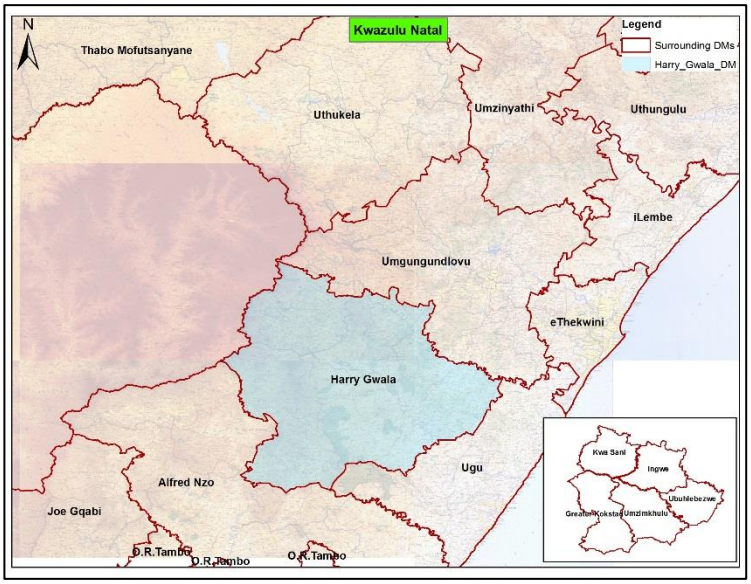
Umgeni Water

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

REPORT

HARRY GWALA DISTRICT MUNICIPALITY

CONTRACT NO. 2015/178



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LIST OF ABBREVIATIONS

AADD	Average Annual Daily Demand
Ave.	Average
CoGTA	Department of Cooperative Governance and Traditional Affairs
DM	District Municipality
DMA	District Management Area
DWS	Department of Water and Sanitation
GIS	Geographical Information System
GRIP	Groundwater Research Information Project
HGDM	Harry Gwala District Municipality
HFY	Historical Firm Yield
IDP	Integrated Development Plan
KZN	KwaZulu-Natal
l/c/d	Litres per capita per day
LM	Local Municipality
LoS	Level of Service
Max.	Maximum
Min.	Minimum

m^3	Cubic meters
Mcm	Million Cubic Meters
Mcm/a	Million Cubic Meters per Annum
PSP	Professional Service Provider
RDP	Reconstruction and Development Plan
RF	Reference Framework
TBD	To be Determined
UAP	Universal Access Plan
UW	Umgeni Water
WARMS	Water Authorisation and Registration Management System
WSA	Water Service Authority
WSDP	Water Services Development Plan
WSP	Water Service Provider
WSS	Water Supply Scheme
WTW	Water Treatment Works

EXECUTIVE SUMMARY

This report presents findings of the study: Universal Access Plan Phase 2 – Progressive Development of a Regional Concept Plan for Harry Gwala District Municipality.

The Harry Gwala District Municipality (HGDM) is located in the south western corner of KwaZulu-Natal and covers an area of 11 132 square kilometres.

To the south and west the District Municipality borders the Eastern Cape, then follows the Lesotho border northwards to the point where it meets the KZDMA43 boundary and follows the boundary to Giants Castle. The boundary then follows the southern boundaries of the uThukela and uMgungundlovu District Municipalities in an easterly direction until it meets the Ugu District Municipality border where it turns southwards following the western Ugu DM boundary up to the Eastern Cape border.

Harry Gwala District Municipality's estimated population is 461 423 people (Statistics South Africa Census, 2011). The majority of the population in the Harry Gwala District is located in the Ingwe (Creighton), Ubuhlebezwe (Ixopo) and Umzimkhulu Local Municipalities which are mainly in tribal areas and on commercial farms, representing 82.5 percent of the total population combined. Populations in the other two Local Municipalities (Greater Kokstad and KwaSani) are mainly located in urban areas and on commercial farms. The long term water demand for the Harry Gwala District Municipality is estimated at **95.23 Mℓ/day.**

In this UAP Phase 2 study, the entire HGDM was broken down into bulk supply zones 24 Bulk Supply Zones. These zones were developed using topography, settlement densities, and footprints of existing water supply schemes. Command reservoirs were positioned in each supply zone to allow for maximum supply via gravity to settlements or to tie into existing bulk schemes.

Apart from abstractions from localised sources such as rivers and dams for major towns such as Ixopo, Underberg, Bulwer and Umzimkhulu, there are a number of smaller stand alones schemes that supply communities in HGDM.

The only regional scheme of significance currently in implementation that covers sections of Ingwe and Ubuhlebezwe LM's is the Greater Bulwer Donnybrook Regional Scheme. This scheme covers Zones 15 to 19 of UAP Phase 2 and will distribute to the scheme area as far as Ixopo. The scheme will abstract and treat water from the proposed Bulwer Dam that will yield 8.4 Mℓ/day and the Comrie Dam that currently yields 2.33 Mℓ/day and has the potential to yield 3.73 Mℓ/day if the dam wall is raised by 4 meters. (DWA, 2015)

The Greater Bulwer Donnybrook Regional Scheme itself has been divided into 5 Zones that are being implemented in phases. The final phase is due for completion in 2021.

In this UAP Phase 2 study, options of augmenting water supply to Bulwer Dam in order to allow the Greater Bulwer Donnybrook Scheme footprint to be expanded to supply the entire Ingwe and Ubuhlebezwe LM's were investigated. These options included the following:

- Raw water transfer from the proposed Smithfield Dam to Bulwer Dam. This option requires pumping for a static lift of approximately 600m. Due to the high capital and operation and maintenance costs, this option is not recommended.
- Raw water transfer from the future Impendle Dam. This option also requires high pumping lifts and is thus not recommended.
- Raw water transfer from the possible New Biggin Dam on the Mzimkhulu River to Bulwer Dam. This option is recommended for further investigation.
- Dam and raw water transfer from the Pholela River to Bulwer Dam. From the hydrological investigations, it was determined that a 2.04Mcm storage (35m high wall) on the Pholela River would yield be 12.7 Mℓ/day. A 250m static lift is required to pump water from this dam to the U10F quaternary catchment that Bulwer Dam is positioned in. An upgrade of the Bulwer Dam WTP to 21 Mℓ/day and a bulk distribution network along the R617 and R612 will enable bulk water supply to the Ingwe and Ubuhlebezwe LM's. Details of this Option are presented in Section 7.3.1.2. & 7.3.2.2. This Option is recommended for further investigation.

Other investigations to supply the Kwa Sani (Underberg), Umzimkhulu Ingwe and uBuhlebezwe LM's include:

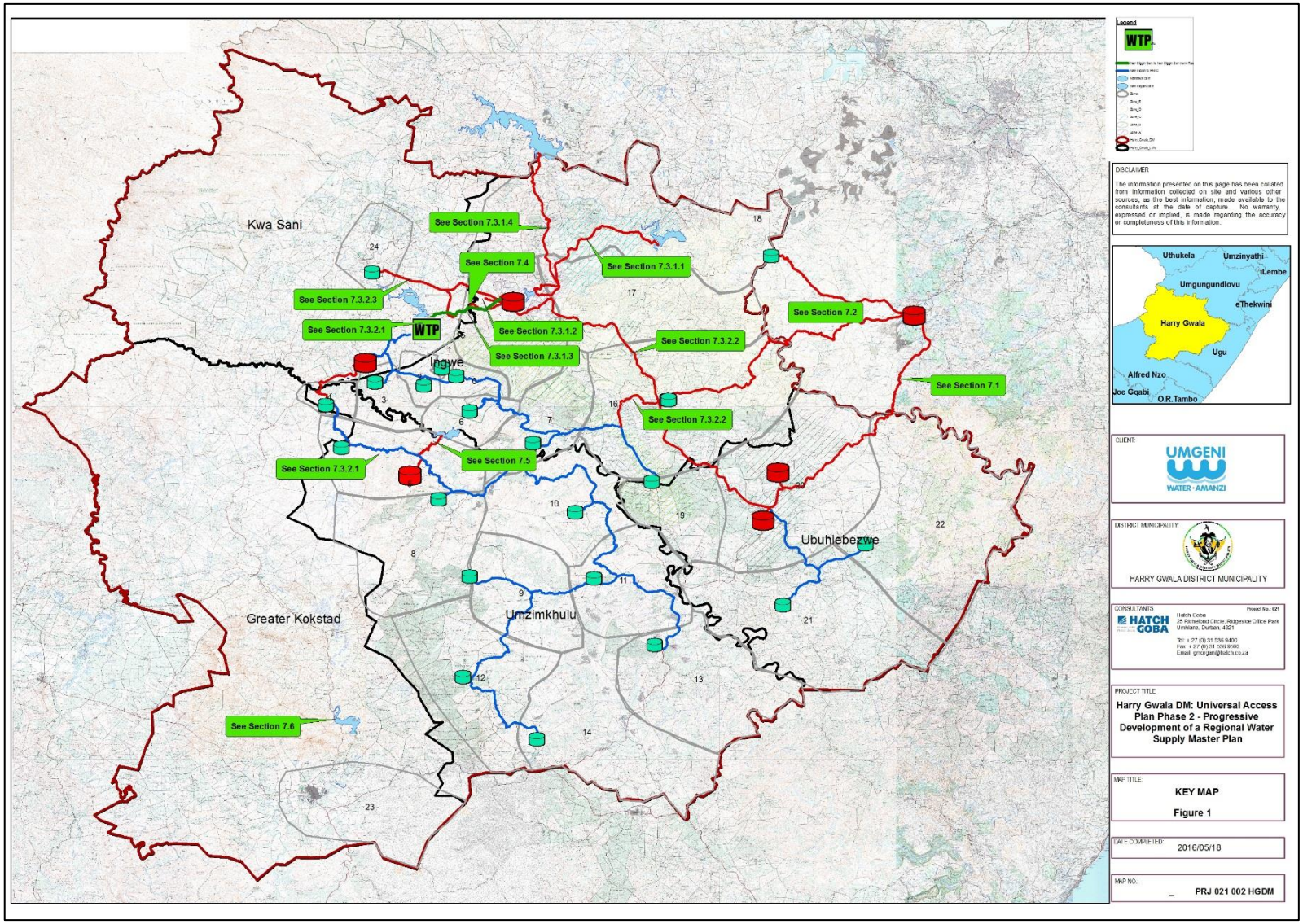
- Bulwer Dam WTP to New Biggin Command Reservoir A at elevation 1858m from where bulk distribution to Umzimkhulu and KwaSani LM's will be possible under gravity. (See Section 7.3.2.1). This option is viewed as a medium term option.
- New Biggin Dam WTP to New Biggin Command Reservoir A. From the hydrological investigations, it was determined that with a 76.74 Mcm storage (45m high wall) the yield at the New Biggin Dam would be 347.7 Mℓ/day. This yield is sufficient to supply the entire Umzimkhulu and KwaSani LM's.This option is recommended for further investigation.
- New Biggin Dam WTP to Command Reservoir B. This option will supply the Ingwe and Ubuhlebezwe LMs and augment supply to the Greater Bulwer Donnybrook Scheme. This option is recommended for further investigation.
- Ngwangwane River Dam, at co-ordinates -30.0340 S; 29.6317 E, will allow supply to Umzimkhulu LM as well as the southern of Ingwe LM. Preliminary investigations indicate that the yield at this site with a storage capacity of 25Mcm will yield 111 Mℓ/day. This option needs to be compared to the New Biggin option to determine which is more feasible.

In addition other scheme extensions, potential abstraction points and regional schemes were investigated as follows:-

- Richmond to Mariathal Bulk Pipeline to supply Ubuhlebezwe LM. This option is not recommended for further investigation due to technical and water resource constraints in the Mgeni Catchment
- Option 2: Richmond to Ingwe Bulk Pipeline. This option is not recommended for further investigation due to technical and water resource constraints in the Mgeni Catchment.
- A possible dam at co-ordinates -30.4585 S; 29.4817 E, on the Mzintlava River for additional raw water storage for Kokstad Town. From hydrological investigations it was established that the yield at this dam would be 31 Mℓ/day. Further detailed investigation of this dam is recommended.

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

A water resource versus water demand balance was carried out and is presented in **Table A** below. A discussion on the water balance (Yield versus Demand) for each Regional Scheme is discussed thereafter.


Kwa Sani
Ingwe
Greater Kokstad
Umzimkhulu
Ubuhlebezwe
See Section 7.3.1.4
See Section 7.4
See Section 7.3.1.1
See Section 7.3.2.3
See Section 7.3.2.1
WTP
See Section 7.3.1.2
See Section 7.3.1.3
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Legend
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Uthukela
Umzinyathi
eLembe
Umgungundlovu
eThekwini
Harry Gwala
Ugu
Alfred Nzo
Joe Gqabi
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CLIENT:
UMGENI WATER · AMANZI
DISTRICT MUNICIPALITY:
HARRY GWALA DISTRICT MUNICIPALITY
CONSULTANTS
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MAP TITLE:
KEY MAP
Figure 1
DATE COMPILED:
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Table A: Water Balance

					Resource Assessment			
Local Municipality	UAP Phase 2 Supply Zones	Existing Water Resource	Yield /Registered Water Use (Mℓ/day)	UAP Phase 2 : 30 Year Demand GAADD (Mℓ/day)	Water Surplus (Mℓ/day)	Water Deficit (Mℓ/day)	UAP Phase 2/HGDM Long Term Option	UAP Phase 2/HGDM Long Term Option Available Yield after all other Allocations (Mℓ/day)
Ingwe	0 to 3, 6, 7 and 15 to 18	Localised Abstractions Boreholes	-	17.60	-	17.60	New Biggin Dam	330.10
Kwa Sani	24	Umzimkhulu River	1.23	3.74	-	2.51	New Biggin Dam	345.19
Ubuhlebezwe	19 to 22	Home Farm Dam Umzimkhulu River Boreholes	3.1	18.53	-	15.43	Ngwangwane Dam/ New Biggin Dam	332.27
Kokstad	23	Crystal Springs Dam Mzintlava River	9.5	23.55	-	14.05	Mzintlava Dam	TBC
Umzimkhulu	4,5 & 8 to 14	Boreholes Umzimkhulu River	4.00	31.80	-	27.80	Ngwangwane Dam/ New Biggin Dam	319.90

References: All Town Recon Strategies of the respective Regional Schemes
Umgeni Water Infrastructure Masterplan
EVN Hydrology Report Ngwangwane Site 2
JG Afrika Hydrology

Ingwe LM

The long term water demand for the Ingwe LM is 17.6 Mℓ/day. The Bulwer Dam together with raw water augmentation from the proposed Pholela Dam will provide a surplus of 75.8 Mℓ/day for the Ingwe LM.

KwaSani LM

The long term water demand for the KwaSani LM is 3.74 Mℓ/day. The existing water use on the Umzimkhulu River is 1.23 Mℓ/day. There is thus a long term deficit of 2.51 Mℓ/day. The application for an increased water use up to 3.45 Mℓ/day is one option of addressing the deficit. Another option is a supply from the New Biggin Dam that would yield 347.7 Mℓ/day.

Ubuhlebezwe LM

The long term water demand for the Ubuhlebezwe LM is 18.53 Mℓ/day. The current supply to Ixopo from the Home Farm Dam and existing boreholes is 3.1 Mℓ/day resulting in a deficit of 15.43 Mℓ/day. The options to address this deficit are as follows:

- The Bulwer Pholela Dam combination that yields 21.1 Mℓ/day,
- New Biggin Dam that yields 347.7 Mℓ/day
- Ngwangwane Dam that yields 111 Mℓ/day

Detailed feasibility studies are required to confirm which configuration proves to be the most feasible to address this deficit.

Umzimkhulu LM

The long term water demand for the Umzimkhulu LM is 31.80 Mℓ/day. The current registered water use is 4 Mℓ/day resulting in a deficit of 27.80 Mℓ/day.

The options to address this deficit are as follows:

- New Biggin option that yields 347.7 Mℓ/day
- Ngwangwane Dam that yields 111 Mℓ/day

Detailed feasibility studies are required to confirm which configuration proves to be the most feasible to address this deficit.

Greater Kokstad LM

The long term water demand for the Kokstad LM is 23.55 Mℓ/day. The current registered water use is 9.5 Mℓ/day resulting in a deficit of 14.05 Mℓ/day. The option to address this deficit is the Mzintlava Dam that will yield 31 Mℓ/day.

RECOMMENDATIONS

- The Greater Bulwer-Donnybrook Regional Water Supply Scheme is currently in construction and is due to be completed in 2021. This scheme intends using both the Bulwer and Comrie dams as water sources. The Bulwer Dam, situated on the Luhane River will yield **8.4 Mℓ/day** and Comrie Dam **3.73 Mℓ/day** (full use after raising of the dam wall). The combination of these two dams is not sufficient for the current scheme footprint. It is recommended that a raw water transfer scheme from the Pholela River be investigated in detail to augment this scheme.
- A dam on the Ngwangwane River, at co-ordinates -30.0340 S; 29.6317 E will allow supply to the Umzimkhulu LM as well as the southern of Ingwe LM. Preliminary investigations indicate that the yield at this site with a storage capacity of 25Mcm will yield 111Mℓ/day. This will be adequate to supply Zones 0 to 19 as well as 16, & 19 to 22.
- An impoundment on the Umzimkhulu River, at co-ordinates -29.900 S; 29.6070 E, known as the New Biggin Dam will allow supply to Umzimkhulu LM. Preliminary investigations indicate that the yield at this site with a storage capacity of 76.74 Mcm will yield 347.7 Mℓ/day. This will be also adequate to supply Zones 0 to 19 as well as 16, & 19 to 22.
- It is recommended that a detailed feasibility study be undertaken to compare the Ngwangwane, and New Biggin options, including bulk scheme configurations from each site, financial, economic, social, environmental and technical matters to determine which option or combination of options are more feasible for implementation.
- It is recommended that a detailed water resources assessment of the catchment above Kokstad on the Mzintlava River be undertaken to confirm existing water use. Preliminary investigations show that a dam, at co-ordinates -30.4585 S; 29.4817 E, on the Mzintlava River will allow additional raw water yield of 31 Mℓ/day for Kokstad Town.

1. OBJECTIVES AND METHODOLOGY

1.1. BACKGROUND

The Department of Co-operative Governance and Traditional Affairs (CoGTA) in association with Umgeni Water initiated the development of a Universal Access Plan (UAP) for bulk water supply in the KwaZulu-Natal province in 2013. The study focused on the ten WSA's in the KwaZulu-Natal Province and constituted Phase 1 of the project. The outcome of this Phase 1 plan provided good base information in some of the WSA's with regards to water supply and sanitation in KwaZulu-Natal.

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

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

1.2. PURPOSE AND OBJECTIVES

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

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

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

1.3. SPECIFIC TARGETS OF THE INTERVENTION

The Specific Targets of the Intervention are summarised as follows:

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

1.4. STUDY PROCESS

The study process involved the following steps

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

1.5. DATA SOURCES

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

Table 1: Source Documents

Document	Compiler(s)	Document Owner (Client)	Date
The Development of Universal Access Plan for Water & Sanitation in Harry Gwala District Municipality	• LDM • SMEC South Africa	Umgeni Water Cogta Department of Water Affairs	September 2014
The Harry Gwala District Municipality Infrastructure Planning	• Bhungane Consulting	Harry Gwala District Municipality	August 2011
The Harry Gwala District Municipality Water Services Development Plan (WSDP) 2011	• Bhungane Consulting • AB Projects	Harry Gwala District Municipality	July 2011
Harry Gwala District Municipality - Backlogs and water service levels	• Bhungane Consulting	Harry Gwala District Municipality	May 2011
Harry Gwala District Municipality Water Resources Assessment _ Surface water	• Bhungane Consulting • Terratest	Harry Gwala District Municipality	May 2011
Harry Gwala District Municipality Water Resources Assessment _ Ground water	• Bhungane Consulting • Terratest	Harry Gwala District Municipality	May 2011
Harry Gwala District Municipality :Water Services Master Plan	• Bhungane Consulting • MNA	Harry Gwala District Municipality	June 2011
The uMkhomazi Water Project: Phase 1 : Module 1 : Technical Feasibility Study Raw Water: Water Requirements and Return Flows Report: Write up 2 : Community Supply from Smithfield-Comrie Dam : Pre-Feasibility Study	• Aecom	Department of Water Affairs	November 2015
First Order determination of the Firm Yield : Proposed Dam A : Ngwangwane River : Umzimkhulu District Bulk Water Supply Scheme	• EVN Africa	Umgeni Water	May 2016

2. STUDY AREA

2.1. CONTEXT

The Harry Gwala District Municipality (HGDM) is located in the south western region of the KwaZulu-Natal Province and borders Lesotho and the Eastern Cape Province.

2.2. BOUNDARIES OF THE STUDY AREA

Harry Gwala District Municipality is surrounded by the Umgungundlovu DM to the north-east; and Ugu DM to the south-east. The Alfred Nzo and OR Tambo DM's within the Eastern Cape Province are situated to the west and south-west respectively. Harry Gwala consists of five Local Municipalities, namely Greater Kokstad, Ingwe, KwaSani, Ubuhlebezwe, and Umzimkhulu. The DM covers the total population of 461 423 (Statistics South Africa Census, 2011).

Figure 2 below illustrates the locality of HGDM and its neighbours as described above.

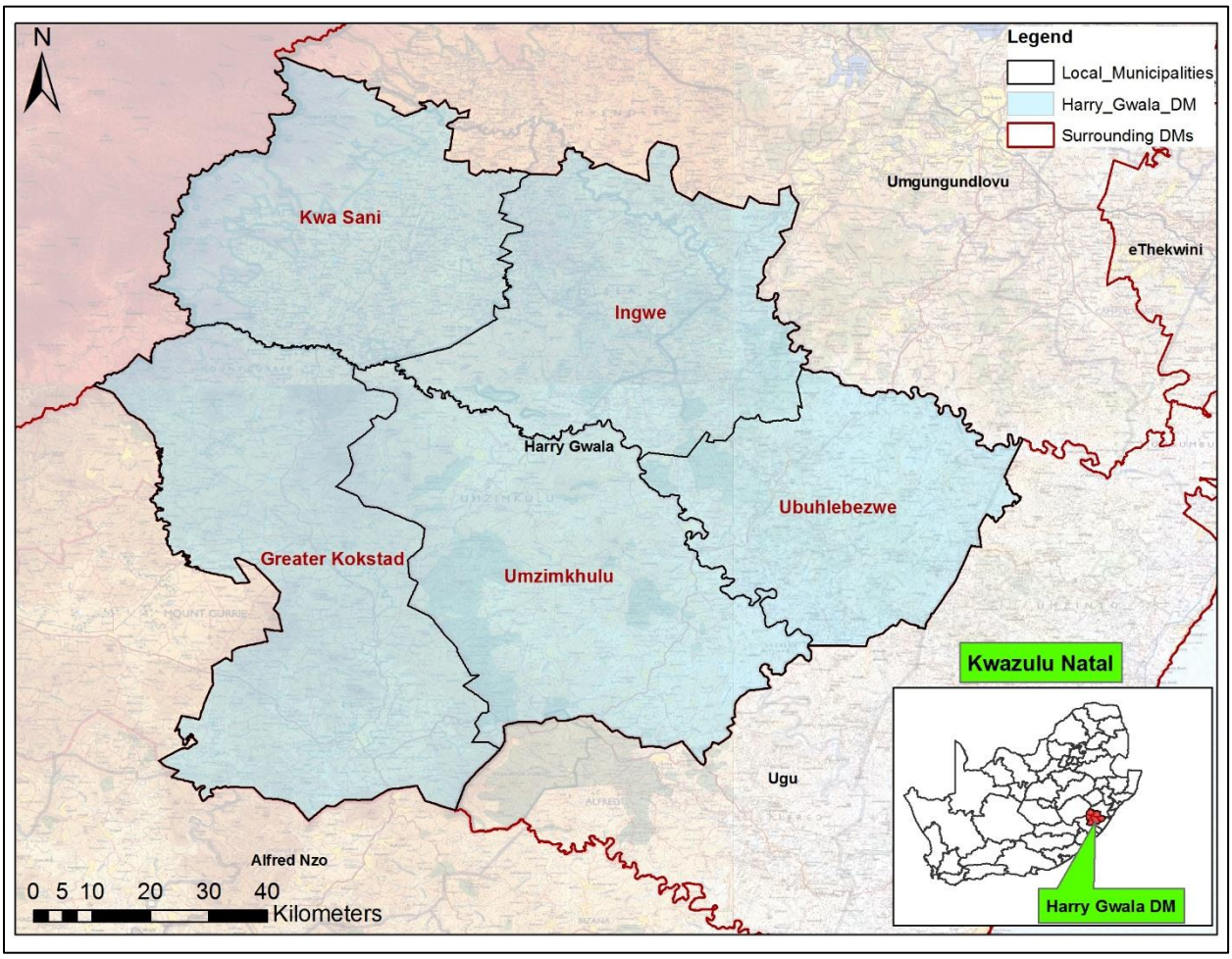


Figure 2: Locality of Harry Gwala District Municipality

2.3. PHYSICAL CHARACTERISTICS OF STUDY AREA

Harry Gwala District Municipality (previously Sisonke District Municipality) is situated south of KwaZulu-Natal. It is comprised of five local municipalities: Ingwe, KwaSani, uMzimkhulu, Greater Kokstad and Ubuhlebezwe. The Harry Gwala District Municipality's Office is Ixopo.

The municipality is surrounded by uMgungundlovu to the north-east, Ugu to the south-east, OR Tambo to the south, Alfred Nzo to the south-west, the Kingdom of Lesotho to the north-west and uThukela to the north. It is also bordered by the Drakensberg Mountains, which form a 200km-long World Heritage Site.

Economically, the most prominent employment sectors are agriculture, construction and small-scale manufacturing. The district is known for its progressive farming methods. The unspoilt natural environment has high ecotourism and adventure-tourism potential. Harry Gwala has an abundance of high quality soils, high altitude, abundant water, and climatic extremes, which makes the area suitable for dairy farming. A significant portion of dairy consumed in KZN is produced within the district.

2.4. CLIMATE

The climate of Harry Gwala is influenced by the cool Drakensberg Mountains to the west. Temperatures vary with altitude, so in KZN we have a range from warm and humid conditions at sea level, contrasting with very hot and often dry in the bushveld, to very cold at 2000-3000 m above sea level in the Drakensberg. The highest rainfall areas are in the Drakensburg, in winter, spring and early summer most of the rain is caused by cold fronts, moving in from the south-west. These are often preceded by hot, desiccating, dry "Berg" winds from the north and north-west.

Snowfalls are common mainly in the Drakensberg, where snow usually melts within a few days, though heavy snowfalls can blanket the summit for weeks. Many species of plants are adapted to the harsh conditions, and thrive in areas prone to frost and snow.

2.5. TOPOGRAPHY, GEOLOGY AND SOILS

Ubuhlebezwe demonstrates rugged terrain with hilly rolling country. In the East numerous river valleys fragment the Local Municipality making the topography steep with gently sloping valley bottoms. KwaSani demonstrates moderately rolling topography with much of the area covered by mountainous topography. The District Management Area (DMA) moves from moderately

rolling topography to the steeply rising foothills of the little berg. The rest of the District including Kokstad is generally characterised by rolling topography and uncharacteristic flat topography.

Soils and geology vary greatly throughout the District. Around Ixopo soils are leached and of low inherent nutrient status with problems with phosphorus fixation and aluminium toxicity, they have low agricultural potential. East of Ixopo soils on hillsides are shallow of the Mispah and Glenrosa. In the valley bottoms pockets of deep alluvial soils are found. Areas of calcareous duplex soils are also found east of Ixopo, these soils are highly erodible. Around the edges of Ubuhlebezwe soils are of the Table Mountain Sandstone plateau, with rugged low potential soils in the north of the Local Municipality. On the eastern boundary of the Municipality the soils are acid and leached. They consist of shallow sandy soils derived from the Table Mountain series with heavier soils are derived from dolerite and Dwyka Tillite. Within the Ubuhlebezwe Local Municipality however small pockets of high potential soils do occur, erosion on the steep slopes is however problematic in these areas. Surrounding Creighton soils are highly variable in both depth and drainage. These soils have a relatively low agricultural potential. The rest of the Ingwe Local municipal area however has soils of higher potential. East of Underberg and Himeville soils are sedimentary derived and tend to be shallow and dry or poorly drained. The rest of the Municipality is characterised by high potential soils that support a large variety of crops. The majority of the Municipality however is dominated by sedimentary derived soils that tend to be shallow and dry or poorly drained.

