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Department:
Co-operative Governance and Traditional Affairs
PROVINCE OF KWAZULU-NATAL

**PROJECT: DEVELOP A UNIVERSAL ACCESS PLAN ACROSS FIVE DISTRICT MUNICIPALITIES IN KZN**

FOCUS
A Division of the Crowie Property Group

SIVUNO CONSULTING VIKANI FUNDA

Mott MacDonald PDNA

MHP GEOSPACE

# [REPORT: DEVELOPMENT OF UNIVERSAL ACCESS PLAN FOR WATER SERVICES FOR UGU DISTRICT MUNICIPALITY]

| REPORT TITLE | Development of Universal Access Plan for Water Services in Ugu District Municipality | | |
|---|---|---|---|
| CLIENT | Department of Cooperative Governance and Traditional Affairs | | |
| FOCUS | Prepared by : ____________ | Reviewed by: ____________ | Approved by: ____________ |
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| DESCRIPTION | REVISION | DATE |
|---|---|---|
| Ugu District Municipality Universal Access Plan | Final | 07/10/2014 |
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## GLOSSARY

| | | |
|---|---|---|
| COGTA | - | Department of Cooperative Governance and Traditional Affairs |
| DM | - | District Municipality |
| DRDLR | - | The Department of Rural Development and Land Reform |
| DWA | - | Department of Water Affairs |
| GIS | - | Geographical Information System |
| IDP | - | Integrated Development Plan |
| LM | - | Local Municipality |
| MIG | - | Municipal Infrastructure Grant |
| PIG | - | Provincial Infrastructure Grant |
| PMU | - | Project Management Unit |
| RWSS | - | Regional Water Supply Scheme |
| TA | - | Traditional Authorities |
| TOR | - | Terms of reference |
| UAP | - | Universal Access Plan |
| UDM | - | Ugu District Municipality |
| WARMS | - | Water Authorisation and Registration Management System |
| WSA | - | Water Services Authority |
| WSDP | - | Water Services Development Plan |
| WSP | - | Water Services Provider |
| WTW | - | Water Treatment Works |
| WWTW | - | Waste Water Treatment Works |
| WUA | - | Water User Association |

## 1. EXECUTIVE SUMMARY

The consortium consisting of Focus, Mott Macdonald PDNA,MHP GeoSpace and Sivuno Consulting were appointed to undertake the Universal Access Plan (UAP) for water in five of the District Municipalities in KwaZulu- Natal. The report was to focus on the following:

- Assessment of water planning status quo.
- Identify existing water supply schemes.
- Identify already proposed future water supply schemes (at a conceptual level).
- Existing and proposed water supply and demand options.
- An updated geo database.
- Preparation of a Universal Access Plan (UAP) which entails collection of infrastructure backlog, verification of existing data from the various municipalities and formulating a plan with relevant milestones and associated costs to achieve Universal Access.

The following documents were viewed for information regarding the water planning status quo and assessment of all existing supply schemes as well as proposed future supply options for each of the Local Municipalities and the District Municipality:

| Documents | Latest Report |
|---|---|
| Ugu District Municipality Integrated Development Plan | 2013 |
| Vulamehlo Local Municipality Integrated Development Plan | 2013 |
| Umdoni Local Municipality Integrated Development Plan | 2013 |
| Umzumbe Local Municipality Integrated Development Plan | 2013 |
| Umiziwabantu Local Municipality Integrated Development Plan | 2013 |
| Ezingoleni Local Municipality Integrated Development Plan | 2013 |
| Hibiscus Coast Local Municipality Integrated Development Plan | 2013 |
| Water Services Development Plan | 2008 |
| Development of Water Reconciliation Strategy for all towns in the Eastern Region for Ugu District Municipality | 2011 |
| Department of Water Affairs Priority Projects | 2011 |

The methodology applied in the development of a Universal Access Plan for Water Services in Ugu District Municipality was as follows:-

- MM PDNA arranged meetings with the technical staff of the Ugu District Municipality in order to obtain GIS information and confirm the water backlog data, as well as confirm existing and proposed schemes in the Ugu District Municipality.

- MHP GeoSpace obtained Geographic Information System (GIS) spatial information from various sources, including the Ugu District Municipality and the Department of Water Affairs. All data has been stored in an ESRI ArcGIS 10.1 relational geodatabase, using a geographic co-ordinate system (decimal degrees). Metadata has been captured for all the data within the geodatabase. Domains or look-up tables have also been included to ensure consistency in data capture across all areas, and by all users.

- Draft water supply footprints were digitised off the latest colour aerial photography available from the Department of Rural Development and Land Reform. These were captured as polygons following settlement boundaries, and using existing water infrastructure where available. Settlement boundary datasets from the Department of Water Affairs and the Department of Rural Development and Land Reform, together with household points from Eskom (captured in 2011), were used as informants in this process. Outlying households were incorporated where possible but this was not always achievable in cases of isolated households that were located away from the more densely settled areas. In some cases these isolated households consisted of independent, privately owned farms which have their own local supply. These were excluded from the water supply footprint.

- A web mapping application was developed for the District, and served on the internet using ArcGIS Server, from the ESRI suite of GIS software products. This allowed users to view the data in their particular area, and where possible, to identify gaps in the data which could then be addressed by the project team. The engineering team had editing capabilities on this website and were able to identify and edit the attributes of any of the water supply footprints, to edit their shape if necessary, or to capture completely new water supply footprints in any area. Often these consisted of Independent farm houses with their own local supply, which were excluded from the water supply footprint.

- GIS analysis was used to calculate the high and low household numbers, as well as the high and low population counts, for each of the water supply footprints. Statistics SA were consulted on the best method in which to do this, and their census data was used to calculate the average growth rate per annum between 2001 and 2011. This data was applied to calculate the population in 2014 for each polygon. The same growth rate was applied to the number of households, which was calculated from the Eskom 2011 household point data. The table below indicates the growth rate for the Ugu District Municipality.

| **Census Year** | **1996** | **2001** | **2011** | **% Growth from 1996 - 2001** | **% Growth from 2001 - 2011** | **% growth pa (1996 - 2001)** | **% growth pa (2001 - 2011)** |
|---|---|---|---|---|---|---|---|
| Ugu | 641491 | 704030 | 722484 | 9.7 | 2.6 | 1.9 | 0.3 |

- The levels of service (LOS) points, supplied by the Department of Water Affairs, were mapped along with the water supply footprints. These were used to indicate which households were currently supplied with water services, and those which were not yet serviced and needed schemes to be implemented.

The water backlogs in the Ugu District Municipality are presented in the table below.

| Local Municipality | Backlogs (Households) |
|---|---|
| Vulamehlo | 3420 |
| Umdoni | 837 |
| Umzumbe | 7080 |
| Umiziwabantu | 2296 |
| Ezingoleni | 873 |
| Hibiscus Coast | 2034 |
| Ugu | 16540 |

- The highest number of households for each water supply footprint (whether from 2011 or 2014) was used to calculate current, future and probable water demand requirements, measured in million $m^3$ per annum.

- Map series at a scale of 1:20 000 were printed of the entire District Municipality, and these were given to MM PDNA so that conceptual water supply schemes could be designed. These designs were then returned to the GIS team, and captured into the geodatabase.

- Once the concept plans had been captured, they were checked for connectivity between adjacent municipalities. Attribute data, where available, was added to the geodatabase.

- Ownership information was added to each footprint polygon, using cadastral from the Surveyor-General and ownership data from the Deeds office. As the polygons did not follow cadastral boundaries, but rather the actual settlement points, the centroid of each footprint was used to determine the ownership of the property at that location. Ownership was divided into private, non-private (which included national, provincial and local municipal ownership) and land owned by the Ingonyama Trust Board.

- Each water supply footprint was checked against existing water infrastructure data to determine whether there was, or was not, short term water supply in the area.

| LOCAL MUNICIPALITY | NO OF WATER SUPPLY FOOTPRINTS | NO OF WATER SUPPLY FOOTPRINTS WITH SHORT TERM SUPPLY |
|---|---|---|
| Vulamehlo | 36 | 22 |
| Umdoni | 24 | 22 |
| Umzumbe | 34 | 27 |
| Umiziwabantu | 36 | 27 |
| Ezingoleni | 9 | 6 |
| Hibiscus Coast | 34 | 32 |
| Ugu | 173 | 136 |

➢ MM PDNA undertook the conceptual design based on the water supply footprints provided by MHP GeoSpace. Where possible the concept designs were tied into the Ugu District Municipality's planned network to avoid any duplication of infrastructure and to reduce costs.

The following assumptions were made in undertaking the conceptual designs for the un-serviced population:

- Water consumptions were based in accordance to the table below:

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

- Each household has an average of 6 people
- Some of the existing boreholes are functional.
- The existing water reticulation schemes are operational.
- Some of the existing water reticulation schemes have spare capacity.
- Existing water treatment works have the potential to be upgraded or rehabilitated.
- Schemes have some form of power supply.
- General pipe size range is from 25 mm to 150 mm diameter.
- Peak factor - 1.5
- Water losses were considered to be 35%
- Where there is an existing bulk line, connections to the bulk were kept to a minimum
- Reticulation mains were placed in the road reserve for maintenance purposes.
- District and provincial road crossings were kept to a minimum

➢ In viewing the water supply footprints on the GIS mapping the following parameters were used by MM PDNA to determine the type of scheme applicable to the different water supply footprints. The following scheme types were considered in the conceptual designs:

- Tie into existing schemes
- Existing boreholes and standpipes that are non-functional to be rehabilitated.
- Existing boreholes with reticulation to be rehabilitated.
- Boreholes mechanically operated for settlements with a low population.
- Boreholes electronically operated for settlements with a high population.

- Package Plants for settlements which are densely populated.
- From existing scheme pumped to new reservoir and reticulated.

Schematics and a detailed description of the various scheme types indicated above are indicated later in this document.

➢ The conceptual designs were quantified according to scheme types and the rates for various components of the water reticulation were provided by Umgeni Water and are stated in the document.

The conceptual designs and cost estimates for each of the local municipalities as well as the district municipality and based on the various schemes are summarized in the following tables. The detailed costs for each scheme type are indicated in section 8.5 of this document.

| **Vulamehlo LM** | |
|---|---|
| **Scheme Type** | **Total** |
| Link to Existing Scheme | R 291 160 632 |
| New boreholes mechanically operated | R 5 881 260 |
| New boreholes electronically operated | R 9 652 359 |
| **TOTAL** | **R 306 694 251** |

| **Umdoni LM** | |
|---|---|
| **Scheme Type** | **Total** |
| Link to Existing Scheme | R 41 554 530 |
| **TOTAL** | **R 41 554 530** |

| **Umzumbe LM** | |
|---|---|
| **Scheme Type** | **Total** |
| Link to Existing Scheme | R 443 303 125 |
| **TOTAL** | **R 443 303 125** |

| **Umuziwabantu LM** | |
|---|---|
| **Scheme Type** | **Total** |
| Link to Existing Scheme | R 173 793 594 |
| New boreholes electronically operated | R 9 169 825 |
| **TOTAL** | **R 182 963 419** |

| **Ezingoleni LM** | |
|---|---|
| **Scheme Type** | **Total** |
| Link to Existing Scheme | R 220 519 973 |
| New boreholes electronically operated | R 3 285 706 |
| **TOTAL** | **R 223 805 679** |

| Hibiscus Coast LM | |
|---|---|
| **Scheme Type** | **Total** |
| Link to Existing Scheme | R 217 662 386 |
| **TOTAL** | **R 217 662 386** |

The following table is a summary of all the local municipalities in the Ugu District Municipality for the various scheme types, and illustrates the total estimated cost for the District Municipality.

| Ugu DM | |
|---|---|
| **Scheme Type** | **Total** |
| Link to Existing Scheme | R 1 387 994 240 |
| New boreholes mechanically operated | R 5 881 260 |
| New boreholes electronically operated | R 22 107 890 |
| **TOTAL** | **R 1 415 983 390** |

- The table below indicates the backlogs in the Ugu District Municipality and the cost per capita to eradicate the current backlog.

| Local Municipality | Backlogs (Households) | Cost per capita |
|---|---|---|
| Vulamehlo | 3420 | R 14 946 |
| Umdoni | 837 | R 8 274 |
| Umzumbe | 7080 | R 10 436 |
| Umiziwabantu | 2296 | R 13 281 |
| Ezingoleni | 873 | R 42 727 |
| Hibiscus Coast | 2034 | R 17 835 |
| Ugu | 16540 | R 14 268 |

- The phasing of schemes is based on the proposed plans which cover all reticulation and bulk supplies to address the water backlogs. Potential funding such as Municipal Infrastructure Grant (MIG), Provincial Infrastructure Grant (PIG), Cooperative Governance and Traditional Affairs (COGTA), Department of Water Affairs and Forestry (DWAF) etc may be applied for to undertake these projects. The table below indicates the phasing.

  An average cost for each scheme type was compared with the cost estimate for an individual scheme. If the scheme was less than or equal to the average it was assumed that the project could be untaken over a year. If the cost ratio was higher than the average cost, the ratio was used to determine the duration of the project. However, this is flexible depending on the nature and type of project.

| Implementation Year | LM | Total Cost |
|---|---|---|
| 2015/16 | Vulamehlo | R 210 000 628 |
| | Umdoni | R 9 912 780 |
| | Umzumbe | R 113 904 727 |
| | Umuziwabantu | R 85 534 954 |
| | Ezingoleni | R 89 912 206 |
| | Hibiscus Coast | R 130 458 982 |
| | **TOTAL** | **R 639 724 277** |

| Implementation Year | LM | Total Cost |
|---|---|---|
| 2016/17 | Vulamehlo | R 40 246 448 |
| | Umdoni | R 31 641 751 |
| | Umzumbe | R 210 784 920 |
| | Umuziwabantu | R 97 428 465 |
| | Ezingoleni | R 133 893 472 |
| | **TOTAL** | **R 513 995 056** |

| Implementation Year | LM | |
|---|---|---|
| 2017/18 | Vulamehlo | R 56 447 175 |
| | Umzumbe | R 118 613 477 |
| | **TOTAL** | **R 175 060 652** |

| Implementation Year | LM | |
|---|---|---|
| 2018/19 | Hibiscus Coast | R 87 203 404 |
| | **TOTAL** | **R 87 203 404** |

- In the Ugu District Municipality, it is estimated that the existing water backlog of 16540 households can be eradicated by 2019 at a cost of R 1 415 983 390 to develop 59 schemes.

- All GIS data, including all current infrastructure, together with proposed schemes and the costs thereof have been incorporated into a structured geodatabase, with all relevant metadata. In some cases, metadata has also been captured for individual fields within particular datasets.

## 2. INTRODUCTION

### 2.1 Background of the study

In terms of the Department of Cooperative Governance and Traditional Affairs (COGTA) strategic priorities 2013/14 Programme 3 (Development Planning), the Department must prepare a UAP (Universal Access Plan) with a specific focus on water, sanitation and electricity as contained in the MEC's 2013/14 Vote 11 Budget Speech of the 30th of May 2013.

The intention of the UAP is to create service delivery liberated zones. A significant number of municipalities in KwaZulu-Natal are close to achieving universal access in key municipal infrastructure services such as water, sanitation and electricity.

Hence there is a need to formulate a plan to quantify remaining backlogs and the cost thereof.

As a result, the Municipal Infrastructure Development Business Unit of the KwaZulu - Natal Province Department of COGTA required the Focus Consortium to undertake the collection of infrastructure backlog data, verify data and compile a UAP document with relevant milestones and associated costs. The resources were selected in terms of the TOR (terms of reference) from all service providers from the PMU (Project Management Unit), provided that the requirements are met.

The consortium consisting of Focus, Mott Macdonald PDNA, MHP GeoSpace and Sivuno Consulting, and were appointed to undertake the UAP for water in five of the District Municipalities in KwaZulu-Natal. The report was to focus on the following:

- Assessment of water planning status quo.
- Identify existing water supply schemes.
- Identify already proposed future water supply schemes (at a conceptual level).
- Existing and proposed water supply and demand options.
- An updated geodatabase.
- Preparation of a UAP which entails collection of infrastructure backlog, verification of existing data from the various municipalities and formulating a plan with relevant milestones and associated costs to achieve a UAP.

## 2.2 Ugu District Municipality Overview

Ugu District Municipality (UDM) is one of the ten district municipalities in the province. It is 5 866 km² in extent and has a coastline which extends for 112 km, which forms its eastern border. The region is bordered on the north by the EThekwini Municipality, in the west by Umgungundlovu District Municipality and Sisonke District Municipality and on the southern side it borders with the Eastern Cape Province.

The municipality consists of eighty one municipal wards, which culminate into six local municipalities (LM), namely Hibiscus Coast (KZ 216), Ezinqoleni (KZ 215), Umuziwabantu (KZ 214), Vulamehlo (KZ 211), Umzumbe (KZ 213) and Umdoni (KZ 212). The region also boasts forty two traditional authorities. According to the Household Survey Data, Statistics SA (2011) UDM has a population of 722484.


**Figure 1 – Ugu District Municipality Locality Map**

The following are the local municipalities situated in the UDM:

### 2.2.1 Vulamehlo LM (KZ 211)

The Vulamehlo LM forms part of the UDM. It is located south of the eThekwini municipality and is bordered by Umdoni to the east, Mkhambathini and Richmond to the north and Ubuhlebezwe to the west. It covers a geographical area of 960 km². It has a population of approximately 77403.

The Vulamehlo Municipality comprises of eight traditional areas under the Vulamehlo House of Traditional leadership made up of Izimpethu Zendlovu, Mandleni, KwaLembe, AmaNyuswa, Qiko, Zembeni, Kwa-Cele and Ukuthula. There are, however, three other traditional houses which form part of Umbumbulu Traditional house namely Thoyana, Maphumulo and Isimahla traditional houses also forming part of the Vulamehlo LM.

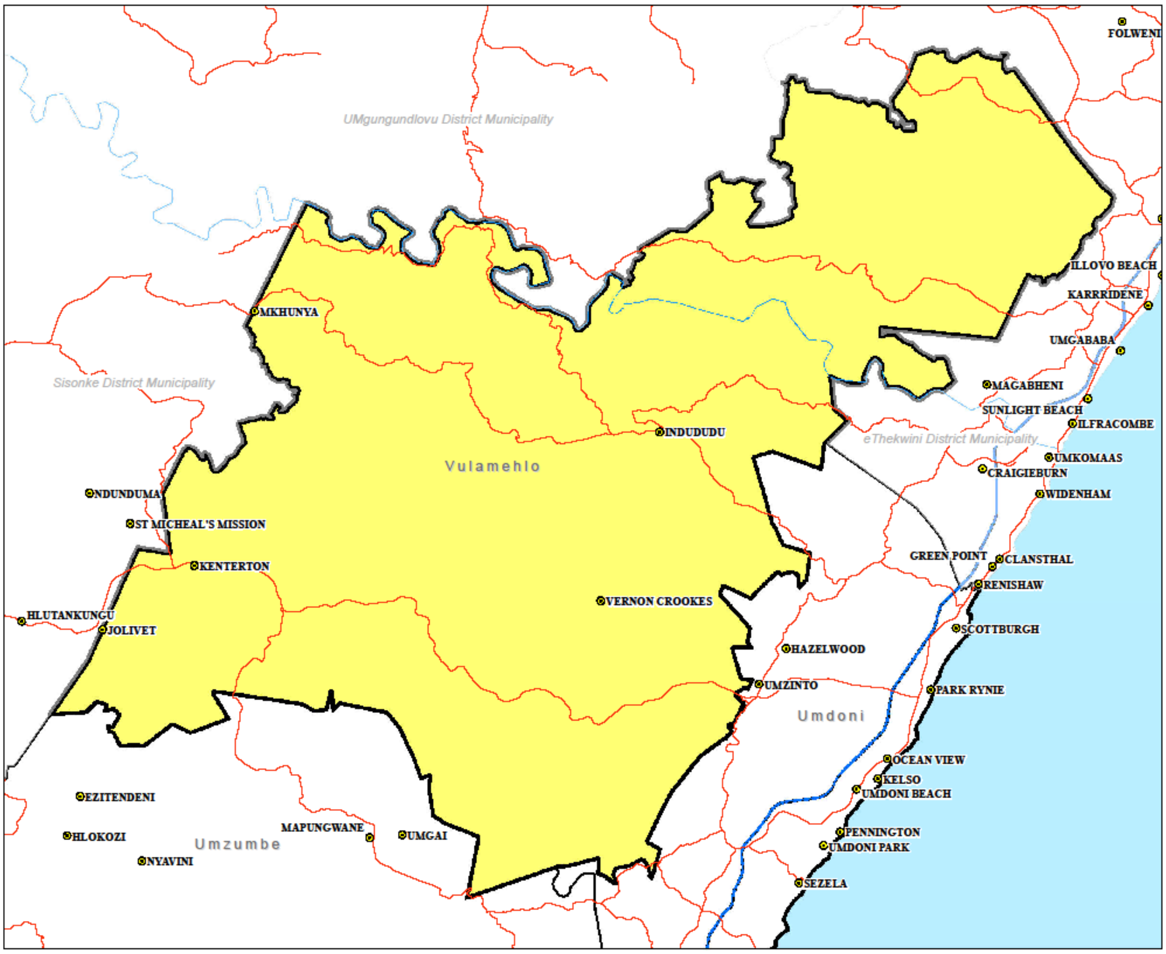



**Figure 2 - Vulamehlo Local Municipality**

### 2.2.2 Umdoni LM (KN 212)

Umdoni LM is located in KwaZulu-Natal within the UDM. The LM consists of 10 wards with a geographical area of 238 km$^2$. The municipality comprises of 10 municipal wards. The municipality incorporates 07 Traditional Authority (TA) areas comprising 10 municipal wards. The Umdoni LM covers a geographical area of 252 km$^2$ and has a total population of approximately 78875.

There are three Traditional Council areas in Umdoni LM which are: Shozi TA-Langa /Emalangeni, Cele TA, Zembeni TA.

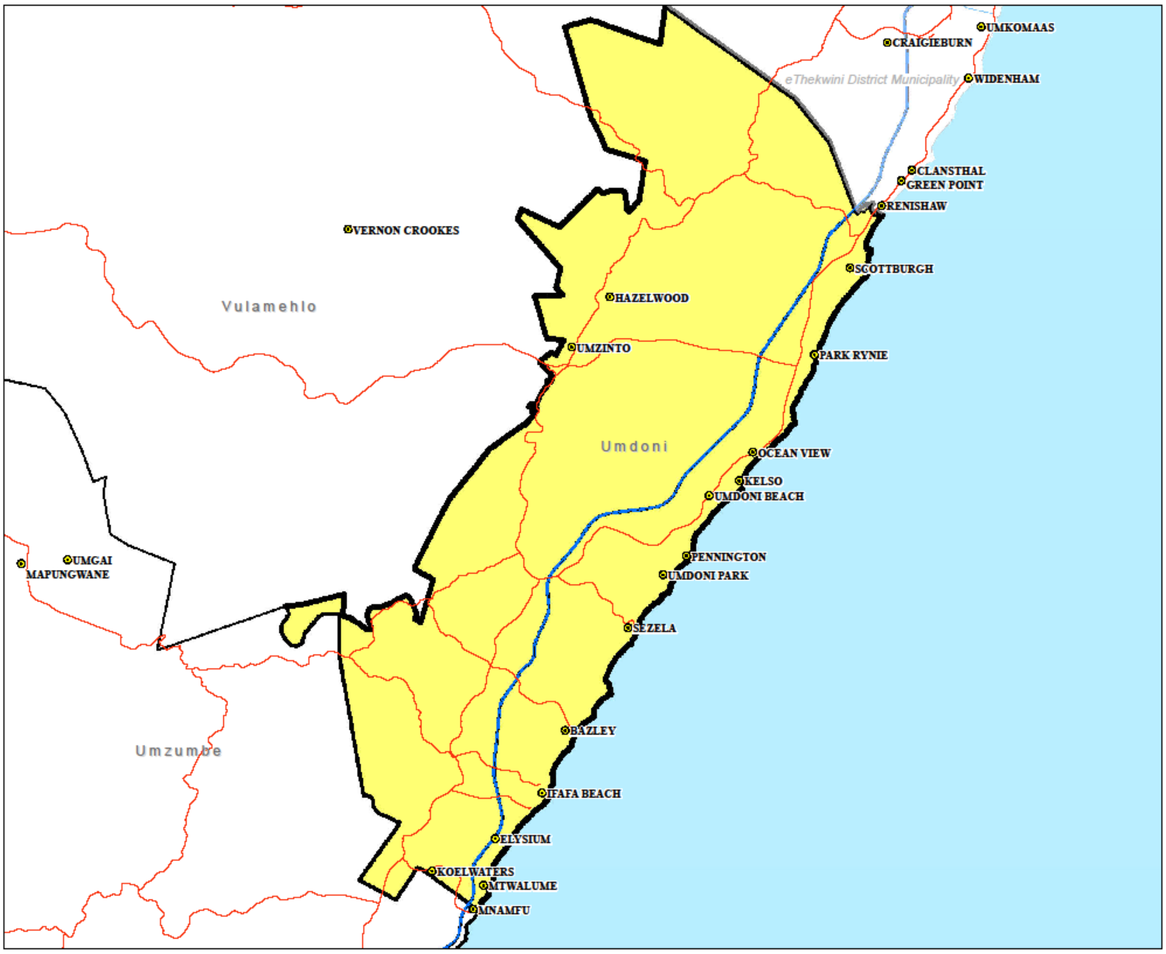



**Figure 3 - Umdoni Local Municipality**

### 2.2.3 Umzumbe Local Municipality (KZ 213)

Umzumbe Local Municipality (LM) is one of the six local municipalities within the UDM. The Municipal boundary runs along the coast for a short strip between Mthwalume and Hibberdene and then balloons out into the hinterland for approximately 60 km. It is the largest municipality within the district and has no established towns. It covers a vast, largely rural area of some 1259 km$^2$ with approximately 1% being built up/ semi-urban area.

The municipality incorporates 17 traditional authority areas comprising 19 municipal wards. The Umzumbe Council comprises of 19 ward Councillors and 18 Proportional Representation Councillors.

It embraces 17 traditional authority areas: the Bhekani, Cele, Dungeni, Emandleni, Frankland, Hlongwa, Hlubi, Izimpethu Zendlovu, Mabheleni, Ndelu, Nhlangwini, Nyavivini, Qoloqolo, Qwabe N, Qwabe P, Shiyabanye and Thulini Traditional Authorities. The total population within Umzumbe LM is 160975.

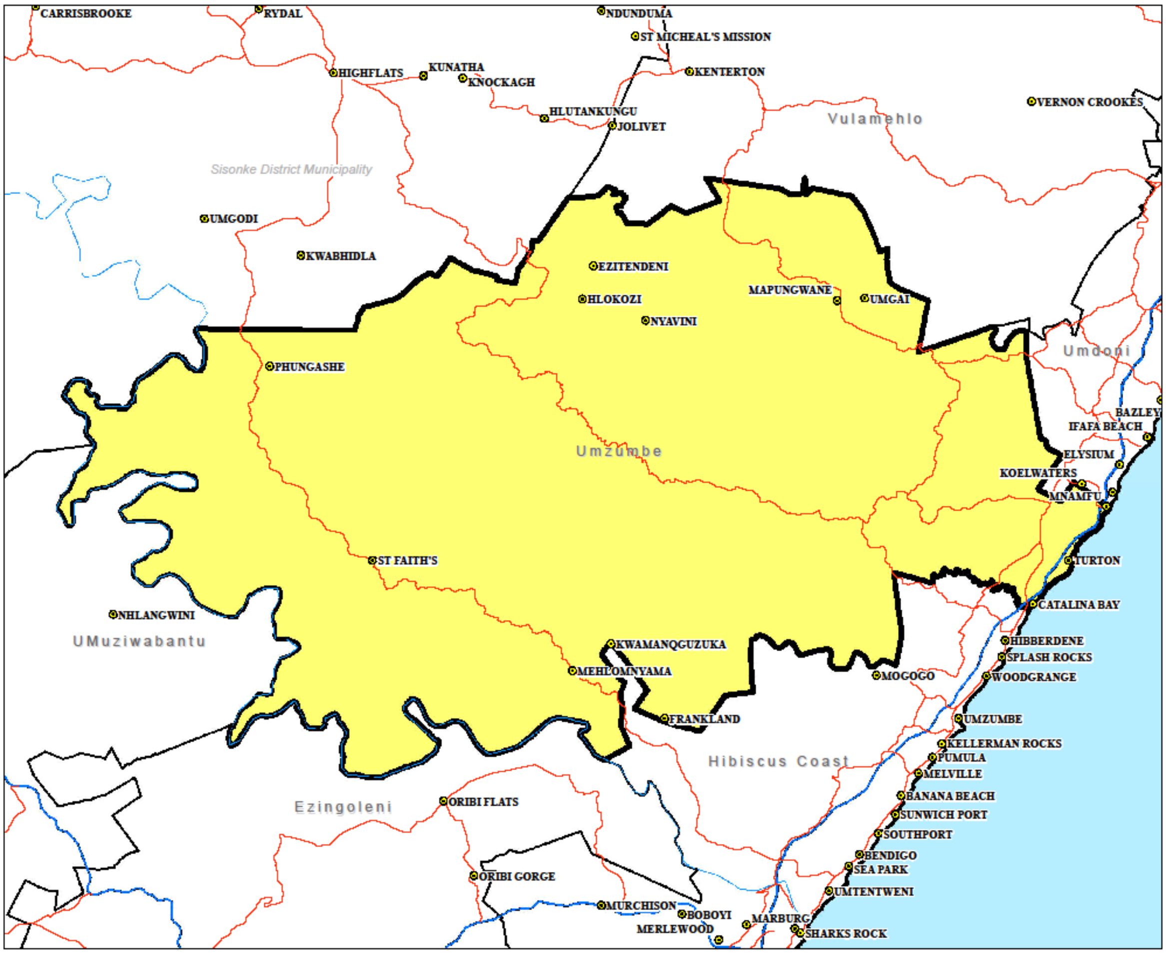



**Figure 4 – Umzumbe Local Municipality**

### 2.2.4 Umuziwabantu Local Municipality (KZ 214)

The Umuziwabantu LM is located on the western boundary of the UDM and shares its borders with the Eastern Cape; Sisonke District and to the east with the Umzumbe and Ezinqoleni Municipalities. The extent of the Umuziwabantu Municipal area is 1088 km².

This area is constituted as follows: Farmlands, Urban, Tribal, and Forestry. Umuziwabantu LM consists of 10 wards with six tribal authorities which include KwaFodo TA, KwaMbotho TA and Thokozani Madumisa TA, Bashaweni TA, Izibonda TA and Inhlangano TA and has a total population of 96556.

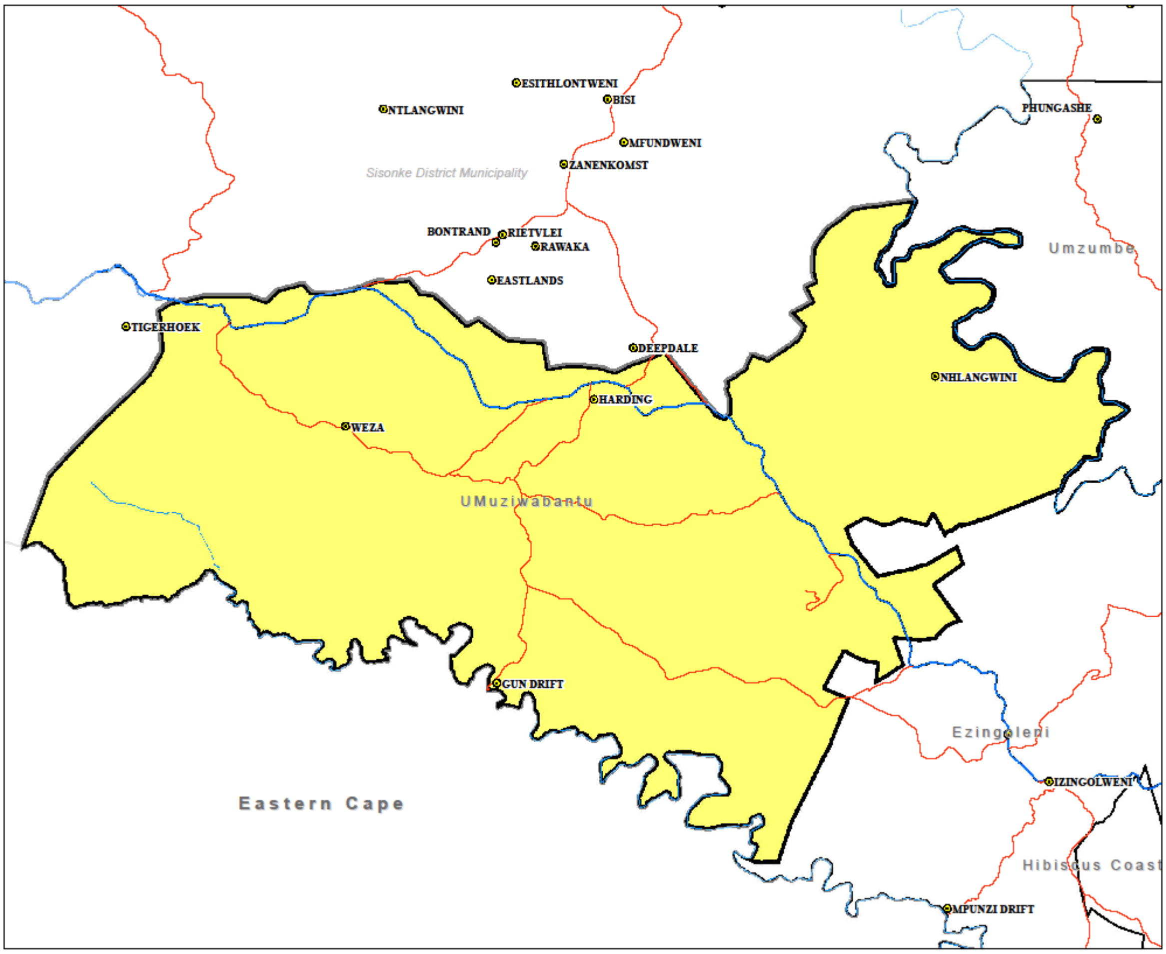



**Figure 5 - Umuziwabantu Local Municipality**

### 2.2.5 Ezingoleni LM (KZ 215)

Ezinqoleni LM is one of the six local municipalities that form part of the UDM. This municipality is located on the south-western boundary of the UDM, adjacent to the west of the Hibiscus Coast LM and east of the Umuziwabantu LM. The Ezinqoleni Municipal area is 649 km$^2$ with a population of approximately 52540.

The institutional and spatial make up of Ezinqoleni Municipality is fundamentally informed by three traditional authority areas, namely: KwaNyuswa, KwaMthimude and KwaVukuzithathe.

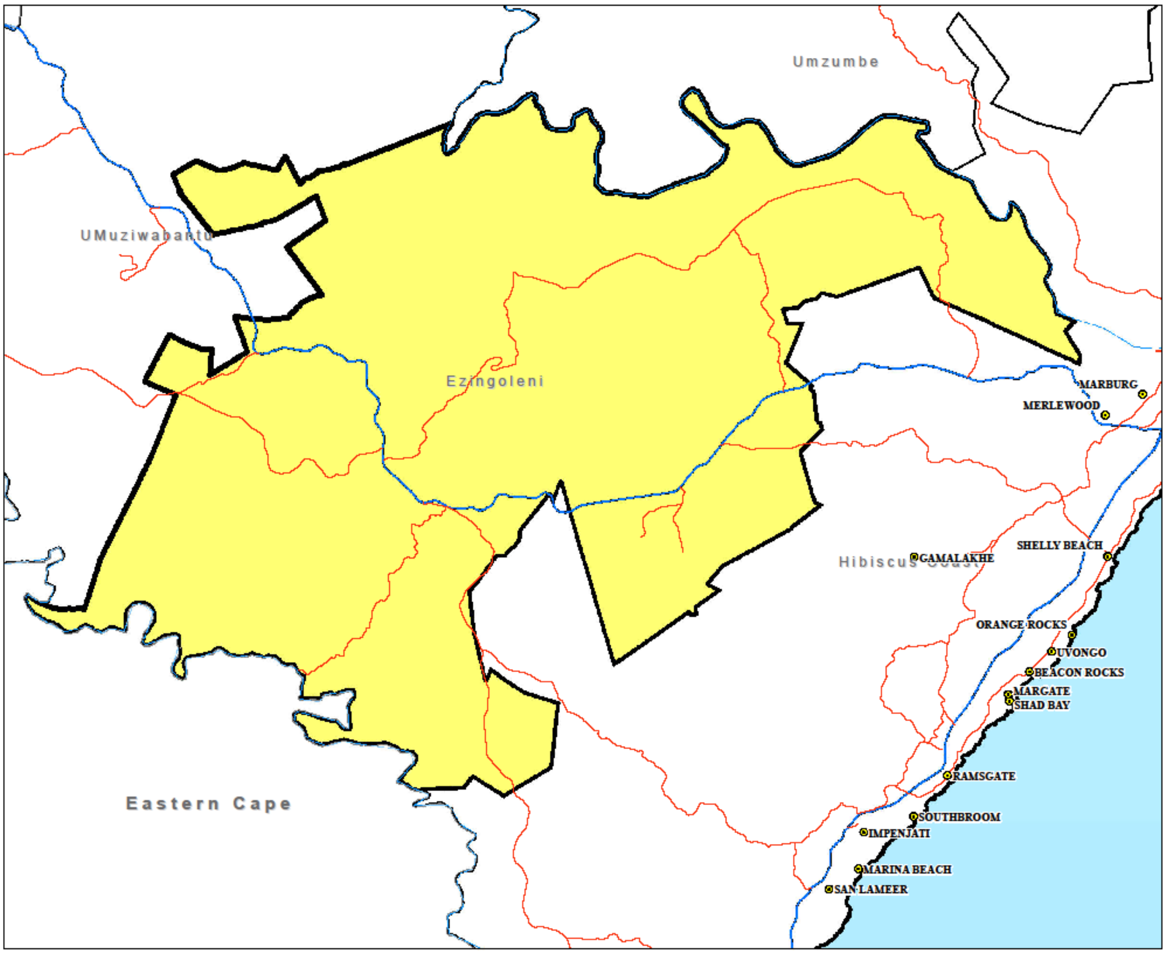



**Figure 6 - Ezingoleni Local Municipality**

### 2.2.6 Hibiscus Coast Local Municipality (KZ 215)

The Hibiscus Coast LM is located on the South Eastern part of KwaZulu Natal. It runs along the costal belt stretching from Hibberdene to Port Edward and about 30km into the interior. It has a population of 256135 and it covers approximately 837km² in geographic area.

It consists of 29 wards, six town centres and six traditional authority areas. The traditional areas include; KwaXolo; KwaNzimakwe; KwaNdwalane; KwaMadlala; KwaMavundla; and KwaLushaba. The town centres include; Port Shepstone, Port Edward, Margate, Hibberdene and Shelly Beach.

The towns are located along the urban strip and the traditional areas in the hinterland or the south western side of the Municipality. The Indian Ocean borders the Eastern part of the Municipality, while on the Southern part runs Umtamvuna River which is the boundary between KZN and the Eastern Cape. Ezinqoleni Municipality borders the north-western part while Umzumbe Municipality borders the northern part while Umdoni Municipality is on its north-eastern boundary.

