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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 AMAJUBA DISTRICT MUNICIPALITY]

REPORT TITLE	Development of Universal Access Plan for Water Services in Amajuba District Municipality		
CLIENT	Department of Cooperative Governance and Traditional Affairs		
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GLOSSARY

ADM	-	Amajuba District Municipality
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
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**
Amajuba District Municipality Integrated Development Plan	2013
Newcastle Local Municipality Integrated Development Plan	2013
Emadlageni Local Municipality Integrated Development Plan	2013
Dannhauser Local Municipality Integrated Development Plan	2013
Development of Water Reconciliation Strategy for all towns in the Eastern Region for Amajuba 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 Amajuba District Municipality was as follows:-

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

- MHP GeoSpace obtained Geographic Information System (GIS) spatial information from various sources, including the Amajuba 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 Amajuba District Municipality.

Census Year	1996	2001	2011	% Growth from 1996 - 2001	% Growth from 2001 - 2011	% growth pa (1996 - 2001)	% growth pa (2001 - 2011)
Amajuba	410790	468036	499839	13.9	6.8	2.8	0.7

- 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 Amajuba District Municipality are presented in the table below.

Local Municipality	Backlogs (Households)
Newcastle	7763
Emadlageni	1938
Dannhauser	14213
Amajuba	23914

- 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 demand 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
Newcastle	66	54
Emadlangeni	86	77
Dannhauser	137	135
Amajuba	289	266

- 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 Amajuba 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 8.4 of this document.

Newcastle DM	
Scheme Type	**Total**
Link to Existing Scheme	R 170 509 470
Small Package Plants	R 95 307 226
New boreholes electronically operated	R 42 103 421
TOTAL	**R 307 920 117**

Emadlageni DM	
Scheme Type	**Total**
Link to Existing Scheme	R 114 683 798
Boreholes electronically operated with Storage	R 25 013 994
New boreholes electronically operated	R 259 140 479
TOTAL	**R 398 838 271**

Dannhauser DM	
Scheme Type	**Total**
Link to Existing Scheme	R 200 097 630
New boreholes electronically operated	R 20 166 071
TOTAL	**R 220 263 701**

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

Amajuba DM	
Scheme Type	**Total**
Link to Existing Scheme	R 485 290 897
Small Package Plants	R 95 307 226
Boreholes electronically operated with Storage	R 25 013 994
New boreholes electronically operated	R 321 409 971
TOTAL	**R 927 022 088**

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

Local Municipality	Backlogs (Households)	Cost per Capita
Newcastle	7763	R 6 611
Emadlageni	1938	R 34 300
Dannhauser	14213	R 2 583
Amajuba	23914	R 6 461

- 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	Newcastle	R 192 980 990
	Emadlageni	R 238 472 793
	Dannhauser	R 71 299 691
		R 502 753 474

Implementation Year	LM	Total Cost
2016/17	Newcastle	R 41 751 569
	Emadlageni	R 31 206 497
	Dannhauser	R 47 787 081
		R 120 745 147

Implementation Year	LM	Total Cost
2017/18	Newcastle	R 73 187 558
	Emadlageni	R 85 155 549
		R 158 343 107

Implementation Year	LM	Total Cost
2018/19	Emadlageni	R 44 003 432
	Dannhauser	R 101 176 928
		R 145 180 360

- In the Amajuba District Municipality, it is estimated that the existing water backlog of 23914 households can be eradicated by 2019 at a cost of R 927 022 088 to develop 79 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 Amajuba District Municipality (ADM) Overview

The Amajuba District Municipality (ADM) is located in the north-western corner of KwaZulu-Natal and comprises the three local municipalities of Newcastle (KZ 252), Emadlangeni (KZ 253) and Dannhauser (KZ 254). The ADM is 6 910 km^2 size with Emadlangeni occupying the largest area of 3 539 km^2, Newcastle some 1855 km^2 and Dannhauser some 1 516 km^2 with a population of 499839.

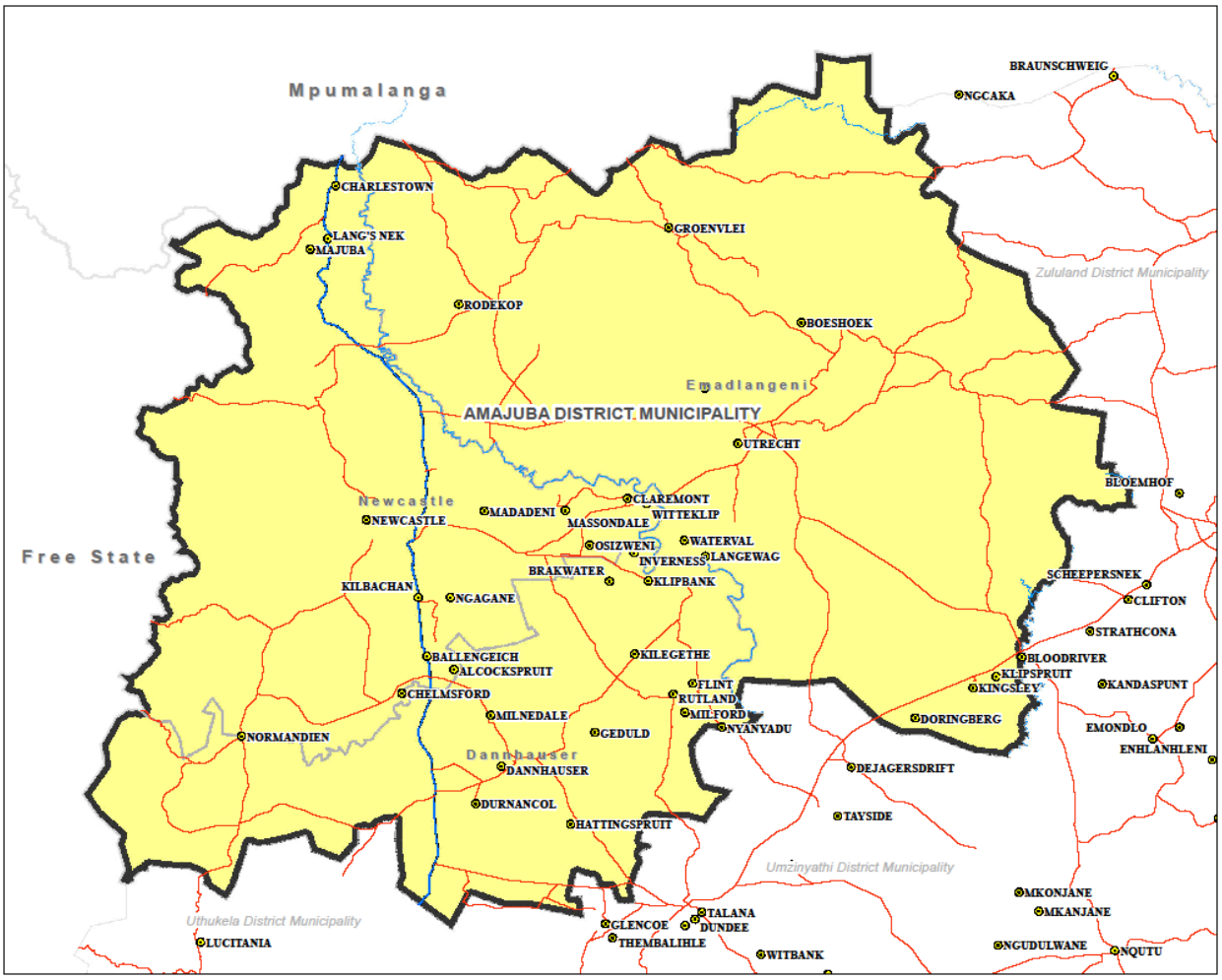


Figure 1 – Amajuba District Municipality Locality Map

The following are the local municipalities situated in the ADM:

2.2.1 Newcastle Local Municipality (KZ 252)

Newcastle Municipality falls within Amajuba District (DC 25) and it is located in the inland region of the Northwest corner of KwaZulu Natal; a few kilometers south of the Free State, Mpumalanga, and Gauteng provincial borders. The municipality covers an area of 1855km^2 made up of 31 wards. The total population consists of approximately 363236 people.

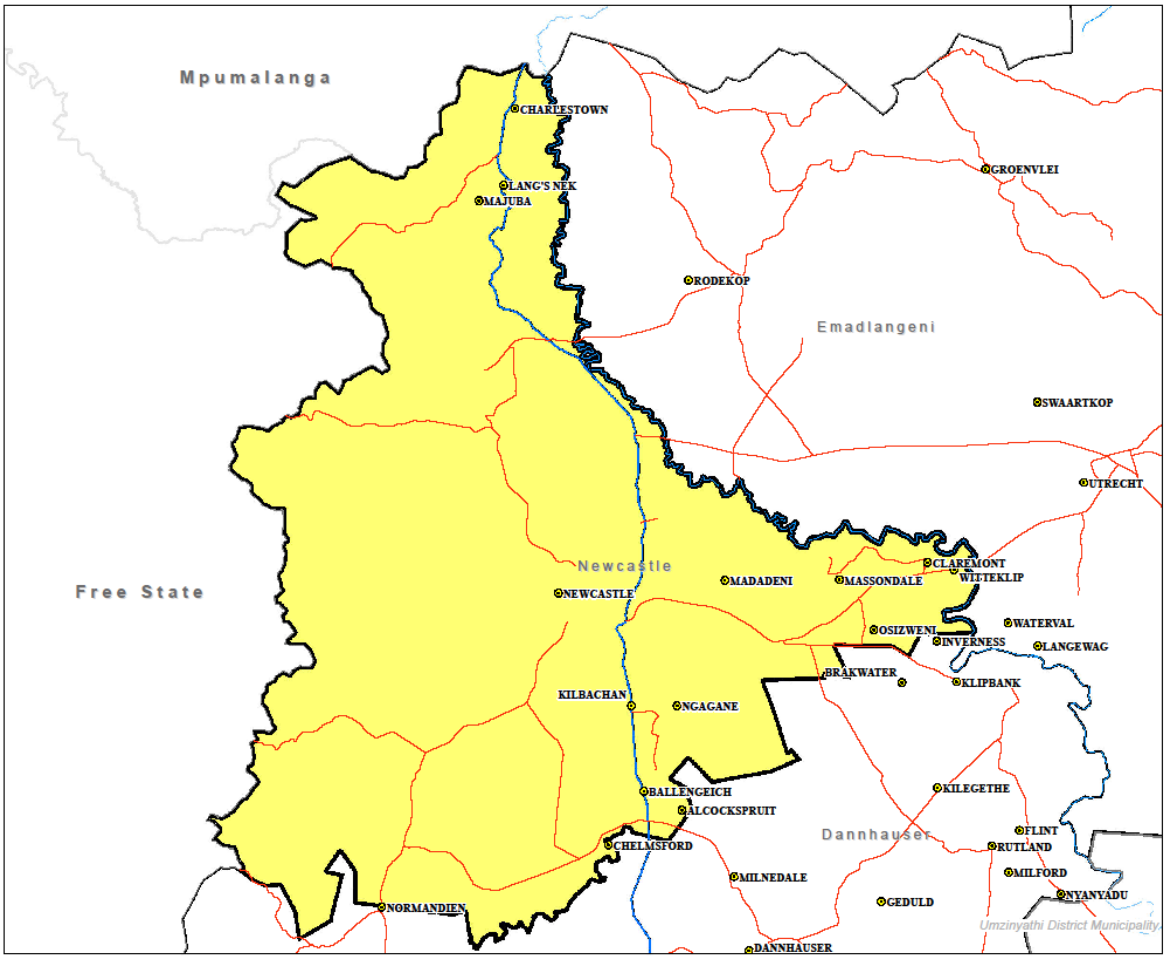


Figure 2 – Newcastle Local Municipality

2.2.2 Emadlangeni Local Municipality (KZ 253)

Emadlangeni Municipality (KZ 253) is located in the Amajuba District Municipality in the North-western corner of KwaZulu-Natal. Its area comprises 3539km². The total population is approximately 34442.

The Municipality (KZ 253) is surrounded by Newcastle East (52km), 68km west of Vryheid, South West from Dundee and North East from Volksrust/Wakkerstroom.

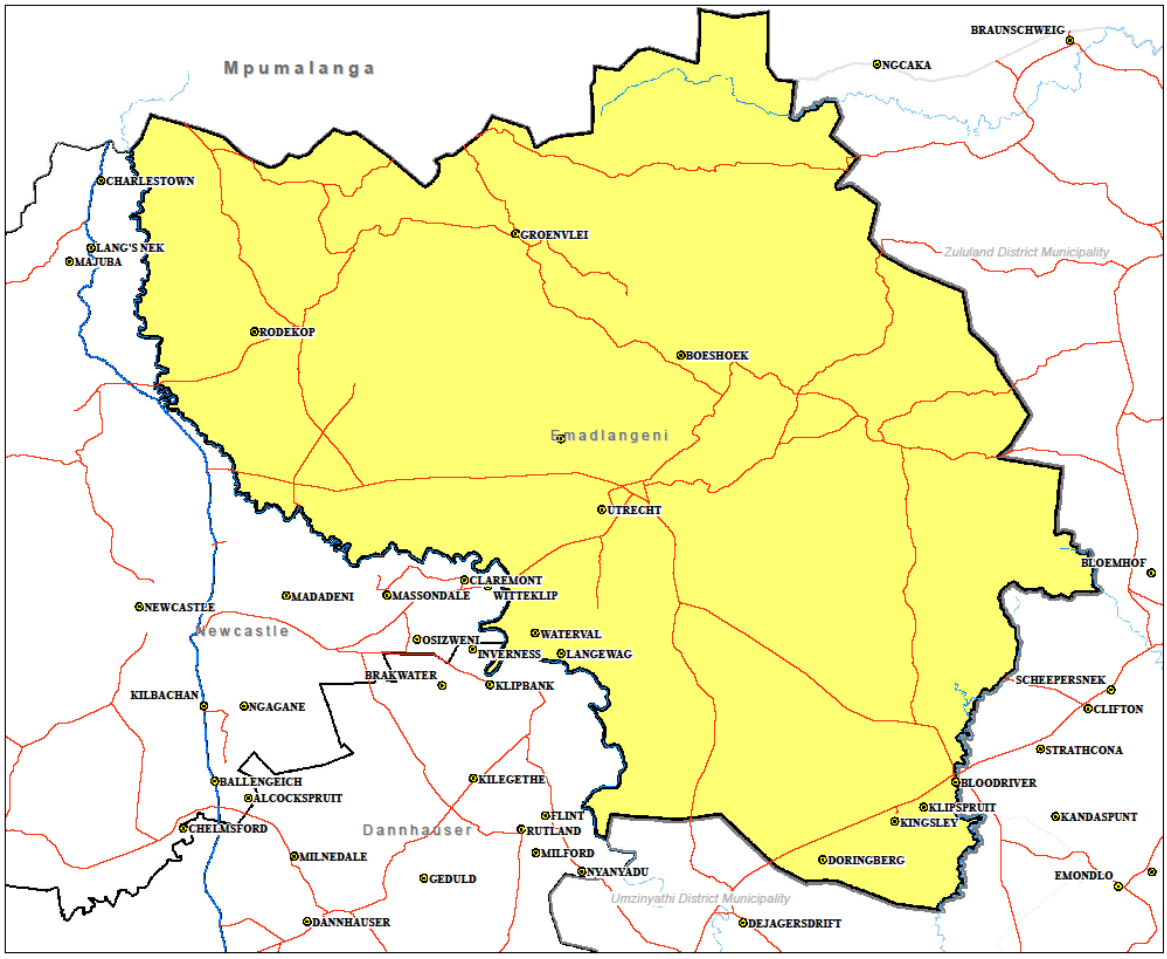


Figure 3 – Emadlangeni Local Municipality

2.2.3 Dannhauser Local Municipality (KZ 254)

The population of the municipality is currently 102 161 people and covers a total area of 1516 km^2. Population densities are highest in the traditional authority areas in the north eastern portion of the municipal area and in the town of Dannhauser itself.

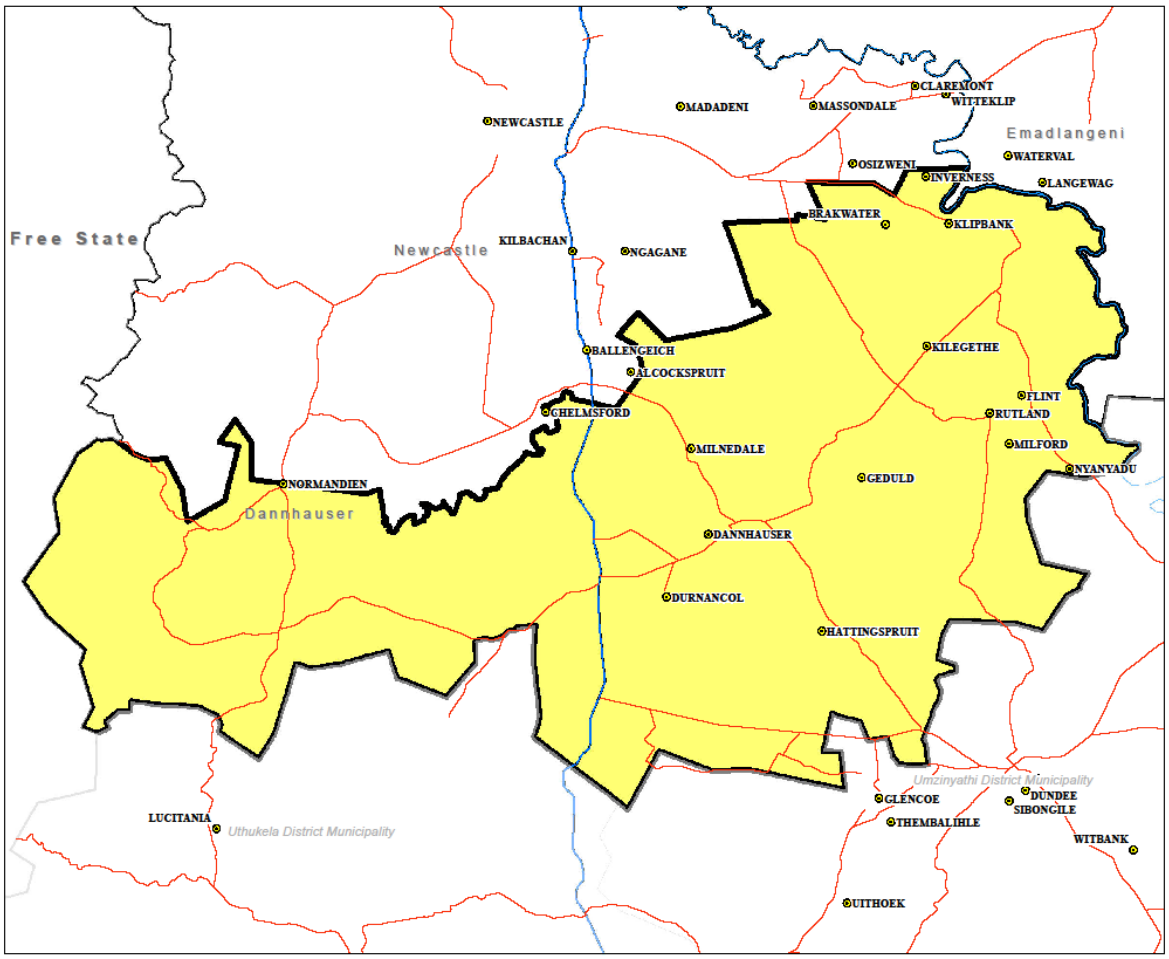


Figure 4 – Dannhauser Local Municipality

3. ASSESMENT OF WATER PLANNING STATUS QUO

In order to assess the current water and sanitation situation in Amajuba 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), Amajuba District Municipality, and Newcastle Local Municipality. Other documents are discussed in section 5 and section 7 of this report.

