INFRASTRUCTURE MASTER PLAN 2025
2025/2026 – 2055-2056

VOLUME 8
Middle uThukela System and uMhlathuze System

Improving Quality of Life and Enhancing Sustainable Economic Development in KwaZulu-Natal

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uMngeni-uThukela Water

Infrastructure Master Plan 2025

2025/2026 – 2055/2056

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PREFACE

This Infrastructure Master Plan 2025 describes:

- uMngeni-uThukela Water's infrastructure plans for the financial period 2025/2026 – 2055/2056, and
- Infrastructure master plans for other areas outside of uMngeni-uThukela Water's Operating Area but within KwaZulu-Natal.

It is a comprehensive technical report that provides information on current infrastructure and on future infrastructure development plans. This report replaces the last comprehensive Infrastructure Master Plan that was compiled in 2024.

The report is divided into **ten** volumes as per the organogram below.

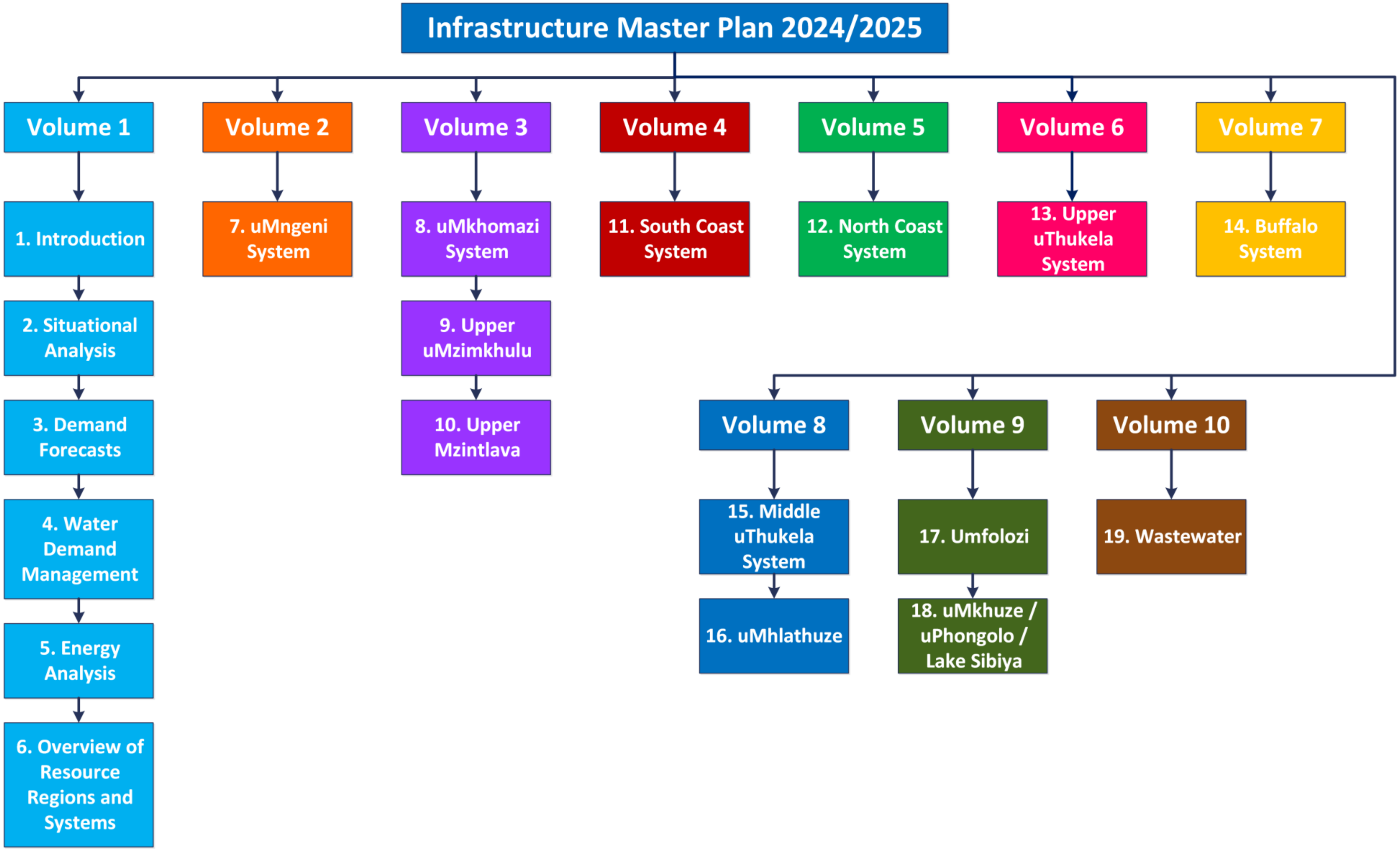
Volume 1 includes the following sections and a description of each is provided below:

- **Section 2** describes the most recent changes and trends within the primary environmental dictates that influence development plans within the province.
- **Section 3** relates only to the uMngeni-uThukela Water Operational Areas and provides a review of historic water sales against past projections, as well as uMngeni-uThukela Water's most recent water demand projections, compiled at the end of 2024.
- **Section 4** describes Water Demand Management initiatives that are being undertaken by the utility and the status of Water Demand Management Issues in KwaZulu-Natal.
- **Section 5**, which also relates to uMngeni-uThukela Water's Operational Area, contains a high level review of the energy consumption used to produce the water volumes analysed in Section 3.
- **Section 6** provides an overview of the water resource regions and systems supplied within these regions.

The next eight volumes describe the current water resource situation and water supply infrastructure of the various systems in KwaZulu-Natal, including:

- **Volume 2 Section 7** uMngeni System.
- **Volume 3 Section 8** uMkhomazi System
  Section 9 uMzimkhulu System
  Section 10 Mzintlava System
- **Volume 4 Section 11** South Coast System
- **Volume 5 Section 12** North Coast System
- **Volume 6 Section 13** Upper uThukela System
- **Volume 7 Section 14** Buffalo System
- **Volume 8 Section 15** Middle uThukela System
  Section 16 Mhlathuze System
- **Volume 9 Section 17** Umfolozi System
  Section 18 uMkhuze / uPhongolo / Lake Sibiya System

Volume 10, Section 19 describes the wastewater works currently operated by uMngeni-uThukela Water (shown in pale brown in the adjacent figure) and provides plans for development of additional wastewater treatment facilities. The status of wastewater treatment in WSA's that are not supplied by uMngeni-uThukela Water are also described in this section.



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It is important to note that information presented in this report is in a summarised form and it is recommended that the reader refer to relevant planning reports if more detail is sought. Since the primary focus of this Infrastructure Master Plan is on bulk supply networks, the water resource infrastructure development plans are not discussed at length. The Department of Water and Sanitation (DWS), as the responsible authority, has undertaken the regional water resource development investigations. All of these investigations have been conducted in close collaboration with uMngeni-uThukela Water and other major stakeholders in order to ensure that integrated planning occurs. Details on these projects can be obtained directly from DWS, Directorate: Options Analysis (East).

The Infrastructure Master Plan is a dynamic and evolving document. Outputs from current planning studies, and comments received on this document will therefore be taken into account in the preparation of the next update.

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AADD	Annual Average Daily Demand
AC	Asbestos Cement
ADWF	Average Dry Weather Flow
API	Antecedent Precipitation Index
AVGF	Autonomous Valveless Gravity Filter
BID	Background Information Document
BPT	Break Pressure Tank
BWL	Bottom Water Level
BWSP	Bulk Water Services Provider
BWSS	Bulk Water Supply Scheme
CAPEX	Capital Expenditure
CMA	Catchment Management Agency
CoGTA	Department of Co-operative Governance and Traditional Affairs
CWSS	Community Water Supply and Sanitation project
DAEA	Department of Agriculture and Environmental Affairs
DEA	Department of Environmental Affairs
DEFF	Department of Environment, Forestry and Fisheries
DM	District Municipality
DRDLR	Department of Rural Development and Land Reform
DWA	Department of Water Affairs
DWS	Department of Water and Sanitation
DWAF	Department of Water Affairs and Forestry
EFR	Estuarine Flow Requirements
EIA	Environmental Impact Assessment
EKZN Wildlife	Ezemvelo KZN Wildlife
EMP	Environmental Management Plan
EWS	eThekwini Water Services
EXCO	Executive Committee
FC	Fibre Cement
FL	Floor level
FSL	Full Supply level
GCM	General Circulation Model
GDP	Gross Domestic Product
GDPR	Gross Domestic Product of Region
GVA	Gross Value Added
HDI	Human Development Index
IDP	Integrated Development Plan
IFR	In-stream Flow Requirements
IMP	Infrastructure Master Plan
IRP	Integrated Resource Plan

ISP	Internal Strategic Perspective
IWRM	Integrated Water Resources Management
KZN	KwaZulu-Natal
LM	Local Municipality
LUMS	Land Use Management System
MA	Moving Average
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
MBR	Membrane Bioreactor
MMTS	Mooi-uMngeni Transfer Scheme
MMTS-1	Mooi-uMngeni Transfer Scheme Phase 1
MMTS-2	Mooi-uMngeni Transfer Scheme Phase 2
mPVC	Modified Polyvinyl Chloride
MTEF	Medium-Term Expenditure Framework
MTSF	Medium-Term Strategic Framework
MWP	Mkomazi Water Project
MWP-1	Mkomazi Water Project Phase 1
NCP-1	North Coast Pipeline I
NCP-2	North Coast Pipeline II
NCSS	North Coast Supply System
NGS	Natal Group Sandstone
NPV	Net Present Value
NRW	Non-Revenue Water
NSDP	National Spatial Development Perspective
NWSP	National Water Sector Plan
OPEX	Operating Expenditure
p.a.	Per annum
PES	Present Ecological Status
PEST	Political, Economical, Sociological and Technological
PGDS	Provincial Growth and Development Strategy
PPDC	Provincial Planning and Development Commission (KZN's)
PSEDS	Provincial Spatial Economic Development Strategy
PWSP	Provincial Water Sector Plan
RDP	Reconstruction and Development Programme
RO	Reverse Osmosis
ROD	Record of Decision
RQO	Resource Quality Objective
SCA	South Coast Augmentation
SCP	South Coast Pipeline
SCP-1	South Coast Pipeline Phase 1
SCP-2a	South Coast Pipeline Phase 2a
SCP-2b	South Coast Pipeline Phase 2b

SDF	Spatial Development Framework
SHR	St Helen's Rock (near Port Shepstone)
STEEPLE	Social/demographic, Technological, Economic, Environmental (Natural), Political, Legal and Ethical
SWRO	Seawater Reverse Osmosis
TEC	Target Ecological Category
TWL	Top Water Level
uPVC	Unplasticised Polyvinyl Chloride
UUW	uMngeni-uThukela Water
WA	Western Aqueduct
WC	Water Conservation
WDM	Water Demand Management
WMA	Water Management Area
WRC	Water Research Commission
WSA	Water Services Authority
WSDP	Water Services Development Plan
WSNIS	Water Services National Information System
WSP	Water Services Provider
WTP	Water Treatment Plant
WWW	Wastewater Works

Spellings of toponyms have been obtained from the Department of Arts and Culture (DAC). DAC provides the official spelling of place names and the spellings, together with the relevant gazette numbers, can be accessed at http://www.dac.gov.za/content/toponymic-guidelines-map-and-other-editors.

When using any part of this report as a reference, please cite as follows:

uMngeni-uThukela Water, 2025. uMngeni-uThukela Water Infrastructure Master Plan 2025/2026 – 2055/2056, Vol 1 - 10. Prepared by Planning Services, June 2025.

LIST OF UNITS

Length/Distance:	mm	millimetre
	m	metre
	km	kilometre
Area:	m^2	square metres
	ha	hectare
	km^2	square kilometres
Level/Altitude:	mASL	metres above sea-level
Time:	s	second
	min	minute
	hr	hour
Volume:	m^3	cubic metres
	Mℓ	megalitre
	million m^3	million cubic metres
	mcm	million cubic metres
Water Use/Consumption/Treatment/Yield:	ℓ/c/day	litre per capita per day
	kℓ/day	kilolitre per day
	Mℓ/day	megalitre per day
	million m^3/annum	million cubic metres per annum
	kg/hr	kilograms per hour
Flow velocity/speed:	m/s	metres per second
Flow:	m^3/s	cubic metres per second
	ℓ/hr	litres per hour
	m^3/hr	cubic metres per hour

15. MIDDLE UTHUKELA SYSTEM

15.1 Synopsis of the Middle uThukela System

The Middle uThukela region consists of the uThukela catchment between the Buffalo-uThukela confluence and the Woshi-uThukela confluence. The uThukela River meanders in a south-easterly direction, with the Mvoti Local Municipality (uMzinyathi WSA) located predominantly south of the uThukela River and the Nkandla Local Municipality (King Cetshwayo WSA) occupying the area north of the uThukela River (**Figure 15.1**).

Whilst the Nkandla Local Municipality has the largest area in the Middle uThukela region, the town of Nkandla is located approximately 1.4 km east of the Middle uThukela-uMhlathuze watershed. The settlements of Qudeni and Kranskop, however, are located on the Middle uThukela watershed: Qudeni on the Buffalo-Middle uThukela watershed and Kranskop on the Mvoti-Middle uThukela watershed. Settlements situated in the Middle uThukela region include Dlolwana, Jameson's Drift and The Ranch.

This region is home to the uThukela-Goedertrouw Transfer Scheme, an inter-basin transfer scheme where water is pumped from uThukela River to Goedertrouw Dam to improve the assurance of water supply to the Goedertrouw Regional Scheme supply area, including Richard's Bay, the largest port in Africa. The uThukela-Goedertrouw Transfer Scheme can also be supported by releases from the Spioenkop Dam (uThukela DM), via the uThukela River, if necessary. Pumping from uThukela-Goedertrouw Transfer Scheme usually commences when the Goedertrouw Dam's water level drops below 90% of its full supply capacity. The scheme was designed to pump approximately 1.2 m^3/s from the uThukela River over the divide into the Goedertrouw Dam; however, only about 1.0 m^3/s is transferred due to operational inefficiencies. Following the 2014/15 drought, the uThukela-Goedertrouw Transfer Scheme was re-designed to increase its capacity from 1.0 to 2.0 m^3/s (UUW, 2020). The upgrade project is expected to be completed in July 2025. This scheme is further discussed in **Section 16**.

The WTPs located in the Middle uThukela Region are summarised in **Table 15.1**.

Table 15.1 WTPs located in the Middle uThukela Region (UAP Phase 3 2020: GIS Dataset).

Scheme	Water Treatment Plant	Capacity (Mℓ/day)	Site
Vutshini-Nkandla	Mfongosi WTP	0.6	Manzawayo-Mfongosi confluence.
Vutshini-Nkandla	Khombe Hospital WTP	1	Upstream of tributaries flowing into the Vutshini River.
Makhabeleni	Makhabeleni WTP	4	uThukela River near Jameson's Drift.
Middledrift	Middledrift WTP	10	East of Ntolwane, on the banks of the Mkalazi, which flows westwards into the Nsuze
Ngcebo Water Supply Scheme	Ngcebo WTP	4	uThukela River near Middle uThukela-Lower uThukela watershed.

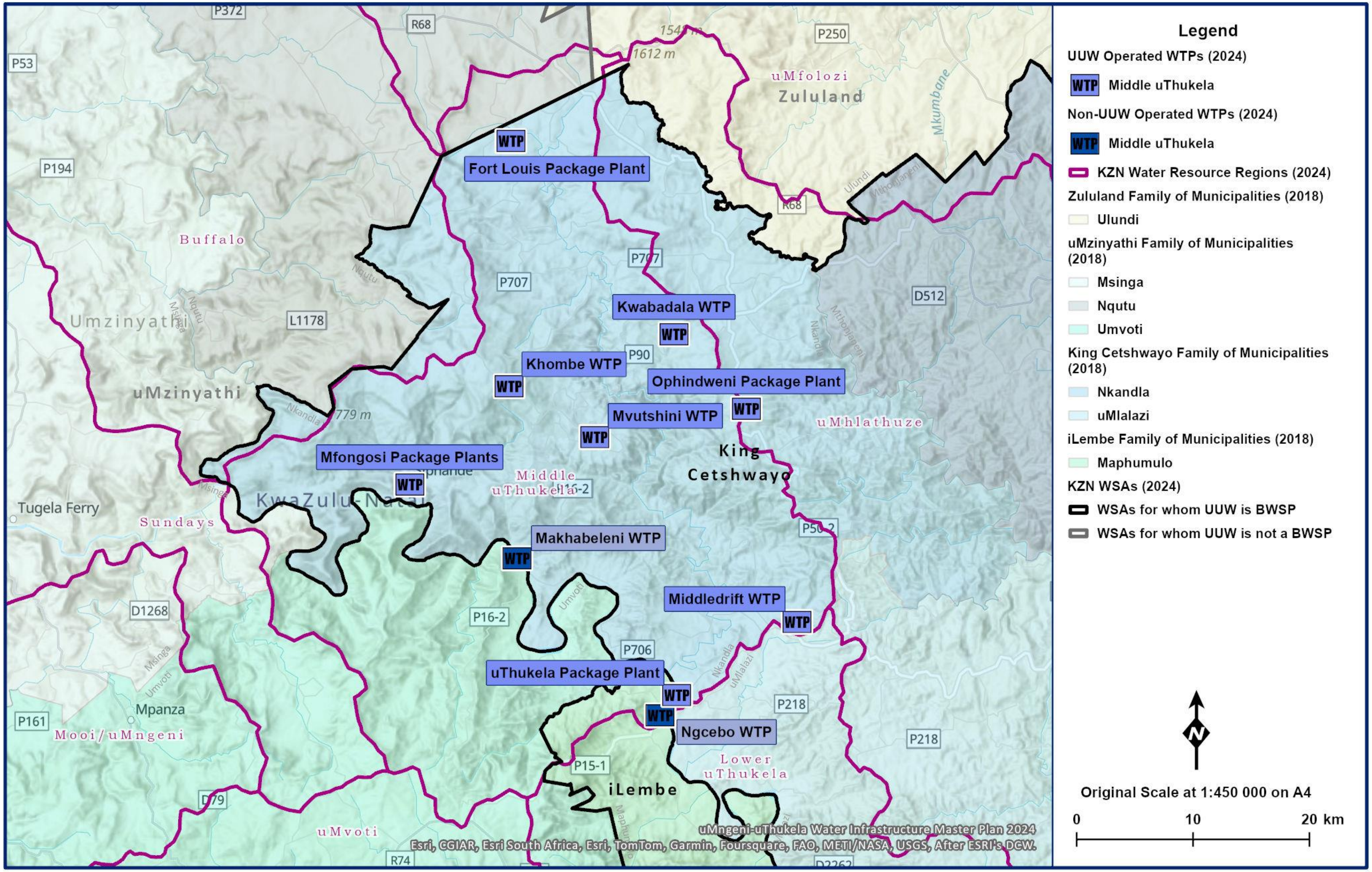

Figure 15.1 General layout of the Middle uThukela Region.

The water supply schemes in this region are predominantly supplied from run-of-river abstraction infrastructure:

- Vutshini Nkandla Water Supply Scheme – this scheme sources its water from three river systems; (i) through run-of-river abstraction from the Vutshini Stream (a tributary of the Nsuze River); (ii) the Vove Dam in the Buffalo System (historical firm yield of 0.55 Mℓ/day) and (iii) the Mhlathuze River in the uMhlathuze System (yield of 1.34 Mℓ/day).
- The Makhabeleni Water Supply Scheme – this scheme is supplied from the uThukela River (yield of 1 Mℓ/day) near Jameson's Drift.
- Middledrift Water Supply Scheme – this scheme is supplied from the uThukela-Goedertrouw Transfer scheme abstraction works (through the Madungela High Lift Pump) downstream of the uThukela-Nsuze confluence, with water feeding various villages in the Middledrift Supply Area.
- Ngcebo Water Supply Scheme - raw water is abstracted at the Middledrift Abstraction works and is supplied via a raw water pipeline, across the river, to the Ngcebo WTP. From the treatment works, a bulk potable water rising main supplies a few reticulation reservoirs.

15.2 Water Resources of the Middle uThukela System

15.2.1 Description of the Middle uThukela System Water Resource Regions

(a) Middle Thukela Region

(i) Overview

As mentioned in **Section 15.1**, the uThukela River meanders in a south-easterly direction from the Buffalo-uThukela confluence, which is located approximately 1.9 km west of the Ntshongweni Hill, Trig Beacon 388, at an elevation of 1 032.8 mASL. Tributaries flowing from the north into the uThukela River include the:

- Mfongosi River with its headwaters located approximately 3.9 km north-west of Dlolwane and south-east of the Nkonyane Hill (Trig Beacon 413) in the Qudeni Nature Reserve. The Mfongosi flows in a south-westerly direction into the uThukela River.

  The Mfongosi WTP is positioned at the Manzawayo-Mfongosi confluence, approximately 2 km upstream of the Mfongosi-uThukela confluence (UAP Phase 3 2020: GIS dataset.

- Manyane River, whose headwaters are located north-east of Dlolwane and flows in a southerly direction, passing the Isilokomane Mountain on the east and into the uThukela River at Jameson's Drift.

- Nsuze River, which sources its water from the Siphezi Hill (Trig Beacon 331 at 1 547.6 mASL). The Nsuze River meanders in a southerly direction with tributaries including the Maxhuma, Mathole, Vutshini and Mkalazi, before it flows into the uThukela River approximately 2.2 km downstream of the Shu Shu Warm Baths. The uThukela-Goedertrouw Transfer Scheme is approximately 1.1 km downstream of the uThukela-Nsuze confluence.

The headwaters of the Vutshini are located approximately 2.9 km south-east of Qudeni as the crow flies. The Vutshini flows in a south-easterly direction into the Nsuze River. The Khombe Hospital WTP, in the settlement of Spinnies, is located upstream of this tributary.

The Middledrift WTP is located east of Ntolwane, on the banks of the Mkalazi River, which flows westwards into the Nsuze River. The capacity of the WTP is 10 Mℓ/day (UAP Phase 3 2020: GIS Dataset).

The proposed location for the Nsuze WTP is on the Nsuze River, south of the Sangeni settlement and between the Maxhuma-Nsuze and Mathole-Nsuze confluences (UAP Phase 3 2020: GIS dataset. The UAP Phase 3 further identified the capacity of the proposed Nsuze WTP as 20 Mℓ/day (2020: GIS dataset).

Tributaries flowing into the uThukela River from the south include the Vamvule and the Ngcaza Rivers.

The Middle uThukela Region comprises of tertiary catchment V40 and quaternary catchment V60K. The most dominant land cover category in this region is forestland and grassland, occupying 50% and 27% of the entire region, respectively (**Figure 15.2**).

(ii) Surface Water

The hydrological characteristics for this region are summarised in **Table 15.2**.

Table 15.2 Hydrological characteristics of the Middle Thukela Region (WR2012: Thukela Quat Info WMA 7 7Jul2015 spreadsheet)

Region	River (Catchment)	Area (km^2)	Annual Average				
			Evaporation (mm)	Rainfall (mm)	Natural Runoff (million m^3)	Natural Runoff (mm)
Middle Thukela	Thukela River (V40)	1 753	1 415	817	159.2	90.8
	Thukela River (V60K)	228	1 400	691	13.0	57.1
	Total	**1 981**				

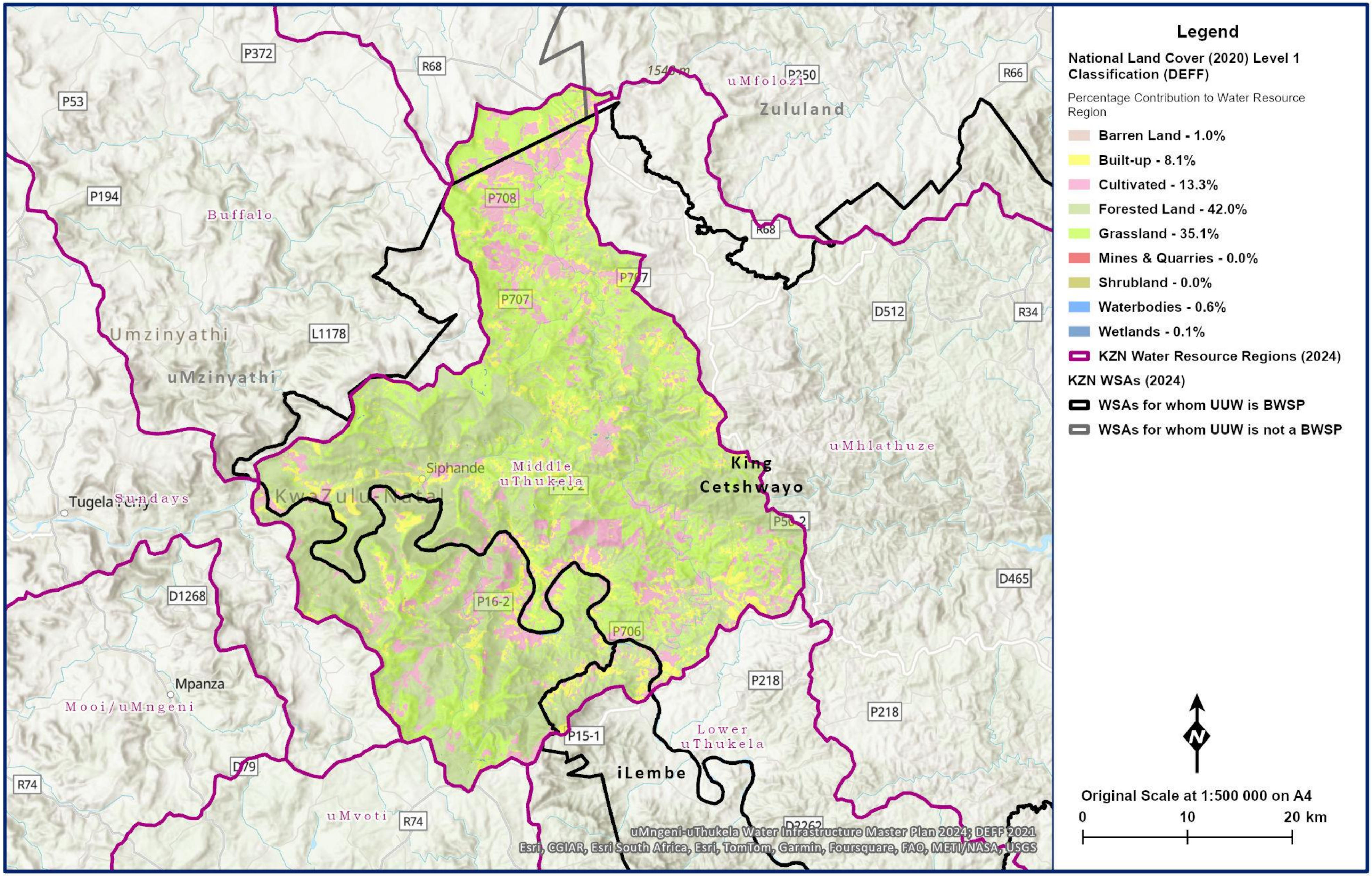

Figure 15.2 Middle uThukela land cover (DEFF 2020, MDB 2020, uMngeni-uThukela Water 2024, WR2012).

(iii) Groundwater

The Middle uThukela region is located in two hydrogeological regions, the KwaZulu-Natal Coastal Foreland and North Eastern Middleveld (DWAF 2008) (**Figure 15.3**).

- ### Hydrogeological Units

Basement rocks are exposed mainly in the northern parts of the area, comprising granite-gneiss, schists and amphibolites.

The outcrop of Dwyka Group Tillite is prevalent around Kranskop and Qudeni. Sediments of the Ecca Group are found in the eastern part of the area, with rocks of the Vryheid Formation underlying much of the area. These rocks mainly comprise sandstones and are relatively resistant to erosion, resulting in relatively narrow and deeply incised river channels.

All the above sedimentary strata have been extensively intruded by dykes and sills of dolerite. These features play an important role in the geohydrology of the area, and significantly enhance the water-bearing properties of aquifers in the area.

The Natal Metamorphic Province includes rocks of some 1000 Ma, but their extent is limited to the south-eastern part of the catchment around Kranskop. The extent of the Natal Group is also limited to the area east of Kranskop.

- ### Geohydrology

The study area is mostly underlain by the Karoo Supergroup and is either sub-horizontal or has a very gentle inland dip to the west, wherein the structure comprises numerous south-easterly tilted fault blocks. These fault blocks play an important role in groundwater flow. Aquifers within the study area include:

- Weathered and fractured hard rock aquifer systems.
- Primary aquifers that are confined to a narrow strip along the middle reaches of the uThukela, Sundays and Buffalo Rivers.

- ### Groundwater Potential

Groundwater yields from 'hard-rock' boreholes in the area are generally low and in the range 0.1 to 0.6 ℓ/s, although significantly higher yields (3 ℓ/s) can be obtained in hydrogeologically favourable situations, such as fracturing and intrusive Karoo dolerite contact zones. Contacts between different lithologies were also seen to be important drilling targets. There is little difference in yield amoung the various geological formations. Higher borehole yields can be obtained in some localities. Juxtaposition of sandstone horizons to dolerite, major structural features such as faults and fractures and more competent Natal Group quartzites and sandstones have produced borehole yields in excess of 2 ℓ/s. The likelihood of obtaining yields in excess of 2 ℓ/s, however, is less than 30%, while few boreholes yield more than 3 ℓ/s. Groundwater recharge over the area varies from 1 to 5 % of the mean annual precipitation (MAP), with an average of about 3 percent of the MAP.

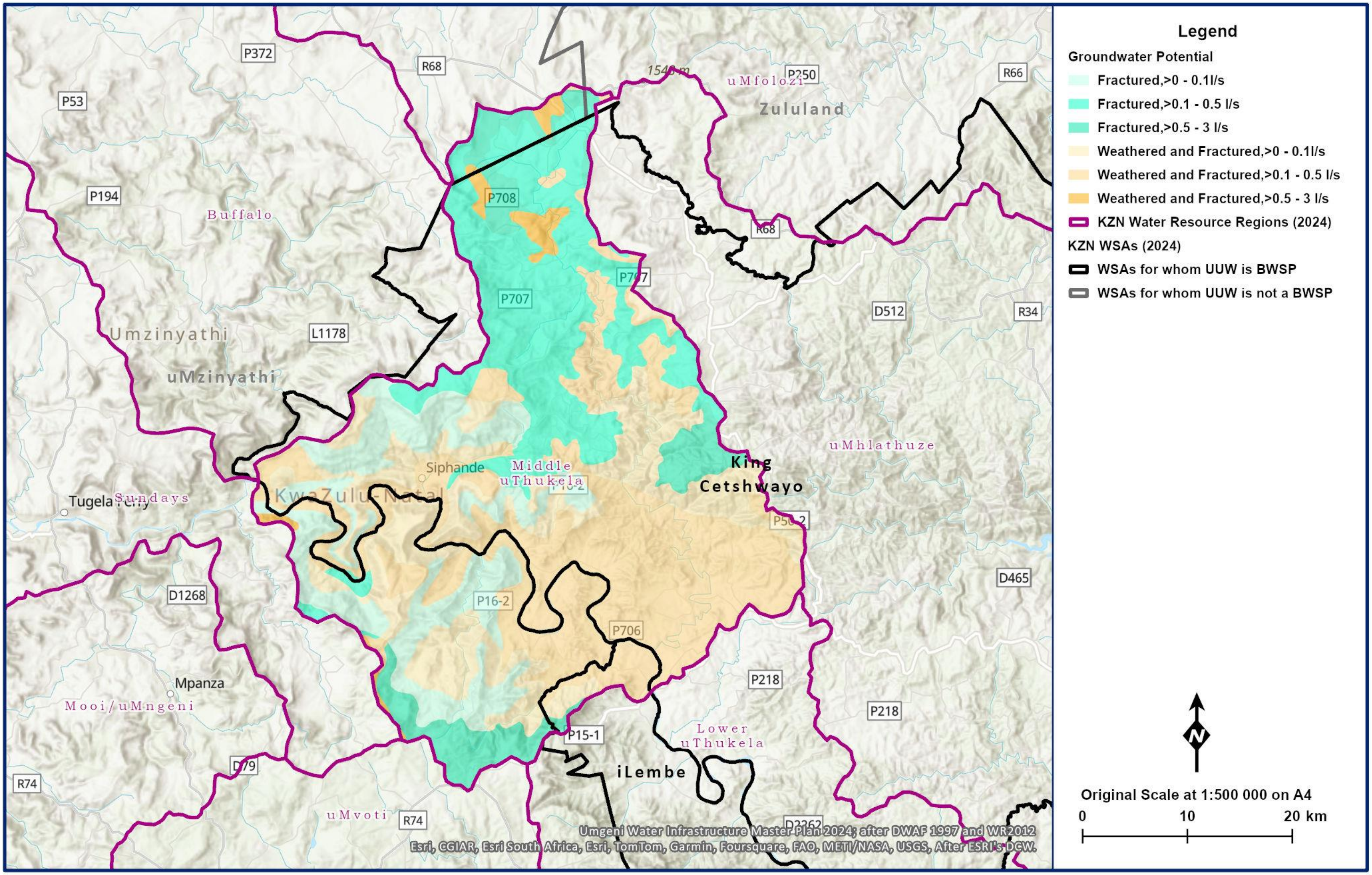

Figure 15.3 Groundwater potential in the Middle Thukela Region (MDB 2020, uMngeni-uThukela Water 2024, after DWAF 1997 and WR2012).

(iv) Water Quality

- **Surface Water**

There are no known major water quality problems in the Vutshini Water Supply Scheme area. It is, however, likely that the quality of the Vutshini River is significantly affected during periods of low flow due to the land use activities upstream and soil erosion (Department of Water Affairs Vutshini All Town Study, 2011, Page23).

- **Groundwater**

Groundwater quality in the area is generally good, with the best quality groundwater found in the higher rainfall portions, and the poorest quality in the lower rainfall areas towards the east, groundwater quality deteriorates in the direction of flow and assumes a more dominant N-Cl character. The total dissolved solid (TDS) content of the groundwater is generally in the range 50 to 200 mg/l, but this can rise considerably to more than 420 mg/l in the lower rainfall portions. Poorer quality groundwater is found in the lower reaches of the Upper uThukela, Bushmans and Mooi Catchments, probably reflecting the influence of the argillaceous sediments in this part of the study area. Instances of elevated fluoride were reported for the western part of the catchment.

15.2.2 Reserve

This section summarises key findings from the recently completed ***Determination of Water Resource Classes and Associated Resource Quality Objectives in the Thukela Catchment*** study by the Department of Water and Sanitation (Gazetted in March 2023), with a focus on the middle uThukela water resource region. Of particular interest from a water resources management perspective, is the present ecological state (PES) and the recommended or targeted ecological state (TEC) of water resources in the region.

The Water Resource Classes and Associated Resource Quality Objectives report categorises the study area into different integrated units of analysis (IUAs) based on various factors, including the homogeneity of climate, soils and land use. For the purpose of this report, the middle uThukela water region falls within two IUAs: (i) quaternary catchments V40A and B are grouped into one integrated unit of analysis (IUA), forming part of the area downstream of the Mooi River confluence to the uThukela-Goudertrouw Transfer Scheme pump station and (ii) the uThukela River from the uThukela-Goudertrouw Transfer Scheme abstraction point to the Lower Thukela Bulk Water Supply Scheme abstraction point. The water resources classes and associated resources quality objectives for these two IUAs are shown in **Table 15.3** below.

Table 15.3 The present and targeted ecological state of water resources within the Middle uThukela Water Resource Region (DWS, 2023).

IUA Description	PES	TEC
Mooi River confluence to the uThukela-Goudertrouw Transfer Scheme pump station	The present ecological state (PES) of this IUA is category C with significant modification due to subsistence agriculture in the rural settlements, as well as pumping of water to the uMhlathuze River via the uThukela-	The targeted ecological state (TEC) for this IUA (V40A &B) is category C, where it is recommended that base flow patterns are maintained to sustain low flows and river health during drought periods.

	Goudertrouw Transfer Scheme.	
The uThukela River from the uThukela-Goudertrouw Transfer Scheme abstraction point to the Lower Thukela Bulk Water Supply Scheme (LTBWSS) abstraction point.	The PES of this segmnent of the uThukela River is currently category B, as the amount of villages and subsistence agriculture are less significant along the river.	The TEC for this region is category C due to the expected increase in the amount of water pumped out of the river through the LTBWSS. It is recommended that both low/base flows during winter and high flows (or freshets) during summer are maintained to sustain riverine ecology and water quality.

According to the DWAF (2004) ***Thukela Reserve Determination*** study, the uThukela Reserve water resource analysis assumed that the Spioenkop, Ntshingwayo and Wagendrift Dams will contribute to the users and the Reserve in the Middle to Lower uThukela areas. This conjunctive use of these three dams results in large theoretical surpluses in the Lower uThukela River.

15.2.3 Existing Water Resource Infrastructure and Yields

The Vutshini and Nkandla supply areas were combined into a single supply area in order to shift the supply area boundary eastwards, incorporating the Nsuze River as a sustainable supply source. The water supply area covers the north-western section of the Nkandla Local Municipality, within the King Cetshwayo District Municipality.

The Vutshini-Nkandla Regional Scheme is the main water supply scheme in this region and is described below:

- The Nkandla Water Supply Scheme area straddles the Upper Mhlathuze River (i.e. quaternary catchment W12A) and the Nsuze River catchments (i.e. Quaternary Catchments V40C & D). There is a current deficit of 0.38 million m^3/annum (1.0 Mℓ/day) on the registered water use for the Nkandla Water Supply Scheme. The water supply deficit will continue to increase to 1.91 million m^3/annum (5.2 Mℓ/day) by 2030 on the high growth scenario. The available water resources of 1.65 million m^3/annum (4.5 Mℓ/day) are not sufficient to meet the current and future water requirements of the Nkandla Water Supply Scheme Area, particularly during low flow periods (DWAF, 2011).

- The Vutshini Water Supply Scheme utilises the uThukela River as its main source (1 Mℓ/day) and the Vutshini River, which is a tributary of the Nsuze River, as an alternate source. The scheme also receives its water from Vove Dam (yield of 0.55 Mℓ/day) on the Vove River and the Mhlathuze River (yield of 1.34 Mℓ/day). The Vutshini Water Supply Scheme comprises of two WTPs. Only one plant falls within this region, namely, the Vutshini WTP at the Vutshini Village. The WTP supplies the village and the surrounding villages up to Msobotsheni in the north-east and Ntingwe in the south (Department of Water Affairs, 2011, page 17). The Ntingwe Dam **(Figure 15.4** and **Table 15.5**) supplies raw water for both irrigation and domestic water supply purposes to the Ntingwe rural community.

  During low flow periods, the maximum abstraction over a 3-month period at the Vutshini WTP is approximately 0.03 million m^3. This amount is not sufficient to meet the 3-month peak summer demand of 0.39 million m^3 (Department of Water Affairs All Town Study, 2011, Page 22).

Dams found in this region include the Ntingwe Masonry and Ntingwe Dams which are being used as irrigation dams in the Ntingwe Tea Estate. During dry periods, there is insufficient water in the lower uThukela River and releases from upstream dams are needed.

A dam on the Nsuze River is recommended to supply the future demand of the Vutshini-Nkandla regional scheme. Preliminary hydrological investigations indicate that a dam impounding 31 million m^3 will have an estimated yield of 19 Mℓ/day for the scheme (UAP Phase 3, 2020).

The Kranskop Water Supply Scheme, which is currently supplied by groundwater abstraction, also forms part of this region. It forms part of the Mandleni River catchment, which is part of the uThukela River system.

Other small treatment works exist in this area but are not part of this report as they do not constitute bulk schemes. These are either supplied from run-of-river abstractions or boreholes (Department of Water Affairs All Town Study, 2011, Page 22).

The water supply area showing the respective sources of supply is presented in **Table 15.4**.

Table 15.4 Supply Area and their respective water sources (Umgeni Water, 2019: 17)

Scheme supply Area	Local Municipality	Source
Vutshini-Nkandla	Nkandla	Nsuze River, uThukela River

15.2.4 Operating Rules

The Ntingwe Dam (**Figure 15.4** and **Table 15.5**) is used to support irrigation needs. As a result, there are no operating rules presented for Ntingwe Dam in this report.

Figure 15.4 Ntingwe Dam (MBB Consulting Engineers 2020: website).

Table 15.5 Characteristics of Ntingwe Dam.

Catchment Details	
Incremental Catchment Area:	1.03 km^2 [a]
Total Catchment Area:	5 km^2 [a]
Mean Annual Precipitation:	810 mm [b]
Mean Annual Runoff:	0.21 million m^3 [b]
Annual Evaporation:	1400 mm [b]
Dam Characteristics	
Gauge Plate Zero:	943.5 mASL [e]
Full Supply Level:	960 mASL [e]
Net Full Supply Capacity:	0.4 million m^3 [c]
Spillway Height:	16.5 m [c]
Dead Storage:	N/A
Total Capacity:	0.4 million m^3 [c]
Original Measured Dam Capacity:	0.4 million m^3 [c]
Surface Area of Dam at Full Supply Level:	0.07 km^2 [c]
Dam Type:	Earth fill [c]
Material Content of Dam Wall:	Earth fill [c]
Crest Length:	Crest length: 134 m [c] Spillway Section: 24 m [d] Non-Spillway Section: 110 m [d]
Type of Spillway:	Side Channel Spillway [c]
Capacity of Spillway:	N/A
Date of Completion:	2001 [c]
Date of Last Area Capacity Survey:	2009 [c]
Date of Next Area Capacity Survey:	N/A

[a] Catchment delineation using 20m DEM and spatial analyst.
[b] WR2012
[c] DWS List of Registered Dams Database (April 2019).
[d] Measured on Google Earth.
[e] 0.5 m Contours

15.3 Supply Systems

15.3.1 Description of the Middle uThukela System

The Middle uThukela System includes supply to two major areas, including those south of the uThukela River in the uMzinyathi DM and those north of the uThukela River in the King Cetshwayo DM (KCDM), including the City of uMhlathuze WSA. Supply to the King Cetshwayo areas is predominantly from water abstracted at Middledrift, through the uThukela-Goedertrouw Transfer Scheme. Information on KCDM systems is reported on the uMhlathuze System (**Section 16)**. Supply to the uMzinyathi Area is described below.

