

Infrastructure Master Plan 2023 2023/2024 – 2053/2054 Volume 1

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UMGENI WATER

INFRASTRUCTURE MASTER PLAN 2023

2023/2024 – 2053/2054

JUNE 2023

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PREFACE

This Infrastructure Master Plan 2023 describes:

- Umgeni Water’s infrastructure plans for the financial period 2023/2024 – 2053/2054, and
- Infrastructure master plans for other areas outside of Umgeni 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 2022.

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:

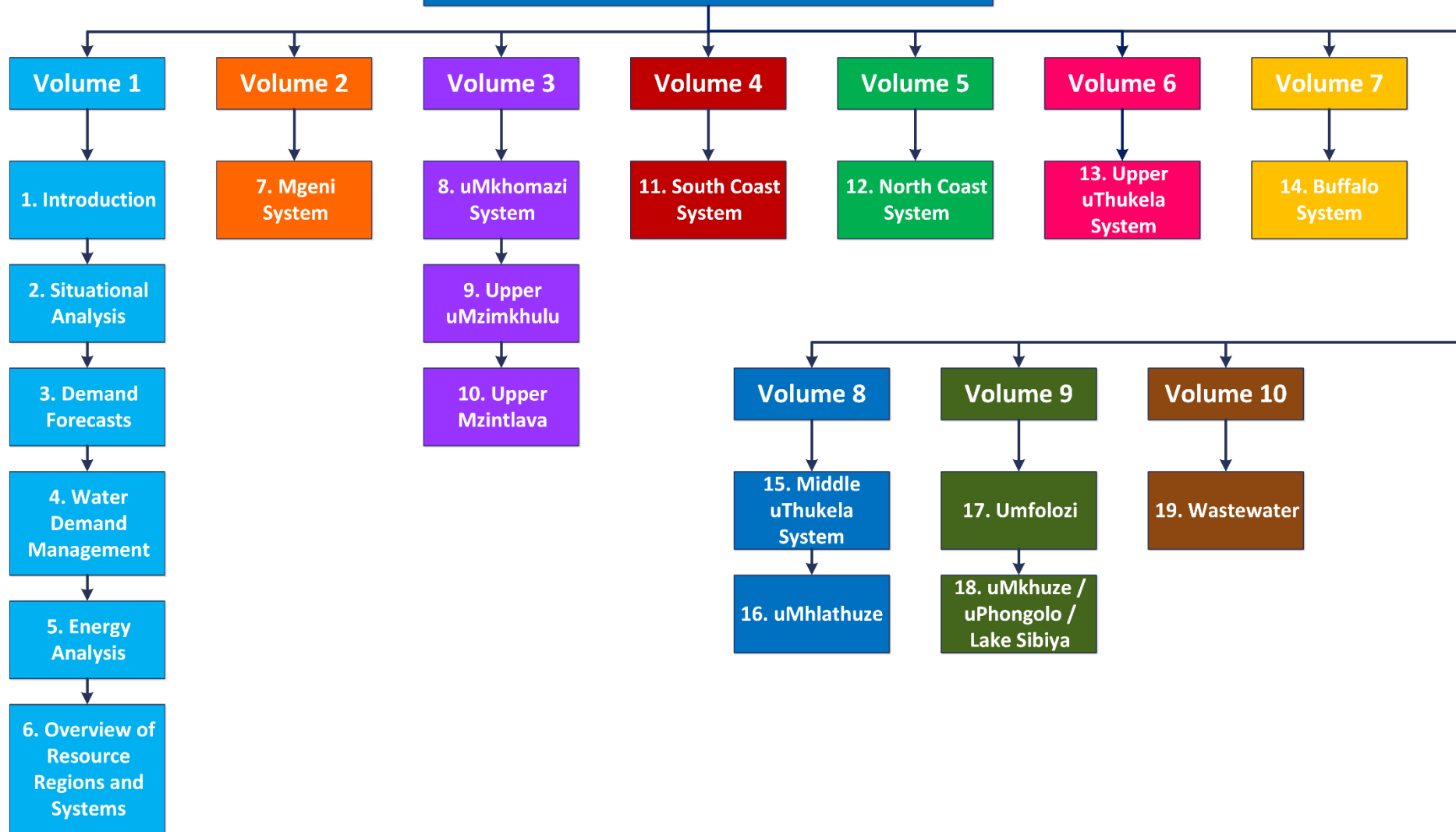
- **Section 2** describes the most recent changes and trends within the primary environmental dictates that influence development plans within the province.
- **Section 3** relates only to the Umgeni Water Operational Areas and provides a review of historic water sales against past projections, as well as Umgeni Water’s most recent water demand projections, compiled at the end of 2021.
- **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 Umgeni 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** Mgeni 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 Umgeni 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 Umgeni Water are also described in this section.

Infrastructure Master Plan 2023/2024



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 Umgeni 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	eThekwinini 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-Mgeni Transfer Scheme
MMTS-1	Mooi-Mgeni Transfer Scheme Phase 1
MMTS-2	Mooi-Mgeni 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
UW	Umgeni 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>.

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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

1. INTRODUCTION

1.1 Purpose

“Plan for what it is difficult while it is easy, do what is great while it is small.”

Sun Tzu, The Art of War

Established in 1974, Umgeni Water has developed into the second largest water utility in South Africa, supplying over 410 million cubic metres of bulk potable water annually to seven Water Services Authorities (WSAs), comprising one metropolitan municipality, five District Municipalities, and one Local Municipality (LM), within the province of KwaZulu-Natal (KZN). The extent of these eight WSAs, is shown in **Figure 1.1**.



Figure 1.1 Locality of Umgeni Water’s area of operation.

The seven WSAs with whom Umgeni Water currently has a signed bulk supply agreement, collectively contribute approximately 84%¹ of the province’s Gross Value Added (GVA). However, the

¹ KZN Treasury 2022 after IHS Markit Regional eXplorer 2201 (2.6p)

highest poverty densities in KZN are also located in these areas. Hence, Umgeni Water is faced with the dual challenge of ensuring that the province's economic engine remains served with a reliable supply of potable water, whilst also ensuring that water is adequately provided for the eradication of water backlogs, the improvement of the level of water services, and the alleviation of poverty.

In November 2022 the Minister of Water and Sanitation published a Government Gazette (No. 47442) with the proposal to extend the Umgeni Water boundary to include Mhlathuze Water to form a single water board in KZN in terms of Section 28 of the Water Services Act, 1997 (Act No. 108 of 1997). At the time of updating this IMP, the proposal was out on public comment and the due diligence on the proposal was in progress. The outcome of this proposal will be reported in the next IMP.

In December 2015 the Minister of Water and Sanitation published a Government Gazette (No. 39491) which extends Umgeni Water's operational area to include all WSA's within the province. With this instruction, Umgeni Water can become the bulk water provider for any of the WSA's in KZN if a Bulk Supply Agreement is concluded with the WSA.

This Infrastructure Master Plan (IMP) includes, not only detailed planning for the seven WSAs supplied by Umgeni Water, but also bulk water infrastructure master plans for the remaining WSA's in KwaZulu-Natal. Umgeni Water recognises that many of the WSA's in KZN do not have the funds or resources to undertake comprehensive planning. As a result, plans for the areas are included here to assist these WSA's in understanding and planning water supply through their areas.

It is also important to note that, even though Umgeni Water has a bulk supply agreement with a WSA, it is not mandated to supply bulk water across the entire WSA. In particular, Umgeni Water does not supply bulk water in the southern portion of Ugu DM, the area north of the uThukela River in iLembe DM or the entire Harry Gwala DM apart from the town of Ixopo and a small portion of the southern uBuhlebezwe Local Municipality (that was formerly a part of the Umzumbe Local Municipality in Ugu DM).

WSAs are responsible for water service delivery to the people who reside within their respective areas of jurisdiction. The areas that currently receive reticulated water from the WSAs, who in turn receive bulk potable water from Umgeni Water, are shown in **Figure 1.2**.

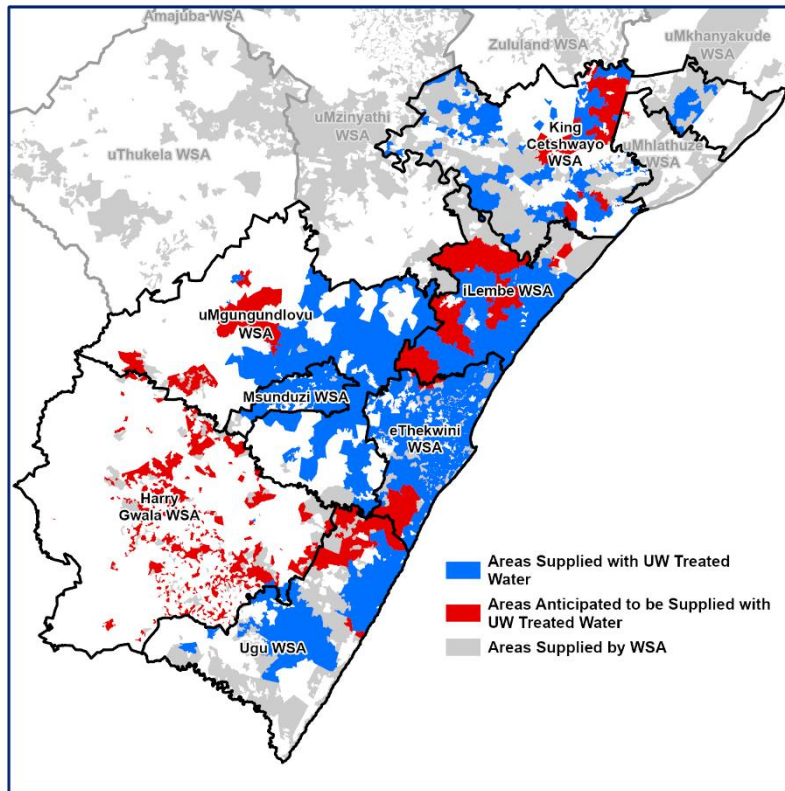


Figure 1.2 Umgeni Water’s supply footprint including KCDM.

This collective reticulated area constitutes Umgeni Water’s ‘supply footprint’ and comprises of various levels of service based on a number of bulk supply schemes that are both interdependent and stand-alone.

The environment within which Umgeni Water is required to fulfil its function as a regional bulk water service provider is constantly undergoing change, with many factors influencing both the water demand and water supply components of its business. In particular, the Covid Pandemic, the economic up- and down-turns that the country, including KZN, has experienced over the past few years as well as the most recent drought, have a marked influence. Umgeni Water’s infrastructure planning therefore needs to be continually reviewed, updated and adapted in order to be responsive (wherever possible) to this dynamic external environment.

For Umgeni Water or any WSA for that matter, to effectively achieve its mission, it must have, amongst other things, a clearly defined plan of what is required in the future so that it can be addressed in the present. This Infrastructure Master Plan 2023 (IMP 2023) describes how Umgeni Water intends to address the future bulk water infrastructure requirements within its area of operation in order to meet the anticipated needs and provides plans for other WSA’s in KZN so that these areas can ultimately achieve universal access to water. It also shows the proposed integration between water supply infrastructure plans and the regional water resource plans being developed by the DWS.

This infrastructure master plan comprises the following sections:

- **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 Umgeni Water Operational Areas and provides a review of historic water sales against past projections, as well as Umgeni Water’s most recent water demand projections, compiled at the end of 2022.
- **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 Umgeni 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.

Water Resource Catchments and Water Supply Systems, unfortunately, do not follow WSA / Municipal boundaries. As a result, Water Supply Infrastructure often crosses municipal boundaries and for this reason this IMP has been divided into 12 “Systems”. A system is described as a water resource region (generally conforming to catchment boundaries) and the area supplied by that resource. The next 12 Sections describe the current water resource situation and water supply infrastructure of the various systems that have been identified by Umgeni Water for the purpose of this IMP and which cover the full extent of the KZN Province. These 12 systems include:

- **Section 7** Mgeni System
- **Section 8** uMkhomazi System
- **Section 9** uMzimkhulu System
- **Section 10** Mzintlava System
- **Section 11** South Coast System
- **Section 12** North Coast System
- **Section 13** Upper uThukela System
- **Section 14** Buffalo System
- **Section 15** Middle uThukela System
- **Section 16** Mhlathuze System
- **Section 17** Umfolozi System
- **Section 18** uMkhuze / uPhongolo / Lake Sibiya System

Section 19 describes the wastewater works currently operated by Umgeni Water and provides plans for development of additional wastewater treatment facilities. The status of wastewater treatment in WSA’s that are not supplied by Umgeni Water, are also described in this section.

1.2 Setting the Scene

The extent of the WSA’s in KwaZulu-Natal are shown in **Figure 1.3** together with the Umgeni Water operational area. Also shown in this figure are the system boundaries that have been defined for the purposes of this IMP and the location of the bulk Water Treatment Plants and Wastewater Treatment Plants that exist in the province.

The distribution of Umgeni Water’s infrastructure is shown in **Figure 1.4**.

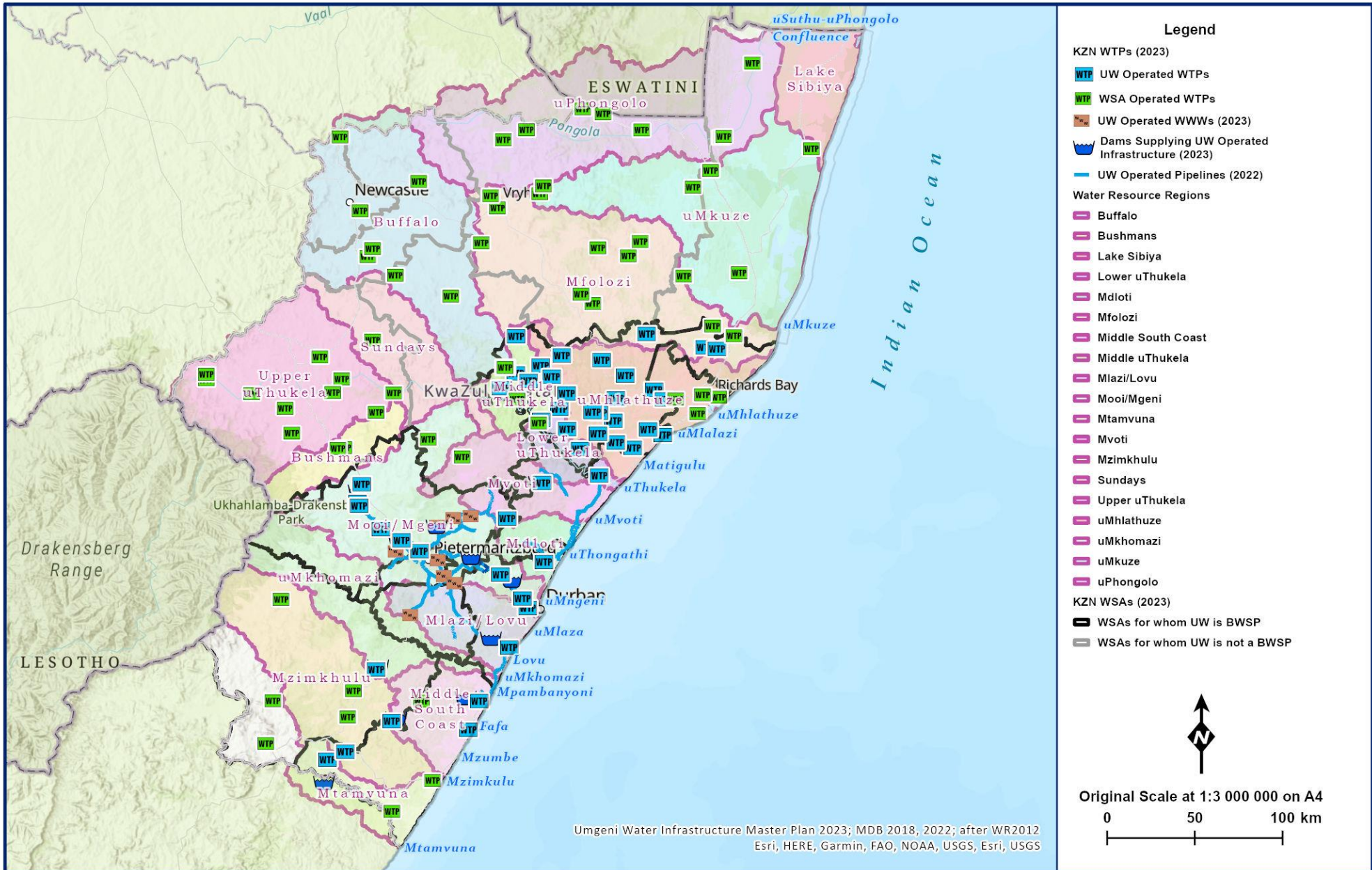


Figure 1.3 KZN water resource regions and WSA boundaries.

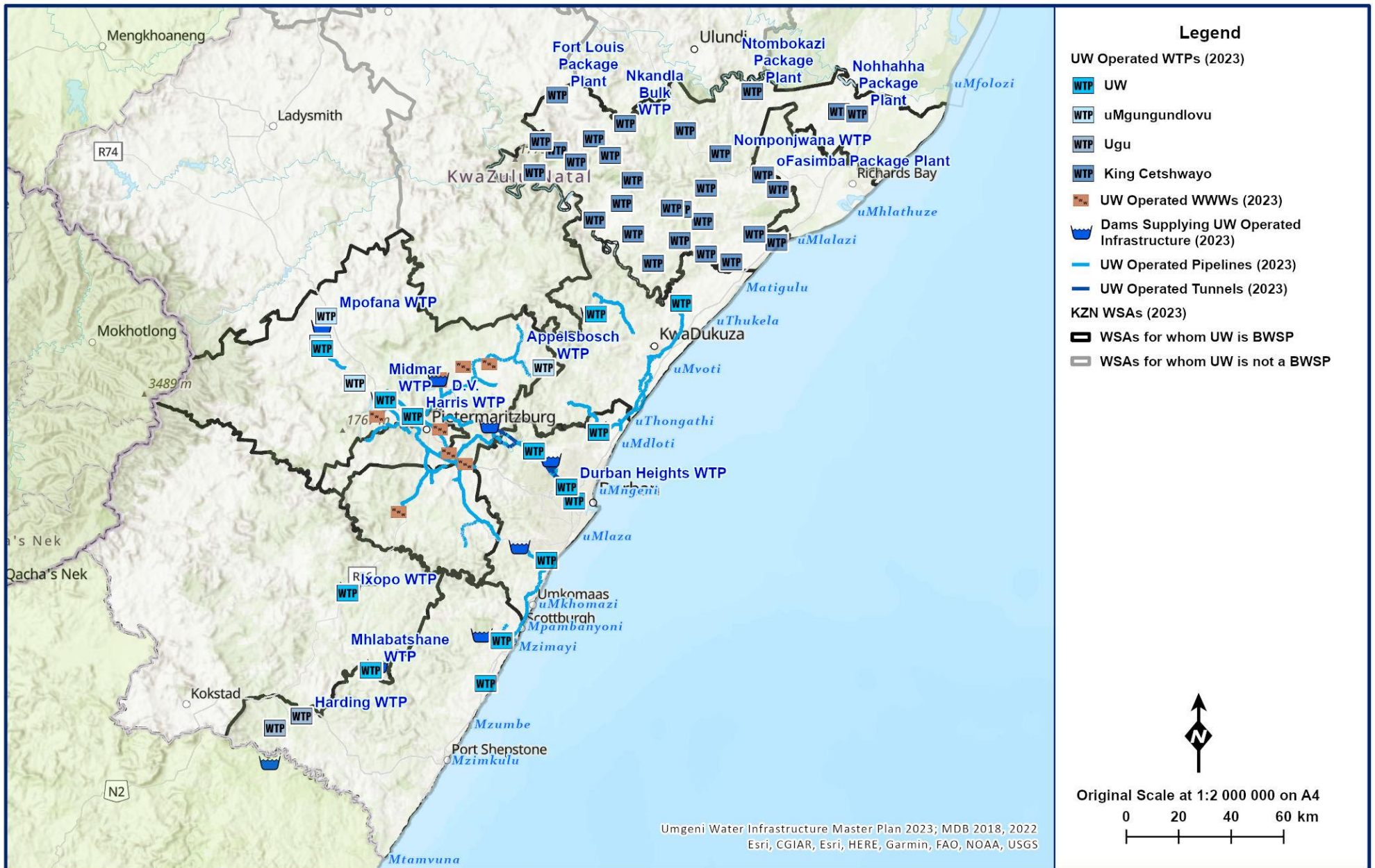


Figure 1.4 Umgeni Water's infrastructure (January 2022 – present).

2. SITUATIONAL ANALYSIS

2.1 Administrative Landscape

The different role-players within the KwaZulu-Natal (KZN) water and sanitation “governance landscape” (KZN Planning Commission 2020: 43) are illustrated in **Figure 2.1**.



Figure 2.1 KZN water and sanitation role-players (KZN CoGTA 2020: 22).

Umgeni Water’s role within this “governance landscape” is shown schematically in **Figure 2.2**.

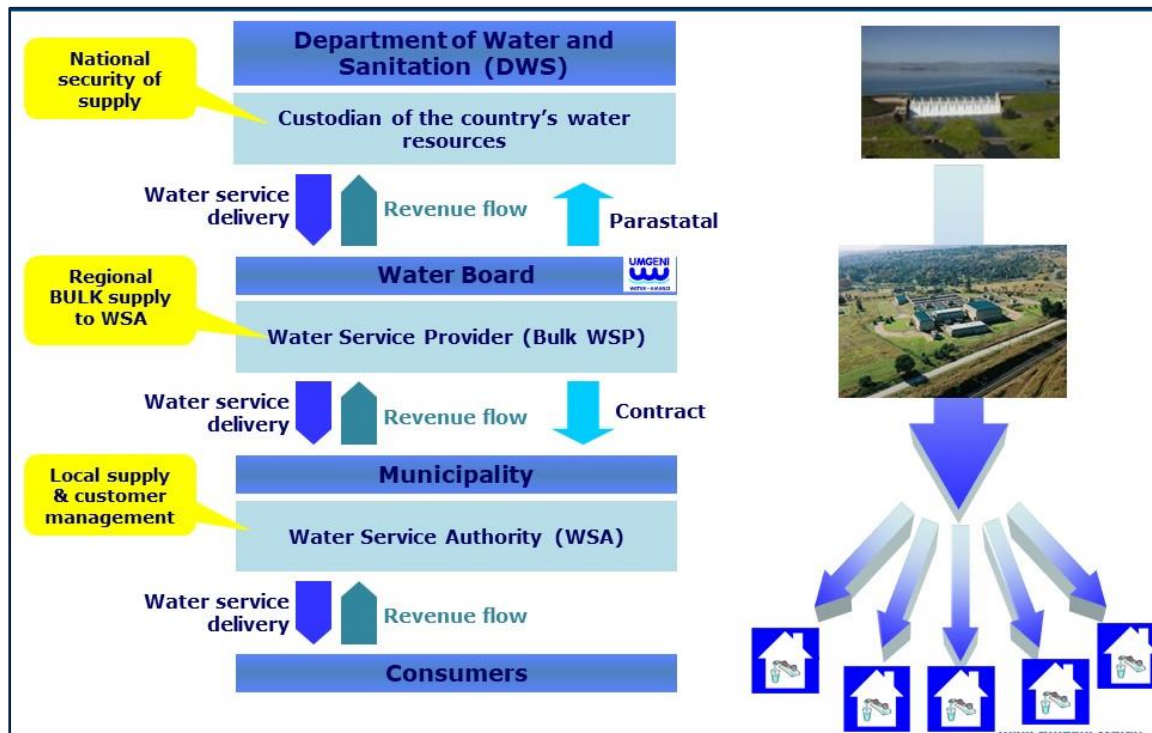


Figure 2.2 Water and sanitation “governance landscape” in KwaZulu-Natal.

The KZN “administrative landscape” (KZN Planning Commission 2011: 35) emanating from this “governance landscape” consists of 14 Water Service Authorities (WSAs) as shown in **Figure 2.3** and **Figure 2.4**. These 14 WSAs are composed of eThekweni Municipality (the only KZN metropolitan municipality), ten KZN district municipalities and three local municipalities viz. Msunduzi Municipality, Newcastle Municipality and the City of uMhlatuze (**Figure 2.3** and **Figure 2.5**).

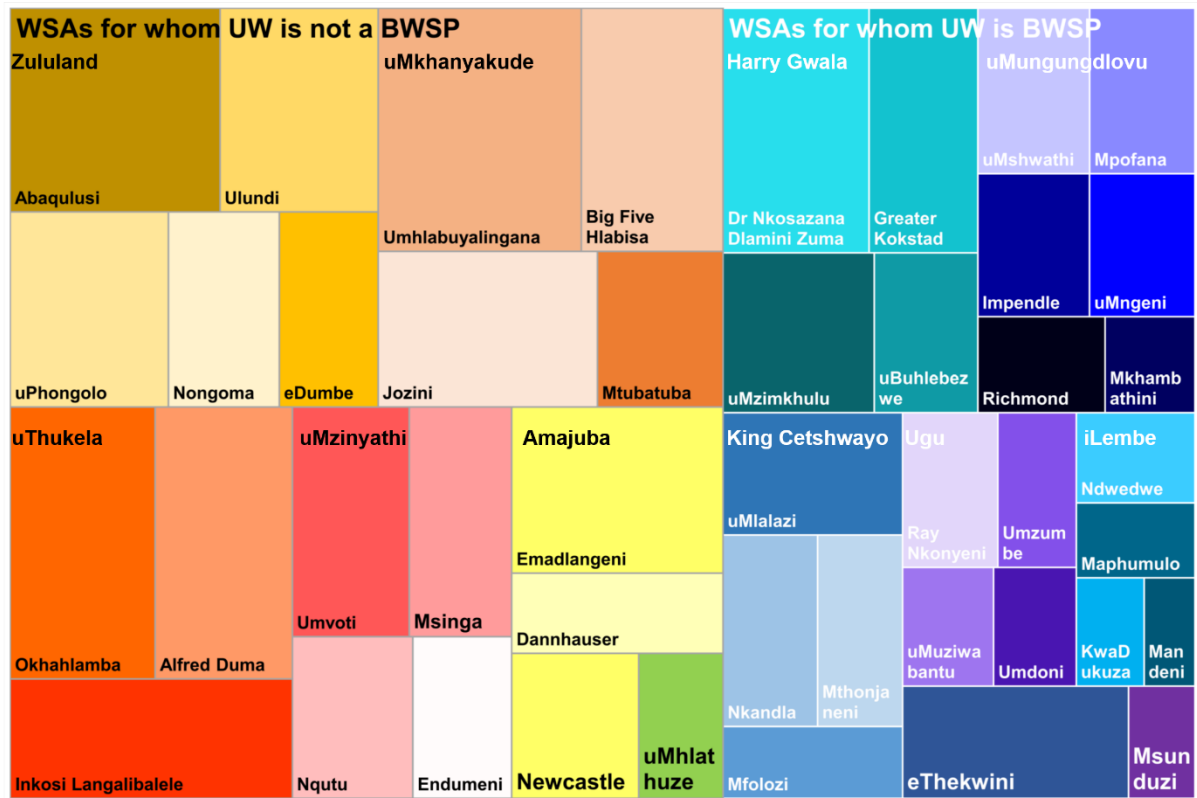


Figure 2.3 KZN Water Services Authorities (after MDB 2020).

Proposed changes anticipated to occur in the 2023/2024 financial year to the KZN water and sanitation administrative landscape are summarised in **Figure 2.6**. The Municipal Demarcation Board (MDB) has reduced the number of proposals received to 89 proposals and is currently assessing these proposals. Five of the proposals received may increase the number of WSAs in KZN. All five proposals are located in Umgeni Water’s operational area (**Figure 2.6**).

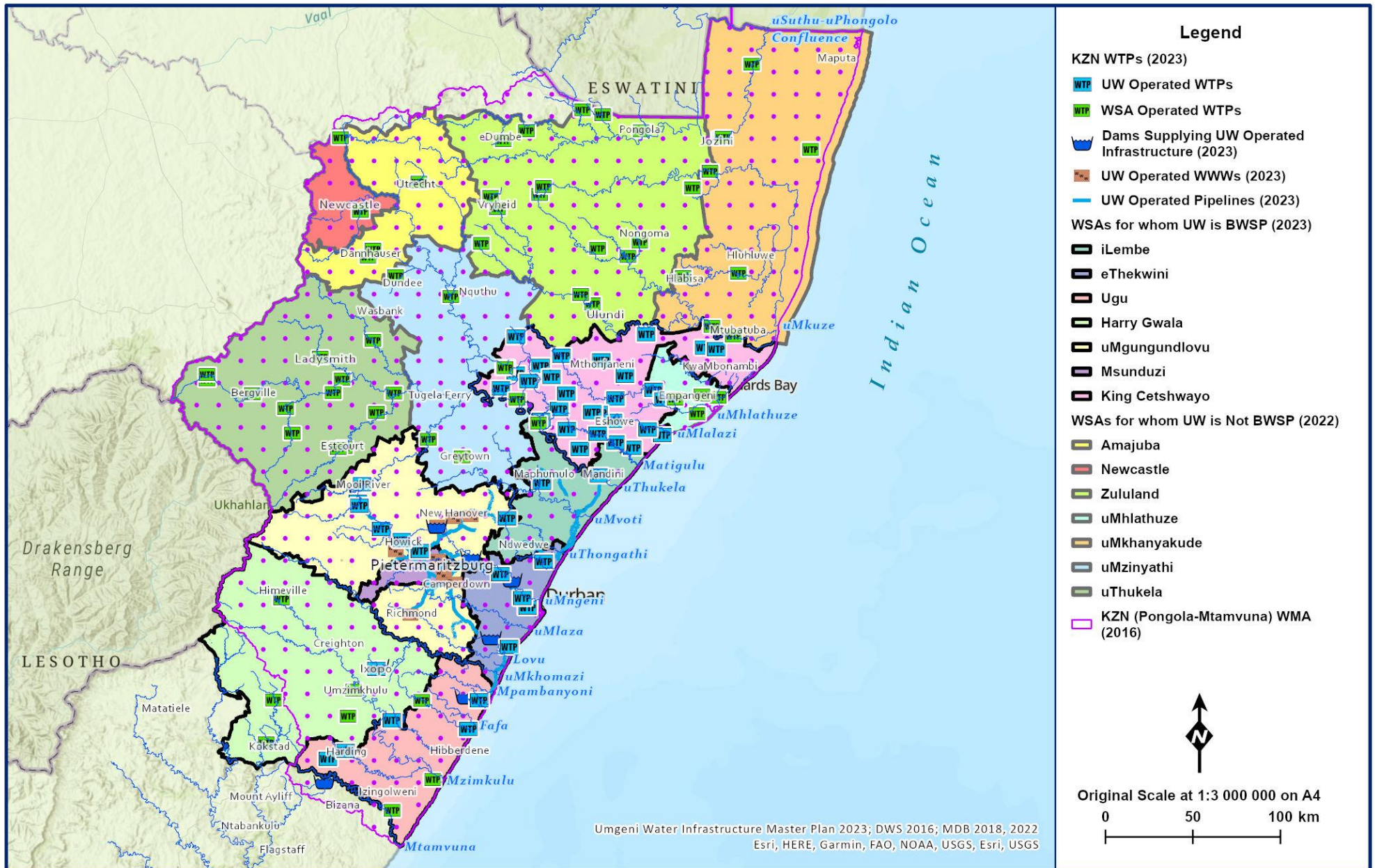


Figure 2.4 Institutional boundaries (DWS 2016; MDB 2020; Umgeni Water 2023).

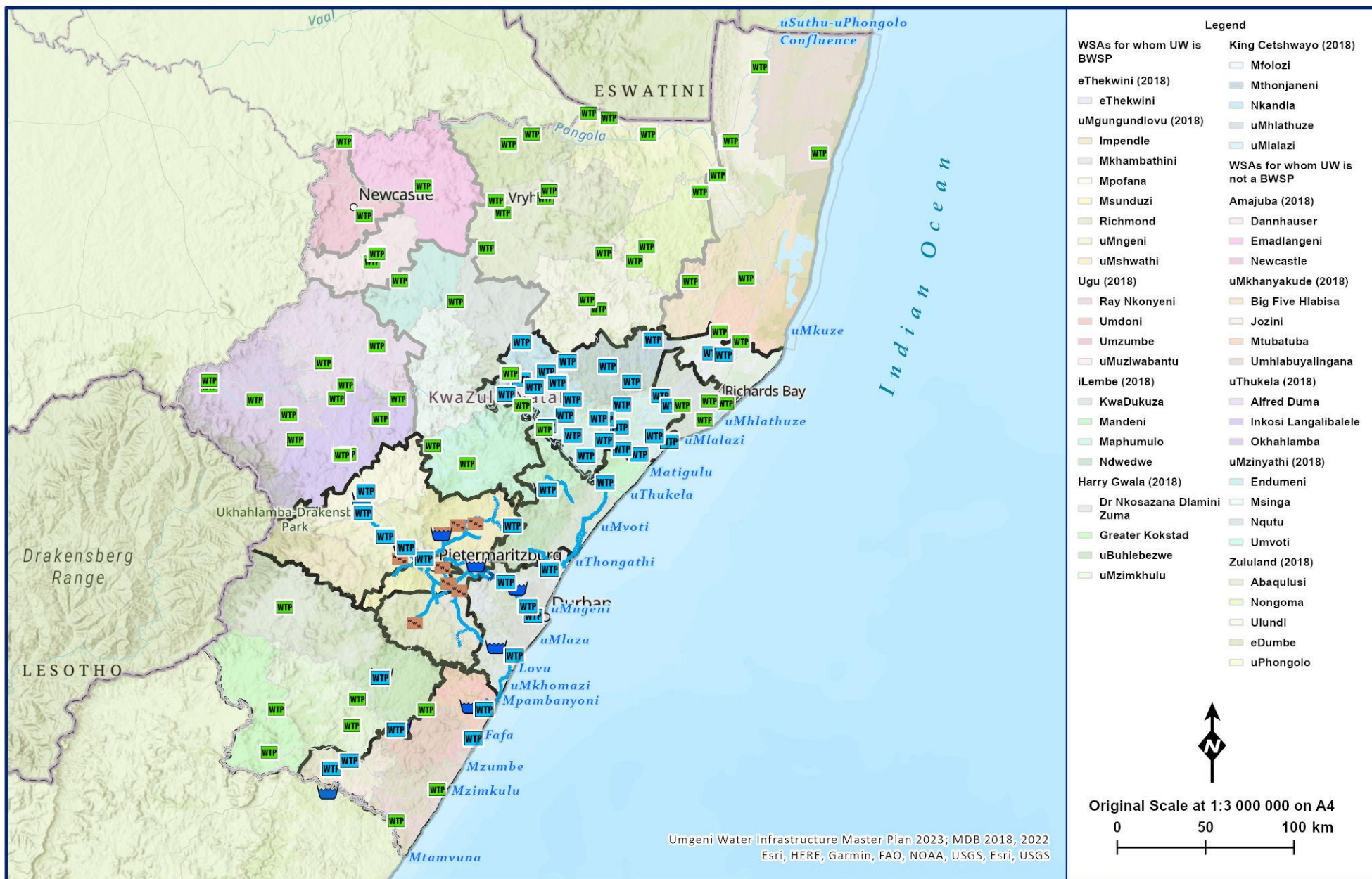


Figure 2.5 WSAs and their constituent local municipalities (MDB 2018; Umgeni Water 2023).

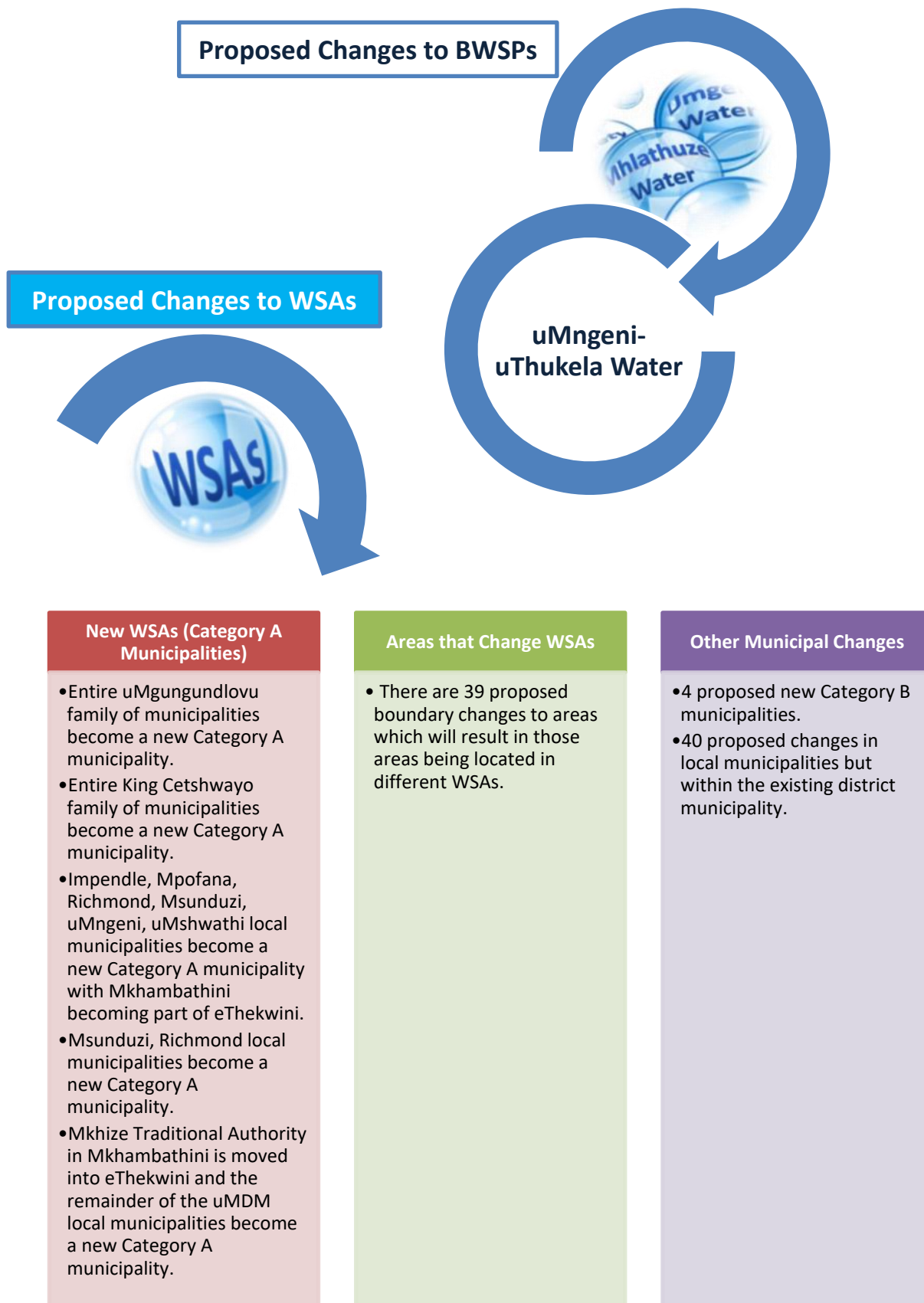


Figure 2.6 Proposed changes to the administrative landscape (DWS 2023; MDB 2023).

The 2022 KZN Spatial Development Framework (SDF) further identifies that:

“Within KwaZulu-Natal there is a spatially varied level of governance where the level of governance is affected by land ownership... there is a dynamic relationship between traditional and municipal governance which often impacts on the level of overall governance and service delivery in traditional areas... The clear role definition between these two leadership systems and the functional framework for collaboration... will need to be properly addressed towards improved governance in such areas.”

(KZN CoGTA 2022: 43)

The Ingonyama Trust is the public entity that was established in 1994 to administer the land that was owned by the former KwaZulu Government with the sole trustee being the king of the Zulu people (Ingonyama Trust 2019: website). However, areas under traditional jurisdiction are not only located on Ingonyama Trust land but also on state land and private land as illustrated in **Figure 2.7**.

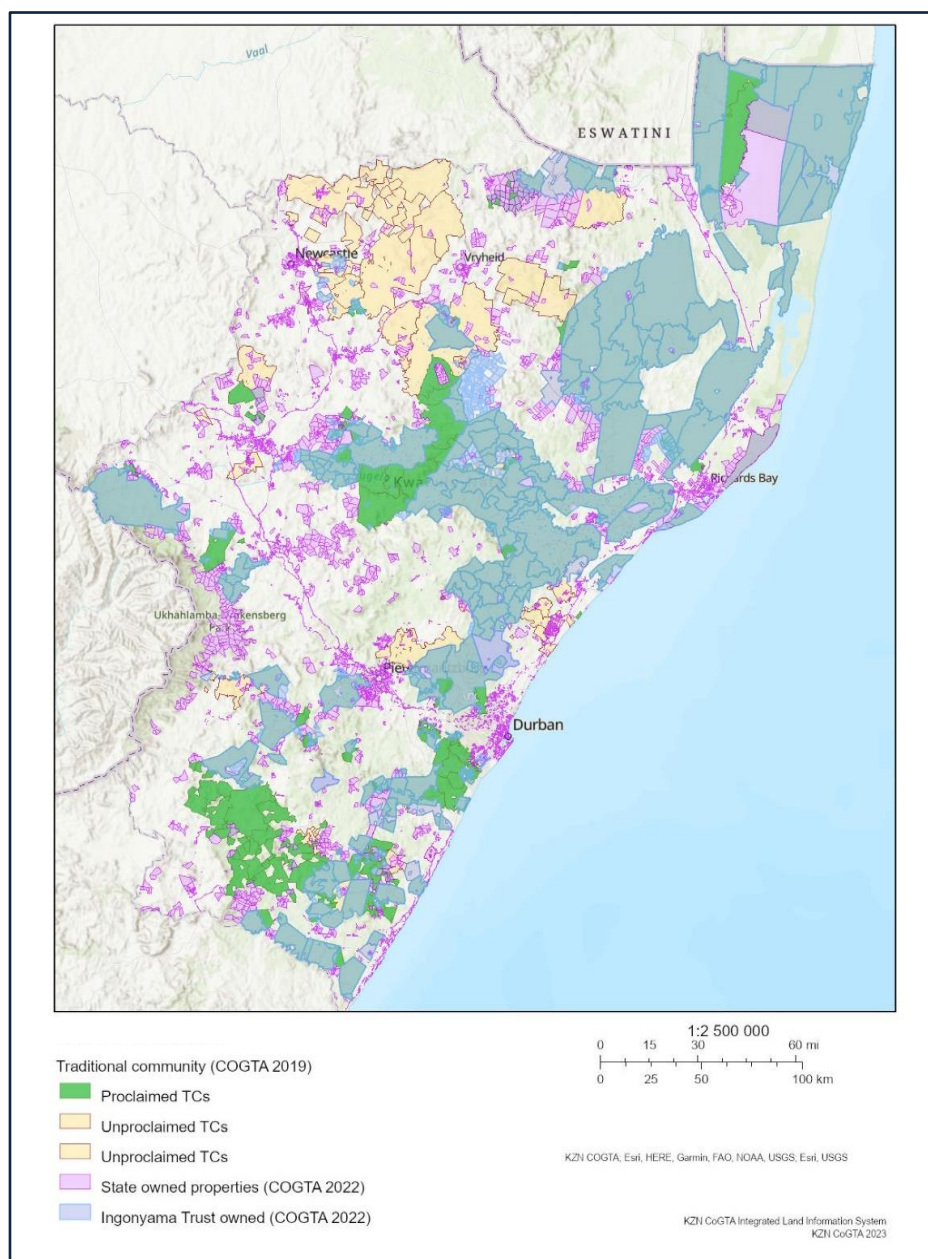


Figure 2.7 Location of traditional authority areas in KZN (KZN CoGTA 2023: website).

The changing “human footprint” (after KZN PGDS 2011) within Umgeni Water’s area of operation is summarised in **Figure 2.8**. The 2011 KZN PGDS explains that “the human footprint depicts human impact on the environment and is related to population density, infrastructure investment and economic activities” (2011: 33). The “human footprint” shown here is the result of the “assessment of the REGIO-OECD² degree of urbanisation model using population as an input for the years 1975, 1990, 2000, 2015 and 2020” (GHS 2023: website).

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The results are illustrated with the following three categories in **Figure 2.8**:

- 1 = “rural cells” defined as the grid cells outside high density clusters and urban clusters.
- 2 = “towns or suburbs or small urban areas” defined as “urban clusters” or low density clusters which are contiguous grid cells with a density of at least 300 inhabitants per km² and a minimum population of 5 000 inhabitants.
- 3 = “cities or large urban areas” defined as “urban centres” or high density clusters which are contiguous grid cells with a density of at least 1 500 inhabitants per km² or a density of built-up area greater than 50% and a minimum of 50 000 inhabitants.

(GHS 2019: website after Dijkstra, Lewis and Poelmann 2014)

It is shown in **Figure 2.8** that within Umgeni Water’s operational area, the provision of bulk water infrastructure “follows those areas in which population density increases”.

The land cover components of the “human footprint” are shown in **Figure 2.9** at a finer resolution. The building density (a Thiessen polygon analysis on Stats SA 2017 Dwelling Framework dataset), as shown in **Figure 2.10**, correlates with the spatial distribution of urban areas as illustrated in **Figure 2.9**. The relationship between the distribution of people (using the building density as a proxy) and access (using the national and provincial roads as a proxy) is shown in **Figure 2.11**.

The highest levels of human impact are shown to be along the key routes of accessibility viz. the “T-junction” formed by the N3 and N2 highways and along the provincial roads. In addition to the “T-junction” (**Figure 2.9**), **Figure 2.10** and **Figure 2.11** show that there is a concentration of people in the “shadow corridor” which runs parallel to the N2 highway.

² European Commission’s Directorate-General for Regional and Urban Policy and the Organisation for Economic Co-Operation and Development.

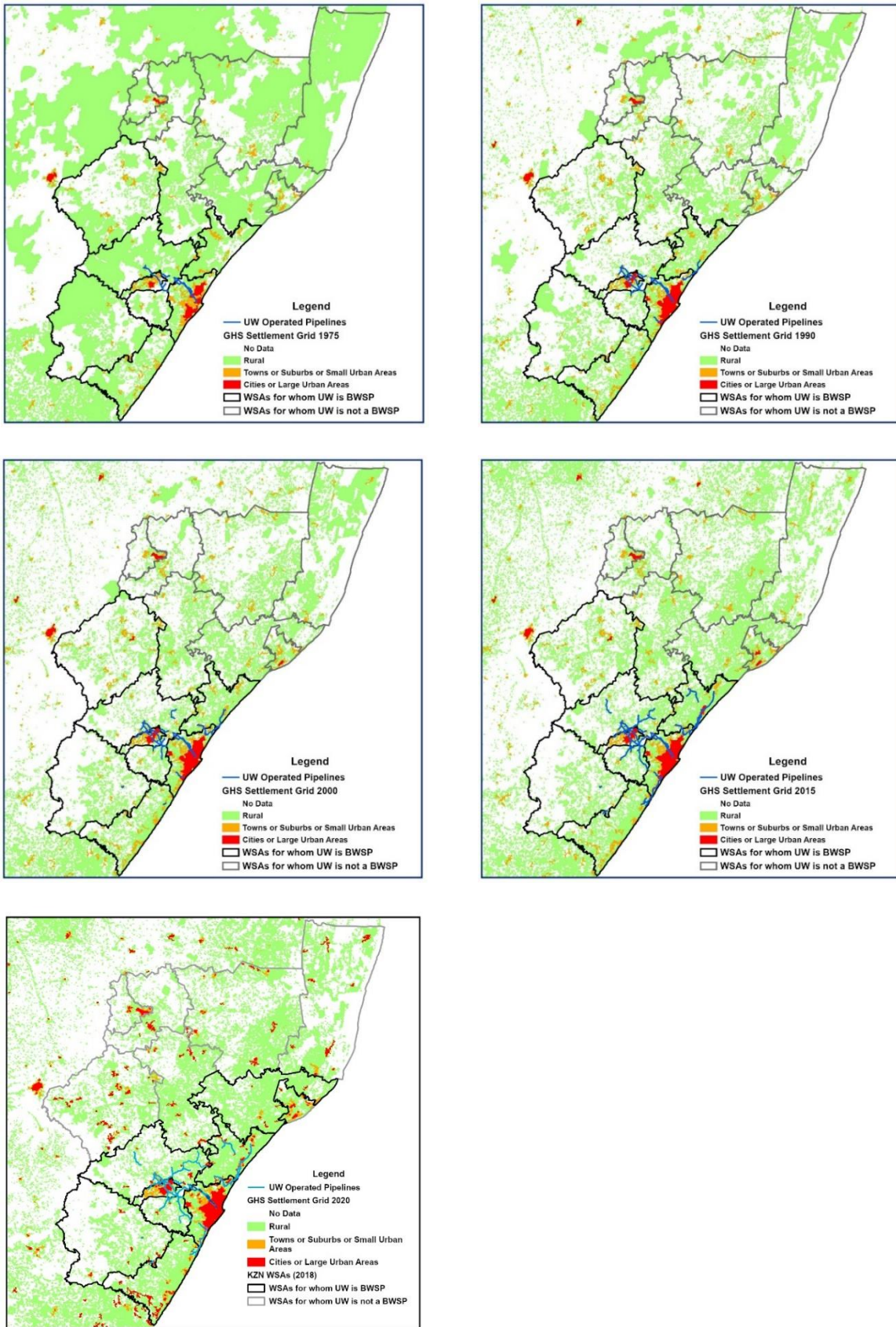


Figure 2.8 Change in the degree of urbanisation for four epochs, 1975; 1990; 2000; 2015 and 2020 (Global Human Settlements 2023).

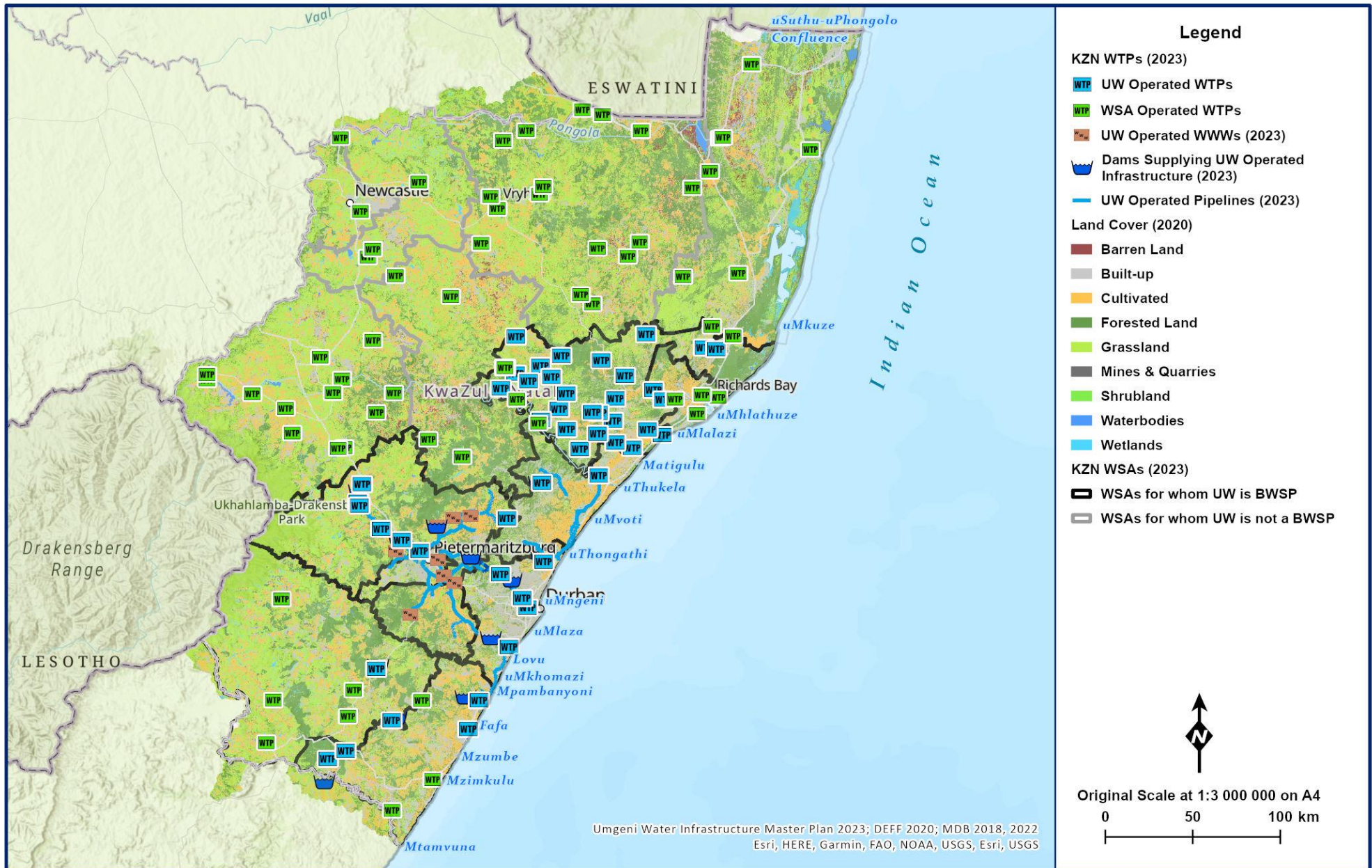


Figure 2.9 Land cover (DEFF 2020; MDB 2018; Umgeni Water 2023).

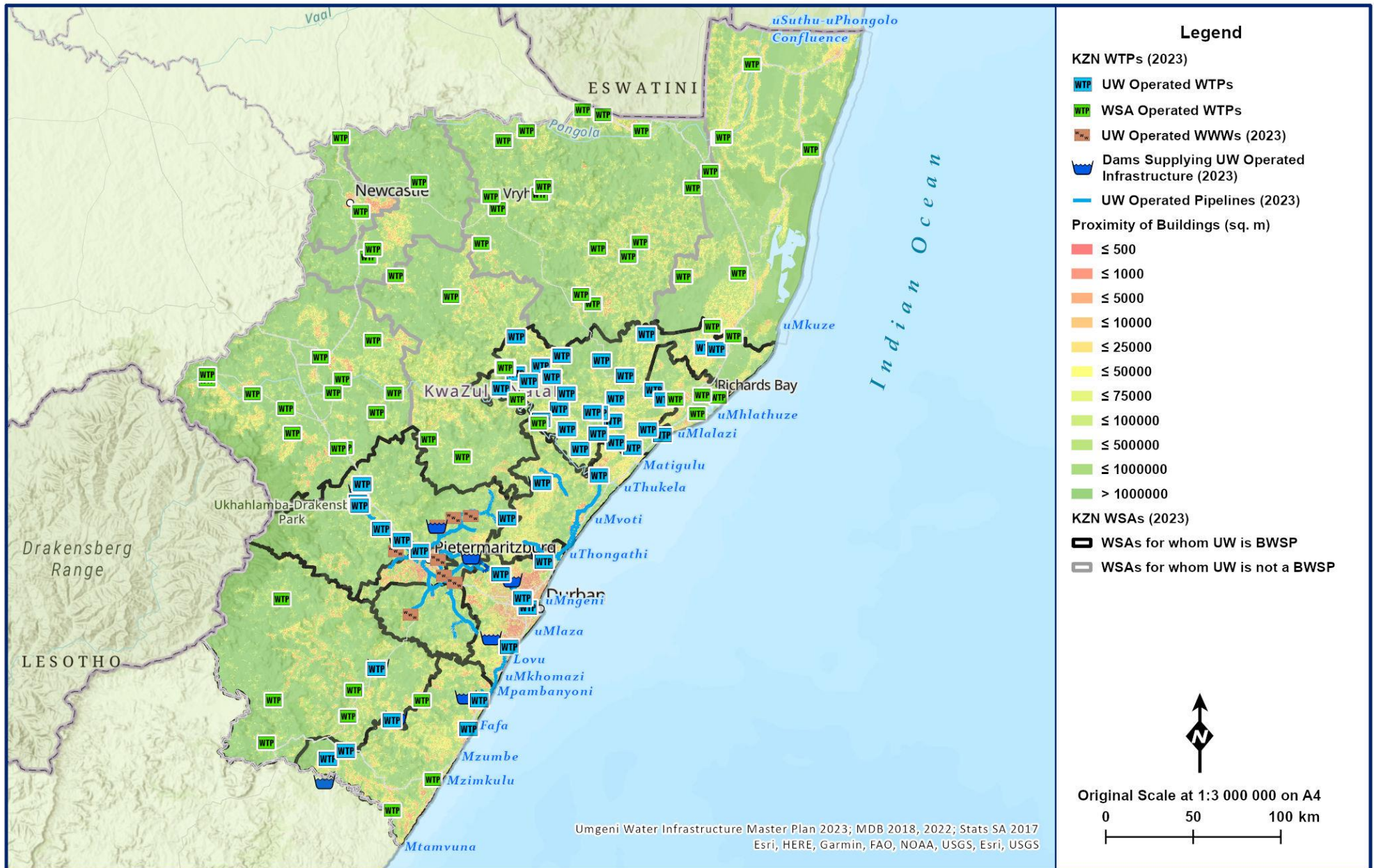


Figure 2.10 Thiessen polygon analysis showing proximity of buildings to one another (per m²) (after Stats SA DF 2017; MDB 2018; Umgeni Water 2023).

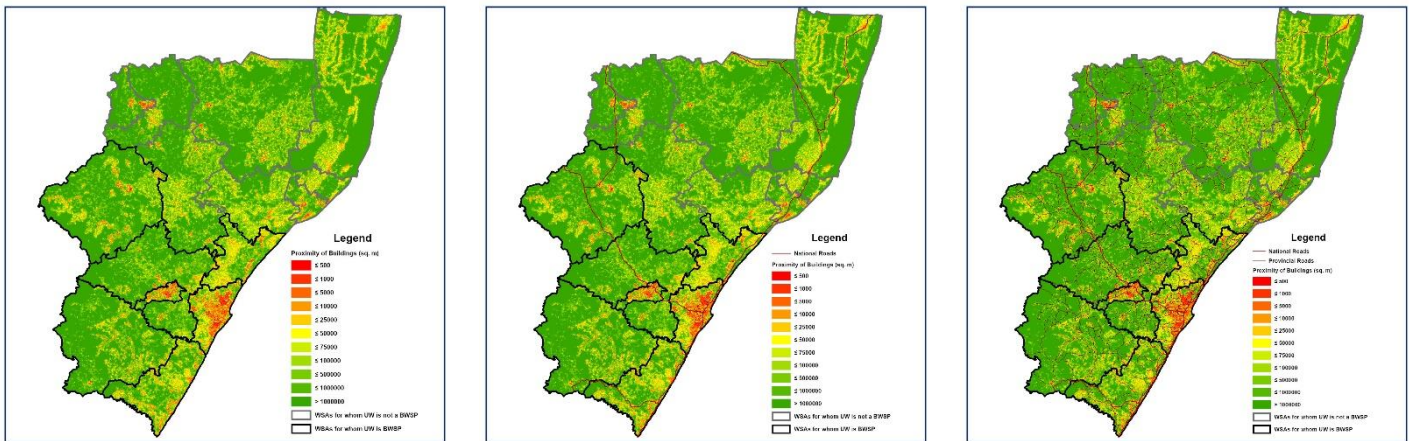


Figure 2.11 Relationship between distribution of people and access using proximity of buildings to one another and national and provincial roads as proxies (after Stats SA Dwelling Framework 2017, KZN DoT 2022, MBD 2018).

The urban category of land cover consists of settlements with land uses i.e. “human activity that is associated with a specific land unit in terms of utilisation, impact or management practice” (Thompson 1999: presentation) such as residential, commercial, industrial, administration, recreation etc. The KZN office of the Department of Rural Development and Land Reform (DRDLR) in 2014 updated the methodology used in the 2009 study on “Rural Settlements” and “Urban Edges” (see **Section 2.1 in IMP 2016**) to identify the larger settlements shown in **Figure 2.12**. Also shown in **Figure 2.12**, in purple, is the 2019 WorldPop Urban Building Pattern (Dooley et al. 2020) which shows that the rate of densification for certain of the “rural settlements” is increasing as the 2019 WorldPop Urban Building Pattern dataset classifies these polygons as “urban” due to the proximity of the buildings to one another. Whilst the methodologies and the scale of the raw data used in these two studies were different, it is highlighted in **Figure 2.12** that for those areas in KZN conventionally identified as “rural”, the densities within these areas need to be monitored as increasing densities require higher levels of services.

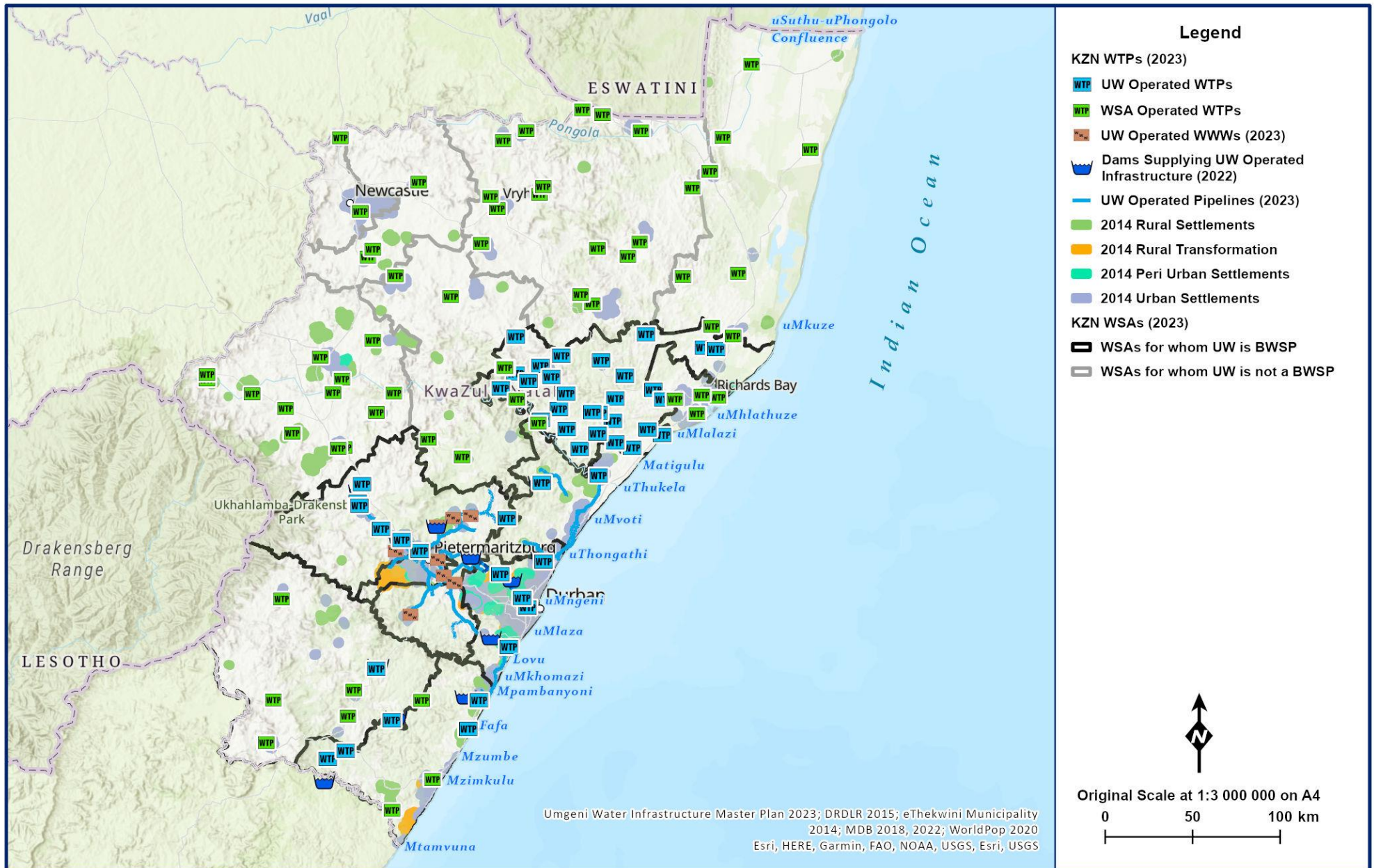


Figure 2.12 Settlement footprints (WorldPop 2020; DRDLR 2015; eThekweni Municipality 2014; MDB 2018; Umgeni Water 2023).

