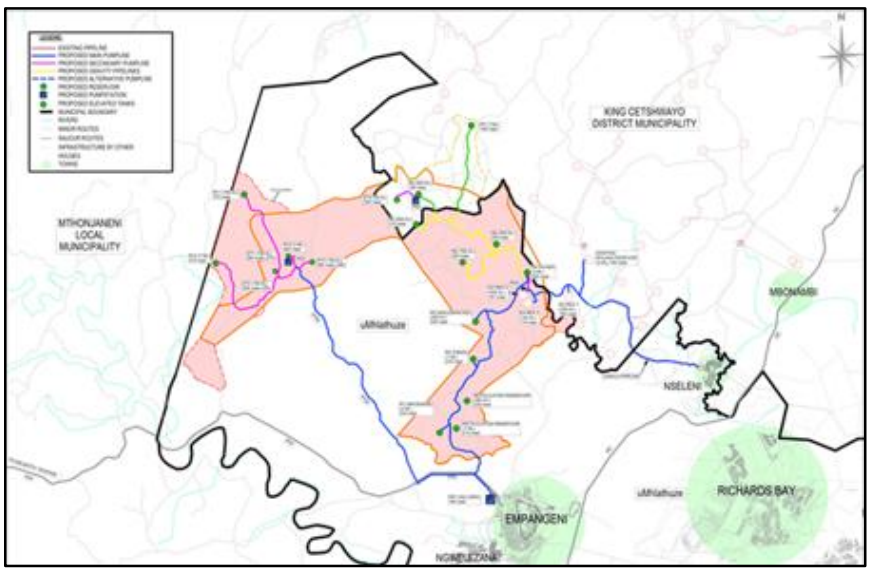
The project area was previously served by King Cetshwayo District Municipality which is a Water Service Authority (WSA). This are was within Ntambanana Local Municipality which was dissolved I September 2012 and absolved by City of uMhlathuze whom is also a WSA. This are according to Census 2011 has 75% dependency ratio and 49% unemployment rate and is regarded as of the poorest areas.

A number of funding applications were lodged for this area by King Cetshwayo District Municipality to supply the project are with a water demand of 25ℓ/c/d. The project area is experiencing a number of water challenges, those being:

- Design philosophy adopted was uneconomical.
- Water interruptions which has created dissatisfaction to the community whom has affected illegal connections.
- Water source was unreliable and was shared with a number of water schemes.
- Poor water management with no individual household wate meter installed to control water leakage and to manage water losses.

The project was redesigned with a correct design philosophy where topography was divided into specific reservoir supply zones and the reticulation form each reservoir zone independently. A water reconciliation strategy for Richards Bay and surrounding towns undertaken by DWS was implemented where reliable source was developed and implemented. A detailed assessment fo a water source was undertaken to this project. Water source to this project is from eMpangenin which utilises 22Mℓ/d with an infrastructure which has a capacity of 37Mℓ/d with a spare capacity of 7.2Mℓ/d. Water demand to this project being Ntambananan Water Supply Scheme will require a future water demnd of 3Mℓ/d at Hillview as a source to this project. An existing spare capacity of 7.2Mℓ/d is more than enough to supply 3Mℓ/d to this project.

The current population of 29 545 was projected for 20 years with 1% growth rate for a design population of 37 895. A water demand of 75ℓ/c/d was calculated to supply an average annual daily demand of 2 935kℓ/day for this project. An overview map idicaing only the bulk infrastructure is indicated below:



This project needs to be upgraded with a new infrastructure which among others are to construct 79.8km of bulk water pipelines of between 110 dia – 450 to supply specific reservoirs. Installation of 6 pump stations and 12 reservoirs with a total capacity of 7.5Mℓ/d. Reticulationof approximately 395km with metered connections will also form part of the project and will be implemented simultaneously with the bulk but funded separately from MIG Programme.

The following specialist studies on the bulk pipeline have been completed as indicated on the table below:

Planning activity	Status	Remarks
Environmental application	Completed	Environmental authorisations was obtained on 1 November 2019 with reference no.DC/0013/2019
Specialist studies	Completed	Specialist studies such as Vegetation and Wetlands delineation, etc was undertaken and completed as part of the Environmental authorisation
WULA	WULA licence issued	A Water Use licence was obtained on 17 February 2020 with reference no.27/2/2/W612/4/5/24
Pipeline survey	Completed	Undertaken by Biyela MM Geomatics (Pty) Ltd. List of all properties affected, Registration of servitude for existing concrete pipe required and proposed infrastructure.
Geotechnical investigations	Completed	Geotechnical report prepared by Terratest Geotechnical Consultants civil materials testing laboratory dated June 2018.
Preliminary design	Completed	Complete
Power supply application	Power connection approved	Power supply application was approved by the service provider, City of uMhlathuze for a 3 phase with a maximum demand of 800KVA.
Land acquisition	Completed	All private land owners were approached and have agreed to a 6m wide servitude for the pipeline.
Wayleaves	Approved	Wayleave application approvals were obtained from DoT on all road crossings, Transnet for railway crossings and Sasol for a gas pipeline.
Heritage Assessment	Completed	A Heritage assessment was completed on 14 August 2018.
Council Resolution	Approved	Council resolution No.13140 dated 10 April 2019

The project needs to be funded through different funding programmes, those being:

- Own funding : R86,259,038-18 – Specialised studies and Phase 1
- MIG funding : R595,824,495-38 – Reticulation Infrastructure
- RBIG funding : R592,032,337-31 – Bulk Infrastructure
- **Total project amount : R1,187,856,832-70**

The abovementioned project will cost R31,346 per capita and the operations and maintenance cost per annum will be R32,790,000-00. An estimated 290 job opportunities will be created for ± 5 years at a financial input of R90 million to the community.

The project was supported by City of uMhlathuze Council for implementation included as part of the IDP.

UPGRADE OF WATER SUPPLY INFRASTRUCTURE FOR NTAMBANANA SUPPLY AREA

FEASIBILITY REPORT

1. INTRODUCTION

1.1 Project description

This project is for the extension of the existing water supply scheme originally named Khoza water supply in order to supply the Upper Nseleni area and specifically the Ntambanana, Obizo and Macekane areas.

Civtech Engineers (Pty) Ltd before changing their name from Iqaba Engineers (Pty) Ltd which was previously appointed by the City of uMhlathuze to investigate, design and document the Khoza water supply project. Ntambanana water supply is an extention from Khoza water.

1.2 Project title

Upgrade of water supply infrustructuctre for Ntambanana supply areas (Extension to the old Upper Nseleni supply).

1.3 Project objectives

The project objective is to ensure that the basic water are provided to all of the residents within the project area on a continuous and uninterrupted basis, and in the most economically feasible manner possible. This can be achieved through the following:

- Evaluation of existing water supply schemes for extension to include rural areas that were not occupied and serviced previously.
- Evaluation of areas that were previously considered as a rural and specifically Bhucanana, but now urban due to the increased settlement densities. The water supply to these areas must be increased to meet the higher demands, as well as, the increased per capita demand of urban dwellings.
- Water demand of the rural areas must be reviewed and increased (from 25 to 75ℓ/cday) based on higher accepted per capita demands.
- Evaluate and upgrade storage facilities due to the increased water demand, but also to ensure efficient distribution at acceptable pressures.
- Determine the bulk water supply demands in the bulk scheme.
- To empower the community to accept the responsibilities associated with the consumers of a water supply scheme in water loss control, water demand management and to provide employment opportunities in order to improve their living conditions and enhance their economic development.

1.4 Information

The following information and design guidelines were utilized:

- Ntambanana Local Municipality Integrated Development Plans (IDPs) for 2017/2018.
- The “Guidelines for Human Settlement Planning and Design”, dated 2005.
- GIS shape data from the Water Services department of City of uMhlathuze.

Meetings with the City of uMhlathuze maintenance personnel were also conducted on numerous occasions in order to obtain information on operational issues related to the Ntambanana water supply system.

1.5 Previous report

Various investigations and reports compiled in the past have been made available, the following being of relevance:

- The Integrated Development Plan for 2012/13 to 2016/17 for the Mthonjaneni Local Municipality dated June 2012.
- The Greater Khoza Water Supply Master Plan for City of uMhlathuze as prepared by VGC Consulting Engineers of 2003.
- The Greater Khoza Water Supply Design Report for City of uMhlathuze as prepared by VGC Consulting Engineers of 2004.
- The Water Master Plan for Upper Nseleni Water Supply for King Cetshwayo District Municipailty as prepared by Aurecon as part of the Water Services Master Plan Update of 2009.
- Department of Water and Sanitation in association with Aurecon. “First Stage Reconciliation Strategy for Richards Bay Water Supply Scheme Area” June 2011.
- CSIR. “City of uMhlathuze bulk water Master Plan” of February 2014.

In addition information was also obtained from the City of uMhlathuze Technical department, and specifically WSA which information was obtained during meetings in their offices.

1.6 Purpose of this report

The final purpose of the feasibility study report is to evaluate all of the abovementioned and to identify and quantify deficiencies required in improving the efficiency of the bulk water infrastructure and also to act as motivation to secure funds from Regional Bulk Infrastructure Grant (RBIG) national sources to effect the required upgrading.

Once approved by the funder, it will form the guideline along which the project will be designed and implemented of both the bulk and reticulation which will be funded on MIG Pogramme. This application is to address the current need to eradicate water tankers and also to conduct detail design and all other planning requirements.

2. DESCRIPTION OF PROJECT SUPPLY AREA

2.1 Project supply area

2.1.1 Locality

The study area is located in the North West part of the City of uMhlathuze. It is approximately 160km north of Durban and can be accessed via R34 from Empangeni and also R619 from Richards Bay through Nseleni township. The area includes local new council wards such as 24, 31, 32 and 33 of the City of uMhlathuze. The locality of the project in the regional contex is as indicated hereunder.

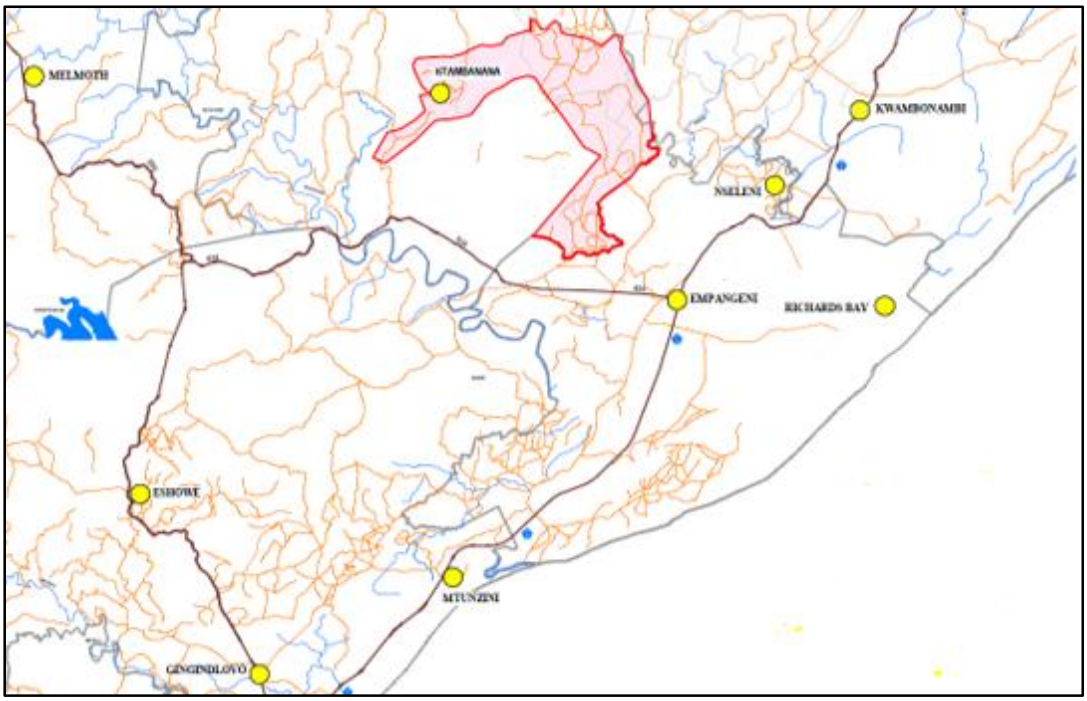


Figure 1

This area is embraced with meandering valleys which house numerous rivers flowing either towards the Umflolozi River in the north or the Umhlathuze River to the south .The biggest proportion of the project area is predominantly within the Obuka, Somopho, Obizo and Mambuka Traditional Authorities.

The location of the project area is indicated on the plan attached hereto and mentioned as **Annexure A**.

2.1.2 Typography & Geology

The typography of the study area is bit undulating varying between ± 60m and 400m AMSL. The geology consist of Mafic/basic lavas and compact arenaceous and argillaceous strata. (According to “Vegter dataset))

2.1.3 General description

Ntambanana Local Municipality was dissolved in September 2016 and absorbed by the neighbouring municipalities such as Mthonjaneni, Mbonambi and also a larger portion into City of uMhlathuze.

Ntambanana was originally located within the jurisdiction of King Cetshwayo District Municipality as the Water Services Provider and Water Services Authority, which responsibility had to be shifted to City of uMhlathuze. On the most recent Master Plan undertaken by King Cetshwayo District Municipality (KCDM) for water supply to Ntambanana, Obizo and Macekane areas are denoted as sub-supply areas 2, 4, 5 and 6 of their Master Plan.

The study area has been declared and rated as the poorest areas in the Municipality. According to Census 2011 this area has 79% dependency ratio and 49% unemployment rate. Ntambanana Municipality was faced with the challenge of improving the quality of life of its communities, most of whom, who are illiterate, very poor, unemployed or earn very little income and also very poor water supply to the area. These challenges were automatically shifted to the City of uMhlathuze whom need to improve the living conditions of this area.

2.2 Historical background

2.2.1 Development of Upper Nseleni water supply scheme

The original Water Supply Master Plan for King Cetshwayo District Municipality (KCDM) identified that a scheme known as the Upper Nseleni water supply scheme which was located to the north of the Nseleni township and included Obizo, Ntambana and Bhucanana. The source of the Upper Nseleni water supply scheme was Mzingazi Lake in Richards Bay, where the water was purified and transferred to the Nseleni town, where the water for the Upper Nseleni supply scheme was to be obtained. The original Master Plan layout for KCDM is indicated below as follows:

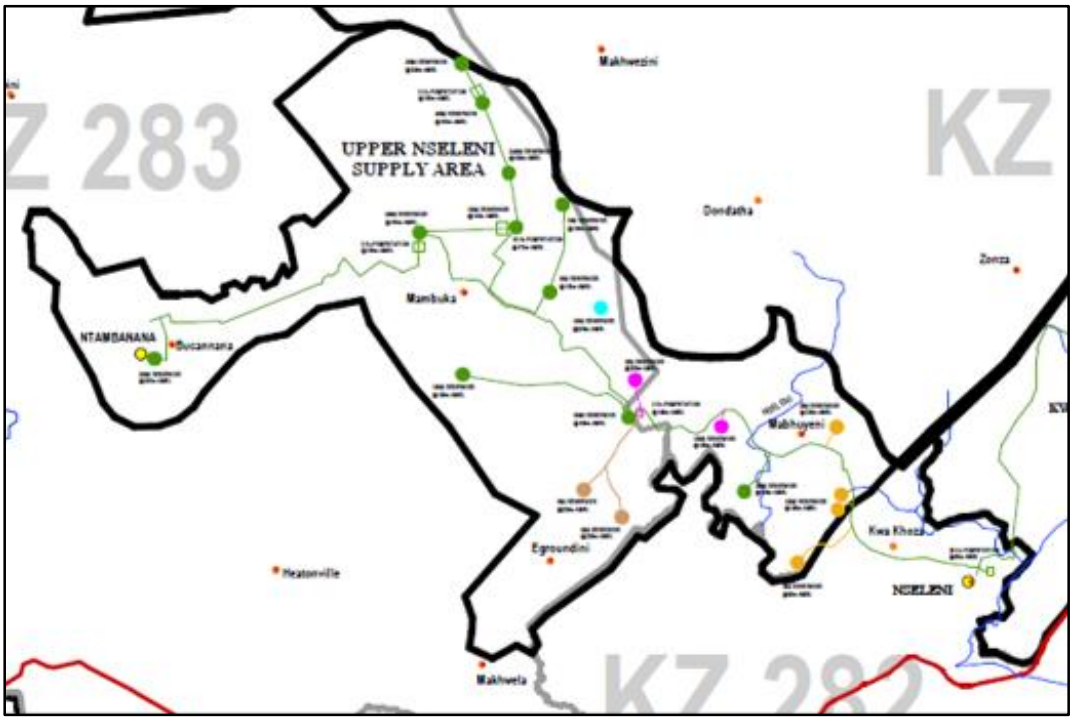


Figure 2

The water supply plans for the Upper Nseleni were continuously updated with each revision and variation orders to the funder, which updates were necessitated due to changes in population and also through additional information in respect of the sustainability of water sources and other factors. Major revisions to the water supply master plans were undertaken during the 2004 / 2005 update, during the 2007 update and again through the 2009 update.