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 waters 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, Amajuba District Municipality and Newcastle Local Municipality were contacted to see if there was any additional data that could be obtained and added to the database. Amajuba 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.

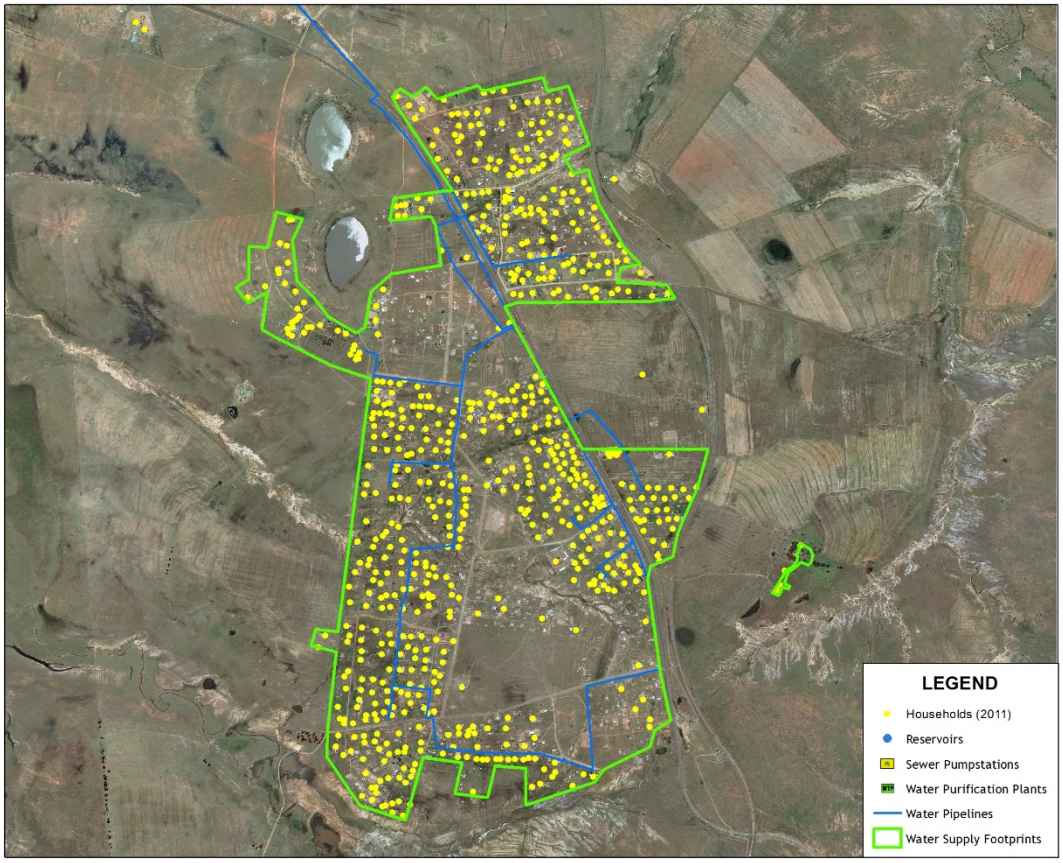
Map 1 – Example of water infrastructure in the Newcastle area

4. DEVELOP CONTINUOUS WATER SUPPLY FOOTPRINT AREAS

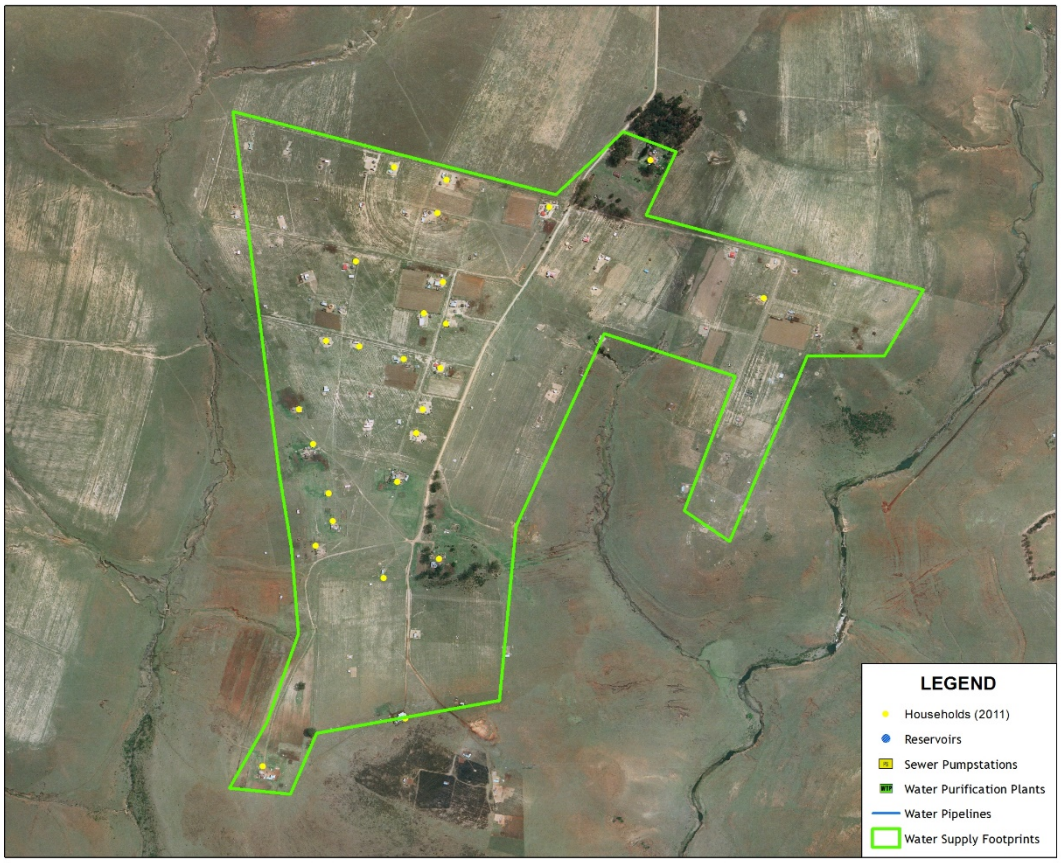
After consultation with Umgeni Water, water supply footprints in the District Municipality were captured as polygons tightly following the edge of settled areas. The data was captured on screen through heads-up digitising against the latest colour aerial photography (ranging from 2009 – 2011) available 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.

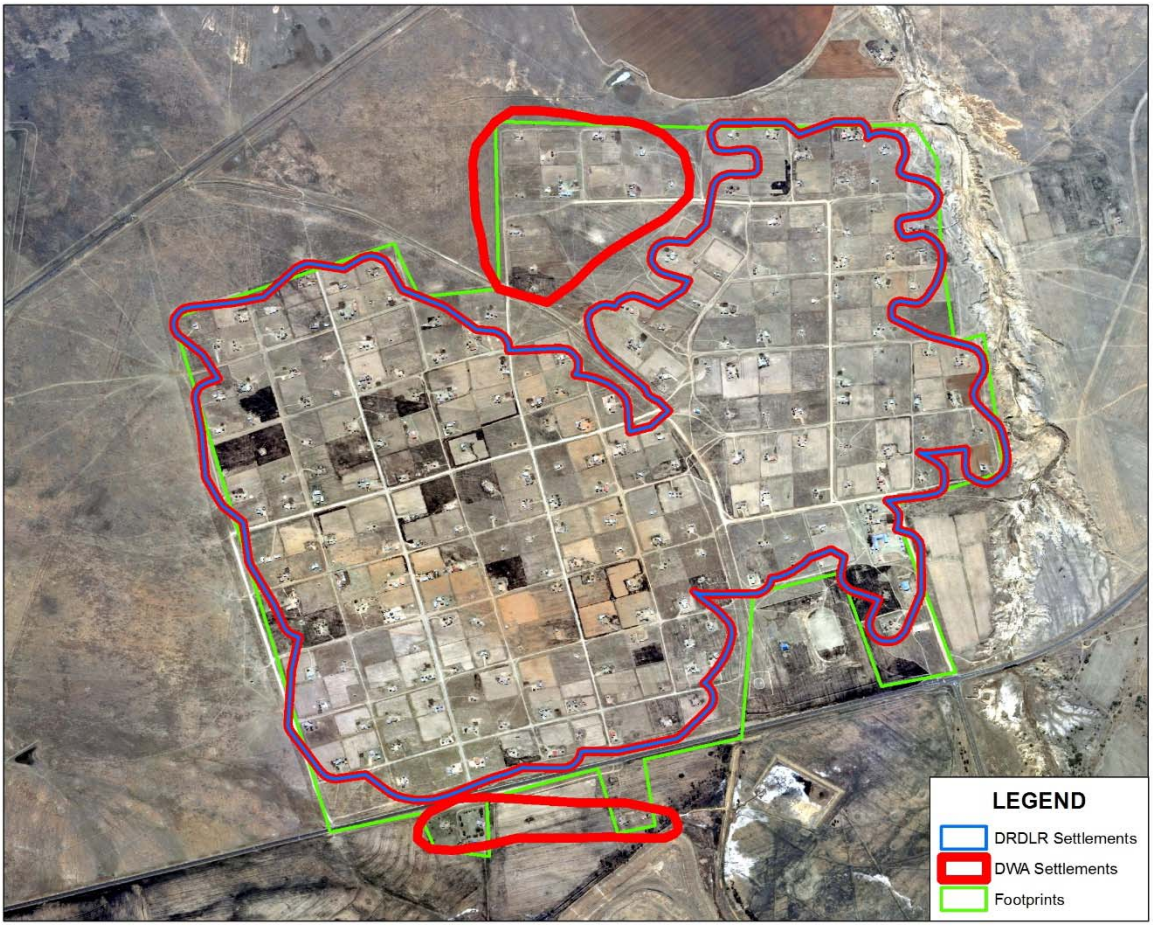


Map 2 – Water Supply Footprint with existing water reticulation



Map 3 – Water Supply Footprint where no water reticulation exists

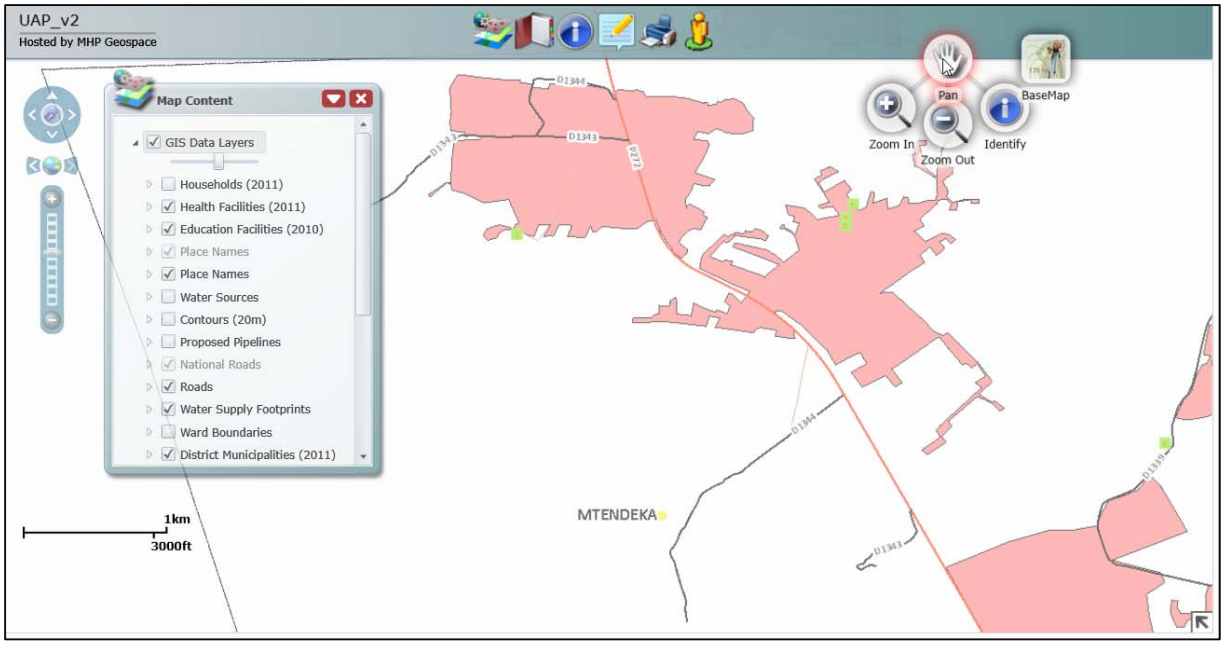
An example of the differences between the settlement boundary datasets is illustrated in Map 4. There were areas where the boundaries between the datasets were co-incident (the blue lines lie over the red lines), as well as areas where the datasets differ.



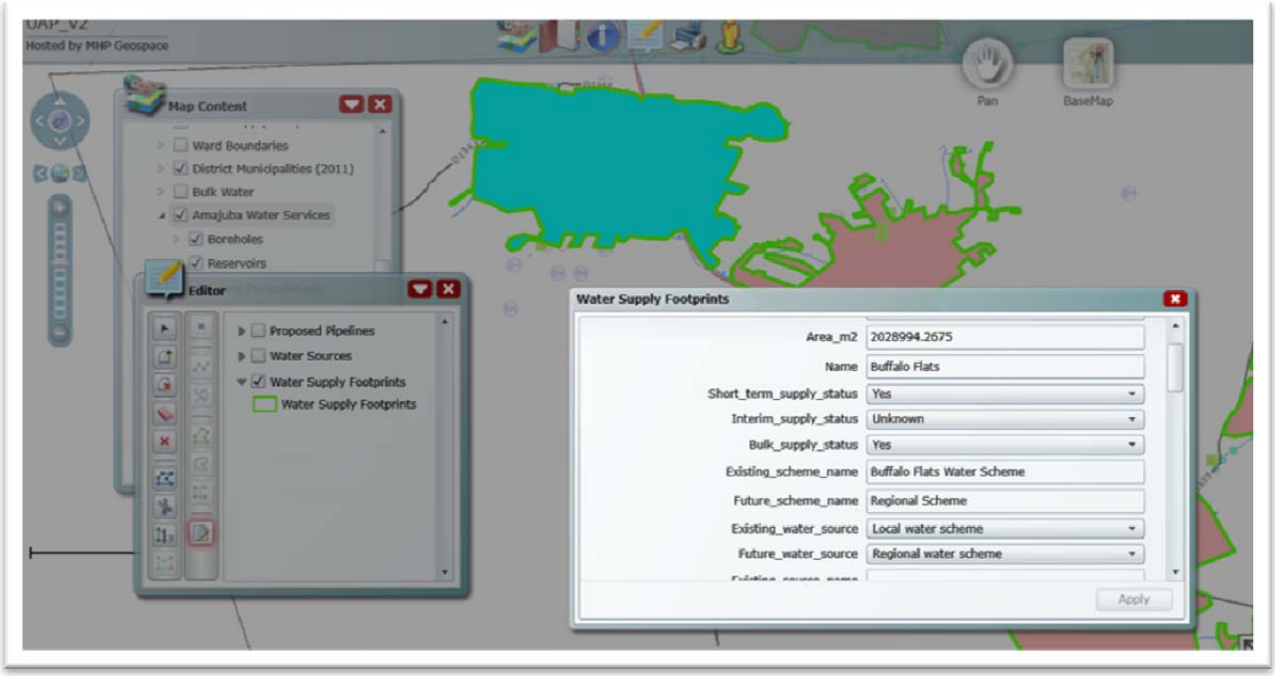
Map 4 – Example of settlement boundary datasets

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 1.

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 to 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 footprint 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 demand area 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. 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 reason 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 ADM

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

Newcastle LM

Representative:	Sbusiso Buthelezi	0726361020	sibusiso.buthelezi@newcastle.gov.za
Information received:	None		
Comments:	The meeting was disrupted by a protest at the Newcastle LM offices that Mr. Buthelezi had to attend to.		

Subsequent to the above meeting MMPDNA have been trying to source the service information from this municipality but to date have been unsuccessful. The local municipality indicated that they are not willing to hand over their GIS data at this stage. MMPDNA have therefore used the IDP's and WSDP's to extract information on the backlogs and existing services. The information in the WSDP's is however incomplete or lacking valuable information. Our confidence level is therefore 0%.

Emadlangeni LM and Dannhauser LM

Representative:	Sabelo Madela	0832929065	sabelom@amajuba.gov.za
	Sphamandla Mabizela	0832596448	sphamandlam@amajuba.gov.za

Information received:
Buffalo Flats co-ordinates of completed VIP units
Emadlangeni co-ordinates of completed VIP units
Buffalo Flats Phase 3 Part 1 Tank sizes and co-ordinates
Amajuba District PMU Report (August 2013)
Buffalo Flats Water Master Plan Layout
Amajuba District Water Supply Master Plan (May 2011)

Comments:
Representatives from the Amajuba District Municipality supplied MMPDNA with several documents as indicated above. This information included plans indicating services already installed and the future plans for the area. They indicated that for the scattered settlements production boreholes will be installed to supply these settlements with a UAP level of service for water. The municipality also indicated that residents who currently do not have access to reticulation are being supplied by water tankers.

No verification of their bulk water GIS and attributes were undertaken.