(a) Makhabeleni WTP and Supply System

The Makhabeleni WTP is located in Makhabeleni (Jameson's Drift) along the uThukela River in the uMzinyathi District Municipality.

The Makhabeleni WTP obtains its raw water from the uThukela River and pumped via an abstraction tower and bridge to a 4 Mℓ/day WTP on the southern banks of the uThukela River. At the WTP, raw water is treated and pumped to a high level command reservoir before being distributed to various reservoirs in different parts of Makhabeleni.

The WTP was upgraded from 2 Mℓ/day to 4 Mℓ/day towards the end of 2017 and five phases of the distribution network were completed towards the end of 2018. A portion of the sixth phase of the distribution system was also completed in 2018.

The spatial layout of the completed phases 1 to 5, a portion of phase 6 and the planned phases 7 and 8 are shown in **Figure 15.5** and the schematic is illustrated in **Figure 15.6**.

The characteristics of the Makhabeleni WTP are shown in **Table 15.6**. The pump details, reservoir details and pipeline details are listed in **Table 15.7**, **Table 15.8** and **Table 15.9** respectively.

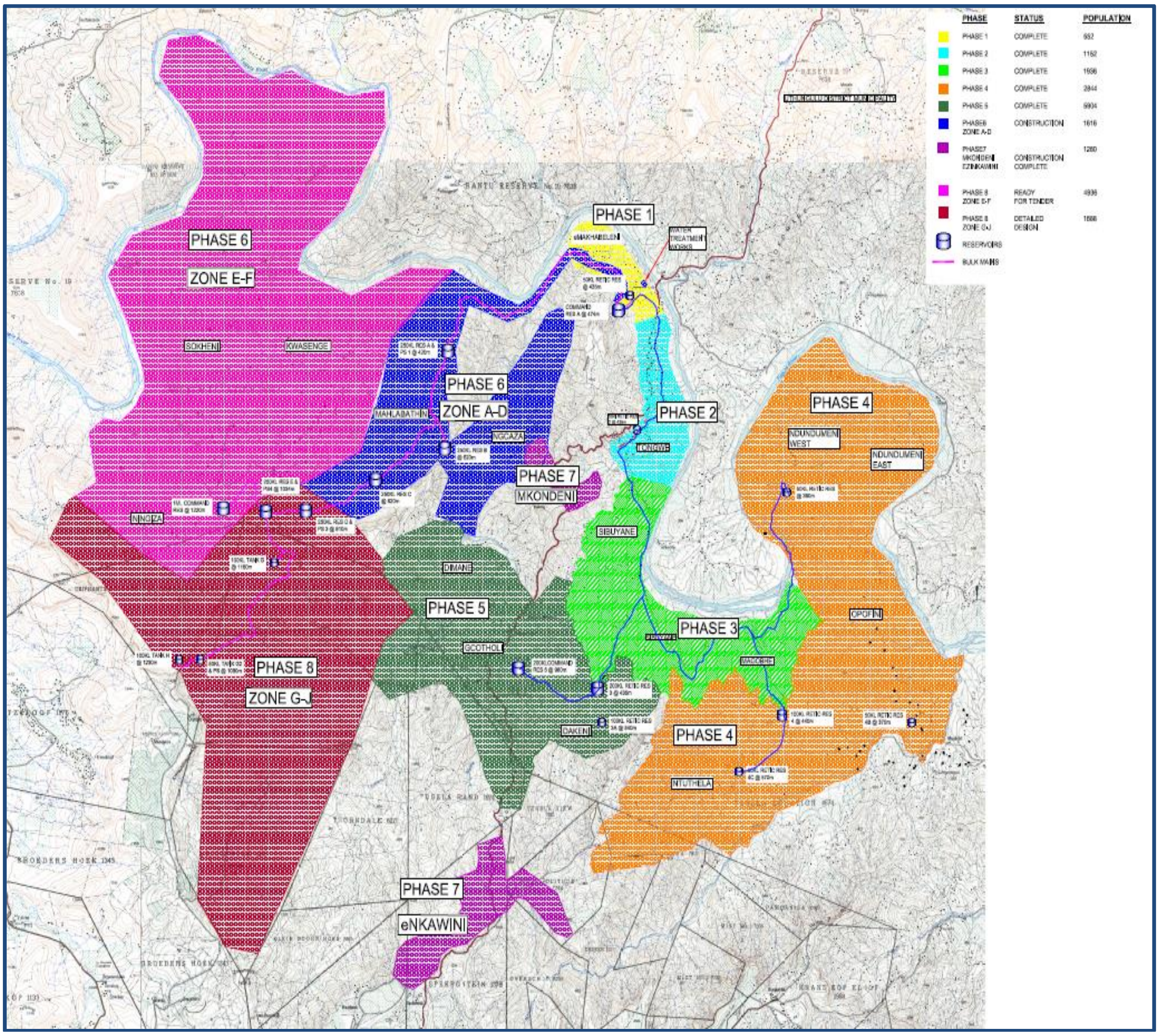

Figure 15.5 Spatial layout of the Makhabeleni Supply System.

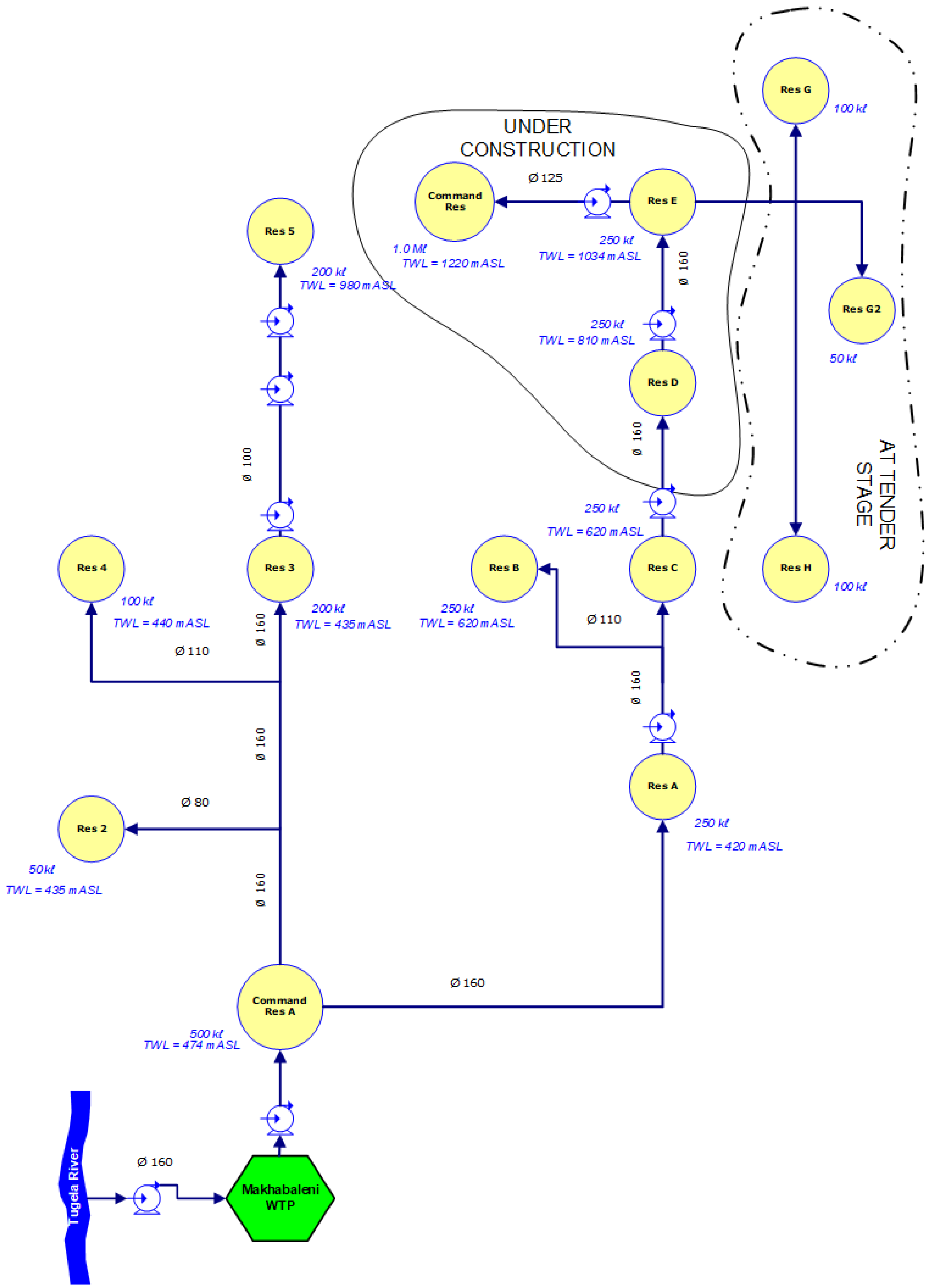

Figure 15.6 Schematic of the Makhabeleni Supply System.

Table 15.6 Characteristics of the Makhabeleni WTP.

WTP Name:	Makhabeleni WTP
System:	Tugela Supply System
Maximum Design Capacity:	4 Mℓ/day
Current Utilisation:	2.0 Mℓ/day
Raw Water Storage Capacity:	0 Mℓ
Raw Water Supply Capacity:	2.0 Mℓ/day due to constraint of abstraction works
Pre-Oxidation Type:	None
Primary Water Pre-Treatment Chemical:	Polymeric Coagulant
Total Coagulant Dosing Capacity:	13 ℓ/hour (running at 50%)
Rapid Mixing Method:	Conventional Paddle Flash Mixer
Clarifier Type:	Dortmund manual clarifiers
Number of Clarifiers:	6 (2 old and 4 new)
Total Area of all Clarifiers:	140.4 m^2 (28.08 m^2 old and 112.32 m^2 New)
Total Capacity of Clarifiers:	4.5 Mℓ/day
Filter Type:	Constant Rate Rapid Gravity Filters
Number of Filters:	8 (2 Old and 6 New)
Filter Floor Type	Laterals with Nozzles
Total Filtration Area of all Filters	83.64 m^2
Total Filtration Design Capacity of all Filters:	4 Mℓ/day
Total Capacity of Backwash Water Tanks:	0 m^3
Total Capacity of Sludge Treatment Plant:	None
Capacity of Used Washwater System:	0 Mℓ/day
Primary Post Disinfection Type:	Sodium Hypocloride
Disinfection Dosing Capacity:	13 ℓ NaOCl/hr
Disinfectant Storage Capacity:	
Total Treated Water Storage Capacity:	0.5 Mℓ

Table 15.7 Pump details: Makhabeleni Supply System.

System	Pump Station Name	Number of Pumps		Pump Description	Supply From	Supply To	Static Head (m)	Duty Head (m)	Duty Capacity (Mℓ/day)
		Number of Duty Pumps	Number of Standby Pumps						
Makhabeleni	Raw Water (WTP)	1	1	Gorman Rupp	Tugela Abstraction	Makhabeleni WTP Pre-settlement Tank	32.8	35.2	4.240
Makhabeleni	Potable Water High Lift (WTP) (Umzinyathi)	2	1	KSB WKLn 65/6	WTP	Command Reservoir	166.1	194.0	2.000
Makhabeleni	Potable Water High Lift (WTP) B (Uthungulu)	2	1	KSB WKLn 65/6	WTP	Uthungulu Reservoir	192.8	217.0	2.000
Makhabeleni	Phase 4	1	1	Grundfos CR 3-31	Ph4 Res 4 Bulk	Res 4 C	135.0	160.0	0.125
Makhabeleni	Phase 5 (Lift 1A)	1	1	TBC	Ph3 Reservoir	Tank 2	201.0	222.0	0.480
Makhabeleni	Phase 5 (Lift 1B)	1	1	TBC	Ph3 Reservoir	Dakeni Res 3b	122.0	137.0	0.107
Makhabeleni	Phase 5 (Lift 2)	1	1	TBC	Tank 2	Tank 3	169.0	189.0	0.480
Makhabeleni	Phase 5 (Lift 3)	1	1	TBC	Tank 3	Ph 5 Command Res	190.0	210.0	0.480
Makhabeleni	Phase 6 (Lift 1A)	1	1	Grundfos CR 5-36	Res 6A	Res 6B	190.4	234.0	0.099
Makhabeleni	Phase 6 (Lift 1B)	1	1	Grundfos CR 45-10	Res 6A	Res 6C	188.7	255.5	0.828
Makhabeleni	Phase 6 (Lift 2)	1	1	Grundfos CR 45-10	Res 6C	Res 6D	207.1	232.8	0.810
Makhabeleni	Phase 6 (Lift 3)	1	1	Grundfos CR45-11	Res 6D	Res 6E	226.4	247.7	0.764
Makhabeleni	Phase 6 (Lift 4A)	1	1	Grundfos CR32-14	Res 6E	Res 6F (Command)	206.1	221.8	0.642
Makhabeleni	Phase 6 (Lift 4B)	1	1	TBC	Res 6E	Res G1 (future)	132.8	154.5	0.316
Makhabeleni	Phase 6 (Lift 5)	1	1	Grundfos CRE1-27	Tank F1	Tank F2 (under construction)	100.0	106.0	0.023
Makhabeleni	Ph 7 (Ezinkawini)	1	1	Grundfos CRE 10-17	Tank E1	Tank E2	224.0	245.4	0.171
Makhabeleni	Ph 7 (Mkondeni)	1	1	Grundfos CR 5-36	Tank M1	Tank M2	199.0	214.0	0.071

Table 15.8 Reservoir details: Makhabeleni BWSS.

System	Reservoir Site	Reservoir Name	Capacity (Mℓ)	Function	TWL (m ASL)	FL (m ASL)
Makhabeleni	Makhabeleni	Command Res A	0.500	Distribution	474	468#
Makhabeleni	Makhabeleni	Res 2	0.050	Terminal	435	429#
Makhabeleni	Makhabeleni	Res 3	0.200	Distribution	435	431#
Makhabeleni	Makhabeleni	Res 4	0.100	Distribution	440	436#
Makhabeleni	Makhabeleni	Res 5	0.200	Terminal	980	976#
Makhabeleni	Makhabeleni	Res A	0.250	Distribution	420	416#
Makhabeleni	Makhabeleni	Res B	0.250	Terminal	620	615#
Makhabeleni	Makhabeleni	Res C*	0.250	Distribution	620	615#
Makhabeleni	Makhabeleni	Res D*	0.250	Distribution	810	805#
Makhabeleni	Makhabeleni	Res E*	0.250	Distribution	1034	1030#
Makhabeleni	Makhabeleni	Res G**	0.100	Terminal	1160	1155#
Makhabeleni	Makhabeleni	Res G2**	0.050	Terminal	1090	1085#
Makhabeleni	Makhabeleni	Res H**	0.100	Terminal	1230	1225#
Makhabeleni	Makhabeleni	Res F**	1.0	Distribution	1230	1225#

*Under construction (anticipated completion is end 2020); **At tender stage; #Based on assumed reservoir depth

Table 15.9 Pipeline details: Makhabeleni BWSS.

System	Pipeline Name	From	To	Length (km)	Nominal Diameter (mm)	Material	Capacity (Mℓ/day)	Age (years)
Makhabeleni	Raw water pipeline	Abstraction works	Makhabeleni WTP	0.127	160	uPVC	2.6**	8
Makhabeleni	Potable water pipeline	Makhabeleni WTP	Command Res A	0.947	160	uPVC	2.6**	8
Makhabeleni	Potable water pipeline	Command Res A	Res 2	4.652	160	uPVC	2.6**	8
Makhabeleni	Potable water pipeline	Command Res A	Res 3	11.91	160	uPVC/HDPE	2.6**	8
Makhabeleni	Potable water pipeline	Res 3	Res 5	2.916	100	Klambon	1.02**	8
Makhabeleni	Potable water pipeline	Command Res A	Res 4	16.617	160/110	uPVC	1.23**	8
Makhabeleni	Potable water pipeline	Command Res A	Res A	8.556	160	uPVC	2.6**	8
Makhabeleni	Potable water pipeline	Res A	Res B	2.983	110/75	uPVC/HDPE	0.572**	8
Makhabeleni	Potable water pipeline	Res A	Res C	4.165	110	uPVC	1.23**	8
Makhabeleni	Potable water pipeline	Res C	Res D	2.393	125	uPVC	1.59**	8
Makhabeleni	Potable water pipeline	Res D	Res E	1.196	125	uPVC	1.59**	3
Makhabeleni	Potable water pipeline	Res E	Res F	1.730	125	Steel	1.59**	3
Makhabeleni	Potable water pipeline	Res E	Res G	1.162	110	HDPE	1.23**	Planned
Makhabeleni	Potable water pipeline	Res E	Res G2	5.553	110	HDPE	1.23**	Planned
Makhabeleni	Potable water pipeline	Res G2	Res H	1.080	110	HDPE	1.23**	Planned

* Based on a velocity of 2 m/s ** Based on a velocity of 1.5 m/s # Age need to be verified

15.3.2 Status Quo and Limitations of the Middle uThukela System

(a) Makhabeleni WTP and Supply System

The Makhabeleni BWSS has recently been upgraded and is adequate to meet current and future demand. The main challenge facing the WTP is limited raw water abstraction capacity (currently limited to 2 Mℓ/day). It is proposed that a feasibility study be undertaken to investigate the potential for an upgrade of the abstraction works to cater for both current and future demands.

15.4 Water Balance/Availability

The Vutshini-Nkandla Regional Water Supply Scheme is mainly supplied from run-of-river abstractions through the Vutshini Stream, the Vove Dam yielding 0.33 Mℓ/day, the Mhlathuze River and the uThukela River. The source yield will be insufficient to cater for the current requirements of the Vutshini-Nkandla Scheme.

A dam on the Nsuze River is recommended to supply the future demand of the Vutshini-Nkandla regional scheme; the preliminary hydrological investigations indicate that a dam impounding 31 million m^3 will have a sufficient yield of 19 Mℓ/day for the scheme (UAP Phase 3, 2020).

15.5 Recommendations for the Middle uThukela System

15.5.1 System Components

(a) Ngcebo WTP and Supply System

The Ngcebo Bulk Water Supply Scheme is located in the far northern reaches of the Maphumulo Local Municipality, along the Mzinyathi-KCDM border. This bulk water supply scheme obtains its raw water supply via the Madungela Abstraction Works, which sources its water from the uThukela River. Raw water is pumped to the Ngcebo WTP via a bulk water pipeline where it is treated, then distributed to areas north and south of the WTP.

The Ngcebo Water Supply System (WSS) was implemented in five phases by uMngeni-uThukela Water, with the first phase completed in June 2008, supplying an estimated population of 6 104. Phase 1 also included the upgrade of the Ngcebo WTP to 0.25 Mℓ/day, as well as the implementation of a reticulation system.

Phase 2 and Phase 3 entailed the construction of reticulation to supply an additional estimated population of 7 128 and were completed in December 2008 and June 2009, respectively. uMngeni-uThukela Water then implemented an upgrade of existing bulk pipelines and an upgrade of the WTP to 0.43 Mℓ/day before implementation of Phase 4 could take place.

Phase 4 consisted of newly laid reticulation pipelines to supply a population of approximately 2 168, and was completed in April 2010. By January 2012, uMngeni-uThukela Water had then completed the upgrade of the raw water bulk pipeline from the Madungela Abstraction Works to increase the supply of raw water to the Ngcebo WTP.

In October 2013, Phase 5 of the Ngcebo BWSS was completed, ultimately providing water to an additional population of approximately 1 656. The Ngcebo WTP has recently undergone a capacity upgrade to 4 Mℓ/day in order to provide a consistent supply of water to all households within the area.

The Universal Access Plan Phase III planning study (Umgeni Water 2020) identified the following upgrades and augmentation required to adequately supply the Ngcebo WSS:

- The bulk distribution infrastructure is to be extended to include three (3) primary bulk pipes of diameter ranging between 63 – 315 mm, totalling 6.04 km in length, 17 secondary bulk pipes ranging in diameter of between 110 - 630 mm, totalling 50.04 km in length and 21 tertiary bulk pipes ranging in diameter between 50 – 125 mm, totalling 21.48 km in length
- Increase the existing storage capacity by constructing two (2) primary reservoirs, having a total storage capacity of 800 kℓ and 25 tertiary reservoirs, having a total storage capacity of 8 220 kℓ
- Construction of one 15.51 kW pump station to serve the primary command reservoir

The total bulk cost requirement for the Ngcebo BWSS is R250.8 million (excl VAT).

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16. uMhlathuze System

16.1 Synopsis of the uMhlathuze System

With a total catchment area of approximately 5 653 km^2, the uMhlathuze Water Resource Region (W1 secondary catchment) is composed of the uMhlathuze River (W12 tertiary catchment), Mlalazi River (W13 tertiary catchment) and Matigulu River (W11 tertiary catchment) catchments (**Figure 16.1**). Four Water Service Authorities (WSAs) are located in the uMhlathuze Water Resource Region (**Figure 16.1**):

i) A small portion of the Zululand WSA is located in the north-west of the uMhlathuze Region.
ii) The King Cetshwayo District Municipality (KCDM) WSA.
iii) The City of uMhlathuze WSA (an independent WSA within KCDM).
iv) The northern portion of the iLembe WSA, which is located in the Matigulu portion of the uMhlathuze Resource Region.

The headwaters of the uMhlathuze River are located approximately 0.4 km from the Zululand-King Cetshwayo District Municipal boundary[1] approximately 1.8 km south-west of the Babanango Hill (Trig Beacon 308 at an elevation of 1 598.1 mASL) and approximately 10.9 km south-west of the settlement of Babanango (Ulundi Local Municipality), as the crow flies. Babanango is located on the uMhlathuze-Mfolozi watershed. From the uMhlathuze headwaters, the river meanders in a south-easterly direction, with the town of Nkandla (Nkandla Local Municipality) to the west and the town of Melmoth (Mthonjaneni Local Municipality) to the east. At the Nkandla-Mthonjaneni-uMlalazi local municipal boundary, the uMhlathuze River flows eastward, passing the town of Eshowe to the south. At the Mthonjaneni-uMlalazi-uMhlathuze local municipal boundary, the uMhlathuze River meanders in a southerly direction, passing the town of Empangeni to its east before discharging into Richards Bay (formerly called the uMhlathuze Bay/Lagoon[2]), the largest port in South Africa by tonnage, handling about 89 million tonnes of cargo per year, equating to about 55% of South Africa's seaborne cargo (KZN Department of Transport).

The integrated uMhlathuze System consists of:

- The Goedertrouw Dam (owned and operated by DWS), which is the largest water resource in the system. The dam supplies water to the Greater Mthonjaneni WTP below the dam wall. Furthermore, water is released from the dam for downstream users including irrigation, industry and domestic supply.
- The Mhlathuze Weir (owned and operated by uMngeni-uThukela Water), which is located at the Mhlathuze River about 10 km before it discharges into the Indian Ocean. The weir is essential for UUW operations as it supplies raw water to the Nsezi WTP and Lake Nsezi. In addition, the weir supplies water for irrigation and industrial purposes.
- Local coastal lakes, namely, Lake Nsezi, Lake Cubhu, Lake Mzingazi and Lake Nhlabane. Lake Nsezi, owned by UUW, primarily supplies raw water to Richards Bay Minerals. The lake also supplies supplementary raw water to the Nsezi WTP, as and when required. Water is transferred from the Mhlathuze Weir to augment Lake Nsezi when storage levels decline.

[1] 2016 municipal boundary (Municipal Demarcation Board).
[2] Jones 2014:1.

Lake Mzingazi supplies raw water to the Mzingazi WTP, which is operated by the City of uMhlathuze.

- The uThukela-Goedertrouw Transfer Scheme (near Middledrift), which was built as a drought emergency scheme in 1997. This scheme was designed to pump 1.2 m^3/s but only supplies up to 1.0 m^3/s (as a result of operational inefficiencies) from the uThukela River over the divide into the Goedertrouw Dam. An upgrade of the uThukela-Goedertrouw Transfer Scheme capacity, from 1 to 2 m^3/s, was proposed and designed during the 2014/15 drought. This upgrade includes the installation of additional river abstraction pumps, the construction of a parallel de-sanding works, parallel high lift pump station and a parallel rising main from the second high lift pump station to the Mvuzane stream which feeds the Goedertrouw Dam. The project is 97% complete, with the power supply being the main delay for commissioning. It is expected to be completed in July 2025.

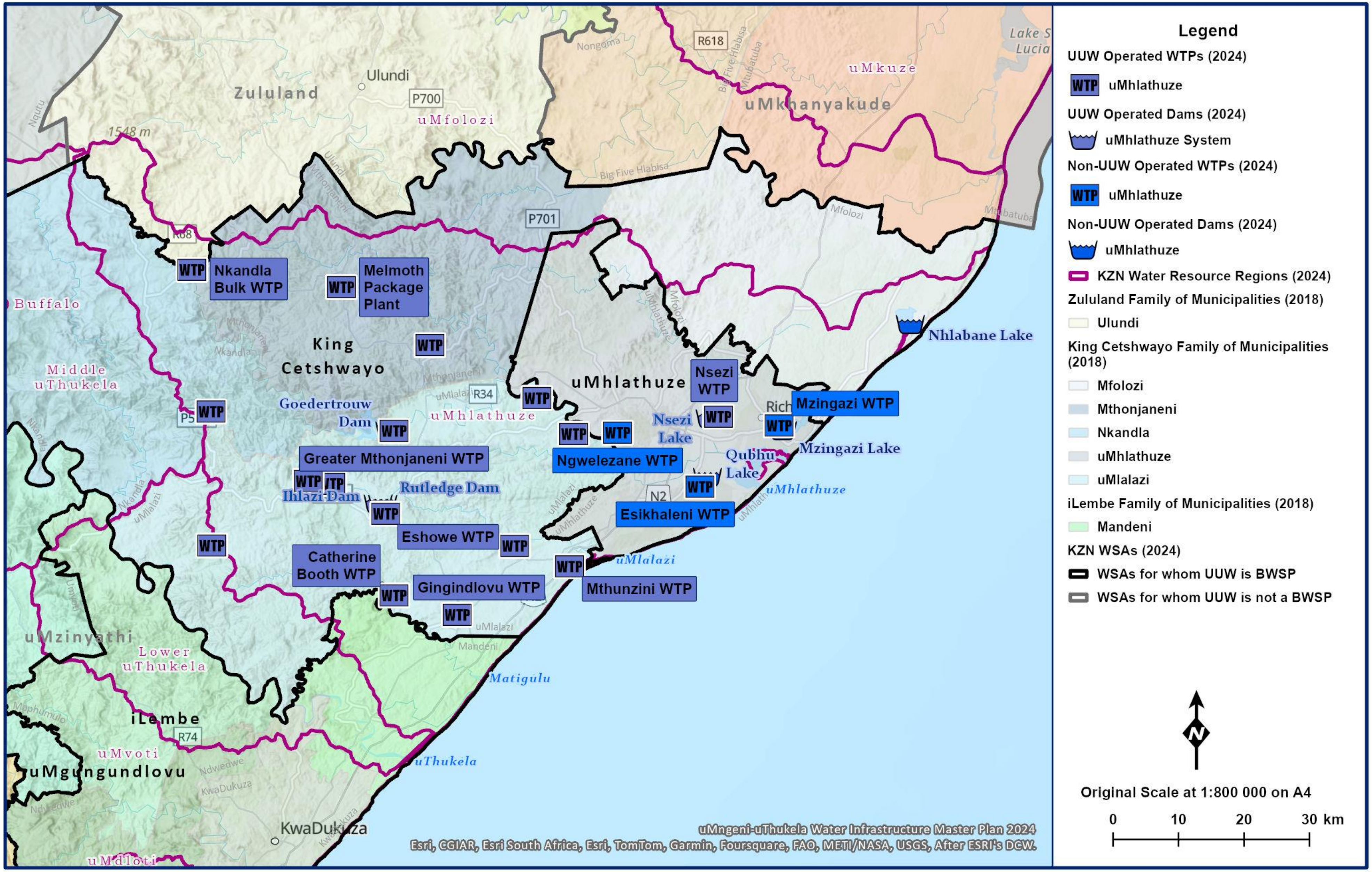

Figure 16.1 General layout of the uMhlathuze System.

16.2 Water Resources of the uMhlathuze System

16.2.1 Description of the uMhlathuze System Water Resource Regions

(a) uMhlathuze Region

(i) Overview

From its headwaters, the uMhlathuze River meanders in a south-easterly direction for approximately 4.2 km, serving as the Zululand-King Cetshwayo District Municipal boundary[3]. Thereafter, the uMhlathuze River continues to meander in a south-easterly direction, with the Gologodo Stream joining upstream of the Riversmeer and Phambana settlements[4]. The Babanango Dam on the Gologodo Stream (approximately 2 km south-west of Babanango as the crow flies) supplies water to Babanango via a water treatment plant (WTP) located immediately downstream of the dam wall (**Figure 16.2**).

The uMhlathuze River continues meandering in a south-easterly direction with contributions from the Gosweni, Mbizweni, Manzimnyama and Ngwekweni Rivers flowing from the west across Ingoyama Trust Board (ITB) land. The Nkandla Bulk WTP Abstraction Weir is located approximately 2 km downstream of the uMhlathuze-Ngwekweni confluence. At the P226 bridge (about 150 m downstream the weir), the Zululand-King Cetshwayo District Municipal boundary stops following the uMhlathuze River, with the river flowing in a southerly direction and the Xhaphozini and Nomasila Rivers joining from the east.

The Ntumbeni River, located south of the Nkandla cemetery and wastewater works (WWW), flows east across ITB land, joining the Madiyana River (also on ITB land east of Nkandla), which discharges into the uMhlathuze River. The uMhlathuze River meanders in a south-easterly direction with the Nyawashune River, Middle uThukela-uMhlathuze watershed, joining it from the west. The uMvuzane River meanders from the west, passing the KwaNtoza Hill (Trig Beacon 256 at an elevation of 843.8 mASL), with the Bomvana River joining it from the south, downstream of the KwaNtoza Hill before it flows into the uMhlathuze River. Water from the uThukela-Goedertrouw Transfer Scheme is pumped into the Mvuzane River. The Nhlisa River flows from the south into the uMhlathuze River downstream of the Bomvana-Mhlathuze confluence. Thereafter, the uMhlathuze River flows into Goedertrouw Dam in the Nkwaleni Valley.

Tributaries flowing into Goedertrouw Dam from the south include Vuma, Ndlovane and Ncemaneni. The Manzini River, whose headwaters are near the St. Mary's Hospital in the KwaMagwaza settlement, meanders from the north into the KwaMazula River which flows into Goedertrouw Dam.

The uMhlathuze meanders eastwards from the Goedertrouw Dam Wall, with tributaries including the Mfule River flowing from the north-west. Tributaries of the Mfule include the Mfulazane on which the Melmoth Abstraction Weir is located. At the Majaji-Mhlathuze confluence (the Ntambanana River, whose headwaters are located south of the the Ntambanana settlement is a tributary of the Majaji River), the uMhlathuze River flows in a south-easterly direction, passing the town of Empangeni on the east. The uMhlathuzana River discharges into the uMhlathuze River from the west and the Mpangeni River, flowing on the outskirts of Empangeni via the Mpangeni Lake,

[3] 2016 municipal boundary (Municipal Demarcation Board).

[4] Approximately 1.7 km south-east of Owen's Cutting (2831AC 1:50 000 Topographic Map 2013).

discharges into the uMhlathuze River from north (2831DD 1:50 000 Topographic Map 2013). The uMhlathuze River then flows eastwards, passing the Sigwenyane and Niwe Lakes to the east and the Mangeza Lake, adjacent to the University of Zululand, to the west. It continues to meander eastward with the Nseleni River flowing into it from the north, passing the Mhlathuze Weir before it discharges into the uMhlathuze Estuary.

The lower reaches of the Mhlathuze catchment include a number of "off-channel lakes". The lakes include Lake Mpangeni, Lake Sigwenyane, Lake Niwe and Lake Mangeza. The lakes are found in small catchment rivers with insufficient flow to maintain an open channel connection (Kelbe and Germishuyse, 2001). The lower reaches of these rivers in the uMhlathuze flood plain are blocked by sand bars, resulting in the formation of small lakes. Due to their formation being based on rivers, the lakes are dependant on surface runoff for recharge, while groundwater seepage is also considered to be significant. Discharge into the uMhlathuze River is generally through groundwater.

The headwaters of the Nseleni River are located to the north, approximately 3 km from the uMhlathuze-Mfolozi watershed and approximately 1 km from the Ndondondwana settlement as the crow flies (2831DA 1 : 50 000 Topographic Map 2013). The Nseleni River meanders eastward and at the confluence with the Mvuzane River (2831DB 1:50 000 Topographic Map 2013), it flows southwards with the Okula River joining it from the west. The Nseleni-Okula confluence is located approximately 7 km west of the Nseleni settlement as the crow flies and approximately 320 m east of the Reding Dam Wall (2831DB 1:50 000 Topographic Map 2013). The Okula River is located to the north of Empangeni. The Nseleni River meanders to the south of the Ntseleni settlement, forming the eastern boundary of the Enseleni Nature Reserve before flowing into Lake Nsezi.

Lake Nsezi is located on the western edge of the coastal plain (Kelbe and Germishuyse 2001: 50). This coastal plain is "*the largest primary aquifer in southern Africa, extending from Mtunzini on the Zululand coast up through Maputaland for the full length of the Mozambique coastal zone. This region is very flat with highly permeable soils that promotes a rapid recharge to the aquifer. The uppermost formation on this coastal plan is an uncontrolled aquifer which has as its upper boundary a 'water table' that is the top of the saturated zone*" (Kelbe and Germishuyse 2001: 17). Due to the aquifer characteristicts, Lake Nsezi is considered to have a significant groundwater component (**Section 16.2.1 (a)(iii)**). However, the lake is still controlled, to a large extent, by the Nseleni River that is situated in a different geological region (Kelbe and Germishuyse 2001: 50). Due to this dual-dependancy on the aquifer and the Nseleni River, Lake Nsezi is called a "combination lake" (Kelbe and Germishuyse 2001: 50). Lake Nsezi further obtains water from the uMhlathuze River, via the Mhlathuze Weir as and when required (i.e. based on lake water level).

Rivers flowing into Lake Mzingazi, a coastal lake (Kelbe and Germishuyse 2001: 49), include Nundwane from the north, as well as Mpisini and Bhodlisa from the north-east. Kelbe and Germishuyse explain coastal lakes as *"lakes that have significant flow-through characteristics where there is generally continuous and simultaneous recharge and discharge through various parts of the lake bed to the aquifer. Generally, this seepage rate is greatest at the surface shoreline and decreases exponentially with distance underneath the lake."* Existing geological research suggests that the Zululand coastal lakes also have direct interaction with the aquifer and that they have similar seepage characteristics. As a result, these lakes are assumed to be supplied through direct rainfall, surface runoff from riparian zones, streamflow and groundwater recharge. Lakes controlled by subsurface conditions in the Richards Bay area include Lake Mzingazi, Lake Nhlabane and Lake Qhubu.

Lake Mzingazi has two main compartments with the northern and southern parts of the lake separated by a very shallow and narrow section that is exposed during extremely dry conditions.

According to Kelbe and Germishuyse (2001), the southern compartment is approximately 14 m below mean sea level at its deepest point and is therefore susceptible to saline intrusion under adverse conditions.

Rivers flowing into Lake Qhubu include the Mzingwenya and Mpembeni and the lake is situated to the south of the Richards Bay Harbour. The physical characteristics of the lake suggest that it may have originally part of the uMhlathuze Estuary but has become isolated due to deposition processes on its northern sections (Kelbe and Germishuyse, 2001). During flood events, overflow from the lake is believed to flow through this section directly into the uMhlathuze estuary via a small channel linked to a series of canals on the uMhlathuze floodplain

The headwaters of the Mlalazi River are located approximately 3 km north-east of the Entumeni Nature Reserve as the crow flies. It flows approximately 3.5 km in a south-easterly direction into the Eshlazi Dam and then into the Rutledge Park Dam, with the D313 road separating the two dams. The Eshlazi and Rutledge Park Dams are located north of the Dlinza Nature Reserve and Eshowe town. The Mlalazi River meanders north of Eshowe and then eastward, with tributaries including the Mtilombo, Ndlovini and Tondo flowing from the north. The Mkukuze and Bhadi Rivers flow into the Mlalazi River from the west before it flows east around Mtunzini (north of the Umlalazi Nature Reserve), where in discharges into the Indian Ocean.

The headwaters of the Matigulu River are located approximately 440 m west of the Osulgulweni settlement, about 850 m south-east of Trig Beacon 79 at an elevation 856.5 mASL, on the uMhlathuze-Lower-uThukela watershed. It meanders in a southerly direction, flowing through wetlands at Mpongolwane and then heads eastward with the Matimefu River joining it from the north. As the Matigulu River continues meandering eastward, the uMngwenya River joins it from the west, while the Mkono, Nwaku and Mpushini (with its headwaters located south of the Dlinza Nature Reserve) Rivers joining it from the north. At the Mpushini-Matigulu confluence, the Matigulu turns southward, with Honothi and the Mombeni Rivers flowing into it from the west and the Bumba River from the north. The Matigulu River continues meandering southward, passing the Catherine Booth Hospital on the east, the Msunduze River discharging into it from the west and the Nyezane River flowing into it from the north. The town of Gingindlovu is located approximately 5.6 km north of the Nyezane-Matigulu confluence. Thereafter, the Matigulu River flows in a south-easterly direction and at the confluence with the iNoyoni River, which flows parallel to the coast, the Matigulu River turns eastward into the Matigulu Lagoon.

(ii) Surface Water

The predominant land cover categories in the uMhlathuze Water Resource Region are forested land, cultivation and residential areas (predominately rural). The hydrological characteristics for this region are summarised in **Table 16.1.**

Table 16.1 Hydrological Characteristics of uMhlathuze Region (WR2012: Usutu-Mhlathuze Quat Info WMA 6 July2015).

Region	River (Catchment)	Area (km^2)	Annual Average			
			Evaporation (mm)	Rainfall (mm)	Natural Runoff (million m^3)	Natural Runoff (mm)
uMhlathuze	Matigulu River (W11)	954	1300	1077	198.2	207.8
	uMhlathuze River (W12)	4209	1375	973	628.6	149.4
	Mlalazi River (W13)	498	1300	1205	131.0	264.7

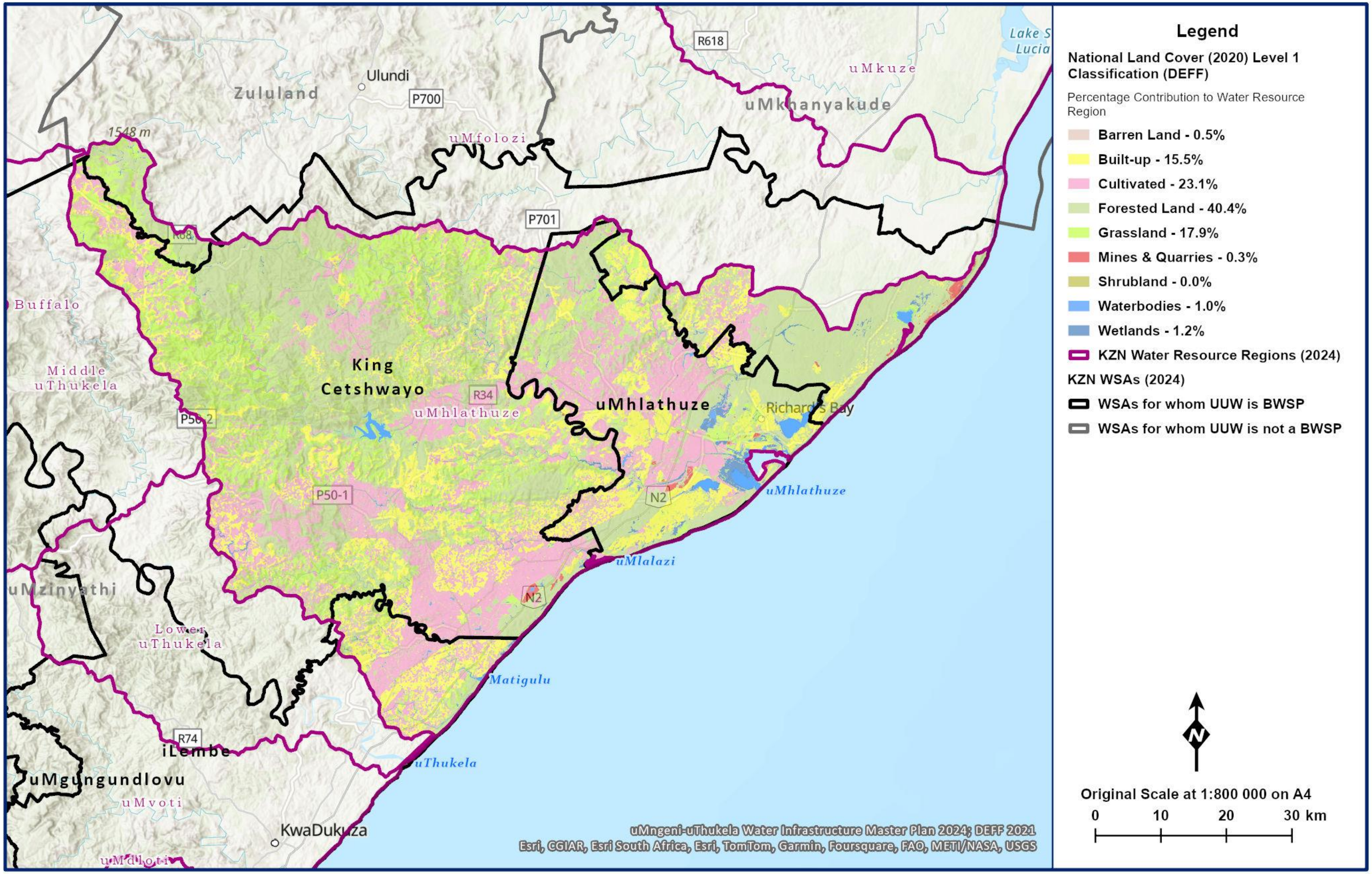

Figure 16.2 Land cover map of the uMhlathuze Region (DEFF 2020, MDB 2020, uMngeni-uThukela Water 2024, WR2012).