It is shown in **Figure 2.13** that whilst Harry Gwala District Municipality has the largest surface area within Umgeni Water's area of operation, it only contributes 4.62% (510 865 people) to the total number of people, whilst eThekweni Municipality has the highest number of people (3 702 231 people) but the second smallest surface area (Community Survey 2016).

The change in the number of people per WSA for the period 2011 - 2016 is shown in **Figure 2.14**. The change in the number of households per WSA for the period 2011 – 2016 is shown in **Figure 2.15**. It is noted that these two figures are comparing data from two different sources viz. the Census 2011 and the Community Survey 2016. The numbers therefore should be read as estimates as the Community Survey 2016 is a sample in which the results are extrapolated to represent entire municipalities⁴.

The average household size decreased in the eThekweni, iLembe and King Cetshwayo WSAs for the period 2011 – 2016 (3.6 people to 3.3 people in eThekweni, 3.8 people to 3.4 people in iLembe and 4.5 to 4.3 people in King Cetshwayo) as shown in **Figure 2.16**. It is further shown that the average household size remained constant in the Msunduzi, uMgungundlovu, Harry Gwala and uThukela WSAs (3.8 people, 3.7 people, 4.1 people and 4.5 people respectively) and increased in the Ugu WSA from 4.0 people to 4.3 people (**Figure 2.16**).

The mid-year population estimates per district municipality (2016 municipal boundaries)⁵ is presented in **Figure 2.17** and **Table 2.1**.

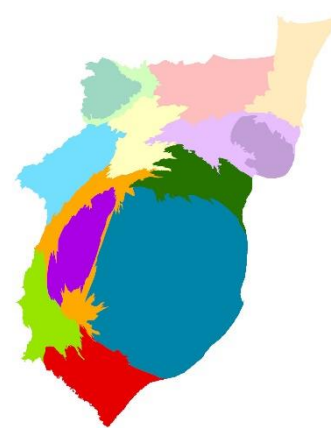
⁴ See http://cs2016.statssa.gov.za/?portfolio_page=cs-2016-technical-report-web for the methodology report on the Community Survey 2016 and http://cs2016.statssa.gov.za/?portfolio_page=cs-2016-metadata for the metadata report.

⁵ See http://www.statssa.gov.za/?page_id=1854&PPN=P0302.

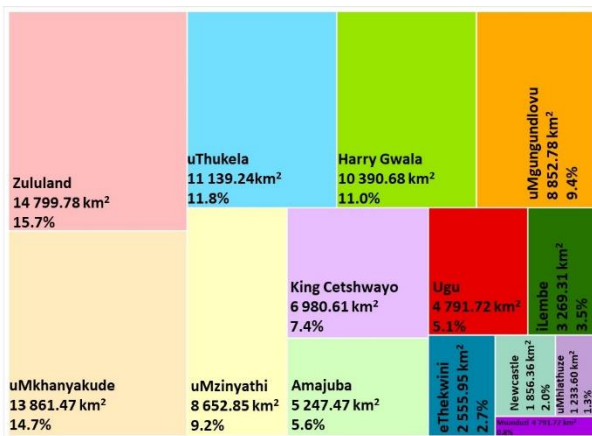
Surface Area (km²) of WSAs (MDB 2016)



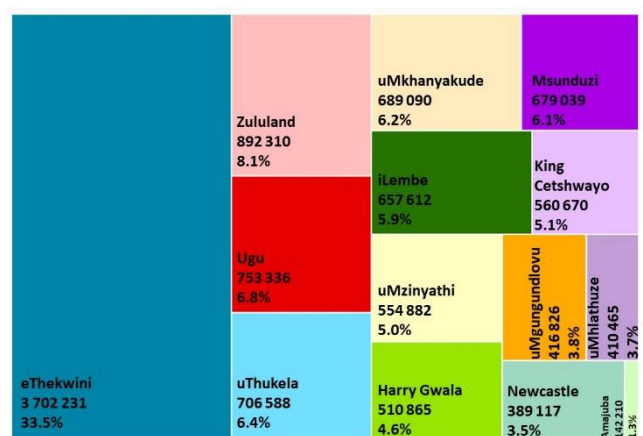
Cartogram of Number of People per WSA (CS 2016)



Contribution of WSA Surface Area to KZN



Contribution of Number of People per WSA to KZN



WSA Name	Area (sq. km) (MDB 2016)	Percentage Contribution per Area	Percentage Contribution per Number of People	Number of People (CS 2016)
Amajuba	5 247.47	5.56	1.29	142 210.00
eThekweni	2 555.95	2.71	33.46	3 702 231.00
iLembe	3 269.31	3.46	5.94	657 612.00
Newcastle	1 856.36	1.97	3.52	389 117.00
Harry Gwala	10 390.68	11.01	4.62	510 865.00
Msunduzi	751.19	0.80	6.14	679 039.00
Ugu	4 791.72	5.08	6.81	753 336.00
uMgungundlovu	8 852.78	9.38	3.77	416 826.00
uMhlathuze	1 233.60	1.31	3.71	410 465.00
uMkhanyakude	13 861.47	14.69	6.23	689 090.00
uMzinyathi	8 652.85	9.17	5.01	554 882.00
uThukela	11 139.24	11.80	6.39	706 588.00
King Cetshwayo	6 980.61	7.40	5.07	560 670.00
Zululand	14 799.78	15.68	8.06	892 310.00
Total	94 383.02	100.00	100.00	11 065 241.00

Figure 2.13 WSA contribution per number of people (Community Survey 2016) and surface area (MDB 2016) to KZN.

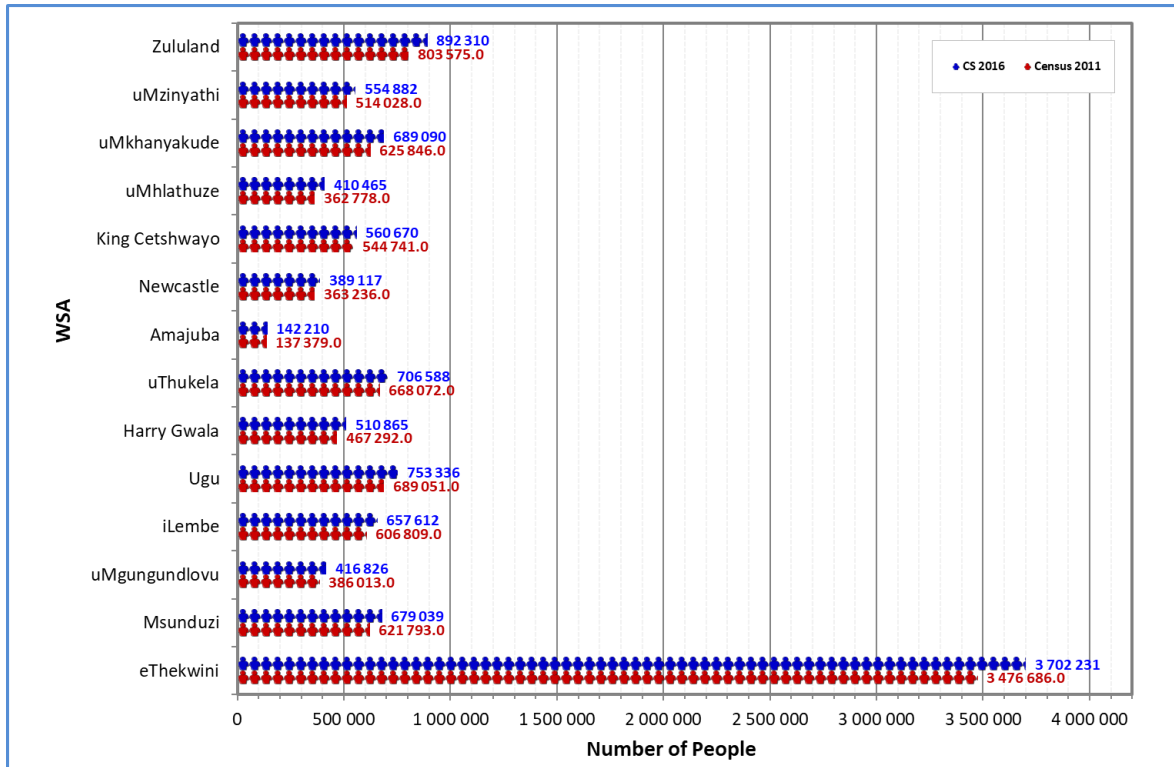


Figure 2.14 Change in number of people per WSA for 2011 and 2016 (Stats SA 2017).

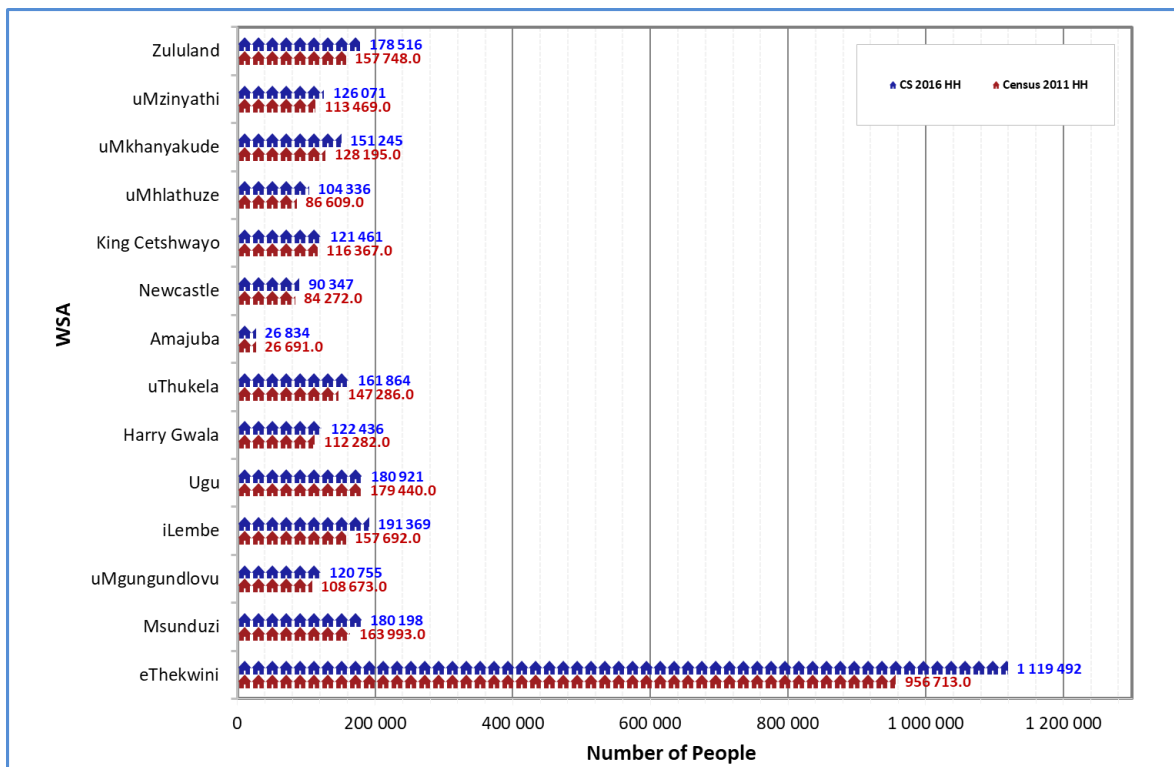


Figure 2.15 Change in number of households per WSA for 2011 and 2016 (Stats SA 2017).

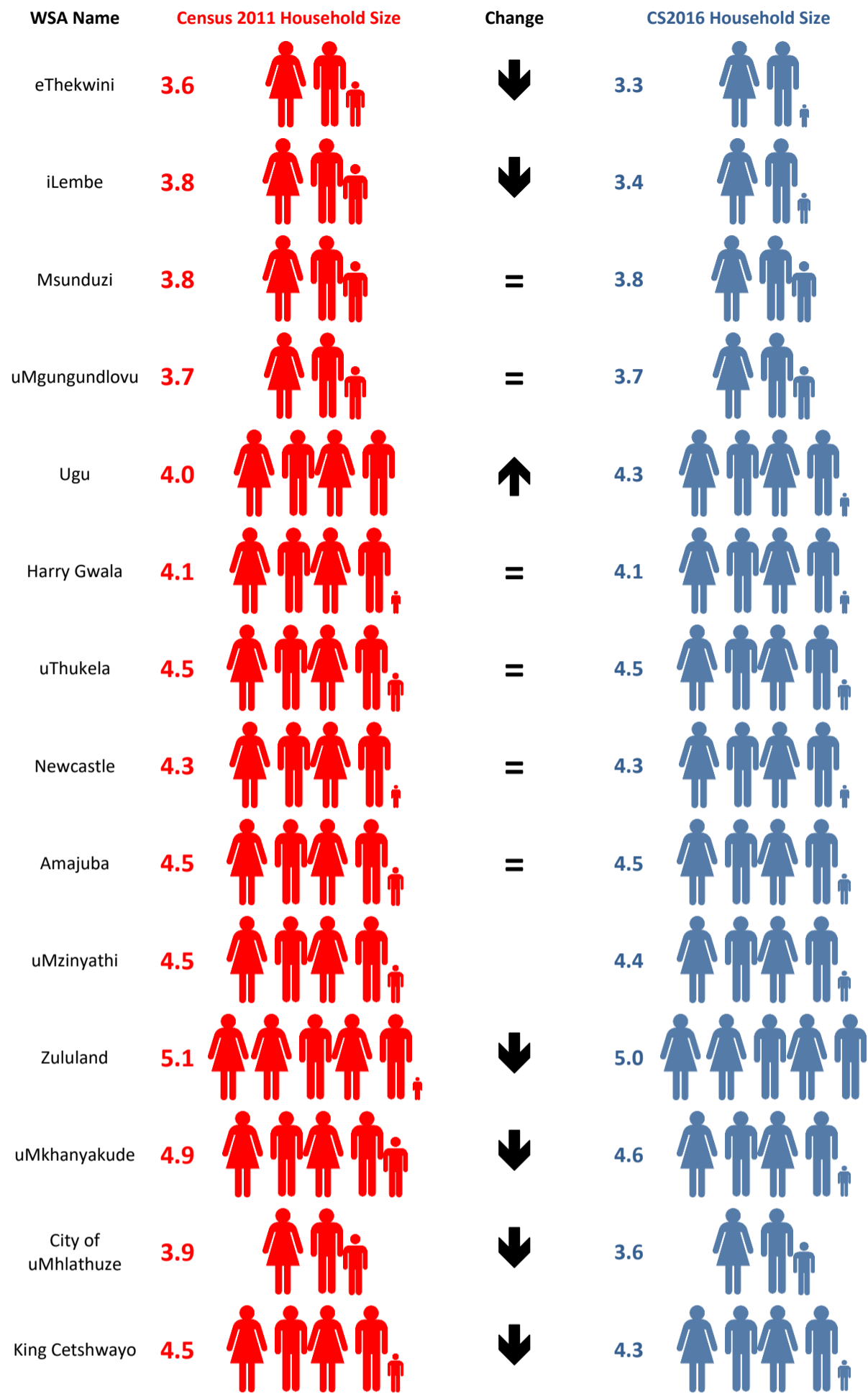


Figure 2.16 Change in average household size per WSA for 2011 and 2016 (Stats SA 2017).

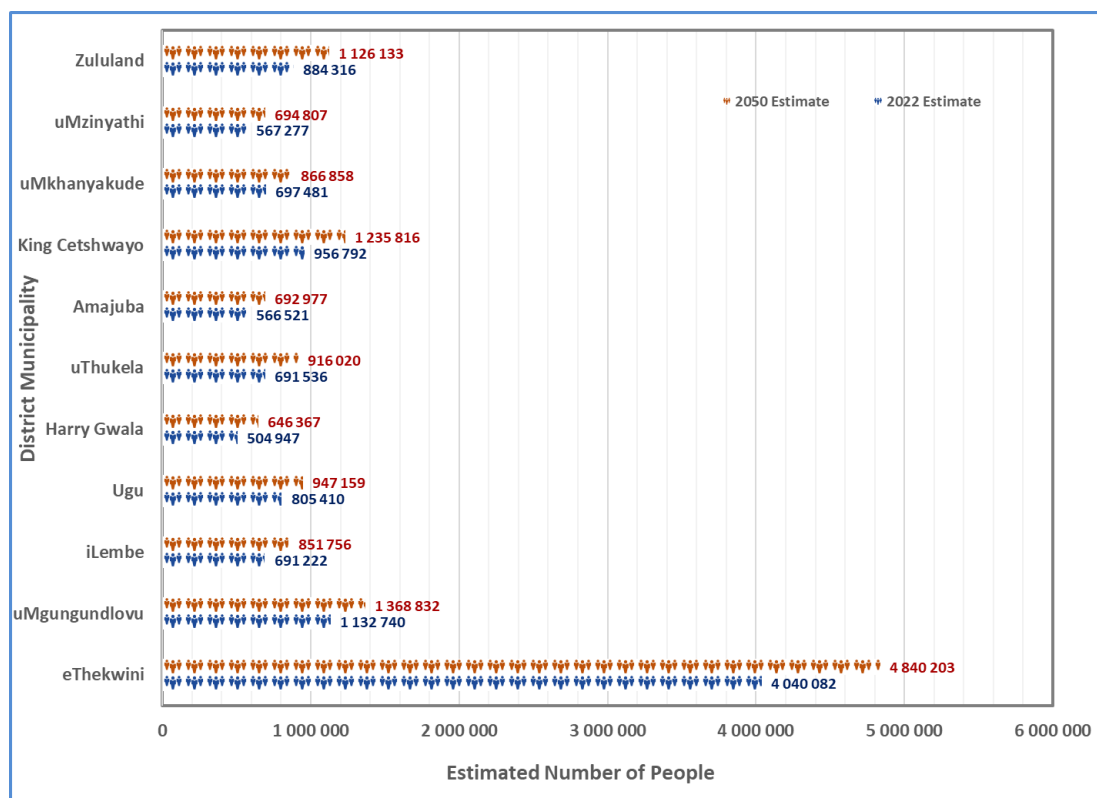


Figure 2.17 2022 and 2050 population estimates per KZN district municipality (after Stats SA 2023: spreadsheet).

Table 2.1 Mid-year population estimates 2022 (MYPE 2022) per district municipality⁶ (2022 – 2050) (after Stats SA 2023: spreadsheet).

District Municipality	Census 2011	CS 2016	Mid-Year Population Estimates			
			2022	2030	2040	2050
eThekweni	3 476 686	3 702 231	4 040 082	4 395 584	4 586 260	4 840 203
uMgungundlovu	1 007 806	1 095 865	1 132 740	1 235 523	1 297 016	1 368 832
iLembe	606 809	657 612	691 222	745 619	807 069	851 756
Ugu	689 051	753 336	805 410	906 302	897 466	947 159
Harry Gwala	467 292	510 865	504 947	536 180	612 456	646 367
uThukela	668 072	706 588	691 536	707 773	867 961	916 020
Amajuba	500 615	531 327	566 521	612 447	656 620	692 977
uMzinyathi	514 028	554 882	567 277	620 479	658 354	694 807
Zululand	803 575	892 310	884 316	929 370	1 067 050	1 126 133
uMkhanyakude	625 846	689 090	697 481	740 595	821 378	866 858
King Cetshwayo	907 519	971 135	956 792	996 380	1 170 979	1 235 816
KZN	10 267 300	11 065 240	11 538 325	12 426 253	13 442 607	14 186 929

⁶ 2016 municipal boundaries.

2.2 Natural Environment

There are three distinct climatic zones within Umgeni Water's operational area (**Figure 2.18**), namely:

- The Köppen classification Cwa (temperate, dry winter, hot summer) which is the humid subtropical climate with long, hot dry winters found in the Battlefields region (see distribution of grassland and thicket, bushland and scrub forest in **Figure 2.9**).
- The Köppen classification Cwb (temperate, dry winter, warm summer) which is the alpine-type climate found in and along the Drakensberg Mountains (see distribution of grassland in **Figure 2.9**).
- The Köppen classification Cfb (temperate, no dry season, warm summer) which is the more temperate summer rain climate of the Midlands region (see distribution of forests in **Figure 2.9**).
- The Köppen classification Cfa (temperate, no dry season, hot summer) which is the subtropical perennial rainfall characterising the areas along the coast (see distribution of thicket, bushland and scrub forest in **Figure 2.9**).

The mean annual precipitation (MAP) within the Umgeni Water operational area varies between 700 and 1000 mm (**Figure 2.18**) with most rains falling in summer (October to March), although there are occasional winter showers. The national average MAP is about 450 mm per year. The peak rainfall months are December to February in the inland areas and November to March along the coast.

The prevailing weather patterns are predominantly orographic, where warm moist air moves in over the continent from the Indian Ocean, rises up the escarpment, cools down and creates rainfall. Rain shadows occur in the interior valley basins of the major rivers where the annual rainfall can drop to below 700 mm.

The precipitation shown in **Figure 2.18** drains into the catchments shown in **Figure 2.19**. These catchments encompass, and impact upon, Umgeni Water's operational area. These catchments have been grouped into logical regions as shown in **Figure 2.19**.

The spatial distribution of evaporation is shown in **Figure 2.18** (A-Pan and S-Pan). This distribution has a similar pattern to rainfall where a relative high humidity is experienced in summer. There is a daily mean peak in February, ranging from 68% in the inland areas to greater than 72% for the coast and a daily mean low in July, ranging from 60% in the inland areas to greater than 68% at the coast. Potential mean annual gross evaporation (as measured by 'A' pan) ranges from between 1 600 mm and 2 000 mm in the west to between 1 400 mm and 1 600 mm in the coastal areas (**Figure 2.18**).

Temperature distribution is shown in **Figure 2.18**. The mean annual temperature ranges between 12°C and 14°C in the west to between 20°C and 22°C at the coast. Maximum temperatures are experienced in the summer months of December to February and minimum temperatures in the winter months of June and July. Snowfalls on the Drakensberg Mountain between April and September have an influence on the climate. Frost occurs over the same period in the inland areas. The average number of heavy frost days per annum range from 31 to 60 days for inland areas to nil for the eastern coastal area.

The mean annual runoff is illustrated in **Figure 2.18**. The spatial distribution of mean annual runoff is highly variable from the Drakensberg mountain range towards the coastal areas with more runoff

generated from the mountains and the coastal areas and lesser generated in the inland regions. It is estimated that the surface runoff in the catchments of the Mvoti to uMzimkhulu is 433 million m³/annum.

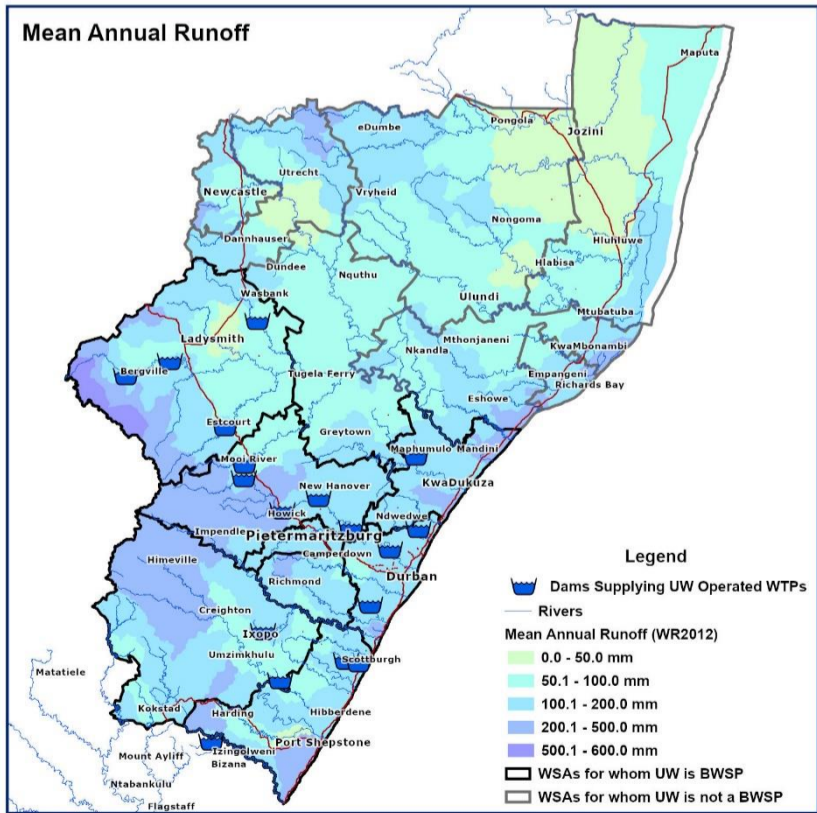
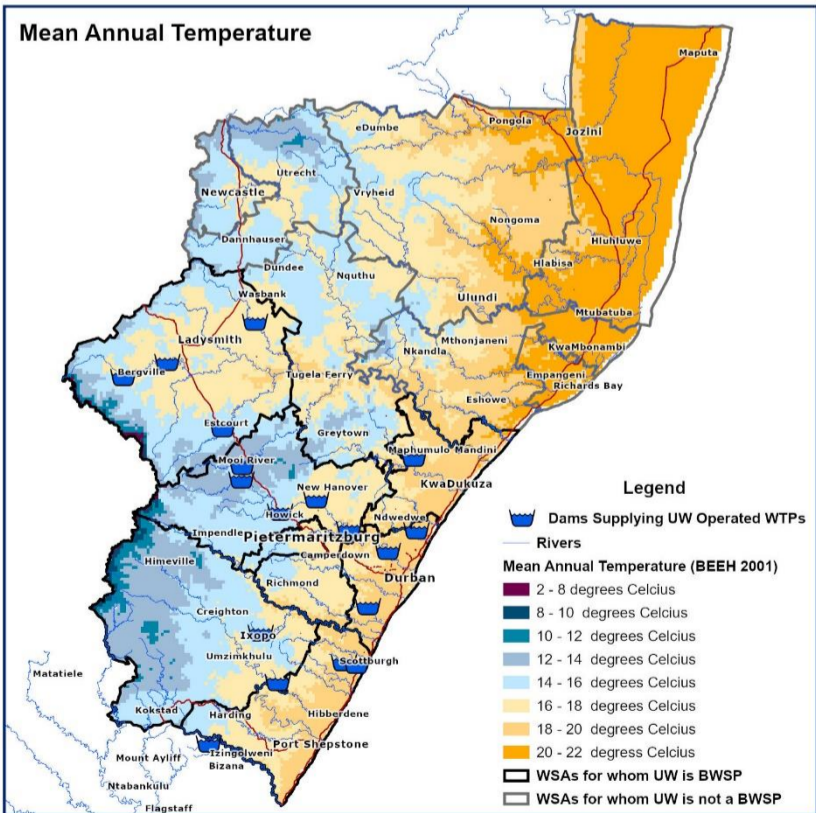
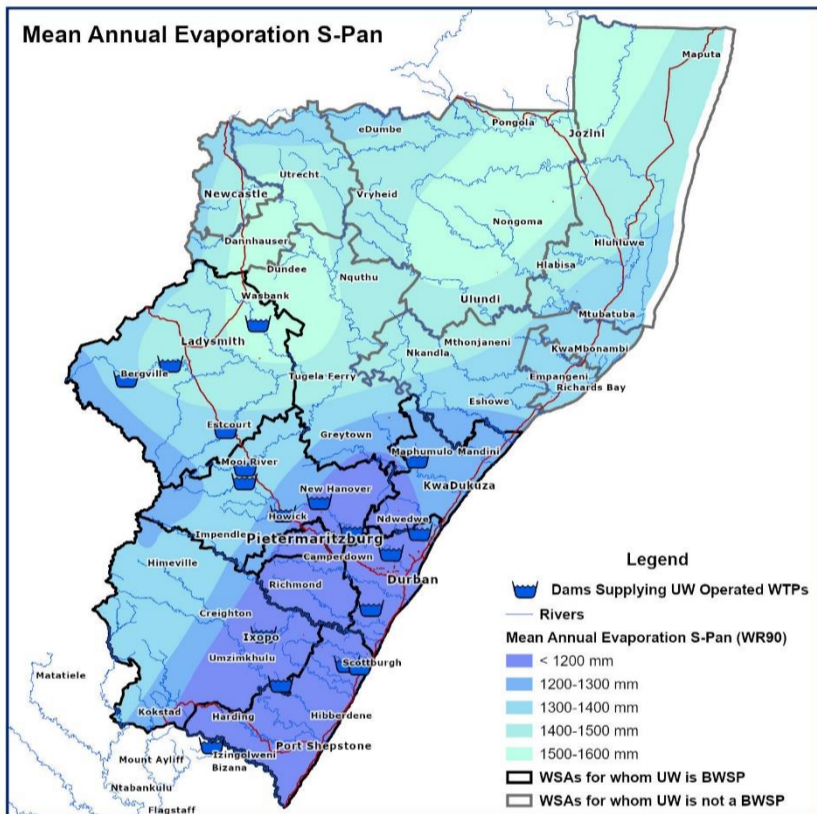
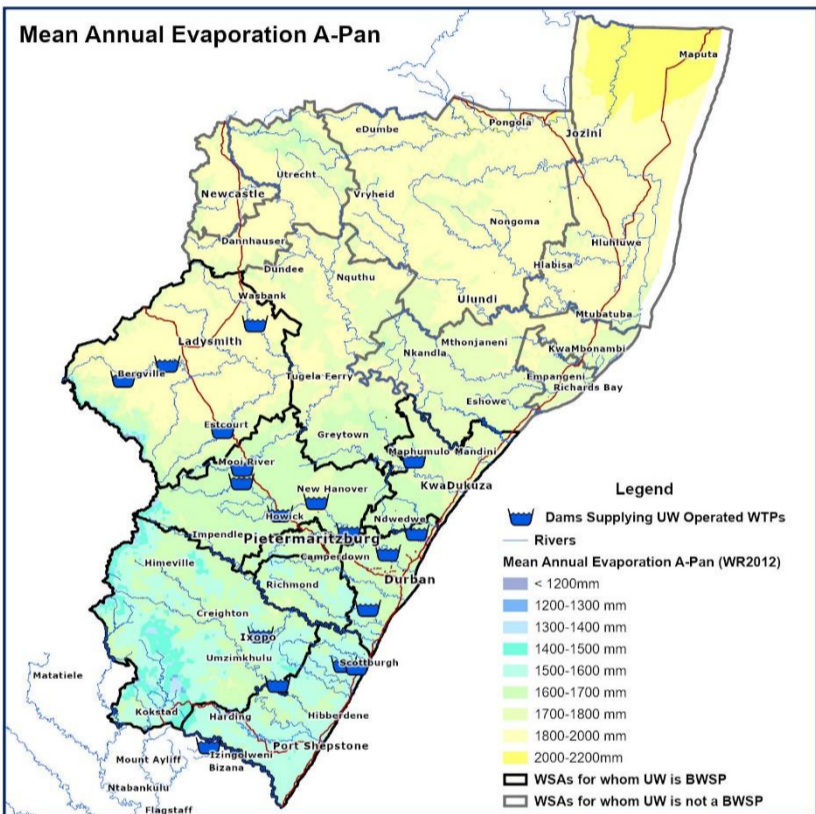
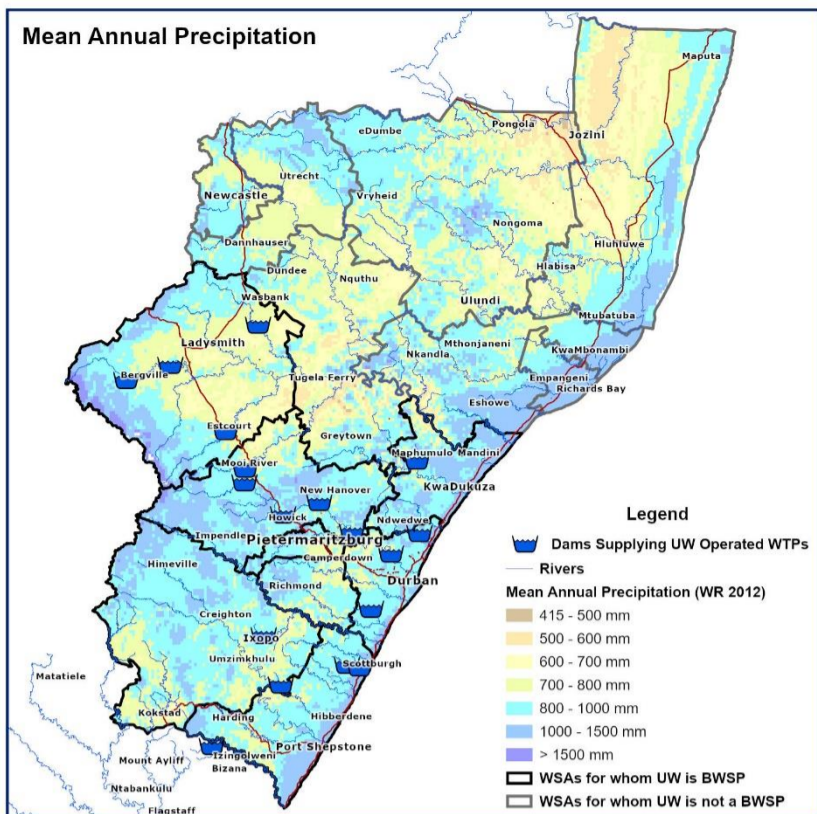
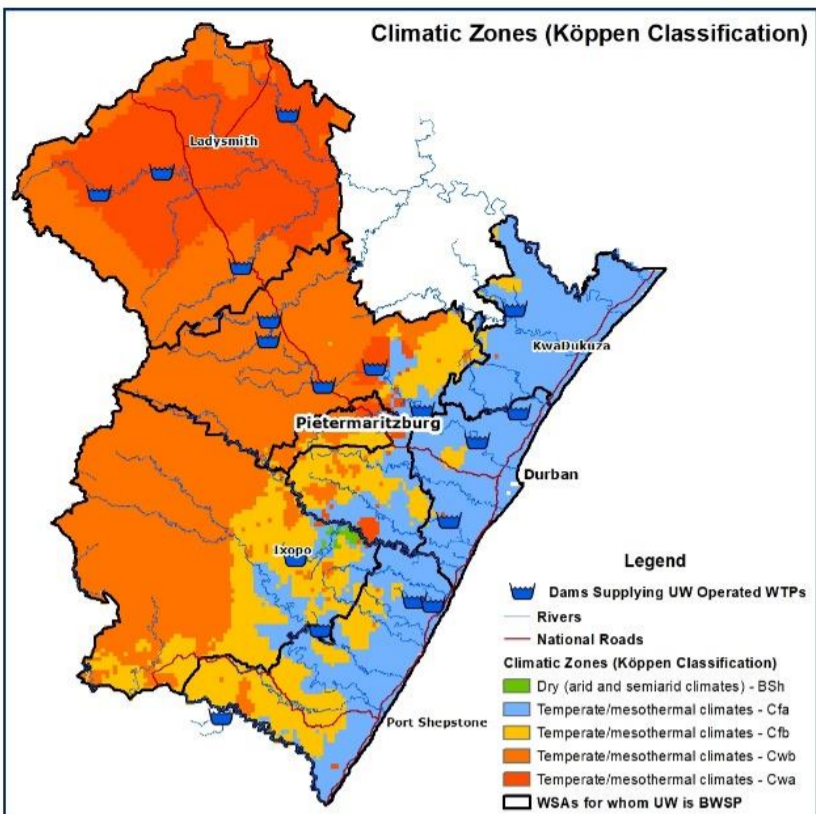


Figure 2.18 Climatic variables (BEEH 2011; KZN DoT 2021; MDB 2018; Umgeni Water 2023; WR2012).

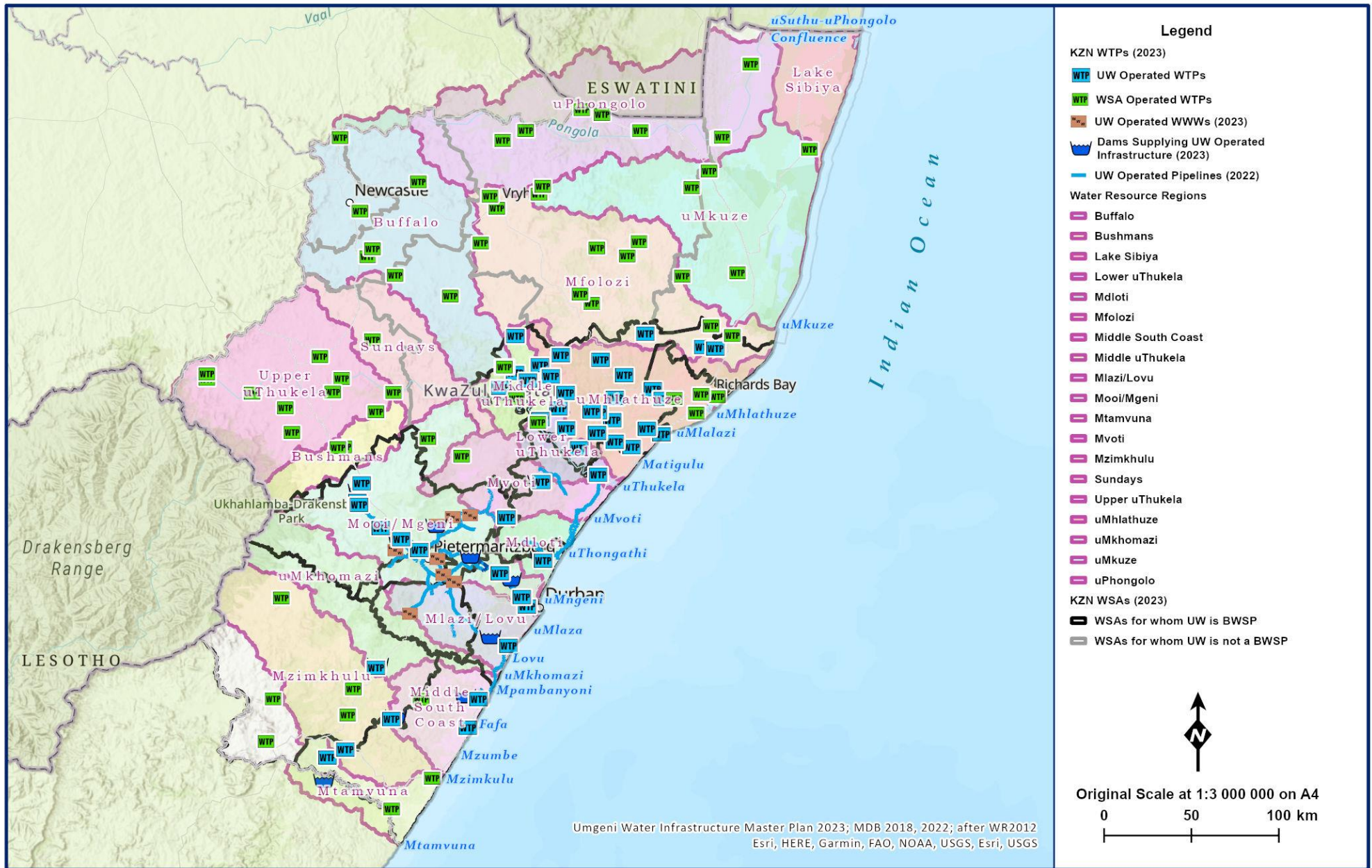


Figure 2.19 Water resource regions (MDB 2018; Umgeni Water 2023; WR2012).

The groundwater regions (commonly referred to as the Vegter regions) based on lithology and climatology are shown in **Figure 2.20**. It is shown that there are three regions in Umgeni Water's operational area:

- *KwaZulu-Natal Coastal Foreland* where “the fractured aquifers are formed by predominantly arenaceous rocks consisting of sandstone and diamictite that is Dwyka tillite, which forms very productive aquifers in KZN. The intergranular and fractured aquifers are formed by meta-arenaceous and acid/intermediate intrusive rocks” (DWA 2008: 18).
- *Transkeian Coastal Foreland and Middleveld* where DWS states that the “aquifer types occurring in this region are mapped as low to medium potential and the geology consists of mostly arenaceous rocks” (DWA 2008: 20).
- *Northwestern Middleveld* where “the 1 : 500 000 scale hydrogeological map indicate the aquifer type as intergranular and fractured with an extremely low to medium development potential. The underlying geology is mostly arenaceous rock of the Ecca Formation” (DWA 2008: 16).

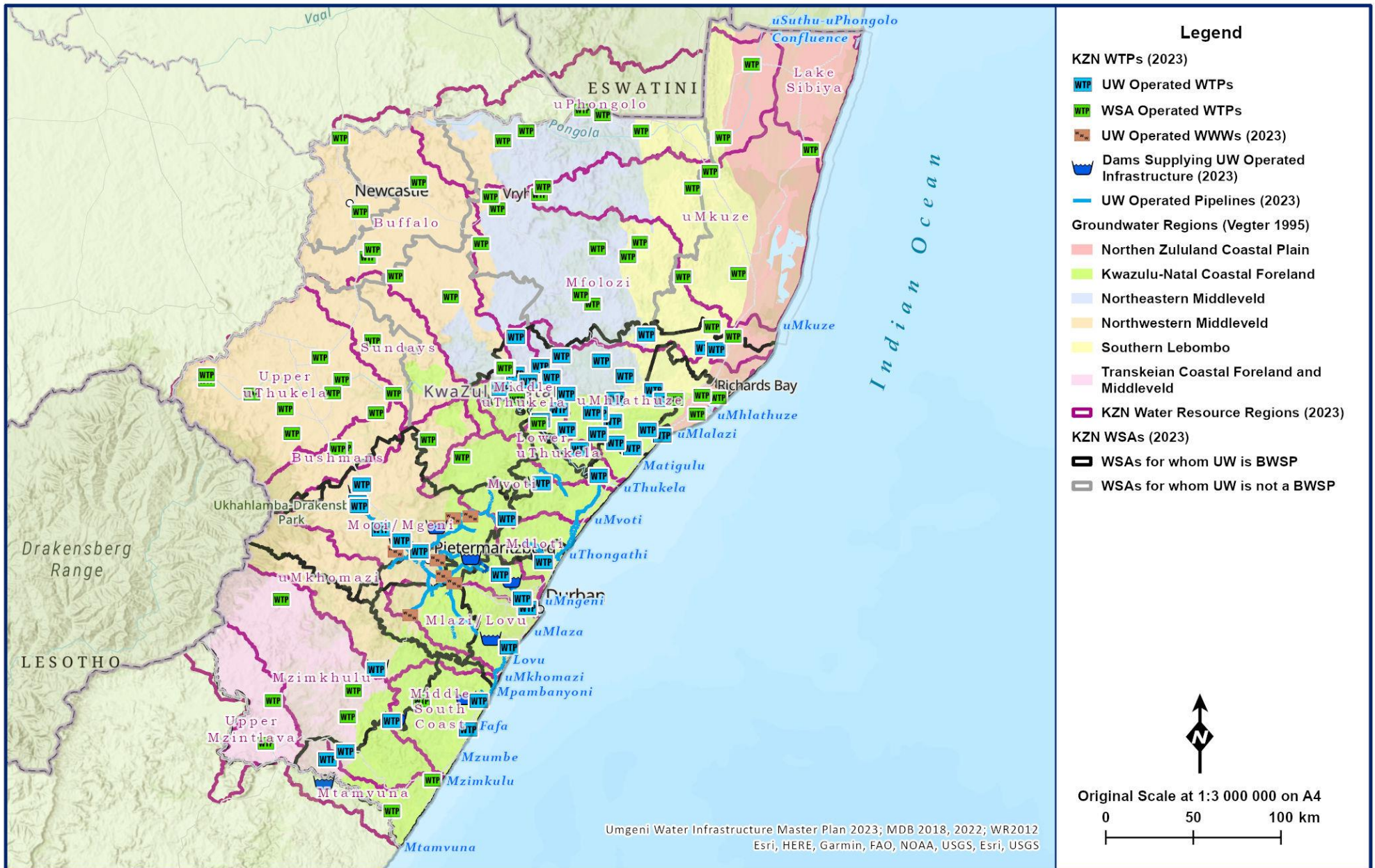


Figure 2.20 Groundwater regions (MDB 2018; Umgeni Water 2023; WR2012).

Ezemvelo KZN Wildlife (EKZNW) explains that the:

“KZN Biodiversity Plan (KZN BP) provides a spatial representation of land and coastal marine area required to ensure the persistence and conservation of biodiversity within KZN, reflected as *Critical Biodiversity Areas (CBA)* and *Ecological Support Areas (ESA)*”.

(EKZNW 2016: 23)

The definitions and categories of the CBAs and ESAs are defined in **Table 2.2**. The distribution of these areas in relation to Umgeni Water’s existing and recommended infrastructure (**Volumes 2 - 10**) and the KZN WTPs is shown in **Figure 2.21**.

Table 2.2 Definitions of key KZN Biodiversity Plan terms (EKZNW 2016: 25).

KZN Biodiversity Plan Area	Purpose of this Area
Critical Biodiversity Areas: Irreplaceable	“Areas considered critical for meeting biodiversity targets and thresholds, and which are required to ensure the persistence of viable populations of species and the functionality of ecosystems”.
Critical Biodiversity Areas: Optimal	“Areas that represent an optimised solution to meet the required biodiversity conservation targets while avoiding high cost areas as much as possible (Category driven primarily by process, but is informed by expert input)”.
Ecological Support Areas	“Functional but not necessarily entirely natural terrestrial or aquatic areas that are required to ensure the persistence and maintenance of biodiversity patterns and ecological processes within the Critical Biodiversity Areas. The area also contributes significantly to the maintenance of <i>Ecosystem Services</i> ”.
Ecological Support Areas: Species Specific	“Terrestrial modified areas that provide a critical support function to a threatened or protected species, for example agricultural land or dams associated with nesting/roosting sites”.

It is shown in **Figure 2.21** that some of Umgeni Water’s existing infrastructure and recommended infrastructure are located within CBAs and ESAs. Similarly, it is shown in **Figure 2.22** that some of Umgeni Water’s existing infrastructure and recommended infrastructure are located on high-value agricultural land i.e. land the KZN Department of Agriculture and Rural Development (DARD) have identified as “Category A: Irreplaceable” and “Category B: Threatened”.

KZN DARD undertook a study in 2012 categorising all agricultural land within KZN. This study (**Figure 2.22**) is important for food security as it shows the most high-value agricultural land as well as those areas in which the land has been completely transformed. It is shown in **Figure 2.22** that most of the transformed land is within Msunduzi WSA and eThekweni WSA. It is also shown that the most high-value agricultural land i.e. the agricultural land that is “Category A – Irreplaceable” is predominantly located in uMgungundlovu WSA with large areas in Harry Gwala WSA, along the “shadow corridor” in iLembe WSA and along the Drakensberg in uThukela WSA.

Conventionally, the provision of bulk infrastructure acts as a catalyst in transforming land into “urban” areas. This means that when Umgeni Water receives requests for the provision of bulk potable water in areas that are categorised as CBAs and ESAs in terms of biodiversity value or “Irreplaceable” in terms of agricultural value, Umgeni Water will need to work in close consultation

with the EKZNW and/or KZN DARD to determine the most appropriate form of infrastructure provision.

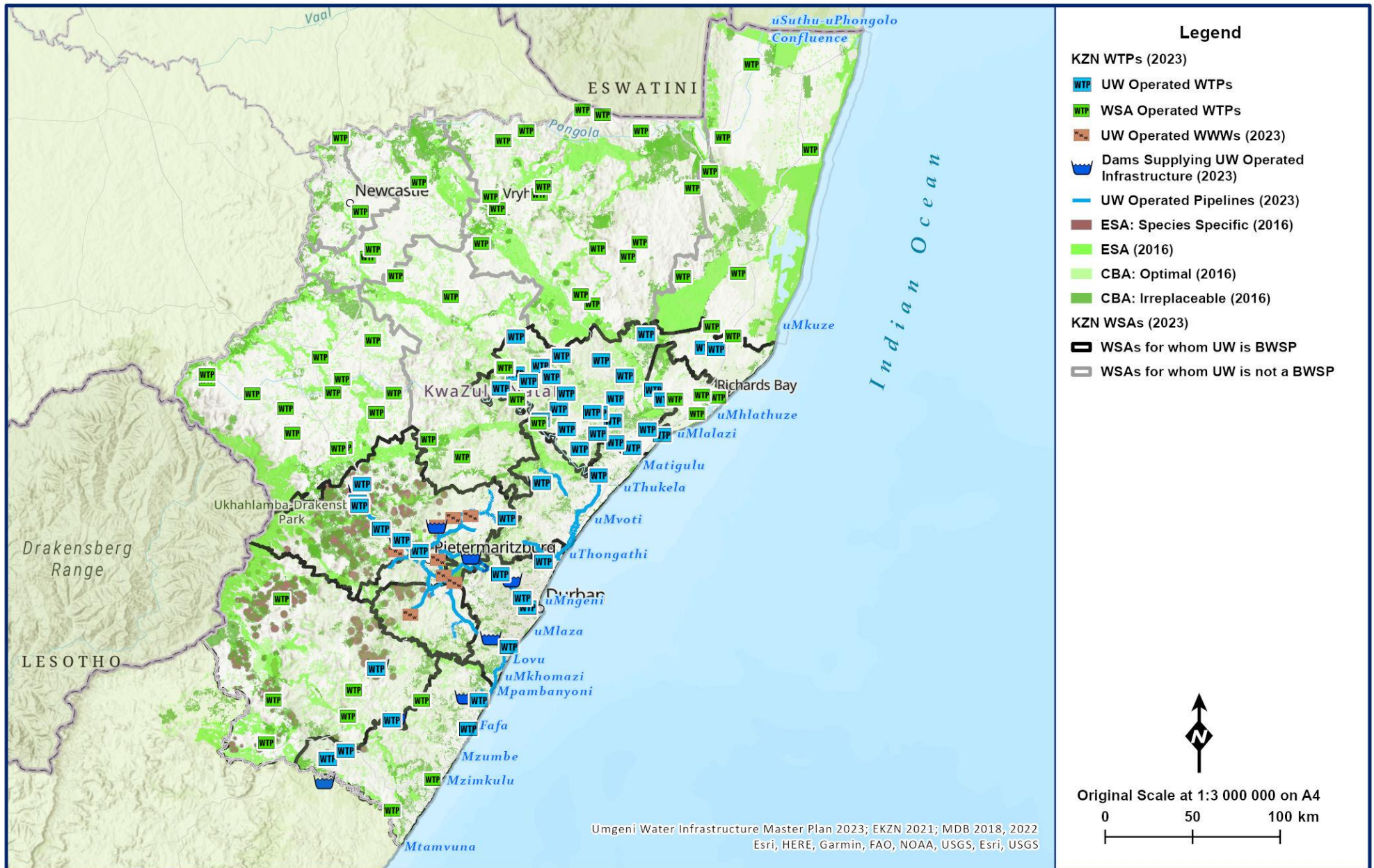


Figure 2.21 KZN Biodiversity Plan Critical Biodiversity Areas and Ecological Supports Areas (EKZNW 2021; MDB 2018; Umgeni Water 2023).

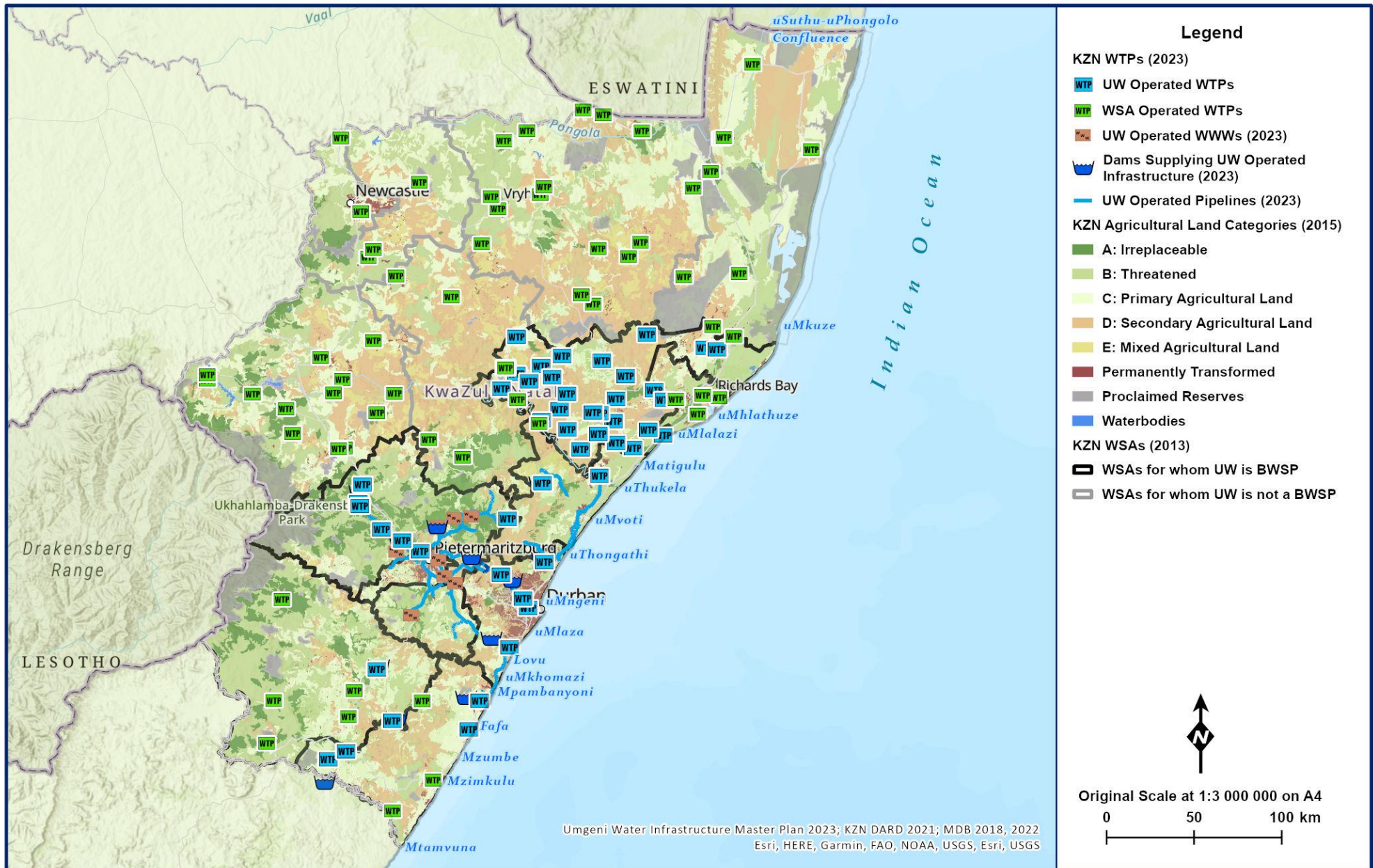


Figure 2.22 Agricultural land categories (KZN DARD 2015; MDB 2018; Umgeni Water 2023).

Using the agricultural land categories shown in **Figure 2.22** in conjunction with field testing where available, the national Department of Agriculture, Land Reform and Rural Development (DALRRD) has delineated Protected Agricultural Area (PAA) land use zones (**Figure 2.23**). The Preservation and Development of Agricultural Land Bill (2021) defines the PAA as an:

“... agricultural land use zone, protected for purposes of food production and ensuring that high potential and best available agricultural land are protected against non-agricultural land uses in order to promote long-term agricultural production and food security.”

A comparison of **Figure 2.22** and **Figure 2.23** shows that some of Umgeni Water’s operated infrastructure is located on these PAAs. When the Preservation and Development of Agricultural Land Bill is promulgated and becomes operational, the PAAs will become an additional informant to the location of proposed water and wastewater infrastructure, similar to the biodiversity protected areas (**Figure 2.21**).

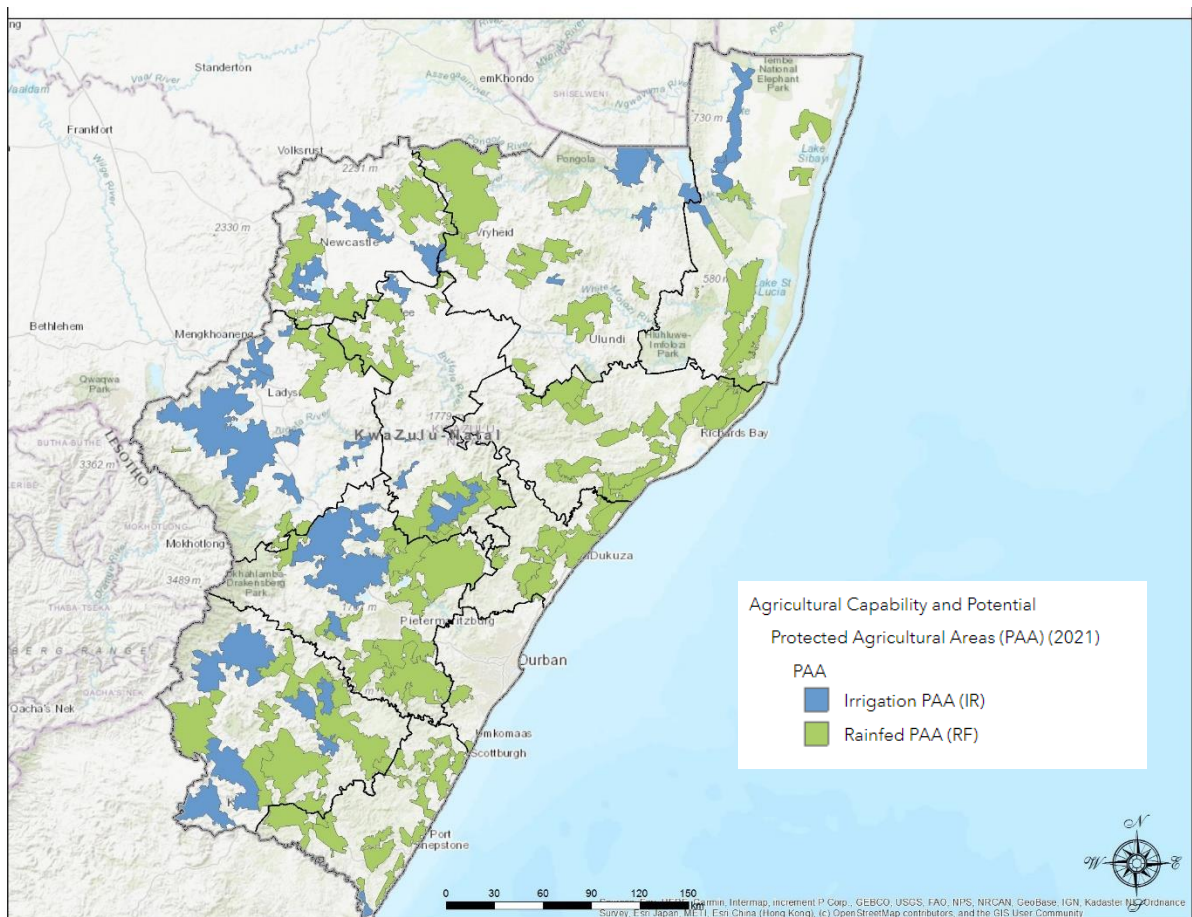


Figure 2.23 Protected Agricultural Areas (PAA) in KZN (DALRRD 2023: website).

2.3 Existing Development Status

The Gross Domestic Product by Region (GDP-R) for the KZN WSAs for the period 2001 – 2022 is shown in **Figure 2.24** and the percentage contributions of WSA and municipal GDP-R to the total KwaZulu-Natal GDP-R for 2022 are illustrated in **Figure 2.25** and **Figure 2.26**.

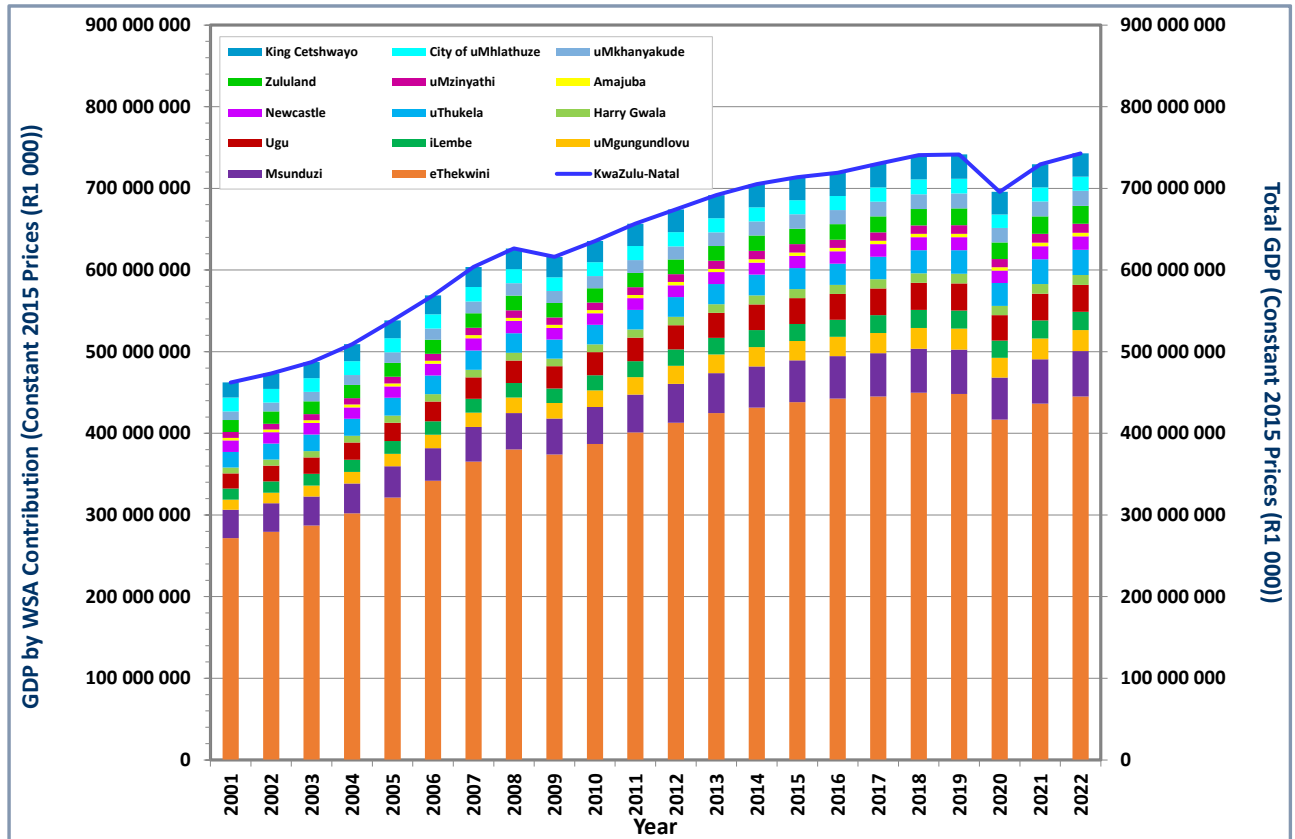


Figure 2.24 GDP by WSA Contribution for the period 2001 – 2022 (KZN Treasury after Global Insight 2023; 2016 municipal boundaries).