5. EXISTING WATER SUPPLY SCHEMES

5.1 ADM Service Policy

The Newcastle Local Municipality and Amajuba District Municipalities was designated a Water Services Authority for its area of jurisdiction in terms of the Municipal Structures Act, with Amajuba serving Emadlangeni and Dannhauser municipal areas and Newcastle Local Municipality being responsible for its own municipal area. Both municipalities make use of uThukela Water as the Water Services Provider as the current status. UThukela's Service policy is stated below:

5.1.1 Water Service Levels

Communal / basic water supply: i.e. Communal street taps (RDP standards) a minimum of 25 litres per person per day at a maximum walking distance of 200m.

Controlled volume supply: E.g. Yard Tanks. Each house is provided with a tank, which holds about 200 litres. The tank gets filled up once a day. This type of service is often referred to as an intermediate level of supply.

Uncontrolled volume supply: There are generally two types: yard tap connection which provides a minimum of 60 litres per person per day from a single tap within the consumer's property or water is piped into the house at to take water to taps in the kitchen, bathroom, toilet etc.

Rudimentary potable water supply: a minimum of 5 litres per person per day at a maximum walking distance of 800m and not more than 50 families per source that can be upgraded.

5.1.2 Sanitation Service Levels

5.1.2.1 Consumer installations: Dry

Basic sanitation: The provision of appropriate health and hygiene education and a toilet which is safe, reliable, environmentally sound, easy to keep clean, provides privacy and protection against the weather, well ventilated, keeps smells to a minimum and prevents the entry and exit of flies and other disease- carrying pests.

Ventilated Pit: A basic pit latrine structurally reinforced without preventing water seepage into surrounding soil, a slab that seals the edges of the pit and a screened air pipe that vents smells from the pit into the air above the privy. The concrete slab over the pit is not standard requirement for all VIP toilets, but necessary under certain geotechnical conditions and it must comply with ground water protocol.

Eco San option: one of a range of sanitation options that covert the waste products into re-usable agricultural soil conditioners of fertilizers on-site (usually without water use) a ventilate improved pit (VIP) latrine per household that includes approved sub and top structures located within50m of the homestead.

5.1.2.2 Consumer installations: Wet (septic tanks)

Water is flushed into a digester where certain bacteria and other organisms breakdown the solids. Digester effluent flows into the soak away, then the ground and it must be ensured that the soak away does not cause pollution of ground water. There can be a build-up of sludge in the digester that has to be pumped out occasionally. In some cases the effluent from the septic tank is discharged into the bulk sewer network, which leads to a sewage treatment plant or oxidation ponds.

Discharge to wastewater treatment works
Here there are generally two types: intermediate (e.g. aqua privy with solids free sewer which is similar to a septic tank, but instead of a soak away the digester effluent flows into a pipe which connects to a small sewer in the road reserve).
Full waterborne refers to the situation where a flushing toilet is used; the wastewater flows to a sewer on the site, then to sewers on the street. Effluent discharged from sewage treatment works must meet national effluent discharge quality standards in order to avoid polluting the water resources.

With regards to standards of service, each level of service will comply with the design standards in terms of the municipal water services bylaws.

5.2 Water Resources

The rural areas are supplied from the following sources:

- 78 boreholes of which 3 are without pumps, 3 are dry, 18 have submersible pumps, 2 have play pumps, 34 have hand pumps, 7 have wind pumps and the type of pump fitted to 12 new boreholes are known.
- 21 springs
- 1 dam
- 2 streams
- 10 JoJo tanks which are supplied by tankers
- 17 standpipes which are reticulated from nearby boreholes/springs.

5.2.1 Rivers

The DM has the following rivers and dams:

Newcastle

The Slang River with the Zaaihoek dam
The Slang River is the first major tributary of the Buffalo River, joining the Buffalo River 4 km east of Volksrust. Rising at 2275msl south of Wakkerstroom on the high Balelesberg-Skurweberg Plateau, the Slang River flows westerly - a unique feature in Natal - to the Zaaihoek dam, from where water is

pumped to the Majuba coal-fired power station at a rate of 55 Mm³/annum. The yield of the Zaaihoek dam according to White Paper WPE 86 is 47Mm³/annum. The excess water is allocated to the Vaal system. Only water for ecological purposes and for irrigators at an agreed pattern is generally released from this dam on a continuous basis. In emergency situations, depending on the urgency of supply to the Vaal system, water may be released into the Buffalo river system.

The Buffalo River with the Mahawane dam

The Buffalo River rises in the Transvaal, 4 km north of Volksrust on Verkykkop at 2047msl and has in its headwall erosion, captured and diverted the course of the Slang River in a narrow gorge 4km east of Charlestown. The Mahawane dam, situated in a tributary of the Buffalo river, just north of Volksrust, with capacity of 2,1 m³, supply water to Volksrust. No irrigation is possible from this dam. The domestic water supply to Volksrust/Charlstown and Wakkerstroom may be supplemented from the Zaaihoek dam.

Hereafter the flow is southerly, collecting east-flowing drainage from the Drakensberg range as well as streams draining west from the Balelesberg.

A raw water pump station for domestic purposes is situated on the Utrecht-Osizweni road.

The Ncandu River with the Amcor dam

The Ncandu River rises at 1994msl near Die Ark on the Normandien Pass, flows easterly and then northerly to join the Ngagane River east of Newcastle. The Amcor dam, situated in Newcastle, with capacity estimated at 720 000 m³, is relatively small in relation to the mean annual runoff (MAR) and will therefore not have a long life. No irrigation is possible from this dam as it is badly silted up at this stage and is used for recreational and environmental purposes only.

The Ngagane River with the Ntshingwayo and Mfushane dams

The Ngagane River rises at 1993m MSL near Die Ark on the Normandien Pass on the opposite side of the watershed of the Ncandu River. The Ntshingwayo Dam captures the flow of the river south of Newcastle. The capacity of the dam is 194 Mm³ with an available reserve yield of 21 m³/annum, which should be reserved for the expected domestic and industrial growth of the supply area of between 11 and 39 Mm³ over the next 20 years if other dams are not constructed in the demand area not taking account of the associated increase in return flow. The Ncandu River joins northwest of Madadeni from where the Ngagane River flows in an easterly direction to join the Buffalo River just north of Madadeni. The Mfushane dam is a relative small dam in a tributary to the Ngagane River, near Durnacol. No further irrigation is possible from this dam. Domestic water for Durnacol and Dannhauser is supplied from the Ntshingwayo dam.

The Horn River

The Horn River rises at approximately 1800msl north of the Normandien Pass, between the Ncandu and Ngagane rivers. The Horn River joins the Ngagane River near Ballengeich. Allegedly, the water quality of the Horn River is not very good for irrigation purposes.

<u>Dannhauser</u>

The Ngagane River with the Ntshingwayo and Mfushane dams

Same as description in Newcastle.

Emadlangeni

The Slang River with the Zaaihoek dam
Same as description in Newcastle.

The Buffalo River with the Mahawane dam
Same as description in Newcastle.

The Blood River with the Blood river dam
The Blood River rises at Aasvoëlkrans (1681 msl) near the headwaters of the White Umfolozi River, 17 km west of Vryheid. The Amajuba district boundary veers away from the Blood River in a westerly direction, some 10km southeast of the R 33 (Vryheid-Dundee road) The Blood River joins the Buffalo River approximately 25 km east of Dundee. A fairly large private earth dam captures the water just downstream of the Dundee-Vryheid road.

Pongola River
Rising at approximately 2200msl southeast of Wakkerstroom in the Donkerhoek/Nauwhoek valley, the Pongola River flows easterly, crossing the Amajuba boundary south-west of Luneburg, and passing Paul Pietersburg on the north, forming the northern boundary of KwaZulu-Natal. The Pongola poort dam at Jozini captures the flow of the river. The water is used extensively around Pongola, mainly for the growing of sugarcane. Any new applications for water will only be considered when DWAF has completed a major study to establish the “reserve”. The Pandana and Tsakwane rivers are tributaries of the Pongola River and the same ruling therefore applies.

Bivane River
The Bivane river rises due North of Utrecht at Bivaanspoort, south of the Pongola river. The Bivane River crosses the Amajuba boundary just west of the Vryheid-Paul Pietersburg road. The water of the Bivane is captured by the Bivane dam, west of Coronation in the Amajuba District. This dam was constructed recently to augment the water supply to the Pongola farmers. It forms part of the Pongola system and any new applications for water will only be considered when DWAF has completed a major study to establish the “reserve”

The White Umfolozi
The White Umfolozi rises just west of Vryheid on the eastern boundary of the Amajuba District. The Klipfontein dam captures the flow just southeast of Vryheid. This dam is not of adequate size and the water supply to Vryheid and Ulundi is often under stress, with the result that additional abstraction from the rivers feeding the dam will most likely not be allowed unless the wall is raised or additional dams are constructed. The domestic and industrial demand of Vryheid/Ulundi will always receive first priority.

5.3 Existing Water Supply Schemes

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 growth in population there was a need to determine when interventions were required i.e. extension of existing water treatment works or construction of new plant to serve the new/additional demands.

The information indicated in the Department of Water Affairs Reconciliation Strategies undertaken in 2011, covers the identification of the different catchments in the water management areas that were experiencing water supply deficits and a reconciliation strategy was developed particularly for the major economic areas, as well as the growing non-agricultural sectors.

Another objective of the study was to develop a water reconciliation strategy to enable effective and efficient use of the water supplies, while determining optimal and sustainable ways to source additional water supply for selected towns.

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

5.3.1.1 Newcastle Water Supply Scheme (Newcastle LM)

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

The Newcastle Water Supply Scheme, supplied by only the Ngagane WTW, is the only source of domestic water supplies to Newcastle and surrounding areas. The Ntshingwayo Dam was built to supply the town, Eskom's thermal power station (which has subsequently been decommissioned), and to a lesser extent to cater for the reasonable needs of riparian irrigation agriculture along the Ngagane River.

The Ngagane WTW is supplied with raw water from three sources namely from the following:

(i) Ntshingwayo Dam. This is the main source of supply with an allocation of 33.0 million m^3/a

(ii) Ngagane River. There is a raw water abstraction works downstream of the dam near Ngagane at Roy Point, where water is abstracted to supply the Ngagane WTW. The registered water use is 11.0 million m^3/a.

(iii) Buffalo River at Schurvepoort. This source is mainly to supplement the two main sources of supply, particularly during the rainy season when there is surplus water available from the Buffalo River. The registered water use is 11.0 million m_3/a. This source is not very reliable but could, in an emergency, be augmented from the Zaaihoek Dam.

The other WTW and sources of supply which have since been decommissioned included the Boschhoek WTW supplied from the Boschhoek weir in the Ncandu River, which has since silted up and the Eskom WTW which was supplied from the Ntshingwayo Dam.

The average treated water production for Newcastle and the surrounding areas of Madadeni and Osizweni in 2008 was 89.11 ML/d (32.52 million m^3/a. The current raw water abstraction from the Ntshingwayo Dam, Ngagane and Buffalo Rivers was estimated to be 111.39 ML/d (40.66 million m^3/a), assuming water losses from the raw water abstraction, pumping main as well as the treatment water losses.

Water Treatment Works

The town of Newcastle has three WTW with two plants recently decommissioned. The Ngagane WTW is the only plant that is currently operational, and which is supplying treated water to the area. The total peak hydraulic design capacity of the Ngagane WTW is 150 ML/d. The average annual flow rate of the WTW is estimated to be 103.3 ML/d.

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

(i) *Flocculation channels*: The raw water is supplied by gravity from the Ntshingwayo Dam and the Buffalo River and pumped from the Ngagane River and chemicals are added, as the water flows into flocculation channels where coagulation after polyelectrolyte dosing takes place to form the flocs.

(ii) *Clarification (sedimentation) tanks*: The flocs that have formed in the flocculation channels are then settled in the sedimentation tanks under gravity. The settled sludge is frequently removed by de-sludging 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) *Chorine contact tank*: The filtered water is then stored in the chorine contact tanks where chlorination takes place before pumping the water to the command reservoirs in the Newcastle Water Supply Scheme area for distribution.

As illustrated in Table 1, the average annual capacity of the water treatment works is not sufficient to meet the future (from 2009) water requirements. There are increasing water quality problems downstream of Ntshingwayo Dam in the Ngagane River owing to coal mining activities.

This has been affecting the treatment capacity of the Ngagane WTW which has been encountering major operational problems from time to time because of seasonal changes in the quality of the water in the Ngagane River, including the turbidity that can be high in summer. The operational constraints in some of the WTW modules are resulting in a need to refurbish and upgrade them to treat the deteriorating raw water quality.

Treatment Work Name	Type of plant	Raw water source	Hydraulic Design capacity (ML/d)	Average Design capacity (ML/d)	Treated water production (ML/d)	Current utilisation(% of average design capacity)
Ngagane WTW	Conventional treatment	Ntshingwayo Dam	135	103.3	89.11	86%
Boschoek WTW	Conventional treatment	Ncandu River	(5)	(3.33)	Decommissioned	N/A
Eskom WTW	Conventional treatment	Ntshingwayo Dam	(4)	(2.67)	Decommissioned	N/A
Total			**150**	**103.3**	**89.11**	**86%**

Table 1 - Water Treatment Works in operation in the Newcastle Water Supply Scheme area
(Source : First Stage Reconciliation Strategy for Newcastle Water Supply Scheme Area Newcastle Municipality,2011)

Treated water bulk supply infrastructure

The treated water from the Ngagane WTW is pumped from the clearwater tanks to the various command reservoirs in Braakfontein and Newcastle town. These have cumulative storage capacities of 78.8 ML and 46 ML respectively. The bulk water is then distributed to the various supply areas in the town and the surrounding townships of Madadeni and Osizweni.

Besides the clearwater pump station there is also a pump station which pumps water from the clearwater tank at the Ngagane WTW to a 4 ML reservoir at Ekuseni, supplying the low pressure sections of the town. All pumping systems have standby capacity.

Bulk Storage

The Newcastle Water Supply Scheme area has a total service reservoir storage capacity of 128.8 ML including the smaller reservoirs supplying the various water supply areas of the town including Madadeni and Osizweni. The capacities of the reservoirs range from 2 ML tanks to a 45 ML reservoir, and are distributed throughout the various water supply areas.

The service storage capacity provides for a 1.45-day or 1.45-hour storage based on the current treated water production, but in summer months this reduces to approximately a 23-hour or 1.0-day storage capacity, based on present water requirements. The reservoir storage capacity of Newcastle is therefore significantly less than 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 reservoirs; and
- Provide a reserve of water to meet fire and other emergency demands.

Additional service storage capacity is therefore required immediately and further into the future to meet the current and future summer peak requirements.

Parameters	Newcastle Water Supply Scheme Area
Total Storage capacity (ML)	128.8
Storage Ratio on present annual average consumption (Hours)	35
Storage Ratio on present average peak week consumption (Hours)	23

Table 2 – Water Treatment Works serving the Newcastle Water Supply Scheme area

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

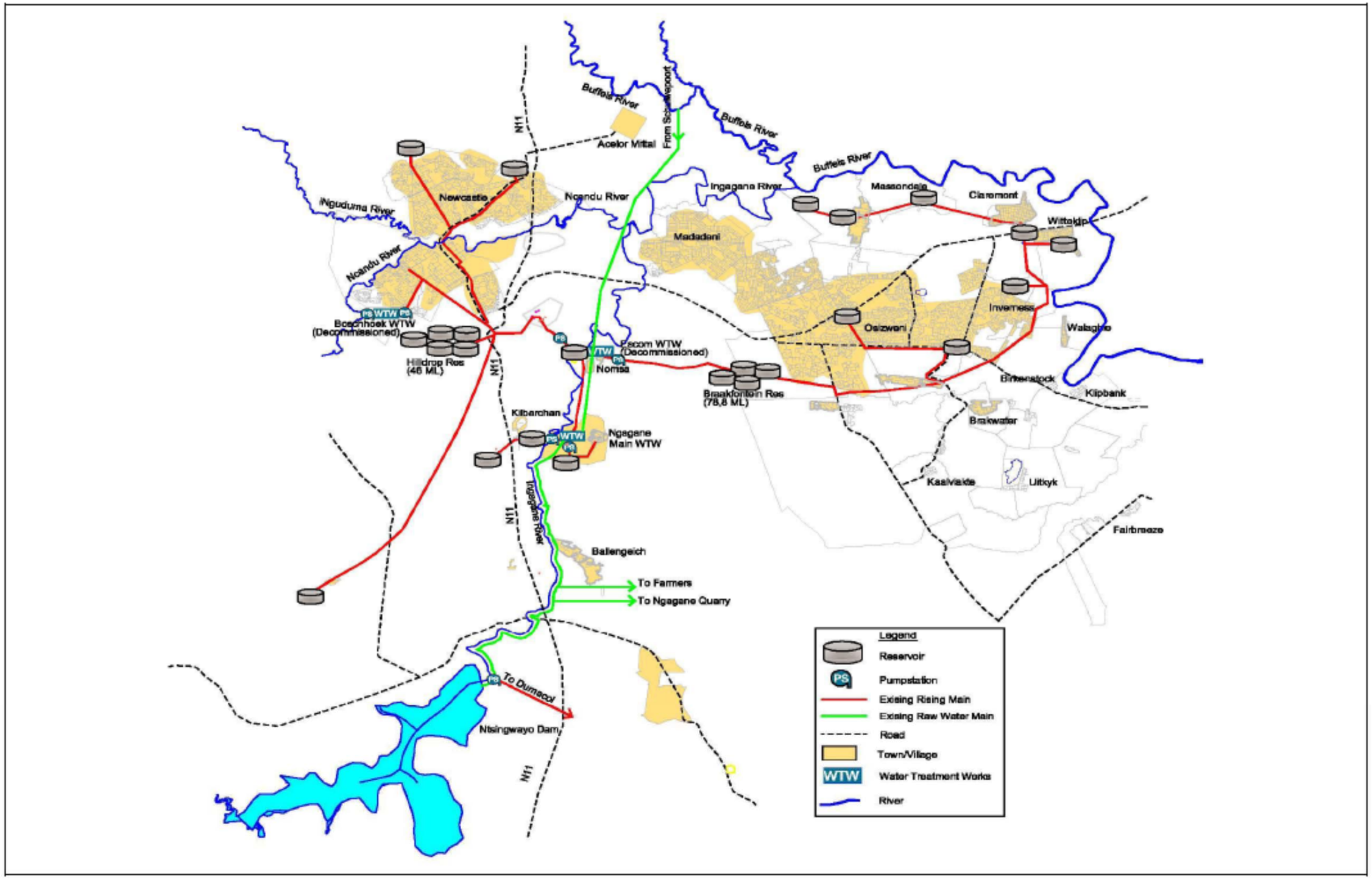


Figure 5 - Schematic layout of Newcastle Water Supply Scheme Area

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

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 water demand area. While the calculation of the household counts for each area was a simple GIS query, the population statistics, and projection thereof, required more detailed analysis.