(iii) Groundwater

The uMhlathuze Region is located in three hydrogeological regions; the Northern Eastern Middleveld, KwaZulu-Natal Coastal Foreland and Southern Lebombo (DWAF 2008) (**Figure 16.3**).

- #### Hydrogeological Units

The oldest rocks in KwaZulu-Natal, forming part of the Kaapvaal craton, are of Swazian age and are represented, by the Nondweni Group and Empangeni Metamorphic Suite of the Barberton Sequence and its intrusive granites. These rocks are overlain by the rocks of the Pongola Supergroup. These metamorphosed sedimentary and volcanic rocks rest unconformably upon the granites.

The Natal Group outcrops in the Eshowe and Hlabisa areas, where it rests unconformably on the basement granites in parts. The Dwyka Formation rests unconformable on the Natal Group. Pietermaritzburg shale and the Vryheid Formation are the other significant sedimentary rocks in the area.

Outcrops of Karoo dolerite occur throughout the area and form massive sills that have intruded the Karoo Formation.

- #### Geohydrology

The Vryheid Formation has a very similar yield distribution to the Pietermaritzburg Shale contradicting the belief that porosity plays a role in groundwater occurrence and yield in these rocks. Dykes and sills are as important for the occurrence of groundwater in these sandstones as for that in the Pietermaritzburg Shales.

The Karoo dolerite sills can form extensive weathered and fractured aquifers with, on average, moderate borehole yields.

- #### Groundwater Potential

The groundwater resources are suitable for the development of primary rural water supply boreholes. The main constraints to exploitation are the low permeability's of the aquifers and the really limited nature of the weathered and fractured zones of the various rocks within the area. This results in relatively low to average sustainable borehole yields.

Eighty percent of the reported borehole yields fall into the poor to moderate category (< 3 ℓ/s). Poor yields are typically found in areas of severe topography in all lithologies, but particularly where unweathered dolerite capping occur.

(iv) Water Quality

- #### Surface Water

There is no surface water quality information available for this region at this time.

- #### Groundwater

Groundwater quality is generally good with electrical conductivity (EC) <70 mS/m. Groundwater of unacceptable quality due to excessive EC is found in areas in the Dwyka Tillite and Pietermaritzburg Formation Shales. Groundwater of acceptable quality occurs in the basement granites and Natal Group Sandstones (**Figure 16.3**).

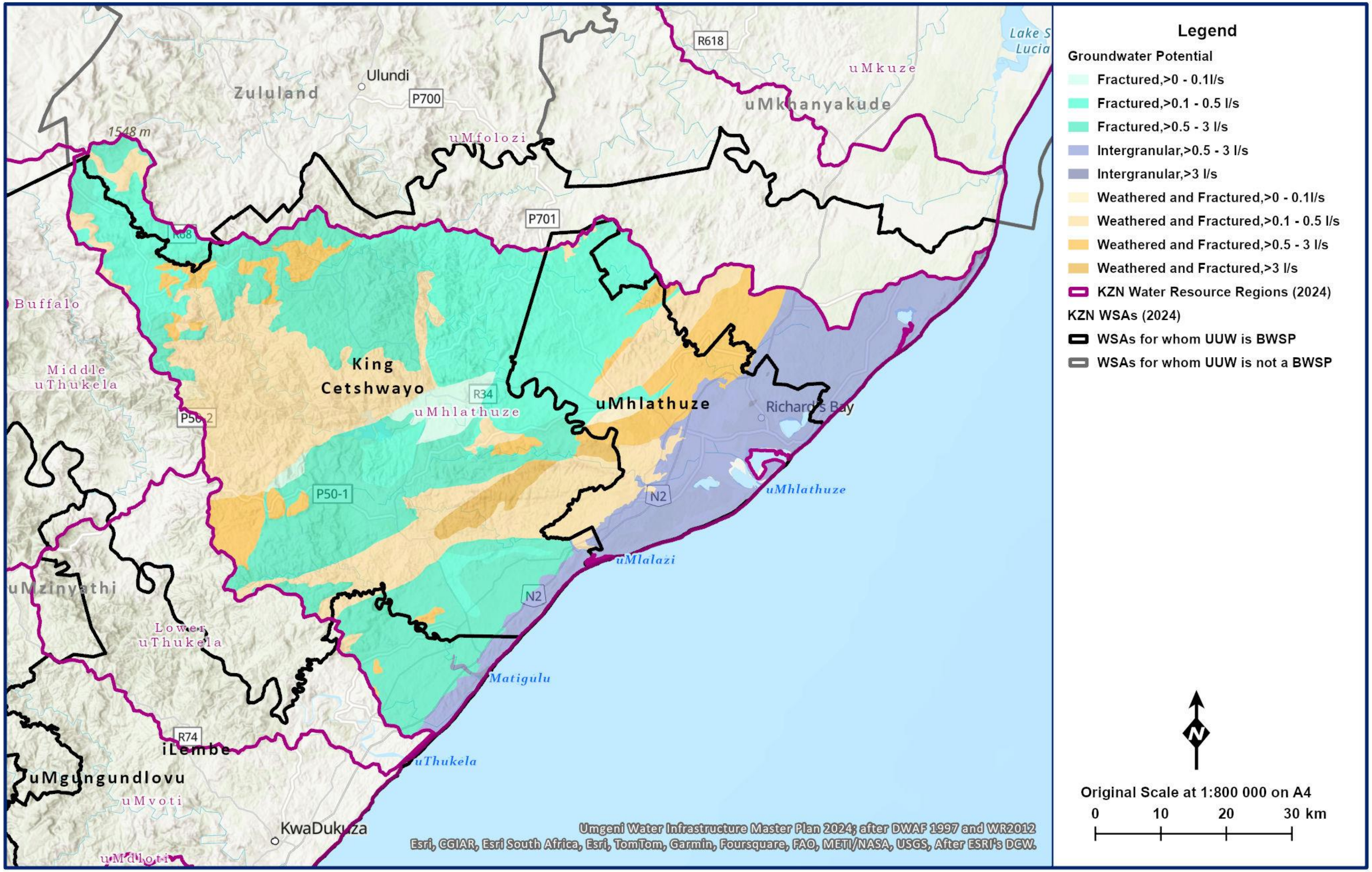

Figure 16.3 Groundwater potential in the uMhlathuze Region (MDB 2020, uMngeni-uThukela Water 2024, after DWAF 1997 and WR2012).

16.2.2 Reserve

(a) uMhlathuze Region

This section summarises the recently Gazzeted Resource Classes and Resource Quality Objectives (RQOs) for Water Resources in the Usutu to Mhlathuze Catchments, focusing on the Mhlathuze water resource region.

(i) Groundwater

The total groundwater component of the Reserve in the Mhlathuze catchment is 105.4 million m^3/a. There is minimal groundwater use in the catchment and, as such, the Present State Category of the groundwater component of the Reserve is Category A.

(ii) Nhlabane Wetlands

The main water users within and around the Nhlabane wetlands are agriculture and commercial forestry. These land uses threaten critical components such as water quality and species habitat, which poses a threat to endemic/endangered animal and plant species found in the wetlands. The Present Ecological State (PES) is Category D and the Recommended Ecological Category (REC) is C. It is recommended that there should be no further growth in afforestation and agriculture. In addition, it is recommended that no dams be developed within the wetlands and that flows and inundation regimes be maintained.

(iii) Lake Mzingazi

The PES of Lake Mzingazi is Category D/E and the REC is Category D. In order to achieve this, it is recommended that; (i) the expansion of forestry and urban development is controlled; (ii) water quality is improved; (iii) gill netting is controlled and upstream/downstream connectivity is mitigated through a fish ladder.

(iv) uMhlathuze Floodplain

The floodplain of the uMhlathuze River is currently at category E and it is recommended that it is improved to category D. Sugarcane farming is the main land use activity along the floodplain and it is recommended that the extent of sugarcane is reduced or controlled.

(v) aMatigulu/Inyoni Estuary

The ecological health status of the aMatigulu Estuary is currently category B/C and it is recommended that it is improved towards category B. Some of the key interventions needed include, among others; (i) the removal of alien invasive plants in order to control base flows; (ii) restoration of the esuarine floodplain through controlling the impacts of agricultures and (iii) maintaining flood inflows within 10% of PES (i.e. MAR = 113.77 million m^3/annum).

(vi) uMlalazi Estuary

The ecological health status of the uMlalalazi Estuary is currently category B/C and it is recommended that it is improved towards category B. Water quality is one of the most threatened attribute in the Estuary, due to neigbouring land use activities. It is recommended that wastewater should not be disposed into the system and that agricultural practices that reduce transportation of nutrient-rich return flows into the estuary be implemented. From a water quantity perspective, it is recommended that hydrological connectivity is maintained and the following monthly river inflow targets be met:

- Inflow < 0.25 m^3/s more than 1% of the time;
- Inflow between 0.25 – 0.5 m^3/s more than 2% of the time;
- Inflow between 0.5 – 1.0 m^3/s more than 29% of the time;
- Inflow between 1.0 – 15.0 m^3/s more than 29% of the time;
- Inflow > 0.25 m^3/s more than 3% of the time.

Some of the key interventions needed include, among others; (i) the removal of alien invasive plants in order to control base flows; (ii) restoration of the esuarine floodplain through controlling the impacts of agricultures and (iii) maintaining flood inflows within 10% of PES (i.e. MAR = 113.77 million m^3/annum).

(vii) iNhlabane Estuary/Nhlabane Lakes

The present health category of the uMhlathuze Estuary is a D and it is recommended that this is improved to category C both in the short (<5 years) and long-term (5-10 years). Industrial activities have significantly affected the ecological health of the lake/estuary system and several inteventions are required to improve its status in the short term. These include, among others; (i) development of an Estuary Management Plan; development of an Estuary Mouth Maintenance Plan and ensuring connectivity between the estuary and various parts of the lakes. From a water quantity perspective, the following is recommended;

- River inflow distribution patterns should not differ by <5% from the restoration scenario (MAR = 289.59 million m^3/annum);
- Historical EWR should be implemented, i.e. (i) continuous fishway discharges of 0.1 m3/s and (ii) an inflow of 33 m3/s for 9 hours every two years for the estuary to fill up and breach.
- Water withdrawals from the lakes should be controlled such to avoid reaching a point where the North and South Lakes are separated.

(viii) uMhlathuze Estuary

The present health category of the uMhlathuze Estuary is a D and it is recommended that this is maintained both in the short (<5 years) and long-term (5-10 years). The main activity posing a threat to the Estuary is fishing and it is recommended that regulation be improved and compliance be enforced. From a water quantity perspective, it is recommended that river inflow patterns do not differ by more than 5% of the PES (i.e. MAR = 289.59 million m^3/annum) and that the following are met:

- Monthly river inflow >0.5 m^3/s more than 60% of the time;
- Monthly river inflow >20 m^3/s more than 30% of the time;
- River inflow flood distribution patterns should not differ by more than 10% of PES (i.e. magnitude, timing and variability).

(ix) uMhlathuze River

The construction of Goedertrouw Dam, together with extensive land use impacts on the catchment, have resulted in changes in the habitat integrity, ecological status and hydrology of the river. While the river has low to moderate social importance, it has moderate to very high ecological importance, which justifies the need for the application of an Ecological Reserve. The status of the river ecology is shown in **Table 16.2** below. Some parts of the Mhlathuze River were not prioritised in the DWS (2024) study; therefore, the results from the DWS (2009) report were used for these IUAs.

Table 16.2 uMhlathuze River Ecological Status (DWS, 2009; 2024).

River Reach	PES		Importance and ensitivity		TEC	
	Instream	Riparian	Ecological	Social	Instream	Riparian
Matigulu River	B	B/C	Moderate	Moderate	B	B/C
Nseleni River	C	C	Moderate	Moderate	B	C
*Goedertrouw Dam to Mfule Confluence	C/D	E	Moderate	Moderate	C/D	D
*Mfule Confluence to uMhlathuze Weir	C/B	D	High	Moderate	B	C/D
*uMhlathuze Weir to Estuary	E	E	Very High	Low	N/A	

** From the DWS (2009) study.*

16.2.3 Existing Water Resource Infrastructure and Yields

(a) uMhlathuze Region

The Mhlathuze Water Resource Region is a complex system consisting of numeruous water resources infrastructure, including small farm dams. For the purpose of this report, only the major water resource infrastructure are discussed.

The largest water resource in the Mhlatuze Region is the Goedertrouw Dam (**Figure 16.4** and **Table 16.3**) on the uMhlathuze River, which supplies water (through releases into the Mhlathuze River) for downstream irrigation in the Mlalazi LM (KCDM WSA) and the City of uMhlathuze WSA. In addition, releases are made for industrial and domestic purposes as far as Richards Bay, with the main abstractions occurring at the uMhlathuze Weir. The dam also supplies water to the Greater Mthonjaneni WTP, which is located below the dam wall. The Greater Mthonjaneni WTP has a capacity of 20 Mℓ/d, and supply from this WTP includes potable water transfer to the Eshowe WTP to augment water supply from the Eshowe Water Supply Scheme. This transfer scheme began as a drought mitigation strategy during the 2014-2017 drought and has remained as an augmentation option as and when required. KCDM is currently upgrading the Greater Mthonjaneni WTP reservoir from 1 Mℓ to 10 Mℓ and the project should be completed in 2025. The Goedertrouw Dam is owned and operated by DWS and, according to the DWS (2018) Hydrographic Surveys Dams Database, a new dam hydrographic survey is overdue as the latest survey was conducted in 1999.

Water supply in the uMhlathuze System is augmented by the uThukela-Goedertrouw Transfer Scheme, which was built as a drought emergency scheme in 1997. This scheme currently pumps water at approximately 1 m^3/s from the uThukela River over the divide into the Mvuzane stream, which flows into the Goedertrouw Dam. The uThukela-Goedertrouw Transfer Scheme is currently being upgraded to increase its capacity to 2 m^3/s. The main impact of the scheme would be to increase the assurance of supply for users in the uMhlathuze system.

The Nkandla raw water abstraction weir, located at the headwaters of the Mhlathuze River (outlet of quaternary catchment W12A), supplies water to the Nkandla Bulk WTP. Being a run-of-river abstraction system, there is limited storage potential on the infrastructure. Therefore, the yield is largely dependent on WTP capacity (3.9 Ml/d). The weir is currently being upgraded by KCDM to increase its capacity and the project will be completed in June 2025

Key water resources infrastructure found in the Mthonjaneni LM include the Melmoth abstraction weir, located in the Mfulazane River, which supplies raw water to the Melmoth Package Plant. As a run-of-river abstraction system, there is minimal storage in the weir and yield is limited by plant capacity (3.2 Ml/d). The Melmoth weir is supported by raw water from the Melmoth Off-Channel Storage Dam (**Figure 16.5** and **Table 16.4**). According to the DWS Dams Database, the Dam is owned by the Mthonjaneni Local Municipality. The Melmoth package plant also supplies water from a borehole near the plant. uMngeni-uThukela Water recently (2022) conducted a hydrographic survey on the weir and the dam. The survey information will enable the development of water resources yield assessment studies, as well as the configuration of water resources planning models to develop efficient operating rules.

Key water resources infrastructure found in the Mlalazi LM include the Eshlazi **Figure 16.6** and **Table 16.5**) and Rutledge Park Dams (**Figure 16.7** and **Table 16.6**) which are located in the headwaters of the Mlalazi River (W13A). The dams are owned by the KCDM and supply raw water to the Eshowe WTP, which supplies water to Eshowe town and surrounding areas. Yield determination studies for the two dams have been previously conducted by DWS (2015) and will be discussed below. uMngeni-uThukela Water has recently (2022) conducted hydrographic surveys for the two dams and the results are shown in **Table 16.5** and **Table 16.6** below.

Other key water resources infrastructure in the region include:

- Abstraction from the uMhlathuze River upstream of the uMhlathuze Weir on the border with uMlalazi LM for the Ngwelezane WTP.
- Lake Nsezi, (**Section 16.2.1 (a))**, as well as Lakes Nhlabane, Mzingazi and Qhubu, "coastal lakes" (**Section 16.2.1 (a))**. These coastal lakes are augmented by abstractions from the Mfolozi River.
- Run-of-river abstraction for the Gingindlovu WTP from the Matigulu and Msunduze Rivers.

Figure 16.4 Goedertrouw Dam (Aerial photograph taken by Helene Smith showing the extent of the drop in water levels).

Table 16.3 Goedertrouw Dam Hydrographic Survey (DWS 2018: Hydrographic Surveys Dams Database, DWS 2019: List of Registered Dams Database, WR2012).

Catchment Details	
Incremental Catchment Area:	1280 km^2 [a]
Total Catchment Area:	1280 km^2 [a]
Mean Annual Precipitation:	876 mm [b]
Mean Annual Runoff:	336.38 million m^3 [b]
Mean Annual Evaporation:	1 450 mm [b]
Dam Characteristics	
Gauge Plate Zero:	145.1 mASL [d]
Full Supply Level:	214.0 mASL [d]
Spillway Height:	88 m [c]
Net Full Supply Capacity:	301.26 million m^3 [d]
Dead Storage:	14.15 million m^3 [d]
Total Capacity:	301.27 million m^3 [d]
Surface Area of Dam at Full Supply Level:	12 km^2 [c]
Original Measured Net Dam Capacity	315.38 million m^3 (1981) [d]
Second Measured Net Dam Capacity	315.38 million m^3 (1984) [d]
Third Measured Net Dam Capacity	304.04 million m^3 (1987) [d]
Fourth Measured Net Dam Capacity	301.26 million m^3 (1999) [d]
Dam Type:	Earth-fill [c]
Crest Length:	Crest Length: 660 m [c] Spillway Section: 660 m
Type of Spillway:	Uncontrolled Ogee [c]
Capacity of Spillway:	7000 m^3/s [e]
Date of Completion:	1982 [c]
Date of Area Capacity Survey:	1999 [d]
Date of next Area Capacity Survey:	2017 [f] (Overdue but targeting 2025 for the survey)

[a] WR2012 quaternary catchment dataset (summation of the quaternary catchment areas contributing

[b] WR2012 Database of Quaternary Catchment Information.

[c] DWS List of Registered Dams Database (April 2019).

[d] DWS Hydrographic Surveys Dams Database (2018).

[e] SANCOLD

[f] DWS Survey Return Period

Figure 16.5 Melmoth Off-Channel Storage Dam (UUW, 2022).

Table 16.4 Melmoth Off-Channel Storage Dam (DWS 2018: List of Registered Dams Database; UUW, 2022).

Catchment Details	
Incremental Catchment Area:	1.75 km^2
Total Catchment Area:	1.75 km^2
Mean Annual Precipitation:	893
Mean Annual Runoff:	-
Mean Annual Evaporation:	1 762
Raised Dam Characteristics	
Gauge Plate Zero:	683.3 mASL
Full Supply Level:	692.6 mASL
Spillway Height:	18 m
Net Full Supply Capacity:	0.118 million m^3
Dead Storage:	N/A
Total Capacity:	0.118 million m^3
Surface Area of Dam at Full Supply Level:	0.026 km^2
Original Measured Dam Capacity	0.138 million m^3
Dam Type:	Earth Fill
Crest Length:	Crest Length: 182 m
Type of Spillway:	Open Channel
Capacity of Spillway:	N/A
Date of Completion:	1995
Date of Area Capacity Survey:	2022
Date of next Area Capacity Survey:	2027

Figure 16.6 Eshlazi Dam (UUW, 2023).

Table 16.5 Eshlazi Dam (DWS 2018: List of Registered Dams Database; DWS 2015: Eshowe Drought Operating Rules Study; UUW 2022: Eshlazi Dam Hydrographic Survey).

Catchment Details	
Incremental Catchment Area:	17.5 km^2 [a]
Total Catchment Area:	17.5 km^2 [a]
Mean Annual Precipitation:	1135 mm [b]
Mean Annual Runoff:	4.24 million m^3 [c]
Mean Annual Evaporation:	1 400 mm [b]
Raised Dam Characteristics	
Gauge Plate Zero:	482.7 mASL [e]
Full Supply Level:	490.2 mASL [e]
Spillway Height:	8 m [a]
Net Full Supply Capacity:	0.728 million m^3 [e]
Dead Storage:	N/A
Total Capacity:	0.728 million m^3 [e]
Surface Area of Dam at Full Supply Level:	0.228 km^2 [e]
Original Measured Dam Capacity	0.909 million m^3 [a] (1997)
Dam Type:	Gravity [a]
Crest Length:	Crest Length: 165 m [a] Spillway Section : 7 m [d] Non Spillway Section : 140 m [d]
Type of Spillway:	Ogee Spillway [a]
Capacity of Spillway:	N/A
Date of Completion:	1978 [a]
Date of Area Capacity Survey:	2022
Date of next Area Capacity Survey:	2027

[a] DWS List of Registered Dams (2018)
[b] WR2012 Mhlathuze Quaternary Info WMA 2015 spreadsheet.
[c] DWS (2016) Drought Operating Rules study.
[d] Measured on Google Earth.
e uMngeni-uThukela Water Hydrographic Survey (2022).

Figure 16.7 Rutledge Park Dam (UUW, 2022).

Table 16.6 Rutledge Park Dam (DWS 2018: List of Registered Dams Database; DWS 2015: Eshowe Drought Operating Rules Study; UUW 2022: Rutledge Park Dam Hydrographic Survey).

Catchment Details	
Incremental Catchment Area:	1.3 km^2 [a]
Total Catchment Area:	18 km^2 [a]
Mean Annual Precipitation:	1135 mm [b]
Mean Annual Runoff:	0.346 million m^3 [b]
Mean Annual Evaporation:	1 300 mm [b]
Raised Dam Characteristics	
Gauge Plate Zero:	477.0 mASL [c]
Full Supply Level:	482.0 mASL [c]
Spillway Height:	7 m [d]
Net Full Supply Capacity:	0.148 million m^3 [c]
Dead Storage:	N/A
Total Capacity:	0.148 million m^3 [c]
Surface Area of Dam at Full Supply Level:	0.087 km^2 [c]
Original Measured Dam Capacity	0.148 million m^3 [c]
Dam Type:	Gravity [d]
Crest Length:	Crest Length: 96 m [d]
Type of Spillway:	Ogee Spillway [d]
Capacity of Spillway:	N/A
Date of Completion:	1925 [d]
Date of Area Capacity Survey:	2022
Date of next Area Capacity Survey:	2027

[a] DWS (2016) Drought Operating Rules study.
[b] WR2012 Mhlathuze Quaternary Info WMA 2015 spreadsheet.
c uMngeni-uThukela Water Hydrographic Survey (2022).
[d] DWS List of Registered Dams (2018).

In terms of water resources yield, the Goedertrouw Regional Scheme is the most viable source to supply water to Mthonjaneni, Kwahlokohloko and Eshowe, through the Greater Mthonjaneni WTP. The Eshowe Water Supply Scheme (which includes the town of Eshowe) is supplied from the Eshowe WTP, with the deficit supplemented by the Greater Mthonjaneni WTP via an offtake from the Kwahlokohloko Reservoir. Water supply from the Greater Mthonjaneni WTP to the Eshowe WTP varies daily depending on (i) the demand from the Eshowe WSS and the productivity of the Eshowe WTP. This augmentation can be as high as 10 Mℓ/d. **Table 16.7** shows the yield of the Goedertrouw Dam, as well as major lakes within the uMhlathuze System.

Table 16.7 uMhlathuze System yields (DWS 2015).

Dam/Lake	Yield (million m^3/annum)	Yield (Mℓ/day)
Goedertrouw Dam excl. uThukela Transfer	51.5	141.1
Goedertrouw Dam incl. uThukela Transfer	84.5	231.5
Lake Nsezi	6.6	18.1
Lake Cubhu	0.4	1.1
Lake Mzingazi	10.5	28.8
Lake Nhlabane with support from Mfolozi	34.5	94.5
Lake Nhlabane without support from Mfolozi	7.9	21.6
Total Yield from lakes (support from Mfolozi)	**52.0**	**142.5**
Total Yield from lakes (no support from Mfolozi)	**25.4**	**69.6**

The Goedertrouw Dam is the main source of water for users in the uMhlathuze System, supplying water for irrigation, domestic and industrial purposes in the KCDM and CoU WSAs. Irrigation is the major water user in the uMhlathuze System, with a licenced volume of 114 million m^3/annum from the uMhlathuze River catchment downstream of the Goedertrouw Dam.

The Mlalazi River Catchment is the main source of supply for the Eshowe Water Supply Scheme, through the Eshlazi and Rutledge Park Dams. These dams are operated in conjunction to supply raw water to the Eshowe WTP, with abstractions being made from the downstream dam (Rutledge Park) and releases being made from the upstream dam (Eshlazi) when the water level at Rutledge Park is low. In addition, this system is supplemented by potable water supply from Goedertrouw Dam (uMhlathuze River) as and when needed. Two small treatment plants, namely Catherine Booth Hospital and Obanjeni WTPs, supply the surrounding communities.

The Matigulu River is the main source of raw water for the Gingindlovu WTP, which supplies water to the Gingindlovu town and surrounding villages, as well as the area of Emacambini (Ilembe DM). This river also supports irrigation within the Eshowe Water Supply Scheme area. The abundance of commercial forestry within the Matigulu River catchment poses a threat to water resources sustainability as these plantations have been shown to have negative effects on runoff generation and system yield (DWA 2011: 14 – 19).

The Kwahlokohloko Water Supply Scheme is supplied by the Mpungose command reservoir, which receives its potable water from the Greater Mthonjaneni WTP.

DWS has recently completed a study (2021) to review and update of the hydrology and yields of the uMhlathuze System as part of the improvement of the 2015 Reconciliation Strategy for Richards Bay and surrounding towns. In the study, DWS (2021) mention that a holistic approach is followed when assessing the yield of the uMhlathuze System. This approach considers the impact of tributaries downstream the Goedertrouw Dam on the system yield, rather than assessing the Goedertrouw Dam in isolation. From this assessment, a historic firm yield of 245 million m^3/annum was obtained for the uMhlathuze System, including transfers from the uThukela River. The long-term stochastic yield at various assurance of supply levels is shown in **Table 16.8** below.

Table 16.8 The long-term stochastic yields of uMhlathuze System (DWS 2021).

Stochastic firm yield at levels of assurance in supply (million m^3/a)			
1:200	**1:100**	**1:50**	**1:20**
243.3	251.6	260.0	272.3

To enable annual and seasonal water resources planning, the short-term stochastic yield (for a period of five years) of the uMhlathuze System was also assessed in the DWS (2021) study (**Table 16.9**). Short-term stochastic modelling is important for short-term operation of the system based on starting storage levels.

Table 16.9 The short-term stochastic yield of uMhlathuze System at different starting storage levels (DWS 2021).

	Yield million m^3/a at indicated Recurrence Interval in years					
Starting storage (% of live FSC)	**1:200**	**1:100**	**1:50**	**1:20**	**1:10**	**1:4**
100%	207.33	214.00	227.44	250.46	269.27	297.76
80%	192.48	202.43	217.12	239.02	261.36	295.86
60%	174.18	184.10	198.77	224.01	247.87	289.51
40%	145.33	158.56	170.54	193.71	226.94	270.59
20%	101.50	114.83	126.15	153.84	179.65	212.59
10%	78.39	87.67	95.95	107.61	132.34	164.74

The impact of the 2014-2017 drought prompted DWS to conduct a Drought Operating Rules (DOR) study for the Eshowe WSS (DWS, 2016). According to this study, the Eshlazi and Rutledge Park Dams operate as a unit to supply the Eshowe Water Supply Scheme and their combined historic firm yield is 1.29 million m^3/annum (3.53 Mℓ/d). The long-term stochastic yield of this integrated system was assessed by DWS using three different scenarios (for optimal utilisation of the resource between the two dams):

- Scenario 1 - both dams are drawn down simultaneously;
- Scenario 2 – the Rutledge Park Dam is emptied before the Eshlazi Dam is utilised; and
- Scenario 3 - the storage in both dams is split 50/50 to ensure that water was utilisation altered between Rutledge Park and Eshlazi Dams.

The results of the long-term stochastic yield analysis of the system, for different assurance levels of supply, are provided in **Table 16.10**. Different orders in utilisation of the storage from the two dams had little effect of safe yield of the system. This is likely due to the dams being close together and there being an insignificant catchment area for runoff generation into the lower Rutledge Park Dam. With UUW now managing and operating the two dams, it has been established that operators utilise the Rutledge Park Dam until it reaches a relatively low level, before water is released from the Eshlazi Dam (i.e. Scenario 2).

Table 16.10 The long-term stochastic yield of the integrated system of Eshlazi and Rutledge Park Dams for three different scenarios (DWS 2016).

		Yield at corresponding assurance level (million m^3/annum)		
Scenario	**Description**	**1:20**	**1:50**	**1:100**
1	Dual drawdown	2.1	1.77	1.57
2	Rutledge fully then Eshlazi	2.1	1.77	1.58
3	50/50 Stepwise drawdown with Rutledge first	2.1	1.77	1.57

The DWS (2016) study also developed short-term stochastic yield curves for the integrated system, for short-term operation of the system, based on combined system storage levels (**Table 16.11**).

Table 16.11 The short-term stochastic yield of the integrated system of Eshlazi and Rutledge Park Dams at different starting storage levels (DWS 2016).

	Yield at indicated Recurrence Interval (million m^3/a) for 1st May start date				
Starting storage (% of live FSC)	**1:200**	**1:100**	**1:50**	**1:20**	**1:10**
100%	1.53	1.66	1.81	2.08	2.33
80%	1.50	1.60	1.78	2.02	2.30
60%	1.35	1.48	1.64	1.87	2.11
40%	1.15	1.25	1.40	1.50	1.78
5%	0.80	0.84	0.90	1.10	1.28

16.2.4 Operating Rules

(a) Mhlathuze Region

The Department of Water and Sanitation prepared an Annual Operating Analysis (AOA) for the uMhlathuze Water Supply System and the Goedertrouw Dam in May 2024. The purpose of AOA is to define and optimise the short-term (annual) allocation of water by means of operating rules. The outcome of the AOA is to minimise the risk of non-supply for high priority use in the system. The annual operating rules for the 2024/25 operating year were as follows (**Figure 16.8**):

- Due to the high storage levels at the Goedertrouw Dam on 1st May 2024, no restrictions were proposed for the 2024/25 operating year if irrigators were limited to 94.7 million m^3/annum (of which 80 million m^3/annum is the limit for schemes dependent on the Goedertrouw Dam).
- It was recommended that no pumping occurs from the uThukela-Goedertrow Transfer Scheme in the 2024/25 planning year, i.e. while the water levels were high.
- In order to optimise the uThukela-Goedertrow Transfer Scheme, it is recommended that the pumping is resumed in the 2025/26 planning year. The scheme should be operated such that pumping only occurs when the Goedertrouw Dam drops to 90% FSL and ceased when the dam reaches full supply level.

- With maximum support from the uThukela-Goedertrow Transfer Scheme, there is no risk of failure for the uMhlathuze system in the planning horizon, i.e. 5 years.
- The worst-case scenario showed that there is a 1% risk of failure at the beginning of 2027 should there be no pumping from the uThukela-Goedertrow Transfer Scheme. If minimal pumping is implemented, however, there is a 0.5% risk of failure at the beginning of 2027.

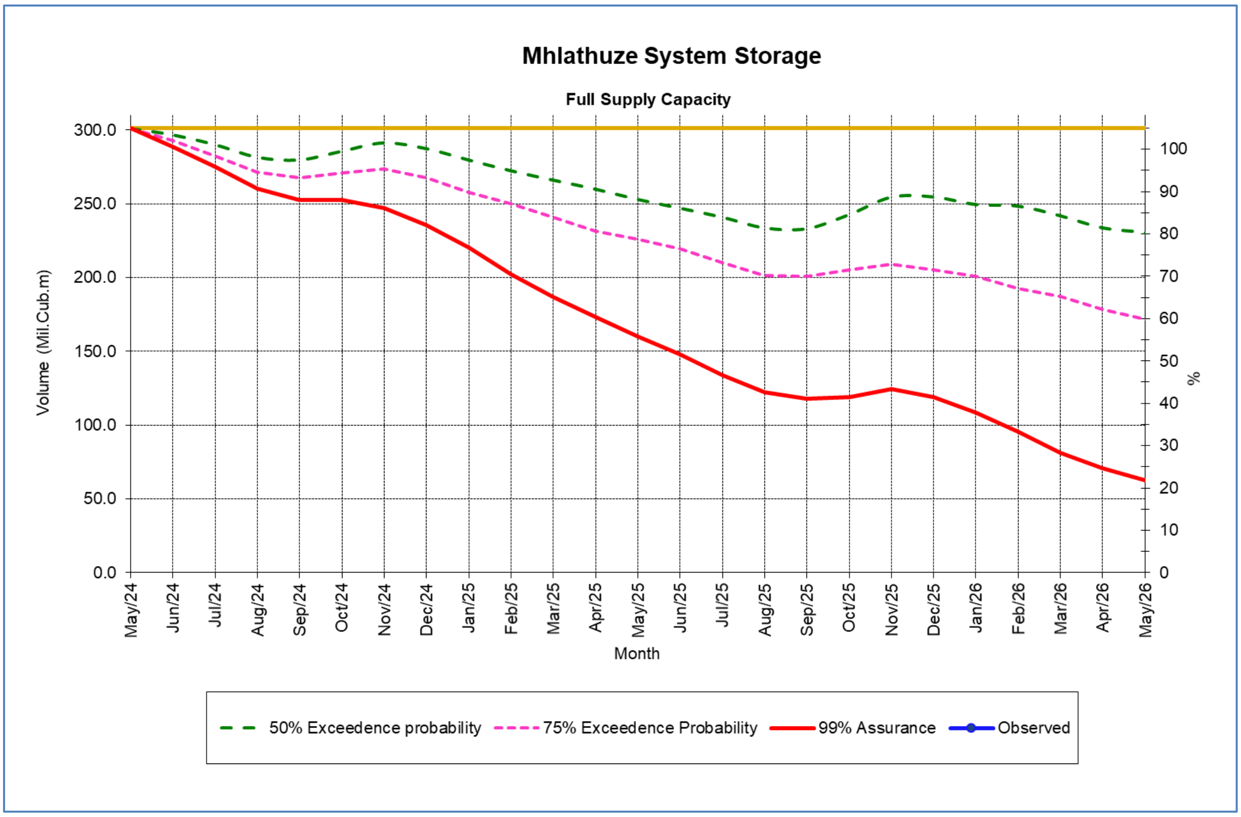

Figure 16.8 Storage trajectories for the uMhlathuze system based on a May 2024 decision date.

Continued monitoring of storage levels in the Goedertrouw Dam and Lake Nsezi, as well as actual water use for all sectors is required to manage the system. uMngeni-uThukela Water will track the storage levels against model projections and recalibrate the model when necessary.

The water supply operating rule aims to utilise resources in the most cost efficient manner while maximising the yield of the system. In the Eshowe WSS, for example, DWS (2016) concluded that it is more cost-effective to optimise supply from the local Rutledge Park and Eshlazi Dams before water is transferred from the Goedertrouw Dam. A drought-operating rule was developed to determine the maximum allowable volume of water that should be abstracted each year from the Rutledge Park and Eshlazi Dams. The operating rules for these dams include the following (DWS, 2016):

- If the dams were spilling, a maximum of 8 Mℓ/day could be withdrawn from the local resource; and
- Once the dam stops spilling, abstraction should be reduced to a maximum of 5.8 Mℓ/day.

The drought operating rule curtailment curves for the Mlalazi System are shown in **Figure 16.9.** The rule is based on three decision date curves (August, May and February).

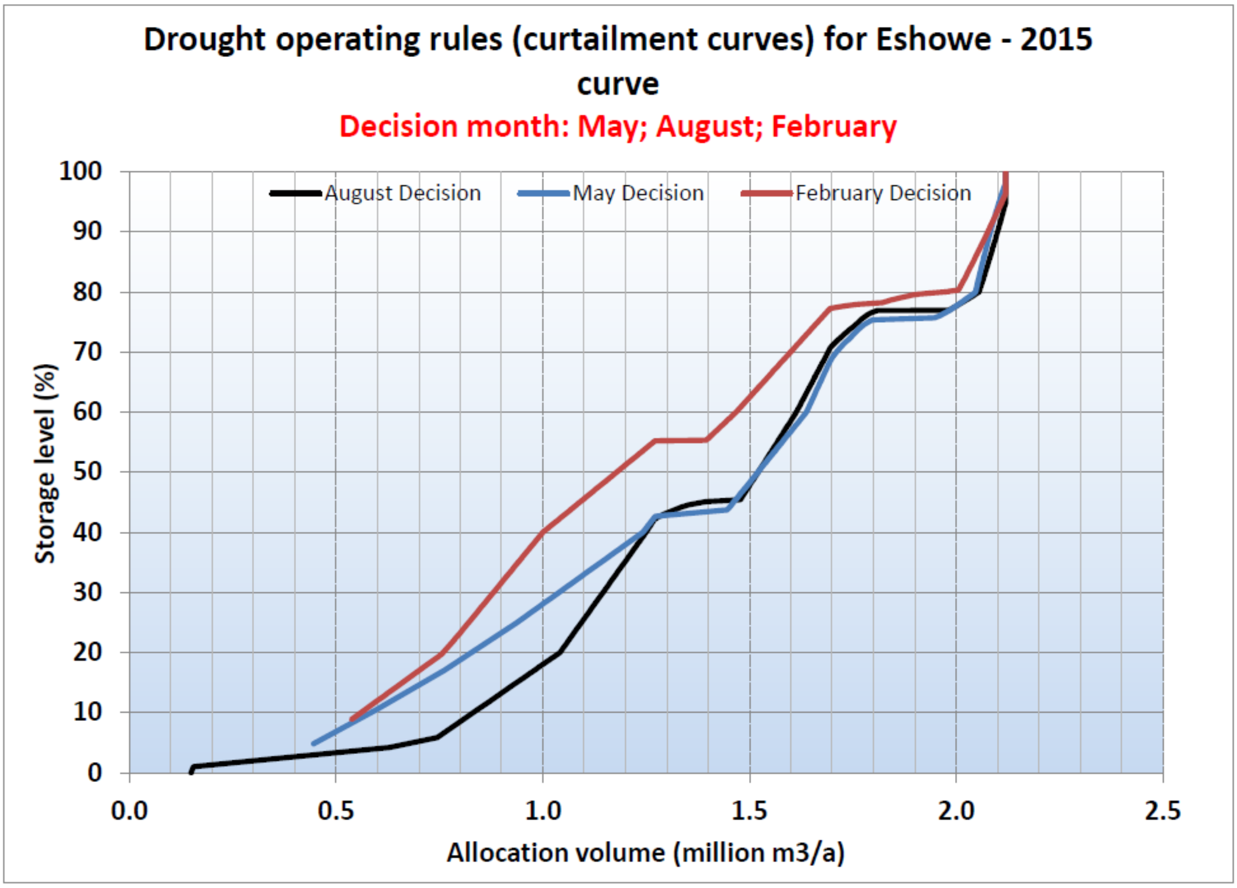

Figure 16.9 The drought operating rules (Curtailment curves) for the Eshowe WSS (DWS 2016).

The following conclusions can be drawn from the curtailment curve:

- The maximum amount of water that should be allocated from the two local dams is 2.1 million m^3/annum (5.8 Mℓ/day), when the storage volume is 100%;
- Once the combined storage volume drops below 80%, allocation should be reduced to less than 2.0 million m^3/annum (5.5 Mℓ/day); and
- If the combined storage level drops to approximately 50%, the maximum allocation should be reduced to 1.5 million m^3/annum (4.1 Mℓ/day) for a May decision date and 1.2 million m^3/annum (3.3 Mℓ/day) for a February decision date.

uMngeni-uThukela Water updated the Mlalazi System planning model for a February 2025 decision date with a starting storage of 100% FSC and an average abstraction of 3.5 Mℓ/day (1.28 million m^3/annum). Based on this simulation, there is no risk of non-supply for the Mlalazi System (**Figure 16.10**). It should be noted, however, that the average abstraction of 3.5 Mℓ/day is lower than the WTP capacity. Therefore, maximum abstraction may increase the possibility of non-supply. The next analysis will be conducted in August 2025. It should be noted that the raw water abstraction level at the Rutledge Park Dam corresponds to approximately 65% FSC and water cannot be abstracted below this point. Therefore, the interim operating rule is such that water is released from the Eshlazi Dam as soon as storage in the Rutledge Park Dam reaches 70% FSC. The Department of Water and Sanitation is currently updating the Drought Operating Rules for the Mlalazi System and findings from the study will be incorporated in the Infrastructure Master Plan once the results are available.