3. POPULATION AND WATER DEMAND

This project is an upgrade of an existing water supply scheme originally named Upper Nseleni water supply which was also considered by DWS in the past with the following details:

3.1 Demographics

The study areas are categorised in terms of the rural and urban area, demographics for both are discussed below under each as follows:

3.1.1 Population for rural areas

The population in the rural area can be classified as rural scattered with a number of small settlements distributed across the project area with the population density of the area being on average 1 dwelling/unit per 10 hectares.

The population figures were obtained from the most recent 2011 Census, which are the most recent Census figures available from Statistics South Africa (Stats SA).

The current Stats SA growth rate for Ntambanana is 1%, and the Stats SA average household size for Ntambanana is 5.6 people/household. Therefore, a growth rate of 1% per annum was used for the Upper Nseleni area (i.e. the population growth rate remains constant.). These same population growth rates were also used in the most recent IDP (2016/2017), as indicated in the table below as follows:.

Table 1: Population per council ward

Municipal Wards	Tribal Authority (Sub wards)	Census Households	Census Population
33	Sangweyana Estate	575	3,45
	Ntambanana	602	3,612
	Lower Umfolozi	345	2,07
	Makholwase	722	4,332
	Maqedipuleti	182	1,092
	Malongweni	111	666
	Ndondwane	375	2,25
32	Hlaza	97	595
	Mabeka	168	1,008
	Obizo	175	1,05
	Ningizimu	245	1,47
	Sihuzu	302	1,812
	Macekane	365	2,19
31	Ntabinamasi	269	1,614
	Makhwela	389	2,334
	Private own farms	0	0
24	Part of Empangeni (Source)	0	0
	Private own farms	0	0
Total		**4,922**	**29,545**

The City of uMhlathuze has Aerial Topographic Maps (dated 2016) depicting dwellings within a project foot print. 2.26 People per dwelling, and 6 people per household were assumed for the manual household count in order to obtain current population figures. (Note: In rural areas, dwellings/rondavels/huts constitute a household)

Due to the topography, the project supply area has been divided into 12 logical supply zones and is reflected in the following table:

Table 2: Design population

Reservoir supply zone	No. of dwellings	Current Population (1)	Populatiom incl. growth (2)
R1	2,285	5,164	6,301
R2	1,279	2,891	3,527
R3	595	1,345	1,641
R4	770	1,740	2,123
R5	973	2,199	2,683
R6	689	1,557	1,900
R7	434	981	1,197
R8	1,925	4,351	5,308
R9	123	278	339
R10	3,029	6,846	10,200
R11	618	1,397	1,704
R12	353	798	973
Total	**13,073**	**29,545**	**37,895**

(1) Dwelling occupancy assumed to be 2,26 people.
(2) The design population was derived from current population which is increased by a growth factor of 1% per annum over a design period of 20 years.

3.1.2 Water demand

Based on the demographics depicted above, and allowing for community facilities such as schools and clinics, the water demand per reservoir zone is reflected in the table hereunder as follows:

Table 3: AADD Average annual daily demand for each reservoir zone

Reservoir supply zone	Population incl. growth (2)	Schools	Clinics	Hospitals	AADD kℓ/d (3)	GAADD kℓ/d (4)
R1	6,301	2	0	0	485	557
R2	3,527	2	0	0	277	318
R3	1,641	0	0	0	123	142
R4	2,123	2	0	0	171	197
R5	2,683	2	0	0	213	245
R6	1,900	0	0	0	143	164
R7	1,197	2	1	0	122	140
R8	5,308	2	0	0	410	472
R9	339	0	0	0	25	29
R10	10,200	0	0	0	765	880
R11	1,704	0	0	0	128	147
R12	973	0	0	0	73	84
Total	**37,893**	**12**	**1**	**0**	**2,935**	**3,375**

(3) AADD = average annual daily demand
(4) GAADD = (I + Lf) x AADD = 15%

From the abovementioned the average annual daily demand for the rural population will amount to 2, 935kℓ/day for this project.

4. EXISTING INFRASTRUCTURE

The existing infrastructure for this project are categorized in terms of the water source, reservoirs, bulk supply and reticulation, all of which will be retained and briefly discussed below as follows:

4.1 Water source

The source of potable water for both original Ntambana and Upper Nseleni are from the Nseleni town reservoir, the source of which is Lake Mzingazi, with water treated at the Mzingazi water treatment plant and which is in turn provided to the Mandlazini bulk reservoir in Richards Bay and there from transferred to the Nseleni town reservoir.

4.2 Nseleni reservoirs and pump stations

The Nseleni reservoirs are located on the western side of Nseleni. From the Nseleni bulk reservoir water gravitates to the Nseleni low level reservoir. From the Nseleni low level reservoir water is distributed from the sump which feed both pump stations which supplies Mhlana and Upper Nseleni supply areas.

A schematic layout of the reservoirs and the relevant pipelines supplying water to Nseleni are indicated below:

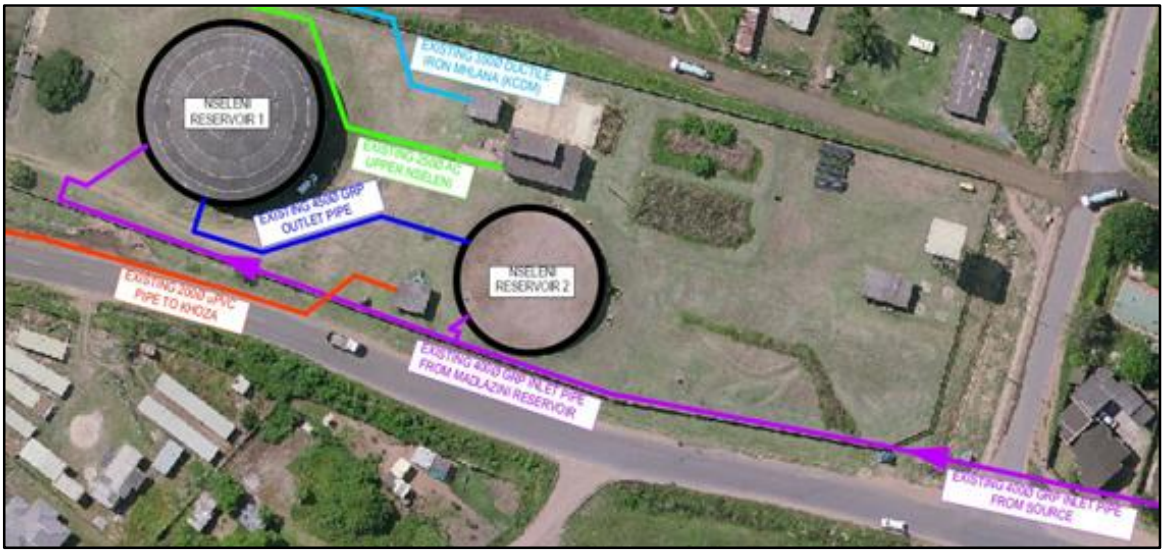


Figure 3

The capacity and the levels of the reservoirs are indicated in the table below:

Table 4: Existing bulk reservoirs

Reservoir	Capacity	Bottom level (MASL)	Top of water level (MASL)
Nseleni bulk reservoir	10Mℓ	63.5	72.27
Nseleni low level reservoir	2.7Mℓ	62.1	66.2

4.3 Bulk water supply

Water from the Nseleni reservoirs indicated above and the existing pump station water is through a 250mm diameter AC pipe (11,585km) pumped and distributed as follows:

- Tee-off to 200mm GRP pipe (2,736km) to supply 300kℓ Mnqagayi reservoir in Mhlana supply area under the King Cetshwayo District Municipality juristriction.
- Tee-off to 90mm uPVC pipe (1,855km) to supply Owen Sithole internal reservoir (properly 200kℓ) within the private area.
- Tee-off to 110mm uPVC pipe (168mm) to supply 250kℓ Makhuba reservoir
- Tee-off to 90mm uPVC pipe (302mm) to supply 100kℓ Nqutshini reservoir
- Pipe reduces to a 200mm diameter uPVC which supplies directly to 250kℓ Hlaza reservoir.

Water from the 250kℓ Hlaza balancing reservoir located at 180m AMSL gravites into four (4) supply area as follows:

- 75mm uPVC pipe (830m) to supply 100kℓ new Hlaza localized reservoir.
- 160mm uPVC pipe (3,395km) and the inline pump station which supplies water through 110mm uPVC to a 150kℓ Obizo reservoir on one hand and through a 63mm HDPe pipe (1,06km) to 100kℓ Mqunzankunzi localized reservoir on the other.
- A direct 200mm uPVC pipe (8,598km) to 150kℓ Mambuka balancing reservoir and with it is the Mambuka pump station.
- From the 200mm Mambuka pipeline is the tee-off to 90mm uPVC pipe (5,533m) and the inline pump station. Water is then distributed to 2 separate Ndondwane reservoirs 100kℓ and the 150kℓ.

Mambuka balancing reservoir and the pump station is located at Ntambana area. Water from the 150kℓ balancing and pump station is distributed into Mposwa and Mathunzini supply areas as follows:

- In Mposa water is pumped through a 150mm AC pipe pipe (4,426km) to supply a 600kℓ reservoir and the inline pump station which supplies water through 150mm AC pipe (1.493km) to a 150kℓ reservoir. From the 150kℓ reservoir water is transfeered to 30kℓ reserboir at Mposwa through a 75mm uPVC pipe (3,125km) and reduced to 63mm HDPe pipe (1,488km) on one hand and through a 63mm HDPe pipe (1,06km).

- To Mathunzini water is supplied through a 160mm uPVC pipe (4,998km) to 600kℓ reservoir and therafter 75mm uPVC pipe (1,997km).

Water for Bhucanana is obtained from two (2) sources being from Ntambanana and from Crocodile dam and treatment works.

- Water from Mathunzini reservoir indicated above gravites through Thula Thula game reservoir with a 160mm uPVC pipe (1.755km) to supply Maxwell reservoir at Bhucanana. This reservoir supplies the northern part of Bhucanana reticulation.

- Water for Bhucanana is also obtained from Crocodile dam where water is treated and gravites to 200kℓ Presssed steel tank and the gravites to supply the sourthen part of the reticulation.

The current problems in existence are in brief as follows:

- The existing bulk supply pipelines are of insufficient capacity to provide in the normal demand of 25ℓ/c/d and in some instances certain communities are without a continuous supply or are without water for prolonged periods of time.

- Insufficient electrical capacity at pump stations for the installation of additional pumps and or simultaneous operation of pumps to increase pump capacities.

4.4 Distribution infrastructure

Within the project footprint there are eight (8) existing small schemes, Hlaza and Nqutshini is supplied from the Upper Nseleni bulk pipeline and Obizo, Isihuzu, Mpemvu and Mqunzankunzi is supplied from local boreholes. The level of supply is by means of communal standpipes.

Table 5: Existing schemes in the project area

Existing Scheme	Design households	Design water demand (ℓ/c/d)	Level of service	Source	Res cap (kℓ)
Kwa Hlaza Nqutshini	48	25	Standpipe	Upper Nseleni Bulk	500
Mambuka	300	25	Standpipe	Upper Nseleni Bulk	1,200
Ndondwane	86	25	Standpipe	Upper Nseleni Bulk	30
Emzini / Malongweni	24	Below RDP	Metered standpipe	Spring	30
Buchanana town	423	25	Yard and standpipe	Upper Nseleni Bulk, Crocodile Dam WTW	200
Obizo	120	Below RDP	Standpipe	Borehole	45
Mquzankunzi	217	Below RDP	Standpipe	Borehole/existing dam	105
Isihuzu	76	Below RDP	Standpipe	Borehole	85
Total	**1,294**				**2,195**

The Mqunzankunzi Scheme supplies the areas known as Ndondwane, Makholwase and Macekane, while the Buchanana Scheme supplies Buchanana town and Mancence. The Mambuka Scheme supplies the area of Ntambanana. The existing schemes do not cover the entire area and schemes provided by boreholes will also need to be upgraded. The current problems in existence are in brief as follows:

- The design philosophy adopted to supply water to the area is un-economical as some connections are affected directly from the pumping line and bypassing as the main reservoir.

- Some of the plastic break pressure tanks have gone brittle and its being vandalized by the community through poking with knifes.

- According to WSSA operations and maintenance team only 30% of communities receive water from the system, therefore in order to supply water to each area, water is being diverted to that specific area for a certain period of time.

- Water management problem with no individual household water meter installed to control water leakage and managing water loss. Each section of the system is being monitored by a section operator that opens and closes the valves during the supply times and walks the line to check water leakages. This system of water management cannot be guaranteed for efficiency.

A layout plan indicating the existing scheme and which pipelines need to be replaced and which will be utilised in the new system is attached as **Annexure B**.

4.5 Current concerns

Concerns are growing at the costly expense of water tankers used to supply water to rural residents across the Municipality. City of Municipality is spending over R20 million per annum to deliver water in various parts of Ntambanana since water tankers had to fetch water from eMpangeni for distribution in these areas which is between 60 to 100 km return trips. With all the costs incurred, the drought is persisting.

The objective of this phase is to urgently eradicate water supply through tankers which is very expensive. This will be done through the following:

- Allow additional source of water through Nsezi/eMpangeni supply which currently has a spare capacity.

- Retrofit the existing water infrastructure to supply water to the affected areas.

- Reduce the number of tanker tankers by installing tanker refill points closer to the affected areas.

The balance of the other phases will be implemented at the later stage once construction funding has been secured from grand funds either.

Due to the urgency of the concerns raised, the municipality has initiated this project and will fund the abovmentioned internally through own funds.

5. DETERMINATION

5.1 Design standards

The design standards is based on The Guidelines for Human Settlement Planning and Design (2019), also known as the ‘Red Book’. Refer to the following refences within the Red Book:

Table J.3: Residential AADD (per capita)

Table J.9: Recommended peak hour, day and week factors, based on land use

Table J.15: Suggested minimum reservoir storage volumes

Table J.16: Minimum elevated storage capacity

A summary of the chosen design standards for bulk water supply is as follows:

-	House Connection - Rural areas	: Range	:	60 to 120 ℓ/c/d
		: Chosen demand	:	75 ℓ/c/d
-	House Connection - Semi-Urban areas	: Range	:	60 to 120 ℓ/c/d
		: Chosen demand	:	120 ℓ/c/d
-	Average people per household	: 7 (as per quality of life survey)		
		: 5 (for proposed new low cost housing project)		
-	Population growth for rural area	: 1.5% over 20 years		
-	Population growth for semi-urban area	: 2.5% over 20 years		
-	Annual Average Daily Demand (AADD)	: Peak Factor x AADD		
-	Peak Factor (day)	: 1.5 (for AADD of 10000-15000 kℓ/day)		
-	Instantaneous peak factor for reticulation	: 4.0		
-	Reservoir storage capacity	: 36 hours (AADD ÷ 24 Hours x 36 hours)		
-	Elevated tank storage capacity	: 4 hours x TAADD		
-	Design pumping period	: 18 hrs/day		
-	Average Annual Daily Demand (AADD)	: Water demand x Growth factor x Loss factor x Summer peak factor		
-	Design peak flow rate	: AADD x Instantaneous peak factor		
-	Maximum distance to water points	: Metered yard connection		
-	Standpipe minimum flow	: 15ℓ/min		

Macekance is growing significantly is attracted to eMpangeni town, making an urbanization effect. Bhuchana thus functions as the economic, administrative and service hub for a substantial number of people, whom reside in the vicinity of Ntambanana.