Household Counts:

Unique ID numbers were given to 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 polygon in which it fell. This data could then be summarised and a count done of the number of households in each footprint. This count was then added to the water demand attribute table.

Table

footprint_pop_2014

OID	UID	Cnt_UID	Sum_HH_2014
128	Amajuba_216	11	68.97
129	Amajuba_217	13	68.51
130	Amajuba_218	18	112.86
131	Amajuba_22	55	348.15
132	Amajuba_223	15	79.05
133	Amajuba_224	10	52.7
134	Amajuba_225	15	79.05
135	Amajuba_226	11	64.68
136	Amajuba_227	12	75.24
137	Amajuba_228	7	43.89
138	Amajuba_229	7	43.89
139	Amajuba_23	34	215.22
140	Amajuba_230	25	156.75
141	Amajuba_231	14	87.78
142	Amajuba_232	8	50.16
143	Amajuba_233	13	81.51
144	Amajuba_234	5	26.35
145	Amajuba_235	8	42.16
146	Amajuba_236	9	52.92
147	Amajuba_237	8	47.04
148	Amajuba_238	13	81.51
149	Amajuba_239	16	100.32
150	Amajuba_24	36	227.88
151	Amajuba_240	12	75.24

Table 3 – Example of household statistics unique 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 figures 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 46 wards falling within Amajuba 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
31	Amajuba	Amajuba_31	-0.92	9359.0968	9272.993109	9187.681573	4.69		4.65	4.61	4.57
31	Amajuba	Amajuba_31	-0.92	9359.0968	9272.993109	9187.681573	4.69		4.65	4.61	4.57
31	Amajuba	Amajuba_31	-0.92	9359.0968	9272.993109	9187.681573	4.69		4.65	4.61	4.57
31	Amajuba	Amajuba_31	-0.92	9359.0968	9272.993109	9187.681573	4.69		4.65	4.61	4.57
31	Amajuba	Amajuba_31	-0.92	9359.0968	9272.993109	9187.681573	4.69		4.65	4.61	4.57
30	Amajuba	Amajuba_30	-0.92	9359.0968	9272.993109	9187.681573	5.59		5.54	5.49	5.44
30	Amajuba	Amajuba_30	-0.92	9359.0968	9272.993109	9187.681573	5.59		5.54	5.49	5.44
30	Amajuba	Amajuba_30	-0.92	9359.0968	9272.993109	9187.681573	5.59		5.54	5.49	5.44
30	Amajuba	Amajuba_30	-0.92	9359.0968	9272.993109	9187.681573	5.59		5.54	5.49	5.44
30	Amajuba	Amajuba_30	-0.92	9359.0968	9272.993109	9187.681573	5.59		5.54	5.49	5.44
57	Amajuba	Amajuba_57	-0.92	9359.0968	9272.993109	9187.681573	5.59		5.54	5.49	5.44
57	Amajuba	Amajuba_57	-0.92	9359.0968	9272.993109	9187.681573	5.59		5.54	5.49	5.44
57	Amajuba	Amajuba_57	-0.92	9359.0968	9272.993109	9187.681573	5.59		5.54	5.49	5.44
57	Amajuba	Amajuba_57	-0.92	9359.0968	9272.993109	9187.681573	5.59		5.54	5.49	5.44
57	Amajuba	Amajuba_57	-0.92	9359.0968	9272.993109	9187.681573	5.59		5.54	5.49	5.44
57	Amajuba	Amajuba_57	-0.92	9359.0968	9272.993109	9187.681573	5.59		5.54	5.49	5.44
5	Amajuba	Amajuba_5	1.2	9904.444	10023.297328	10143.576896	4.18		4.23	4.28	4.33
5	Amajuba	Amajuba_5	1.2	9904.444	10023.297328	10143.576896	4.18		4.23	4.28	4.33
5	Amajuba	Amajuba_5	1.2	9904.444	10023.297328	10143.576896	4.18		4.23	4.28	4.33
5	Amajuba	Amajuba_5	1.2	9904.444	10023.297328	10143.576896	4.18		4.23	4.28	4.33
5	Amajuba	Amajuba_5	1.2	9904.444	10023.297328	10143.576896	4.18		4.23	4.28	4.33

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 footprint) was calculated. This was joined to the demand area attribute table, and used as the low population 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
Amajuba	32	33	191	197
Amajuba	32	33	140	147
Amajuba	1221	1232	4397	4434
Amajuba	24	25	147	152
Amajuba	58	59	302	306
Amajuba	54	56	234	240
Amajuba	57	59	345	357
Amajuba	627	666	2840	3010
Amajuba	16	17	97	100
Amajuba	134	135	698	706
Amajuba	30	31	182	188
Amajuba	16	17	97	100
Amajuba	15	16	91	94
Amajuba	33	34	200	207
Amajuba	24	25	145	150
Amajuba	37	38	224	232
Amajuba	214	216	1185	1199
Amajuba	13	13	79	82
Amajuba	10	10	57	58
Amajuba	106	118	205	233
Amajuba	286	289	1478	1496
Amajuba	58	59	298	306
Amajuba	146	148	805	814
Amajuba	281	284	1579	1591
Amajuba	152	154	876	890
Amajuba	20	20	81	82
Amajuba	6	6	34	35
Amajuba	99	100	436	439
Amajuba	34	35	199	202
Amajuba	11105	11900	37732	40467
Amajuba	298	347	1207	1406
Amajuba	150	175	827	965
Amajuba	695	738	3248	3449
Amajuba	92	93	362	364
Amajuba	37	37	155	156

Table 4 – 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
Amajuba	0.012549	0.019774	0.015895	0.015895	0.019774
Amajuba	0.009198	0.014755	0.011651	0.011651	0.014755
Amajuba	0.288883	0.445063	0.365918	0.365918	0.445063
Amajuba	0.009658	0.015257	0.012233	0.012233	0.015257
Amajuba	0.019841	0.030715	0.025132	0.025132	0.030715
Amajuba	0.010249	0.019272	0.01452	0.01452	0.019272
Amajuba	0.022666	0.035834	0.028711	0.028711	0.035834
Amajuba	0.186588	0.302129	0.236345	0.236345	0.302129
Amajuba	0.006373	0.010038	0.008072	0.008072	0.010038
Amajuba	0.045859	0.070865	0.058088	0.058088	0.070865
Amajuba	0.011957	0.01887	0.015146	0.015146	0.01887
Amajuba	0.006373	0.010038	0.008072	0.008072	0.010038
Amajuba	0.005979	0.009435	0.007573	0.007573	0.009435
Amajuba	0.01314	0.020778	0.016644	0.016644	0.020778
Amajuba	0.009527	0.015056	0.012067	0.012067	0.015056
Amajuba	0.014717	0.023287	0.018641	0.018641	0.023287
Amajuba	0.051903	0.09628	0.073529	0.073529	0.09628
Amajuba	0.00519	0.008231	0.006574	0.006574	0.008231
Amajuba	0.002497	0.004657	0.003537	0.003537	0.004657
Amajuba	0.013469	0.023387	0.01706	0.01706	0.023387
Amajuba	0.064736	0.120129	0.09171	0.09171	0.120129
Amajuba	0.013052	0.024572	0.018491	0.018491	0.024572
Amajuba	0.035259	0.065364	0.04995	0.04995	0.065364
Amajuba	0.06916	0.127757	0.097977	0.097977	0.127757
Amajuba	0.038369	0.071467	0.054356	0.054356	0.071467
Amajuba	0.005322	0.008231	0.006741	0.006741	0.008231
Amajuba	0.001489	0.002811	0.00211	0.00211	0.002811
Amajuba	0.019097	0.035252	0.027054	0.027054	0.035252
Amajuba	0.008716	0.016221	0.012348	0.012348	0.016221
Amajuba	2.478992	4.061875	3.140057	3.140057	4.061875
Amajuba	0.0793	0.141127	0.100447	0.100447	0.141127
Amajuba	0.036223	0.07749	0.051315	0.051315	0.07749
Amajuba	0.142262	0.276955	0.201538	0.201538	0.276955
Amajuba	0.023783	0.036537	0.030126	0.030126	0.036537

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 a water supply footprint) 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 FOOTPRINTS	NO OF FOOTPRINTS WITH SHORT TERM SUPPLY
Dannhauser	137	135
Emadlangeni	86	77
Newcastle	66	54
Amajuba	289	266

6.1 Existing Water and Sanitation Infrastructure

Table 5 - Access to water (households) is a summary of the number of households w supplied by various sources of water within the ADM. The table was obtained from the IDP which was undertaken in 2013.

Water	Households	%
Piped water inside the dwelling	33739	40.5%
Piped water inside the yard	19744	23.7%
Piped water from access point outside the yard	20327	24.4%
Borehole	6024	7.2%
Spring	557	0.7%
Dam/pool	357	0.4%
River/stream	1249	1.5%
Water vendor	156	0.2%
Rain water tank	284	0.3%
Other	870	1.0%
Total	83307	100.0%

Table 5 - Access to water (households)

(Source: IDP 2013 and Stats SA)

6.2 Water and Sanitation Backlogs

Table 6 indicates the total number of households as well as water backlogs within the various local municipalities in the ADM.

Water	Total Households	Backlogs (households)
Newcastle LM	60539	7763
Emadlangeni LM	5740	1938
Dannhauser LM	17027	14213
Total	83306	23914

Table 6 - Water Backlogs

(Source: Eskom study 2011 and Stats SA)

Table 7 indicates the total number of households as well as sanitation backlogs within the various local municipalities in the ADM.

Sanitation	Total Households	Backlogs (households)
Newcastle LM	60539	15740
Emadlangeni LM	5740	4362
Dannhauser LM	17027	3746
Total	83306	23848

Table 7 – Sanitation Backlogs

(Source: IDP 2013 and Stats SA)

7. PROPOSED FUTURE SUPPLY OPTIONS

7.1 Existing proposals for future supply

Figure 6 indicates the spatial location of infrastructure investments or initiatives currently being pursued by the Amajuba District Municipality. Priority areas are indicated on the map, hence these areas are to receive attention so as to ensure backlogs pertaining to water and sanitation are addressed.

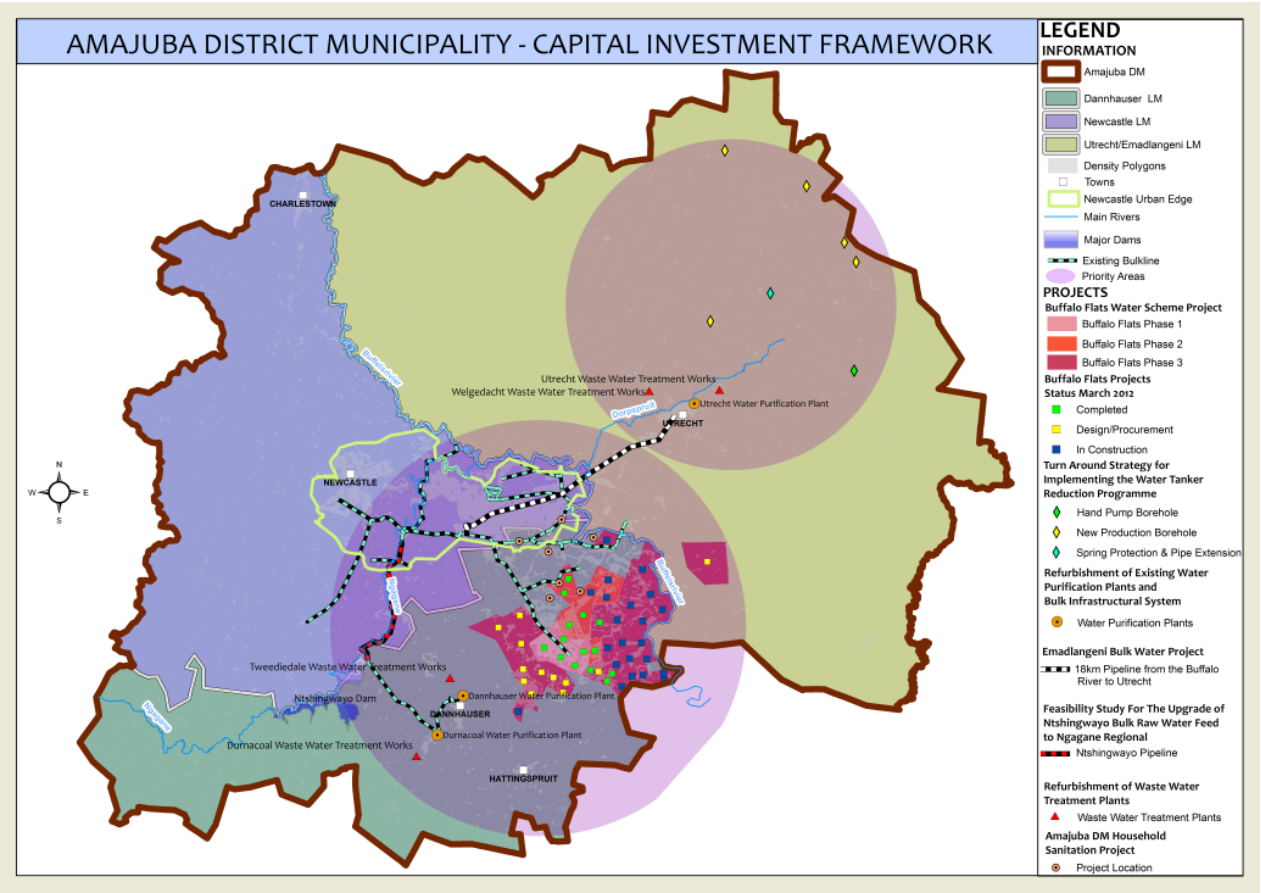


Figure 6 - Spatial Location of Infrastructure Investments
(Source: IDP 2013)

In the Dannhauser Municipal area the bulk infrastructure for Buffalo Flats has been sized for the 25 litres per capita per day. This is considered to be an interim level of service. Reticulation has been sized for the proposed 60 litres per capita per day. In the areas not yet reticulated boreholes are providing water in the interim.

In the Emadlangeni Municipal area water tankers are used to deliver potable water to communities where their water sources are inadequate.

The Master Plan Water Supply report outlines the requirements of the proposed infrastructure in the Dannhasuer Local Municipality regional scheme:

- The upgrading of Ngagane WTW by 5ML/day plus growth for Dannhauser Municpality.
- A new pump station to pump water from Ngagane WTW to a reservoir near Dannhauser.
- A 27 km long rising main from Ngagane WTW to the new reservoir near Dannhauser.
- A new 7.5 ML reservoir near Dannhauser.
- A new 6km long gravity main between the new reservoir near Dannhauser and the existing Dannhauser and Durncol Reservoirs.
- A new 14km long gravity main from the new Reservoir near Dannhauser to the Annieville Reservoir in Buffalo Flats.
- A new 8km long gravity main to Hattingspruit (this main will continue for a further 16 km's on to Dundee).

The Master Plan Water Supply report outlines the requirements of the proposed infrastructure in the Emadlangeni Local Municipality regional scheme:

- The bulk pipelines from Ngagane WTW to Utrecht and the off-take to Amangthungwa and Berouw have been designed and budgeted for. The reticulation to the approximately 637 households in Amangthungwa and 345 households in Berouw must be budgeted for, designed and constructed.

Table 8 indicates the cash flow required to eradicate the water and sanitation backlogs for the next 3 financial years. It also provided an indication of the amount of funds which have been allocated by MIG and MWIG. This information was obtained from the IDP which was undertaken in 2013.

Cash flow required to eradicate the water services backlog within the national target timeframe	**Total Capital Required**	**FY14 15**	**FY15 16 (Estimate)**	**FY16 17 (Estimate)**
Water	R 132 300 000	R 26 002 192	R 26 188 021	R 36 246 593
Sanitation	R 160 000 000	R 34 727 808	R 40 944 813	R 14 766 573
Total	**R 292 300 000**	**R 60 730 000**	**R 67 132 834**	**R 51 013 166**
MIG Allocation	R 222 329 015	R 41 650 000	R 41 625 000	R 41 600 015
MWIG allocation	R 69 700 000	R 19 080 000	R 34 650 000	
Available MIG for water services (At approx 100% of the Total MIG Allocation)	R 257 379 015	R 60 730 000	R 41 625 000	R 41 600 015
TOTAL COMMITTED FUNDING	**R 257 379 015**	**R 60 730 000**	**R 41 625 000**	**R 41 600 015**
Balance of funding allocations	**R -34 920 985**	**R 0**	**R -25 507 834**	**R -9 413 151**

Table 8 - Cash flow required to eradicate water and sanitation backlogs

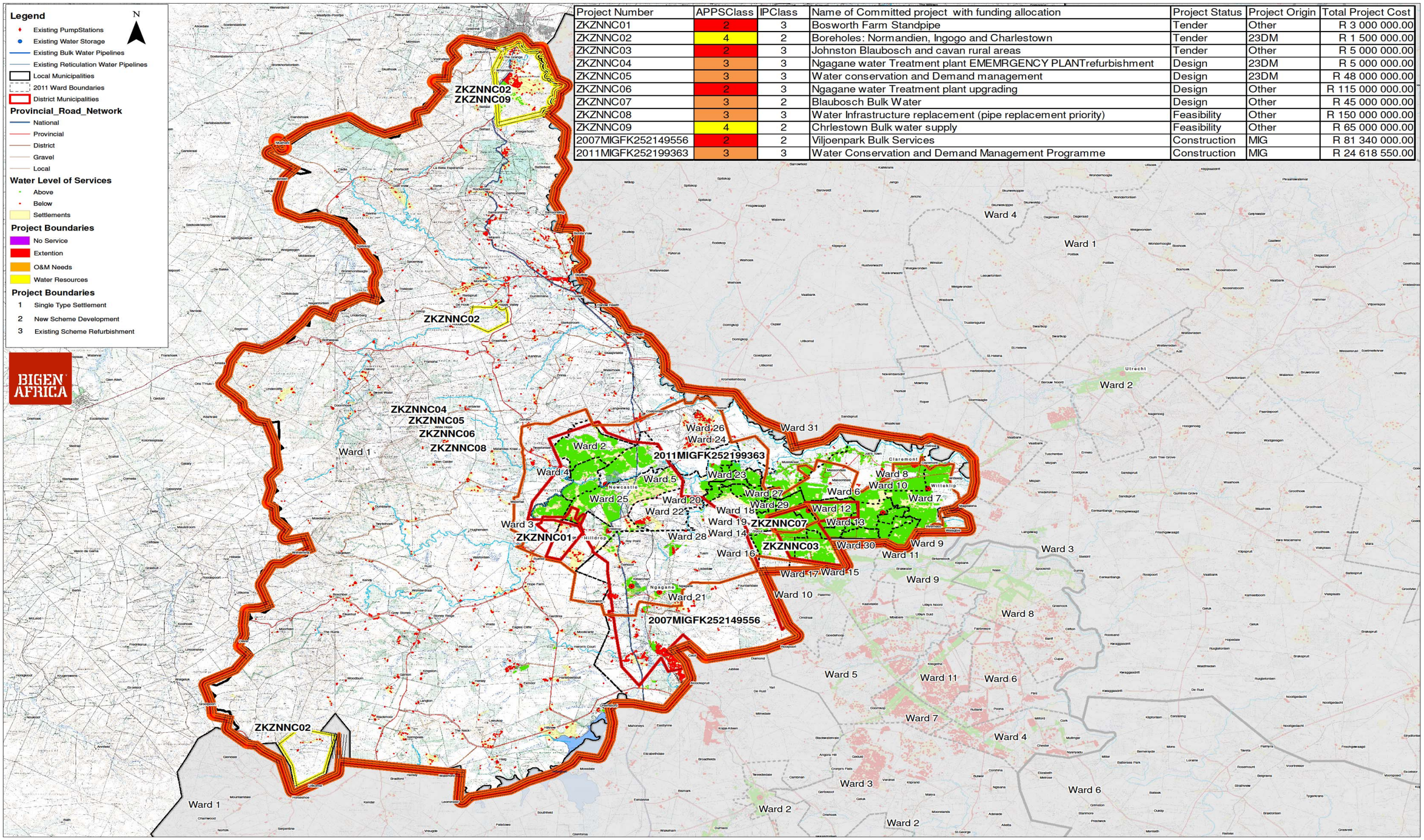
(Source: IDP 2013)

The maps on pages 40-42 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 ADM indicated their proposed water supply schemes. Where possible the concept designs were tied into the ADM's planned network to avoid any duplication of infrastructure and reduce costs.