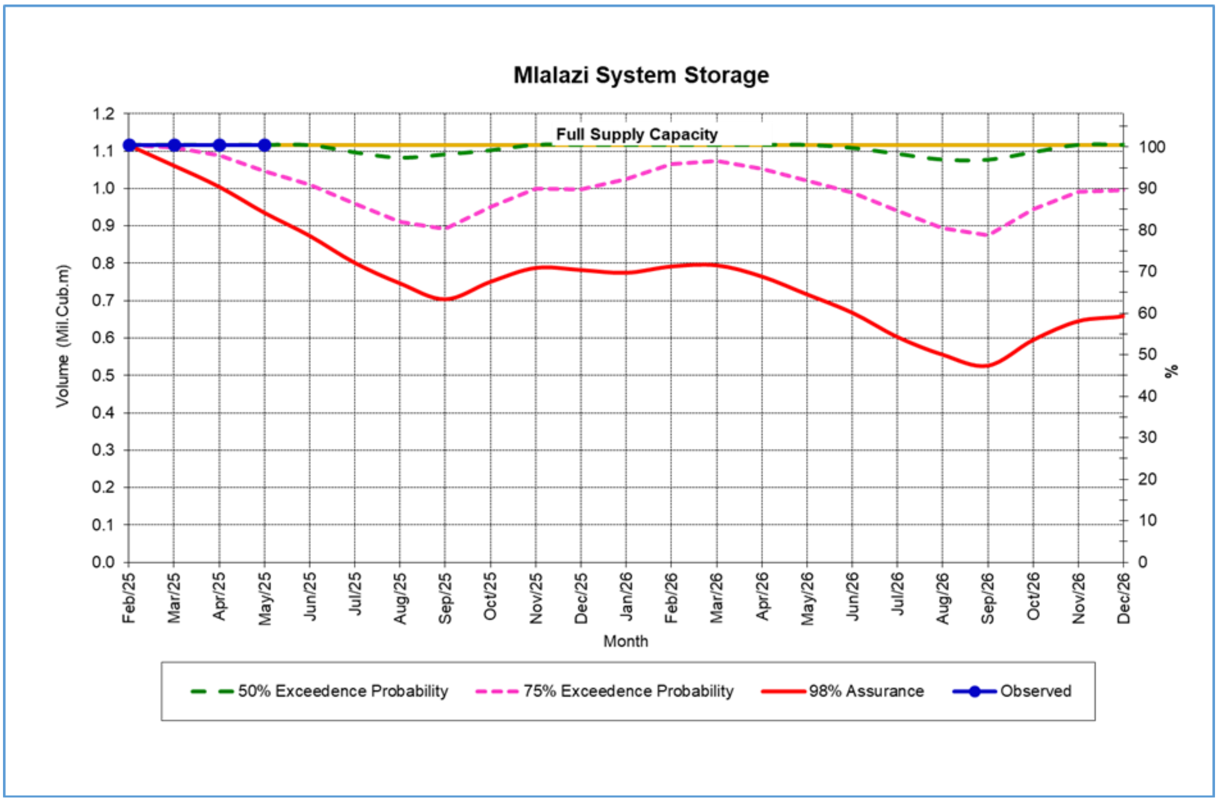

Figure 16.10 Storage trajectories for the Mlalazi System based on a February 2025 decision date.

The operating rules of the uMhlathuze System, including Goedertrouw Dam, are as follows (DWS, 2020):

- Supply as much as possible of the 9 million m^3/annum required for the smelter from Lake Nhlabane;
- If Lake Nhlabane cannot supply the full 9 million m^3/annum demand, supply the difference from uMngeni-uThukela Water via Lake Nsezi;
- Supply the required 23 million m^3/annum for the RBM ponds from the Mfolozi River;
- If the Mfolozi River supply is insufficient, then supply from Lake Nhlabane (up to a total of 12 million m^3/annum, including supply for the smelter), and
- If the RBM ponds demand is still not met, then supply from Mhlathuze Water via Lake Nsezi (up to a total limit of 16 million m^3/annum, including supply for the smelter).
- The transfer from the uThukela is to take place when Goedertrouw Dam drops below 90% (2024 AOA).

16.3 Supply Systems

16.3.1 Description of the uMhlathuze System

(a) Overview

The uMhlathuze System is the main source of water for KCDM and the City of uMhlathuze. It supplies water to the rural settlements, urban areas and industries in the Nkandla, Mthonjaneni, uMlalazi and uMhlathuze Local Municipalities of KCDM. The uMhlathuze Local Municipality is a legislated water service authority referred to as City of uMhlathuze (CoU). **Figure 16.11** provides an overview of the municipalities within KCDM and the relative location of CoU. It also shows the bounding District Municipalities of Zululand and Umkhanyakude to the north, Umzimyathi to the east and iLembe sharing its southern border.

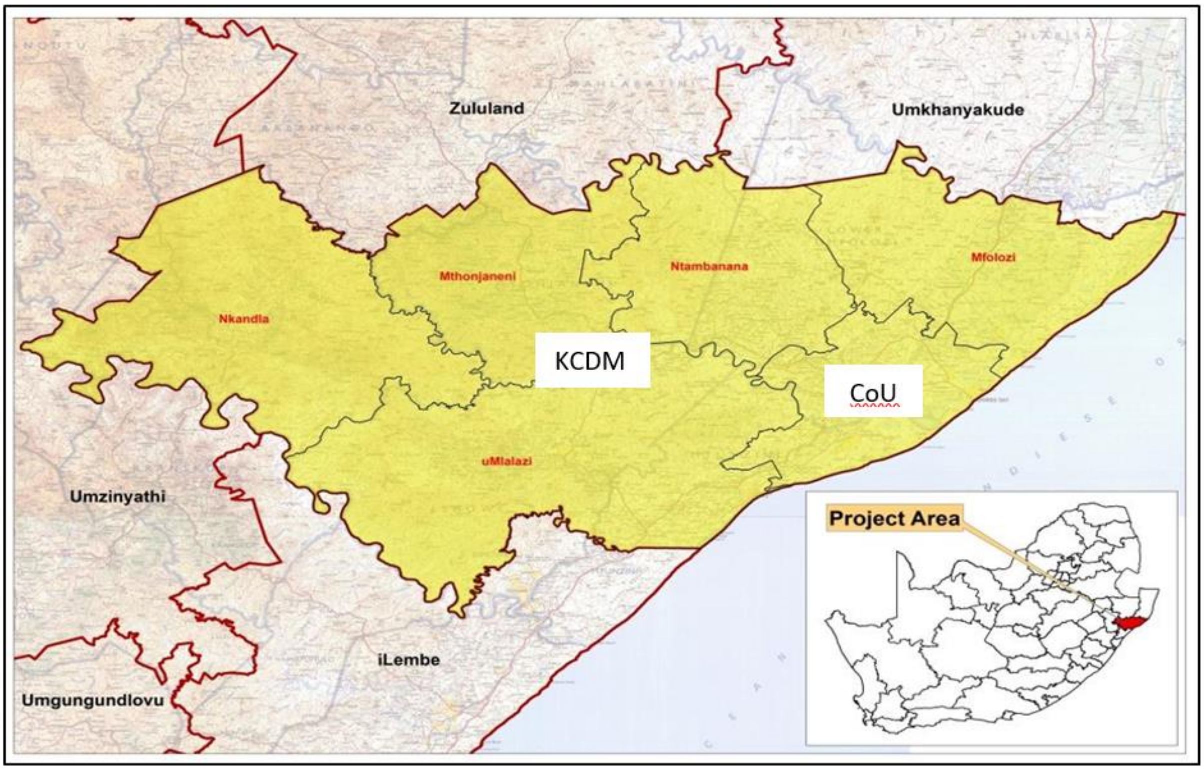

Figure 16.11 KCDM and City of uMhlathuze

The following WTPs obtain water from the uMhlathuze River. In some of these plants, the river augments supply and, in the case Greater Mthonjaneni WTP, supply is supplemented by an inter-basin transfer from the uThukela River. WTPs that have a treatment capacity greater than 2 Mℓ/day include the:

- Nkandla WTP;
- Middledrift WTP;
- Goedertrouw WTP;
- Eshowe WTP;
- eSikhaleni WTP;
- Nsezi WTP;
- Mzingazi WTP.

(b) Nkandla Water Treatment Plant and Supply System

The Nkandla WTP (**Figure 16.13**) abstracts raw water from a weir on the uMhlathuze River (**Figure 16.12**). The plant has a capacity of 3.6 Mℓ/day and potable water is pumped to the Mpongose Tribal Authority, towards Nkandla Town. The Nkandla WTP currently produces 3.5 Mℓ/day (June 2024) which is just within the design treatment capacity. The 12 month moving average of daily demand is 3.36 Mℓ/day (June 2024). Associated bulk infrastructure consists of two pump stations, pumping a total head of 280 m, four bulk storage reservoirs, with a total capacity of 3 600 kℓ and 67 km of bulk pipelines, ranging from 90 mm to 160 mm in diameter.

Figure 16.12 Nkandla abstraction weir at Mhlathuze River (Photo by UUW, 2023).

Figure 16.13 The Nkandla WTP (Photo taken by UUW).

The Nkandla Water Treatment Plant Supply System is shown in **Figure 16.14** and the characteristics of the plant are indicated in **Table 16.12**.

Table 16.12 Characteristics of the Nkandla WTP

WTP Name:	Nkandla WTP
System:	Nkandla Bulk Supply System
Maximum Design Capacity:	3.9 Mℓ/day[1]
Current Utilisation (July 2024):	3.36 Mℓ/day
Raw Water Storage Capacity:	0
Raw Water Supply Capacity:	10 Mℓ/day
Pre-Oxidation Type:	Chlorine
Primary Water Pre-Treatment Chemical:	Polymeric Coagulant (SUDFLOC 3856)
Total Coagulant Dosing Capacity:	6 ℓ/hr
Rapid Mixing Method:	Hydraulic mixing
Clarifier Type:	Sedimentation Tanks (Dortmund type clarifiers)
Number of Clarifiers:	2
Total Area of all Clarifiers:	137.28 m^2
Total Capacity of Clarifiers:	205.92 m^3
Filter Type:	Slow Sand Filters
Number of Filters:	3
Filter Floor Type	Porous concrete floor type
Total Filtration Area of all Filters	1 875 m^2
Total Filtration Design Capacity of all Filters:	162.5 m^3/hr
Total Capacity of Backwash Water Tanks:	1Mℓ – Backwash water obtained from clear water reservoir
Total Capacity of Sludge Treatment Plant:	N/A
Capacity of Used Washwater System:	N/A
Primary Post Disinfection Type:	Chlorine gas
Disinfection Dosing Capacity:	0.4 kg/hr
Disinfectant Storage Capacity:	700 kg
Total Treated Water Storage Capacity:	1 Mℓ Clear water reservoir

[1]Nkandla Bulk Waterworks, Design Capacity Assessment, 2020

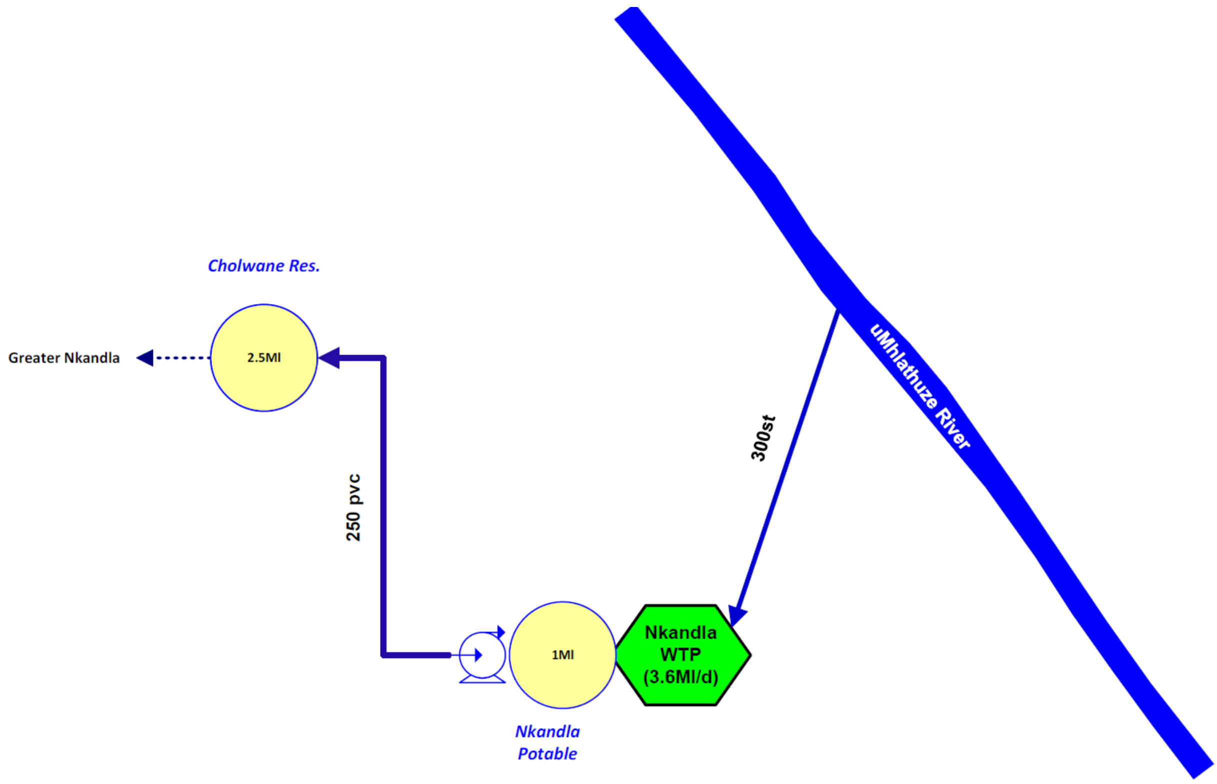

Figure 16.14 Schematic of Nkandla WTP Supply System

The Nkandla WTP is a conventional treatment plant comprising of the following process components:

(i) Raw water is gravity fed from a weir located on the uMhlathuze River into a Pre-sedimentation tank from which two submersible pumps (duty/standby) convey water to an aerator.
(ii) Flocculation channels: The raw water flows by gravity to the dosing room for pre-chlorination and coagulation. Lime is dosed after the hydraulic jump that is used for flash mixing. The coagulated water flows through the flocculation channel.
(iii) Clarification (sedimentation) tanks: The flocs that have formed in the flocculation channels are settled in the two existing sedimentation tanks under gravity. The settled sludge is removed by frequent de-sludging of the tanks.
(iv) Slow Sand Filtration: The clarified water is then filtered through a set of three slow sand filters as a final polishing before chlorination of the treated water.
(v) Chorine contact tank: The filtered water is disinfected and gravitate to the onsite clear water reservoir (1Mℓ) before pumping the water to the command reservoirs in the Nkandla supply area.

The reservoir, pump station and pipeline details are summarised in **Table 16.13**, **Table 16.14** and **Table 16.15.**

Table 16.13 Pump Details: Nkandla WTP Supply System

System	Pump Station Name	Number of Pumps		Pump Description	Supply From	Supply To	Static Head (m)	Duty Head (m)	Duty Capacity (Mℓ/day)
		Number of Duty Pumps	Number of Standby Pumps						
uMhlathuze	Nkandla Pump Station	2	1	KSB WKLn 100/7	WTP	Cholwane	139	147	3.12

Table 16.14 Pipeline Details: Nkandla WTP Supply System

System	Pipeline Name	From	To	Length (km)	Nominal Diameter (mm)	Material	Capacity (Mℓ/day)	Age (years)
uMhlathuze	Raw Water	Abstraction	WTP	0.6	300	Steel	9.2[1]	24
uMhlathuze	Nkandla Bulk	WTP	Cholwane	6.4	250	uPVC	6.4[1]	24

[1]Based on a velocity of 1.5m/s

Table 16.15 Reservoir Details: Nkandla WTP Supply System

System	Reservoir Site	Reservoir Name	Capacity (Mℓ)	Function	TWL (mASL)	FL (mASL)
uMhlathuze	Nkandla WTP	Nkandla Potable	1	Clear Well	873	868
uMhlathuze	Cholwane	Cholwane Reservoir	2.5	Balancing	1146	1141

(c) Middledrift Water Treatment Plant and Supply System

The uThukela-Goedertrouw Water Transfer Scheme abstracts raw water from the left bank of the uThukela River (**Figure 16.15**). This scheme is being operated and maintained by Mngeni-Uthuleka Water on behalf of Department of Water and Sanitation. The Madungela High Lift Pump Station (**Figure 16.18**) and the Mkhalazi High Lift Pump Station (**Figure 16.19**) transfer water across the catchment into the uMhlathuze catchment. Raw water for the Middledrift WTP is supplied from the Madungela High Lift Pump Station and is conveyed into two onsite raw water-holding tanks.

The Middledrift WTP, which is being operated and maintained by uMngeni-uThukela Water, is at the Middledrift Village and supplies the village itself and surrounding villages up to Msobotsheni in the north east and Ntingwe in the south. The Middledrift WTP is shown in **Figure 16.16** and **Figure 16.17** and the supply system is shown in **Figure 16.20**.

Figure 16.15 Thukela Transfer Scheme Abstraction Works.

Figure 16.16 An aerial photo of the Middledrift WTP.

Figure 16.17 Photo of Middledrift WTP Clarifiers.

Figure 16.18 The Madungela High Lift Pump Station.

Figure 16.19 The Mkhalazi High Lift Pump Station.

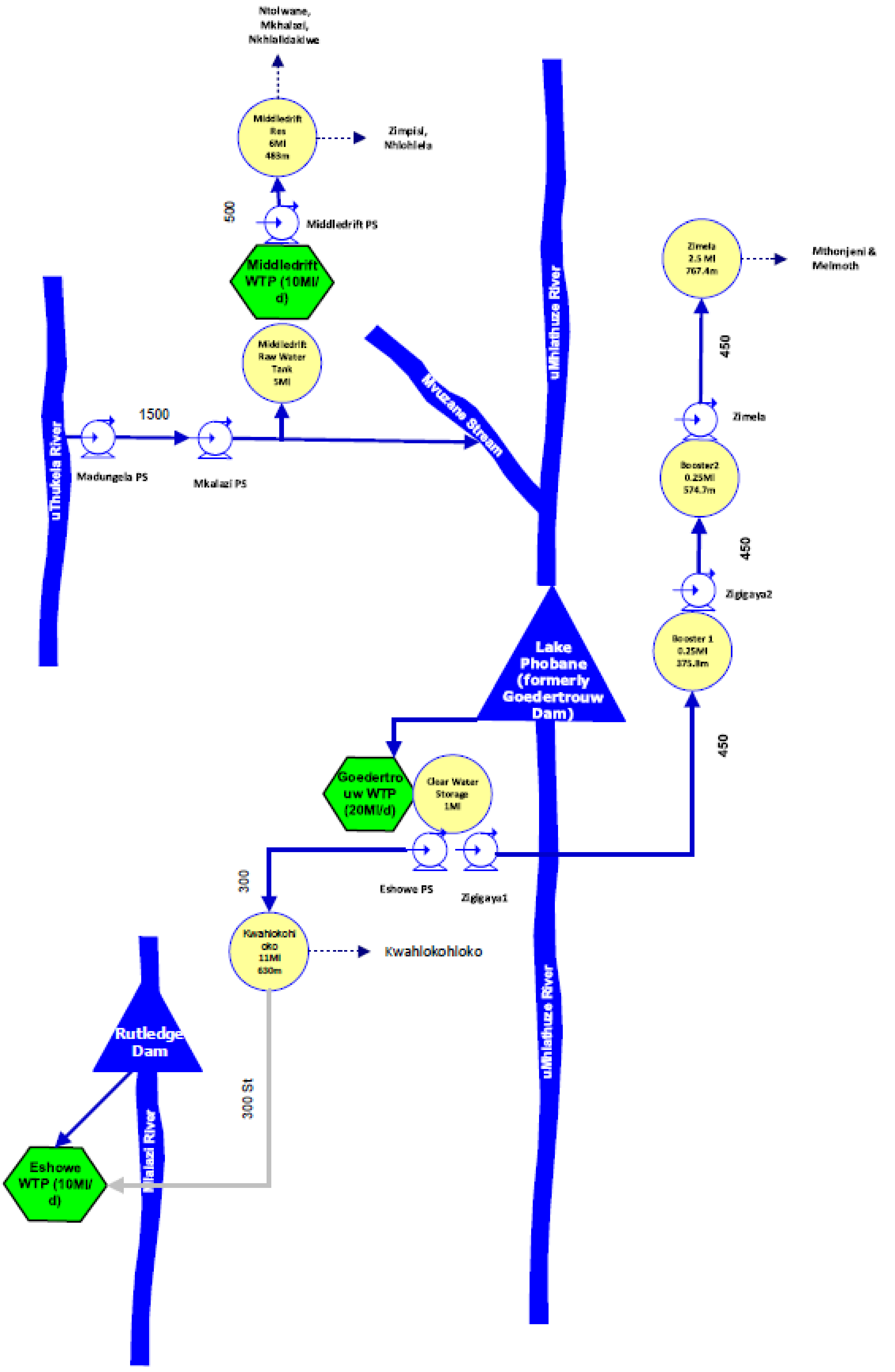

Figure 16.20 A schematic of Central uMhlathuze System.

The Middledrift WTP (**Table 16.16**) is a conventional treatment plant comprising the following process components:

(i) Raw water holding tanks: Raw water for the Middledrift WTP is supplied from the Madungela pump station and is conveyed into two onsite raw water-holding tanks

(ii) Static inline mixers: The raw water is conveyed by gravity to the inlet head of works (HoW) chamber where polymeric (SUDFLOC 3870) and Soda ash for pH correction is injected before two static inline mixers to achieve flash mixing. Chlorine is added for pre-chlorination process after the inline mixers.

(iii) Clarification (sedimentation) tanks: The flocs that have formed are settled in the two clari-flocculators under gravity. The settled sludge is removed by frequent de-sludging of the tanks.

(iv) Rapid Gravity Sand Filtration: The clarified water is then filtered through a set of five rapid gravity sand filters as a final polishing before chlorination of the treated water. The filters are backwashed daily using the final water from the 1.25 Mℓ onsite reservoir. The spent backwash water is sent to the sludge holding tanks. The supernatant from the holding tanks is recycled to the head of works and the settled sludge is discharged to the drying beds.

(v) Final water reservoir: The filtered water flows into the clearwells then into a collection chamber where chlorine is added before entering the final water reservoir, before pumping the water to the command reservoir in the Middledrift supply area.

The reservoirs pump station and pipeline details related to the Middledrift Supply Scheme are summarised in **Table 16.17**, **Table 16.18** and **Table 16.19.**

Table 16.16 Characteristics of the Middledrift WTP

WTP Name:	Middledrift WTP
System:	Middledrift Bulk Supply System
Maximum Design Capacity:	10 Mℓ/day
Current Utilisation (June 2024):	9.58 Mℓ/day
Raw Water Storage Capacity:	5 Mℓ
Raw Water Supply Capacity:	10 Mℓ
Pre-Oxidation Type:	None
Primary Water Pre-Treatment Chemical:	SUDFLOC 3870 and Soda Ash
Total Coagulant Dosing Capacity:	20.5 ℓ/hr
Rapid Mixing Method:	Static inline mixers
Clarifier Type:	Clarifloculators with paddle mixers and scrapers
Number of Clarifiers:	2
Total Area of all Clarifiers:	1 005.42 m^2
Total Capacity of Clarifiers:	926 m^3
Filter Type:	Rapid Gravity Sand Filters
Number of Filters:	5
Filter Floor Type	Suspended floor slap (CADAR GRC Monolithic flat panel) with underfloor drainage.
Total Filtration Area of all Filters	87.5 m^2
Total Filtration Design Capacity of all Filters:	417 m^3/hr
Total Capacity of Backwash Water Tanks:	1.25 Mℓ - water obtained from Clear water reservoir
Total Capacity of Sludge Treatment Plant:	1296 kℓ
Capacity of Used Washwater System:	1296 kℓ - Included in the Sludge Lagoons
Primary Post Disinfection Type:	Chlorine gas
Disinfection Dosing Capacity:	0.4 kg/hr
Disinfectant Storage Capacity:	2 820 kg
Total Treated Water Storage Capacity:	1.25 Mℓ Clear water reservoir

Table 16.17 Pump Details: Middledrift WTP Supply

System	Pump Station Name	Number of Pumps		Pump Description	Supply From	Supply To	Static Head (m)	Duty Head (m)	Duty Capacity (Mℓ/day)
		Number of Duty Pumps	Number of Standby Pumps						
uMhlathuze	Madungela Transfer Ph1	2	2	Sulzer SM 302.640	Abstraction	Umkhalazi PS	230	254	86.4
uMhlathuze	KCDM Transfer Pumps	1	1	KSB - WKn 150/6	Abstraction	WTP	233	270	5.7
uMhlathuze	Middledrift	1	1	Grundfos NK 200-450/455	WTP	Middledrift Command	60.6	70	10.3

Table 16.18 Pipeline Details: Middledrift WTP Supply

System	Pipeline Name	From	To	Length (km)	Nominal Diameter (mm)	Material	Capacity (Mℓ/day)	Age (years)
uMhlathuze	Raw Water Transfer[1]	Thukela River	Middledrift	12.6	1500	Steel	86.4	26
uMhlathuze	Supply to WTP	Transfer take-off	Middledrift WTP	0.16	500	DI	25	11
uMhlathuze	Middledrift Res supply	Middledrift WTP	Middledrift Command	0.5	500	DI	25	11

[1] This pipeline is the raw water transfer to Goedertrouw Dam.

Table 16.19 Reservoir Details: Middledrift WTP Supply

System	Reservoir Site	Reservoir Name	Capacity (Mℓ)	Function	TWL (mASL)	FL (mASL)
uMhlathuze	WTP	Middledrift Command	6.0	Balancing	487.7	480.5

(d) Greater Mthonjaneni Water Treatment Plant and Supply System

The Goedertrouw Dam remains the most viable water source to the Greater Mthonjaneni, Kwahlokohloko and Eshowe supply areas. Abstraction from the dam is via an existing 1.8 m diameter steel pipe to the Greater Mthonjaneni WTP, from which potable water is distributed to pump stations serving both the northern areas (which form part of the Mthonjaneni Local Municipality) and the southern areas (within the uMlalazi Local Municipality).

The Goedertrouw Dam is on the uMhlathuze River and its yield is augmented by an inter-basin transfer from the uThukela River (described in **Section 16.1** above). This transfer scheme includes a second high-lift pump-station (Mkhalazi) at the end of the 1.5 m diameter pipeline, to pump water over the watershed, through an extra rising main and gravity main.

A 450 mm diameter ductile iron rising main from the Greater Mthonjaneni WTP supplies water to a 2.5 Mℓ concrete reservoir and four pump stations (Zigigaya Booster 1, Zigigaya Booster 2, Zimela Booster and PSA). The system supplies Greater Mthonjaneni.

The WTP also supplies south via a 300 mm pipeline (previously a raw water pipeline from Goedertrouw Dam) to Kwahlokohloko. The pipeline extends to Eshowe to supply the Eshowe Command reservoirs. A schematic of the Greater Mthonjaneni WTP Supply System is shown in **Figure 16.22.** The reservoir, pump station and pipeline details are summarised in **Table 16.21**, **Table 16.22** and **Table 16.23**.

The Greater Mthonjaneni WTP is a conventional treatment plant comprising the following process components:

(i) Hydraulic rapid mixing: Raw water for the Greater Mthonjaneni WTP is sourced from Goedertrouw Dam. The pre-treatment process involves polymeric coagulant dosing to aid coagulation followed by hydraulic rapid mixing.

(ii) Clarification (sedimentation) tanks: The coagulated water is controlled through sluice gates and conveyed into two clari-flocculators. The flocs that have formed are then settled in the sedimentation tanks under gravity. Sludge from each of the clari-flocculators and spent backwash water is discharged into three sludge lagoons.

(iii) Rapid Gravity Sand Filtration: The clarified water from the clari-flocculators is then conveyed into five rapid gravity sand filters as a final polishing step before chlorination of the treated water.

(iv) Chlorine Contact Tank: Filtered water from the clear wells is disinfected with chlorine gas. Final water is then stored in a 1 Ml onsite reservoir before it is pumped to Kwahlokohloko, Mthonjaneni and Eshowe command reservoirs.

Figure 16.21 Greater Mthonjaneni WTP.

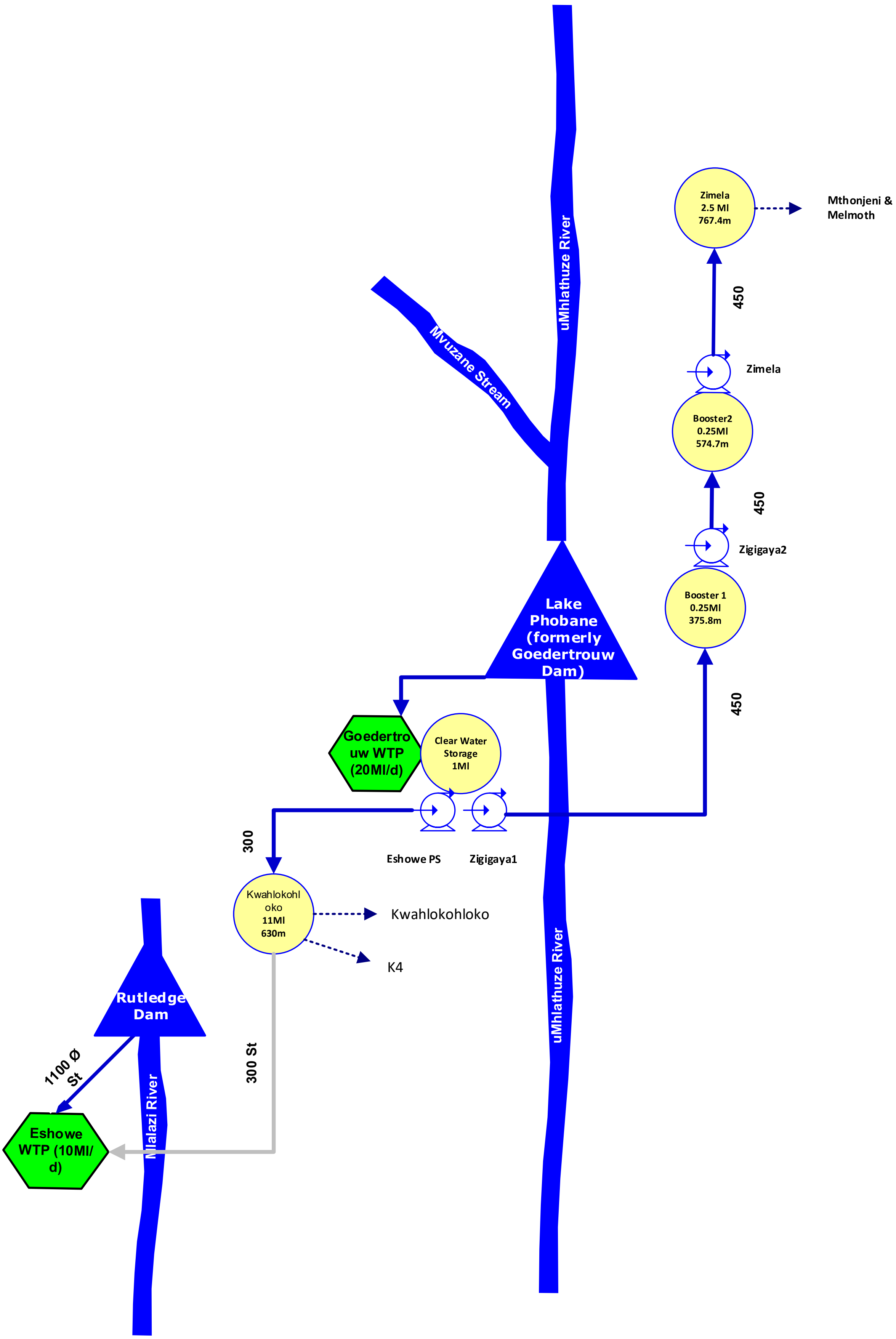

Figure 16.22 Schematic of Goedertrouw Supply System.

Table 16.20 Characteristics of the Greater Mthonjaneni WTP

WTP Name:	Greater Mthonjaneni WTP
System:	Goedertrouw Bulk Supply System
Maximum Design Capacity:	20 Mℓ/day
Current Utilisation (June 2024):	20.43 Mℓ/day
Raw Water Storage Capacity:	0
Raw Water Supply Capacity:	25 Mℓ/day
Pre-Oxidation Type:	None
Primary Water Pre-Treatment Chemical:	SUDFLOC 3450
Total Coagulant Dosing Capacity:	50 ℓ/hr
Rapid Mixing Method:	Compartment Drop
Clarifier Type:	Sedimentation Tanks
Number of Clarifiers:	2
Total Area of all Clarifiers:	780 m^2
Total Capacity of Clarifiers:	20 Mℓ/day
Filter Type:	Rapid Gravity Sand Filtration
Number of Filters:	5
Filter Floor Type	Monolithic flat panel with underfloor drainage
Total Filtration Area of all Filters	196 m^2
Total Filtration Design Capacity of all Filters:	20 Mℓ/day
Total Capacity of Backwash Water Tanks:	1 Mℓ
Total Capacity of Sludge Treatment Plant:	Three sludge lagoons
Capacity of Used Washwater System:	Unknown
Primary Post Disinfection Type:	Chlorine Gas
Disinfection Dosing Capacity:	4 kg/hr
Disinfectant Storage Capacity:	6 * 1 Tonne
Total Treated Water Storage Capacity:	1 Mℓ

Table 16.21 Pump Details: Greater Mthonjaneni WTP Supply

System	Pump Station Name	Number of Pumps		Pump Description	Supply From	Supply To	Static Head (m)	Duty Head (m)	Duty Capacity (Mℓ/day)
		Number of Duty Pumps	Number of Standby Pumps						
Mthonjaneni	Zigigaya Booster 1	1	1	KSB WKLn 150/5	Goedertrouw WTP	Zigigaya 1	202	211	6.7
Mthonjaneni	Zigigaya Booster 2	1	1	KSB WKLn 150/5	Zigigaya 1	Zigigaya 2	195	211	6.7
Mthonjaneni	Zimela	1	1	KSB WKLn 150/5	Zigigaya 2	Zimela Res	198	211	6.7
Kwahlokhloko	Eshowe	1	1	KSB MTC D 100	Goedertrouw WTP	Kwahlokohloko Res	450	420	4.2

Table 16.22 Pipeline Details: Greater Mtonjaneni WTP Supply

System	Pipeline Name	From	To	Length (km)	Nominal Diameter (mm)	Material	Capacity (Mℓ/day)	Age (years)
uMhlathuze	Mthonjaneni Bulk	WTP	Zigigaya Booster 1	2.9	450	Ductile Iron	6.72	15
uMhlathuze	Mthonjaneni Bulk	Zigigaya Booster 1	Zigigaya Booster 2	3.4	450	Ductile Iron	6.72	15
uMhlathuze	Mthonjaneni Bulk	Zigigaya Booster 2	Zimel2 Res	3.6	450	Ductile Iron	6.72	15
uMhlathuze	Kwahlokohloko Bulk	WTP	Kwahlokohloko	10	300	Steel	9.2[1]	15

[1]Capacity based on 1.5m/s velocity

Table 16.23 Reservoir Details: Goedertrouw WTP Supply

System	Reservoir Site	Reservoir Name	Capacity (Mℓ)	Function	TWL (mASL)	FL (mASL)
uMhlathuze	Greater Mthonjaneni WTP	Goedertrouw Potable	1	Balancing	163	160
uMhlathuze	Zigigaya	Zigzag 1	0.25	Pump Suction Storage	375.8	373
uMhlathuze	Zigigaya	Zigzag 2	0.25	Pump Suction Storage	574.7	571
uMhlathuze	Zimele	Zimele Reservoir	2.5	Distribution	767.39	762

(e) Eshowe Water Treatment Plant and Supply System

The Eshowe Water Supply Scheme comprises of one main treatment works namely the Eshowe WTP (**Figure 16.23**). The Eshowe WTP abstracts raw water from the Rutledge Park Dam (**Figure 16.7**) through a raw water pumping station at the outlet works of the dam. The supply from the dam to the treatment plant is through a 1.1 m diameter steel pipeline. The Rutledge Park Dam is augmented with raw water from the Eshlazi Dam (**Figure 16.6**). The Rutledge Dam and Eshlazi Dams have a combined historical firm yield of 1.29 million m^3/annum (3.53 Mℓ/day). The Eshowe WTP also receives 9.9 Mℓ/day (June 2024) potable water from the Greater Mthonjaneni WTP via a 300mm diameter pipeline. The Eshowe WTP is currently producing 1.79 Mℓ/day (June 2024), which is below the design treatment capacity.

The WTP is located within the town of Eshowe and supplies the existing domestic users in Eshowe and the surrounding communities, which is made up of several formal and informal townships in Eshowe and rural villages. The town also has several small industries as well as commercial concerns, businesses and institutions such as the hospital, schools and municipal buildings. Treated water from the Eshowe WTP is pumped from the clearwater tanks to service reservoirs in Eshowe town and surrounding villages to the west and east of the town before distribution to the users (**Figure 16.24**).

Figure 16.23 The Eshowe WTP.

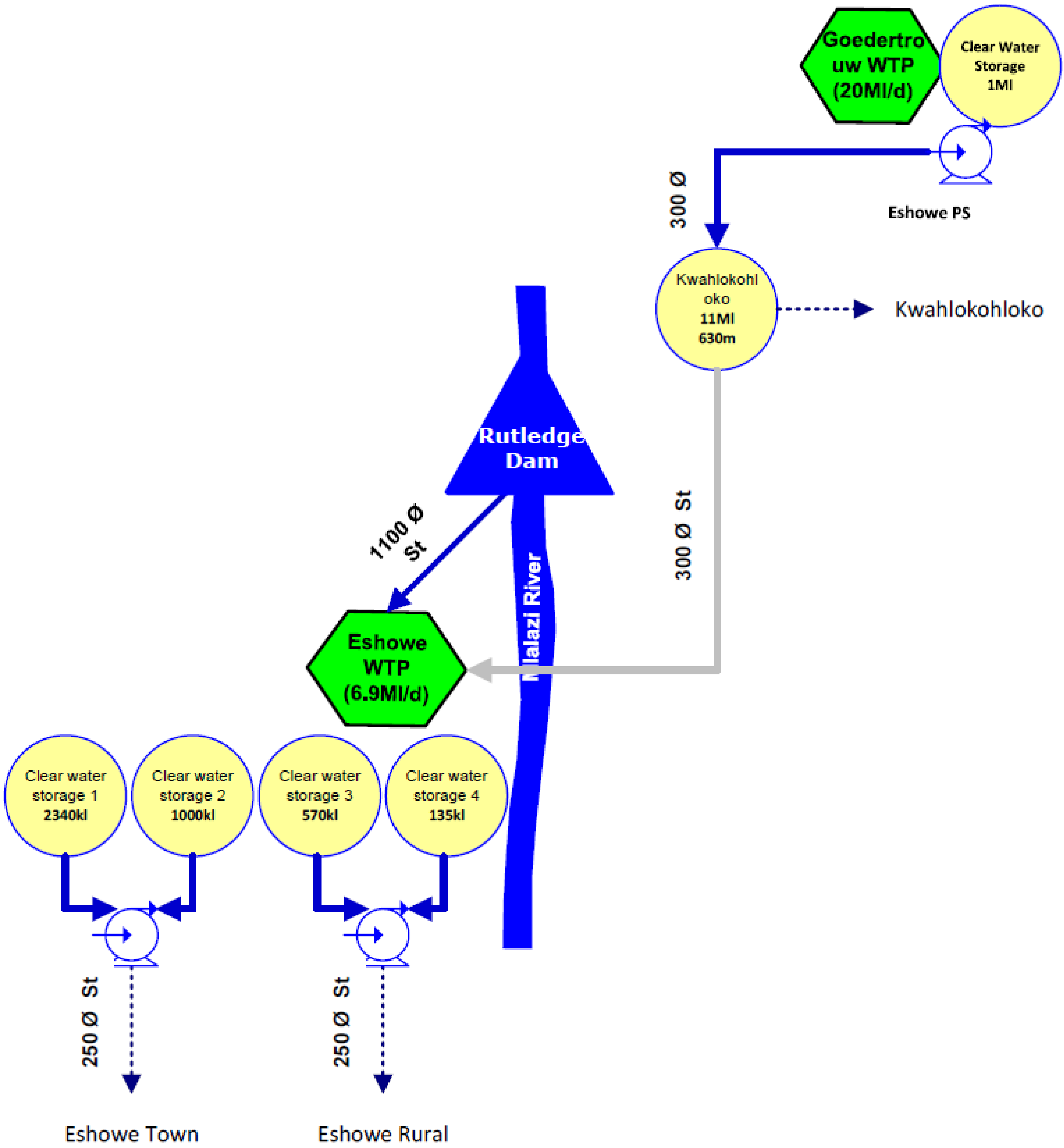

Figure 16.24 Schematic of Eshowe System.