5.2 **Desgin philosophy**

The design standards as reflected in Section 5.1 will be applied to the water supply system over the total project area.

As indicated above, the implementation of the most recent Master Plan prepared by CSIR will extend over many years, at present believed to be 20 years, which currently being undertaken as a phased development. Portion of the infrastructure will be completed in the near future which infrastructure will form part of this project upgrade.

Cognisance had to be taken to the Water Reconciliation Strategy for Richards Bay and surrounding towns study done by DWS in October 2015, in all instances of the future requirements for water supply to City of uMhlathuze areas and specifically Empangeni and Richards Bay being the two sources of water for this project which will be retained.

The reservoirs, break pressure tanks and reticulation networks designed for this project takes cognizance of the regional scheme which will be incorporated in future.

The project area will further be divided into specific reservoir zones, as required through the topography, and the reticulation from these reservoir zones will be designed as independent systems so as to facilitate the water demand management and water loss control in future.

5.3 Bulk water supply options

Two (2) bulk water supply options have been identified for the project area and is hereafter defined.

- **Bulk water supply option 1**

Proposed Option 1 of the bulk water supply is in the form of a new pump station to be constructed at the Hillview reservoir site in Empangeni, pumping water to the entire project area through a dedicated pipeline that will start at the proposed new pump station and traverse in a northern direction through Macekane, Obizo, Mquzankunzi areas and end at the proposed new Hlaza reservoir which will be a bulk storage reservoir for the remaining areas.

The Hlaza reservoir to be sized to supply water to the remaining water supply zones 5 to 13 through a gravity pipeline traversing in a western direction. Water supply zones 10 to 13 cannot be fed by gravity alone due to the zones located on a higher elevation than the Hlaza reservoir. A booster pump station will therefore be required at Reservoir no. 8 to pump the water to zones 10 to 13. Reservoir no. 8 must also act as a bulk storage reservoir for zones 10 to 13. Refer to Figure 4 depicting the proposed bulk water supply Option 1.

This option was considered as the original bulk supply proposal, but was determined to be un-desirable due to the single supply pipe system for the entire project area. If a fault or breakage occurs on any part of the proposed bulk water supply system, the areas furthest away from the supply source will always be affected. A different option had to be developed, which is bulk water supply Option 2 which is further described below.

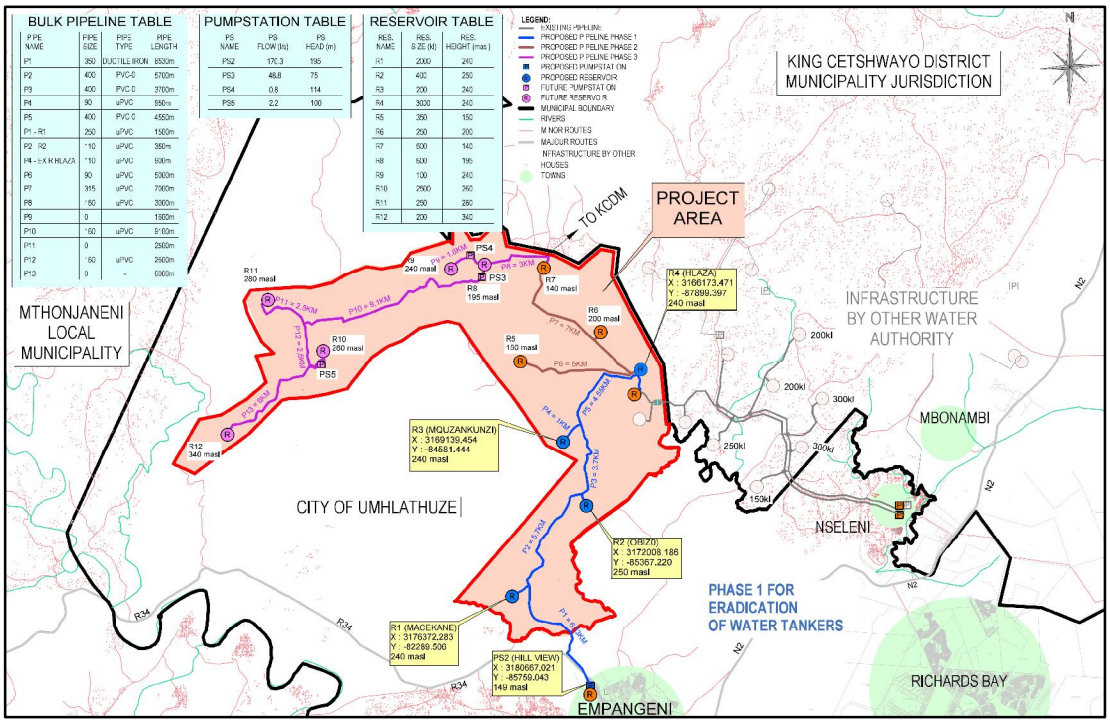


Figure 4: Bulk waer supply option 1

- **Bulk water supply option 2**

Proposed Option 2 of the bulk water supply is in the form of a new pump station to be constructed at the Hillview reservoir site in Empangeni, pumping water to the entire project area through a two (2) separate pipelines from the intersection with the R34 provincial road.

The one (1) pipe (to be known as the eastern supply) will traverse in a northern direction through Macekane, Obizo, Mquzankunzi areas and end at the proposed new Hlaza reservoir which will be the command reservoir for the remaining water supply zones 5 to 9. The Hlaza reservoir to be sized to supply water to the remaining water supply zones 5 to 9 through a gravity pipeline traversing in a western direction.

The other pipe (to be known as the western supply) will traverse in a northern western direction along the R34 and P700 provincial roads and will end in Ntambanana at a bulk storage reservoir within water supply zone 10. The proposed new Ntambanana reservoir will also be the command reservoir for the remaining water supply zones 11 to 13. A booster pump station is required at the Ntambanana reservoir to pump water to the higher elevations of the proposed reservoirs and elevated towers required for water supply zones 11 to 13.

With this proposed option, if a fault of breakage occurs on the eastern bulk pipeline, it will not affect the western supply to zones and visa versa. The bulk water supply Option 2 is therefore considered the most feasible and viable option and is chosen as the system to be implemented and is further developed and discussed in this report.

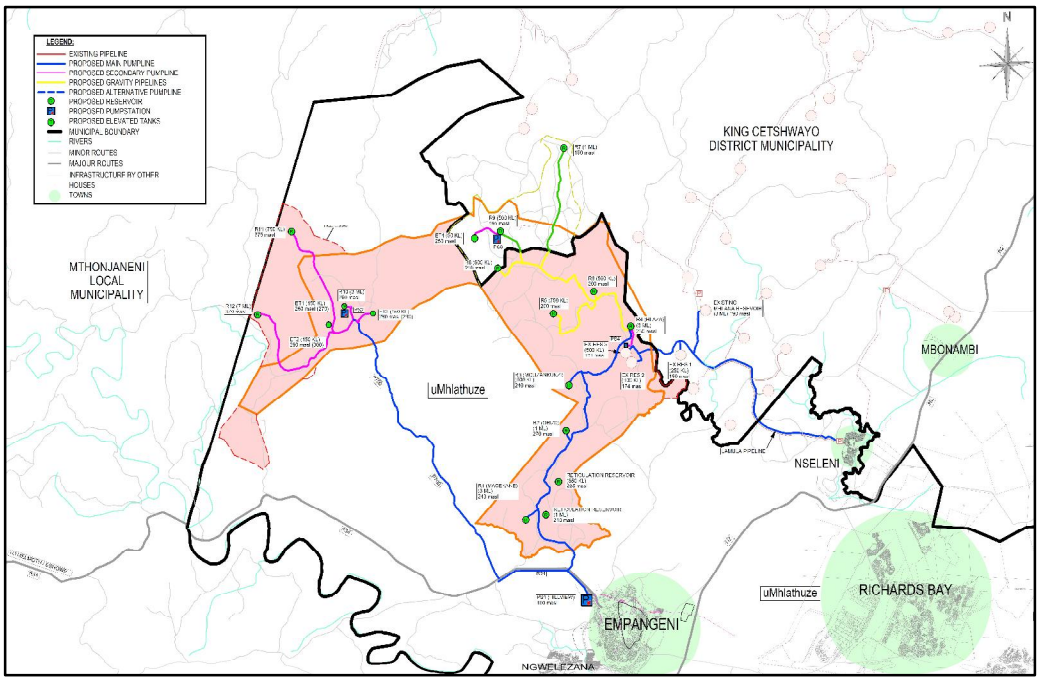


Figure 5: Bulk water supply option 2

6. PROPOSED WATER SUPPLY SYSTEM

6.1 Ultimate Scope of works

In order to address the problems being experienced in the water supply within project area, the following need to be resolved:

- Provide water from 2 different sources being Macekane as a main supply and Nseleni supply as an alternation supply.
- Upgrade or extend existing bulk water pipeline to supply required water demand.
- Upgrade existing retriculation with 25ℓ/c/d standard or less on rudimentary into a more acceptable standard of 75ℓ/c/day as currently accepted by DWS.
- The construction of new storage facilities or upgrade where required, based on the design criteria that all reservoirs must allow for 48hrs storage.
- Install a metered yard connetions at each house within a 200m walking distance.

6.2 Interim Scope of works (Phase 1)

The interim scope of works for this application is indicated below as follows:

a) **Hillview to Macekane pipeline**

- Pipe will be a 450mm diameter Ductile Iron Pipeline which terminates at Macekane area.
- The bulk pipeline length is approximately 7,238m.
- The required current design flows to the reservoir will be 68.75/s in 16hrs at a velocity of 0.796m/s.

- The future design flow will be increased to the ultimate flow of 135l/s at a velocity of 1.31m/s. To oachieve this flow, the pumps will need to be upgraded in.
- The pipeline has one stream crossing and 1 paved road (R34) crossing.
- This pipe tees off to Macekane reservoir and terminates after the tee connectionaloowing for the future extension to Hlaza.
- New 3Ml concrete reservoir at Macekane.

b) **Hlaza pipeline**

- Existing pipe will be a 250mm diameter AC pipeline with continuous breakages as an alternative.
- The new bulk pipeline length is approximately 5,346m.
- The current design flows to Hlaza reservoir will be 42,42l/s in 18hrs at a velocity of 0.75m/s.
- The pipeline has one minor stream crossing and 1 gravel road crossing.
- This pipe terminates at Hlaza reservoir.
- New 3Ml concrete reservoir at Hlaza.

c) **Hillview new pump station**

Supply volume	:	15.358 Mℓ (36 Hour storage to be supplied within one day)
Pumping hours	:	18 Hours
Pumping rate	:	237 ℓ/s
Pumps on duty	:	Three (3)
Pumps on standby	:	One (1)
Pump rate per pump	:	79 ℓ/s
Main Suction pipe	:	450mm Ø GMS pipe (Flooded suction with v=1.503 m/s)
Delivery pipe	:	400mm Ø Steel pipe (v=1.413 m/s) 450mm Ø Ductile Iron pipe (v=1.777 m/s)
Pumping head	:	183 m (determined on Civil Designer program)
Proposed pump	:	KSB WKLn 150/5 (FS) - (1450 rpm)
Electric motor	:	220 Kw x 1490 rpm
Estimated Electricity Supply	:	1 MVA
Pump Control	:	VSD & PLC

The pumps can be installed as per the demand for each specific implementation phase. The proposed phased installation of the pumps is determined to be as follows:

One (1) on duty, One (1) on standby : up to 5.12 Mℓ reservoir storage
Two (2) on duty, One (1) on standby : up to 10.24 Mℓ reservoir storage
Three (3) on duty, One (1) on standby : up to 15.36 Mℓ reservoir storage

d) **Water truck refill station**

The water truck refill stations including road works will be installed at strategic position such as Macekane and Hlaza area. This has been designed to prevent backflow and potential contamination of the potable water supply. Both fill stations are a steel support structure with a pipe clamp connection between the tower and the fill hose. The steel structure has an optional swivel that allows the fill arm to swing away from the fill location when not in use.

The detailed design, drawings for Phase 1 have been completed and construction is underway.

6.3 Source

The Water Reconciliation Strategy for Richards Bay and surrounding towns study done by DWS in October 2015. In all instances of the future requirements for water supply to City of uMhlathuze areas and specifically Empangeni and Richards Bay will be retained, those being as follows:

a) Raising of Goedertrouw Dam by 28m to increase storage.

b) The Mfolozi River off-channel Dam and transfers scheme to the Richards Bay water supply system.

c) A new earthfill dam on the Nseleni River.

d) Use of treated effluent from the Richards Bay macerator.

e) Seawater desalination treatment at Richards Bay hour blended with Mzingazi WTW.

The abovementioned future intervention is currently under feasibility stage to ensure that the growing water requirements are met in the long term. This study for Ntambanana water supply conforms to the WSA's Master Plan which was prepared by CSIR in 2014.

In line with the future plans for water supply on studies done by DWS, this project will have 2 sources of water being Nseleni reservoir in the north and Hillview for the south, both of which will be retained and briefly discussed below as follows:

- The Nseleni bulk water pipeline supplies water for existing Upper Nseleni scheme that includes Obizo, Ndodwane and Buchanana. This pipeline is connected to the Mandlazini bulk reservoirs in Richards Bay with the Mzingazi purification works at the Mzingazi Lake being the source. Bulk water is thus supplied from the Mandlazini reservoirs to the Nseleni town reservoir from where the water is pumped directly to the project area. The source will be retained in the interim and disconnected at a later stage due to limitation on the capacity.

- The source of potable water for Ntambanana Water Supply Scheme is from Hillview reservoirs wich in turn is supplied from the 800mm diameter bulk pumping main reduced to 600mm and 450mm diameter, the main source of which is from Lake Nsezi. Water from this source is treated at the Nsezi water treatment plant and transferred through a pumping main to Pearce Crescent bulk reservoirs in Empangeni CBD and gravitate to Hillview and then feed Macekane. This source is under the jurisdiction of the uMhlathuze Water, and a supply agreement is in existence between the uMhlathuze Water and the City of uMhlathuze to provide water from Lake Nsezi.

The source of portable water for Ntambanana Water Supply Scheme will primarily be obtained from Lake Nsezi through Empangeni town. The specific connection point will be at Hillview Reservoir and will supply the whole project areas water demand.

An alternative source of water for this project will be obtained from Lake Mzingazi through Richards Bay town via Nseleni township and a specific connection point will be at Lamula. This source will only be necessary for emergency purposes or to increase the rate of flow of pressure through the existing pipeline. Under normal operating conditions, this will however be not utilized.

Nsezi Waterworks is managed by Mhlathuze Water and is currently providing water to different supply areas at a current design capacity of 205 Mℓ/day. This plant is currently being upgraded to provide additional 55Mℓ/day, and its due for completion in 2020.