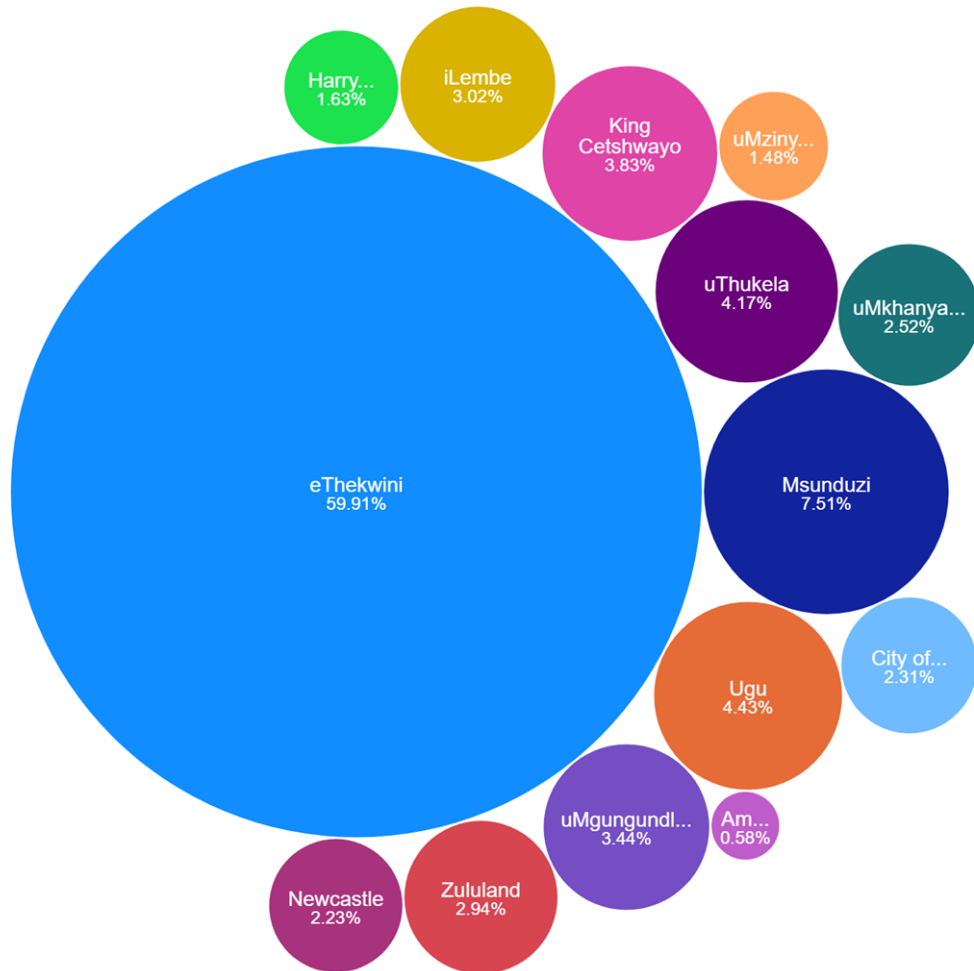


Figure 2.25 Percentage contribution of WSA GDP to KZN GDP (2022) (KZN Treasury after Global Insight 2023).

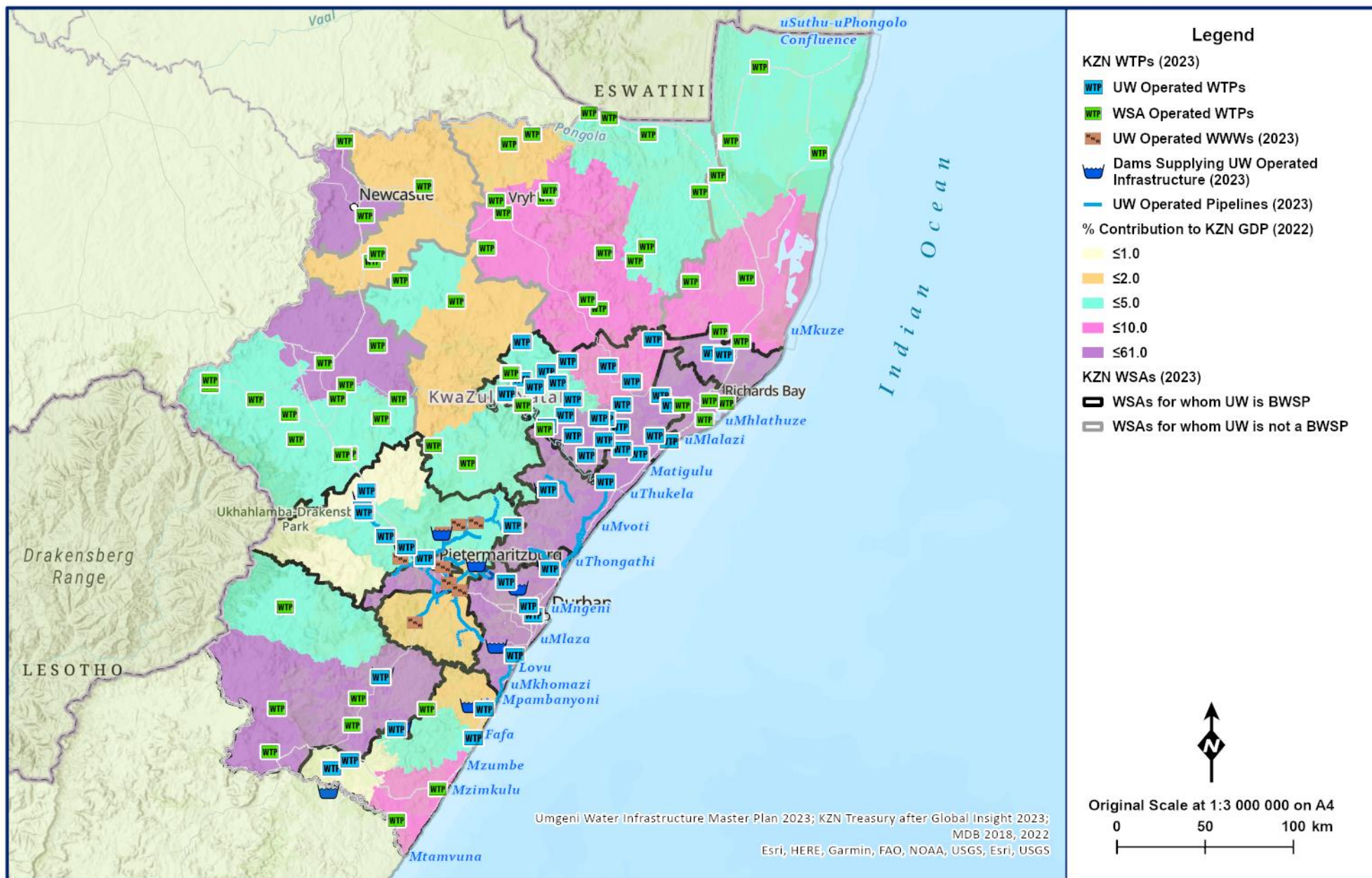


Figure 2.26 Percentage contribution of municipal GDP to KZN GDP (2022) (KZN Treasury after Global Insight 2023).

The categorisation of municipalities and settlements assists in planning for the appropriate level of service provision. Schmidt and Du Plessis state that the primary variables used in the classification of settlement typology are administration; morphology; demographics and function (2013: 13).

The Municipal Infrastructure Investment Framework (MIIF) categorisation (Municipal Demarcation Board 2012) was developed in 2009 using administration as the predominant variable (the criteria included municipal category type; budget size; number of people; size of settlements etc.). Based on the 2009 State of Local Government Report (CoGTA 2009a) and using the 2011 municipal boundaries, this categorisation is still used in some planning reports e.g. the 2018 KZN Citizen Satisfaction Survey: Analytical Report. The MIIF categorisation has been used by the National Treasury, Municipal Demarcation Board (MDB) and Statistics South Africa (Stats SA). Research undertaken to date has not identified if this categorisation has been updated.

The MIIF categorisation for KZN is illustrated in **Figure 2.27**. A comparison between **Figure 2.26** and **Figure 2.27** shows that Umgeni Water’s existing infrastructure is predominantly located in the higher performing municipalities.

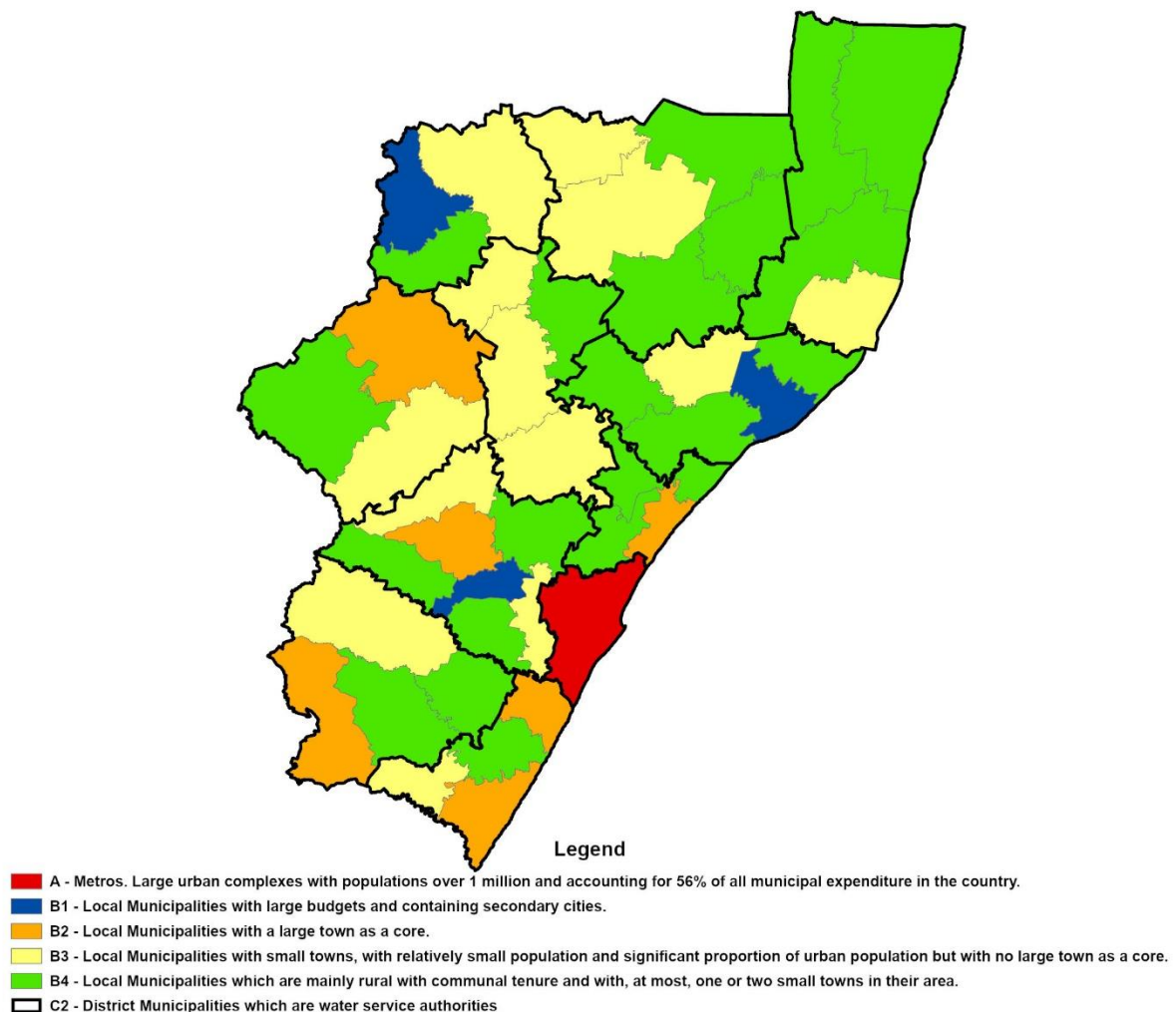


Figure 2.27 Municipal Infrastructure Investment Framework categorisation of municipalities (CoGTA 2009; MDB 2016; Stats SA 2018).

The “Functional Settlement Typology” was “originally developed by the Council for Scientific and Industrial Research (CSIR) as part of the National Spatial Trends Overview project (2008 – 2009) commissioned by the South African Cities Network, The Presidency and the former DPLG to inform Cabinet discussions on urban development policy aspects and the process of developing a National Urban Development Framework” (CSIR 2015: 2). This settlement typology is commonly referred to as the “CSIR/SACN South African Settlement Typology”⁷ and was updated in 2018 (second update was in 2015) with the objective of “supporting the identification, description and understanding of:

- Nodes, settlement and land use patterns;
- Sparsely populated areas of South Africa, in terms of key land; and
- Municipality-wide settlement patterns.”

(CSIR 2015: 3)

The definitions used in this typology are shown in **Table 2.3** and the typology classification is illustrated in **Figure 2.28**.

Table 2.3 CSIR/SACN Settlement Typology functional settlement type (CSIR 2015:6-8).

CSIR/SACN Settlement Typology Type	Definition	Example
City Region	Population > 1 million Government and Economic Services Index > 7	eThekweni City Region
City	Population 500 000 – 1 million Government and Economic Services Index 2 - 5	Pietermaritzburg
Regional Centre 1	Population 300 000 – 500 000 Government and Economic Services Index 1 – 2 High population numbers and high economic activity	This type is not found within Umgeni Water’s area of operation
Regional Centre 2	Population 100 000 – 300 000 Government and Economic Services Index > 0.3 High population numbers in densely settlement areas	KwaDukuza
Regional Centre 3	Population 40 000 – 100 000 Government and Economic Services Index > 0.25 Low population numbers playing a key role in sparsely populated areas	This type is not found within Umgeni Water’s area of operation
Service Town	Population mostly > 20 000 Significant role in hinterland (Service Index 0.065 – 0.25)	Mandini
Local or Niche Town	Population size varies widely Service role in immediate surroundings (Service Index 0.001 – 0.065)	Mooi River
High Density Rural	Rural nodes in high density settlement areas – meso zones with > 100 people/km ² OR more than 10 people/km ² PLUS economic activity in service sector – identified as areas within high density settlement areas, with highest levels of access to household income.	Ozwothini

⁷ See http://stepsa.org/pdf/profiler/201508_South%20African%20Settlement%20Typology_Technical_Report.pdf for the CSIR/SACN South African Settlement Typology technical report.

	These areas typically have very little economic activity, no consolidated town centre/nodes, and a spread out morphological structure.	
Rest of South Africa	Less densely populated areas, sparsely populated areas, mountainous areas, national parks.	

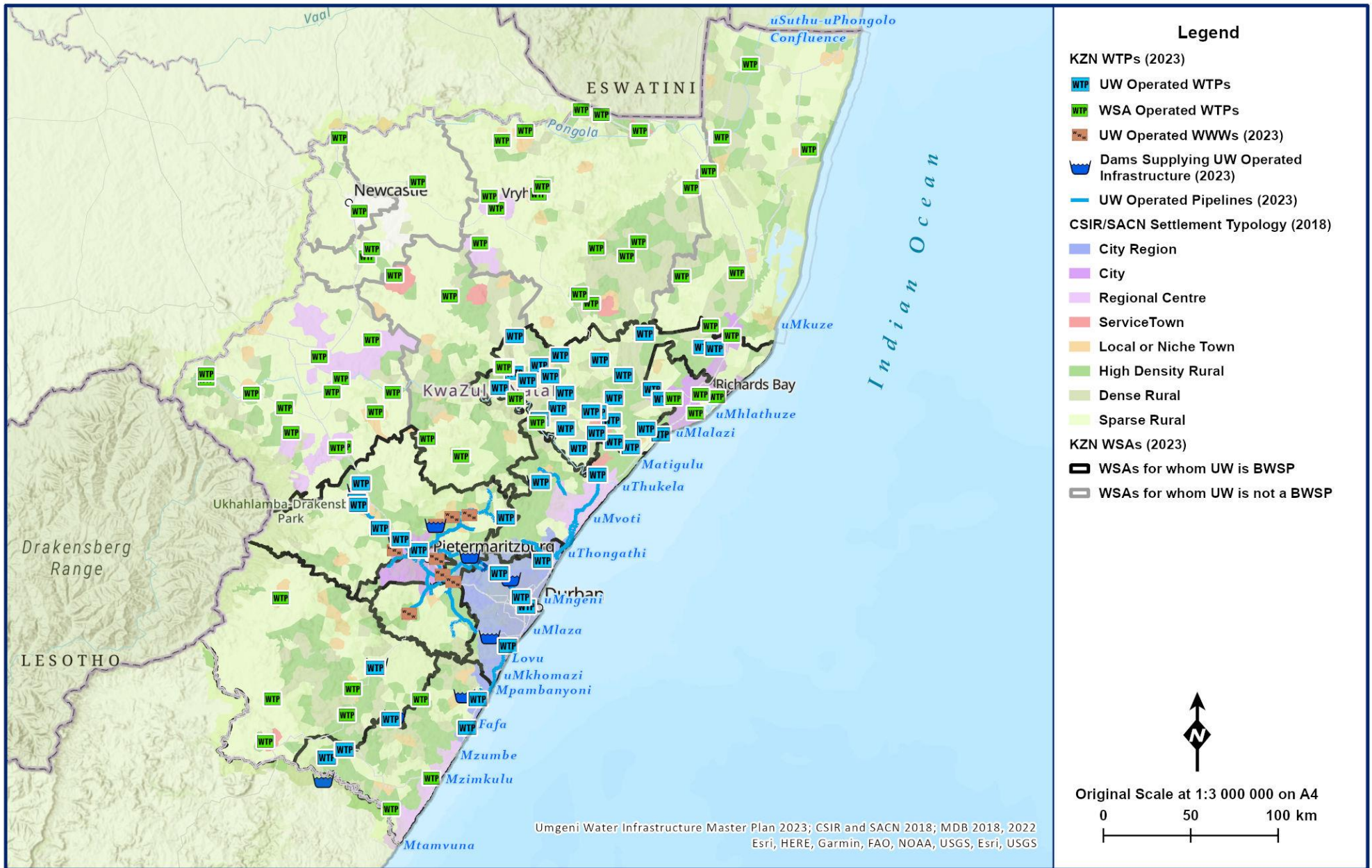


Figure 2.28 CSIR/SACN Settlement Typology (CSIR and SACN 2018; KZN DoT 2021; MDB 2018; Umgeni Water 2023; WR2012).

It is noted in **Figure 2.28** that Umgeni Water’s infrastructure is predominantly located in those settlements categorised as city region; city; regional centre; local or niche town; high density rural and dense rural i.e. the infrastructure is located where there is the greatest demand as these areas have higher numbers of people.

The KZN DRDLR in their 2015 study refined the settlement typology that had been developed in their 2019 study. The 2015 DRDLR settlement typology (**Figure 2.29**) is useful as the differentiation includes the function of the settlement and this therefore assists in bulk infrastructure planning as the type of demands per settlement function can be estimated in the demand projections.

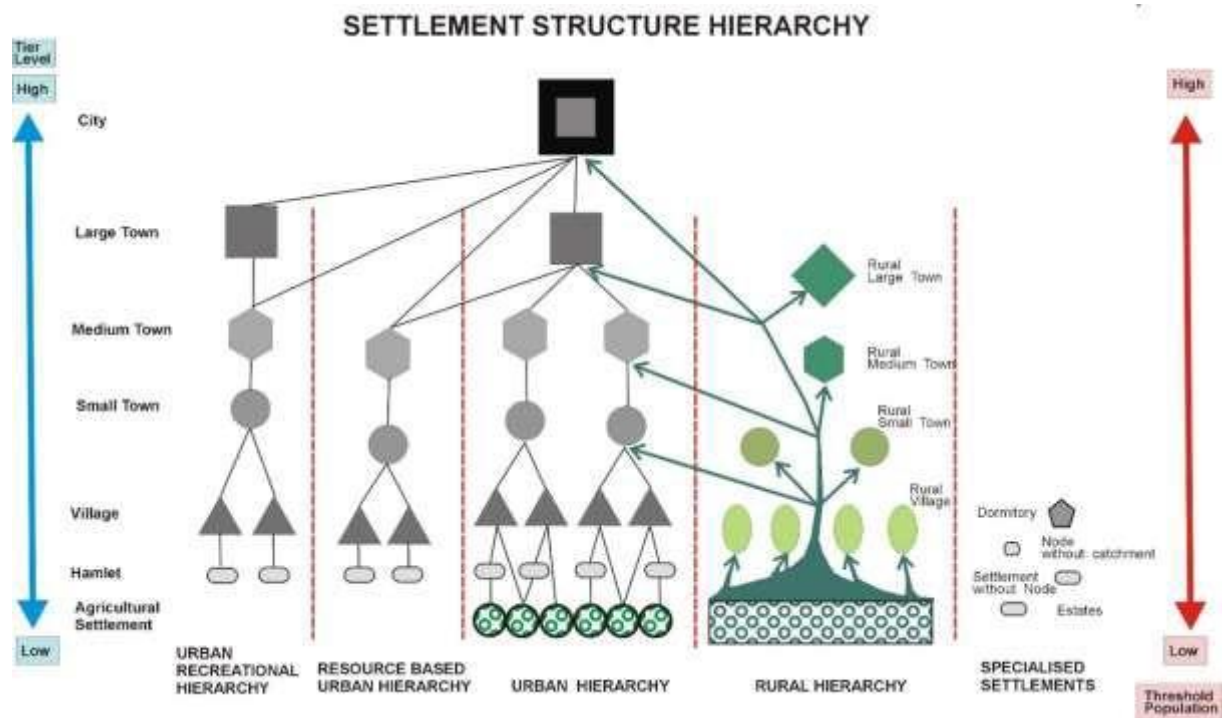


Figure 2.29 The 2015 DRDLR Settlement Typology structure hierarchy (Kahn in DRDLR 2015: 40).

It is shown in **Figure 2.30** that Umgeni Water’s infrastructure is predominately located in those settlements categorised as “urban” and “recreational” in the 2015 DRDLR Settlement Typology with the Maphumulo System (**Section 12**) the only system that is predominately located in settlements classified as “rural”. The Mhlabatshane System (**Section 11**) supplies settlements that were not identified by the 2015 DRDLR Settlement typology methodology i.e. these settlements are less than the thresholds used.

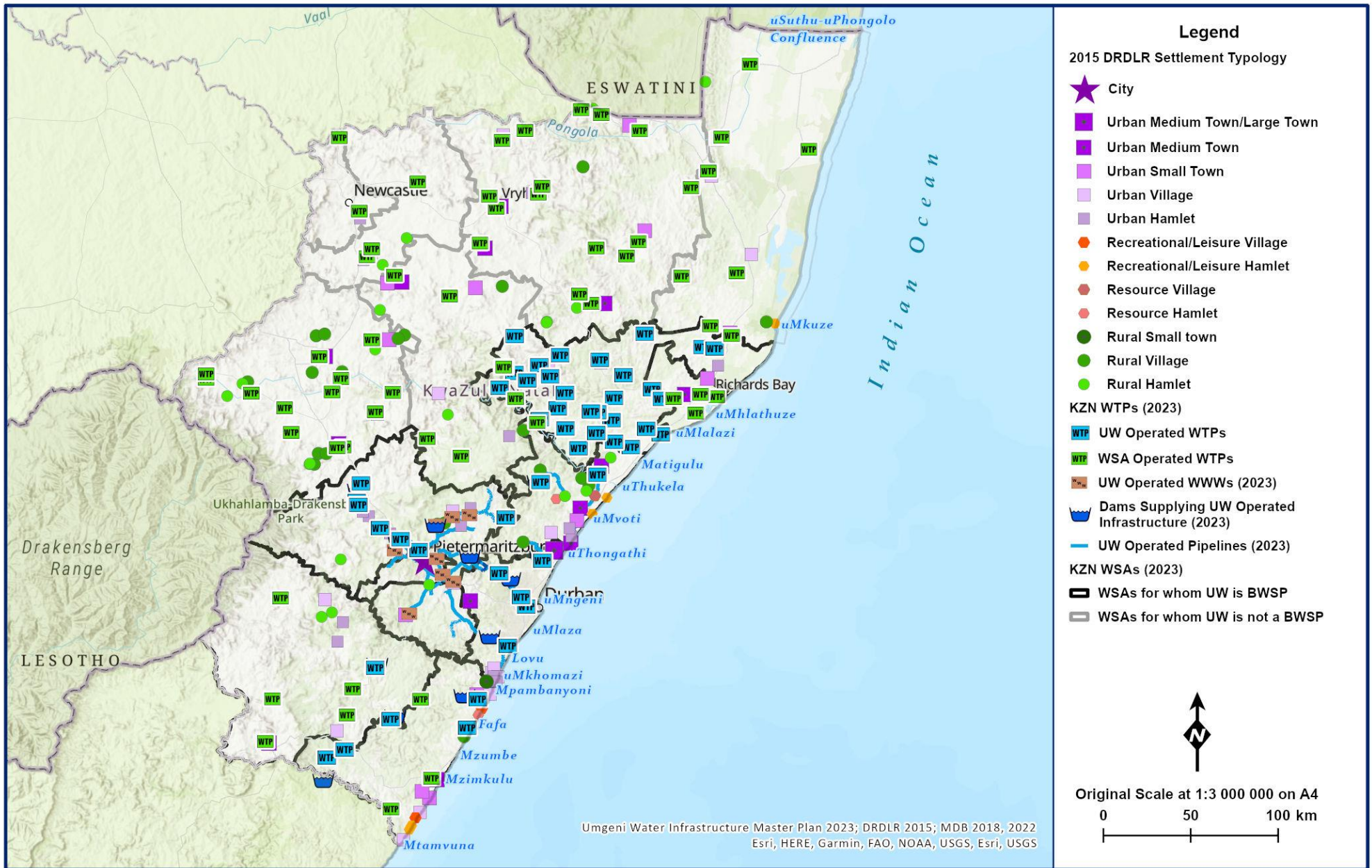


Figure 2.30 DRDLR 2015 Settlement Typology (DRDLR 2015; KZN DoT 2021; MDB 2018; Umgeni Water 2023; WR2012).

2.4 Basic Needs

The KZN Provincial Growth and Development Strategy (PGDS) determined the areas of social need using population density, dependency ratio and the provincial index of multiple deprivation (KZN Planning Commission 2011; 2016). This is shown in **Figure 2.31**. The comparison of this figure with **Figure 2.9**, **Figure 2.12** and **Figure 2.31** shows that those with the highest social need are residing in the “shadow corridor”. A comparison with **Figure 2.27** further shows that these municipalities are classified as “B3”; and “B4” and the comparison with **Figure 2.28** identifies that these areas are predominantly classified as “high density rural”; “dense rural”; and “sparse rural” in the CSIR/SACN Typology.

Stats SA have improved the provincial index of multiple deprivation by adapting the global Multidimensional Poverty Index (MPI) which “complements traditional income/expenditure-based poverty measures by capturing the severe deprivations that each person or household faces with respect to education, health and living standards” (Stats SA 2014b: 3 after OPHI 2014).

The 2011 SAMPI score per ward is shown in **Figure 2.32**. It is illustrated in **Figure 2.32** that the areas in which Umgeni Water operated infrastructure is located have relatively low SAMPI scores (shown in shades of green) except for the Tugela Estates WTP in the uThukela WSA, which located in an area with a high SAMPI score (shown in red). Therefore, it may be deduced that the areas with high SAMPI scores (those shown in shades of green) have reasonable access to “piped water in dwelling or on stand” and a “flush toilet”.

A comparison of **Figure 2.32** with **Figure 2.26** shows that those areas which have relatively low SAMPI scores make a larger percentage contribution to the KZN GDP. Therefore, the provision of bulk water infrastructure in those areas with relatively high SAMPI scores will require additional public sector funding or cross-subsidisation from those areas with high GDP and relatively low reliance on government grants as a source of income (**Figure 2.29 in UW IMP 2019**). The information could also be inferred that areas with good access to water have the higher contribution to GDP.

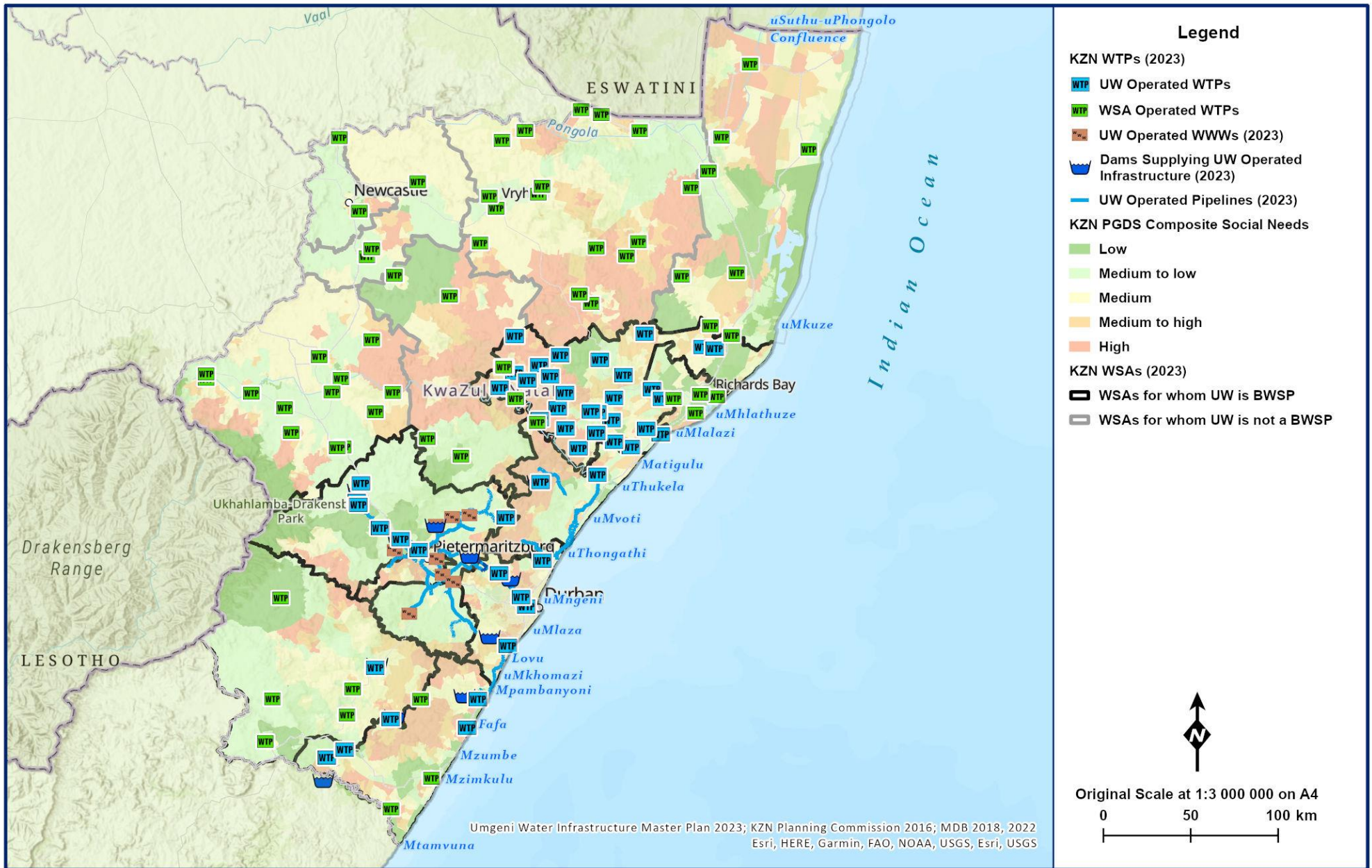


Figure 2.31 KZN PGDS composite social needs (KZN Planning Commission 2016).

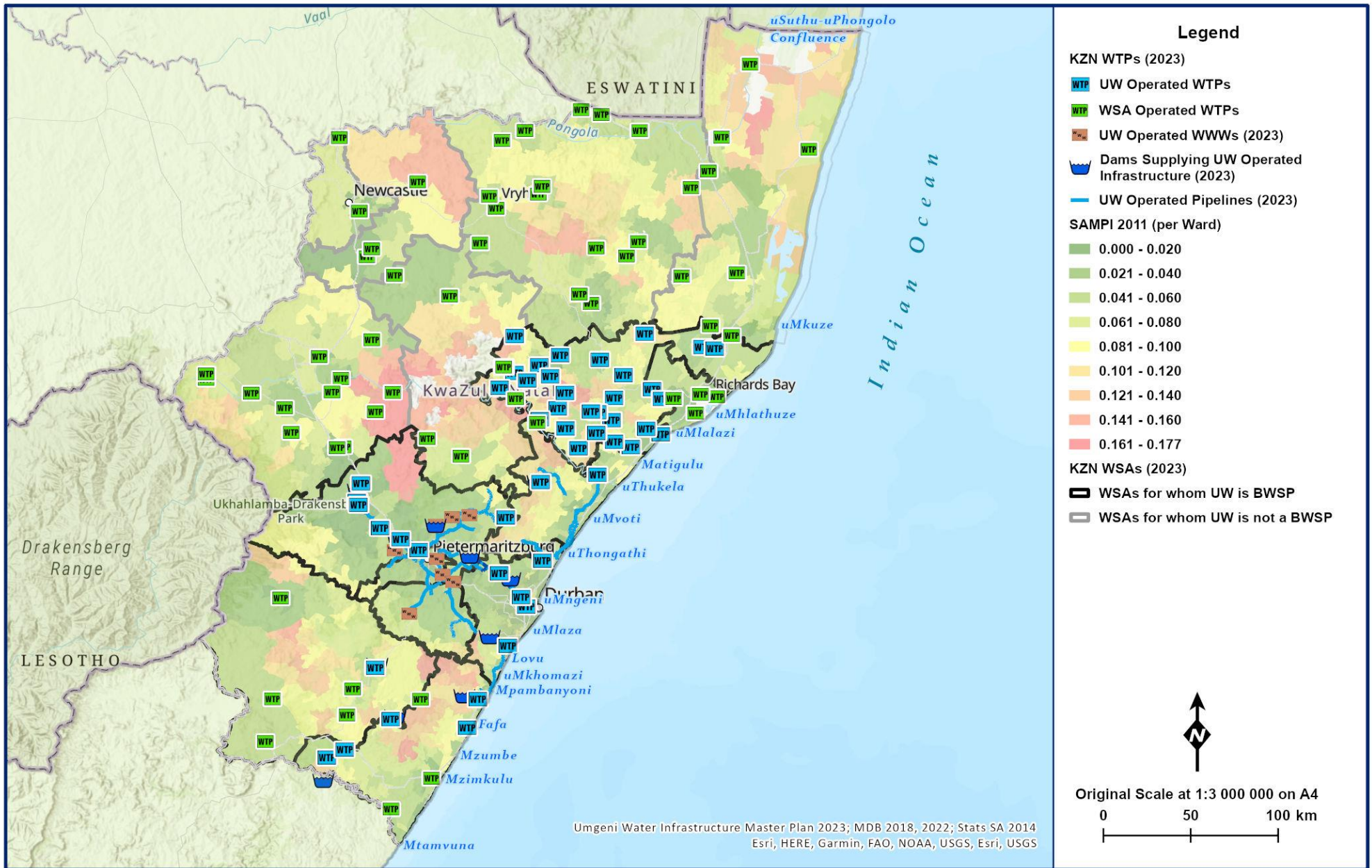


Figure 2.32 2011 SAMPI score per ward (Stats SA 2014).

The contribution of the weighted indicators to SAMPI 2011 in KwaZulu-Natal is shown in **Figure 2.33**. It is shown that sanitation is the third largest contributor at 8% and water and heating the fourth largest contributor at 7%.

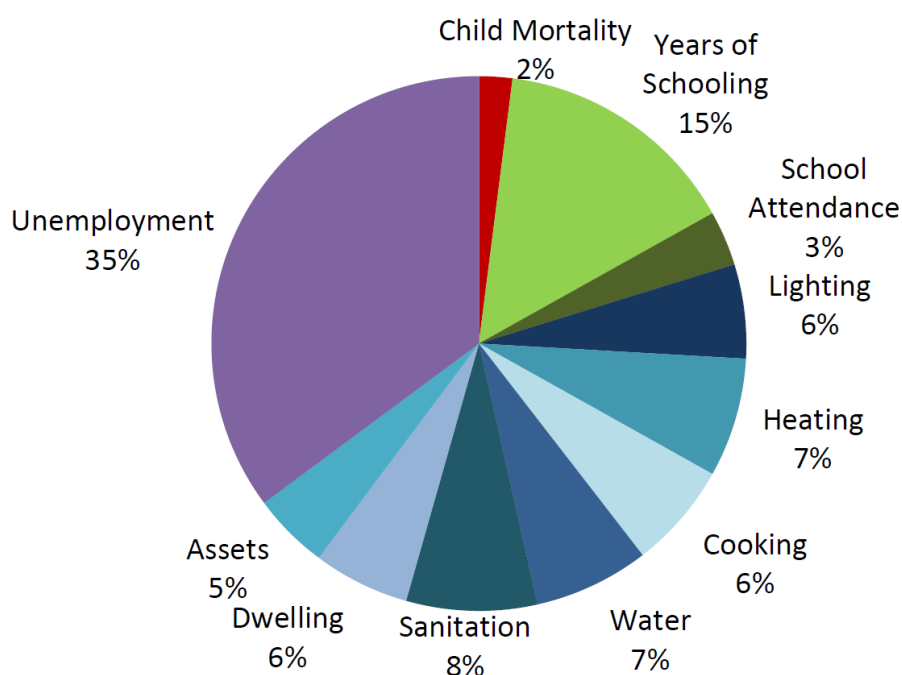


Figure 2.33 Contribution of weighted indicators to SAMPI 2011 in KwaZulu-Natal (Stats SA 2014b: 32).

The KZN government has been implementing a number of programmes and projects to address the components of poverty as discussed above. In 2018, the KZN Office of the Premier and Statistics SA implemented the second iteration of the KZN Citizen Satisfaction Survey (KZN CSS 2018). The aim of this survey is to “understand how KZN citizens rated services provided by their provincial and local governments to assess service delivery performance, inform improved service delivery plans, and to provide a platform for government to engage more directly with its constituent” (Statistics SA 2018: 8). This survey was undertaken from April to May 2018 and the results released in August 2018. The overall ranking of water and sanitation services in KZN is shown in **Table 2.4**; the level of satisfaction with the provision of water and sanitation services in **Table 2.5**; and if service delivery complaints were made with reference to water and sanitation services in **Table 2.6**. The KZN CSS 2018 further identified the perceived prioritisation of the municipal services (**Table 2.7**).

Table 2.4 The top six very important municipal services in KZN as identified by the KZN CSS 2018 (Stats SA 2018: 3).

Top six very important municipal services	Not important	Important	Very important
Water services	1.1%	25.8%	73.2%
Electricity services	0.8%	27.6%	71.6%
Municipal clinic services	1.5%	30.6%	68.0%
Affordable housing	1.6%	32.3%	66.1%
Sanitation services	1.9%	33.0%	65.1%
Road maintenance	1.6%	33.6%	64.8%

Table 2.5 Level of satisfaction with KZN local municipal performance on the top five very important services (Stats SA 2018: 3).

Level of satisfaction with local municipal performance on top five very important services	Outright dissatisfied	Somewhat satisfied	Outright satisfied
Water services	25.5%	24.7%	49.8%
Electricity services	19.7%	27.7%	52.6%
Municipal clinic services	15.0%	27.0%	58.1%
Affordable housing	48.6%	21.4%	30.0%
Sanitation services	38.3%	19.3%	42.4%

Table 2.6 Service delivery complaints on the top five very important services (Stats SA 2018: 3).

Whether (or not) service delivery complaints were made	Yes	No
Water services	40.8%	59.2%
Electricity services	29.1%	70.9%
Refuse disposal	19.1%	80.9%
Housing	34.0%	66.0%
Sanitation services	23.9%	76.1%

Table 2.7 Top five municipal services perceived as important by MIIF category in the KZN CSS 2018 (Stats SA 2018: 82).

	MIIF Category A	MIIF Category B1	MIIF Category B2	MIIF Category B3	MIIF Category B4
Highest Proportion	Water Services	Water Services	Water Services	Water Services	Water Services
2nd Highest Proportion	Electrical Services	Electrical Services	Electrical Services	Electrical Services	Electrical Services
3rd Highest Proportion	Municipal Clinic Services	Municipal Clinic Services	Municipal Clinic Services	Affordable Housing	Municipal Clinic Services
4th Highest Proportion	Road Maintenance	Sanitation Services	Affordable Housing	Municipal Clinic Services	Affordable Housing
5th Highest Proportion	Sanitation Services	Affordable Housing	Sanitation Services	Road Maintenance	Road Maintenance

It is shown in **Figure 2.34** that the KZN CSS 2018 identified that:

“... approximately half of KZN citizens (49.8%) were outright satisfied with the quality of their main source of drinking water. This is also true across all MIIF categories. MIIF categories B2 and B1 had the highest proportion of citizens (59.0% and 58.6%, respectively) who were outright satisfied with the quality of their main source of drinking water. MIIF categories B3 and B4 had the largest proportion of citizens who were outright dissatisfied.”

(Stats SA 2018: 82)

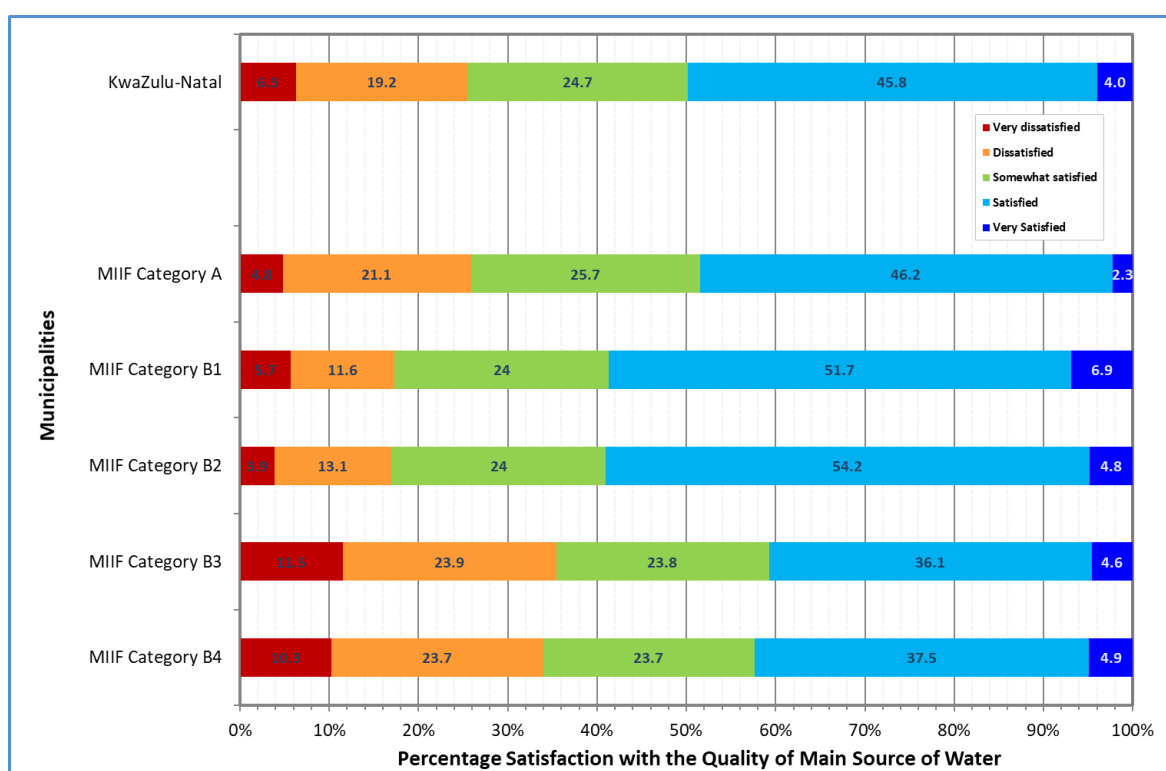


Figure 2.34 Percent distribution of persons aged 15 years and older by MIIF category and level of satisfaction with the quality of their main source of water as identified in the KZN CSS 2018 (Stats SA 2018: 83).

The KZN CSS 2018 results identified that:

“As seen in the previous analysis (**Table 2.7**), citizens of KZN perceived sanitation services as one of the most important services. It is evident from **Figure 2.35** that regardless of MIIF category, less than 5% of citizens reported being very satisfied with the sanitation services used by their households. In terms of satisfaction, 42.4% of citizens were outright satisfied with the overall quality of sanitation services used by their households. Moreover, 19.3% were somewhat satisfied and 38.3% were outright dissatisfied with the overall quality of sanitation services used by their households. Over 40% of citizens were outright satisfied with the overall quality of sanitation services used by their households in MIIF categories A, B1 and B2 with 44.9%, 44.2%, and 52.7%, respectively.”

(Stats SA 2018: 91)

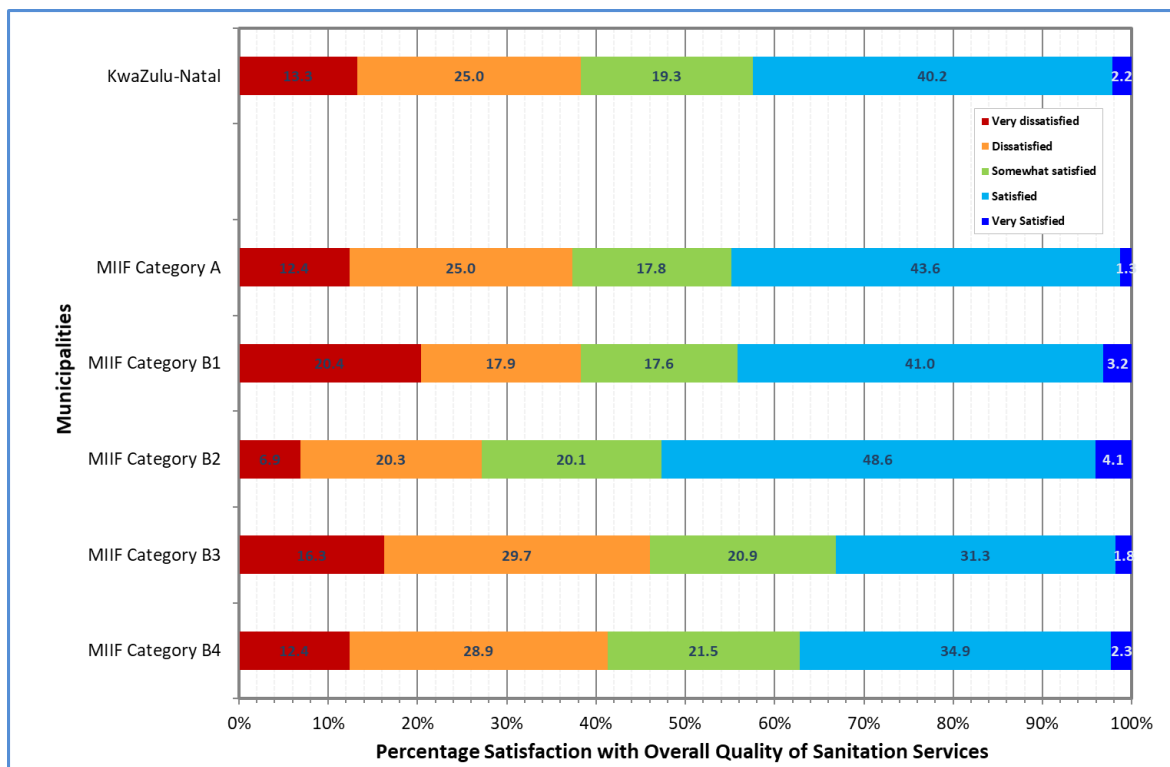


Figure 2.35 Percent distribution of persons aged 15 years and older by MIIF category and level of satisfaction with the overall quality of sanitation services used by their households as identified by the KZN CSS 2018 (Stats SA 2018: 91).

The Community Survey results showing the number of people with the main source of water for drinking per WSA is shown in **Figure 2.36**. The number of people with the main source of water for drinking per WSA in Umgeni Water’s operational area is listed in **Table 2.8**.

Table 2.8 Community Survey 2016 number of people with main source of water for drinking per WSA (Stats SA 2017).

Main Source of Water	eThekwini	Msunduzi	uMgungundlovu	iLembe	Ugu	Harry Gwala	uThukela	KCDM
Piped (tap) water inside the dwelling/house	2 205 755	267 470	108 140	118 349	125 739	45 814	120 240	46 415
Piped (tap) water inside yard	992 591	361 535	129 268	145 753	95 485	105 593	227 213	212 062
Piped water on community stand	283 625	23 894	63 654	171 811	286 129	126 563	94 457	88 225
Borehole in the yard	9 880	723	3 700	2 796	2 705	7 689	8 024	3 490
Rain-water tank in yard	4 278	858	4 128	12 630	8 940	13 011	4 652	8 786
Neighbours tap	63 646	10 208	8 131	8 280	3 192	3 418	10 162	9 204
Public/communal tap	85 045	7 205	26 490	23 180	134 285	38 591	54 570	43 926
Water-carrier/tanker	29 603	4 544	23 493	49 406	22 306	10 771	42 996	56 302
Borehole outside the yard	8 263	401	4 405	3 097	8 024	22 300	67 233	16 515
Flowing water/stream/river	9 413	970	37 701	110 867	63 772	125 157	45 009	67 384
Well	0	123	79	345	500	776	5 967	228
Spring	227	48	4 825	7 598	690	9 940	24 032	6 496
Other	9 903	1 062	2 811	3 500	1 568	1 242	2 032	1 636
Total	3 702 231	679 039	416 825	657 612	753 336	510 865	706 588	560 670

The distance people travel on average to their main source of water for drinking per WSA is illustrated in **Figure 2.37**. The main supplier of drinking water per WSA is shown in **Figure 2.38**.

The main type of toilet facility per WSA is presented in **Figure 2.39**.

eThekwini Municipality is the predominant contributor of people to Umgeni Water's operated area at 55% (**Figure 2.13**) and has the largest number of people with access to piped water inside their dwellings (**Figure 2.36**) as well as with a flush toilet connected to a public sewerage system (**Figure 2.39**).

A comparison of **Table 2.8**, **Figure 2.36**, **Figure 2.37**, **Figure 2.38** and **Figure 2.39** with **Figure 2.40** and **Figure 2.41** show that the data categories currently collected are not aligned with those of the National Norms and Standards for Domestic Water and Sanitation Services (Government Gazette No. 41100 No. 982, 8 September 2017). It is anticipated that this mis-alignment may be addressed in the next Census⁸.

⁸ Was scheduled for 2021 but may occur in 2022 due to the Covid-19 pandemic.

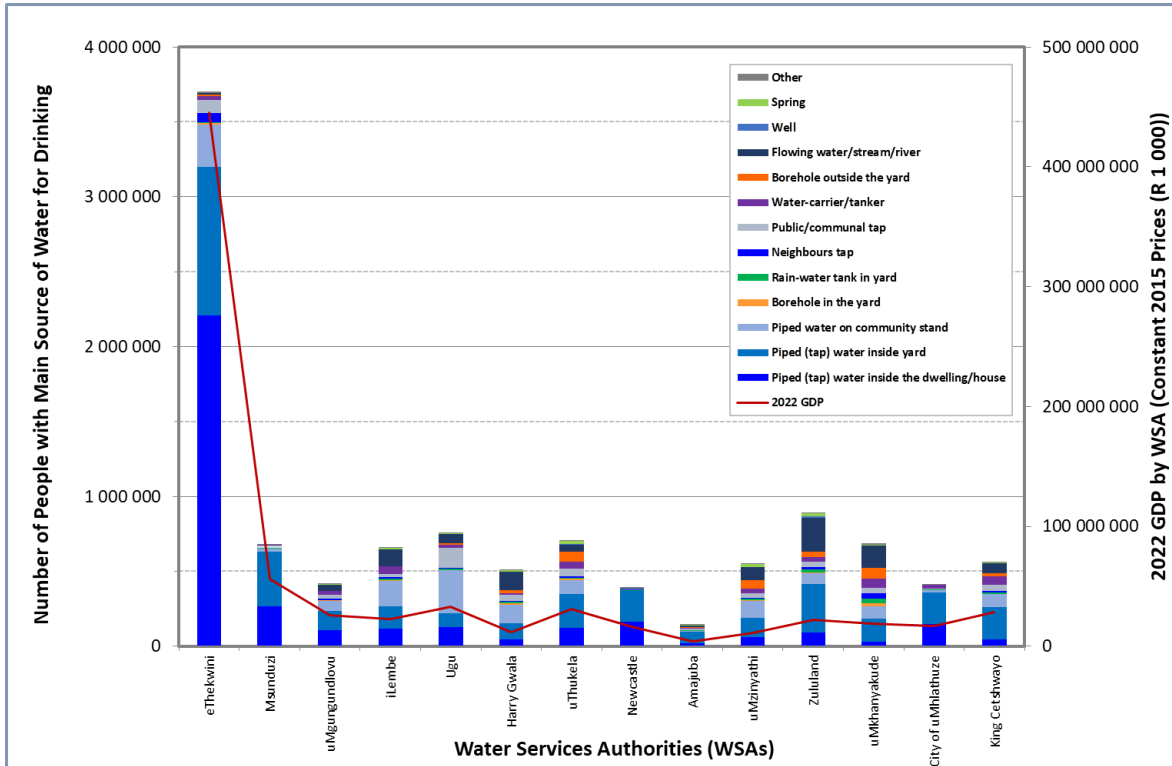


Figure 2.36 Community Survey 2016 number of people with main source of water for drinking per WSA (Stats SA 2017; KZN Treasury after Global Insight 2023).

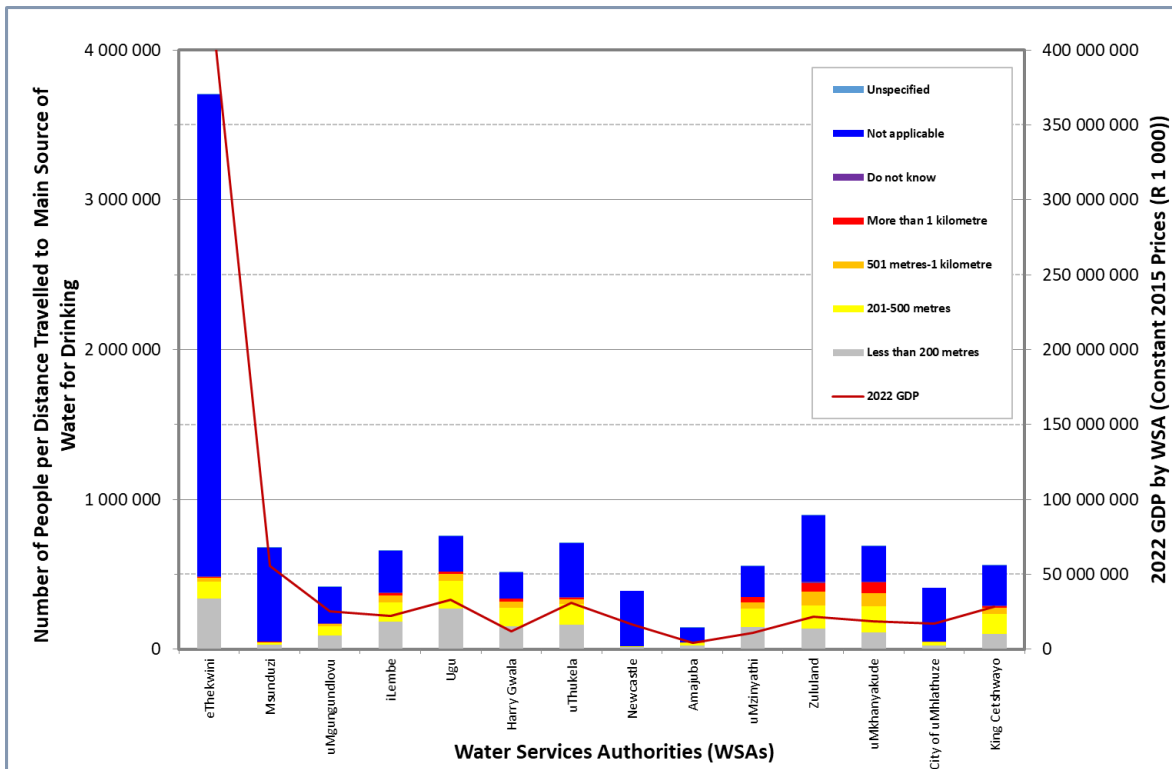


Figure 2.37 Community Survey 2016 number of people per distance travelled to main source of water for drinking per WSA (Stats SA 2017; KZN Treasury after Global Insight 2023).

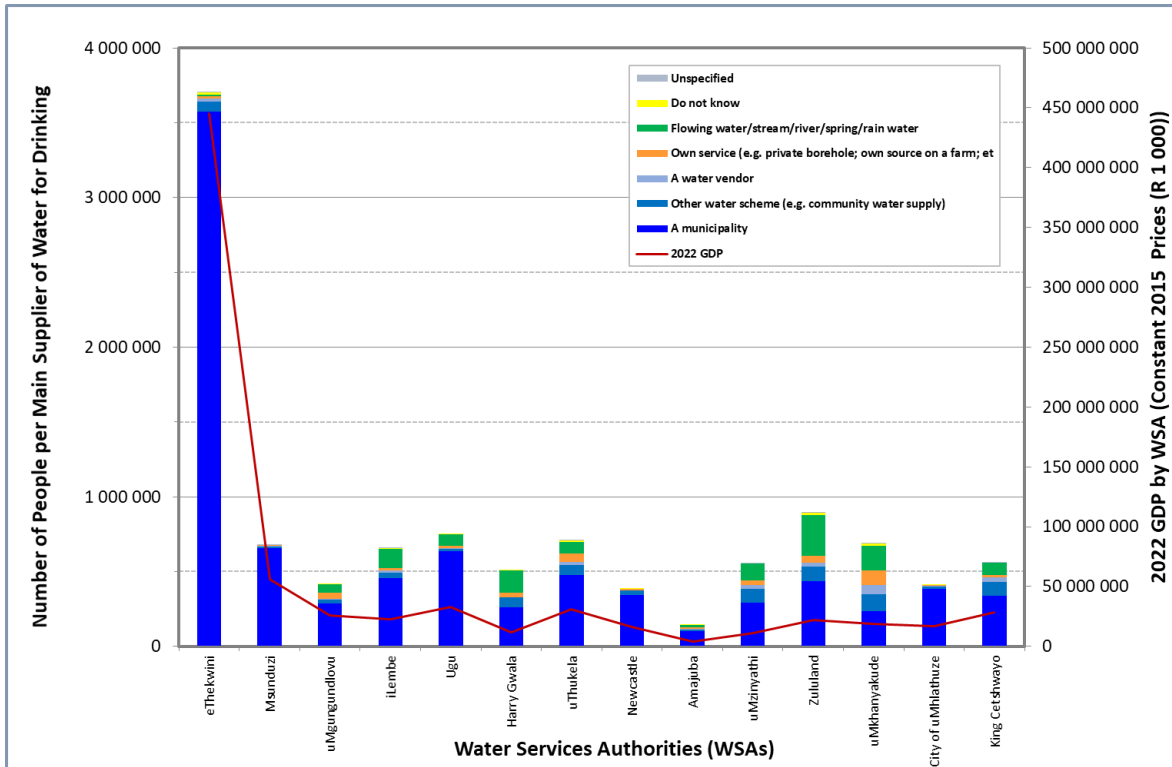


Figure 2.38 Community Survey 2016 number of people per main supplier of drinking water per WSA (Stats SA 2017; KZN Treasury after Global Insight 2023).

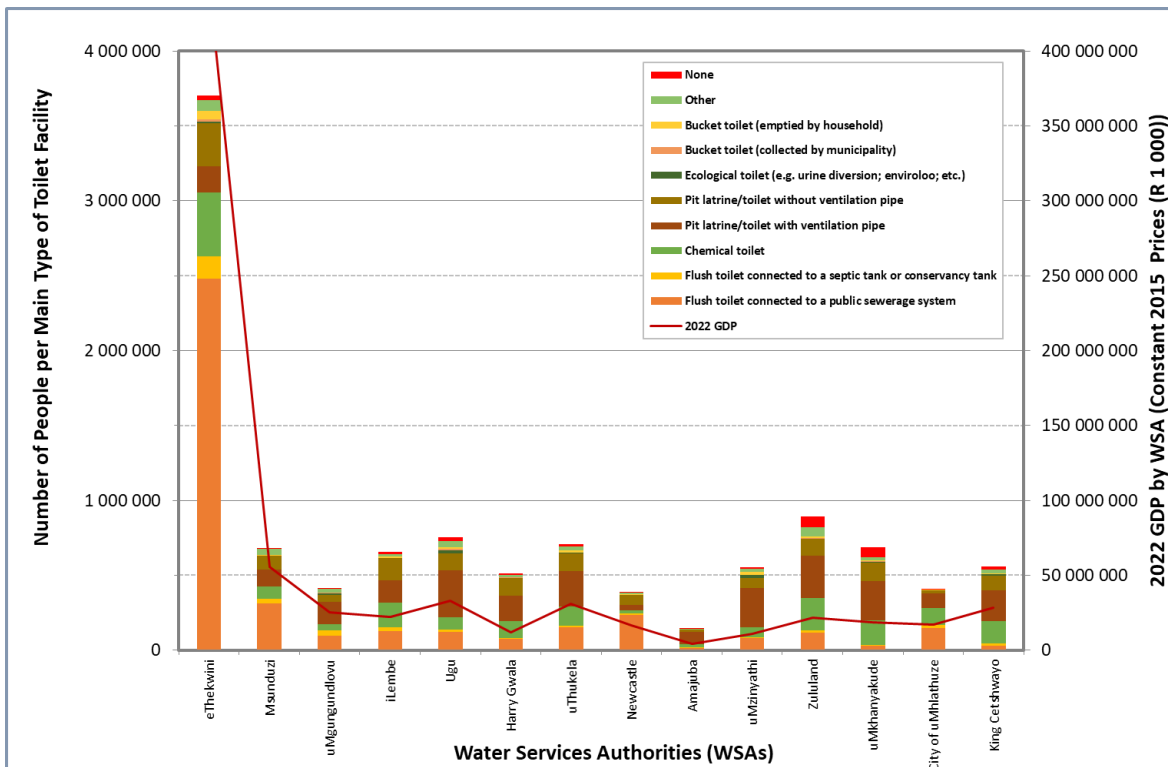


Figure 2.39 Community Survey 2016 number of people per main type of toilet facility per WSA (Stats SA 2017; KZN Treasury after Global Insight 2023).

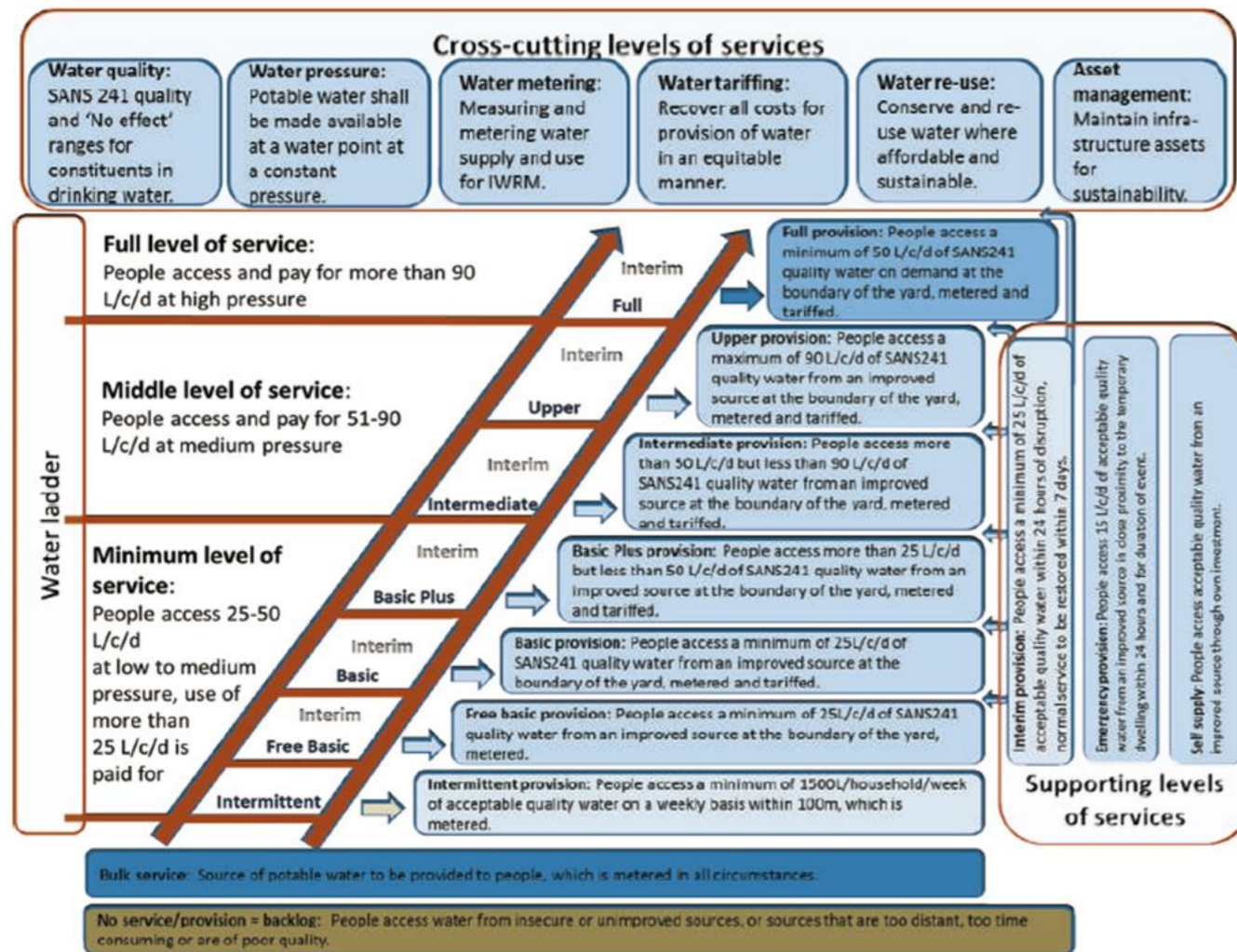


Figure 2.40 Norms and standards for water supply services (DWS 2017: 14).