2.6. ENVIRONMENTAL

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

3. DEMOGRAPHICS

3.1. EXISTING POPULATION AND DISTRIBUTION

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

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

3.1.1. POPULATION SOURCES

UAP Phase 1

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

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

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

Census 2011

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

Table 2: Census Population and Households (2011)

Municipality	Population	Households	PP/HH
Greater Kokstad LM	65 982	19 140	3.45
Ingwe LM	100 548	23 073	4.36
Kwasani LM	12 900	3 672	3.51
Ubuhlebezwe LM	101 691	23 487	4.33
Umzimkhulu LM	180 302	42 909	4.20
Total	**461 423**	**112 281**	**4.11**

Source: Census 2011

Population	461 423
Age Structure	
Population under 15	37.90%
Population 15 to 64	57.20%
Population over 65	4.90%
Dependency Ratio	
Per 100 (15-64)	74.90
Sex Ratio	
Males per 100 females	86.80
Labour Market	
Unemployment rate (official)	36.00%
Youth unemployment rate (official) 15-34	44.40%
Education (aged 20 +)	
No schooling	9.80%
Higher education	5.70%
Matric	19.30%
Household Dynamics	
Households	112 281
Average household size	3.80
Female headed households	55.20%
Formal dwellings	41.50%
Housing owned	59.50%
Household Services	
Flush toilet connected to sewerage	17.60%
Weekly refuse removal	20.70%
Piped water inside dwelling	14.70%

DWS Reconciliation Strategy 2011

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

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

Donnybrook Bulwer water Supply Scheme (Ingwe LM)		**2010**	**2015**	**2020**	**2025**
Future requirements without WC/WDM	High growth (Mcm/a)	3.57	4.15	4.85	5.64
	Low growth (Mcm/a)	3.38	3.62	3.75	3.85
Future requirements with WC/WDM	High growth (Mcm/a)	3.57	3.38	3.87	4.52
	Low growth (Mcm/a)	3.38	2.95	2.95	3.09
Additional water required above registered water use (without WC/WDM)	High growth Scenario (Mcm/a)	3.01	3.59	4.29	5.08
	Low growth Scenario (Mcm/a)	2.82	3.06	3.19	3.29
Additional water required above registered water use (with WC/WDM)	High growth Scenario (Mcm/a)	3.01	2.82	3.31	3.97
	Low growth Scenario (Mcm/a)	2.82	2.39	2.39	2.53
Umzimkhulu Water Supply Scheme (Umzimkhulu LM)		**2010**	**2015**	**2020**	**2025**
Future requirements without WC/WDM	High growth (Mcm/a)	0.61	0.71	0.83	0.97
	Low growth (Mcm/a)	0.58	0.62	0.64	0.66
Future requirements with WC/WDM	High growth (Mcm/a)	0.61	0.58	0.66	0.78
	Low growth (Mcm/a)	0.58	0.51	0.51	0.53
Additional water required above registered water use (without WC/WDM)	High growth Scenario (Mcm/a)	0.33	0.43	0.55	0.69
	Low growth Scenario (Mcm/a)	0.30	0.34	0.36	0.38
Additional water required above registered water use (with WC/WDM)	High growth Scenario (Mcm/a)	0.33	0.30	0.38	0.49
	Low growth Scenario (Mcm/a)	0.30	0.22	0.22	0.25
Ixopo Water Supply Scheme		**2010**	**2015**	**2020**	**2025**
Future requirements without	High growth (Mcm/a)	2.23	2.59	3.03	3.52

WC/WDM	Low growth (Mcm/a)	2.11	2.26	2.34	2.40
Future requirements with WC/WDM	High growth (Mcm/a)	2.23	2.11	2.41	2.83
	Low growth (Mcm/a)	2.11	1.84	1.84	1.93
Additional water required above registered water use (without WC/WDM)	High growth Scenario (Mcm/a)	1.39	1.75	2.19	2.68
	Low growth Scenario (Mcm/a)	1.27	1.42	1.50	1.56
Additional water required above registered water use (with WC/WDM)	High growth Scenario (Mcm/a)	1.39	1.27	1.57	1.99
	Low growth Scenario (Mcm/a)	1.27	1.00	1.00	1.09
Nokweja water Supply Scheme		**2010**	**2015**	**2020**	**2025**
Future water requirements with WC/WDM	High growth (Mcm/a)	1.57	1.82	2.13	2.48
	Median growth (Mcm/a)	1.53	1.70	1.87	2.04
	Low growth (Mcm/a)	1.48	1.59	1.65	1.69

Source: DWS Reconciliation strategies 2011

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

3.2. SOCIAL AND ECONOMIC INDICATORS

Unemployment in Harry Gwala is higher by 3% from that of the Province. This is an indication that more work still needs to be done in terms of working together will private businesses to create employment, but of critical importance to create a conducive environment where business flourish. More money over the next five years has been invested to infrastructure development as one critical factor that will boost economic development in the district.

Umzimkhulu, Ingwe and Ubuhlebezwe Local Municipalities are the critical municipalities when it comes to youth unemployment. Working together with relevant stakeholders the municipality will ensure that this trend is reversed. Harry Gwala District Municipality has since developed programs in the 2014-2015 financial year that will assist youth with skills and create job opportunities.

The income inequality can be observed if an income distribution is considered. The monthly income for residents is categories using the 2011 Census. It is evident that of those employed; most workers earn low levels of remuneration. Nearly 80% of Harry Gwala District workers earn R1 600 per month or less while 40% earn R800 or less. In stark contrast, very few workers earn R12 800 per month or more – less than 2%.

Given the above, it is not surprising that the Harry Gwala District Municipality is home to a significant number of residents who could be classified as living in poverty. In 2011, almost 350,000 residents could be classified as "poor". (Harry Gwala IDP, 2015)

3.3. COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL DEVELOPMENT

The Sisonke Development Agency ("the SDA") has a strategic mandate to help promote economic development and create jobs in the Harry Gwala District. This enjoins the SDA to play a leadership role in the efforts aimed at creating work and real economic growth and thus imperative that the entity embarks on such an exercise to ensure it can survive in the ever changing environment.

Harry Gwala District Municipality is ranked 5th out of the 11 district municipalities in KwaZulu-Natal with respect to provincial Gross Domestic Product (GDP) per capita (R9 920 in 2004). Even with this small amount, 53% of the population is dependent on grants. Harry Gwala also makes a negligible contribution to provincial GDP, of about 1.1% (R2.578bn) better only than uMzinyathi. Moreover, this is after a 30% increase, mostly fuelled by the Community Services sector, which has outpaced the Agriculture sector. Both the Community services and Agriculture sectors dominate the economy, contributing 60% of the district's Value-Added by Region (GVA-R) in 2010.

With regards to social indicators, Harry Gwala is the smallest district municipality in the province, having a population of 500 000 in 2010, and a population growth rate less than 1% from 1997 to 2010. This is less than half the provincial average. This was accredited to shifting dynamics, rural-urban migration patterns, and HIV/AIDS (prevalence at 14% in 2010 and rising). Furthermore, the population is concentrated in the 3 largest local municipalities in the district – Umzimkhulu, Ingwe, and Ubuhlebezwe. This makes service and infrastructure delivery extremely costly, thereby causing glaring inequalities across geographical divides.
Apart from low population rates and the consequences thereof, Harry Gwala faces other social problems. Poverty was as high as 66% in 2010, although this is a reduction from 74% in 2001.

Low income is also a problem as the high dependency of grants suggests, illiteracy rates are high, at 11%; however this is less than the provincial average, which lies at 15.7%. Unemployment however, is almost double the provincial average, and lies at 48%.

However, despite the gloomy outlook, HGDM has a very strong agriculture sector, with favourable soils, and a dairy industry that supplies 10% of all milk consumed in South Africa, and 35% of Clover's total milk intake. Forestry, maize, potatoes, and beef farming are also very strong in the area. The tourism sector is also playing a significant role, with the public sector management team expressing a deep commitment to promoting the industry in the district. HGDM is thus looking to utilise its comparative advantages.

3.4. POPULATION GROWTH SCENARIOS

The following trends are noted regarding population growth dynamics in Harry Gwala:

- Future growth and development in Harry Gwala is likely to take place in the urban areas;
- Rural population growth is likely to stabilize rather than moving into negative growth rates; and
- Out migration from Harry Gwala of the economically active age groups will continue in future with an increasing number of women participating in the migration process.

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

Table 4: Population Projections (2015 – 2045)

Year	Greater Kokstad	Ingwe	KwaSani	Ubuhlebezwe	Umzimkhulu
2015	66 642	101 553	13 029	102 708	182 105
2020	70 041	106 734	13 694	107 947	191 394
2025	73 614	112 178	14 392	113 453	201 157
2030	77 369	117 900	15 126	119 241	211 418
2035	81 316	123 915	15 898	125 323	222 203
2040	85 464	130 235	16 709	131 716	233 537
2045	89 823	136 879	17 561	138 435	245 450

4. WATER DEMANDS

4.1. LEVEL OF SERVICE

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

UAP Phase 1

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

- RDP and Above – referring to the population or area that receives at least the minimum level of service or above
- Dysfunctional Schemes – referring to the population or area that is covered by a scheme which is dysfunctional to an extent that even minimum RDP level of service is not achieved
- Unreliable source – referring to the population or area that is covered under a scheme but sporadic, seasonal or experiences continuous failure of raw water source resulting in supply that is below the RDP level of service.

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

Table 5: Unit Demands

Category	Description of Consumer Category	Household Annual Income Range	Per Capita Cons (l/c/d)		
			Min	Ave.	Max.
1	Very High Income: villas, large detached house, large luxury flats	>R1 228 000	320	410	500
2	Upper middle income: detached houses, large flats	R153 601 – R1 228 000	240	295	350
3	Average Middle Income: 2 - 3 bedroom houses or flats with 1 or 2 WC, kitchen, and one bathroom, shower	R38 401 – R153 600	180	228	275
4	Low middle Income: Small houses or flats with WC, one kitchen, one bathroom	R9 601– R38 400	120	170	220
5	Low income: flatlets, bedsits with kitchen & bathroom, informal household	R1 - R9600	60	100	140
6	No income & informal supplies with yard connections		60	80	100

Category	Description of Consumer Category	Household Annual Income Range	Per Capita Cons (l/c/d)		
			Min	Ave.	Max.
7	Informal with no formal connection		30	50	70
8	Informal below 25 l/c/d		25	25	25
9a	Non Residential - Rural		As per Red Book Guidelines		
9b	Non Residential - Urban		As per Red Book Guidelines		
9c	Non Residential - Industrial		As per Red Book Guidelines		

Census 2011

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

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

Local Municipality	Piped (tap) water inside dwelling/institution	Piped (tap) water inside yard	Piped (tap) water on community stand: distance less than 200m from dwelling/institution	Piped (tap) water on community stand: distance between 200m and 500m from dwelling/institution	Piped (tap) water on community stand: distance between 500m and 1000m (1km) from dwelling /institution	Piped (tap) water on community stand: distance greater than 1000m (1km) from dwelling/institution	No access to piped (tap) water	Number of Households
Greater Kokstad	6 912	7 398	3 354	624	261	138	450	19 140
Ingwe	2 700	4 671	3 744	1 359	504	483	9 612	23 073
Kwasani	1 578	1 239	162	39	27	27	603	3 672
Ubuhlebezwe	2 913	2 070	6 036	2 691	1 083	624	8 073	23 487
Umzimkhulu	2 412	4 839	10 359	3 432	987	519	20 367	42 909
Harry Gwala District Municipality	**16 515**	**20 217**	**23 655**	**8 145**	**2 862**	**1 791**	**39 105**	**112 281**

Source: Census 2011

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

Table 7: Water Demand Scenarios

	Urban			Rural			
Scenario 1	**Portion to Convert**	**Start Year**	**End Year**	**Portion to Convert**	**Start Year**	**End Year**	**WSA Targets**
Convert from No Service to RDP LOS	100%	2015	2020	100%	2015	2020	All pop. without supply converted to RDP level of service by 2020
Convert from <RDP LOS to RDP LOS	100%	2015	2020	100%	2015	2020	All pop with <RDP LOS converted to RDP level of service by 2020
Convert from RDP LOS to Yard Conn.	50%	2020	2030	50%	2020	2030	50% of Pop with RDP LOS in 2020 converted to YC LOS between 2020 and 2030
Convert from Yard Conn. to House Conn.	10%	2020	2035	10%	2025	2035	10% of pop with YC LOS converted to HC LOS between 2020 and 2035 for urban and between 2025 and 2035 for Rural

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

Scenario 3	Portion to Convert	Start Year	End Year	Portion to Convert	Start Year	End Year	Realistic Achievable Estimate
Convert from No Service to RDP LOS	100%	2015	2020	100%	2015	2020	All pop. without supply converted to RDP level of service by 2020
Convert from <RDP LOS to RDP LOS	90%	2015	2020	80%	2015	2020	90% of Urban pop and 80% of Rural pop with <RDP LOS converted to RDP level of service by 2020
Convert from RDP LOS to Yard Conn.	80%	2020	2035	50%	2020	2035	80% of Urban pop and 30% of Rural pop with RDP LOS converted to YC LOS by 2035
Convert from Yard Conn. to House Conn.	40%	2020	2035	20%	2025	2035	40% of Urban pop and 20% of Rural pop with YC LOS converted to HC LOS between 2020 and 2035 for Urban and between 2025 and 2035 for Rural

4.2. WATER DEMAND CALCULATION

For the purposes of water demand calculations, Scenario 2 is deemed to be the most probable scenario in Harry Gwala District Municipality. The water demand for each Local Municipality using Scenario 2 is presented in Table 8.

Table 8: Demand Calculation

Local Municipality	Households	Population	30 YEAR DEMAND Mℓ/day
Greater Kokstad	10997	65982	23.55
Ingwe	16758	100548	17.60
KwaSani	2150	12900	3.74
Ubuhlebezwe	16949	101691	18.53
Umzimkhulu	30050	180302	31.80

For the purposes of water supply infrastructure sizing, the projected 30 year water demands per supply area was used. Water demands per supply area are discussed further in Section 7.

5. EXISTING WATER SUPPLY INFRASTRUCTURE

5.1. WATER RESOURCES AND AVAILABILITY

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

Greater Kokstad LM

Kokstad receives its water from two main sources. The first source of raw water supply is the Crystal Springs Dam which has a total storage capacity of 2.1 million m^3. The dam has a catchment area of 15 km^2 and is also fed from the springs. The firm yield of the dam is 1.6 million m^3/a (4.5 Mℓ/day). The registered water use from the Crystal Springs Dam according to WARMS is 2.1 million m^3/a, which is more than the firm yield of the dam.

The other source of supply is from the Mzintlava River. Kempdale Dam was constructed in the Mzintlava River and has an estimated storage capacity of 400 000 m^3. Water is then released from the dam to the abstraction weir where water is pumped to the Kokstad WTW. This is done in winter because of the extensive irrigation taking place upstream of Kokstad, which reduces the flow of the Mzintlava River. The dam was designed to be raised to increase the storage capacity to 750 000 m^3. The current registered and licensed water use for Kokstad from the Mzintlava River is 1.8 million m^3/a (5 Mℓ/day).

Ingwe LM

The main sources of supply of the Ingwe LM are the boreholes and abstraction from a spring and a weir in the Mkobeni River in quaternary catchment U10F, a water treatment works and bulk service storage infrastructure and bulk distribution networks.

The raw water from the spring and Mkobeni River is delivered to Bulwer WTW where it is treated to potable drinking water quality standards. The peak hydraulic design capacity of the water treatment works is 0.5 Mℓ/day or 0.18 million m^3/a. The average annual flow rate of the treatment works is estimated to be 0.33 Mℓ/day or 0.12 million m^3/a based on a peak factor of 1.5.

The Ingwe LM also has the weir on the Luhane River that supplies water to a package plant from where sections of the Greater Bulwer Donnybrook Scheme is supplied. This scheme will be used as a temporary measure until construction of the Bulwer Dam is complete.

KwaSani LM

The KwaSani LM abstracts raw water from a weir in the Mzimkulu River system although DWA records show that its source is from the Pholela River catchment, a tributary of the Mzimkulu River.

Water gravitates to a pump station approximately 0.4 km from the weir in the Mzimkulu River. It is then pumped from the raw water pumping station to the Underberg-Himeville WTW which is located in Underberg where it is treated to potable standards.

Ubuhlebezwe LM

The Ubuhlebezwe LM's raw water is abstracted from the Umkhomazi River, Umzimkhulu River and Ixopo Dam.

The town of Ixopo is supplied from the Ixopo Dam as well as a borehole situated in the Ixopo Golf Course. Ixopo Dam has a capacity of 0.5 mcm and a yield of 2.7 Mℓ/day. The borehole has a yield of 0.4 Mℓ/day. The two water sources therefore have a combined yield of 3.1 Mℓ/day available for the Ixopo water supply system. The Ixopo Water Works has a capacity of 3.1 Mℓ/day. There was a year on year decrease of 8.06% in water sales at the Ixopo Water Works in 2014 mainly due to water conservation and demand management initiatives by HGDM. The average daily sales in June 2014 was 2,375 Mℓ/day (UW IMP, 2015).

The scheme to supply Chibini, Mariathal and Ufafa has been completed. It consists of a pumping main from St Isidore Dam to a 1 Mℓ/day package plant and gravity fed pipelines to the areas. A rising main supplies water to a high level reservoir from where water is gravity fed to the Ithubalethu area.

Umzimkhulu LM

The Umzimkhulu Bulk Water Supply Scheme comprises raw water supply from the Mzimkulu River, a water treatment works and a bulk water reticulation system servicing some of the communities such as Umzimkhulu town and Hopewell. There is a rudimentary water supply system which provides basic water services and standpipe connection to some of the surrounding communities.

The Umzimkhulu town depends on the raw water supplies of the Mzimkulu River as its source of supply. The other areas of Hopewell and Clydesdale have stand-alone schemes at present and are currently supplied by boreholes.

Water gravitates to a pump station near the Mzimkulu River. It is then pumped from the raw water pumping station to the Umzimkhulu town WTW which is located near the town where it is treated to potable standards. The Umzimkhulu WTW is the only treatment works that supplies the scheme area. The peak hydraulic design capacity of the water treatment works is 1.0 Mℓ/day or 0.4 million m^3/a. The average annual flow rate of the treatment works is estimated to be 0.67 Mℓ/day or 0.3 million m^3/a based on a peak factor of 1.5.

5.2. BULK WATER SUPPLY SCHEMES AND CONSTRAINTS

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

Table 9: Summary of Existing Infrastructure per Water Supply Scheme

Scheme Area	Source	Infrastructure	
		Abstraction	WTW
Donnybrook Bulwer	Polela River	250mm diameter	Mzimkhulu WTW - 1.0 Mℓ/day conventional plant
	Borehole	Rising main design capacity not known	Borehole – 0.36 Mℓ/day
Greater Ixopo	Ixopo Dam	300mm diameter 2.83 Mℓ/day	Ixopo WTW - 3.1Mℓ/day , Conventional plant
Nokweja	Mzimkhulu River	Rising main design capacity not known	Nokweja WTW - 0.12Mℓ/day, Conventional plant
Mahehle Ncakubana	Boreholes	Rising main design capacity not known	N/A
Mgodi-Mahlabatshane	Boreholes	Rising main design capacity not known	N/A
Umzimkhulu Town & Hopewell	Mzimkhulu River	Rising main design capacity not known	Mzimkhulu WTW - 4.7. Mℓ/day, Conventional plant
	Borehole	Rising main design capacity not known	Borehole – 0.36 Mℓ/day
Kokstad	Crystal Springs Dam	250mm diameter FC pipe and 300mm diameter FC pipeline	Kokstad WTW - 18 Mℓ/day, Conventional Plant
Underberg-Himeville	Umzimkhulu River	Rising main design capacity not known	Underberg-Himeville WTW - 2.5 Mℓ/day, Conventional Plant

6. BULK WATER SUPPLY INTERVENTIONS CURRENTLY IN PLANNING

Planned infrastructure information has been collated from service providers working in HGDM in various drawing formats and transferred to GIS.

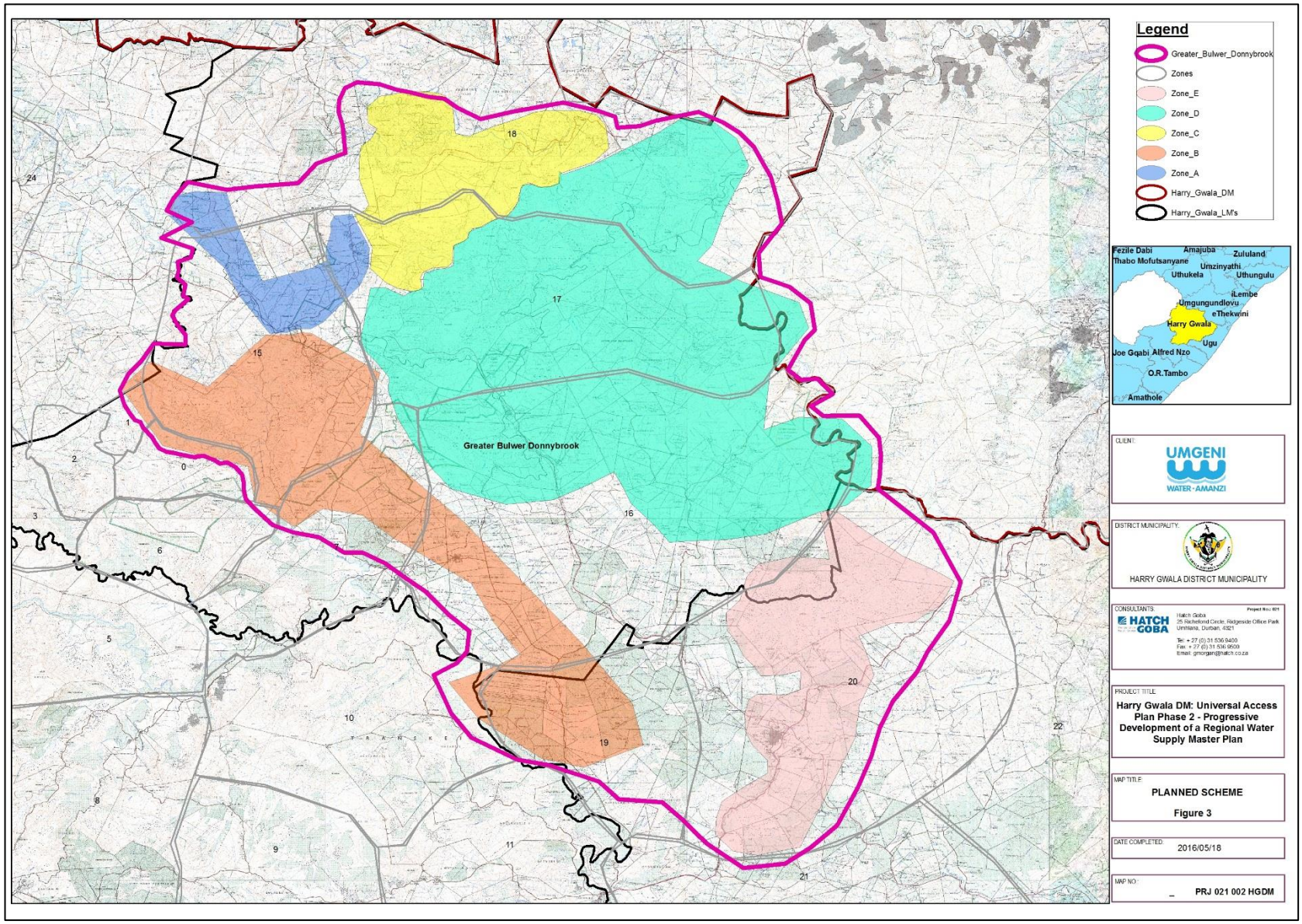
The information below was obtained from All Towns Reconciliation Study undertaken by DWS (2011) as well as information that was obtained from service providers working in HGDM.

6.1. GREATER BULWER DONNYBROOK REGIONAL SCHEME

Information regarding this scheme was obtained from the following sources:-

- *A layout map of the Greater Bulwer Donnybrook Regional Bulk Water Supply Project, provided by Terratest (Pty) Ltd.*
- *A report by AECOM titled "The uMkhomazi Water Project Phase 1 : Module 1: Technical feasibility Study Raw Water, Water Requirements and Return Flows Report, Write-up 2: Community Supply from Smithfield-Comrie Dam: pre-feasibility study, November 2015"*
- *Department of Water Affairs Report titled "Development of a Water Reconciliation Strategy for All Town in the Eastern Region, Sisonke District Municipality, First Stage Reconciliation Strategy for the Bulwer Donnybrook Water Supply Scheme Area – Ingwe Local Municipality, Final, June 2011"*
- *Sisonke Masterplan Studies, Bhungane Consulting*

The proposed Greater Bulwer-Donnybrook Regional Bulk Water Supply scheme footprint is shown in **Figure 3**.


Legend
Greater_Bulwer_Donnybrook
Zones
Zone_E
Zone_D
Zone_C
Zone_B
Zone_A
Harry_Gwala_DM
Harry_Gwala_LM's
Fezile Dabi
Amajuba
Zululand
Thabo Mofutsanyane
Umzinyathi
Uthukela
Uthungulu
iLembe
Umgungundlovu
eThekwini
Harry Gwala
Ugu
Joe Gqabi
Alfred Nzo
O.R.Tambo
Amathole
Greater Bulwer Donnybrook
CLIENT:
UMGENI WATER · AMANZI
DISTRICT MUNICIPALITY:
HARRY GWALA DISTRICT MUNICIPALITY
CONSULTANTS:
HATCH GOBA
PROJECT TITLE:
Harry Gwala DM: Universal Access Plan Phase 2 - Progressive Development of a Regional Water Supply Master Plan
MAP TITLE:
PLANNED SCHEME
Figure 3
DATE COMPLETED:
2016/05/18
MAP NO:
PRJ 021 002 HGDM

A layout plan of the project that was obtained from Terratest is attached in Annexure A.

The Greater Bulwer-Donnybrook Regional Scheme is currently in implementation and is planned to be fully completed by the year 2021. The project has been divided into five supply zones, viz, Zone A to Zone E.
It is proposed that the water supply for this scheme will be from three dams, the existing Comrie and Ixopo Dams and the proposed Bulwer Dam which is currently in construction. A water treatment works at each of these dams will allow for treatment and distribution of water to consumers within the project footprint. The domestic water demand in the year 2045 for the Greater Bulwer Donnybrook Regional Bulk Water Supply Scheme is estimated at **12.31 Mℓ/day.** An additional 3.75 Mℓ/day will be required for livestock and irrigation purposes.

The Ixopo Dam has a yield of 2.7 Mℓ/day. Water is transferred from the dam and treated at the Ixopo Waterworks that has capacity of 3.1 Mℓ/day. A production borehole in Ixopo augments raw water supply to the Ixopo Waterworks.

The existing Comrie Dam which is owned by Sappi Saiccor has a yield of **2.33 Mℓ/day** after making an allowance for environmental water releases. It is understood that negotiations between HGDM and Sappi Saiccor on the use of this dam for domestic water supply is yet to be finalised with either the option of partial or full use of the dam's yield. The Comrie Dam would supply the south-eastern section of Zone D of the scheme.
The possibility of raising the Comrie Dam from 12m wall to 16m thereby increasing the yield to **3.73 Mℓ/day** was investigated and recommended as the option for water supply for the Greater Bulwer-Donnybrook Scheme.

The proposed Bulwer Dam will have a yield of **8.4 Mℓ/day** (DWS,2015). This Dam is the proposed water source for Zones A, B, and C of the Greater Bulwer Donnybrook Regional Scheme.
Water would be abstracted and treated at the new waterworks adjacent to the dam. Potable water would then be pumped in an easterly direction along main road R617 to a command reservoir. From this command reservoir the town of Bulwer as well as areas to the north can be supplied under gravity.

The second rising main would tee off the pipeline between Bulwer and the service reservoir in a southerly direction towards a high point in the Gala region.

From the bulk reservoir in Gala, potable water would be conveyed in three directions:

- In the southerly direction to Tarrs Valley and Creighton under gravity
- In a south-easterly direction to Donnybrook and easterly to Mnywaneni and Sandanezwe
- In a north-easterly direction, potable water would be pumped to a bulk reservoir in the Ntandela area and would supply the Qadi, Bethlehem and lower lying areas under gravity. This however would require crossing the Umkomazi Valley/River.

6.2. GREATER KILAMON REGIONAL SCHEME

The majority of the settlements within the Greater Kilamon area have no access to water. There is one localised water supply scheme in the area called the Centocow Scheme. According to the assessment carried out by the UAP Phase 1 study, this scheme is in need of major repairs and is not deemed sustainable. The central area of the region is reliant on springs for water supply and is also regarded as not sustainable.

The raw water is abstracted from the Ngwangwane River on the Ingwe and Kilamon boundaries and then treated close to the river. Potable water would be pumped from the Water Treatment Works to a command reservoir at the highpoint near the Thonsini settlement. From this reservoir potable water can be gravity fed to four reservoirs to the east. These reservoirs would be able to gravity feed potable water to the settlement areas.

6.3. GREATER IXOPO REGIONAL SCHEME

This scheme is a reconnaissance level study undertaken by Umgeni Water.

This scheme involves the abstraction of raw water from the Mzimkulu River within the Mahehle footprint and treated close to the river. Potable water would then be pumped in two lifts from the Water Treatment Works. The first lift would pump potable water to the existing Mahehle bulk reservoir from where the Mahehle/ Ncakabane footprint is supplied and the second lift would pump potable water to a service reservoir along main road R612. From this service reservoir the Ufafa Scheme, Masameni Scheme (existing scheme), Eskhesheni Scheme (existing scheme), communities surrounding the Mariathal Mission and the Town of Ixopo can be gravity fed.

It is important to note that these areas could be supplied, under gravity, by the Donnybrook-Bulwer Scheme and would be dependent on the yield of the dam/river abstraction. The Mzimkulu River would however have a greater level of assurance for supply. Detailed costing analysis needs to be carried out to determine the most feasible option.

6.4. GREATER MKUNYE REGIONAL SCHEME

The raw water is abstracted from the Mzimkulu River within the Mgodi/Mhlabashane footprint and treated close to the river. Water would then be pumped in two lifts from the Water Treatment Works to the command reservoir at Mgodi/Mhlabashane. The Mgodi/Mhlabashane area could then be gravity fed from this reservoir. Potable water would also be pumped from this reservoir to the Mgodi/Skeyi reservoir. The Mgodi/Skeyi areas could in turn be gravity fed from this reservoir.