The current design capacity for each supply area together with the proposed upgrade are provided here under:

Table 6: Water source capacities

Supply Areas	Current Allocations (Mℓ/day)	Upgrades due in 2020 (Mℓ/day)
Mondi	100	100
Richards Bay	25	65
eMpangeni	37	37
Foskor	17	25
uThungulu / uMkhanyakude	N/A	25
Decommission Ngwelezane WTW	N/A	8
Reserve	26	25
Total Capacity	**205**	**260**
Additional capacity		**55**

Water utilisation records for the past 5 years were obtained from Mr. Chris Khumalo whom is a superintendent at Nsezi Waterworks. These peak and average demand volumes are depicted on the chart below:

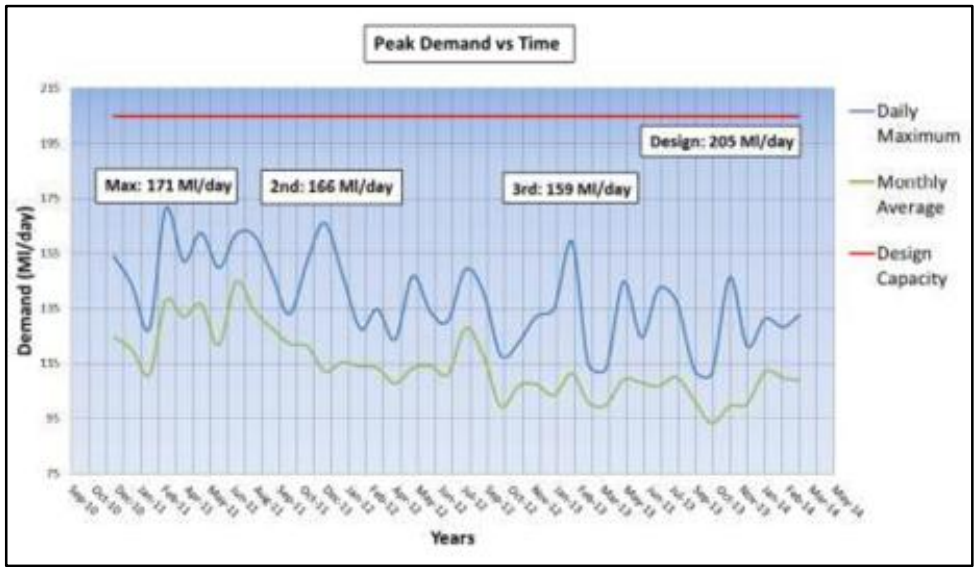


Figure 6

A summary of the past 3 years peak volumes are presented in a table below:

Table 7: Actual water utilised

Year	Peak Demand (Mℓ/day)	Design Capacity (Mℓ/day)	Percentage of Design Capacity (%)
March 2014	171	205	83
January 2015	166	205	81
February 2016	159	205	78
January 2017	154	205	75
February 2018	170	205	82

From the aforementioned table, the design capacity of Nsezi Water Treatment Works is 205 Ml/day (24hours operation) and the actual highest peak demand occurred in March 2014 was recorded at 171 Ml/day. This is a clear indication that this plant has operated at 83% maximum of its design capacity and has never utilised its maximum capacity.

The recent water supply figures from Nsezi to eMpangeni and the spare capacity for 3 years are indicated on the table below:

Table 8: Nsezi to eMpangeni spare capacity for 3 years

Monthly records	2015	2016	2017	2018	2019
January		21,6	21,4	24,6	22,0
February		22,1	21,7	22,1	22,0
March		23,2	21,6	21,3	23,1
April		21,5	22,4	22,2	22,6
May		23,0	22,4	22,8	23,1
June		21,3	21,3	24,0	21,0
July	23,3	19,9	21,3	21,9	
August	21,8	18,8	21,5	20,6	
September	20,5	19,8	21,9	20,6	
October	21,4	18,9	22,4	19,5	
November	21,9	19,7	21,8	20,7	
December	23,0	21,6	26,8	22,8	
Average Mℓ/d	**22,0**	**21,0**	**22,2**	**21,9**	**22,3**

The table indicates that the average eMpangeni demand from the Nsezi WTW is 22.2 Mℓ/day, while the peak demand is 29.7 Mℓ/day which occurred in 2014. The current eMpangeni Contract Allocation from the Nsezi WTW is 37 Mℓ/d, of which has a spare capacity available to supply the proposed Ntambanana scheme as indicated below:

- eMpangeni Contract Allocation - 37 Mℓ/d
- Highest Peak Demand: eMpangeni Supply - 29.7 Mℓ/d
- **Current Spare Capacity - 7.2 Mℓ/d**
- Ntambanana Water Supply - 3 Mℓ/d (This project)

Ntambanana Water Supply Scheme will require a future water demand of 3 Ml/day at Hillview as a source of this project. Empangeni has 7.2 Ml/day spare capacity which is more than sufficient to supply Ntambanana Water Supply Scheme.

As indicated below, Nsezi Treatment Works will still have a spare capacity of 34 Mℓ/day even after the total demand of 37 Mℓ/d to eMpangeni has been allocated:

- Nsezi WTW Design Capacity - 205 Mℓ/d
- Highest Peak Demand recorded - 171 Mℓ/d
- **Spare Plant Capacity - 34 Mℓ/d**

Water for this project will be sourced from Lake Nsezi which has 34 Ml/day spare capacity for all supply areas. Ntambanana Water Supply Scheme will require a future water demand of 3 Ml/day at Hillview as a source of this project. Empangeni has 7.2 Ml/day spare capacity which is more than sufficient to supply Ntambanana Water Supply Scheme.

6.4 Water Conservation and Water Demand Management

- **Demand management**

  Water is a scarce and essential commodity as proven again during the present drought conditions. It can be accepted that the water demands and pressure on the resources will continue to increase in future. It is, therefore, important that this water resource together with the distribution and demands be managed effectively.

  Ntambanana water supply extension cover a large area including Ntambanana Bhuchanana which requires operational monitoring. The following monitoring and data logging will be evaluated by the operational team of system efficiency:

  - Reservoir levels
  - Pump station operation
  - Main supply water meters
  - Flow control / pressure control

  A low energy system capturing the data and sending it to a Central position is proposed. Energy provided by solar cells fixed into the concrete reservoir / pump station roofs. Data forwarded every 15 minutes at pump stations and every 30 minutes at reservoirs and water meters to save power. Included in the system is an alarm for low water levels, reservoir overflow, flow pump failure and high flow rates. Data to be processed and submitted in report form weekly.

- **Pumpstation**

  - Timer starts pump(s) at preset time after pump stop
  - Pressure switch stop pump(s) if pressure in rising main rises to a predetermined level
  - Low suction pressure switch protection

- Cellphone communication to maintenance / operating personnel
  - Reservoir level
  - Flow ℓ/s
  - Pump failure
  - Pump mode
  - Delivery kℓ accumulative
- Reservoir at discharge top water level close valve will result in pressure at pumpstation rising and pump shutdown. A pressure switch will be installed at each reservoir to control pressures.

- **Gravity Pipelines**

  - Hydraulic gradient will be controlled by hydraulic control valves. Altitude, pressure sustaining / PRV will be set at between 25 to 60 bar depending on the system.

    Pressure reducing by means of PRV and orifice plate combination or two PRV's in series will be introduced to allow 1:3 maximum pressure reducing.

- **Flow Metering**

  Flow metering will be installed at pumpstation, all reservoirs and break pressure tank outlets. Automatic recording and transmission of data for real time water balancing at control centre / computer.

- **Water Hammer**

  The water hammer will be controlled through the installation of the following:

  - Pressure surge relief at pumpstation.
  - Geared valve close control.
  - Pressure relief valves at PRV installations.

- **Air Management**

  Air valves will be appropriately designed for mass air handling during draining and filling, as well as, under operating conditions. Air valves to mitigate surges through controlled opening and closing on the bulk pipeline air valves will be installed within 500m depending on the topography.

- **Isolation Valves**

  Isolation valve will be provided at scour valves, reservoir connections and along route so that spacing is not more than 1 km and also to allow manageable isolation to avoid unnecessary interruptions.

All components of WC/WD will be addressed in detail during the detail design which will again be presented to DWS for the second approval of the project.

6.5 Infrastructure

The following infrastructure is proposed within the project area:

a) Bulk pipelines

The flow rates in the bulk pipelines and the resultant pipe sizes and velocity of all of the respected bulk pipelines are indicated in the table hereunder as follows:

Table 9: Bulk pipeline sizes

Pipeline name	Sub-supply area	Length (m)	Flow (ℓ/s)	Required diameter (mm)	Existing bulk pipeline (mm)	Additional bulk required (mm)
P1[1]	1	11,906	232	332	0	350
P2[1]	5	13,331	115	299	160	160
P3	3	4,019	18.0	150	160	160
P4[1]	3	1,170	27	58	63	0
P5[1]	3	3,415	16.6	145	160	0
P6	4	1,590	9.7	111	90	75
P7[1]	5	3,326	30.7	197	200	0
P8[1]	5	1,649	0.6	27	0	75
P9[1]	6	12,996	21.0	164	0	200
P10[1]	6	2,742	2.8	60	110	110
P11[1]	6	6,304	1.6	45	0	75
P12[1]	6	2,489	9.75	113	90	75
P13[1]	6	5,972	1.42	30	75	75

The new bulk water supply pipeline within the project footprint as envisaged is indicated on the plan attached as **Annexure C**.

6.6 Pump stations

The pump station demand is reflected in terms of the reservoir zones in the following table hereunder as follows:

Table 10: Pump station sizes

Pump station name	Sub-supply area	Pipeline name	Duty flow (ℓ/s)	Duty head (m)	Pump efficiency	Required power (kW)
PS1[6]	1	P1+P5+P4	187.2	190	70%	498.6
PS2	2	P6	0.5	75	70%	0.5
PS3[6]	3	P7	3.8	85	70%	4.5
PS4[6]	3	P9	2.1	172	70%	5.2
PS5[6]	3	P10	13.4	172	70%	32.2
PS6[6]	5	P12	24.5	75	70%	25.7
PS7[6]	7	P13	40.5	147	70%	83.4
PS8[6]	6	P17	16.8	114	70%	26.9

Insufficient electrical supply at the pump stations for the installation of additional pumps will require an additional electrical supply. The Electrical supply Authority is the City of uMhlathuze whom have indicated that sufficient capacity is available from the bulk source for these upgrades.

6.7 Reservoirs

The project area has been divided into 12 logical reservoir supply zones. The reservoirs to be provided in each of the zones are indicated in the table hereunder as follows:

Table 11: Reservoir sizes

Reservoir supply zone	AADD (kℓ/d)	Storage required - excl. regional storage (kℓ)	Allowance for regional storage (kℓ)	Existing storage (kℓ)	Total storage required (kℓ)
R1	390	969	0	0	969
R2	224	553	121	150	524
R3	98	246	0	40	206
R4	139	343	281	560	2,434
R5	173	426	0	100	326
R6	114	285	0	50	235
R7	104	244	350	150	444
R8	331	820	248	600	468
R9	20	51	0	0	51
R10	612	1,530	18	200	1,348
R11	102	256	0	0	256
R12	58	146	0	0	146
Total	**2,365**	**5,869**	**1,018**	**1,850**	**7,407**

6.8 Flow diagrams

Refer to figure 5 and 6 below for the schematic flow diagrams for the proposed project area depicting the proposed bulk infrastructure to be implemented. Also refer to **Drawing 3 - 6** attached to this report for the an accurate depiction of the proposed infrastructure on scaled layout plans with aerial photography as the background.

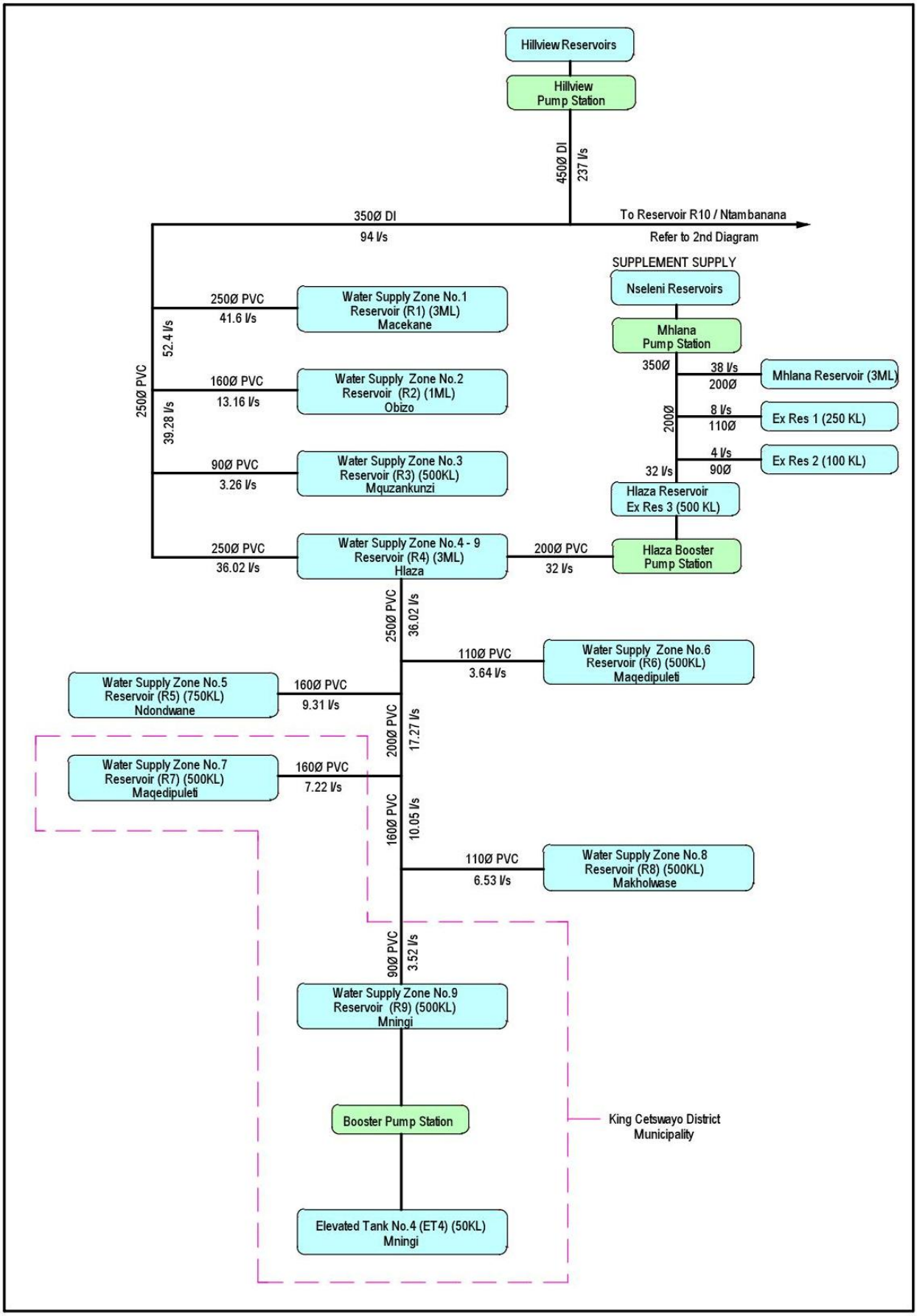


Figure 7: Schematic flow diagram (1 of 2)