Table 16.24 Characteristics of the Eshowe WTP

WTP Name:	Eshowe WTP
System:	Kwahlokohloko Bulk Supply System
Maximum Design Capacity:	10 Mℓ/day
Current Utilisation (June 2024):	1.79 Mℓ/day
Raw Water Storage Capacity:	River Abstraction
Raw Water Supply Capacity:	16 Mℓ
Pre-Oxidation Type:	Flocculation channels
Primary Water Pre-Treatment Chemical:	RHEOFLOC 35643 XI
Total Coagulant Dosing Capacity:	6.94 l/hr (solution flow rate)
Rapid Mixing Method:	Pump diffusion/in-line mixer
Clarifier Type:	Dortmund and Upflow Circular Type Clarifier
Number of Clarifiers:	4
Total Area of all Clarifiers:	565.28 m^2
Total Capacity of Clarifiers:	10 Mℓ/day
Filter Type:	Rapid Gravity filters & Airlift filters
Number of Filters:	12 no’s
Filter Floor Type	Porous concrete floor type
Total Filtration Area of all Filters	1085 m^2
Total Filtration Design Capacity of all Filters:	10 Mℓ/day
Total Capacity of Backwash Water Tanks:	4 Mℓ Clear water reservoir used for backwashing
Total Capacity of Sludge Treatment Plant:	N/A
Capacity of Used Washwater System:	N/A
Primary Post Disinfection Type:	Chlorine Gas
Disinfection Dosing Capacity:	2.1 kg/hr
Disinfectant Storage Capacity:	1 050 kg
Total Treated Water Storage Capacity:	Eshowe WTP complex 1 x 2.34 Mℓ, 1 x 1 Mℓ, 1 x 0.57 Mℓ, 1 x 0.134 Mℓ

Table 16.25 Pump Details: Eshowe WTP Supply

System	Pump Station Name	Number of Pumps		Pump Description	Supply From	Supply To	Static Head (m)	Duty Head (m)	Duty Capacity (Mℓ/day)
		Number of Duty Pumps	Number of Standby Pumps						
Kwahlokohloko	Rutledge Dam	1	1	KSB Eta 100-250	Rutledge Dam	Eshowe WTP	Unknown	Unknown	Unknown
Kwahlokohloko	Eshowe	0	1	KSB MTC D 100	Goedertrouw WTP	Kwahlokohloko Res	450	420	4.2
Kwahlokohloko	Eshowe WTP	1	1	WILo NL 125/400-08	Eshowe WTP	Eshowe Town	Unknown	Unknown	Unknown
Kwahlokhloko	Eshowe WTP	1	1	Salmron 125-400V-H31/GM	Eshowe WTP	Eshowe Rural	Unknown	Unknown	Unknown

Table 16.26 Pipeline Details: Eshowe WTP Supply

System	Pipeline Name	From	To	Length (km)	Nominal Diameter (mm)	Material	Capacity (Mℓ/day)	Age (years)
Kwahlokohloko	Kwahlokohloko Bulk	Rutledge Dam	Eshowe WTP	4	1100	Steel	123.16[1]	Unknown
uMhlathuze	Kwahlokohloko Bulk	Goedertrouw WTP	Eshowe WTP	10	300	Steel	9.2[1]	Unknown
Kwahlokohloko	Kwahlokohloko Bulk	Eshowe WTP	Eshowe Town		250	PVC	6.36[1]	Unknown
Kwahlokohloko	Kwahlokohloko Bulk	Eshowe WTP	Eshowe Rural		250	PVC	6.36[1]	Unknown

[1]Capacity based on 1.5m/s velocity

Table 16.27 Reservoir Details: Eshowe WTP Supply

System	Reservoir Site	Reservoir Name	Capacity (Mℓ)	Function	TWL (mASL)	FL (mASL)
uMhlathuze	Greater Mthonjaneni WTP	Goedertrouw Potable	1	Balancing	163	160
Kwahlokohloko	Eshowe WTP	Eshowe Potable 1	2.5	Balancing	Unknown	Unknown
Kwahlokohloko	Eshowe WTP	Eshowe Potable 2	1	Balancing	Unknown	Unknown
Kwahlokohloko	Eshowe WTP	Eshowe Potable 3	0.5	Balancing	Unknown	Unknown
Kwahlokohloko	Eshowe WTP	Eshowe Potable 4	0.2	Balancing	Unknown	Unknown

(f) Ngwelezane Water Treatment Plant and Supply System (CoU)

Ngwelezane and Madlebe towns are supplied from the Ngwelezane WTP (**Figure 16.25 and Table 16.28**). Ngwelezane WTP abstracts water from the uMhlathuze River upstream of the uMhlathuze Weir on the border with uMlalazi LM. The communities are supplied via three (3) reservoirs located on the edge of town. The WTP has a capacity of 12 Mℓ/day and operates at full capacity.

Figure 16.25 Ngwelezane WTP.

The Ngwelezane WTP and Supply System is shown in **Figure 16.26.**

Water is abstracted from the left bank of the uMhlathuze River and pumped to the WTP located on the river bank. A 250 mm diameter pipeline from the works feeds the 13.4 Mℓ Ngwelezane Bulk Reservoir. The reservoir supplies the Ngwelezane community.

The reservoir, pump station and pipeline details are summarised in **Table 16.29, Table 16.30** and **Table 16.31.**

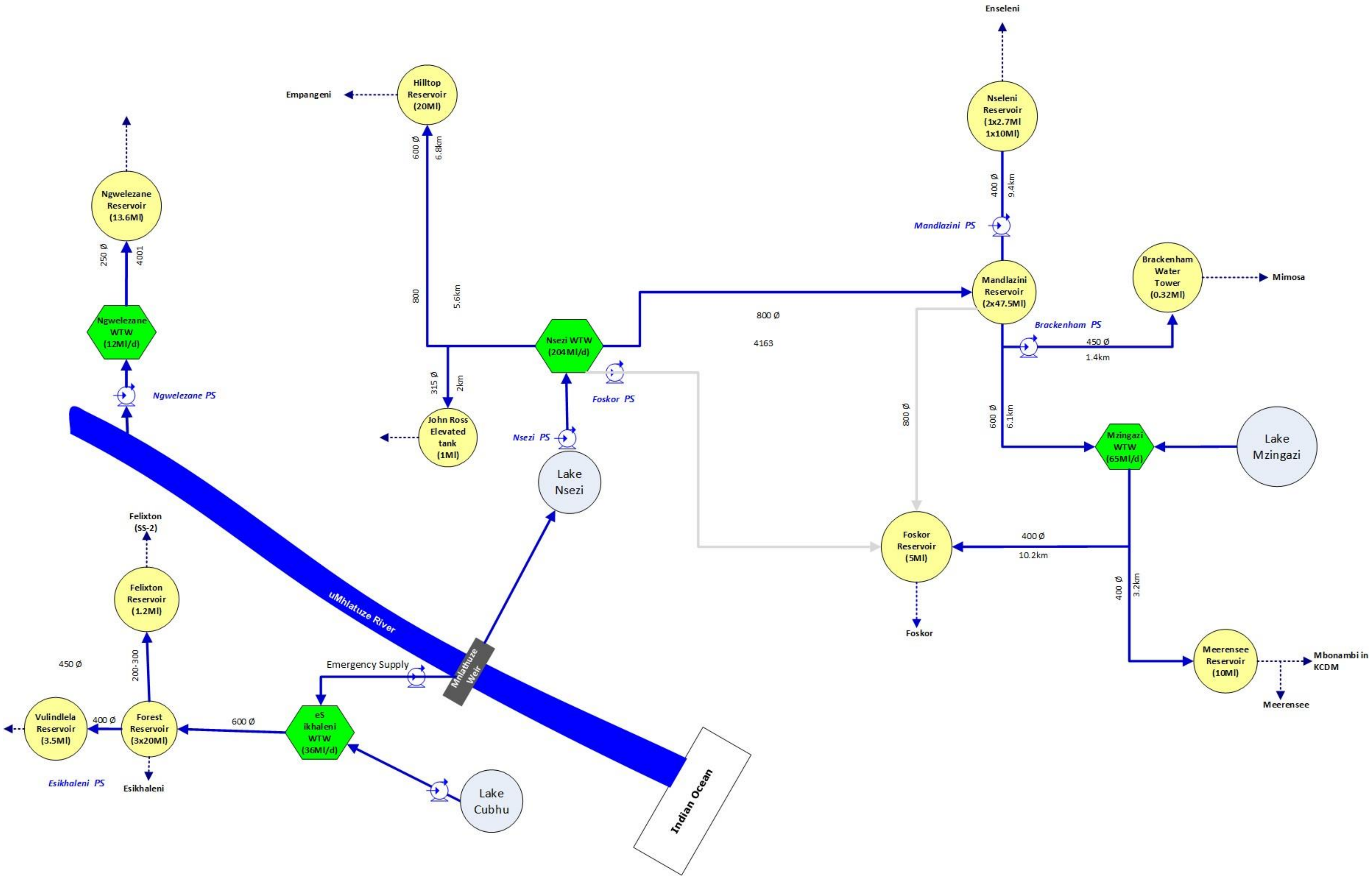

Figure 16.26 Schematic of CoU System

Table 16.28 Characteristics of the Ngwelezane WTP

WTP Name:	Ngwelezane WTP
System:	Ngwelezane Bulk Supply System
Maximum Design Capacity:	12 Mℓ/day
Current Utilisation (January 2022):	Unknown
Raw Water Storage Capacity:	River Abstraction
Raw Water Supply Capacity:	8 Mℓ/day
Pre-Oxidation Type:	Flocculation channels
Primary Water Pre-Treatment Chemical:	Lime
Total Coagulant Dosing Capacity:	Unknown
Rapid Mixing Method:	Unknown
Clarifier Type:	n/a
Number of Clarifiers:	n/a
Total Area of all Clarifiers:	Horizontal Flow Sedimentation tanks 14 x 7.5 m
Total Capacity of Clarifiers:	Two No's with total capacity of +/- 10-11.5 Mℓ/day
Filter Type:	Rapid Gravity filters
Number of Filters:	3 no's
Filter Floor Type	Unknown
Total Filtration Area of all Filters	5m x 4 m x 3 no's = 60 sqm
Total Filtration Design Capacity of all Filters:	8 Mℓ/day
Total Capacity of Backwash Water Tanks:	Unknown
Total Capacity of Sludge Treatment Plant:	Sludge Lagoons
Capacity of Used Washwater System:	Unknown
Primary Post Disinfection Type:	Chlorine Gas
Disinfection Dosing Capacity:	Unknown
Disinfectant Storage Capacity:	Unknown
Total Treated Water Storage Capacity:	Ngwelezana complex 2x1.68 Mℓ, 1 x 6.5 Mℓ, 1 x 3.5 Mℓ

Table 16.29 Pump Details: Ngwelezane WTP Supply

System	Pump Station Name	Number of Pumps		Pump Description	Supply From	Supply To	Static Head (m)	Duty Head (m)	Duty Capacity (Mℓ/day)
		Number of Duty Pumps	Number of Standby Pumps						
uMhlathuze	Ngwelezane Abstraction	tbc	tbc	tbc	uMhlathuze River	Ngwelezane WTP	8	tbc	tbc
uMhlathuze	Ngwelezane	4	0	WKLN 125/5	Ngwelezane WTP	Ngwelezane Res	175	160	4.8

Table 16.30 Pipeline Details: Ngwelezane WTP Supply

System	Pipeline Name	From	To	Length (km)	Nominal Diameter (mm)	Material	Capacity (Mℓ/day)	Age (years)
uMhlathuze	Ngwelezane Bulk	Ngwelezane WTP	Ngwelezane Res	4	250	tbc	6.4	tbc

Table 16.31 Reservoir Details: Ngwelezane WTP Supply

System	Reservoir Site	Reservoir Name	Capacity (Mℓ)	Function	TWL (mASL)	FL (mASL)
uMhlathuze	Ngwelezane	Ngwelezane	13.4	tbc	115	110

(g) eSikhaleni Water Treatment Plant and Supply System (CoU)

The eSikhaleni WTP (**Figure 16.27** and **Table 16.32**) sources water from Lake Cubhu and is supplemented by raw water from the uMhlathuze Weir. This WTP supplies Esikhawini, Vulindlela and surrounding industries, i.e. Mondi Felixton and Tongaat-Hulett.

An emergency pipeline exists between the uMhlathuze Weir and the eSikhaleni WTP for use during times when the Lake Cubhu water level is too low for abstraction. The lake is generally preferred as a water source for the municipality, since the river abstraction requires pumping, which has cost implications. The WTP has a capacity of 36 Mℓ/day.

Historically eSikhaleni WTP relied completely on Lake Cubhu as a source. Serious problems were experienced during the 1992/94 drought, with low lake levels and an augmented supply from the uMhlathuze River was implemented. The scheme from the uMhlathuze River was implemented as part of the Iscor Mining water supply scheme, and was completed during May/June 2001. This system has a capacity of 34 Mℓ/day.

Due to the decreasing lake levels, as from August 2014, eSikhaleni WTP was supplemented with 7.5Mℓ/day (raw water from uMhlathuze Water Weir Pump Station) and this volume was increased gradually to a maximum system capacity of 30Mℓ/day in January 2015.

Figure 16.27 eSikhaleni WTP.

The eSikhaleni WTP Supply System is shown in **Figure 16.26** and the details of the WTP is shown in **Table 16.32.** The reservoir, pump station and pipeline details are summarised in **Table 16.33**, **Table 16.34** and **Table 16.35.**

Table 16.32 Characteristics of the eSikhaleni WTP

WTP Name:	eSikhaleni WTP
System:	eSikhaleni Bulk Supply System
Maximum Design Capacity:	36 Mℓ/day
Current Utilisation (July 2023):	36 Mℓ/day
Raw Water Storage Capacity:	Lake Chubu
Raw Water Supply Capacity:	36 Mℓ/day
Pre-Oxidation Type:	Flocculation channels
Primary Water Pre-Treatment Chemical:	Lime
Total Coagulant Dosing Capacity:	Unknown
Rapid Mixing Method:	Concrete inlet chamber
Clarifier Type:	4 No's Horizontal flow tanks 11x38m each
Number of Clarifiers:	4
Total Area of all Clarifiers:	1675 sqm
Total Capacity of Clarifiers:	36 Mℓ/day
Filter Type:	Rapid gravity (dual media)
Number of Filters:	8 Rapid Gravity filters
Filter Floor Type	False Floor
Total Filtration Area of all Filters	8m x 5 m x 8No's 40 sqm each
Total Filtration Design Capacity of all Filters:	36 Mℓ/day
Total Capacity of Backwash Water Tanks:	Unknown
Total Capacity of Sludge Treatment Plant:	Sludge Lagoons
Capacity of Used Washwater System:	Unknown
Primary Post Disinfection Type:	Chlorine Gas
Disinfection Dosing Capacity:	Unknown
Disinfectant Storage Capacity:	Unknown
Total Treated Water Storage Capacity:	Esikhaleni = 3 x 20 Mℓ/day

Table 16.33 Pump Details: eSikhaleni WTP Supply

System	Pump Station Name	Number of Pumps		Pump Description	Supply From	Supply To	Static Head (m)	Duty Head (m)	Duty Capacity (Mℓ/day)
		Number of Duty Pumps	Number of Standby Pumps						
uMhlathuze	Esikhaleni High Lift Pump station	3	1	Sulzer Weir, Centrifugal Pumps	Treatment Plant	Storage Reservoir	125	130	13

Table 16.34 Pipeline Details: eSikhaleni WTP Supply

System	Pipeline Name	From	To	Length (km)	Nominal Diameter (mm)	Material	Capacity (Mℓ/day)	Age (years)
uMhlathuze		eSikhaleni WTP	Forrest Reservoir	9.3	600		34	23

Table 16.35 Reservoir Details: eSikhaleni WTP Supply

System	Reservoir Site	Reservoir Name	Capacity (Mℓ)	Function	TWL (m ASL)	FL (m ASL)
uMhlathuze		Forrest Reservoir	60	Balancing	135	130

(h) Nsezi Water Treatment Plant and Supply System (CoU)

The Nsezi WTP was orringally constructed in 1984 to supply the Mondi factory. Situated on the banks of Lake Nsezi, the consumers of the Nsezi Water Treatment Plant are the City of uMhlathuze and bulk industrial consumers like Mondi Paper, Richards Bay Minerals (RBM), Tronox and Foskor.

The natural flow in the Mhlathuze River is normally insufficient to meet the demands of the area; so the river flow is augmented by water releases from the Goedertrouw Dam, which is operated by the Department of Water and Sanitation. The dam is further replenished by transfers from the uThukela River via the uThukela-Goedertrouw Transfer Scheme.

The primary raw water source for the Nsezi WTP is the Mhlathuze Weir (**Figure 16.28**). The Mhlathuze Weir is supported by releases from Goedertrouw Dam (owned and operated by DWS) which is about 90 km upstream. Raw water for the Nsezi WTP (**Figure 16.32**) is also sourced from Lake Nsezi as and when required, i.e. when the demand is high, or during maintenance of the Mhlathuze Weir supply. The operating rule is such that Lake Nsezi primarily supplies raw water to RBM and supports the Nsezi WTP, as and when required.

This WTP is the most significant in CoU and supplies Empangeni, Richards Bay, and Ngwelezane. An 800 mm diameter pipeline, from the WTP, supplies the 20 Mℓ Hilltop Reservoir which supplies Empangeni. There is also an 800 mm diameter pipeline supplying Mandlazini Command Reservoir that serves Richards Bay.

Figure 16.28 uMhlathuze Weir (UUW, 2023).

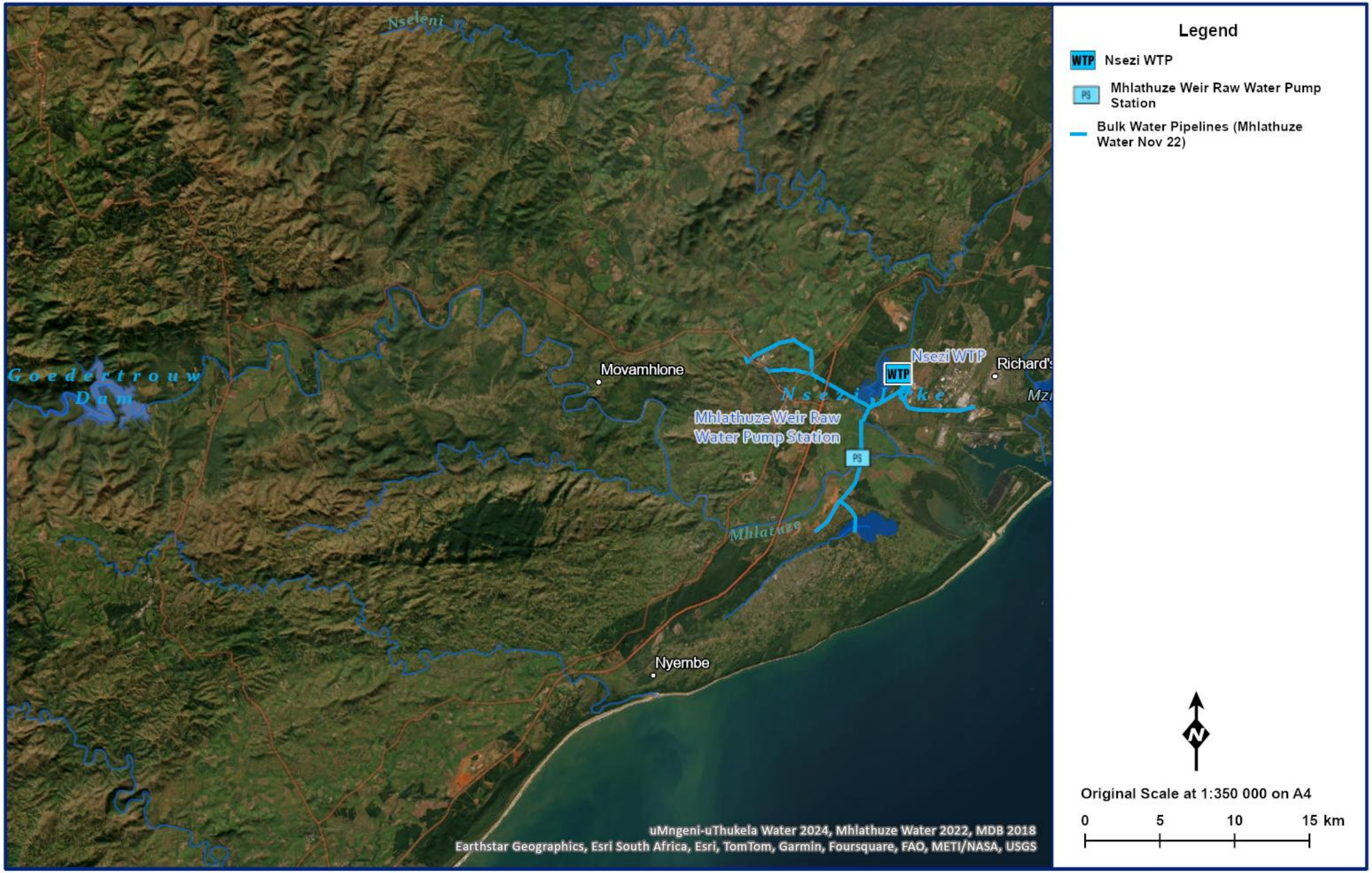

Figure 16.29 Nsezi Supply System.

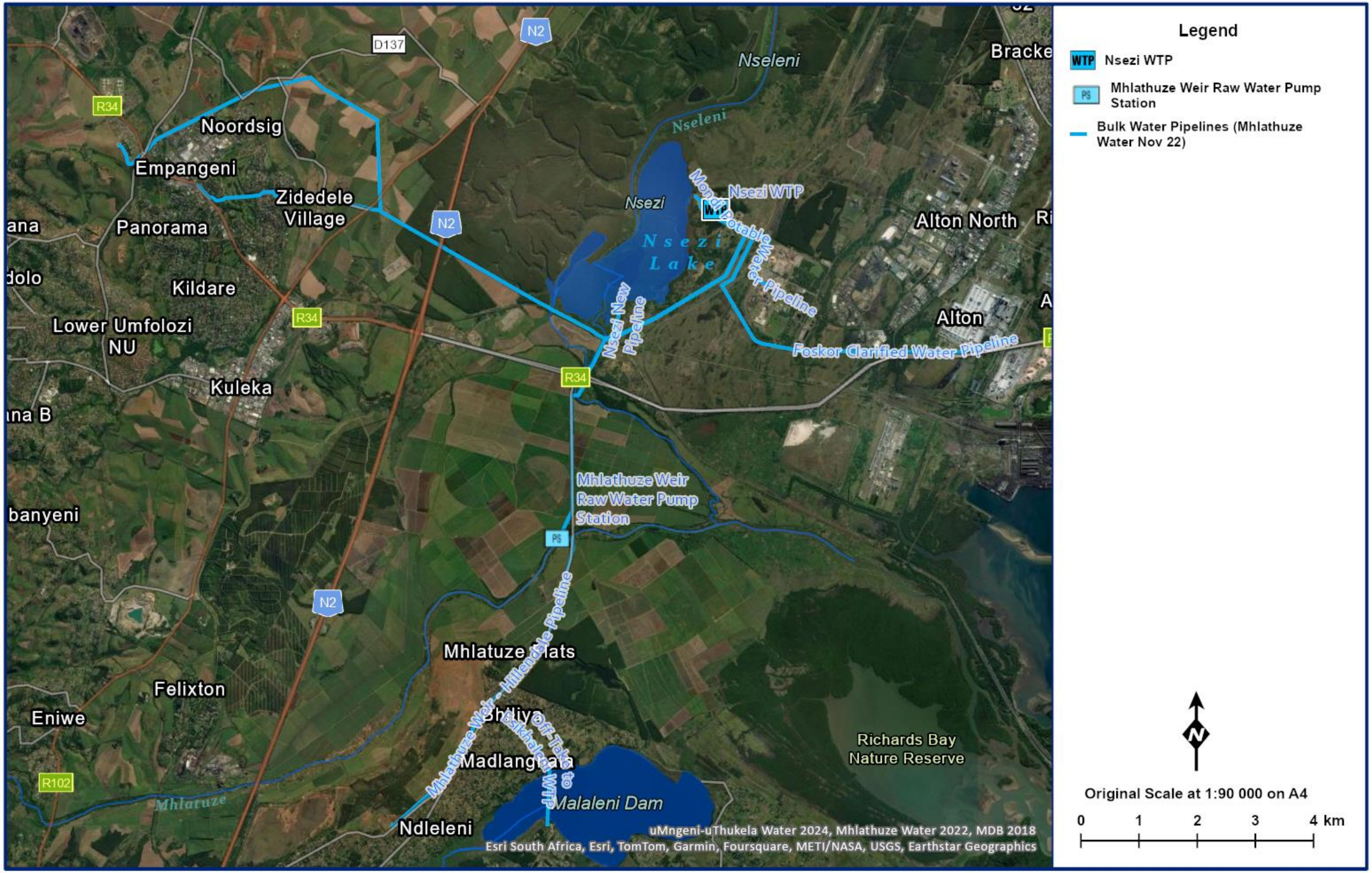

Figure 16.30 Mhlathuze Weir to Nsezi WTP.

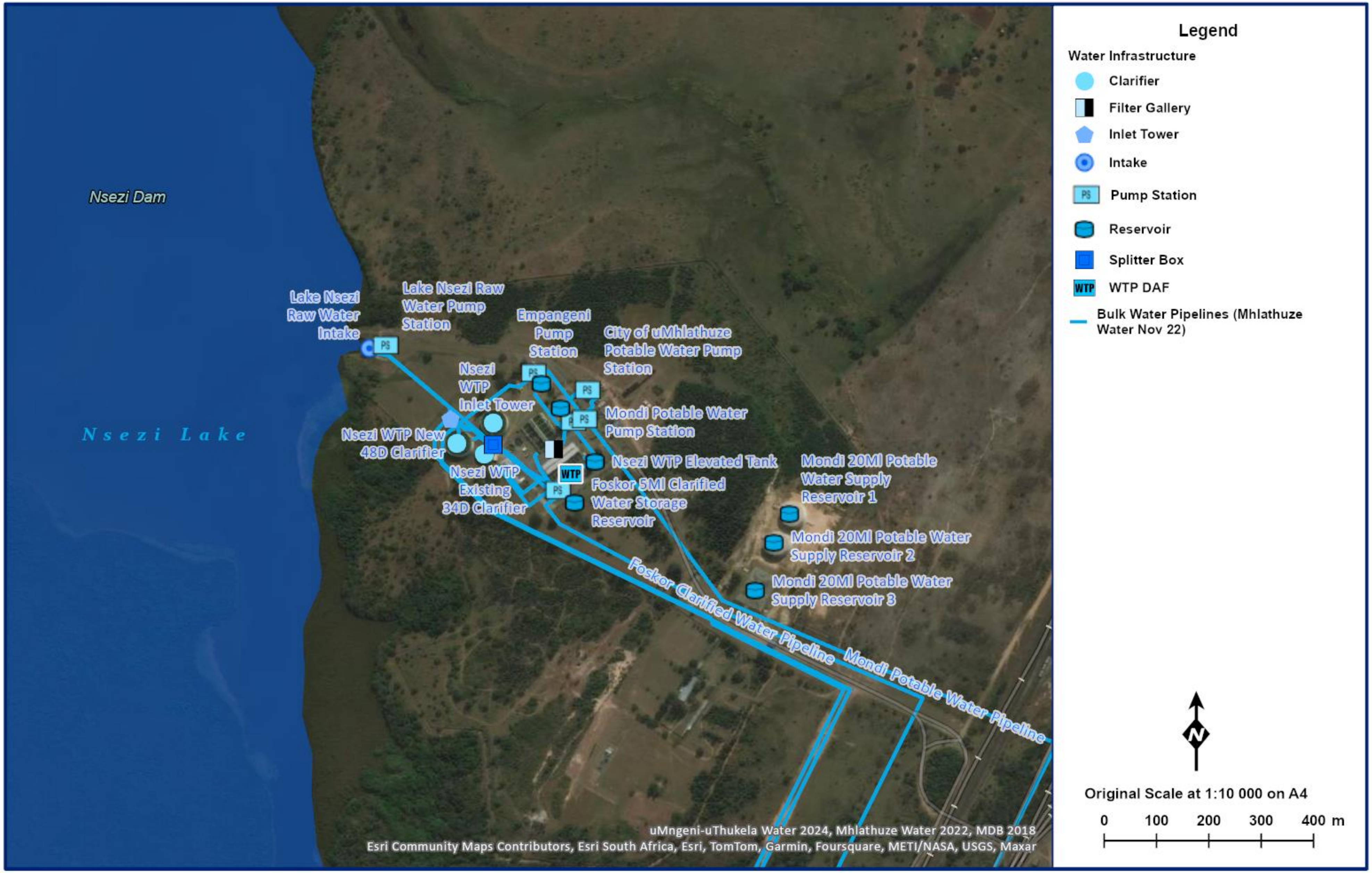

Figure 16.31 Nsezi WTP.

Figure 16.32 Nsezi WTP (27 March 2025).

Nsezi WTP was constructed to supply bulk water to both industrial and domestic users. The design capacity of the plant is currently being upgraded to 94.9 million m^3/annum (260Mℓ/day) from the current 74.8 million m^3/annum (205Mℓ/day) and it operates on a dissolved air flotation principle.

The WTP comprises a raw water system from Mhlathuze Weir (or alternatively from Lake Nsezi) chemical dosing, pre-settling, flocculation, flotation cells, rapid gravity filters, disinfection, four pump stations and five purified water storage reservoirs. The following storage capacity is available:

- 6Mℓ – storage/distribution on-site reservoir
- 3Mℓ – Mhlathuze City Empangeni supply reservoir
- 3No of 20Mℓ – Mondi Supply Reservoirs
- 5Mℓ – Clarified storage reservoir for Foskor at the WTW

Pump Stations to supply the main bulk customers are located at the Nsezi WTW and include:
- Mondi Pump Station
- Foskor Clarified Water Pump Station
- Empangeni Pump Station
- City of uMhlathuze Pump Station

The following four pipelines supply bulk water to main consumers:

- 800 ND rising main delivering treated water to the CoU
- 2 x 900 ND gravity main delivering treated water to Mondi
- 800 ND rising main delivering treated water to Empangeni Town
- 600 ND rising main delivering clarified water to Foskor.

The Nsezi WTP Supply System is shown in **Figure 16.26** and details of the WTP are shown in **Table 16.36**.

The reservoir, pump station and pipeline details are summarised in **Table 16.37**, **Table 16.38** and **Table 16.39**.

Mhlathuze Weir
Mhlathuze Weir, with a rated capacity of approximately 2.7 m^3/s (233 Mℓ/day), consists of diversion flumes at the weir, a pump station and rising main. The original weir was constructed in 1983, but was damaged during the October 1985 floods and repairs were then undertaken. In September 1987 the original 1983 weir, that incorporated a low-level bridge structure over the crest, was largely washed away by a flood recorded as the largest measured historical event. The weir was reconstructed without the bridge and with new sheet piling upstream and downstream to replace the original sheet piles where these were washed away.

In March 2017, a new Mhlathuze Weir Structure was commissioned that included:

- New weir structure and new inlet channel
- Stabilisation of the new structure and construction of a fishway/ladder
- Incorporation of a DWS flow gauging station
- Provide a safe crossing for vehicles and stabilise the river bed and both banks

By replacing the old weir structure and providing a strengthened and more stable weir, the project prolonged the life of a critical asset that is used to transfer raw water to the Nsezi WTP. The Completion Certificate for the above work was issued on 23 January 2020. Further details are in the Mhlathuze Water – Mhlathuze Weir Completion Report dated June 2020. To increase the security of raw water supply to the Nsezi WTP, a backup power supply was installed at the Mhlathuze Weir in the form of a standby diesel generator. Raw water is also pumped from the Mhlathuze Weir to the Hillendale and Fairbreeze Mines with an offtake to enable augmentation of the Esikhaleni WTP. Another recent project has involved upgrading the existing 1200mm diameter pipeline from the Mhlathuze Weir to the Nsezi offtake (shooting range) to a 1500mm diameter continuously welded mild steel pipeline.

Table 16.36 Characteristics of the Nsezi WTP

WTP Name:	Nsezi WTP
System:	Nsezi Bulk Supply System
Maximum Design Capacity:	204 Mℓ/day
Current Utilisation (July 2024):	205 Mℓ/day
Raw Water Storage Capacity:	Lake Nsezi, Mhlthuze River, Goedertrouw system
Raw Water Supply Capacity:	333 Mℓ/day
Pre-Oxidation Type:	Unknown
Primary Water Pre-Treatment Chemical:	Unknown
Total Coagulant Dosing Capacity:	Alum and Polyelectrolyte
Rapid Mixing Method:	Concrete Flash mixing chamber & Flocculation conditioning
Clarifier Type:	1 no's 34 m dia , 2 no's 48 m dia
Number of Clarifiers:	3No's
Total Area of all Clarifiers:	3970 sqm
Total Capacity of Clarifiers:	210 Mℓ/day
Filter Type:	Degramont V type – Rapid Gravity
Number of Filters:	12 filters
Filter Floor Type	Unknown
Total Filtration Area of all Filters	17.5 m x 8 m x 12 No's = 1680 sqm
Total Filtration Design Capacity of all Filters:	202 Mℓ/day
Total Capacity of Backwash Water Tanks:	Unknown
Total Capacity of Sludge Treatment Plant:	Unknown
Capacity of Used Washwater System:	Unknown
Primary Post Disinfection Type:	Chlorine Gas and Caustic Soda
Disinfection Dosing Capacity:	Unknown
Disinfectant Storage Capacity:	Unknown
Total Treated Water Storage Capacity:	Unknown

Table 16.37 Pump Details: Nsezi WTP Supply

System	Pump Station Name	Number of Pumps		Pump Description	Supply From	Supply To	Static Head (m)	Duty Head (m)	Duty Capacity (Mℓ/day)
		Number of Duty Pumps	Number of Standby Pumps						
uMhlathuze	Empangeni	2	1		Nsezi	Empangeni/Hillview	120	158	52

Table 16.38 Pipeline Details: Nsezi WTP Supply

System	Pipeline Name	From	To	Length (km)	Nominal Diameter (mm)	Material	Capacity (Mℓ/day)	Age (years)
uMhlathuze	Mandlazini Supply	Nsezi WTP	Pierce Cres. Res.	5.7/1.8	800/600	Steel	65/37	tbc
uMhlathuze	Empangeni Supply	T-off	Hilltop Res.	1.5	600	Steel	37	tbc

Table 16.39 Reservoir Details: Nsezi WTP Supply

System	Reservoir Site	Reservoir Name	Capacity (Mℓ)	Function	TWL (m ASL)	FL (m ASL)
uMhlathuze	Hilltop	Hilltop Reservoir	60	Distribution	135	130

(i)Mzingazi Water Treatment Plant and Supply System (CoU)

Mzingazi WTP (**Figure 16.33**) has a capacity of 65 Mℓ/day. Raw water is abstracted from Lake Mzingazi, which is then treated and distributed into Richards Bay and the industrial areas. The industrial area within the city of Richards Bay includes the Alton area, where Mondi, Hillside and Bayside Aluminium and Foskor are located. The residential suburbs include Meerensee, Arboretum and Veld en Vlei and the commercial/ light-industrial centre. Both residential and commercial / light industry, are supplied from the Mzingazi WTP, and supplemented, when necessary, from the Nsezi WTP. The rural town of Nseleni is also supplied via this scheme.

Mzingazi WTP supplies two command reservoirs, namely Mandlazini and Meerensee Reservoirs.

The Mzingazi WTP Supply System is shown in **Figure 16.26** and details of the WTP is shown in **Table 16.40**.

The reservoir, pump station and pipeline details are summarised in **Table 16.41**, **Table 16.42** and **Table 16.43**.

Figure 16.33 Mzingazi WTP

Table 16.40 Characteristics of the Mzingazi WTP

WTP Name:	Mzingazi WTP
System:	Mzingazi Bulk Supply System
Maximum Design Capacity:	65 Mℓ/day
Current Utilisation (January 2024):	Unknown
Raw Water Storage Capacity:	Mzingazi Lake 164 sq/km - 47.6 million cubic meters
Raw Water Supply Capacity:	The estimated duty of the existing pumps are 1300m³/h at a head of 13.5m per pump (3 pumps)
Pre-Oxidation Type:	Unknown
Primary Water Pre-Treatment Chemical:	Lime Dosing & Pre-chlorination
Total Coagulant Dosing Capacity:	Unknown
Rapid Mixing Method:	Unknown
Clarifier Type:	N/A
Number of Clarifiers:	N/A
Total Area of all Clarifiers:	N/A
Total Capacity of Clarifiers:	N/A
Filter Type:	Rapid gravity (dual media)
Number of Filters:	8 Rapid Gravity filters
Filter Floor Type	False Floor
Total Filtration Area of all Filters	9m x 7.5 m x 8No's = 67.5 sqm. each
Total Filtration Design Capacity of all Filters:	36 Mℓ/day
Total Capacity of Backwash Water Tanks:	Unknown
Total Capacity of Sludge Treatment Plant:	Unknown
Capacity of Used Washwater System:	Unknown
Primary Post Disinfection Type:	Chlorine Gas
Disinfection Dosing Capacity:	Unknown
Disinfectant Storage Capacity:	Unknown
Total Treated Water Storage Capacity:	Mandlazini 2 x 47.5 Mℓ & Meerensee 1 x 10 Mℓ

Table 16.41 Pump Details: Mzingazi WTP Supply

System	Pump Station Name	Number of Pumps		Pump Description	Supply From	Supply To	Static Head (m)	Duty Head (m)	Duty Capacity (Mℓ/day)
		Number of Duty Pumps	Number of Standby Pumps						
uMhlathuze	Mandlazini	4	1	Samco Vertical turbine	Mzingazi WTP	Mandlazini Res.	54	60	27.7
uMhlathuze	Meerensee	2	1	Samco Vertical turbine	Mzingazi WTP	Meerensee Res	72	67	23.3

Table 16.42 Pipeline Details: Mzingazi WTP Supply

System	Pipeline Name	From	To	Length (km)	Nominal Diameter (mm)	Material	Capacity (Mℓ/day)	Age (years)
uMhlathuze	Meerensee Pipeline	Mzingazi WTP	Meerensee Res.	3.2	400	Steel	16.3	Unknown
uMhlathuze	Mandlazini Pipeline	Mzingazi WTP	Mandlazini Res.	6.1	600	Steel	36.7	Unknown

Table 16.43 Reservoir Details: Mzingazi WTP Supply

System	Reservoir Site	Reservoir Name	Capacity (Mℓ)	Function	TWL (m ASL)	FL (m ASL)
uMhlathuze	Meerensee	Meerensee	10	Distribution	51	47
uMhlathuze	Mandlazini	Mandlazini	95	Distribution	67	62

16.3.2 Status Quo and Limitations of the uMhlathuze System

(a) Nkandla Water Treatment Plant and Supply System

The WTP is currently operating at 3.36 Mℓ/day as at June 2024 (**Figure 16.34**), which is within its design treatment capacity (3.6 Mℓ/day). The demand in this area is now constrained by the WTP capacity. The existing bulk treated water supply capacity is not sufficient to meet future water requirements of the Nkandla Water Supply Scheme.

Apart from the Nkandla System, there are numerous boreholes, springs and minor river abstractions that serve the Nkandla Local Municipality. These standalone schemes do not have a sustainable supply and are also an operational challenge. There is a need to consolidate these schemes into a more sustainable bulk supply system. The population in the region is projected to be 128 694 by 2050 with a total demand of 24 Mℓ/day. The current Nkandla Supply System cannot meet this demand. A new resource will have to be developed to ensure a sustainable future supply. In addition, an assessment of the maximum potential yield from the existing resource should be established to evaluate the potential of upgrading the WTP.

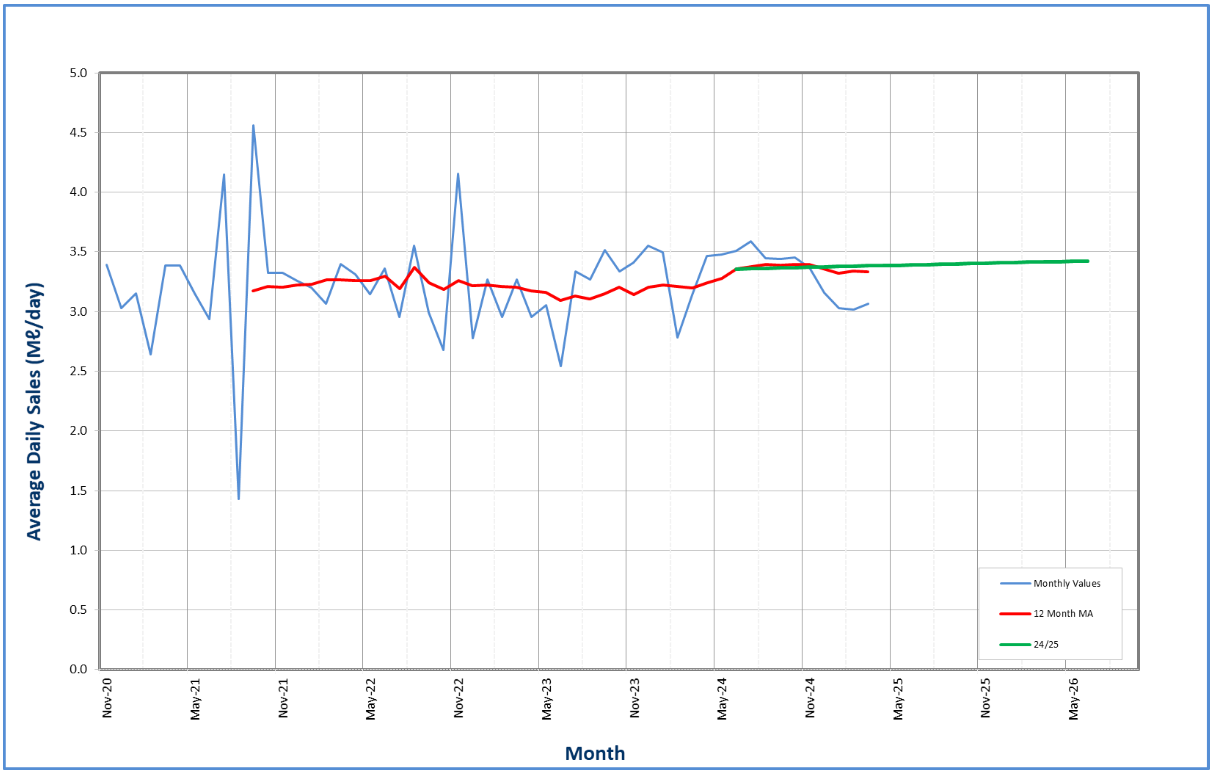

Figure 16.34 Water demand for Nkandla WTP

(b) Middledrift Water Treatment Plant and Supply System

The water treatment plant is operating at approximately 9.46 Mℓ/day as at June 2024 (**Figure 16.35**). The plant is approaching its capacity (10 Mℓ/day) and will need to be upgraded as some months it exceeds the design capacity. Supply to the WTP is heavily dependent on the operation of the uThukela-Goedertrouw Transfer Scheme. There is a need for a dedicated supply to this plant to alleviate this dependency. This will require new pump stations and a dedicated raw water pipeline. In addition, a formal water resource structure should be established to improve the assurance of raw water availability.