The Town of Highflats as well as the Hlokozi, Erith Trust Farm (existing scheme), Ebhayi (existing scheme), Springvale (existing scheme) and Kweletsheni and Mkunye settlements could also be supplied under gravity from the Mgodi/Skeyi reservoir. A gravity booster pump would be required on the line supplying Hlokozi, Highflats, Springvale, Kweletsheni and Mkunye.

A detailed hydrological study to investigate the safe yield of the Mzimkulu River needs to be undertaken and the requirements and size of a dam, if required, could be determined.

7. BULK WATER SUPPLY INTERVENTIONS CONSIDERED IN THIS STUDY

Using available information, the following regional schemes have been investigated as options to supply the bulk water in Harry Gwala District Municipality. It must be noted that viability of these options are dependent on many factors such as:

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

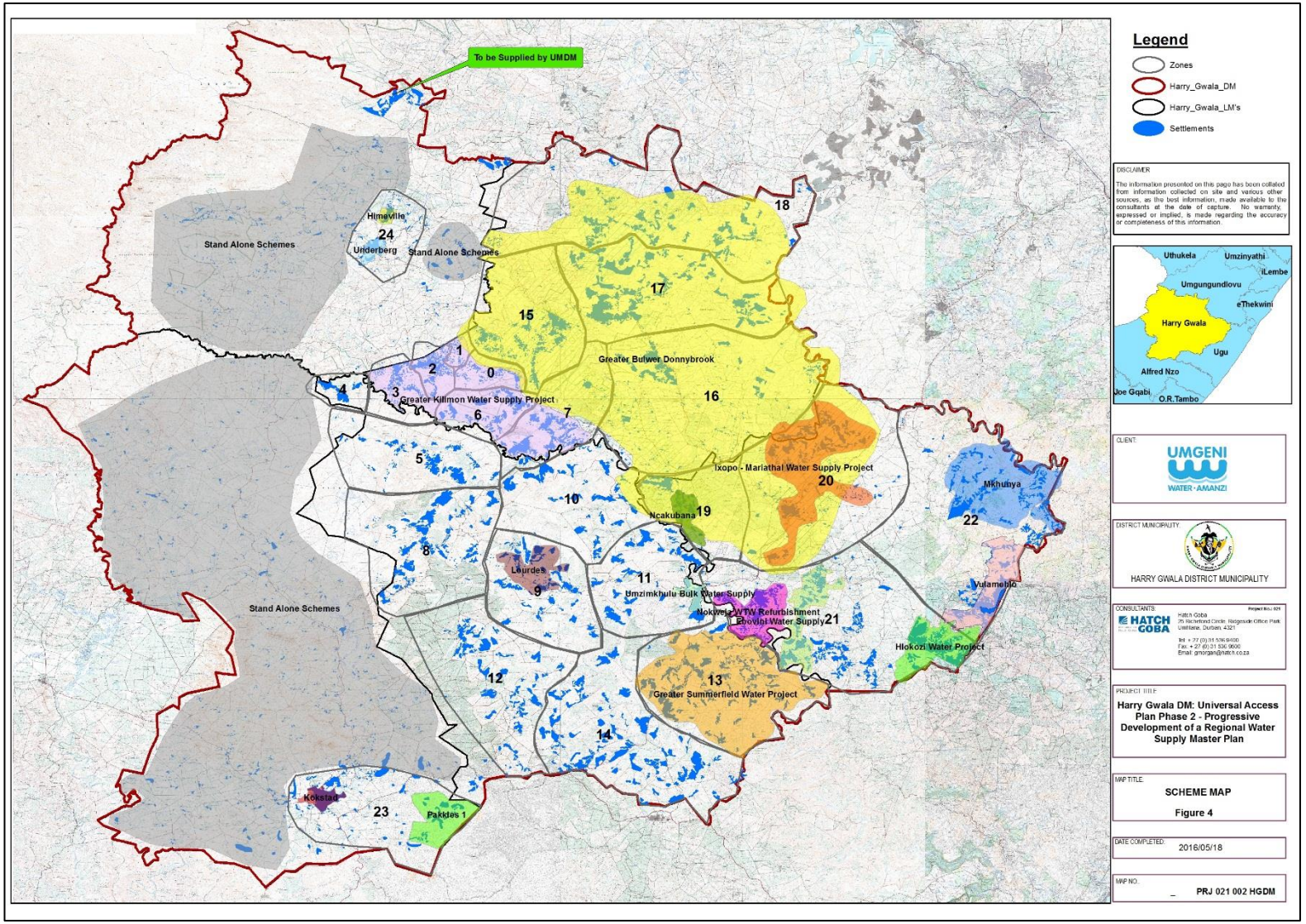
All options that were investigated are presented in this report and the viability and possible further investigation of each option is discussed after the option is presented.

Using the methodology presented in section 1.4, the Harry Gwala District Municipality was broken up into 24 Bulk Supply Zones with possible command reservoir positions in each zone. These zones together with the demand for each zone are shown in **Figure 5** and summarised in **Table 10**.

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

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

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


To be Supplied by UMDM
Himeville
24
Underberg
Stand Alone Schemes
Stand Alone Schemes
Stand Alone Schemes
18
17
15
16
Greater Bulwer Donnybrook
Greater Kilimon Water Supply Project
Ixopo - Mariathal Water Supply Project
20
Mkhunya
22
Ncakubana
19
10
Lourdes
9
11
Umzimkhulu Bulk Water Supply
Nokweja WTW Refurbishment
Ethovini Water Supply
21
Hlokozi Water Project
Xulamehlo
12
13
Greater Sumnerfield Water Project
14
Kokstad
23
Pakkies 1
Legend
Zones
Harry_Gwala_DM
Harry_Gwala_LM's
Settlements
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HARRY GWALA DISTRICT MUNICIPALITY
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SCHEME MAP
Figure 4
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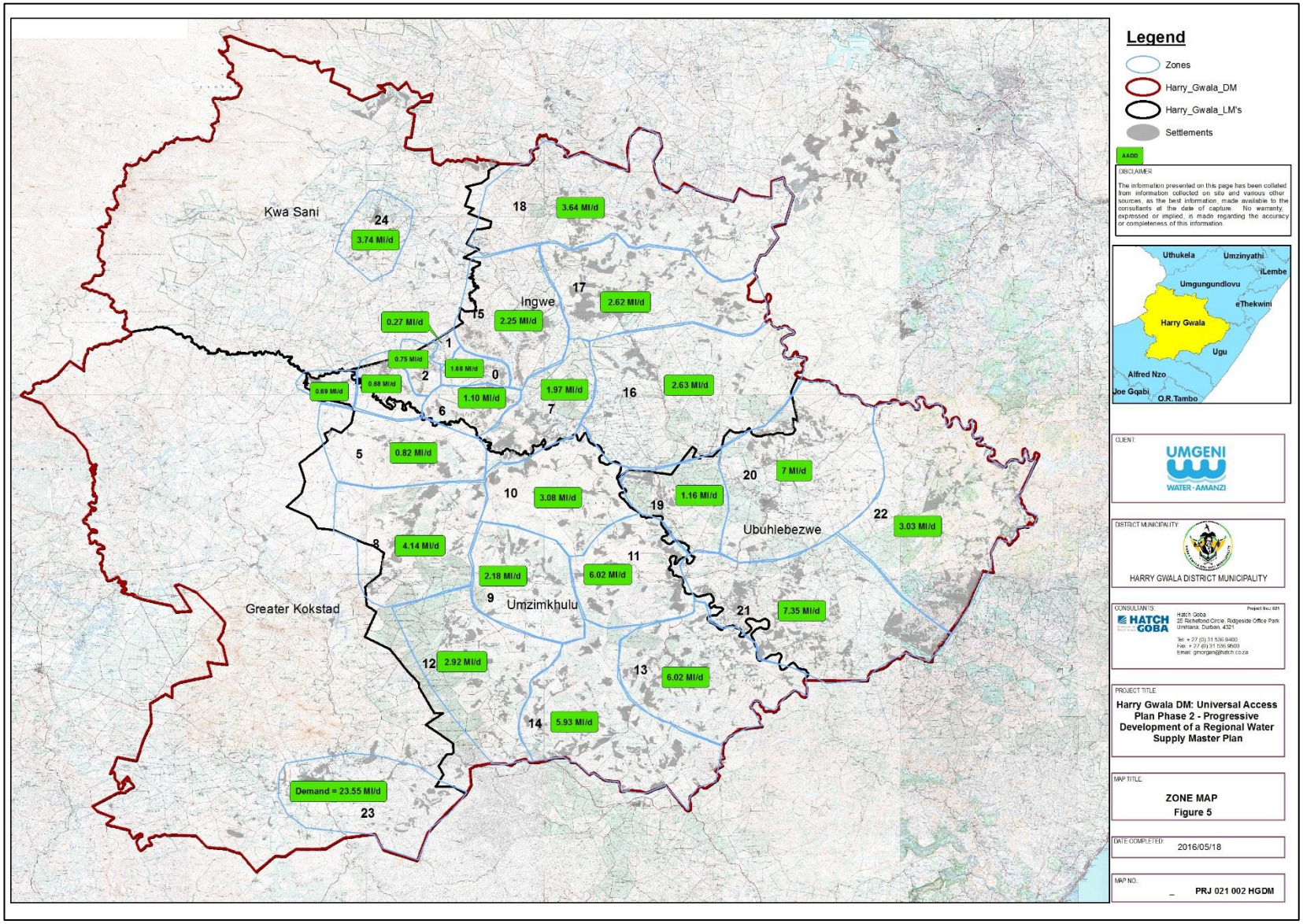
Legend
Zones
Harry_Gwala_DM
Harry_Gwala_LM's
Settlements
AADD
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ZONE MAP
Figure 5
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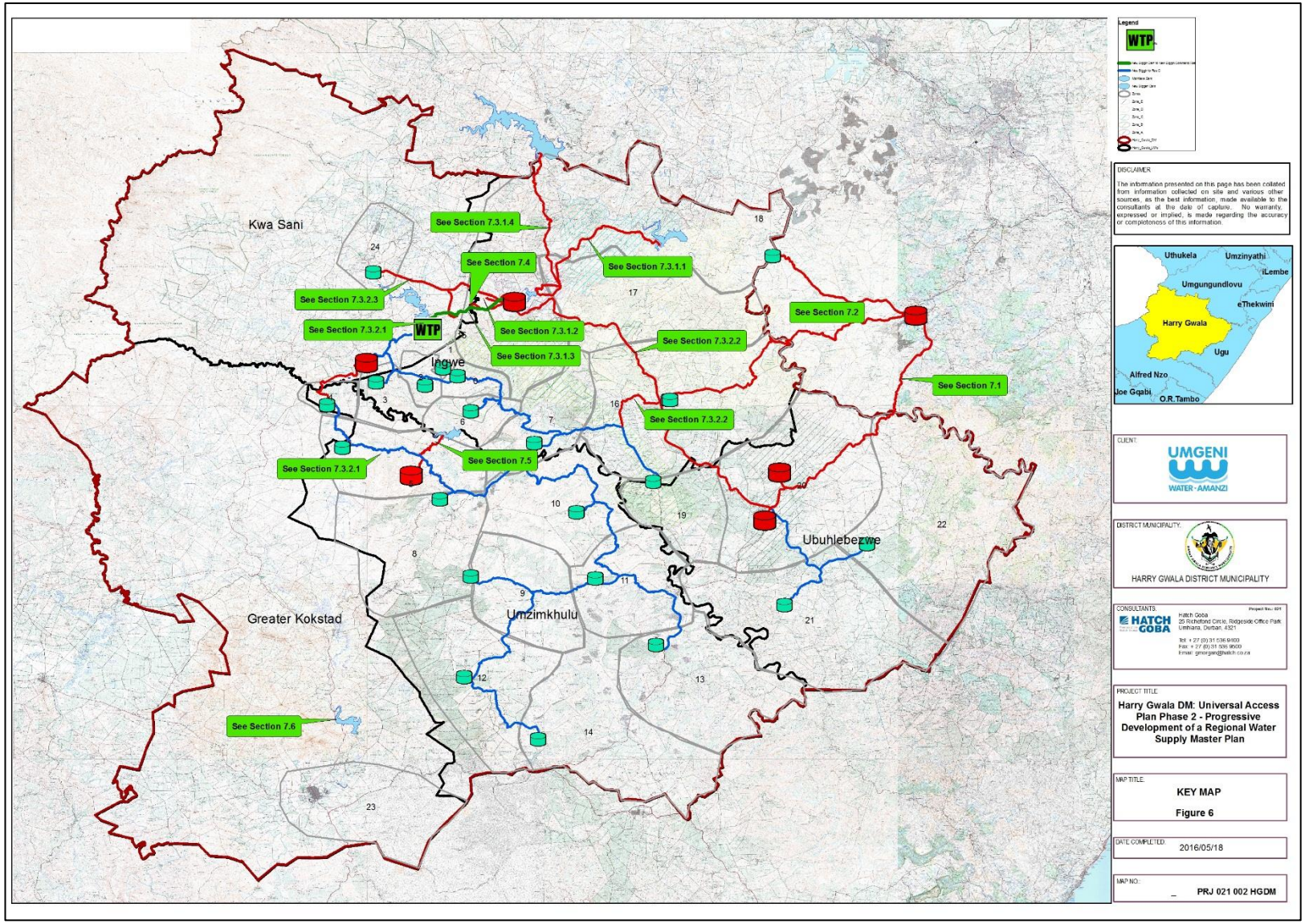
Kwa Sani
Ingwe
Ubuhlebezwe
Greater Kokstad
Umzimkhulu
Demand = 23.55 Ml/d
3.74 Ml/d
3.64 Ml/d
2.62 Ml/d
2.25 Ml/d
0.27 Ml/d
0.75 Ml/d
1.68 Ml/d
0.68 Ml/d
0.69 Ml/d
1.10 Ml/d
1.97 Ml/d
2.63 Ml/d
0.82 Ml/d
7 Ml/d
3.08 Ml/d
1.16 Ml/d
3.03 Ml/d
4.14 Ml/d
2.18 Ml/d
6.02 Ml/d
7.35 Ml/d
2.92 Ml/d
6.02 Ml/d
5.93 Ml/d

Table 10: Project Demands per Zone

Zone	Population 2015	Population 2045	Mℓ/day 2015	Mℓ/day 2045
0	9 610	12 953	1.25	1.68
1	1 528	2 060	0.20	0.27
2	4 286	5 777	0.56	0.75
3	3 905	5 263	0.51	0.68
4	3 943	5 315	0.51	0.69
5	4 685	6 315	0.61	0.82
6	6 271	8 452	0.82	1.10
7	11 233	15 140	1.46	1.97
8	23 634	31 855	3.07	4.14
9	12 456	16 789	1.62	2.18
10	17 591	23 710	2.29	3.08
11	34 379	46 338	4.47	6.02
12	16 637	22 424	2.16	2.92
13	34 359	46 311	4.47	6.02
14	33 816	45 579	4.40	5.93
15	12 855	17 327	1.67	2.25
16	15 036	20 266	1.95	2.63
17	14 977	20 187	1.95	2.62
18	20 768	27 992	2.70	3.64
19	6 602	8 898	0.86	1.16
20	18 126	24 431	2.36	7.00
21	41 961	56 557	5.45	7.35
22	17 268	23 275	2.24	3.03
23	40 000	72 454	13.00	23.55
24	21 351	28 778	2.78	3.74
TOTALS	**427 277**	**594 445**	**63.35**	**95.23**


Kwa Sani
Ingwe
Greater Kokstad
Umzimkhulu
Ubuhlebezwe
See Section 7.3.1.4
See Section 7.4
See Section 7.3.2.3
See Section 7.3.2.1
See Section 7.3.1.2
See Section 7.3.1.3
See Section 7.3.1.1
See Section 7.2
See Section 7.3.2.2
See Section 7.1
See Section 7.5
See Section 7.6
WTP
Legend
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KEY MAP
Figure 6
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Table 11: Water Balance

					Resource Assessment			
Local Municipality	UAP Phase 2 Supply Zones	Existing Water Resource	Yield /Registered Water Use (Mℓ/day)	UAP Phase 2 : 30 Year Demand GAADD (Mℓ/day)	Water Surplus (Mℓ/day)	Water Deficit (Mℓ/day)	UAP Phase 2/HGDM Long Term Option	UAP Phase 2/HGDM Long Term Option Available Yield after all other Allocations (Mℓ/day)
Ingwe	0 to 3, 6, 7 and 15 to 18	Localised Abstractions Boreholes	-	17.60	-	17.60	New Biggin Dam	330.10
Kwa Sani	24	Umzimkhulu River	1.23	3.74	-	2.51	New Biggin Dam	345.19
Ubuhlebezwe	19 to 22	Home Farm Dam Umzimkhulu River Boreholes	3.1	18.53	-	15.43	Ngwangwane Dam/ New Biggin Dam	332.27
Kokstad	23	Crystal Springs Dam Mzintlava River	9.5	23.55	-	14.05	Mzintlava Dam	TBC
Umzimkhulu	4,5 & 8 to 14	Boreholes Umzimkhulu River	4.00	31.80	-	27.80	Ngwangwane Dam/ New Biggin Dam	319.90

References: All Town Recon Strategies of the respective Regional Schemes
Umgeni Water Infrastructure Masterplan
EVN Hydrology Report Ngwangwane Site 2
JG Afrika Hydrology

7.1. OPTION 1: RICHMOND TO MARIATHAL RESERVOIR BULK PIPELINE

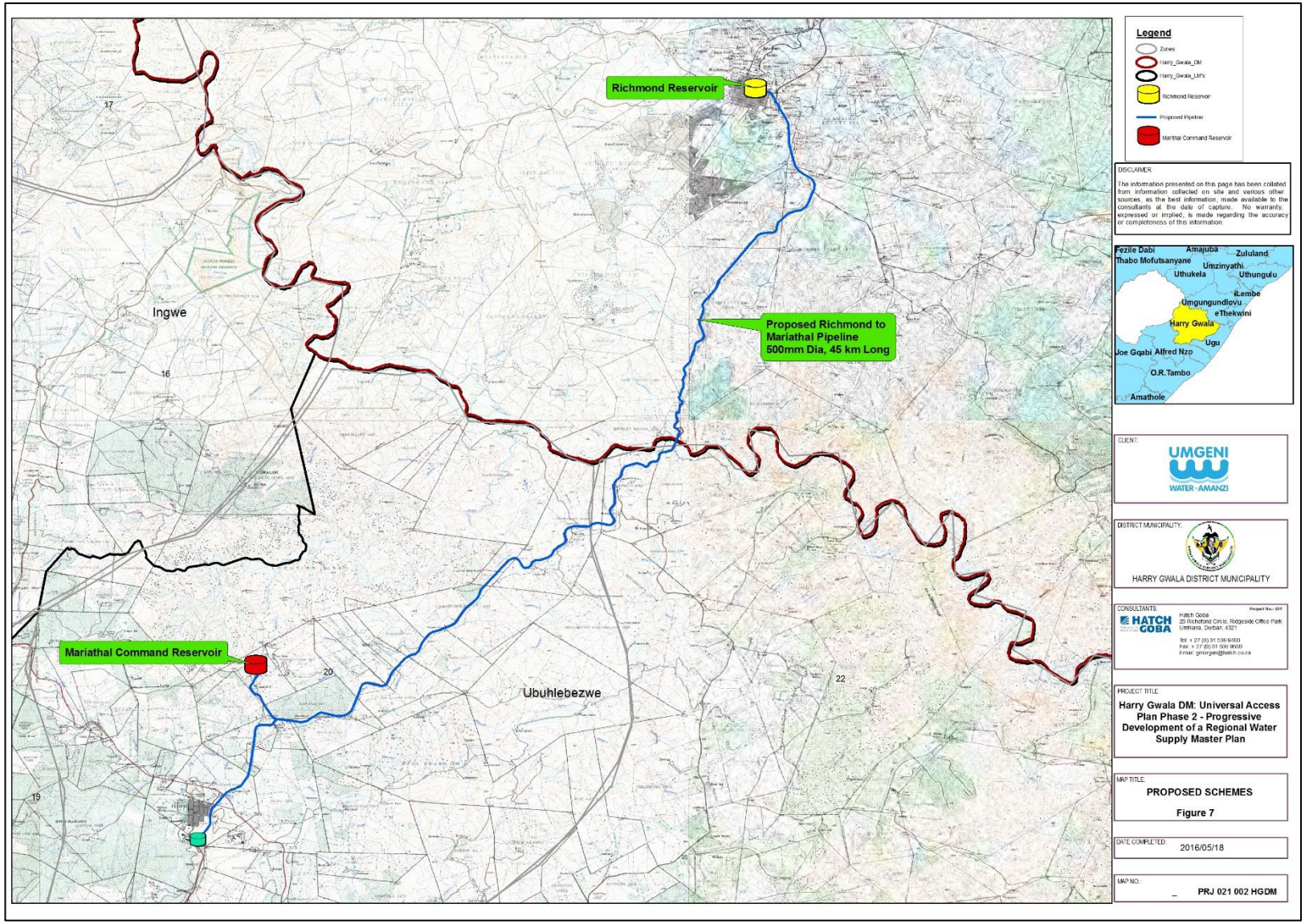
Umgeni Water commissioned the Richmond Pipeline in 2015. From discussions with Umgeni Water, it is understood that this pipeline has a capacity of 12 Mℓ/day. The pipeline is currently operating at 8.5 Mℓ/day. The pipeline thus has a spare capacity of 3.5 Mℓ/day.

It is also understood that Umgeni Water plans to commence with an investigation into the need to augment this pipeline within the next two years. Using this information, the possibility of extending this pipeline to a command position to supply areas in the Harry Gwala District Municipality, was investigated.

The one option is a bulk pipeline from the current terminal point on the Richmond Pipeline, viz, the Richmond Reservoir at Elevation 920m, and along the R56 road towards Ixopo with a proposed terminal command point at Mariathal Mission at an elevation of 1230m. This option is shown on **Figure 7** and a longitudinal profile is shown in **Figure 7a**.

A 45km long 500mm Ø pipeline will be required to supply 18 Mℓ/day to the Mariathal Terminal Reservoir. With an optimal route that may require deviation at points to optimise hydraulics, it will be possible to gravitate for 32km where after two 0.5 Mw booster pump stations will be required to pump water from an elevation of 850m to up to the Mariathal Reservoir, elevation 1230m.

It will be possible to supply Zones 20, 21 and sections of Zone 22 from the Mariathal Reservoir. The layout for these secondary bulk pipelines is shown **Figure 7b**.


Richmond Reservoir
Proposed Richmond to Mariathal Pipeline 500mm Dia, 45 km Long
Mariathal Command Reservoir
Ingwe
Ubuhlebezwe
17
16
20
22
19
Legend
Zones
Harry_Gwala_DM
Harry_Gwala_LM's
Richmond Reservoir
Proposed Pipeline
Mariathal Command Reservoir
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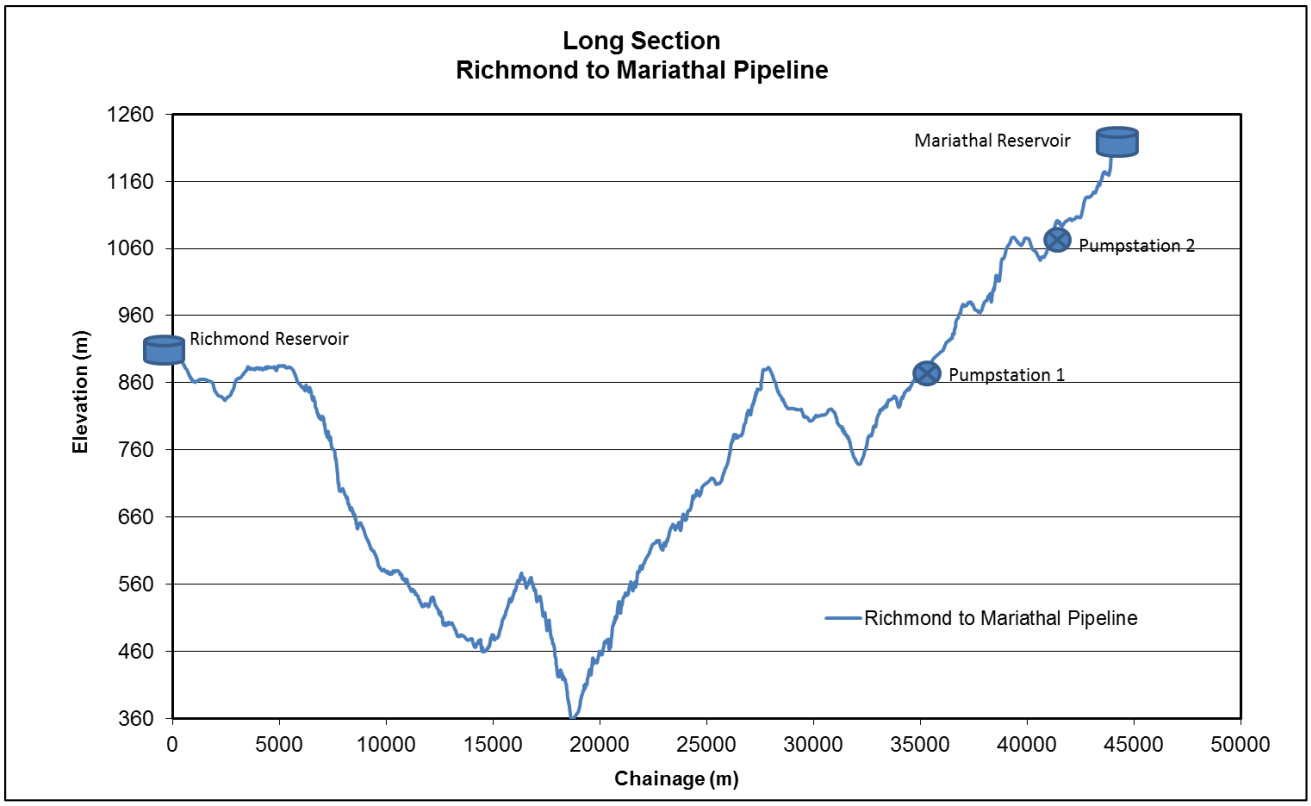

Figure 7a: Long Section - Option 1

Table 12: Capital Costs – Richmond Reservoir to Mariathal Reservoir

Consultants	
Design and Tender Documentation	R 37 495 677
Geotech Survey	R 3 000 000
Land Survey	R 360 855
Cathodic Protection	R 5 000 000
Construction Monitoring	R 8 419 950
Construction	
Pipe Supply	R 99 235 125
Pipeline Construction	R 176 840 744
Pipe Bridge/Jack	R 60 000 000
Pumpstation	R 48 114 000
Water Works	R 0
Reservoir	R 32 428 763
Dam	R 0
Abstraction	R 0
Land Acquisition - 7.5%	R 31 246 397
Environmental, Community Liaison	R 5 000 000
Health & Safety, Quality Assurance	R 4 166 186
Project Office	R 14 581 652
Contingencies	R 262 944 674
Sub total	R 788 834 023
VAT (14%)	R 110 436 763
Grand total	**R 899 270 787**

Electricity capital costs excluded

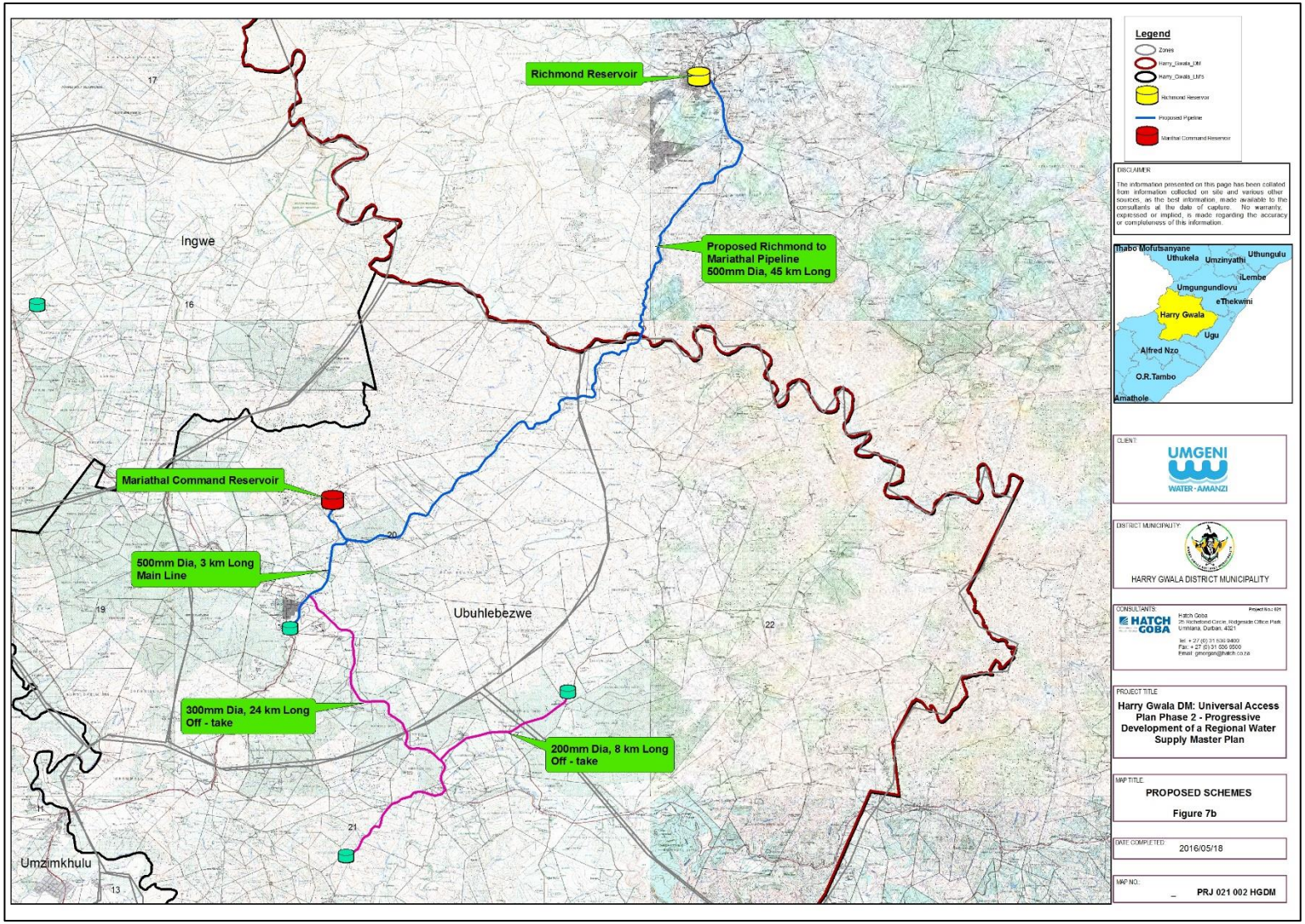
Richmond Reservoir
Proposed Richmond to Mariathal Pipeline 500mm Dia, 45 km Long
Mariathal Command Reservoir
500mm Dia, 3 km Long Main Line
300mm Dia, 24 km Long Off - take
200mm Dia, 8 km Long Off - take
Ingwe
Ubuhlebezwe
Umzimkhulu
Legend
Zones
Harry_Gwala_LM
Harry_Gwala_LMS
Richmond Reservoir
Proposed Pipeline
Mariathal Command Reservoir
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Figure 7b
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Table 13: Capital Costs – Secondary Bulk Pipelines