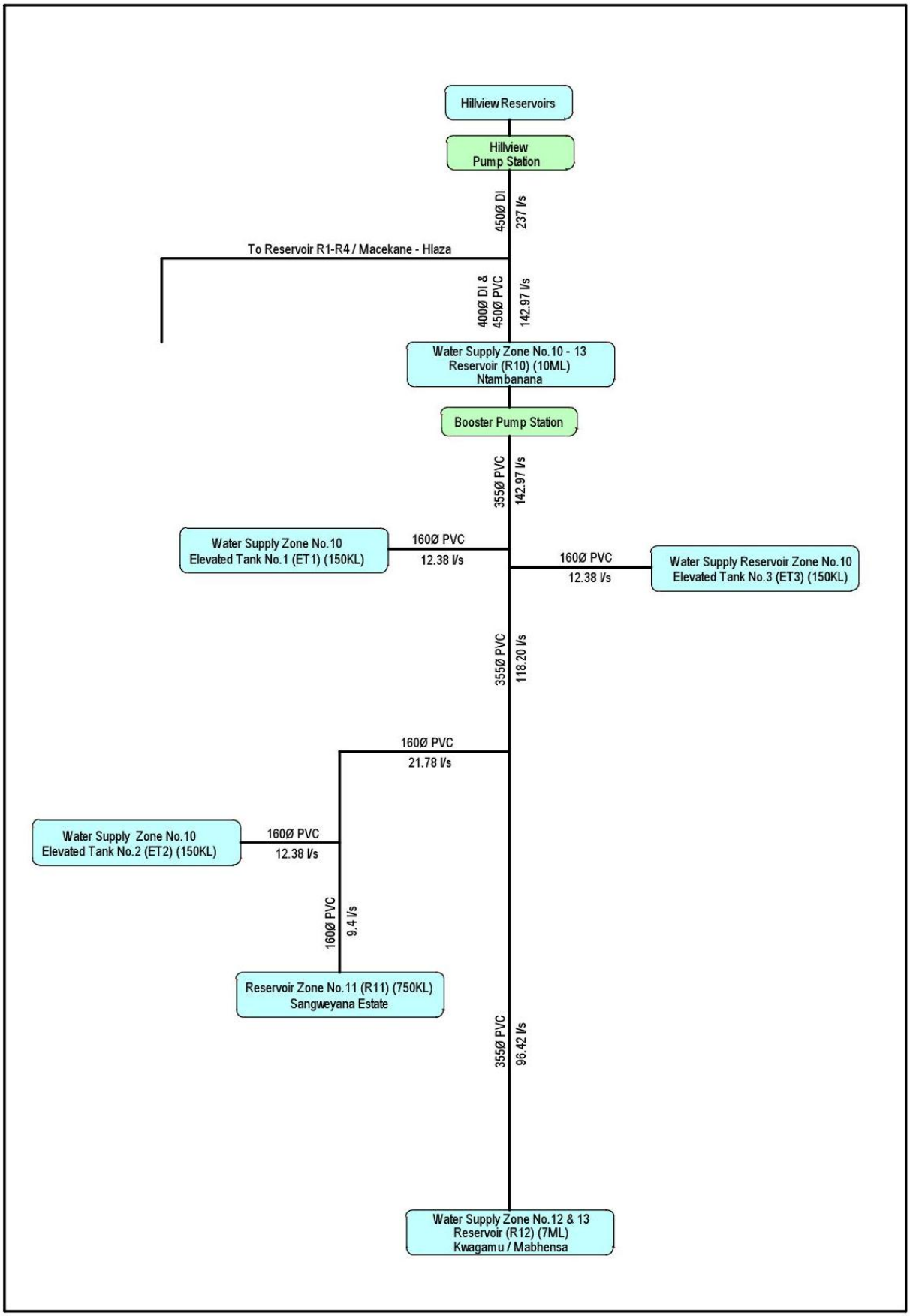


Figure 8: Schematic flow diagram (2 of 2)

6.9 Power Supply

Power to the pump stations will be supplied by either City of uMhlathuze or eskom depending on the location of the pumpstation, summarised as follows:

- **City of uMhlathuze power supply**

  The proposed power requirement for the new Hillview pumpstation are indicated as follows:

  - Type of Supply : Bulk, Metered
  - No. of phases : 3-Phase
  - Maximum Demand : 715KVA (say 800KVA)
  - Protection : MCCB
  - Main Switch Current : 1200A
  - Main Switch Voltage : 400V
  - Main Switch Fault Rating : 25KA

- **Eskom power supply**

  The following power requirements for other pump stations were lodged with Eskom and implementation will only be undertaken once the project is approved:

Table 12: Pump station sizes

Pump station name	Sub-supply area	Required power (kW)
PS2	2	0.5
PS3	3	4.5
PS4	3	5.2
PS5	3	32.2
PS6	5	25.7
PS7	7	83.4
PS8	6	26.9

6.10 Pipe route

The topography is generally sloping in very steep gradients. The pipe route passes through steep to slightly rolling terrain comprising high hills and is drained by tributaries of the Okula and Ntambanana river.

The route commences at a level of 360 metres above mean sea level at the top and reaches the level down to 125 metres above mean sea level. The maximum pipe gradients are between 45º and 65º.

With a given undertaking, there was some flexibility regarding choice of a route. The pipeline route has been selected to minimise damage and disturbance to the environment. Where required the pipeline has been located closer or further away from the road to avoid unnecessary damage to vegetation. Indigenous trees and plants have been avoided and where this is not possible.

The final route includes pipe crossings, where the stream is straight, unobstructed and well defined where it is possible to minimize the risk of damage from environmental hazards such as floods, landslides, etc.

6.11 Crossings and servitudes

The need arise where the pipe have to cross through a river. In river crossings, buried crossings are preferred over elevated crossings because they are subjected to less exposure, costs for construction is less, accidental, damage or vandalism.

The potential for river flow and bank erosion were determined in order to provide the necessary depth and length of burial required to prevent exposure. It was taken into consideration to make the design as efficient, minor maintenance work and cost-effective as possible.

The proposed pipe installation route will be located within the municipal properties or within servitudes already registeredin favour of the municipality. It was also noted that some of the existing pipes around Hillview did not have a registered servitude and it is proposed that these be formalised as part of this project.

Wayleave applications for crossings have been secured with the following:

- DoT : R33 and various gravel roads within project footprint
- Transnet : railway line crossings
- Sasol : pipe crossings on gas pipeline

6.12 Materials

Due to height differences the pipe experience high pressures of more than 35 bar. Ground conditions of hard rock is also a constrain but allowance have been made for blasting.

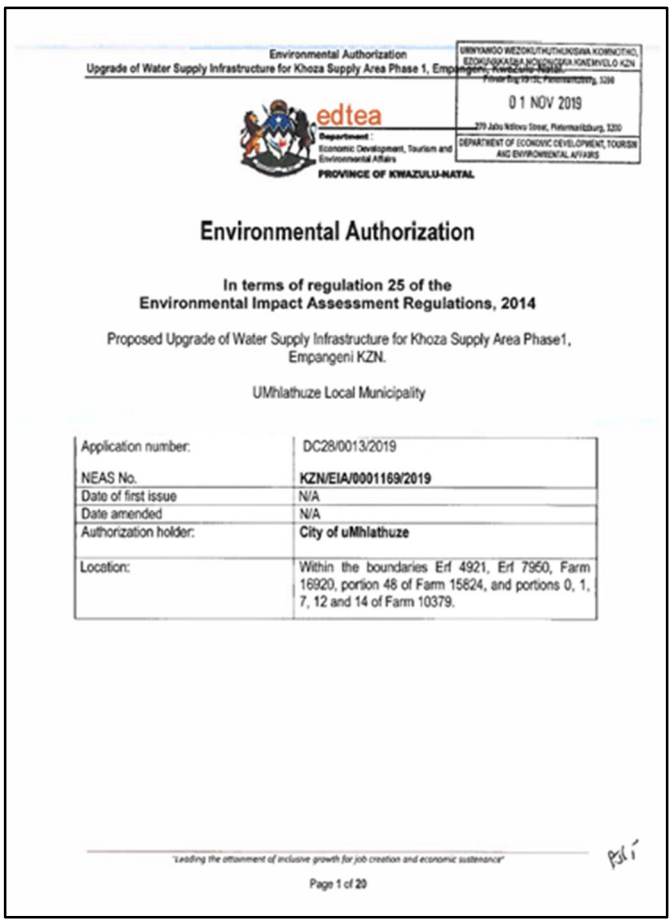
Ductile Iron pipe was introduced, because of its available water working pressure of up to 45bar for K9 class. Ductile Iron's great strength, durability, additional wall thickness and it is cheaper than steel pipe. Therefore all 450mm and 300mm pipes will be a ductile iron pipes K9.

6.13 Specialist studies

Special studies were undertaken by he municipality, those being:

- **Environmental Authorisation**

  Environmental authorisation was obtained with Economic Development, Tourism and Environmental Affairs as indicated below:



Environmental Authorization
Upgrade of Water Supply Infrastructure for Khoza Supply Area Phase 1, Empangeni, KwaZulu-Natal

edtea
Department: Economic Development, Tourism and Environmental Affairs
PROVINCE OF KWAZULU-NATAL

0 1 NOV 2019
DEPARTMENT OF ECONOMIC DEVELOPMENT, TOURISM AND ENVIRONMENTAL AFFAIRS

Environmental Authorization

In terms of regulation 25 of the
Environmental Impact Assessment Regulations, 2014

Proposed Upgrade of Water Supply Infrastructure for Khoza Supply Area Phase1, Empangeni KZN.

UMhlathuze Local Municipality

Application number:	DC28/0013/2019
NEAS No.	**KZN/EIA/0001169/2019**
Date of first issue	N/A
Date amended	N/A
Authorization holder:	**City of uMhlathuze**
Location:	Within the boundaries Erf 4921, Erf 7960, Farm 16920, portion 48 of Farm 15824, and portions 0, 1, 7, 12 and 14 of Farm 10379.

"Leading the attainment of inclusive growth for job creation and economic sustenance"

Page 1 of 20

Figure 9

- **Water Use Licence**

  Water Use Licence was obtained with Department of Water and Sanitation as indicated below:

water & sanitation
Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

KWAZULU NATAL PROVINCIAL OPERATIONS
Southern Life Building, 88 Joe Slovo Street, Durban, 4000 ; PO Box 1018, Durban, 4000
Ms S. Shoba
(031) 336 2786
ShobaS@dws.gov.za
27/2/2/W612/4/5/24

City of uMhlathuze Local Municipality
Private Bag X1004
RICHARDS BAY
3900

Attention: Ms Nontsundu Ndinga

GENERAL AUTHORISATION IN TERMS OF SECTION 39 OF THE NATIONAL WATER ACT, 1998 (ACT 36 OF 1998) (ACT): WATER SUPPLY INFRASTRUCTURE FOR KHOZA SUPPLY AREA, EMPANGENI, KWAZULU-NATAL

Your request to use water in terms of Section 21 (c) and (i) of the National Water Act, 1998 (Act 36 of 1998), associated with the construction of a raw water bulk infrastructure within quaternary catchmentsW12G, W12F and W12H of the Pongola to Umzimkhulu Water Management Area (WMA) within the province of KwaZulu Natal refers;

The Department has evaluated the submitted documents and has confirmed that the intended water uses fall within the ambit of the General Authorisation, GN509 dated 26 August 2016 as published in Government Gazette 40229 for Section 21(c) and (i). The Department hereby authorises the following water uses under General Authorisation:

1. **Water User:** City of uMhlathuze Local Municipality

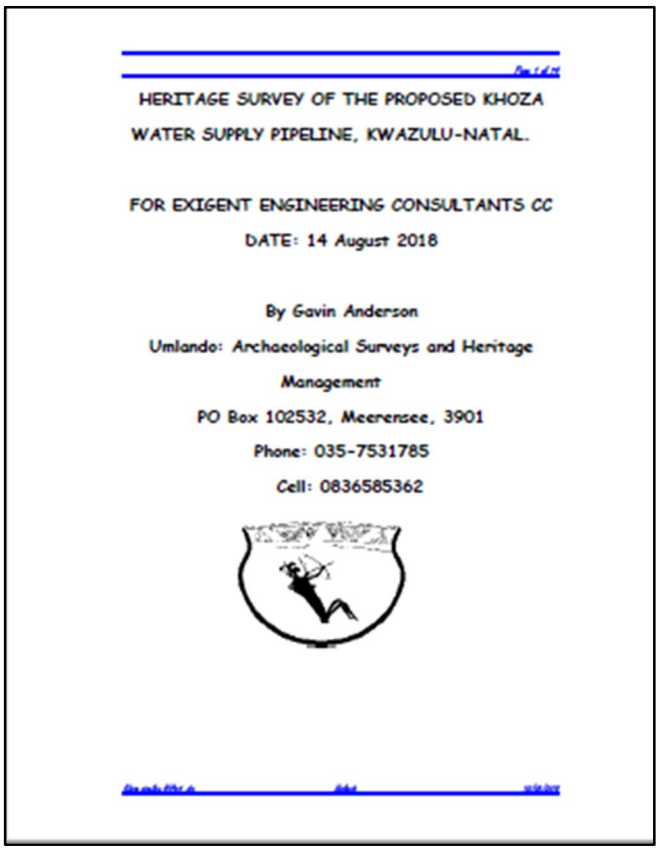
   Water Use(s): Section 21(c) of the Act: Impeding or diverting the flow of water in watercourse.

   Section 21(i) of the Act: Altering the bed, banks or characteristics of a watercourse.

Figure 10

- **Heritage Impact Assessment**

  Heritage Impact Assessment was conducted as indicated below:



HERITAGE SURVEY OF THE PROPOSED KHOZA WATER SUPPLY PIPELINE, KWAZULU-NATAL.

FOR EXIGENT ENGINEERING CONSULTANTS CC

DATE: 14 August 2018

By Gavin Anderson
Umlando: Archaeological Surveys and Heritage Management
PO Box 102532, Meerensee, 3901
Phone: 035-7531785
Cell: 0836585362

Figure 11

- **Specialist Studies such as Vegetation and Wetland Delineation**

  Other specilialist studies was conducted as indicated below:

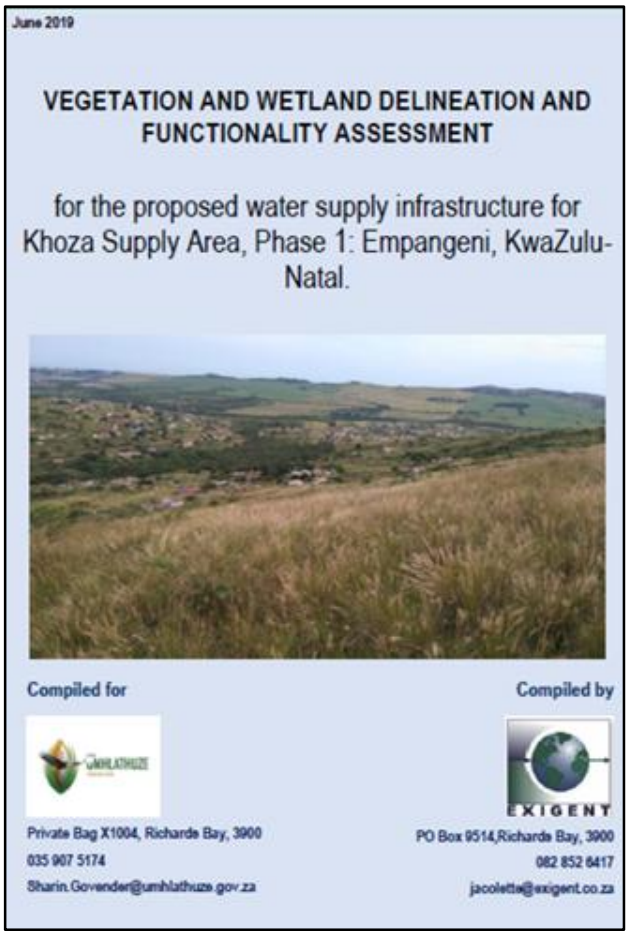


Figure 12

- **Summary of speciailist studies**

  The summary of the specialist studies and the status of each is indicated on the table below:

Table 13: Summary of specialist studies

Planning activity	Status	Remarks
Environmental application	Completed	Environmental authorisations was obtained on 1 November 2019 with reference no.DC/0013/2019
Specialist studies	Completed	Specialist studies such as Vegetation and Wetlands delineation, etc was undertaken and completed as part of the Environmental authorisation
WULA	WULA licence issued	A Water Use licence was obtained on 17 February 2020 with reference no.27/2/2/W612/4/5/24
Pipeline survey	Completed	Undertaken by Biyela MM Geomatics (Pty) Ltd. List of all properties affected, Registration of servitude for existing concrete pipe required.
Geotechnical investigations	Completed	Geotechnical report prepared by Terratest Geotechnical Consultants civil materials testing laboratory.
Preliminary design	Completed	Complete
Power supply application	Power connection approved	Power supply application was submitted to the service provider, City of uMhlathuze for a 3 phase with a maximum demand of 800KVA.
Land acquisition	Completed	All private land owners were approached and have agreed to a 6m wide servitude for the pipeline.
Wayleaves	Approved	Wayleave application approvals were obtained from DoT on all road crossings, Transnet for railway crossings and Sasol for a gas pipeline.
Heritage Assessment	Completed	A Heritage assessment was completed on 14 August 2018.
Council Resolution	Approved	Council resolution No.13140 dated 10 April 2019

6.14 Reticulation

The existing reticulation consists mainly of small diameter pipes which had been connected to the existing old Upper Nseleni scheme. These pipes were not designed to provide the required 75ℓ/capita/day and therefore most of those cannot be retained in this new proposed system and will be regarded as obsolete in this design.