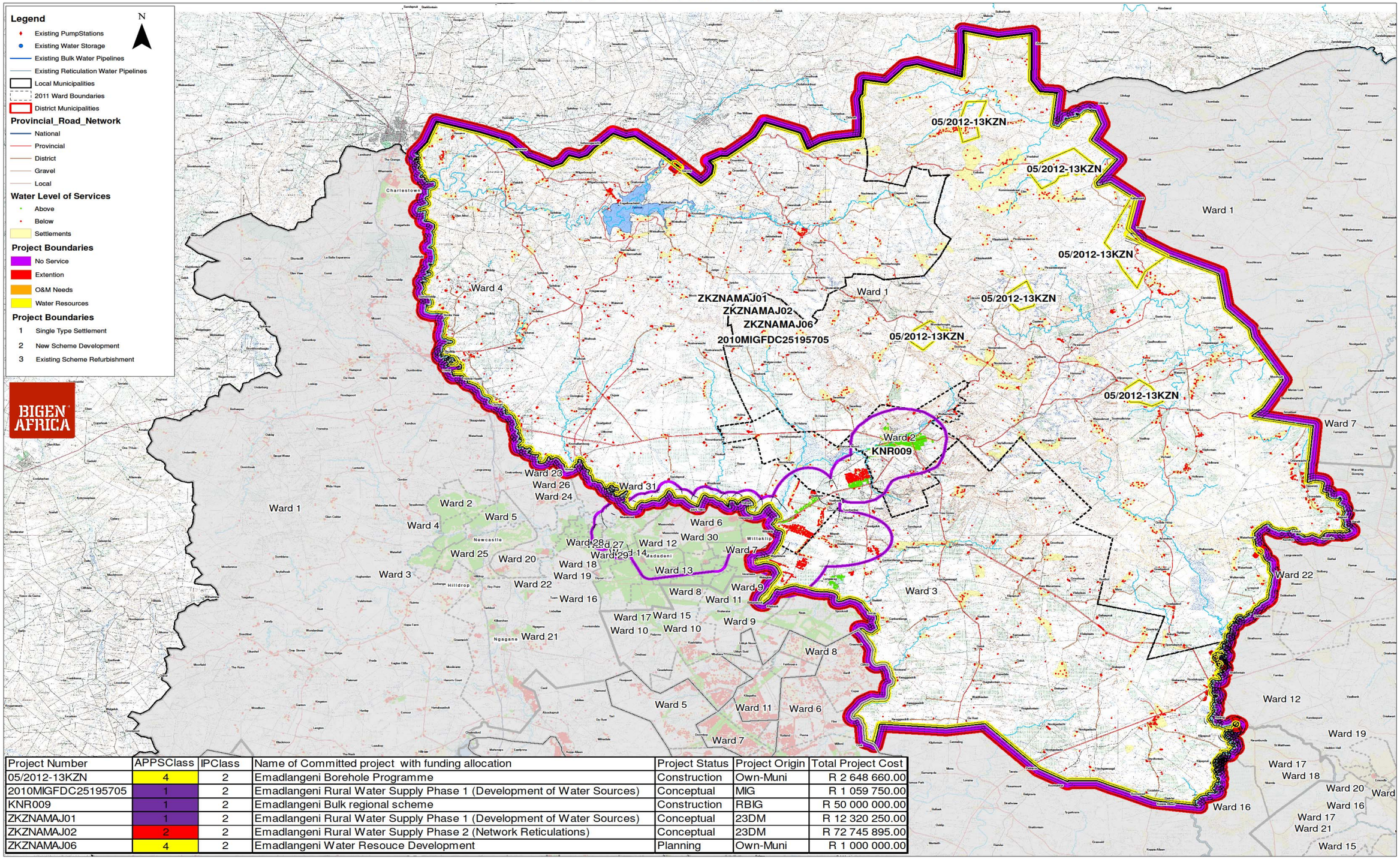
The quantification and pricing undertaken in this report is based on UAP proposals only and does not take into consideration the future infrastructure already planned by the ADM as it is assumed that funding for these proposals have already been secured by ADM.

AMAJUBA - NEWCASTLE



Project Number	APPSClass	IPClass	Name of Committed project with funding allocation	Project Status	Project Origin	Total Project Cost
ZKZNNC01	2	3	Bosworth Farm Standpipe	Tender	Other	R 3 000 000.00
ZKZNNC02	4	2	Boreholes: Normandien, Ingogo and Charlestown	Tender	23DM	R 1 500 000.00
ZKZNNC03	2	3	Johnston Blaubosch and cavan rural areas	Tender	Other	R 5 000 000.00
ZKZNNC04	3	3	Ngagane water Treatment plant EMEMRGENCY PLANTrefurbishment	Design	23DM	R 5 000 000.00
ZKZNNC05	3	3	Water conservation and Demand management	Design	23DM	R 48 000 000.00
ZKZNNC06	2	3	Ngagane water Treatment plant upgrading	Design	Other	R 115 000 000.00
ZKZNNC07	3	2	Blaubosch Bulk Water	Design	Other	R 45 000 000.00
ZKZNNC08	3	3	Water Infrastructure replacement (pipe replacement priority)	Feasibility	Other	R 150 000 000.00
ZKZNNC09	4	2	Chrlestown Bulk water supply	Feasibility	Other	R 65 000 000.00
2007MIGFK252149556	2	2	Viljoenpark Bulk Services	Construction	MIG	R 81 340 000.00
2011MIGFK252199363	3	3	Water Conservation and Demand Management Programme	Construction	MIG	R 24 618 550.00

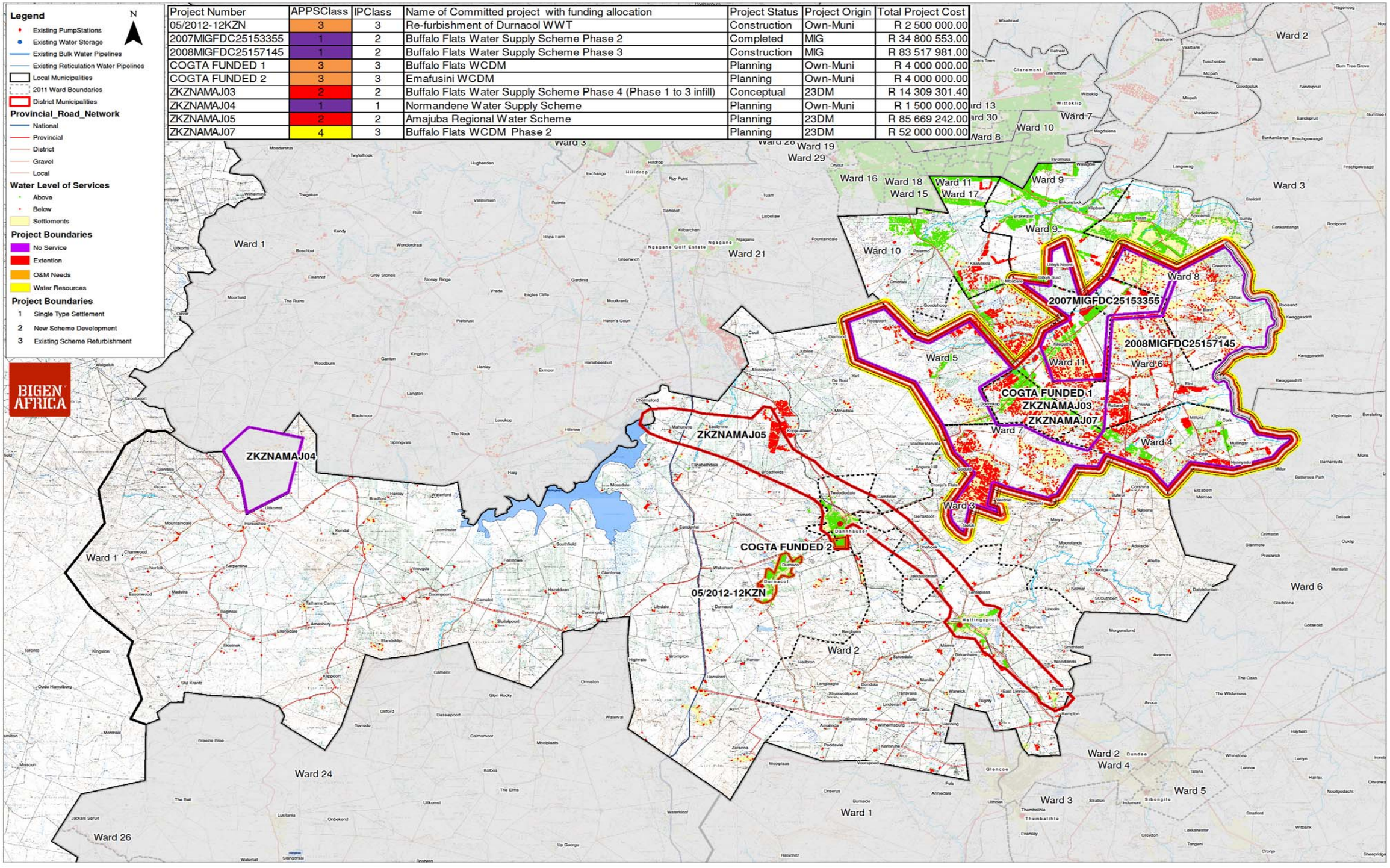
AMAJUBA - EMADLANGENI



Project Number	APPSClass	IPClass	Name of Committed project with funding allocation	Project Status	Project Origin	Total Project Cost
05/2012-13KZN	4	2	Emadlangeni Borehole Programme	Construction	Own-Muni	R 2 648 660.00
2010MIGFDC25195705	1	2	Emadlangeni Rural Water Supply Phase 1 (Development of Water Sources)	Conceptual	MIG	R 1 059 750.00
KNR009	1	2	Emadlangeni Bulk regional scheme	Construction	RBIG	R 50 000 000.00
ZKZNAMAJ01	1	2	Emadlangeni Rural Water Supply Phase 1 (Development of Water Sources)	Conceptual	23DM	R 12 320 250.00
ZKZNAMAJ02	2	2	Emadlangeni Rural Water Supply Phase 2 (Network Reticulations)	Conceptual	23DM	R 72 745 895.00
ZKZNAMAJ06	4	2	Emadlangeni Water Resouce Development	Planning	Own-Muni	R 1 000 000.00

AMAJUBA - DANNHAUSER

Project Number	APPSClass	IPClass	Name of Committed project with funding allocation	Project Status	Project Origin	Total Project Cost
05/2012-12KZN	3	3	Re-furbishment of Durnacol WWT	Construction	Own-Muni	R 2 500 000.00
2007MIGFDC25153355	1	2	Buffalo Flats Water Supply Scheme Phase 2	Completed	MIG	R 34 800 553.00
2008MIGFDC25157145	1	2	Buffalo Flats Water Supply Scheme Phase 3	Construction	MIG	R 83 517 981.00
COGTA FUNDED 1	3	3	Buffalo Flats WCDM	Planning	Own-Muni	R 4 000 000.00
COGTA FUNDED 2	3	3	Emafusini WCDM	Planning	Own-Muni	R 4 000 000.00
ZKZNAMAJ03	2	2	Buffalo Flats Water Supply Scheme Phase 4 (Phase 1 to 3 infill)	Conceptual	23DM	R 14 309 301.40
ZKZNAMAJ04	1	1	Normandene Water Supply Scheme	Planning	Own-Muni	R 1 500 000.00
ZKZNAMAJ05	2	2	Amajuba Regional Water Scheme	Planning	23DM	R 85 669 242.00
ZKZNAMAJ07	4	3	Buffalo Flats WCDM Phase 2	Planning	23DM	R 52 000 000.00



8. DEVELOPMENT OF CONCEPTUAL PLANS

8.1 Design Parameters

MM PDNA undertook the conceptual design for the entire District Municipality and divided this into each Local Municipality. The following assumptions were made in undertaking the conceptual design:

- Water consumptions were based in accordance to the Table 9 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

Table 9 - Water Consumptions

- 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

8.2 Scheme Types

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

- 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.
- Where the existing borehole schemes are indicated but the settlement households are still indicated as un-serviced. It was assumed that there was an issue with the existing boreholes; therefore it was linked to the contiguous water supply schemes. **Error! Reference source not found.** below indicates this principle.

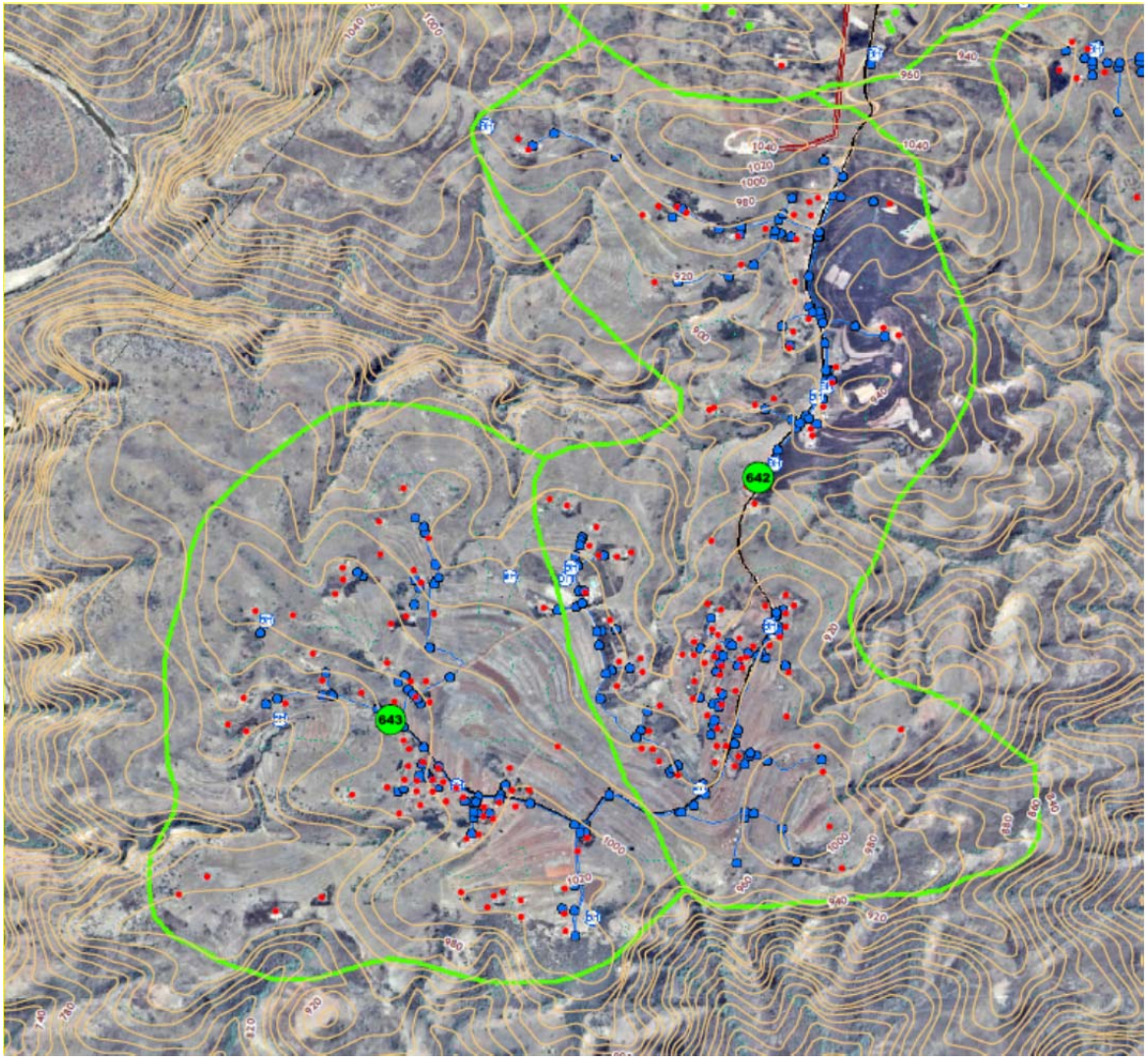


Figure 7 - Existing Borehole Schemes not in operation

8.2.1 Link to existing scheme

Areas currently without supply that are located adjacent to existing water mains could be supplied by extending the existing reticulation to the adjacent, currently unserviced area.