Consultants	
Design and Tender Documentation	11 492 331
Geotech Survey	3 000 000
Land Survey	256 608
Cathodic Protection	5 000 000
Construction Monitoring	5 987 520
Construction	
Pipe Supply	35 283 600
Pipeline Construction	62 876 709
Pipe Bridge/Jack	0
Pumpstation	0
Water Works	0
Reservoir	29 532 255
Dam	0
Abstraction	0
Land Acquisition - 7.5%	9 576 942
Environmental, Community Liaison	5 000 000
Health & Safety, Quality Assurance	1 276 926
Project Office	4 469 240
Contingencies	86 876 065
Sub total	260 628 196
VAT (14%)	36 487 947
Grand total	**297 116 144**

Electricity capital costs excluded

Discussion

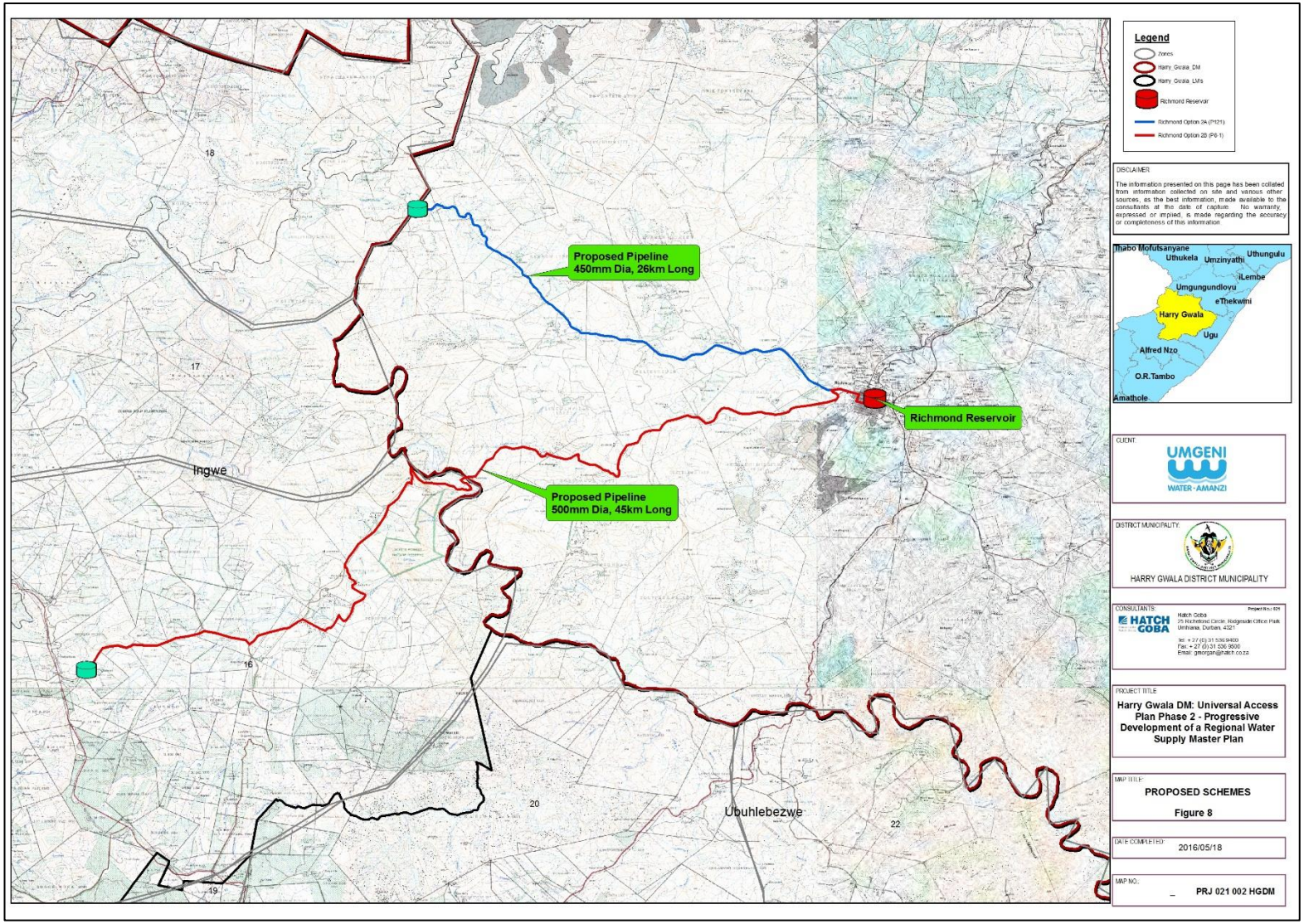
- This option will require two stage pumping and hence high operation and maintenance costs
- A pipeline crossing across the uMkhomazi River will be necessary
- Static pressure on the gravity system will exceed 50 bar
- Water resource availability could be a constraint (Upper Umgeni System)
- The will be technical challenges with steep sections along the pipeline route
- Environmental and social matters could affect the viability of this option
- Capital costs for this option are high and the relatively low volumes that will be supplied affects the financial viability of this option.

7.2. OPTION 2: RICHMOND TO INGWE BULK PIPELINE

Two possible pipeline routes from Richmond Reservoir along District Roads P8-1 and P121 to the Ingwe LM were investigated.

Option 2A along Road P121 will require a 26km long 450mm Ø pipeline with a capacity of 8.2 Mℓ/day to supply Zones 16, 17 & 18.

Option 2B along Road P8-1 will require a 50km long, 500mm Ø pipeline with a capacity of 15 Mℓ/day to supply Zones 19, 20 & 21. The pipeline routes are shown in **Figure 8** and the longitudinal profiles are shown in **Figure 8a** & **Figure 8b** respectively.


Proposed Pipeline
450mm Dia, 26km Long
Richmond Reservoir
Proposed Pipeline
500mm Dia, 45km Long
Ingwe
Ubuhlebezwe
18
17
16
20
22
19
Legend
Zones
Harry Gwala_DM
Harry Gwala_LMs
Richmond Reservoir
Richmond Option 3A (PT21)
Richmond Option 2B (P6-1)
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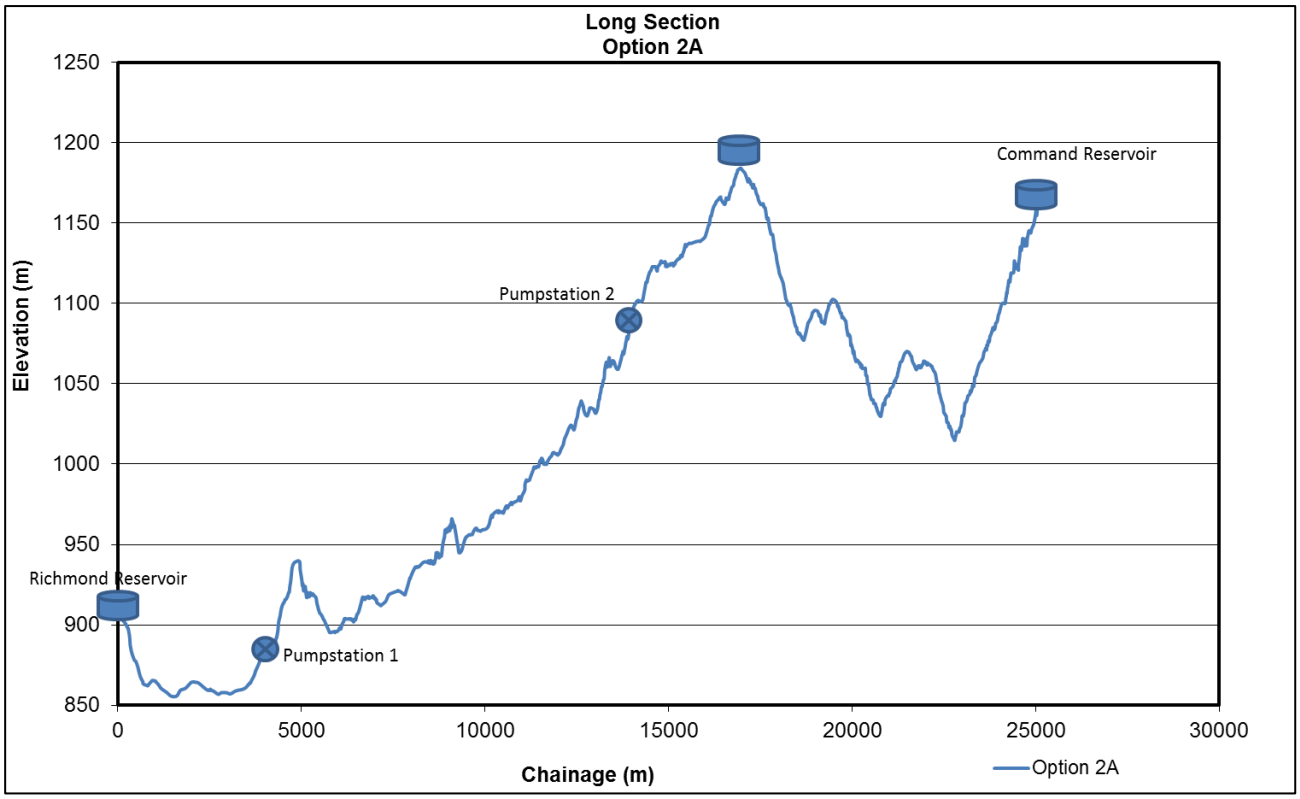


Figure 8a: Option 2A Long Section

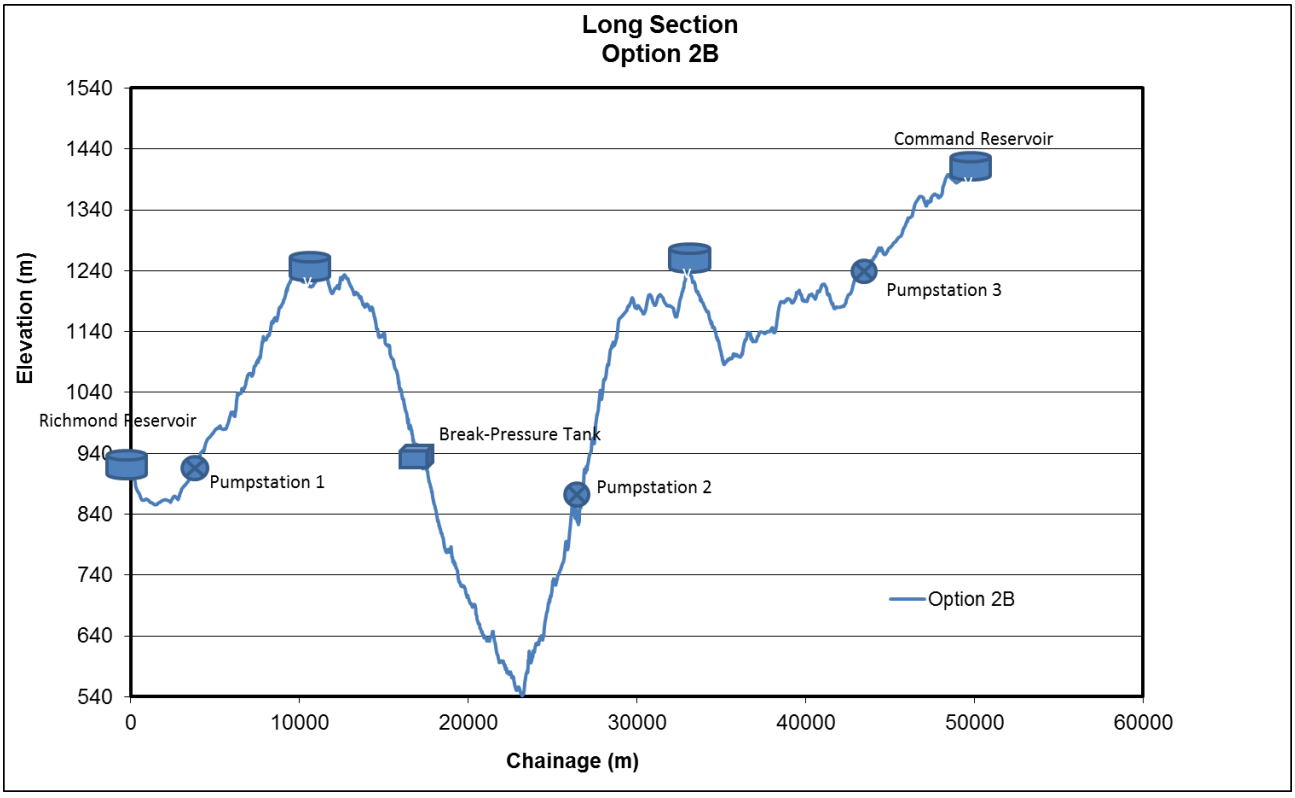


Figure 8b: Option 2B Long Section

Table 14: Capital Costs - Option 2A

Consultants	
Design and Tender Documentation	R 18 577 570
Geotech Survey	R 3 000 000
Land Survey	R 208 494
Cathodic Protection	R 5 000 000
Construction Monitoring	R 4 864 860
Construction	
Pipe Supply	R 45 173 700
Pipeline Construction	R 80 501 241
Pipe Bridge/Jack	R 30 000 000
Pumpstation	R 29 403 000
Water Works	R 0
Reservoir	R 21 339 501
Dam	R 0
Abstraction	R 0
Land Acquisition - 7.5%	R 15 481 308
Environmental, Community Liaison	R 5 000 000
Health & Safety, Quality Assurance	R 2 064 174
Project Office	R 7 224 610
Contingencies	R 133 919 229
Sub total	R 401 757 688
VAT (14%)	R 56 246 076
Grand total	**R 458 003 764**

Electricity capital costs excluded

Table 15: Capital Costs - Option 2B

Consultants	
Design and Tender Documentation	R 48 933 338
Geotech Survey	R 3 000 000
Land Survey	R 400 950
Cathodic Protection	R 5 000 000
Construction Monitoring	R 9 355 500
Construction	
Pipe Supply	R 60 142 500
Pipeline Construction	R 107 176 208
Pipe Bridge/Jack	R 230 000 000
Pumpstation	R 120 285 000
Water Works	R 0
Reservoir	R 26 100 052
Dam	R 0
Abstraction	R 0
Land Acquisition - 7.5%	R 40 777 782
Environmental, Community Liaison	R 5 000 000
Health & Safety, Quality Assurance	R 5 437 038
Project Office	R 19 029 632
Contingencies	R 340 319 000
Sub total	R 1 020 957 000
VAT (14%)	R 142 933 980
Grand total	**R 1 163 890 980**

Electricity capital costs excluded

Discussion

- The longitudinal profiles indicate that these pipeline routes are not optimal for pipeline hydraulics as both require pumping and a combination of pumping and gravity supply for sections. The operation and maintenance costs will be high on these options.
- Environmental and social issues will also affect these routes.
- It is not recommended that these options be considered further

7.3. OPTION 3: EXTENSION OF THE GREATER BULWER-DONNYBROOK REGIONAL SCHEME

The Greater Bulwer-Donnybrook Regional Bulk Water Supply Scheme is expected to be fully completed by the year 2021. The footprint of the proposed Greater Bulwer-Donnybrook Regional Water Supply currently covers the supply Zones 15 to 19 that have a combined 30 year water demand of **12.31 Mℓ/day**. This scheme will use the proposed Bulwer Dam and existing Comrie Dam to supply water within the project footprint. A study by AECOM recommended the raising of Comrie Dam as the most feasible option to increase the yield of the dam and hence allow water to be supplied to the proposed scheme footprint. This option however only allows an additional yield of **1.4 Mℓ/day.** In addition to Comrie Dam, an augmentation scheme will be required at some point in the future to allow the projected demands to be supplied especially when the supply to Ixopo is implemented.

7.3.1. BULWER DAM RAW WATER AUGMENTATION

From a regional perspective additional raw water resource options were investigated to augment supply to the Bulwer Dam as follows:-

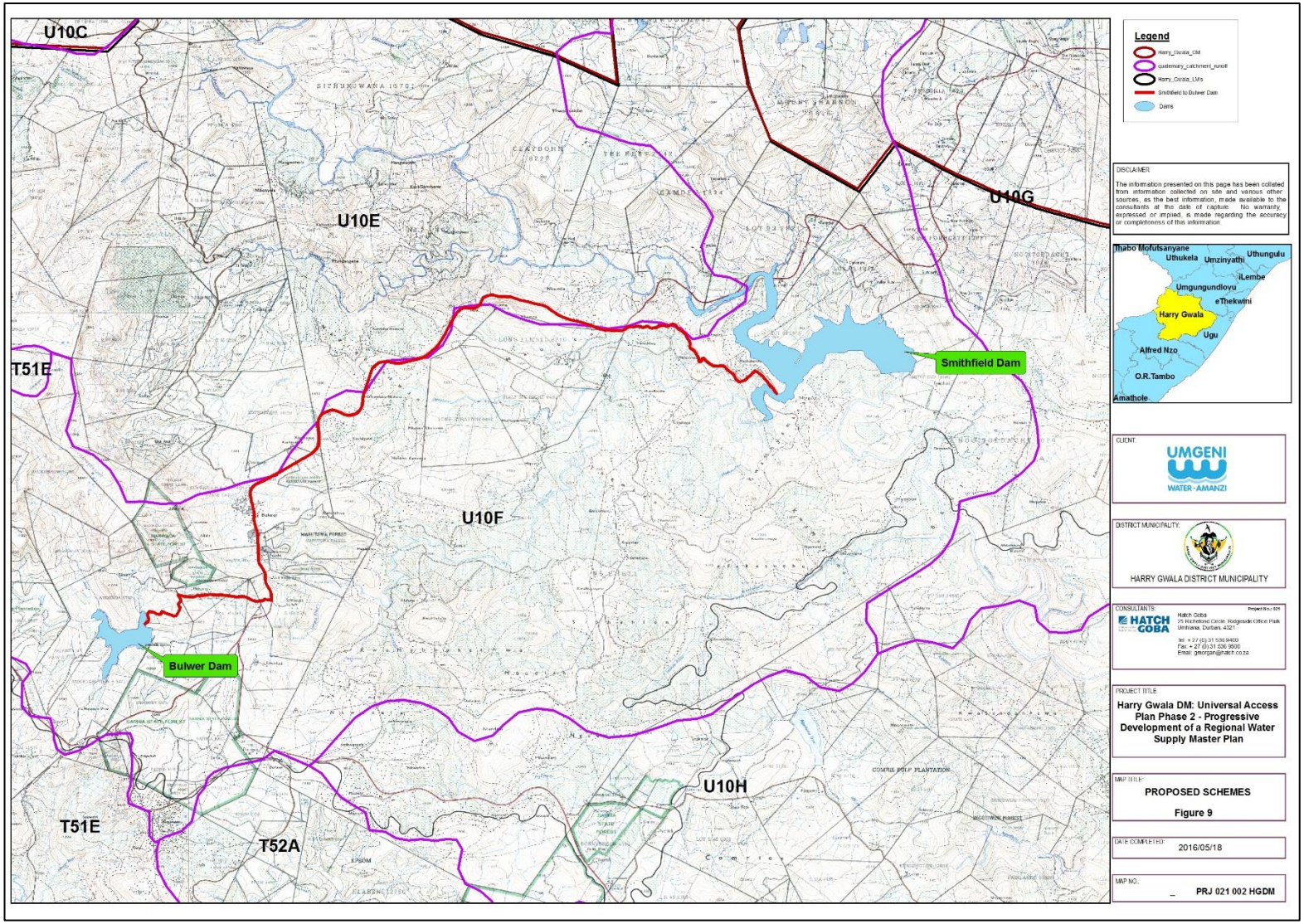
- The option of an inter-basin raw water transfer from the proposed Smithfield Dam to the proposed Bulwer Dam,
- The option of raw water transfer from the proposed Impendle Dam to the proposed Bulwer Dam,
- Two other possible raw water augmentation options from the Pholela and Mzimkhulu Rivers were also investigated.

The reasons for these investigations are as follows:

- The Bulwer Dam together with a treatment works are already in construction and will yield **8.38 Mℓ/day** once completed.
- As a treatment works is already planned at the dam, additional raw water will allow for this works to be upgraded and this dam together with its treatment works and the proposed Command Reservoir (Reservoir A) could allow for this system that is located high up in the catchment to become a regional supply hub down to Ixopo and Highflats in the Ubhulebezwe LM as well as other areas in the Ingwe and Umzimkhulu LM's down to the town of Umzimkhulu.

7.3.1.1. SMITHFIELD DAM TO BULWER DAM RAW WATER TRANSFER

A possible raw water pipeline route from Smithfield Dam to the Bulwer Dam was investigated. This is shown in **Figure 9** and Longitudinal Section is shown in **Figure 9a**.


U10C
U10E
U10G
U10F
U10H
T51E
T51E
T52A
Smithfield Dam
Bulwer Dam
Legend
Harry_Gwala_LM
quaternary_catchment_runoff
Harry_Gwala_LMs
Smithfield to Bulwer Dam
Dams
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MAP NO.:
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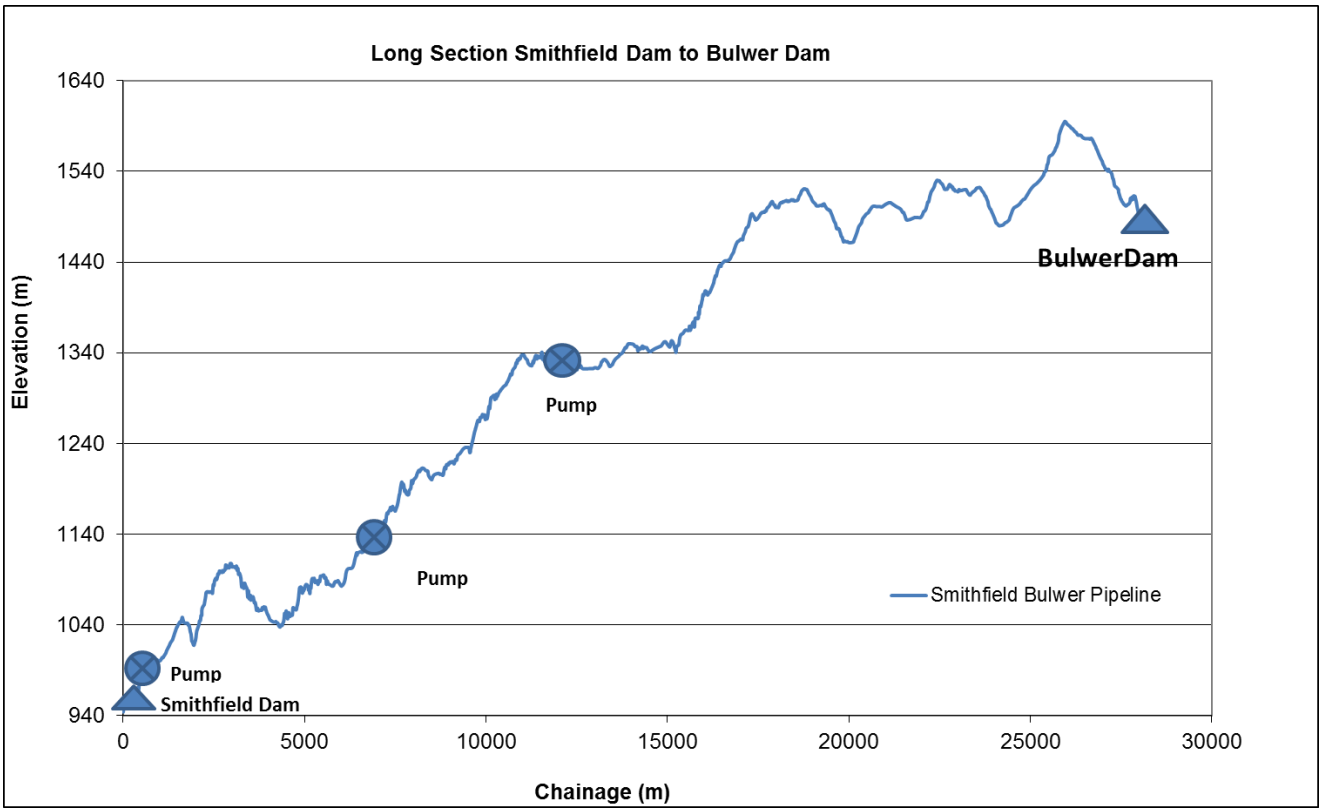


Figure 9a: Long Section Smithfield to Bulwer Dam

From Smithfield Dam, the pipeline goes through the Machabasini and Mkhohlwa communities (determined from Google Earth) up to the R617 and then follows the R617 through to Bulwer Town where the raw water can be discharged at an elevation of 1565m. From this point the water can gravitate into the Bulwer Dam catchment. This option will require a 27km 650mm Ø pipeline and static pumping of over 600m with at least 3 stages.

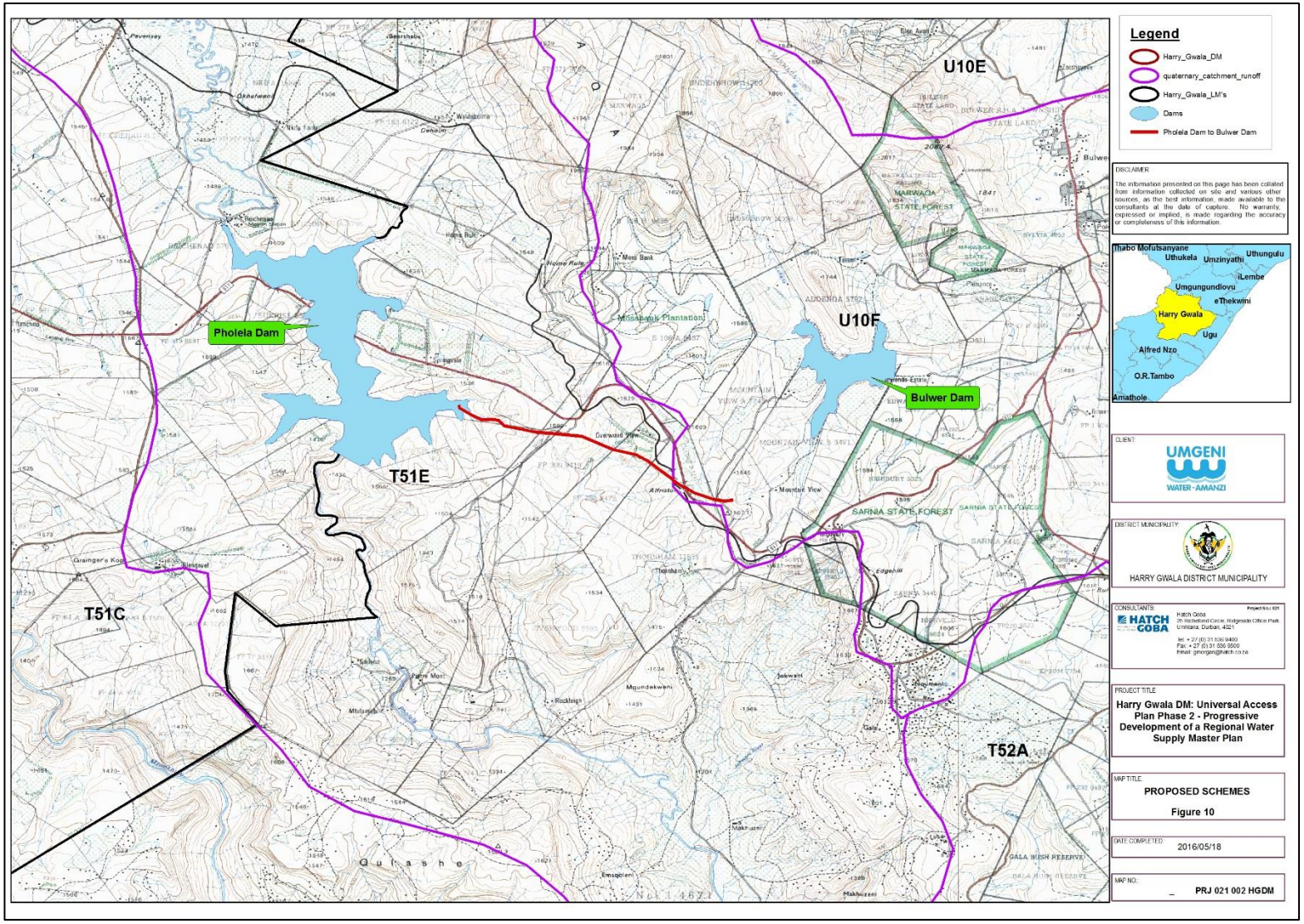
Table 16: Capital Costs – Smithfield Dam to Bulwer Dam

Consultants	
Design and Tender Documentation	104 916 358
Geotech Survey	3 000 000
Land Survey	216 513
Cathodic Protection	5 000 000
Construction Monitoring	5 051 970
Construction	
Pipe Supply	90 213 750
Pipeline Construction	160 764 313
Pipe Bridge/Jack	0
Pumpstation	176 418 000
Water Works	3 341 250
Reservoir	0
Dam	700 000 000
Abstraction	35 000 000
Land Acquisition - 7.5%	87 430 298
Environmental, Community Liaison	5 000 000
Health & Safety, Quality Assurance	11 657 373
Project Office	40 800 806
Contingencies	714 405 316
Sub total	2 143 215 947
VAT (14%)	300 050 233
Grand total	**2 443 266 179**

Electricity capital costs excluded

7.3.1.2. PHOLELA RIVER TO BULWER DAM RAW WATER TRANSFER

Another option of augmenting the raw water supply to Bulwer dam will be from the Pholela River. A possible pipeline route is shown in **Figure 10** and a longitudinal section is shown in **Figure 10a**. Assuming a yield of 5 Mℓ/day from this river for the Bulwer Scheme, an 8.5km pipeline 250mm Ø with a static pumping head of 250m will augment raw water to the Bulwer waterworks and allow a higher level of service to Zones 15 to 19 within the current Greater Bulwer-Donnybrook Scheme footprint. A hydrological assessment will have to be carried out in order to determine the yield as well as the best possible abstraction point of the Pholela River.