The analysis indicates that all of the households can effectively be provided with water in terms of the diameters and pipe classes as proposed. Below is a summary of the pipe sizes and type required for this project:

Table 14: Proposed pipe quantities and type

DIAMETER (mm)	PIPE TYPE	TOTAL (m)
25	HDPe	147 000
32	HDPe	117 000
40	HDPe	45 250
50	HDPe	44 500
63	HDPe	46 000
75	uPVC	36 690
90	uPVC	26 085
110	uPVC	25 140
160	uPVC	31 410
200	uPVC	15 885
250	uPVC	6 990
315	uPVC	780
Total Reticulation		**542 730**

The layout of the reticulation is indicated on the map attached as **Annexure D** indicating the following:

- Storage reservoir location and size.
- Reservoir supply zones.
- Propose reticulation network.
- Metered stand pipe to each household.

7. PROPOSED INFRASTRUCTURE

The summary of proposed infrastructure are indicated as follows:

- **Bulk pipelines**
  - 450mm dia Ductile Iron K9 : 2 023m
  - 400mm dia Ductile Iron K9 : 5 525m
  - 350mm dia Ductile Iron K9 : 4 510m
  - 450mm dia PVC-O 25 : 11 795m
  - 450mm dia PVC-O 16 : 5 276m
  - 355mm dia PVC-O 20 : 2 332m
  - 355mm dia PVC-O 16 : 8 278m
  - 250mm dia PVC-O 25 : 13 635m
  - 250mm dia PVC-O 16 : 4 369m

- 200mm dia PVC-O 16 : 4 379m
- 160mm dia PVC-O 20 : 1 241m
- 160mm dia PVC-O 16 : 13 110m
- 110mm dia PVC-O 16 : 2 361m
- 90mm dia PVC-O 16 : 1 046m

- **Proposed reservoir storage**

  - R1 : 3Mℓ
  - R2 : 1Mℓ
  - R3 : 0.5Mℓ
  - R4 : 3Mℓ
  - R5 : 0.75Mℓ
  - R6 : 0.5Mℓ
  - R7 : 0.5Mℓ
  - R8 : 0.5Mℓ
  - R9 : 0.5Mℓ
  - R10 : 10Mℓ
  - R11 : 0.75Mℓ
  - R12 : 7Mℓ

- **Proposed elevated tanks**

  - ET1 : 150kℓ
  - ET2 : 150kℓ
  - ET3 : 150kℓ
  - ET4 : 50kℓ

- **Proposed pumpstations**

  - New PS1 : 187.2ℓ/s @ 190m duty head
  - New PS6 : 24.5ℓ/s @ 75m duty head
  - New PS7 : 40.5ℓ/s @ 147m duty head
  - Upgrade PS2 : 0.5ℓ/s @ 75m duty head
  - Upgrade PS3 : 3.8ℓ/s @ 85m duty head
  - Upgrade PS4 : 2.1ℓ/s @ 172m duty head
  - Upgrade PS5 : 13.4ℓ/s @ 172m duty head
  - Upgrade PS8 : 16.8ℓ/s @ 114m duty head

- **Reticulation**

  - 25mm dia : 147 km
  - 32mm dia : 117 km
  - 40mm dia : 45.25 km
  - 50mm dia : 44.5 km
  - 63mm dia : 46 km
  - 75mm dia : 36.69 km
  - 90mm dia : 26 km
  - 110mm dia : 25.1km
  - 160mm dia : 31.4 km
  - 200mm dia : 15.8 km
  - 250mm dia : 6.9 km
  - 315mm dia : 0.7 km

8. FINANCIAL IMPLICATIONS

The cost estimate based on the proposed scope of works so as to address the identified problems is divided into various specific indicators as follows:

8.1. Estimate of Direct Cost

The cost to implement (direct cost) the proposed bulk infrastructure, as described in this report, is estimated in this section. The cost estimate is based on rates from recently completed water infrastructure projects as well as quotes received from the local industries. The preliminary and general section is estimated on 20% of the construction cost. The project is estimated to be implemented over a 10 year period and therefore escalation is applied. The escalation rate (%) is based on the average inflation rate of South Africa over the past 10 years. The costs have been split between bulk infrastructure and reticulation infrastructure as follows:

a) Bulk Infrastructure

A cost estimate for bulk infrastructure is indicated in the table below:

Table 15: Bulk infrastructure Cost estimate

NTAMBANANA BULK WATER SUPPLY		
COST ESTIMATE - DIRECT COST		
Item	**Description**	**Amount**
1	**Preliminary and General**	
1.1	Fixed Charged Items	R21 840 000,00
1.2	Time Related Items	R8 064 000,00
1.3	Health and Safety	R1 344 000,00
1.4	Environmental Management	R1 344 000,00
Sub- Total 1:		**R32 592 000,00**
2	**Provisional Sums**	
2.1	CLO	R440 000,00
2.2	Formal Training	R850 000,00
2.3	Controlled Construction Insurance	R200 000,00
2.4	Loss of crops	R420 000,00
2.5	Fencing	R850 000,00
2.6	Deal with Traffic	R400 000,00
2.7	Deal with water	R200 000,00
2.8	Deal with Stormwater	R350 000,00
2.9	As Built Information	R170 000,00
2.10	Repairs to Existing Infrastructure	R840 000,00
Sub- Total 2:		**R4 720 000,00**
3	**Pipe Trenches**	
3.1	Site Clearence	R778 320,00
3.2	Excavation	R12 621 040,00
3.3	Existing Services	R527 140,00
3.4	Bedding	R12 568 483,00
Sub- Total 3:		**R26 494 983,00**
4	**Eroision Protection**	
4.1	Gabion & Pitching	R2 275 125,00

4.2	Grassing	R1 689 000,00
4.3	Berms	R375 000,00
Sub-Total 4:		**R4 339 125,00**
5	**Preassure Pipelines**	
5.1	Ductile Iron (K9)	R21 993 515,50
5.2	PVC-O Class 16	R26 732 178,00
5.3	PVC-O Class 20	R4 691 000,00
5.4	PVC-O Class 25	R57 958 250,00
5.5	Resilient Seated Valves	R2 831 400,00
5.6	Air valves	R2 759 800,00
5.7	Scour valves	R1 621 600,00
5.8	Flow Control & Pressure Reducing Valve	R2 218 500,00
5.9	Surge Relief Tank	R3 510 000,00
5.10	Bends - Ductile Iron Pipe	R536 363,30
5.11	Bends- PVC pipe	R731 286,00
5.12	Steel Bends	R7 291 038,00
5.13	Tees - PVC Pipe	R11 890,80
5.14	Reducers - PVC pipe	R4 905,60
5.15	Steel tees	R83 336,40
5.16	Steel Reducer	R21 414,00
5.17	Concrete Anchor Blocks	R511 875,00
Sub- Total 5:		**R133 508 352,60**
6	**Pipe Jacking**	
6.1	900mm Sleese for 350mm DI - R34 crossing	R736 000,00
6.2	900mm Sleevw for 350mm DI -Transnet crossing	R460 000,00
6.3	900mm Sleeve for 350mm DI - Sasol crossing	R184 000,00
6.4	900mm Sleeve for 350mm DI -D1586 crossing	R874 000,00
6.5	900mm Sleeve for 350mm DI - L2570 crossing	R690 000,00
6.6	900mm Sleeve for 450mm PVC - P700 crossing	R920 000,00
6.7	900mm Sleeve for 355mm PVC- P700 crossing	R920 000,00
Sub- Total 6:		**R4 784 000,00**
7	**Reservoirs**	
7.1	R1 - 3Ml	R9 000 000,00
7.2	R2 - 1Ml	R3 000 000,00
7.3	R3 - 500kl	R1 500 000,00
7.4	R4 - 3Ml	R9 000 000,00
7.5	R5 - 750kl	R2 250 000,00
7.6	R6 - 500kl	R1 500 000,00
7.7	R8 - 500kl	R1 500 000,00
7.8	R10 - 10Ml	R30 000 000,00
7.9	R11 - 750kl	R2 250 000,00
7.10	R12 - 7Ml	R21 000 000,00
7.11	Augmenting Hillveiw - 5 Ml	R15 000 000,00
Sub- Total 7:		**R96 000 000,00**

8	Elevated Tower	
8.1	ET1 - 150kl	R1 117 455,00
8.2	ET2 - 150kl	R1 117 455,00
8.3	ET3 -150kl	R1 117 455,00
Sub- Total 8		**R3 352 365,00**
9	**Hillveiw Pump Station**	
9.1	Building	R1 200 000,00
9.2	Suction pipework & Fittings: Reservoir ro Pump station	R600 000,00
9.3	Suction Pipework & Fittings: Pump Station	R300 000,00
9.4	Delivery Pipework & Fittings	R530 000,00
9.5	Pumps	R1 400 000,00
9.6	Motors	R680 000,00
9.7	Electricity Supply	R1 200 000,00
9.8	Control Panel - VSD	R1 419 000,00
9.9	Ancillaries	R100 000,00
Sub- Total 9:		**R7 429 000,00**
10	**Ntambanana PS**	
10.1	Building	R600 000,00
10.2	Suction pipework & Fittings: Reservoir to Pump station	R510 000,00
10.3	Suction Pipework & Fittings: Pump Station	R255 000,00
10.4	Delivery Pipework & Fittings	R450 000,00
10.5	Pumps	R900 000,00
10.6	Motors	R390 000,00
10.7	Electricity Supply	R1 200 000,00
10.8	Control Panel - VSD	R930 000,00
10.9	Ancillaries	R85 000,00
Sub-Total 10:		**R5 320 000,00**
11	**Hlaza PS**	
11.1	Building	R400 000,00
11.2	Suction pipework & Fittings: Reservoir to Pump station	R150 000,00
11.3	Suction Pipework & Fittings: Pump Station	R75 000,00
11.4	Delivery Pipework & Fittings	R100 000,00
11.5	Pumps	R54 000,00
11.6	Motors	R75 000,00
11.7	Electricity Supply	R500 000,00
11.8	Control Panel - VSD	R500 000,00
11.9	Ancillaries	R50 000,00
Sub-Total 11:		**R1 904 000,00**

Total of Sub-Totals 1 to 11	**R320 443 825,60**
10% Contingencies:	R32 044 382,56
Sub- Total:	**R352 488 208,16**
Escalation of Sub-Total (Calculated separately):	R449 422 465,40
15% VAT	R67 413 369,81
Direct Cost Total	**R516 835 835,21**

b) **Reticulation Infrastructure**

A cost estimate for reticulation infrastructure is indicated in the table below:

Table 16: Reticulation infrastructure Cost estimate

NTAMBANANA BULK WAER SUPPLY		
COST ESTIMATE - DIRECT COST		
Item	**Description**	**Amount**
1	**Preliminary and General**	
1.1	Fixed Charged Items	R17 160 000,00
1.2	Time Related Items	R6 336 000,00
1.3	Health and Safety	R1 056 000,00
1.4	Environmental Management	R1 056 000,00
Sub- Total 1:		**R25 608 000,00**
2	**Provisional Sums**	
2.1	CLO	R350 000,00
2.2	Formal Training	R660 000,00
2.3	Controlled Construction Insurance	R170 000,00
2.4	Loss of crops	R330 000,00
2.5	Fencing	R660 000,00
2.6	Deal with Traffic	R300 000,00
2.7	Deal with water	R160 000,00
2.8	Deal with Stormwater	R300 000,00
2.9	As Built Information	R150 000,00
2.10	Repairs to Existing Infrastructure	R660 000,00
Sub- Total 2:		**R3 740 000,00**
12	**Reticulation**	
12.1	Macekane	R109 221 392,00
12.2	Ntambanana	R68 755 480,00
12.3	Bhucanana	R125 460 700,00
Sub- Total		**R303 437 572,00**

Total of Sub-Totals 1 to 11	**R332 785 572,00**
10% Contingencies:	R33 278 557,20
Sub- Total:	**R366 064 129,20**
Escalation of Sub-Total (Calculated separately):	R466 731 764,73
15% VAT	R70 009 764,71
Direct Cost Total	**R536 741 529,44**

c) **Total Direct Cost**

Total direct costs for this project are indicated as follows:

- Bulk infrastructure : R 516,835,835-,21
- Reticulation infrastructure : R 536, 741,529-44
- **Total direct cost : R 1,053,577,364-65**

8.2. Estimate of indirect cost

The indirect project cost for professional fees, construction supervision, disbursements, facilitation and sub-consultants is estimated in this section. The indirect cost is based on a percentage of the direct cost excluding 10% contingencies, escalation and VAT. Refer to table below for the estimate for indirect cost. The costs have been split between bulk infrastructure and reticulation infrastructure as follows:

a) Bulk Infrastructure

A cost estimate for bulk infrastructure is indicated in the table below:

Table 17: Bulk infrastructure Cost estimate

NTAMBANANA BULK WATER SUPPLY		
COST ESTIMATE - INDIRECT COST		
Item	**Description**	**Amount**
1	Professional Fees (@11%)	R44 262 823,98
2	Site Supervision - Clerk of Works (@2%)	R8 047 786,18
3	Disbursements (@0,15%)	R603 583,97
4	Health and Safety (Audits, Risk Assessment & Spec.) (@0,4%)	R1 609 557,24
5	Environmental (Audits & Authorisations) (@0,6%)	R2 414 335,85
6	Surveyor (@0,25%)	R1 005 973,27
7	Geotechnical Engineer (@0,25%)	R1 005 973,27
8	Electrical Engineer (@0,25%)	R1 005 973,27
9	Facilitator (@1,35%)	R5 432 255,67
Sub- Total		**R65 388 262,70**
15% VAT		R9 808 239,40
Direct Cost Total		**R75 196 502,10**

b) Reticulation Infrastructure

A cost estimate for reticulation infrastructure is indicated in the table below:

Table 18: Reticulation infrastructure Cost estimate

NTAMBANANA BULK WATER SUPPLY		
COST ESTIMATE - INDIRECT COST		
Item	**Description**	**Amount**
1	Professional Fees (@11%)	R34 777 933,13
2	Site Supervision - Clerk of Works (@2%)	R6 323 260,57
3	Disbursements (@0,15%)	R474 244,55
4	Health and Safety (Audits, Risk Assessment & Spec.) (@0,4%)	R1 264 652,11
5	Environmental (Audits & Authorisations) (@0,6%)	R1 896 978,17
6	Surveyor (@0,25%)	R790 407,57

7	Geotechnical Engineer (@0,25%)	R790 407,57
8	Electrical Engineer (@0,25%)	R790 407,57
9	Facilitator (@1,35%)	R4 268 200,88

Sub- Total	**R51 376 492,12**
15% VAT	R7 706 473,82
Direct Cost Total	**R59 082 965,94**

c) **Total Indirect Cost**

Total direct costs for this project are indicated as follows:

- Bulk infrastructure : R 75,196,502-10
- Reticulation infrastructure : R 59,082,965-94
- **Total indirect cost : R 134 279 468,04**

8.3. Summary of total estimated cost

The costs have been split between bulk infrastructure and reticulation infrastructure as follows:

a) **Bulk Infrastructure**

A summary of cost estimate for bulk infrastructure is indicated in the table below:

Table 19: Bulk infrastructure Cost estimate summary

Description	Amount
Direct Cost	R516 835 835,21
Indirect Cost	R75 196 502,10
Total	**R592 032 337,31**

b) **Reticulation Infrastructure**

A summary of cost estimate for reticulation infrastructure is indicated in the table below:

Table 20: Reticulation infrastructure Cost estimate summary

Description	Amount
Direct Cost	R536 741 529,44
Indirect Cost	R59 082 965,94
Total	**R595 824 495,38**

c) **Total Cost Estimate Summary**

Total direct costs for this project are indicated as follows:

- Direct Cost : R 1,053,577,364-65
- Indirect Cost : R 134,279,468-04
- **Total : R 1,187,856,832-69**

From the aforementioned, the cost estimate to provide the upgrade to this project area water supply will thus amount to approximate R 1,187,856,832-70 which results in a cost of R 31 346,00/capita.

9. PHASED IMPLEMENTATION PLAN

This project is phased to be Implemented in the following manner discussed below:

a) **Phasing of project**

Based on the practicality of the project, the phasing is allocated as follows:

- **Phase 1**

  This phase has been designed to assist City of uMhlathuze in reducing the costs to supply water from water tankers. As indicated in section 6.2 of this report, this phase will be construction of a new pump station at Hillview, a bulk water pipeline and a storage reservoir at Macekane, and on the other a pipeline from Lamula to Hlaza and a storage reservoir at Hlaza. Additional water tankers refill discharge points will be installed at strategic positions.