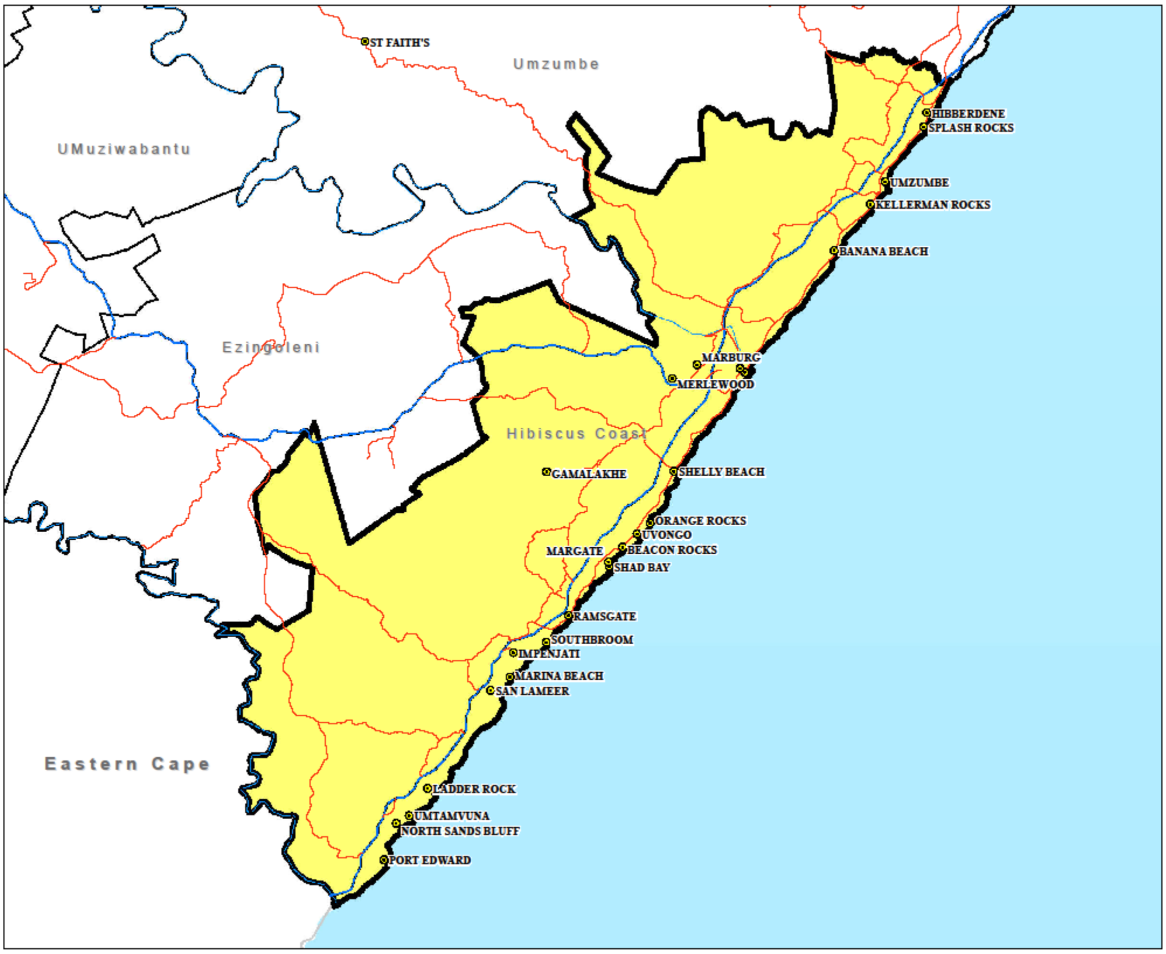



**Figure 7 - Hibiscus Coast Local Municipality**

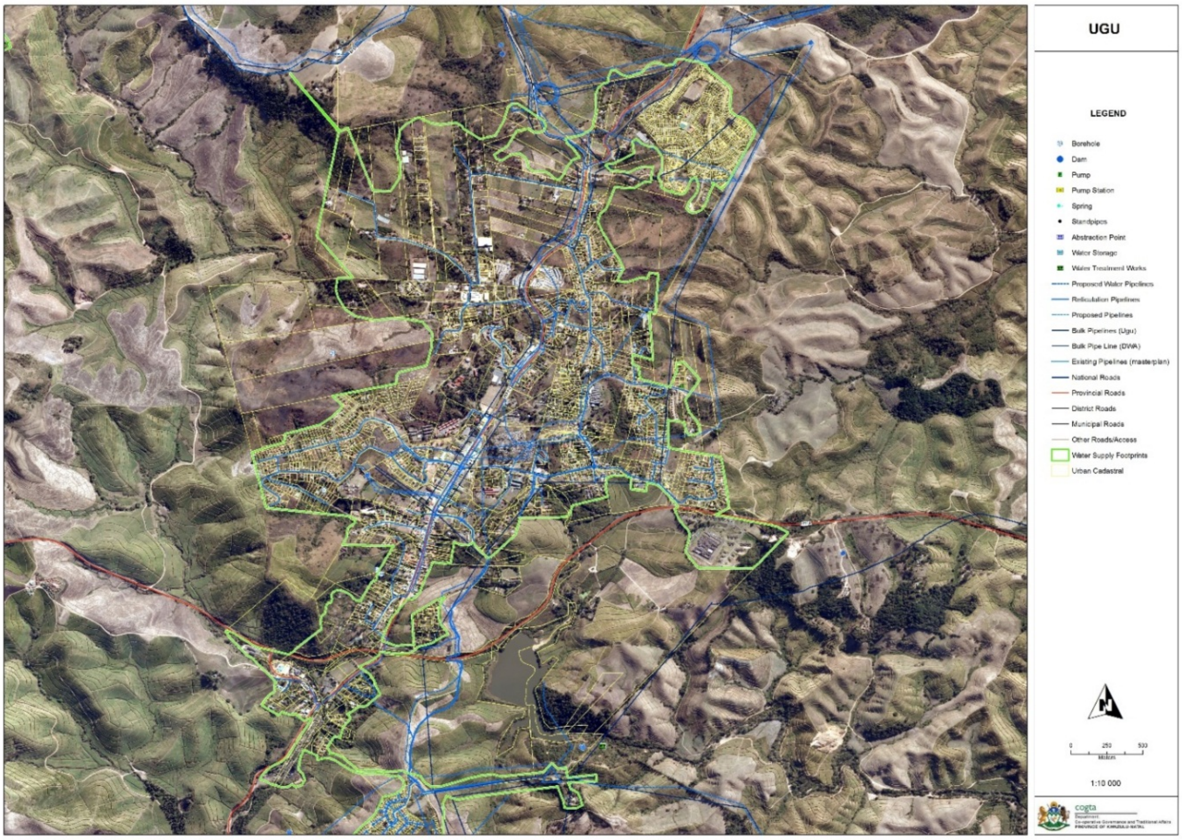
## 3. ASSESMENT OF WATER PLANNING STATUS QUO

In order to assess the current water and sanitation situation in Ugu District Municipality, data in the form of Geographic Information System (GIS) spatial information was obtained from various sources, among them the Department of Water Affairs (DWA) and Ugu District Municipality.

All spatial data has been stored in an ESRI ArcGIS 10.1 relational geodatabase. Due to the spatial location of the five District Municipalities in which work was undertaken, all data was stored in a geographic co-ordinate system i.e. decimal degrees. Where necessary, source data has been projected to the required co-ordinate system. Metadata (information about the data – e.g. source, date, capture method) has been captured within the geodatabase.

The geodatabase also includes base data such as boundaries, roads and place names, as well as household points from the Eskom study of 2011. Domains within the geodatabase behave as look-up tables, which allow the user to update the data using specific values. This ensured consistency in data capture across all team members and across all areas in terms of the way data was captured, as well as the type of data captured.

Domains include the bulk water classification, type and condition, together with the water scheme name and maintenance requirements. Domains can be edited and updated to allow for changes in users and projects. Once all currently available data had been collated, the district municipality was contacted to see if there was any additional data that could be obtained and added to the database. Ugu District Municipality provided the project team with all data that was available and this data has been incorporated into the mapping and design of the proposed schemes.



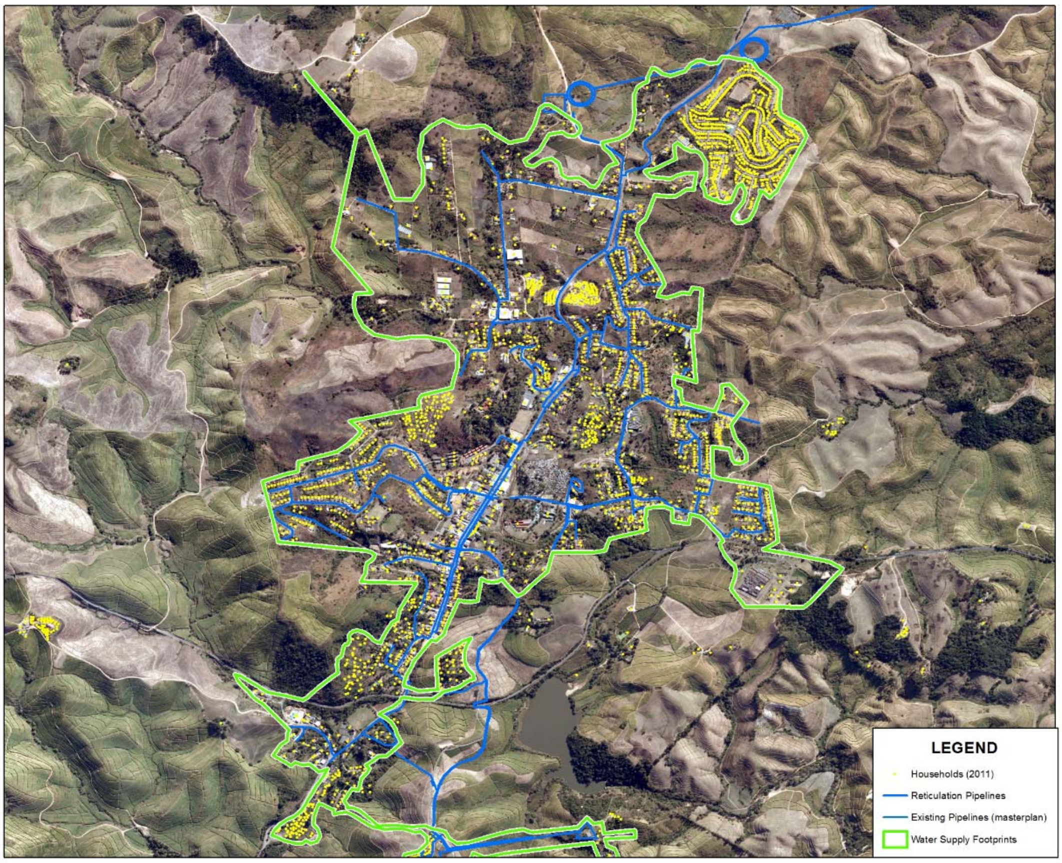

**Map 1 – Example of water infrastructure in the Umzinto area**

## 4. DEVELOP CONTINUOUS WATER SUPPLY FOOTPRINT AREAS

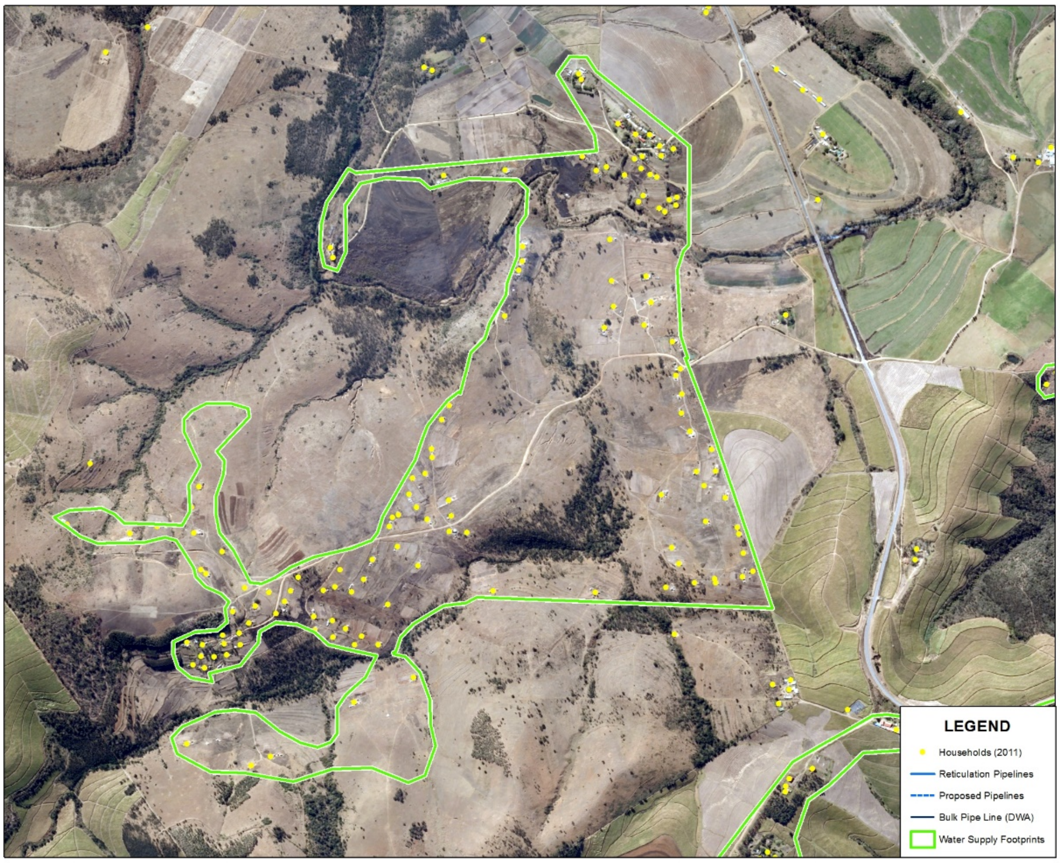
After consultation with Umgeni Water, water supply footprints in the District Municipality were captured as polygons tightly following the edge of settled areas. The data was captured on screen through heads-up digitising against the latest colour aerial photography (ranging from 2009 – 2011) available from the Department of Rural Development and Land Reform. The scale of capture was 1: 10 000, with 1: 5000 capture being done in dense areas.

Areas for capture were identified primarily using the Eskom 2011 household point data, together with additional settlement information (DWA settlements; Department of Rural Development and Land Reform settlements) and existing infrastructure data. These were overlaid onto aerial photography, and polygons were created around obvious settled areas. Outlying households were incorporated where possible but this was not always achieved in cases of isolated households that were far away from more densely settled areas. Once the above data sources had been exhausted, the whole district was panned through and any additional settlements were picked up from the aerial photography.

These water supply footprints were captured over the whole district, including areas where there was existing infrastructure and/or supply

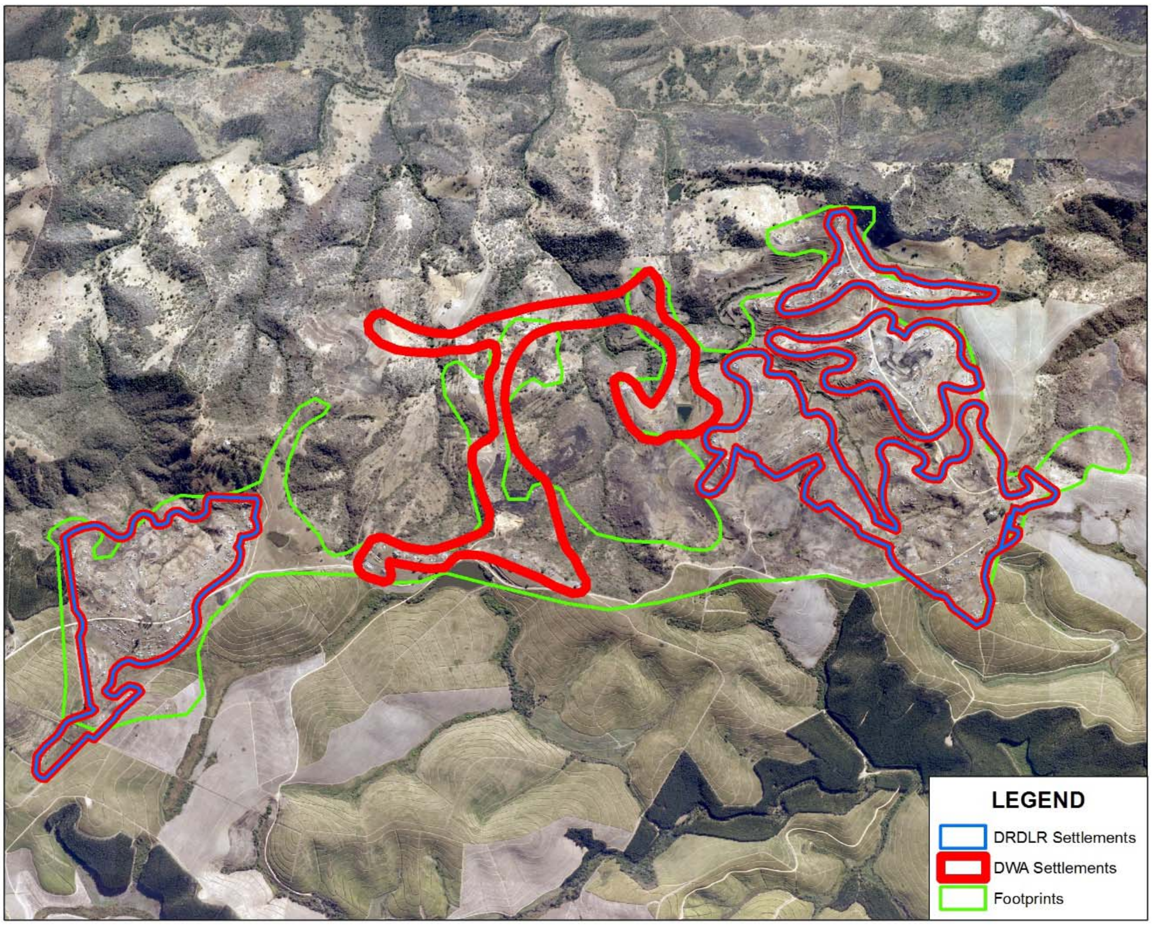



**Map 2 – Water Supply Footprint with existing water reticulation**




**Map 3 – Water Supply Footprint where no water reticulation exists**

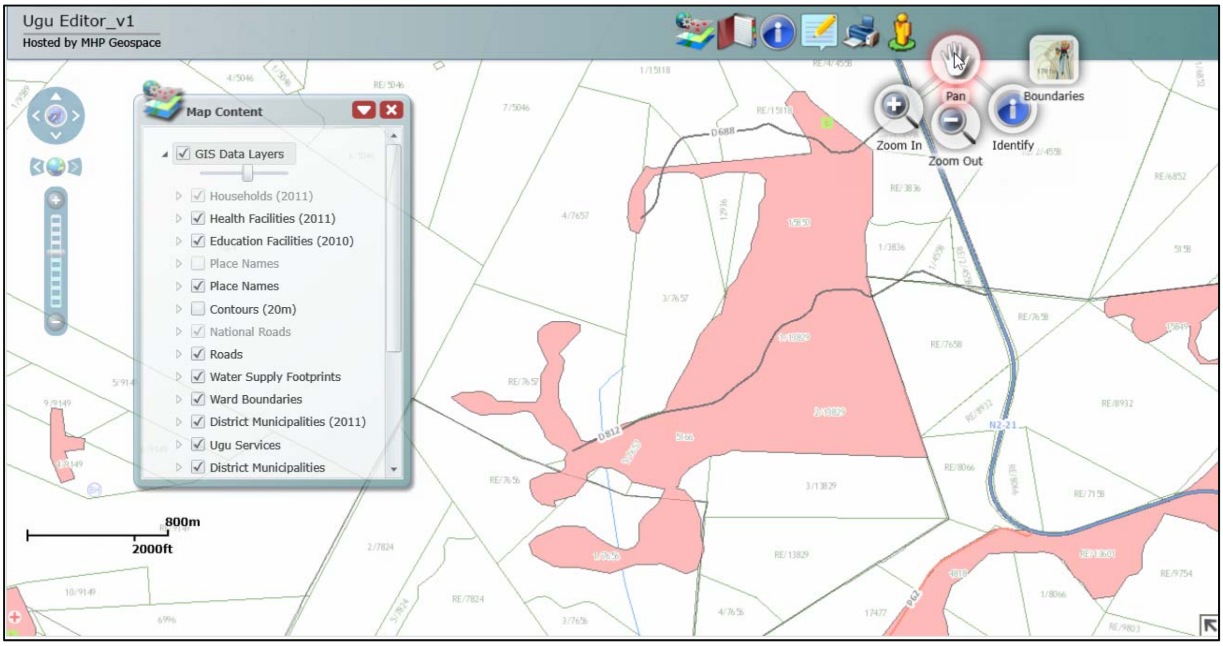
An example of the differences between the settlement boundary datasets is illustrated in Map 4 . There were areas where the boundaries between the datasets were co-incident (the blue lines lie over the red lines), as well as areas where the datasets differ.



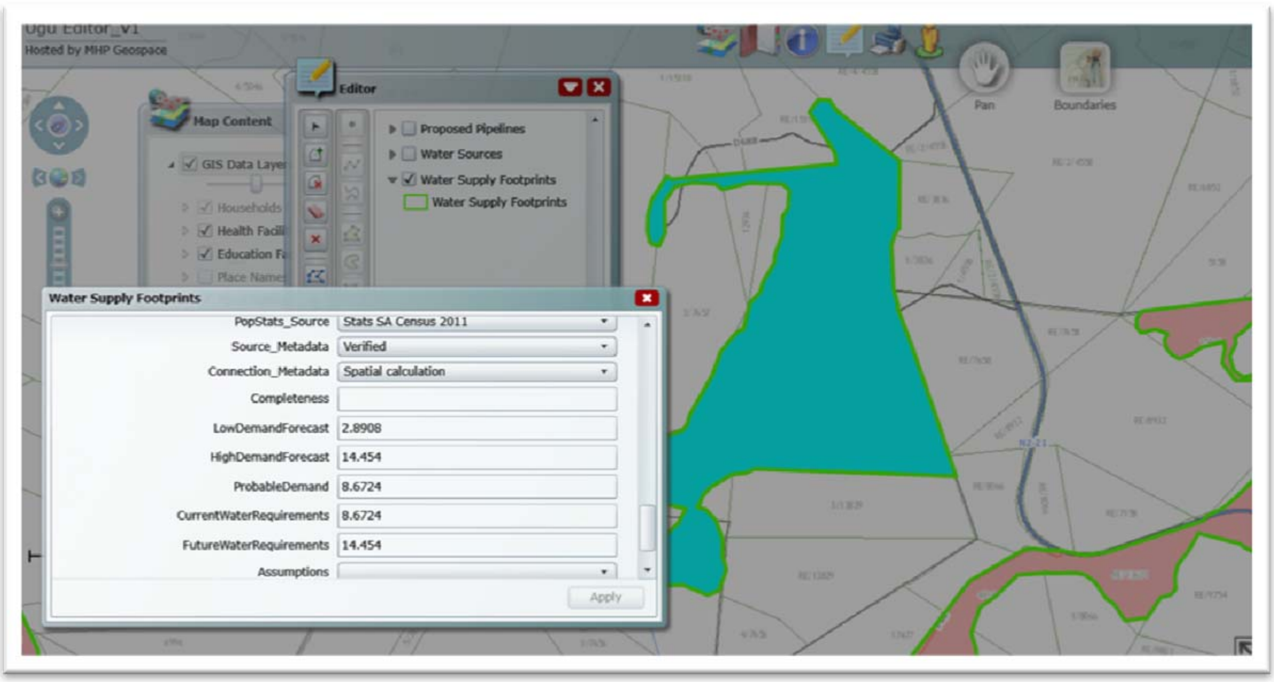

**Map 4 – Example of settlement boundary datasets**

Database fields were added to the attribute listing as per the attributes stipulated by Umgeni Water. A detailed list and descriptions of these fields can be found in Annexure A.

Due to the time constraints of this project, and in an effort to make as much data as possible available to both the project team, and the District Municipality, a web mapping application was developed for the District, and served on the internet using ArcGIS Server, from the ESRI suite of GIS software products. This allowed users to view the data in their particular area, and where possible, to identify gaps in the data which could then be addressed by the project team. The water demand area polygons captured in the desktop study were included in this application.




**Map 5 – Screenshot of the web mapping application**




**Map 6 – Screenshot of the editor capability on the web mapping application**

The engineers from Mott Macdonald PDNA (MM PDNA) were given editing capabilities to the water supply footprint layer on the website. This allowed them to identify and edit the attributes of any of these areas, to edit their shape if necessary, or to capture completely new areas at any location. These online edits were written back to the base database, to be verified later in the office.

In conjunction with this data capture through the web application, visits to the District Municipality were undertaken to explain the steps of the project. A brief overview of the existing data was given, together with a short demonstration of the web mapping application, with explanation of the reasons behind this application which is primarily that of onsite data capture while working with the municipal employees.

## 4.1 Verification of existing information received from the UDM

MMPDNA met with a representative from UDM. The outcomes of this meeting are summarized below.

| | | |
|---|---|---|
| **Date:** | 12/3/2014 | |
| **Officials:** | Khomba Mkhize | 082 519 6592 |
| | Lungile Cele | 082 414 7774 |
| | Sayimite Molo | 082 066 3588 |
| | Vuyo Gege | 039 688 3487 |
| | Sibonelo Lushaba | 082 334 6244 |
| | Sizwe Malinga | 082 718 8800 |
| | Thuli Mwelase | 039 688 5700 |

**Comments:** The Ugu District Municipality provided digital information with regards to the priorities on capital projects for the future.

## 5. EXISTING WATER SUPPLY SCHEMES

### 5.1 Water Resources

#### 5.1.1 Rivers

Eight main river systems and numerous minor coastal catchments drain the Ugu region. The major systems with the largest carrying capacity are the Mkomazi, the Mzimkulu and the Mtamvuna which flow all year around. The Mtamvuna River is regarded as being in the best ecological state of all rivers within southern KwaZulu - Natal. The main systems include Mkomazi River, Mpambanyoni River, Mzinto River, Fafa River, Mtwalume River, Mzumbe River, Mzimkulu River, Mtamvuna River.

Table 1 indicates the various types of water resources within the UDM. The table indicates the current use of the water source as well as the additional requirements required within a 5 year period.

| Water Source | Type | Licensed Abstraction | Current Use | Additional Requirement at Year -5 |
|---|---|---|---|---|
| Umzimkhulu | River | Yes | Raw water supply | Augmentation to increase the capacity |
| Umtamvuna | River | Yes | Raw water supply | |
| Umtwalume | River | Yes | Raw water supply | Increase the abstraction point capacity |
| Harding | Dam | Yes | Raw water supply | Safety inspection and clearing of bushes and trees. |
| Pungashe | River | Yes | Raw water supply | None |
| Hlokozi | River | Yes | Raw water supply | None |
| Vulamehlo | River | Yes | Raw water supply | None |
| KwaHlongwa | River | Yes | Raw water supply | None |
| KwaNyuswa | Stream | Yes | Raw water supply | None |
| KwaFodo | Dam | Yes | Raw water supply | Safety inspection and clearing of bushes and trees. |
| KwaMbotho | Stream | Yes | Raw water supply | None |
| Weza | River | Yes | Raw water supply | Augmentation to increase the capacity |
| E.J.Smith | Dam | Yes | Raw water supply | None |
| KwaLembe | River | Yes | Raw water supply | None |
| Ndelu | River | Yes | Raw water supply | None |
| Assisi | River | Yes | Raw water supply | None |

**Table 1 – Existing Water Resources**

(Source: WSDP 2008)

### 5.1.2 Dams

The major water bodies in the district are:

- Harding Dam
- KwaFodo Dam
- E.J.Smith Dam
- Nungwane Dam
- Umzinto Dam

### 5.1.3 Existing Water Schemes

According to reports outlining the reconciliation strategies for the various water schemes in the UDM, the availability of water resources is outlined below.

In undertaking the design of new and additional reticulation for the various local municipalities the available capacities of the various treatment plants were required. With the population growth figures tabled we needed to determine when interventions were required i.e extension of existing water treatment plants or construction of new plant to serve the new/additional demands.

#### 5.1.3.1 Kwalembe Water Supply Scheme (Vulamehlo LM)

(Source: First Stage Reconciliation Strategy for Kwalembe Water Supply Scheme Area Vulamehlo Municipality,2011)

Based on the available information from the reconciliation strategy, the current and future water requirements for domestic water use of Kwalembe Water Supply Scheme in UDM which depends on run-of-river abstraction from Mkomazi River can be supplied from the available water supplies without development of additional water supplies.

According to the WSDP, the Mkomazi River catchment is relatively undisturbed with a very low sediment load compared to the other rivers in the UDM. The water quality is considered as moderate to good. The geology and the topography of the area are such that there is no potential for significant groundwater development. Currently there is limited groundwater use in the Kwalembe Water Supply Scheme area. There is no reported water quality problems associated with the groundwater.

The Kwalembe Water Supply Scheme comprises raw water abstraction from the Mkomazi River, a water treatment works near the river and bulk service storage bulk pipelines, and distribution networks. The raw water from Mkomazi River is pumped to the Kwalembe WTW, where it is treated to potable drinking water quality standards. The Kwalembe WTW is the main treatment works that supplies the scheme area.

The total raw water that was expected to be abstracted for treatment at the Kwalembe WTW in 2008 was estimated as 0.6 million $m^3$/a (1.6 ML/d). This includes water services backlogs in the supply area. Based on the estimated raw water requirements, the treated water production with 12% losses was estimated to be 0.5 million $m^3$/a (1.4 ML/d)

The Kwalembe WTW is a conventional treatment plant comprising the following process components:

(i) *Flocculation channels*: The raw water is pumped from the Mkomazi River to the inlet works where the chemicals are added as the water flows into the flocculation channels at the treatment works, where coagulation after polyelectrolyte dosing takes place to form the flocs.

(ii) *Clarification (sedimentation) tanks*: The flocs that have formed during the flocculation process are then settled in the sedimentation tanks under gravity. The settled sludge is removed by frequent de-sludging of the tanks and sent to the sludge lagoons where the sludge is dried, while the supernatant water is discharged back into the river. The plant was not designed for recycling of the wastewater.

(iii) *Rapid Gravity Sand Filtration*: The clarified water is then filtered through a set of rapid gravity sand filters as a final polishing before chlorination of the treated water.

(iv) *Disinfection*: The filtered water then gravitates to the chorine contact tanks where chlorination takes place before pumping the potable water to the command reservoirs in Kwalembe supply area for distribution.

The current utilization of the bulk water supply infrastructure is approximately 83%. When compared with the estimated water requirements, the existing bulk water supply infrastructure has sufficient capacity to meet the current water requirements of Kwalembe Water Supply Scheme as well as the future water requirements on a long term sustainable basis. The condition and performance of the treatment works is not known. It is also not known whether the treatment works have been compliant with SANS 241, 2001 for potable drinking water quality standards.

| Treatment Work Name | Type of plant | Raw water source | Hydraulic Design capacity (ML/d) | Average flow rate (ML/d) | Treated water production (ML/d) | Current utilisation(% of ave.design capacity) |
|---|---|---|---|---|---|---|
| Kwalembe WTW | Conventional | Mkomazi | 2.50 | 1.67 | 1.38 | 83% |

**Table 2 - Water Treatment Works in operation in the Kwalembe Water Supply Scheme area**
(Source: First Stage Reconciliation Strategy for Kwalembe Water Supply Scheme Area Vulamehlo Municipality,2011)

**Treated water bulk supply infrastructure**
The treated water from the treatment works in the Kwalembe Water Supply Scheme is pumped from the clear water tanks to various service reservoirs in the scheme area before distribution into the scheme's reticulation network (see Table 2). The pumping systems have standby capacity.

**Bulk Storage**

The total service storage capacity of the Kwalembe Water Supply Scheme area is unknown to determine whether there is sufficient storage to meet the accepted norm of 48 hours of summer peak requirement for urban areas. This norm has been determined to meet the following requirements:

- Balance the fluctuating demands from the distribution system, permitting the source to give a steady or differently phased output;
- Provide a supply during a failure or shutdown of treatment plant, pumps or bulk mains leading to the reservoir; and
- Provide a reserve of water to meet fire and other emergency demands.

Therefore no conclusion could be drawn on whether additional service storage capacity is required currently or in the future. However as the demands grow in the scheme, additional service storage capacity will probably be required sometime in the future to meet the summer peak requirements of Kwalembe Water Supply Scheme.


**Figure 8 – Schematic layout of Kwalembe Water Supply Scheme area**

(Source: First Stage Reconciliation Strategy for Kwalembe Water Supply Scheme Area Vulamehlo Municipality,2011)

#### 5.1.3.2 Ndelu Water Supply Scheme (Umzumbe LM)

(Source: First Stage Reconciliation Strategy for Ndelu Water Supply Scheme Area Umzumbe Municipality,2011)

The main source of supply for Ndelu Water Supply Scheme is the run-of-river abstraction from the Mzumbe River which supplies Ndelu WTW as well as the Kwamalukaka River which supplies KwaHlongwa WTW. Based on the available information from the reconciliation strategy, the supply area of the Ndelu Water Supply Scheme has a water supply deficit as the available water from the Mzumbe River is not sufficient to meet the current water requirements.

The current and future water requirements for domestic water use of Ndelu Water Supply Scheme in Ugu DM which depends on run-of-river abstraction from Mzumbe River cannot be supplied from the available water supplies without development of additional water supplies.

According to the WSDP, the Mzumbe River catchment is relatively undisturbed with a very low sediment load compared to the other rivers in the UDM. The water quality is considered as moderate to good. The geology and the topography of the area are such that there is no potential for significant groundwater development. Currently there is limited groundwater use in the Ndelu Water Supply Scheme area. There is no reported water quality problems associated with the groundwater.

The Ndelu Water Supply Scheme comprises raw water abstraction from the Mzumbe River, a raw water abstraction from Kwamalukaka River, two water treatment works and bulk service storage infrastructure and bulk distribution networks.

**Water Treatment Works**

**Ndelu Water Treatment Works**

The total raw water that was expected to be abstracted for treatment at the Ndelu WTW in 2008 was estimated as 1.5 million $m^3$/a (4.1 ML/d). This includes water services backlogs in the supply area. Based on the estimated raw water requirements, the treated water production with 12% losses was estimated to be 1.3 million $m^3$/a (3.6 ML/d).

The Ndelu WTW is a conventional treatment plant comprising the following process components:

(i) *Flocculation channels*: The raw water is pumped from the Mzumbe River to the inlet works where the chemicals are added as the water flows into the flocculation channels where coagulation, after polyelectrolyte dosing, takes place to form the flocs.

(ii) *Clarification (sedimentation) tanks*: The flocs that have formed during the flocculation process are then settled in the sedimentation tanks under gravity. The settled sludge is removed by frequent de-sludging of the tanks and sent to the sludge lagoons where the sludge is dried while the supernatant water is discharged back into the river. The plant was not designed for recycling of the wastewater.

(iii) *Rapid Gravity Sand Filtration*: The clarified water is then filtered through a set of rapid gravity sand filters as a final polishing before chlorination of the treated water.

(iv) *Disinfection*: The filtered water then gravitates to the chorine contact tanks where chlorination takes place before pumping the potable water to the command reservoirs in Ndelu supply area for distribution.

**KwaHlongwa Water Treatment Works**

The raw water from Kwamalukaka River is pumped to the KwaHlongwa WTW where it is treated to potable drinking water quality standards. The KwaHlongwa WTW is the other treatment works that supplies the scheme area. The peak hydraulic design capacity of the water treatment works is 1.1 ML/d or 0.4 million $m^3$/a (WSDP, 2008). The average annual flow rate of the treatment works is estimated to be 0.75 ML/d or 0.3 million $m^3$/a based on a peaking factor of 1.5.

The KwaHlongwa WTW is a conventional treatment plant comprising the following process components:

(v) *Flocculation channels*: The raw water is pumped from the Kwamalukaka River to the inlet works where the chemicals are added as the water flows into the flocculation channels where coagulation, after polyelectrolyte dosing, takes place to form the flocs.

(vi) *Clarification (sedimentation) tanks*: The flocs that have formed during the flocculation process are then settled in the sedimentation tanks under gravity. The settled sludge is removed by frequent de-sludging of the tanks and sent to the sludge lagoons where the sludge is dried while the supernatant water is discharged back into the river. The plant was not designed for recycling of the wastewater.

(vii) *Rapid Gravity Sand Filtration*: The clarified water is then filtered through a set of rapid gravity sand filters as a final polishing before chlorination of the treated water.

(viii) *Disinfection*: The filtered water then gravitates to the chorine contact tanks where chlorination takes place before pumping the potable water to the command reservoirs in the southern area of Ndelu water supply scheme for distribution.

The current utilization of the bulk water supply infrastructure is approximately 102%. When compared with the estimated water requirements, the existing bulk water supply infrastructure does not have sufficient capacity to meet the current water requirements of Ndelu Water Supply Scheme as well as the future water requirements on a long term sustainable basis.

The condition and performance of the two treatment works is not known. It is also not known whether the treatment works have generally been compliant with SANS 241, 2001 for potable drinking water quality standards.

| Treatment Work Name | Type of plant | Raw water source | Hydraulic Design capacity (ML/d) | Average flow rate (ML/d) | Treated water production (ML/d) | Current utilisation (% of ave.design capacity) |
|---|---|---|---|---|---|---|
| Ndelu WTW | Conventional | Umzumbe | 2.10 | 1.40 | 1.40 | 100% |
| KwaHlongwa WTW | Conventional | Kwamalukaka | 1.13 | 0.75 | 0.80 | 107% |
| Total | | | 3.23 | 2.15 | 2.20 | 102.3% |

**Table 3 - Water Treatment Works in operation in the Ndelu Water Supply Scheme area**
(Source: First Stage Reconciliation Strategy for Ndelu Water Supply Scheme Area Umzumbe Municipality,2011)

**Treated water bulk supply infrastructure**
The treated water from the two treatment works in the Ndelu Water Supply Scheme is pumped from the clearwater tanks to various service reservoirs in the scheme area before distribution into the scheme's reticulation network (see table above). The pumping systems have standby capacity.

**Bulk Storage**
The total service storage capacity of the Ndelu Water Supply Scheme area is unknown to enable determination of whether there is sufficient storage to the accepted norm of 48 hours of summer peak requirement for urban areas. This norm has been determined to meet the following requirements:

- Balance the fluctuating demands from the distribution system, permitting the source to give a steady or differently phased output;
- Provide a supply during a failure or shutdown of treatment plant, pumps or bulk mains leading to the reservoir; and
- Provide a reserve of water to meet fire and other emergency demands.

Therefore no conclusion could be drawn on whether additional service storage capacity is required currently or in the future. However as the demands grow in the scheme, additional service storage capacity will be required sometime in the future to meet the future summer peak requirements of Ndelu Water Supply Scheme.