KCDM is in the process of implementing secondary bulk infrastructure that relies on supply from this water treatment plant. As the supply increases, there will be a need to upgrade the bulk supply infrastructure and treatment capacity. The population in the region is projected to be 106 063 in 2050 with a total demand of 19.71 Mℓ/day.

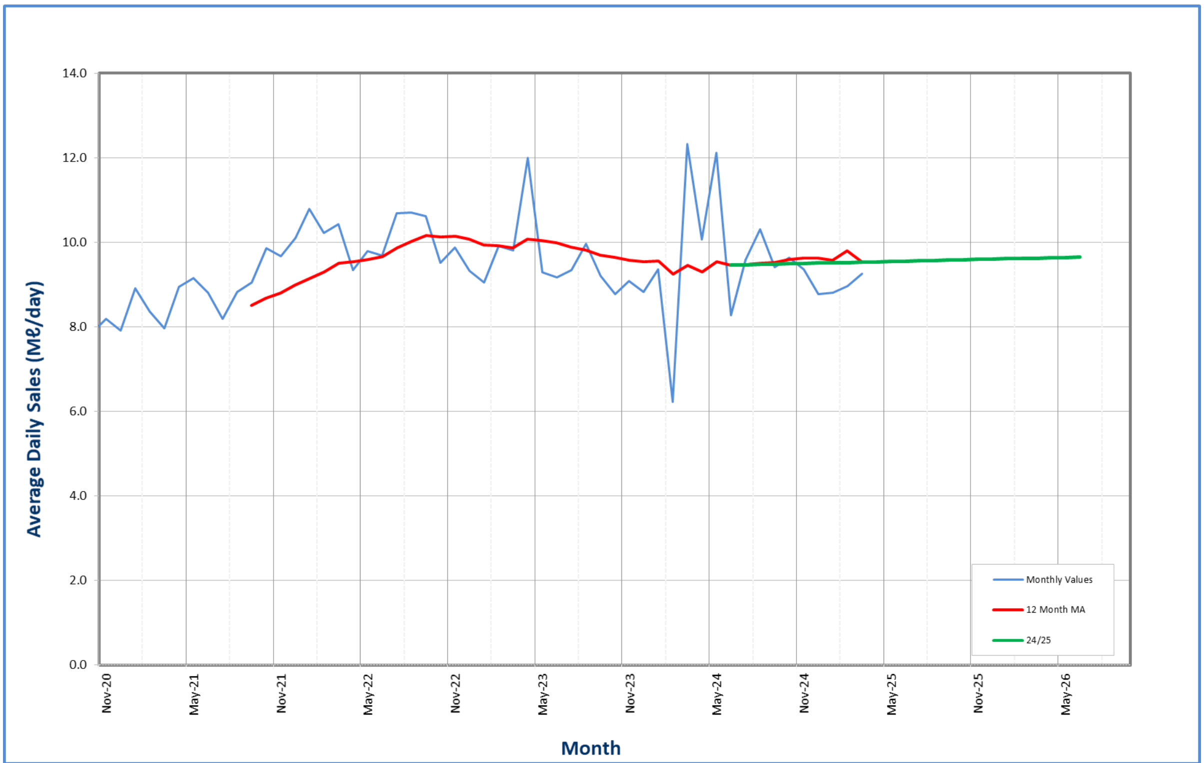

Figure 16.35 Water demand for Middledrift WTP

(c) Greater Mthonjaneni Water Treatment Plant and Supply System

The current utilisation of the plant is 20.43 Mℓ/day as at June 2024 (**Figure 16.36**). The plant is approaching its capacity and will need to be upgraded. KCDM have appointed a PSP to upgrade the plant in phases to its maximum capacity of 80 Mℓ/day. The first phase, which will take the capacity to 40 Mℓ/day, is being designed and construction will likely be completed by 2026.

The Goedertrouw Supply System has three bulk supply zones which includes Mthonjaneni, Kwahlokohloko and Eshowe. Mthonjaneni to the north is expected to have a population of 113 317 in 2050 with a total demand of 22.02 Mℓ/day. The bulk infrastructure for this system is currently being completed in order to ensure that the 2050 water demand is met.

The supply to the south is to Kwahlokohloko. The Kwahlokohloko Water Supply area is supplied by the Mpungose command reservoir which gets its potable water from Greater Mthonjaneni WTP. The scheme has a number of smaller schemes abstracting from run-of-river abstractions (e.g. Gingindlovu Water Supply Scheme) or from boreholes. The scheme supplies a rudimentary level of service. There are plans (currently at design phase and some at construction phase) to develop a bulk supply system from Greater Mthonjaneni WTP into Kwahlokohloko and further on to Eshowe and Gingindlovu.

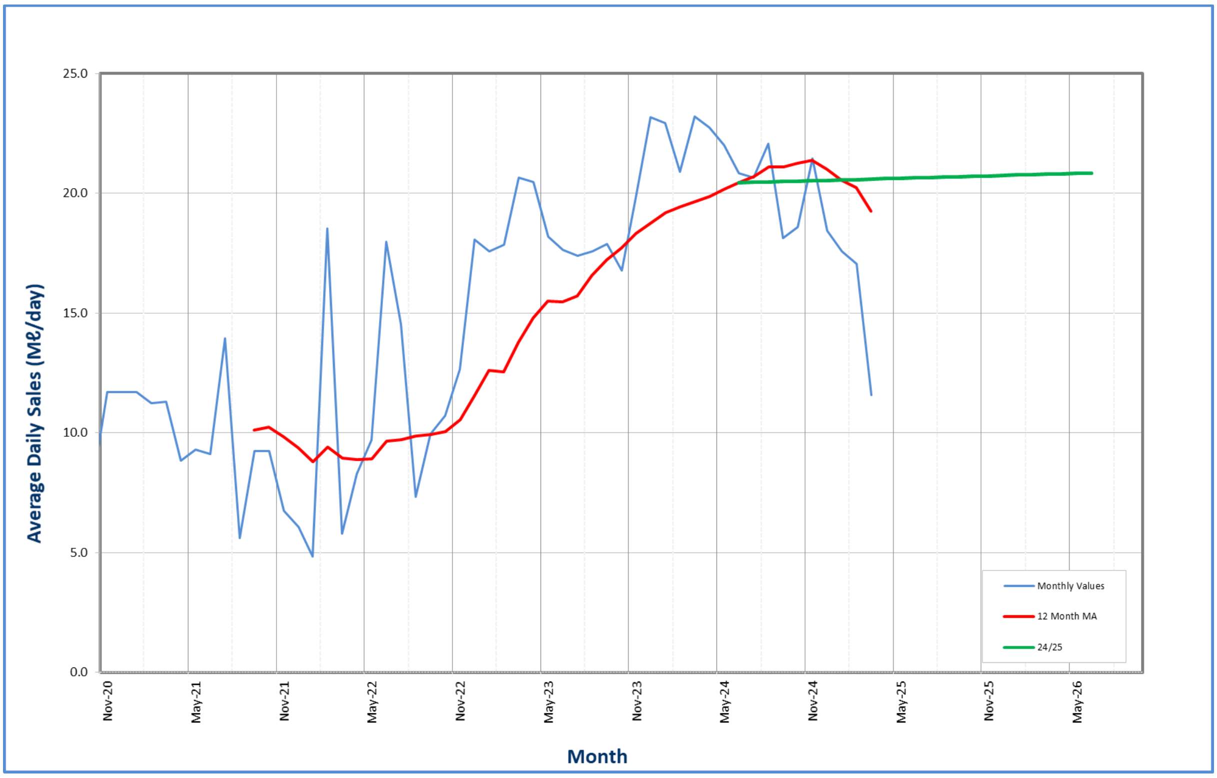

Figure 16.36 Water demand for Greater Mthonjaneni WTP

(d) Eshowe Water Treatment Plant and Supply System

The water treatment plant at June 2024, was operating at approximately 1.8 Mℓ/day (**Figure 16.37**) and the usage as at March 2025 was 3.93 Ml/day. The Universal Access Plan Phase 3 for KCDM reported that the plant has a design capacity of approximately 6.9 Mℓ/day. The existing raw water abstraction works, including the raw water pumps, have sufficient capacity to meet the hydraulic design requirements of the existing WTP. Eshowe WTP also receives 9.9 Mℓ/day potable water from

Greater Mthonjaneni WTP via a 300mm diameter pipeline. Represented below is the combined demand at the plant.

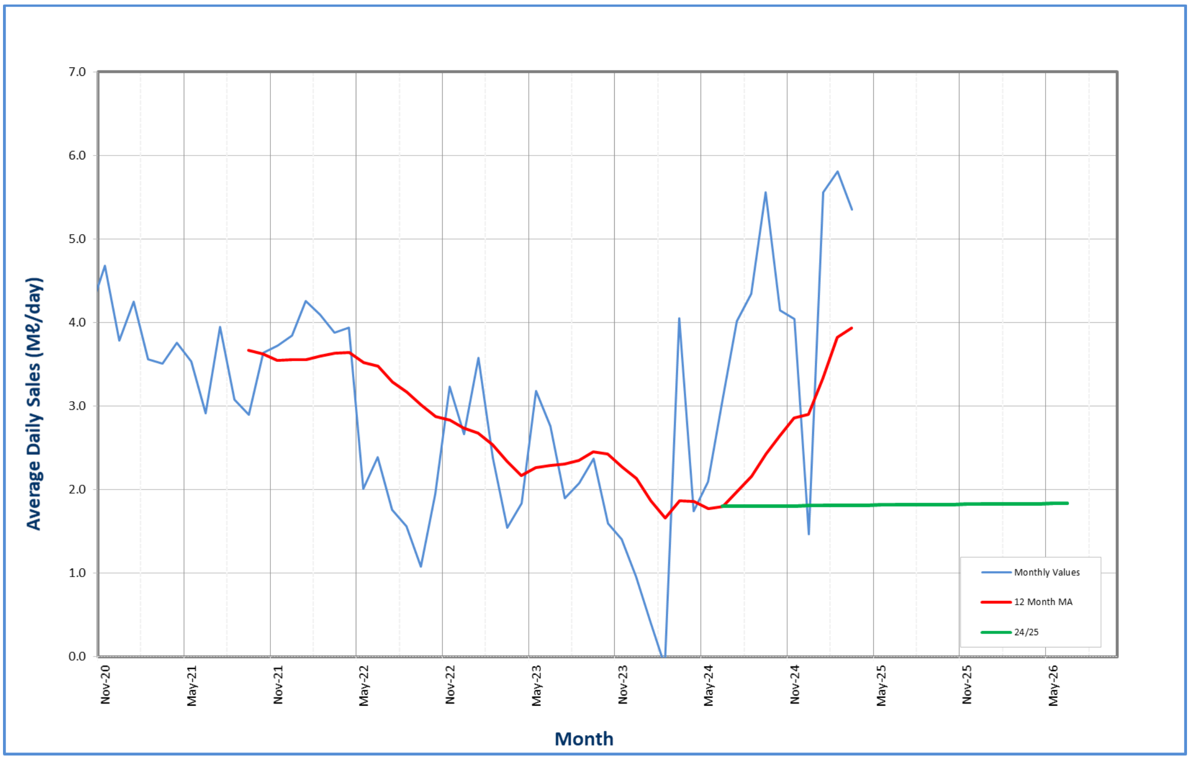

Figure 16.37 Water demand for Eshowe WTP

(e) City of uMhlathuze Bulk Water Supply

The WTP's in CoU are integrated and a review of the sustainable approach to bulk water supply in CoU suggests that a more optimum usage of the plants are required. This is also guided by the depletion of some of the lakes. The existing WTPs were used as the basis to establishing future water supply arrangements.

CoU currently has four (4) WTPs that are considered to be in operating condition. Nsezi WTP serves as a redundancy to Mzingazi WTP and Ngwelezane WTP by supplementing the Northern and Western areas when required. During the drought in 2015, the low water levels in Lake Mzingazi, Lake Nsezi and Lake Chubu resulted in the Nsezi WTP being used to serve the aforementioned resources' supply areas. This, in reality, meant the plants were being operated as one scheme.

The Nsezi WTP is operating at 141.3 Mℓ/day (as at June 2024) on average. This is 95% of its capacity. There is an urgent need to upgrade the plant to reduce the risk of non-supply. This plant is a key supply to the region and serves as a back up to supply the Mzingazi Supply System which carries the risk of an erratic supply from Lake Mzingazi.

The draft Water and Waste Water Master Plan by Mhlathuze Water (2016), lists various WTP scenarios for future potable water supply to CoU based on the aforementioned relationships between the existing WTPs. These scenarios are listed in **Table 16.44.**

Table 16.44 WTP Scenarios in CoU

Scenario	Water Treatment Plant
Scenario A	▪ Nsezi WTP (Lake Nsezi supplemented by uMhlathuze Weir)
Scenario B	▪ Nsezi WTP (Lake Nsezi supplemented by uMhlathuze Weir) ▪ eSikhaleni WTP (Lake Chubu supplemented by uMhlathuze Weir)
Scenario C	▪ Nsezi WTP (Lake Nsezi supplemented by uMhlathuze Weir) ▪ Mzingazi WTP (Lake Mzingazi) ▪ eSikhaleni WTP (Lake Chubu supplemented by uMhlathuze Weir)
Scenario D (Status Quo)	▪ Nsezi WTP (Lake Nsezi supplemented by uMhlathuze Weir) ▪ Mzingazi WTP (Lake Mzingazi) ▪ eSikhaleni WTP (Lake Chubu supplemented by uMhlathuze Weir) ▪ Ngwelazane WTP (uMhlathuze River)

Scenario B is considered the most likely option (UUW 2016 : 42). This scenario dictates the suggested upgrades that will be required.

(f) Ngwelezane Water Treatment Plant and Supply System

The existing treatment capacity of the Ngwelezane WTP is 8 Mℓ/day and is supplied from the uMhlathuze River. The current operation of this plant is 8.96 Mℓ/day (CoU IWA water balance spreadsheet, June 2024). This is well above its design capacity and optimal operating capacity.

Ngwelezane WTP is very old and is experiencing many operational problems which, apart from operating above its design capacity, has the following challenges:

- Low water levels in the river resulting in insufficient flow to the intake tower;
- Variable sand and silt levels in the river. This not only results in problems at the abstraction but high turbidity levels at the plant;
- Pump damage during flooding.

Given the age of the works and the relatively small amount of water it supplies, the plans by CoU is to decommission the works and supply this system from the Nsezi WTP. There are inter-connections between these systems that will allow a quick change to introduce this operational regime. The load transfer is, however, dependant on the upgrade of the treatment capacity of the Nsezi WTP.

Alternatively, the Ngwelezane WTP can be upgraded to 20 Mℓ/day and the bulk conveyance and storage infrastructure can also be upgraded to ensure that the current and future demands are met.

(g) eSikhaleni Water Treatment Plant and Supply System

The current treatment capacity of the eSikhaleni WTP is 36 Mℓ/day. The current operation of this plant is 10.38 Mℓ/day (CoU IWA water balance spreadsheet, June 2023) which is 29 % of its maximum operating capacity.

After consolidation of the WTPs, eSikhaleni WTP will supply the northern and western areas of CoU. There is no redundancy for good operating practices such as taking filters offline for cleaning.

The plant relies on Lake Chubu, augmented by a supply from the uMhlathuze River at the Weir. There is an increased reliance on the uMhlathuze weir. This has resulted in an increased cost to produce potable water due to the pumping required.

The plant supplies the eastern portion of KCDM and the ideal solution is to load-shed this zone onto a different supply system.

(h) Nsezi Water Treatment Plant and Supply System

The current treatment capacity of the Nsezi WTP is 205 Mℓ/day. The Nsezi WTP is operating at an average of 141 Mℓ/day which is 69 % of its maximum design capacity and is below the optimal operating capacity. The demand growth has been estimated at 1% per annum and is illustrated in **Figure 16.38**. The Nsezi WTP produces potable water for Richards Bay, Empangeni, Mondi and supplies clarified water to Foscor. **Figure 16.39** and **Figure 16.40** illustrate the average daily supply of the two varients of water supplied by the WTP over the past year.

After consolidation of the WTPs, Nsezi WTP will supply the southern areas of CoU. The Ngwelezane, eSikhaleni and Mzingazi Water Treatment Plant Supply zones are planned to eventually be supplied from Nsezi WTP. The long term demand is anticipated to be approximately 240 Mℓ/day. Included in this estimate is the supply of 90 Mℓ/day and 21 Mℓ/day to Mondi and Foskor respectively. Richards Bay Minerals utilises raw water and is excluded from these demands. This should, however, need to be considered in the resource calculations.

Nsezi is a key water treatment plant in the supply of potable water to CoU. The resource to supply this plant with adequate raw water is critical. The primary supply is from the uMhlathuze weir with the assurance of supply from Goedertrouw Dam via controlled releases. This, however, is not enough to meet the long term demands and other resources are required to augment supply to the plant. The resource options are discussed in the recommended projects section of this report. (**Section 16.5.1)**)

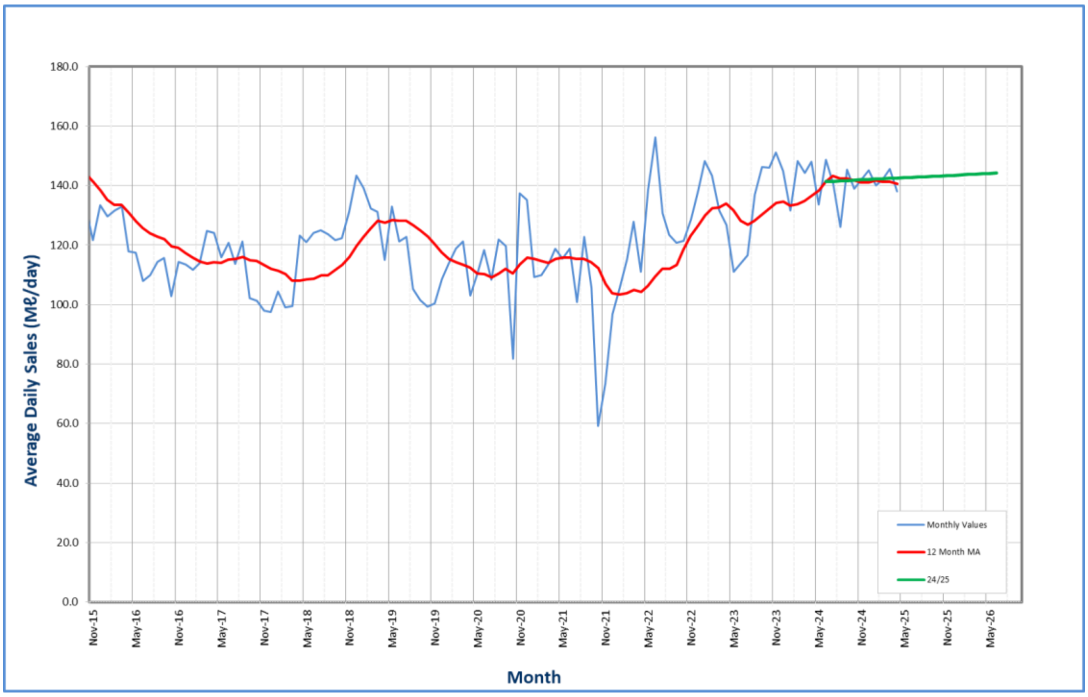

Figure 16.38 Water demand for Nsezi WTP (Potable and Clarified Water only)

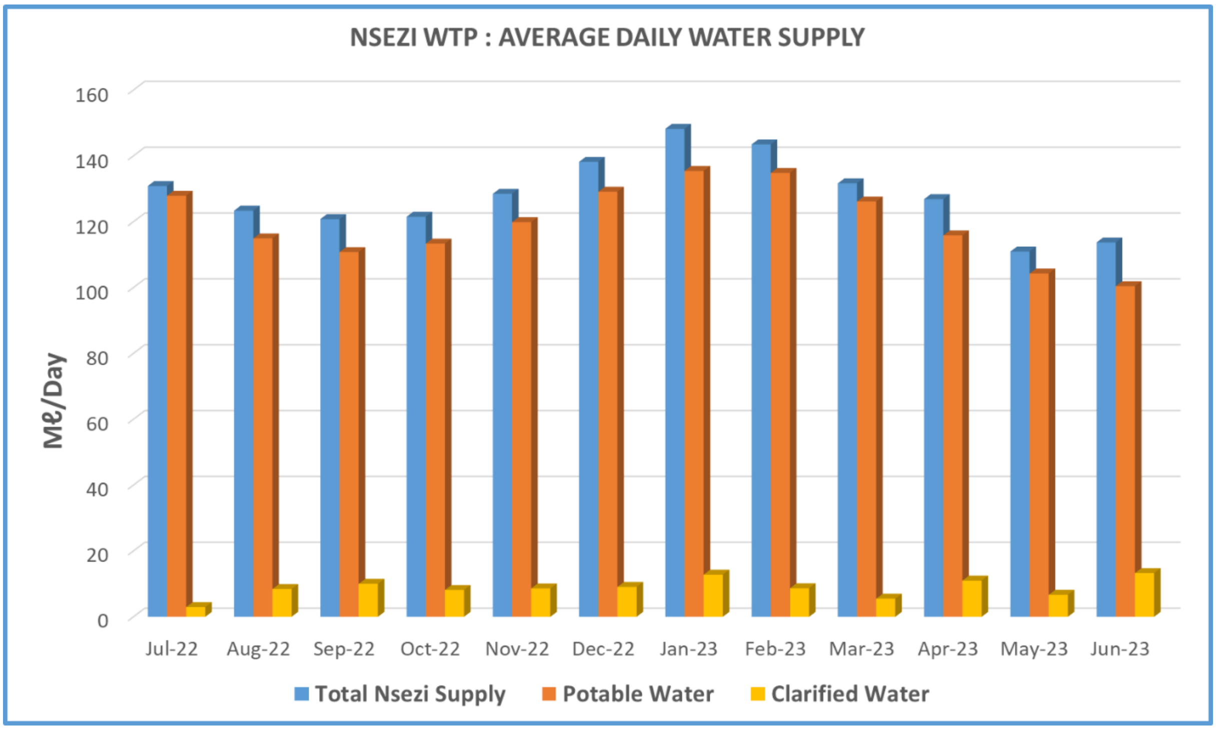

Figure 16.39 Average Water Supply from Nsezi WTP

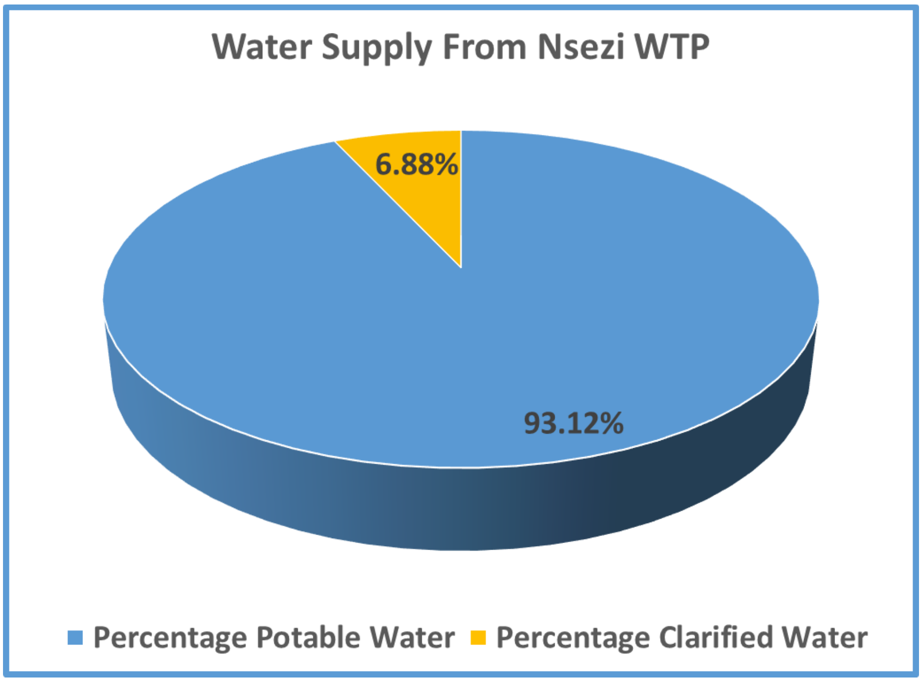

Figure 16.40 Average Daily Percentage Split on Potable and Clarified Water from Nsezi

(i)Mzingazi Water Treatment Plant and Supply System

The biggest concern with regards to the Mzingazi WTP is the supply of raw water from Lake Mzingazi. During droughts, the lake level drops, resulting in very little or no water flow to the intake tower. This has an impact on the treatment capacity of the works. Historical figures indicate a reduction in production to zero. This occurred during the drought of 2011/12 and has since occurred more frequently. This has resulted in an increased reliance on supply from Nsezi WTP.

When there is sufficient supply from Lake Mzingazi, raw water from Lake Mzingazi (HFY of 10.5 million m^3/annum or 28.77 Mℓ/day) is abstracted and is treated at the Mzingazi WTP for distribution into Richards Bay and the Industrial areas. The Mzingazi WTP has an existing treatment capacity of 65 Mℓ/day and cannot be upgraded in future due to the Historic Firm Yield of Lake Mzingazi that restricts the allocation to 28.77 Mℓ/day.

Because there is a low assurance of raw water supply to the plant, any upgrades to this plant is not prudent. Ultimately, this supply zone will be permanently supplied from Nsezi WTP.

16.4 Water Balance/Availability

The Department of Water and Sanitation completed a Reconcilation Strategy study for Richards Bay and surrounding towns (DWS, 2021). Theafter, DWS commissioned a project to update, evaluate update and monitor the progress of the implementation of the Strategy. Results from the final report of the project are shown below (**Figure 16.41**). The reconciliation strategy study compares demand growth projections with available water resources and provides potential intervention options where the demand exceeds available supply. Key findings from the 2021 and updated studies include the following:

- The combined firm yield of the Eshlazi and Rutledge Park Dams is 1.29 million m^3/annum (3.53 Ml/day). Supply from these dams, including transfers from the Greater Mthonjaneni WTP, is sufficient to meet the current demand.
- Existing resources at Mtunzini are sufficient to meet the demand.
- The towns of Gingindlovu and Melmoth are not supplied at a satisfactory level of assurance.
- The actual water use in the uMhlathuze System has been less than the projections in the DWS (2021) study. The existing water resources in the uMhlathuze System, are currently insufficient to meet the demand at a satisfactory assurance of supply.
- Two key interventions, *viz.* improved operational efficiency, as well as completion of the uThukela-Goedertrouw Transfer Scheme (additional 33 million m^3/annum) are expected to ensure that demands are met until 2030.
- Thereafter, raising Goedertrouw Dam by 2.8 m (additional 5.8 million m^3/annum) should be considered.
- There is also an option to develop new water resources infrastructure through assessing to potential to build a dam on the Nseleni River and an off-channel dam on the Mfolozi River.

It is important to note that the scenario in **Figure 16.41** includes (i) increasing the capacity of the Greater Mthonjaneni WTP to 80 Ml/d from 2040 onwards, as well as (ii) water transfer from the Mfolozi River (Mpukunyoni) growing from 5 million m^3 to 10 million m^3 between 2030 and 2038. In addition, this scenario includes implementation of water conservation and water demand management measures.

The Goedetrouw Dam storage level has been relatively high over the last four years due to good rains, and the system has been able to meet current demand. However, this clearly shows that available resources cannot sustainably meet demand. Therefore, it is important that the next supply intervention, i.e. the uThukela-Goedertrouw Water Transfer upgrade project, be completed.

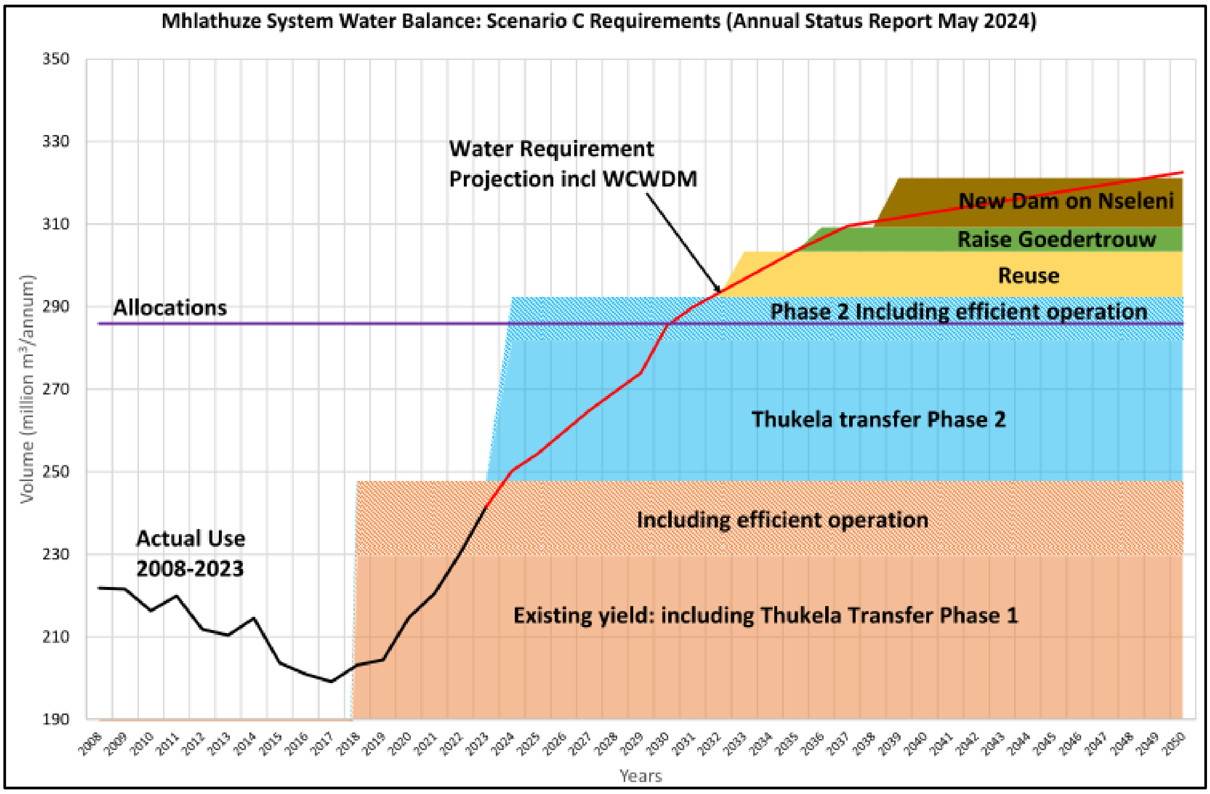

Figure 16.41 uMhlathuze System Balance for a moderate growth scenario.

16.5 Recommendations for the uMhlathuze System

16.5.1 System Components

(a) Nkandla Water Treatment Plant and Bulk Water Supply System

An upgrade of this system may be constrained by its run-of-river abstraction nature, where the assurance of supply, particularly during the dry season, cannot be assured as there is no storage facility. There is also limited physical space to expand the water treatment plant. There are numerous standalone schemes and small treatment plants within the Nkandla municipal area and a regional scheme is needed to consolidate these schemes.

The Universal Access Plan Phase III (UUW, 2021) recommended the establishment of a new dam on the Nsuze River. Further investigation into the potential site dam, as well as the potential yield of the proposed Nsuze Dam is recommended as the current abstraction is insufficient to meet the water requirements for all the water users in the future. A new proposed Nsuze WTP (20 Mℓ/day) would be linked to the Nsuze Dam by a bulk pipeline. It is also recommended that a new pump station at the Nsuze WTP be constructed. Both the existing primary, secondary and tertiary bulk pipelines and storage will have to be augmented in order to ensure that the current and future demand for the Nkandla supply area can be met.

(b) Middledrift Water Treatment Plant and Supply System

The Middledrift Regional Water Supply Scheme area is supplied from the uThukela-Goedertrouw Water Transfer scheme abstraction works downstream of the uThukela-Nsuze confluence. The uThukela-Goedertrouw Transfer Scheme Pipeline has a diameter of 1.5 m and raw water is pumped from the uThukela River to a tributary of the uMhlathuze River, above Goedertrouw Dam. Operationally, it is preferred that there is a dedicated supply to the treatment plant so that there is no conflict with the uThukela-Goedertrouw Transfer Scheme's operational regime.

The uThukela-Goedertrouw Transfer Scheme is undergoing a capacity upgrade and an additional 1.0 m^3/s will then be pumped to the Goedertrouw Dam through the transfer scheme. The capacity upgrade includes the installation of additional river abstraction pumps, the construction of a parallel de-sanding works, parallel high lift pump stations and a parallel rising main from the second high lift pump station to the Mvuzane stream which feeds Goedertrouw Dam.

In order to meet the future demand, the existing Middledrift WTP will have to be upgraded to 19 Mℓ/day. It is also necessary to upgrade and extend both the existing secondary and tertiary bulk pipelines storage infrastructure. The existing pump station at Middledrift WTP, that pumps water to the Command Reservoir, will also have to be upgraded.

(c) Greater Mthonjaneni Water Treatment Plant and Supply System

To meet the future 80 Mℓ/day demand, the WTP should be upgraded by 60 Mℓ/day to a total capacity of 80 Mℓ/day. These upgrades should be implemented incrementally in 20 Mℓ/day modules. The first phase is being designed and should be implemented as soon as possible so that it can supply Kwahlokohloko and Mthonjaneni. The bulk infrastructure to Kwahlokohloko and Mthonjaneni is in place for the increased treatment requirements.

The Goedertrouw Dam will be able to support this upgrade as its assurance of supply will improve due to the capacity upgrade of the inter-basin transfer scheme from the uThukela River. The dam is a major source of water for the City of uMhlathuze through controlled releases for abstraction at uMhlathuze Weir. Two interventions are recommended:

- Increasing the capacity of the inter-basin transfer scheme from 100 Mℓ/day to 200 Mℓ/day, which is currently in construction; and
- Raising the Dam Wall. This involves a 2.8 m raising of the dam wall by building a concrete wave wall on the existing earthfill dam wall, and increasing the capacity of the spillway through a labyrinth spillway configuration (DWS, Reconciliation Strategy 2015).

The following infrastructure upgrades and augmentation will be required in order to adequately meet the current and future demand:

- Upgrade the existing Goedertrouw WTP to 80 Mℓ/day. Upgrades to be implemented incrementally in 20 Mℓ/day modules.
- Upgrade the existing primary and secondary bulk pipelines.
- Extend the existing secondary and tertiary bulk pipelines.
- Increase the existing primary, secondary, and tertiary storage.
- Increase pumping capacities of the existing pump stations.

- Add four (4) new pump stations – One (1) at Melmoth WTP, one (1) pump station at the Mfule River to pump to Nomponjwane WTP, one (1) pump station at the Nomponjwane WTP, and one (1) pump station at KwaMagwaza WTP.

(d) Eshowe Water Treatment Plant and Supply System

The current capacity (and efficiency) of the Eshowe WTP is insufficient to meet present day water demand. Raw water from the Rutledge Park Dam is limited and additional potable water should be supplied from the Greater Mthonjaneni WTP (Goedertrouw). In addition, the Eshowe WTP is characterised by aging infrastructure which requires maintenance and/or upgrade works. KCDM is considering decommissioning this plant and supply Eshowe from Greater Mthonjaneni WTP and the Lower Thukela Bulk Water Supply Scheme (See S**ection 16.5.2**). It is a possibility to supply Eshowe, Gingindlovu and Mtunzini by extending the Lower Thukela pipeline to feed into the Eshowe WTP clear wells. This will shift the demand from Goedertrouw Dam and, therefore, the uMhlathuze catchment.

UAP Phase 3 recommended that the Lower Thukela Bulk Water Supply Scheme be extended to transfer 55 Mℓ/day via a 60 km long, 1 000 mm diameter bulk pipeline to supply the Goedertrouw Regional Scheme (Eshowe, Kwahlokohloko and Mthonjaneni). This would shift the demand from the Goedertrouw WTP.

The following infrastructure upgrades and augmentation will be required in order to adequately meet the current and future demand:

- Upgrade the Eshowe WTP to 30 Mℓ/day or extend the Lower Thukela BWSS to feed into the Eshowe WTP clear wells.
- Upgrade the secondary bulk pipelines.
- Extend the secondary and tertiary bulk pipelines.
- Increase the existing primary, secondary and tertiary storage capacity.
- Upgrade the pump station at Matigulu River.

(e) Supply to CoU

Future configuration of water supply to the CoU is shown in **Figure 16.42**. With the potential consolidation of the WTP's, there is a need to review and develop further raw water resources. CoU commissioned a Water Recourses Study in 2020 and the following resource augmentations are mooted (CoU 2020: 31):

- Increased capacity of the uThukela-Goedertrouw Transfer Scheme.
- Kwesibomvu Dam on the Mfolozi River. Due to the very high ecological impacts that this scheme would have, it was regarded as preferable to consider an off-channel dam instead.
- Off-channel transfer scheme from the Mfolozi River.
- Nseleni Dam on the Nseleni River.
- uThukela-Mhlathuze Transfer Scheme.
- Desalination of seawater.
- Bulk effluent re-use.

Off channel storage dam: This would involve pumping from a weir on the Mfolozi River to an off-channel earthfill dam at the Nkatha Pan. The scheme would transfer water to Nsezi WTP and provide a regional water supply to Mtubatuba and other small towns.

The proposed use of only Nsezi WTP and eSikhaleni WTP, to meet 2035 potable water demands, means that the four (4) existing water schemes will have to be consolidated into two (2) future schemes, namely the Southern Scheme and Nsezi Scheme. The Southern Scheme boundary remains unchanged. The Nsezi Scheme is a consolidation of the existing Western, Empangeni and Northern Scheme.

According to the Mhlathuze Water Annual Report 2019/2020, Mhlathuze Water proposes alterations and additions to the existing Mhlathuze weir. The execution of which includes: new mass concrete ogee spillway; bulk earthworks; new inlet channel to existing pump station; installation of permanent sheet piles; construction of a fish ladder; stabilisation of riverbed and banks with excavation and the placement of riprap. The overall purpose of undertaking this exercise is to strengthen and stabilise the weir structure, thus prolonging useful life.

It is also proposed that a new 1 500mm diameter Raw Water Pipeline from Mhlathuze River to the Nsezi offtake be constructed. The project scope includes construction of a 1 500mm diameter, 3.98km long continuously welded mild steel pipeline. The overall purpose of undertaking this exercise is to upgrade the maximum abstraction capacity at the weir pump station from 205Mℓ/day to 265 Mℓ/day.

Mhlathuze Water also proposes to upgrade the Nsezi WTP from 205 Mℓ/day to 260Mℓ/day potable water capacity, of which 25Mℓ/day will be supplied to FOSKOR; the balance will be further treated by dissolved air flotation, rapid gravity filtration and disinfection to achieve an excellent water quality to satisfy the stringent requirements of MONDI for paper making and for potable water distribution. The project scope includes upgrading the inlet tower; two new 48m diameter Clariflocculators; four new Rapid Gravity Filters; new Dissolved Air Flotation; a new 2Mℓ Backwash Recovery Tank; a new Sand Trap and a new loading bay.