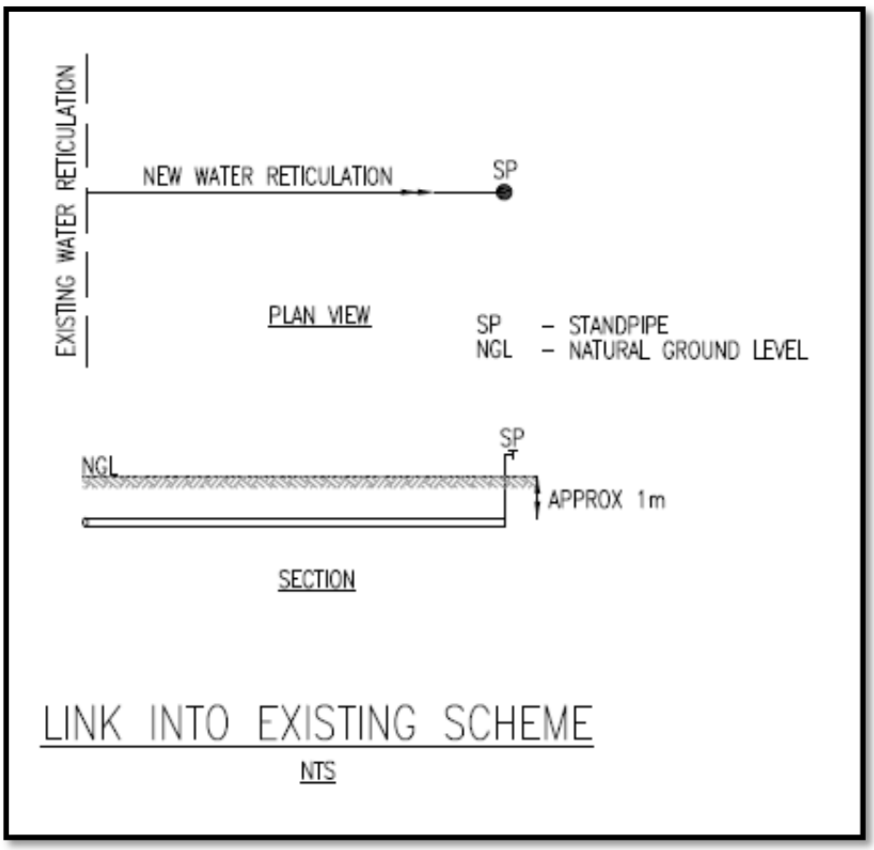
- During the assessment of the reticulation needs for the polygons, it was noted that several of the schemes contain boreholes which are not currently supplying the surrounding households. It was therefore assumed that these particular boreholes are non-functional and as such MM PDNA provided alternative supply sources to these schemes.

  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.

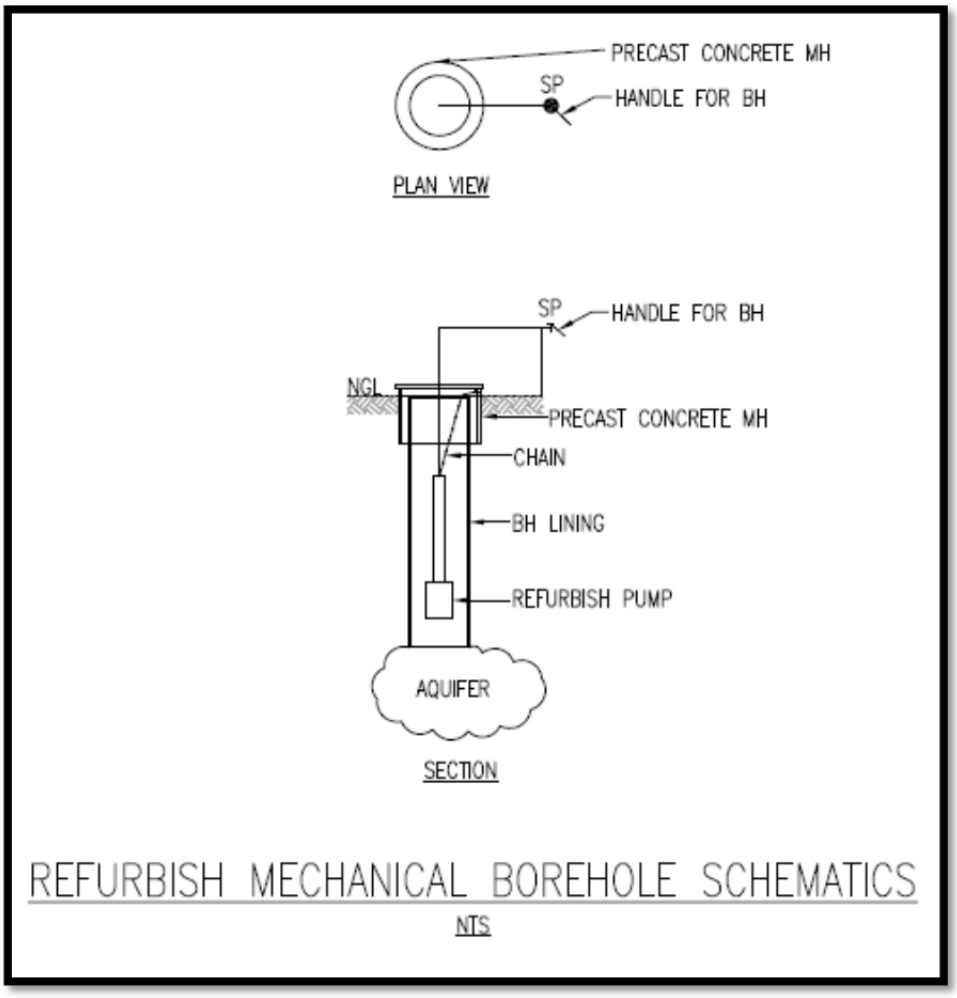
  These households were serviced by undertaking a pumping main from the existing bulk to a new reservoir at a higher elevation where it can be gravity fed to the households. This was deemed to be the cost effective option.

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



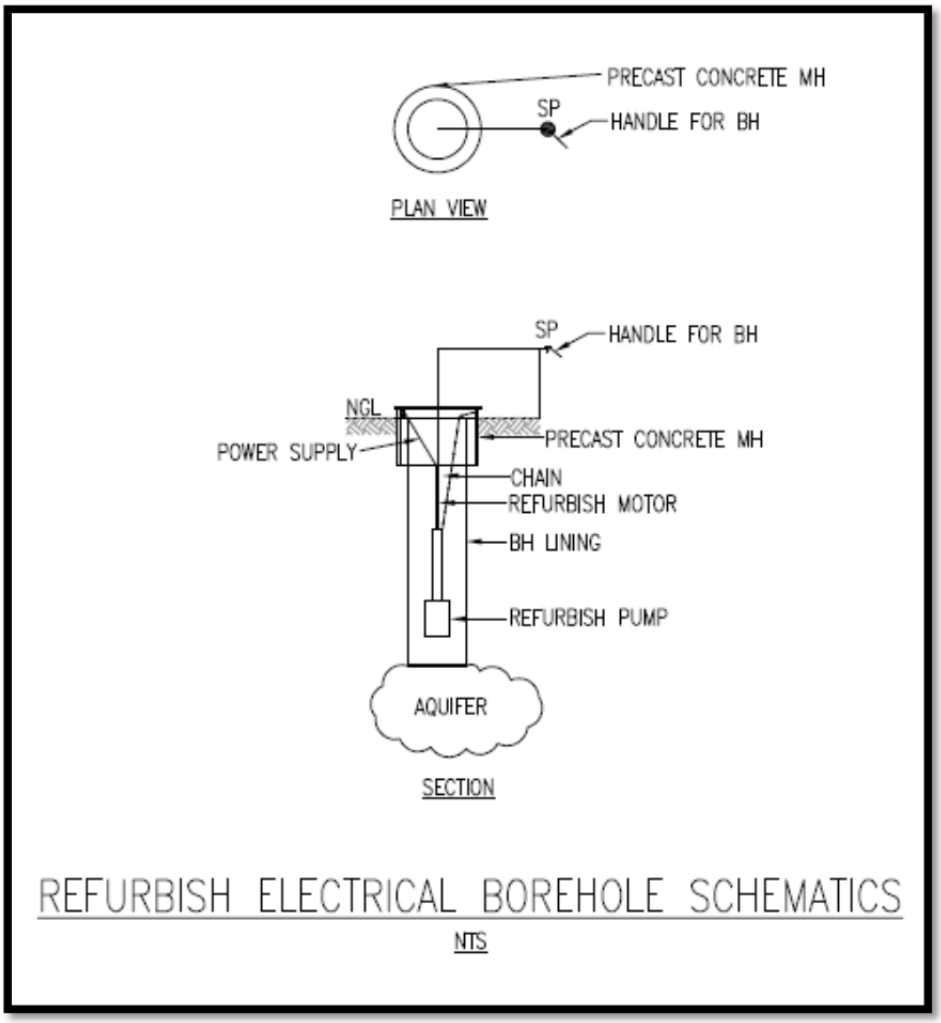
8.2.2 Refurbishment of Mechanical Boreholes

The existing mechanical boreholes that previously supplied water to a community are now defunct as the pumps are no longer functioning. Hence a replacement pump needs to be installed to ensure the continued delivery of water.



8.2.3 Refurbishment of Electrical Boreholes

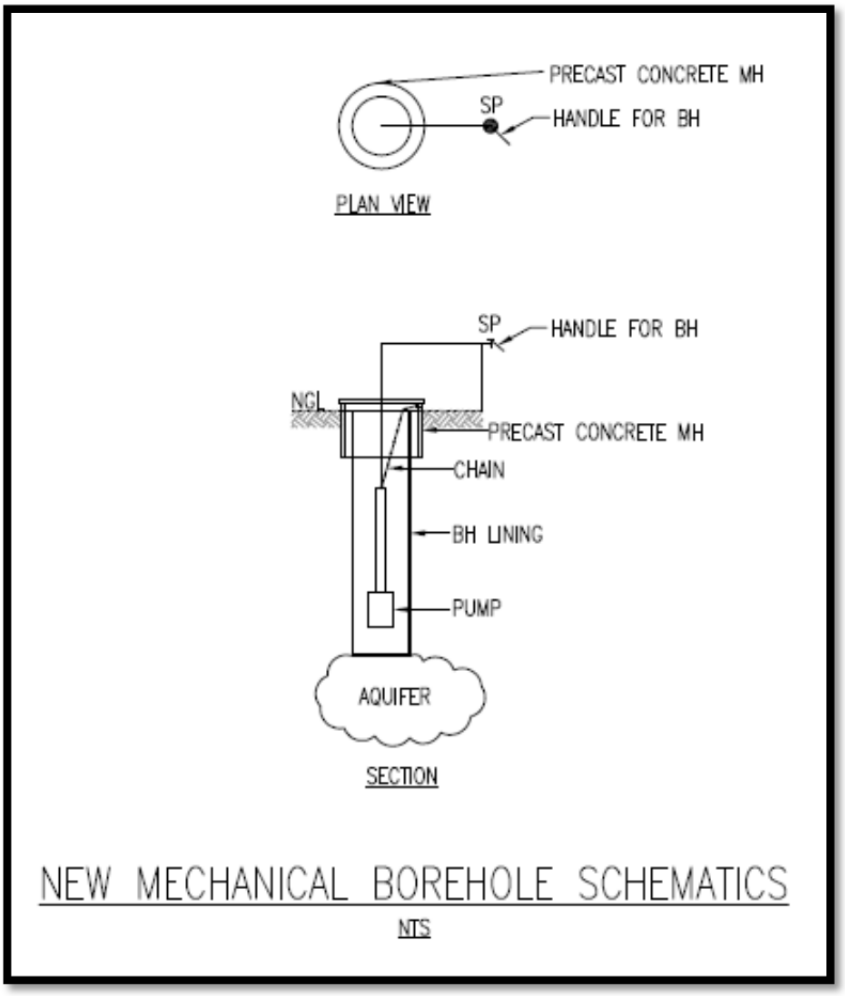
The existing electrical boreholes that previously supplied water to a community are now defunct as the pumps or motors are no longer functioning. Hence replacement pumps or motors need to be installed to ensure the continued delivery of water.



8.2.4 New Mechanical Boreholes

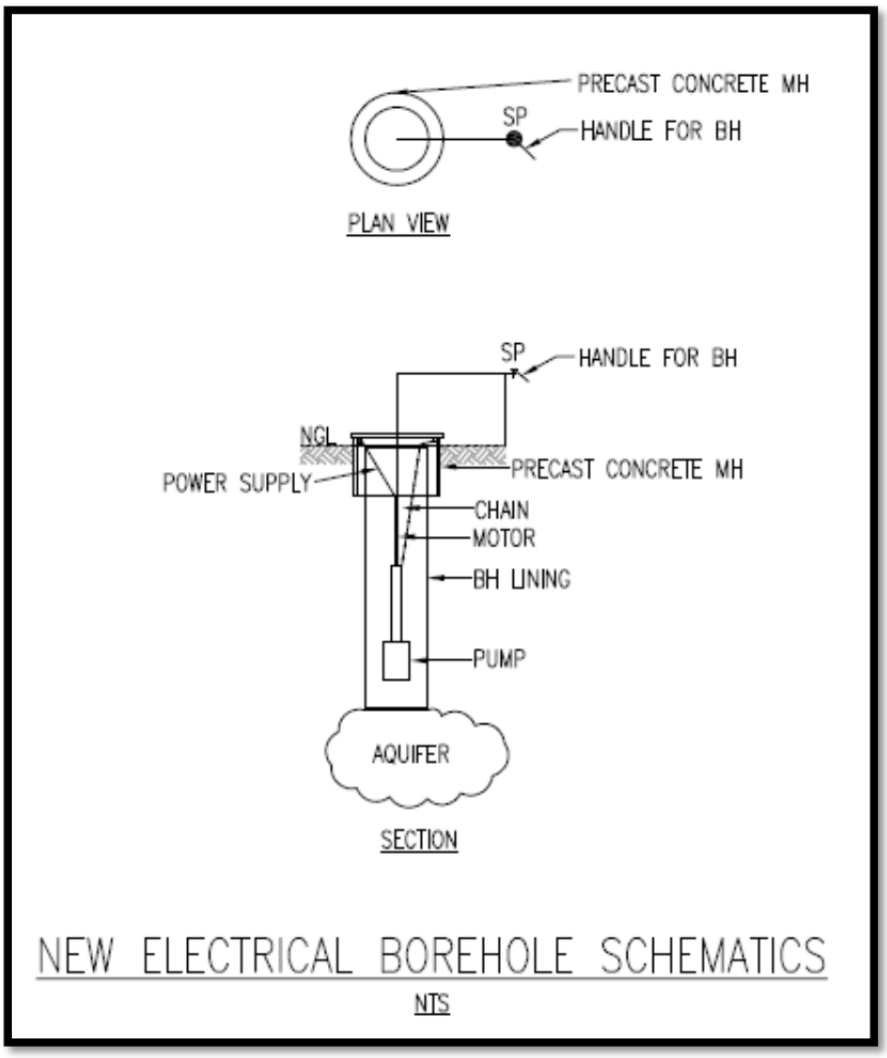
Mechanical boreholes are installed in remote rural areas where there is no available water reticulation and electrical supply.

The view adopted by MM PDNA was, where the population was in the region of 20-30 people mechanical boreholes would be the most cost effective supply of water. The alternative considered to a mechanical borehole system was the installation of a wind powered borehole system.



8.2.5 New Electrical Boreholes

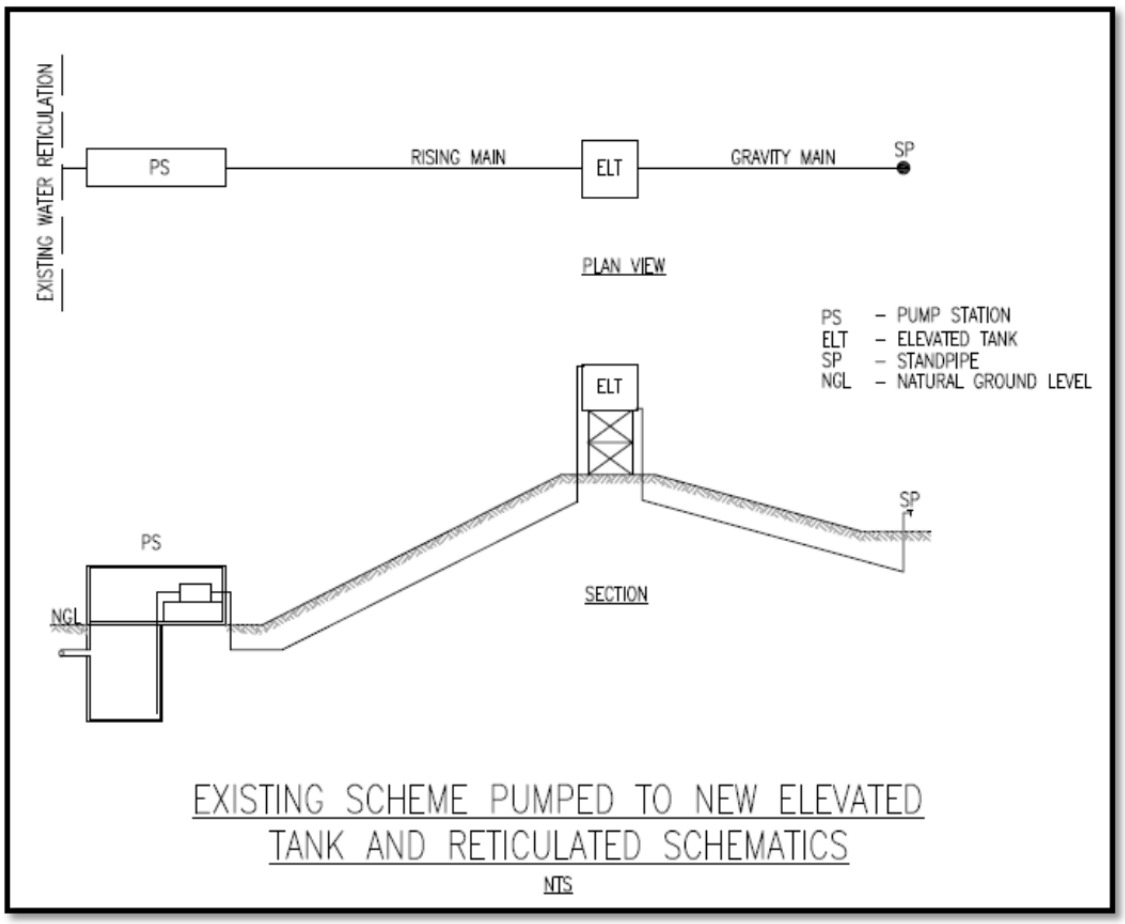
Electrical boreholes are installed in remote rural areas where there is no available water reticulation, but where electrical supply is available.