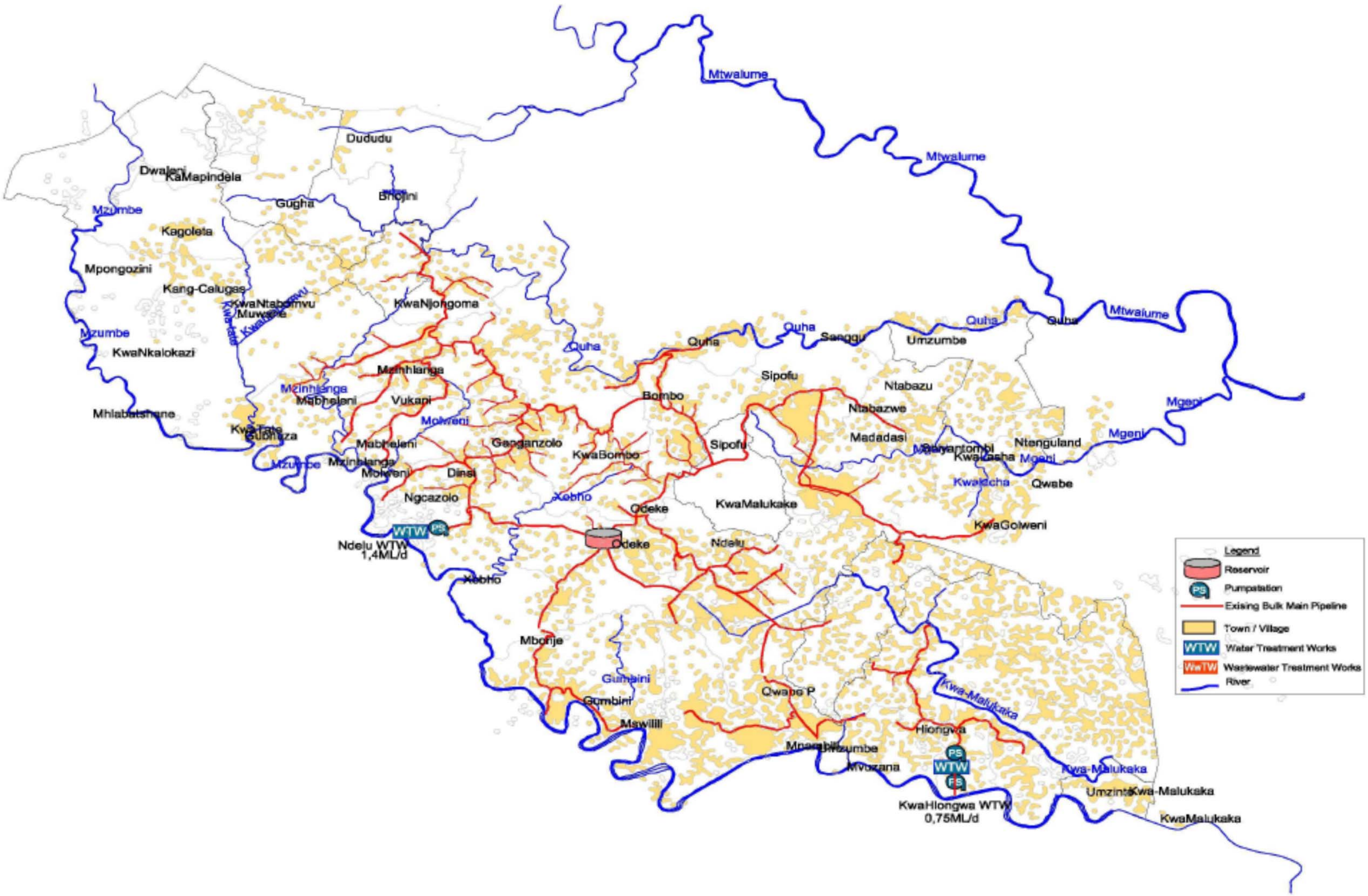



**Figure 9 – Schematic layout of Ndelu Water Supply Scheme area**

(Source: First Stage Reconciliation Strategy for Ndelu Water Supply Scheme Area Umzumbe Municipality,2011)

#### 5.1.3.3 Pungase Water Supply Scheme (Umzumbe LM)

(Source: First Stage Reconciliation Strategy for Pungase Water Supply Scheme Area Umzumbe Municipality,2011)

Based on the available information from the reconciliation strategy, the supply area of the Pungashe Water Supply Scheme has a water supply deficit as the available water from the Mhlabatshane River is not sufficient to meet the current water requirements. The current and future water requirements for domestic water use of Pungashe Water Supply Scheme in UDM which depends on run-of-river abstraction from Mhlabatshane River cannot be supplied from the available water supplies without development of additional water supplies. This depends on the operating rules of the two sources of supply, namely the Mhlabatshane and Umzumbe Rivers.

According to the WSDP, the Mhlabatshane River catchment is relatively undisturbed with a very low sediment load compared to the other rivers in the UDM. The water quality is considered as moderate to good.

The geology and the topography of the area are such that there is no potential for significant groundwater development. Currently there is limited groundwater use in the Pungashe Water Supply Scheme area. There is no reported water quality problems associated with the groundwater.

**Pungashe Water Treatment Works**

The raw water from Mhlabatshane River is pumped to the Pungashe WTW where it is treated to potable drinking water quality standards. The Pungashe WTW is the main treatment works that supplies the scheme area. The peak hydraulic design capacity of the water treatment works is only 0.45 ML/d or 0.2 million $m^3$/a (WSDP, 2008). The average annual flow rate of the treatment works is estimated to be 0.3 ML/d or 0.1 million $m_3$/a based on a peaking factor of 1.5.

The table below provides the future raw water requirements for the different growth scenarios at the current estimated water use efficiency levels. The future raw water requirements allow for the high system losses of 24% of raw water abstracted based on an estimate of present (2008) raw water abstraction in order to supply the water required at present at the point of consumption. In order to supply the water required, the additional raw water abstracted in 2008 amounted to approximately 0.4 million $m^3$/a (1.2 ML/d) to deliver the water requirements at the consumer end.

The Pungashe WTW is a conventional treatment plant comprising the following process components:

(i) *Flocculation channels*: The raw water is pumped from the Mhlabatshane River to the inlet works where the chemicals are added as the water flows into the flocculation channels, where coagulation after polyelectrolyte dosing, takes place to form the flocs.

(ii) *Clarification (sedimentation) tanks*: The flocs that have formed during the flocculation process are then settled in the sedimentation tanks under gravity. The settled sludge is removed by frequent de-sludging of the tanks and sent to the sludge lagoons where the sludge is dried, while the supernatant water is discharged back into the river. The plant was not designed for recycling of the wastewater.

(iii) *Rapid Gravity Sand Filtration*: The clarified water is then filtered through a set of rapid gravity sand filters as a final polishing before chlorination of the treated water.

(iv) *Disinfection*: The filtered water then gravitates to the chorine contact tanks where chlorination takes place before pumping the potable water to the command reservoirs in the Pungashe supply area for distribution.

The current utilization of the bulk water supply infrastructure is approximately 100%. When compared with the estimated water requirements, the existing bulk water supply infrastructure does not have sufficient capacity to meet the current water requirements of Pungashe Water Supply Scheme as well as the future water requirements on a long term sustainable basis.
The condition and performance of the treatment works is not known. It is also not known whether the treatment works have been generally compliant with SANS 241, 2001 for potable drinking water quality standards.

| **Treatment Work Name** | **Type of plant** | **Raw water source** | **Hydraulic Design capacity (ML/d)** | **Average flow rate (ML/d)** | **Treated water production (ML/d)** | **Current utilisation (% of ave.design capacity)** |
|---|---|---|---|---|---|---|
| Pungashe WTW | Conventional | Mhlabatshane | 0.45 | 0.3 | 0.3 | 100% |

**Table 4 - Water Treatment Works in operation in the Pungase Water Supply Scheme area**
(Source: First Stage Reconciliation Strategy for Pungase Water Supply Scheme Area Umzumbe Municipality,2011)

**Treated water bulk supply infrastructure**
The treated water from the two treatment works in the Pungashe Water Supply Scheme is pumped from the clear water tanks to various service reservoirs in the scheme area before distribution into the scheme's reticulation network (see table above). The pumping systems have standby capacity.

**Bulk Storage**
The total service storage capacity of the Pungashe Water Supply Scheme area is unknown so it cannot be determined if there is sufficient storage to meet the accepted norm of 48 hours of summer peak requirement for urban areas. This norm has been determined to meet the following requirements:

- Balance the fluctuating demands from the distribution system, permitting the source to give a steady or differently phased output;
- Provide a supply during a failure or shutdown of treatment plant, pumps or bulk mains leading to the reservoir; and
- Provide a reserve of water to meet fire and other emergency demands.

Therefore no conclusion could be drawn on whether additional service storage capacity is required currently or in the future. However as the demands grow in the scheme, additional service storage capacity will be required to meet the future summer peak requirements of Pungashe Water Supply Scheme.


**Figure 10 – Schematic layout of Pungashe Water Supply Scheme area**

(Source: First Stage Reconciliation Strategy for Pungashe Water Supply Scheme Area Umzumbe Municipality,2011)

#### 5.1.3.4 Umtamvuna Water Supply Scheme (Hibiscus Coast LM)

(Source: First Stage Reconciliation Strategy for Umtamvuna Water Supply Scheme Area Hibiscus Coast Municipality)

The main source of supply for Umtamvuna Water Supply Scheme is the run-of-river abstraction from the Mtamvuna River. Based on the available information from the reconciliation strategy, the Mtamvuna Catchment has a water supply surplus .The current and future water requirements for domestic water use of Umtamvuna Water Supply Scheme in UDM which depends on run-of-river abstraction from Mtamvuna River can be supplied from the available water supplies without development of additional water supplies.

According to the WSDP, there are no known major water quality problems in the Umtamvuna Water Supply Scheme area. It is however likely that the quality of the Mtamvuna River is, however, significantly affected during periods of rainfall due to the land use activities upstream and soil erosion as the turbidity levels are very high during rainfall periods. The geology and the topography of the area are such that there is no potential for significant groundwater development.

Currently there is no groundwater use in the Umtamvuna Water Supply Scheme area. There is no reported water quality problems associated with the groundwater.

The Umtamvuna Water Supply Scheme comprises raw water abstraction from the Mtamvuna River in quaternary catchment T40E, a balancing dam near the river, a water treatment works and bulk service storage infrastructure and bulk distribution networks.

**Water Treatment Works**

The raw water is pumped to the Umtamvuna WTW where it is treated to potable drinking water quality standards. The Umtamvuna WTW is the only treatment works that supplies the scheme area. The peak hydraulic design capacity of the water treatment works is only 20 ML/d or 7.3 million $m^3/a$ (WSDP, 2008). The average annual flow rate of the treatment works is estimated to be 13.3 ML/d or 4.9 million $m^3/a$ based on a peaking factor of 1.5.

The Umtamvuna WTW is a conventional treatment plant comprising the following process components:

(i) *Flocculation channels*: The raw water is pumped from the Mtamvuna River to the inlet works where the chemicals are added as the water flows into the flocculation channels at the treatment works. Coagulation results from polyelectrolyte dosing to form the flocs.

(ii) *Clarification (sedimentation) tanks*: The flocs that have formed during the flocculation process are then settled in the sedimentation tanks under gravity. The settled sludge is removed by frequent de-sludging of the tanks and sent to the sludge lagoons where the sludge is dried while the supernatant water is discharged back into the river. The plant was not designed for recycling of the wastewater.

(iii) *Rapid Gravity Sand Filtration*: The clarified water is then filtered through a set of rapid gravity sand filters as a final polishing before chlorination of the treated water.

(iv) *Disinfection*: The filtered water then gravitates to the chorine contact tanks where chlorination takes place before pumping the potable water to the command reservoirs from where the treated water is distributed inland and to the coastal areas respectively.

The current utilization of the bulk water supply infrastructure is approximately 101%. The existing bulk water supply infrastructure has sufficient capacity to meet the current water requirements of Umtamvuna Water Supply Scheme but does not have sufficient capacity to meet future water requirements on a long term sustainable basis.

| Treatment Work Name | Type of plant | Raw water source | Hydraulic Design capacity (ML/d) | Average flow rate (ML/d) | Treated water production (ML/d) | Current utilisation (% of ave.design capacity) |
|---|---|---|---|---|---|---|
| Umtamvuna | Conventional | Mtam vuna | 20.00 | 13.33 | 13.43 | 101% |

**Table 5 - Water Treatment Works in operation in the Umtamvuna Water Supply Scheme area**
(Source: First Stage Reconciliation Strategy for Umtamvuna Water Supply Scheme Area Hibiscus Coast Municipality)

According to the Blue Drop Report, 2009, the performance of the Umtamvuna Water Supply Scheme was classified as very good with the scheme likely to attain blue drop status in 2011. The condition of the components making up the scheme was in a generally good.

The performance of the works has been very good even during rainfall seasons when there are changes to the quality of the raw water with high turbidity levels due to lack of pre-settlement. The treatment works therefore has generally been compliant with SANS 241, 2001 for potable drinking water quality standards.

**Treated water bulk supply infrastructure**
The treated water from the treatment works in the Umtamvuna Water Supply Scheme is pumped from the clearwater tanks to various service reservoirs in the scheme area before distribution into the scheme's reticulation network. The pumping systems have standby capacity.

**Bulk Storage**
The total service storage capacity of the Umtamvuna Water Supply Scheme area is unknown to determine whether there is sufficient storage to meet the accepted norm of 48 hours of summer peak requirement for urban areas. This norm has been determined to meet the following requirements:

- Balance the fluctuating demands from the distribution system, permitting the source to give a steady or differently phased output;

- Provide a supply during a failure or shutdown of treatment plant, pumps or bulk mains leading to the reservoir; and
- Provide a reserve of water to meet fire and other emergency demands.

Therefore no conclusion could be drawn on whether additional service storage capacity is required currently or in the future. However as the demands grow in the scheme, additional service storage capacity will be required to meet the future summer peak requirements of Umtamvuna Water Supply Scheme.

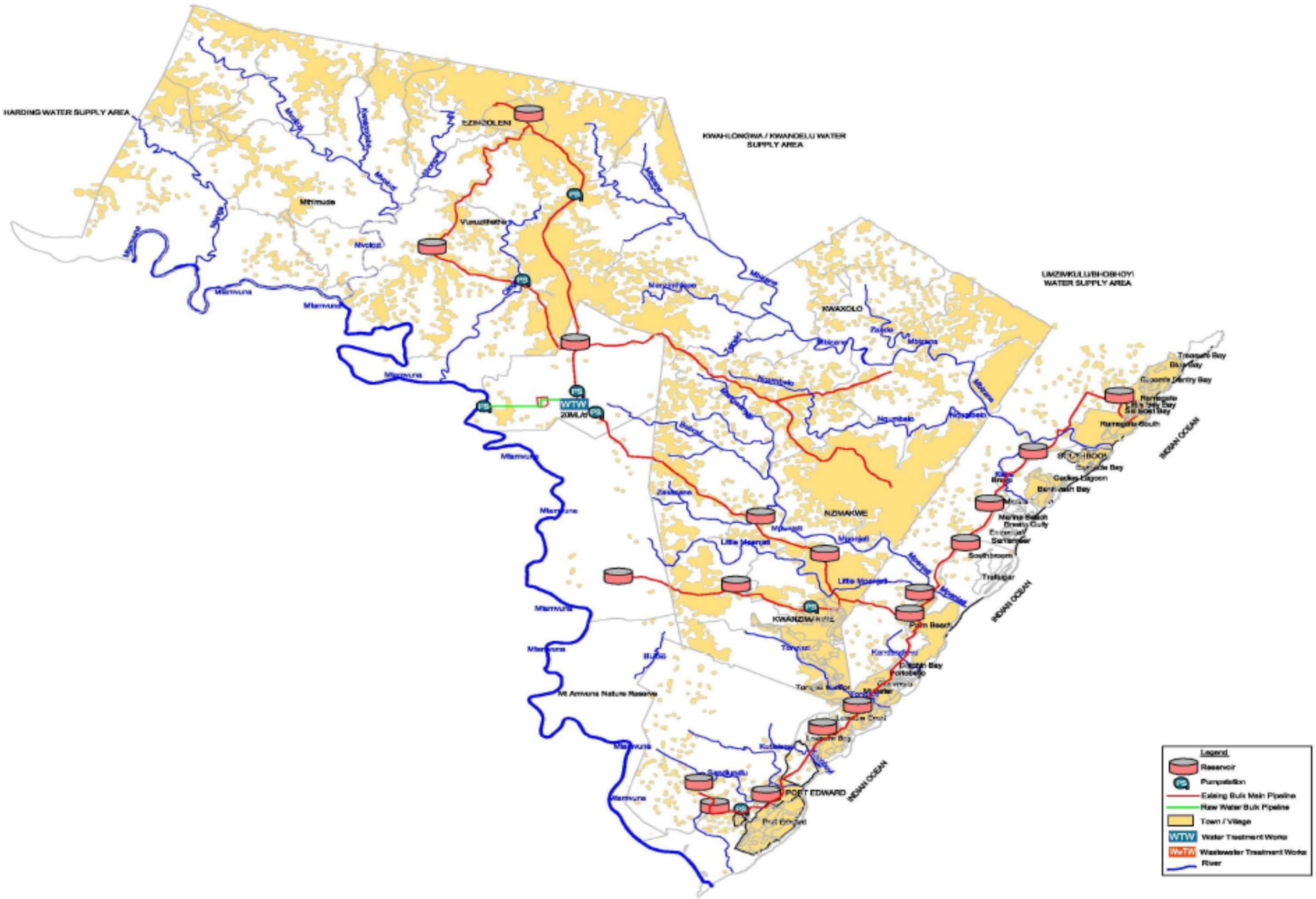



**Figure 11 – Schematic layout of Umtamvuna Water Supply Scheme area**

(Source: First Stage Reconciliation Strategy for Umtamvuna Water Supply Scheme Area Hibiscus Coast Municipality)

#### 5.1.3.5 Mtwalume Water Supply Scheme (Umzumbe LM)

(Source: First Stage Reconciliation Strategy for Mtwalume Water Supply Scheme Area Umzumbe Municipality)

The main source of supply for Mtwalume Water Supply Scheme is the well points in the Mtwalume River.Based on the available information from the reconciliation strategy; the Mtwalume Catchment does not have sufficient water available. The current and future water requirements for domestic water use of Mtwalume Water Supply Scheme in UDM which depends on abstractions from the Mtwalume River cannot be supplied from the available water supplies without development of additional water supplies or supplementing the water supplies from other sources. There is not sufficient runoff during low flow periods to meet the long term future water requirements of the scheme as the dam storage capacity is very limited.

According to the WSDP, there are no major water quality problems in the Mtwalume Water Supply Scheme area. The quality of the Mtwalume system was considered satisfactory. The geology and the topography of the area are such that there is no potential for significant groundwater development. Currently there is no groundwater use in the Mtwalume Water Supply Scheme area. There is no reported water quality problems associated with the groundwater.

**Water Treatment Works**

Raw water is pumped from the wells in Mtwalume River to the Mtwalume WTW where it is treated to potable drinking water quality standards. The Mtwalume WTW is the only treatment works that supplies the scheme area. This is supplemented with a number of boreholes supplying the outlying rural communities in the supply area.

The peak hydraulic design capacity of the water treatment works is only 9.0 ML/d or 3.3 million $m_3$/a (WSDP, 2008). The average annual flow rate of the treatment works is estimated to be 6.0 ML/d or 2.2 million $m^3$/a based on a peaking factor of 1.5.

The Mtwalume WTW is a conventional treatment plant comprising the following process components:

(i) *Balancing tank*: The raw water is pumped from the Mtwalume River into a balancing tank which provides sufficient contact time for natural settling of the suspended solids to take place in the tanks as well as providing the balancing storage for the plant. The supernatant water is then mixed with the chemicals such as polyelectrolytes to form the flocs during flocculation in the outlet channels to the sedimentation tanks.

(ii) *Clarification (sedimentation) tanks*: The flocs that have formed during the flocculation process are then settled in the sedimentation tanks through an upflow sedimentation process. The settled sludge is removed by frequent de-sludging of the tanks and sent to the sludge lagoons where the sludge is dried while the supernatant water is discharged back into the river. The plant was not designed for recycling of the wastewater.

(iii) *Rapid Gravity Sand Filtration*: The clarified water is then filtered through a set of rapid gravity sand filters as a final polishing before chlorination of the treated water.

(iv) *Disinfection*: The filtered water then gravitates to the chorine contact tanks where chlorination takes place before pumping the potable water to the command reservoirs in Mtwalume as well as Mnamfu for distribution to the rest of the scheme area.

**Borehole supply**

The Mtwalume Water Supply Scheme is also supplied from groundwater for the outlying areas of the scheme which have not been linked to the existing bulk water supply scheme. This is mainly inland where the rural villages of Goloqolo are supplied from boreholes. The total capacity of the groundwater into Mtwalume supply area was estimated to be 1.44 ML/d or 0.5 million $m^3$/a.

The current utilisation of the Mtwalume WTW is approximately 104%. The existing bulk water supply infrastructure therefore has only sufficient capacity to meet the current water requirements of Mtwalume Water Supply Scheme, excluding any current water services backlogs included in the water requirements estimates. However, as the future water requirements increase as the backlogs are removed, the existing bulk water supply infrastructure cannot meet these demands on a long term sustainable basis under the current water use estimates and practices.

| Treatment Work Name | Type of plant | Raw water source | Hydraulic Design capacity (ML/d) | Average flow rate (ML/d) | Treated water production (ML/d) | Current utilisation(% of average design capacity) |
|---|---|---|---|---|---|---|
| Umtwalume WTW | Conventional | Mtwalume | 4.50 | 3.00 | 3.16 | 105% |
| Mtuwalume WTW upgrade | N/A | Mtwalume | 4.50 | 3.00 | 3.16 | 105% |
| Boreholes | | | 1.44 | 1.44 | 1.44 | 100% |
| **Total** | | | **10.44** | **7.44** | **7.76** | **104.3%** |

**Table 6 - Water Treatment Works in operation in the Mtwalume Water Supply Scheme area**
(Source: First Stage Reconciliation Strategy for Mtwalume Water Supply Scheme Area Umzumbe Municipality)

According to the Blue Drop Report, 2009, the performance of the Mtwalume Water Supply Scheme was classified as very good with the scheme likely to attain blue drop status in 2011. The condition of the components making up the scheme was generally good.

The treatment works therefore has generally been compliant with SANS 241, 2001 for potable drinking water quality standards.

**Treated water bulk supply infrastructure**

The treated water from the treatment works in the Mtwalume Water Supply Scheme is pumped from the clearwater tanks to various service reservoirs in the scheme area before distribution into the scheme's reticulation network (see table above). The pumping systems have standby capacity.

**Bulk Storage**

The total service storage capacity of the Mtwalume Water Supply Scheme area is unknown to determine whether there is sufficient storage to the accepted norm of 48 hours of summer peak requirement for urban areas. This norm has been determined to meet the following requirements:

- Balance the fluctuating demands from the distribution system, permitting the source to give a steady or differently phased output;
- Provide a supply during a failure or shutdown of treatment plant, pumps or bulk mains leading to the reservoir; and
- Provide a reserve of water to meet fire and other emergency demands.

Therefore no conclusion could be drawn on whether additional service storage capacity is required currently or in the future. However as the demands grow in the scheme, additional service storage capacity will be required sometime in the future to meet the summer peak requirements of Mtwalume Water Supply Scheme.

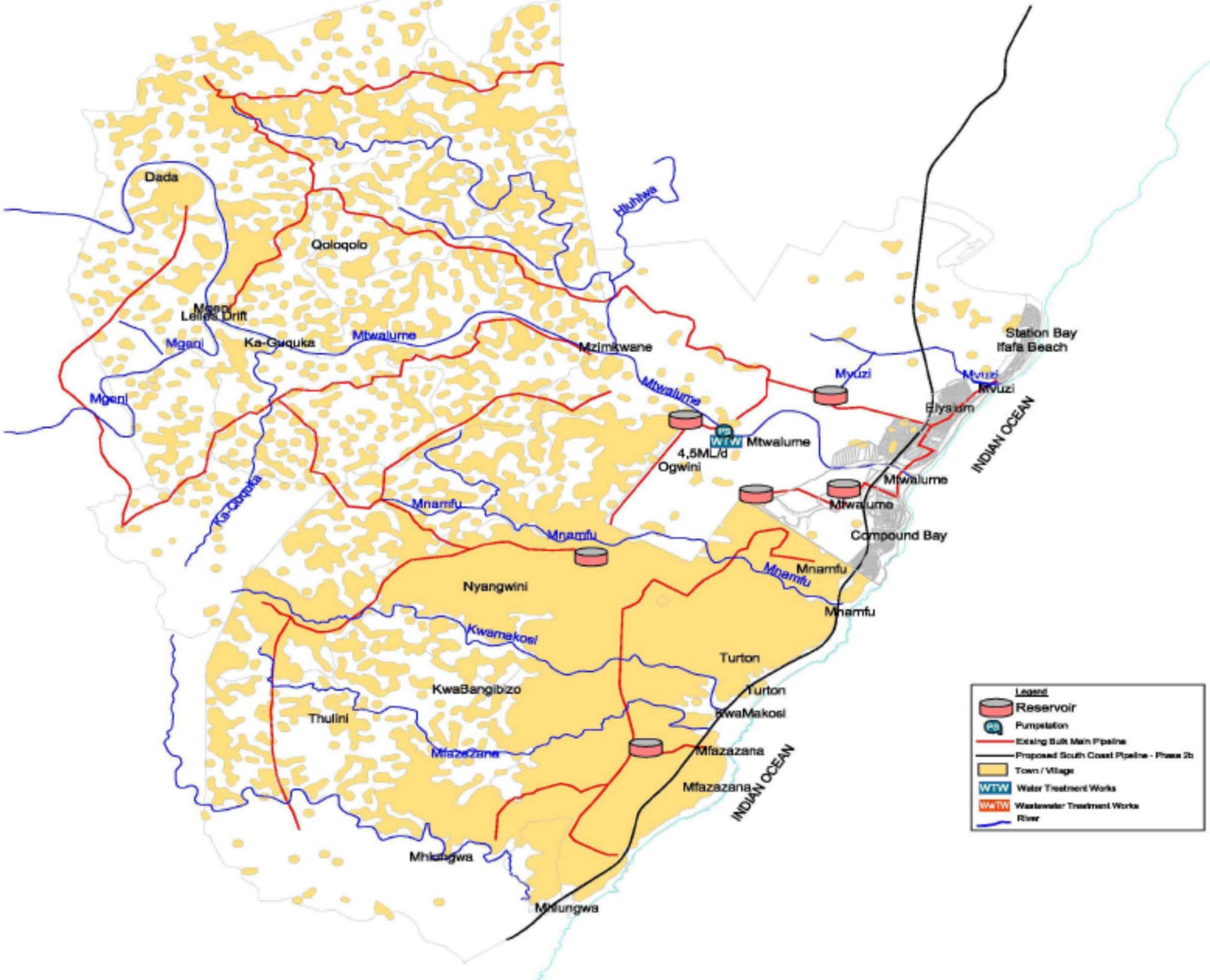



**Figure 12 – Schematic layout of Mtwalume Water Supply Scheme area**

(Source: First Stage Reconciliation Strategy for Mtwalume Water Supply Scheme Area Umzumbe Municipality)

#### 5.1.3.6 Umzimkhulu Water Supply Scheme (Hibiscus Coast LM)

(Source: First Stage Reconciliation Strategy for Umzimkhulu Water Supply Scheme Area Hibiscus Coast Municipality)

The main source of supply for Lower Mzimkhulu Water Supply Scheme area is the run-of-river abstraction from the Mzimkhulu River, below the confluence with the Mzimkhulwana River. There is not sufficient unregulated runoff from the Mzimkulu River catchment during low flow periods to meet the current and future water requirements of the Umzimkhulu Water Supply Scheme area as well as those of the other water users in the catchment at adequate assurances of supply .Therefore the water supplies available to the Lower Mzimkulu Water Supply Scheme area from the Mzimkhulu River catchment must be augmented immediately.

According to the WSDP, there are no known major water quality problems in the Lower Mzimkhulu Water Supply Scheme area. It is however likely that the quality of the Mzimkhulu River is significantly affected during periods of rainfall, due to the land use activities upstream, particularly in the rural areas, resulting in soil erosion. This results in the high turbidity levels during rainfall periods.

The geology and the topography of the area are such that there is no potential for significant groundwater development. Currently there is no groundwater use in the Lower Mzimkhulu Water Supply Scheme area. There is no reported water quality problems associated with the groundwater.

**Water Treatment Works**

The Lower Mzimkhulu Water Supply Scheme comprises a raw water abstraction works, water treatment works, at Boboyi, and bulk service storage infrastructure and bulk distribution networks. The raw water is pumped to the Boboyi WTW where it is treated to potable drinking water quality standards. The Boboyi WTW is the only treatment works that supplies the scheme area. The peak hydraulic design capacity of the water treatment works is only 54 ML/d or 19.7 million $m^3$/a (WSDP, 2008). The average annual flow rate of the treatment works is estimated to be 36.0 ML/d or 13.1 million $m_3$/a based on a peaking factor of 1.5. The Boboyi WTW is a conventional treatment plant, comprising the following process components:

(i) Flocculation channels: The raw water is pumped from the Mzimkhulu River to the inlet works, where the chemicals are added as the water flows into the flocculation channels. Polyelectrolyte dosing takes place resulting in coagulation and forms the flocs.

(ii) Clarification (sedimentation) tanks: The flocs that have formed during the flocculation process are then settled in the sedimentation tanks under gravity. The settled sludge is removed by frequent de-sludging of the tanks and sent to the sludge lagoons, where the sludge is dried. The supernatant water is discharged back into the river. The plant was not designed for recycling of the wastewater.

(iii) Rapid Gravity Sand Filtration: The clarified water is then filtered through a set of rapid gravity sand filters as a final polishing, before chlorination of the treated water.

(iv) Disinfection: The filtered water then gravitates to the chorine contact tanks where chlorination takes place, before pumping the potable water to the command reservoirs in the Lower Mzimkhulu Water Supply Scheme area for distribution.

As illustrated in Table 7, the current utilization of the bulk water supply infrastructure is approximately 117%. The existing bulk water supply infrastructure does not have sufficient capacity to meet the current water requirements of the Lower Mzimkhulu Water Supply Scheme, as well as the future water requirements on a long term sustainable basis.

| Treatment Work Name | Type of plant | Raw water source | Hydraulic Design capacity (ML/d) | Average flow rate (ML/d) | Treated water production (ML/d) | Current utilisation (% of ave.design capacity) |
|---|---|---|---|---|---|---|
| Bobhoyi | Conventional | Mzimkhulu River | 54.00 | 36.00 | 42.06 | 117% |

**Table 7 - Water Treatment Works in operation in the Umzimkhulu Water Supply Scheme area**
(Source: First Stage Reconciliation Strategy for Umzimkhulu Water Supply Scheme Area Hibiscus Coast Municipality)

According to the Blue Drop Report, 2009, the performance of the Umzimkhulu Water Supply Scheme was classified as very good with the scheme likely to attain blue drop status in 2011. The condition of the components making up the scheme was in a generally good. The performance of the works has been very good, even during rainfall seasons when there are changes to the quality of the raw water with high turbidity levels, due to lack of pre-settlement. The treatment works therefore has generally been compliant with SANS 241, 2001 for potable drinking water quality standards.

**Treated water bulk supply infrastructure**
The treated water from the treatment works is pumped from the clear water tanks to various service reservoirs in the scheme area before distribution into the scheme's reticulation network. The pumping systems have standby capacity.

**Bulk Storage**
The total service storage capacity of the Lower Mzimkhulu Water Supply Scheme area is not known to enable a determination of whether there is sufficient storage to the accepted norm of 48 hours of summer peak requirement for urban areas. This norm has been determined to meet the following requirements:

- Balance the fluctuating demands from the distribution system, permitting the source to give a steady or differently phased output;
- Provide a supply during a failure or shutdown of the treatment plant, pumps or bulk mains leading to the reservoir; and
- Provide a reserve of water to meet fire and other emergency demands.

Therefore no conclusion could be drawn on whether additional service storage capacity is required currently or in the future. However, as the demands grow in the scheme, additional service storage capacity will be required sometime in the future, to meet the future summer peak requirements of Lower Mzimkhulu Water Supply Scheme.

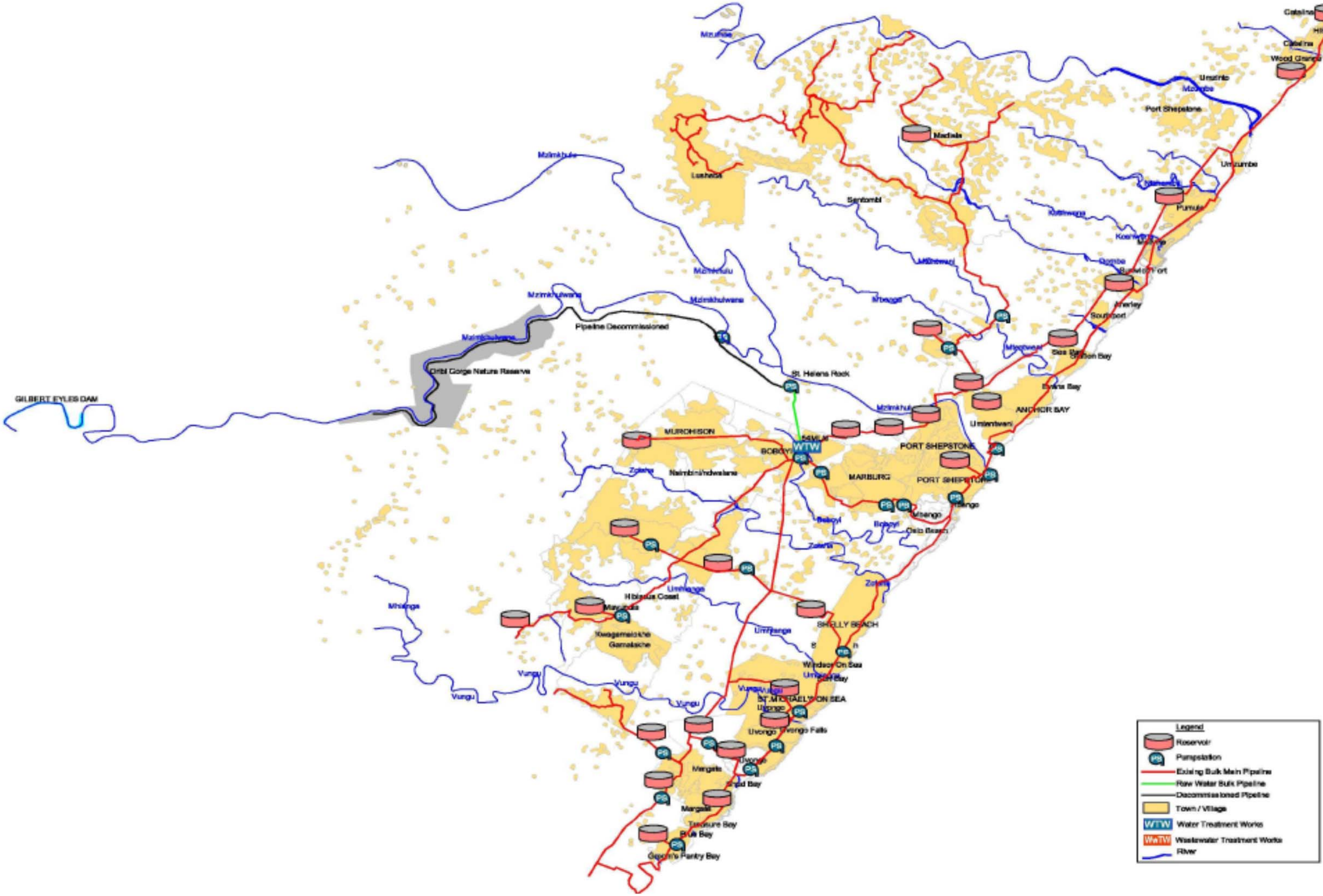


**Figure 13 – Schematic layout of Lower Umzimkhulu Water Supply Scheme area**
(Source: First Stage Reconciliation Strategy for Umzimkhulu Water Supply Scheme Area Hibiscus Coast Municipality)

#### 5.1.3.7 Umzinto Water Supply Scheme (Umdoni LM)

(Source: First Stage Reconciliation Strategy for Umzinto Water Supply Scheme Area Umdoni Municipality)

The main source of supply for Umzinto Water Supply Scheme is the Esperanza weir in the Umzinto River as well as from EJ Smith Dam in the Mzimayi River. Furthermore the Umgeni Water is implementing the South Coast Pipeline Phase 2 (SCP-2a) to supplement the water supplies of the Umzinto Water Supply Scheme from the Umgeni System in the Ethekwini Metropolitan Municipality. The Mzimayi and Umzinto River are regulated with the EJ Smith Dam and Esperanza weir being the main storages in the system with most users relying on run-of-river abstraction.

The water requirements in the Region are estimated to be 18 million $m_3$/a. The Middle South Coast Region therefore has a water supply deficit of 4 million $m^3$/a. The water supply shortages are experienced in the dry periods because there is not sufficient storage capacity to meet demands during the low flow periods. Based on the available information from the reconciliation strategy, the Umzinto Catchment has a water supply deficit. The current and future water requirements for domestic water use of Umzinto Water Supply Scheme in UDM which depends on abstractions from the Umzinto River and Mzimayi cannot be supplied from the available water supplies without development of additional water supplies or supplementing the water supplies from other sources. There is not sufficient runoff during low flow periods to meet the long term future water requirements of the scheme as the dam storage capacity is very limited.

According to the Umgeni Water Master Plan, there are major water quality problems in the Umzinto Water Supply Scheme area. The quality of the Mzimayi system was considered not satisfactory due to ongoing sewer problems, while the EJ Smith Dam has been highly impacted by the town, farming and industrial activities in the area. The geology and the topography of the area are such that there is no potential for significant groundwater development. Currently there is no groundwater use in the Umzinto Water Supply Scheme area. There is no reported water quality problems associated with the groundwater.

**Water Treatment Works**

The raw water is pumped to the Umzinto WTW where it is treated to potable drinking water quality standards. The Umzinto WTW is the only treatment works that supplies the scheme area. The peak hydraulic design capacity of the water treatment works is only 13.6 ML/d or 5.0 million $m^3$/a (WSDP, 2008). The average annual flow rate of the treatment works is estimated to be 9.1 ML/d or 3.3 million $m_3$/a based on a peaking factor of 1.5.

The Umzinto WTW is a conventional treatment plant comprising the following process components:

(i) *Flocculation channels*: The raw water is pumped from the Umzinto River and Esperanza to the inlet works where the chemicals are added as the water flows into the flocculation channels at the treatment works. Polyelectrolyte dosing takes place resulting in coagulation to form the flocs.

(ii) *Clarification (sedimentation) tanks*: The flocs that have formed during the flocculation process are then settled in the sedimentation tanks under gravity. The settled sludge is removed by frequent de-sludging of the tanks and sent to the sludge lagoons where the sludge is dried while the supernatant water is discharged back into the river. The plant was not designed for recycling of the wastewater.

(iii) *Rapid Gravity Sand Filtration*: The clarified water is then filtered through a set of rapid gravity sand filters as a final polishing before chlorination of the treated water.

(iv) *Disinfection*: The filtered water then gravitates to the chorine contact tanks where chlorination takes place before pumping the potable water to the command reservoirs in Umzinto scheme area for distribution.

**South Coast Pipeline**
The Umzinto Water Supply Scheme is also supplied with treated water from the Umgeni Water's South Coast Pipeline (SCP). The total capacity of the SCP into the Umzinto supply area at Scottburgh South Reservoir after the commissioning of the phase 2(a) is envisaged to be 17.5 ML/d or 6.4 million $m^3$/a (Umgeni Water, 2010)

As illustrated in Table 8, the current utilisation of the Umzinto WTW is 77% because of limited raw water supplies while the SCP has a current utilisation of 13% of the capacity of the bulk pipeline. The existing bulk water supply infrastructure therefore has sufficient capacity to meet the current water requirements of Umzinto Water Supply Scheme as well as the future water requirements on a long term sustainable basis. This is assuming there is a sufficient raw water supply in the Umgeni System to deliver the capacity of the SCP.

| Treatment Work Name | Type of plant | Raw water source | Hydraulic Design capacity (ML/d) | Average flow rate (ML/d) | Treated water production (ML/d) | Current utilisation (% of avedesign capacity) |
|---|---|---|---|---|---|---|
| Umzinto WTW Capacity | Conventional | Umzinto, Mzimayi | 13.60 | 9.07 | 7.00 | 77% |
| South Coast Pipeline | N/A | Umgeni Water | - | 17.50 | 2.21 | 13% |
| **Total** | | | **13.60** | **26.57** | **9.21** | **34.7%** |

**Table 8 - Water Treatment Works in operation in the Umzinto Water Supply Scheme area**
(Source: First Stage Reconciliation Strategy for Umzinto Water Supply Scheme Area Umdoni Municipality)

According to the Blue Drop Report, 2009, the performance of the Umzinto Water Supply Scheme was classified as very good with the scheme likely to attain blue drop status in 2011. The condition of the components making up the scheme was generally good.