Pholela Dam
Bulwer Dam
U10E
U10F
T51E
T51C
T52A
SARNIA STATE FOREST
MARWAQA STATE FOREST
Legend
Harry_Gwala_DM
quaternary_catchment_runoff
Harry_Gwala_LM's
Dams
Pholela Dam to Bulwer Dam
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eThekwini
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Amathole
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DISTRICT MUNICIPALITY:
HARRY GWALA DISTRICT MUNICIPALITY
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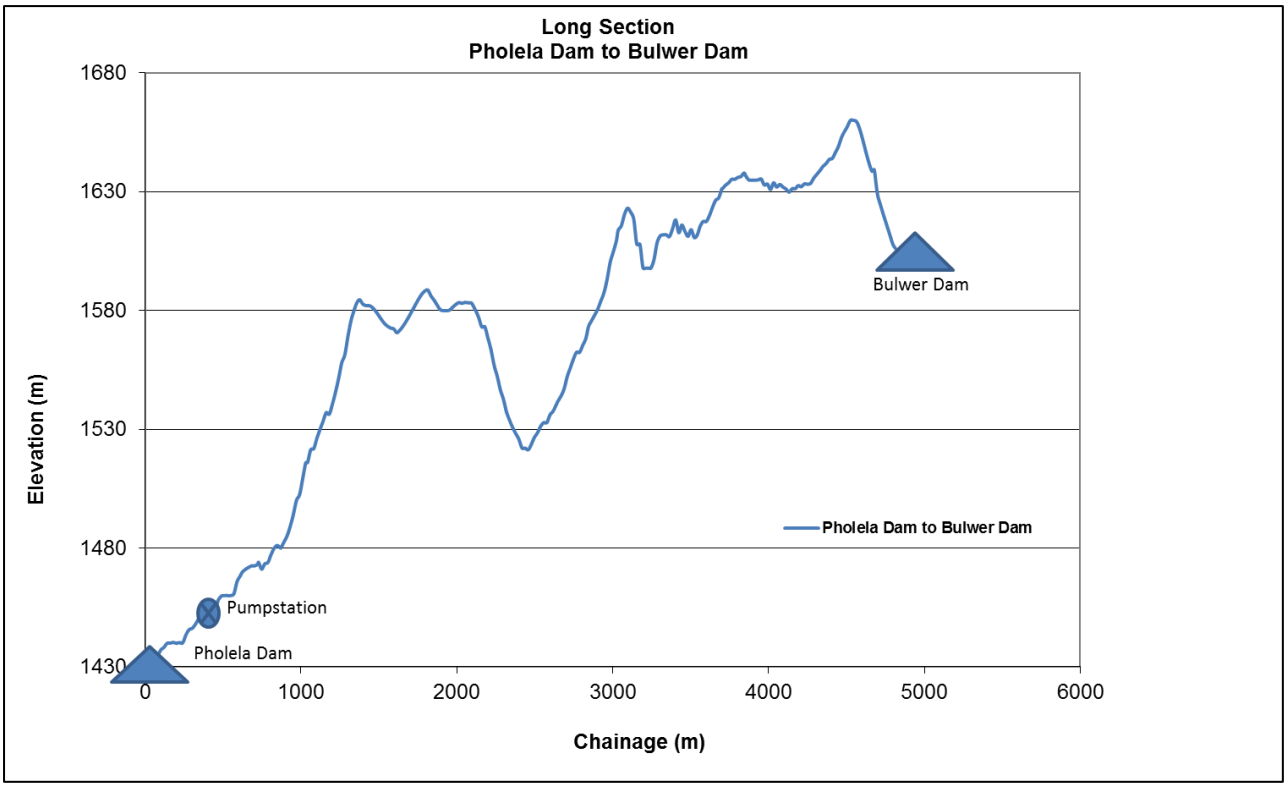


Figure 10a: Long Section - Pholela River to Bulwer Dam

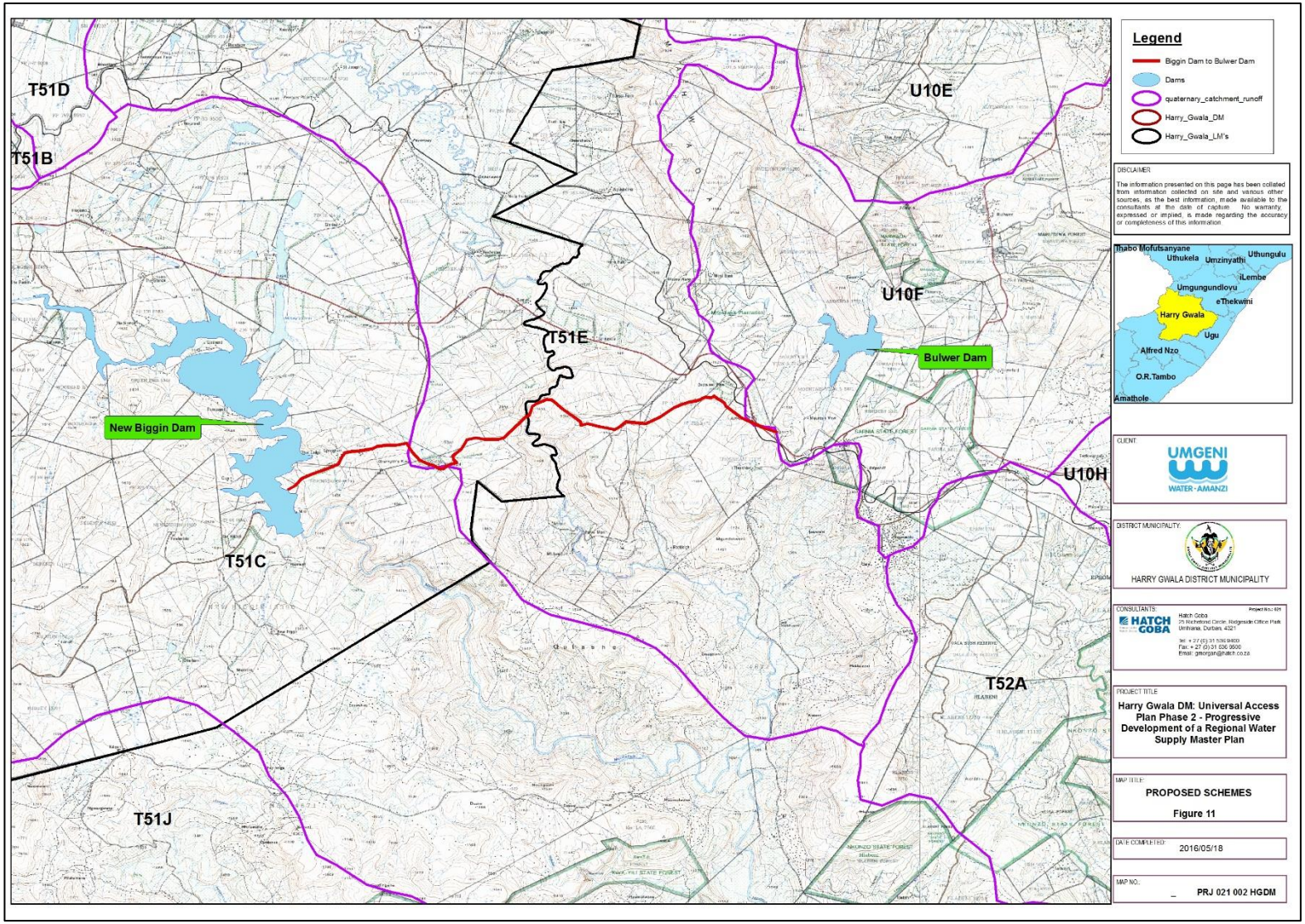
Table 17: Capital Costs – Pholela River to Bulwer Dam

Consultants	
Design and Tender Documentation	71 088 075
Geotech Survey	3 000 000
Land Survey	68 162
Cathodic Protection	5 000 000
Construction Monitoring	1 590 435
Construction	
Pipe Supply	7 952 175
Pipeline Construction	14 171 076
Pipe Bridge/Jack	0
Pumpstation	29 403 000
Water Works	3 341 250
Reservoir	0
Dam	700 000 000
Abstraction	35 000 000
Land Acquisition - 7.5%	59 240 063
Environmental, Community Liaison	5 000 000
Health & Safety, Quality Assurance	7 898 675
Project Office	27 645 363
Contingencies	485 199 137
Sub total	1 455 597 410
VAT (14%)	203 783 637
Grand total	**1 659 381 047**

Electricity capital costs excluded

7.3.1.3. UMZIMKHULU (NEW BIGGIN DAM SITE) TO BULWER DAM RAW WATER TRANSFER

The proposed site of the New Biggin Dam (co-ordinates -29.900 S; 29,6076 E) on the Mzimkulu River together with a possible raw water pipeline route to Bulwer Dam is shown in **Figure 11**.


T51D
T51B
T51E
T51C
T51J
U10E
U10F
U10H
T52A
New Biggin Dam
Bulwer Dam
Legend
Biggin Dam to Bulwer Dam
Dams
quaternary_catchment_runoff
Harry_Gwala_DM
Harry_Gwala_LM's
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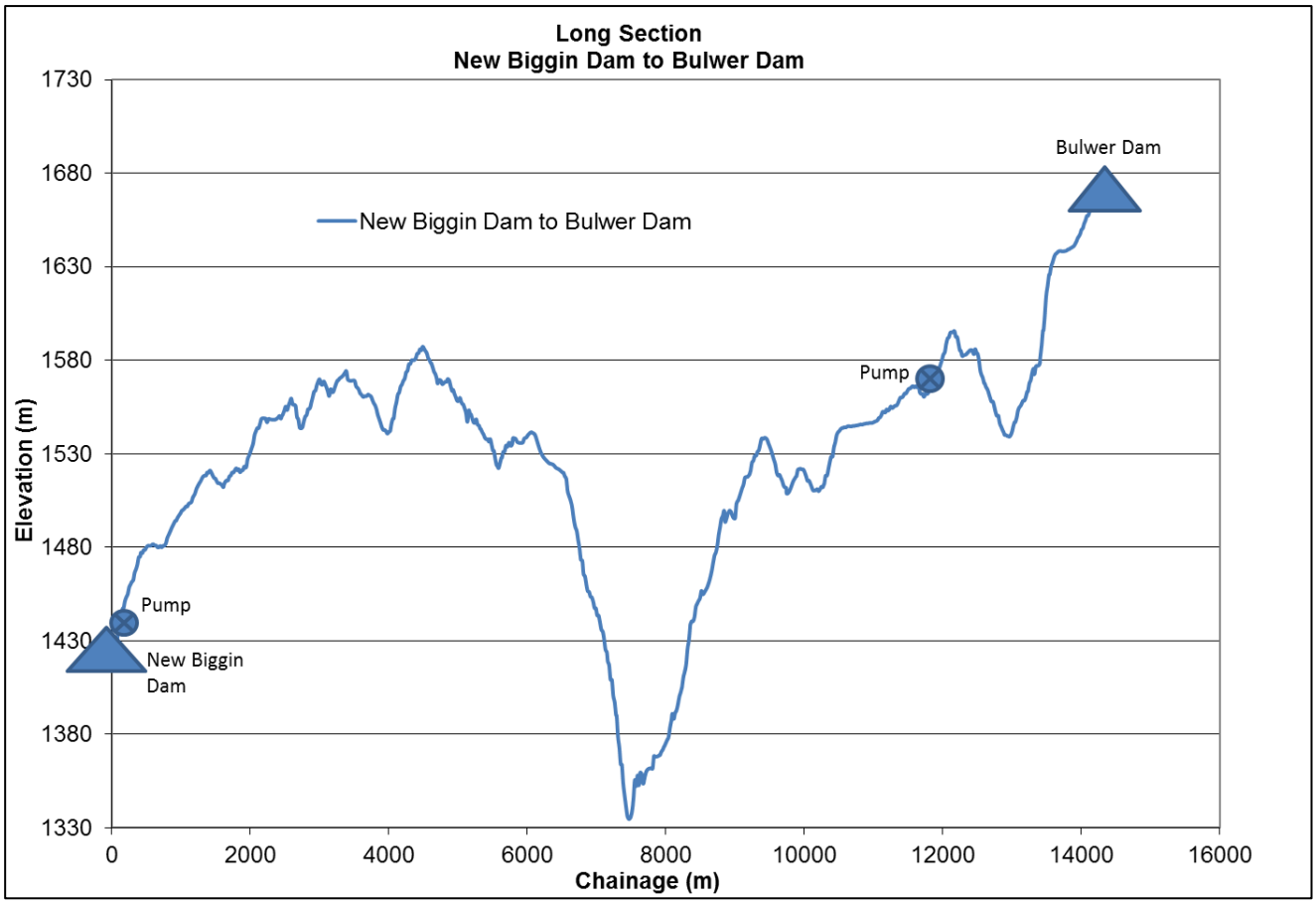

Figure 11a: Long Section - New Biggin Dam to Bulwer Dam

An option of a new waterworks at the dam site could allow for water supply to Zones 1 to 14 using the proposed Regional Reservoir at Elevation 1858m and pipeline configuration described in section 7.3.2.1 and shown in **Figure 13**.

Table 18: Capital Costs – New Biggin Dam to Bulwer Dam

Consultants	
Design and Tender Documentation	R 107 861 603
Geotech Survey	R 3 000 000
Land Survey	R 120 285
Cathodic Protection	R 5 000 000
Construction Monitoring	R 2 806 650
Construction	
Pipe Supply	R 50 118 750
Pipeline Construction	R 89 313 507
Pipe Bridge/Jack	R 30 000 000
Pumpstation	R 294 030 000
Water Works	R 0
Reservoir	R 0
Dam	R 700 000 000
Abstraction	R 35 000 000
Land Acquisition - 7.5%	R 89 884 669
Environmental, Community Liaison	R 5 000 000
Health & Safety, Quality Assurance	R 11 984 623
Project Office	R 41 946 179
Contingencies	R 733 033 133
Sub total	R 2 199 099 399
VAT (14%)	R 307 873 916
Grand total	**R 2 506 973 315**

Electricity capital costs excluded

7.3.1.4. IMPENDLE DAM TO BULWER DAM RAW WATER TRANSFER

It is envisaged that the Impendle dam will be constructed and commissioned within the next 30 years. This dam would be an option to augment raw water to Bulwer Dam. The footprint of the proposed dam together with a possible raw water transfer pipeline is shown in **Figure 12**.

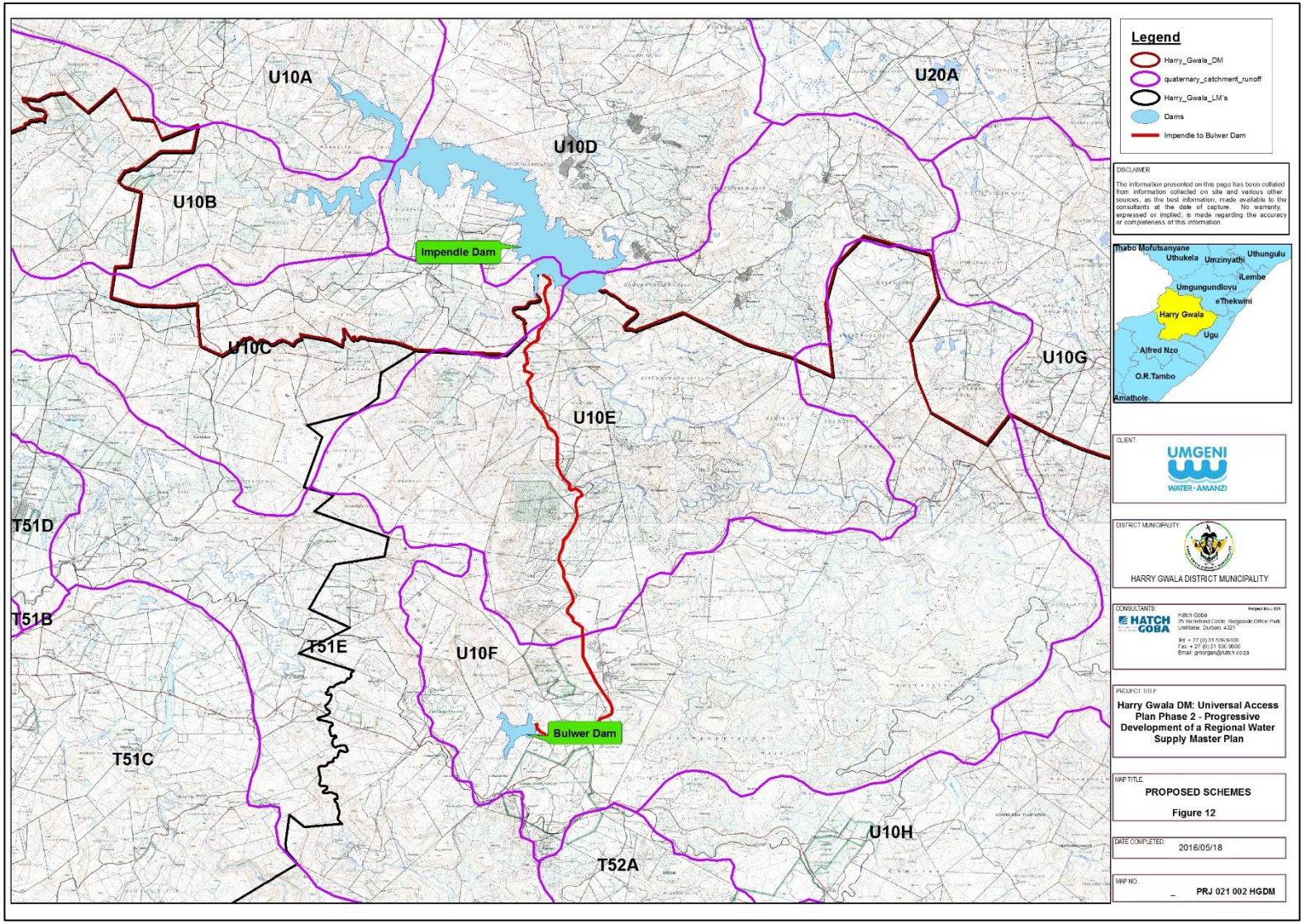
U10A
U20A
U10D
U10B
Impendle Dam
U10C
U10G
U10E
T51D
T51B
T51E
U10F
Bulwer Dam
T51C
U10H
T52A
Legend
Harry_Gwala_DM
quaternary_catchment_runoff
Harry_Gwala_LM's
Dams
Impendle to Bulwer Dam
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Table 19: Capital Costs –Impendle Dam to Bulwer Dam

Consultants	
Design and Tender Documentation	R 48 608 238
Geotech Survey	R 3 000 000
Land Survey	R 232 551
Cathodic Protection	R 5 000 000
Construction Monitoring	R 5 426 190
Construction	
Pipe Supply	R 96 896 250
Pipeline Construction	R 172 672 780
Pipe Bridge/Jack	R 15 000 000
Pumpstation	R 220 522 500
Water Works	R 0
Reservoir	R 0
Dam	R 0
Abstraction	R 35 000 000
Land Acquisition - 7.5%	R 40 506 865
Environmental, Community Liaison	R 5 000 000
Health & Safety, Quality Assurance	R 5 400 915
Project Office	R 18 903 204
Contingencies	R 336 084 746
Sub total	R 1 008 254 239
VAT (14%)	R 141 155 593
Grand total	**R 1 149 409 832**

Electricity capital costs excluded

Discussion

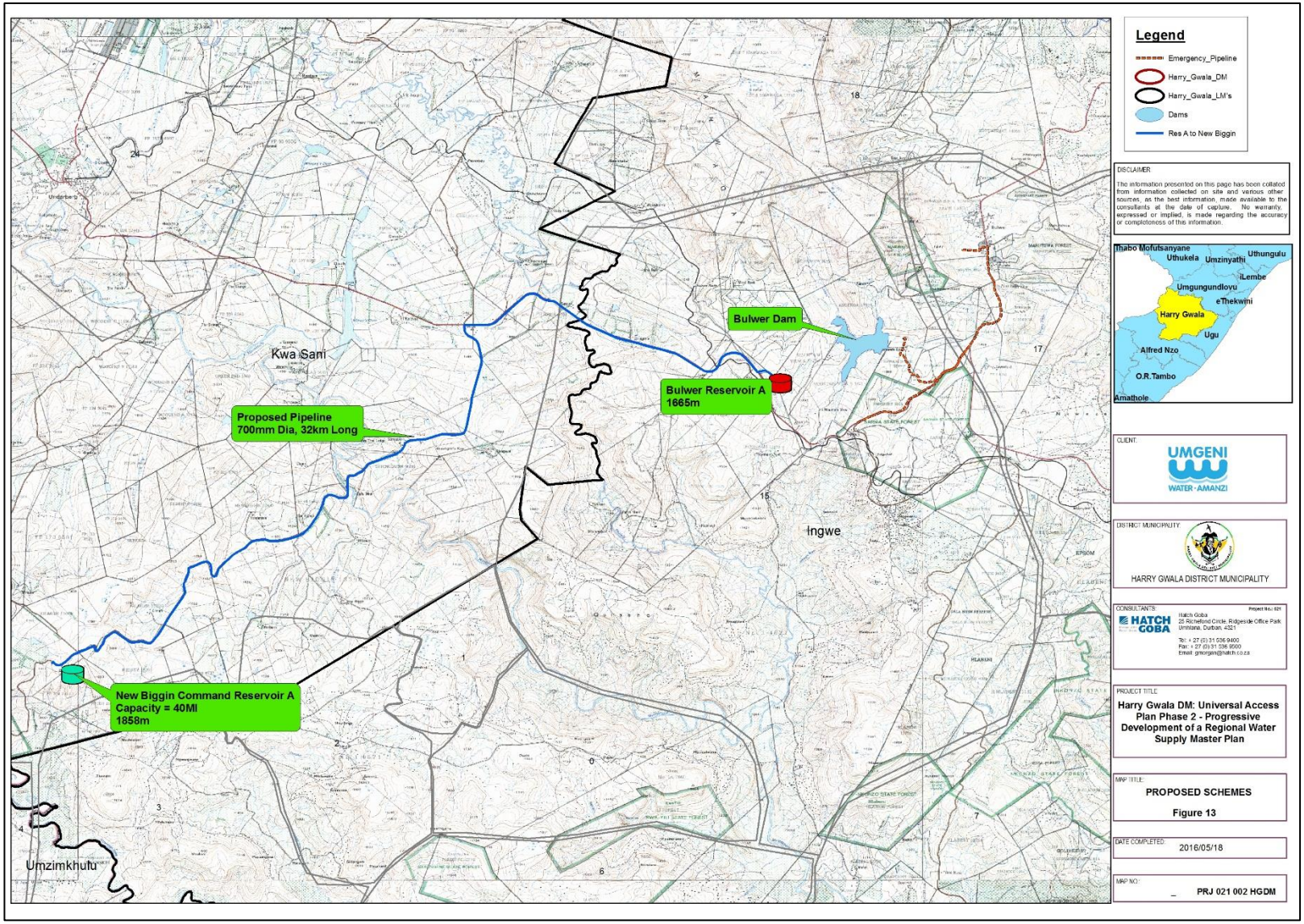
- The pumping costs of the raw water for the options presented will be high due to the volume and high lifts required.
- A more detailed economic analysis of the options will be required to compare the capital cost of developing resources, together with treatment and distribution including energy costs although the Pholela River Option appears to be the most favourable.
- The allowable water use from Smithfield Dam for the Harry Gwala DM needs to be determined although this option will have high capital and O&M costs.

7.3.2. BULWER DAM POTABLE WATER DISTRIBUTION OPTIONS

The possibility of extending the Greater Bulwer Scheme further to cover the remainder of Ingwe, Ubuhlebezwe and Umzimkhulu LM's (Zones 1 to 14 as well as Zones 20, 21 & 22) was investigated and is presented in this section.

7.3.2.1. POTABLE WATER SUPPLY: BULWER DAM TO UMZIMKHULU LM

A 27km long 700mm Ø pipeline with a capacity of 40 Mℓ/day from the proposed Bulwer Reservoir A on the Greater Bulwer scheme to a command position at an elevation of 1858m (proposed **New Biggin Reservoir A – See Section 7.4**) in the KwaSani LM close to the border of Umzimkhulu LM. This option is shown in **Figure 13** and the longitudinal section is shown in **Figure 13a**.


Legend
Emergency_Pipeline
Harry_Gwala_DM
Harry_Gwala_LM's
Dams
Res A to New Biggin
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Bulwer Dam
Bulwer Reservoir A
1665m
Proposed Pipeline
700mm Dia, 32km Long
New Biggin Command Reservoir A
Capacity = 40Ml
1858m
Kwa Sani
Ingwe
Umzimkhulu

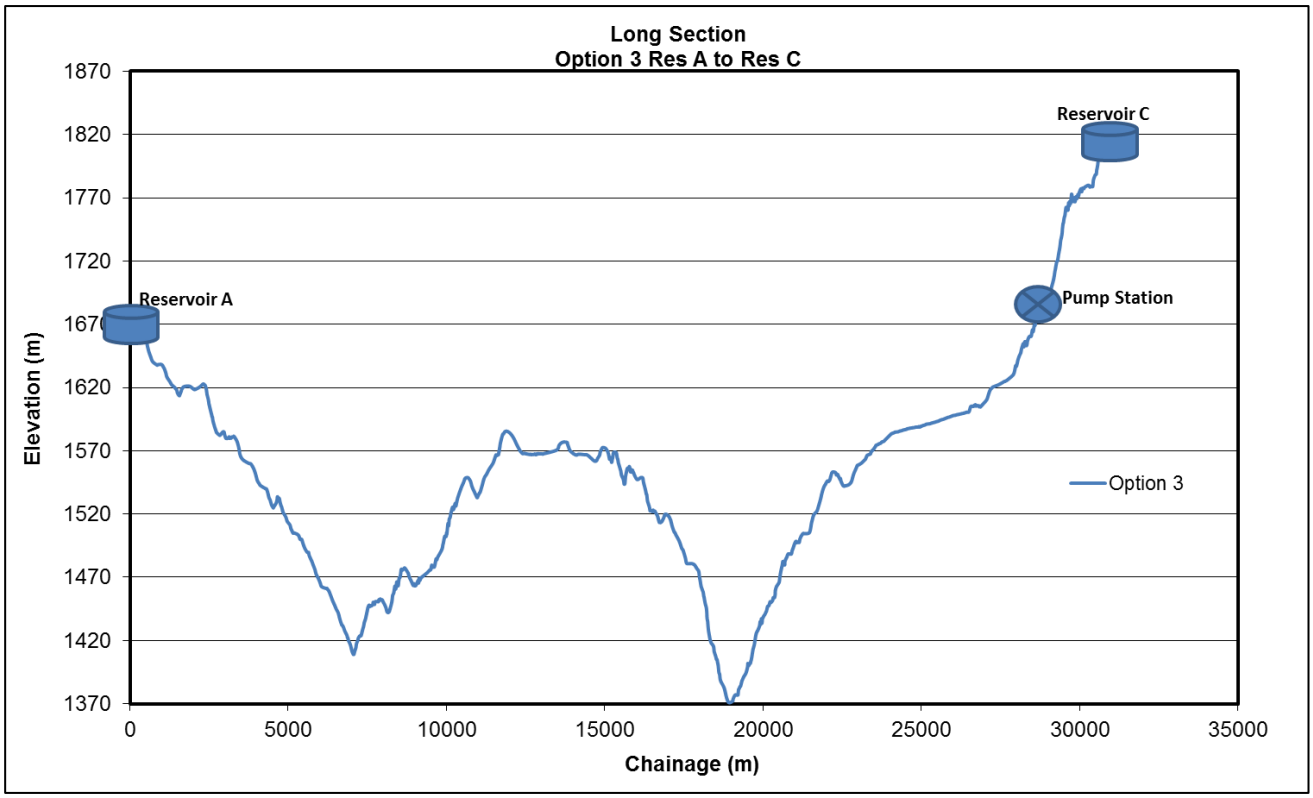

Figure 13a: Long Section from Bulwer Reservoir A to New Biggin Reservoir

Water can be supplied under gravity for approximately 24km and the remaining 3km will have to be pumped.