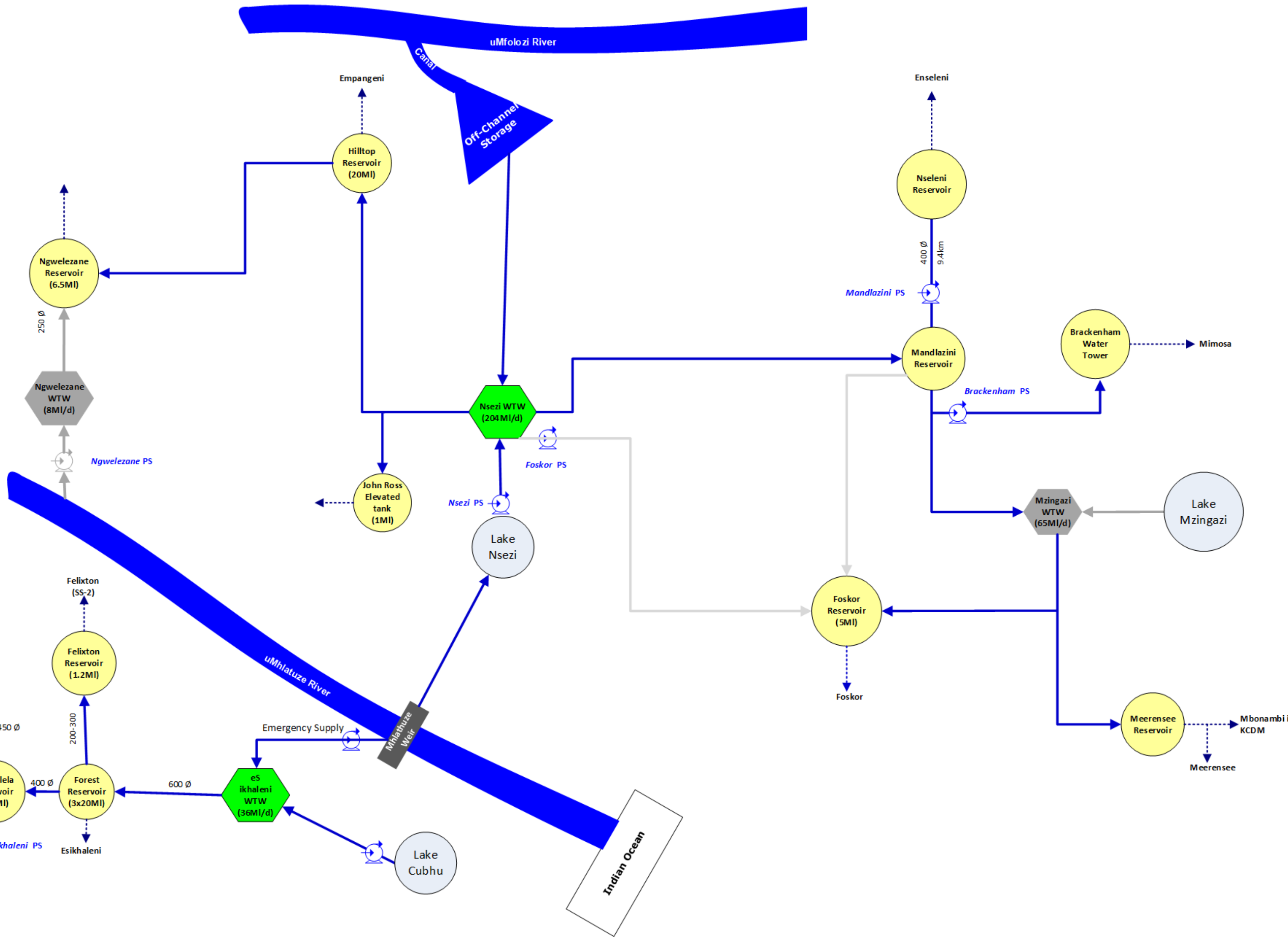

Figure 16.42 Future Bulk Scenario for CoU

(f) eSikhaleni Water Treatment Plant and Supply System

The existing design capacity for eSikhaleni WTP is 36 Mℓ/day. The potable water demand projected to 2050 is estimated at 51.64 Mℓ/day. There is thus a shortfall of 15.64 Mℓ/day of treatment capacity when comparing the future demand against the existing supply capacity. Lake Chubu is unlikely to meet this demand and given its dramatic reduction in yield, during droughts, abstraction from uMhathuuze Weir should become a permanent solution. This will require upgrades to the abstraction works, pumps and pipelines.

Forrest Reservoirs function as balancing and reticulation reservoirs. The storage capacities of the three (3) existing Forrest Reservoir Complex reservoirs (Res 11, Res 12, and Res 13) and the Felixton Reservoir (Res 9) is sufficient to meet the demand in 2050.

It is a possibility to supply the eSikhaleni supply system by extending the Lower Thukela pipeline to feed into the eSikhaleni WTP clear wells. This will shed the demand from Goedertrouw Dam and thus the uMhlathuze catchment. This option will be investigated in the LTBWSS Phase 3 Detailed Feasibility Study and Preliminary Design that is currently in progress by uMngeni-uThukela Water.

(g) Nsezi Water Treatment Plant and Supply System

Development of the uMfolozi off-channel dam is required to meet future resource deficits. For the future abstraction required from uMhlathuze Weir, an upgrade to the abstraction works and raw water pipelines is required.

The existing design capacity of Nsezi WTP is 204 Mℓ/day. An upgrade of 100 – 145 Mℓ/day will be required to meet the future demand for the Northern, Empangeni and Western Scheme. The upgrade will require the following:

- Upgrading of inlet tower;
- New 48 m diameter clarifier;
- Four new rapid gravity filters;
- New dissolved air flotation;
- New 2Mℓ backwash recovery tank;
- New sand trap;
- Sludge handling facility;
- New office and training facility.

At the time of writing, uMhlathuze Water has appointed a professional services provider to increase the treatment capacity by from 205Mℓ/day to 260Mℓ/day potable water capacity. An additional 60 Mℓ storage is required at Madlazini Reservoir and an additional 80 Mℓ at Pearce Crescent and Hillview Reservoirs.

Due to the proposal that the Nsezi WTP becomes the main supplier of potable water to the Northern Scheme (Richards Bay and surrounding areas), a new dedicated line from Nsezi WTP to Madlazini is required. The new line is estimated to be 950 - 1000 mm ND pipe, 7700 m in length. To supply the existing Empangeni and Western Scheme, the following upgrades to existing pipelines are proposed:

- Upgrade Nsezi WTP to Hilltop Reservoir with an additional 300 mm diameter pipeline.
- Upgrade the pipeline to Hilltop Reservoir and Pearce Reservoir with additional 350mm diameter pipeline

16.5.2 Projects

(a) Lower Thukela BWSS Phase 3 – Supply to KCDM

Planning No.	KCDM - 208.1
Project No.	FA2020/011-03
Project Status	Detailed Feasibility Stage

(i) Project Description

Construction of Phase 1 of the Lower Thukela Bulk Water Supply Scheme (LTBWSS) was completed in August 2017. The Lower Thukela Bulk Water Supply Scheme supplies the town of KwaDukuza and other communities on the KwaZulu-Natal North Coast (between Ballito and the uThukela River). Phase 2 of the LTBWSS will double the treatment capacity from 55 Mℓ/day to 110 Mℓ/day and construct a pipeline to feed into a new 30 Mℓ reservoir on the outskirts of Mandini.

The Universal Access Plan Phase 3 planning study (Umgeni Water 2020) identified an option to use the LTBWSS to supply approximately 55 Ml/day to the King Cetshwayo District Municipality and the City of uMhlathuze.

Key information on this project is summarised in **Table 16.45** and shown in **Figure 16.43**.

Table 16.45 Project information: Lower Thukela BWSS – Phase 3

Project Components	• 47km of 660mm diameter steel pipeline to supply the Gingindlovu Water Supply Scheme, Mthunzini Water Supply Scheme and Eshowe Water Supply Scheme. • Two Booster Pump Stations • Clear water wells at Eshowe WTP
Capacity	55 Mℓ/day

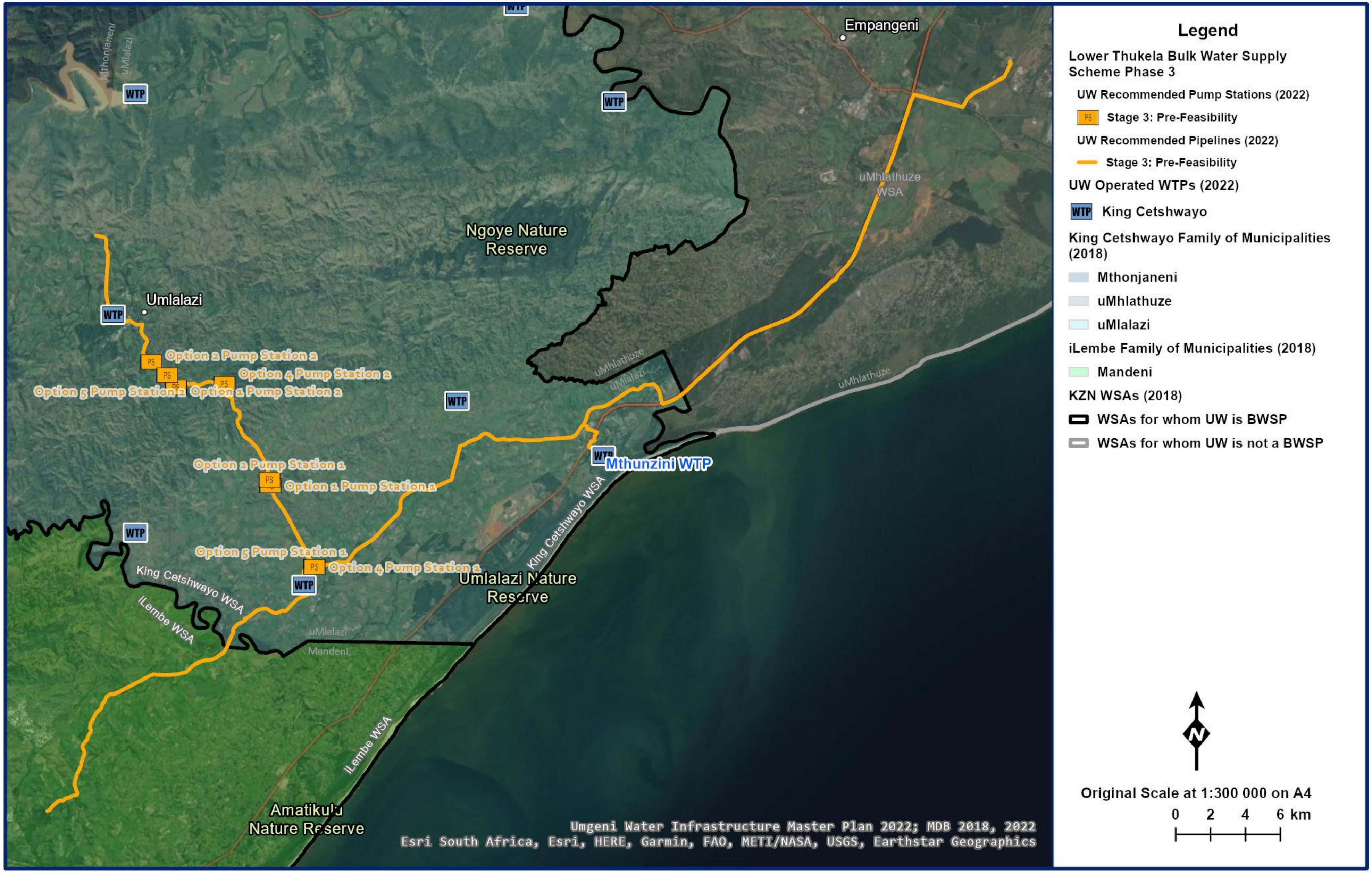

Figure 16.43 General layout of Lower Thukela Bulk Water Supply Scheme Phase 3.

(ii) Institutional Arrangements

uMngeni-uThukela Water would own, operate and maintain the infrastructure of the Lower Thukela BWSS and would sell potable water from this system to King Cetshwayo District Municipality. A PSP appointed by uMngeni-uThukela Water has conducted a feasibility study to assess the financial and technical viability of this project. The project has been put on hold and would only be reinstated if / when UUW becomes a bulk water provider to King Cetshwayo District Municpality once more.

(iii) Beneficiaries

The beneficiaries of this scheme will be the Eshowe WTP supply area, Mthunzini water supply area, and Gingindlovu WTP supply area within King Cetshwayo District Municipality. The estimated number of beneficiaries from the Lower Thukela BWSS Phase 3 is 176 756 people.

(iv) Implementation

The Lower Thukela Bulk Water Supply Scheme – Phase 1 is complete and Phase 2 is currently in the detail design stage. The Universal Access Plan identified various options to supply King Cetshwayo District Municipality and the City of uMhlathuze. A PSP was appointed by uMngeni-uThukela Water and recently completed a feasibility study of the Lower Thukela BWSS Phase 3 in order to assess the financial and technical viability of this phase and will be implemented if it is determined to be a preferred supply option. The detailed feasibility has been completed. The project has been placed on hold until the institutional arrangements can be finalised by KCDM and UUW.

Based on the Options Analysis report completed for the Lower Thukela BWSS Phase 3, the estimated capital cost required for the implementation of Phase 3 of the project is R584 551 552 (2021 costs- excluding professional fees for the design development and construction monitoring phase).

(b) Eshowe BWSS

Planning No.	KCDM - 208.2
Project No.	FA2020/012-05
Project Status	Pre-Feasibility Stage

(i) Project Description

The existing bulk infrastructure for the Eshowe Water Supply Areas consist of the Eshowe WTP which abstracts raw water from the Rutledge Park Dam through a raw water pumping station at the outlet works of the dam. The supply from the dam to the treatment plant is through a 1.1 m diameter steel pipeline. The Rutledge Park Dam is augmented with raw water from the Ihlazi Dam which is situated on the Mlalazi River, a tributary of the uMhlathuze River. The Eshowe WTP also receives 4 Mℓ/day potable water from the Greater Mthonjaneni WTP via a 300mm diameter pipeline. From the Eshowe WTP, there is existing bulk conveyance infrastructure to supply the Eshowe town and surrounding rural communities. The Eshowe BWSS also includes the Gingindlovu WTP (1.5 Mℓ/day) and the Catherine Booth Hospital WTP (1 Mℓ/day).

The Universal Access Plan Phase 3 planning study (Umgeni Water 2020) identified the proposed bulk water supply interventions required to address the water supply backlogs in Eshowe and surrounding rural communities. The Eshowe scheme is expected to have a demand of 23 Mℓ in 2050.

The key information on this project **(Figure 16.44**) is summarised as follows:

- Upgrade the Eshowe WTP to 30 Mℓ/day and/or construct a pipeline from Mandeni Reservoir to supply Eshowe WTP clear wells.
- Upgrade approximately 30 km secondary bulk pipelines ranging between 200 mm and 650 mm diameter.
- Extend the secondary and tertiary bulk mains by adding approximately 47 km secondary bulk pipelines ranging between 63 mm and 450 mm and 107 km of tertiary bulk ranging between 63 mm and 450 mm diameter.
- The existing primary storage capacity should be increased to 32.8 Mℓ and the secondary storage to 16.2 Mℓ. The tertiary storage capacity needs to be increased to 880 kℓ. Additional secondary storage of approximately 18 Mℓ and tertiary storage 15.4 Mℓ should also be added.
- The pump station at Matigulu River (next to Amatikulu community) should be upgraded.
- Upgrade the pump station which pumps from the Matigulu River to the Catherine Booth WTP.

(ii) Institutional Arrangements

If implemented by UUW then UUW would own, operate and maintain the infrastructure of the Eshowe BWSS and would sell potable water from this system to King Cetshwayo District Municipality. A PSP has completed a feasibility study to assess the financial and technical viability of this bulk water supply scheme. This project was assessed and found to be not viable due to the ongoing project by KCDM that should cater for the needs of this area.

(iii) Beneficiaries

The beneficiaries of this scheme will be the town of Eshowe and surrounding rural communities. The anticipated population in 2050 is 103 835 with a water demand of 23Mℓ.

(iv) Implementation

A PSP has been appointed by uMngeni-uThukela Water to complete a feasibility study of the Eshowe BWSS to assess the technical and financial viability of this scheme. The project will be complete by December 2023

The total bulk cost requirement for the Eshowe BWSS is estimated at R426.4 million (2021 costs-excl VAT).

The pre feasibility stydy has been completed and subsequent to the project commencing and after numerous attempts to obtain information on current projects in the area, it has been established that KCDM has funding approved for the extension of the supply scheme in the area and there is a duplication of work for the area. For this reason, UUW will only take the project up to detailed feasibility stage and will not proceed further.

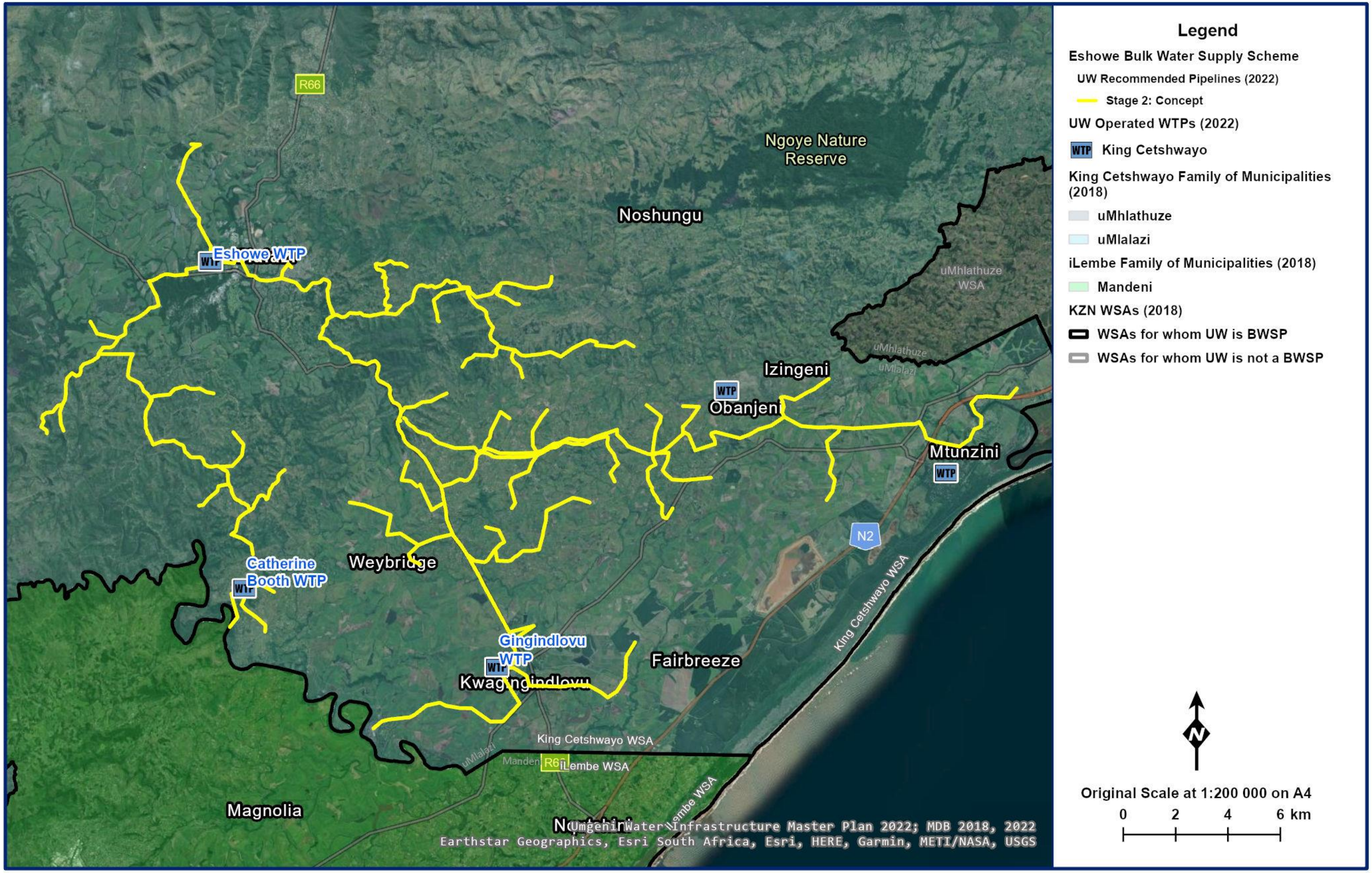

Figure 16.44 General layout of the Eshowe Bulk Water Supply Scheme.

(c) Mthonjaneni BWSS

Planning No.	KCDM - 208.3
Project No.	FA 2020/011-06
Project Status	Pre-Feasibility Stage

(i) Project Description

The Mthonjaneni Water Supply Scheme area is supplied by two main Water Treatment Plants (WTPs) at Greater Mthonjaneni and Nomponjwana. The scheme receives raw water from the Hlambanyathi River, a tributary of the uMhlathuze River. A 450mm diameter ductile iron rising main from the Greater Mthonjaneni WTP supplies water to a 2.5Mℓ concrete reservoir with four pump stations (Zigigaya Booster 1, Zigigaya Booster 2, Zimela Booster and PSA). The Mthonjaneni Command Reservoir (2.5Mℓ) serves Sub-Supply Area 1. An approximate 45km bulk pipeline (ranging from 355mm – 640mm diameter) services Sub-Supply Area 1. Sub-Supply areas 4 & 5 are provided with water through 5 reservoirs (1 & 4 reservoirs respectively) and an almost 38km bulk pipeline (8km and 30km and ranging from 110mm – 400mm diameter).

The Universal Access Plan Phase 3 planning study (Umgeni Water 2020) identified the proposed bulk water supply interventions required to address the water supply backlogs in Melmoth and surrounding rural communities. The Mthonjaneni scheme is expected to have a demand of 22Mℓ/day in 2050.

The key information on this project (**Figure 16.45**) is summarised as follows:

- Upgrade the existing Greater Mthonjaneni WTP to 80Mℓ/day.
- Upgrade the existing primary bulk pipeline from 450mm to 660mm diameter.
- Upgrade 64km existing secondary bulk pipelines ranging between 125mm and 660mm diameter and upgrade approximately 24km existing tertiary bulk pipelines ranging from 75mm and 160mm diameter.
- Extend the secondary and tertiary bulk mains by adding approximately 80km secondary bulk ranging between 50mm and 355mm diameter and approximately 171km of tertiary bulk ranging between 50mm and 140mm diameter.
- Existing primary storage capacity to increase to 7.5Mℓ and existing secondary storage capacity would need to increase to 5.8Mℓ. Existing tertiary storage capacity also needs to increase to 5.1Mℓ. Additional secondary storage capacity of approximately 16Mℓ and tertiary storage of 13Mℓ.
- Increase pumping capacities of the existing Zigigaya Booster 1, Zigigaya Booster 2 and Zimele Booster pump stations (800kW, 576kW & 795kW).
- Add four (4) new pump stations – One (1) at Melmoth WTP (76kW) to Res 1, one (1) pump station at the Mfule River towards Nomponjwane WTP (35kW) and one (1) pump station at the WTP (32kW) and a pump station at KwaMagwaza WTP (87kW).

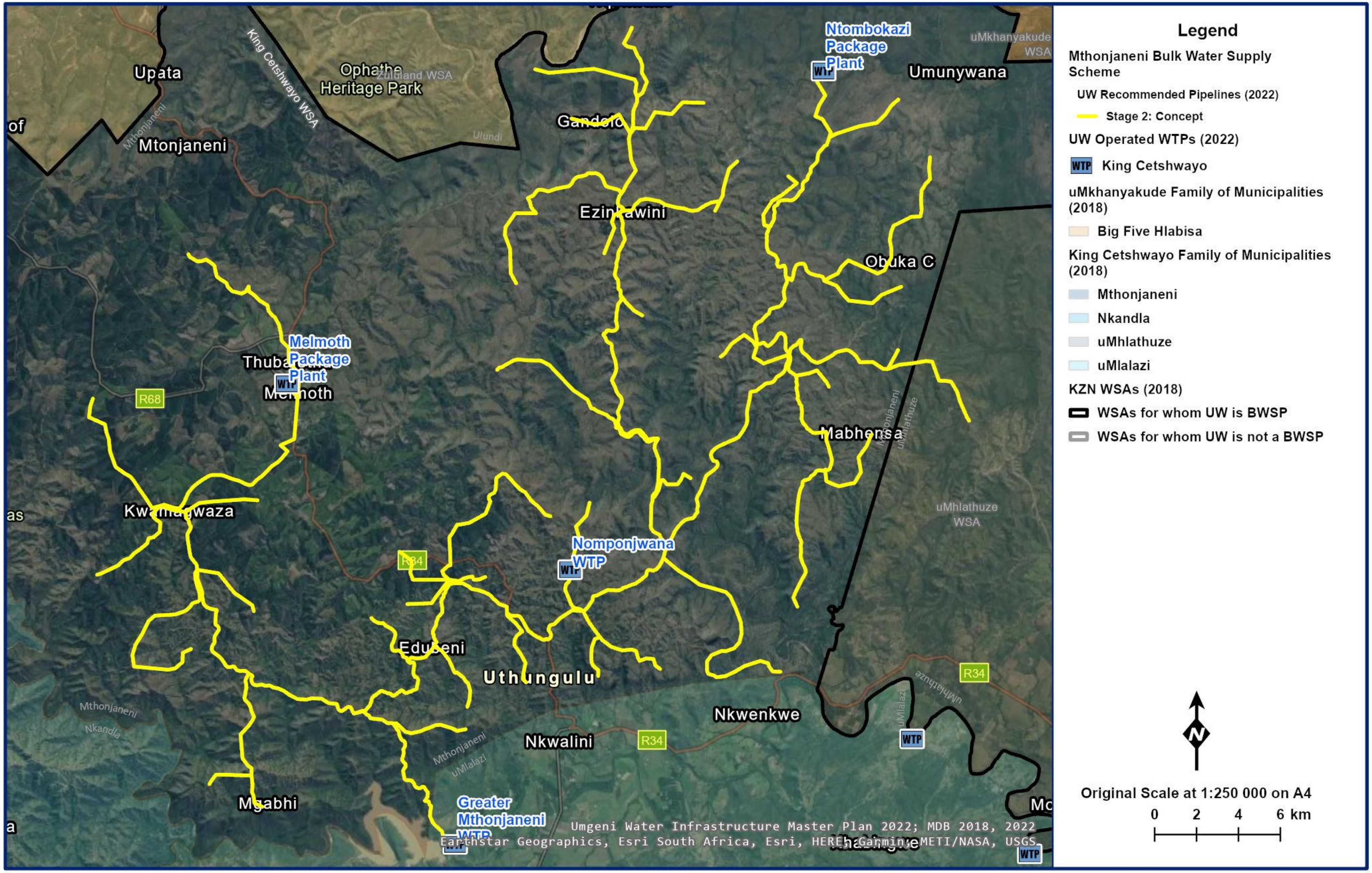

Figure 16.45 General layout of the Mthonjaneni Bulk Water Supply Scheme.

(ii) Institutional Arrangements

If implemented by UUW then UUW would own, operate and maintain the infrastructure of the Mthonjaneni BWSS and would sell potable water from this system to King Cetshwayo District Municipality. A PSP appointed by uMngeni-uThukela Water is conducting a feasibility study to assess the financial and technical viability of this project. The project will be put on hold after the feasibility study and would only be reinstated if / when UUW becomes a bulk water provider to King Cetshwayo District Municpality once more.

(iii) Beneficiaries

The beneficiaries of this scheme will be the town of Melmoth and surrounding rural communities. The anticipated population in 2050 is 113 317 with a water demand of 22Mℓ.

(i) Implementation

A PSP has been appointed by uMngeni-uThukela Water to complete a feasibility study of Mthonjaneni BWSS to assess the technical and financial viability of this scheme. The pre feasibility study has commenced and subsequent to the project commencing and after numerous attempts to obtain information on current projects in the area, it has been established that KCDM has funding approved for the extension of the Mthonjaneni Bulk Water Supply Scheme in the area and there is a duplication of work for the area. UUW will continue with the study by investigating alternatives to allow for a greater assurance of supply for the area.

The total bulk cost requirement for the Mthonjaneni BWSS is estimated at R1.124 billion (2021 costs-excl VAT).

(d) New Water Resources: Seawater Desalination

(i) (a) Background

With the raw water supply constraints and increasing demands in the Richards Bay area, seawater desalination is increasingly being looked at as a potential option to contribute towards the future water requirements in the area. Desalination is a process that removes mineral components from saline water. The by-product of the desalination process is brine. While desalination is used on many seagoing ships and submarines, most of the modern interest in desalination is focused on cost-effective bulk provision of fresh water for domestic supply. Along with recycled wastewater, it is one of the few rainfall-independent water resources. Due to its energy consumption, desalinating sea water is generally costlier than fresh water from surface water or groundwater, water recycling and water conservation. Desalination processes are usually driven by either thermal (in the case of distillation) or mechanical (in the case of reverse osmosis (RO)) as the primary energy types. The energy requirements of a desalination plant can account for up to 50 percent of its running costs.

(ii) (b) Proposal

The proposal is that seawater will be abstracted from the Richards Bay harbour or at a marine intake and pumped to a site close to Alkantstrand, where the RO desalination plant will be situated. Potable water will be pumped to the Mzingazi WTW for blending and distribution.

(iii) (c) Feasibility Study Issues

Outstanding key feasibility issues of the proposed desalination project include:

- Role of desalination in the overall water portfolio for the region
- Ecological impacts of impingement and entrainment, associated with seawater intake
- Ecological impacts associated with brine and related discharges
- Siting related to habitat value, public access, energy and other infrastructure, as well as visual and other aesthetic considerations
- Concentration of organic and inorganic material in the incoming feed water
- Desired quality of the product water and level of pre-treatment required
- Need for blending of treated seawater with other supplies
- Sensitivity of the surrounding waters to concentrated brine and thermal discharge.
- Potential project impacts on population growth
- Energy consumption levels, sources and costs
- Possible co-location with power plants, wastewater treatment plants and other facilities with water intake or outfall structures
- Public health considerations and regulatory requirements
- Land use implications and secondary cumulative impacts
- Identification of suitable land for siting the plant and linkages to existing infrastructure.

However new desalination technologies and mitigation measures are being developed all the time, some of the above issues may become less of a concern in the future.

(iv) (d) Yield

Clearly seawater could yield a limitless volume of water. However, the water demand versus available sources at the time of implementation will determine the yield of the scheme to be developed. In the DWS Richards Bay Reconciliation Study of 2021[5], a treated water output of 60 Mℓ/day (21.9 million m^3/annum) was considered to be comparable with some of the other potential interventions. Phased development would be considered and it was assumed that the plant would be constructed in two 30 Mℓ/day phases.

(v) (f) Allocated Budget

A budget of R 7.5 million has been allocated for the commencement of this project in the 2022-2023 financial year (see 3.6).

(vi) (g) Conclusion

Desalination of seawater is an expensive option of providing potable water and this is reflected in the URV values that are presented in **Table 79**. However, given the increasing water resource constraints, it is an option that requires continued serious investigation and consideration.

5 Reference 2 – DWS (2021) Reconciliation Strategy for Richards Bay and Surrounding Towns, First Stage.
Report No 6: Infrastructure and Cost Assessment Report Page 51-58

(e) 16.8.4 New Water Resources: Nseleni River Dam

(i) (a) Description

An earthfill dam is proposed on the Nseleni River tributary of the Mhlathuze River, just upstream of the Bhejane Township from where water could be released to flow downstream or piped to Lake Nsezi for abstraction and treatment. Although this river has a MAR that is much lower than that of the Mfolozi, Mhlatuze or Thukela rivers, there is still potential for storage to support the demand. The Nseleni Dam is located upstream of the Nsezi WTP. Water released from the dam can either flow directly into the Nseleni River and then be abstracted from Lake Nsezi at the Nsezi WTP, or be piped under gravity to the Nsezi WTP.

(ii) (b) Options

The following two options for infrastructure downstream of the proposed Nseleni Dam have been identified:

Option 1:

- A new abstraction works at the Nsezi WTP
- Augmentation of the Nsezi WTP with an additional 49.3 Mℓ/day.

Option 2:

- A new DN 1000 gravity pipeline to the Nsezi WTP
- A new abstraction works at the Nsezi WTP
- Augmentation of the Nsezi WTP with an additional 49.3 Mℓ/day.

An advantage of the location of this dam is that there is only a short distance (approximately 13.6km) between the release point and the abstraction point at Lake Nsezi. This means that there would be relatively low river losses due to infiltration and evaporation along the route, as well as limited opportunity for contamination of the water downstream of the dam.

(iii) (c) Current Status

DWS requested Mhlathuze Water to implement and budget for this intervention option. Mhlathuze Water issued a TOR to appoint a PSP to conduct a Feasibility Study for a new dam on the Lower Nseleni River (**Figure 16.46**). However, given that the dam will not be required until 2036, the R7.5 million budget, that was allocated for this feasibility study in 2022-23, has now been reallocated. A new feasibility study budget of R7.5 million will therefore be required for the Nseleni Dam Pre-feasibility Study to commence in 2024-2025.

(iv) (d) Yield

Mhlathuze Water has commissioned a study to further ascertain the feasibility of a proposed Nseleni Dam (see allocated budget in (f)). A detailed water resources assessment will therefore be undertaken as part of this feasibility study. However, indications are that an additional yield of 12.0 million m^3/annum can potentially be added to the system for a 1 MAR dam with a capacity of 55 Million m^3.

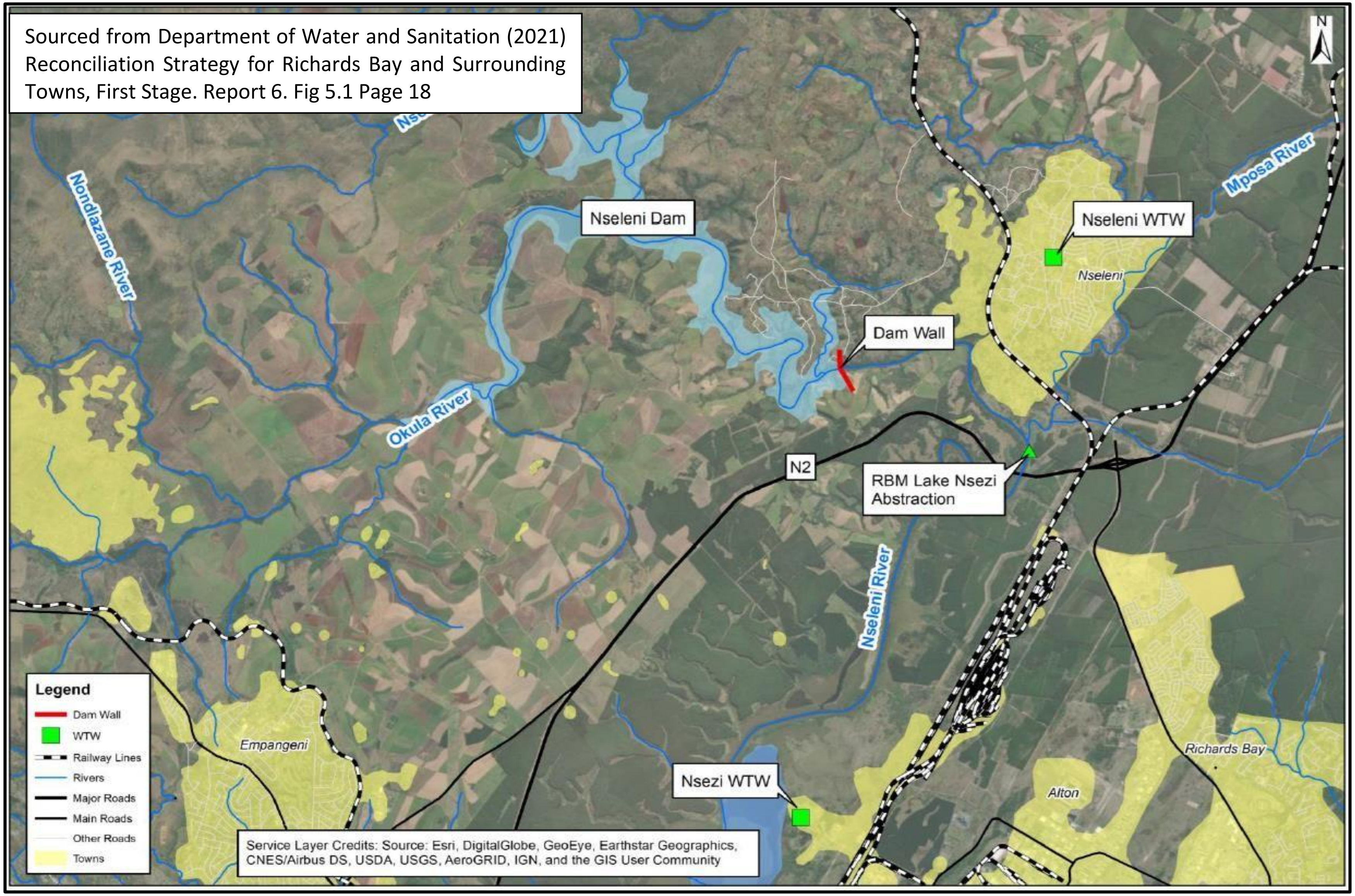

Figure 16.46 Location and footprint of the proposed Nseleni River Dam.

(v) (f) Allocated Budget

R 7.5 million was initially allocated for this project in the 2022-2023 financial year. However this has now been reallocated; so a new budget will be required in a future year.

(vi) (g) Conclusions

The maximum yield of this intervention would likely be taken up by the predicted increase in demand within a short space of time (likely two years). However, this dam will increase the assurance of supply to both the Nsezi WTP and RBM, which will be of indirect benefit to the system as a whole. The alternative source of water for Nsezi WTP is the uMhlathuze River and greater abstraction from Lake Nsezi would result in increased availability of water from the river for other users. Similarly, RBM abstracts water from the Mfolozi River and from Lake Nhlabane, and the pressure on those sources can be reduced by increased availability of water from Lake Nsezi. The dam will capture and store floods, providing both attenuation and increased yield to the system.

(f) 16.8.5 New Water Resources: uMfolozi Off-Channel Dam

(i) (a) Description

One of the initiatives to augment supplies to the Richards Bay area is a transfer scheme based around an off-channel dam situated close to the uMfolozi River.

This involves pumping water from a weir in the uMfolozi River, about 4km upstream of the Kwesibomvu Dam site (see 16.8.6) to an off-channel earthfill dam at the Nkatha Pan, via a pipeline of 960m length. From the off-channel dam, water will be pumped to a 60Mℓ storage reservoir via a pipeline of 3.9km length. From the reservoir water would gravitate 49 km to the Nsezi Water Treatment Plant for treatment and distribution.

An alternative would be to gravitate the water up to a point where the N2 highway crosses the Mposa tributary of the Nseleni River. From there, the water could flow down to Lake Nsezi under gravity. This alternative would shorten the required gravity line by 19km to 30km.

During preparation of the conceptual design, diversion volumes of $2m^3/s$ and $2.5m^3/s$ and two dam sizes were considered in order to determine preliminary, conceptual yields and costs.

The scheme will provide a regional water supply to Mtubatuba and other small towns. A layout of the proposed infrastructure for the uMfolozi Off-channel Dam is shown in **Figure 16.47**.

(ii) (b) Current Status

Concept has been developed but a feasibility study, commissioned by uMngeni-uThukela Water, is still required.

(iii) (c) Yield

The Department of Water and Sanitation's (2014) Water Reconciliation Strategy for Richards Bay of 2014 estimated the following historical firm yields (**Table 16.46**) for the uMfolozi Off-channel Dam:

Table 16.46 Estimated Historical Firm Yields for uMfolozi Off-Channel Dam

Transfer Capacity (m^3/s)	Off-Channel Dam Size (million m^3)	Historical Firm Yield (million m^3/annum)
2.0	30	36.9
2.0	63	47.1
2.5	39	40.8
2.5	78	56.9

The above table indicates that an additional yield of 36.9 million m^3/annum can potentially be added to the system for an off-channel dam size of 30 million m^3 with a transfer capacity of $2.0m^3/s$.

Sourced from Department of Water and Sanitation 2021 Reconciliation Strategy for Richards Bay and Surrounding Towns, First Stage. Report 6. Fig 9.1 Page 45

Figure 16.47 Location and footprint of the proposed uMfolozi Off-channel Dam .

(iv) (e) Allocated Budget

No budget currently allocated for this project in the 2023-2024 financial year.

(v) (f) Conclusions

A study should be initiated to further ascertain the feasibility of a proposed uMfolozi Off-channel Dam. It should be noted that the uMfolozi River hydrology has never been studied at the detailed level that is required before any large capital investment can be made. Only after this study has been undertaken can the additional availability of water from an off-channel dam on the uMfolozi River be stated with confidence.

Strengths:

This is a surface water transfer scheme that would increase the assurance of supply to the Richards Bay Water Supply System, as droughts may occur at different times in the uMfolozi and uMhlathuze catchments. The uMfolozi is currently an under-utilised river, with significant potential for development that could also assist with urgently required water supplies for Mtubatuba and its surrounding areas. The uMfolozi Off-channel Dam will also inundate a significantly smaller area than other alternatives such as the Kwezibomvu On-channel Dam (see 16.8.6).

Weaknesses:

Environmental impacts are significant and a large area of land would be inundated; although these will be less for the off-channel dam than for the on-channel dam. Aspects relating to the inter-basin transfer of water could potentially be an obstacle, especially if water is transferred for release in the Mposa tributary river.

(g) 16.8.6 New Water Resources: In-stream Kwesibomvu Dam

(i) (a) Description

Another potential water resource that has been considered in the past is the Kwesibomvu Dam. This is a proposed in stream earthfill dam on the uMfolozi River about 7km upstream of the N2 road bridge, that would transfer water to Nsezi WTP and provide a regional water supply to Mtubatuba and other small towns. This is located close to the uMfolozi Off-channel Dam site (16.7.5); but is a much more substantial dam so is considered separately.

A study was conducted by DWS in the late 1980s, to consider the feasibility of augmentation of the Mhlathuze River System from the uMfolozi River. The findings indicated that, with the sporadic flows, unless major storage was provided on the uMfolozi River, the uMhlathuze River System would ultimately have to be augmented from the uThukela River. Indications at the time were that, viewed on a long-term basis it would be cheaper to build the Thukela Transfer Scheme from the start.

The very silt-laden river poses many problems to the construction of an in-stream dam and a very large spillway would be needed. Previously identified dam sites in the Mfolozi River located upstream of the N2 road bridge could also stabilise the Lower Mfolozi River. Ezemvelo KZN Wildlife however had a problem with any dam on the Mfolozi River in the past. However such a dam on the uMfolozi River might be further able to supply the region with a secure future water supply.