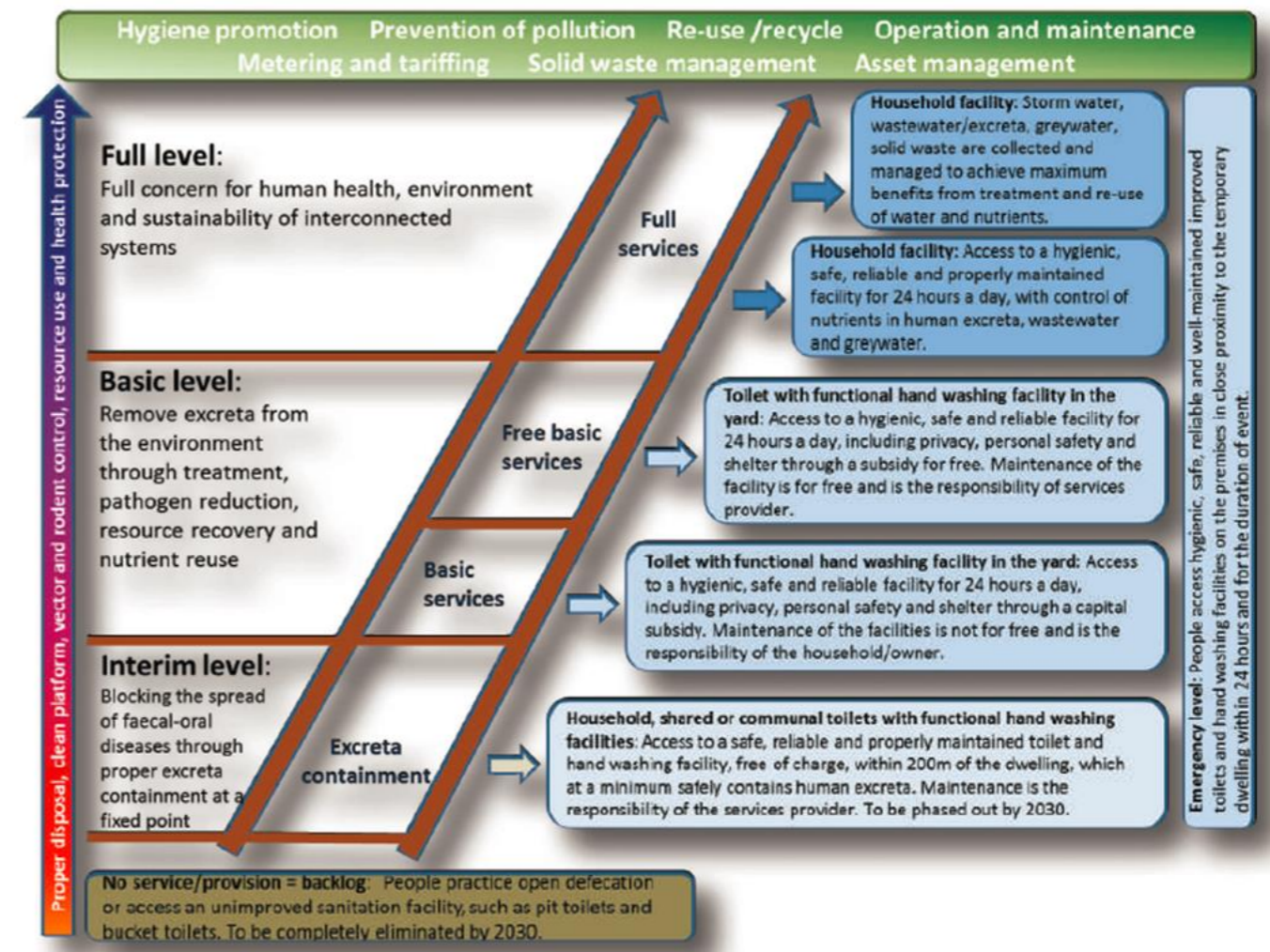


Figure 2.41 Norms and standards for sanitation services (DWS 2017: 32).

KZN CoGTA undertook an “Access to Water” study in 2020 to determine household access to water via infrastructure. The results of this study are summarised in **Table 2.9**.

Table 2.9 Summary of Results of the KZN CoGTA “Access to Water” Study (2020: vi).

District Municipality	Percentage Household Water Access			
	Infrastructure Water Access		No Water Access (No Infrastructure)	No Access to Reliable Water Supply
	Functional	Dysfunctional		
	(KZN CoGTA 2020 Study)			(UAP Ph3 2020 Study)
Amajuba	81.4%	6.8%	11.8%	31%
Harry Gwala	75.0%	9.0%	16.0%	44%
iLembe	33.7%	35.4%	29.5%	19%
King Cetshwayo	72.7%	3.6%	23.7%	32%
uMgungundlovu	78.8%	10.6%	10.6%	20%
uMkhanyakude	41.3%	40.5%	18.8%	60%
uMzinyathi	60.6%	2.4%	28.1%	49%
uThukela	90.2%	2.9%	6.9%	17%
Zululand	81.9%	5.5%	10.7%	23%
Ugu	82.1%	0.0%	17.9%	37%
eThekwini	100.0%	0.0%	0.0%	0.0%
Total	78.3%	6.3%	15.4%	30.2%

2.5 Development Plans

The KZN Planning Commission summarises the alignment of the key strategic plans occurring at the different spheres in **Figure 2.42**.

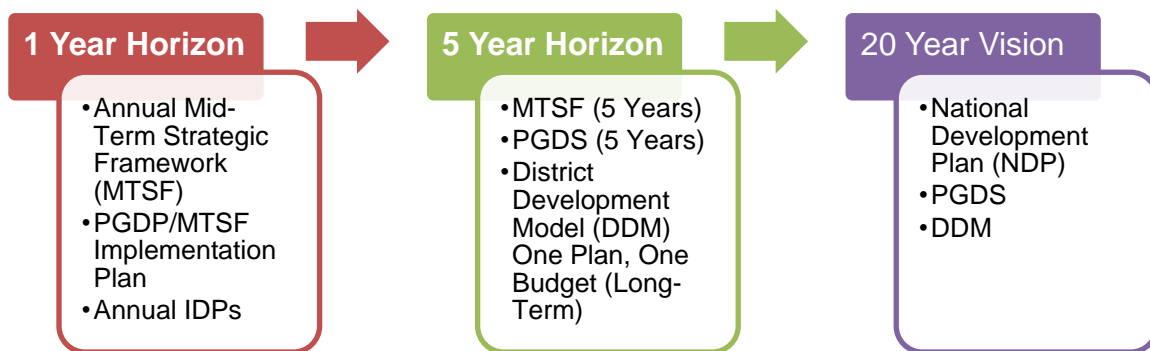


Figure 2.42 Alignment between key strategic plans occurring at the different spheres (KZN Planning Commission 2021).

National CoGTA explains the District Development Model as follows:

“The District Development Model was initiated by President Cyril Ramaphosa in his Budget Speech in 2019. Subsequently, the District Development Model was discussed and adopted by Cabinet, the 2019 Presidential Coordinating Council (PCC), the March 2020 extended PCC and various MINMECs. The President in the 2019 Presidency Budget Speech (2019) identified the “pattern of operating in silos” as a challenge which led to “to lack of coherence in planning and implementation and has made monitoring and oversight of government’s programme difficult”. The consequence has been non-optimal delivery of services and diminished impact on the triple challenges of poverty, inequality and employment... The Model consists of a process by which joint and collaborative planning is undertaken at local, district and metropolitan by all three spheres of governance resulting in a single strategically focussed One Plan for each of the 44 districts and 8 metropolitan geographic spaces in the country, wherein the district is seen as the ‘landing strip’.”

(CoGTA 2021: website)

Identified as an “operational model” (CoGTA 2021; IUDF 2020), the DDM is summarised in **Figure 2.43** and the implementation framework for the DDM shown in **Figure 2.44**.

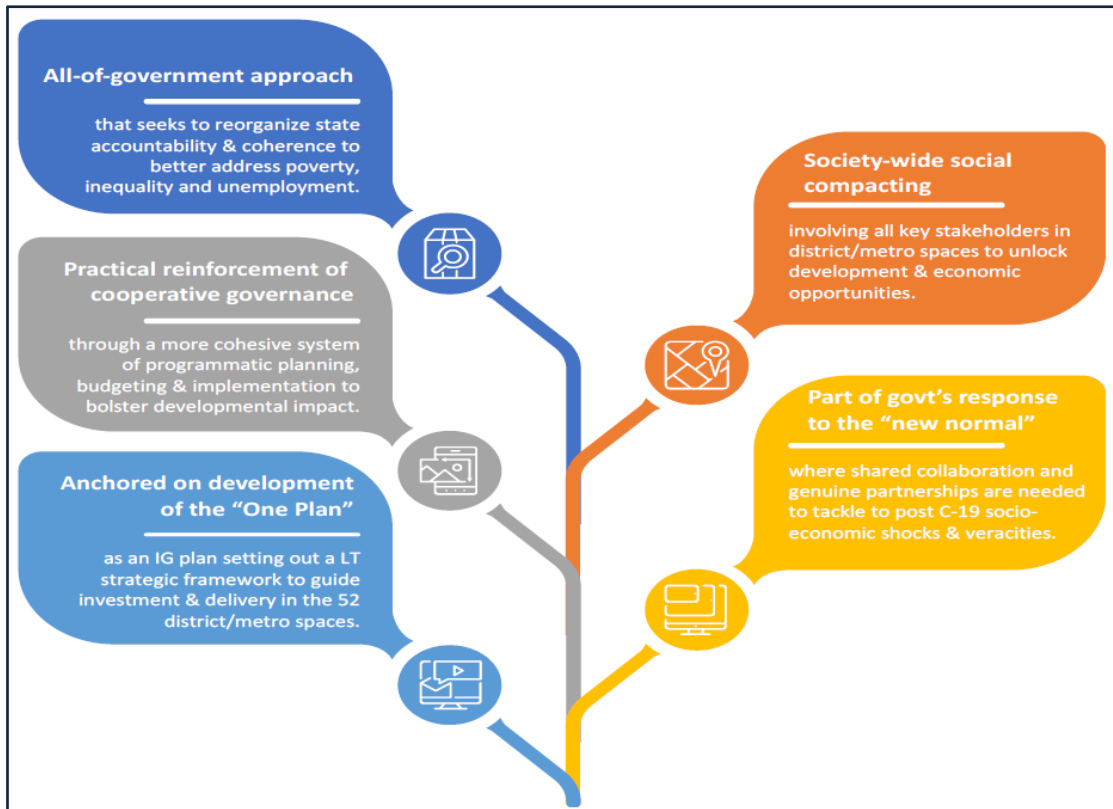


Figure 2.43 District Development Model (DDM) overview (DBSA and CoGTA 2020: website).

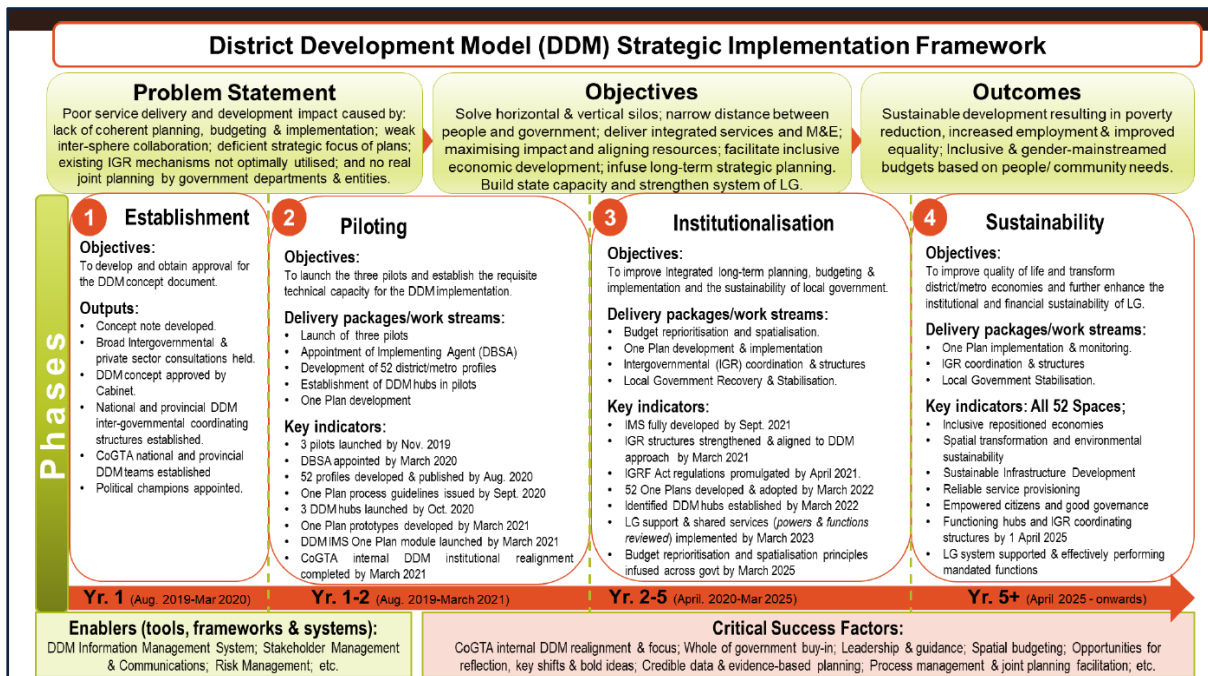


Figure 2.44 District Development Model (DDM) implementation framework (DBSA and CoGTA 2020: website).

At the global scale, the 17 Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development (adopted by the 193 Member States of the United Nations in September 2015) became officially operational on 1 January 2016 (United Nations 2016: website). The global indicator framework for the SDGs was agreed upon at the 48th session of the United Nations Statistical Commission in March 2017 (United Nations Statistical Commission 2017: i). The targets and indicators for Goal 6 Ensure availability and sustainable management of water and sanitation for all is listed in **Table 2.10**.

Table 2.10 Targets and indicators for SDG Goal 6 Ensure Availability and Sustainable Management of Water and Sanitation for All (United Nations Statistical Commission 2017: 9/26 – 10/26).

Targets	Indicators
6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all.	6.1.1 Proportion of population using safely managed drinking water services.
6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.	6.2.1 Proportion of population using safely managed sanitation services, including a hand-washing facility with soap and water.
6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimising release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.	6.3.1 Proportion of wastewater safely treated. 6.3.2 Proportion of bodies of water with good ambient water quality.
6.4 By 2030, substantially increase water use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity.	6.4.1 Change in water use efficiency over time. 6.4.2 Level of water: freshwater withdrawal as a proportion of available freshwater resources.
6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate.	6.5.1 Degree of integrated water resources management implementation (0 – 100). 6.5.2 Proportion of transboundary basin area with an operational arrangement for water cooperation.
6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.	6.6.1 Change in the extent of water-related ecosystems over time.
6.a By 2030, expand international cooperation and capacity-building support to development countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies.	6.a.1 Amount of water- and sanitation-related official development assistance that is part of a government-coordinated spending plan.
6.b Support and strengthen the participation of local communities in improving water and	6.b.1 Proportion of local administrative units with established and operational policies and

sanitation management.	procedures for participation of local communities in water and sanitation management.
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Put forward as “an extension of the 2030 Agenda for Sustainable Development” (UN Habitat 2016: website), the *New Urban Agenda*, the “framework that lays out how cities should be planned and managed to best promote sustainable urbanisation” was adopted at Habitat III, the United Nations Conference on Housing and Sustainable Development in October 2016 in Quito, Ecuador (UN Habitat 2016: website). The *New Urban Agenda* is unique as it has four items out of 175 items that are specific to water i.e. in contrast to the convention of water issues being included with the natural environment or with all basic services:

“72. We commit to long-term urban and territorial planning processes and spatial development practices that incorporate integrated water resources planning and management, considering the urban-rural continuum at the local and territorial scales, and including the participating of relevant stakeholders and communities.

73. We commit to promote conservation and sustainable use of water by rehabilitating water resources within the urban, peri-urban, and rural areas, reducing and treating waste water, minimising water losses, promoting water reuse, and increasing water storage, retention, and recharge, taking into consideration the water cycle.

119. We will promote adequate investments in protective, accessible, and sustainable infrastructure and service provision systems for water, sanitation, and hygiene, sewage, solid waste management, urban drainage, reduction of air pollution, and storm water management, in order to improve safety against water-related disasters, health, and ensure universal and equitable access to safe and affordable drinking water for all; as well as access to adequate and equitable sanitation and hygiene for all; and end open defecation, with special attention to the needs and safety of women and girls and those in vulnerable situations, We will seek to ensure that this infrastructure is climate resilient and forms part of integrated urban and territorial development plans, including housing and mobility, among others, and is implemented in a participatory manner, considering innovative, resource efficient, accessible, context specific, and culturally sensitive sustainable solutions.

120. We will work to equip public water and sanitation utilities with the capacity to implement sustainable water management systems, including sustainable maintenance of urban infrastructure services, through capacity development with the goal of progressively eliminating inequalities, and promoting both the universal and equitable access to safe and affordable drinking water for all, and adequate and equitable sanitation and hygiene for all.”

(UN Habitat 2016: 10; 16)

The water sector falls within two priority areas in the African Union (AU) Agenda 2063:

- The “*Priority Area Water Security*” under the “*Environmentally sustainable and climate resilient economies and communities*” Goal which falls under the “*A prosperous Africa, based on inclusive growth and sustainable development*” Aspiration (African Union 2015: 94 – 95); and

- The “Priority Area Modern, affordable and liveable habits and quality basic services” which falls under the “A high standard of living, quality of life and wellbeing for all citizens” Goal which falls under the same Aspiration as above (AU 2015: 94).

At the national sphere, the National Development Plan (adopted in 2011) identified 17 Strategic Integrated Projects (SIPs) and required the preparation of a National Spatial Development Framework (NSDF). A draft version of this NSDF was released in September 2018 and once adopted, will be discussed in the next version of the IMP. The National Infrastructure Plan (2012) elaborates on the 17 identified SIPs and added an additional SIP, SIP 18 for Water and Sanitation.

In July 2020, the Presidential Infrastructure Coordinating Commission “in terms of Section 8(1)(a) read with Section 7(1) of the Infrastructure Development Act, as amended, 2014 (Act No. 23 of 2014) designated a further 18 SIPs with Water and Sanitation being assigned to SIP 19” (Figure 2.45). SIP 19 has 11 sub-projects with “SIP 19c. uMkhomazi Water Project” located in KZN (Government Gazette No. 43547 No. 812, 24 July 2020).

The National Water Resources Strategy Second Edition (NWRS2) responds to the National Development Plan and “outlines the strategy for protecting, using, developing, conserving, managing and controlling South Africa’s scarce water resources towards achieving the 2030 Vision” (DWS 2013: 1). The NWRS2 therefore responds directly to SIP 18 and SIP 19. The original 18 SIPs and those which are applicable to KZN are illustrated in Table 2.11. All sub-projects for SIP 19 are listed in Figure 2.45 and only those applicable to KZN are in Figure 2.45 for SIPs 20 – 36.

Table 2.11 Strategic Integrated Projects applicable to KZN (KZN Planning Commission 2013).

SIP No.	Strategic Integrated Project	KZN
1	Unlocking the Northern Mineral Belt with Waterberg as a Catalyst	
2	Durban - Free State - Gauteng Logistics and Industrial Corridor	Yes
3	South Eastern Node and Corridor Development	
4	Unlock the Economic Opportunities in the North West Province	
5	Saldanha - Northern Cape Development Corridor	
6	Integrated Municipal Infrastructure Project	Yes
7	Integrated Urban Space and Public Transport Programme	Yes
8	Green Economy in Support of the South Africa Economy	Yes
9	Electricity Generation to Support Socio-Economic Development	Yes
10	Electricity Transmission and Distribution for All	Yes
11	Agri-Logistics and Rural Infrastructure	Yes
12	Revitalisation of Public Hospitals and other Health Facilities	Yes
13	National School Build Programme	Yes
14	Higher Education Infrastructure	Yes
15	Expanding Access to Communication Technology	Yes
16	SKA and Meerkat	
17	Regional Integration for African Co-operation and Development	
18	Water and Sanitation	Yes

Note: SIPs 2, 6 and 18 influence Umgeni Water’s planning.

Strategic Integrated Project No. 19: Water and Sanitation

SIP 19: Sub-Projects

- a. Vaal River System including Phase 2 of the Lesotho Highlands Water Project: Gauteng
- b. Phase 2A of the Mokolo Crocodile River (West) Augmentation Project: Limpopo
- c. uMkhomazi Water Project: KwaZulu-Natal
- d. Olifants River Water Resource Development Project - Phase 2: Limpopo
- e. Vaal-Gamagara: Northern Cape
- f. Mzimvubu Water Project: Eastern Cape
- g. Rehabilitation of the Vaalharts-Taung Irrigation Scheme: Northern Cape & North West
- h. Groot Letaba River Water Development Project - Nwamitwa Dam: Limpopo
- i. Berg River Voëlvei Augmentation Scheme: Western Cape
- j. Rustfontein Water Treatment Works: Free State
- k. Orange-Riet Canal Increase of Bulk Raw Water Supply: Free State

2. Strategic Integrated Project No. 20: Energy

SIP 20: Sub-Projects

- a. Emergency/Risk Mitigation Power Purchase Procurement Programme (2000MW): National
- b. Small IPP Power Purchase Procurement Programme (100MW): National
- c. Embedded Generation Investment Programme (EGIP)-400MW: National

3. Strategic Integrated Project No. 21: Transport

SIP 21: Sub-Projects

- e. N2 Mtunzini Toll Plaza to Empangeni T-Junction: KwaZulu-Natal
- f. N3 Cato Ridge to Dardanelles: KwaZulu-Natal
- g. N3 Dardanelles to Lynnfield Park: KwaZulu-Natal
- h. N3 Paradise Valley to Mariannahill Toll Plaza: KwaZulu-Natal
- i. N2 Edwin Swales to South of EB Cloete Interchange: KwaZulu-Natal
- j. N3 Ashburton Interchange to Murray Road: KwaZulu-Natal
- k. N3 Mariannahill Toll Plaza to Key Ridge: KwaZulu-Natal
- l. N2 EB Cloete Interchange: KwaZulu-Natal
- m. Small Harbours Development: National

4. Strategic Integrated Project No. 22: Digital Infrastructure

SIP 22: Sub-Project

- a. National Spatial Infrastructure Hub

5. Strategic Integrated Project No. 23: Agriculture and Agro-Processing

6. Strategic Integrated Project No. 24: Human Settlements

SIP 24: Sub-Projects

- a. Greater Cornubia: KwaZulu-Natal
- k. Newcastle Hospital Street Social Housing Project: KwaZulu Natal

7. Strategic Integrated Project No. 25: Rural Bridges "Welisizwe" Programme

8. Strategic Integrated Project No. 26: Rural Roads Upgrade Programme

9. Strategic Integrated Project No. 27: Upgrading and Repair of Township Roads in Municipalities Programme

10. Strategic Integrated Project No. 28: PV and Water Savings on Government Buildings Programme

11. Strategic Integrated Project No. 29: Comprehensive Urban Management Programme

12. Strategic Integrated Project No. 30: Digitising of Government Information Programme

13. Strategic Integrated Project No. 31: Removal of Alien Vegetation and

14. Strategic Integrated Project No. 32: National Upgrading Support

15. Strategic Integrated Project No. 33: Solar Water Initiatives Programme



Figure 2.45 SIPs 19 – 36 designated in July 2020 (Government Gazette No. 43547 No. 812, 24 July 2020).

The study for the KZN portion of SIP 2 was completed in 2016. Called the “N3 Strategic Corridor Development Plan 2016”, the study area is illustrated in **Figure 2.46**. The regions identified by this study occurring in Umgeni Water’s area is summarised in **Figure 2.47**.

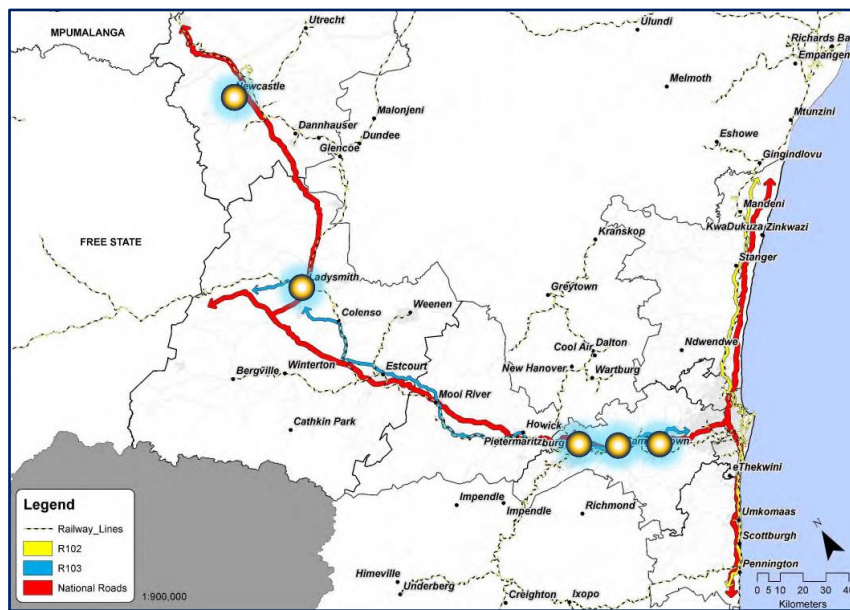


Figure 2.46 “N3 Strategic Corridor Development Plan 2016” study area (KZN CoGTA 2016).

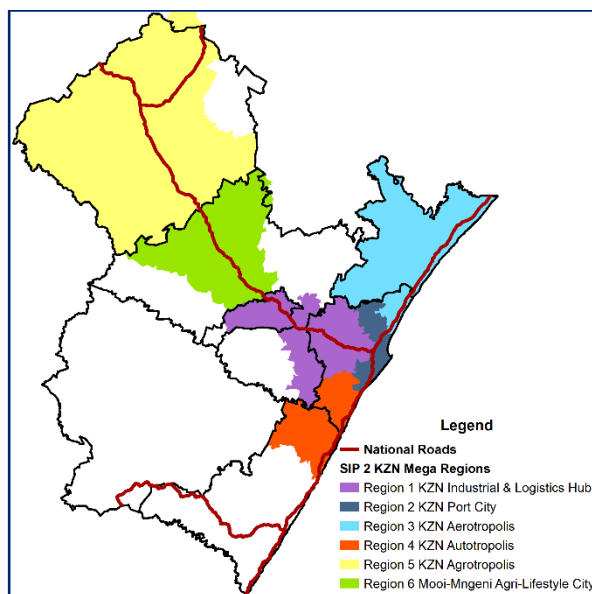
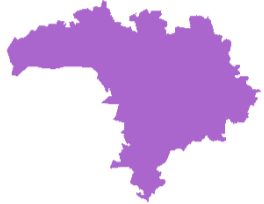
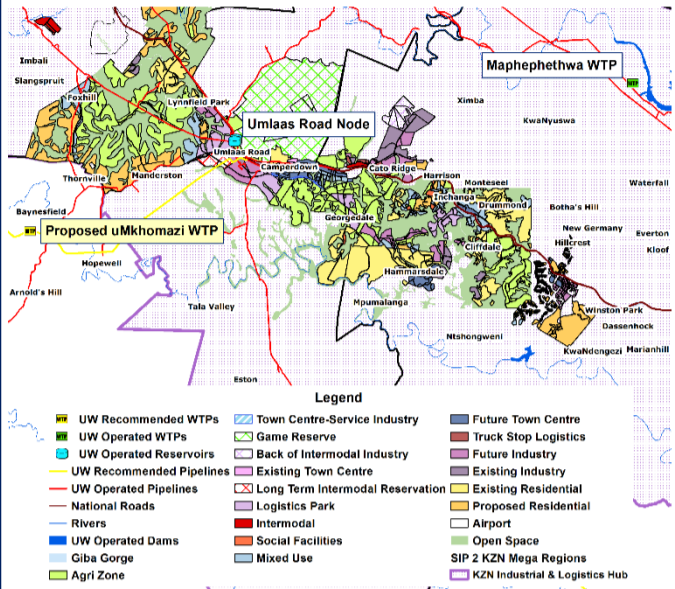

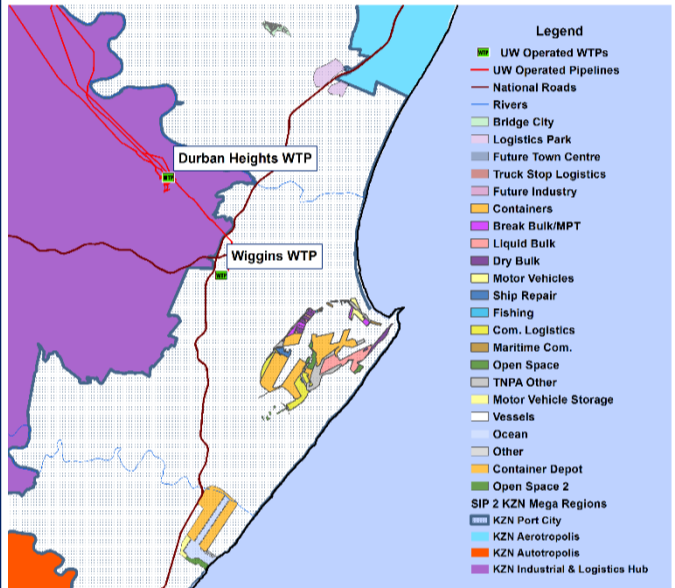

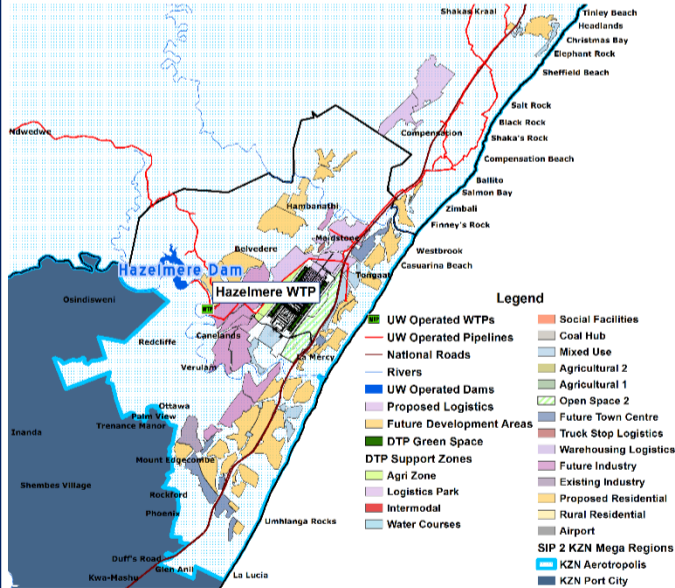

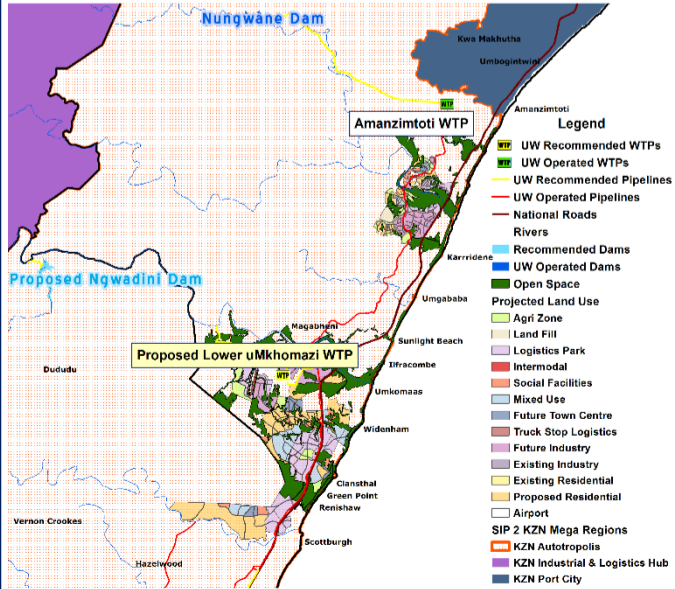


Figure 2.47 Location of the SIP 2 KZN Mega Regions in Umgeni Water's area (KZN CoGTA 2016; KZN DoT 2017; MDB 2016).

A summary of the regional interventions required for water and sanitation as identified by this study is shown in **Table 2.12**. Those regional interventions identified by this study that are direct water users are summarised in **Table 2.13**. It is noted that Region 5, the KZN Agrotropolis displays a polycentric nodal approach and is different from the other regions in that the identified nodes are not all located along the national roads (**Table 2.12**). From a bulk water supply planning perspective, this means that not all the identified nodes in Region 5 may be supplied from one regional bulk WTP in an economically sustainable manner (see **Section 12**).

Table 2.12 Summary of regional interventions required for water and sanitation (KZN CoGTA 2016: 258).

SIP 2 KZN Region	Proposed Land Use	Utilities Sector Development – Bulk Water Capacity Improvements – Water Demand (MI/day) (Additional Capacity Required 30 Years)	Utilities Sector Development – Bulk Sanitation Capacity Improvements – Sewer Flow (MI/day) (Additional Capacity Required 30 Years)	Utilities Sector Development – Water Transfer Schemes / Augmentation Schemes
<p>Region 1 Industrial and Logistics Hub</p> 		282 MI/day.	212 MI/day.	Western Aqueduct.
<p>Region 2 Durban Port City</p> 		274 MI/day.	217 MI/day.	Western Aqueduct.
<p>Region 3 Aerotropolis</p> 		318 MI/day.	235 MI/day.	Northern Aqueduct Augmentation Project.
<p>Region 4 Autotropolis</p> 		78 MI/day.	53 MI/day.	uMkhomazi-Mgeni Transfer Scheme.


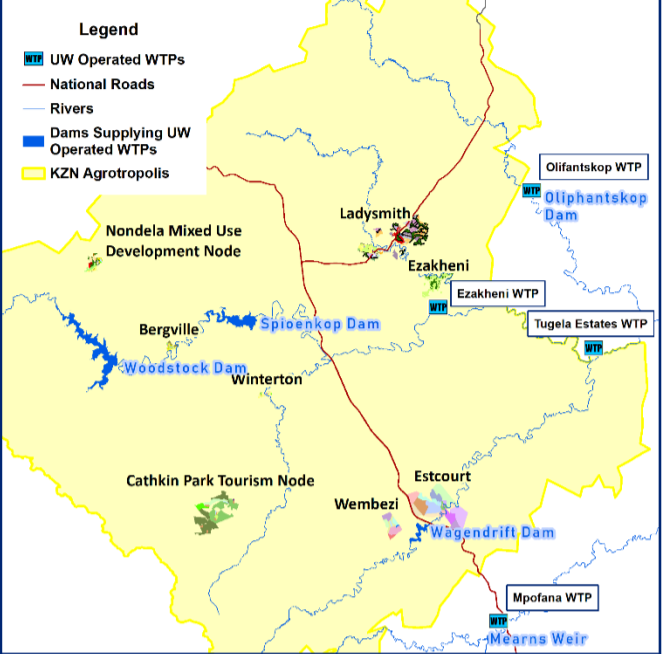

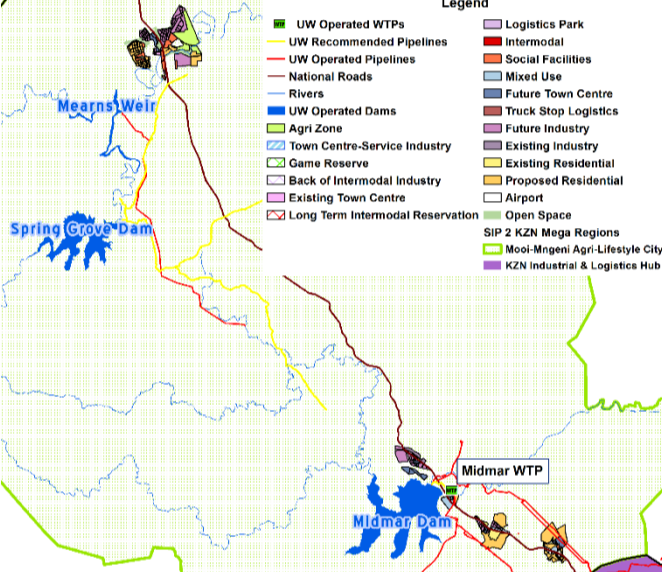
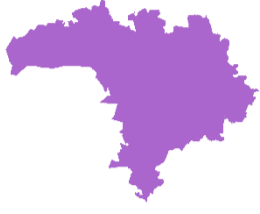





SIP 2 KZN Region	Proposed Land Use	Utilities Sector Development – Bulk Water Capacity Improvements – Water Demand (Ml/day) (Additional Capacity Required 30 Years)	Utilities Sector Development – Bulk Sanitation Capacity Improvements – Sewer Flow (Ml/day) (Additional Capacity Required 30 Years)	Utilities Sector Development – Water Transfer Schemes / Augmentation Schemes
Region 5 Agrotropolis 		87 Ml/day.	66 Ml/day.	Wagendrift Dam/Tugela River/Klip River
Region 6 Agri-Tourism and Lifestyle City 		55 Ml/day.	42 Ml/day.	Midmar Dam / Mearns Weir.

Table 2.13 Summary of regional interventions that are direct water users (KZN CoGTA 2016: 256).

SIP 2 KZN Region	Agriculture Sector Development	AgriParks / Agri-Villages / Commercial Agrizones (Intensive Farming)	Manufacturing Sector Development	Tourism Sector Development (No. of Hotels up to 2045) (Short-Stay Accommodation)	Warehouse and Distribution Sector	Retail Sector Development	Office and Services Sector Development – sq. m (additional up to 2045)	Integrated Sustainable Human Settlements
Region 1 Industrial and Logistics Hub 	Unleashing 10 000 ha of new agricultural land.	<i>Mkhambathini</i> - AgriPark (Eston) / Agri-village / Commercial AgriZones potential. <i>Msunduzi</i> – Agri-Village / Commercial AgriZones potential. <i>eThekwini</i> – Commercial AgriZones (Intensive farming).	908 ha required by 2045.	10.	1 328 ha required by 2045.	118 738 m ² .	107 871 m ² .	179 751 units.
Region 2 Durban Port City 	Unleashing 600 ha of new agricultural land.	Commercial AgriZones (Intensive farming).	132 ha required by 2045.	12	193 ha required by 2045.	20 996 m ² .	73 282 m ² .	240 140 units.
Region 3 Aerotropolis 	Unleashing 16 000 ha of new agricultural land.	AgriPark (DTP/Stanger) / Agri-Village / Commercial AgriZones potential.	1 323 ha required by 2045.	13	1 935 ha required by 2045.	87 260 m ² .	64 006 m ² .	180 108 units.
Region 4 Autotropolis 	Unleashing 2 000 ha of new agricultural land.	Agri-Village / Commercial AgriZones potential.	648 ha required by 2045.	6	948 ha required by 2045.	214 m ² .	3 746 m ² .	18 119 units.
Region 5 Agrotropolis 	Unleashing 25 000 ha of new agricultural land.	<i>uMtshezi</i> - Agri-village / Commercial AgriZones potential. <i>Okhahlamba</i> - AgriPark (Bergville) / Agri-Village / Commercial AgriZones potential. <i>Emnambithi/Ladysmith</i> - Agri-village / Commercial AgriZones potential.	250 ha required by 20245.	7	366 ha required by 2045.	58 297 m ² .	39 859 m ² .	56 807 units.
Region 6 Agri-Tourism and Lifestyle City 	Unleashing 7 000 ha of new agricultural land.	<i>uMngeni</i> – AgriPark (Dargle / Cedara) / Agri-Village / Commercial AgriZones potential. <i>Mpofana</i> – Agri-Village / Commercial AgriZones potential.	161 ha required by 2045.	2	236 ha required by 2045.	25 926 m ² .	21 699 m ² .	36 553 units.

In October 2018, DWS released [Version 10.1 of the National Water and Sanitation Master Plan \(NW&SMP\)](#). Consisting of three volumes, the National Water and Sanitation Master Plan:

- “Sets out a schedule of prioritised actions for the period to 2030 that will create a water and sanitation sector that can meet national objectives as set out in the National Development Plan and the Sustainable Development Goals” (**Table 2.10**).
- “Sets out the roles and responsibilities in government, the private sector and civil society for the implementation of the plan”.

(DWS 2018: 1-16).

DWS explains the three volumes as follows:

“Volume One of the NW&SMP is the Call to Action, which is divided into two sections, Water and Sanitation Management, and Enabling Environment, each having six sub-sections. Each section includes critical actions that, when implemented, will have a significant impact on addressing the crisis...

Volume Two: Plan to Action provides a more detailed analysis of and rationale for the key issues identified in the Call to Action.

Volume Three: Schedule of Actions provides a detailed costed implementation plan covering all the actions required across the sector to achieve the objectives of the plan.”

(DWS 2018: 1-16 – 1-17)

The philosophy of the NW&SMP is illustrated in **Figure 2.48** and the alignment with other planning instruments’ timelines in **Figure 2.49**.

The NW&SMP shows that there is a 63% reliability of water and sanitation services in KZN (**Figure 2.50**). **Section 4** and **Section 19** discuss Umgeni Water’s water demand management planning and wastewater planning respectively as initiatives contributing towards improving the reliability of water and sanitation services in KZN.

The NW&SMP further notes that the predominant water quality problems in KZN are agricultural chemicals, urban/industrial effluent and metals (from mining and waste disposal). **Sections 7, 8, 11, 12 and 13** summarise briefly the water quality monitoring at the dams Umgeni Water operates in the different systems.

Critically, the NW&SMP identifies the “key strategic water source areas i.e. the 10% of South Africa’s land that delivers 50% of South Africa’s water which must be protected and maintained if water security is to be achieved” (DWS 2018a: 35). It is shown in **Figure 2.52** that some of these key strategic water source areas are located in Umgeni Water’s area of operation and these are discussed further in **Sections 7, 8, 11, 12 and 13**. The NW&SMP summarises the inter-basin transfers in South Africa (**Figure 2.53**) and shows these water transfers out of the key strategic water source areas (**Figure 2.54**). It is shown in **Figure 2.54** that the uThukela key strategic water source area, located within Umgeni Water’s operational area, supplies the Johannesburg economic hub. **Figure 2.53** shows that a portion of this water also supplies the Richard’s Bay area i.e. Umgeni Water now contributes to the water supply management to the largest economic hub in the country and to the second largest economic hub in KZN.

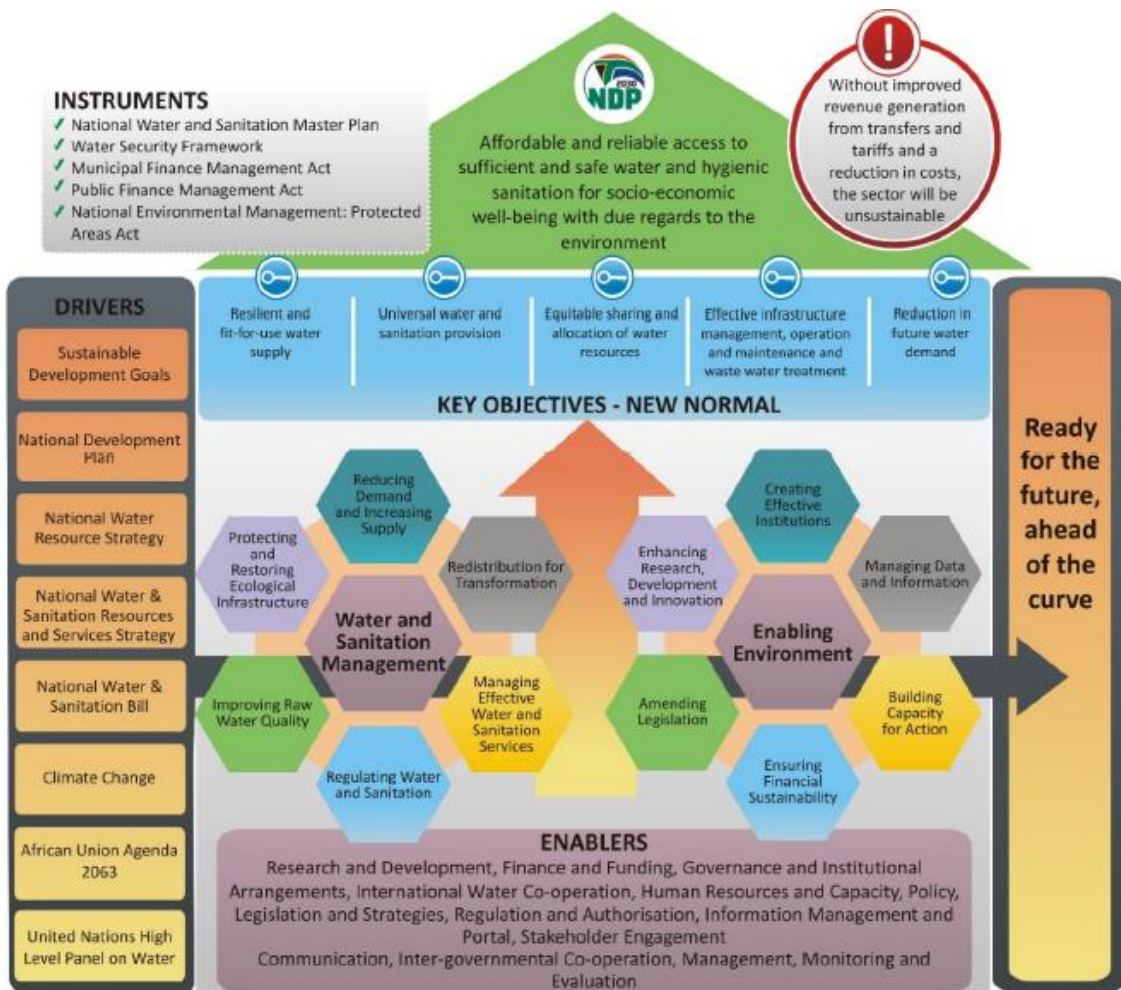


Figure 2.48 National Water and Sanitation Master Plan philosophy (DWS 2018: 7).

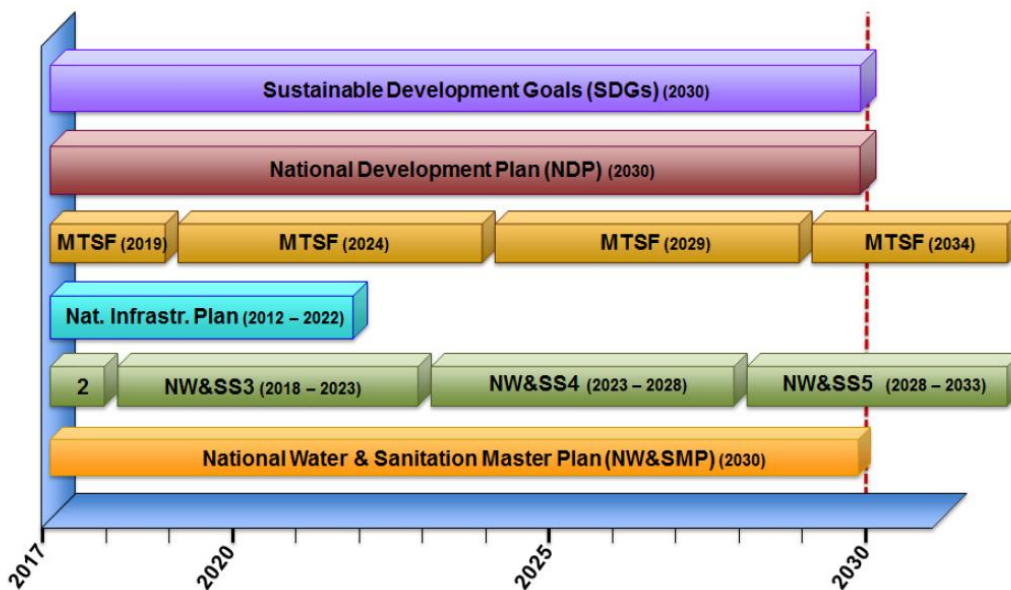


Figure 2.49 National Water and Sanitation Master Plan timelines relative to other planning instruments (DWS 2018: 2-2).

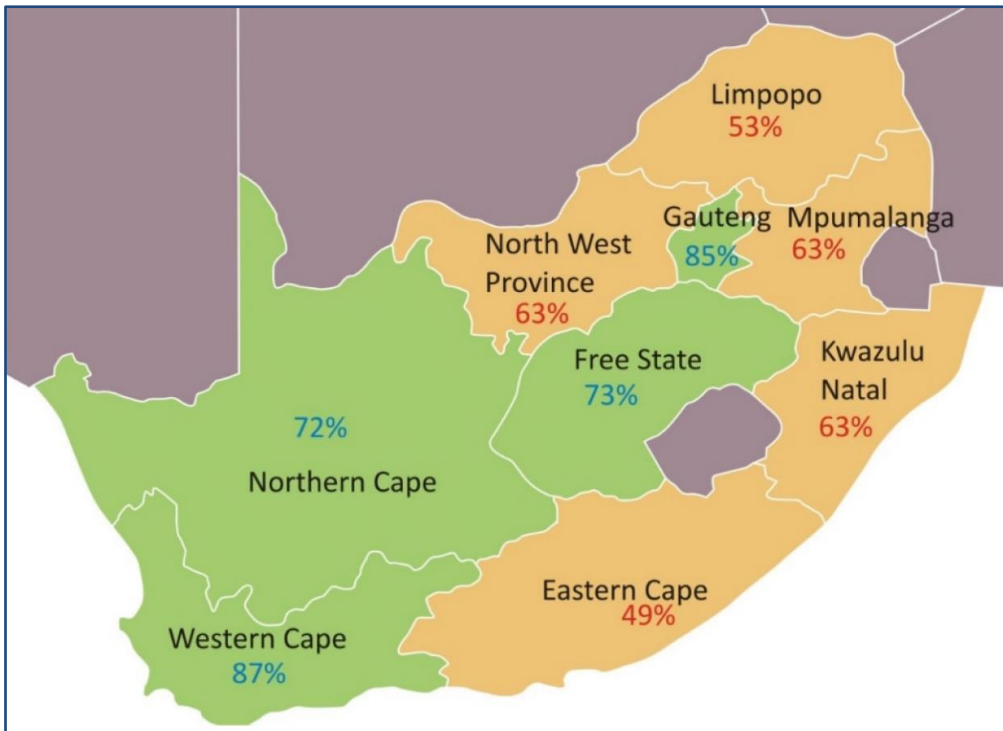


Figure 2.50 Reliability of water and sanitation services per province (DWS 2018a: 21).

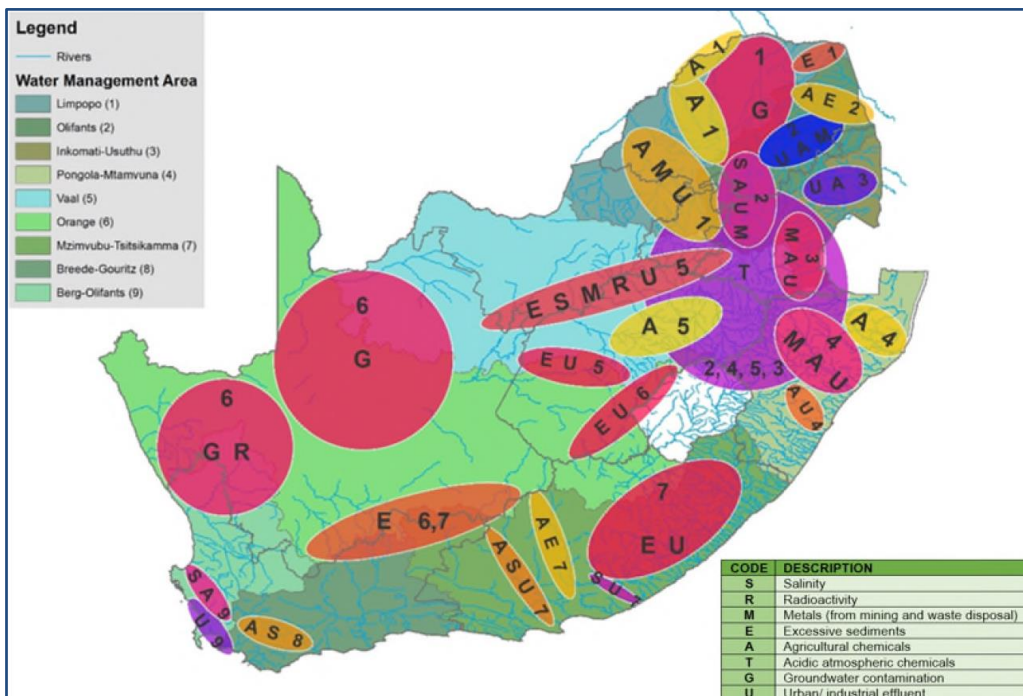


Figure 2.51 Different types of water quality problems across South Africa (Ashton 2012 in DWS 2018a: 30).

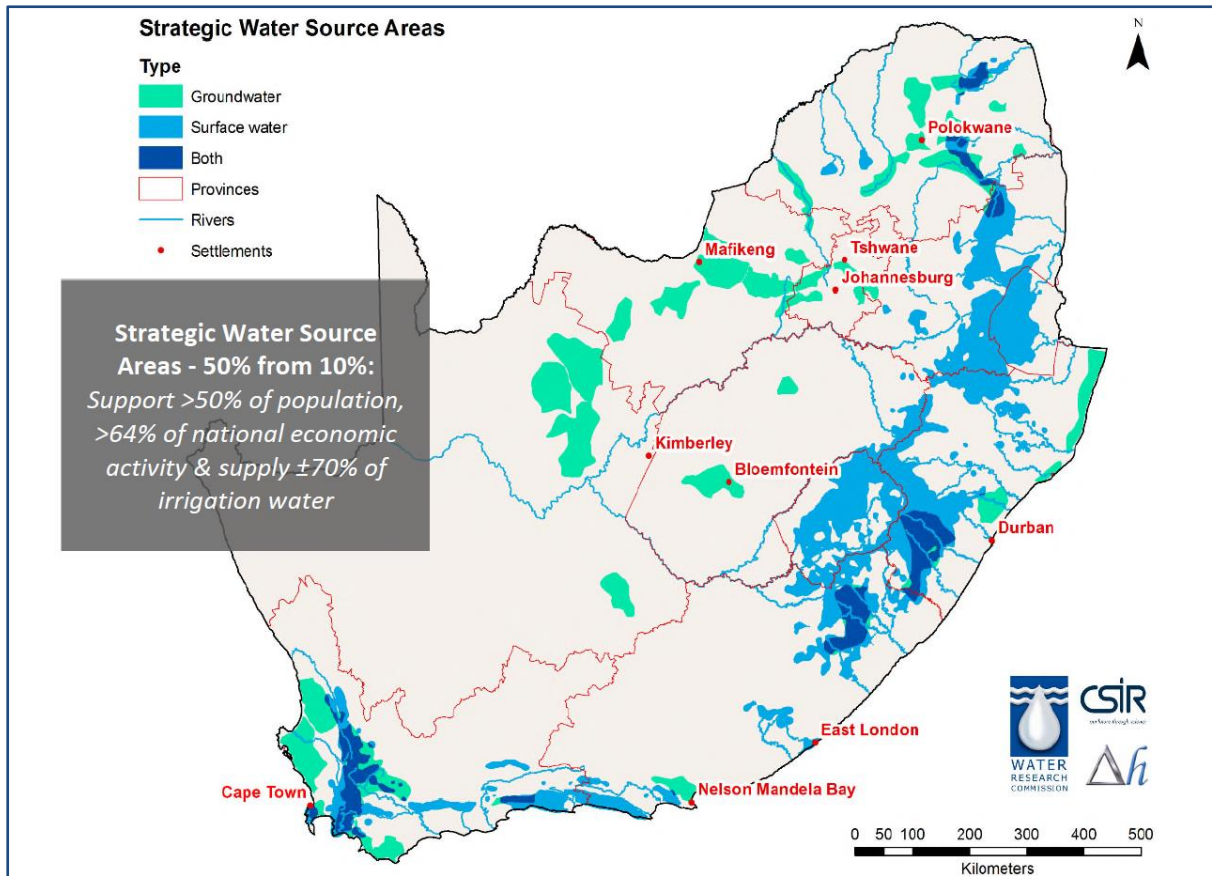


Figure 2.52 “Strategic water source areas: the 10% of South Africa’s land that delivers 50% of our water” (DWS 2018a: 36).

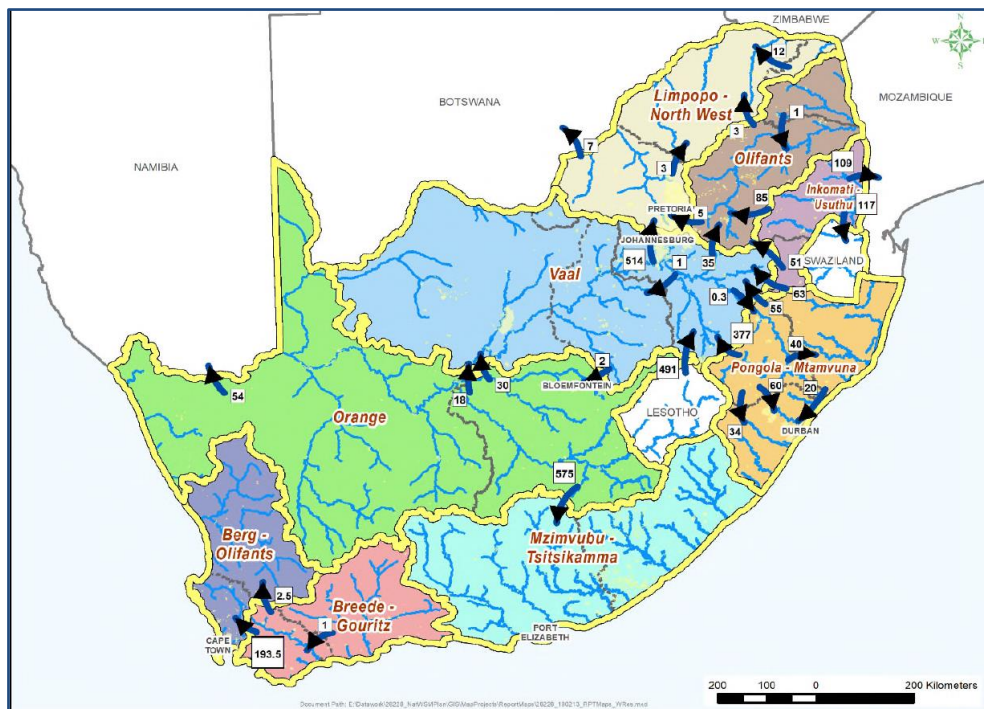


Figure 2.53 Inter-basin water transfers in South Africa (DWS 2018b: 3-12).

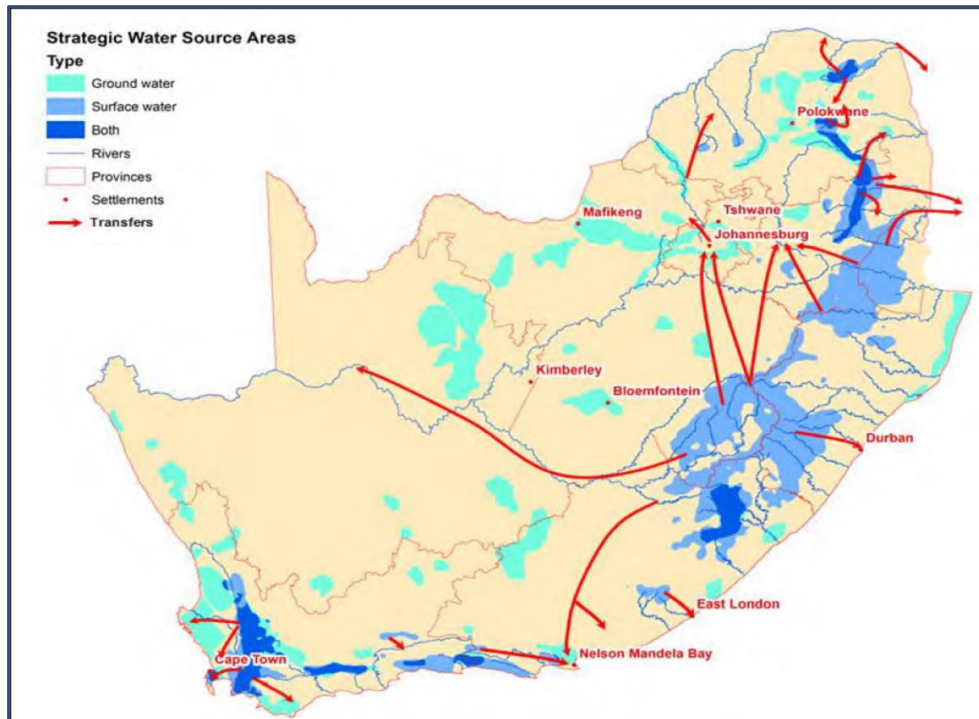


Figure 2.54 Water transfers out of the key water source areas (DWS 2018b: 8-9).

In July 2020, the National Planning Commission (NPC) released the National Water Security Framework (NWSF) for South Africa. The NPC explains the NWSF as follows:

“The National Water Security Framework (NWSF) responds to the question of the extent of the threat to water security in South Africa and the actions required in the short, medium and long term to mitigate or offset the threat. It frames a national pathway to a water secure country up to 2050 to enable inclusive economic growth, poverty eradication and reducing inequality, in line with the National Development Plan (NDP) imperatives.”

(NPC 2020: iii)

The five key recommendations from the NWSF are:

- a) “Adopt the NWSF as a national guide.
- b) Adopt a relational definition of water security for South Africa, in addition to the UN Water definition.
- c) Adopt the following eight principles:
 - i) Source to sea across the water value chain/water cycle.
 - ii) Long-term view based on scenario planning and associated risks.
 - iii) Policy and legislation as starting point.
 - iv) NEXUS approach to planning, implementation and management.
 - v) Decision support from credible information and research results.
 - vi) Mass balance approach to assessment and implementation.
 - vii) Accountability and clear roles and responsibility.
 - viii) Total value chain ownership concept in context of the trusteeship doctrine.