It will be possible to supply the entire Umzimkhulu LM and sections of Ingwe LM, i.e. Zones 1 to 14, under gravity from this command reservoir. A layout of the trunk main and off-takes to all of the command reservoirs in each supply zone is shown in **Figure 13b**.

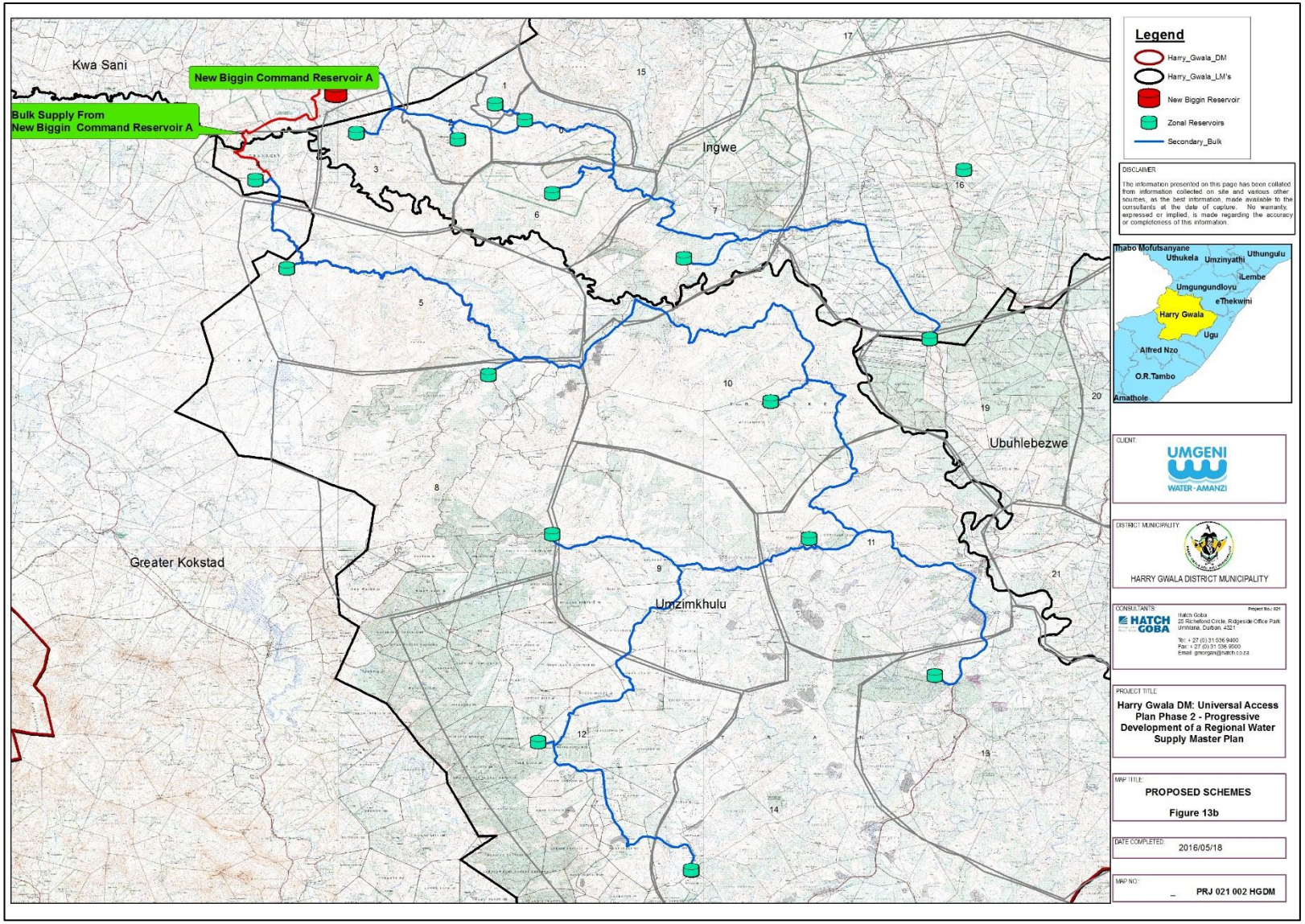
Kwa Sani
New Biggin Command Reservoir A
Bulk Supply From
New Biggin Command Reservoir A
Ingwe
Greater Kokstad
Umzimkhulu
Ubuhlebezwe
Legend
Harry_Gwala_DM
Harry_Gwala_LM's
New Biggin Reservoir
Zonal Reservoirs
Secondary_Bulk
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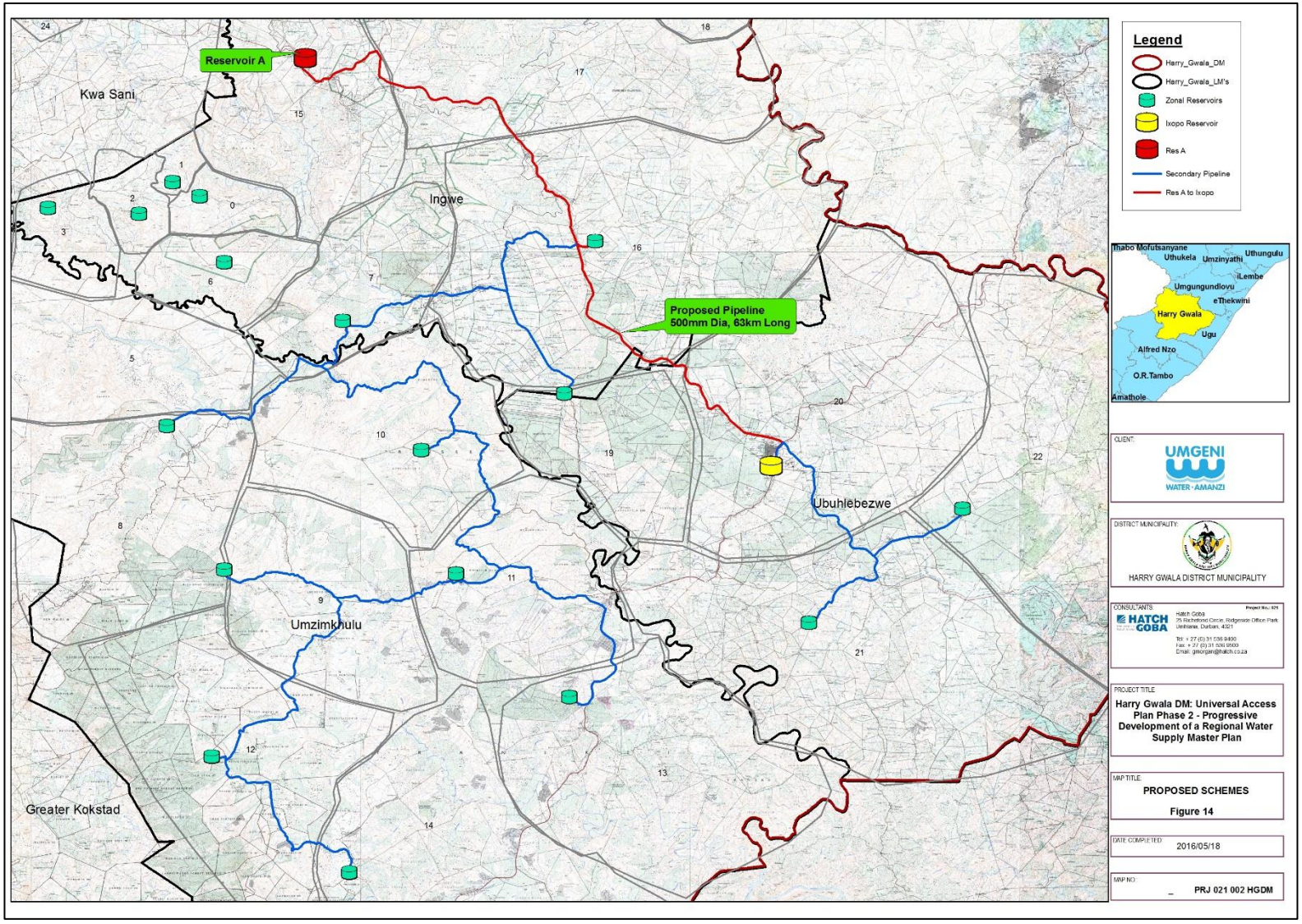
Table 20: Capital Costs – Reservoir A to New Biggin Reservoir

Consultants	
Design and Tender Documentation	38 225 382
Geotech Survey	3 000 000
Land Survey	216 513
Cathodic Protection	5 000 000
Construction Monitoring	5 051 970
Construction	
Pipe Supply	90 213 750
Pipeline Construction	160 764 313
Pipe Bridge/Jack	30 000 000
Pumpstation	73 507 500
Water Works	0
Reservoir	70 240 907
Dam	0
Abstraction	0
Land Acquisition - 7.5%	31 854 485
Environmental, Community Liaison	5 000 000
Health & Safety, Quality Assurance	4 247 265
Project Office	14 865 426
Contingencies	266 093 756
Sub total	798 281 267
VAT (14%)	111 759 377
Grand total	**910 040 644**

Electricity capital costs excluded

7.3.2.2. POTABLE WATER SUPPLY: BULWER DAM TO IXOPO

A bulk pipeline from Reservoir A along the R617 and R612 will allow supply to Zones 20, 21 & 22 including Zones 15, 16, 17 & 18 that make up the Greater Bulwer Regional Scheme. The pipeline routes to bulk command reservoir positions are shown in **Figure 14** and a longitudinal section to Ixopo is shown in **Figure 14a**. Water can be gravitated to Ixopo and beyond to Highlflats and Hlokozi but pressure management, PRV's or BPT's will be necessary.


Reservoir A
Kwa Sani
Ingwe
Proposed Pipeline
500mm Dia, 63km Long
Ubuhlebezwe
Umzimkhulu
Greater Kokstad
Legend
Harry_Gwala_DM
Harry_Gwala_LM's
Zonal Reservoirs
Ixopo Reservoir
Res A
Secondary Pipeline
Res A to Ixopo
Thabo Mofutsanyane
Uthukela
Umzinyathi
Uthungulu
iLembe
Umgungundlovu
eThekwini
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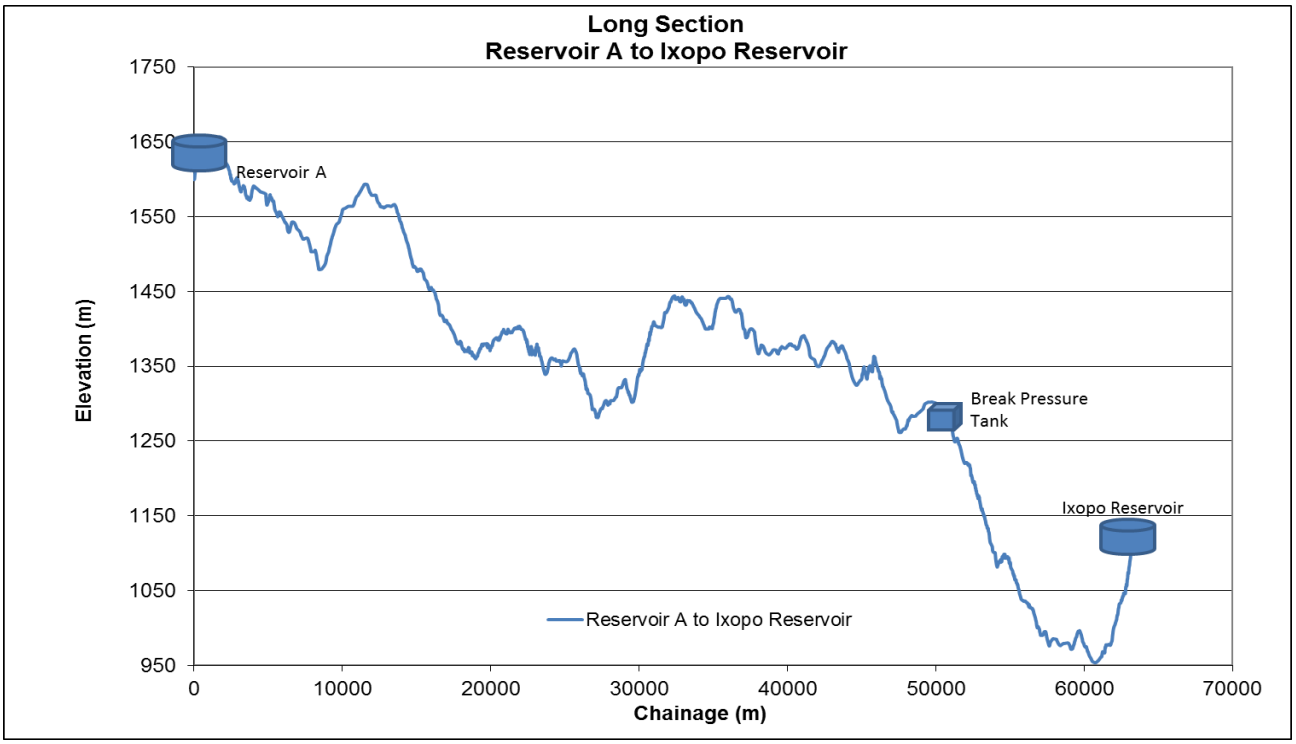


Figure 14a: Longitudinal Section Reservoir A to Ixopo

Table 21: Capital Costs – Reservoir A to Ixopo

Consultants	
Design and Tender Documentation	38 355 245
Geotech Survey	3 000 000
Land Survey	505 197
Cathodic Protection	5 000 000
Construction Monitoring	11 787 930
Construction	
Pipe Supply	138 929 175
Pipeline Construction	247 577 041
Pipe Bridge/Jack	0
Pumpstation	0
Water Works	0
Reservoir	39 663 177
Dam	0
Abstraction	0
Land Acquisition - 7.5%	31 962 704
Environmental, Community Liaison	5 000 000
Health & Safety, Quality Assurance	4 261 694
Project Office	14 915 929
Contingencies	270 479 046
Sub total	811 437 138
VAT (14%)	113 601 199
Grand total	**925 038 338**

Electricity capital costs excluded

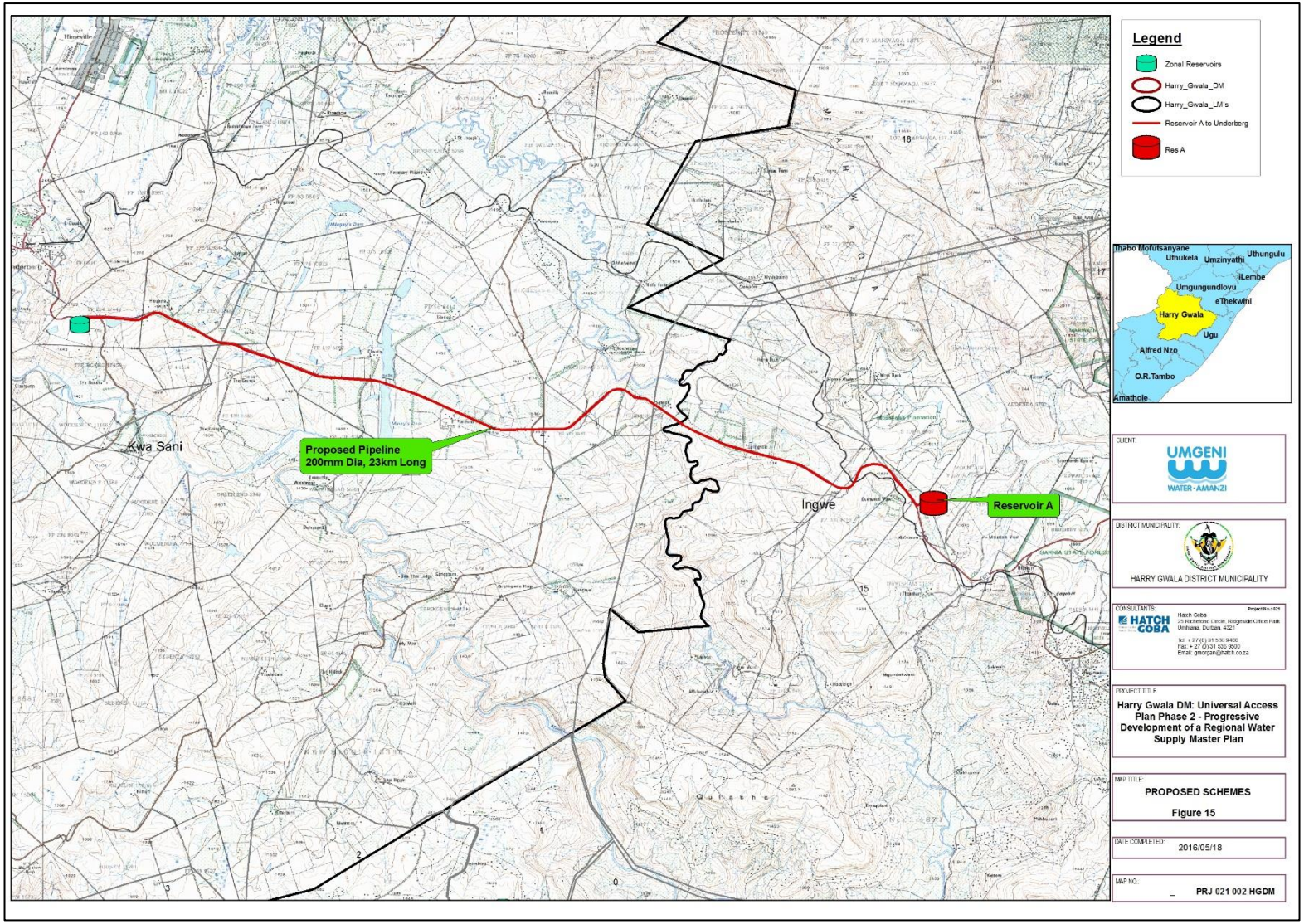
Table 22: Capital Costs – Umzimkhulu Secondary Bulk Pipelines

Consultants	
Design and Tender Documentation	76 443 724
Geotech Survey	3 000 000
Land Survey	1 499 553
Cathodic Protection	5 000 000
Construction Monitoring	34 989 570
Construction	
Pipe Supply	264 132 495
Pipeline Construction	470 694 090
Pipe Bridge/Jack	0
Pumpstation	0
Water Works	0
Reservoir	114 548 121
Dam	0
Abstraction	0
Land Acquisition - 7.5%	63 703 103
Environmental, Community Liaison	5 000 000
Health & Safety, Quality Assurance	8 493 747
Project Office	29 728 115
Contingencies	538 616 259
Sub total	1 615 848 776
VAT (14%)	226 218 829
Grand total	**1 842 067 605**

Electricity capital costs excluded

7.3.2.3. POTABLE WATER SUPPLY: BULWER TO UNDERBERG

The Bulwer Scheme Reservoir A can also be used as a command reservoir to supply water under gravity to Underberg and Himeville (Zone 24). An 18km long, 200mm Ø pipeline will supply 2 Mℓ/day to a command reservoir position at an elevation of 1600m. From this point water can be gravitated to Underberg and Himeville towns. The pipeline route is shown in **Figure 15** and a longitudinal section in **Figure 15a**.


Legend
Zonal Reservoirs
Harry_Gwala_DM
Harry_Gwala_LM's
Reservoir A to Underberg
Res A
Thabo Mofutsanyane
Uthukela
Umzinyathi
Uthungulu
iLembe
Umgungundlovu
eThekwini
Harry Gwala
Ugu
Alfred Nzo
O.R.Tambo
Amathole
Kwa Sani
Proposed Pipeline
200mm Dia, 23km Long
Ingwe
Reservoir A
CLIENT:
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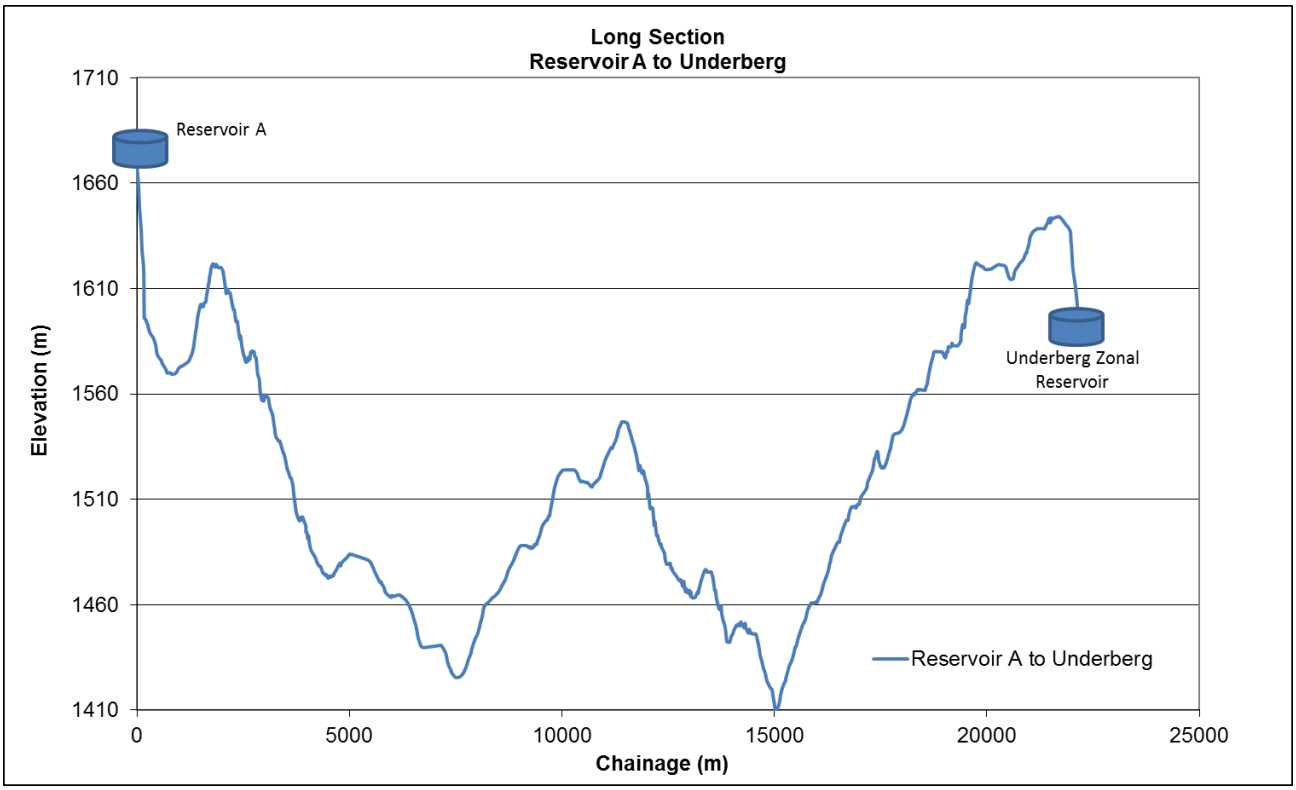


Figure 15a: Longitudinal Section - Reservoir A to Underberg

Table 23: Capital Costs – Bulwer to Underberg

Consultants	
Design and Tender Documentation	R 13 348 012
Geotech Survey	R 3 000 000
Land Survey	R 144 342
Cathodic Protection	R 5 000 000
Construction Monitoring	R 3 367 980
Construction	
Pipe Supply	R 14 434 200
Pipeline Construction	R 25 722 290
Pipe Bridge/Jack	R 30 000 000
Pumpstation	R 0
Water Works	R 0
Reservoir	R 78 154 751
Dam	R 0
Abstraction	R 0
Land Acquisition - 7.5%	R 11 123 343
Environmental, Community Liaison	R 5 000 000
Health & Safety, Quality Assurance	R 1 483 112
Project Office	R 5 190 893
Contingencies	R 97 984 462
Sub total	R 293 953 386
VAT (14%)	R 41 153 474
Grand total	**R 335 106 860**

Electricity capital costs excluded

7.4. OPTION 4: NEW BIGGIN DAM BULK DISTRIBUTION

Preliminary hydrological investigations on the Umzimkhulu River at the proposed New Biggin Dam site (Bhungane, 2011), indicate that an impoundment of 76.74Mcm would yield 347.7 Mℓ/day. This would be sufficient to meet the future water needs of 95.23 Mℓ/day for HGDM. There will also be a surplus of supply to distribute to other potential users outside HGDM if necessary.

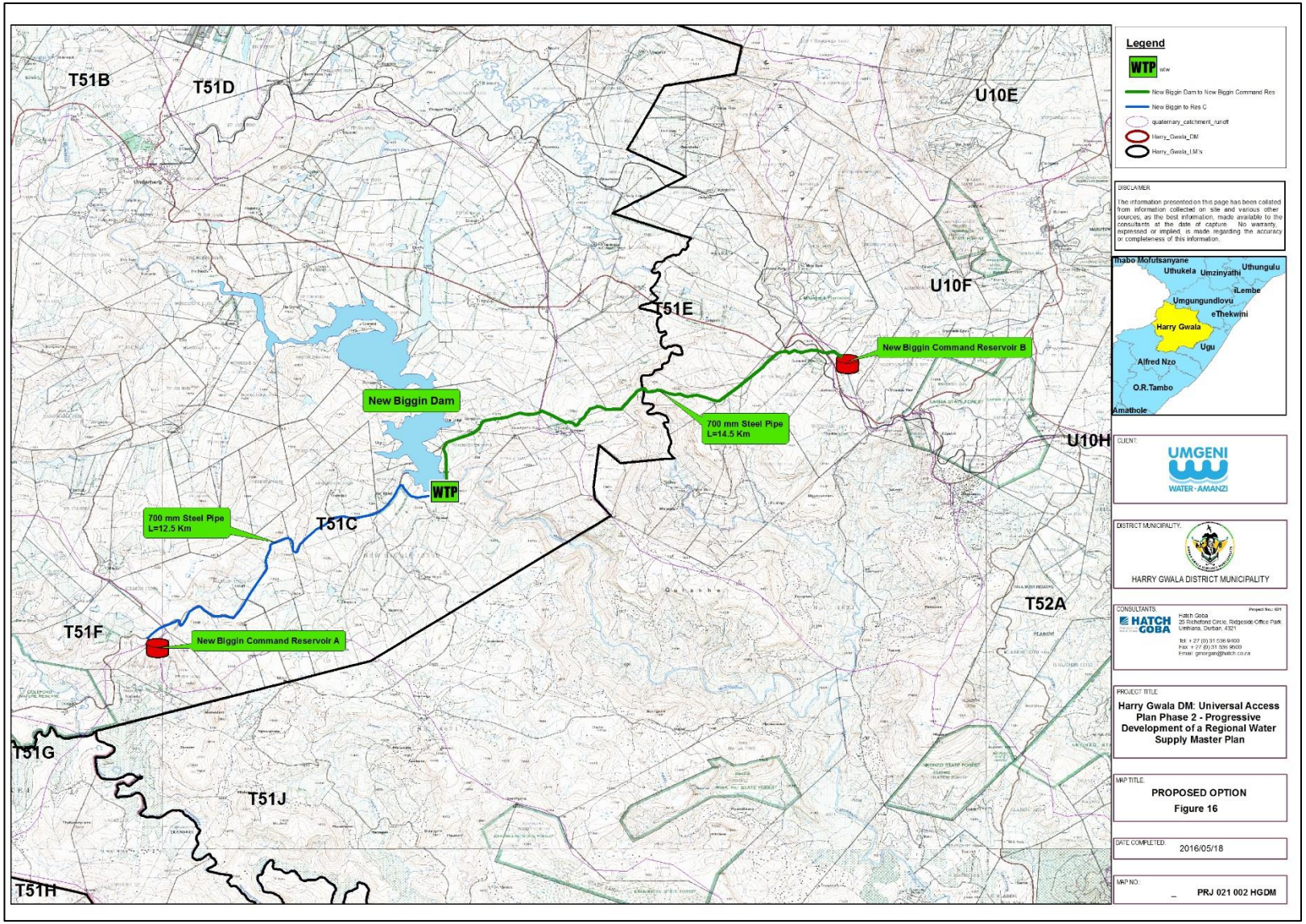
The New Biggin Dam site is situated high up in the catchment at river bed level of 1386m. The option of a WTP and bulk distribution from this proposed dam to two command reservoir positions will allow distribution to the Umzimkhulu, KwaSani, Ingwe and Ubuhlebezwe LM's.