The treatment works therefore has generally been compliant with SANS 241, 2001 for potable drinking water quality standards.

**Treated water bulk supply infrastructure**

The treated water from the treatment works in the Umzinto Water Supply Scheme is pumped from the clearwater tanks to various service reservoirs in the scheme area before distribution into the scheme's reticulation network (see table above). The pumping systems have standby capacity.

**Bulk Storage**

The total service storage capacity of the Umzinto Water Supply Scheme area is unknown. Therefore one cannot determination whether there is sufficient storage to the accepted norm of 48 hours of summer peak requirement for urban areas. This norm has been determined to meet the following requirements:

- Balance the fluctuating demands from the distribution system, permitting the source to give a steady or differently phased output;
- Provide a supply during a failure or shutdown of treatment plant, pumps or bulk mains leading to the reservoir; and
- Provide a reserve of water to meet fire and other emergency demands.

Therefore no conclusion could be drawn on whether additional service storage capacity is required currently or in the future. However as the demands grow in the scheme, additional service storage capacity will be required sometime in the future to meet the future summer peak requirements of Umzinto Water Supply Scheme.

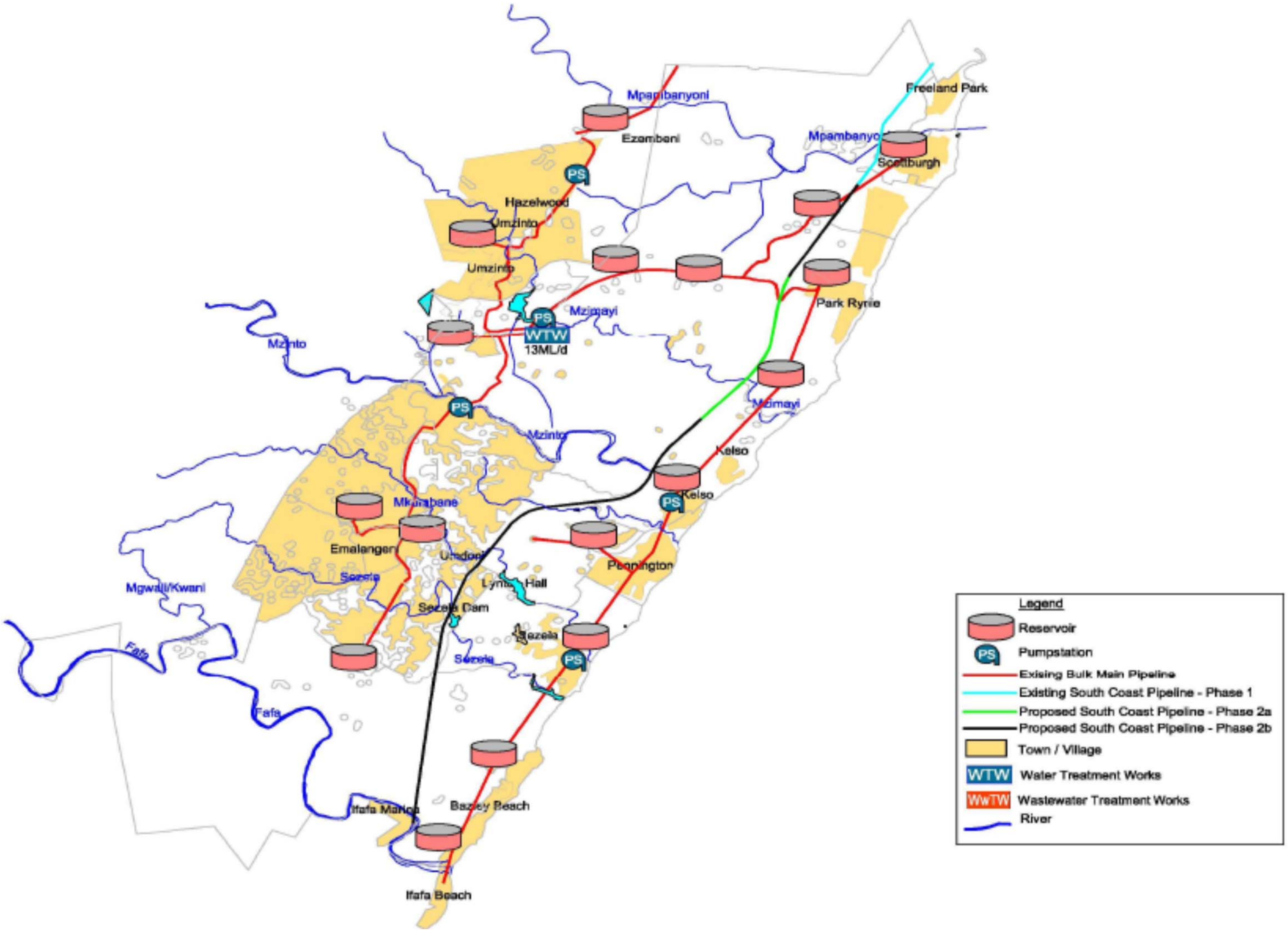



**Figure 14 – Schematic layout of Umzinto Water Supply Scheme area**

(Source: First Stage Reconciliation Strategy for Umzinto Water Supply Scheme Area Umdoni Municipality)

### 5.1.3.8 Vulamehlo Water Supply Scheme (Vulamehlo LM)

(Source: First Stage Reconciliation Strategy for Vulamehlo Water Supply Scheme Area Vulamehlo Municipality)

The main source of supply for the Vulamehlo Water Supply Scheme is the run-of-river abstraction from the Mtwalume River, whilst a dam on the Mzinto River supplies the Braemar WTW. According to the ISP, the available water in the South Coast catchments which make up the Mtwalume, Mzinto, and Mpambanyoni River catchments is in deficit. Based on the available information from the reconciliation strategy, the supply area of the Vulamehlo Water Supply Scheme has a water supply deficit, as the available water from the two sources is not sufficient to meet the current water requirements.

The current and future water requirements for domestic water use of the Vulamehlo Water Supply Scheme in the UDM which depends on run-of-river abstraction from Mtwalume River and the Mzinto River cannot be supplied from the available water supplies, without development of additional water supplies. This depends on the operating rules of the two sources of supply.

According to the WSDP, the conductivity of the water in the Mzinto River has been increasing substantially while the water quality in the Mtwalume River is considered of average quality with slight increases in the chloride levels and alkalinity concentration. The geology and the topography of the area are such that there is no potential for significant groundwater development. Currently there is limited groundwater use in the Vulamehlo Water Supply Scheme area. There is no reported water quality problems associated with the groundwater.

The Vulamehlo Water Supply Scheme comprises raw water abstraction from the Mtwalume River which supplies Vulamehlo WTW as well as from the Mzinto River which supplies Braemar WTW, two water treatment works near Jolivet and Braemar respectively and bulk service storage infrastructure and bulk distribution networks.

**Water Treatment Works**

**Vulamehlo (Jolivet) Water Treatment Works**

The raw water from Mtwalume River is pumped to the Vulamehlo WTW, where it is treated to potable drinking water quality standards. The Vulamehlo WTW is the main treatment works that supplies the scheme area. The peak hydraulic design capacity of the water treatment works is only 2.25 ML/d or 0.82 million $m^3$/a (WSDP, 2008). The average annual flow rate of the treatment works is estimated to be 1.5 ML/d or 0.6 million $m_3$/a based on a peaking factor of 1.5.

The Vulamehlo WTW is a conventional treatment plant comprising the following process components:

(i) *Flocculation channels*: The raw water is pumped from the Mtwalume River to the inlet works where the chemicals are added as the water flows into the flocculation channels at the treatment works where coagulation after polyelectrolyte dosing takes place to form the flocs.

(ii) *Clarification (sedimentation) tanks*: The flocs that have formed during the flocculation process are then settled in the sedimentation tanks under gravity. The settled sludge is removed by frequent de-sludging of the tanks and sent to the sludge lagoons where the sludge is dried while the supernatant water is discharged back into the river. The plant was not designed for recycling of the wastewater.

(iii) *Rapid Gravity Sand Filtration*: The clarified water is then filtered through a set of rapid gravity sand filters as a final polishing before chlorination of the treated water.

(iv) *Disinfection*: The filtered water then gravitates to the chorine contact tanks where chlorination takes place before pumping the potable water to the command reservoirs in Vulamehlo supply area for distribution.

**Braemar Water Treatment Works**

The raw water from Mzinto Dam is pumped to the Braemar WTW where it is treated to potable drinking water quality standards. The Braemar WTW is the secondary treatment works that supplies the scheme area. The peak hydraulic design capacity of the water treatment works is only 1.5 ML/d or 0.6 million $m^3$/a (WSDP, 2008). The average annual flow rate of the treatment works is estimated to be 1.0 ML/d or 0.4 million $m^3$/a based on a peaking factor of 1.5.

The Braemar WTW is a conventional treatment plant, comprising the same process components as the Vulamehlo WTW.

Potable water is pumped to the command reservoirs in Braemar town area for distribution.
The current utilisation of the bulk water supply infrastructure is approximately 125%. When compared with the estimated water requirements, the existing bulk water supply infrastructure does not have sufficient capacity to meet the current water requirements of Vulamehlo Water Supply Scheme as well as the future water requirements on a long term sustainable basis.

| Treatment Work Name | Type of plant | Raw water source | Hydraulic Design capacity (ML/d) | Average flow rate (ML/d) | Treated water production (ML/d) | Current utilisation (% of ave.design capacity) |
|---|---|---|---|---|---|---|
| Vulamehlo (Jolivet) WTW Capacity | Conventional | Mtwalume River | 2.25 | 1.50 | 1.95 | 130% |
| Braemar WTW Capacity | Conventional | Mzinto River Dam | 1.50 | 1.00 | 1.35 | 135% |
| Boreholes | | | 0.72 | 0.72 | 0.72 | 100% |
| **Total** | | | **4.47** | **3.22** | **4.02** | **124.8%** |

**Table 9 - Water Treatment Works in operation in the Vulamehlo Water Supply Scheme area** (Source: First Stage Reconciliation Strategy for Vulamehlo Water Supply Scheme Area Vulamehlo Municipality)

The condition and performance of the two treatment works is not known. It is also not known whether the treatment works have been generally been compliant with SANS 241, 2001 for potable drinking water quality standards.

**Treated water bulk supply infrastructure**

The treated water from the two treatment works in the Vulamehlo Water Supply Scheme is pumped from the clearwater tanks to various service reservoirs in the scheme area before distribution into the scheme's reticulation network .The pumping systems have standby capacity.

**Bulk Storage**

The total service storage capacity of the Vulamehlo Water Supply Scheme area is unknown. It is thus not possible to determine whether there is sufficient storage to the accepted norm of 48 hours of summer peak requirement for urban areas. This norm has been determined to meet the following requirements:

- Balance the fluctuating demands from the distribution system, permitting the source to give a steady or differently phased output;
- Provide a supply during a failure or shutdown of treatment plant, pumps or bulk mains leading to the reservoir; and
- Provide a reserve of water to meet fire and other emergency demands.

Therefore no conclusion could be drawn on whether additional service storage capacity is required currently or in the future. However, as the demands grow in the scheme, additional service storage capacity will be required sometime in the future, to meet the future summer peak requirements of Vulamehlo Water Supply Scheme.

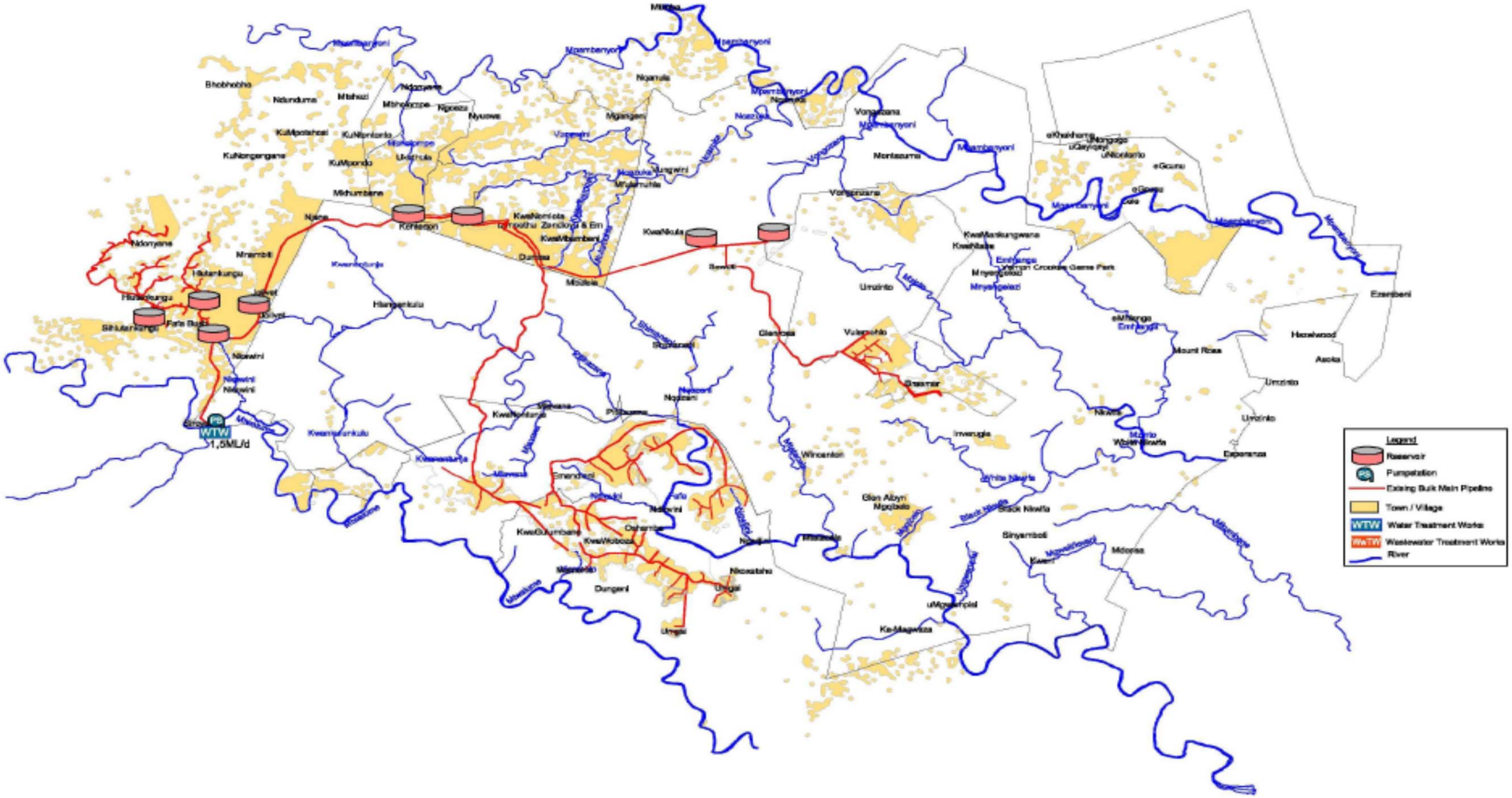



**Figure 15 – Schematic layout of Vulamehlo Water Supply Scheme area**
(Source: First Stage Reconciliation Strategy for Vulamehlo Water Supply Scheme Area Vulamehlo Municipality)

#### 5.1.3.9 Weza Harding Water Supply Scheme (Umuziwabantu LM)

(Source: First Stage Reconciliation Strategy for Weza Water Supply Scheme Area Umuziwabantu Municipality)

The main source of supply for Weza Harding Water Supply Scheme is the run-of-river abstraction from the Weza River and the municipal dam in a tributary of the Mzimkulwana River which supplies Harding WTW. The Weza and Mzimkhulwana Rivers is not well regulated with the water users relying on run-of-river abstraction. According to the ISP, the available water in the Mtamvuna River catchment has surplus water available at the coast.

Based on the available information from the reconciliation strategy, the Weza Catchment has a water supply deficit as the available water from the two sources is not sufficient to meet the current water requirements. The current and future water requirements for domestic water use of Weza Harding Water Supply Scheme in UDM which depends on run-of-river abstraction from Weza River and a municipal dam near Harding cannot be supplied from the available water supplies without development of additional water supplies. This depends on the operating rules of the two sources of supply. There may be sufficient runoff during low flow periods from the municipal dam if it was operated only during low flow periods to meet the current water requirements of the scheme. However the water treatment works at Harding presents a limiting factor at a design capacity of 2.0 ML/d. However, during normal flows the Weza WTW, with a design capacity of 4.0 ML/d can supply the current water requirements of the water supply area. This however, cannot be done on a long term sustainable basis.

According to the WSDP, there are no known major water quality problems in the Weza Harding Water Supply Scheme area. It is however likely that the quality of the Weza and Mzimkhulwana Rivers is, however, significantly affected during periods of rainfall as a result of land use activities upstream, soil erosion and resulting increase in turbidity.

The geology and the topography of the area are such that there is no potential for significant groundwater development. Currently there is no groundwater use in the Weza Harding Water Supply Scheme area. There is no reported water quality problems associated with the groundwater.

The Weza Harding Water Supply Scheme comprises raw water abstraction from the Weza River as well as from the Mzimkhulwana Rivers, two water treatment works near Weza and Harding respectively and bulk service storage infrastructure and bulk distribution networks.

**Water Treatment Works**

**Weza Water Treatment Works**

The raw water from Weza River is pumped to the Weza WTW where it is treated to potable drinking water quality standards. The Weza WTW is the main treatment works that supplies the scheme area. The peak hydraulic design capacity of the water treatment works is only 4 ML/d or 1.5 million $m^3$/a (WSDP, 2008). The average annual flow rate of the treatment works is estimated to be 2.7 ML/d or 1.0 million m3/a based on a peaking factor of 1.5.

The Weza WTW is a conventional treatment plant comprising the following process components:

(i) *Flocculation channels*: The raw water is pumped from the Weza River to the inlet works where the chemicals are added as the water flows into the flocculation channels at the treatment works. Coagulation after polyelectrolyte dosing takes place to form the flocs.

(ii) *Clarification (sedimentation) tanks*: The flocs that have formed during the flocculation process are then settled in the sedimentation tanks under gravity. The settled sludge is removed by frequent de-sludging of the tanks and sent to the sludge lagoons where the sludge is dried while the supernatant water is discharged back into the river. The plant was not designed for recycling of the wastewater.

(iii) *Rapid Gravity Sand Filtration*: The clarified water is then filtered through a set of rapid gravity sand filters as a final polishing before chlorination of the treated water.

(iv) *Disinfection*: The filtered water then gravitates to the chorine contact tanks where chlorination takes place before pumping the potable water to the command reservoirs in Weza supply area for distribution.

**Harding Water Treatment Works**

The raw water from municipal dam in Harding is pumped to the Harding WTW where it is treated to potable drinking water quality standards. The Harding WTW is the secondary treatment works that supplies the scheme area. The peak hydraulic design capacity of the water treatment works is 2 ML/d or 0.73 million $m^3$/a (WSDP, 2008). The average annual flow rate of the treatment works is estimated to be 1.33 ML/d or 0.49 million $m_3$/a based on a peaking factor of 1.5. The type of treatment plant at Harding is not known.

The current utilization of the bulk water supply infrastructure is approximately 185%. The existing bulk water supply infrastructure does not have sufficient capacity to meet the current water requirements of Weza Harding Water Supply Scheme as well as the future water requirements on a long term sustainable basis.

| Treatment Work Name | Type of plant | Raw water source | HydraulicDesign capacity (ML/d) | Average flow rate (ML/d) | Treated water production (ML/d) | Current utilisation (% of ave.design capacity) |
|---|---|---|---|---|---|---|
| Weza WTW Capacity | Conventional | Weza | 4.00 | 2.67 | 5.42 | 203% |
| Harding WTW Capacity | Unknown | Mzimkulwana | 2.00 | 1.33 | 2.00 | 150% |
| **Total** | | | **6.00** | **4.00** | **7.42** | **185.5%** |

**Table 10 - Water Treatment Works in operation in the Weza Water Supply Scheme area**

(Source: First Stage Reconciliation Strategy for Weza Water Supply Scheme Area Umuziwabantu Municipality)

The condition and performance of the two treatment works is not known. It is also not known if the treatment works have been generally compliant with SANS 241, 2001 for potable drinking water quality standards.

**Treated water bulk supply infrastructure**

The treated water from the treatment works in the Weza Harding Water Supply Scheme is pumped from the clearwater tanks to various service reservoirs in the scheme area before distribution into the scheme's reticulation network (see table above). The pumping systems have standby capacity.

**Bulk Storage**

The total service storage capacity of the Weza Harding Water Supply Scheme area is not known to enable a determination of whether there is sufficient storage to the accepted norm of 48 hours of summer peak requirement for urban areas. This norm has been determined to meet the following requirements:

- Balance the fluctuating demands from the distribution system, permitting the source to give a steady or differently phased output;
- Provide a supply during a failure or shutdown of treatment plant, pumps or bulk mains leading to the reservoir; and
- Provide a reserve of water to meet fire and other emergency demands.

Therefore no conclusion could be drawn on whether additional service storage capacity is required currently or in the future. However as the demands grow in the scheme, additional service storage capacity will be required sometime in the future to meet the future summer peak requirements of Weza Harding Water Supply Scheme.

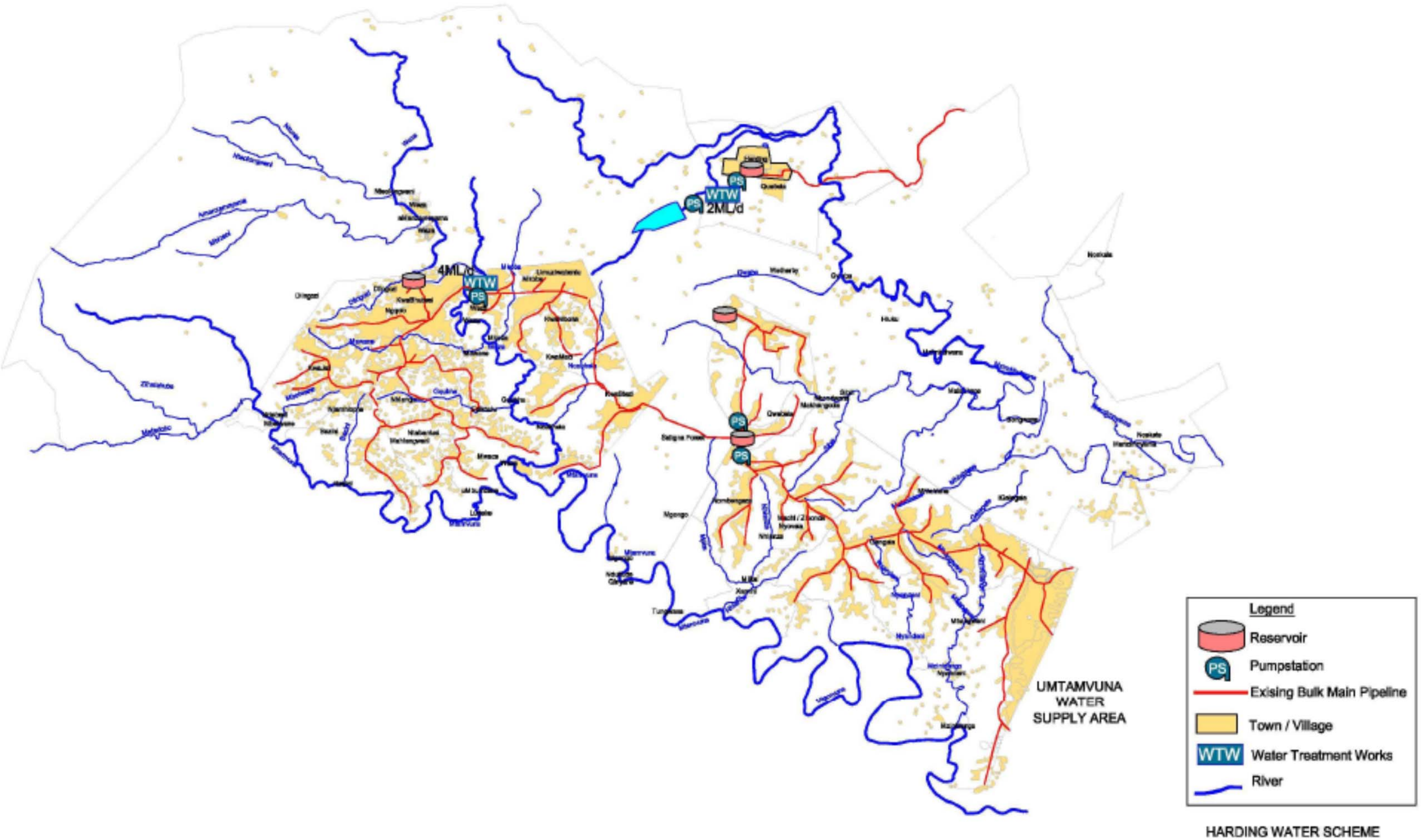



**Figure 16 – Schematic layout of Weza Water Supply Scheme area**
(Source: First Stage Reconciliation Strategy for Weza Water Supply Scheme Area Umuziwabantu Municipality)

## 6. RECONCILIATION OF EXISTING AND PROPOSED WATER SUPPLY AND DEMAND OPTIONS

GIS analysis was used to calculate both high and low household counts, as well as high and low population counts, for each of the water supply footprint polygons. While the calculation of the household counts for each water supply footprint was a simple GIS query, the population statistics, and projection thereof, required more detailed analysis.

**Household Counts**:

Unique ID numbers were given to all the demand areas, which could then be used to link data from other sources. A spatial join was performed on the Eskom 2011 household points falling within each polygon. This gave each household point the unique ID of the area in which it fell. This data could then be summarised and a count done of the number of households in each area. This count was then added to the water demand attribute table.

Table

footprint_pop_2014

| OID | UID | Cnt_UID | Sum_HH_2014 |
|---|---|---|---|
| 312 | Ugu_134 | 5 | 9.2 |
| 313 | Ugu_135 | 16 | 29.44 |
| 314 | Ugu_14 | 947 | 4549.32 |
| 315 | Ugu_140 | 7 | 54.18 |
| 316 | Ugu_146 | 20 | 68.73 |
| 317 | Ugu_15 | 1081 | 5121.41 |
| 318 | Ugu_153 | 3 | 7.17 |
| 319 | Ugu_157 | 11 | 26.29 |
| 320 | Ugu_16 | 7421 | 31511.26 |
| 321 | Ugu_160 | 17 | 52.08 |
| 322 | Ugu_17 | 2887 | 14970.96 |
| 323 | Ugu_178 | 14 | 36.47 |
| 324 | Ugu_18 | 132 | 592.21 |
| 325 | Ugu_181 | 161 | 383.65 |
| 326 | Ugu_185 | 125 | 301.94 |
| 327 | Ugu_19 | 576 | 3009.6 |
| 328 | Ugu_2 | 1082 | 2766.5 |
| 329 | Ugu_20 | 263 | 1454.84 |
| 330 | Ugu_202 | 9 | 24.96 |
| 331 | Ugu_204 | 7 | 22.19 |
| 332 | Ugu_206 | 22 | 58.52 |
| 333 | Ugu_21 | 8889 | 30875.97 |
| 334 | Ugu_22 | 153 | 773.37 |
| 335 | Ugu_220 | 4 | 18.8 |

**Table 11 – Example of household data with unique water supply footprint identifier**

These figures were used as the “Low” count, until the “High” had been calculated. The high count was obtained by extrapolating the growth rate for each ward from the Census 2001/2011 figure through to 2014. This information was obtained using the online Statistics SA Superweb application. Statistics SA was consulted on the best method in achieving these calculations. The 84 wards falling within Ugu District Municipality were selected, and the population figures for both 2001 and 2011 were added to the table. These two figures were used to calculate the percentage growth over that ten year period. The result was divided by 10 to get an average growth rate per annum for each ward.

This growth rate was then applied to the household count for each subsequent year (2012, 2013, 2014), and the result was used to populate the “High” values for both population and number of households in the attribute table. Once the high count had been completed, the two figures could be compared. Where “Low” > “High”, the figures were swapped. Since the calculations for high and low demand for water were based on the required million m³ per annum, the number of decimal places in the household count was significant, and the project team made the decision to keep this to two decimal places.

**Population Numbers:**

Census 2011 data was used for the population figures. The Supercross programme was used to extract the household sizes and the total population counts for each subplace within the District. The total population was divided by the number of households (from the Eskom 2011 point data) to get the average household size.

Table

hholds_with_UID_pop_growth_hhold_size

| Id | DM | UID | GrPA_2 | Pop2012 | Pop2013 | Pop2014 | Av_HHSize | OH_Cmmts | HH_2012 | HH_2013 | HH_2014 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 96 | Ugu | Ugu_96 | 1.13 | 6299.3877 | 6370.570781 | 6442.558231 | 5.92 | | 5.99 | 6.06 | 6.13 |
| 96 | Ugu | Ugu_96 | 1.13 | 6299.3877 | 6370.570781 | 6442.558231 | 5.92 | | 5.99 | 6.06 | 6.13 |
| 96 | Ugu | Ugu_96 | 1.13 | 6299.3877 | 6370.570781 | 6442.558231 | 5.92 | | 5.99 | 6.06 | 6.13 |
| 96 | Ugu | Ugu_96 | 1.13 | 6299.3877 | 6370.570781 | 6442.558231 | 5.92 | | 5.99 | 6.06 | 6.13 |
| 96 | Ugu | Ugu_96 | 1.13 | 6299.3877 | 6370.570781 | 6442.558231 | 5.92 | | 5.99 | 6.06 | 6.13 |
| 96 | Ugu | Ugu_96 | 1.13 | 6299.3877 | 6370.570781 | 6442.558231 | 5.92 | | 5.99 | 6.06 | 6.13 |
| 96 | Ugu | Ugu_96 | 1.13 | 6299.3877 | 6370.570781 | 6442.558231 | 5.92 | | 5.99 | 6.06 | 6.13 |
| 96 | Ugu | Ugu_96 | 1.13 | 6299.3877 | 6370.570781 | 6442.558231 | 5.92 | | 5.99 | 6.06 | 6.13 |
| 96 | Ugu | Ugu_96 | 1.13 | 6299.3877 | 6370.570781 | 6442.558231 | 5.92 | | 5.99 | 6.06 | 6.13 |
| 96 | Ugu | Ugu_96 | 1.13 | 6299.3877 | 6370.570781 | 6442.558231 | 5.92 | | 5.99 | 6.06 | 6.13 |
| 97 | Ugu | Ugu_97 | 0.27 | 8065.7188 | 8087.496241 | 8109.332481 | 3.73 | | 3.74 | 3.75 | 3.76 |
| 97 | Ugu | Ugu_97 | 0.27 | 8065.7188 | 8087.496241 | 8109.332481 | 3.73 | | 3.74 | 3.75 | 3.76 |
| 97 | Ugu | Ugu_97 | 0.27 | 8065.7188 | 8087.496241 | 8109.332481 | 3.73 | | 3.74 | 3.75 | 3.76 |
| 97 | Ugu | Ugu_97 | 0.27 | 8065.7188 | 8087.496241 | 8109.332481 | 3.73 | | 3.74 | 3.75 | 3.76 |
| 97 | Ugu | Ugu_97 | 0.27 | 8065.7188 | 8087.496241 | 8109.332481 | 3.73 | | 3.74 | 3.75 | 3.76 |
| 97 | Ugu | Ugu_97 | 0.27 | 8065.7188 | 8087.496241 | 8109.332481 | 3.73 | | 3.74 | 3.75 | 3.76 |
| 97 | Ugu | Ugu_97 | 0.27 | 8065.7188 | 8087.496241 | 8109.332481 | 3.73 | | 3.74 | 3.75 | 3.76 |
| 97 | Ugu | Ugu_97 | 0.27 | 8065.7188 | 8087.496241 | 8109.332481 | 3.73 | | 3.74 | 3.75 | 3.76 |
| 97 | Ugu | Ugu_97 | 0.27 | 8065.7188 | 8087.496241 | 8109.332481 | 3.73 | | 3.74 | 3.75 | 3.76 |
| 97 | Ugu | Ugu_97 | 0.27 | 8065.7188 | 8087.496241 | 8109.332481 | 3.73 | | 3.74 | 3.75 | 3.76 |
| 97 | Ugu | Ugu_97 | 0.27 | 8065.7188 | 8087.496241 | 8109.332481 | 3.73 | | 3.74 | 3.75 | 3.76 |
| 97 | Ugu | Ugu_97 | 0.27 | 8065.7188 | 8087.496241 | 8109.332481 | 3.73 | | 3.74 | 3.75 | 3.76 |
| 97 | Ugu | Ugu_97 | 0.27 | 8065.7188 | 8087.496241 | 8109.332481 | 3.73 | | 3.74 | 3.75 | 3.76 |

This household size data was then linked to the household points, again using a spatial join in ArcGIS. Using the unique ID, the data was summarised and the number of people (a sum of the household size in each water supply footprint) was calculated. This was joined to the water supply footprint attribute table, and used as the low populatio count. In the same way as the growth of the number of households was calculated, the growth rate was applied to the population figures, and the result was again summarised, population figures summed, and this data added as the high population figure.

| DM | HH_Low | HH_High | Pop_Low | Pop_High |
|---|---|---|---|---|
| Ugu | 3 | 3 | 15 | 15 |
| Ugu | 4 | 4 | 20 | 20 |
| Ugu | 3 | 3 | 15 | 15 |
| Ugu | 29 | 33 | 93 | 104 |
| Ugu | 53 | 57 | 117 | 125 |
| Ugu | 23 | 26 | 125 | 140 |
| Ugu | 16 | 16 | 29 | 30 |
| Ugu | 47 | 53 | 96 | 109 |
| Ugu | 50 | 57 | 102 | 116 |
| Ugu | 7 | 7 | 22 | 22 |
| Ugu | 9 | 9 | 28 | 28 |
| Ugu | 4 | 4 | 13 | 13 |
| Ugu | 3 | 3 | 16 | 17 |
| Ugu | 7 | 8 | 38 | 42 |
| Ugu | 4 | 4 | 18 | 19 |
| Ugu | 13 | 15 | 42 | 47 |
| Ugu | 2783 | 2884 | 9248 | 9545 |
| Ugu | 20 | 21 | 66 | 69 |
| Ugu | 2556 | 2646 | 11570 | 12000 |
| Ugu | 199 | 215 | 884 | 954 |
| Ugu | 938 | 1013 | 4980 | 5383 |
| Ugu | 1325 | 1376 | 6214 | 6455 |
| Ugu | 30 | 32 | 145 | 153 |
| Ugu | 332 | 351 | 1788 | 1893 |
| Ugu | 1917 | 2112 | 8799 | 9694 |
| Ugu | 3326 | 3513 | 15713 | 16567 |
| Ugu | 469 | 530 | 1347 | 1525 |
| Ugu | 81 | 84 | 403 | 418 |
| Ugu | 475 | 520 | 1468 | 1610 |
| Ugu | 652 | 676 | 2764 | 2862 |
| Ugu | 963 | 998 | 2806 | 2898 |

**Table 12 – Example of low and high household and population statistics**

**Water Demand Forecasts**

The higher of the two household counts was used to calculate the low demand forecast (million m³ pa), using the figures supplied by the Department of Water Affairs using the All Town Study. The high demand forecast (million m³ pa) was calculated in the same way. The probable demand forecast (million m³ pa) was the average of these two figures.

| DM | LowDemandForecast | HighDemandForecast | ProbableDemand | CurrentWaterRequirements | FutureWaterRequirements |
|---|---|---|---|---|---|
| Ugu | 0.017651 | 0.033565 | 0.025006 | 0.025006 | 0.033565 |
| Ugu | 0.128597 | 0.205678 | 0.158067 | 0.158067 | 0.205678 |
| Ugu | 0.121063 | 0.229819 | 0.171506 | 0.171506 | 0.229819 |
| Ugu | 0.184354 | 0.290887 | 0.233515 | 0.233515 | 0.290887 |
| Ugu | 0.12229 | 0.237849 | 0.173244 | 0.173244 | 0.237849 |
| Ugu | 0.0491 | 0.095477 | 0.069558 | 0.069558 | 0.095477 |
| Ugu | 0.110069 | 0.221467 | 0.155932 | 0.155932 | 0.221467 |
| Ugu | 0.780297 | 1.705331 | 1.105421 | 1.105421 | 1.705331 |
| Ugu | 0.081556 | 0.162607 | 0.115537 | 0.115537 | 0.162607 |
| Ugu | 0.063247 | 0.104116 | 0.077741 | 0.077741 | 0.104116 |
| Ugu | 0.002234 | 0.003614 | 0.002829 | 0.002829 | 0.003614 |
| Ugu | 0.000591 | 0.000903 | 0.000749 | 0.000749 | 0.000903 |
| Ugu | 0.00184 | 0.002811 | 0.00233 | 0.00233 | 0.002811 |
| Ugu | 0.008344 | 0.012948 | 0.010569 | 0.010569 | 0.012948 |
| Ugu | 0.019644 | 0.030414 | 0.024883 | 0.024883 | 0.030414 |
| Ugu | 0.00887 | 0.013751 | 0.011235 | 0.011235 | 0.013751 |
| Ugu | 0.005782 | 0.008933 | 0.007323 | 0.007323 | 0.008933 |
| Ugu | 0.002694 | 0.004216 | 0.003412 | 0.003412 | 0.004216 |
| Ugu | 0.000854 | 0.001305 | 0.001082 | 0.001082 | 0.001305 |
| Ugu | 0.022294 | 0.042318 | 0.031583 | 0.031583 | 0.042318 |
| Ugu | 0.19526 | 0.314977 | 0.24733 | 0.24733 | 0.314977 |
| Ugu | 0.234286 | 0.462207 | 0.331905 | 0.331905 | 0.462207 |
| Ugu | 0.028295 | 0.054684 | 0.040084 | 0.040084 | 0.054684 |
| Ugu | 0.014366 | 0.027784 | 0.020352 | 0.020352 | 0.027784 |
| Ugu | 0.13797 | 0.257201 | 0.195458 | 0.195458 | 0.257201 |
| Ugu | 0.059831 | 0.115873 | 0.08476 | 0.08476 | 0.115873 |
| Ugu | 0.012439 | 0.02401 | 0.017622 | 0.017622 | 0.02401 |
| Ugu | 0.029762 | 0.047979 | 0.037699 | 0.037699 | 0.047979 |
| Ugu | 0.293197 | 0.542587 | 0.415363 | 0.415363 | 0.542587 |
| Ugu | 0.545354 | 1.047112 | 0.772585 | 0.772585 | 1.047112 |
| Ugu | 0.028908 | 0.055808 | 0.040953 | 0.040953 | 0.055808 |
| Ugu | 0.007884 | 0.013049 | 0.009986 | 0.009986 | 0.013049 |
| Ugu | 0.001971 | 0.003854 | 0.002792 | 0.002792 | 0.003854 |

**Water Supply Status and Water Source**

The supply status of each area was assessed using all available spatial water infrastructure data (boreholes, reservoirs, springs, pipelines etc.) and intersections with the water supply footprint polygons. Where there were intersections (i.e. there was some form of water supply within, or very close to  water supply footprints) it was assumed that there was short term supply to that area. Assessments were checked manually to ensure that very close water supplies to settlement boundaries were taken into account.