8.2.6 Existing Scheme Pumped to New Elevated Tank and Reticulated

There are areas at elevations higher than the existing reticulation without supply, which cannot be supplied by the existing reticulation due to the height difference.

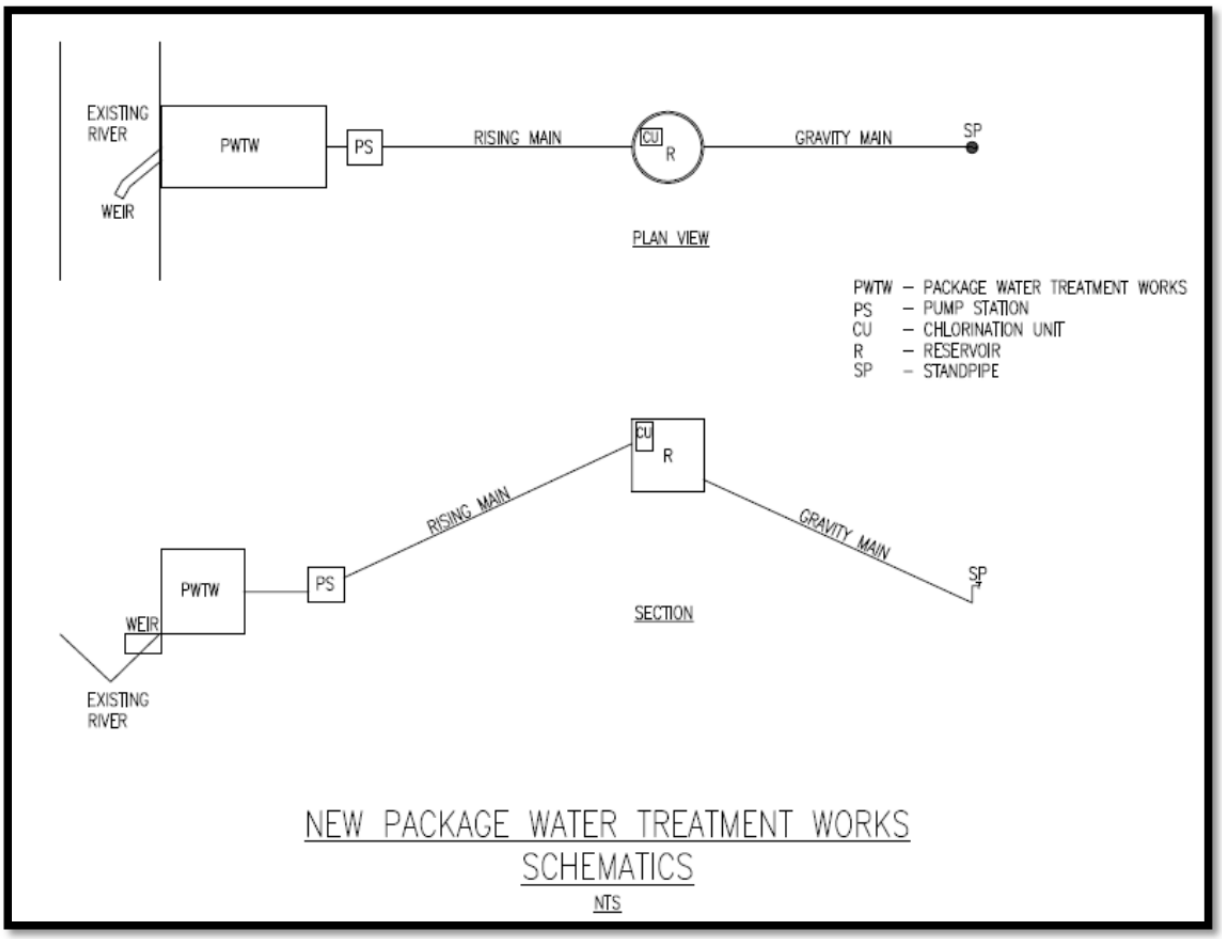
This alternative proposes to supply the houses at these higher elevations by obtaining water from the existing mains and installing a wet well and a pump station as well as an elevated reservoir.



8.2.7 New Package Water Treatment Works

Areas which are located close to a river source can be supplied by a containerized package treatment plant, which could abstract water from the river.

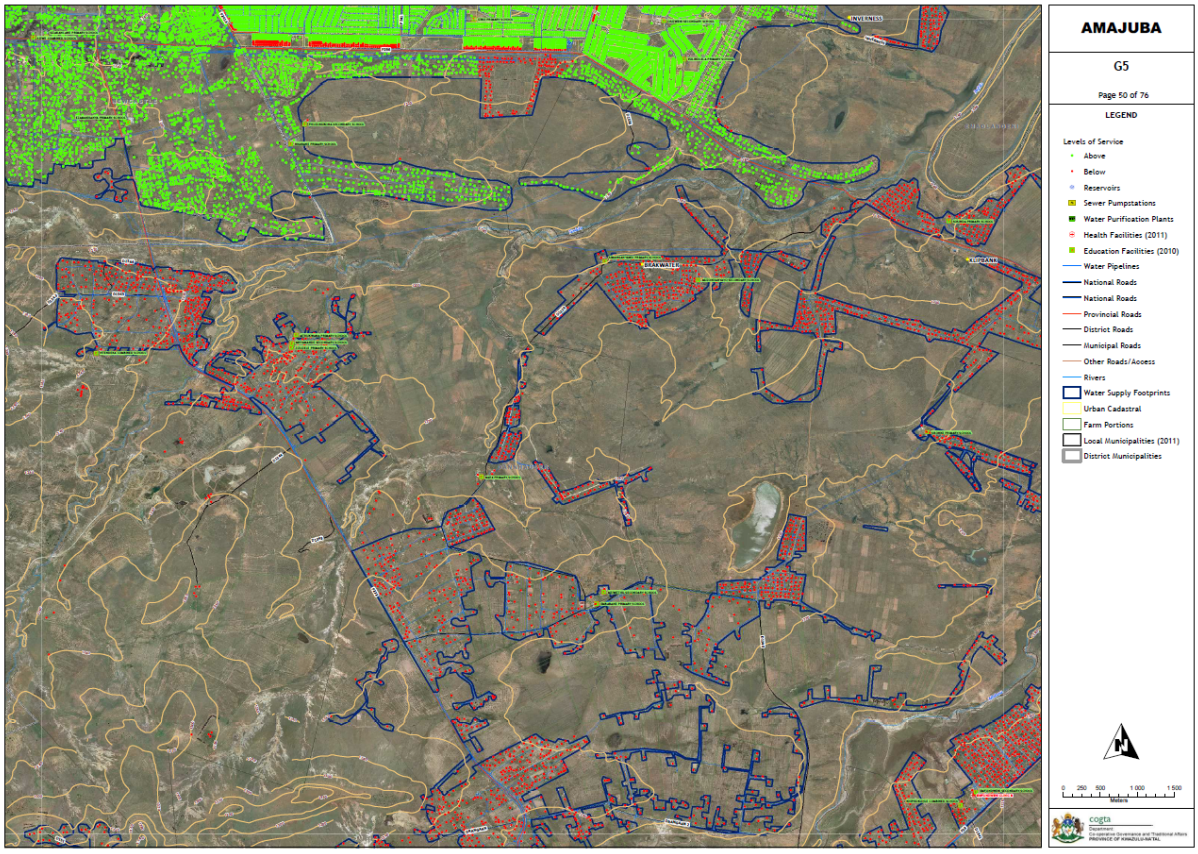
This alternative proposes to abstract water from the river through the package plant which has flocculation units, clarification units and filtration units. The water would then be pumped via a pump station to the storage reservoir which will require a chlorination unit to be installed.


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

8.3 Description and Mapping of Supply Schemes

Concept layouts of the proposed infrastructure have been included in the GIS database. The names and costs of the schemes are indicated in the tables in section 8.4. These tables refer to individual water supply footprints and have been indicated on the aforementioned database. A detailed description of the geodatabase is continued in section 9 of the report.

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

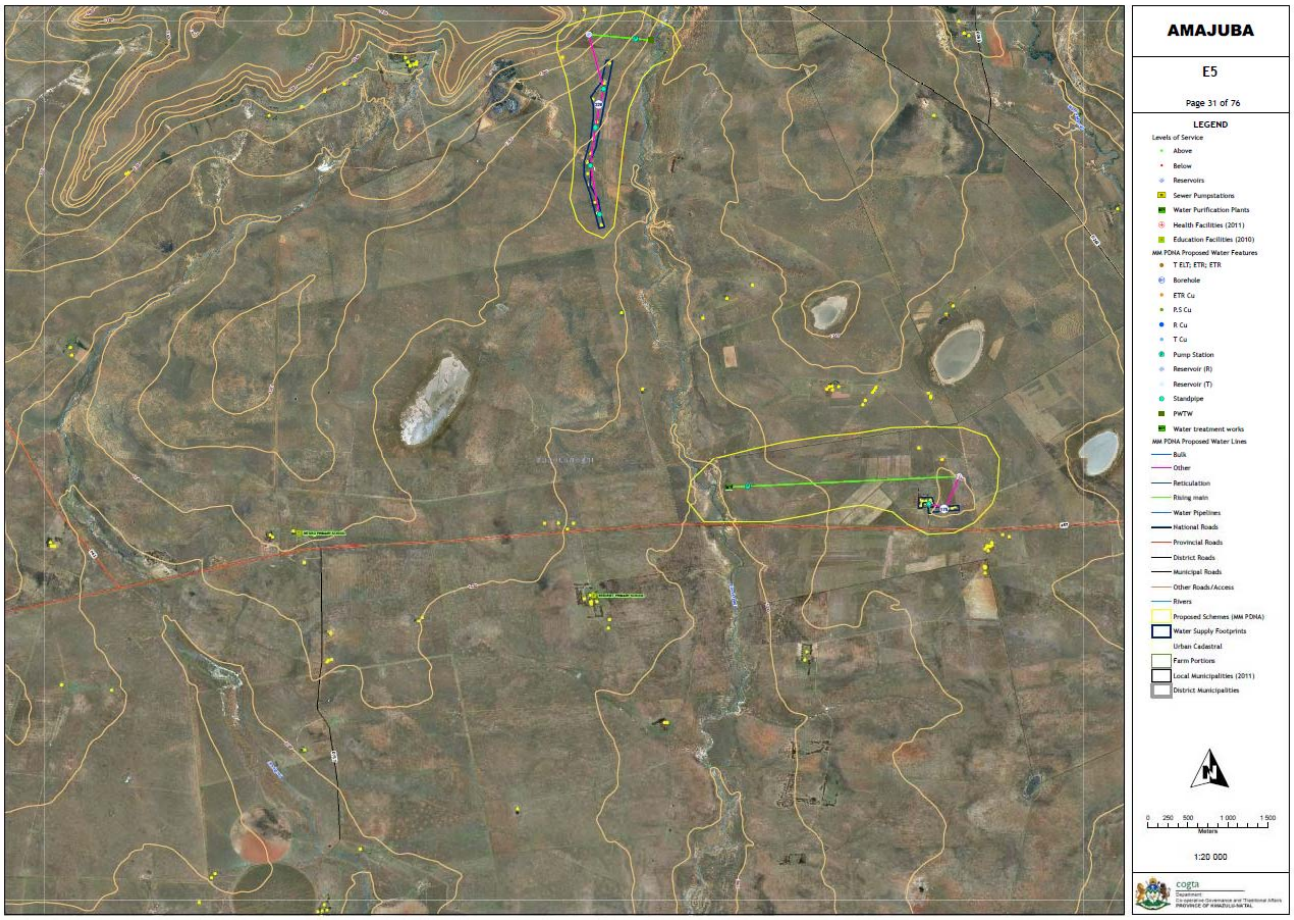


Map 7 – Example of map series sheet

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, as well as between the adjacent district municipalities in our project area, namely Zululand to the east and Uthukela to the south. 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

8.4 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

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
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

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

8.4.1 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
B3-1	R 31 480 100

B3 – 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 are based on providing a UAP service only. The upgrading of existing works or rehabilitation of existing water infrastructure have not been included in the cost estimates. The estimates exclude all operational 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, it was proposed that these houses be supplied with standpipes by connecting into the existing water reticulation infrastructure.

8.4.1.1 Newcastle Local Municipality

Scheme Name	Cost
Link to existing	
B3-1	R 31 480 100
C3-1	R 9 939 259
F3-1	R 4 440 921
F3-2	R 852 705
F3-4	R 1 955 232
F3-5	R 3 471 564
F3-6	R 5 116 776
F4-1	R 4 292 026
F4-2	R 14 370 810
F5-1	R 5 542 018
G2-1	R 18 195 344
G3-1	R 29 137 588
G4-1	R 11 465 598
H3-1	R 23 556 224
H3-2	R 2 643 954
H3-3	R 1 266 510

H4-1	R 2 782 842
TOTAL	**R 170 509 470**

8.4.1.2 Emadlangeni Local Municipality

Scheme Name	Cost
Link to existing	
E6-1	R 12 217 331
E6-2	R 13 508 891
E7-1	R 6 976 754
F6-1	R 60 873 118
F6-2	R 21 107 704
TOTAL	**R 114 683 798**

8.4.1.3 Dannhauser Local Municipality

Scheme Name	Cost
Link to existing	
G5-1	R 13 812 399
G5-2	R 6 090 422
G6-1	R 2 918 871
H4-1	R 4 157 426
H4-2	R 12 971 923
H5-1	R 101 176 928
H6-1	R 39 615 881
I4-1	R 11 173 526
I5-1	R 4 018 538
J5-1	R 4 161 715
TOTAL	R 200 097 630

Summary of short term supply

Municipality	Total Cost
Newcastle	R 170 509 470
Emadlangeni	R 114 683 798
Dannhauser	R 200 097 630
TOTAL	**R 485 290 897**

8.4.2 Proposed Long Term Supply Schemes

8.4.2.1 Newcastle Local Municipality

Scheme Name	Cost	Total
Small Package Plant		**R 95 307 226**
D3-1	R 95 307 226	
New Borehole electronically operated		**R 42 103 421**
C2-1	R 3 630 781	
D2-1	R 4 458 391	
E2-1	R 3 148 247	
E3-1	R 3 216 976	
E3-2	R 3 493 323	
E3-3	R 3 907 128	
E3-4	R 3 216 976	
F2-1	R 12 569 870	
H1-1	R 2 781 412	
H2-1	R 1 680 315	
TOTAL		**R 137 410 647**

Cost per capita = R 6 611

8.4.2.2 Emadlangeni Local Municipality

Scheme Name	Cost	Total
New Borehole electronically operated		**R 259 140 479**
A7-1	R 4 044 586	
B7-2	R 4 734 738	
C4-1	R 4 250 774	
C4-2	R 6 591 857	
C6-1	R 5 698 377	
C8-1	R 10 725 617	
C8-2	R 5 214 413	
C8-3	R 6 243 922	
D7-1	R 5 076 954	
D7-2	R 6 384 239	
D8-1	R 3 905 698	
D8-2	R 3 355 865	
D8-3	R 5 696 947	
D8-4	R 4 320 933	
D9-1	R 24 282 431	
E4-1	R 10 439 264	
E5-1	R 3 424 594	
E5-2	R 5 420 601	

E8-1	R 3 285 706	
E8-2	R 14 016 043	
E9-1	R 8 858 492	
E9-2	R 17 190 454	
F7-1	R 5 560 918	
F7-2	R 10 444 982	
F8-1	R 44 003 432	
F10-1	R 3 424 594	
G7-1	R 8 516 275	
G8-1	R 5 696 947	
G8-2	R 4 869 337	
H8-1	R 7 558 355	
H9-1	R 5 903 135	
New Borehole electronically operated with storage		**R 25 013 994**
B7-1	R 25 013 994	
TOTAL		**R 284 154 473**

Cost per capita = R 34 300

8.4.2.3 Dannhauser Local Municipality

Scheme Name	Cost	Total
New Borehole electronically operated		**R 20 166 071**
I1-1	R 4 939 496	
I3-1	R 3 079 518	
J2-1	R 3 975 857	
J4-1	R 8 171 199	
TOTAL		**R 20 166 071**

Cost per capita = R 2 583

Summary of long term supply

Municipality	Total Cost
Newcastle	R 137 410 647
Emadlangeni	R 284 154 473
Dannhauser	R 20 166 071
Total	**R 441 731 191**

8.5 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 Newcastle Local Municipality.

Scheme Name	Cost
Link to existing	
B3-1	R 31 480 100
C3-1	R 9 939 259
F3-1	R 4 440 921
F3-2	R 852 705
F3-4	R 1 955 232
F3-5	R 3 471 564
F3-6	R 5 116 776
F4-1	R 4 292 026
F4-2	R 14 370 810
F5-1	R 5 542 018
G2-1	R 18 195 344
G3-1	R 29 137 588
G4-1	R 11 465 598
H3-1	R 23 556 224
H3-2	R 2 643 954
H3-3	R 1 266 510
H4-1	R 2 782 842
Total	**R 170 509 470**

The total number of schemes is 17.

The total cost of the 17 schemes is R 170 509 470.

The average cost per scheme is R 170 509 470 / 17 = R 10 029 969.

To phase scheme B3-1 which costs R 31 480 100, is R 31 480 100 / R 10 029 969 = 3.0, hence scheme B1-2 is phased to be undertaken in three years.

To phase scheme H3-2 which costs R 2 643 954, is R 2 643 954 / R 10 029 969 = 0.3, hence scheme H3-2 is phased over one year.

The phasing of the schemes is indicated in Table 10.

Implementation Year	LM	Total Cost
2015/16	Newcastle	R 192 980 990
	Emadlageni	R 238 472 793
	Dannhauser	R 71 299 691
		R 502 753 474

Implementation Year	LM	Total Cost
2016/17	Newcastle	R 41 751 569
	Emadlageni	R 31 206 497
	Dannhauser	R 47 787 081
		R 120 745 147

Implementation Year	LM	Total Cost
2017/18	Newcastle	R 73 187 558
	Emadlageni	R 85 155 549
		R 158 343 107

Implementation Year	LM	Total Cost
2018/19	Emadlageni	R 44 003 432
	Dannhauser	R 101 176 928
		R 145 180 360

Table 10 - 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 demand and costed water supply 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.