A 12.5km long, 700 diameter pipeline from the dam to the proposed New Biggin Command Reservoir A will allow distribution to Umzimkhulu and KwaSani LM's (Zones 4, 5, 8 to 14 & 24). The bulk pipeline from the New Biggin WTP to the New Biggin Command Reservoir A is shown in **Figure 16** and a long section of the pipeline shown in **Figure 16a**. The distribution from the New Biggin Command Reservoir A will be as indicated in Section 7.3.2.1.

A 14.5km long, 700 diameter pipeline from the dam to the proposed New Biggin Command Reservoir B will allow distribution to Ingwe and Ubuhlebezwe LM's (Zones 0 to 3, 6, 7, 15 to 22). The bulk pipeline from the New Biggin WTP to the New Biggin Command Reservoir B is shown in **Figure 16** and a long section of the pipeline shown in **Figure 16b**.

The capital costs for these pipelines are shown in **Table 24** and **Table 25**.

The proposed New Biggin Command Reservoir B will be situated adjacent to the Greater Bulwer-Donnybrook Reservoir A. Distribution from this reservoir will be as indicated in Section 7.3.2.2, A connection to the Greater Bulwer Donnybrook Reservoir A will allow distribution to the Greater Bulwer Donnybrook scheme.


T51B
T51D
U10E
U10F
T51E
New Biggin Command Reservoir B
New Biggin Dam
700 mm Steel Pipe
L=14.5 Km
U10H
WTP
700 mm Steel Pipe
L=12.5 Km
T51C
T52A
T51F
New Biggin Command Reservoir A
T51G
T51J
T51H
Legend
WTP
New Biggin Dam to New Biggin Command Res
New Biggin to Res C
quaternary_catchment_runoff
Harry_Gwala_DM
Harry_Gwala_LM's
DISCLAIMER
The information presented on this page has been collated from information collected on site and various other sources, as the best information, made available to the consultants at the date of capture. No warranty, expressed or implied, is made regarding the accuracy or completeness of this information.
Thabo Mofutsanyane
Uthukela
Umzinyathi
Uthungulu
iLembe
Umgungundlovu
eThekwini
Harry Gwala
Ugu
Alfred Nzo
O.R.Tambo
Amathole
CLIENT:
UMGENI WATER - AMANZI
DISTRICT MUNICIPALITY:
HARRY GWALA DISTRICT MUNICIPALITY
CONSULTANTS:
Hatch Goba
25 Richford Circle, Ridgeside Office Park
Umhlanga, Durban, 4321
PROJECT TITLE:
Harry Gwala DM: Universal Access Plan Phase 2 - Progressive Development of a Regional Water Supply Master Plan
MAP TITLE:
PROPOSED OPTION
Figure 16
DATE COMPLETED:
2016/05/18
MAP NO.:
PRJ 021 002 HGDM

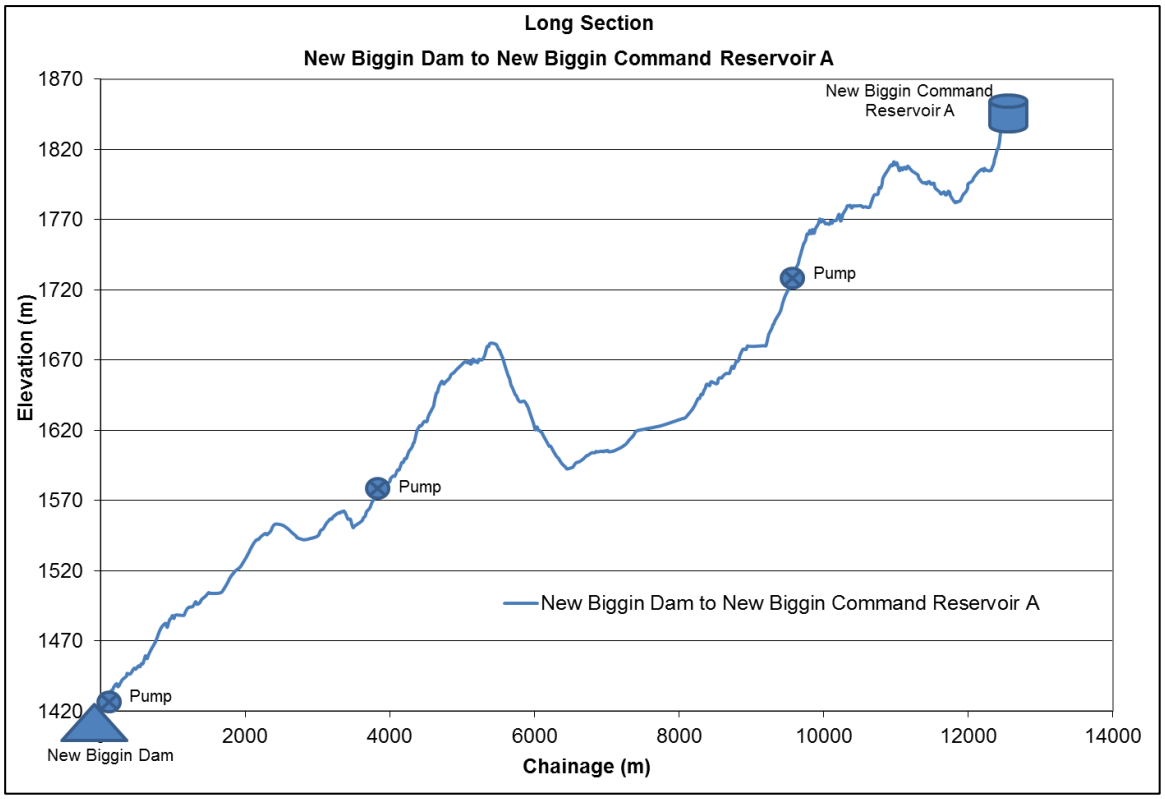


Figure 16a: Longitudinal Section - New Biggin Dam to New Biggin Command Reservoir A

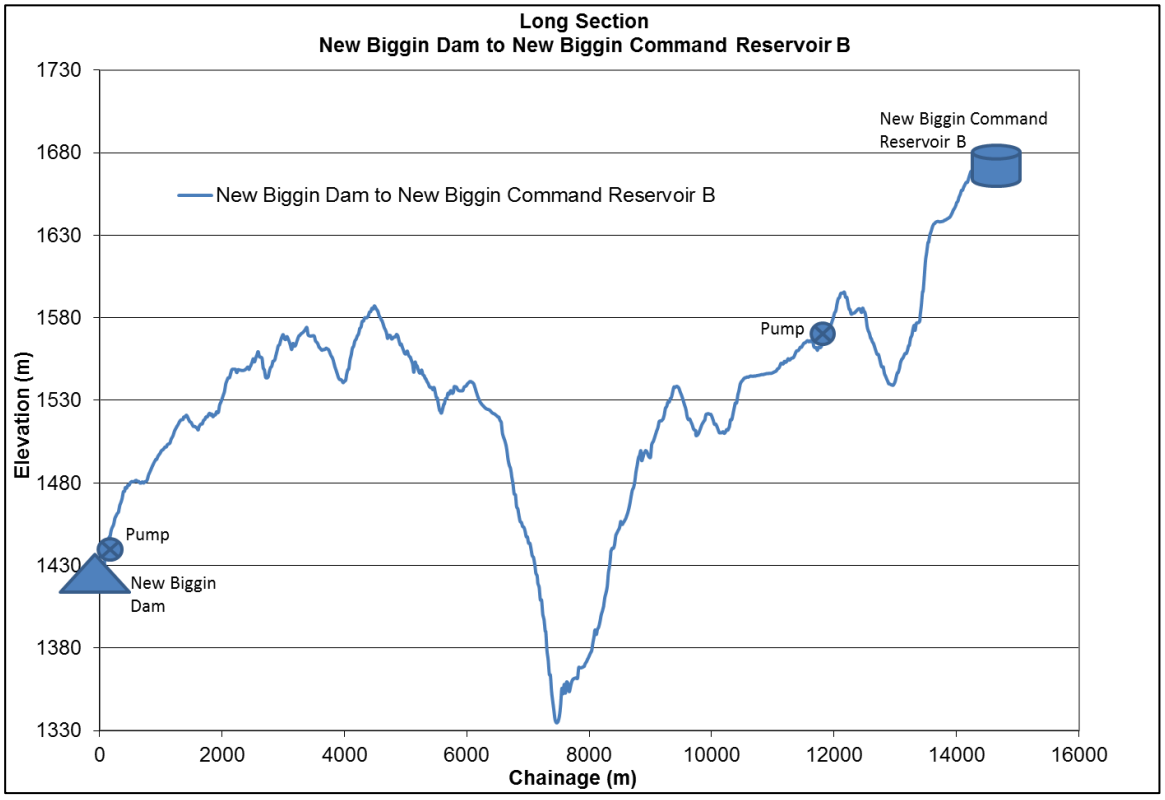


Figure 16b: Longitudinal Section - New Biggin Dam to New Biggin Command Reservoir B

Table 24: Capital Costs – New Biggin Dam to New Biggin Command Reservoir A

Consultants	
Design and Tender Documentation	R 35 887 316
Geotech Survey	R 3 000 000
Land Survey	R 100 238
Cathodic Protection	R 5 000 000
Construction Monitoring	R 2 338 875
Construction	
Pipe Supply	R 41 765 625
Pipeline Construction	R 74 427 922
Pipe Bridge/Jack	R 0
Pumpstation	R 132 313 500
Water Works	R 0
Reservoir	R 70 240 907
Dam	R 0
Abstraction	R 80 000 000
Land Acquisition - 7.5%	R 29 906 097
Environmental, Community Liaison	R 5 000 000
Health & Safety, Quality Assurance	R 3 987 480
Project Office	R 13 956 178
Contingencies	R 248 962 069
Sub total	R 746 886 206
VAT (14%)	R 104 564 069
Grand total	**R 851 450 275**

Electricity capital costs excluded

Table 25: Capital Costs – New Biggin Dam to New Biggin Command Reservoir B

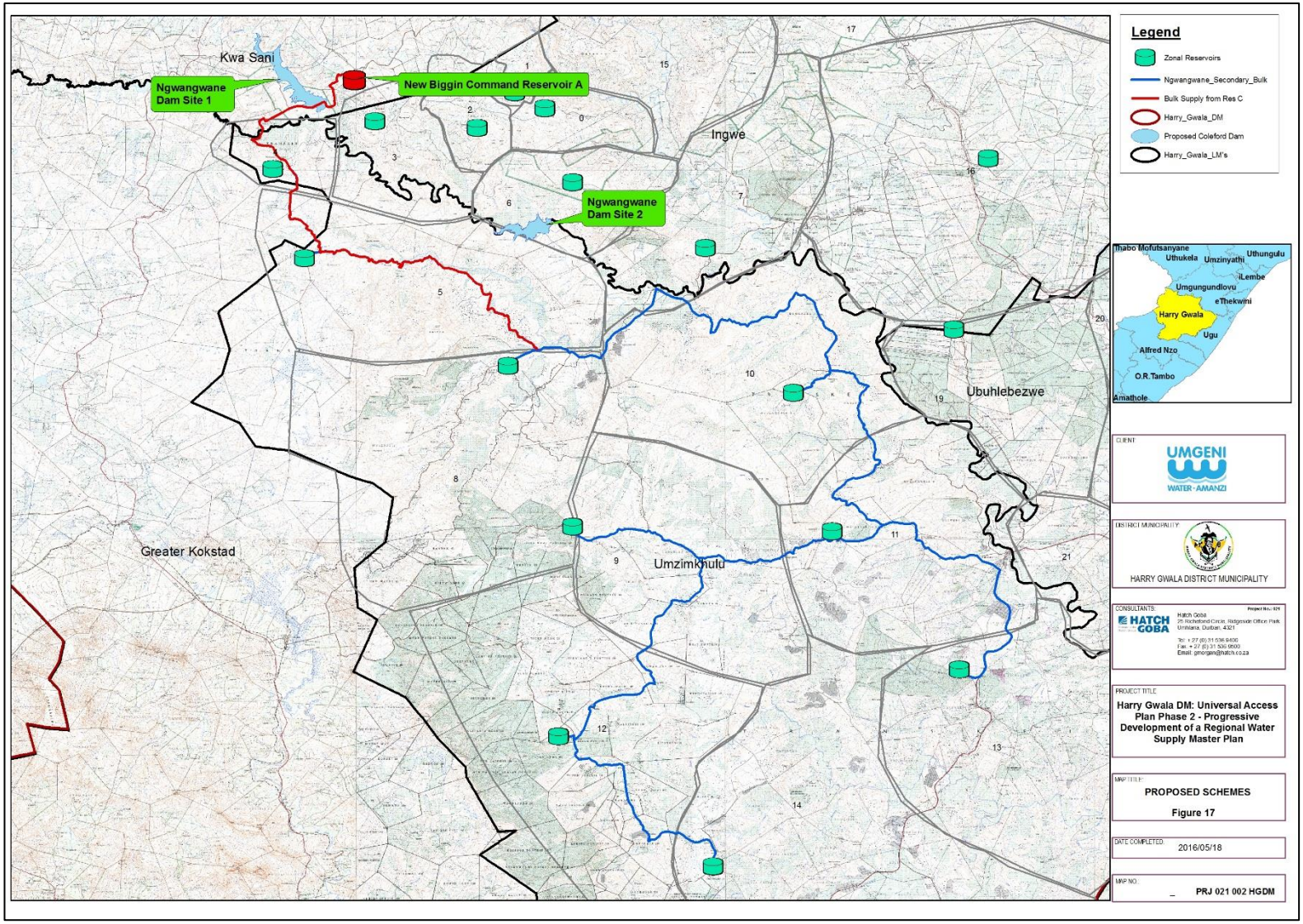
Consultants	
Design and Tender Documentation	R 99 772 238
Geotech Survey	R 3 000 000
Land Survey	R 116 276
Cathodic Protection	R 5 000 000
Construction Monitoring	R 2 713 095
Construction	
Pipe Supply	R 48 448 125
Pipeline Construction	R 86 336 390
Pipe Bridge/Jack	R 30 000 000
Pumpstation	R 88 209 000
Water Works	R 5 346 000
Reservoir	R 70 240 907
Dam	R 700 000 000
Abstraction	R 80 000 000
Land Acquisition - 7.5%	R 83 143 532
Environmental, Community Liaison	R 5 000 000
Health & Safety, Quality Assurance	R 11 085 804
Project Office	R 38 800 315
Contingencies	R 678 605 841
Sub total	R 2 035 817 522
VAT (14%)	R 285 014 453
Grand total	**R 2 320 831 975**

Electricity capital costs excluded

7.5. OPTION 5: NGWANGWANE RIVER DAM

A number of possible dam sites have been investigated on the Ngwangwane River in the Umzimkhulu LM. One of the dam sites that will be ideal for water supply to the entire Umzimkhulu LM (Zones 4, 5 & 8 to 14) is at position -29.9656 S; 29,4746 E. This site was however not recommended in a previous study done by Bhungane Consulting (Bhungane, 2012) as the Coleford Nature Reserve would be inundated. A second site further downstream was recommended instead. This possible site is shown in **Figure 17**.

An impoundment at this site together with a treatment works will enable supply to all the supply zones in Umzimkhulu LM although pumping will be required to get water to the command positions Zones 5, 8 & 10. The system layout is shown in **Figure 18**.


Kwa Sani
Ngwangwane Dam Site 1
New Biggin Command Reservoir A
Ngwangwane Dam Site 2
Ingwe
Ubuhlebezwe
Greater Kokstad
Umzimkhulu
Legend
Zonal Reservoirs
Ngwangwane_Secondary_Bulk
Bulk Supply from Res C
Harry_Gwala_DM
Proposed Coleford Dam
Harry_Gwala_LM's
Thabo Mofutsanyane
Uthukela
Umzinyathi
Uthungulu
iLembe
Umgungundlovu
eThekwini
Harry Gwala
Ugu
Alfred Nzo
O.R.Tambo
Amathole
CLIENT
UMGENI WATER · AMANZI
DISTRICT MUNICIPALITY
HARRY GWALA DISTRICT MUNICIPALITY
CONSULTANTS:
HATCH GOBA
PROJECT TITLE
Harry Gwala DM: Universal Access Plan Phase 2 - Progressive Development of a Regional Water Supply Master Plan
MAP TITLE:
PROPOSED SCHEMES
Figure 17
DATE COMPLETED:
2016/05/18
MAP NO.:
PRJ 021 002 HGDM

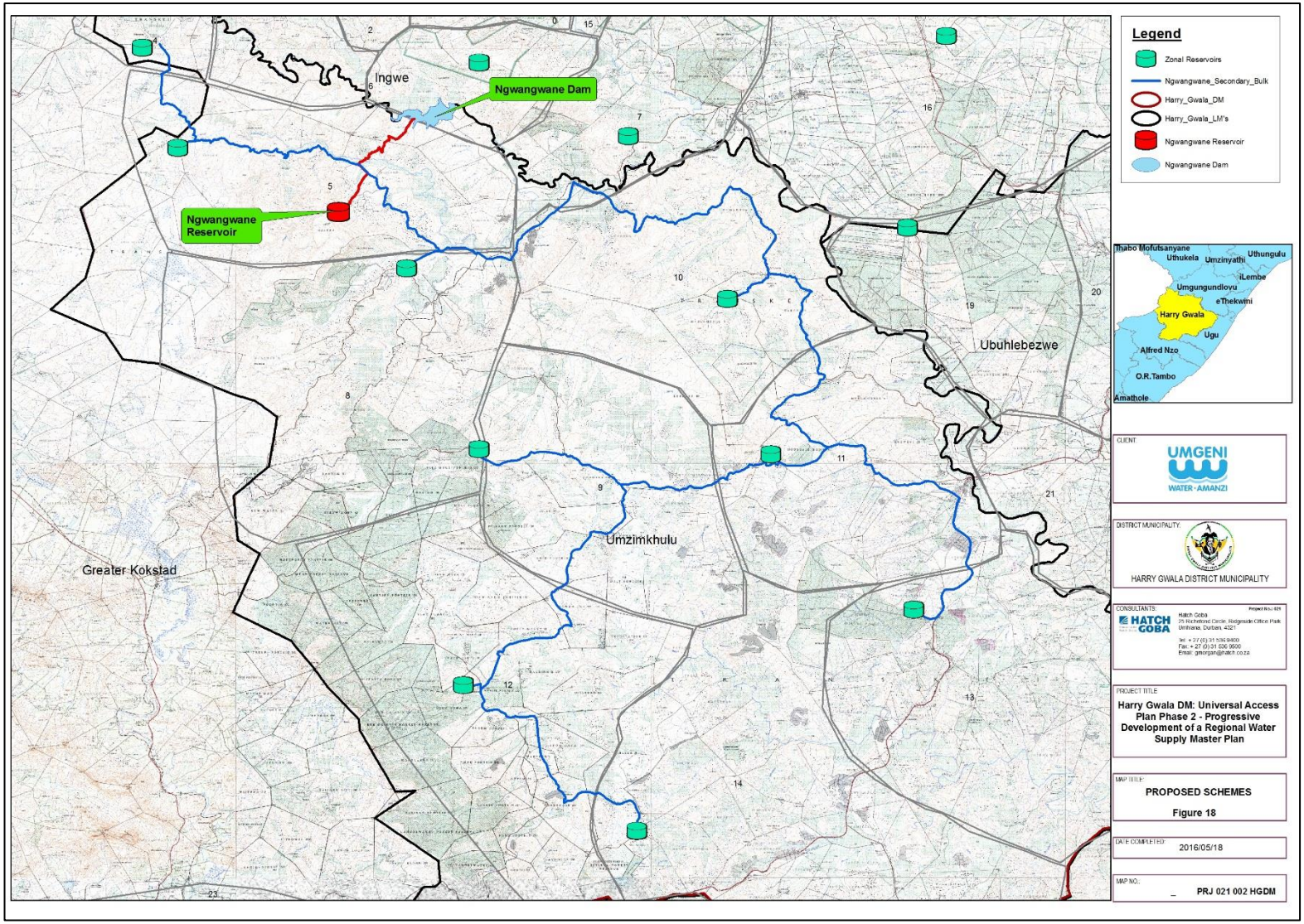

Ingwe
Ngwangwane Dam
Ngwangwane Reservoir
Ubuhlebezwe
Umzimkhulu
Greater Kokstad
Legend
Zonal Reservoirs
Ngwangwane_Secondary_Bulk
Harry_Gwala_DM
Harry_Gwala_LM's
Ngwangwane Reservoir
Ngwangwane Dam
Thabo Mofutsanyane
Uthukela
Umzinyathi
Uthungulu
iLembe
Umgungundlovu
eThekwini
Harry Gwala
Ugu
Alfred Nzo
O.R.Tambo
Amathole
CLIENT:
UMGENI WATER · AMANZI
DISTRICT MUNICIPALITY:
HARRY GWALA DISTRICT MUNICIPALITY
CONSULTANTS:
HATCH GOBA
PROJECT TITLE:
Harry Gwala DM: Universal Access Plan Phase 2 - Progressive Development of a Regional Water Supply Master Plan
MAP TITLE:
PROPOSED SCHEMES
Figure 18
DATE COMPLETED:
2016/05/18
MAP NO.:
PRJ 021 002 HGDM

Table 26: Capital Costs – Ngwangwane Bulk

Consultants	
Design and Tender Documentation	R 84 487 200
Geotech Survey	R 3 000 000
Land Survey	R 80 190
Cathodic Protection	R 5 000 000
Construction Monitoring	R 1 871 100
Construction	
Pipe Supply	R 26 462 700
Pipeline Construction	R 47 157 532
Pipe Bridge/Jack	R 30 000 000
Pumpstation	R 44 104 500
Water Works	R 3 341 250
Reservoir	R 52 680 680
Dam	R 700 000 000
Abstraction	R 35 000 000
Land Acquisition - 7.5%	R 70 406 000
Environmental, Community Liaison	R 5 000 000
Health & Safety, Quality Assurance	R 9 387 467
Project Office	R 32 856 133
Contingencies	R 172 625 213
Sub total	R 1 323 459 964
VAT (14%)	R 185 284 395
Grand total	**R 1 508 744 358**

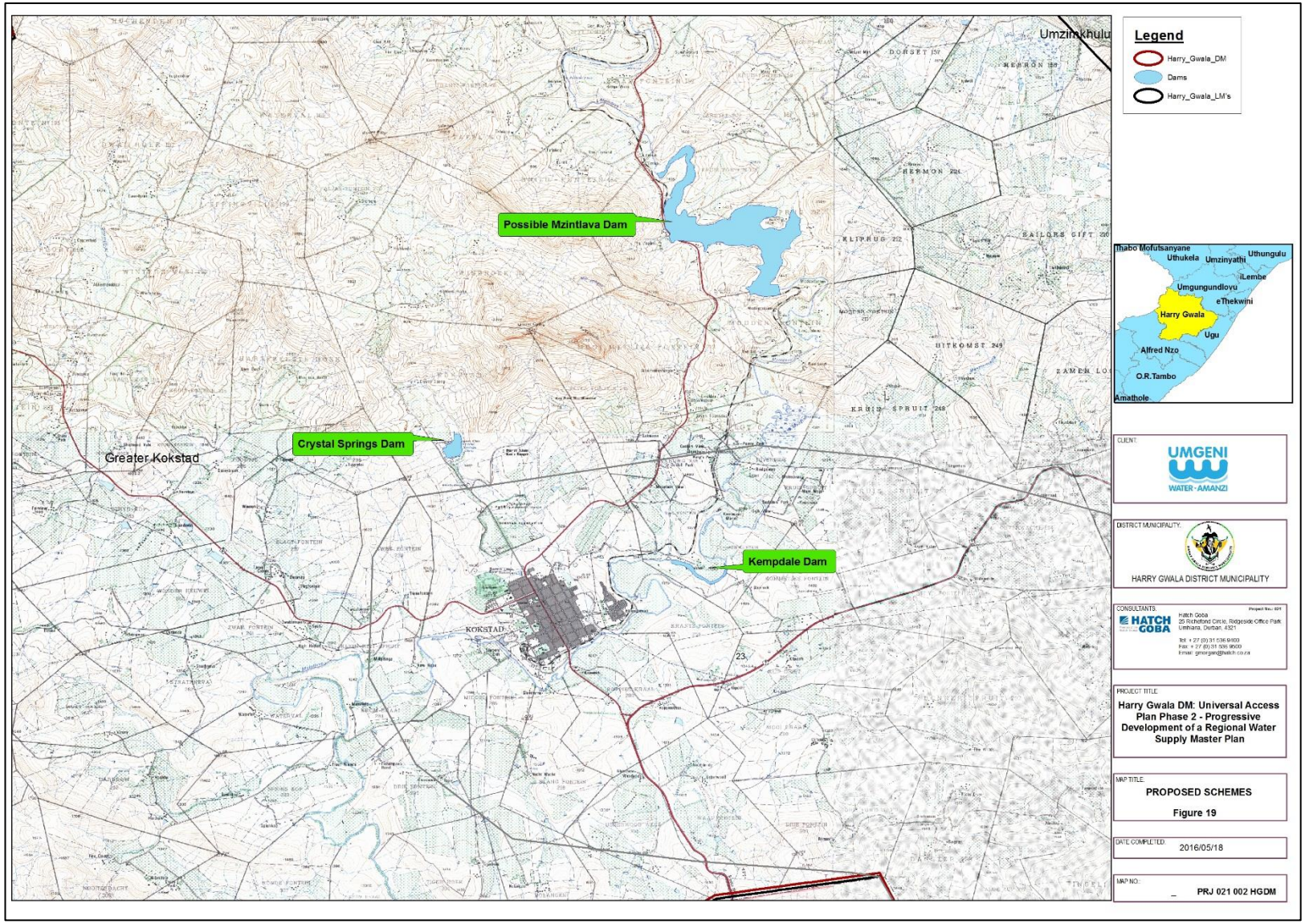
Electricity capital costs excluded

7.6. OPTION 6: KOKSTAD DAM

Kokstad town, Zone 23, is currently supplied by the Crystal Springs Dam, Kempdale Dam and the Mzintlava River. The current water demand is approximately 10 Mℓ/day. The estimated long term demand for Kokstad is 23.55 Mℓ/day. The registered water use for Kokstad is 10.9 Mℓ/day. The water treatment works at Kokstad has a capacity of 18 Mℓ/day and thus does not require an upgrade until at least 2030 depending on the demand uptake. Additional water resources investigations will be required to supply the long term demand in Kokstad.

According to the All Towns Reconciliation Study, the natural MAR of Mzintlava River from the catchments upstream of Kokstad is 99.3 Mcm, whilst additional water may be abstracted from the Mzintlava River for use in Kokstad, water use upstream is affecting river flow. As this river is the closest and thus possibly the most feasible surface water source to meet the long term water needs of Kokstad, a detailed hydrological assessment is required of the catchments above Kokstad to determine water use and allowable abstraction for Kokstad. The option of additional storage either at Kempdale, Crystal Springs Dam or at some other point in the vicinity of Kokstad will be utilised to secure water especially during low flow months.

One such possibility is on the Mzintlava River in Quarternary Catchment T32B (co-ordinates - 30.4585 S; 29.4817 E). An impoundment at this point will provide additional storage that can be released to the Kempdale Dam from where water is currently abstracted for supply to Kokstad town. A possible impoundment is shown in **Figure 19**.


Possible Mzintlava Dam
Crystal Springs Dam
Greater Kokstad
Kempdale Dam
KOKSTAD
Umzimkhulu
Legend
Harry_Gwala_DM
Dams
Harry_Gwala_LM's
Thabo Mofutsanyane
Uthukela
Umzinyathi
Uthungulu
iLembe
Umgungundlovu
eThekwini
Harry Gwala
Ugu
Alfred Nzo
O.R.Tambo
Amathole
CLIENT:
UMGENI WATER - AMANZI
DISTRICT MUNICIPALITY:
HARRY GWALA DISTRICT MUNICIPALITY
CONSULTANTS:
HATCH GOBA
PROJECT TITLE:
Harry Gwala DM: Universal Access Plan Phase 2 - Progressive Development of a Regional Water Supply Master Plan
MAP TITLE:
PROPOSED SCHEMES
Figure 19
DATE COMPLETED:
2016/05/18
MAP NO.:
PRJ 021 002 HGDM

8. RECOMMENDATIONS

- The Greater Bulwer-Donnybrook Regional Water Supply Scheme is currently in construction and is due to be completed in 2021. This scheme intends using both the Bulwer and Comrie dams as water sources. The Bulwer Dam, situated on the Luhane River will yield **8.4 Mℓ/day** and Comrie Dam **3.73 Mℓ/day** (full use after raising of the dam wall). The combination of these two dams is not sufficient for the current scheme footprint. It is recommended that a raw water transfer scheme from the Pholela River be investigated in detail to augment this scheme.
- A dam on the Ngwangwane River, at co-ordinates -30.0340 S; 29.6317 E will allow supply to the Umzimkhulu LM as well as the southern of Ingwe LM. Preliminary investigations indicate that the yield at this site with a storage capacity of 25Mcm will yield 111Mℓ/day. This will be adequate to supply Zones 0 to 19 as well as 16, & 19 to 22.
- An impoundment on the Umzimkhulu River, at co-ordinates -29.900 S; 29.6070 E, known as the New Biggin Dam will allow supply to Umzimkhulu LM. Preliminary investigations indicate that the yield at this site with a storage capacity of 76.74 Mcm will yield 347.7 Mℓ/day. This will be also adequate to supply Zones 0 to 19 as well as 16, & 19 to 22.
- It is recommended that a detailed feasibility study be undertaken to compare the Ngwangwane, and New Biggin options, including bulk scheme configurations from each site, financial, economic, social, environmental and technical matters to determine which option or combination of options are more feasible for implementation.
- It is recommended that a detailed water resources assessment of the catchment above Kokstad on the Mzintlava River be undertaken to confirm existing water use. Preliminary investigations show that a dam, at co-ordinates -30.4585 S; 29.4817 E, on the Mzintlava River will allow additional raw water yield of 31 Mℓ/day for Kokstad Town.