Similarly, analysis using existing mapped boreholes and other water sources, was used to populate the existing water source field.

| LOCAL MUNICIPALITY | NO OF WATER SUPPLY FOOTPRINTS | NO OF WATER SUPPLY FOOTPRINTS WITH SHORT TERM SUPPLY |
|---|---|---|
| Vulamehlo | 36 | 22 |
| Umdoni | 24 | 22 |
| Umzumbe | 34 | 27 |
| Umiziwabantu | 36 | 27 |
| Ezingoleni | 9 | 6 |
| Hibiscus Coast | 34 | 32 |
| Ugu | 173 | 136 |

## 6.1 Existing Water and Sanitation Infrastructure

Table 13 is a summary of the water infrastructure components within the UDM. This information was extracted from the WSDP which was undertaken in 2008.

| **Components** | **Total** |
|---|---|
| Dams | 5 |
| Water mains | 3896 km |
| Reservoirs | 150 |
| Pump stations | 120 |
| WTW | 16 |
| WWTW | 10 |

**Table 13 - Summary of water infrastructure components**
(Source: WSDP 2008)

Table 14 is a summary of the sanitation infrastructure components within the UDM. This information was extracted from the WSDP which was undertaken in 2008.

| **Components** | **Total** |
|---|---|
| VIP toilets | 63 638 |
| Septic tanks/conservancy tanks | 19362 |
| Bulk sewer | 17800 |
| New wastewater treatment works | 6 |
| Pump stations | 30 |

**Table 14 - Existing Sanitation Infrastructure**
(Source: WSDP 2008 page 79)

## 6.2 Water and Sanitation Backlogs

Table 15 indicates the total number of households as well as water backlogs within the various local municipalities in the UDM.

| Water | Total Households | Backlogs |
|---|---|---|
| Vulamehlo LM | 12901 | 3420 |
| Umdoni LM | 13146 | 837 |
| Umzumbe LM | 26829 | 7080 |
| Umuziwabantu LM | 16093 | 2296 |
| Ezingoleni LM | 8757 | 873 |
| Hibiscus Coast LM | 42689 | 2034 |
| Total | 120414 | 16540 |

**Table 15 - Water Backlogs**
(Source: Eskom study 2011 and Stats SA)

Table 16 indicates the total number of households as well as sanitation backlogs within the various local municipalities in the UDM.

| Sanitation | Total Households | Backlogs |
|---|---|---|
| Vulamehlo LM | 12901 | 903 |
| Umdoni LM | 13146 | 920 |
| Umzumbe LM | 26829 | 1878 |
| Umuziwabantu LM | 16093 | 1126 |
| Ezingoleni LM | 8757 | 613 |
| Hibiscus Coast LM | 42689 | 2988 |
| Total | 120414 | 8429 |

**Table 16 - Sanitation Backlogs**

(Source: WSDP 2012/16 and Stats SA)

## 7. PROPOSED FUTURE SUPPLY OPTIONS

### 7.1 Existing proposals for future supply

UDM has developed a water master plan that seeks to integrate the 16 individual water schemes into sustainable systems, as follows:

- Harding Weza water supply scheme
- Umtamvuna water supply scheme
- UMzimkhulu water supply scheme
- Umtwalume water supply scheme
- Vulamehlo water scheme
- KwaLembe water scheme
- Mhlabashane water scheme
- South coast water transfer system from Inanda Dam

Table 17 indicates the projects/programmes for water supply projects in the various geographical areas, the targets (description of the work to be undertaken for these projects), budgets and the years of implementation. The table was extracted from the IDP undertaken in 2013.

| PROJECT / PROGRAMMES | TARGET | BUDGET | TIME FRAME | | | | | GEOGRAPHICAL AREA |
|---|---|---|---|---|---|---|---|---|
| | | | 2012/2013 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | |
| South Coast Augmentation Booster Pump Station | New in-line booster pump station (capacity = 120ML/day) | **R86,680,000** | **Construction** (R10,148,000) | **Commissioning** (R6,676,000) | 0 | 0 | 0 | eThekwini Municipality |
| Nungwane Raw Water Aqueduct | New 450mm diameter steel pipeline (capacity = 20ML/day) | **R68,580,000** | **Design** (R1,000,000) | **Design** (R2,500,000) | **Construction** (R1,500,000) | **Construction** (R42,000,000) | **Construction** (R21,580,000) | Vulamehlo LM ward 1 and eThekwini Municipality |
| South Coast Pipeline Phase 2A | 4.5km South Coast Pipeline exte. Phase 1 (capacity = 35ML/day) | **R38,368,000** | **Retention** (R3,922,000) | 0 | 0 | 0 | 0 | Wards 4 and 10 of Umdoni Municipality |
| Ellingham Link Pipeline | 3km long x 350mm diameter steel pipeline that links Scottburgh South Reservoir to Ellingham Reservoir.<br>Scottburgh South Pump Station with two pump sets (one operating and one standby). | R36,500,000 | **Tender** (R1,700,000) | **Construction** (R20,800,000) | **Construction** R14,000,000 | 0 | 0 | Wards 4, 5 & 10 of Umdoni LM. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Mhlabatshane Bulk Water Supply Scheme (Phase 1) | Dam – 25m high composite earth embankment and central concrete spillway.<br>Raw water pump stations – at the dam and intermediate booster. | **R182,120,000** | **Construction** (R49,440,000) | 0 | 0 | 0 | 0 | Ward 3 of Umzumbe Municipality |
| Mhlabatshane Bulk Water Supply Scheme (Phase 1) | Raw water rising main – 400mm diameter steel pipeline.<br>WTP – 4ML/day upgrade to 8ML/day.<br>Potable water pump station.<br>Potable water rising main – 350mm diameter uPVC pipeline.<br>Reservoir – 2ML upgrade to 4ML. | **R182,120,000** | **Construction** (R49,440,000) | 0 | 0 | 0 | 0 | Ward 3 of Umzumbe Municipality |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Potable water gravity main: 200mm diameter uPVC | | | | | | | |
| Lower Mkomazi Bulk Water Supply Scheme | This scheme will receive raw water from the lower Mkomazi River for treatment and distribution into the South Coast Pipeline. Potable water would be fed northwards to the Upper South Coast region and Amanzimtoti, and southwards to the Middle South Coast region. This would then allow the Amanzimtoti & Craigieburn WTPs to be fully decommissioned | **R796,000,000** | 0 | 0 | **Planning** (R2,500,000) | **Planning** (R3,500,000) | 0 | eThekwini Municipality and Ugu District Municipality |
| East Coast | Inlet and outlet | **R18,000,000** | **Feasibility** | **Feasibility** | N/A | N/A | N/A | eThekwini |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Desalination Plants | works, bulk supply infrastructure, 150ML/day reverse osmosis desalination plant. | | (R11,791,000) | (R4,500,000) | | | | Municipality |
| South Coast Pipeline Phase 2B | New 600mm diameter x 5km long steel pipeline from Kelso Off-take to Pennington Reservoir | **R40,000,000.00** | N/A | **Feasibility** (R3,000,000) | **Design & Construction** (R37,000,000) | N/A | N/A | Ward 10 of Umdoni Municipality |

**Table 17 – Projects/programmes for water supply projects**
(Source: IDP 2013)

Figure 17 indicates the planned bulk pipelines and reticulation projects within the Ugu District Municipality. This figure was extracted from the IDP undertaken in 2013.

Figure 19 indicates the existing and completed water projects within the Ugu District. It indicates all existing reservoirs, water treatment works and water pipelines. This figure was extracted from the IDP undertaken in 2013.

The maps on pages 76-81 indicate the various projects in each Local Municipality, the funding agent, status of the projects and total project cost. These drawings were sourced from Bigen Africa

The GIS provided by the UDM indicated their proposed water supply schemes. Where possible the concept designs were tied into the UDM's planned network to avoid any duplication of infrastructure and reduce costs.

The quantification and pricing undertaken in this report is based on UAP proposals only and does not take into consideration the future infrastructure already planned by the UDM as it is assumed that funding for these proposals have already been secured by UDM.

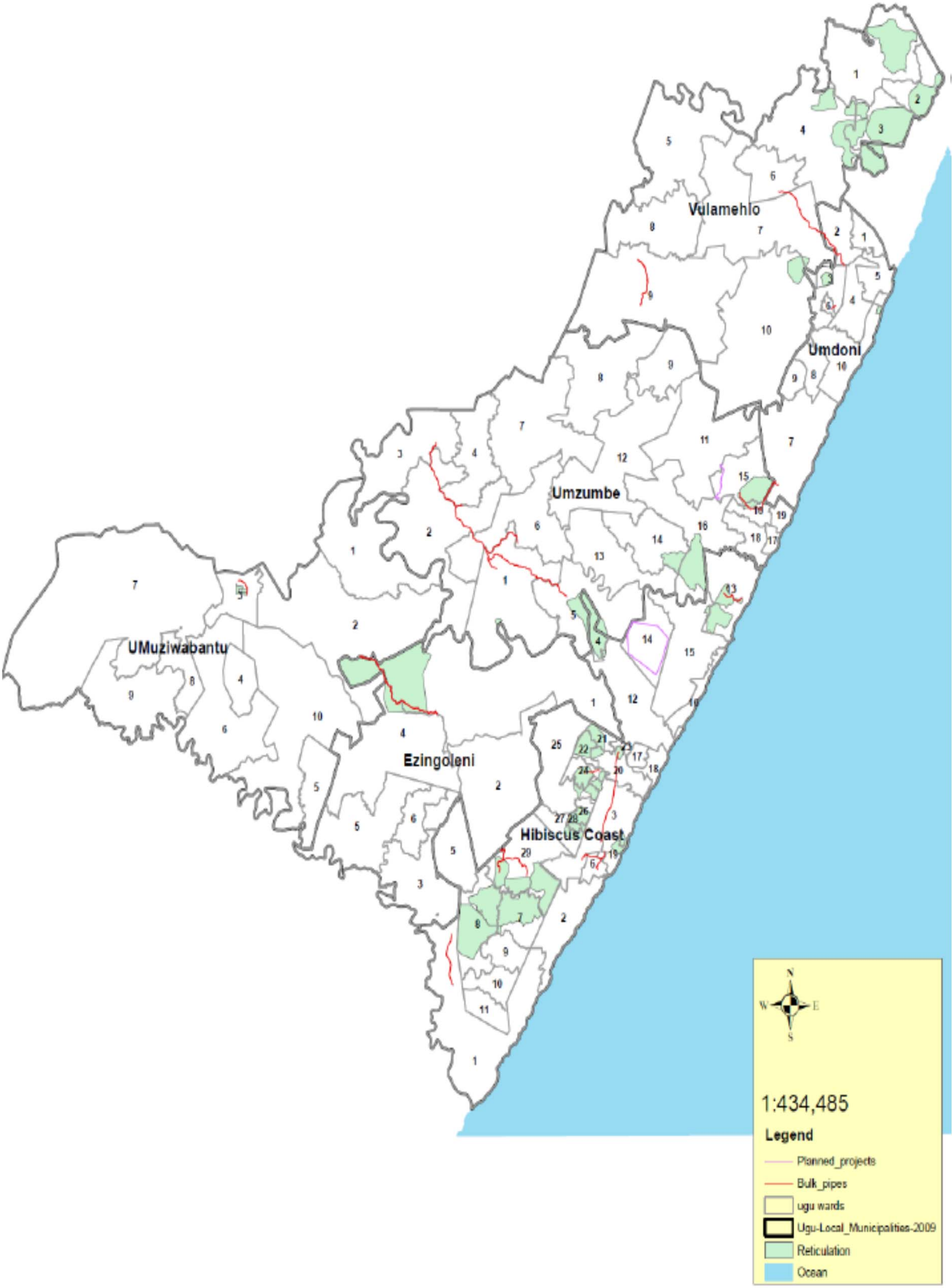



**Figure 17 – Ugu District Planned & Currently Under Construction Water & Sanitation Projects**

Source (IDP 2013)

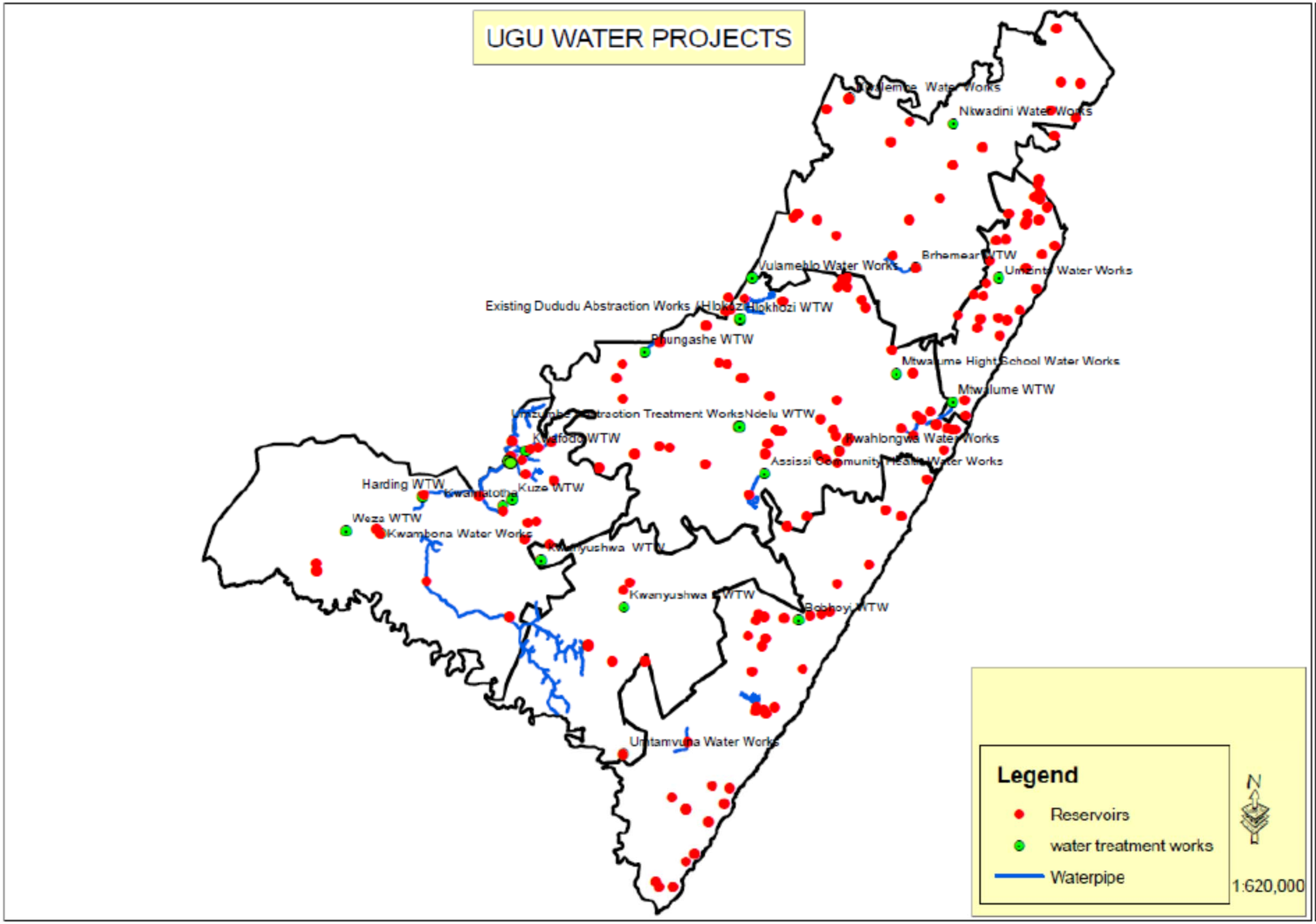
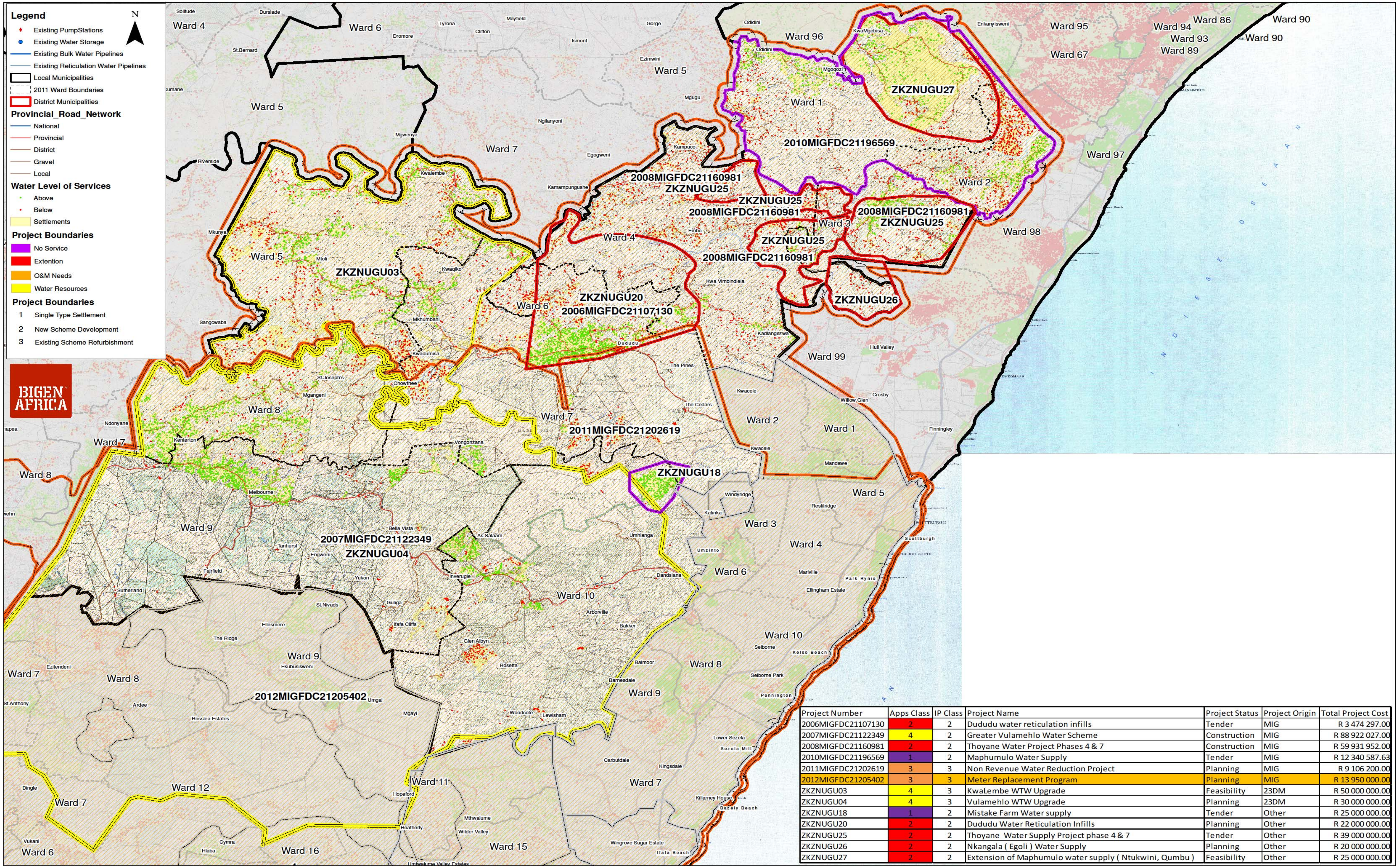



**Figure 18 – Ugu District Completed & Existing Projects**

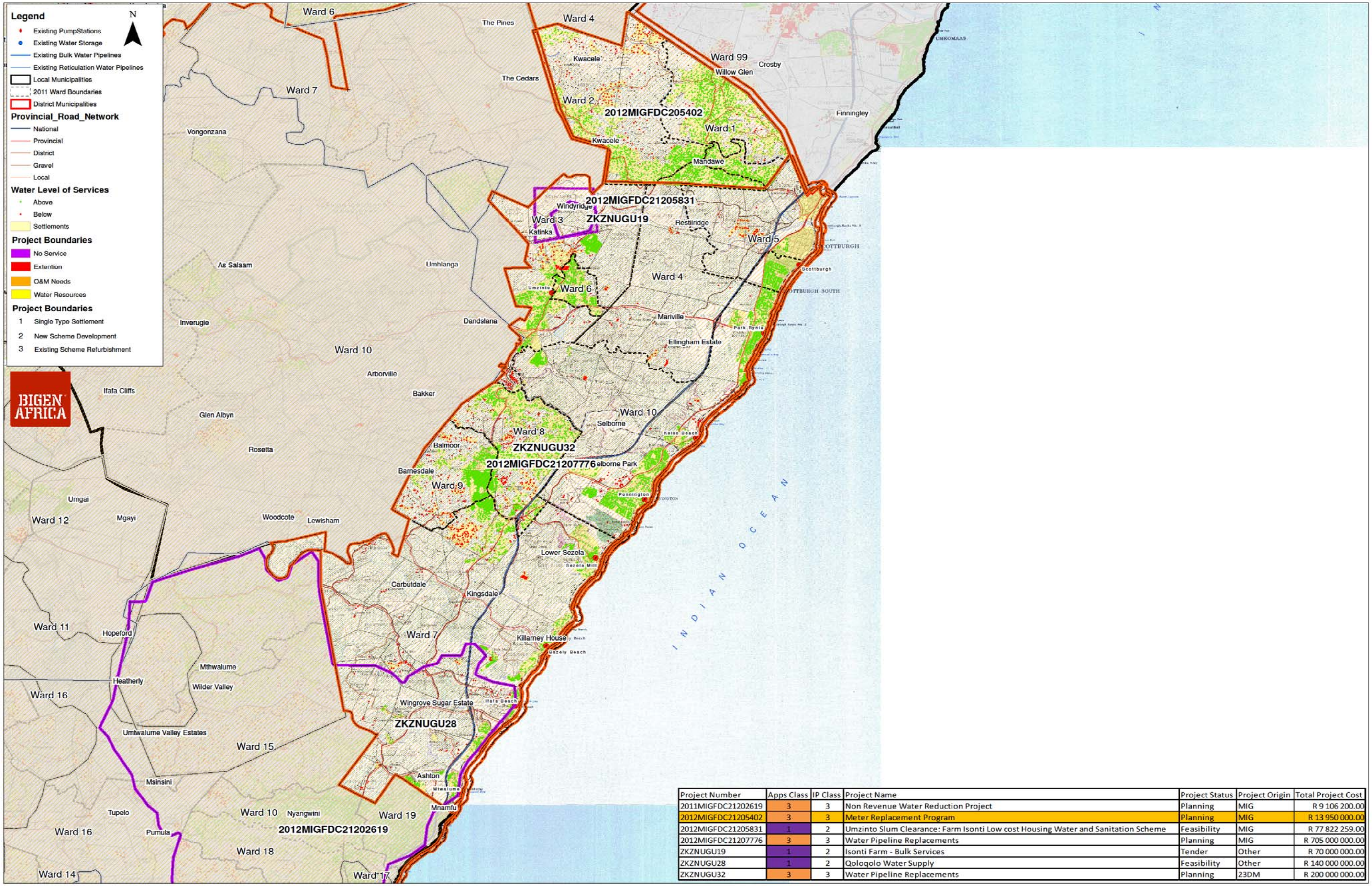
(Source: IDP 2013)

# UGU - VULAMEHLO



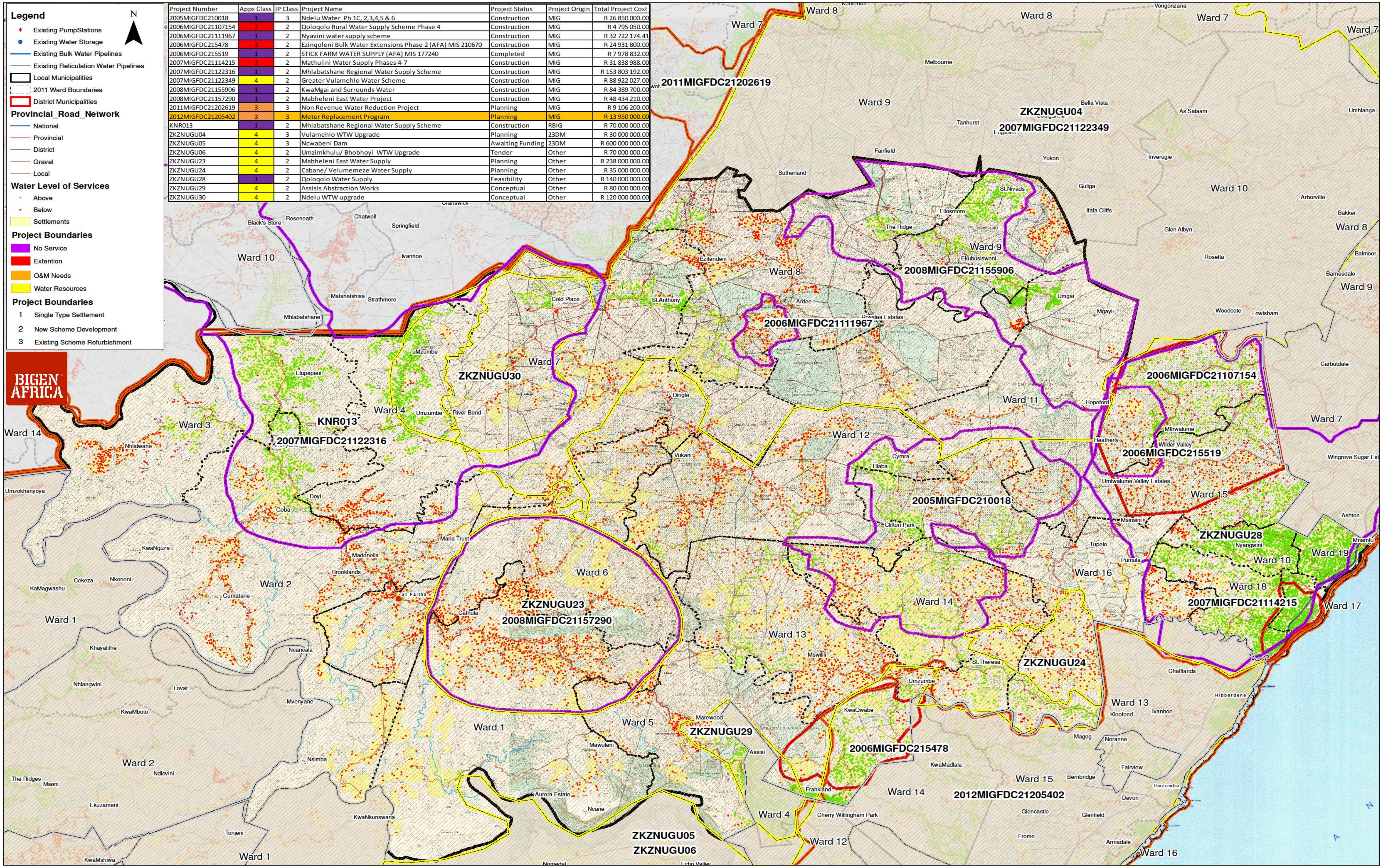

| Project Number | Apps Class | IP Class | Project Name | Project Status | Project Origin | Total Project Cost |
|---|---|---|---|---|---|---|
| 2006MIGFDC21107130 | 2 | 2 | Dududu water reticulation infills | Tender | MIG | R 3 474 297.00 |
| 2007MIGFDC21122349 | 4 | 2 | Greater Vulamehlo Water Scheme | Construction | MIG | R 88 922 027.00 |
| 2008MIGFDC21160981 | 2 | 2 | Thoyane Water Project Phases 4 & 7 | Construction | MIG | R 59 931 952.00 |
| 2010MIGFDC21196569 | 1 | 2 | Maphumulo Water Supply | Tender | MIG | R 12 340 587.63 |
| 2011MIGFDC21202619 | 3 | 3 | Non Revenue Water Reduction Project | Planning | MIG | R 9 106 200.00 |
| 2012MIGFDC21205402 | 3 | 3 | Meter Replacement Program | Planning | MIG | R 13 950 000.00 |
| ZKZNUGU03 | 4 | 3 | KwaLembe WTW Upgrade | Feasibility | 23DM | R 50 000 000.00 |
| ZKZNUGU04 | 4 | 3 | Vulamehlo WTW Upgrade | Planning | 23DM | R 30 000 000.00 |
| ZKZNUGU18 | 1 | 2 | Mistake Farm Water supply | Tender | Other | R 25 000 000.00 |
| ZKZNUGU20 | 2 | 2 | Dududu Water Reticulation Infills | Planning | Other | R 22 000 000.00 |
| ZKZNUGU25 | 2 | 2 | Thoyane Water Supply Project phase 4 & 7 | Tender | Other | R 39 000 000.00 |
| ZKZNUGU26 | 2 | 2 | Nkangala ( Egoli ) Water Supply | Planning | Other | R 20 000 000.00 |
| ZKZNUGU27 | 2 | 2 | Extension of Maphumulo water supply ( Ntukwini, Qumbu ) | Feasibility | Other | R 25 000 000.00 |

# UGU - UMDONI



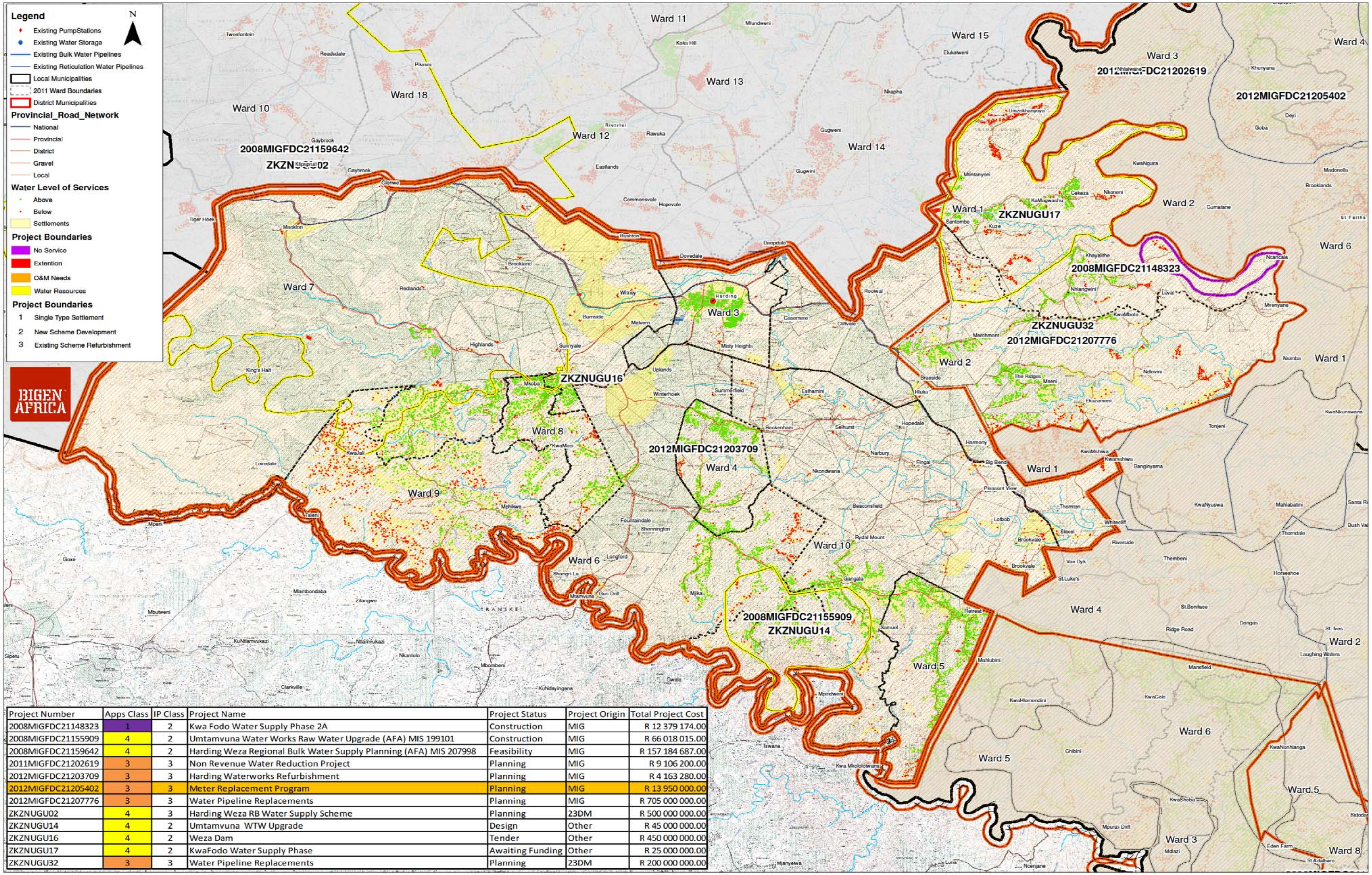

| Project Number | Apps Class | IP Class | Project Name | Project Status | Project Origin | Total Project Cost |
|---|---|---|---|---|---|---|
| 2011MIGFDC21202619 | 3 | 3 | Non Revenue Water Reduction Project | Planning | MIG | R 9 106 200.00 |
| 2012MIGFDC21205402 | 3 | 3 | Meter Replacement Program | Planning | MIG | R 13 950 000.00 |
| 2012MIGFDC21205831 | 1 | 2 | Umzinto Slum Clearance: Farm Isonti Low cost Housing Water and Sanitation Scheme | Feasibility | MIG | R 77 822 259.00 |
| 2012MIGFDC21207776 | 3 | 3 | Water Pipeline Replacements | Planning | MIG | R 705 000 000.00 |
| ZKZNUGU19 | 1 | 2 | Isonti Farm - Bulk Services | Tender | Other | R 70 000 000.00 |
| ZKZNUGU28 | 1 | 2 | Qoloqolo Water Supply | Feasibility | Other | R 140 000 000.00 |
| ZKZNUGU32 | 3 | 3 | Water Pipeline Replacements | Planning | 23DM | R 200 000 000.00 |

# UGU - UMZUMBE



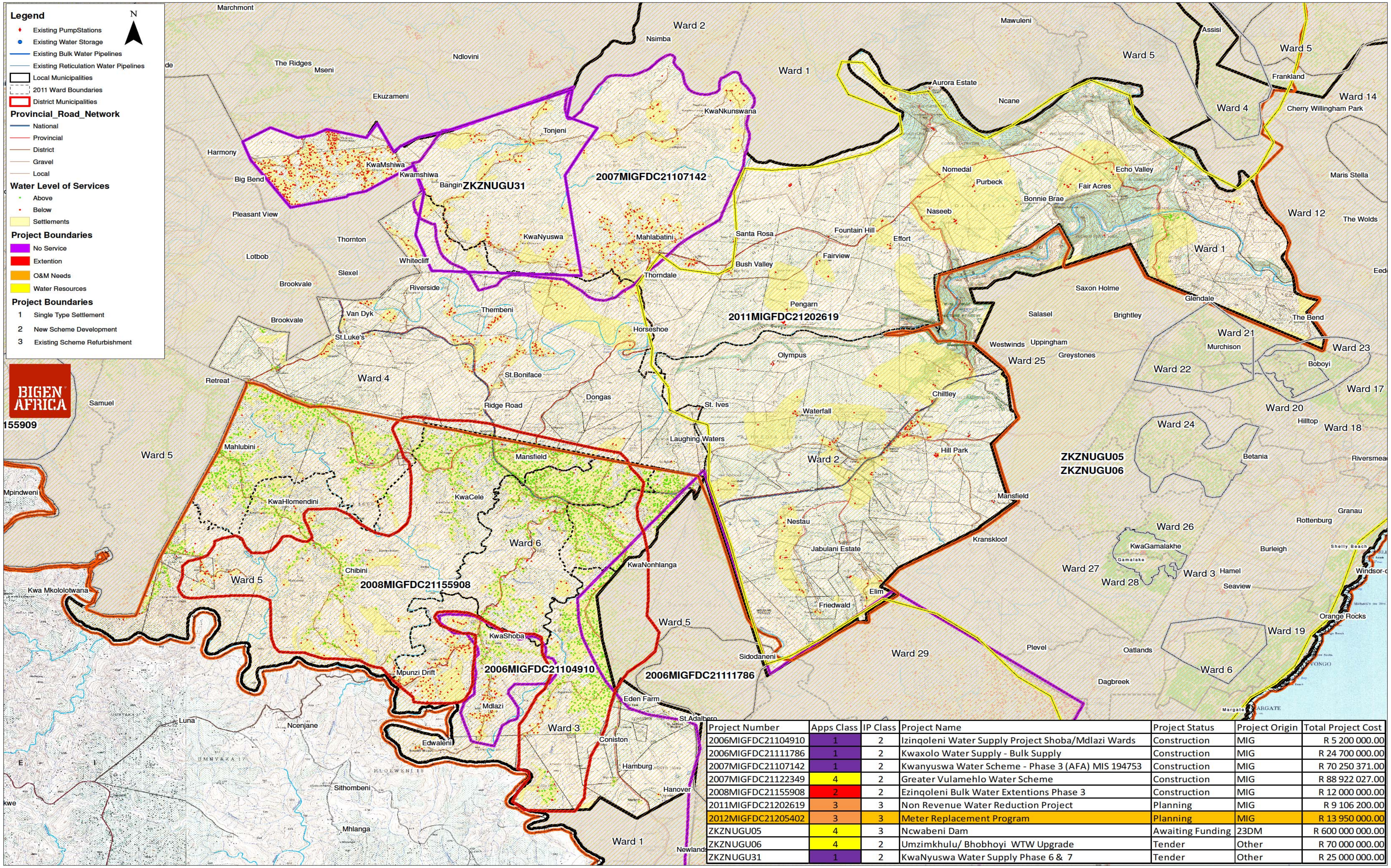

| Project Number | Apps Class | IP Class | Project Name | Project Status | Project Origin | Total Project Cost |
|---|---|---|---|---|---|---|
| 2005MIGFDC210018 | 1 | 3 | Ndelu Water Ph 1C, 2,3,4,5 & 6 | Construction | MIG | R 26 850 000.00 |
| 2006MIGFDC21107154 | 2 | 2 | Qoloqolo Rural Water Supply Scheme Phase 4 | Construction | MIG | R 4 795 050.00 |
| 2006MIGFDC21111967 | 1 | 2 | Nyavini water supply scheme | Construction | MIG | R 32 722 174.41 |
| 2006MIGFDC215478 | 2 | 2 | Ezinqoleni Bulk Water Extensions Phase 2 (AFA) MIS 210670 | Construction | MIG | R 24 931 800.00 |
| 2006MIGFDC215519 | 1 | 2 | STICK FARM WATER SUPPLY (AFA) MIS 177240 | Completed | MIG | R 7 978 832.00 |
| 2007MIGFDC21114215 | 2 | 2 | Mathulini Water Supply Phases 4-7 | Construction | MIG | R 31 838 988.00 |
| 2007MIGFDC21122316 | 1 | 2 | Mhlabatshane Regional Water Supply Scheme | Construction | MIG | R 153 803 192.00 |
| 2007MIGFDC21122349 | 4 | 2 | Greater Vulamehlo Water Scheme | Construction | MIG | R 88 922 027.00 |
| 2008MIGFDC21155906 | 1 | 2 | KwaMgai and Surrounds Water | Construction | MIG | R 84 389 700.00 |
| 2008MIGFDC21157290 | 1 | 2 | Mabheleni East Water Project | Construction | MIG | R 48 434 210.00 |
| 2011MIGFDC21202619 | 3 | 3 | Non Revenue Water Reduction Project | Planning | MIG | R 9 106 200.00 |
| 2012MIGFDC21205402 | 3 | 3 | Meter Replacement Program | Planning | MIG | R 13 950 000.00 |
| KNR013 | 1 | 2 | Mhlabatshane Regional Water Supply Scheme | Construction | RBIG | R 70 000 000.00 |
| ZKZNUGU04 | 4 | 3 | Vulamehlo WTW Upgrade | Planning | 23DM | R 30 000 000.00 |
| ZKZNUGU05 | 4 | 3 | Ncwabeni Dam | Awaiting Funding | 23DM | R 600 000 000.00 |
| ZKZNUGU06 | 4 | 2 | Umzimkhulu/ Bhobhoyi WTW Upgrade | Tender | Other | R 70 000 000.00 |
| ZKZNUGU23 | 4 | 2 | Mabheleni East Water Supply | Planning | Other | R 238 000 000.00 |
| ZKZNUGU24 | 4 | 2 | Cabane/ Velumemeze Water Supply | Planning | Other | R 35 000 000.00 |
| ZKZNUGU28 | 1 | 2 | Qoloqolo Water Supply | Feasibility | Other | R 140 000 000.00 |
| ZKZNUGU29 | 4 | 2 | Assisis Abstraction Works | Conceptual | Other | R 80 000 000.00 |
| ZKZNUGU30 | 4 | 2 | Ndelu WTW upgrade | Conceptual | Other | R 120 000 000.00 |