A detailed list of all the datasets, along with their metadata can be found in Appendix A.
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 has also been prepared and exported to pdf and 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 Amajuba 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 23914 households in the Amajuba District Municipality.

Amajuba DM	
Scheme Type	**Total**
Link to Existing Scheme	R 485 290 897
Small Package Plants	R 95 307 226
Boreholes electronically operated with Storage	R 25 013 994
New boreholes electronically operated	R 321 409 971
TOTAL	**R 927 022 088**

10.2 Total cost of phases of schemes in the Amajuba 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 8.5 of the report.

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

Implementation Year	LM	Total Cost
2015/16	Newcastle	R 192 980 990
	Emadlageni	R 238 472 793
	Dannhauser	R 71 299 691
		R 502 753 474

Implementation Year	LM	Total Cost
2016/17	Newcastle	R 41 751 569
	Emadlageni	R 31 206 497
	Dannhauser	R 47 787 081
		R 120 745 147

Implementation Year	LM	Total Cost
2017/18	Newcastle	R 73 187 558
	Emadlageni	R 85 155 549
		R 158 343 107

Implementation Year	LM	Total Cost
2018/19	Emadlageni	R 44 003 432
	Dannhauser	R 101 176 928
		R 145 180 360

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**
Newcastle	R 170 509 470
Emadlangeni	R 114 683 798
Dannhauser	R 200 097 630
Total	**R 485 290 897**

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 water supply 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

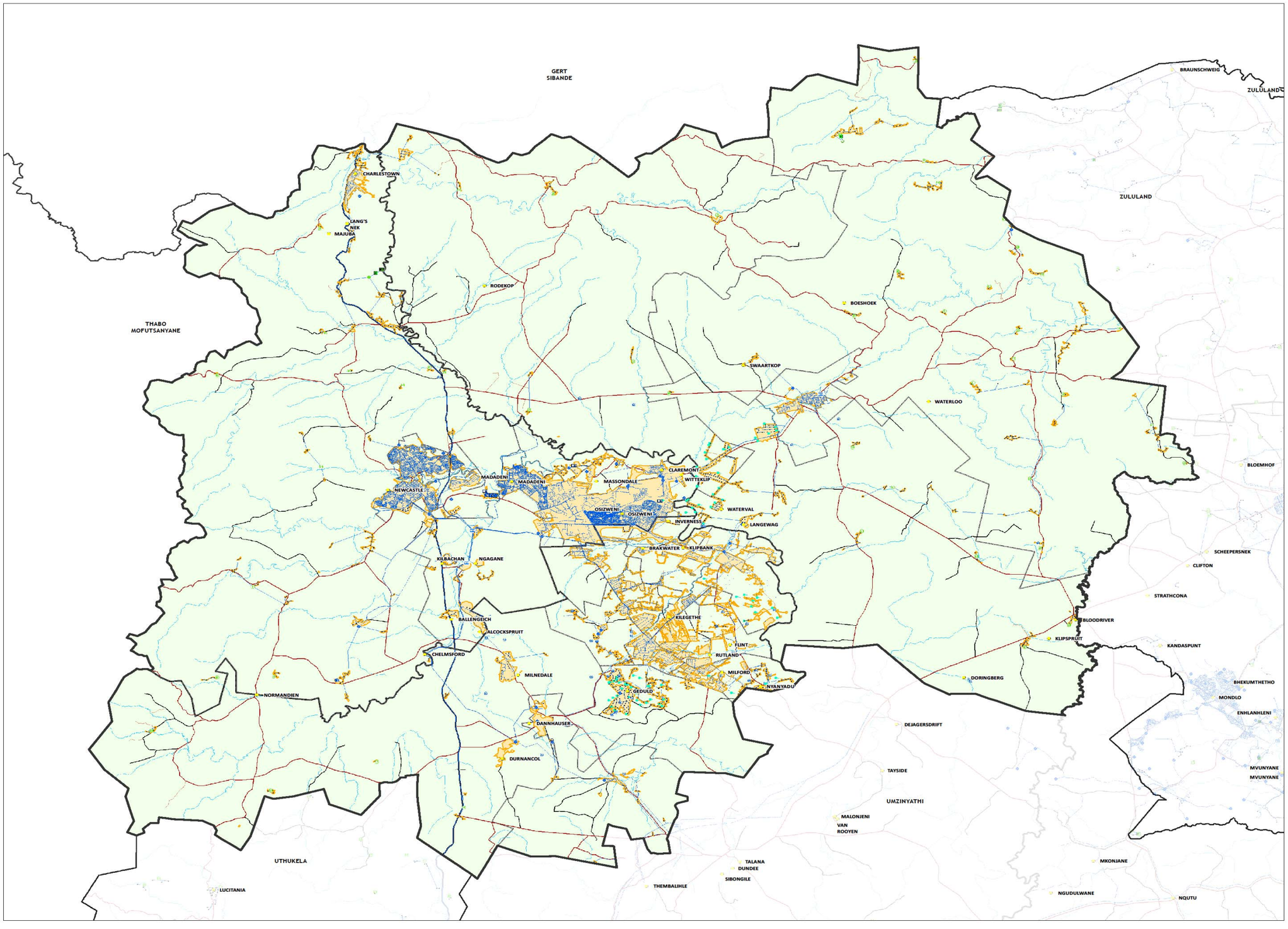
- All water infrastructure data and the water supply footprints plotted on A1 maps at 1:20 000 scale
- Engineers produced concept designs hand drawn onto these maps
- Hard copy maps then scanned and georeferenced
- Concept designs digitized off the georeferenced scans

- 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



AMAJUBA DISTRICT MUNICIPALITY

ALL WATER INFRASTRUCTURE

LEGEND

- Place Namos

Conceptual Design (Features)

- Boroholo
- Rosorvoir/Tank with Chlorination Unit
- Elovated Tank
- Wator Troatmont Works
- Pump Station
- Rosorvoir
- Standpipo
- Pumps
- Rosorvoirs
- Wator Troatmont Works
- Wasto Wator Troatmont Works

Supply Source

- Boroholo
- Dam
- Rivor
- Spring
- Existing and Plannod Pipolinos

Conceptual Design (Pipelines)

- Roticulation
- Rising Main
- Major Rivors
- Minor Rivors

Roads

- National Roads
- Provincial Roads
- District Roads
- Municipal Roads
- Othor Roads/Accoss
- Wator Domand Aroas
- Wards
- Amajuba District Municipality
- Local Municipalitios (2011)
- District Municipalitios (2011)

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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.

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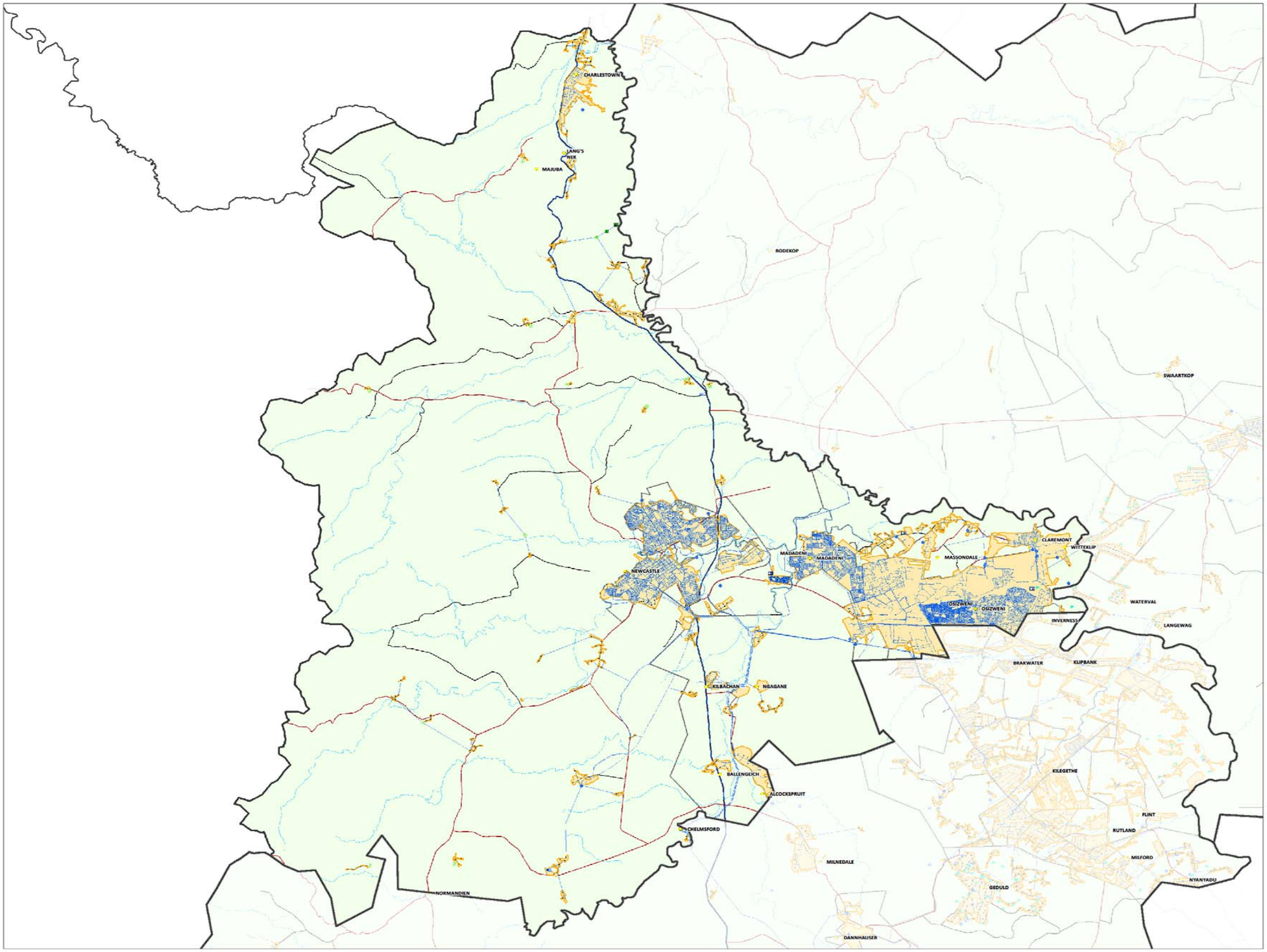

NEWCASTLE LOCAL MUNICIPALITY

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
- Amajuba District Municipality
- Local Municipalities (2011)
- District Municipalities (2011)

N

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Kilometres

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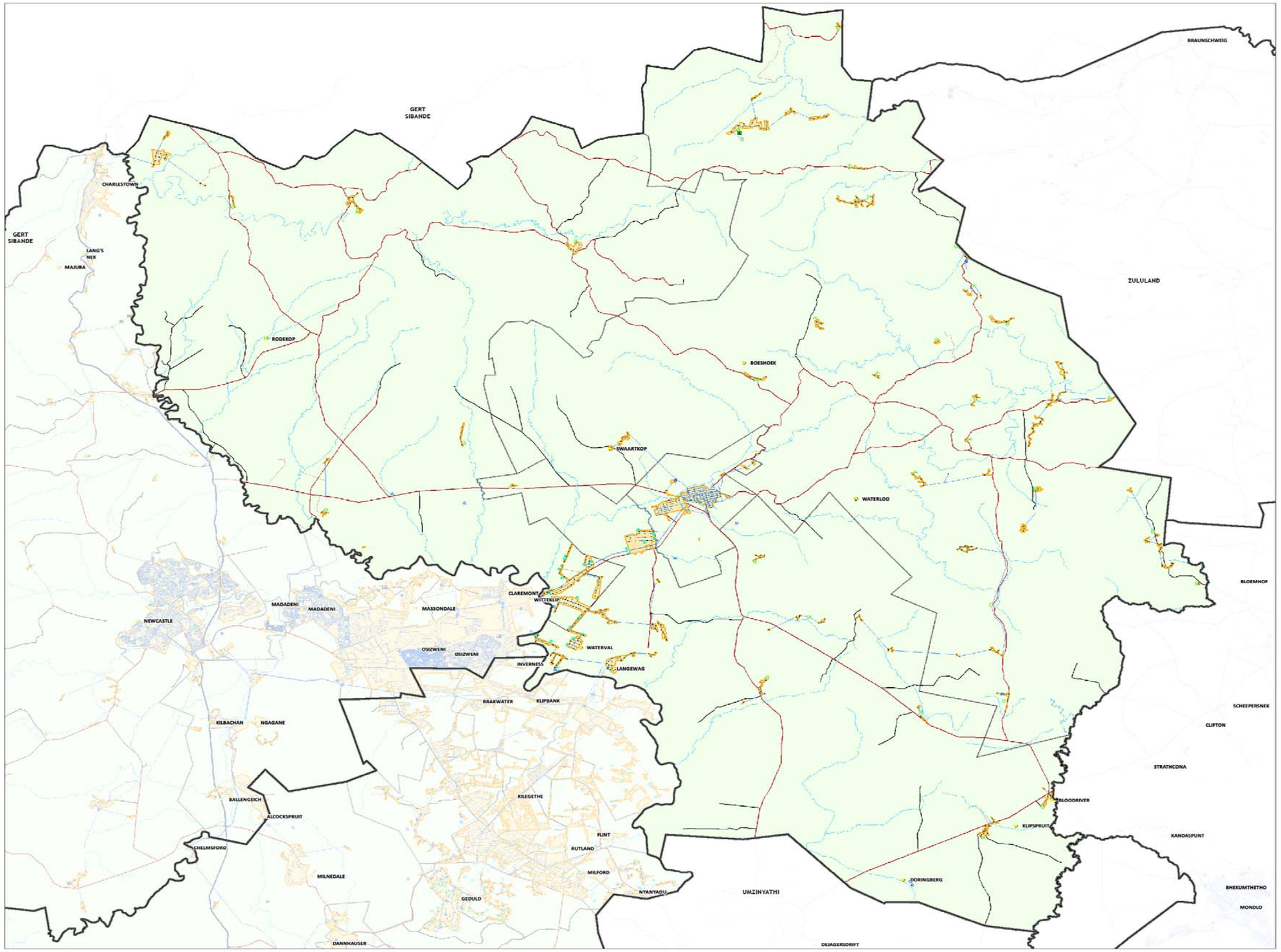

EMADLANGENI LOCAL MUNICIPALITY

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
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- Wards
- Amajuba District Municipality
- Local Municipalities (2011)
- District Municipalities (2011)

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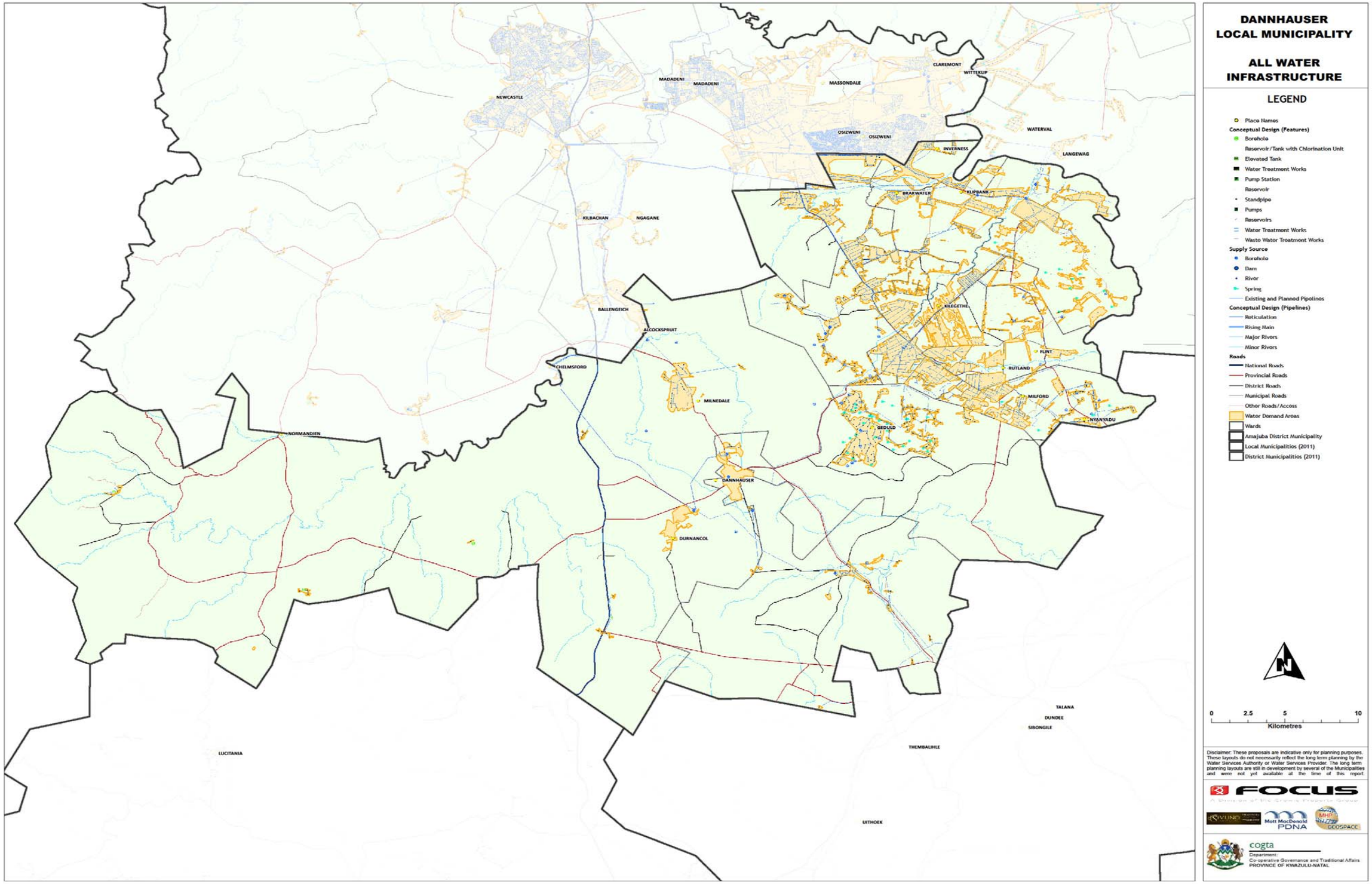

DANNHAUSER LOCAL MUNICIPALITY

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
- Amajuba District Municipality
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Kilometres

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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 Amajuba District Municipality under the direction and review from COGTA and Umgeni Water.

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