- d) Adopt the following ten focus areas as guide to NWSF implementation to be responded to by all institutions and organisations implementing the NDP:
- i) Focus Area 1 – Narrowing the inequality gap.
 - ii) Focus Area 2 – Water infrastructure and finance.
 - iii) Focus Area 3 – Diversifying water sources.
 - iv) Focus Area 4 – Water research, monitoring and information.
 - v) Focus Area 5 – Nexus aspects of water security.
 - vi) Focus Area 6 – Ecological infrastructure.
 - vii) Focus Area 7 – Water and spatial planning.
 - viii) Focus Area 8 – Enabling planning for water security.
 - ix) Focus Area 9 – Managing water risks.
 - x) Focus Area 10 – Communication and Stakeholder empowerment.
- e) Establish a NWSF implementation oversight, monitoring and evaluation.”

(NPC 2020: xxi – xxv)

The NW&SMP and the NWSF were used as inputs into the National Spatial Development Framework (NSDF) which was adopted in February 2023 (Government Notice 47999). This is shown in **Figure 2.55** in which the NW&SMP and the NWSF were used specifically in the “NSDF Sub-Frame 3: Natural Resource Economy Regions” and “NSDF Sub-Frame 5: National Ecological Infrastructure and Natural Resource System”. The NSDF 2022 is illustrated in **Figure 2.56**. The National Spatial Action Plans emanating from the NSDF 2022 are summarised in **Figure 2.57**.

VISION, SPATIAL LOGIC AND SPATIAL LEVERS

NATIONAL SPATIAL OUTCOMES

WE WANT TO ACHIEVE

National Spatial Outcome 1:



A network of consolidated, transformed and well-connected national urban nodes, regional development anchors, and development corridors that enable South Africa to derive maximum transformative benefit from urbanisation, urban living, and inclusive economic development.

National Spatial Outcome 2:



National-scale corridors and regions of opportunity enable sustainable and transformative urbanisation, urban consolidation, mutually beneficial urban and rural linkages, and ecological management.

National Spatial Outcome 3:



National connectivity and movement infrastructure systems are strategically located, extended and maintained, to support a diverse, adaptive and inclusive economy, and a set of key national and regional gateway cities and towns.

National Spatial Outcome 4:



Productive rural regions, supported by sustainable resource economies and strong and resilient regional development anchors that provide access to people living in rural areas to the national and global economy.

National Spatial Outcome 5:



The national ecological infrastructure and natural resource foundation are well-protected and managed, to enable sustainable and just access to water and other natural resources, both for current and future generations.

NSDF MAIN FRAME:
THE IDEAL POST-APARTHEID NATIONAL
SPATIAL DEVELOPMENT PATTERN

THE SHAPE OF A FUTURE SOUTH AFRICA



NSDF
SUB-FRAMES

TOWARDS A TRANSFORMED FUTURE SOUTH AFRICA - LONG TERM GUIDANCE

NSDF Sub-Frame 1: Inter-Regional Connectivity



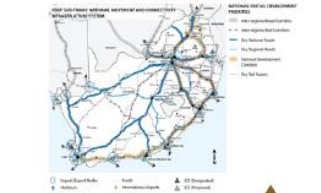
NSDF Sub-Frame 2: National System of Nodes & Corridors



NSDF Sub-Frame 3: National Resource Economy Regions



NSDF Sub-Frame 4: National Movement & Connectivity Infrastructure System



NSDF Sub-Frame 5: National Ecological Infrastructure and National Resource System



Figure 2.55 The National Spatial Development Framework (NSDF) Vision, Spatial Logic and “Spatial Levers” (DALRRD 2023: 115).



Figure 2.56 The National Spatial Development Framework (NSDF) 2022 (DALRRD 2023: 116).

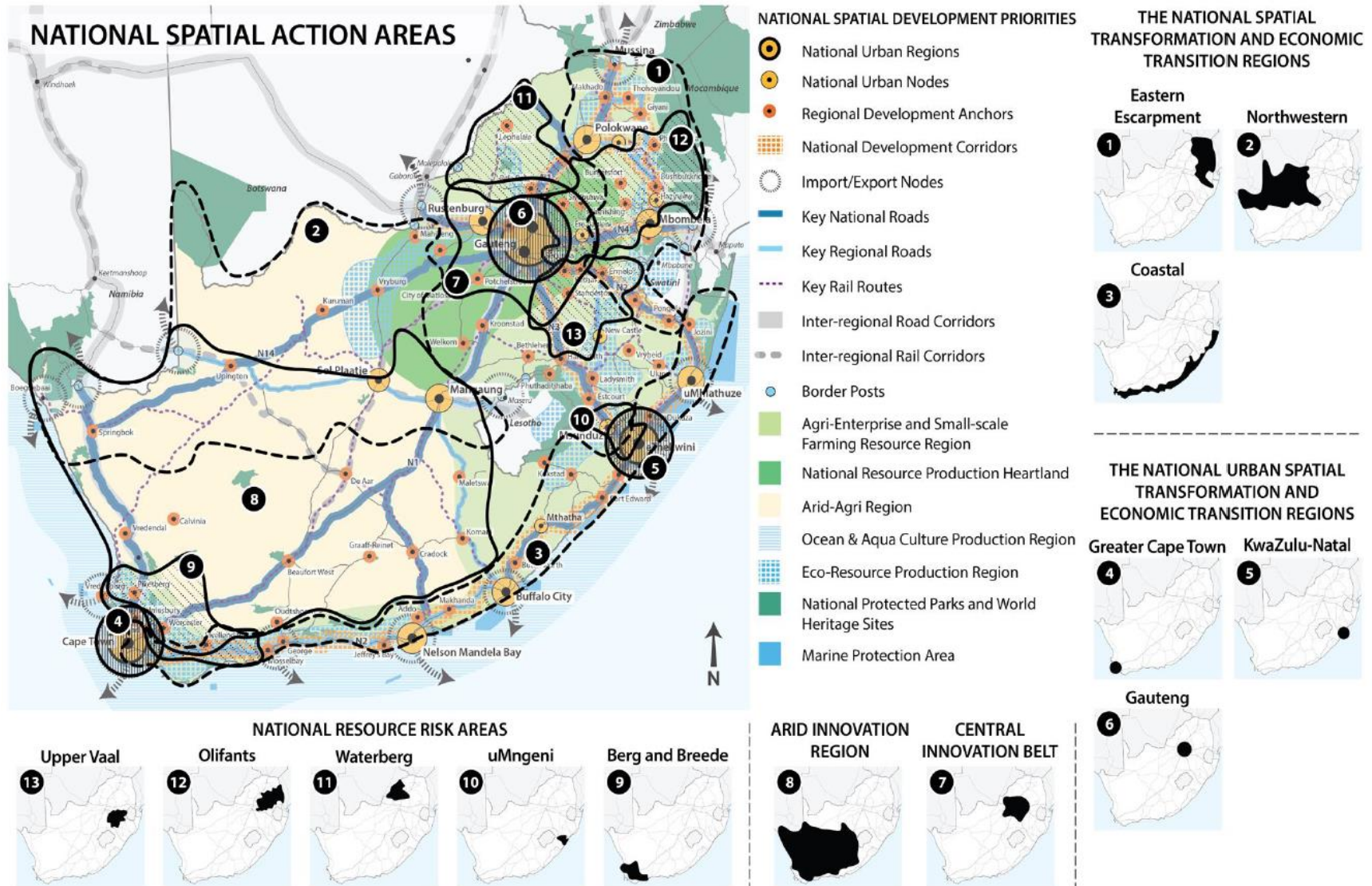


Figure 2.57 National spatial actions (DALRRD 2023: 153).

It is identified from **Figure 2.57** that there are three national action plans within Umgeni Water’s operational area:

- a) Coastal National Spatial Transformation and Economic Transition Region (NSTETR) illustrated in **Figure 2.58**.

COASTAL NATIONAL SPATIAL TRANSFORMATION AND ECONOMIC TRANSITION REGION

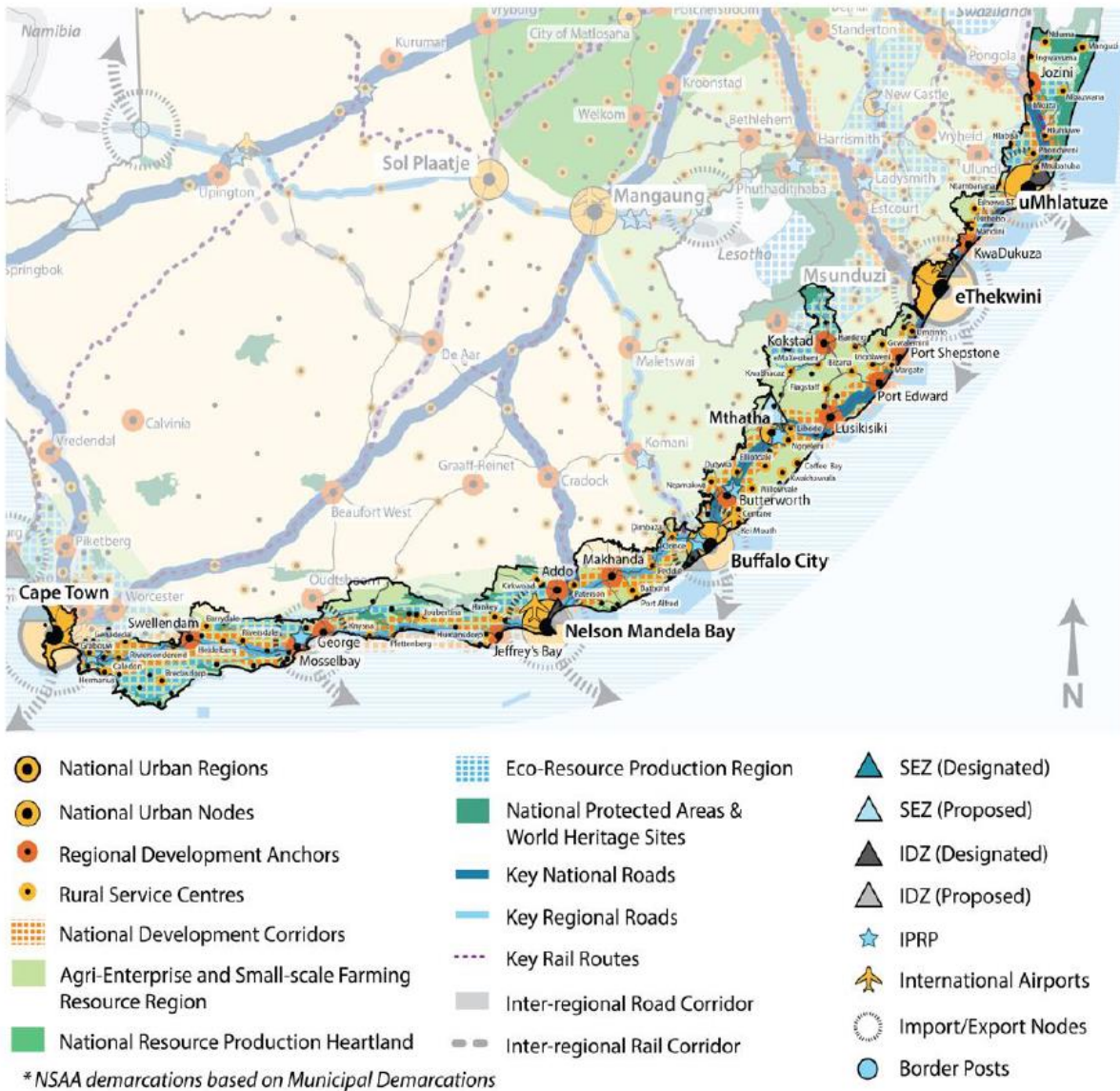


Figure 2.58 Coastal National Spatial Transformation and Economic Transition Region (NSTETR) (DALRRD 2023: 157).

- b) KZN National Urban Spatial Transformation and Economic Transition Region (NUSTETR) shown in **Figure 2.59**.

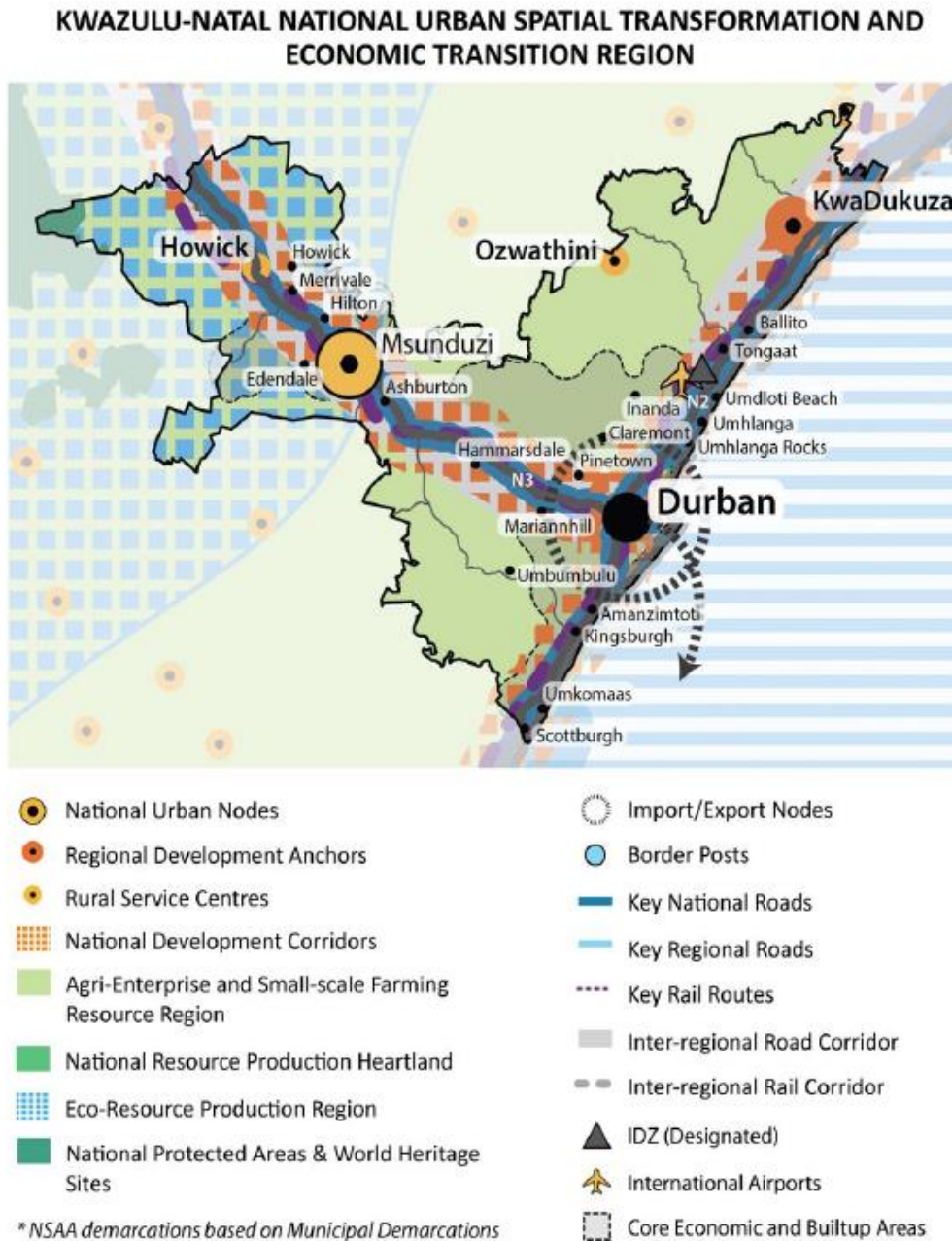


Figure 2.59 KZN National Urban Spatial Transformation and Economic Transition Region (NUSTETR) (DALRRD 2023: 181).

c) uMngeni National Resource Risk Area (NRRRA) summarised in **Figure 2.60**.

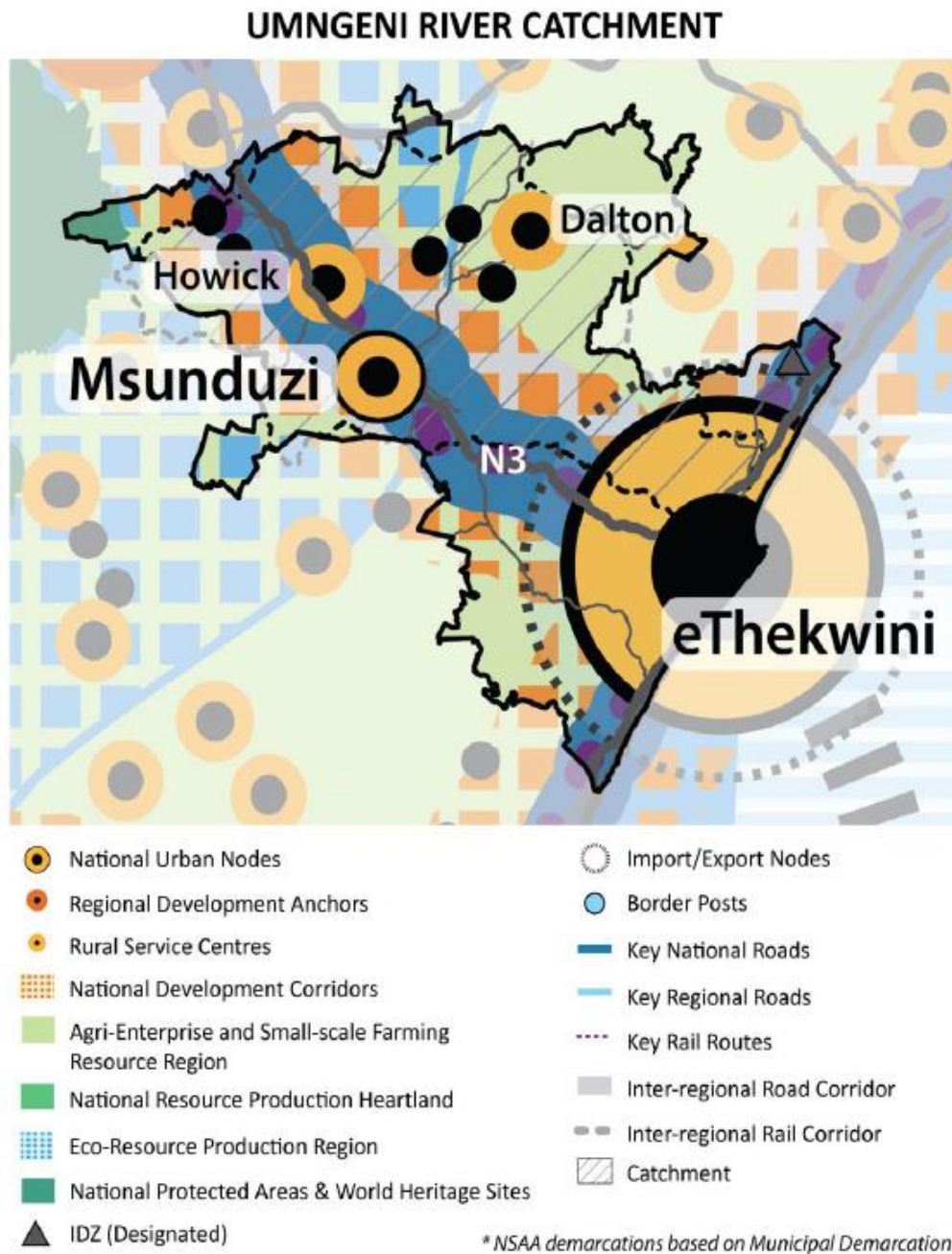


Figure 2.60 uMngeni National Resource Risk Area (NRRRA) (DALRRD 2023: 173).

The above three spatial national action plans are aligned with the spatial interventions identified in the KZN Provincial Growth and Development Strategy (PGDS) and KZN Provincial Growth and Development Plan (PGDP). The KZN PGDS 2021 confirms the 2035 Vision as “KwaZulu-Natal, a prosperous Province with a healthy, secure and skilled population, living in dignity and harmony, acting as gateway to Africa and the world” (KZN Planning Commission 2021: 58).

The seven long term goals shown in **Figure 2.61** are identified in the KZN PGDS to “guide policy making, programme prioritisation and resource allocation” (KZN Planning Commission 2018b: 8).

The KZN PGDS Sustainability Framework is illustrated in **Figure 2.62**.

Umgeni Water contributes directly to *Strategic Objective 4.4 Ensure availability and sustainable management of water and sanitation for all* under *Strategic Goal 4 Infrastructure Development* in the KZN PGDS (Umgeni Water contributes to *Outcome 6: An efficient, competitive and responsive economic infrastructure network* and the *Sub-Outcome 4: Maintenance and supply of our bulk water resources ensured* in the NDP) (KZN Planning Commission 2018a: 15).

The alignment between the AU Agenda 2063 Strategic Goals, the KZN PGDS and the SDG Goals to which Umgeni Water contributes is summarised in **Table 2.14**.

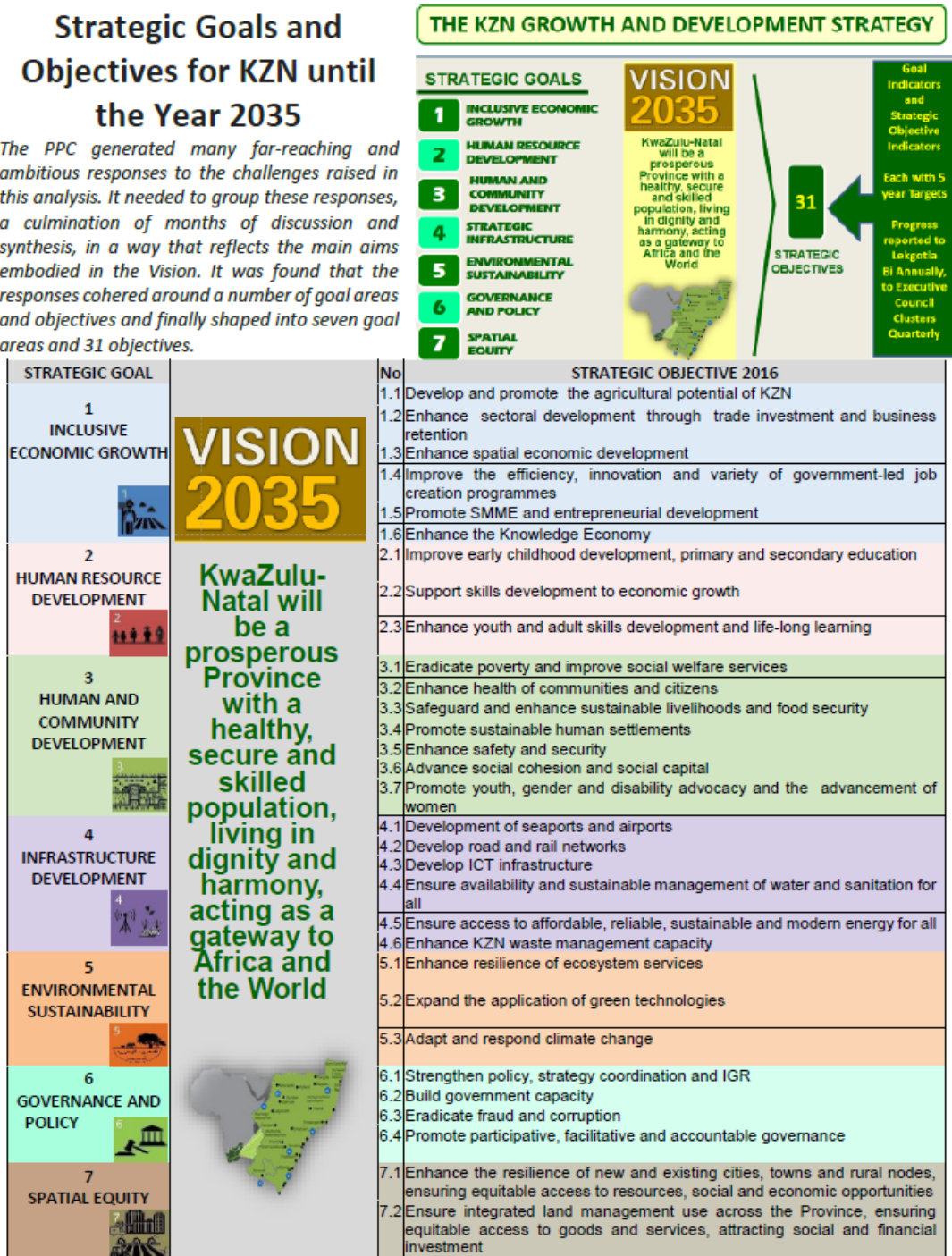


Figure 2.61 The KZN PGDS Vision 2035, Goals and Strategic Objectives (KZN Planning Commission 2018b: 8).

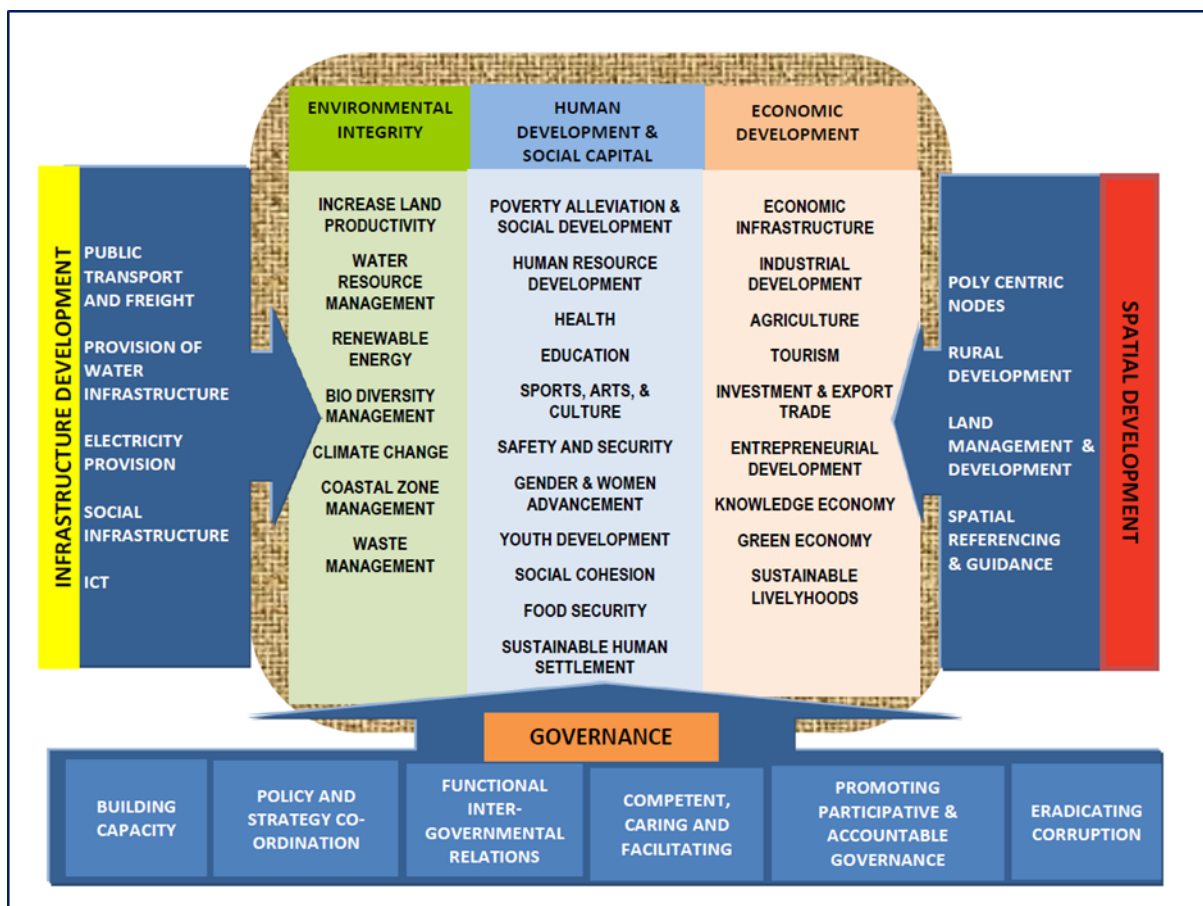


Figure 2.62 KZN PGDS Sustainability Framework (KZN Planning Commission 2018b: 6).

Table 2.14 Alignment between the AU Agenda 2063 Strategic Goals, the KZN PGDS 2016 Goals and the SDG Goals to which Umgeni Water contributes (KZN Planning Commission 2017: 23 – 24).

AU Agenda 2063 Goals	KZN PGDS 2016	SDG Goals
7. Environmentally sustainable and climate resilient economies and communities.	4. Strategic Infrastructure (4.4 Ensure availability and sustainable management of water and sanitation).	6. Ensure availability and sustainable management of water and sanitation for all. 12. Ensure sustainable consumption and production patterns. 13. Take urgent action to combat climate change and its impacts.
10. World class infrastructure criss-crosses Africa.	4. Strategic Infrastructure.	6. Ensure availability and sustainable management of water and sanitation for all. 7. Ensure access to affordable, reliable, sustainable and

		modern energy for all. 9. Build resilient infrastructure, promote inclusive and sustainable industrialisation, and foster innovation.
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The indicators and the interventions for Strategic Objective 4.4 identified in the KZN PGDS are listed in **Table 2.15**.

Table 2.15 Indicators and interventions for Strategic Objective 4.4 (KZN Planning Commission 2018a: 128).

Strategic Objective 4.4 Indicators	Strategic Objective 4.4 Interventions
4.4.1 Surface water storage as a percentage of surface mean annual runoff per district.	4.4(a) Review and implement the Provincial Water Sector Investment Strategy.
4.4.2.1 Quantity of surface water abstracted per annum in each district.	4.4(b) Policy and guidelines on the inclusion of quaternary catchment for groundwater, grey water and desalination.
4.4.2.2 Quantity of groundwater abstracted per annum in KZN as a percentage of groundwater potential in each district.	4.4(c) Develop and implement water sector capacity building programme with all water institutions.
4.4.3 Percentage of households with access to a basic level of sanitation (Ventilated Improved Pit Latrine) and higher.	4.4(d) Develop new water and sanitation tariff policy.
4.4.4 Percentage of households with access to potable drinking water, within 200m of the dwelling.	4.4(e) Expedite the approval of water use licences.
4.4.5.1 Non-revenue water – real physical water loss as a percentage.	4.4(f) Programme for development of water sources (desalination, rainwater, recycling, groundwater).
4.4.5.2 Non-revenue water – non-physical water loss as a percentage.	4.4(g) Programmes for reduction of non-revenue water.
4.4.6 Percentage of water service systems in balance (supply and demand).	
4.4.7 Percentage of households with infrastructure access to 75 litres of water per person per day and higher.	
4.4.8 Percentage of households with yard water connections and higher level of service.	

The KZN PGDS elaborates on the interventions listed in **Table 2.15** and further identifies targets for the indicators shown in **Table 2.15** (see the Appendices (M&E Framework Tables) in the [KZN PGDS 2021](#)).

The KZN PGDS explains that “spatial variables were considered collectively and a ranking order to key elements applied” to update the KZN Provincial Spatial Development Framework (SDF) (KZN Planning Commission 2018: 23). This process identified “Broad Provincial Spatial Planning Categories” (referred to as “sub-frames”) as shown in **Figure 2.63**.

The reviewed KZN PSDF was adopted in 2022. The KZN PSDF 2021 is shown in **Figure 2.64** and Umgeni Water’s infrastructure and the KZN WTPs in relation to the KZN PSDF 2021 is illustrated in **Figure 2.65**. It is shown that Umgeni Water’s existing infrastructure is predominantly located in those areas identified as “economic support areas” and “economic value adding areas” and that the recommended projects (**Figure 2.63 in UW IMP 2019**) are predominately located in those areas identified as “priority intervention areas”.

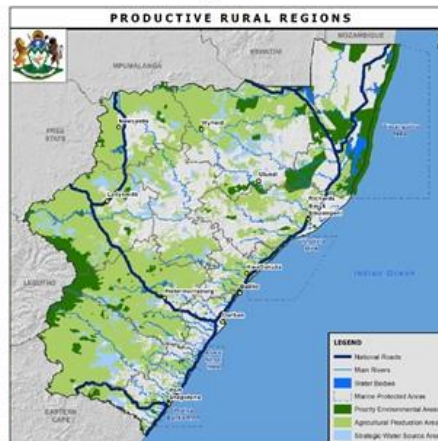
With reference to the KZN WTPs, it is shown in **Figure 2.65** that whilst some of the WTPs are located in the identified nodes and corridors; mandated service delivery areas, agricultural service areas and priority intervention areas, there are some nodes that do not have WTPs in close proximity. This suggests that these planned nodes may not have an assured supply of water.

PROVINCIAL SPATIAL DEVELOPMENT FRAMEWORK: SUB-FRAMES

Natural Resource Protection



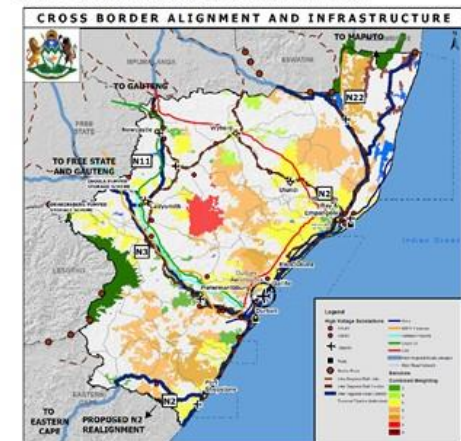
Productive Rural regions



Land and Agrarian Reform



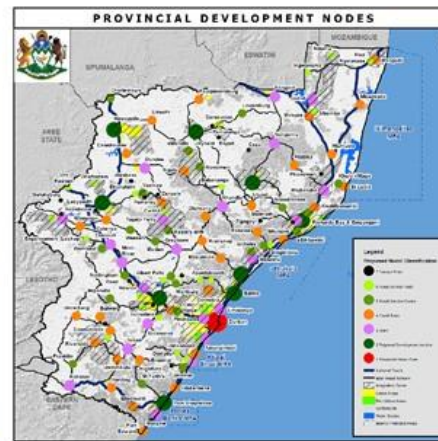
Cross Border Alignment & Infrastructure



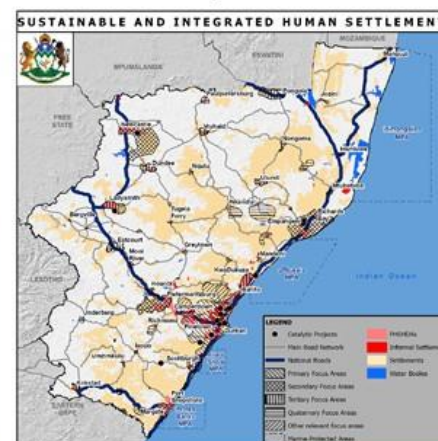
Provincial Development Corridors & Accessibility



Development Nodes and Integration Zones



Sustainable and Integrated Human Settlements



Economic Subframe

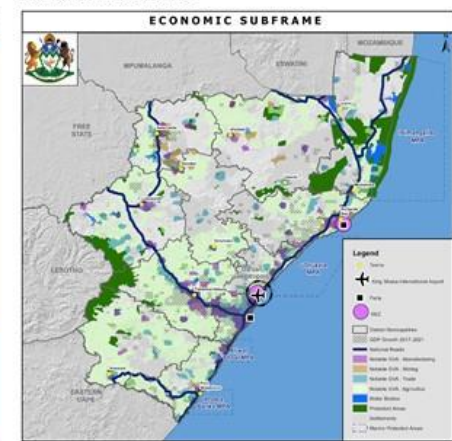


Figure 2.63 Composite map of priority intervention areas in KZN (KZN CoGTA 2022: 29).

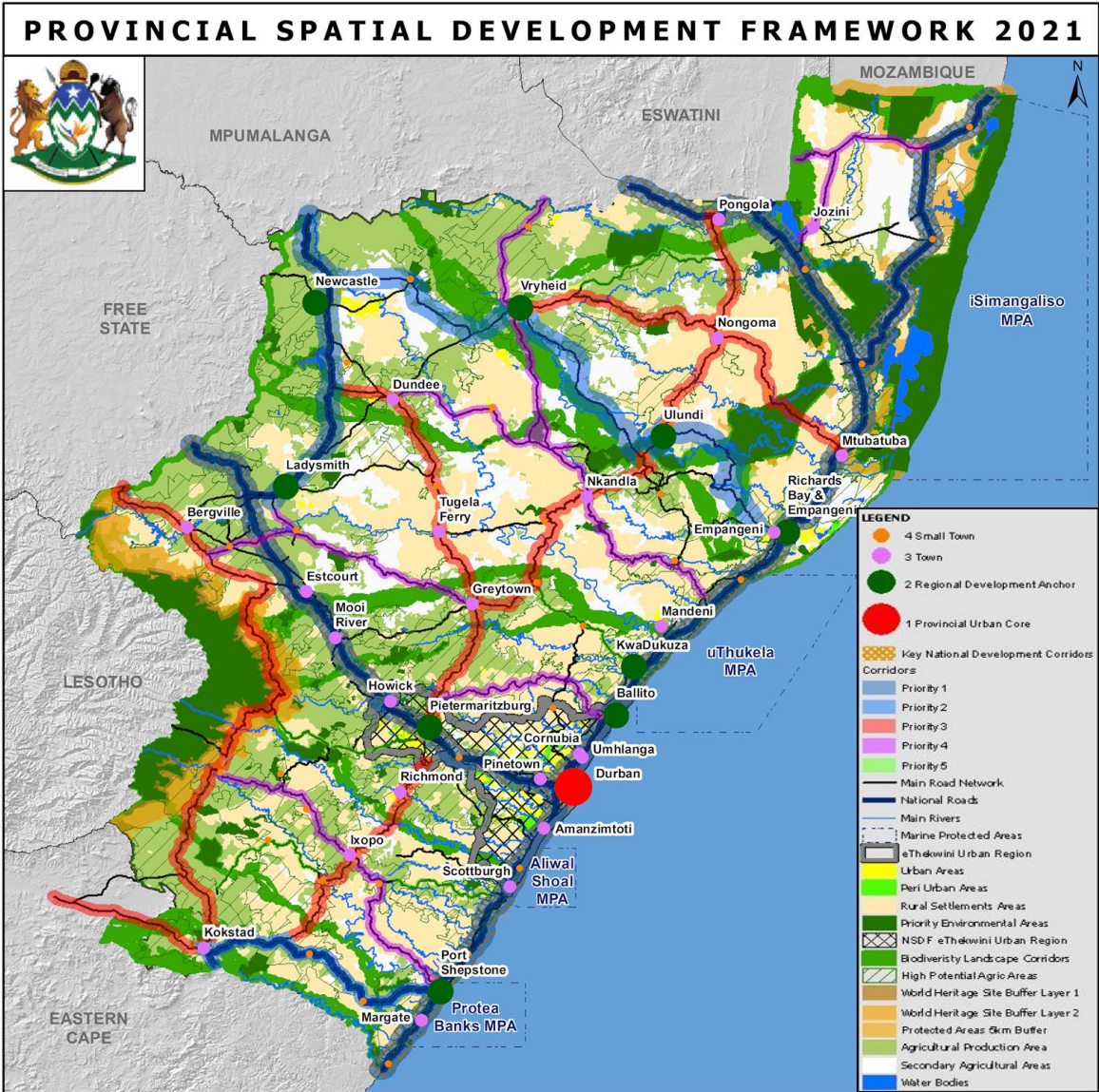


Figure 2.64 KZN PSDF 2021 (KZN CoGTA 2022: 28).

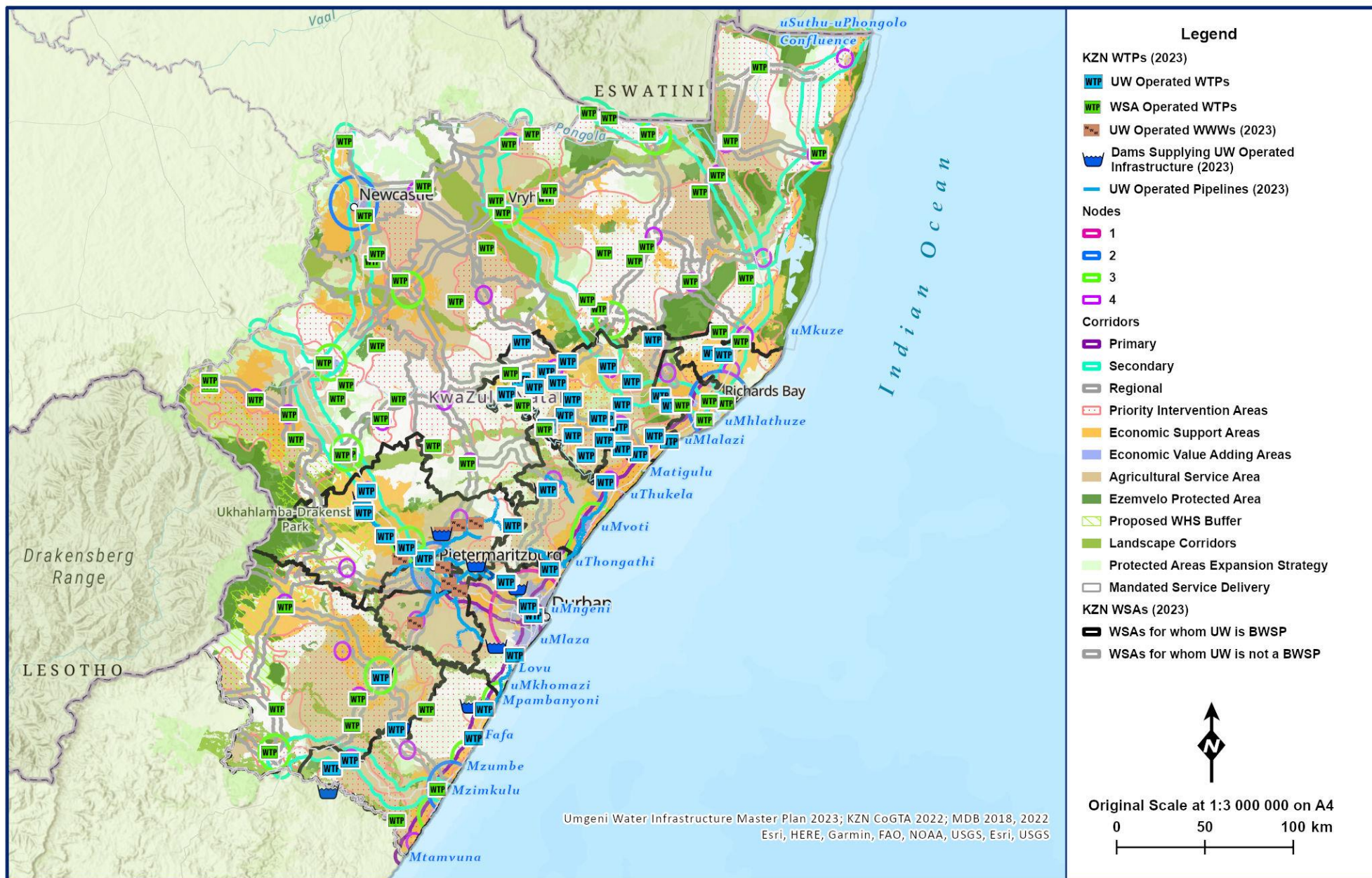


Figure 2.65 KZN WTPs in relation to the KZN PSDF 2021 (KZN DoT 2021; KZN CoGTA 2022; MDB 2018; Umgeni Water 2021; WR2012).

The development of the “KZN Provincial Infrastructure Master Plan” was initiated to facilitate the achievement of the PGDP Strategic Goal 4: Strategic Infrastructure. The KZN Planning Commission explains that the “KZN Infrastructure Master Plan (KZN-IMP) attempts to provide a basis for alignment of the sector master plans of infrastructure implementing agents operating in the Province, focussing on:

- Sea Ports and Airports;
- Road and Rail;
- Water and Sanitation;
- Electricity;
- ICT;
- Health and Education Facilities;
- Human Settlements; and
- Waste Management.”

(KZN Planning Commission 2017: 10)

The KZN Planning Commission continues to state that:

“The KZN-IMP *is not* an attempt to write a unique Provincial Infrastructure Master Plan, but to record and co-ordinate stakeholder sector Infrastructure Master Plans to align with the Provincial objectives. It does not execute or dictate sector master planning.

The KZN-IMP is being developed to:

- Promote provincial alignment to national SIPs, the PGDP, National and Provincial policy as well as support the co-ordination of Strategic Infrastructure Integration.
- Provide an institutionalised decision-making framework and tools in support of the above.”

(KZN Planning Commission 2017: 11)

The KZN Planning Commission explains that the KZN-IMP “attempts to provide a model for integration, alignment and prioritisation support to stakeholders based on variables related to:

- Policy and Planning performance and spatial/land use considerations and alignment to national, provincial and sector policies as well as norms and standards;
- Infrastructure Delivery Management System (IDMS): Service delivery and positioning in the project life-cycle;
- Projects alignment and contribution to PGDP/S Strategic Goals;
- Financial and funding model considerations.”

(KZN Planning Commission 2017: 16)

The institutional framework for the KZN-IMP is illustrated in **Figure 2.66**. Umgeni Water engages with the KZN-IMP through the different Action Work Groups (AWGs) and the Provincial Infrastructure Co-ordination Work Group⁹.

⁹ See **Section 2.5 in IMP 2016** for a discussion on the institutional model.

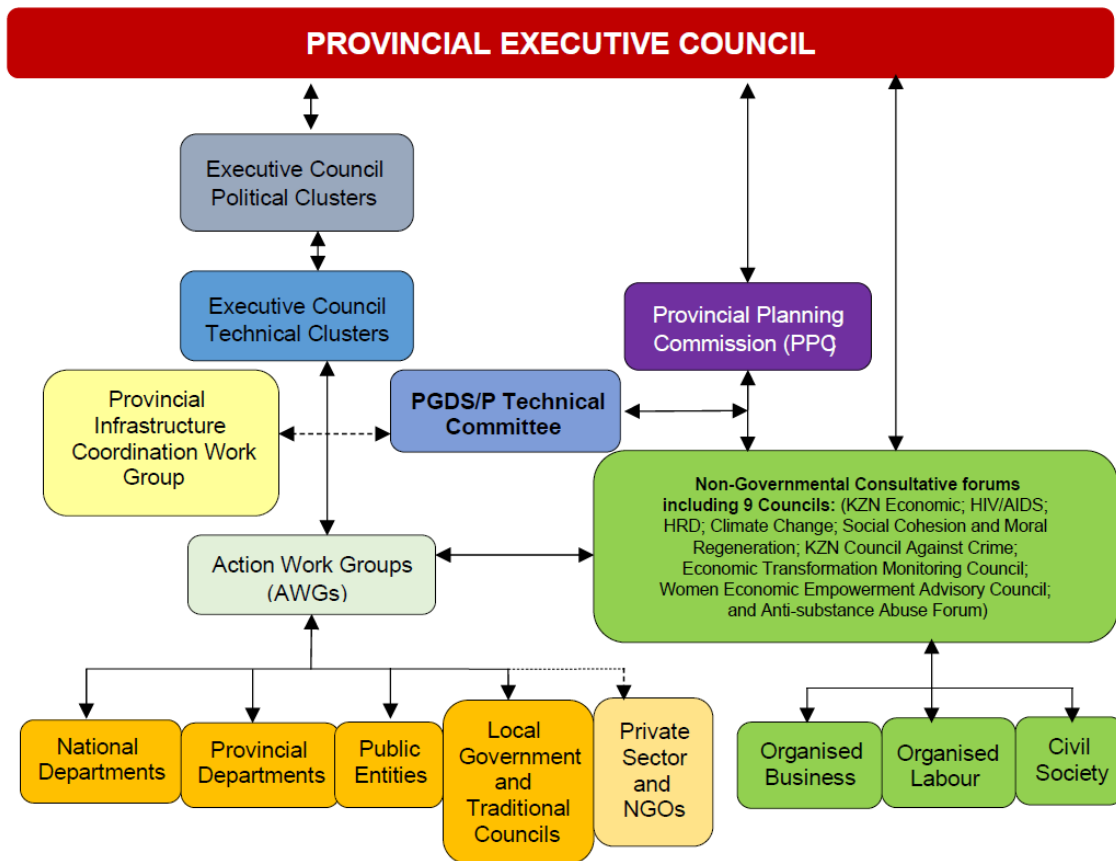


Figure 2.66 The KZN-IMP institutional framework (KZN Planning Commission 2021: 26).

The KZN-IMP is summarised in **Figure 2.67**. The KZN-IMP supports the use of the Infrastructure Delivery Management System (IDMS). In October 2019, National Treasury released a circular requiring all government departments and public entities to start using the IDMS. In October 2020, National Treasury released a circular requiring all municipalities to start using the IDMS at the start of the 2021/2022 financial year. Umgeni Water’s infrastructure planning and implementation process is aligned to the IDMS.

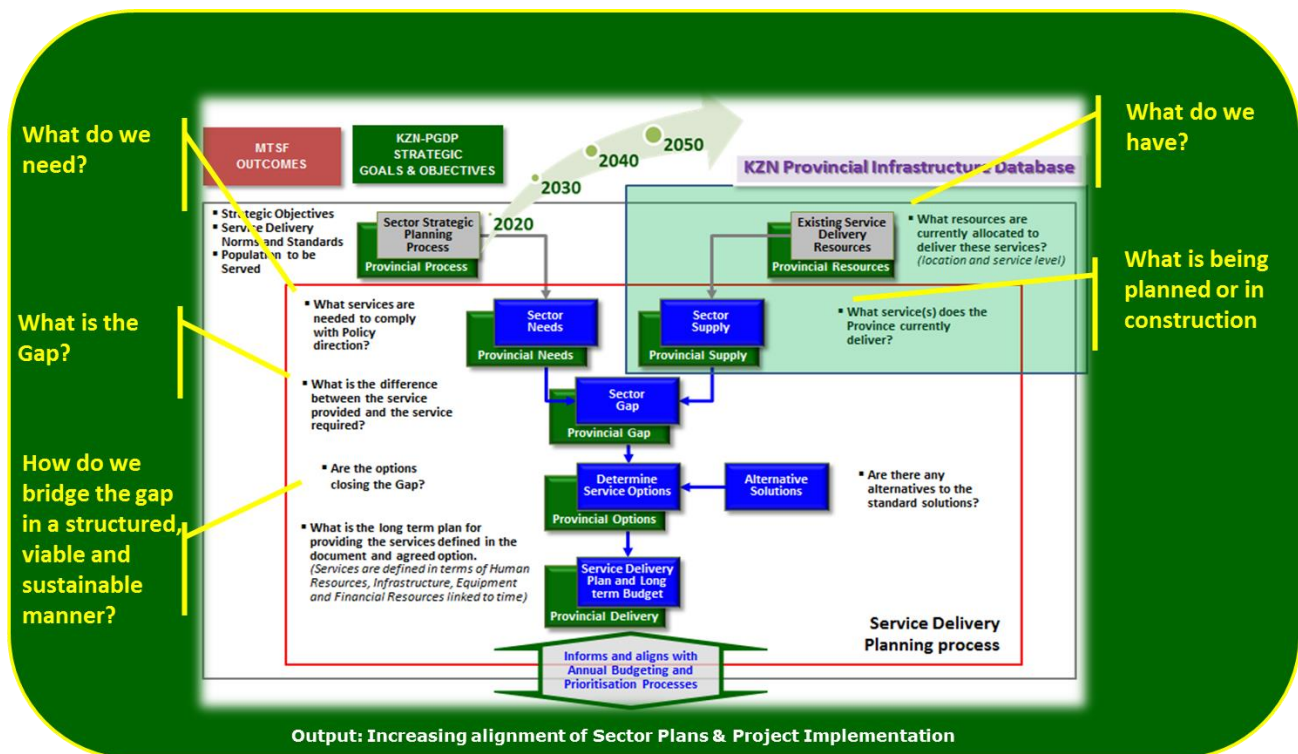


Figure 2.67 Illustration of what the KZN-IMP is (KZN Planning Commission 2017: 28).

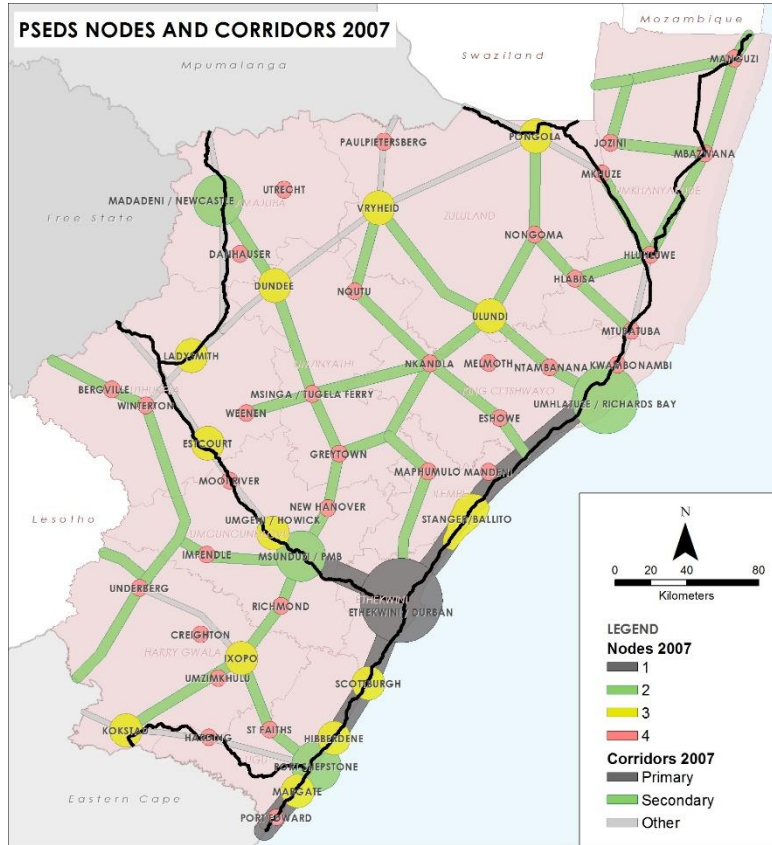
A sector plan informing the KZN-IMP is the [KZN Provincial Water Master Plan](#) (October 2020), which was developed by KZN CoGTA. This Provincial Water Master Plan included the information from the Umgeni Water IMP 2020 and the Universal Access Plan (UAP) Phase 3 project, undertaken by Umgeni Water. The recommendations from the KZN Water Master Plan are discussed briefly in **Sections 7 – 19**.

The 2007 KZN Provincial Spatial Economic Development Strategy (PSEDS) (**IMP 2008**) was reviewed and updated in 2016. The KZN Department of Economic Development, Tourism and Environmental Affairs (EDTEA) undertook research to identify the main economic drivers in the KZN district municipalities and analysed the comparative advantages of each district municipality. The results were then spatially analysed to “objectively determine a framework for the prioritisation of spatial economic development initiatives in the province” (KZN EDTEA 2017: ii). The refinement of the PSEDS is shown in **Figure 2.68**.

Umgeni Water’s infrastructure and the KZN WTPs in relation to the 2016 PSEDS is shown in **Figure 2.69**. It is shown in this figure that Umgeni Water’s existing infrastructure and recommended projects (**Figure 2.68 in UW IMP 2019**) align with the proposed nodes and corridors of the PSEDS 2016.

However, it is also shown in **Figure 2.69** that some of the identified nodes of local influence do not have WTPs located in close proximity and therefore may not have an assured supply of water.

PSEDS Nodes and Corridors 2007



PSEDS Nodes and Corridors 2016

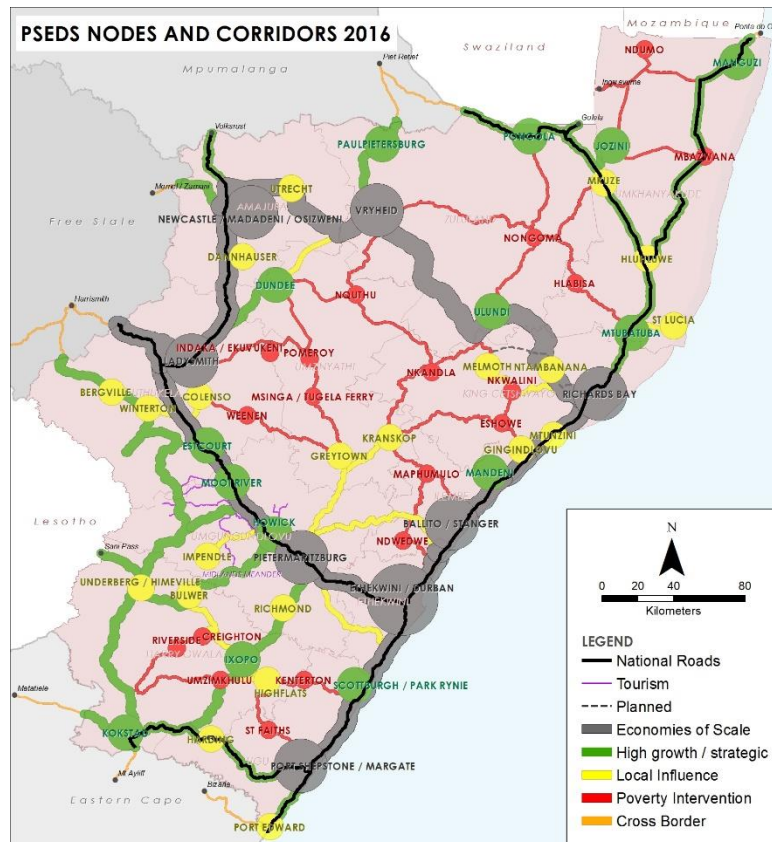


Figure 2.68 The PSEDS 2007 and 2016 (KZN EDTEA 2017: database).

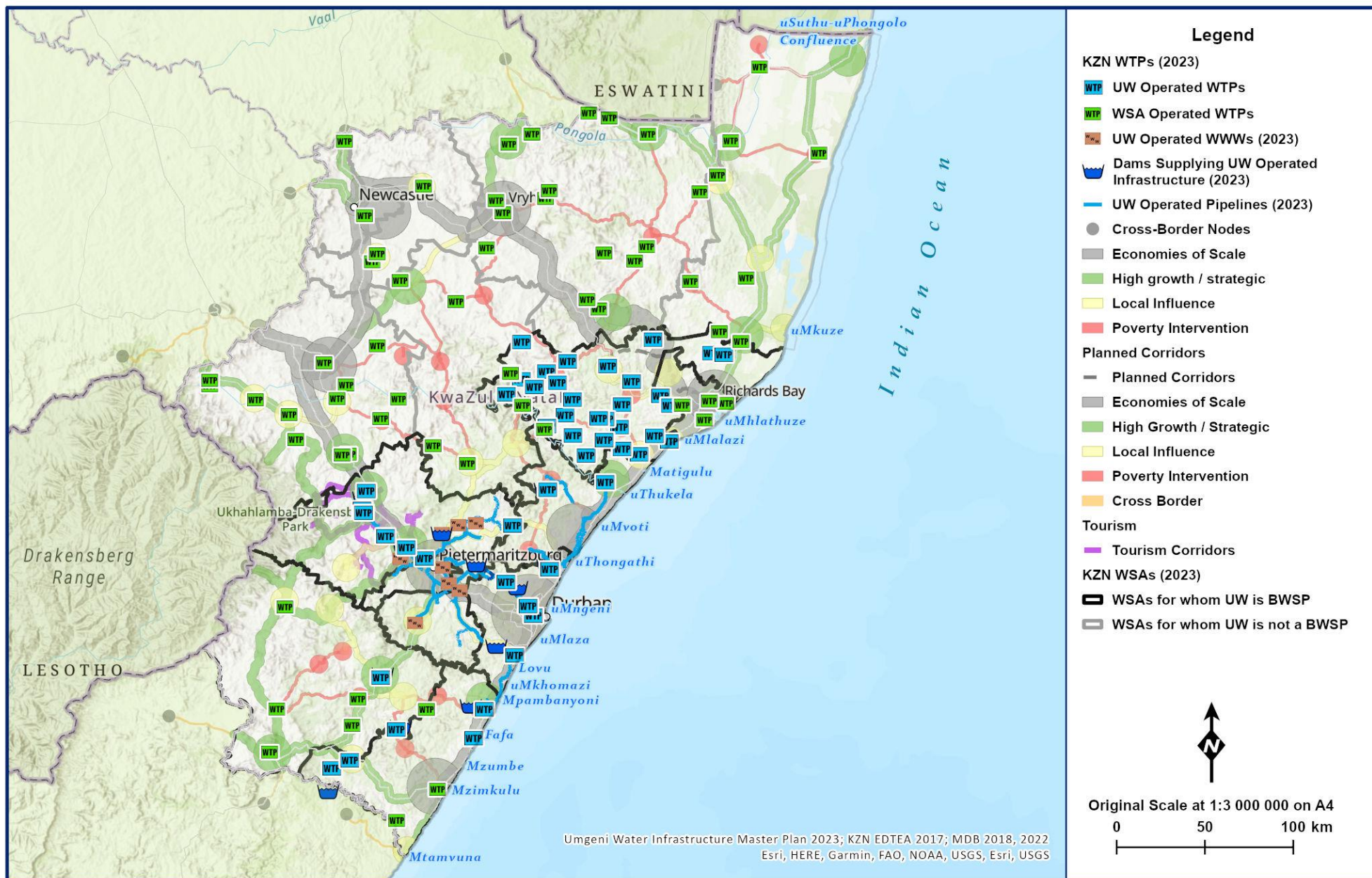


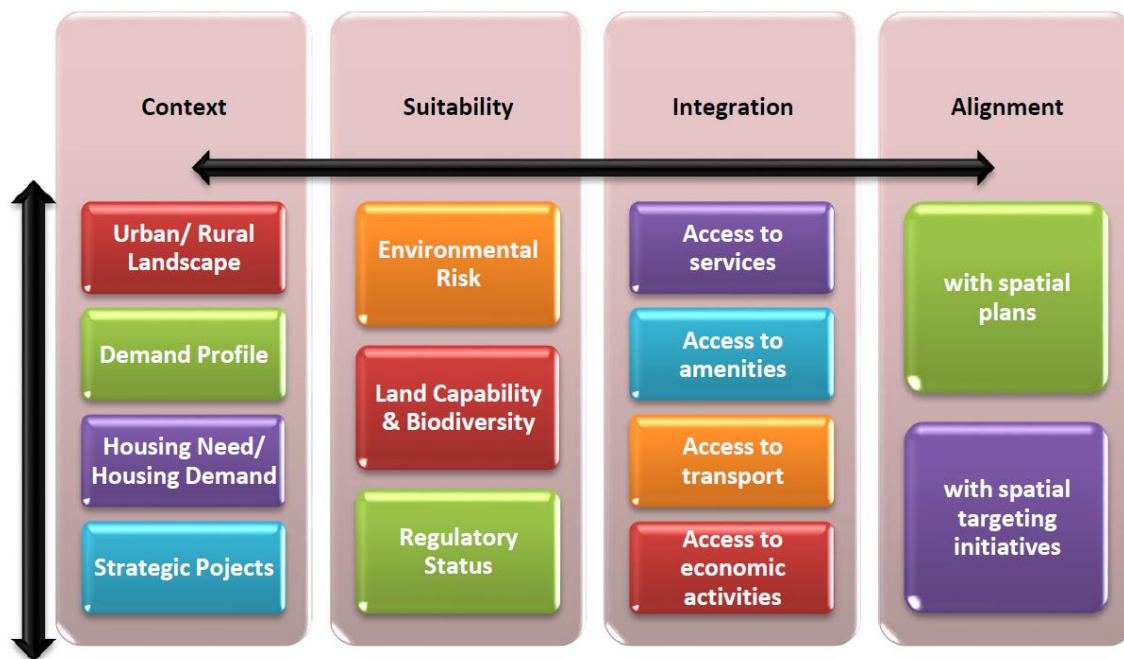
Figure 2.69 KZN WTPs in relation to the KZN PSEDs 2016 (KZN DoT 2021; KZN EDTEA 2017; MDB 2018; Umgeni Water 2023).