# UGU - UMUZIWABANTU



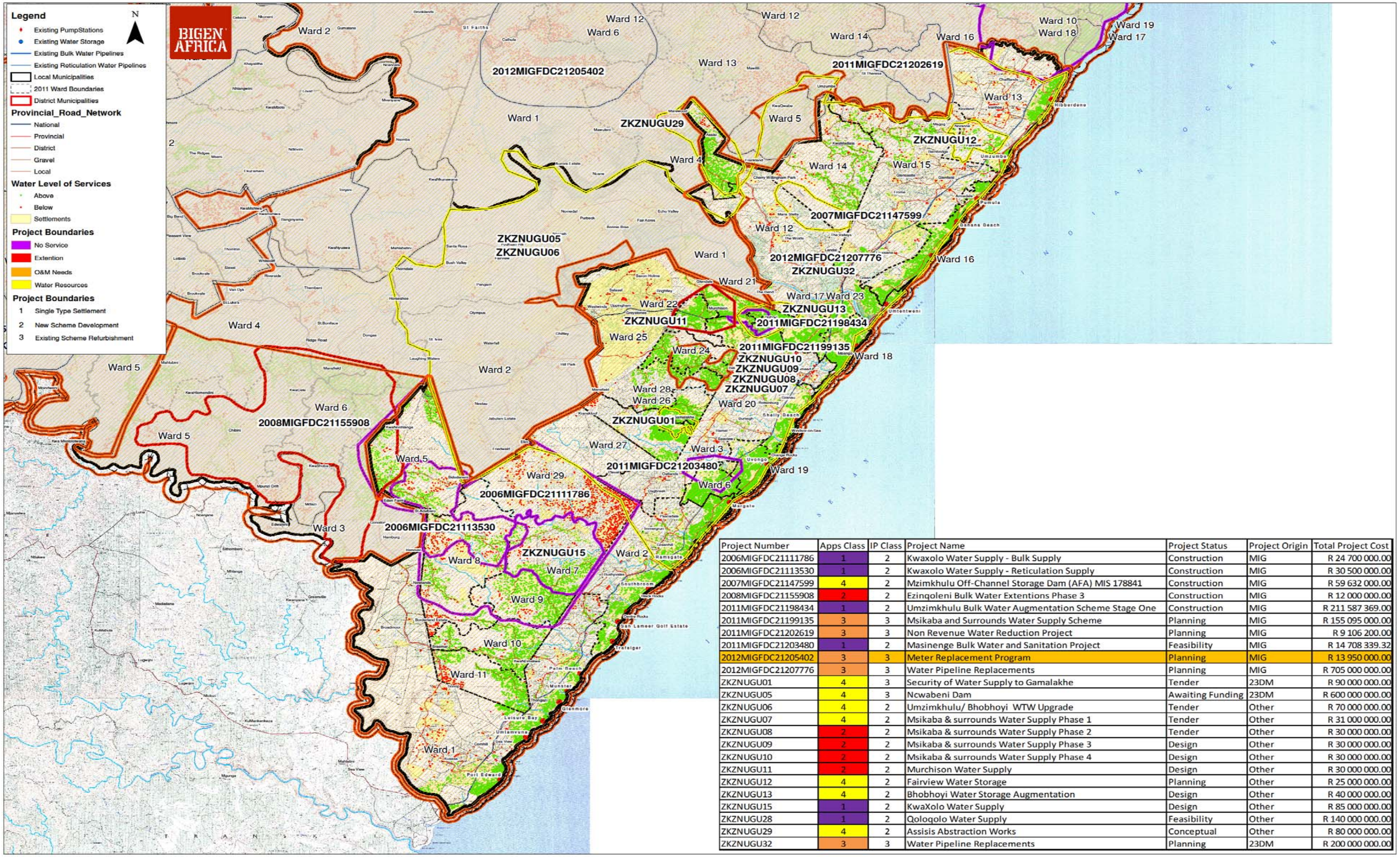

| Project Number | Apps Class | IP Class | Project Name | Project Status | Project Origin | Total Project Cost |
|---|---|---|---|---|---|---|
| 2008MIGFDC21148323 | 1 | 2 | Kwa Fodo Water Supply Phase 2A | Construction | MIG | R 12 379 174.00 |
| 2008MIGFDC21155909 | 4 | 2 | Umtamvuna Water Works Raw Water Upgrade (AFA) MIS 199101 | Construction | MIG | R 66 018 015.00 |
| 2008MIGFDC21159642 | 4 | 2 | Harding Weza Regional Bulk Water Supply Planning (AFA) MIS 207998 | Feasibility | MIG | R 157 184 687.00 |
| 2011MIGFDC21202619 | 3 | 3 | Non Revenue Water Reduction Project | Planning | MIG | R 9 106 200.00 |
| 2012MIGFDC21203709 | 3 | 3 | Harding Waterworks Refurbishment | Planning | MIG | R 4 163 280.00 |
| 2012MIGFDC21205402 | 3 | 3 | Meter Replacement Program | Planning | MIG | R 13 950 000.00 |
| 2012MIGFDC21207776 | 3 | 3 | Water Pipeline Replacements | Planning | MIG | R 705 000 000.00 |
| ZKZNUGU02 | 4 | 3 | Harding Weza RB Water Supply Scheme | Planning | 23DM | R 500 000 000.00 |
| ZKZNUGU14 | 4 | 2 | Umtamvuna WTW Upgrade | Design | Other | R 45 000 000.00 |
| ZKZNUGU16 | 4 | 2 | Weza Dam | Tender | Other | R 450 000 000.00 |
| ZKZNUGU17 | 4 | 2 | KwaFodo Water Supply Phase | Awaiting Funding | Other | R 25 000 000.00 |
| ZKZNUGU32 | 3 | 3 | Water Pipeline Replacements | Planning | 23DM | R 200 000 000.00 |

# UGU - EZINGOLENI




| Project Number | Apps Class | IP Class | Project Name | Project Status | Project Origin | Total Project Cost |
|---|---|---|---|---|---|---|
| 2006MIGFDC21104910 | 1 | 2 | Izinqoleni Water Supply Project Shoba/Mdlazi Wards | Construction | MIG | R 5 200 000.00 |
| 2006MIGFDC21111786 | 1 | 2 | Kwaxolo Water Supply - Bulk Supply | Construction | MIG | R 24 700 000.00 |
| 2007MIGFDC21107142 | 1 | 2 | Kwanyuswa Water Scheme - Phase 3 (AFA) MIS 194753 | Construction | MIG | R 70 250 371.00 |
| 2007MIGFDC21122349 | 4 | 2 | Greater Vulamehlo Water Scheme | Construction | MIG | R 88 922 027.00 |
| 2008MIGFDC21155908 | 2 | 2 | Ezinqoleni Bulk Water Extentions Phase 3 | Construction | MIG | R 12 000 000.00 |
| 2011MIGFDC21202619 | 3 | 3 | Non Revenue Water Reduction Project | Planning | MIG | R 9 106 200.00 |
| 2012MIGFDC21205402 | 3 | 3 | Meter Replacement Program | Planning | MIG | R 13 950 000.00 |
| ZKZNUGU05 | 4 | 3 | Ncwabeni Dam | Awaiting Funding | 23DM | R 600 000 000.00 |
| ZKZNUGU06 | 4 | 2 | Umzimkhulu/ Bhobhoyi WTW Upgrade | Tender | Other | R 70 000 000.00 |
| ZKZNUGU31 | 1 | 2 | KwaNyuswa Water Supply Phase 6 & 7 | Tender | Other | R 25 000 000.00 |

# UGU - HIBISCUS COAST




| Project Number | Apps Class | IP Class | Project Name | Project Status | Project Origin | Total Project Cost |
|---|---|---|---|---|---|---|
| 2006MIGFDC21111786 | 1 | 2 | Kwaxolo Water Supply - Bulk Supply | Construction | MIG | R 24 700 000.00 |
| 2006MIGFDC21113530 | 1 | 2 | Kwaxolo Water Supply - Reticulation Supply | Construction | MIG | R 30 500 000.00 |
| 2007MIGFDC21147599 | 4 | 2 | Mzimkhulu Off-Channel Storage Dam (AFA) MIS 178841 | Construction | MIG | R 59 632 000.00 |
| 2008MIGFDC21155908 | 2 | 2 | Ezinqoleni Bulk Water Extentions Phase 3 | Construction | MIG | R 12 000 000.00 |
| 2011MIGFDC21198434 | 1 | 2 | Umzimkhulu Bulk Water Augmentation Scheme Stage One | Construction | MIG | R 211 587 369.00 |
| 2011MIGFDC21199135 | 3 | 3 | Msikaba and Surrounds Water Supply Scheme | Planning | MIG | R 155 095 000.00 |
| 2011MIGFDC21202619 | 3 | 3 | Non Revenue Water Reduction Project | Planning | MIG | R 9 106 200.00 |
| 2011MIGFDC21203480 | 1 | 2 | Masinenge Bulk Water and Sanitation Project | Feasibility | MIG | R 14 708 339.32 |
| 2012MIGFDC21205402 | 3 | 3 | Meter Replacement Program | Planning | MIG | R 13 950 000.00 |
| 2012MIGFDC21207776 | 3 | 3 | Water Pipeline Replacements | Planning | MIG | R 705 000 000.00 |
| ZKZNUGU01 | 4 | 3 | Security of Water Supply to Gamalakhe | Tender | 23DM | R 90 000 000.00 |
| ZKZNUGU05 | 4 | 3 | Ncwabeni Dam | Awaiting Funding | 23DM | R 600 000 000.00 |
| ZKZNUGU06 | 4 | 2 | Umzimkhulu/ Bhobhoyi WTW Upgrade | Tender | Other | R 70 000 000.00 |
| ZKZNUGU07 | 4 | 2 | Msikaba & surrounds Water Supply Phase 1 | Tender | Other | R 31 000 000.00 |
| ZKZNUGU08 | 2 | 2 | Msikaba & surrounds Water Supply Phase 2 | Tender | Other | R 30 000 000.00 |
| ZKZNUGU09 | 2 | 2 | Msikaba & surrounds Water Supply Phase 3 | Design | Other | R 30 000 000.00 |
| ZKZNUGU10 | 2 | 2 | Msikaba & surrounds Water Supply Phase 4 | Design | Other | R 30 000 000.00 |
| ZKZNUGU11 | 2 | 2 | Murchison Water Supply | Design | Other | R 30 000 000.00 |
| ZKZNUGU12 | 4 | 2 | Fairview Water Storage | Planning | Other | R 25 000 000.00 |
| ZKZNUGU13 | 4 | 2 | Bhobhoyi Water Storage Augmentation | Design | Other | R 40 000 000.00 |
| ZKZNUGU15 | 1 | 2 | KwaXolo Water Supply | Design | Other | R 85 000 000.00 |
| ZKZNUGU28 | 1 | 2 | Qoloqolo Water Supply | Feasibility | Other | R 140 000 000.00 |
| ZKZNUGU29 | 4 | 2 | Assisis Abstraction Works | Conceptual | Other | R 80 000 000.00 |
| ZKZNUGU32 | 3 | 3 | Water Pipeline Replacements | Planning | 23DM | R 200 000 000.00 |

## 8. APPROACH TO WATER SUPPLY

### 8.1 Water Treatment Works Situation Analysis

**Vulamehlo Local Municipality**

| | |
|---|---|
| Current Population | = 77403 |
| Consumption based on 70l/c/d | = 5.72 ML/d |
| | |
| Total Capacity of existing water treatment plants | = 6.25 ML/d |

Vulamehlo Local Municipality is served by Kwalembe WTW (2.50 ML/d), Vulamehlo (Jolivet) WTW (3 2.25 ML), Breemar WTW (1.50 ML/d) and Boreholes (0.72 ML/d).

Total Capacity of existing water treatment works = 6.97 ML/d

***Hence the calculation above indicates that there is insufficient water treatment capacity in the Vulamehlo Local Municipality currently.***

**Umdoni Local Municipality**

| | |
|---|---|
| Current Population | = 78875 |
| Consumption based on 70l/c/d | = 5.52 ML/d |

Umdoni Local Municipality is served by Umzinto WTW (13.60 ML/d).

Total Capacity of existing water treatment plants = 13.60 ML/d

***Hence the calculation above indicates that there is sufficient water treatment capacity in the Umdoni Local Municipality currently.***

**Umzumbe Local Municipality**

| | |
|---|---|
| Current Population | = 160975 |
| Consumption based on 70l/c/d | = 11.27 ML/d |

Umzumbe Local Municipality is served by Ndelu WTW (2.10 ML/d), Pungase WTW (0.45 ML), KwaHongwa WTW (1.13 ML/d), Umtwalume WTW (4.50 ML), Umtwalume Upgrade WTW (4.50 ML) and Boreholes (1.44 ML/d).

Total Capacity of existing water treatment plants = 14.12 ML/d

***Hence the calculation above indicates that there is sufficient water treatment capacity in the Umzumbe Local Municipality currently.***

**Umuziwabantu Local Municipality**

***No information currently available on Water Treatment Plants in the Umuziwabantu Municipality.***

**Ezingoleni Local Municipality**

***No information currently available on Water Treatment Plants in the Ezingoleni Municipality.***

**Hibiscus Local Municipality**

| | |
|---|---|
| Current Population | = 256135 |
| Consumption based on 70l/c/d | = 17.93 ML/d |

Hibiscus Coast Local Municipality is served by Umtamvuna WTW (20.0 ML/d) and Bobhoyi WTW (54.0 ML).

| | |
|---|---|
| Total Capacity of existing water treatment plants | = 70.0 ML/d |

***Hence the calculation above indicates that there is sufficient water treatment capacity in the Hibiscus Coast Local Municipality currently.***

## 8.2 Design Parameters

MM PDNA undertook the conceptual design for the whole district municipality and divided it into each local municipality for that district municipality. The following assumptions were made in undertaking the conceptual design:

- Each household has an average of 6 people.
- Low water demand to be 70 liters per capita per day.
- High water demand to be 120 liters per capita per day.
- The existing boreholes are functional.
- The existing water reticulation schemes are operational.
- The existing water reticulation schemes have spare capacity.
- Water Treatment Works have the potential to be upgraded or rehabilitated.
- Schemes have some form of power supply.
- General pipe size range is from 25 mm to 150 mm diameter.
- Peak factor - 1.5
- Proposed reservoirs storage based on 48 hours water consumption
- Velocity range is between 0.7m/s per second to 1.5 m/s
- Pressure at standpipes/supply point – Average 6m of head
- Water losses were considered to be 35%
- Where there is an existing bulk line, connections to the bulk where kept to a minimum
- Reticulation mains were placed in the road reserve so that it can be maintained
- District and provincial road crossings were kept to a minimum

## 8.3 Scheme Types

MMPDNA assessed some of the existing water supply options that the UDM currently implements and applied the same scheme types to supply the un-serviced polygons. The following schemes were adopted by MMPDNA to determine the type of scheme applicable to the different settlements and their associated costs which was provided by Umgeni Water.

- Tie into existing scheme.

- Existing boreholes and standpipes that is non-functional to be rehabilitated.

- Existing boreholes with a reticulation to be rehabilitated.

- Boreholes mechanically operated for settlements with a low population.

- Boreholes electronically operated for settlements with a high population.

- Small Package Plants for density populated settlements.

- From existing scheme pumped to new reservoir and reticulated.

- Where the existing borehole schemes are indicated but the settlement households are still indicated as un-serviced. We assumed that there was an issue with the existing boreholes and have therefore linked to the contiguous water supply schemes. Figure 19 below indicates this principle.

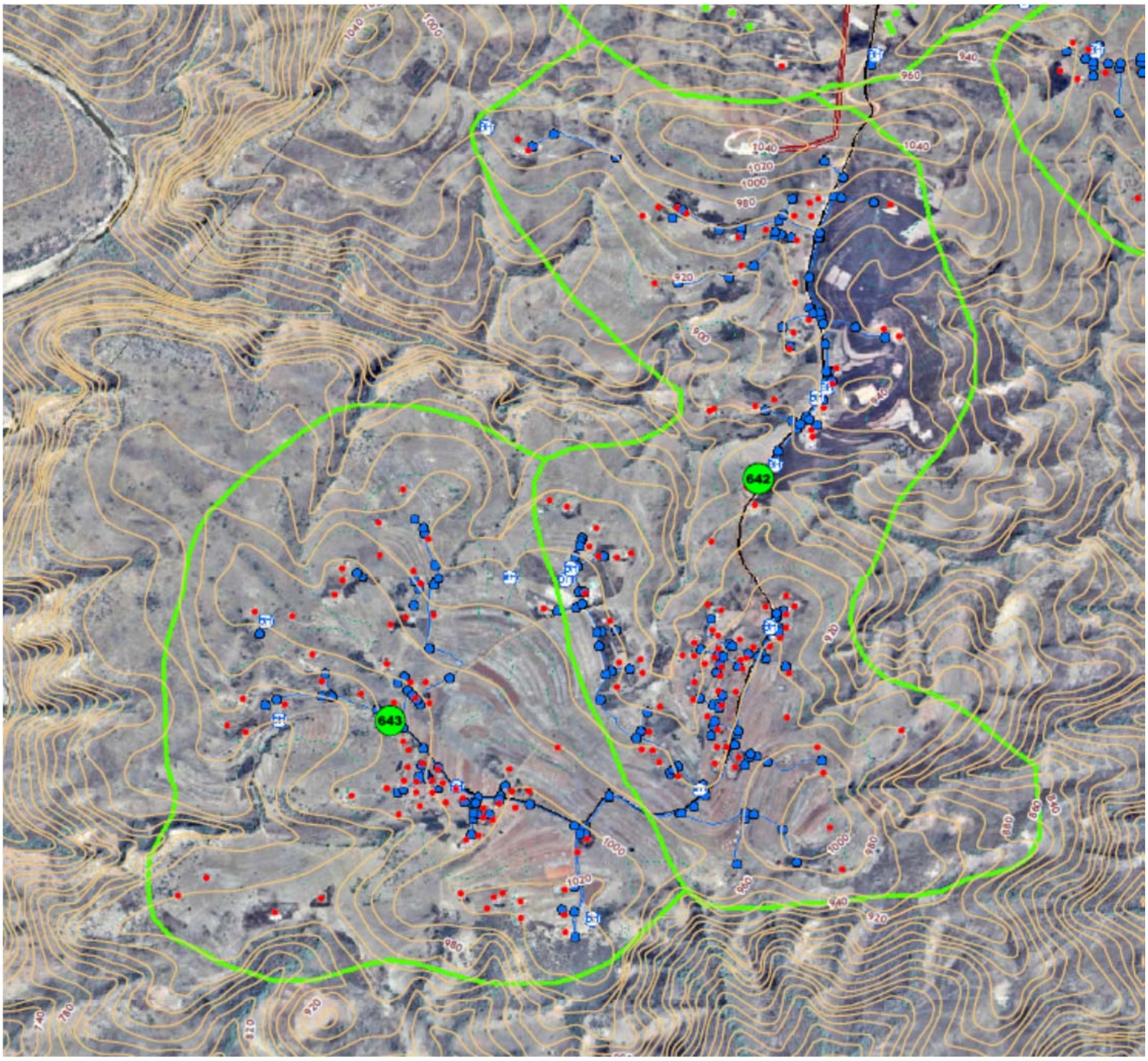



Figure 19 - Existing Borehole Schemes not in operation

### 8.3.1 <u>Link to existing scheme</u>

Areas without supply that are adjacent to existing water mains will be supplied by extending the existing reticulation to the new area that requires water supply.

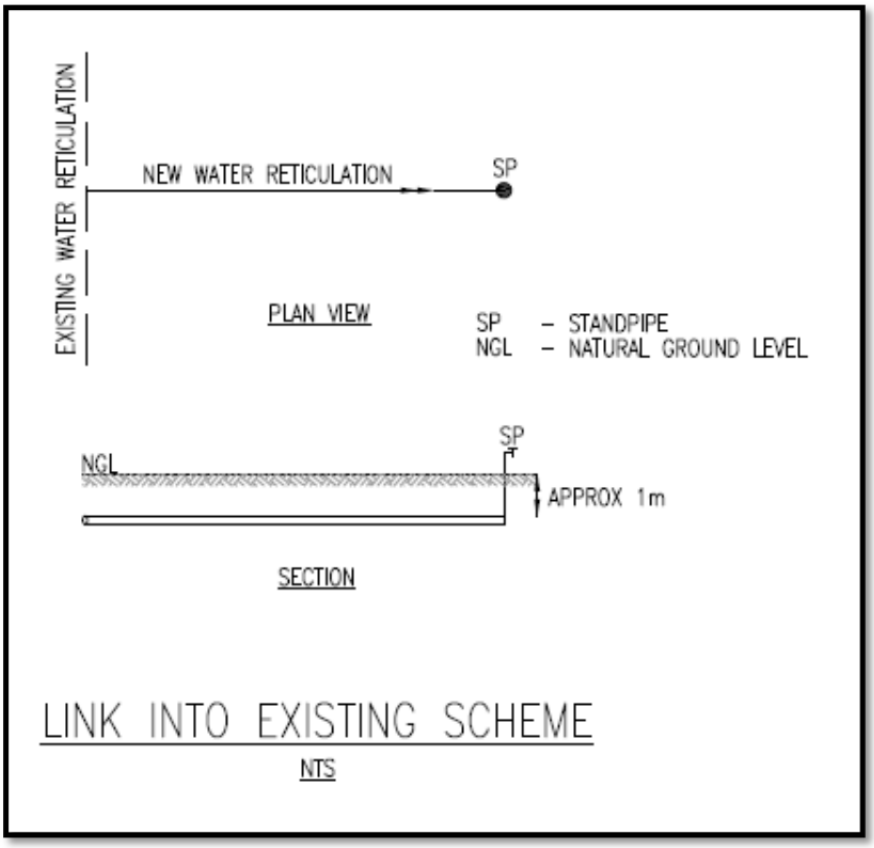
- Assumption in viewing the polygons, we found existing boreholes, however there was no supply to the existing community. Hence it was further assumed that the existing boreholes were non-functional possibly due to the pumps not working or the aquifer being dry.

  The GIS information indicated a bulk supply line indicated contiguous to the community which was used to supply the area.

- In some cases the GIS information indicates that there is an existing bulk line, however there are un-serviced households contiguous to the bulk line, it was assumed that they are un-serviced due to the households being at a higher elevation.

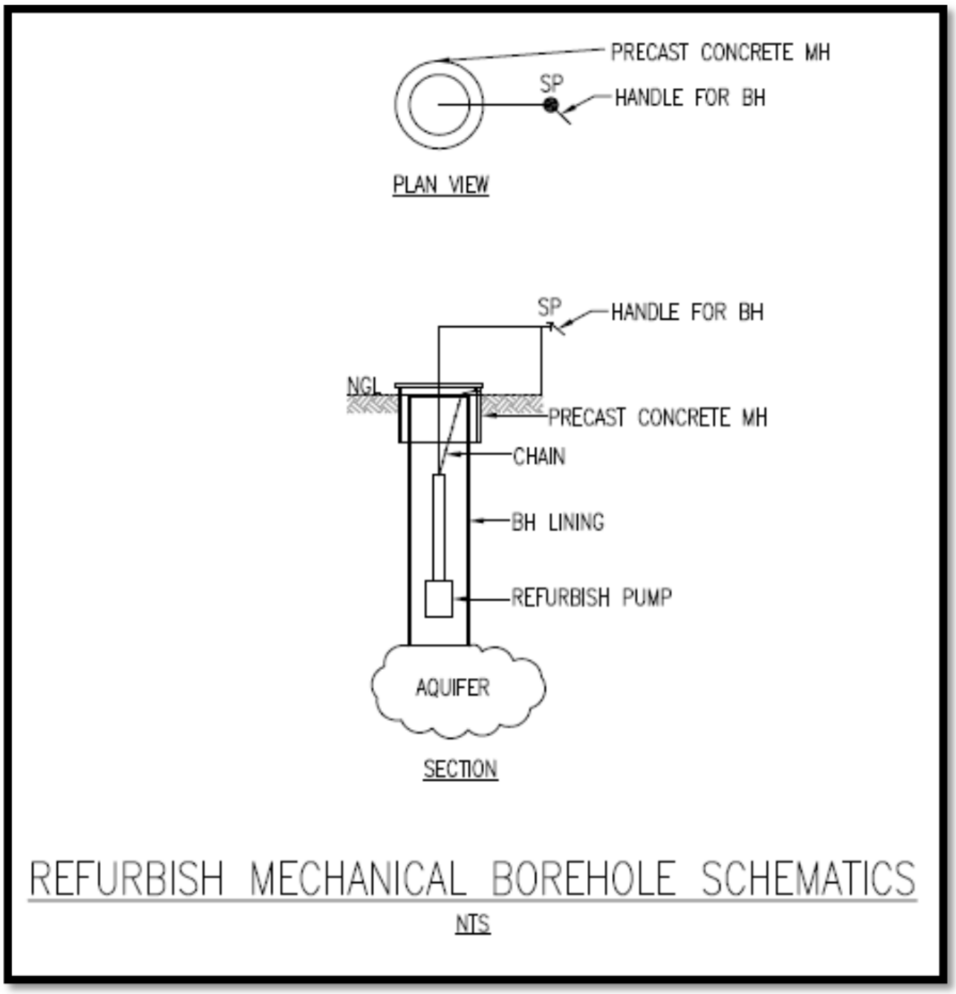
  These households were serviced by undertaking a pumping main from the existing bulk to a new reservoir at a higher elevation where it can be gravity fed to the households. It was assumed to be a cost effective option.

  In areas where the static head exceeds 100m, break pressure tanks should be constructed to reduce the pressure and also create additional storage.



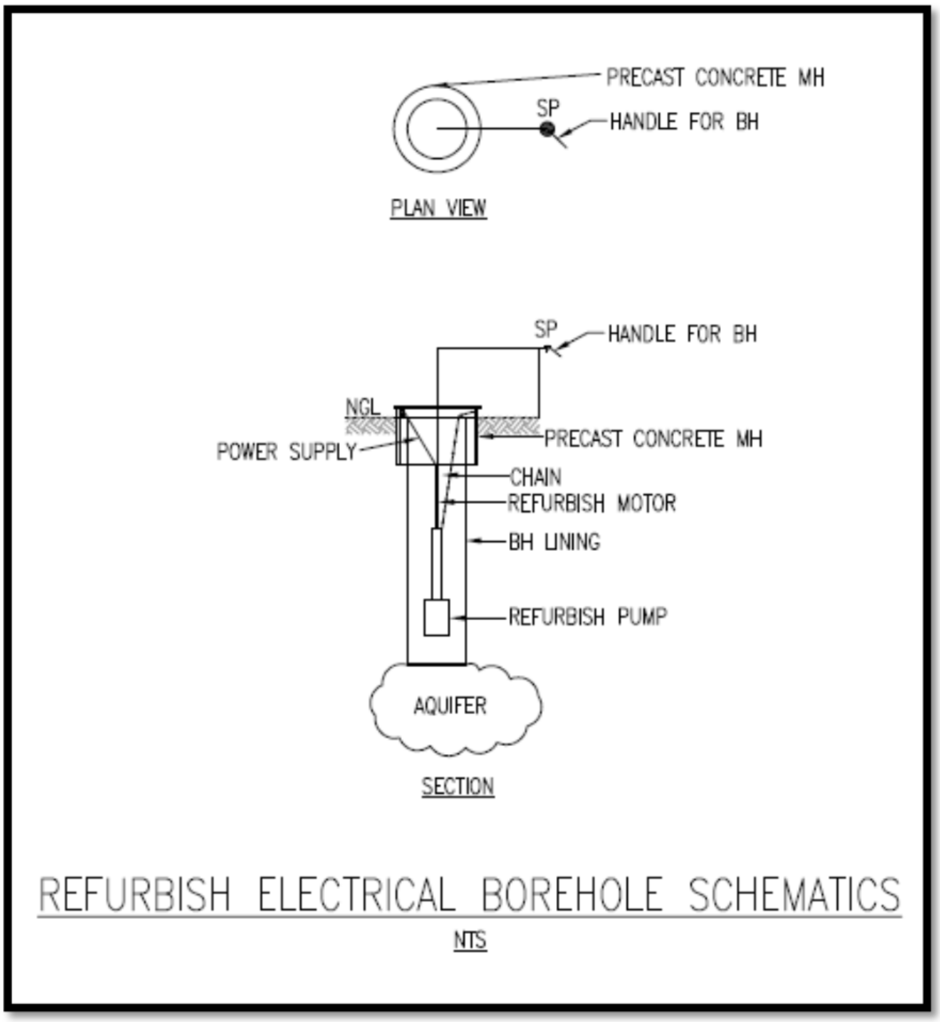

### 8.3.2 Refurbishment of mechanical boreholes

Existing mechanical boreholes that previously supplied water to a community is now defunct due to the pump no longer functioning and hence a replacement pump needs to be installed to ensure the continued delivery of water.




### 8.3.3 Refurbishment of electrical boreholes

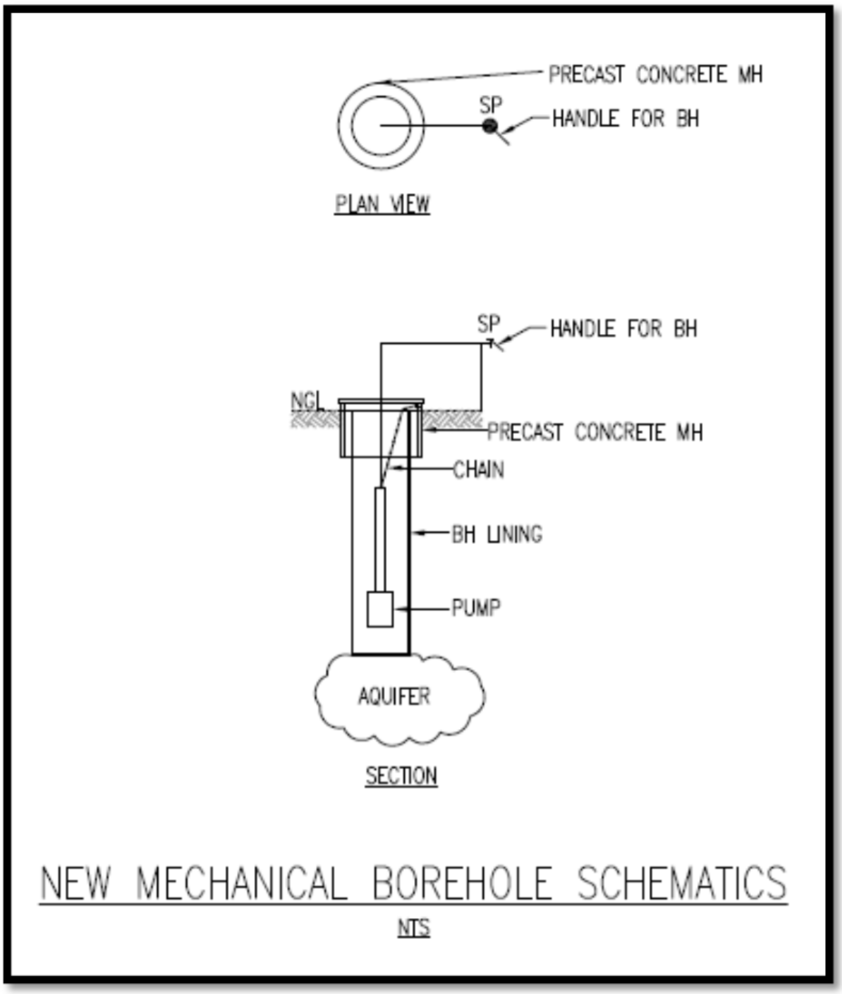
Existing electrical boreholes that previously supplied water to a community is now defunct due to the pump or motor no longer functioning and hence a replacement pump or motor needs to be installed to ensure the continued delivery of water.




### 8.3.4 New mechanical boreholes

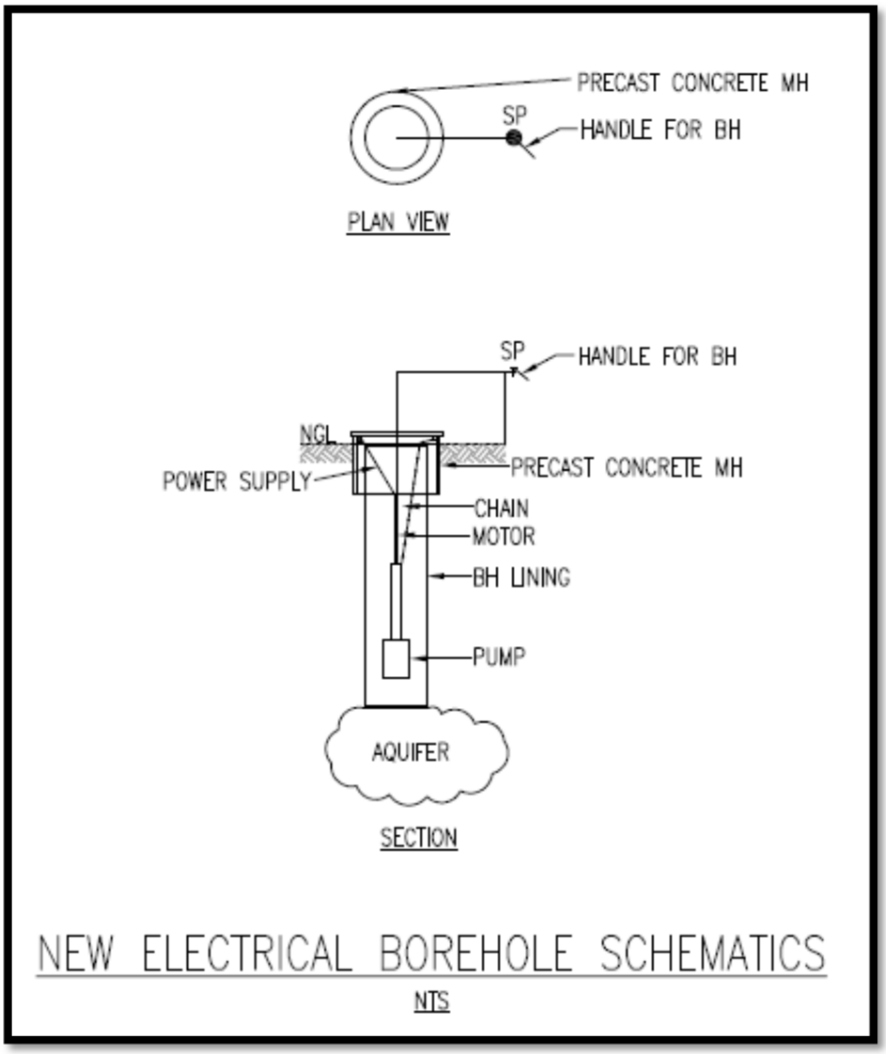
Mechanical boreholes are installed in remote rural areas where there is no available water reticulation and electrical supply.

Our view was that where the population was between 20-30 people mechanical boreholes would be the most cost effective supply of water. Other forms of installing boreholes would be by installing windmills.




### 8.3.5 New electrical boreholes

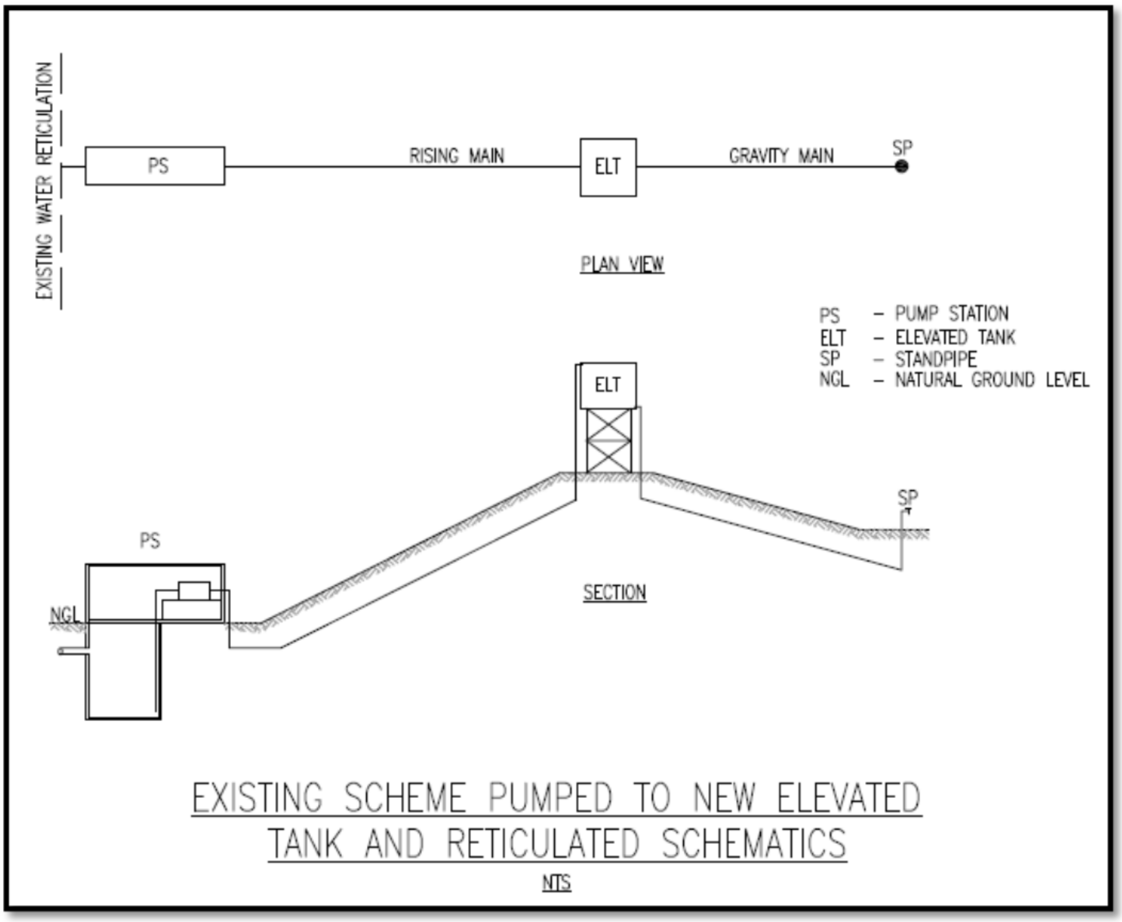
Electrical boreholes are installed in remote rural areas where there is no available water reticulation and where electrical supply is available.