  The summarised cost (inclusive of VAT) for phase 1 is indicated below as follows:

  - Macekane and Hlaza Pipeliness : R 48,264,000-00
  - Macekane and Hlaza Reserviors : R 16,800,000-00
  - Hillview Pumpstaton : R 7,100,000-00
  - **Subtotal : R 72,164,000-00**
  - Design and Planning : R 14,095,038-18
  - **Total Current Application : R 86,259,038-18**

  The abovementioned cost of R 86,259,038-18 including VAT for project design, planning (EIA, WULA, etc.) and phase 1 will be internally funded and the balance is hereby requested to be approved by Grant Funders for this project.

  The City of uMhlathuze is currently spending over R 20 million per annum to deliver water to various parts of Ntambanana, as water tankers have to fetch water from the town of eMpangeni (resulting in a 80-100 km return trip).

  The proposed pump station, pipeline and reservoirs will allow access to portable water to be within the project area. The objective of this phase is to urgently eradicate or reduce water supply through water tankers which is extremely expensive. This will be done in the first phase via the following:

  - Reducing the number of water tankers by installing tanker refill discharge points closer to the affected areas.
  - Reducing return trips to approximately 20 km to 60 km in total (from the current 80 km to 100 km return trip)
  - Retrofitting the existing Macekane reticulation scheme in order to obtain water from the new reservoir.

  Although Phase 1 cannot eradicate water tankers completely, the operational costs will be reduced significantly

- **Phase 2**

  A new pipeline from Macekane connecting to Hlaza reservoir distribution pipeline and reservoir at Ndondwane and a pipeline which terminates at the reservoir in Ntambanana as follows:

  - Water supply zone 2 - 4 - (AADD: 4.134 Mℓ)
    - Reservoirs R2, R3 and R4
    - Pipelines from reservoir R1 to reservoirs R2, R3 and R4

- **Phase 3**

  In this phase water is pumped from Ntambanana to supply three reservoirs in Ntambanana through a bulk pipeline which also supplies directly supply to Bhucanana area where this supplies three reservoirs in different locations as follows:

  - Water supply zones 5 - 9 - (AADD: 6.092 Mℓ)

    - Additional pump at Hillview pump station
    - Reservoirs R5, R6 and R8
    - Pipelines from reservoir R4 to reservoirs R5, R6 and R8
      (Include water supply zones 7 and 9 if agreement is reached with King Cetshwayo District Municipality)

- **Phase 4**

  As indicated on our Feasibility Report the reticulation from the boundary of Mabhuyeni, Hlaza and Ndondwane has been completed in the past by King Cetswayo District Municipality. This implies that the reticulation can only be supplied to Macekane, Ntambanana and Bhucanana which was previously designed at a very low standard. This reticulation upgrade will form part of this phase and the works comprises of the following:

  - Bulk pipeline and reservoir for water supply zones 10 - 13 - (AADD: 15.358 Mℓ)

    - Additional pump at Hillview pump station
    - Augmenting Hillview reservoirs
    - Reservoir R10
    - Pipeline from bulk pipe installed under Phase 1 up to reservoir R10

- **Phase 5**

  - Water supply zones 10 – 13

    - Ntambanana booster pump station
    - Elevated towers ET1, ET2 and ET3
    - Reservoir R11 and R12
    - Pipelines from booster pump station to elevated tower ET1, ET2, ET3, reservoir R11 and R12

b) **Phased cost estimates**

Based on the phasing indicated above each phase cost estimated have been prepared with grant fund allocated as follows:

- Phase 1 : R 86,259,038-18 - Internal funded
- Phase 2 : R 204,488,114-71
- Phase 3 : R 316,482,427-51
- Phase 4 : R 339,362,541-39
- Phase 5 : R 241,264,710-92

The details of phase 2 to phase 4 will be provided at a later stage once the funding been secured.

10. INSTITUTIONAL CONSIDERATIONS

10.1 Implementing Agent

City of uMhlathuze will act as an implementing Agent to the project.

10.2 Service provider

City of uMhlathuze is responsible for the supply of water within the project area.

10.3 Community participation

A project steering committee will be established as part of the detail design process for the project. The PSC will undergo training in the following items:

- Water principles
- Community participation meetings
- Project execution and community involvement
- Co-ordination between service provider, consultant and community

10.4 Institutional and Social Development (ISD)

The function of the ISD will be undertaken over three distinct phases being:

- Prior to construction
- During construction
- Post construction

ISD functions need to address the following:

- Skills development, which requires a skills audit in the community prior to construction so as to recommend on training during construction. Both technical and social and in both accredited and unaccredited format.

- Enhance affirmable business enterprises in the initial identification and recommend the utilization of such a business during construction, these being sand suppliers, hiring of equipment, material suppliers and so forth.

- Address employment of local labour which requires the establishment of a labour desk with the roles and responsibilities appropriately defined.

- Ensure effective communication between all parties being all committees, the institutional organisation such as municipalities, community contractor's project implementing agent.

- Provide Community awareness and enhancement so as to ensure that ownership of infrastructure is taken by the community and involvement of the community with regards to the operation and maintenance phase to ensure longevity of the project.

- Establishment of a clear communication plan.

10.5 Project reporting

The Project Manager for the project will ensure that the reporting schedules prescribed by the Technical Department of City of uMhlathuze as well as the funder (RIBG and MIG) is adhered to. Seen in the light of the primary objectives of this project, key performance indicators used on the project will be as follows:

- Progress against Time. (Both in terms of the design and construction phases.)

- Creation of Management Capacity within the Project Steering Committee.

- Actual versus Budgeted Expenditure.

- The creation of opportunities for emerging contractors.

- Direct creation of employment opportunities.

- Training provided.

10.6 Employment generation

It is anticipated that the following employment will be generated during the construction period. The project will create an additional 6 positions for permanent employment.

Table 21: Employment creation

Category	TOTALS		Adult				Youth				Disabled			
			Male		Female		Male		Female		Male		Female	
	Persons	Person days	Persons	Person days	Persons	Person days	Persons	Person days	Persons	Person days	Persons	Person days	Persons	Person days
Clerical	11	1760	2	320	3	480	2	320	2	320	1	160	1	160
Labourer	190	30400	60	9600	60	9600	40	6400	30	4800				
Managerial	18	2880	3	480	3	480	5	800	5	800	1	160	1	160
Semi-skilled	27	4320	9	1440	6	960	6	960	6	960				
Skilled	38	6080	6	960	8	1280	10	1644	12	1920				
Supervisor	10	1600	4	640	2	320	2	320	2	320				
TOTAL	**290**	**47040**	**84**	**13440**	**82**	**13120**	**67**	**9126**	**57**	**9120**	**2**	**320**	**2**	**320**

10.7 Training cost

Training to be provided for the following skills:

- Plumbing
- Pipe laying
- Backfilling & compaction of a trench
- Quality control
- Life skills
- SMME development

Training will be categorised as follows:

a) Accredited training

Number of trainees : 100 workers
Total training days (@ 10 days per worker) : 1,000 days
Value of training (@ R 10,000 per worker) : R 1,000,000

b) Un-accredited training

Number of trainees : 290 workers
Total training days (@ 5 days per worker) : 1,450 days
Value of training (@ R 3,000 per worker) : R 870,000

10.8 Social and Socio Economic opportunities

The labour requirements during construction are estimated at ± 150 workers per R 90 million per year for 5 years. This is estimated at 750 workers per year for 5 years.

Mandays (@ 240 working days per annum): 900,000

Payment to workers (@ R 200 / day): R 180,000,000

11. ECONOMIC AND SOCIAL ANALYSIS

11.1 Infrastructure cost

11.1.1 Initial capital investment

The initial capital investment is estimated at R 524 829 421,33 (refer to Section 7(e)). This includes the replacement of the existing distribution network.

11.1.2 Long-term operation and maintenance

The future operation and maintenance costs over the ensuing years will be as follows:

Table 22: O & M costs

Period/Term	Expected Operating Cost (1)	Expected Maintenance Cost (2)	Total O & M Cost (3=1+2)
Year 1	R 2,500,000	R 2,125,000	R 4,625,000
Year 2	R 3,050,000	R 2,375,000	R 5,425,000
Year 3	R 3,600,000	R 2,500,000	R 6,100,000
Year 4	R 4,165,000	R 3,825,000	R 7,990,000
Year 5	R 4,700,000	R 4,950,000	R 9,650,000
Total			**R 33,790,000**

11.2 Cost recovery

An overview unit cost recovery for this project is calculated as follows:

- Based on interest and capital recovery at 6 % per year (over 20years)
  - Total Annual costs : R 8,043,360-00
  - Water Demand/year(11,134 kl/day average) : R 4,063,910-00
- Unit cost of water : R 1-98 / kl
- Cost per low income housing : R 11-88 / month

The unit cost of water without interest and cost recovery is 80c/ kl or R4-80 housing unit/month. The additional cost can be recovered by phasing tis into water tariffs.

12. ENVIRONMENTAL CONSIDERATIONS

12.1 Environmental Impact Assessment

The activities which are associated with this project arising from Government Notice R 386 of 21 April 2006 as follows:

- Activity 1 for the construction of facilities or infrastructure, including associated structures or infrastructure for:

  (k) The bulk transportation of sewage and water, including stormwater, in pipelines with:

  i) An internal diameter of 0,36m or more, or;

  ii) A peak throughput of 120ℓ/sec or more.

  (n) The off stream storage of water, including dams and reservoirs with a capacity of 50,000m^3 or more.

- Activity 4 for the dredging, excavation, infilling, removal or moving of soil, sand or rock exceeding 5m^3 from a river, tilde lagoon, tilde river , lake, in-stream, dam, floodplain or wetland.

The activities associated with the works as envisaged through this project have not been classified as listed activities in terms of Government Notice R 386 of 21 April 2006 and thus does not require a basic assessment in terms of the National Environmental Management Act (Act no. 107 of 1998).

An independent environmental practitioner will be appointed to verify and confirm the abovementioned interpretations.

12.2 Social environment

The impact on the social environment is:

Positive:

- Employment opportunities
  (Approximately 900,000 mandays at R 90 million)
- Sustained water supply
- High quality of water
- Reduced health risks

Negative:

- Construction activities affecting access, noise and disturbances.
- Water supply disruptions

Negative impacts will be mitigated by working hours and execution methodology and managed by the EMP.

12.3 Environmental Management Plan

A project specific Environmental Management Plan will be included with the tenders.

13. PROGRAMME AND CASH FLOW

A preliminary programme and cash flow for implementation be provided, the following may be deemed to be the broad parameters:

a) **Programme**

- DWS Feasibility Report approval : 7 April 2022
- **Phase 1 - Bulk pipelines and reservoir**
  - Tender award : 23 July 2020
  - Construction complete : 22 July 2021
- **Phase 2 - Bulk pipelines and reservoirs**
  - Tender award : 16 January 2022
  - Construction complete : 15 December 2022
- **Phase 3 – Pumpstation, Reservoir and Reticulation Portion A**
  - Tender award : 16 September 2022
  - Construction complete : 15 September 2024
- **Phase 4 - Reticulation Portion B and C**
  - Tender award : 25 January 2026
  - Construction complete : 24 January 2027

- **Phase 5 - Bulk pipelines and reservoirs**

  - Tender award : 23 January 2025
  - Construction complete : 24 Feburary 2030

- Final handover : 29 February 2030

b) **Cash flow**

A yearly cash flow for implementation is provided, the following which may be deemed to be the broad parameters in terms of the financial years:

Table 23.1 Preliminary Cash Flow - Indirect Cost

INDIRECT COST ESTIMATE - PRELIMINARY CASH FLOW - SUMMARY				
Financial Year	**Indirect Cost**	**15% VAT**	**Total**	**Accumulative Total**
2020 / 2021	R9,925,004.16	R1,488,750.62	R11,413,754.78	R11,413,754.78
2021 / 2022	R11,092,651.71	R1,663,897.76	R12,756,549.46	R24,170,304.25
2022 / 2023	R12,260,299.26	R1,839,044.89	R14,099,344.14	R38,269,648.39
2023 / 2024	R13,427,946.80	R2,014,192.02	R15,442,138.83	R53,711,787.22
2024 / 2025	R14,011,770.58	R2,101,765.59	R16,113,536.17	R69,825,323.38
2025 / 2026	R12,844,123.03	R1,926,618.45	R14,770,741.48	R84,596,064.87
2026 / 2027	R11,676,475.48	R1,751,471.32	R13,427,946.80	R98,024,011.67
2027 / 2028	R11,092,651.71	R1,663,897.76	R12,756,549.46	R110,780,561.14
2028 / 2029	R10,508,827.93	R1,576,324.19	R12,085,152.12	R122,865,713.26
2029 / 2030	R9,925,004.16	R1,488,750.62	R11,413,754.78	R134,279,468.04
Total:	**R116,764,754.82**	**R17,514,713.22**	**R134,279,468.04**	

Table 23.2: Cash Flow

DIRECT & INDIRECT COST ESTIMATE - PRELIMINARY CASH FLOW - SUMMARY				
Financial Year	**Direct Cost**	**Indirect Cost**	**Total**	**Accumulative Total**
2020 / 2021	R70,210,922.37	R11,413,754.78	R81,624,677.15	R81,624,677.15
2021 / 2022	R82,705,823.13	R12,756,549.46	R95,462,372.59	R177,087,049.74
2022 / 2023	R96,349,123.21	R14,099,344.14	R110,448,467.35	R287,535,517.10
2023 / 2024	R111,226,162.39	R15,442,138.83	R126,668,301.21	R414,203,818.31
2024 / 2025	R122,320,332.04	R16,113,536.17	R138,433,868.20	R552,637,686.51
2025 / 2026	R118,190,308.77	R14,770,741.48	R132,961,050.25	R685,598,736.76
2026 / 2027	R113,259,566.70	R13,427,946.80	R126,687,513.50	R812,286,250.27
2027 / 2028	R113,364,924.44	R12,756,549.46	R126,121,473.90	R938,407,724.17
2028 / 2029	R113,322,781.34	R12,085,152.12	R125,407,933.47	R1,063,815,657.63
2029 / 2030	R112,627,420.28	R11,413,754.78	R124,041,175.07	R1,187,856,832.70
Total:	**R1,053,577,364.65**	**R134,279,468.04**	**R1,187,856,832.70**	

14. RECOMMENDATION

14.1 Recommendation

That the deficiencies in existence in respect of the physical infrastructure to provide water services to the project area have been noted, as well as the need for the upgrade of these water services to allow as the Water Services Authority and Water Services Provider to effectively fulfil each function. Funding for the abovementioned project will be implemented as follows:

- **Municipal Own Funding**

  An amount of R 86,259,038-18 (including VAT) has been spent for preliminary design, EIA, WULA, etc (R 14,095,038-18) and Phase 1 implementation (R 72,164,000-00) of the project to eradicate water tankers and the balance of the cost is requested.

- **MIG Funding**

  An amount of R 595,824,495-38 will be for the reticulation infrastructure and will be funded by MIG.