The KZN Department of Human Settlements (DHS) and the KZN branch of the Housing Development Agency (HDA) developed the KZN Human Settlements Master Spatial Plan in 2016. The purpose of this plan is to:

- “Create a spatial framework to guide investment by all state departments and state owned companies and private sector actors in relation to the human settlement sector.
- Achieve a create balance between spatial equity, economic competitiveness and environmental sustainability to overcome the legacy of apartheid spatial planning.
- Provide guidance to the implementation of all Medium-Term Strategic Framework (MTSF) targets in alignment with a human settlement spatial plan.
- Provide guidance to the implementation of strategically chosen catalytic interventions to achieve spatial transformation.”

(KZN DHS and HDA 2016: 4)

This plan used the HDA’s Land Identification and Assessment Criteria (**Figure 2.70**) with a scoring system and a sensitivity analysis to identify focus areas for human settlements.



Data Source: Adaptation from original model prepared for the HDA, 2014

Figure 2.70 HDA’s Land Identification and Assessment Criteria (LIAC) (KZN DHS and HDA 2016: 143).

The alignment of these focus areas with Umgeni Water’s infrastructure and the KZN WTPs is shown in **Figure 2.71**.

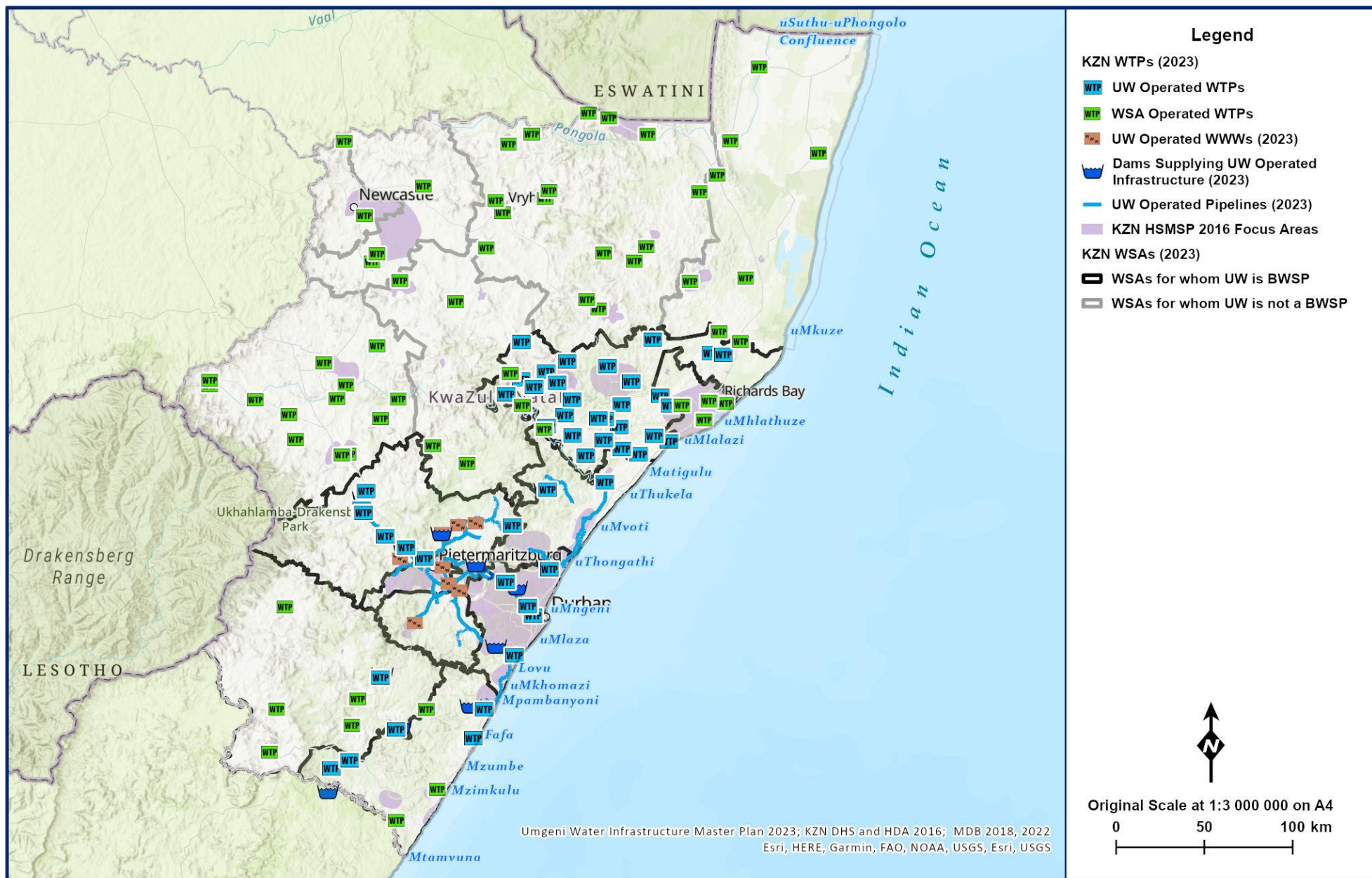


Figure 2.71 KZN WTPs in relation to the KZN Human Settlements Master Spatial Plan 2016 Focus Areas (KZN DHS and HDA 2016; KZN DoT 2021; MDB 2018; Umgeni Water 2023).

In May 2020, the Minister of Human Settlements declared 22 Priority Housing Developments Areas (PHDAs) (Government Notice No. 526, 15 May 2020) in KZN. Section 1 of the Housing Development Agency Act, 2008 defines “Priority Housing Development Areas” as “land identified by the Agency for housing purposes where buildings or structures will be built for the purpose of housing delivery”. The HDA elaborates further by identifying the following criteria:

- “High housing demand.
- Large enough to accommodate social and economic amenities.
- Supports sustainable environmental management and integrated land uses.
- Integrated transportation, integrated bulk services, sustainable economic activities.
- Not situated in environmental sensitive areas.”

(KZN HDA 2019: Slide 4)

The location of the 22 PHDAs are shown in **Figure 2.72** and are listed in **Table 2.16**.

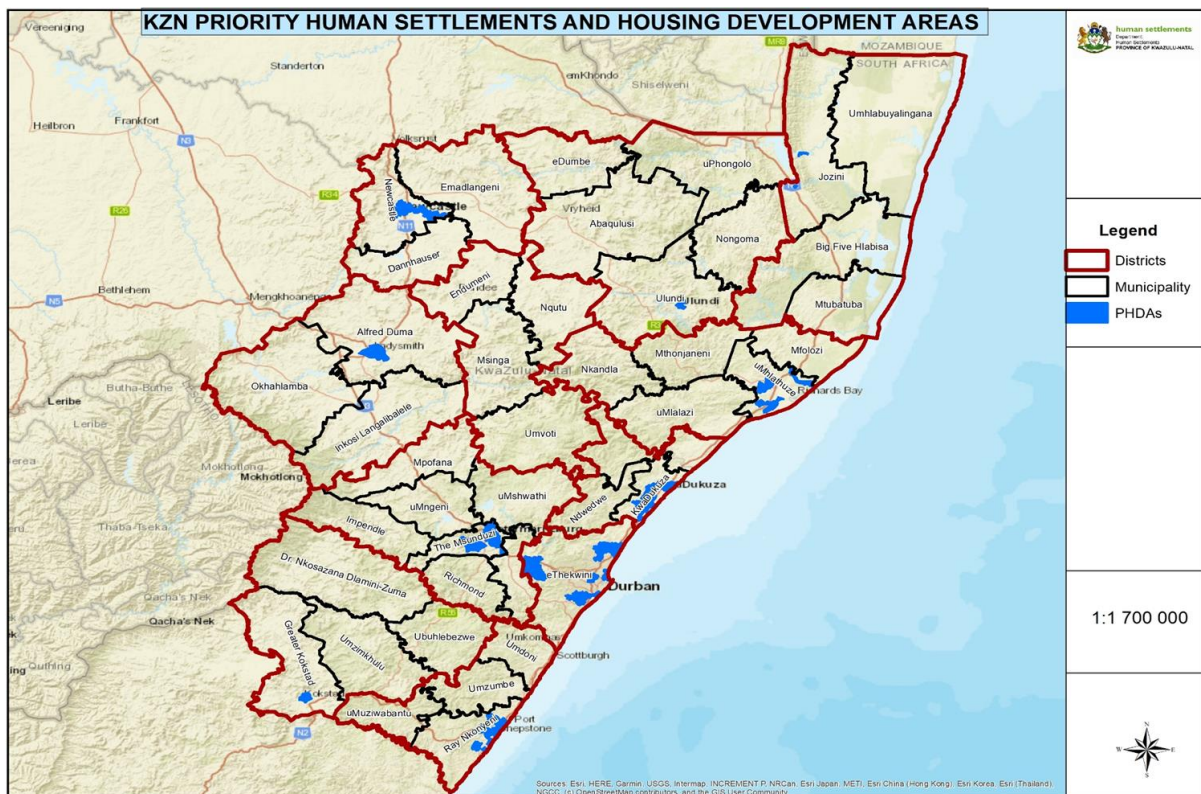


Figure 2.72 KZN Priority Housing Development Areas (HDA 2023: 4).

Table 2.16 KZN Priority Housing Development Areas (PHDAs) per KZN WSA (after KZN HDA 2023: 5).

WSA	Local Municipality	Priority Housing Development Area
eThekwini	-	1. eThekwini Inner City Node 2. uMlazi/Austerville 3. uMhlanga/Cornubia/Mawothi/Kwamashu 4. Greater Mpumalanga 5. Greater Cato Manor-uMkumbaan
iLembe	KwaDukuza	6. Ballito/Shakaskraal Development Area 7. KwaDukuza Town/Hyde Park-Nonoti Area
City of uMhlathuze	-	8. Empangeni 9. Richards Bay 10. Esikhaleni Vulindlela Corridor
Msunduzi	-	11. Edendale 12. Msunduzi North and East Development Areas
uThukela	Alfred Duma	13. Ladysmith Development Area
uMkhanyakude	Jozini	14. Jozini Urban Development Node 15. Mkuze Urban Development Node
Ugu	Ray Nkonyeni	16. Greater Port Shepstone 17. Gamalakhe Nositha PHDA 18. Uvongo-Margate PHDA 19. Shelly Beach PHDA
Zululand	Ulundi	20. uLundi Peri Urban Integration
Newcastle	-	21. Newcastle Priority Development Area
Harry Gwala	Greater Kokstad	22. Kokstad Town

Of the 22 PHDAs identified in KZN, nine are located in areas that are supplied with bulk potable water from Umgeni Water (note that housing projects obtain water from the respective WSAs which in turn are supplied by bulk water service providers such as Umgeni Water). Six of the PHDAs viz. the eThekwini Inner City Node; uMlazi/Austerville; Greater Mpumalanga; Greater Cato Manor-uMkumbaan; the Edendale PHDA and Msunduzi North and East Development Areas are supplied by the Mgeni System (**Section 7**) and the remaining three viz. the uMhlanga/Cornubia/Mawothi/Kwamashu; Ballito/Shakaskraal Development Area and KwaDukuza Town/Hyde Park-Nonoti Area are supplied by the North Coast System (**Section 12**). The Edendale PHDA and Msunduzi North and East Development Areas could be treated by the Darvill WWW (**Section 19**). Umgeni Water does not operate the wastewater infrastructure supplying the remaining PHDAs.

A summary of the municipal Spatial Development Frameworks (SDFs) within Umgeni Water's operational area is presented in **Figure 2.73**. It is shown in this figure that Umgeni Water's existing and proposed infrastructure align with the nodes and corridors identified by the municipalities.

A comparison of **Figure 2.65**, **Figure 2.69**, **Figure 2.71** and **Figure 2.73** shows that there is alignment between the different public sector plans within Umgeni Water's operational area. This alignment is summarised in **Figure 2.74**. Whilst it is clearly shown in **Figure 2.74** that there is existing and

planned bulk water infrastructure in the areas that are densifying, it is unclear whether there is sufficient sanitation infrastructure to support the growth.

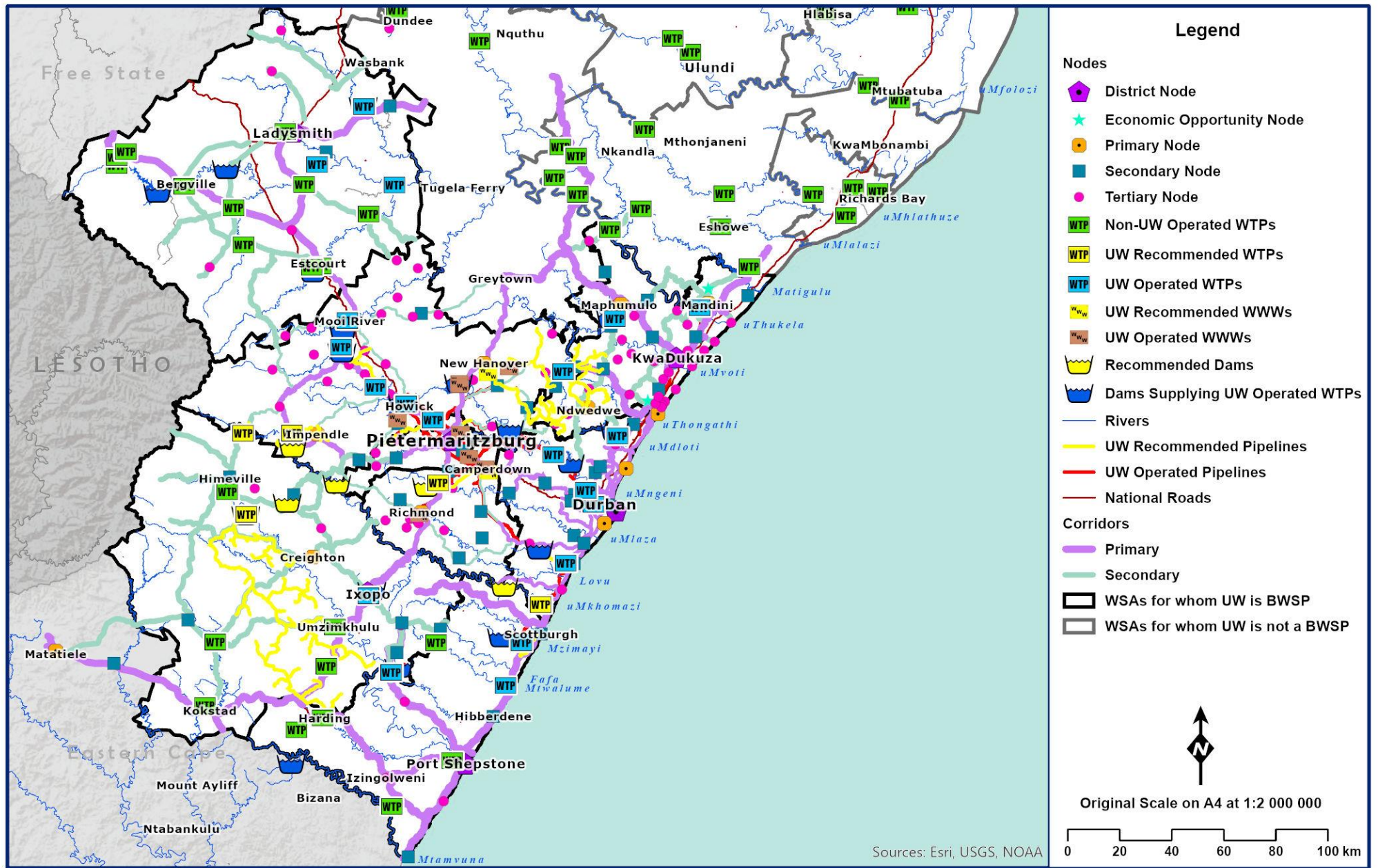


Figure 2.73 Municipal SDFs (eThekweni 2019; Harry Gwala 2016; iLembe 2016; KZN DoT 2017; MDB 2016; Umgeni Water 2023; Ugu 2016; uMgungundlovu 2018; uThukela 2018).

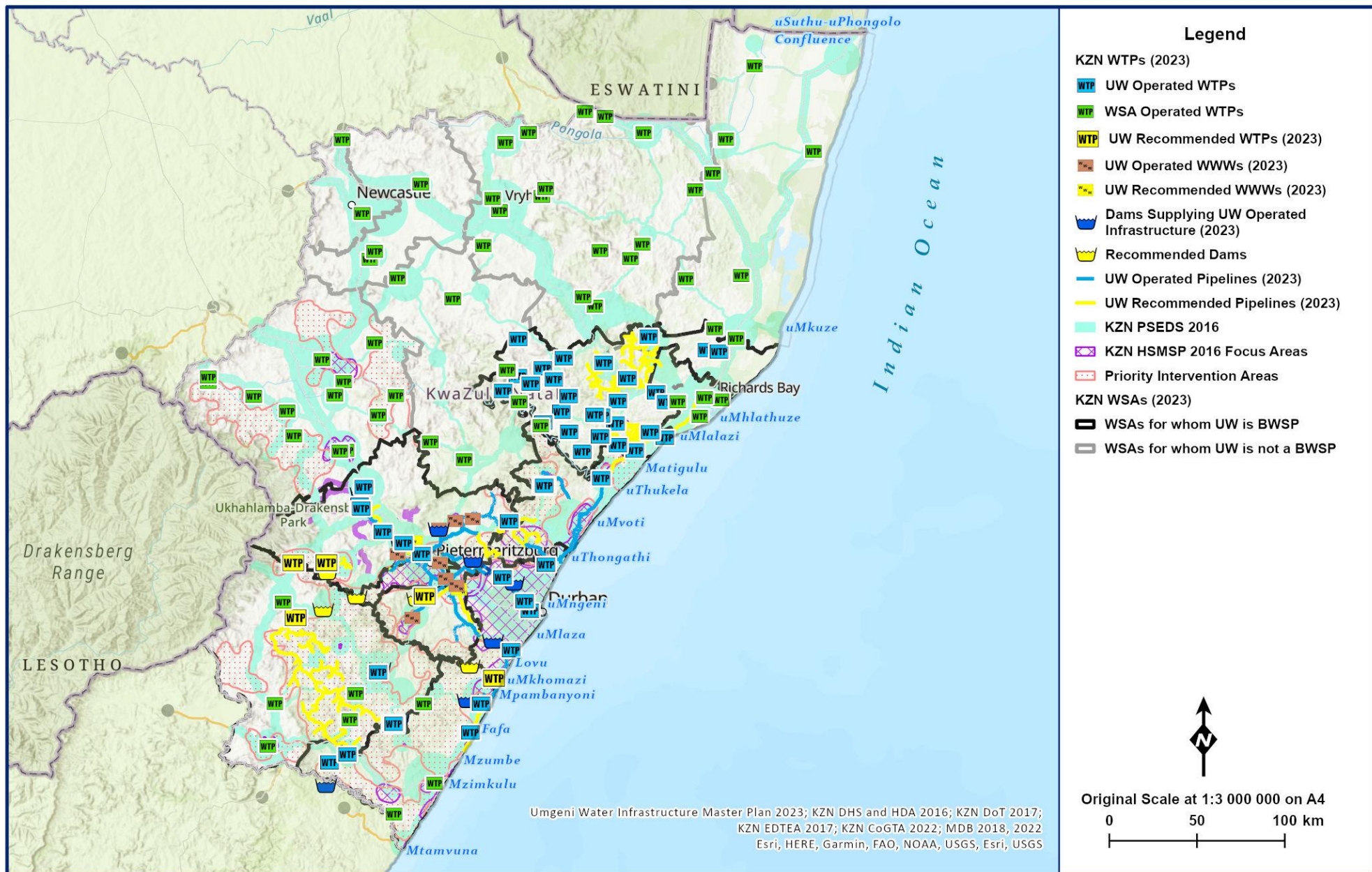


Figure 2.74 Alignment of the different spatial plans (KZN DHS and HDA 2016; KZN DoT 2017; KZN EDTEA 2017; KZN Planning Commission 2018; MDB 2016; Umgeni Water 2023; WR2012).

Sanitation system/technology types may be categorised as those shown in **Table 2.17**.

Table 2.17 Sanitation system/technology types (after DoH and CSIR 2000: 10.4).

Sanitation System Type	Water Added	Conveyance Required (Either Sewer Pipelines or Truck)
Full waterborne sanitation	Yes	Yes
Flushing toilet with conservancy tank	Yes	Yes
Shallow sewers	Yes	Yes
Flushing toilet with septic tank and subsurface soil absorption field	Yes	No
Low-flow on-site sanitation systems	Yes	No
Aqua-privy toilet	Yes	No
Chemical toilet	No	Yes
Ventilated improved pit toilet	No	No
Ventilated improved double-pit toilet	No	No
Ventilated vault toilet	No	No
Urine-diversion toilet	No	No
Pit	No	No
Bucket	No	No
Other	No	No
No sanitation system	No	No

The planned changes in the sanitation system/technology type is explained by Bradley (2012: Slide 23) who states that:

“Feasible solutions to domestic water and sanitation needs are dependent upon residential density to a substantial degree, and the transition from ‘standard’ approaches to alternatives is at a higher residential density for sanitation than for water... This is particularly so with current technological advances...”.

Bradley (2012: Slide 23)

This is summarised in **Figure 2.75**. It is shown in **Figure 2.75** that as residential densities increase, the most appropriate (conventional) sanitation system/technology is that of “piped/sewered waste from household” and that this is the sanitation/technology conventionally used when there is “piped water to household”.

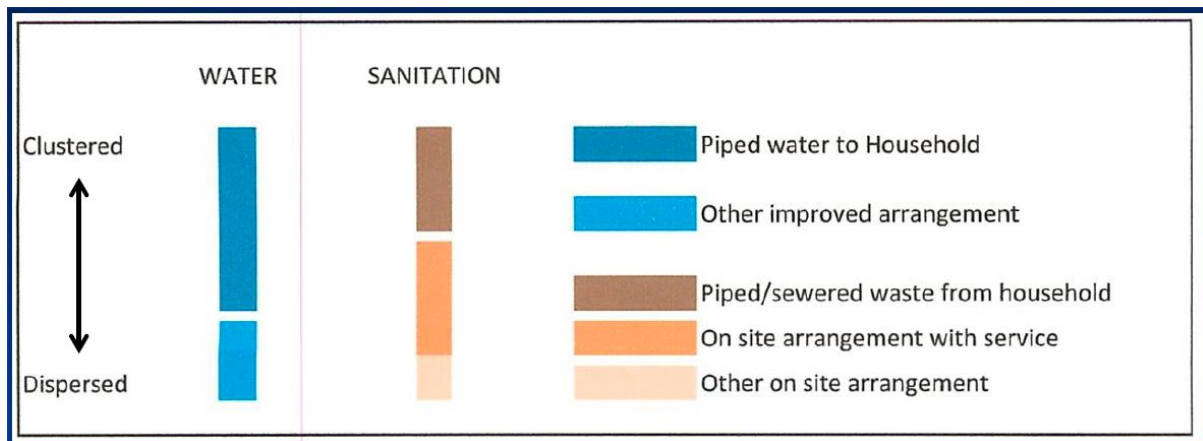


Figure 2.75 Relationship between residential densities and water and sanitation supply options (Bradley 2012: Slide 23).

A simplistic analysis using the relationship shown in **Figure 2.75** was undertaken to identify if there is sufficient existing and planned sanitation infrastructure for the areas planned for densification (**Figure 2.74**) within Umgeni Water’s operational area:

- The planned areas for densification are shown in **Figure 2.76** (after **Figure 2.74**). It is noted that these areas have been identified at a strategic level.
- The location of the planned densification areas in relation to those areas in which the dominant access to piped water is “piped water inside the dwelling” as identified by the Census 2011 is shown in **Figure 2.77**. It is shown in this figure that not all the planned densification areas have piped water inside the dwelling and therefore water service levels are likely to increase in these areas. However, it was shown in **Figure 2.74** that there is planned bulk water infrastructure to cater for this increase in water demand (see **Sections 7, 8, 11, 12 and 19**).
- The location of those areas in which the dominant toilet facility is a “flush toilet connected to a sewerage system” as identified by the Census 2011 in relation to the planned densification areas and those areas in which the dominant access to piped water is “piped water inside the dwelling” is shown in **Figure 2.78**. It is shown clearly in this figure that there are “gaps” between the sewerage system areas and the areas that will be densifying and some areas with piped water inside the dwelling.
- Those areas in which the dominant toilet facility is a “flush toilet with a septic tank” are shown in **Figure 2.79**. As densification increases, the use of a septic tank technology becomes a public health hazard and the sanitation technology should change to a sewerage system. It is shown in this figure that when the sanitation technology changes from septic tank to that of a sewerage system, there will still be “gaps” between the sewerage system areas and the areas that will be densifying.

The above analysis, based on a number of assumptions, suggests that existing wastewater infrastructure may not be sufficient to cater for existing and future needs. This is discussed further in **Section 19**.

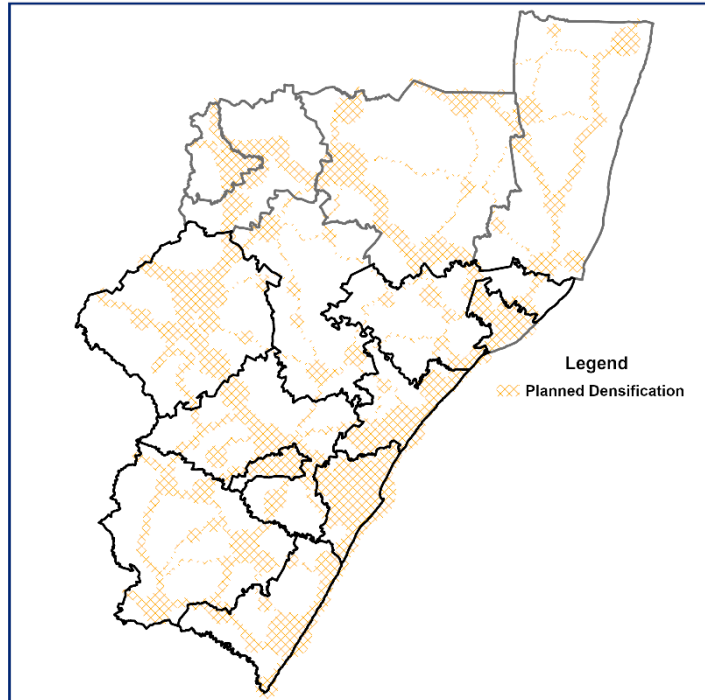


Figure 2.76 Public sector planned densification areas (KZN DHS and HDA 2016; KZN EDTEA 2017; KZN Planning Commission 2018; MDB 2020).

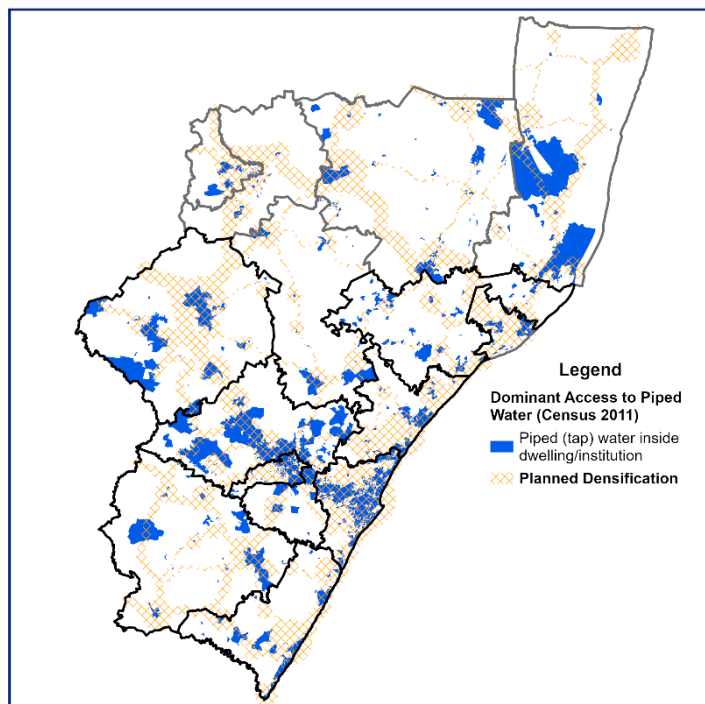


Figure 2.77 Public sector planned densification areas and those areas with a dominant access to piped water inside the dwelling (Census 2011; KZN DHS and HDA 2016; KZN EDTEA 2017; KZN Planning Commission 2018; MDB 2020).

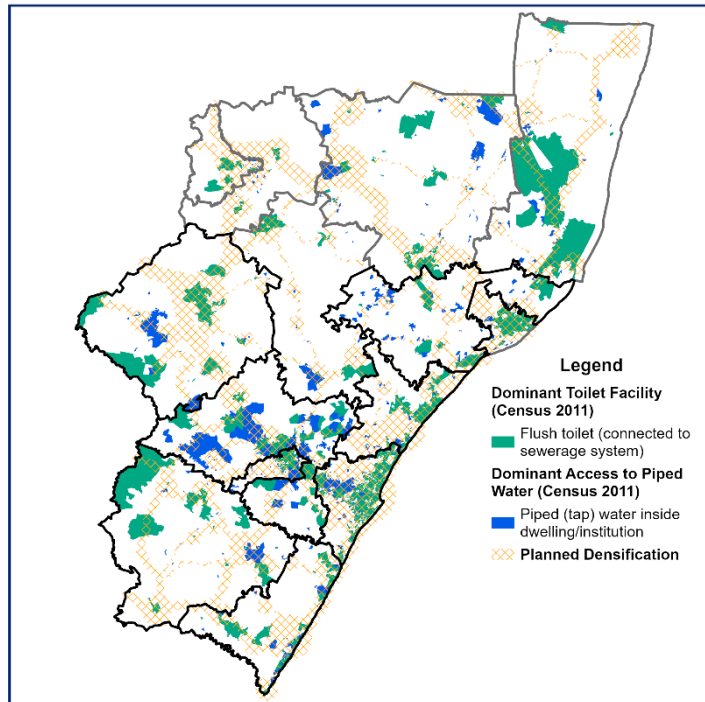


Figure 2.78 Public sector planned densification areas and those areas with a dominant access to piped water inside the dwelling and flush toilet connected to sewerage system (Census 2011; KZN DHS and HDA 2016; KZN EDTEA 2017; KZN Planning Commission 2018; MDB 2020).

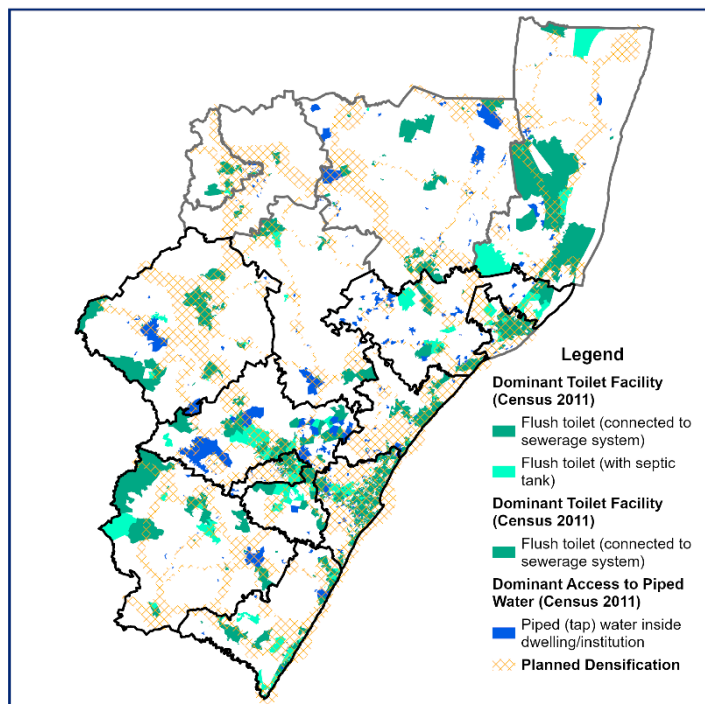


Figure 2.79 Public sector planned densification areas and those areas with a dominant access to piped water inside the dwelling, flush toilet connected to sewerage system and flush toilet with septic tank (Census 2011; KZN DHS and HDA 2016; KZN EDTEA 2017; KZN Planning Commission 2018; MDB 2016).

2.6 Regional Water Planning Overview

This section provides an overview of the infrastructure and supply planning throughout Umgeni Water's Operational Area. The 2020 Infrastructure Master Plan now includes the status quo of water resources and supply infrastructure for all areas in KwaZulu-Natal, even those areas outside of Umgeni Waters Operational Area. Included in this IMP are Umgeni Water's recommendations of regional and other schemes that could be implemented to improve bulk water supply services to these other areas. Since these recommendations have not, necessarily, been adopted by the WSA's, the areas outside of Umgeni Water's Operational Area are not included in this Chapter.

As shown in the previous section, the municipalities of eThekweni and uMgungundlovu are the two main economic contributors within KwaZulu-Natal (KZN). This economic activity is dominated by the two cities of Durban and Pietermaritzburg.

With reference to **Figure 2.65** and **Figure 2.69**, the Provincial Growth and Development Strategy (PGDS) (KZN Provincial Planning Commission 2018) and the PSEDS 2016 identifies eThekweni Municipality as a Primary Node within KZN, which is an urban centre with very high existing economic growth and with the potential for expansion and is of national and provincial economic importance. It is the only Primary Node in the province. Pietermaritzburg has been identified in the PGDS as a Secondary Node within KZN, which is an urban centre with good existing economic development and the potential for growth and services to the regional economy. It is one of four such nodes in the province. These two centres and the development corridor between them is the economic hub of the province (**Figure 2.65**).

Richards Bay on the North Coast, as the second busiest port in KZN and the third largest contributor to the provincial economy, is also classified as a Secondary Node. The corridor between Durban and Richards Bay is also considered to be of economic importance where significant development is expected to occur in the future, particularly in the area surrounding the Dube Trade Port and King Shaka International Airport.

Port Shepstone is also classified as a Secondary Node, and the corridor between it and Durban is experiencing steady growth and has potential for further economic development.

This key KZN developmental region (T-shaped) defined by primary and secondary nodes and corridors constitutes the KZN portion of SIP2 and falls largely within Umgeni Water's current area of operation (**Figure 2.46** and **Figure 2.47**). It was further shown in **Figure 2.53** and **Figure 2.54** that the water within Umgeni Water's area of operation not only supports this area but is also transferred to the largest economic hub in the country viz. that Gauteng region and the Richard's Bay area, the second largest economic hub in KZN.

The primary, secondary and tertiary development nodes are indicated as circles in **Figure 2.80** with the size proportional to its hierarchical level of importance. The KwaZulu-Natal Reconciliation Strategy Study that was completed by the Department of Water and Sanitation¹⁰ (DWAf 2009) termed this region "the KwaZulu-Natal Coastal Metropolitan Area".

In order to maintain its significance, and realise its future growth potential, this region needs to be supported by a sustainable long-term supply of water. The responsibility for the planning, constructing and operating of the required water resource and water supply infrastructure rests with the Department of Water and Sanitation, Umgeni Water and the relevant Water Service

¹⁰ At the time the study was published, the department was called the Department of Water Affairs and Forestry (DWAf).

Authorities. The roles and responsibilities of these institutions in this regard vary, with some overlap in certain instances.

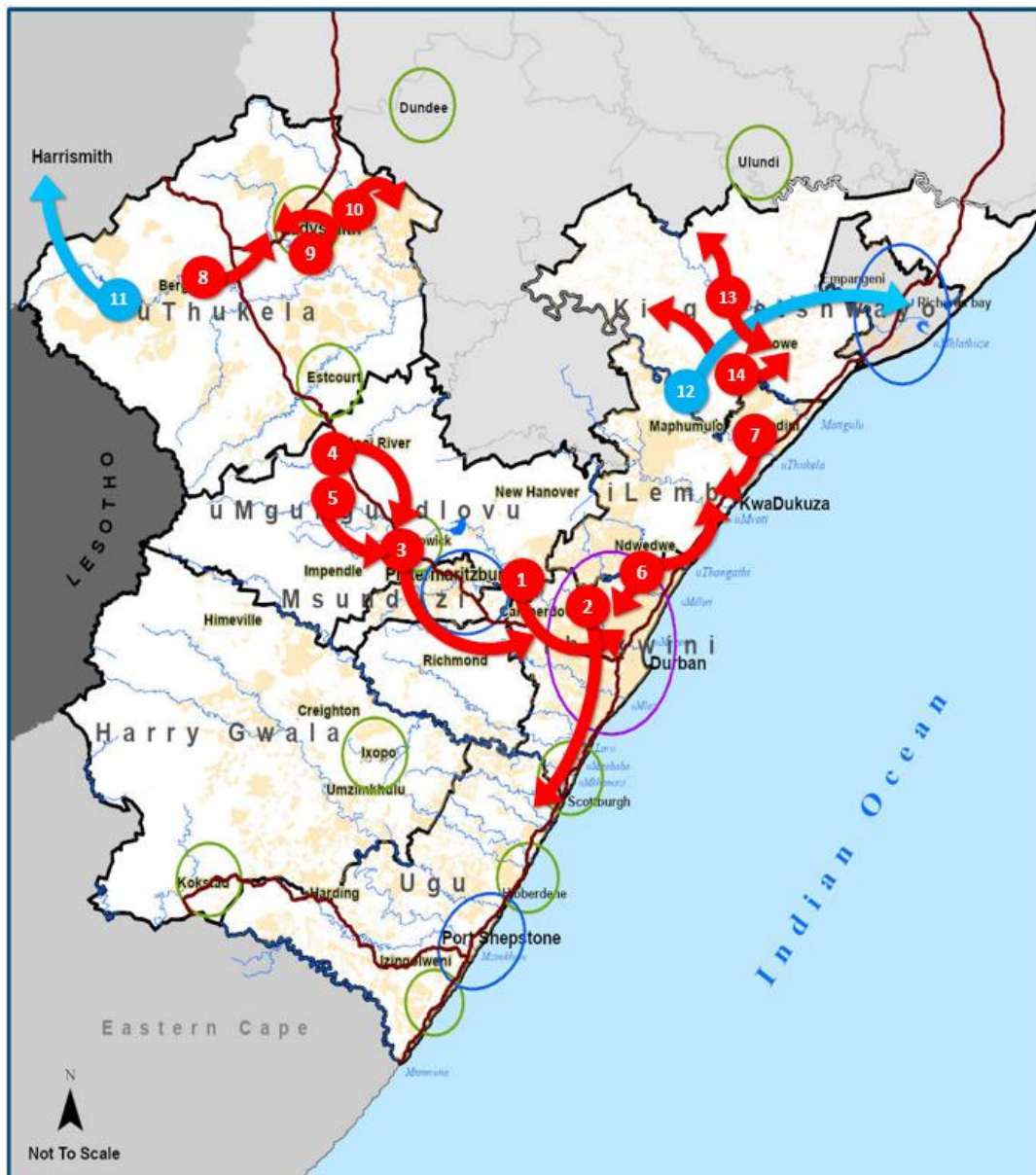


Figure 2.80 Current bulk water supply strategy.

With reference to **Figure 2.80**, the major sources of water to supply the area are as follows:

1. Water is abstracted from Nagle Dam on the uMngeni River to supply primarily the northern and central parts, and to a lesser extent the western part, of eThekweni Municipality. Raw water storage for this abstraction is provided at Albert Falls Dam, and can be supported by Midmar Dam situated upstream;
2. Water is abstracted from Inanda Dam on the uMngeni River to supply primarily the central and southern parts, and to a lesser extent the northern part, of eThekweni Municipality and the southern coastal strip as far south as Scottburgh within Ugu District Municipality. Raw water storage for this abstraction is provided at Inanda Dam, and can be supported by Albert Falls and Midmar Dams upstream;

3. Water is abstracted from Midmar Dam on the uMngeni River to supply the Msunduzi Local Municipality (Pietermaritzburg and Vulindlela), the western part of the eThekweni Municipality and the connecting corridor, which is within Umgungundlovu District Municipality;
4. When the volume at the Mearns Weir is greater than 60% of its capacity then water is transferred from both the Mearns Weir and from Spring Grove Dam to support the Mgeni System. In this scenario the following applies:
 - a. 3.2 m³/s is abstracted from Mearns Weir; and
 - b. 1.3 m³/s from Spring Grove Dam;
5. When the Mearns Weir is less than 60% of full supply capacity then 4.5 m³/s is transferred directly from Spring Grove Dam, to the Mgeni System, to support all abstractions from the uMngeni River; and
6. Water is abstracted from Hazelmere Dam on the uMdloti River to supply the northern part of eThekweni Municipality and the northern coastal strip of iLembe District Municipality as far north as the town of Ballito.
7. Water is abstracted from the uThukela River to supply the southern coastal areas of Mandini Local Municipality and most of the coastal areas of KwaDukuza LM as far south as the town of Ballito.
8. Water is abstracted from Spioenkop Dam on the uThukela River to supply the Ladysmith area.
9. Water is abstracted from the uThukela River to supply the Ezakheni Area.
10. Water is abstracted from the Olifantskop Dam to supply the Ekuvukeni Area.
11. Water is abstracted from the upper reaches of the uThukela River to augment the water supply to the Gauteng economic region.
12. Water is abstracted from the lower reaches of the uThukela River to augment the water supply to the Richard's Bay area.
13. Water is abstracted from the Goedertrouw Dam on the uMhlathuze River to supply the northern areas which form part of the Mthonjaneni Local Municipality and the southern areas which lie within the uMlalazi Local Municipality. Goedertrouw Dam yield is supplemented by an inter basin transfer from the uThukela River.
14. Water is abstracted from the Rutledge Dam through a raw water pumping station at the outlet works of the dam. The Rutledge Dam is augmented with raw water from the Ihlazi Dam. The Eshowe WTP is located within the town of Eshowe and supplies the existing domestic users in Eshowe and the surrounding communities.

From a planning perspective, water from the Mgeni system is required to be supplied at a 99% level of assurance (i.e. a 1:100 year risk of failure) due to the economic and strategic significance (based on the industrial and commercial output) of the greater eThekweni-Msunduzi region. A 98% level of assurance (i.e. a 1:50 year risk of failure) is currently required for supply from the Mdloti system, the uThukela System and for the South Coast as these regions are predominantly of a domestic nature.

A holistic view of the projected water demands from the entire Mgeni System is shown in **Figure 2.81** together with the existing yield (at a 99% level of assurance) available from the system. This yield includes the maximum additional support that it can obtain from the Mooi River. The demand is projected to exceed the available yield once current drought curtailments are lifted. This deficit means that water is being supplied at a lower level of assurance than is required and therefore the risk of a shortfall being experienced has increased. This risk increases as the size of the deficit increases.

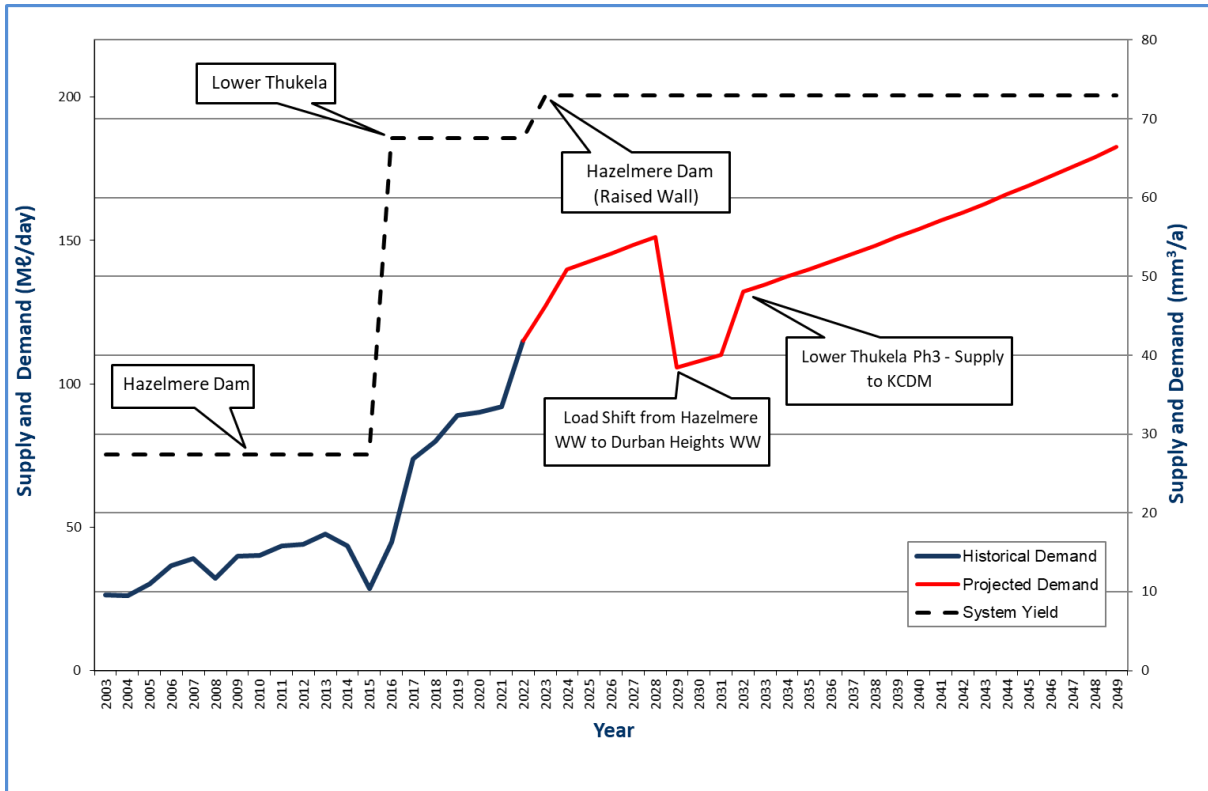


Figure 2.82 illustrates a holistic view of the projected water demands from the entire North Coast Supply System (including supply from Hazelmere and Lower Thukela) together with the historical and existing yield (at a 98% level of assurance) available for the system. Similarly, **Figure 2.83** illustrates a holistic view of the projected water demands for the entire South Coast Supply System and includes the historical yield (at a 98% level of assurance).

Umgeni Water have only recently become the bulk water supplier to King Cetshwayo District Municipality in particular to uMlalazi Local Municipality, uMfolozi Local Municipality, Nkandla Local Municipality and Mthonjaneni Local Municipality. As a result, it has not been possible to undertake an analysis of supply versus demand for these areas. This will be included in the next version of the Umgeni Water Infrastructure Master Plan.

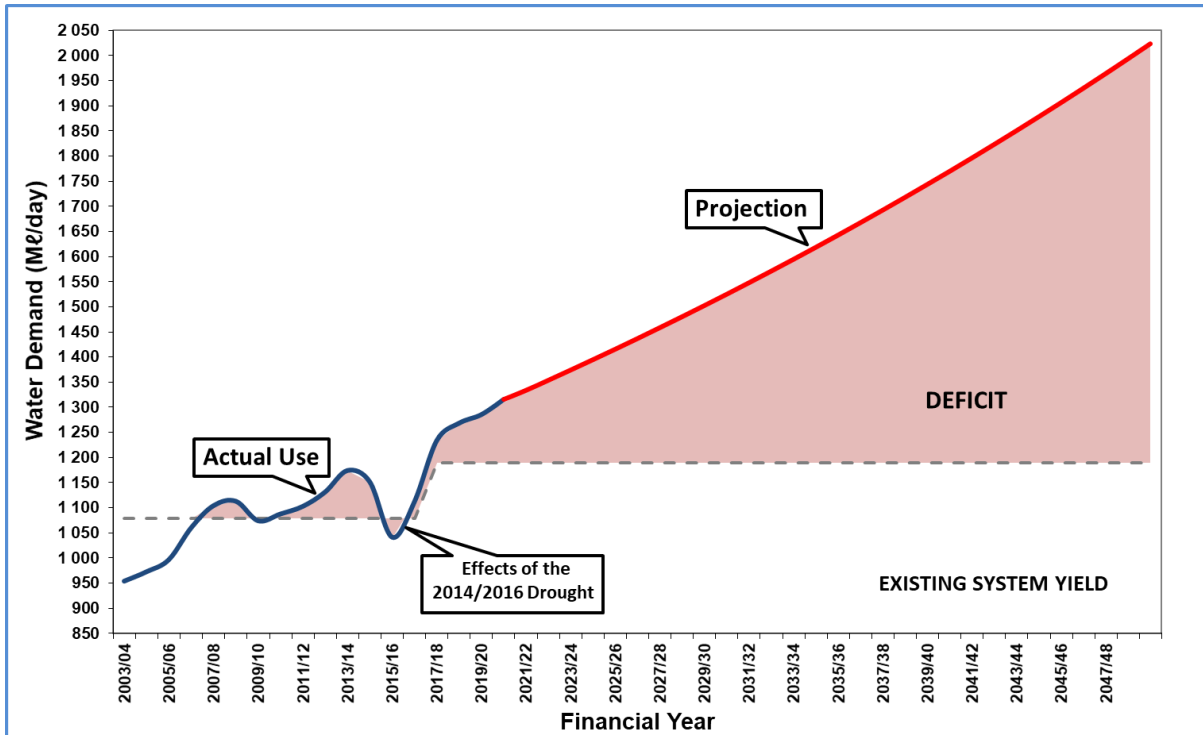


Figure 2.81 Mgeni System - Existing Water Balance

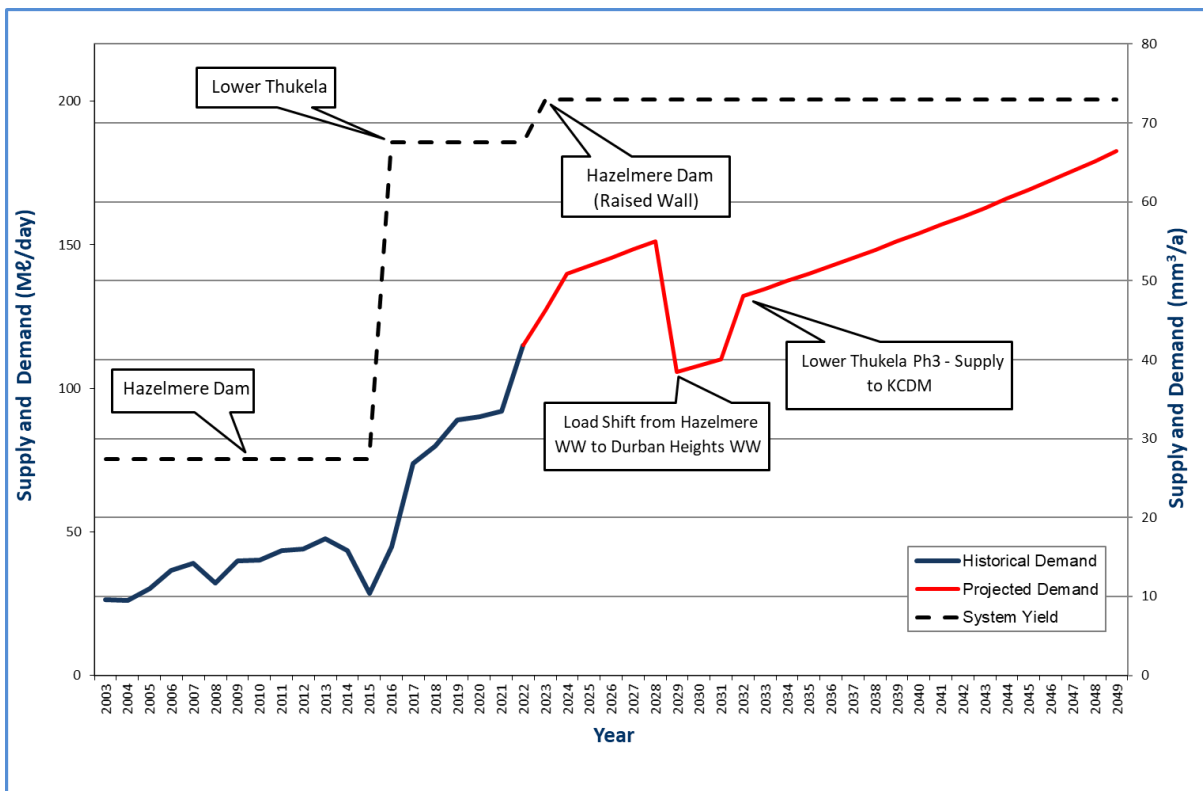


Figure 2.82 North Coast Supply System – Existing Water Balance

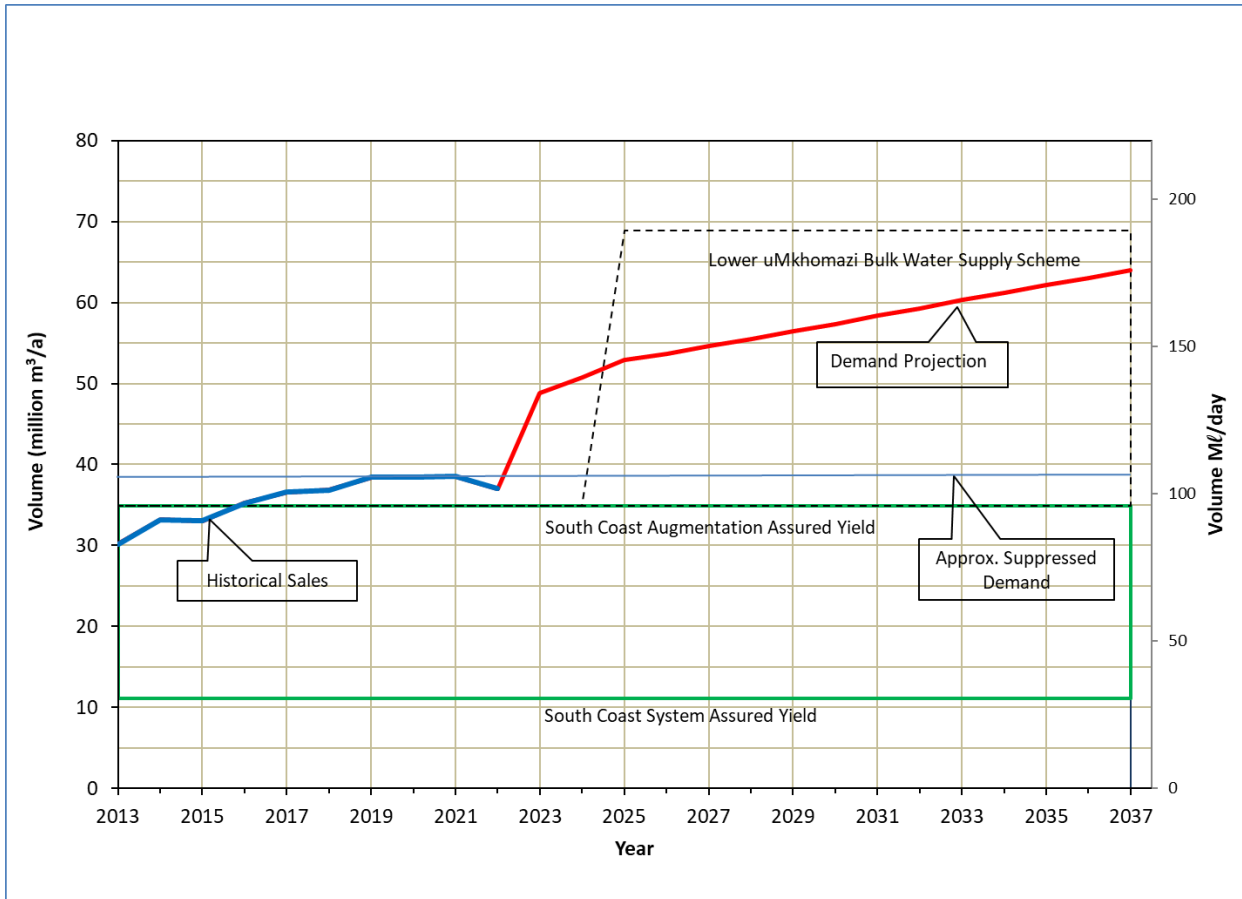


Figure 2.83 South Coast Supply System – Existing Water Balance

Water Demand Management (WDM) initiatives are the quickest measure to implement and have the effect of lowering the demand curve and thereby either reducing the deficit or by delaying the need to implement other measures. However, the extent of the success to be achieved through the implementation of WDM initiatives is very difficult to accurately predict, and once achieved can be difficult to maintain unless there is constant monitoring and management of the systems. Nevertheless, the municipalities that Umgeni Water supply are implementing a wide range of WDM initiatives and these can have a marked impact on the demand requirements from the systems. Notwithstanding these initiatives, it is evident that the long-term projection still anticipates a growth in water demand for the regions where economic development and improved levels of water service outweigh any savings achieved through the WDM initiatives. Hence, further water resource augmentation measures still have to be considered.

eThekweni Municipality has recently constructed the Western Aqueduct Pipeline and this will extend the existing pipeline system that runs from Midmar Dam to the western area of eThekweni. The Western Aqueduct can supply parts of the central and northern areas of the municipality (**Arrow 3 in Figure 2.84**).

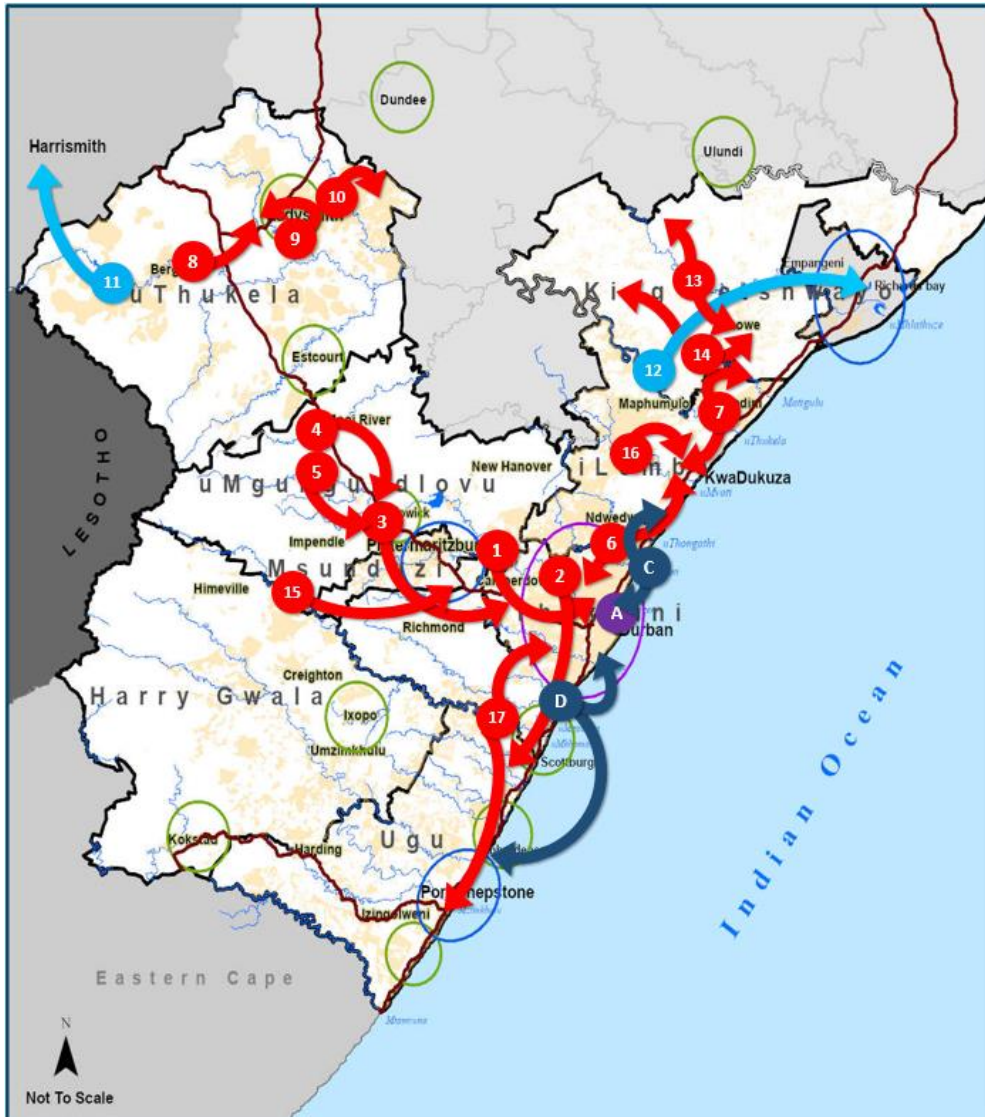


Figure 2.84 Future bulk water supply strategy.

The following have been identified as feasible surface water options available to augment the water resources to supply the KwaZulu-Natal Coastal Metropolitan Area:

- Transfer water from the adjacent uMkhomazi River into the Mgeni catchment. An inter-basin transfer scheme, known as the uMkhomazi Water Project, is current being investigated. This entails the construction of two dams on the river, viz. Smithfield Dam (Phase 1) and Impendle Dam (Phase 2), a new Water Treatment Plant, and a conveyance system of a tunnel and pipelines. Potable water can then be added into the conveyance system (3) from Midmar Dam that supplies the eThekweni area (western, central and northern). Supply would be primarily under gravity and pre-feasibility indications are that the yield (99% assurance) obtainable from Phase 1 is approximately 600 Mℓ/day (**Arrow 15 in Figure 2.84**);
- The Department of Water and Sanitation has recently implemented a project to raise the Hazelmere Dam Wall by 7m. This will increase the yield (98% assurance) that can be supplied to the northern part of eThekweni Municipality and the northern coastal strip by an additional 20 Mℓ/day excluding Reserve requirements (**Arrow 6 in Figure 2.84**). Although the

- raising of the dam is complete, full impoundment cannot occur until two houses have been moved from the dam basin and it is hoped that this will be completed by the end of 2023;
- The Lower Thukela Bulk Water Supply Scheme can be upgraded from 55 Mℓ/day to a maximum capacity of 110 Mℓ/day when needed. The Lower Thukela Bulk Water Supply Scheme can feed water south into the North Coast Pipeline (currently supplied from Hazelmere Dam on the uMdloti River) thereby allowing areas along the North Coast Pipeline to be fed from two separate sources if needed. The Lower Thukela Bulk Water Supply Scheme currently supplies demands as far south as Ballito. Hazelmere Dam can, therefore, be used to satisfy increasing local demands (**Arrow 7 in Figure 2.84**). Once upgraded, the Lower Thukela Bulk Water Supply Scheme will also have the capacity to supply north of the uThukela River to the King Cetshwayo District Municipality area;
 - A dam can be developed on the uMvoti River to link into the supply system from Hazelmere Dam (and the uThukela River). Earlier studies indicated that a supply of approximately 127 Mℓ/day (98% assurance) could be available from this scheme (**Arrow 16 in Figure 2.84**) although this figure will likely reduce once the In-stream Flow Requirements of the Mvoti River are modified;
 - Water can be abstracted from the lower reaches of the uMkhomazi River and linked into the existing pipeline system to supply a large portion of the south coast economic corridor. Water could be supplied northwards to the southern area of eThekweni Municipality and southwards to the northern areas of Ugu Municipality. Reliance on the Mgeni system (**2**) to supply this area could then be partially removed. The South Coast Supply System could be extended to link into the supply from the Mzimkulu River to create an integrated system. The total capacity of this system is 100 Mℓ/day and the project is to be completed by 2026 (**Arrow 17 in Figure 2.84**).

The following have been identified as **wastewater reuse** options available to augment the water resources to supply the KwaZulu-Natal Coastal Metropolitan Area:

- eThekweni Municipality have identified their Northern Wastewater Works (WWW) and KwaMashu WWW as potential sites for reclamation plants. These WWWs are both situated within the northern part of the municipality, and the intention is to treat the effluent back to potable standards on site and feed it directly into the local bulk supply network. These reclamation plants could, jointly, augment the system by approximately 110 Mℓ/day by either a direct reuse option (not considered favourable at present because of public resistance) or indirect reuse through the discharge of treated effluent into existing impoundments such as Hazelmere Dam (**Point A in Figure 2.84**); and

Two **seawater desalination** options have been identified at **Points C and D in Figure 2.84**. These options would be able to augment the water resources to supply the KwaZulu-Natal Coastal Metropolitan Area and are as follows:

- A desalination plant situated in the vicinity of the uMdloti River Estuary to the north of the city of Durban. Potable water can be fed into the local bulk supply network to augment the northern part of eThekweni Municipality as well as into the bulk supply network running northwards from Hazelmere Dam (**5**) into the iLembe District Municipality. It is estimated that the maximum volume that these bulk networks can accommodate (based on pipeline capacities) is in the order of 150 Mℓ/day; and
- A desalination plant in the vicinity of the Lovu River Estuary to the south of the city of Durban. Potable water can be fed into the local bulk supply network to augment the southern part of eThekweni Municipality as well as into the bulk supply network running southwards from Inanda Dam (**2**) into the Ugu District Municipality. It is estimated that the

maximum volume that these bulk networks can accommodate (based on pipeline capacities) is in the order of 150 Mℓ/day.