### 8.3.6 Existing Scheme pumped to new elevated tank and reticulated

Areas without supply are at elevations higher than the existing reticulation and cannot be supplied by the existing reticulation due to the height difference.

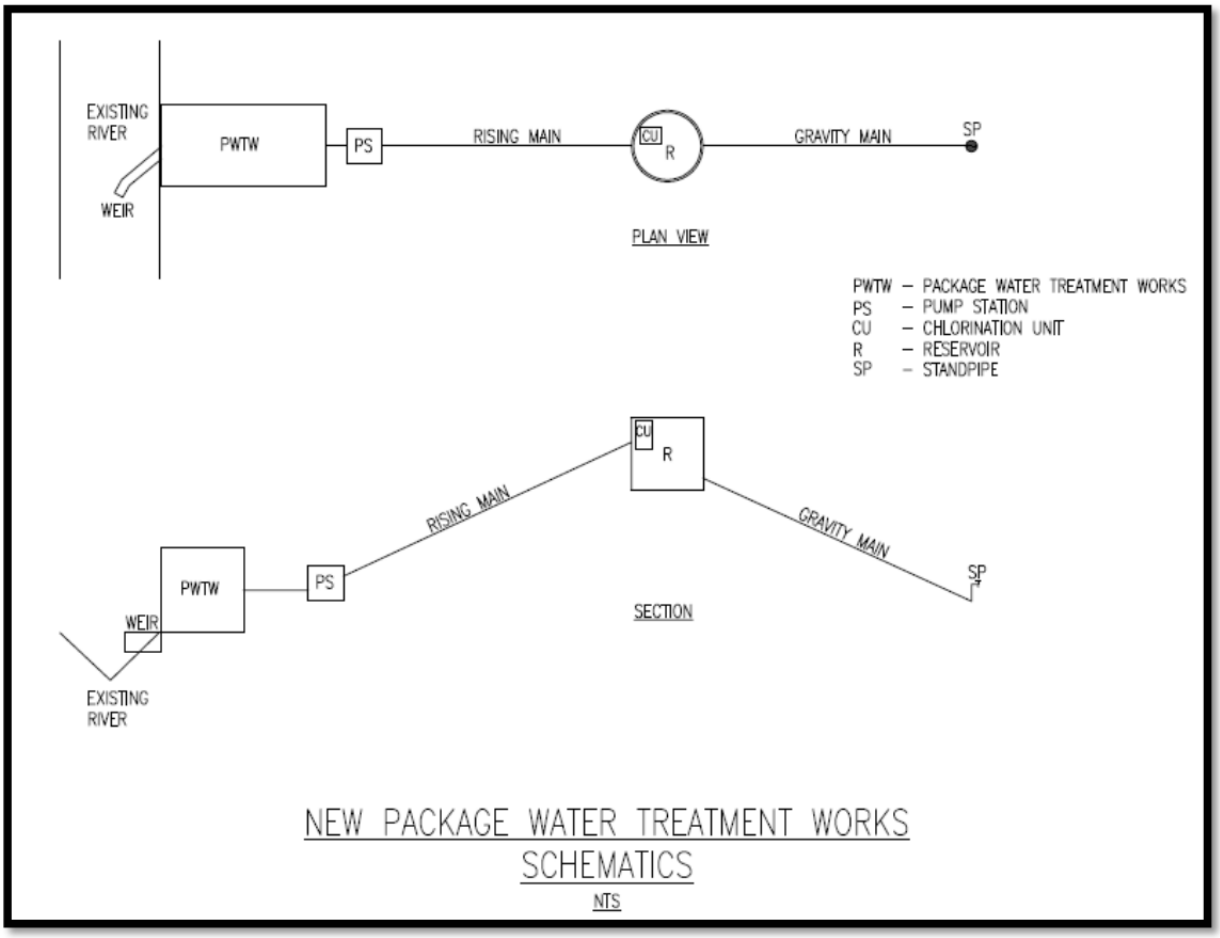
This option proposes to supply the houses at the higher elevation by obtaining water from the existing mains and installing a wet well and a pump station as well as an elevated reservoir.




### 8.3.7 New Package Water Treatment Works

Areas which are close to a river source are supplied by a containerized package treatment plant which abstract water from the river.

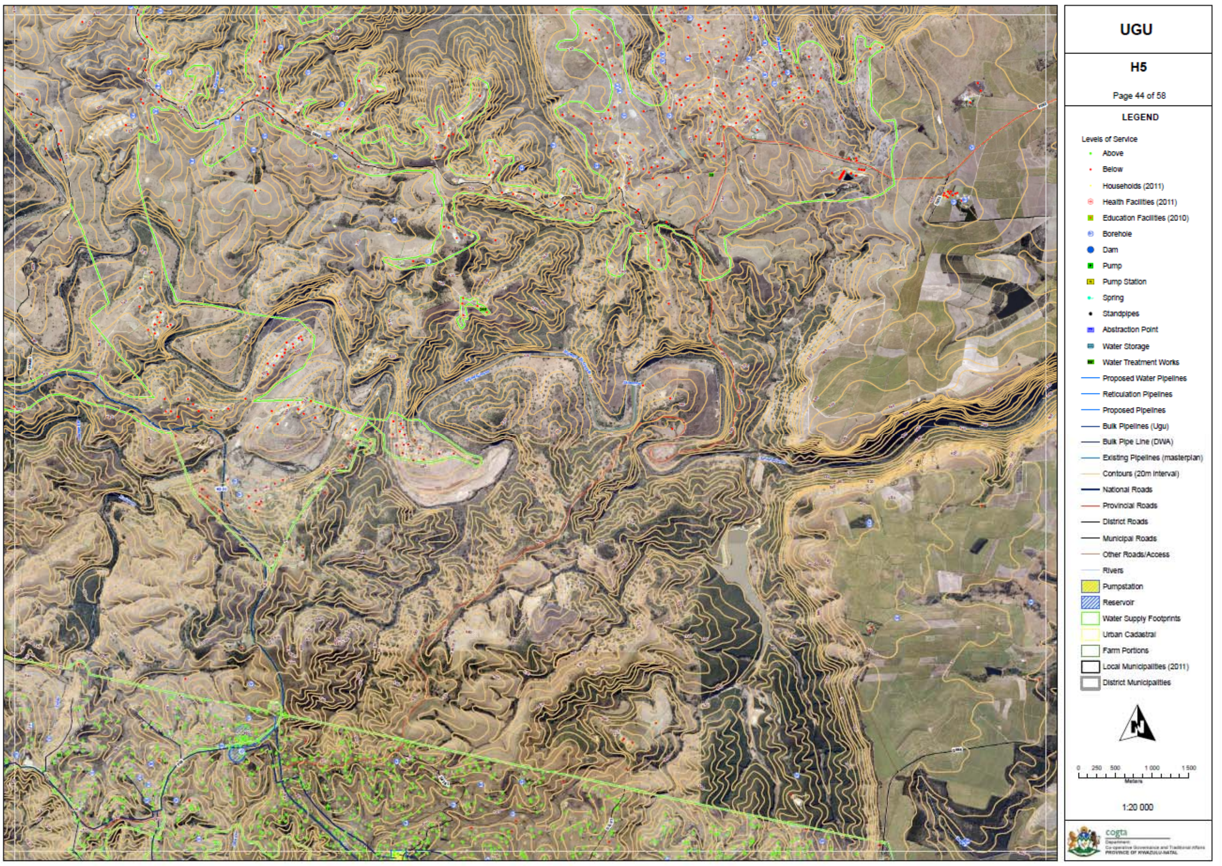
This option proposes to abstract water from the river through the package plant which has flocculation units clarification units and filtration units. The water is pumped via a pump station to the storage reservoir which has a chlorination unit installed.


EXISTING RIVER
WEIR
PWTW
PS
RISING MAIN
CU
R
GRAVITY MAIN
SP
PLAN VIEW
PWTW – PACKAGE WATER TREATMENT WORKS
PS – PUMP STATION
CU – CHLORINATION UNIT
R – RESERVOIR
SP – STANDPIPE
CU
R
RISING MAIN
GRAVITY MAIN
SP
PWTW
PS
WEIR
SECTION
EXISTING RIVER
NEW PACKAGE WATER TREATMENT WORKS SCHEMATICS
NTS

## 8.4 <u>Description and mapping of supply schemes</u>

Concept layouts of the proposed infrastructure have been included in the GIS database. The names of the names of the schemes in the tables in section 7.5 refer to individual water supply footprints and these names have been indicated on the aforementioned database. Drawings/mapping indicating the schemes is attached in a CD. The GIS report undertaken by MHP gives a detailed description of the database.

The Ugu District Municipality area was plotted in a map series produced at a scale of 1:20 000. Existing and proposed infrastructure, together with the water supply footprints and contour information (20m intervals) were overlaid onto aerial photography and both exported to pdf and plotted.

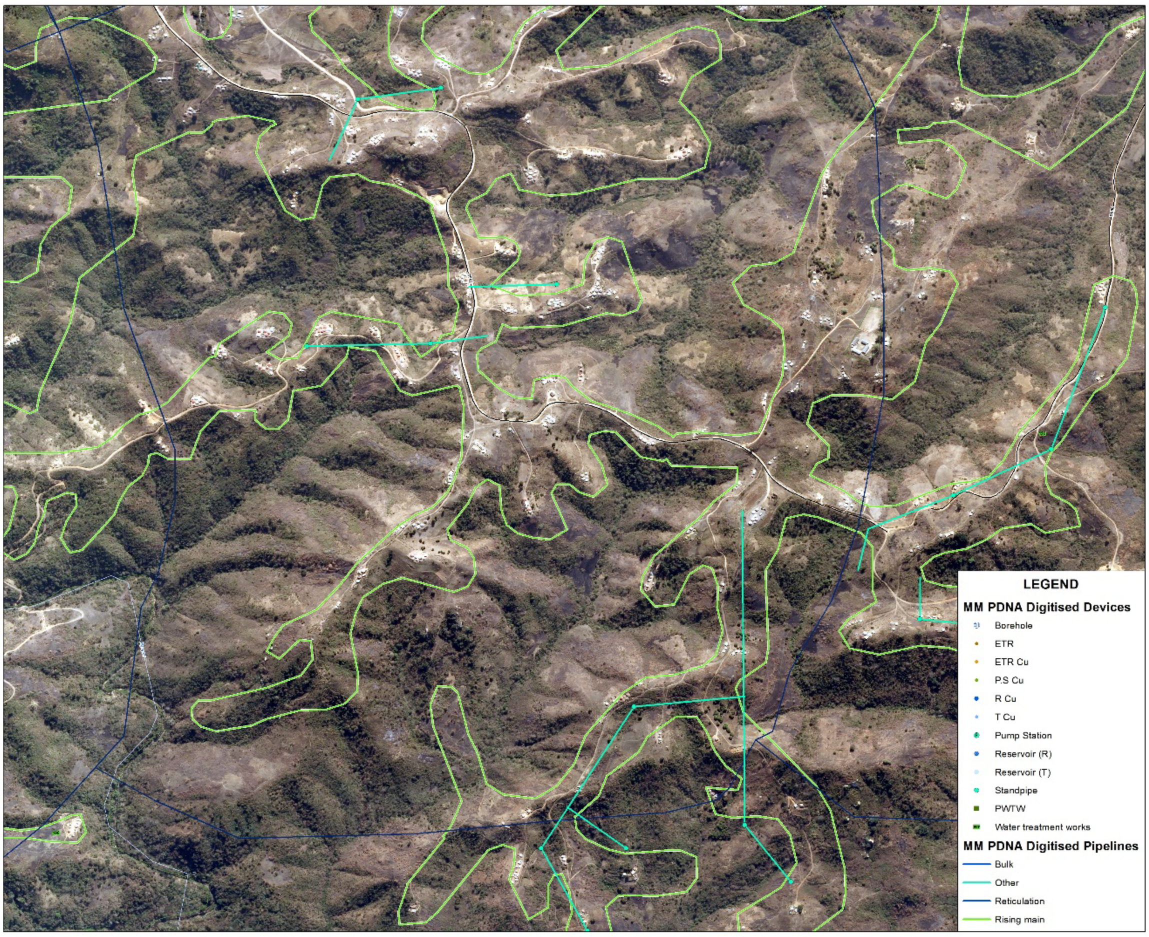



**Map 7 – Example of map series sheet**

These maps were used, together with the population statistics already calculated, by the engineers at MM PDNA, who designed conceptual water supply schemes directly onto the hard copy maps. These maps were returned to MHP GeoSpace, and the concept water pipelines and other infrastructure (standpipes, boreholes, reservoirs etc.) were digitised into the GIS.

New feature classes were added to the geodatabase and lookup tables assigned to fields within the feature classes. This ensured consistency throughout the data capture process, as it meant that there would be no difference in the type of features captured by different users. The digitised infrastructure was checked to ensure that there was consistency between and across the different map sheets. Each individual map sheet was also checked to ensure that all data had been captured.

Where the conceptual water infrastructure was designed and captured (i.e. where there was no existing supply infrastructure) the settlement (water demand) polygon was assigned a unique identifier. This identifier was captured to a separate data set (costed water supply areas) which could later be linked back to the costing model used by the engineers.




**Map 8 – Example of data captured from engineers drawings**

### 8.5 Cost Estimates for Proposed Infrastructure

The rates provided by Umgeni Water are shown on the tables below:

**Reservoir**

| | | |
|---|---|---|
| 0.25 | ML | R 1 381 197 |
| 0.5 | ML | R 2 243 761 |
| 0.75 | ML | R 2 980 166 |
| 1 | ML | R 3 645 000 |
| 1.25 | ML | R 4 261 226 |
| 1.5 | ML | R 4 841 294 |
| 1.75 | ML | R 5 392 922 |
| 2 | ML | R 5 921 320 |
| 2.25 | ML | R 6 430 212 |
| 2.5 | ML | R 6 922 382 |
| 2.75 | ML | R 7 399 978 |
| 3 | ML | R 7 864 705 |
| 3.25 | ML | R 8 317 942 |
| 3.5 | ML | R 8 760 828 |
| 3.75 | ML | R 9 194 316 |
| 4 | ML | R 9 619 213 |
| 4.25 | ML | R 10 036 211 |
| 4.5 | ML | R 10 445 910 |
| 4.75 | ML | R 10 848 834 |
| 5 | ML | R 11 245 442 |
| 5.25 | ML | R 11 636 143 |
| 5.5 | ML | R 12 021 299 |
| 5.75 | ML | R 12 401 237 |
| 6 | ML | R 12 776 250 |
| 6.25 | ML | R 13 146 603 |
| 6.5 | ML | R 13 512 537 |
| 6.75 | ML | R 13 874 271 |
| 7 | ML | R 14 232 007 |
| 7.25 | ML | R 14 585 930 |
| 7.5 | ML | R 14 936 210 |
| 7.75 | ML | R 15 283 004 |
| 8 | ML | R 15 626 457 |
| 8.25 | ML | R 15 966 705 |
| 8.5 | ML | R 16 303 873 |
| 8.75 | ML | R 16 638 079 |
| 9 | ML | R 16 969 431 |
| 9.25 | ML | R 17 298 034 |
| 9.5 | ML | R 17 623 983 |
| 9.75 | ML | R 17 947 368 |
| 10 | ML | R 18 268 275 |
| 10.25 | ML | R 18 586 783 |

**Pump Station (Civil, Mech and Elec)**

| | | |
|---|---|---|
| 0.25 | MW | R 11 000 000 |
| 0.5 | MW | R 18 000 000 |
| 0.75 | MW | R 25 000 000 |
| 1 | MW | R 33 000 000 |
| 1.25 | MW | R 44 000 000 |
| 1.5 | MW | R 55 000 000 |
| 1.75 | MW | R 66 000 000 |
| 2 | MW | R 77 000 000 |

**Pump Station Expansion (Mech and Elec)**

| | | |
|---|---|---|
| 0.25 | MW | R 3 750 000 |
| 0.5 | MW | R 7 500 000 |
| 0.75 | MW | R 11 250 000 |
| 1 | MW | R 15 000 000 |
| 1.25 | MW | R 18 750 000 |
| 1.5 | MW | R 22 500 000 |
| 1.75 | MW | R 26 250 000 |
| 2 | MW | R 30 000 000 |

**Water Works**

| | | |
|---|---|---|
| 0-50 | ML/d | R 4 000 000 |
| 50-100 | ML/d | R 2 500 000 |
| 100-1000 | ML/d | R 2 000 000 |

**Water Works Augmentation**

| | | |
|---|---|---|
| 0-50 | ML/d | R 1 800 000 |
| 50-200 | ML/d | R 1 500 000 |

**Pipes Steel (mm Ø)**

| | | |
|---|---|---|
| 150 | mm | R 550 |
| 200 | mm | R 600 |
| 300 | mm | R 700 |
| 350 | mm | R 800 |
| 400 | mm | R 900 |
| 450 | mm | R 1 300 |
| 500 | mm | R 1 650 |
| 600 | mm | R 1 980 |
| 700 | mm | R 2 500 |
| 800 | mm | R 3 200 |
| 850 | mm | R 3 350 |
| 1000 | mm | R 3 971 |

| | | |
|---|---|---|
| 10.5 | ML | R 18 902 970 |
| 10.75 | ML | R 19 216 906 |
| 11 | ML | R 19 528 659 |
| 11.25 | ML | R 19 838 293 |
| 11.5 | ML | R 20 145 870 |
| 11.75 | ML | R 20 451 447 |
| 12 | ML | R 20 755 080 |
| 12.25 | ML | R 20 056 820 |
| 12.5 | ML | R 21 356 719 |
| 12.75 | ML | R 21 654 824 |
| 13 | ML | R 21 951 180 |
| 13.25 | ML | R 22 245 832 |
| 13.5 | ML | R 22 538 820 |
| 13.75 | ML | R 22 830 185 |
| 14 | ML | R 23 119 964 |
| 14.25 | ML | R 23 408 196 |
| 14.5 | ML | R 23 694 914 |
| 14.75 | ML | R 23 980 153 |
| 15 | ML | R 24 263 945 |
| 15.25 | ML | R 24 546 322 |
| 15.5 | ML | R 24 827 313 |
| 15.75 | ML | R 25 106 948 |
| 16 | ML | R 25 385 254 |
| 16.25 | ML | R 25 662 259 |
| 16.5 | ML | R 25 937 989 |
| 16.75 | ML | R 26 212 467 |
| 17 | ML | R 26 485 720 |
| 17.25 | ML | R 26 757 769 |
| 17.5 | ML | R 27 028 638 |
| 17.75 | ML | R 27 298 349 |
| 18 | ML | R 27 566 923 |
| 18.25 | ML | R 27 834 379 |
| 18.5 | ML | R 28 100 739 |
| 18.75 | ML | R 28 366 021 |
| 19 | ML | R 28 630 244 |
| 19.25 | ML | R 28 893 426 |
| 19.5 | ML | R 29 155 585 |
| 19.75 | ML | R 29 416 737 |
| 20 | ML | R 29 676 900 |
| 20.25 | ML | R 29 936 088 |
| 20.5 | ML | R 30 194 319 |
| 20.75 | ML | R 30 451 606 |
| 21 | ML | R 30 707 965 |
| 21.25 | ML | R 30 963 410 |
| 21.5 | ML | R 31 217 955 |

| | | |
|---|---|---|
| 1100 | mm | R 4 075 |
| 1200 | mm | R 4 500 |
| 1300 | mm | R 6 065 |
| 1400 | mm | R 6 900 |
| 1600 | mm | R 8 500 |
| 1800 | mm | R 9 563 |

**Pipes Plastic (mm Ø)**

| | | |
|---|---|---|
| 75 | mm | R 100 |
| 100 | mm | R 140 |
| 200 | mm | R 250 |
| 300 | mm | R 350 |

**Fittings and Auxiliaries**

**Pipes Installation (mm Ø)**

| | | |
|---|---|---|
| 150 | mm | R 858 |
| 200 | mm | R 936 |
| 300 | mm | R 1 091 |
| 350 | mm | R 1 247 |
| 400 | mm | R 1 403 |
| 450 | mm | R 2 027 |
| 500 | mm | R 2 573 |
| 600 | mm | R 3 087 |
| 700 | mm | R 3 898 |
| 800 | mm | R 4 990 |
| 850 | mm | R 5 224 |
| 1000 | mm | R 6 192 |
| 1100 | mm | R 6 354 |
| 1200 | mm | R 7 017 |
| 1300 | mm | R 9 457 |
| 1400 | mm | R 10 759 |
| 1600 | mm | R 13 254 |
| 1800 | mm | R 14 910 |

| | | |
|---|---|---|
| 21.75 | ML | R 31 471 614 |
| 22 | ML | R 31 724 399 |
| 22.25 | ML | R 31 976 325 |
| 22.5 | ML | R 32 227 402 |
| 22.75 | ML | R 32 477 644 |
| 23 | ML | R 32 727 062 |
| 23.25 | ML | R 32 975 668 |
| 23.5 | ML | R 33 223 474 |
| 23.75 | ML | R 33 470 489 |
| 24 | ML | R 33 716 726 |
| 24.25 | ML | R 33 962 195 |
| 24.5 | ML | R 34 206 906 |
| 24.75 | ML | R 34 450 869 |
| 25 | ML | R 34 694 093 |
| 25.25 | ML | R 34 936 589 |
| 25.5 | ML | R 35 178 366 |
| 25.75 | ML | R 35 419 432 |
| 26 | ML | R 35 659 798 |
| 26.25 | ML | R 35 899 471 |
| 26.5 | ML | R 36 138 460 |
| 26.75 | ML | R 36 376 774 |
| 27 | ML | R 36 614 421 |
| 27.25 | ML | R 36 851 408 |
| 27.5 | ML | R 37 087 744 |
| 27.75 | ML | R 37 323 436 |
| 28 | ML | R 37 558 493 |
| 28.25 | ML | R 37 792 920 |
| 28.5 | ML | R 38 026 726 |
| 28.75 | ML | R 38 259 917 |
| 29 | ML | R 38 492 501 |
| 29.25 | ML | R 38 724 484 |
| 29.5 | ML | R 38 955 873 |
| 29.75 | ML | R 39 186 675 |
| 30 | ML | R 39 416 895 |

### 8.5.1 Proposed Short Term Supply Schemes

The tables below show the cost estimate for short term schemes which tie into the existing reticulation.

| Scheme Name | Cost |
|---|---|
| A9-1 | R 3 956 957 |

A9 – Refers to the drawing number (i.e drawings on the attached CD)
1 – Refers to the scheme number on the associated drawing
Each scheme number has an associated cost which is also captured on the GIS database.

***The cost estimates is based on providing a UAP service only. The upgrading of existing works or rehabilitation of existing water infrastructure has not been included in the cost estimates. The estimates exclude all operation and maintenance costs.***

The cost estimates cover the price of undertaking the construction of the water scheme as well as professional fees for the following: geotechnical engineering fees, environmental fees and engineering fees.

In some cases the GIS picked up single scattered houses which are shown to be un-serviced within a polygon which is serviced. It is assumed that these houses came about after the construction of the water supply in that area. For the purpose of the conceptual design and cost estimates theses houses were supplied with standpipes by connecting into the existing water reticulation infrastructure and it was not considered to be an anomaly.

#### 8.5.1.1 Vulamehlo Local Municipality

| Scheme Name | Cost |
|---|---|
| **Link to existing** | |
| A9-1 | R 3 956 957 |
| A10-1 | R 7 005 346 |
| B7-1 | R 11 053 222 |
| B8-1 | R 24 810 395 |
| B9-1 | R 28 871 138 |
| B10-1 | R 56 447 175 |
| C7-1 | R 29 047 305 |
| C8-1 | R 34 365 188 |
| C9-1 | R 29 879 203 |
| D6-1 | R 6 086 134 |
| D7-2 | R 22 095 646 |
| D8-3 | R 15 469 048 |
| D9-1 | R 12 178 622 |
| D7-1 | R 9 895 253 |
| **TOTAL** | **R 291 160 632** |

#### 8.5.1.2 Umdoni Local Municipality

| Scheme Name | Cost |
|---|---|
| **Link to existing** | |
| C10-1 | R 3 613 311 |
| D10-1 | R 6 299 469 |
| E9-1 | R 31 641 751 |
| **TOTAL** | **R 41 554 530** |

#### 8.5.1.3 Umzumbe Local Municipality

| Scheme Name | Cost |
|---|---|
| **Link to existing** | |
| E4-1 | R 2 440 625 |
| E5-1 | R 8 026 277 |
| F9-1 | R 2 101 268 |
| E6-1 | R 24 421 003 |
| G6-1 | R 15 043 807 |
| E7-1 | R 68 960 184 |
| E8-1 | R 53 141 024 |
| F5-1 | R 8 730 724 |
| F6-1 | R 66 117 872 |
| F7-1 | R 118 613 477 |
| F8-1 | R 75 706 864 |
| **TOTAL** | **R 443 303 125** |

#### 8.5.1.4 Umuziwabantu Local Municipality

| Scheme Name | Cost |
|---|---|
| **Link to existing** | |
| G1-2 | R 2 578 084 |
| G2-1 | R 39 204 825 |
| G3-1 | R 6 849 303 |
| H2-1 | R 29 191 911 |
| H3-1 | R 15 619 373 |
| G5-1 | R 5 610 747 |
| H4-1 | R 16 995 387 |
| F4-1 | R 29 031 728 |
| G4-1 | R 28 712 236 |
| **TOTAL** | **R 173 793 594** |

#### 8.5.1.5 Ezingoleni Local Municipality

| Scheme Name | Cost |
|---|---|
| **Link to existing** | |
| H6-1 | R 15 775 526 |
| G5-H5-H4 | R 133 893 472 |
| I5-1 | R 49 661 675 |
| I4-2 | R 21 189 299 |
| **TOTAL** | **R 220 519 973** |

#### 8.5.1.6 Hibiscus Coast Local Municipality

| Scheme Name | Cost |
|---|---|
| **Link to existing** | |
| I6-1 | R 87 203 404 |
| K5-1 | R 6 849 303 |
| K6-1 | R 2 028 250 |
| I7-1 | R 5 676 617 |
| J5-1 | R 20 152 643 |
| J6-1 | R 29 214 784 |
| H7-1 | R 10 370 219 |
| G8-1 | R 23 281 142 |
| G7-1 | R 32 886 025 |
| **TOTAL** | **R 217 662 386** |

**Summary of Short Term Supply Schemes**

| **Municipality** | **Total Cost** |
|---|---|
| Vulamehlo | R 291 160 632 |
| Umdoni | R 41 554 530 |
| Umzumbe | R 443 303 125 |
| Umuziwabantu | R 173 793 594 |
| Ezingoleni | R 220 519 973 |
| Hibiscus Coast | R 217 662 386 |
| **TOTAL** | **R 1 387 994 240** |

#### 8.5.2 Proposed Long Term Supply Schemes

##### 8.5.2.1 Vulamehlo Local Municipality

| Scheme Name | Cost | Total |
|---|---|---|
| **New Borehole mechanically operated** | | **R 5 881 260** |
| D8-1 | R 2 940 630 | |
| D8-4 | R 2 940 630 | |
| | | |
| **New Borehole electronically operated** | | **R 9 652 359** |
| C8-2 | R 3 285 706 | |
| D8-2 | R 3 148 247 | |
| D9-2 | R 3 218 406 | |
| **TOTAL** | | **R 15 533 619** |

**Cost per capita** = R 14 946

##### 8.5.2.2 Umuziwabantu Local Municipality

| Scheme Name | Cost | Total |
|---|---|---|
| **New Borehole electronically operated** | | **R 9 169 825** |
| F1-1 | R 3 010 789 | |
| F1-2 | R 3 079 518 | |
| G1-1 | R 3 079 518 | |
| **TOTAL** | | **R 9 169 825** |

**Cost per capita** = R 13 281

##### 8.5.2.3 Ezingoleni Local Municipality

| Scheme Name | Cost | Total |
|---|---|---|
| **New Borehole electronically operated** | | **R 3 285 706** |
| I4-1 | R 3 285 706 | |
| **Total** | | **R 3 285 706** |

**Cost per capita** = R 42 727

**Summary of Long Term Supply Schemes**

| **Municipality** | **Total Cost** |
|---|---|
| Vulamehlo | R 15 533 619 |
| Umuziwabantu | R 9 169 825 |
| Ezingoleni | R 3 285 706 |
| **TOTAL** | **R 27 989 150** |

The cost per captia for each of the local municipalities is indicated in the table below. The cost per capita includes the short term and long term supply schemes and is based on an average of 6 people per household.

| Local Municipality | Cost per capita |
|---|---|
| Vulamehlo | R 14 946 |
| Umdoni | R 8 274 |
| Umzumbe | R 10 436 |
| Umuziwabantu | R 13 281 |
| Ezingoleni | R 42 727 |
| Hibiscus Coast | R 17 835 |

## 8.6 Phasing of scheme options

The phasing includes proposed plans to address the water backlogs. Various potential funding such as MIG, PIG etc. may be applied for to undertake these projects. The phasing is based on both the short and long term proposals.

An average cost for each scheme type was compared with the cost estimate for an individual scheme. If the scheme was less than or equal to the average it was assumed that the project could be untaken over a year. If the cost ratio was higher than the average cost, the ratio was used to determine the duration of the project. However, this is flexible depending on the nature and type of project.

An example of the above explanation is demonstrated as follows for the scheme type link to existing for the Vulamehlo Local Municipality.

| Scheme Name | Cost |
|---|---:|
| **Link to existing** | |
| A9-1 | R 3 956 957 |
| A10-1 | R 7 005 346 |
| B7-1 | R 11 053 222 |
| B8-1 | R 24 810 395 |
| B9-1 | R 28 871 138 |
| B10-1 | R 56 447 175 |
| C7-1 | R 29 047 305 |
| C8-1 | R 34 365 188 |
| C9-1 | R 29 879 203 |
| D6-1 | R 6 086 134 |
| D7-2 | R 22 095 646 |
| D8-3 | R 15 469 048 |
| D9-1 | R 12 178 622 |
| D7-1 | R 9 895 253 |
| **TOTAL** | **R 291 160 632** |

The total number of schemes is 14.

The total cost of the 14 schemes is R 291 160 632.

The average cost per scheme is R 291 160 632/ 15 = R 20 797 188.

To phase scheme B10-1 which costs R 56 447 175, is R 56 447 175/ R 20 797 188= 2.7, hence scheme B10-1 is phased to be undertaken in three years.

To phase scheme C8-1 which costs R 34 365 188, is R 34 365 188/ R 20 797 188= 1.7, hence scheme C8-1 is phased over two years.

The phasing of the schemes is indicated in Table 18.

| Implementation Year | LM | Total Cost |
|---|---|---|
| 2015/16 | Vulamehlo | R 210 000 628 |
| | Umdoni | R 9 912 780 |
| | Umzumbe | R 113 904 727 |
| | Umuziwabantu | R 85 534 954 |
| | Ezingoleni | R 89 912 206 |
| | Hibiscus Coast | R 130 458 982 |
| | **TOTAL** | **R 639 724 277** |

| Implementation Year | LM | Total Cost |
|---|---|---|
| 2016/17 | Vulamehlo | R 40 246 448 |
| | Umdoni | R 31 641 751 |
| | Umzumbe | R 210 784 920 |
| | Umuziwabantu | R 97 428 465 |
| | Ezingoleni | R 133 893 472 |
| | **TOTAL** | **R 513 995 056** |

| Implementation Year | LM | |
|---|---|---|
| 2017/18 | Vulamehlo | R 56 447 175 |
| | Umzumbe | R 118 613 477 |
| | **TOTAL** | **R 175 060 652** |

| Implementation Year | LM | |
|---|---|---|
| 2018/19 | Hibiscus Coast | R 87 203 404 |
| | **TOTAL** | **R 87 203 404** |

**Table 18 - Phasing of Schemes**

## 9. DEVELOP AN UPDATED GEO DATABASE INCLUDING META DATA OF ALL RELEVANT INFORMATION

All the GIS infrastructure data, both existing and proposed, together with the water supply footprint areas has been incorporated into a structured geodatabase. All fields requested in the terms of reference, whether populated or not, have been included in the attribute tables of each dataset. Metadata for each dataset has been captured (for the entire dataset), and within the attribute table, metadata fields applicable to specific fields have also been included. These include metadata on the source of the population statistics, the water source data, and the connection type data.

A “completeness” field has also been included in the feature class for the water supply footprints. This field gives a snapshot view of the percentage completeness of all the fields in the dataset for each area.

Other data included in the geodatabase are administrative boundaries (wards, local municipalities, district municipalities) together with locality features such as place names and neighbouring countries. Both urban and cadastral data from the Surveyor General’s Office has been included. Social facilities including health facilities and schools have been provided, both to assist with water planning needs, as well as informing about the area in which the user is working.

All household information has been added to the geodatabase – Eskom household points as well as the DRDLR settlement boundaries. Topography in the form of 20m contours from the 1:50 000 topographic map series were used in the planning process, and can be found in the geodatabase. Rivers and road network data has also been included.

Along with all the base data, infrastructure specific to the District Municipality has been imported. The geodatabase also contains the data which has been captured during this project. The water supply footprints, proposed water pipelines and proposed water features (boreholes, standpipes etc.) have been added to the geodatabase.

A detailed list of all the datasets, along with their metadata can be found in Annexure 1. An outline of the GIS methodology can be found in Annexure 2.

DVD’s containing all spatial information, along with files of all working maps, as well as the map series showing the planned service infrastructure, have been provided along with this report. A series of A0 maps have also been prepared and exported to pdf which can be viewed in Annexure 3. One map shows the entire district municipality, with others showing each of the local municipalities within the district.

## 10. CONCLUSION AND RECOMMENDATIONS

### 10.1 Total cost of proposed schemes in the Ugu District Municipality

The following table gives an indication in the form of a summary of the proposed conceptual scheme types and the associated costs which need to be undertaken to alleviate the current water backlog of 16540 households in the Ugu District Municipality.

| Ugu DM | |
|---|---|
| **Scheme Type** | **Total** |
| Link to Existing Scheme | R 1 387 994 240 |
| New boreholes mechanically operated | R 5 881 260 |
| New boreholes electronically operated | R 22 107 890 |
| **TOTAL** | **R 1 415 983 390** |

### 10.2 Total cost of phases of schemes in the Ugu District Municipality

An average cost for each scheme type was compared with the cost estimate for an individual scheme. If the scheme was less than or equal to the average it was assumed that the project could be untaken over a year. If the cost ratio was higher than the average cost, the ratio was used to determine the duration of the project. However, this is flexible depending on the nature and type of project. A detailed description of the phasing can be viewed in section 8.6 of the report.

The proposed conceptual design schemes may be phased according to the tables below.

| Implementation Year | LM | Total Cost |
|---|---|---|
| **2015/16** | Vulamehlo | R 210 000 628 |
| | Umdoni | R 9 912 780 |
| | Umzumbe | R 113 904 727 |
| | Umuziwabantu | R 85 534 954 |
| | Ezingoleni | R 89 912 206 |
| | Hibiscus Coast | R 130 458 982 |
| | **TOTAL** | **R 639 724 277** |

| Implementation Year | LM | Total Cost |
|---|---|---|
| **2016/17** | Vulamehlo | R 40 246 448 |
| | Umdoni | R 31 641 751 |
| | Umzumbe | R 210 784 920 |
| | Umuziwabantu | R 97 428 465 |
| | Ezingoleni | R 133 893 472 |
| | **TOTAL** | **R 513 995 056** |

| Implementation Year | LM | |
|---|---|---|
| **2017/18** | Vulamehlo | R 56 447 175 |
| | Umzumbe | R 118 613 477 |
| | **TOTAL** | **R 175 060 652** |

| Implementation Year | LM | |
|---|---|---|
| **2018/19** | Hibiscus Coast | R 87 203 404 |
| | **TOTAL** | **R 87 203 404** |

## 10.3 Proposed Future Work

It is recommended that the concept designs covered in this report be advanced to preliminary designs.