(ii) (b) Current Status

This option was considered in the DWS Richards Bay Reconciliation Study of 2014. However it was not considered in the updated Reconciliation Study of 2021; so it appears to no longer be considered as a priority option. No budget has therefore been allocated for this project in the 2022-2023 financial year.

(iii) (c) Yield

According to the DWS Reconciliation Study of 2014, the HFY for the Kwesibomvu in-stream Dam (**Figure 16.48**) based on the current day inflows, taking into account sedimentation (47.8 and 50.5 million m^3/annum respectively for the two dam sizes considered) and the requirements downstream for RBM and the estuary IFR (30%) is:

- 26m high (96 million m^3 storage) dam, HFY = 66.6 million m^3/annum
- 36m high (215 million m^3 storage) dam, HFY = 137.3 million m^3/annum

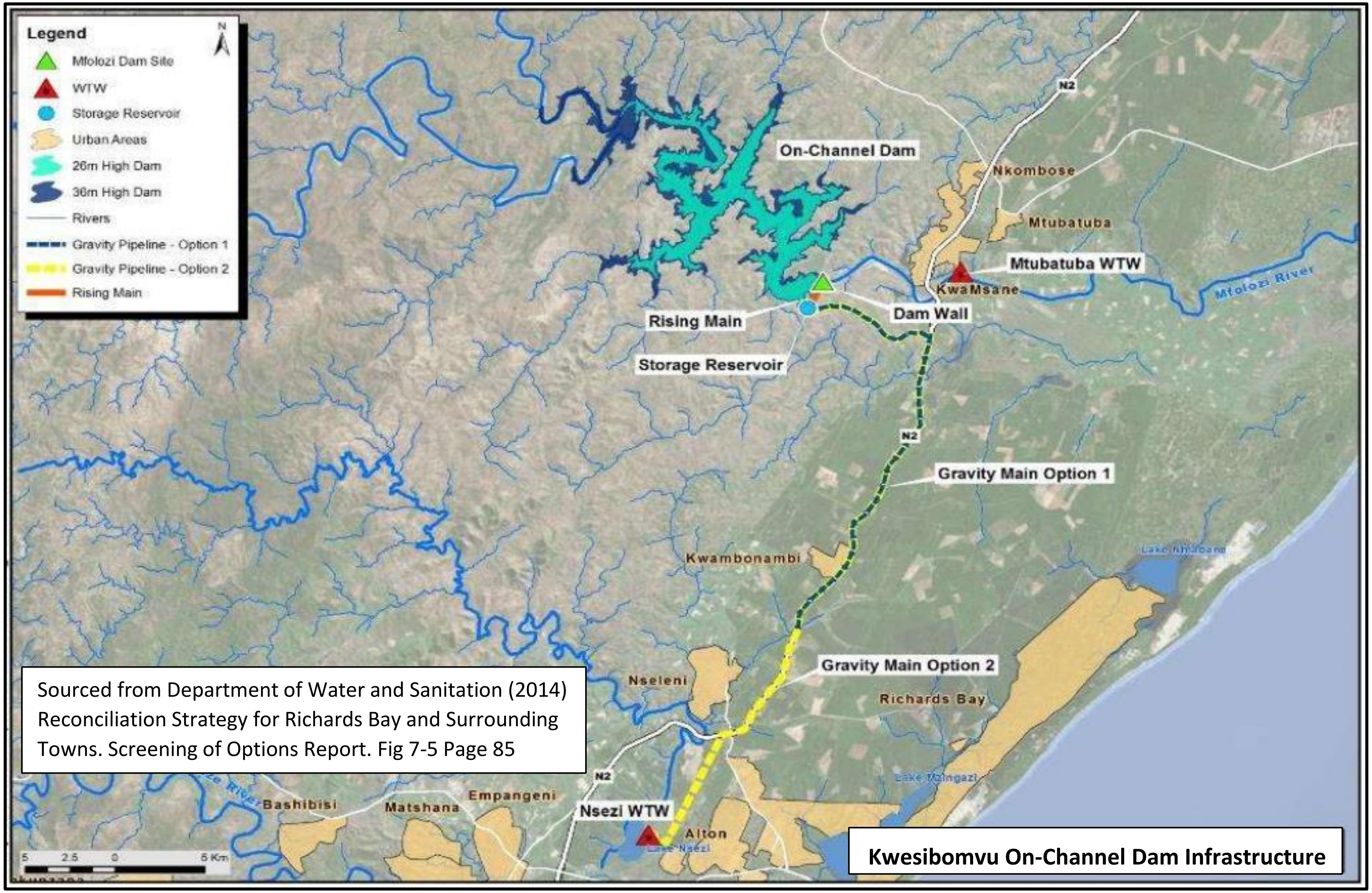

Figure 16.48 Location and footprint of the proposed Kwesibomvu Dam.

(iv) (e) Allocated Budget

As this option no longer be considered as a priority, no budget has been allocated for this project in the 2022-2023 financial year.

(v) (f) Conclusions

Damming the uMfolozi River will result in reduced streamflow downstream of the wall. The dam will block the flow of sediment downstream leading to increased downstream erosion of sedimentary depositional environments (if releases are made) and increased sediment build up in the reservoir. The water released from the dam would probably be quite clear with low turbidity. Any natural habit that remains will be lost due to inundation. This includes several pans/wetlands. The Kwesibomvu Dam may potentially also flood riverine forest areas and affect rare plant species. A significant potential impact would be the flooding of lower portions of the Hluhluwe-iMfolozi Park. For all these reasons and others, the dam is unlikely to have the support of the envioromentalists and KZN Wildlife.

Rural dwellings/homesteads and farmlands will be inundated and associated relocation and compensation is expected to be costly. However, should the dam level be kept under 50m amsl, the number of affected homesteads is expected to be limited.

On the positive side, the dam could potentially provide recreational activities in the area. The Kwesibomvu Dam might also increase fish and waterfowl populations and, if recreational facilities were provided, they would be close to population centres and could generate employment opportunities for the local community.

(h) 16.8.7 New Water Resources: Pre-Feasibility Study – Abstraction from the Thukela River (Mandini)

(i) (a) Description

The idea behind this proposal is to abstract water from the Thukela River at Mandini and construct a raw or clear water pipeline along the coast to augment the supply to the City of uMhlathuze Area. The pipeline will run from the Lower Thukela River at Mandini to the uMhlathuze Local Municipality It will terminate at either the Mhlathuze River, if raw water is transferred, or at the Nsezi WTP (potentially with an offtake to the eSikhaleni WTP), if treated water is transferred. Abstracting water for the pipeline will make use of existing Lower Thukela Bulk Water Supply Scheme (LTBWSS) infrastructure, such as the weir, abstraction works, low-lift pump station and water treatment works (if treated water is to be piped).

Depending on the availability of water from the Lower Thukela River, as well as other factors, either 20 million m³/annum or 40 million m³/annum (although only in the long-term) could be transferred. The pipeline may also supply rural communities along the route with an estimated 5 million m³/annum of water. Half could be abstracted from the northern supply reservoir and the remaining half at the small town of Gingindlovu (**Figure 16.49**). For further details, refer to the DWS Richards Bay Reconciliation Study and the Terms of Reference for the Pre-Feasibility Study commissioned by uMngeni-uThukela Water.

(ii) (b) Options

Two major variables that still need to be resolved are the volume of water to be transferred and the type of pipeline. Pipeline capacities of 20 million m³/annum (55Mℓ/day) and 40 million m³/annum (110Mℓ/day) are currently under consideration. The second major variable is whether the water to be transferred will be treated or raw. The advantages of transferring raw water are that the pipeline can be significantly shorter, as it can discharge straight into the Mhlatuze River; while treated water would have to be pumped all the way to the Nsezi WTP for distribution. However, if raw water is transferred a larger volume would need to be pumped, as approximately 5% is lost during treatment. Providing a WTP for each small community along the way is unlikely to be either feasible or sustainable. However, the primary advantage of this option is that a significant length of pipeline (approximately 24km) would not need to be constructed as part of the transfer scheme.

With a clear water pipeline, the advantages are that the treatment capacity already exists at the Mandini WTP site, which merely requires upgrading rather than a complete new development. This would also obviate the need for a regional, or small, WTP to supply the small towns on the way to Richards Bay. In addition, the piping of treated water will avoid the losses between the discharge of the transferred raw water into the river and the Nsezi WTP. It is also unlikely that additional pumping would be required for the longer treated water pipeline as, after the point of divergence on the two routes, the elevation decreases steadily.

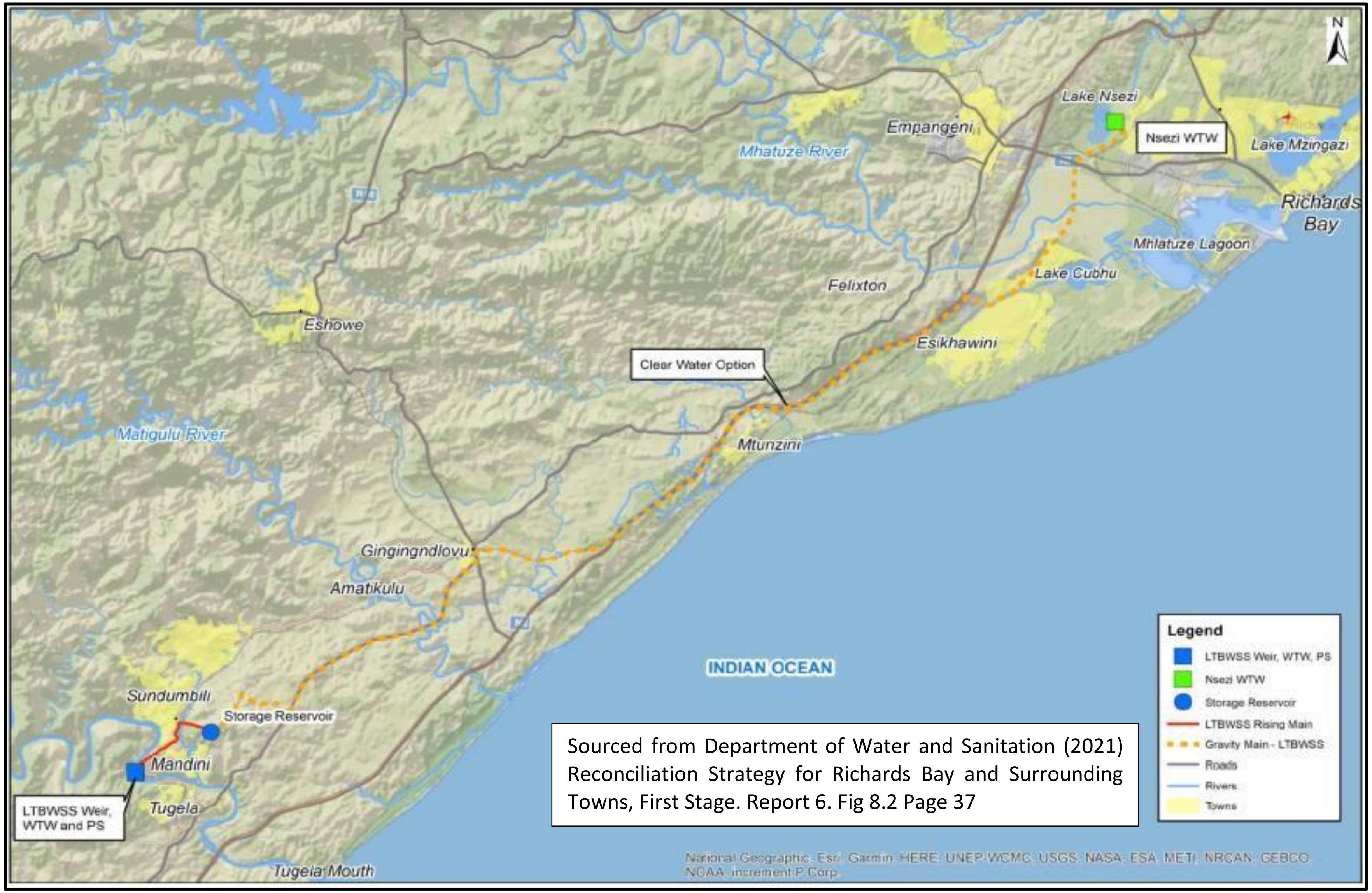

Figure 16.49 Abstraction from Lower Thukela River to uMhlathuze – Treated Water Option .

(c) Additional Yield

Depending on the amount of water available from the LTBWSS weir and the amount of water supplied to the rural communities and the mines (along with other factors and assumptions made) different yields may be possible. In the case of 20 million m^3/annum (55Mℓ/day) being transferred to the north of the Thukela River, 15 million m^3/annum (41.25Mℓ/day) would be available to the Mhlathuze catchment. In the case of the full 40 million m^3/annum (110 Mℓ/day) being available, 35 million m^3/annum (96Mℓ/day) would be available to the uMhlathuze catchment.

(iii) (e) Allocated Budget

A budget of R6 million had been allocated in 2022-2023 to undertake a pre-feasibility study on abstraction from the Thukela River at Mandini. This project has been concluded and this study is required as a pre-requisite to the eventual Coastal Pipeline.

(iv) (f) Conclusions

The costs indicate that the treated-water options are slightly more expensive than the raw-water options, although there are other advantages to treating the water that might outweigh the economic considerations. However, a full cost-benefit, implementation readiness and feasibility analysis will be required before a final informed decision can be taken on the most appropriate option.

For further comment on the strengths and weaknesses of the proposed coastal pipeline from the Lower Thukela River to uMhlathuze, refer to the DWS Reconciliation Strategy.

(i) 16.8.8 New Water Resources: Raising of Lake Nsezi

(i) (a) Description

Lake Nsezi is fed by the Nseleni River, which originates in the granitic formation further inland. Increasing the capacity of the lake by building/raising its wall to limit seepage and increase storage could be considered in conjunction with water transfers. Lake Nsezi can currently be topped up from surplus summer flows in the uMhlathuze River, but water is also transferred directly to the Nsezi WTP from Mhlathuze Weir. The lake is generally kept at 6.2m amsl. Lake Nsezi is largely an artificial lake, with its wall made of rubble and boulders, filled with Berea Red sand. It leaks and water pumped or released into the lake does not get retained for long by this wall. For further information, refer to the DWS (2014) Water Reconciliation Strategy.

Consideration could be given to the option of topping up the coastal lakes that form part of the Richards Bay WSS from surplus summer river flows. Increasing the capacities of the lakes by building/raising their walls to increase storage could further be considered in conjunction with water transfers. Lakes Cubhu, Mzingazi and Nhlabane are perceived to be extensions of the local groundwater.

(ii) (b) Discussion of Options

Water is currently abstracted at the eSikhaleni WTP from Lake Cubhu, but production shortages can be met by transferring water directly from the Mhlathuze Weir to the WTP through the pipeline running under the lake. As the blending is done in the WTP and not in the lake this allows greater control over the blending process. There is, however, significant uncertainty whether Lake Cubhu would be able to hold additional storage or whether it would rapidly seep away. This is because there is a serious deficiency in the geological and hydrological data for the Lake Cubhu region. Until this uncertainty is addressed, it is not considered worthwhile to further pursue artificial recharge of Lake Cubhu.

Artificial recharge from the Mhlathuze Weir is not considered an option for Lake Mzingazi, given the large distance from the weir to the lake. There is also significant uncertainty whether the lake would be able to hold additional storage or whether it would rapidly seep away. Recharge of this lake with treated wastewater will, however, be considered under the Arboretum Effluent Reuse Scheme intervention. Lake Nhlabane was raised by 1m in 1998. Artificial recharge of Lake Nhlabane could only realistically be considered from the uMfolozi River. The RBM uMfolozi run-of-river transfer scheme does not transfer water to the lake. Changes in land use in the Nhlabane catchment have reduced the estimated lake yield to current levels of 30 Mℓ/day. This is likely to fall further, to approximately 20 Mℓ/day, over the next five years. As Lake Nhlabane is over-abstracted, it could thus be a candidate for artificial recharge.

(iii) (c) Conclusion

The raising of Lake Nsezi does not seem attractive owing to the significant potential impacts on the N1 highway, Nsezi WTP intake infrastructure, social infrastructure and on farmland. Given the above challenges and constraints, these options are not proposed for serious consideration in the short term; but may need to be revisited in future if the raw water supply situation deteriorates. Further detailed investigation is therefore not proposed at this stage.

(j) 16.8.9 Water Resources Augmentation: Water Conservation and Demand Management

(i) (a) Description

One progressive method of effectively 'augmenting' the available water resource is to reduce levels of water wastage and systemic losses. While this strictly does not represent a new water source, by minimising losses it makes available additional water for productive consumption.

(ii) (b) Current Water Losses

According to the DWS Reconciliation Strategy of 2015 such systemic water losses are high. Following a preliminary assessment of water use efficiency in the Greater uMhlathuze WSS, it was estimated that the total system losses in the WSS represent approximately 31% of the treated water production (**Table 16.47**).

Table 16.47 Estimated % Water Losses and % Non Revenue Water

Water Supply Area	System Input Volume (Mℓ/day)	% Water Losses	% Non Revenue Water (NRW)
Richards Bay	38.8	10%	30%
Empangeni	20.3	19%	39%
Esikhaweni	28.2	35%	54%
Ngwelezane	7.6	30%	55%
Nseleni	12.2	43%	56%
Eshowe	11.6	42%	50%
Mthunzini	1.3	35%	45%
Amatikulu & Gingindlovu	1.0	25%	30%
Melmoth	3.2	45%	55%

These figures are consistent with the 35% water loss assumption included in the water demand model for this Master Plan.

(iii) (c) Loss Reduction Targets

The DWS Richards Bay Water Reconciliation Strategy of 2021, defines a realistic target of reducing the system input volume required, water losses and non-revenue water by **10%**. A more optimistic target is to reduce the water losses by **20%**.

(iv) (d) Options

In the uMngeni-uThukela Water Core Business Area of Richards Bay, water conservation and demand management initiatives could be centred on:

- Urban WCWDM, comprising a range of measures and the continuation of existing initiatives
- Bulk industrial WCWDM, comprising the continuation of existing initiatives essentially aimed at the significant industrial water users, but also at other industrial water users
- Operational loss reduction and improved efficiency at uMngeni-uThukela Water plants.

Based on a review of available data and existing studies, it is clear that there is significant scope for WCWDM in the Core Area of uMngeni-uThukela Water operation. WCWDM will result in both a reduction of NRW and the total system input volume. A serious concern however, is the pervasive limitation in institutional capacity and technical skills to embark on WCWDM programmes within the municipal area. WCWDM interventions should focus on the following interventions:

- Reduce the high water losses and inefficiencies with set targets and timelines
- Improve service delivery, as this will minimise unauthorised connections in some areas
- Develop and implement effective operation and maintenance plans
- Install bulk meters to measure supply from the zones and districts
- Maintain satisfactory operating pressures and install control valves in areas experiencing high pressures
- Properly investigate the status of the service level for drinking water and sanitation in order to assess the situation and formulate recommendations for future improvements of servicing the entire area
- Investigate the situation of water supply infrastructure on the base of new data in order to assess properly which investments in the refurbishment of the system are required
- Provide training technical staff and for meter readers and perform monthly audits to eliminate estimates and other inaccuracies
- Embark on community awareness programmes that promote the value of water.

(v) (f) Conclusion

The Department of Water and Sanitation prioritises water conservation and demand management initiatives; as they can minimise the need for expensive investment in new supply infrastructure by addressing the demand side of the water equation. There is substantial scope to implement WCDM measures in the Richards Bay area, which will reduce water losses and so conserve the scarce water resources.

(k) 16.8.10 Water Resources Augmentation: Wastewater and Effluent Reuse and Recycling

(i) (a) Description

In partnership with the City of uMhlathuze Municipality, uMngeni-uThukela Water is currently assisting in investigating the feasibility of re-using wastewater and associated by-products.

The project is advancing well with investigating industrial / domestic effluent reuse options as a potential Public Private Partnership (PPP). The project aims at treating industrial and domestic effluent for re-use as a water supply to industries.

The proposed plant is planned to have a capacity of 75Mℓ/day and to be situated between Empangeni and Richards Bay. The proposed 75Mℓ/day regional treatment facility will collect and treat effluent from the Ngwelezane WWTW, Empangeni WWTW, Alton Macerator, Arboretum Macerator and Mondi Paper Mill WWTW. The treated re-use water will then be supplied to the RB IDZ, Foskor, South32, RBM and Eskom.

(ii) (b) Progress

In order to deal with the twin objectives of securing an adequate water supply and dealing with effluent disposal / reuse, the CoU LM has driven this initiative by commissioning a feasibility study to identify the most viable solution for reusing wastewater and associated byproducts generated within the CoU.

In 2015, the CoU applied to National Treasury PPP unit to register a wastewater and associate by-products re-use project. This Project was subsequently registered on the 25 May 2015 (Ref No: M115). A competitive bidding process was then undertaken to appoint a Transactional Advisor (TA) and the resulting TA appointment was effective from 1 December 2016. The Project was to specifically explore the viability of procuring a PPP as the delivery mechanism for the aforementioned re-use of treated waste water and associated by-products.

A Feasibility Study Report (FSR) was compiled, completed and submitted to National Treasury on 28 February 2018. The mandatory 60-day period for public comments as well as the Treasury Views and Recommendations process commenced on 12 March 2018 and expired on 10 May 2018. Presentations were also made to the Project Steering Committee, which includes National Treasury, Provincial Treasury, Department of Water and Sanitation (DWS) and the Development Bank of Southern Africa (DBSA) on 19 March 2018. Mhlathuze Water was part of the Project Steering Committee.

(iii) (c) Roles and responsibilities

As the proposal is that this wastewater re-use facility will be a Public Private Partnership (PPP), a major, initial activity is to confirm and agree on the institutional and contractual roles, responsibilities, committments and obligations.

Particular attention is currently being paid to:

- Role, powers and limitations of the CoU Municipality as the Water Services Authority (WSA)
- Role, powers and limitation of the uMngeni-uThukela Water as a Water Services Provider (WSP)
- Treasury Regulations and requirements regarding Public Private Partnerships (PPP)
- Most appropriate PPP arrangement

The final institutional and contractual structure for the project has not been confirmed and private bidders will be required to propose a functional structure during the bidding process. However, for the purpose of the onging discussions, the following generic structure has been proposed (**Figure 16.50**):

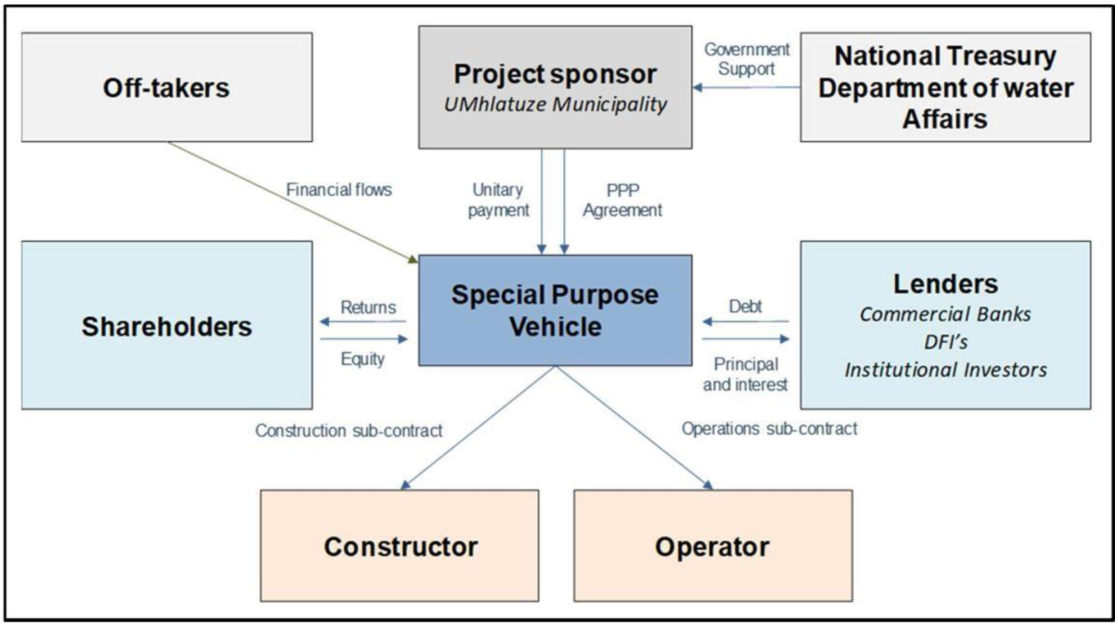

Figure 16.50 Possible generic structure for the Wastewater Reuse PPP

(iv) (d) Role of uMngeni-uThukela Water

The nature of the project and the framework from which it will be implemented limits options for the contractual structure. It is agreed that CoU is the sponsor of the project. However, it appears that three possible options may exist for uMngeni-uThukela Water in this project:

- uMngeni-uThukela Water could participate as co-sponsor to the project
- uMngeni-uThukela Water could participate as investor to the Special Purpose Vehicle (SPV)

- uMngeni-uThukela Water could participate as the main off-taker of clear water and distribute the water to end-users

- uMngeni-uThukela Water's preferred role as an Implementing Agent

(v) (e) Potential Impact on uMngeni-uThukela Water

The impact on uMngeni-uThukela Water will obviously depend on its eventual role. However, the operations of uMngeni-uThukela Water will be impacted by this project as follows:

- The Ngwelezane WWTW, Empangeni WWTW, Alton Macerator, and Arboretum Macerator will be decommissioned and replaced by pump stations and pipelines to the new regional waste water treatment plant. Alton Macerator and Arboretum Macerator currently discharges effluent into the MW sea outfall

- The effluent from Mondi will be redirected to the new regional waste water treatment plant. Mondi industrial effluent currently discharges effluent into the MW sea outfall

- The regional waste water treatment plant will be operated by the PPP

- The supply of reuse water to large industrial users will be undertaken by the PPP.

(vi) (f) Budget

As this project is being driven by the City of uMhlathuze Municipality and the National Treasury PPP Unit, no budget is currently allocated by uMngeni-uThukela Water for this project in the 2022-2023 financial year.

(vii) (g) Conclusion

This is an important project that potentially has many benefits (environmental, financial and technical) for uMngeni-uThukela Water. However the exact role of uMngeni-uThukela Water needs to be confirmed and clarified. Based on the recommendations of the Transaction Advisor (TA) in their discussion document, the two options that appear to present the least risk to uMngeni-uThukela Water and the project are:

- uMngeni-uThukela Water participating as an investor to the SPV

- uMngeni-uThukela Water participating as the main off-taker of clear water and the distributor of the water to end-users.

It is expected that further work or refinement will only be done on the selected option.

(l) 16.8.11 Water Resources Augmentation: Increase capacity of uThukela - Goedertrouw Transfer Scheme

(i) (a) Description of Original Planned Scheme

The original plan for the uThukela–Goedertrouw Transfer Scheme (TGTS - Middledrift Scheme) envisaged a 252 million m^3/annum (8 m^3/s) transfer scheme. This proposed scheme included a weir, pump-station (Madungela), pipeline and a 3.5m diameter, 7.8km long gravity tunnel, introduced to reduce the pumping head required. The augmentation was planned in three phases of 84 million m^3/annum (2.66m^3/s) each over a period of fifteen years. Water abstracted from the uThukela River was to be transferred to the Mhlathuze catchment upstream of Goedertrouw Dam, which supplies a large part of the downstream catchment.

(ii) (b) Actual Emergency Scheme Built

During the drought of 1994, Phase 1 of an emergency augmentation scheme was put in place (commissioned in 1997) with the capacity to deliver 37 million m^3/a (1.2m^3/s) to the Mvuzane stream, a tributary of the Mhlathuze River. This emergency scheme did not include the previously proposed weir or tunnel, and most of the infrastructure was not intended to be permanent. Only the 1,500mm-diameter pipeline between the high-lift pump-station and the future tunnel entrance was intended to remain when the final scheme was to be built. However, once the emergency capital investment had been made, it became apparent that using the emergency infrastructure would be more cost effective than replacing it with the originally proposed tunnel scheme.

In April 2017, Phase 2 of the Emergency Scheme commenced with a view of providing an additional 1.2m^3/s of raw water (2.4m^3/s in total). This water would be transferred over the watershed by pipeline (pump and gravity) to the head waters (Mvuzane River) of the Goedertrouw Dam. Phase 2 included the following main items of infrastructure and was originally scheduled for completion in March 2019:

- New abstraction works at the uThukela River
- Desilting Works
- High Lift Pump Station
- Additional Rising Mains
- Break Pressure Tanks and Gravity Pipeline

(iii) (c) Current Status

The design of the upgraded scheme had been completed. The construction has resumed and there has currently work been completed on the abstraction, the pump stations at Madungela and Mkhalazi. The pipeline from Mkhalazi to watershed will be replaced. The completion is scheduled for end of 2024.

(iv) (d) Proposed further Scheme Phases

If further phases are implemented, it is probable that a new abstraction works, weir and dedicated conveyance infrastructure will be required to address hydraulic and sediment management challenges.

Further phases of the increased transfer from the uThukela River at Middledrift have been incrementally evaluated (New Phases 1, 2 and 3) for a variety of infrastructure combinations, to transfer uThukela River water to a Mhlathuze River tributary that flows to Phobane (formerly Goedertrouw) Dam. The following new phased implementation is proposed (**Table 16.48**):

Table 16.48 Proposed Yields of Additional Phases

Item	New Phase Yield		Cumulative Yield	
	(m^3/s)	(million m^3/annum)	(m^3/s)	(million m^3/annum)
Current Transfer Yield	1.2	37.8	1.2	37.8
New Phase 1	1.5	47.3	2.7	85.1
New Phase 2	3.0	94.6	5.7	179.7
New Phase 3	3.0	94.6	8.7	274.3

(v) (e) Available Yield from uThukela River

The availability of water from the uThukela River will also affect the feasibility of this scheme, and the ultimate capacity that it will be possible to reach. It is not clear how much water is available from the uThukela River, and this will need to be clarified if the scheme is investigated at feasibility level. The theoretical yield of the uThukela River is almost completely taken up, but there may be additional yield as a result of over-allocations and intermittent usage. The hydrological modelling of the uThukela River, from which the availability of water can be deduced, assumes that the full potential volume of 530 million m^3 per annum is transferred out of the upper uThukela River to Sterkfontein Dam. In reality, no significant volumes of water have been pumped to Sterkfontein for the last 10 years.

(vi) (g) Conclusion

The DWS Richards Bay Reconciliation Strategy investigated a range of different options in terms of phasing arrangements and infrastructure. The findings based on the relative costs were that the most cost-effective option is the new Phase 1 option of augmenting the system by 1.5m^3/s (47 million m^3/annum) and including the tunnel. Even if later phases are to be constructed, building the tunnel at the beginning is still the most economical option.

It seems unlikely that enough water will be allocated from the uThukela River for the third phase (an additional 236 million m^3/annum) by the time it is required, and possibly even for the second phase (an additional 142 million m^3/annum). However, there is a possibility that the existing licence for abstraction from the uThukela River at Fairbreeze could be transferred to the Middledrift site.

Advantages of this intervention are that some of the infrastructure is already in place and that the pipeline routes and pump-station sites are already established. The yield of even the first phase is sufficiently large that the system would be adequately supplied for several years.

Disadvantages include the higher costs relative to the Lower Thukela scheme, and the likely lack of availability of water for later phases. **Figure 16.51** shows the key components of the scheme.

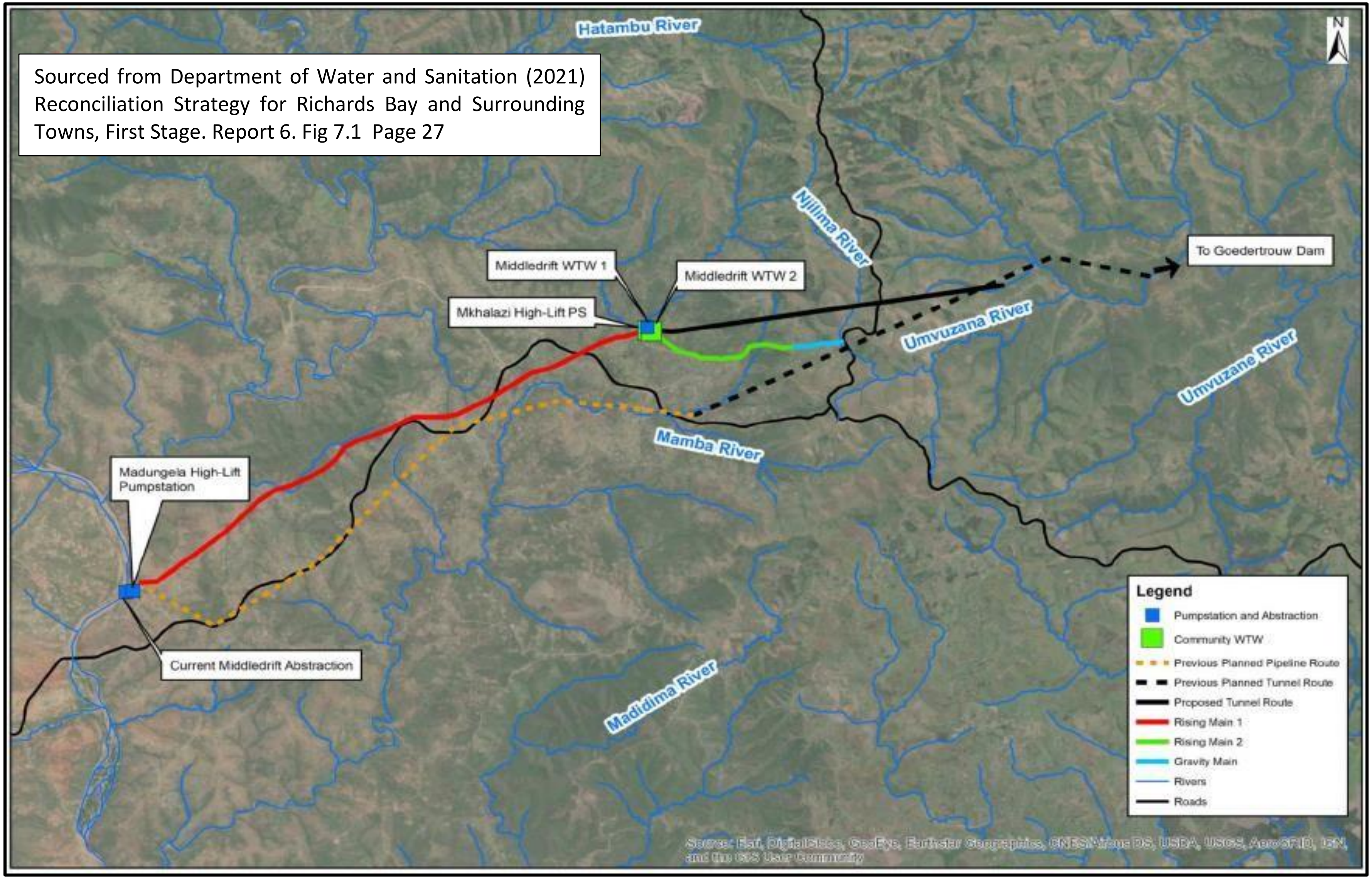

Figure 16.51 uThukela-Goedertrouw Transfer Scheme – Augmentation Options.

(m) 16.8.12 Water Resources Augmentation: Raising Goedertrouw Dam Wall

(i) (a) Description of Dam

The Groedertrouw Dam (officially renamed Phobane Dam) is located on the Mhlatuze River approximately 13km north of Eshowe in Northern KwaZulu-Natal. The dam was completed in 1982. It is an earth fill dam with an uncontrolled ogee spillway situated in a saddle on the right flank, with a total freeboard of 7.5m. The earth embankment has a maximum height of 88m above its lowest foundation and a crest length of 660m. The uncontrolled ogee spillway is 160m long and a hydraulic model study has shown the maximum discharge capacity to be 6957m³/s at the NOC level. The dam, which has a storage capacity of approximately 301 million m³, is used to regulate the flow of the Mhlathuze River and to provide a reliable water supply for urban and industrial use in the Richards Bay - Empangeni area, as well as to supply water for irrigation.

The outlet works of the dam is situated on the left flank and consist of an inlet tower at the upstream toe of the embankment from which two 1400mm outlet pipes and one 2 200mm diameter silt outlet pipe lead through a 577m long outlet tunnel to the downstream outlet control structure.
In terms of the Dam Safety Regulations the dam is classified as a Category III dam with a high hazard potential.

Figure 42: Goedertrouw Dam – Aerial Photo

(ii) (b) Proposed Option

A water resources analyses scenario was undertaken to determine the potential benefit of raising Goedertrouw Dam and this is summarised in the DWS Richards Bay Reconciliation Strategy. The proposal involves a 2.8m raising of the dam wall by building a concrete wave wall on the existing earthfill dam wall, and increasing the capacity of the spillway through a labyrinth spillway configuration. The dam can be raised by 2.8m, which will result in an increase in storage capacity from the existing volume of 301 million m³ to 336 million m³. The corresponding increase in yield to the system would be 5.8 million m³/annum (**Table 16.49**).

Table 16.49 Characteristics and Yield of Raising Goedertrouw (Phobane) Dam

Description	Volume (million m³)	Yield (million m³/annum)	Height (m)	Surface Area (ha)
Existing Dam	301 (2000)	51.5	88.0	1194
Raised Dam	336	57.3	90.8	1279

(iii) (c) Unit Reference Values

The Unit Reference Values for this option are documented in the DWS Richards Bay Reconciliation Strategy. Capital, operational and maintenance costs were updated to a base date of October 2020 for the raising of the dam and ancillary infrastructure and the unit reference values (URV) were determined for discount rates of 6%, 8% and 10%, and for a 37 analysis year period (**Table 16.50**).

Table 16.50 Unit Reference Values of Raising Goedertrouw (Phobane) Dam

Item		Discount Rate 6%	Discount Rate 8%	Discount Rate 10%
Total Capital Cost	(R million)	128	128	128
Annual Operating Cost	(R million)	0.28	0.28	0.28
Increase in Yield	(million m^3/annum)	5.8	5.8	5.8
NPV Cost	(R million)	122	118	116
NPV of Water Supply	(million m^3)	75	58	46
Unit Reference Value	**(R/m^3)**	**1.63**	**2.05**	**2.51**

(iv) (d) Current Status

A preliminary design at pre-feasibility level of detail of the proposed raising of Goedertrouw Dam was completed. DWS Officials requested the inclusion of the raising of Goedertrouw Dam as a second phase of the Upgrading uThukela-Goedertrouw Transfer Scheme, which did not happen.

Currently no funds have been allocated to implement a feasibility study into this option of raising the Goedertrouw Dam wall.

(v) (e) Conclusion

This is a relatively straightforward option, in that there are few additional impacts or peripheral infrastructure required to implement it. As the dam already exists, the environmental impacts will be marginal.

The additional yield is limited, but the related costs are correspondingly low, and the implementation is likely to be quicker than other options that require identification and/or investigation of a new site. Raising the dam would also allow some of the ‘dead’ storage lost to siltation of the dam to be recovered. However overall the DWS Richards Bay Reconciliation Strategy specified this option as a low priority.

(n) 16.8.13 Comparison of Unit Reference Values for Water Resource Augmentation / Supply Initiatives

The following table compares and ranks the estimated URV values for the various New Water Resource or Water Augmentation Initiatives that have been described in this chapter. All URVs are for a net present value discount rate of 8% (**Table 16.51**).

Table 16.51 Unit Reference Values for Water Resource Augmentation / Supply Options

Rank	Chapter Reference	Item	Total Capital Cost (R million)	Annual Operating Cost (R million/annum)	Increase in Yield (million m³/annum)	Increase in Yield (Mℓ/day)	NPV Cost (R million)	Unit Reference Value (R/m³)
1	16.8.12	Raising Goedertrouw Dam	128	0.28	5.8	15.83	118	2.05
2	16.8.4	Nseleni River Dam *	300	1.95	12.0	32.76	283	2.56
3	16.8.6	Kwesibomvu Dam **	2 273	77	66.6	181.81	3 010	4.21
4	16.8.7	Thukela Abstract. (Coastal Pipe) ***	835	Unspecified	20	54.6	1 103	7.36
5	16.8.11	Increase capacity of uThukela - Goedertrouw Transfer Scheme ****	1 205	Unspecified	47.3	129.13	3 470	8.23
6	16.8.5	uMfolozi Off-channel Dam	1 858	150	36.9	100.74	3 105	8.91
7	16.8.3	Seawater Desalination *****	2 747	288	21.9	59.79	5 409	17.78
-	16.8.8	Raising of Lake Nsezi	-	-	-	-	-	-
-	16.8.9	Water Conservation & Demand Man	-	-	-	-	-	-
-	16.8.10	Wastewater & Effluent Reuse	-	-	27.37	75	-	-

Notes:

** 1.0 MAR Dam of the Nseleni River (no pipeline or WTW)
*** 26m high Dam transferring to Nsezi WTW
**** Treated Water Pipeline – 20 million m³/annum
**** Single Phased increase to 2.7m³/s with tunnel
***** Marine Intake

The Unit Reference Value (URV) is a measure developed in the 1980s, by the then Department of Water Affairs, for use in the preplanning stages of water resource development projects. It assists decision-makers in allocating scarce resources in the most effective way by comparing, in a consistent manner, various water schemes. It gives a relative indication of the return, in terms of water delivery, for a given financial investment. The lower the URV, the better value the project.

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- Mlungisi Shabalala (Hydrologist) Water resources of the South Coast, Middle uThukela, uMhlathuze, uMfolozi, uMkhuze, uPhongolo and Lake Sibiya Systems
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Kevin Meier,
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