The time it takes to commission any of the options listed above becomes important if the existing and projected supply deficits are to be adequately addressed. Further to this, there is a spatial context to each option. The importance of developing any specific option is also linked to its area of supply and the rate at which the water demands in that specific area is predicted to increase.

Phase 2A of the Mooi-Mgeni Transfer Scheme was commissioned in November 2013 and Phase 2B in April 2016. This augmentation maximizes the benefit obtained from the Mooi River to support the entire Mgeni system. The total available yield, at a 99% assurance level, is still, however, below the projected demand and hence a deficit will remain in the system.

Of all the remaining options for the Mgeni system, the uMkhomazi Water Project **(12)** can provide the largest contribution and has the ability to meet the long-term requirements of the eThekweni region, particularly making use of the new Western Aqueduct infrastructure **(3)** which was completed in 2020. This option would relieve the demands placed on other Mgeni abstraction points **(1) (2) (4) (6)** so that all the Mgeni system needs could be met. However, the earliest date for the commissioning of Phase 1 of this project is estimated to be 2030, whilst a more realistic date is likely to be around 2032. With either of these dates, a deficit in the system will still exist and will have to be managed or mitigated through the implementation of one or more of the other options.

The reuse **(A)** and seawater desalination **(C) (D)** options, are relatively quick to implement and can be commissioned as early as 2026 if required and all legislative environment requirements can be met. None of these options are able to make as significant a contribution as the uMkhomazi Water Project and would only be able to supply the coastal strip. The DWS Reconciliation Strategy Study has hence highlighted that the uMkhomazi Water Project should proceed in the earliest possible time frame and the Department of Water and Sanitation has now given a directive to TCTA and Umgeni Water to proceed with the development of the project without delay.

The raising of of Hazelmere Dam Wall **(6)** is considered adequate to meet the short-term water resource requirements of the Mdloti System.

With the implementation of both the Lower Thukela Bulk Water Supply Scheme and the Raising of Hazelmere Dam and the potential to further augment the Mdloti system from the Northern Seawater Desalination Plant **(C)**, the requirements of the northern coastal region should be adequately addressed in the medium to long-term.

The Lower uMkhomazi Bulk Water Supply Scheme **(17)** is the preferred option for augmenting supply on the South Coast. The detailed design of the scheme has been completed and a five year implementation programme is expected for the project.

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3. DEMAND FORECASTS IN THE UMGENI WATER OPERATIONAL AREA

This section documents Umgeni Water’s water demand forecast review that was completed in September 2022. This process:

- Reviewed the figures for the financial year ending in June 2022 (2021/2022).
- Assessed and revised the short-term forecast for the financial year ending in June 2023 (2022/2023);
- Compiled short-term forecasts for the financial years ending in June 2024 (2023/2024), June 2025 (2024/2025) and June 2026 (2025/2026); and
- Extended these short-term forecasts to a long-term forecast (30-year forecast) to the end of June 2053 (2052/2053)

All data presented has been updated to include the November 2021 sales figures and all statistics and trends have been based on the moving annual average and year-on-year growth figures as determined at 30 November 2021.

3.1 Review of 2021/22 Sales

The initial forecasted water sales value for the financial year ending in June 2022 (2021/22), as determined in September 2020, was 1 415 Mℓ/day. In September 2021 this figure was revised to 1 518 Mℓ/day after updated discussions with customers. Total sales recorded for the 2021/22 financial year averaged 1 543 Mℓ/day (563 346 Mℓ). This was 1.6% higher than the September 2021 projection and can mainly be attributed to increased non-revenue water in many of the municipalities as well as additional supply through the Western Aqueduct to eThekweni.

Total average water sales for the 2020/21 financial year was 1 474 Mℓ/day, and hence the 2021/22 sales were 4.7% year-on-year higher than the 2020/21 financial year. As discussed above, this increase in demand was as a result of increased sales through the Western Aqueduct and ever increasing water loss in within WSA’s. **Figure 3.1** shows the 12-month moving average of Umgeni Water’s total average daily water sales for the past 10 years.

Bulk water sales to eThekweni Municipality constituted by far the largest percentage (70.8%) of Umgeni Water’s total water sales for 2020/21. Their proportion of the total sales increased slightly from the previous year (69.3%). The Msunduzi Municipality is Umgeni Water’s second largest customer, accounting for 14.8% of the organisation’s total sales. The remaining customers make up the balance of the sales. **Figure 3.2** illustrates the average daily sales volume distribution per customer for the financial year 2020/21.

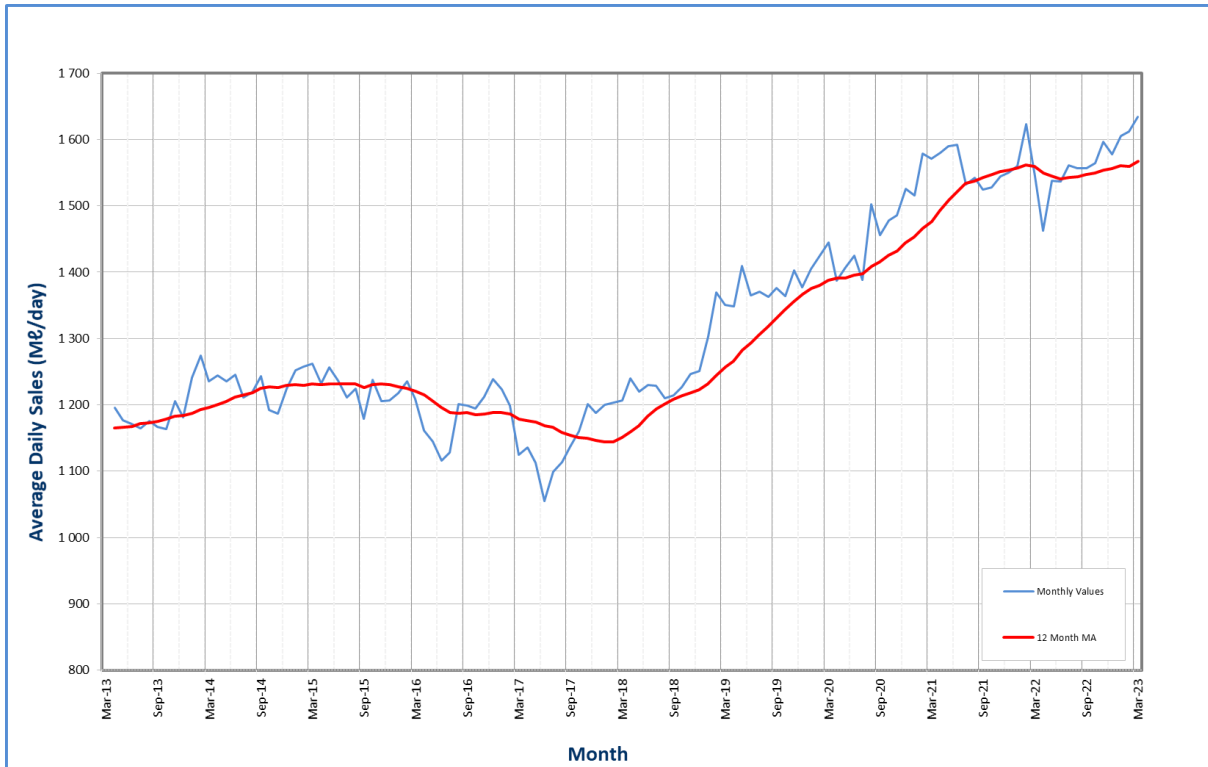


Figure 3.1 Umgeni Water Total Average Daily Sales.

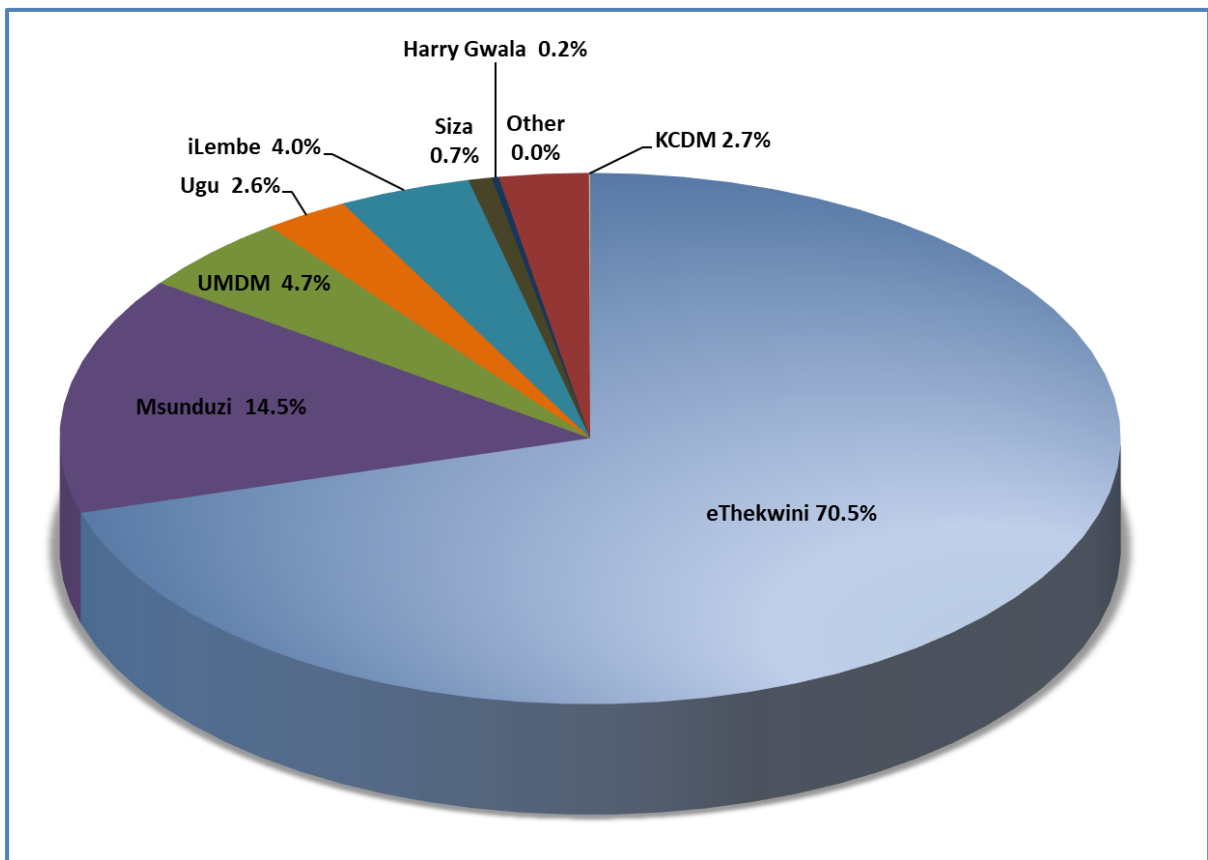


Figure 3.2 Distribution of Sales Volumes for 2020/2021.

3.2 2022 Short-Term Bulk Water Sales Forecasts

Increased growth:

- as a result of the commissioning of eThekweni Municipality’s Western Aqueduct,
- coupled with Umgeni Water’s expansion into KCDM, and
- an unfortunate increase in water loss in some customer areas,

means that a steady growth in demand has been experienced over the past years and this has increased the pressure on supply infrastructure. This demand growth is further projected to increase to 1 565 Mℓ/day for the 2022/2023 financial year following which demand growth is expected to increase to 1 587 Mℓ/day in 2023/2024, 1 587 Mℓ/day in 2024/2025 and 1 593 Mℓ/day in 2025/2026 (**Figure 3.3**). This demand increase, which is mostly driven by increased water loss in systems, is not sustainable and the infrastructure that should supply these high demands is almost certainly inadequate. The unexpected increases in water loss (up to 50% in some WSA’s) have had a corresponding increase in water demand with the result that much of Umgeni Water’s infrastructure is now operating at or near capacity (especially within the Mgeni System). It will not be possible to augment these systems in the short to medium term as a result of resource constraints. Future growth is, therefore, going to have to be curtailed. The uMkhomazi Water Project will increase supply capacity to the Mgeni System by over 600 Mℓ/day. However, this complex project will require approximately ten years to design and construct. Municipalities have therefore been informed that future supply of water to new areas within their domain will only be possible through corresponding savings in water loss.

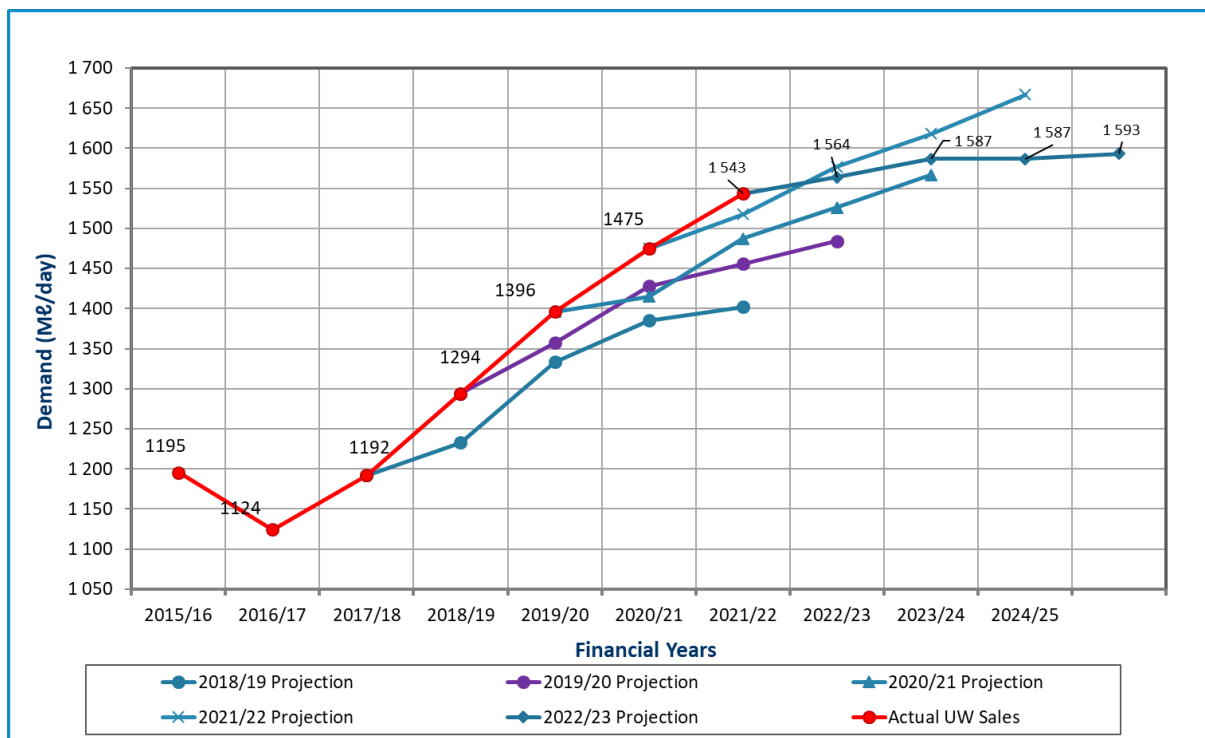


Figure 3.3 Total Average Daily Sales Volumes - Annual short-term forecast comparison.

3.2.1 eThekwini Municipality

In the 2021/2022 financial year, the year-on-year growth in sales to eThekwini Municipality increased by 3.39%. The continued increase in sales is attributed to the commissioning of the Western Aqueduct towards the end of 2019, as well as increased demand along the Southern Aqueduct. The growth in sales is shown in **Figure 3.4**, where the twelve-month moving average of sales increased from 1053 Mℓ/day in July 2021 to 1081 Mℓ/day in June 2022.

Proposed increases in projected demand were discussed with eThekwini Metro during September 2022. Four (4) total demand scenarios of expected increase in demand were analysed. A hybrid demand projection scenario was mutually agreed, taking into account the WC/WDM projects to be completed. A year-on-year increase in demand of 2.2% is expected. Thereafter, a 0.0% increase per annum is estimated for the following years and until the uMkhomazi Water Project is commissioned. This will give the Municipality the time needed to plan and implement WC/WDM initiatives which will then reduce the demand on the oversubscribed system. With the Mgeni System operating at or near capacity, additional growth in supply within the Metro can only be possible with a corresponding decrease in water lost from the system. It is, therefore, imperative that eThekwini Metro and the other WSA’s within the Mgeni System, address water loss through implemented WC/WDM interventions, with a matter of urgency. The historical sales and future demand projection for eThekwini Municipality is presented in **Figure 3.4**.

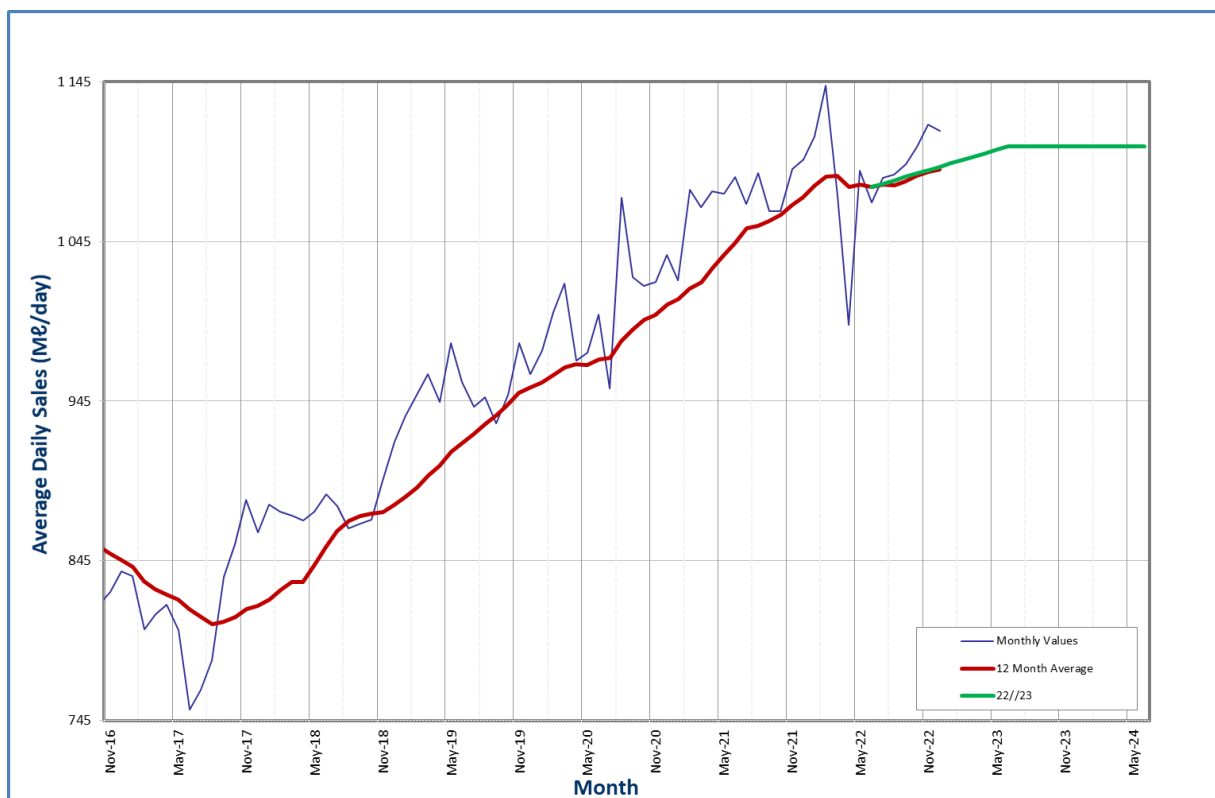


Figure 3.4 eThekwini Municipality Total Volumes - Annual short-term forecast.

3.2.2 The Msunduzi Municipality

The water sales to Msunduzi Municipality increased by 3.7% from 216 Mℓ/day in the 2021/2022 financial year to 224 Mℓ/day in 2022/2023. Projected demands for 2023/2024 were determined in

consultation with the municipality and it was agreed that, due to the over-abstraction of the Midmar Dam resource and the fact that both Midmar and DV Harris WTP's are operating at, or above, design capacity, the demand projection will be capped at 0% over the next two years.

The Clarendon demands have increased significantly and this is currently being investigated. A Copesville and Murray Road new development has been identified and will increase the demand for this area. The Belfort Reservoir high increase in water demand is being investigated by the UW and Msunduzi team.

Msunduzi Municipality have commenced with the implementation of the Vulindlela masterplan to realise a sustainable water supply to Ward 39 off Vulindlela Res 10 and plan to implement the recommendations over the next 4 years. Uncontrolled building has also resulted in high growth in the Vulindlela area and a high increase in water demand is foreseen in this area over the next 5 years due to the inefficient use of water with an increase in demand of approximately 1.5 Mℓ/day in the last financial year. The majority of the supply to the municipality will be from the Midmar WTP.

It was proposed that Msunduzi Municipality implement stringent water demand management (WDM) initiatives within the supply area, including the Vulindlela rural area. It is estimated that savings from these initiatives will offset the growth in sales in the area in the short term. Meetings with both Msunduzi and UMDM will be scheduled to discuss the urgency of implementing WDM initiatives and also where Umgeni Water may assist both WSA's

The projection for Msunduzi Municipality is reflected in **Figure 3.5**.

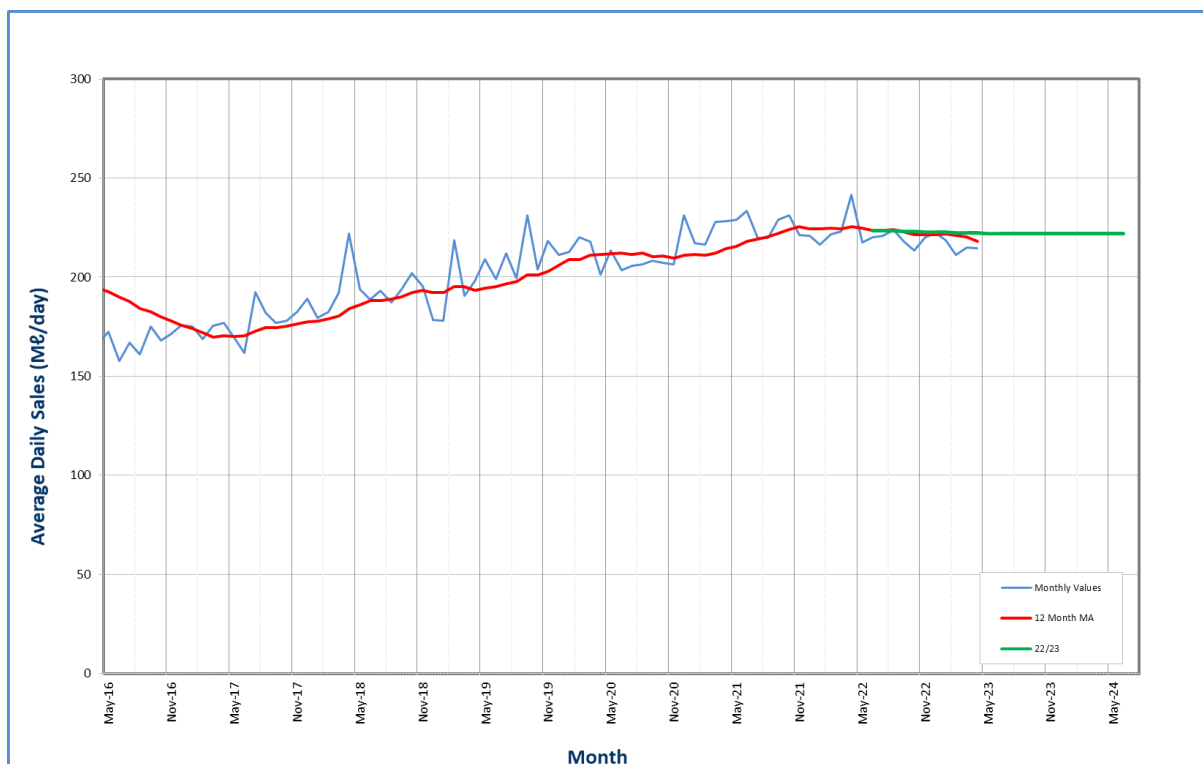


Figure 3.5 Msunduzi Municipality Total Sales Volumes - Annual short-term forecast.

3.2.3 uMgungundlovu District Municipality

The water sales to uMgungundlovu Municipality increased by 7.5% from 67 Mℓ/day in the 2020/2021 financial year to 72 Mℓ/day in 2021/2022. Projected demands for 2023/2024 were determined in consultation with the municipality and it was agreed that due to the over-abstraction of the Midmar Dam resource and the fact that both Midmar and DV Harris WTP's are operating at, or above, design capacity, the demand projection will be capped at 0% over the next two years.

The uMshwati BWSS is now fully commissioned and operational and increases in supply to Cool Air, Dalton and Swayimana has already been noted. The Dalton sales figures increased from 4.3 Mℓ/day in 2020/2021 to 6 Mℓ/day in 2021/2022. UMDM is in the process of connecting the Efaye and Oswathini areas within the uMshwati BWSS. Reticulation construction in Efaye is planned to be completed in 2024. Reticulation within Oswathini reticulation is currently being implemented.

A number of commercial development areas have been planned for UMDM and construction for the Hilton commercial development has progressed steadily.

It was proposed that UMDM implement stringent water demand management (WDM) initiatives within the supply area, including the Vulindlela rural area. It is estimated that savings from these initiatives will offset the growth in sales in the area in the short term. Meetings with both Msunduzi and UMDM will be scheduled to discuss the urgency of implementing WDM initiatives and also where Umgeni Water may assist both WSA's

The projection for uMgungundlovu District Municipality is shown in **Figure 3.6**.

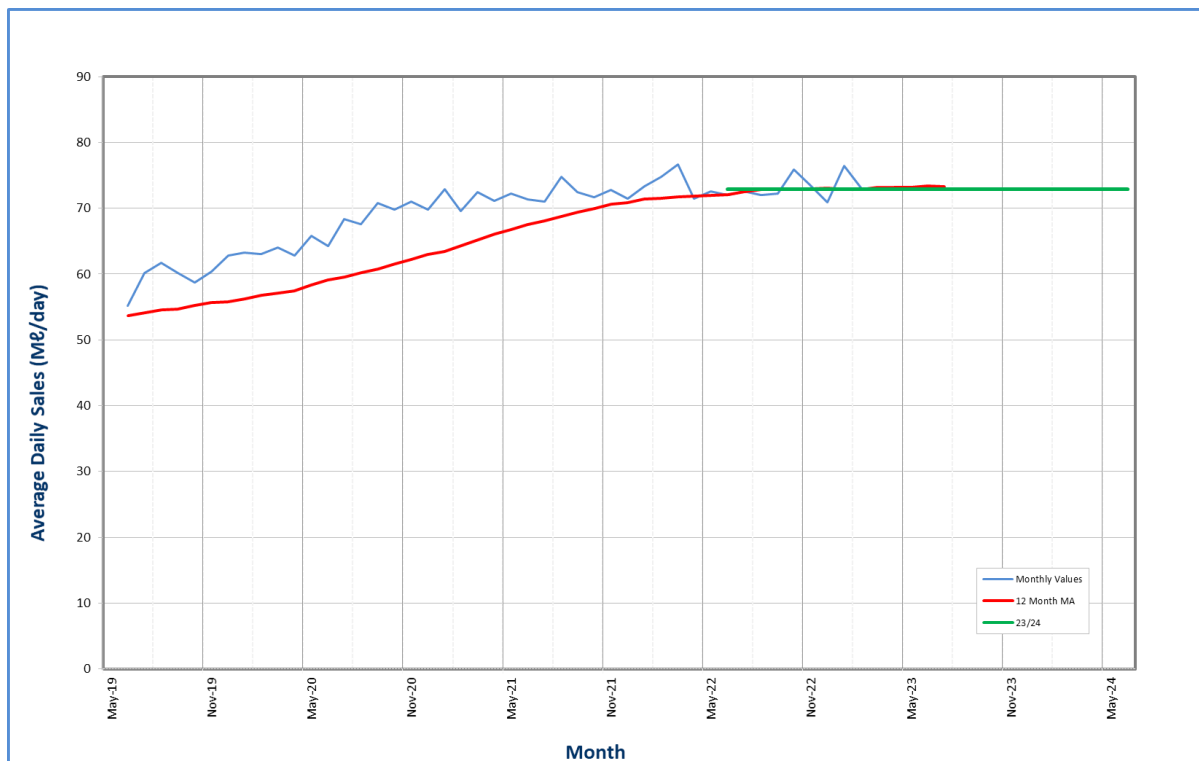


Figure 3.6 uMgungundlovu District Municipality Total Sales Volumes - Annual short-term forecast.

3.2.4 iLembe District Municipality (including Siza Water)

Sales to Ilembe District Municipality can be described as follows:

- Sales to the Coastal Area of iLembe through Siza Water.
- Sales to the Coastal and rural inland areas of iLembe through iLembe District Municipality.

Historical demand has been gradually increasing over the past year. This is reflected in **Figure 3.7** and **Figure 3.8**.

It is predicted that Siza Water’s demand will grow at a rate of approximately 3%. There is high income housing that will be developed over the next 5 years with some occupation taking place. This uptake is accommodated within the short term growth forecast. Siza Water operates a waste water recycling plant that blends about 3 Mℓ/day into the potable supply system. Umgeni Water’s supply to Siza Water is expected to be 11.2 Mℓ/day in 2022/2023, 11.4 Mℓ/day in 2023/2024 and 11.7 Mℓ/day in 2024/2025. The historical and future predicted increase in demand for the company is presented in **Figure 3.7**.

At the time of determining the projections in August 2022, iLembe DM had decommissioned the Mvoti Water Treatment Works. This additional demand is now supplied by the Lower Thukela Bulk Water Supply Scheme. There has been a constrained supply to Ndwedwe and Maphumulo as a result of the effects of load shedding. The demand for iLembe District Municipality is expected to be 68.3 Mℓ/day in 2022/2023, 69.9 Mℓ/day in 2023/2024 and 78.2 Mℓ/day in 2024/2025. The historical and future projected increase in demand for iLembe District Municipality is presented in **Figure 3.8**.

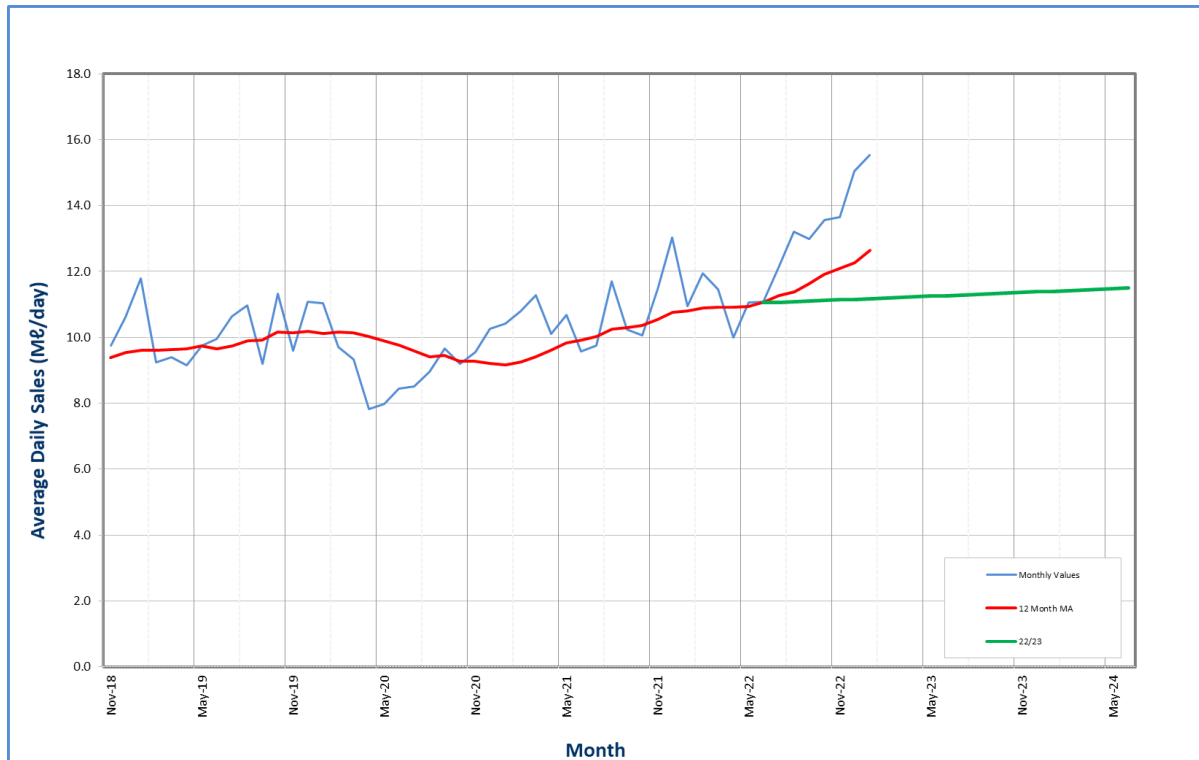


Figure 3.7 Siza Water Total Sales Volumes - Annual short-term forecast.

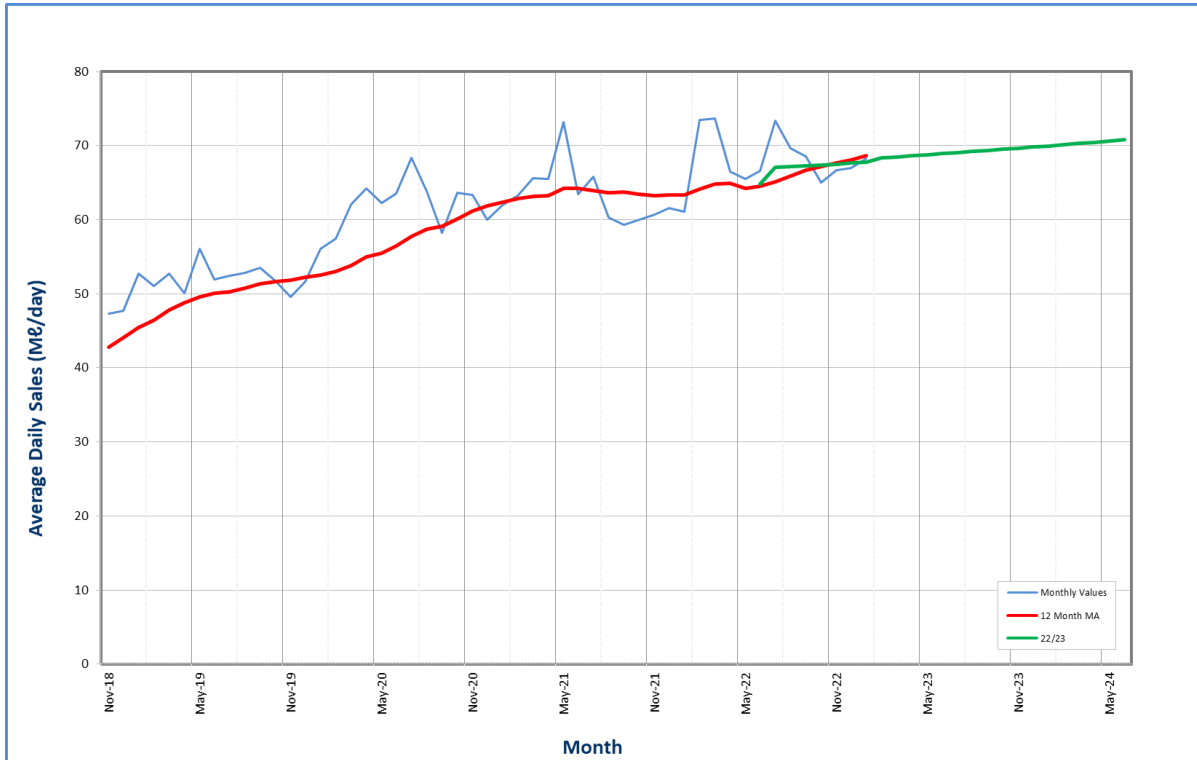


Figure 3.8 iLembe District Municipality Total Sales Volumes - Annual short-term forecast.

3.2.5 Ugu District Municipality

Total sales to the Ugu District Municipality remained “constant” during the 2020/2021 financial year. The marginal increase in sales to Ugu DM may be attributed to Umgeni Water taking over the operations at Harding and Weza WTP’s. Challenges in existing supply to various areas, as well as installed capacity constraints at the various WTP’s, continue to limit the demand in sales volume.

The expected growth in sales to the Municipality is estimated at 4.7% in the 2022/2023 financial year and 2.2% in 2023/2024 (Figure 3.9). The current water resources are insufficient to meet the projected water demands. Furthermore, the water requirements exclude an estimated 30 ME/day suppressed demand within the supply area as a result of infrastructure constraints. Although the water resources within the local rivers and dams have recovered, the area is still augmented by up to 70% from the Mgeni System via the South Coast Augmentation Pipeline and the South Coast Pipeline.

The demand projection scenario was based on operating the local Water Treatment Plants at design capacity. Hence the forecast sales growth is constrained by the available supply in the short term.

The recommended augmentation for the Upper and Middle South Coast Supply Area (refer to Section 10) is the Lower uMkhomazi Bulk Water Supply Scheme (LUBWSS). A shortfall in water supply is projected until the LUBWSS is implemented.

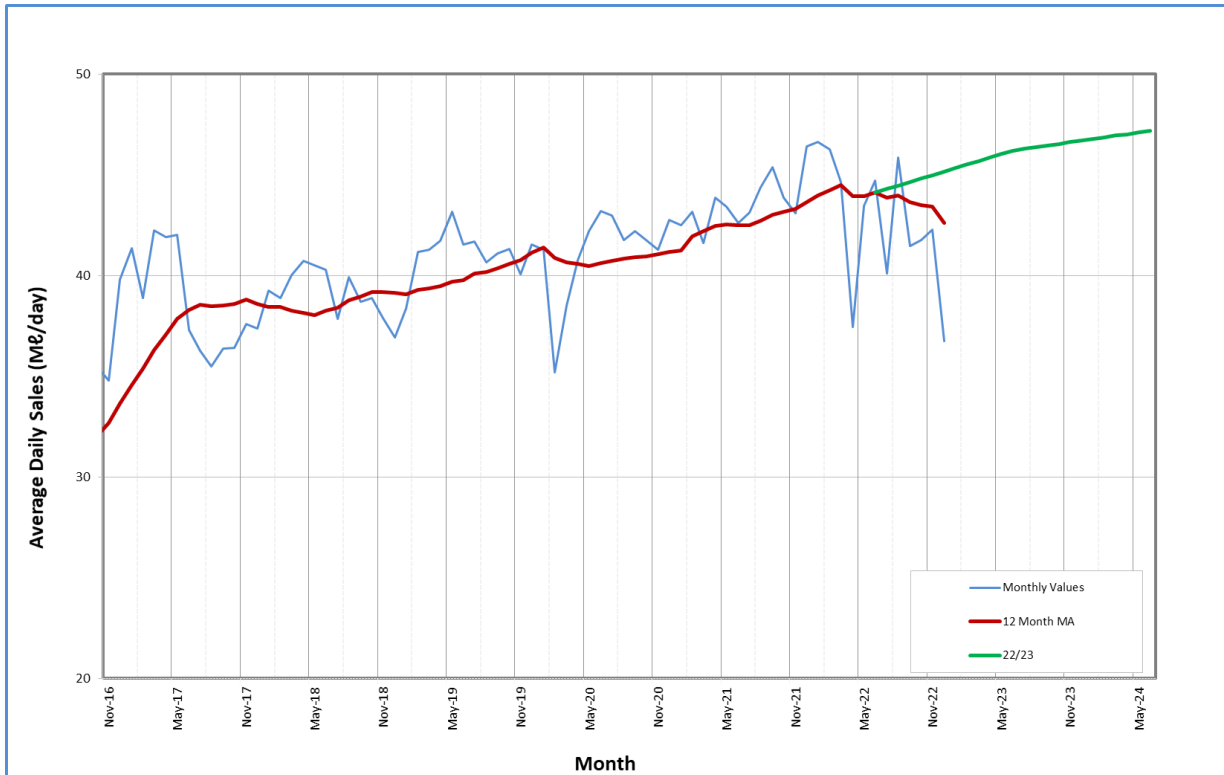


Figure 3.9 Ugu District Municipality Total Sales Volumes - Annual short-term forecast.

3.2.6 Harry Gwala District Municipality

The Ixopo WTP supplies the Greater Ixopo Area. Average daily sales from the WTP between July 2021 and June 2022 is approximately 2.40 Mℓ/day. There was an increase in the monthly sales from November 2021 to June 2022. The year on year growth was 2.3%. The demand increased over the year but remained relatively steady. The Harry Gwala Municipality has agreed that a growth of 1.5 % per annum is an appropriate growth for demand projections over the next four years for this area (Figure 3.10).

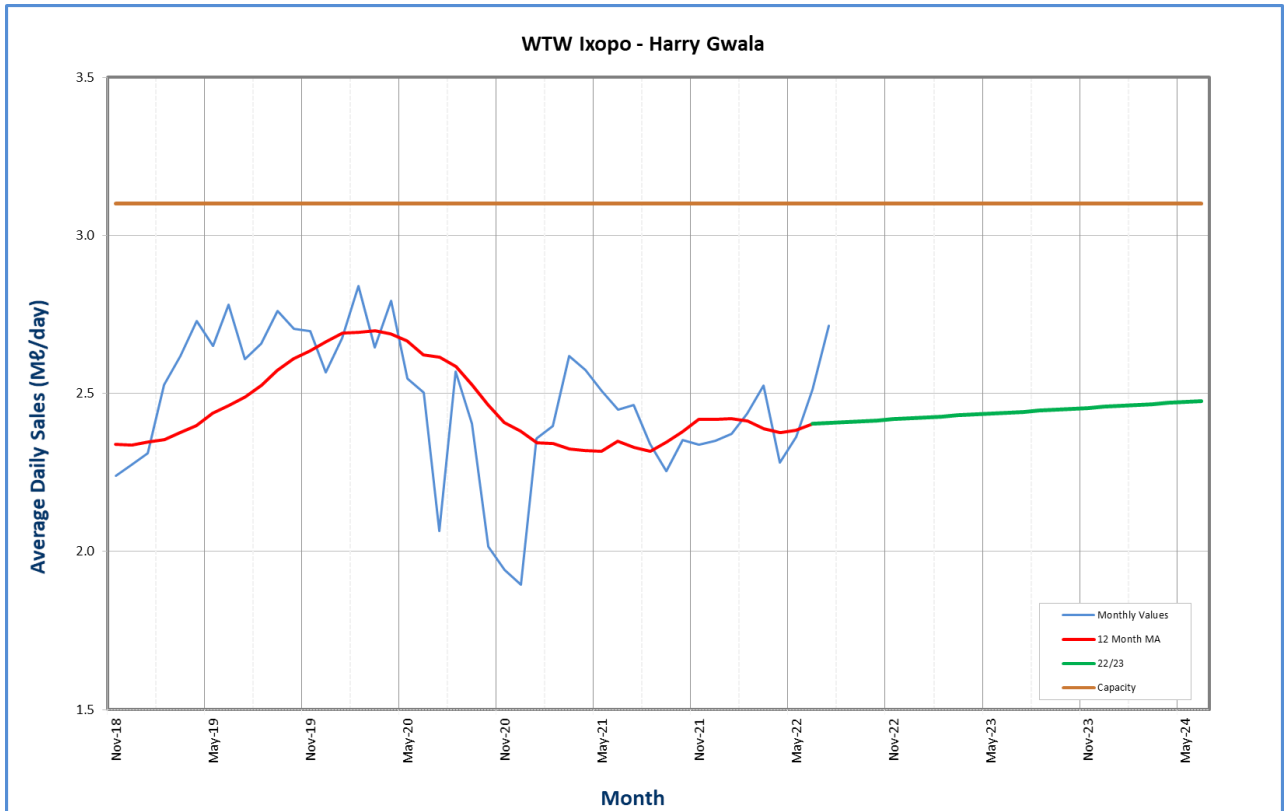


Figure 3.10 Harry Gwala District Municipality Total Sales Volumes - Annual short-term forecast.

3.2.7 King Cetshwayo District Municipality

Umgeni Water became the bulk potable water provider for the King Cetshwayo District Municipality in October 2020. This includes the operation, maintenance and management of some existing secondary bulk schemes, including WTPs, Package Plants, and a number of Rudimentary Schemes. The average daily sales for the 2021/2022 financial year to the King Cetshwayo District Municipality area of supply was 42.39 Mℓ/day (Figure 3.11).

The 12 month moving average indicates that there was an increase in the sales volumes during the peak season and there was a gradual decline in sales volumes as the year was progressing.

The King Cetshwayo District Municipality anticipates a growth of 2.5%, which is an appropriate demand projection over the next three years for this area. The reason for the large anticipated growth is due to the ongoing refurbishment and upgrading of the current systems that will allow for a larger sale volume.

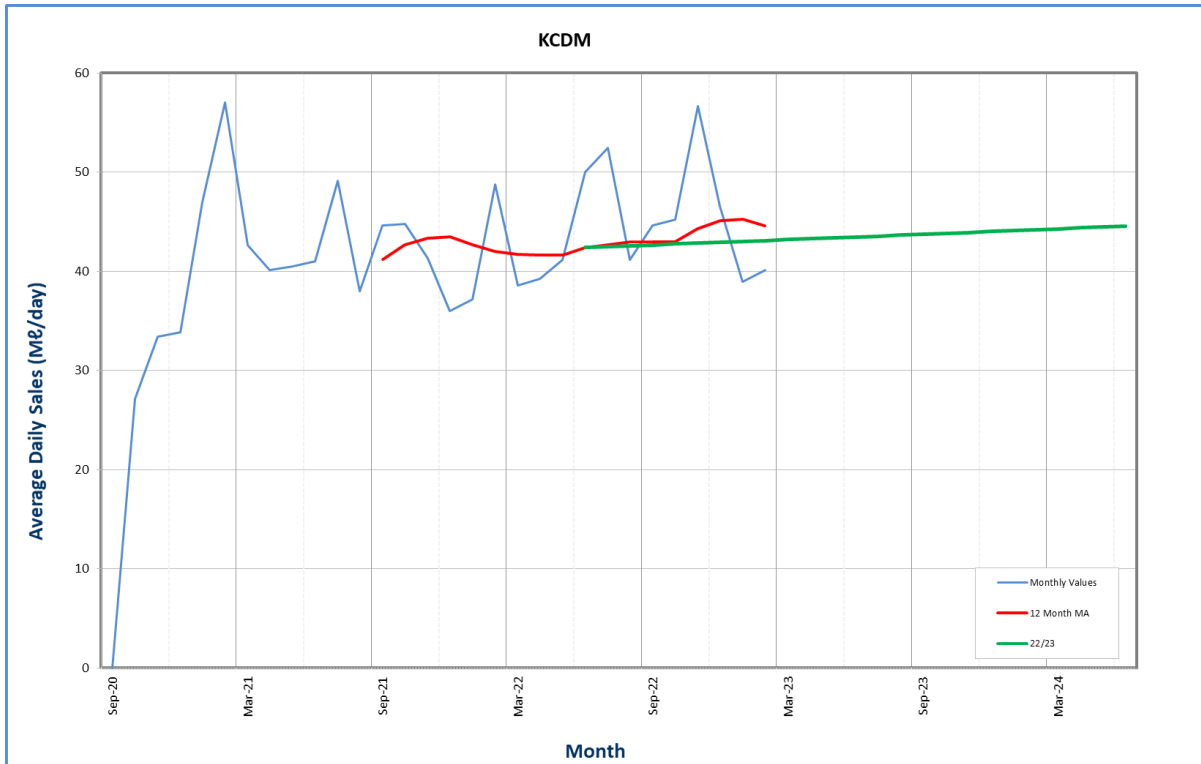


Figure 3.11 King Cetshwayo District Municipality Total Volumes - Annual short-term forecast

3.3 Long-Term Forecast

The 30-year long-term sales forecast for Umgeni Water’s supply area (**Figure 3.12**) takes into account increased sales (following the recent drought and commissioning of the eThekweni Western Aqueduct, new supply to KCDM, anticipated natural growth from the existing supply system, and bulk sales from new supply infrastructure that would extend the area supplied). A base projection has been developed from the short-term forecasts described in **Section 3.2** of this report and then extended at a compounded 1.5% per annum growth rate until 2051/2052. This growth rate is indicative only and assumes growth into new area. The curtailment of growth in the Mgeni System as a result of high water losses and infrastructure now operating at capacity is almost certain to negatively affect the growth in water sales until the uMkhomazi Water Project is constructed.

Furthermore, Umgeni Water (UW) has embarked on a water demand project to install flow control valves at the sales meters of supply areas that have been drawing far more than their agreed theoretical water demand. A take on gate review meeting has been concluded in May 2022 and the project is at an inception stage (feasibility). Theoretical demands of respective zones within each WSA will be agreed with the respective WSAs for the purpose of design and installation of flow control valves. This will enable UW to provide equitable supply to all customers. At present, the Water Treatment Plants within the Mgeni System are operating at near capacity as a result of high water losses within municipal systems. UW will consider the installation of flow control valves at the sales meters where unnecessarily high water losses are experienced. This will, however, be done in consultation with the respective WSAs. UW has begun liaising with the WSAs in this regard.

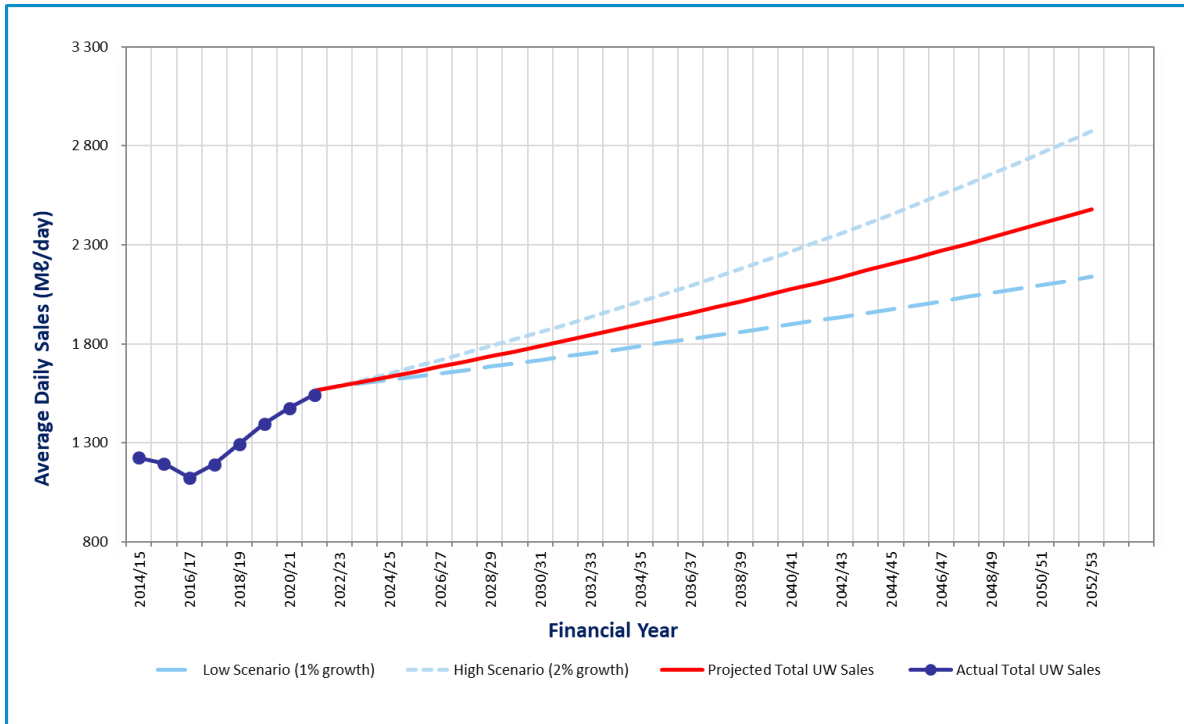


Figure 3.12 Umgeni Water Long-Term Bulk Water Sales Forecast.

4. WATER CONSERVATION AND WATER DEMAND MANAGEMENT

4.1 Background

Umgeni Water's Water Conservation (WC) Policy was adopted in 1999 and the Water Demand Strategy in 2013. These two documents elaborate on the legislative requirements (Umgeni Water 1999; 2013) and the primary reasons for Umgeni Water implementing water demand management, namely:

- To be able to supply all reasonable demands without placing undue stress on exploitable water resources
- To minimise expenditure on developing new resources
- To postpone capital expenditure on expanding bulk water infrastructure.

(Umgeni Water 2013: 3)

The purpose of this section is to:

- (i) Summarise briefly the water demand management (WDM) practices currently being implemented within Umgeni Water; and
- (ii) To detail and elaborate on the WDM initiatives that Umgeni Water is undertaking in partnership with Department of Water and Sanitation (DWS) to assist the Water Service Authorities (WSAs) within the KwaZulu-Natal (KZN) province.

4.2 Current Water Demand Management Practices within Umgeni Water

Umgeni Water undertakes water balances in each of the bulk water supply systems that it operates (**Sections 8, 9, 10, 11 and 12**) in order to determine an indication of the water losses. The results of these water balances indicate that the overall water loss in the bulk systems (including losses from backwash water at the water treatment plants) is less than 5%. This does not include the King Cetshwayo District Municipality, which is a new growth area/region of Umgeni Water. Umgeni Water is committed to reducing or maintaining the average water loss below this level of 5% by continuing to implement asset management plans and ensuring targeted investment in maintenance throughout all the bulk systems.

Current WDM practices being implemented within Umgeni Water include:

- Monthly water balance exercises
- Meter accuracy testing, and calibration thereof (meters are replaced every five years)
- Monitoring and reduction of the average turn-around time to repair leaks and bursts
- Education programme / communication on water conservation water demand management (WCWDM)

The above practices are undertaken diligently and are budgeted for, and thus contribute to the achievement of Umgeni Water's WCWDM objectives summarised in **Table 4.1**.

Table 4.1 Water Demand Management objectives for Umgeni Water (2013: 10).

Objective	Purpose
1. Implement efficient distribution management measures.	Minimise non-revenue water and manage distribution losses.
2. Ensure adequate information to support decision-making.	Accurate information on all aspects of the supply system is vital for the management of system performance.
3. Promote the efficient use of water by customers.	Educate all consumers on the efficient use of water.
4. Adopt Integrated Planning principles.	Develop a sound relationship with customers to integrate planning and development initiatives.
5. Contribute to the Catchment Management strategy.	Effective WDM initiatives will relieve the stress on the resource and thus aid in the management of catchments.
6. Ensure adequate institutional and financial capacity for WDM.	Constantly review and modify (if needed), Umgeni Water's structure and work ethic.

4.3 Assisting WSA's in Reducing Non-Revenue Water

Umgeni Water, as a Bulk Water Service Provider, is cognisant of the impact that Non-Revenue Water (NRW) has on the ability of WSA's to sustainably supply consumers. WSA's within KZN face the challenges of poor and ageing infrastructure. They still have some challenges with regards to technology and vital skills needed to combat NRW. As a result the municipalities are "faced with almost insurmountable odds in combatting water loss".

Umgeni Water, in response to the mandate provided by the Minister of Water and Sanitation, has been providing strategic assistance to all KZN WSA's so that sustainable improvements can be made in the province. This assistance is through the KZN Regional Office of DWS and the Department of Cooperative Governance and Traditional Affairs (CoGTA).

Umgeni Water established a Water Demand Management (WDM) Unit in 2016 to provide support to WSA's in curbing water losses in their respective water supply systems. This WDM Unit provides measurement and analytical support with technical recommendations where necessary. Four areas of framework support that Umgeni Water is currently providing assistance with are:

- (i) **Strategic** – preparation/updating of specific WCWDM master plans for each WSA.
- (ii) **Tactical** – provision of specialist technical assistance and engineering advice for WCWDM or NRW reduction implementation.
- (iii) **Regulatory** – provision of assistance and support for No Drop assessments, monthly reporting to DWS (e.g. WSA submission of water balance and water saving reports to DWS in compliance with regulatory requirements) and training to WSA's to ensure sustainability. This includes tailor made WCWDM handbooks for each WSA.
- (iv) **Financial** – not direct funding support, but assistance in preparation of business plans and funding applications, and tailor made WCWDM handbooks for each WSA. etc.

In addition to the four areas of support, UW is concluding a NRW pilot project at Mpophomeni Township in Howick. This project aims to provide door-to-door community awareness and facilitate internal leak identification and repair. This project was completed by April 2023.

In 2016/17 the DWS developed a report into the State of Non-Revenue Water in KwaZulu-Natal. This report provided comprehensive water balances for each of the 14 Water Service Authorities (WSA's)

in the Province. In addition, Key Performance Measures, economic analysis and an institutional assessment of the capacity and capability of the WSA's to plan, deliver and monitor Water Conservation and Water Demand Management (WCWDM) projects were also defined.

The first study was completed in 2019 and an update of the Non-Revenue Water state in the Province was prepared to highlight any changes in water supply conditions. The figures used in The State of Non-Revenue Water report for the 2021/2022 financial year have been based on information provided by the WSA's in terms of their regular reporting to DWS and UW.

It has not been possible to verify the accuracy of the data provided – where relevant, comments on the validity of the submitted data per WSA have been raised by UW, and the WSAs have been sensitised to this at the quarterly WCWDM forums (and through email correspondence). As such, the accuracy of the data has progressively improved during recent years.

The full report therefore presents the following:

- i) A summary review of the status of Non-Revenue Water in KwaZulu-Natal for the 2021/2022 financial year;
- ii) An assessment of the status of Non-Revenue Water in KwaZulu-Natal for the 2021/2022 financial year, as well as a comparison to the 2020/2021 financial year;
- iii) A review of historical trends of water balances in the Province, dating from the 2017/18 financial year (pre-drought conditions);
- iv) Challenges experienced by the WSA's that affect NRW;
- v) Cautionary notes; and
- vi) Recommendations for continued assistance, monitoring and evaluation.

In the spirit of intergovernmental relations (IGR), a partnership between DWS, Umgeni Water and the CoGTA was formed in 2017/18 to further assess the state of Non-Revenue Water across the Province, and to identify cost-effective measures to reduce Non-Revenue Water. This partnership is ongoing and is part of KZN Water Conservation and Water Demand Management Forum.

4.4 Update of Relevant Water Supply Scheme Information

A comparison of the 2020/2021 data with the 2021/2022 data identified the following (State of Non-Revenue Water Report for the 2021/2022 financial year):

- The length of mains increased by 1 578 km in KZN from the 2020/21 to 2021/22 financial year. This would imply that significant new infrastructure is being constructed although this is most likely not the case. The accuracy of the data reported in 2021/22 could not be verified at the time of drafting this report, as it would be impractical for UW and its service providers to try to verify such data;
- A connection is defined as any point of water supply by the WSA and can be formal, informal, or unauthorised. The total number of connections was reported as being 27 539 more than what was recorded in 2020/21. Several errors have been identified from the data submitted by the WSAs, including confusion on what constitutes a connection and how to go about categorising them for input into the IWA water balance. It appears that some WSAs do not update these figures as they remain constant for years. Nonetheless, an increase in

water connections is a positive trend as an increase in formal and informal connections results in an increase in the consumption;

- Average supply pressure has changed from a provincial perspective, but in a downward direction, which could be due to intermittent water supply, however, the Municipalities have provided very little data in this regard. A number of individual WSAs improved in terms of pressure reduction, while others increased their average operating pressure. The WSAs continue to be perplexed and uncertain about how to calculate average pressure. Furthermore, as natural disasters (flooding and drought) become more common in the province, certain WSAs have more intermittent supply.;
- Average percentage time pressurised in the networks was not accurately completed by the WSA's. Each WSA reported a varying percentage for pressurized system for the fiscal year, which cannot be independently verified on how their calculations were carried out. For the previous fiscal year, an approximation of % time pressurised was used using the service provider's knowledge, and the figure is decreasing over time, which is concerning from the standpoint of service delivery. This will once again be part of the training program in the future.

(MAP AFRICA 2022: 7)

4.5 Update on Water Balance

The International Water Association (IWA), developed the standard water balance to benchmark and evaluate the performance of water distribution systems (bulk and reticulation) and it is being promoted across the world as best practice. The IWA standard water balance was slightly modified for South Africa to allow for free basic water (Table 4.2).

Table 4.2 Modified International Water Association (IWA) Water Balance.

Volume from Own Sources (corrected for known errors)	System Input Volume	Water Exported (corrected for known errors)	Billed Water Exported			Revenue Water
		Water Supplied	Authorized Consumption	Billed Authorized Consumption	Billed Metered Consumption	Revenue Water
Water Imported (corrected for known errors)					Water Losses	Unbilled Authorized Consumption
		Unbilled metered Consumption				
		Apparent Losses	Unbilled unmetered consumption			
			Systematic Data Handling Errors			
			Customer Metering Inaccuracies			
		Real Losses	Unauthorized Consumption			
			Leakage on Transmission and Distribution Mains			
	Leakage and Overflows at Utility's Storage Tanks					
	Leakage on Service Connections up to the point of Customer Metering					

NOTE: All data in volume for the period of reference, typically one year.

The water balance tracks, from left to right, how a water utility supplies water volumes from source to customer, and provides the format for the utility to quantify amounts of billed and lost water.

Figures indicated below are mostly based on this IWA table and are supplied by WSA's on a monthly basis as part of DWS's regulatory requirements on a specially prepared spreadsheet.

The following is noted in terms of the change in water balance components across the Province from the 2020/21 to 2021/22 financial years, with the consideration that uMkhanyakude DM has not provided any information in the past two financial years:

- Water Supplied (System Input Volume) into the reported water supply systems across the province increased by 5.3% It is still noted that many WSAs are not correctly or accurately reporting the Water Supplied volumes, particularly from standalone or borehole-supplied schemes. It is estimated that water supplied across the province is under-reported, though this will require further investigation and further attention.
- Authorised Consumption decreased by 2.3% while Billed Metered Consumption also decreased by 7.5% and Billed Unmetered Consumption increased by 10.4%.
- In terms of improving revenue through the billed metered consumption, Amajuba, uThukela and Msunduzi Municipality showed great improvement by 71 443 kℓ, 1 414 982 kℓ and 3 225 758 kℓ respectively. eThekweni showed a decrease in billed metered consumption by 25 564 953 kℓ.
- Potential Revenue Water (volume only, not revenue as measured in monetary terms) decreased by 6.2% (24 220 108 kℓ). eThekweni Municipality were the main contributor to the decrease as the WSA recorded a decrease of 25 564 953 kℓ in billed metered consumption.
- Unbilled Authorised Consumption increased by 23.8% from the 2020/21 financial year, with City of uMhlatuze, uMgungundlovu and Zululand contributing to the increase. This must be viewed in terms of an offset and might have been recorded as Unauthorised Consumption
- The total losses for the 2020/21 to 2021/22 financial year are 1 148 Mℓ/day, with Apparent Losses and Real Losses (leakage) increased by 21.4% (from 644 Mℓ/day to 782 Mℓ/day). Most WSAs in the province utilise the Percentage Commercial Loss Guideline for calculating their apparent losses and with the remainder of the losses being real losses. It was noticed that WSAs do not put much analysis into these percentages as it remains the same for many financial years, which results in incorrect water loss distribution. It is advised that the WSAs calculate the percentages based on in-situ data and calculation viz:
Unauthorised consumption %: unauthorised connections divided by total number of connections
Meter error %: In-situ meter accuracy testing during normal operation and maintenance procedures.
Date transfer error %: Actual consumption subtracted by the consumption in the billing reports, divided by the actual consumption.
- Non-Revenue Water volumes increased by 18.1% since the 2020/21 financial year.