It is recommended that the link to existing schemes for the various local municipalities be undertaken first due to the existing water treatment and bulk infrastructure. The table below is a summary of the cost of the link to existing schemes that can be undertaken.

| **Link to existing schemes** | |
|---|---|
| **Local Municipality** | **Total** |
| Vulamehlo | R 291 160 632 |
| Umdoni | R 41 554 530 |
| Umzumbe | R 443 303 125 |
| Umiziwabantu | R 173 793 594 |
| Ezingoleni | R 220 519 973 |
| Hibiscus Coast | R 217 662 386 |
| **Total** | **R 1 387 994 240** |

# 11. ANNEXURES

## Annexure 1 - Database Design and attribute table

| GEODATABASE STRUCTURE/DATA DICTIONARY | | | |
|---|---|---|---|
| **BASE DATA** | | | |
| **FEATURE DATASET** | **FEATURE CLASSES** | **DESCRIPTION** | **SOURCE** |
| Administration | District Municipalities 2011 | District municipality boundaries from 2011 | Demarcation Board |
| | Local Municipalities 2011 | Local municipality boundaries from 2011 | Demarcation Board |
| | Neighbouring Countries | Borders of neighbouring countries | SA Atlas |
| | Ocean | Dataset created to show ocean next to KZN coast | MHP GeoSpace |
| | Place Names | Main place names within KZN | SA Atlas |
| | RSA | Provincial boundaries | Demarcation Board |
| | Subplace Names | Subplace names from centroids of poylgon data | Statistics SA |
| | Wards 2011 | Ward boundaries from 2011 | Demarcation Board |
| | | | |
| Cadastral | Urban cadastral | Urban cadastral data | Surveyor General's Office, PMB |
| | Farm portions cadastral | Farm portion cadastral data | Surveyor General's Office, PMB |
| | | | |
| Facilities | Education facilities | Point dataset showing location of all schools | KZN Department of Education |
| | Health facilities | Point dataset showing location of all health facilities | KZN Department of Health |
| | | | |
| Hydrology | Major rivers | Major rivers within KwaZulu-Natal | Department of Water Affairs |
| | Minor rivers | Minor rivers within KwaZulu-Natal | Department of Water Affairs |
| | | | |
| Settlement | Households | 2011 household points | Eskom |
| | | | |
| Topography | Contours 20m | Contours at 20m intervals | National Geospatial Information |
| | | | |
| Transport | DOT 2014 | All roads (major and minor) from 2014 | Department of Transport |
| | | | |

| INFRASTRUCTURE | | | |
|---|---|---|---|
| Infrastructure | Pumps | Point dataset showing existing pumps | Department of Water Affairs; District and Local Municipalities |
| | Supply Source | Point dataset showing existing water sources including boreholes and springs | Department of Water Affairs; District and Local Municipalities |
| | Waste Water Treatment Works | Point dataset showing existing waste water treatment works | Department of Water Affairs; District and Local Municipalities |
| | Water Meters | Point dataset showing existing water meters | Department of Water Affairs; District and Local Municipalities |
| | Water Pipelines | Line dataset showing existing water pipelines – bulk and reticulation | Department of Water Affairs; District and Local Municipalities |
| | Water Reservoirs | Point dataset showing existing reservoirs | Department of Water Affairs; District and Local Municipalities |
| | Water Treatment Works | Point dataset showing existing water treatment works | Department of Water Affairs; District and Local Municipalities |

| UAP | | | |
|---|---|---|---|
| UAP | UAP Demand Areas | Digitised footprints around settlements in the District Municipalities within the project | MHP GeoSpace |
| | UAP Water Nodes | Digitised water nodes (boreholes, standpipes etc) captured off hard copy maps | MM PDNA/MHP GeoSpace |
| | UAP Water Lines | Digitised water pipelines captured off hard copy maps | MM PDNA/MHP GeoSpace |
| | | | |

## WATER SUPPLY FOOTPRINTS ATTRIBUTES

| Field Name | Alias | Description | Units/Values/ Field Type |
|---|---|---|---|
| DM | District Municipality | Name of the municipality in which the area falls | Text |
| Area_m2 | Area in square metres | GIS calculated | Number |
| Name | Name | Name of area if known | Text |
| Short_SS | Short term supply status | Is there an existing supply? | Y/N lookup table |
| Interim_SS | Interim supply status | Is there an interim supply? | Y/N lookup table |
| Bulk_SS | Bulk supply status | Is there a bulk supply? | Y/N lookup table |
| ST_Supply | Sustainable supply | Is the supply sustainable? | Y/N lookup table |
| Sust_2016 | Sustainable to 2016 | Is existing supply sustainable to 2016? | Y/N lookup table |
| Not_2016 | Not sustainable to 2016 | If N, What needs to be done to ensure sustainable supply to 2016? | Text |
| ExistPlans | Existing plans | Are there existing plans to ensure sustainably beyond 2016? | Y/N lookup table |
| Horizon30 | 30 year horizon plans | If Y, are these plans for 30 year horizon? | Y/N lookup table |
| Plans30yr | Detail of plans | If Y, what are these plans. | Text |
| Sust2046 | Sustainable to 2046 | If N, What needs to be done to ensure sustainable supply to 2046? | Text |
| Schm_E | Existing scheme name | Name of any existing supply scheme | Text |
| Schm_F | Future scheme name | Name of any future proposed scheme | Text |

| | | | |
|---|---|---|---|
| Sou_E | Existing source | Existing water source from lookup table | Lookup table (eg borehole, reservoir) |
| Sou_F | Future source | Future water source from lookup table | Lookup table (eg borehole, reservoir) |
| WatNam_E | Existing source name | Name of existing source | Text |
| WatNam_F | Future source name | Name of future source | Text |
| Proj_Typ | Project type | Type of project from lookup table | Lookup table (eg MWIG, BIG) |
| SuppDate | Scheme supply date | Date of proposed intervention | Text |
| Treat | Treatment type | Existing treatment type from lookup table | Lookup table (eg WTP, sand filter) |
| WTP_Nam | WTP name | Name of water treatment plant | Text |
| Conn | Connection | Type of water connection from lookup table | Lookup table (eg yard, house, community standpipe) |
| Design_E | Existing design demand | Demand for which this scheme has been designed | Number (million $m^3$ p.a.) |
| LowDemandForecast | Demand Low | Low demand forecast | Number (million $m^3$ p.a.) |
| HighDemandForecast | Demand High | High demand forecast | Number (million $m^3$ p.a.) |
| ProbableDemand | Probable demand | Probable demand forecast | Number (million $m^3$ p.a.) |
| Supp_E | Existing supply | Current water supply capacity | Number (million $m^3$ p.a.) |
| CurrentWaterRequirements | Water requirements | Current water requirements | Number (million $m^3$ p.a.) |
| FutureWaterRequirements | Future water requirements | Future water requirements | Number (million $m^3$ p.a.) |
| Proj_ID | Project ID | ID of project if known | Text |

| | | | |
|---|---|---|---|
| HH_Low | Households low | Lowest estimate of households served | Number |
| HH_High | Households high | Highest estimate of households served | Number |
| Pop_Low | Population low | Lowest estimate of number of people | Number |
| Pop_High | Population high | Highest estimate of number of people | Number |
| Capturer | Capturer | Person who captured the area from lookup table | Lookup table (eg MHP Geospace, Mlungisi Dimba MMPDNA) |
| Sanitation | Type of sanitation scheme | Type of sanitation scheme from lookup table | Lookup table (eg septic tank, VIP) |
| Comments | Comments | General comments | Text |
| Assumptions | Assumptions | Assumptions made about existing infrastructure | Lookup table (eg Existing water scheme has enough capacity to be extended) |
| Assumptions_Other | Other Assumptions | Any other assumptions made about the area | Text |
| PopStats_Source | Population Statistics Source | The data source for the population statistics | Lookup table (eg Census 2011, Eskom 2011) |
| Source_Metadata | Metadata on water source | Information on whether the population data has been edited or verified | Lookup table (eg. Spatial calculation, Verified) |
| Connection_Metadata | Metadata on connection type | Information on whether the population data has been edited or verified | Lookup table (eg. Spatial calculation, Verified) |
| Completeness | Completeness of data | A percentage showing the number of fields populated per rectod | Number |

| | | | |
|---|---|---|---|
| SettlementType | Settlement Type | Settlement type (rural, urban etc) where available | Text |
| SanitationLOS | Sanitation Level of Service | The current sanitation level of service where data is available | Text |

## WATER PIPELINE ATTRIBUTES

| Field Name | Alias | Description |
|---|---|---|
| Pipeline_Type | Pipeline type | Type of pipeline from lookup table |
| Project_Type | Project type | Project type from lookup table |
| Supply_Type | Supply type | Supply type from lookup table |
| Water_Source | Water source | Water source from lookup table |
| Capturer | Capturer | Data capturer from lookup table |
| Comments | Comments | General comments |

## WATER NODE ATTRIBUTES

| Field Name | Alias | Description |
|---|---|---|
| Node_Type | Type of facility | Type of facility from lookup table |
| Capturer | Data capturer | Data capturer from lookup table |
| Comments | Comments | General comments |

## LOOK UP TABLES

| DOMAIN NAME AND CODES | DESCRIPTION |
|---|---|
| **Capturer** | **Name of data capturer** |
| 0 | Not updated |
| 1 | Juan Wood (MMPDNA) |
| 2 | Petrus Buthelezi (MMPDNA) |
| 3 | Mlungisi Dimba (MMPDNA) |
| 4 | MHP GeoSpace |
| 5 | District Municipality |
| 6 | MMPDNA Data Capturers |
| 7 | MMPDNA Team 2 |
| | |
| **Connection** | **Water connection type** |
| 0 | Unknown |
| 1 | Yard connection |
| 2 | House connection |
| 3 | Community standpipe |
| 4 | Jojo tank |
| 5 | Reservoir |
| | |
| **Metadata** | **Metadata** |
| Calculated | Calculated |
| Verified | Verified |
| Captured | Captured by MHP GeoSpace |
| Quality Assured | QA by MHP GeoSpace |

| PopStats_Source | Source of population stats |
|---|---|
| Eskom | Eskom household points 2011 |
| Census | Stats SA Census 2011 |
| | |

| Project_Type | Project Type |
|---|---|
| 0 | Unknown |
| 1 | BIG |
| 2 | Umgeni Water |
| 3 | MWIG |
| 4 | Umhlathuze Water |
| 5 | CMIP |
| 6 | MIG 1 |
| 7 | MIG 2 |
| 8 | MIG 3 |
| 9 | MIG 4 |
| 10 | MIG 5 |
| | |
| **Sanitation_Type** | **Type of Sanitation** |
| 0 | Unknown |
| 1 | VIP |
| 2 | Septic tank |
| 3 | Chemical |
| 4 | Waterborne |
| 5 | None |
| | |
| **Treatment_Type** | **Treatment Type** |
| 0 | Unknown |
| 1 | WTP |
| 2 | Chlorination |
| 3 | Sand filter |
| 4 | Package plant |
| 5 | None |
| | |
| **Water_Source** | **Water Source** |
| 0 | Unknown |
| 1 | Local water scheme |
| 2 | Borehole |
| 3 | Water tanker |
| 4 | Regional water scheme |
| 5 | Spring |
| 6 | Abstraction |
| 7 | Reservoir |
| 8 | Water Works |

| Yes_No | Yes No |
|---|---|
| 0 | Unknown |
| 1 | Yes |
| 2 | No |
| | |
| **Assumptions** | **Assumptions about water schemes** |
| Capacity can be extended | Existing water scheme has enough capacity to be extended |

| | |
|---|---|
| Scheme to be upgraded | Existing water scheme has to be upgraded in order to have capacity to extend |
| Supplied with electricity | The area is fully supplied with electricity |
| Functional boreholes | All existing boreholes are functional |
| Raw water sources have capacity | Raw water source has enough capacity to abstract from |
| Other | Other assumptions |
| | |
| **Node_Type** | **Type of water point captured** |
| 0 | Unknown |
| 1 | Reservoir |
| 2 | Pumpstation |
| 3 | Raw extraction |
| 4 | Water treament works |
| 5 | Waste water treatment works |
| 6 | Package plant |
| 7 | Borehole |
| | |
| **Pipeline_Type** | **Type of water pipeline captured** |
| 1 | Bulk |
| 2 | Reticulation |
| 0 | Unknown |

## Annexure 2 – GIS Methodology

## GIS METHODOLOGY

### WATER SUPPLY FOOTPRINTS

- Settlement data (DWA settlements; Department of Rural Development and Land Reform settlements; Eskom household points) overlaid on aerial photography
- Polygons digitized around settlement clusters with outlying households being incorporated where possible
- Polygons captured over whole district, including areas with existing supply
- Fields added to attribute table as per Umgeni Water requirements
- Web mapping application developed so polygons could be edited, updated, created by users outside of the office environment

### POPULATION STATISTICS

- Census 2011 data extracted using the SuperCross application from StatsSA
- Household counts calculated for each polygon using a spatial join between the demand polygons and the Eskom 2011 household points
- Population growth rate calculated by extrapolating the growth rate for each ward from 2001 to 2014 using census data from 2001 and 2011
- Growth rate applied to the household count to obtain figures for the highest possible household number in 2014
- Total population was divided by the number of households per sub-place to get the average household size per house per sub-place
- Household size data linked to demand areas (spatial join) and summarized to get the number of people in each demand area
- Growth rate (as calculated previously) applied to these numbers to reach a best possible approximated population figure for 2014 per demand area
- Water demand forecasts (high and low) calculated by using these population figures multiplied by the estimated water consumption appropriate to each settlement type as advised by the engineers in accordance with the Department of water Affairs standard.

### CURRENT WATER INFORMATION

- All available water data from the municipalities – boreholes, reservoirs, springs, pipelines, water treatment works etc – added to ArcGIS project along with the demand area polygons
- Demand areas selected according to data falling within their boundaries (select by location tool) and attribute table updated accordingly
- Where no data was available from the municipality, the spatial information from Umgeni Water and the Department of Water Affairs was used in this query
- Additional data was received towards the end of the project for Amajuba, Ugu and uThukela District Municipalities requiring the spatial queries to be rerun and the attribute tables updated accordingly

### CONCEPT DESIGNS AND COSTING

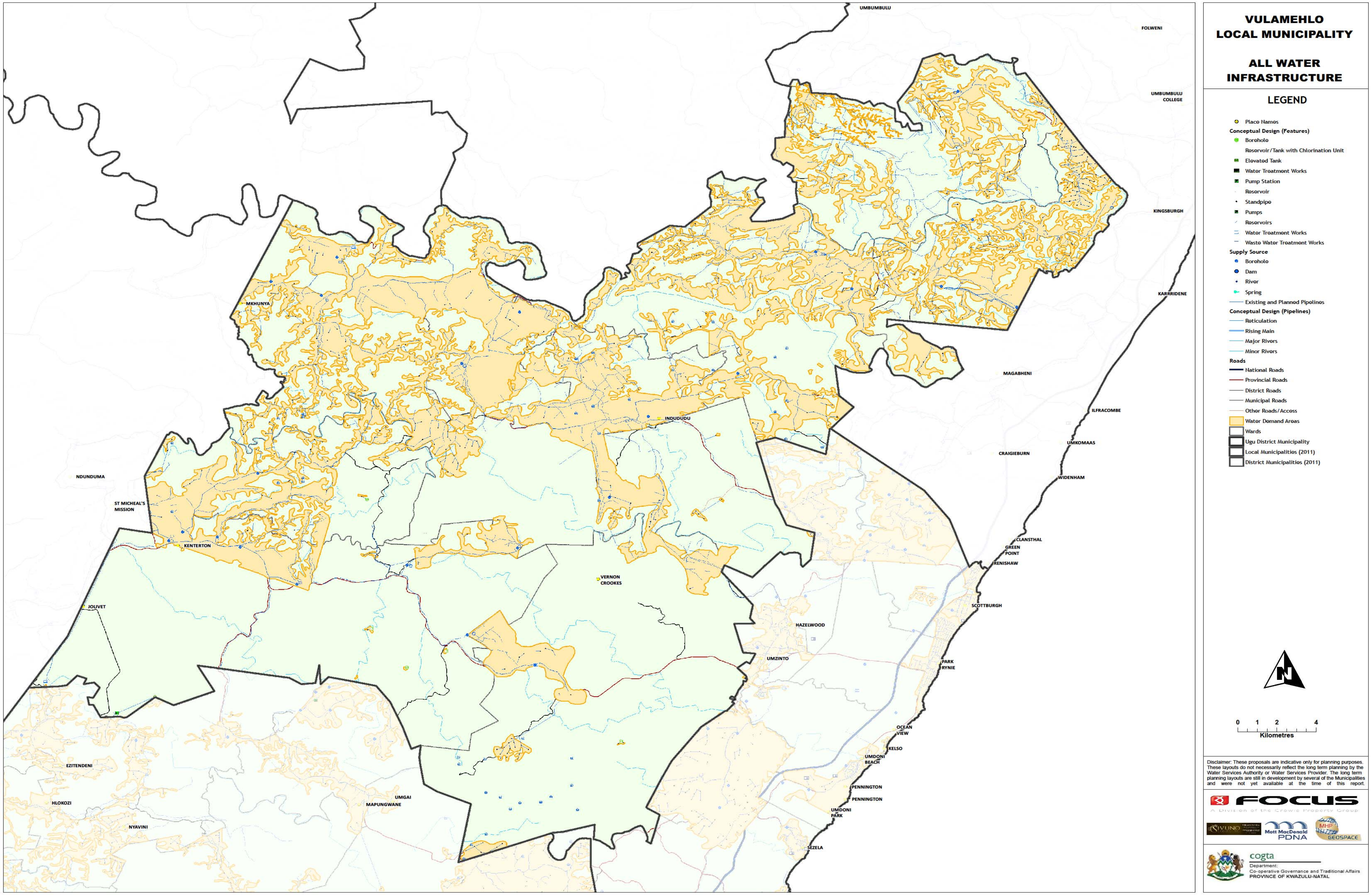
- All water infrastructure data and the water demand areas plotted on A1 maps at 1:20 000 scale
- Engineers produced concept designs hand drawn onto these maps
- Hard copy maps then scanned and georeferenced
- Concept designs digitized off the georeferenced scans

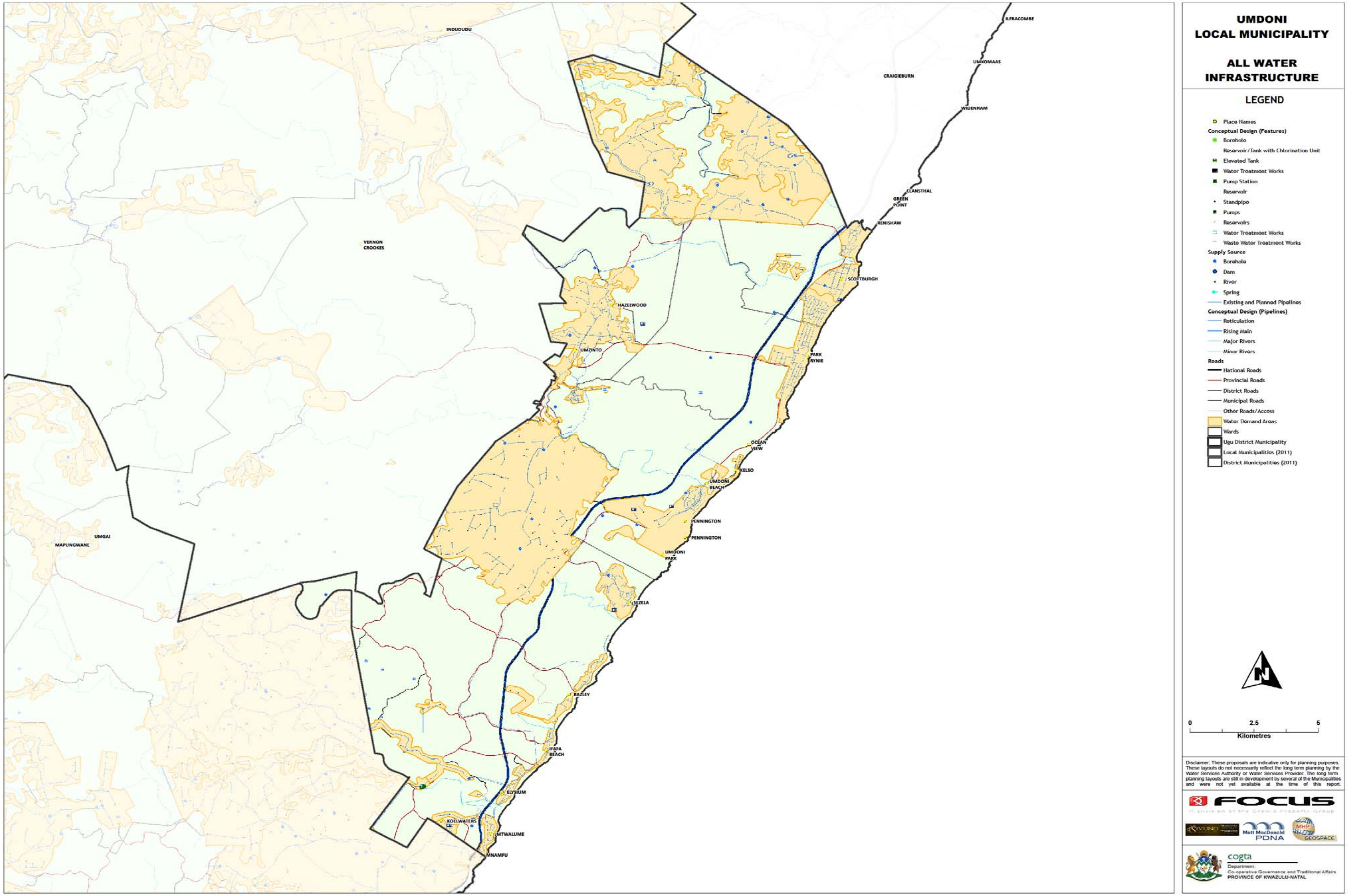
- Geodatabase with feature datasets for lines and points with available attribute information; domains used to reduce data capture time and possibility of errors
- Digitized data checked at map edges to ensure continuity of data
- All concept data (digitized) for each district merged to one dataset in the geodatabase
- Proposed water schemes given a unique ID by the engineers
- These ID captured into the GIS to link to the costing table from the engineers

**METADATA**

- Three geodatabases have been prepared:
    1. Base Data:
        - Roads, rivers, place names, administrative boundaries etc
        - Settlement data – Eskom household points
        - Cadastral data – urban and rural
        - Social facilities – health, education
        - Topography – 20m contours
    2. Infrastructure:
        - Existing pipelines, reservoirs, boreholes etc
    3. UAP:
        - Pipelines, standpipes, boreholes etc
        - Water supply footprints
- Metadata created for each dataset using ArcCatalog
- Data stored in WGS 1984

## Annexure 3 – Planned Infrastructure Maps


VULAMEHLO
LOCAL MUNICIPALITY
ALL WATER
INFRASTRUCTURE
LEGEND
Place Names
Conceptual Design (Features)
Borehole
Reservoir/Tank with Chlorination Unit
Elevated Tank
Water Treatment Works
Pump Station
Reservoir
Standpipe
Pumps
Reservoirs
Water Treatment Works
Waste Water Treatment Works
Supply Source
Borehole
Dam
River
Spring
Existing and Planned Pipelines
Conceptual Design (Pipelines)
Reticulation
Rising Main
Major Rivers
Minor Rivers
Roads
National Roads
Provincial Roads
District Roads
Municipal Roads
Other Roads/Access
Water Demand Areas
Wards
Ugu District Municipality
Local Municipalities (2011)
District Municipalities (2011)
UMBUMBULU
FOLWENI
UMBUMBULU COLLEGE
KINGSBURGH
KARRIDENE
MKHUNYA
MAGABHENI
ILFRACOMBE
INDUDUDU
UMKOMAAS
CRAIGIEBURN
WIDENHAM
NDUNDUMA
ST MICHEAL'S MISSION
KENTERTON
CLANSTHAL
GREEN POINT
RENISHAW
VERNON CROOKES
SCOTTBURGH
JOLIVET
HAZELWOOD
UMZINTO
PARK RYNIE
OCEAN VIEW
KELSO
UMDONI BEACH
EZITENDENI
PENNINGTON
PENNINGTON
UMGAI
MAPUNGWANE
HLOKOZI
UMDONI PARK
NYAVINI
SEZELA
0 1 2 4
Kilometres
Disclaimer: These proposals are indicative only for planning purposes. These layouts do not necessarily reflect the long term planning by the Water Services Authority or Water Services Provider. The long term planning layouts are still in development by several of the Municipalities and were not yet available at the time of this report.
FOCUS
A Division of the Crowie Property Group
Mott MacDonald PDNA
MHP GEOSPACE
cogta
Department:
Co-operative Governance and Traditional Affairs
PROVINCE OF KWAZULU-NATAL


UMDONI
LOCAL MUNICIPALITY
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INFRASTRUCTURE
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Borehole
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District Municipalities (2011)
0 2.5 5
Kilometres
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INDUDUDU
VERNON CROOKES
UMGAI
MAPUNGWANE
HAZELWOOD
UMZINTO
ILFRACOMBE
UMKOMAAS
CRAIGIEBURN
WIDENHAM
CLANSTHAL
GREEN POINT
KENISHAW
SCOTTBURGH
PARK RYNIE
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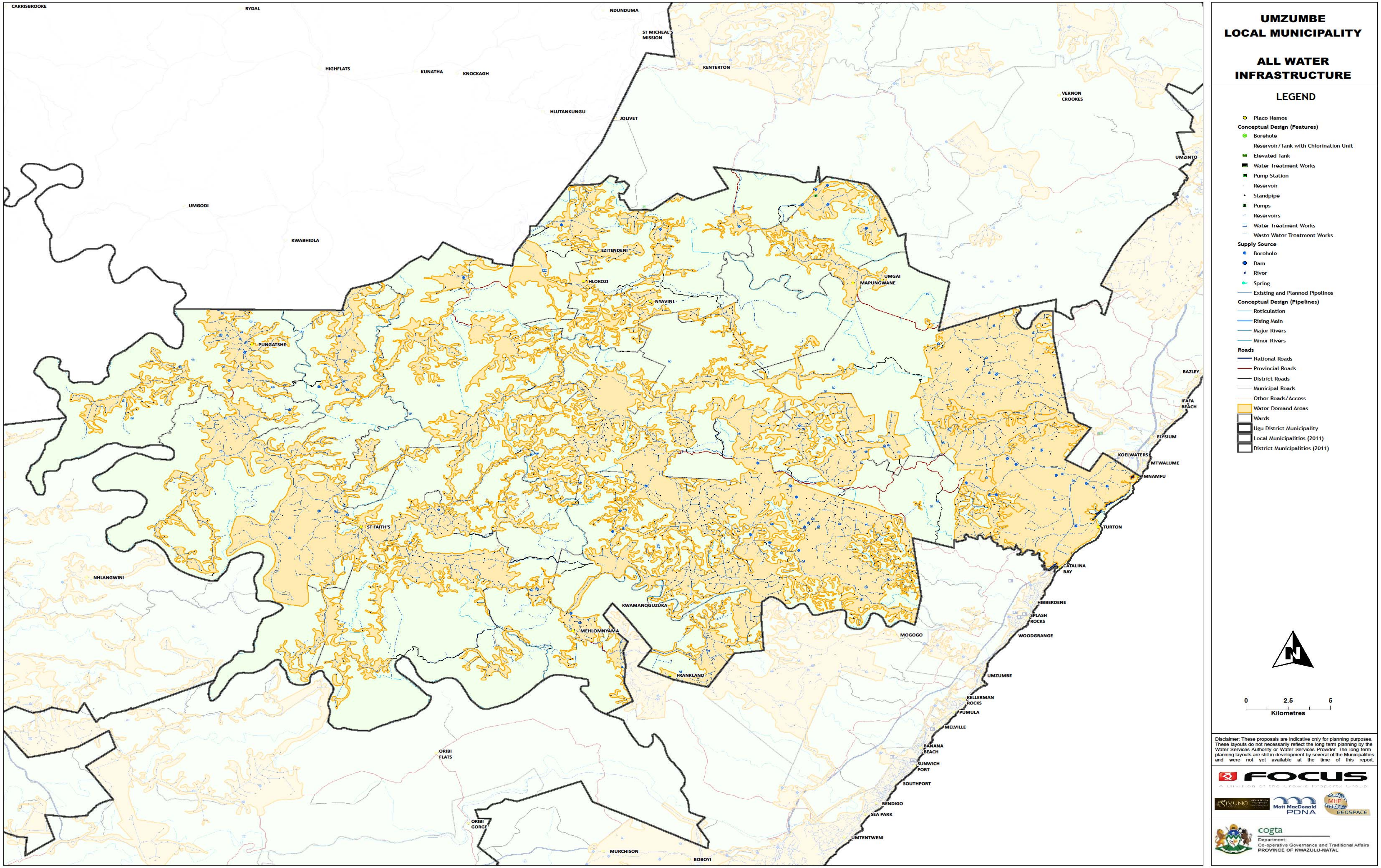
KELSO
UMDONI BEACH
PENNINGTON
PENNINGTON
UMDONI PARK
SEZELA
BAZLEY
IFAFA BEACH
ELYSIUM
KOELWATERS
MTWALUME
MNAMFU


UMZUMBE
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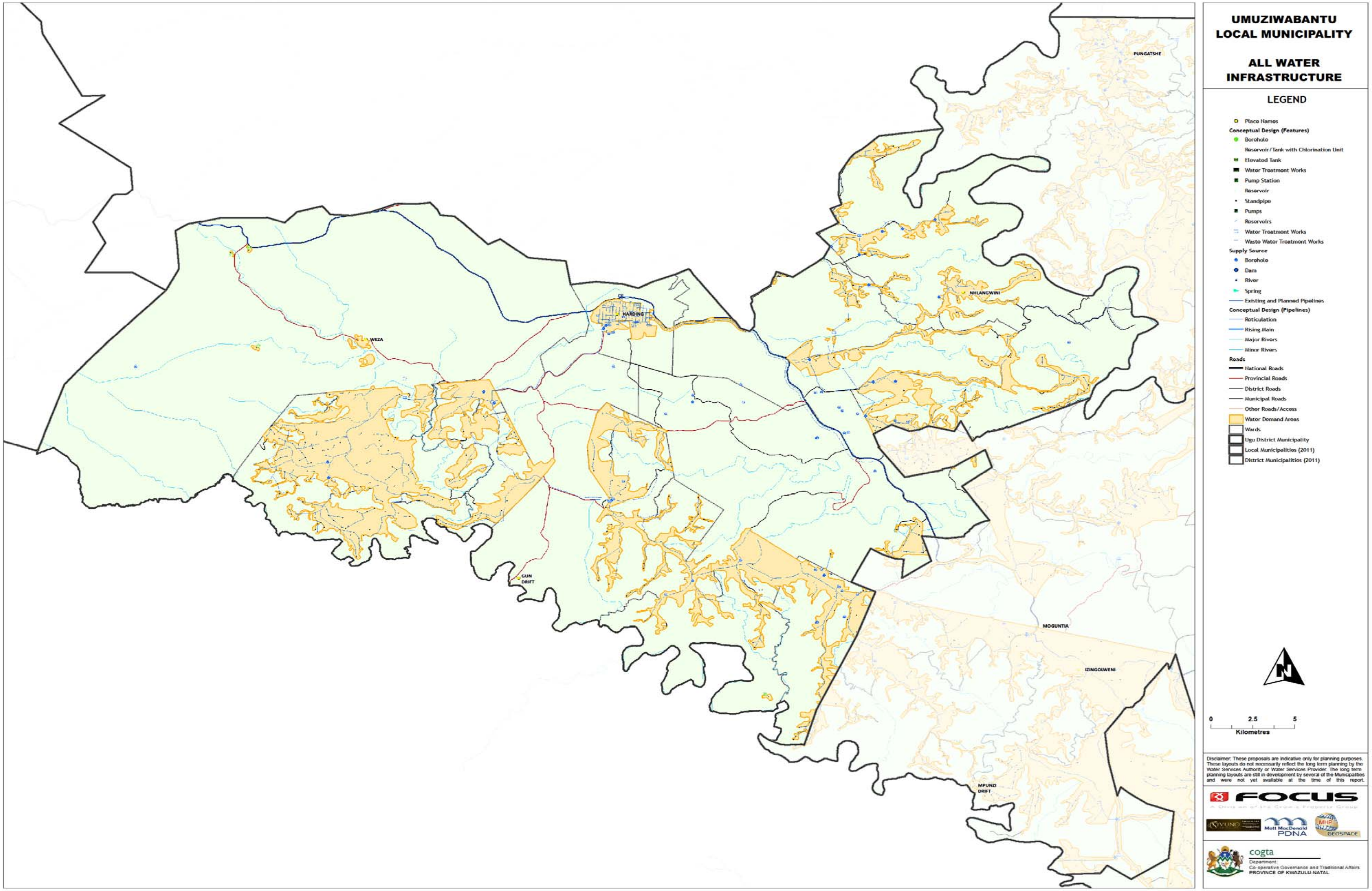
CARRISBROOKE
RYDAL
NDUNDUMA
ST MICHEAL'S MISSION
HIGHFLATS
KUNATHA
KNOCKAGH
KENTERTON
VERNON CROOKES
HLUTANKUNGU
JOLIVET
UMZINTO
UMGODI
KWABHIDLA
EZITENDENI
HLOKOZI
NYAVINI
UMGAI
MAPUNGWANE
PUNGATSHE
BAZLEY
IFAFA BEACH
ELYSIUM
KOELWATERS
MTWALUME
MNAMFU
ST FAITH'S
TURTON
NHLANGWINI
CATALINA BAY
HIBBERDENE
KWAMANQGUZUKA
SPLASH ROCKS
MEHLOMNYAMA
MOGOGO
WOODGRANGE
FRANKLAND
UMZUMBE
KELLERMAN ROCKS
PUMULA
MELVILLE
ORIBI FLATS
BANANA BEACH
SUNWICH PORT
SOUTHPORT
BENDIGO
SEA PARK
ORIBI GORGE
UMTENTWENI
MURCHISON
BOBOYI



UMUZIWABANTU LOCAL MUNICIPALITY
ALL WATER INFRASTRUCTURE
LEGEND
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PUNGATSHE
HARDING
WEZA
NHLANGWINI
GUN DRIFT
MOGUNTIA
IZINGOLWENI
MPUNZI DRIFT
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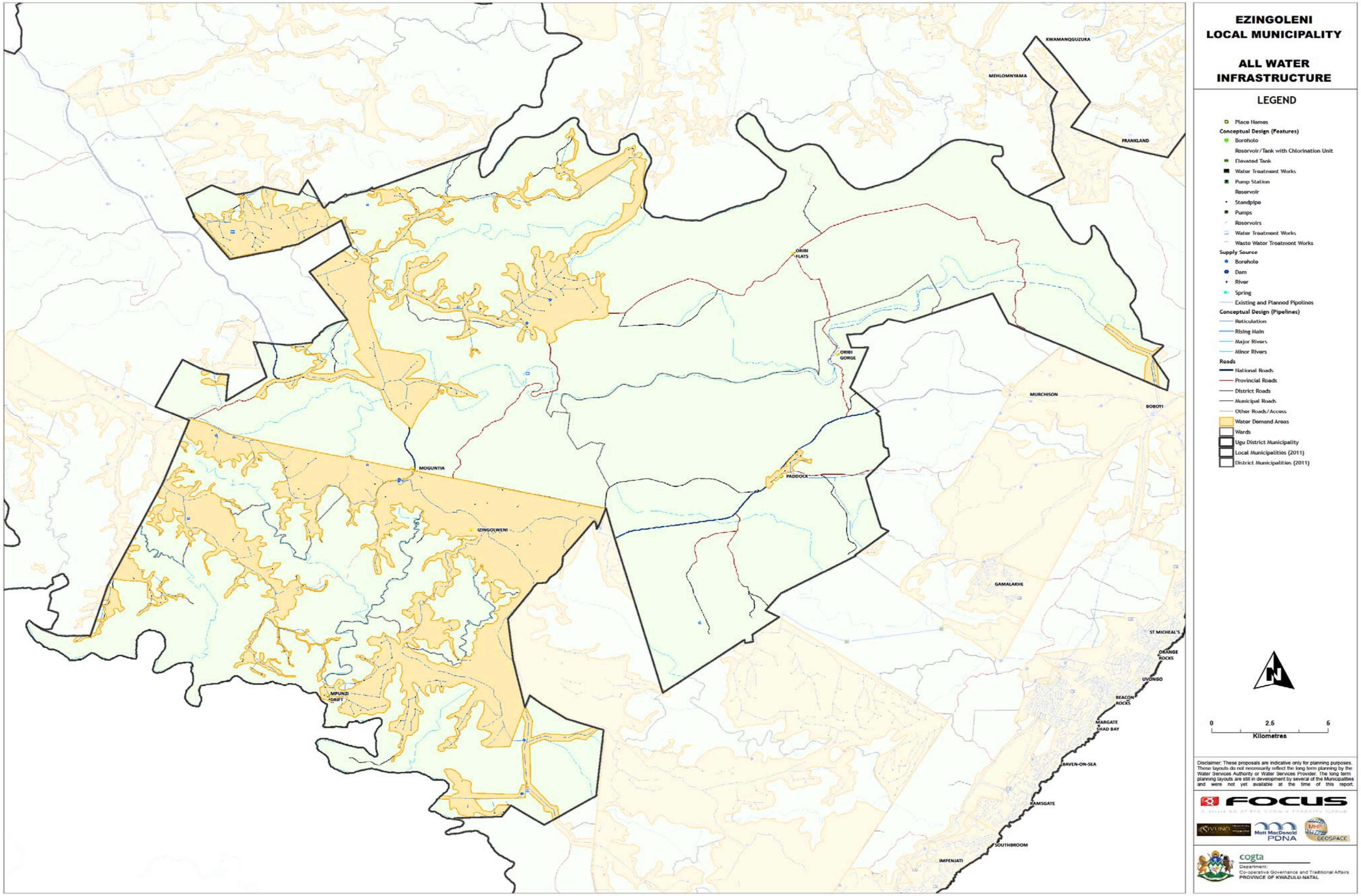
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MEHLOMNYAMA
FRANKLAND
ORIBI FLATS
ORIBI GORGE
MURCHISON
BOBOYI
MOGUNTIA
PADDOCK
IZINGOLWENI
GAMALAKHE
ST MICHEAL'S
ORANGE ROCKS
UVONGO
BEACON ROCKS
MARGATE
SHAD BAY
MPUNZI DRIFT
BAVEN-ON-SEA
RAMSGATE
SOUTHBROOM
IMPENJATI
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5
Kilometres
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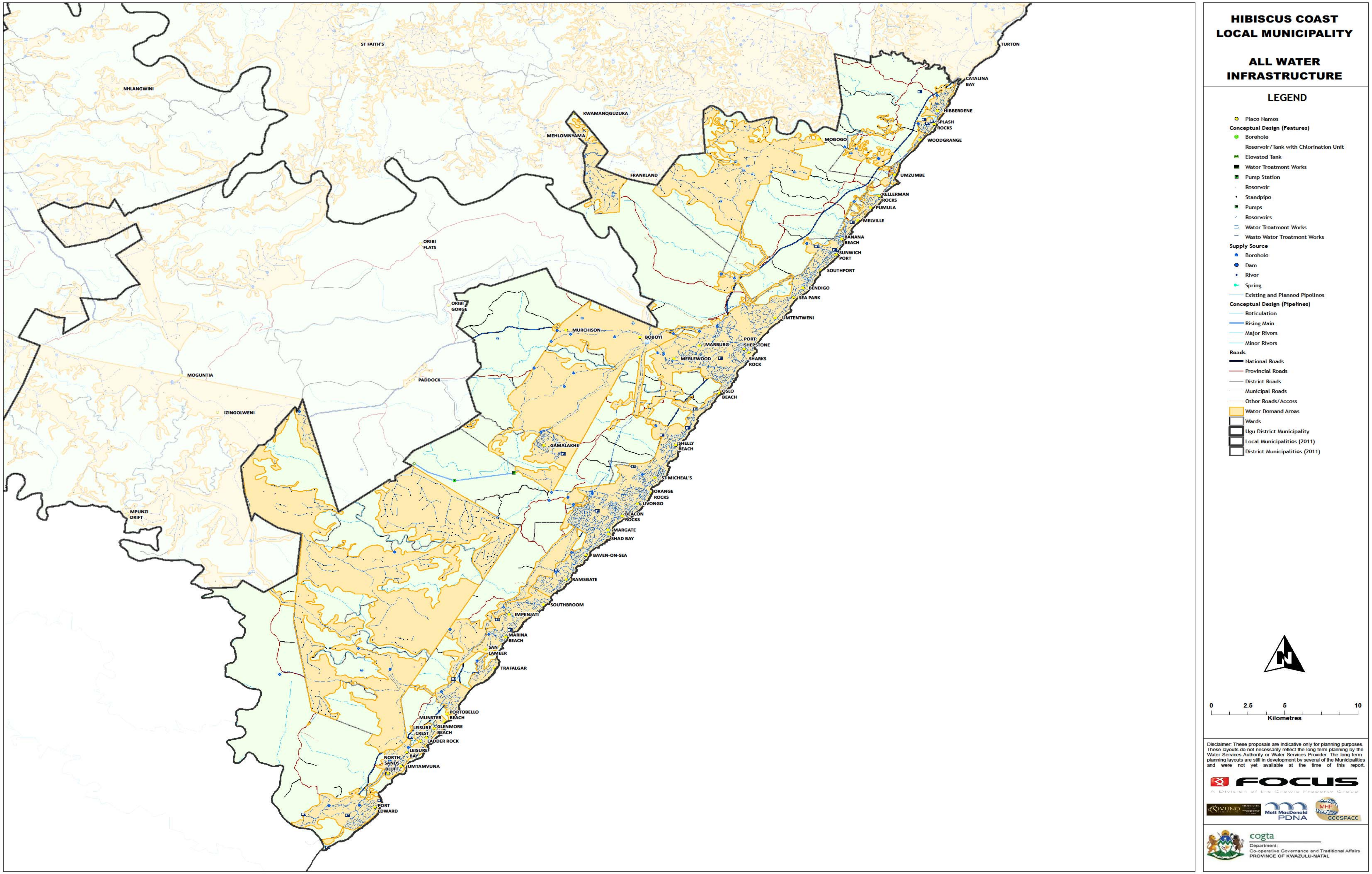
HIBISCUS COAST LOCAL MUNICIPALITY
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0 2.5 5 10
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SOUTHBROOM
IMPENJATI
MARINA BEACH
SAN LAMEER
TRAFALGAR
PORTOBELLO BEACH
MUNSTER
LEISURE CREST
GLENMORE BEACH
LADDER ROCK
LEISURE BAY
NORTH SANDS BLUFF
UMTAMVUNA
PORT EDWARD

## 12. ACKNOWLEDGEMENT AND DISCLAIMER

This report was prepared by the consortium consisting of Focus, Mott Macdonald PDNA, MHP GeoSpace and Sivuno Consulting with the technical support from Zululand District Municipality under the direction and review from COGTA and Umgeni Water.

The information and data obtained in this report was obtained from Zululand District Municipality Infrastructure Development Plans (IDP's), Water Services Development Plans (WSDP) and mainly engagements with Zululand District Municipality staff.

Neither the consortium nor any of its employees assume any liability or responsibility for any third party use of any information discussed in this report.

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Email address: muziwesipho.ngwane@misa.gov.za