- **RBIG Funding**

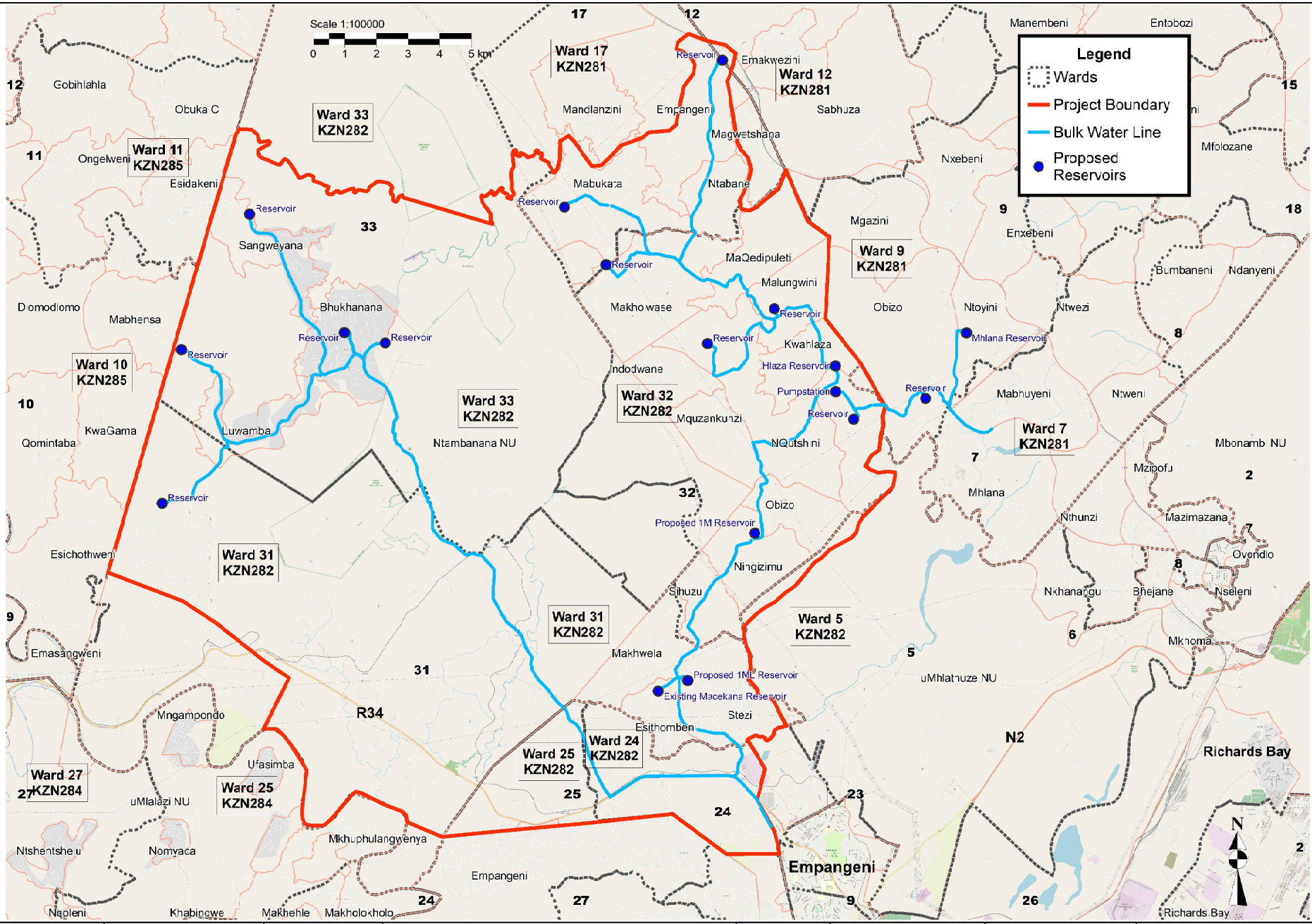
  An amount of R 592,032,337-31 will be for the Bulk infrastructure and will be funded by RBIG.

The funding in the amount of **R 1,187,856,832-70** (inclusive of VAT) as the total project cost be approved in principal as grant funding by the Department of Water and Sanitation which is the estimated cost at this moment. This cost will be reviewed at the detailed design stage.

14 .2 WSA Management Support

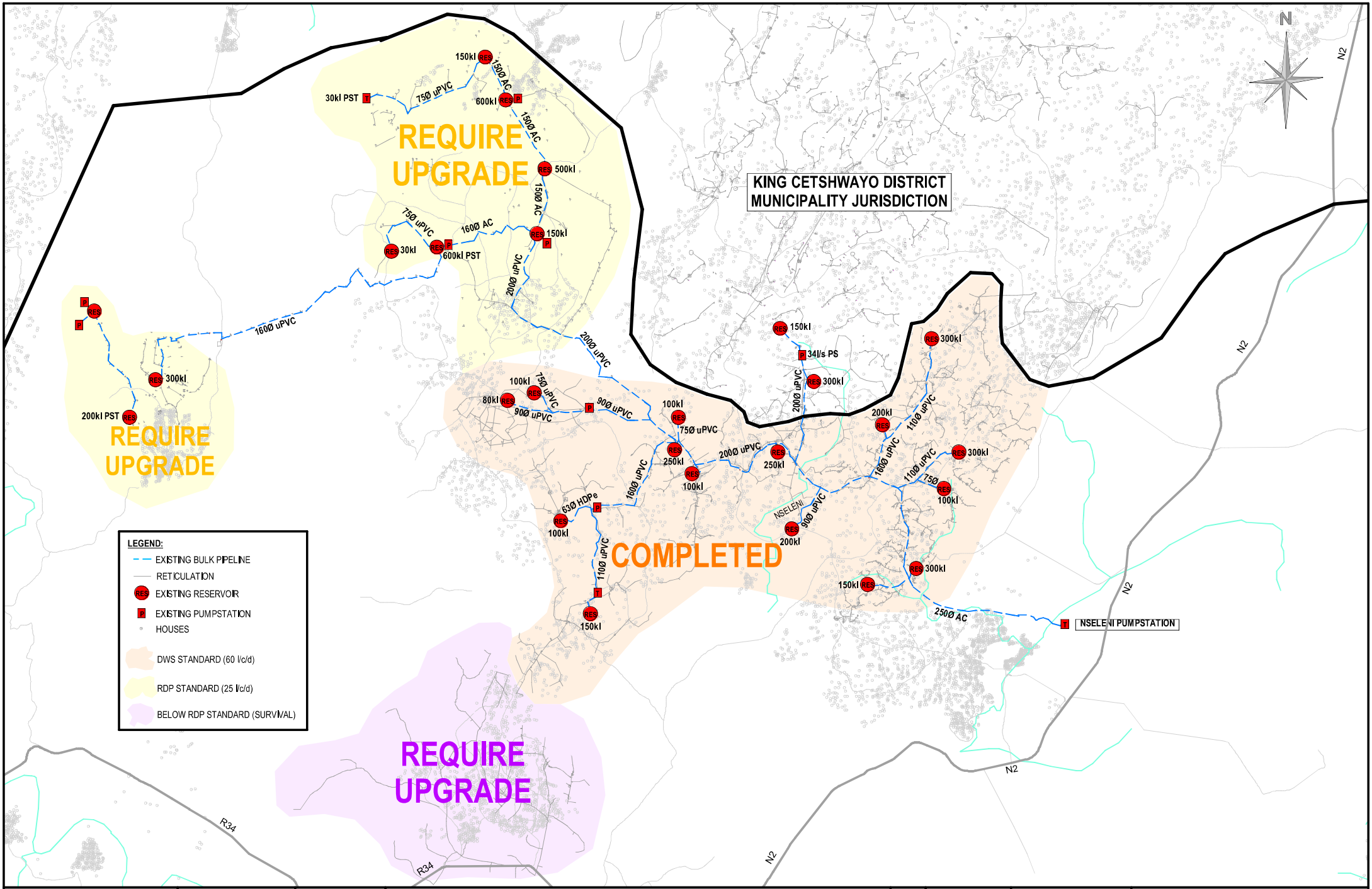
The recommendation in Section 13.1 above is:	
SUPPORTED AND SUBMITTED TO COUNCIL FOR CONSIDERATION	NOT SUPPORTED
Municipal Manager	Municipal Manager
Date:	Date:
Council Resolution No.13140 dated 10 April 2019	

ANNEXURE A
LOCALITY MAP



CONSULTING ENGINEER: CIVTECH ENGINEERS	CLIENT: uMHLATHUZE	DRAWING STATUS: FOR INFORMATION	PROJECT: **NTAMBANANA WATER SUPPLY UPGRADE**	SCALE:	NTS	DRAWING NR.	DRAWING TITLE: **LOCALITY MAP**
				DATE:	02/03/2022		
				DRAWN:	T. Alleaume	INTERNAL FILE: 2017-7	
				CHECKED:	C. Mthiyane		

ANNEXURE B
EXISTING INFRASTRUCTURE



CIVTECH ENGINEERS

uMHLATHUZE

STATUS OF DRAWING: FOR REPORT

PROJECT: NTAMBANANA WATER SUPPLY UPGRADE

SCALE	NTS
DATE	23/03/2017
DRAWN	N. BARNARD
CHECK	C. MTHIYANE

DRAWING NO: ANNEXURE B

FILE: 2017-7

DRAWING TITLE: EXISTING INFRASTRUCTURE

ANNEXURE C
PROPOSED INFRASTRUCTURE

BULK PIPELINE TABLE

PIPE NAME	PIPE SIZE	PIPE TYPE	PIPE LENGTH
P1	350	uPVC	6000m
P2	300	uPVC	5000m
P3	300	uPVC	3000m
P4	110	uPVC	1600m
P5	350	uPVC	4000m
P6	160	uPVC	5000m
P7	250	uPVC	7000m
P8	250	uPVC	3000m
P9	160	uPVC	1600m
P10	200	uPVC	9100m
P11	160	uPVC	2500m
P12	160	uPVC	2600m
P13	110	uPVC	6000m

PUMPSTATION TABLE

PS NAME	PS FLOW (l/s)	PS HEAD (m)
PS1	44	190
PS2	180	120
PS3	7	75
PS4	4	120
PS5	3.8	85
PS6	2.4	172
PS7	13	75
PS8	16	114

RESERVOIR TABLE

RES. NAME	RES. SIZE (kl)	RES. HEIGHT (masl)
R1	400	220
R2	250	250
R3	150	240
R4	1000	240
R5	350	150
R6	250	200
R7	600	140
R8	500	195
R9	200	240
R10	200	260
R11	150	280
R12	200	340

LEGEND:
- PROPOSED PIPELINE PHASE 1
- PROPOSED PIPELINE PHASE 2
- PROPOSED PIPELINE PHASE 3
- PROPOSED PUMPSTATION
- PROPOSED RESERVOIR
- FUTURE PUMPSTATION
- FUTURE RESERVOIR
- MUNICIPAL BOUNDARY
- RIVERS
- MINOR ROUTES
- MAJOUR ROUTES
- INFRASTRUCTURE BY OTHER
- HOUSES
- TOWNS

N

TO KCDM

PROJECT AREA

KING CETSHWAYO DISTRICT MUNICIPALITY JURISDICTION

MTHONJANENI LOCAL MUNICIPALITY

INFRASTRUCTURE BY OTHER WATER AUTHORITY

CITY OF UMHLATHUZE

MBONAMBI

NSELENI

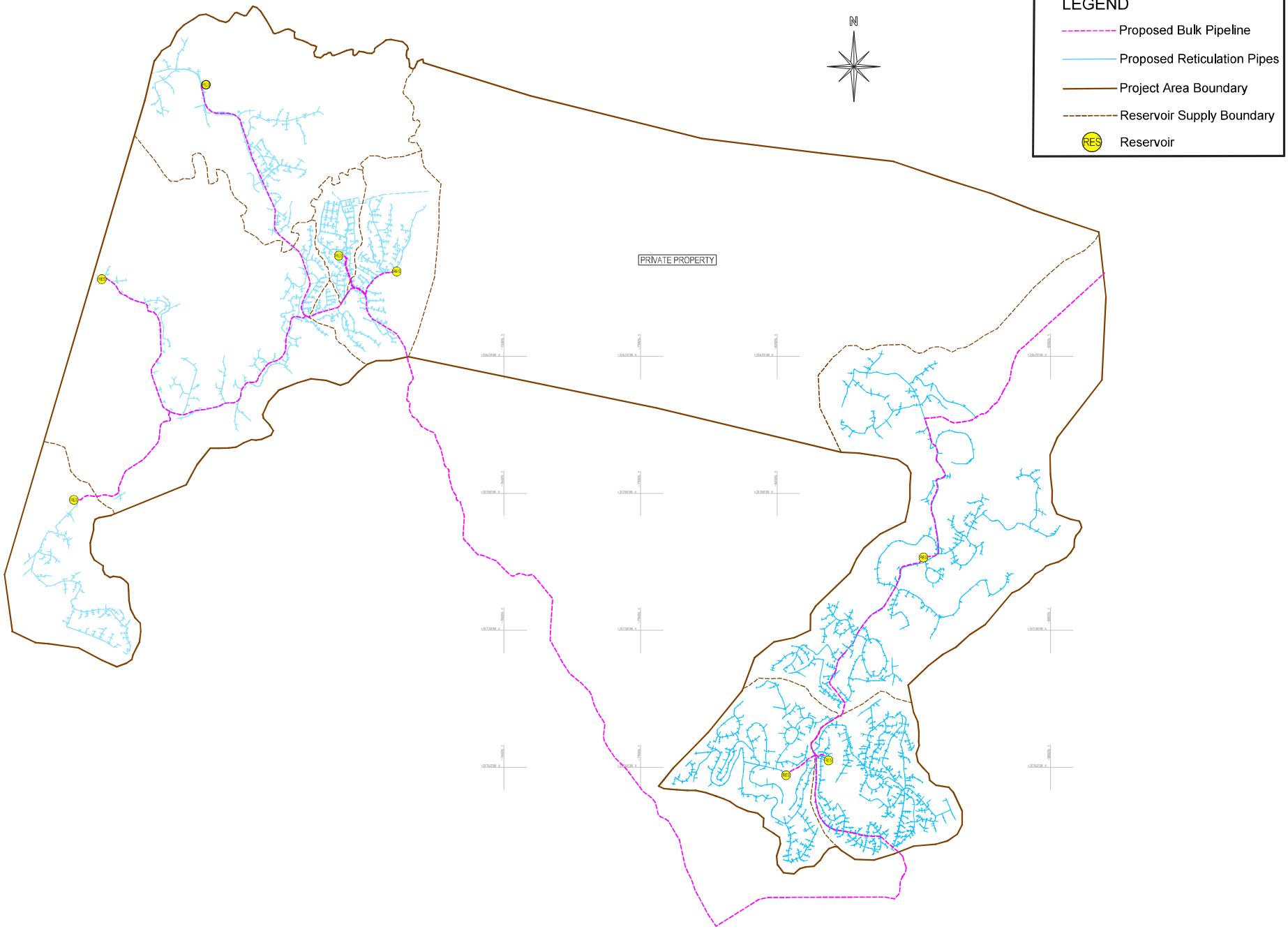
RICHARDS BAY

EMPANGENI

R11 280 masl
P11 = 2.5KM
P10 = 9.1KM
P9 = 1.6KM
PS7
PS6
P8 = 3KM
R9 240 masl
R8 195 masl
R7 140 masl
R6 200 masl
P7 = 7KM
R5 150 masl
P6 = 5KM
PS5
PS4
R4 X : 3168621.784 Y : -86747.074 240 masl
R10 260 masl
PS8
P12 = 2.6KM
P13 = 6KM
R12 340 masl
R3 X : 3170521.613 Y : -83411.481 240 masl
P4 = 1.6KM
PS3
P5 = 4KM
P3 = 3KM
R2 X : 3173147.346 Y : -84368.494 250 masl
15KM
PS1 X : 3173621.871 Y : -97389.543 68 masl
P2 = 5KM
R1 X : 3176887.515 Y : -82336.585 220 masl
PS2 X : 3180667.021 Y : -85714.658 155 masl
P1 = 6KM
R34
N2

CIVTECH ENGINEERS	uMHLATHUZE	STATUS OF DRAWING: FOR REPORT	PROJECT: NTAMBANANA WATER SUPPLY UPGRADE	SCALE: NTS; DATE: 23/03/2017; DRAWN: N. BARNARD; CHECK: C. MTHIYANE	DRAWING NO: ANNEXURE C; FILE: 2017-7	DRAWING TITLE: PROPOSED BULK INFRASTRUCTURE

ANNEXURE D
PROPOSED RETICULATION



CIVTECH ENGINEERS

uMHLATHUZE

STATUS OF DRAWING: FOR REPORT

PROJECT: NTAMBANANA WATER SUPPLY UPGRADE

SCALE	NTS
DATE	09/11/2021
DRAWN	T.NGCOBO
CHECK	C. MTHIYANE

DRAWING NO: ANNEXURE D

FILE: 2017-7

DRAWING TITLE: PROPOSED RETICULATION NETWORK