REFERENCES

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

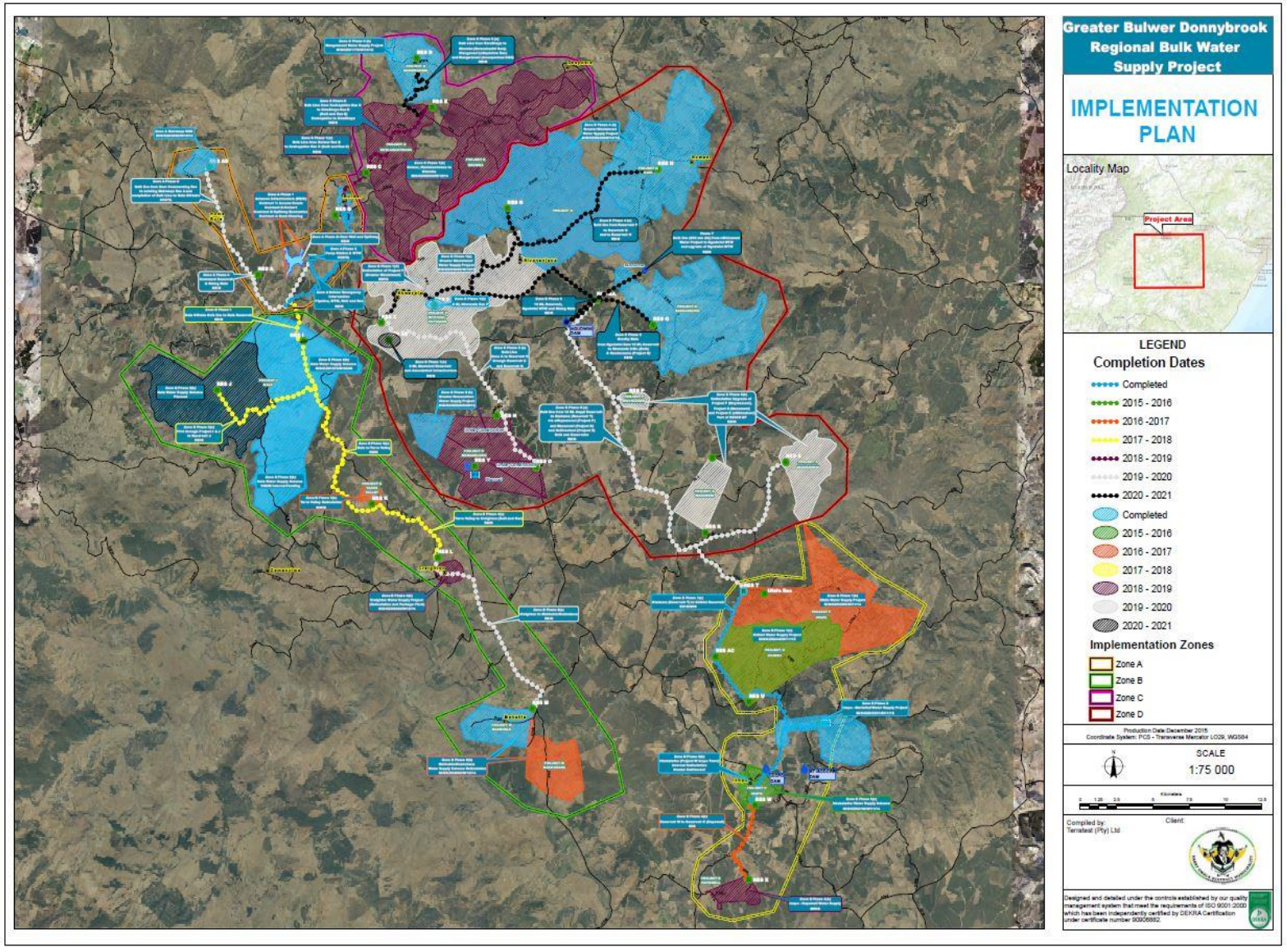
APPROVAL

Approval of report:

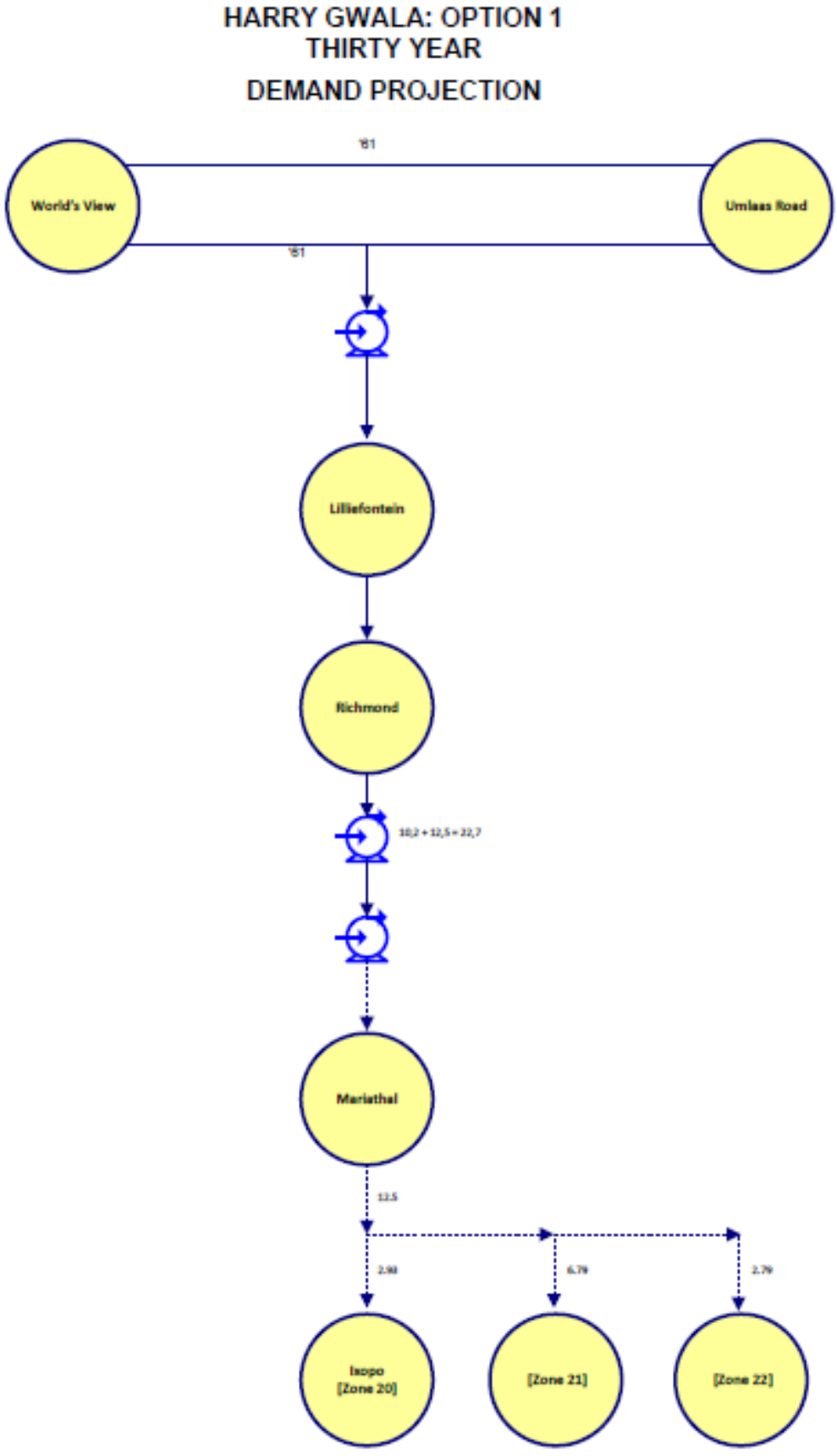
P S MAHARAJ		24/06/2016
JTN Consulting representative	**Signature**	**Date**
G. Morgan		24/06/2016
Hatch Goba representative	**Signature**	**Date**
Umgeni Water representative	**Signature**	**Date**

APPENDICES

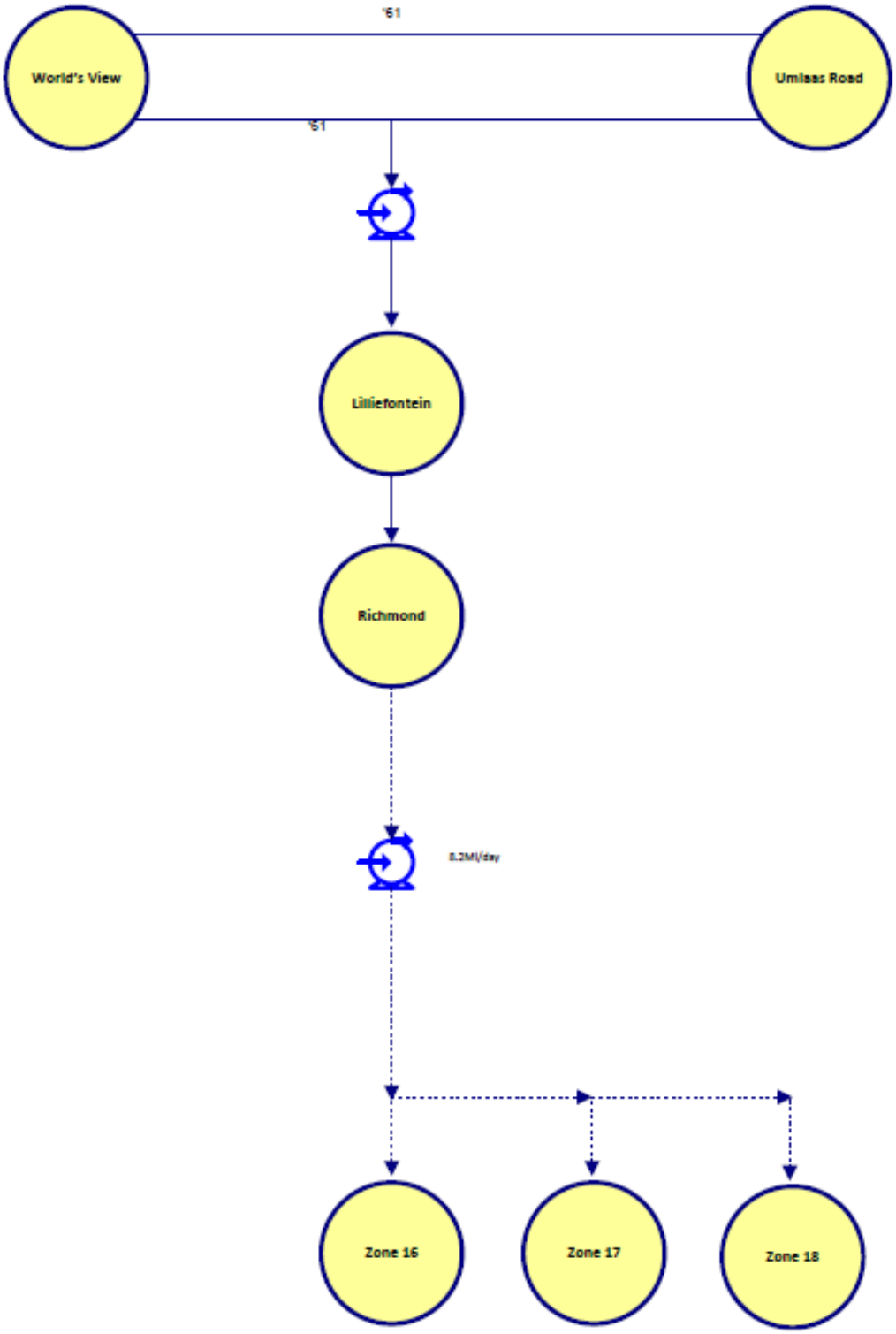
APPENDIX A: Greater Bulwer Scheme


Greater Bulwer Donnybrook Regional Bulk Water Supply Project
IMPLEMENTATION PLAN
Locality Map
Project Area
LEGEND
Completion Dates
Completed
2015 - 2016
2016 -2017
2017 - 2018
2018 - 2019
2019 - 2020
2020 - 2021
Completed
2015 - 2016
2016 - 2017
2017 - 2018
2018 - 2019
2019 - 2020
2020 - 2021
Implementation Zones
Zone A
Zone B
Zone C
Zone D
SCALE
1:75 000
Compiled by:
Client:

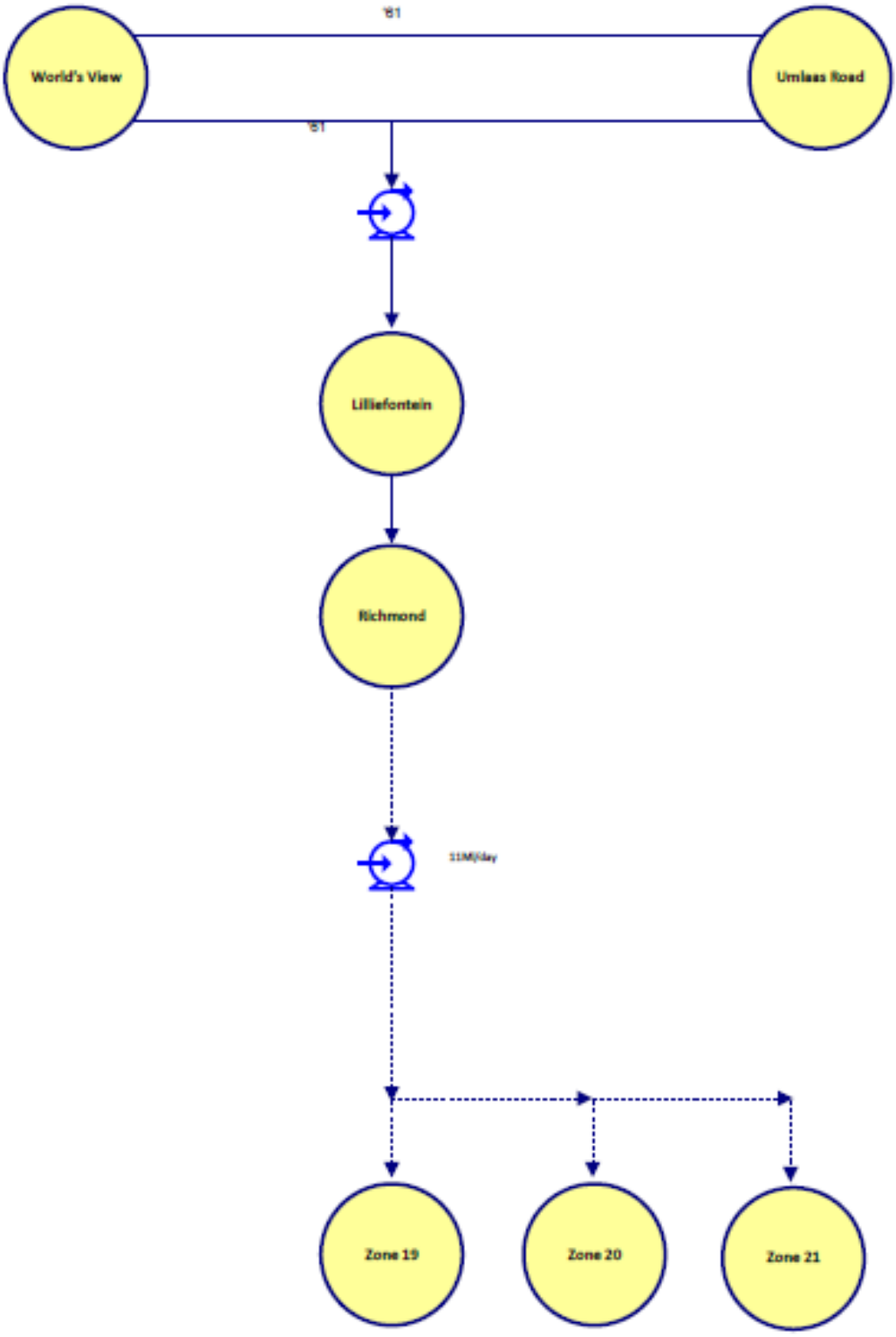
APPENDIX B: Options Schematics


HARRY GWALA: OPTION 1
THIRTY YEAR
DEMAND PROJECTION
'61
'61
World's View
Umlass Road
Lilliefontein
Richmond
10,2 + 12,5 = 22,7
Mariathal
12.5
2.93
6.79
2.79
Ixopo
[Zone 20]
[Zone 21]
[Zone 22]

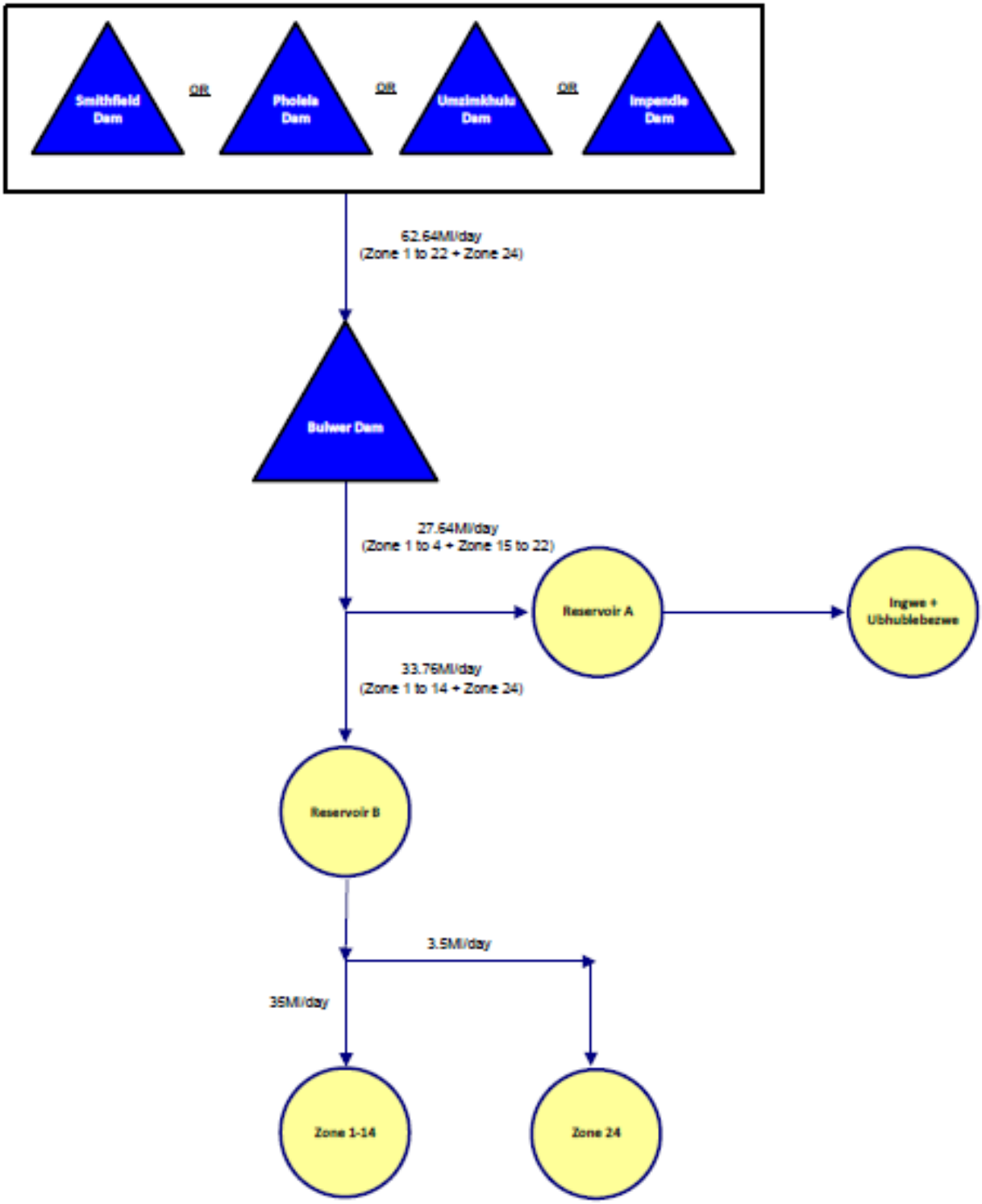
HARRY GWALA: OPTION 2A
THIRTY YEAR
DEMAND PROJECTION



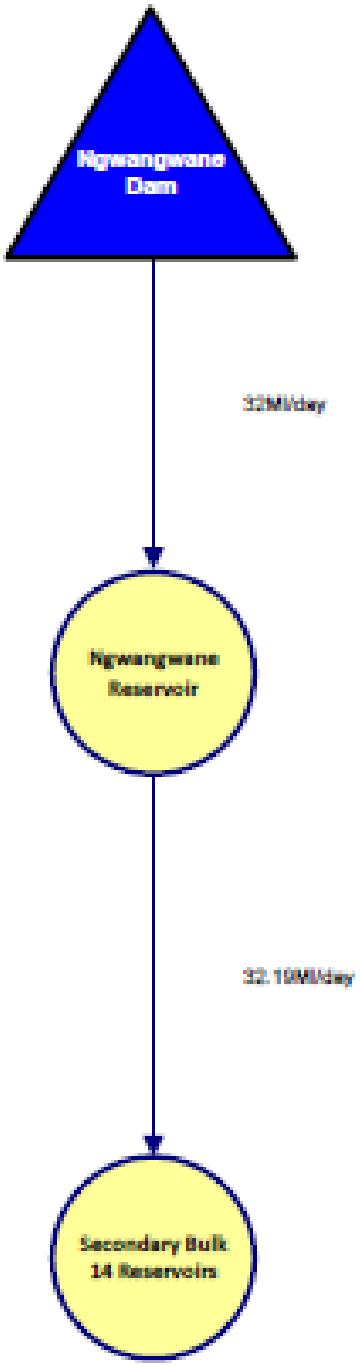
HARRY GWALA: OPTION 2B
THIRTY YEAR
DEMAND PROJECTION



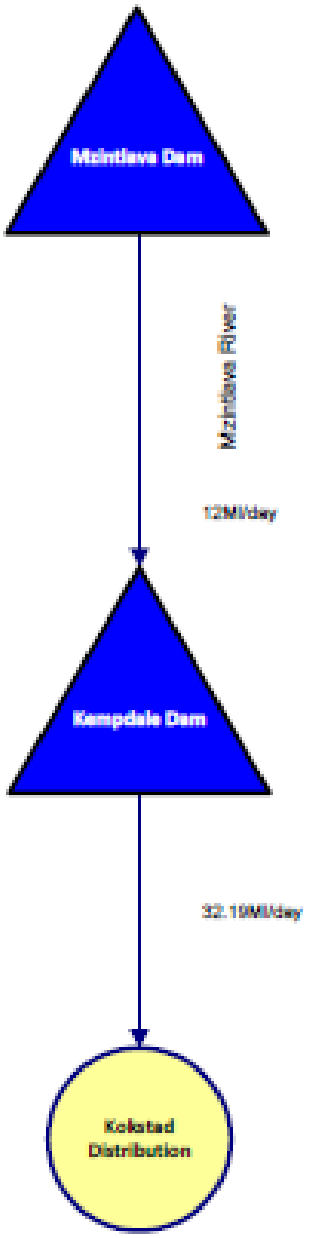
HARRY GWALA: OPTION 3
SMITHFEILD/PHOLELA/UMZIMKHULU/IMPENDLE
THIRTY YEAR
DEMAND PROJECTION



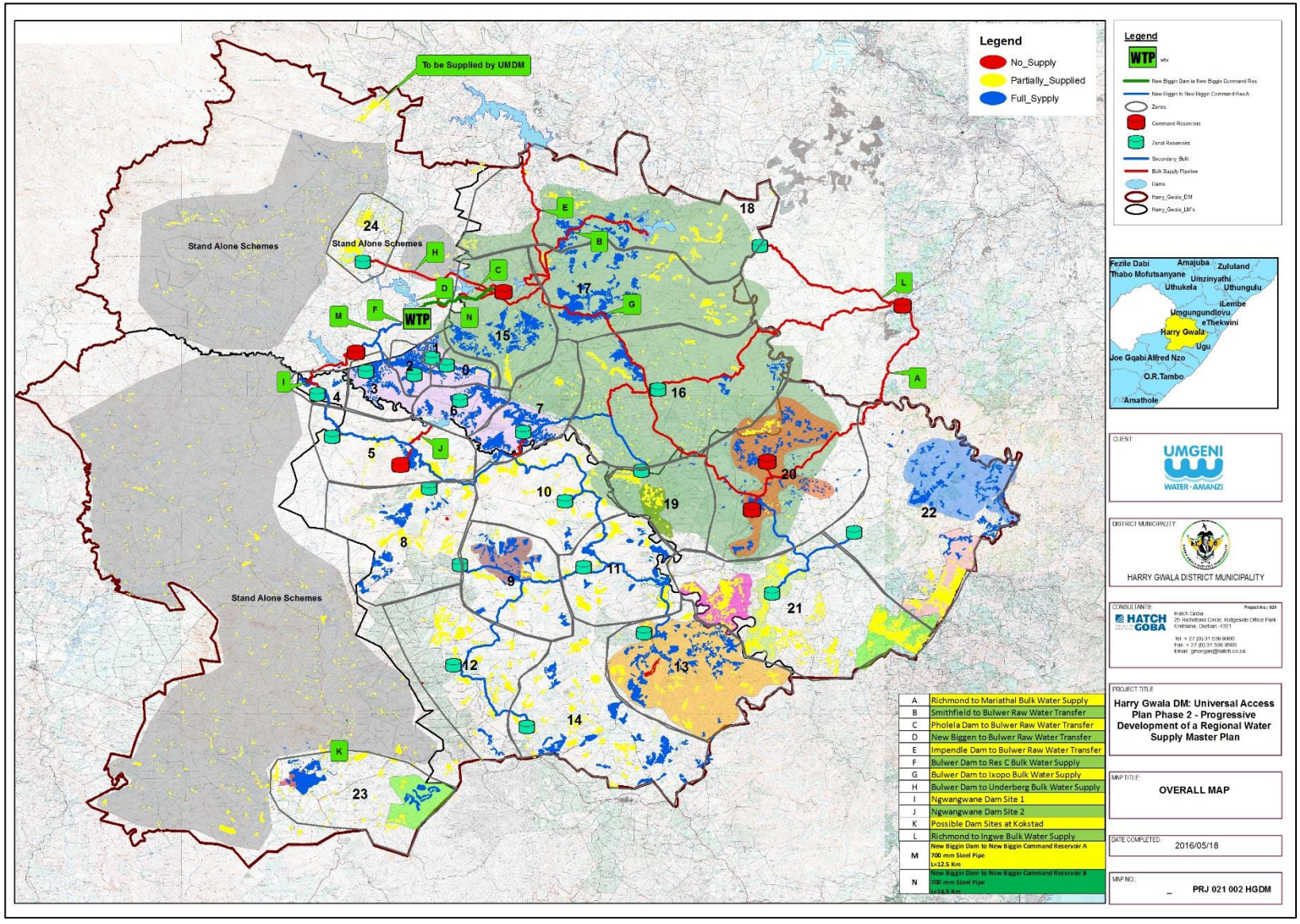
HARRY GWALA: OPTION 4 NGWANGWANE – THIRTY YEAR DEMAND PROJECTION



HARRY GWALA: OPTION 5
KOKSTAD – THIRTY YEAR
DEMAND PROJECTION



APPENDIX C: Overall Layout Plan of Options


To be Supplied by UMDM
Stand Alone Schemes
Stand Alone Schemes
Stand Alone Schemes
WTP
Legend
No_Supply
Partially_Supplied
Full_Sypply
Legend
WTP
Fezile Dabi
Amajuba
Zululand
Thabo Mofutsanyane
Umzinyathi
Uthukela
Uthungulu
iLembe
Umgungundlovu
eThekwini
Harry Gwala
Ugu
Joe Gqabi
Alfred Nzo
O.R.Tambo
Amathole
CLIENT:
UMGENI WATER · AMANZI
DISTRICT MUNICIPALITY:
HARRY GWALA DISTRICT MUNICIPALITY
CONSULTANTS:
HATCH GOBA
PROJECT TITLE:
Harry Gwala DM: Universal Access Plan Phase 2 - Progressive Development of a Regional Water Supply Master Plan
MAP TITLE:
OVERALL MAP
DATE COMPLETED:
2016/05/18
MAP NO.:
PRJ 021 002 HGDM
A Richmond to Mariathal Bulk Water Supply
B Smithfield to Bulwer Raw Water Transfer
C Pholela Dam to Bulwer Raw Water Transfer
D New Biggen to Bulwer Raw Water Transfer
E Impendle Dam to Bulwer Raw Water Transfer
F Bulwer Dam to Res C Bulk Water Supply
G Bulwer Dam to Ixopo Bulk Water Supply
H Bulwer Dam to Underberg Bulk Water Supply
I Ngwangwane Dam Site 1
J Ngwangwane Dam Site 2
K Possible Dam Sites at Kokstad
L Richmond to Ingwe Bulk Water Supply
M New Biggin Dam to New Biggin Command Reservoir A 700 mm Steel Pipe L=12.5 Km
N New Biggin Dam to New Biggin Command Reservoir B 700 mm Steel Pipe L=14.5 Km