In summary, a total of 2 159 Mℓ/day (compared to 2 050 Mℓ/day from the previous financial year) is supplied to the province's served population, with 1 012 Mℓ/day of that being billed to consumers (compared to 1 078 Mℓ/day from the previous financial year). This means that 1 148 Mℓ/day is being lost to Non-Revenue Water (compared to 972 Mℓ/day from the previous financial year), of which 782 Mℓ/day is lost to apparent and real losses (compared to 644 Mℓ/day from the previous financial year). The comparison of the different water balance components has been presented in **Figures 4.1 to 4.9**. Available key performance measure information of all the water supply systems across the province, per WSA.

(MAP AFRICA 2022: 17)

4.6 Non-Revenue Water Economics

The unit cost of water increased by 7.7% from a provincial weighted average of R11.64/kl to 12.54/kl excluding VAT, while the lowest average sales tariff for domestic consumers also increased from a provincial weighted average of R15.77/kl to R16.96/kl. These rates were used to calculate either the cost or equivalent lost revenue of various water balance components.

In summary, the following can be noted for the 2021/2022 financial year:

- The annual estimated cost of Water Supplied across the province increased by 13.9% from R8 758 198 220 in the 2020/21 financial year to R9 978 831 172 in the 2021/22 financial year;
- The annual estimated cost of Non-Revenue Water across the province increased by 79.2% from R2 740 278 436 in the 2020/21 financial year to R4 910 878 501 in the 2021/22 financial year;
- The annual estimated equivalent lost revenue from Non-Revenue Water across the province increased by 31.6% from R6 770 059 614 in the 2020/21 financial year to R8 906 750 852 in the 2021/22 financial year;
- The annual estimated equivalent lost revenue from Unbilled Authorized Consumption across the province increased by 34.4% from R644 384 948 in the 2020/21 financial year to R866 321 420 in the 2021/22 financial year; and
- The annual estimated cost of Real Losses (Leakage) across the province increased by 31.9% from R2 775 985 339 in the 2020/21 financial year to R3 662 496 535 in the 2021/22 financial year. (MAP AFRICA 2022: 43)

4.7 KZN WSA Non-Revenue Water Trends

A comparison for the period 2020/21 – 2021/22 for the KZN WSA's is summarised below.

4.7.1 Water Balance Analysis Across the Province

Water Supplied, Billed Authorized Consumption, Non-Revenue Water and Real Loss volumes from the period 2017/18 financial year to 2021/22 financial year i.e., five years of historical data and trends for both the Province and each of the individual WSA's (14 in total). (

Figure 4.2).

(MAP AFRICA 2022: 44)

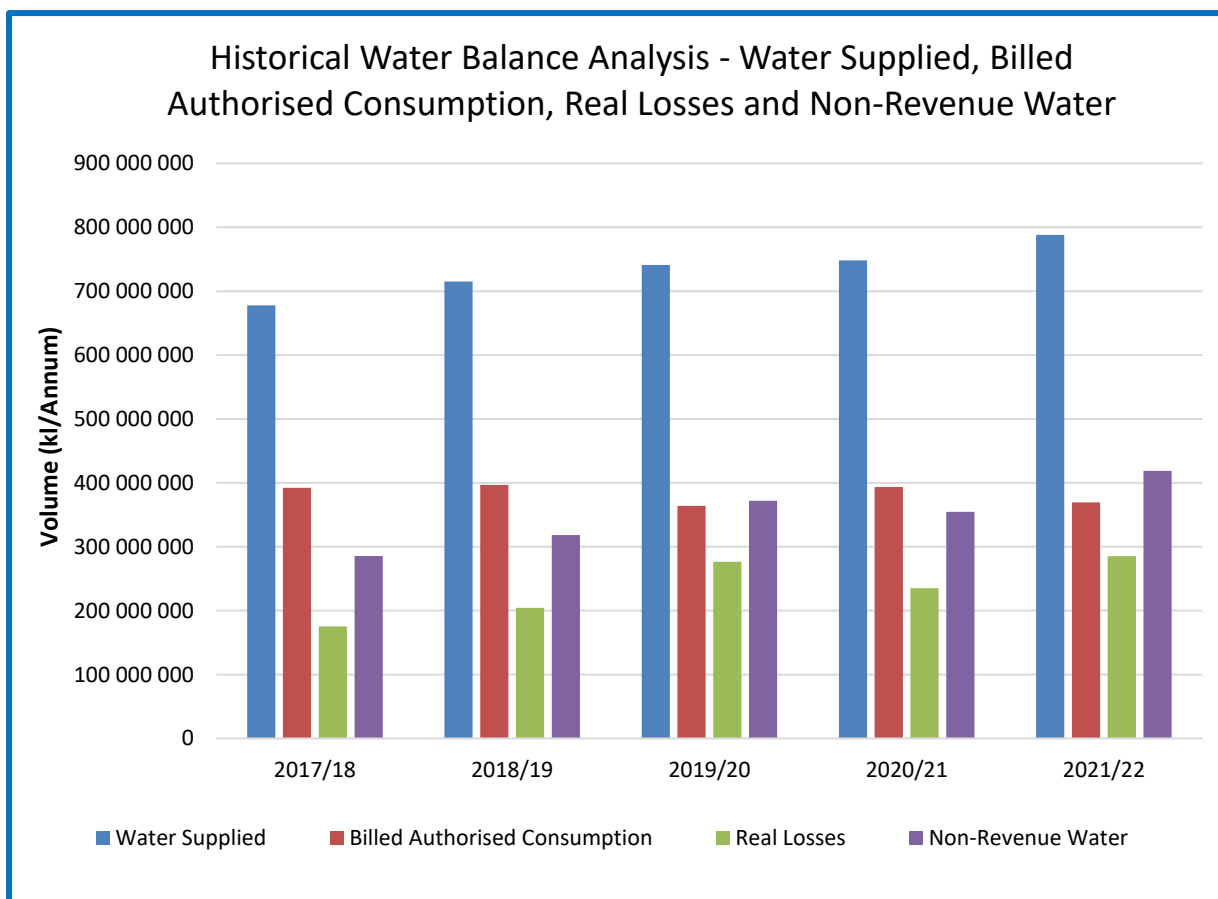


Figure 4.1 Historical Water Balance Analysis (2017/2018 to 2021/2022) (MAP AFRICA 2022).

4.7.2 Length of Mains

The length of mains, as reported 2021/22, was reported as being 48 525km, which is 1 578km more than that recorded in 2020/21 (

Figure 4.22). This would indicate that new infrastructure is being installed through the Province although this total increase in mains length does seem unlikely. The accuracy of the data reported in 2021/22 could not be verified at the time of drafting this report.

(MAP AFRICA 2022: 7)

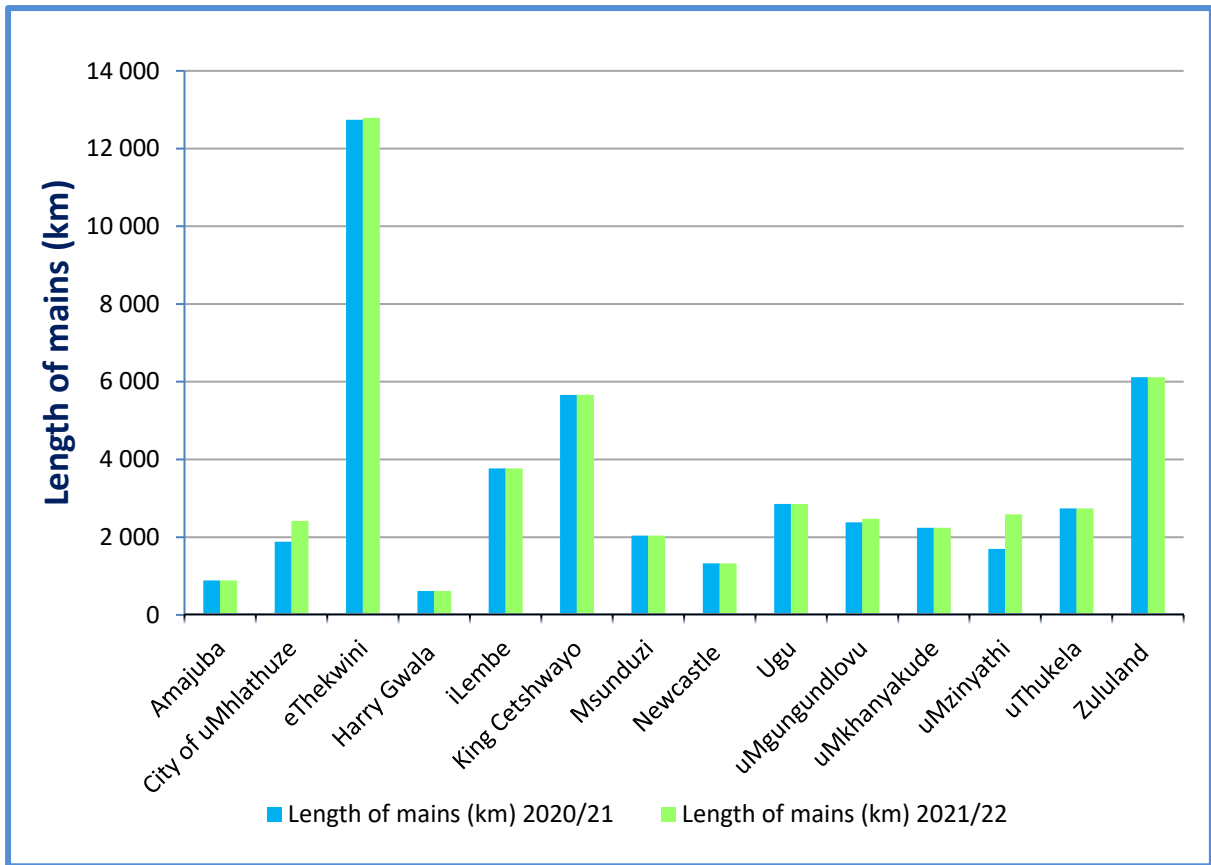


Figure 4.2 WSA length of mains (2020/2021 vs 2021/2022) (MAP AFRICA 2022).

4.7.3 Number of Connections

A connection is defined as any point of water supply by the WSA and can be formal, informal, or unauthorised. The number of connections was reported as being 1 568 731, an increase of 27 539 between 2020/21 and 2021/22 (Figure 4.33). As mentioned earlier, a number of errors have been identified from the data submitted by the WSA’s (and consequently workshopped with those WSAs), including confusion on what constitutes a water connection. The quality of data will continue to improve year on year, thanks to annual training of the WSAs by UW and DWS.

(MAP AFRICA 2022: 7)

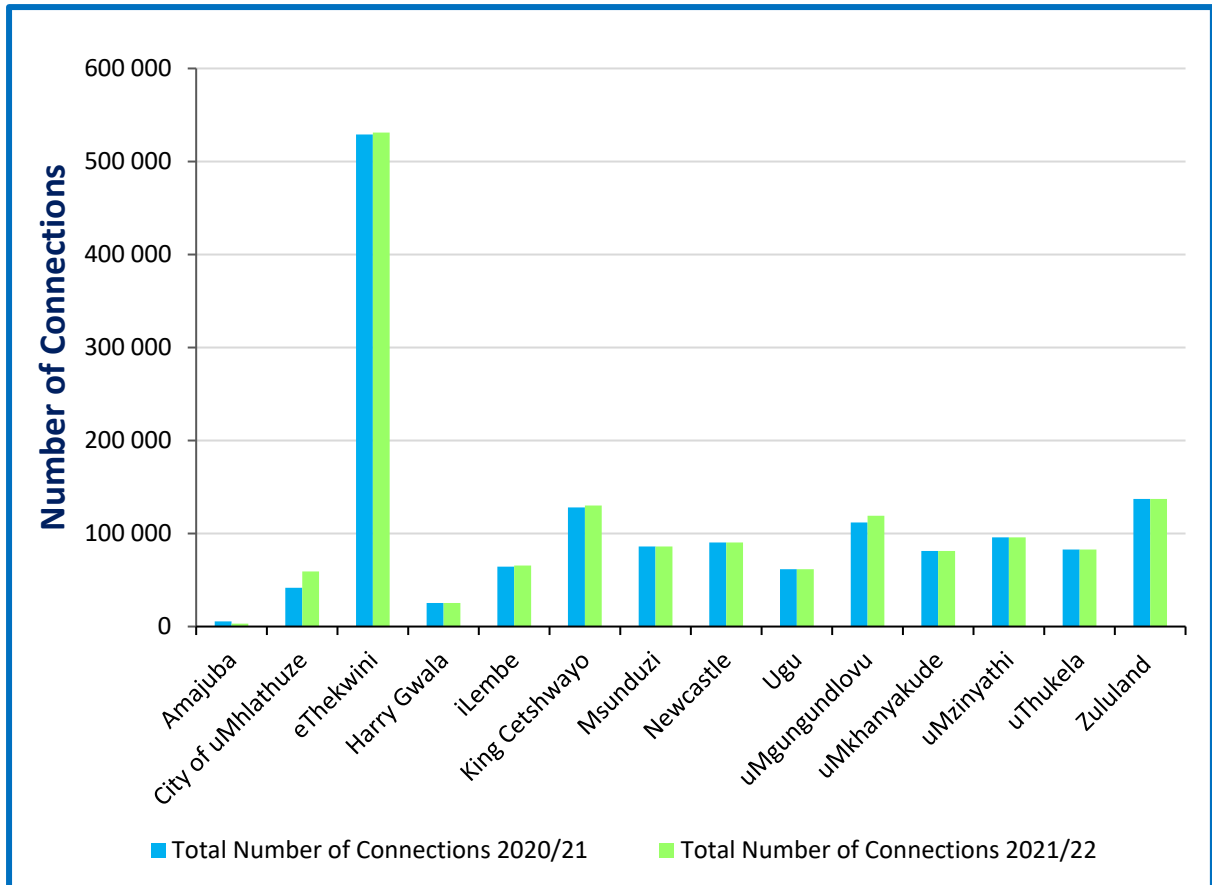


Figure 4.3 WSA total number of connections (2020/2021 vs 2021/2022) (MAP AFRICA 2022).

4.7.4 Percentage Time System Pressurised

Average percentage time pressurized in the networks was not accurately completed by the WSA's – each one of the WSA's reported varying percentages for pressurized system for the financial year. It cannot be independently verified as to how their calculations have been carried made. An approximation of % time pressurized using the service provider's knowledge was used for the previous financial year and the figure is reducing over time which is a worry from a service delivery point of view. Once again this will be part of the training program going forward. (Figure 4.3).

(MAP AFRICA 2022: 7)

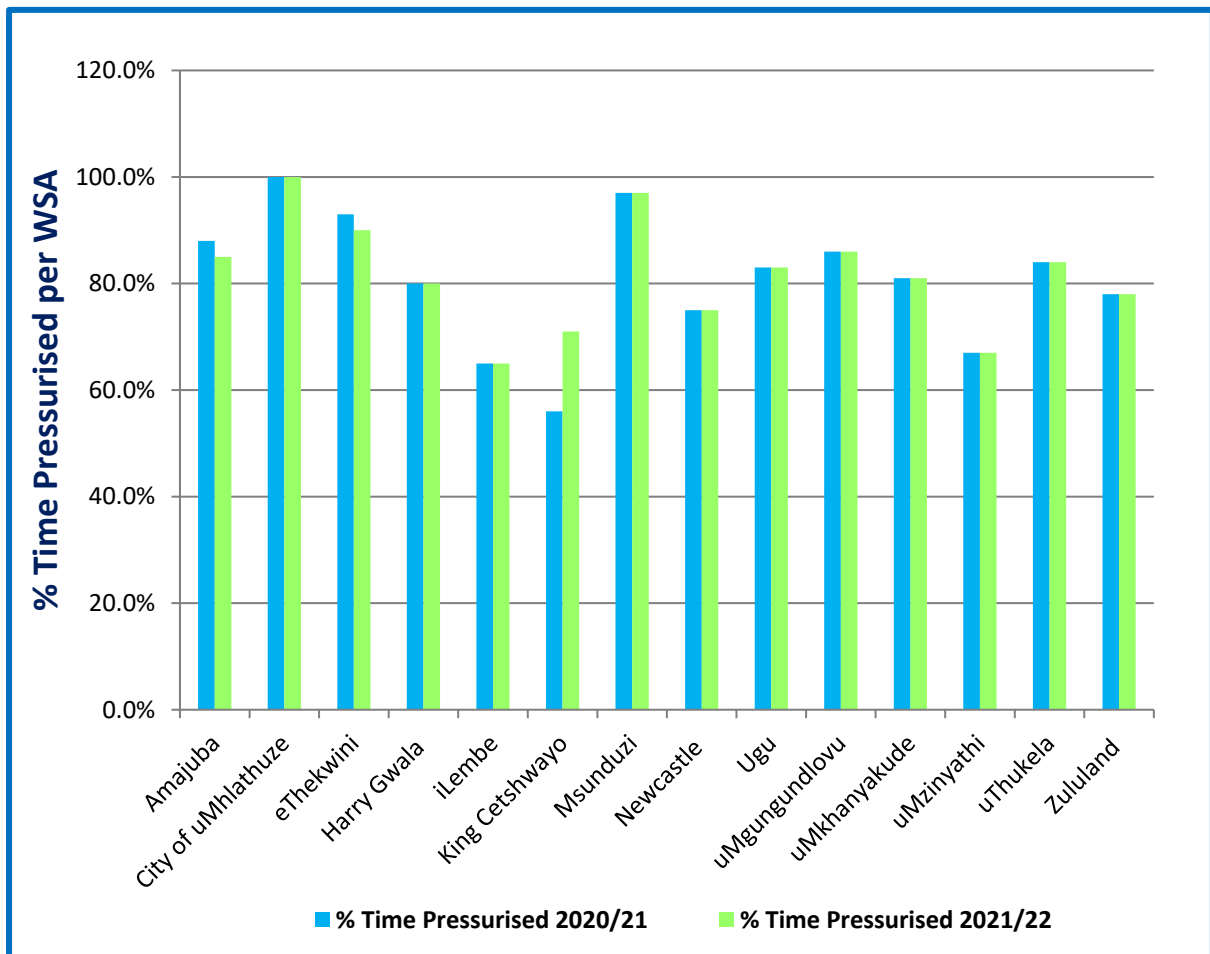


Figure 4.4 WSA percentage time system pressurised (2020/2021 vs 2021/2022) (MAP AFRICA 2022).

4.7.5 Non-Revenue Water by Volume

Non-Revenue Water volumes increased by 18.1% since the 2020/21 financial year. A total of 2 159 Mℓ/day (compared to 2 050 Mℓ/day from the previous financial year) is supplied to the province’s served population, with 1 012 Mℓ/day of that being billed to consumers (compared to 1 078 Mℓ/day from the previous financial year). This means that 1 148 Mℓ/day is being lost to Non-Revenue Water (compared to 972 Mℓ/day from the previous financial year), of which 782 Mℓ/day is lost to apparent and real losses (compared to 644 Mℓ/day from the previous financial year) (Figure 4.5).

(MAP AFRICA 2022: 16)

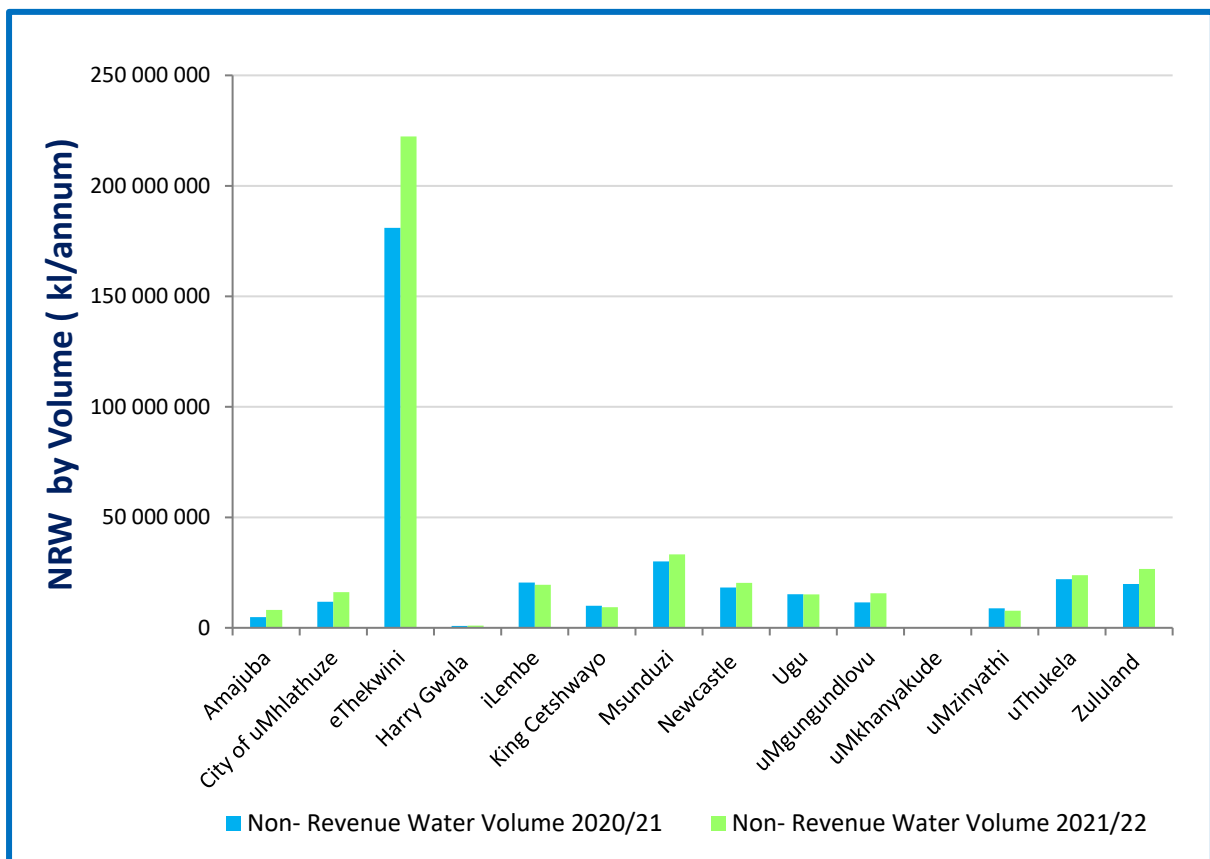


Figure 4.5 WSA Non-Revenue Water by volume (2020/2021 vs 2021/2022) (MAP AFRICA 2022).

4.7.6 Non-Revenue Water by Volume Percentage

Non-Revenue Water by Volume Percentage regressed from 51.6% to 53.7% year-on-year (Figure 4.66). However, the use of percentages as a performance measure is not considered international best practice and is actively discouraged. However the performance measure is presented for compliance purposes for the Department of Water and Sanitation.

(MAP AFRICA 2022: 25)

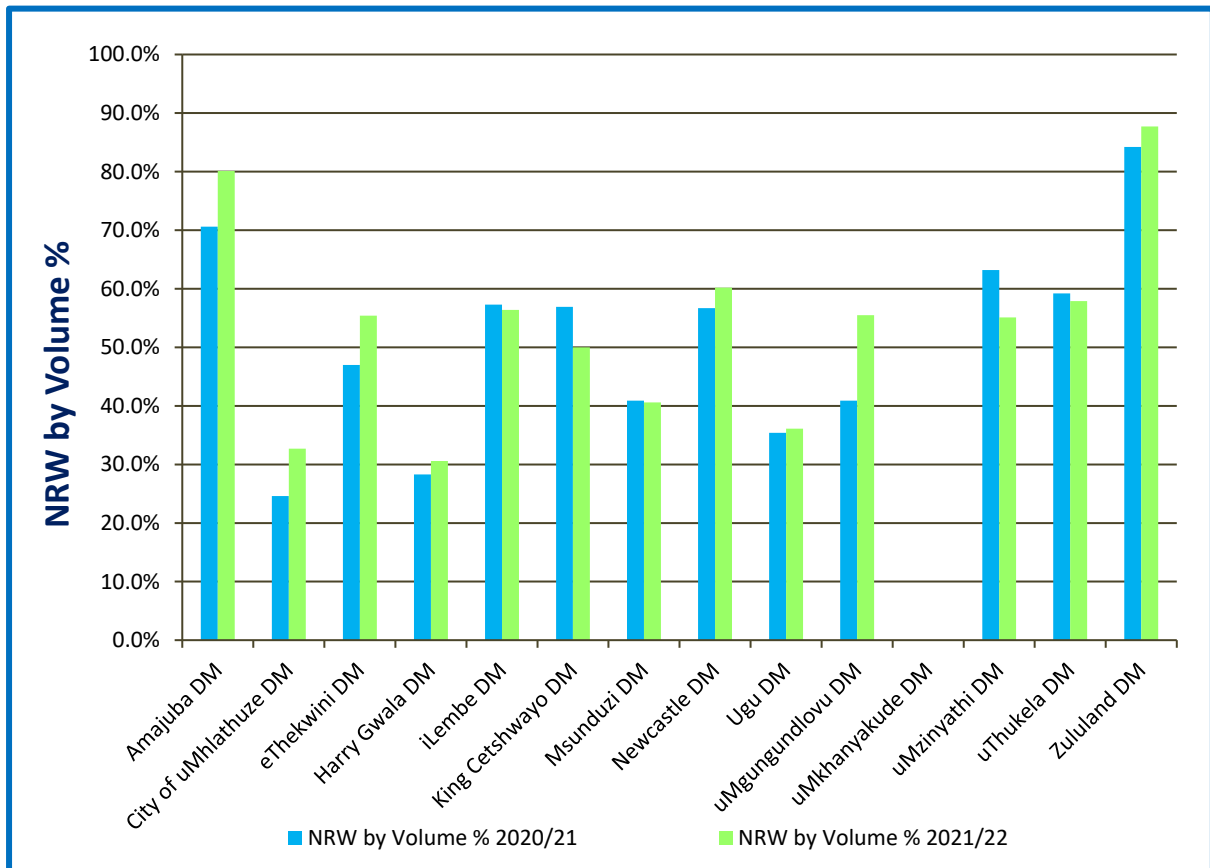


Figure 4.6 WSA non-revenue water by percentage (2020/2021 vs 2021/2022) (MAP AFRICA 2022).

4.7.7 Annual Cost of Real Losses

The annual estimated cost of Real Losses (Leakage) across the province increased by 31.9% from R2 775 985 338 in the 2020/21 financial year to R3 662 496 534 in the 2021/22 financial year (Figure 4.77).

(MAP AFRICA 2022: 36)

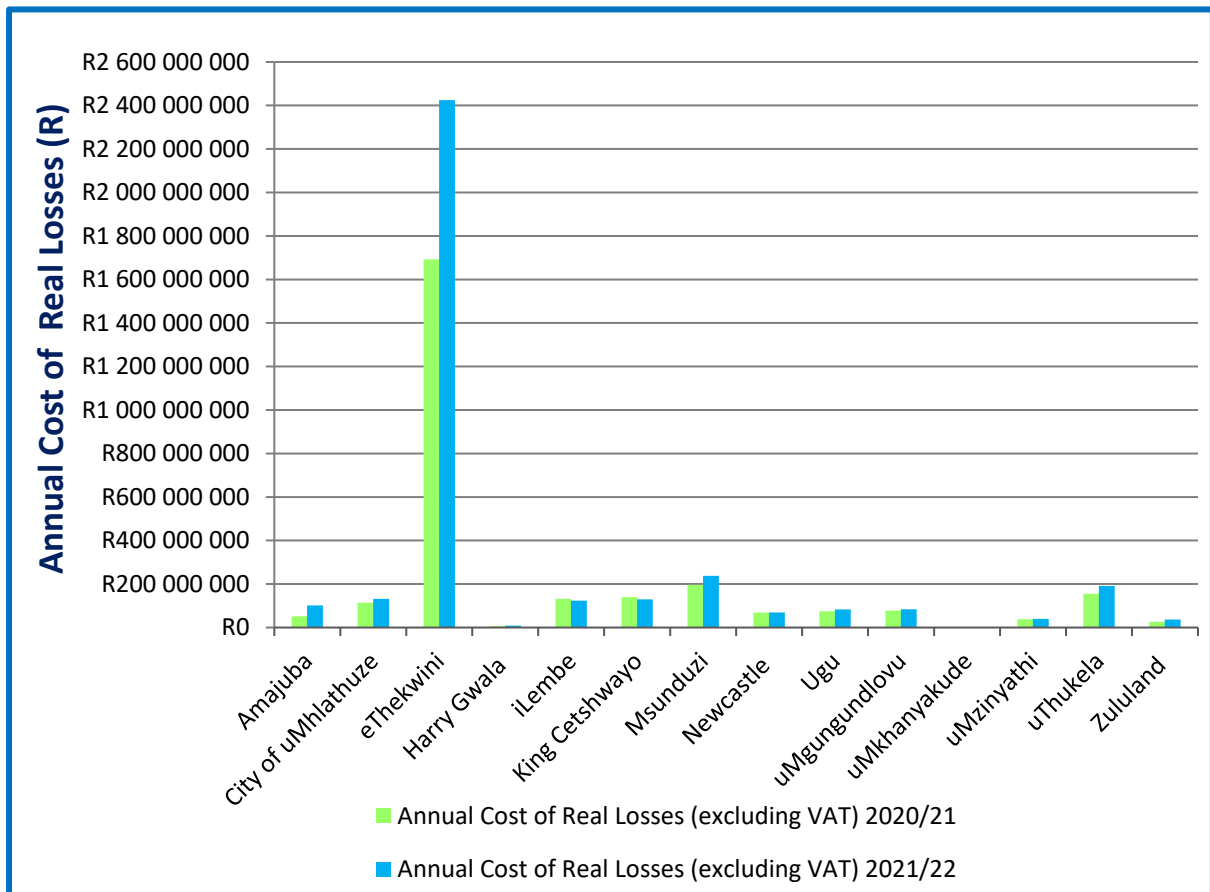


Figure 4.7 WSA annual cost of real losses (2020/2021 vs 2021/2022) (MAP AFRICA 2022).

4.7.8 NRW Historical Trends

Figures 4.8 and 4.9 indicate the 5-year historical trends, comparison of non-revenue water by volume for all 14 KZN WSAs.

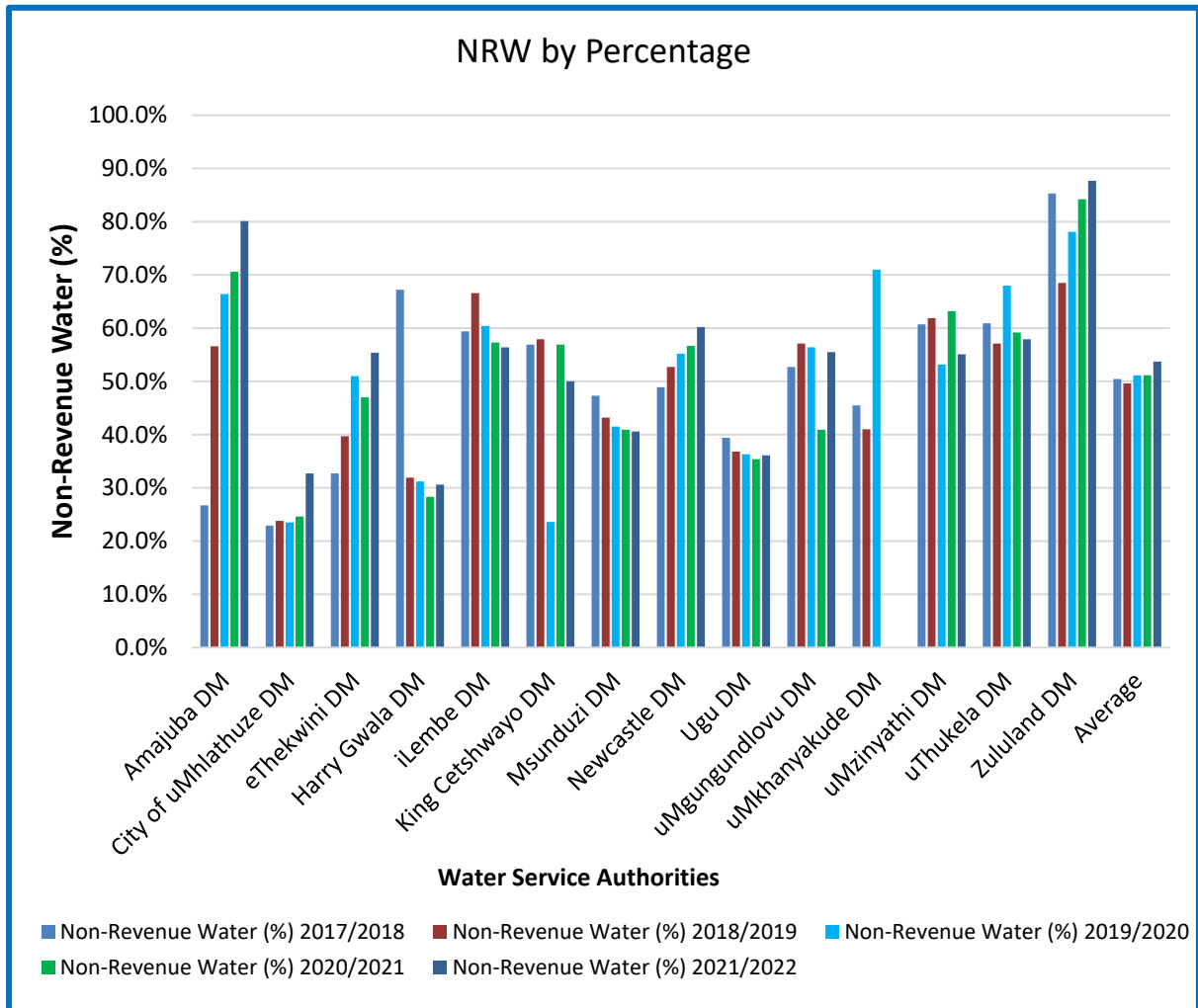


Figure 4.8 Historical NRW comparison between KZN WSAs by percentage volume (2017/2018 – 2021/2022) (MAP AFRICA 2022).

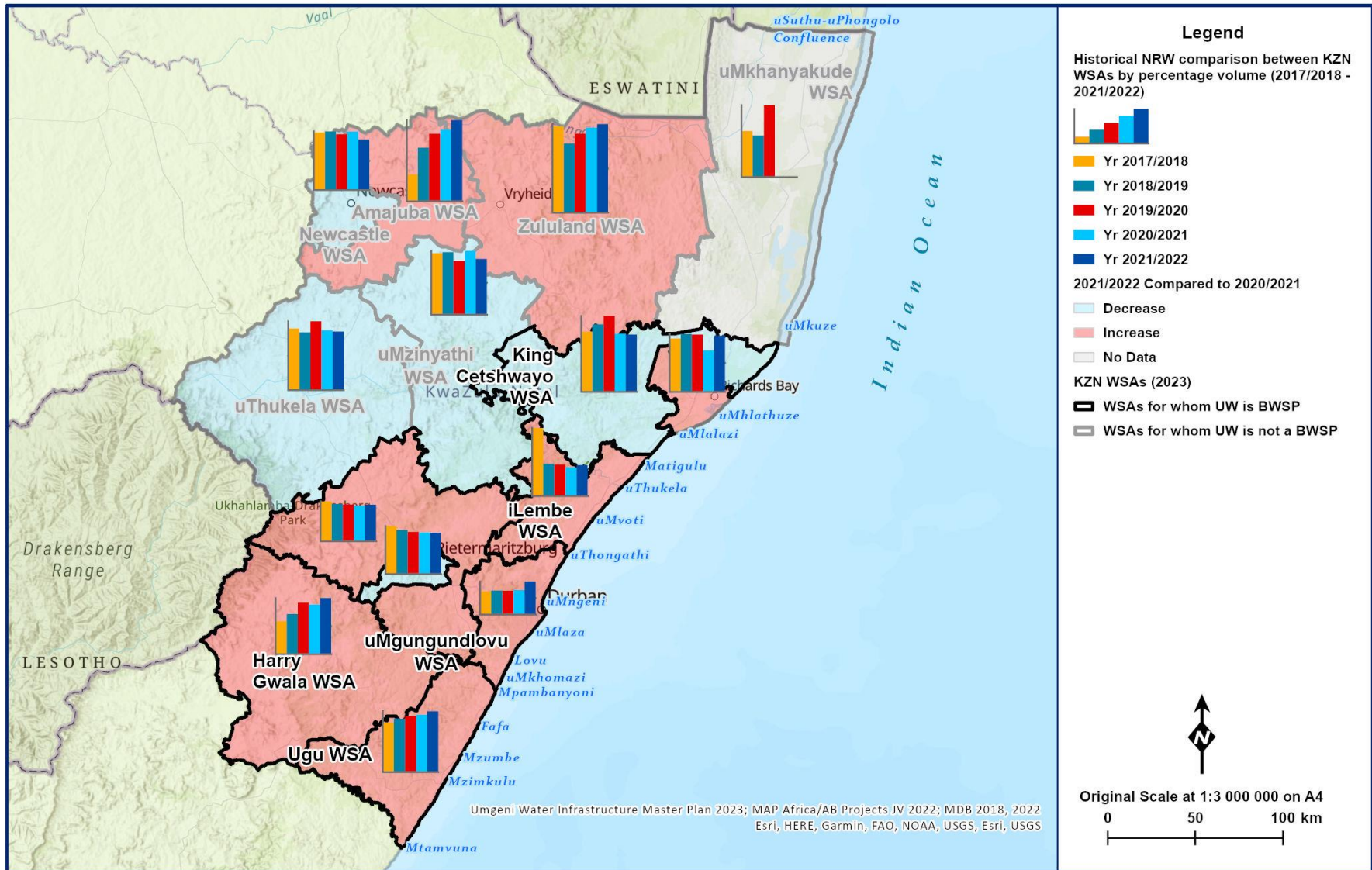


Figure 4.9 Comparison of non-revenue water by volume (MAP AFRICA 2022).

4.8 Summary on the 2021/22 KZN WCWDM Support Programme

This project is currently underway and is due to be completed in September 2023. The project has six Key Support Areas (KSAs) which are:

- KSA 1: WC/WDM State of the Province Report [100% completed and submitted]
- KSA 2: Development and Monitoring of Implementation Plan for WC/WDM in the Province [25%]
- KSA 3: Development of three (3) Business Plans (for WSAs) for Funding Application. [10%]
- KSA 4: DWS Reporting Assistance (UW actively participates in and facilitates the KZN WCWDM quarterly forum) [20%]
- KSA 5: WSA WCWDM Mentorship [35%]
- KSA 6: Program Support [70%]

4.9 Mpophomeni WC/WDM Pilot Initiative: War On Leaks

Water Demand Management Unit conducted its first pilot project in Mpophomeni, a township around 12 kilometers southwest of Howick, as part of its support for the KZN WCWDM Support Programme. EXCO approved the implementation of a Water Conservation and Water Demand Management Pilot Initiative in the Mpophomeni area on 390th EXCO Meeting on 17 November 2020. The objective of this initiative was to determine the effectiveness of implementing on site WCWDM initiatives to assist WSA's in managing water loss in communities that are not metered or are not paying for water.

The approval and measurements of success of the pilot was subject to the following:

- Reduction of overall volume or Non-Revenue Water of between 5% to 8%; and
- Impact to be assessed, not only for the communities and municipalities, but for Umgeni Water.

The project began in March 2022 and ran through April 2023. In order to reduce leaks in Mpophomeni, the project included social awareness and education on water conservation/water demand management (WCWDM), leak detection surveys, flow logging (the measurement of the amount of water supplied to the community in comparison to the sales meter as well as the inflow volumes into the Waste Water Treatment Plant), and internal leak repair (both minor and major).

4.10 Project Results

The Mpophomeni WC/WDM Pilot Project Initiative resulted in positive outcomes in terms of community upliftment, water savings and municipal revenue improvement. The project employed many locals, provided them with leak repair training, and educated the entire community on WC/WDM and NRW, which resulted in positive water saving results.

The amount of water saved due to leak repairs and community awareness over the 12-month project duration was **201 650 m³**. The amount of water that flowed into the Mpophomeni WWTP after the intervention was also reduced by **141 210 m³** over the 12-month project duration.

The two graphs below from Umgeni Water’s bulk sales volume records show significant savings on the two meters feeding Mpophomeni Township. Graph 1 (**Figure 4.10**), Vulindlela to Mpophomeni meter show a decrease in volume from 3750 m³ in April 2022 to 2600m³ in April 2023.

Graph 2 (**Figure 4.11**), Mpophomeni Reservoir meter show a decrease in volume from 7000m³ in April 2022 to 5400m³ in April 2023. Both meters exceeded the 8% savings that was listed as one of the success factors.

Despite the fact that the initiative lasted a year, the beneficial benefits will be felt for many years to come due to a changed community mind-set towards WCWDM, a reduction in continuous water loss, and a reduction in capital expenditure into the overall management of the Mpophomeni WWTP.

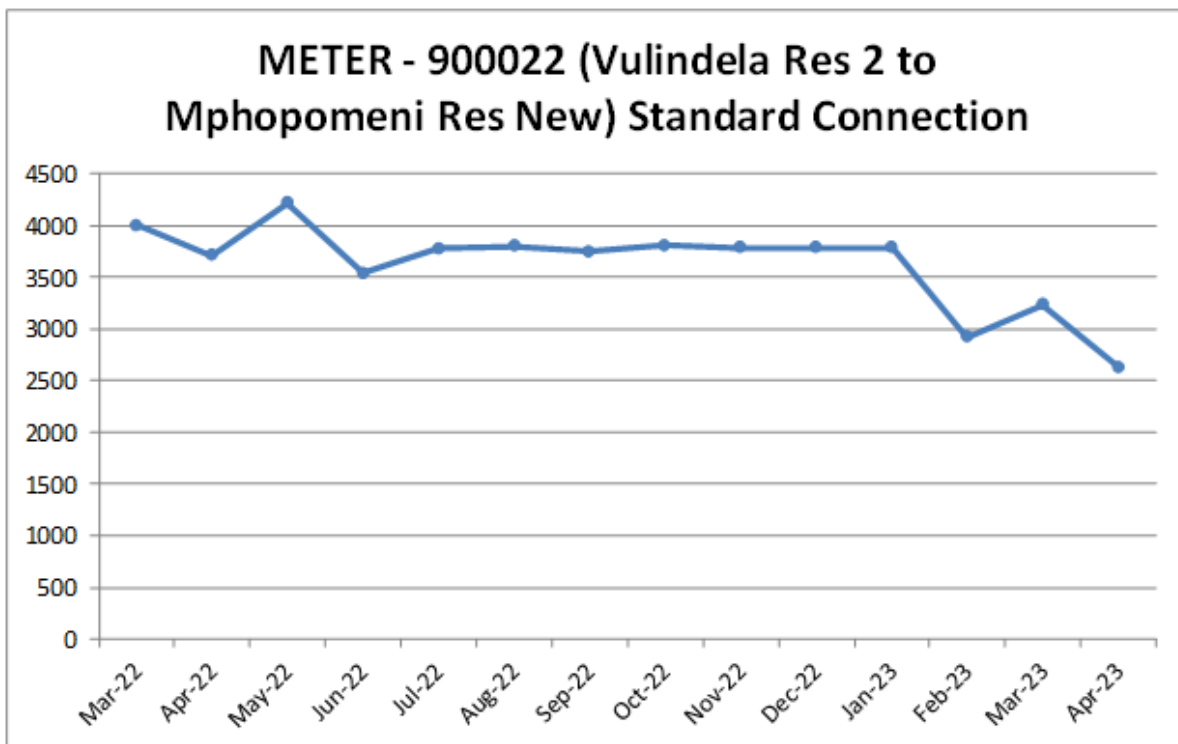


Figure 4.10 Graph 1: Vulindlela to Mpophomeni monthly sales volumes.

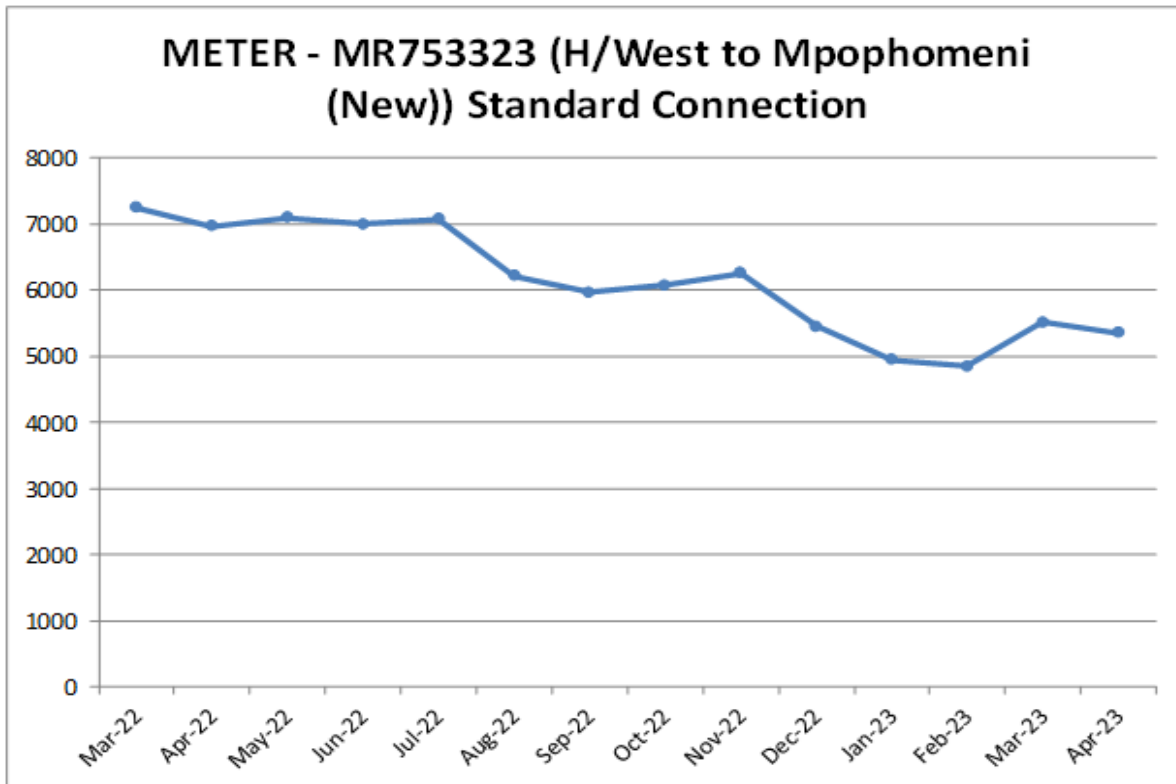


Figure 4.11 Graph 2: Mpophomeni reservoir sales volumes.

4.11 Future WCWDM Projects

Umgeni Water will continue to support the KZN WCWDM Programme in the 2022/23 financial year, with further improvements based on lessons learned and on WSA requests.

Umgeni Water is committed in ensuring that the continued implementation of the NRW reduction support programme yields positive results and as such the following future projects are proposed:

(i) **Confirmation of System Input Volume for Water Balance for UW and WSAs**

- This will involve an assessment and evaluation of bulk meter points. As part of this exercise any new bulk meters that are required for the NRW systems will be identified and motivation made for damaged meters to be repaired, replaced or calibrated. Many WSAs employ estimation for water schemes that do not contain water meters. Other areas of focus such as zoning and thus zonal meters will also be considered, in order to improve monitoring and control. Consolidation and updating of ACIP bulk metering requirements for the Province, detailing remaining meters to facilitate systems-based water balance reporting as well as updated budgets.

(ii) **Rolling out of small to medium scale NRW Projects**

- UW has committed itself in assisting struggling WSAs with the small to medium scale NRW projects. The first pilot project has been undertaken at Mpophomeni Township outside Howick and was completed in April 2023. The project objectives were as follows:
 - Develop a Community Based Team that can be trained in measuring water loss and addressing internal leaks;

- The Community Based Team would be trained to conduct door-to-door social awareness and education on water conservation and water demand management issues;
 - Undertake both water mains and internal leak detection;
 - Undertake leak repairs; and
 - Evaluate the effectiveness of these initiatives on water savings in the area.
- The impact of this project will be measured on the overall NRW savings achieved and lessons learnt will be considered on the future projects as a new project is proposed in Pietermaritzburg, Copesville area under Msunduzi Municipality.

(iii) On-going Monitoring and Evaluation for UW and WSAs

- Preparation of quarterly water balances.
- Preparation of water savings reports.
- No drop assessment improvement reports.
- Acquiring of NRW equipment for assisting WSAs with special projects/requests.
- UW has also acquired a remotely piloted aircraft (RPAS), also known as a drone, to be used for various applications including arial mapping and leak detection. UW is still busy with the SACAA registration of this drone for official usage.

4.12 Way Forward

Water conservation and water demand management has become an integral part of Umgeni Water's operating philosophy. WSA's have been assisted to develop 5 year WC/WDM master plans to specifically deal with NRW. NRW can be reduced to acceptable levels when the KZN water sector has:

- A common vision regarding water efficiency;
- Adequate technical skills, technology and knowledge in NRW reduction;
- Identified NRW reduction as a critical business activity;
- Strong and informed leadership;
- Dedicated NRW teams;
- Strong cooperation between departments; and
- A strong asset management philosophy.

Water conservation and water demand management is often listed as the top priority in all the DWS Reconciliation Strategies for areas of KZN (2012 onwards). This has not changed, and UW views this as the TOP priority for WSAs to implement with urgency. This will result in the sustainable use of the natural water resources and improve supply reliability. By default, it will also free up water for use in areas where there is still a backlog. Considering the unacceptably high water losses and non-revenue water, the WSAs cannot afford to continue with new capital works, without also replacing old AC pipes, resolving illegal connections, and metering all customers with individual connections.

Bulk metering is also a key priority in order to be able to calculate the water balance in each scheme. It should also be remembered that the water demand model utilised for the water master plans of WSAs includes the assumption that water losses percentage will decrease over time, as it plans for good business, not poor management. If the WSAs do not intervene, and reduce water losses, the actual demands for the various schemes will almost certainly exceed the resource yield, leading to

reduced supply to consumers. This is exactly what is being discovered at present in the WSAs of KZN, and curtailment of daily water volumes will have to be instituted where communities refuse to comply with responsible water consumption.

In the longer term, as the service landscape changes, the WSAs needs to move out of the current crisis management to a pro-active WCWDM programme that includes the four elements of WCWDM (Figure 4.12) expounded on in the National Water Resources Strategy (DWA 2013).

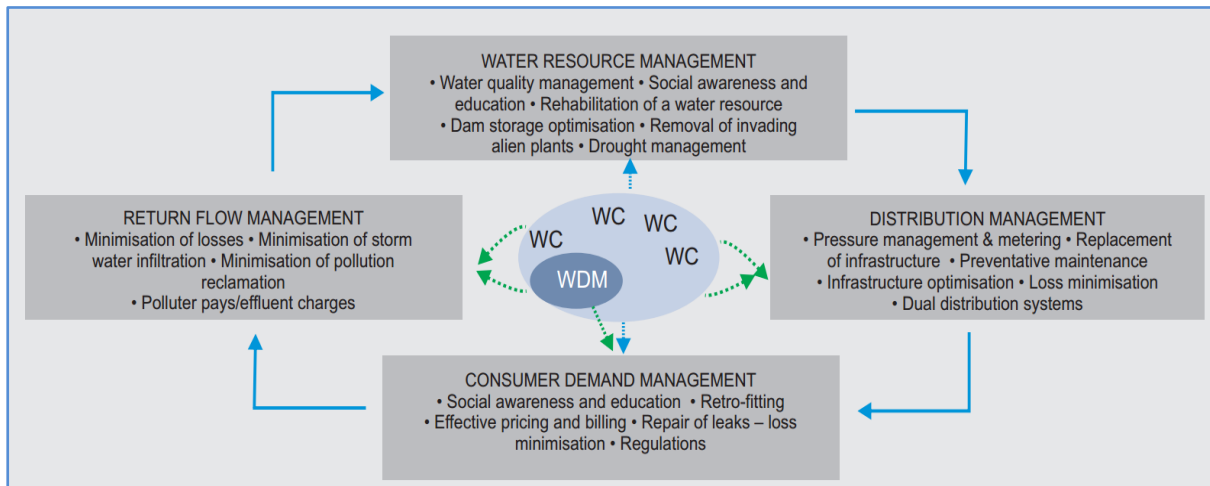


Figure 4.12 Elements of Water Conservation and Water Demand Management (NWRS, DWS, 2013, pg. 57).

An aggressive, expanding WCWDM project needs to be planned for each water supply scheme in the preparation for schemes migrating to a higher level of service. A dedicated WCWDM team is not needed. Instead, the reticulation operations teams, and the maintenance teams in each WSA need to have WCWDM KPIs, with maintenance schedules that ensure coverage of all schemes. This should be coupled with a strong consumer awareness programme, and the implementation of a “citizen science” reporting mechanism to report leaks, bursts etc. This system should be implemented immediately as part of business as usual, by the staff of WSAs. A 5 year WCWDM Master Plan was developed for each of the WSAs through support of UW, DWS and CoGTA KZN but these are not being used by the WSAs to initiate projects. The costed interventions within the primary schemes of each WSA are available in these 5 year WCWDM Master Plans. This is an intense programme dealing with the highest priority interventions.

Due to the significant backlog of water problems, and the urgent nature thereof (and the scale or magnitude of these water supply schemes), this should be a set of outsourced projects to make a rapid, significant impact on NRW in the WSAs. WSAs need to be compelled by CoGTA and DWS to prioritise a certain minimum percentage of funding for implementation of NRW projects.

A significant aspect that is not dealt with specifically in the 5 year WCWDM Master Plan is AC pipe replacement in the older areas of the established towns e.g. Vryheid, Greytown, Pietermaritzburg etc. This ageing infrastructure is a significant contributor to the water losses in these towns and a prioritized programme of replacement needs to be developed and implemented. A set of projects for this replacement, over the next 10 years, is needed urgently and funding would have to be sought from DBSA or international donors e.g. the Orio projects of uMgungundlovu DM.

UW will therefore continue to raise the above issues with the water sector (especially the WSAs) at the quarterly WCWDM forums and assist where possible, in an effort to get the WSAs to prioritise funding for NRW reduction programmes and revenue enhancement programmes.

4.13 WCWDM Projects Currently Underway in KZN

Water Services Infrastructure Grant (WSIG) is, amongst other functions, meant to support municipalities in WCWDM related projects. Some WSAs are taking advantage of this grant and are implementing WCWDM projects whereas others are still behind. **Table 4.3** indicate a list of current projects underway in KZN.

Table 4.3 List of WCWDM Projects currently Underway in KZN.

WSA	Name of the Project	Project Stage	Funding
Amajuba DM	Reduction of Non-Revenue Water via Reduction of Real Losses	Construction	WSIG
ILembe DM	Old Water Mains Replacement: Ndwedwe South and North and KwaDukuza	Defects liability period	WSIG
	Old Mains Replacement – KwaDukuza and Mandeni (Phase 4)	Practical completion	WSIG
	Non-revenue water reduction program in ILembe DM	Construction	WSIG
	Old Mains Replacement Mandeni Municipal Areas	Tender	WSIG
King Cetshwayo DM	(Revenue Enhancement) WC/WDM Strategy Implementation: Phase 3	Construction	WSIG
City of uMhlatuze LM	Reduction of Non-Revenue Water	Construction	WSIG
uThukela DM	Wembezi WCDM Phase1	Construction	WSIG
	Ezakheni water supply system: WCDM	Planning	WSIG
	Steadville WCDM	Planning	WSIG
	Ladysmith AC replacement	Planning	WSIG
Ugu DM	Non-Revenue Water Reduction Programme	Construction	WSIG
	Refurbishment and Replacement of Infrastructure in Ugu DM area of supply.	Construction	WSIG
	Revenue Management Plan	Construction	WSIG
	Pipeline Replacement of Infrastructure in the Ugu DM area of supply Non-Revenue Water Reduction: Phase 3 - AFA	Construction	WSIG
Zululand DM	Simdlangentsha West Regional Water Supply Scheme Water Demand Management	Construction	WSIG
	Nkonjeni Regional Water Supply Scheme Water Conservation and Water Demand Management Phase 3	Construction	WSIG

Furthermore, Umgeni Water (UW) has embarked on a water demand management project to install flow control valves at the sales meters of supply areas that have been drawing far more than their agreed theoretical water demand. Theoretical demands of respective zones within each WSA will be

agreed with the respective WSAs for the purpose of design and installation of flow control valves. This will enable UW to provide equitable supply to all customers. At present, WTWs of UW are under strain due to some areas/communities having an unacceptably high water demand, and these are the points at which UW will look to install flow control valves at the sales meters, in consultation with the respective WSAs. UW has begun liaising with the WSAs in this regard.

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5. SYSTEMS ENERGY ANALYSIS IN THE UMGENI WATER OPERATIONAL AREA

5.1 Overview

The energy efficiency of water supply cannot be optimised unless the impact of infrastructure on energy use is understood. With this in mind, an analysis of energy use is provided in this section of the Infrastructure Master Plan (IMP) and shows the energy “cost” of regional and local water supply.

Umgeni Water’s operational area consists of the following systems:

- Mgeni System comprising the Upper Mgeni and Lower Mgeni (**Section 7**)
- uMkhomazi System (**Section 8**)
- South Coast System (**Section 11**)
- North Coast System (**Section 12**)
- Middle uThukela and uMhlathuze System (**Section 15 and Section 16**)

This section focuses on the period July 2021 to June 2022 and for areas where information was not available, the closest full year cycle was utilised. Values indicated in this section are an indication of power consumption and some values have been averaged due to the lack of available meter readings. Values have also been corrected where obvious errors were detected. These errors could be attributed to meter reading errors and administration errors.

Figure 5.1 indicates the power usage per system. An average of 242 743 MWh was used across all systems within Umgeni Water to supply approximately 616 370 Mℓ per annum. The two systems with the highest power usage are the Upper and Lower Mgeni Systems and their combined systems account for 81.99 % of water produced and 74.87 % of total power usage throughout the Umgeni Water supply area. The majority of water produced by these systems supply the uMgungundlovu and eThekweni municipalities with a smaller percentage been supplied to the southern and northern coastal area and the King Cetshwayo District Municipality (KCDM). Note must be made that only five of the twenty eight plants in the KCDM area were reported on as the information for the rest was not available at the time of publication of this report. The power consumption for the KCDM area was received via Eskom and the exact allocation of the power per system will be verified and corrected in the following publications.

Table 5.1 shows a 3.90 % decrease in the energy consumption across the company, with the largest decrease (in terms of a percentage) being the Upper Mgeni System at 20.83 % followed by Ixopo with a 20.23 decrease. All other systems show an increase in the energy usage with the North Coast increasing by 16.89 % from the previous year.

The large decrease (20.83 %) in the electricity usage in the Upper Mgeni System is attributed to a corresponding decrease in the pumping times and volumes from the inter-basin transfers from the Mooi System via the Mearns pump station. Due to the abundance of water flowing into Midmar Dam the need for pumping was reduced and that resulted in a 39.33% (7 881 MWh) drop in energy used and a corresponding 38.9% (20 258 Mℓ) drop in the water transferred to the Umgeni system. The second largest drop in energy consumption was the Ixopo system. There is an increase in supply to this system from the previous year and the resultant drop in the energy usage does not tie up since the system relies heavily on pumping from the dam and the borehole. Upon inspection of the

usage from the Eskom data, it was noticed that there is a billing correction that has affected the yearly usage calculation.

The large increase in the North Coast System usage is due to the increase in the Lower Thukela WTP output. The total water produced increased by 33.9% that translated into a 32.9% increase in the power used, i.e. 4053.9 MWh more than the previous year. This system relies on low lift pumping from the weir and a high lift pump station to a command reservoir.

The Lower Mgeni and the South Coast Systems showed marginal increases in the electricity usage and that may also be attributed to the increased load shedding. This chapter does not cover the actual generator fuel usage during the load shedding times.

Table 5.1 Yearly comparison on power usage.

Year	2021	2022	% Diff
System	kWh/annum	kWh/annum	kWh
Upper Mgeni	87144970	68991694.36	-20.83
Lower Mgeni	110290876	112750594.8	2.23
North Coast	31549664	36877708.93	16.89
South Coast	14039928	15123509.87	7.72
Ixopo	1274520	1016642	-20.23
King Cetshwayo		7982977	
Total (excl. KCDM)	244 299 958	234760149.9	-3.90

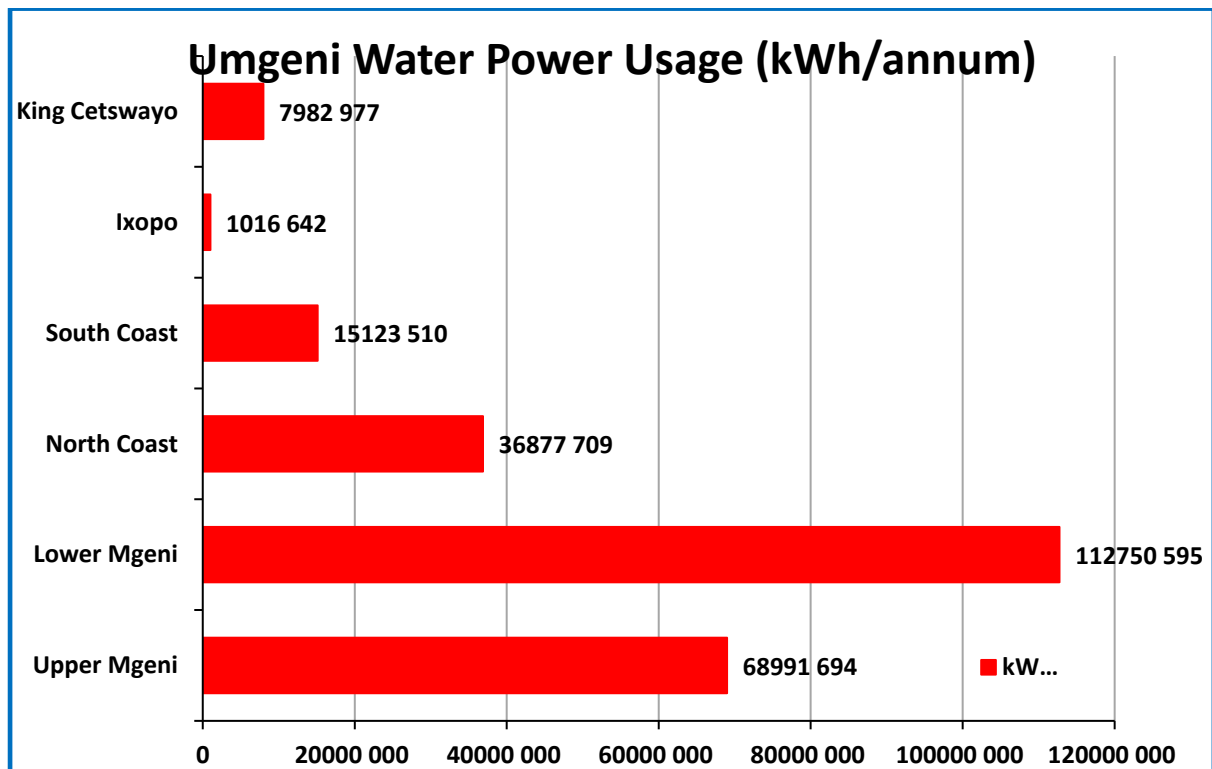


Figure 5.1 Total Energy Consumption for Umgeni Water Systems 2021/22.

Energy Intensity graphs provide an indication of the rate at which power is consumed to produce or transport water i.e. kWh per Kl. This indicator is used to compare power usage of different infrastructure components and systems.

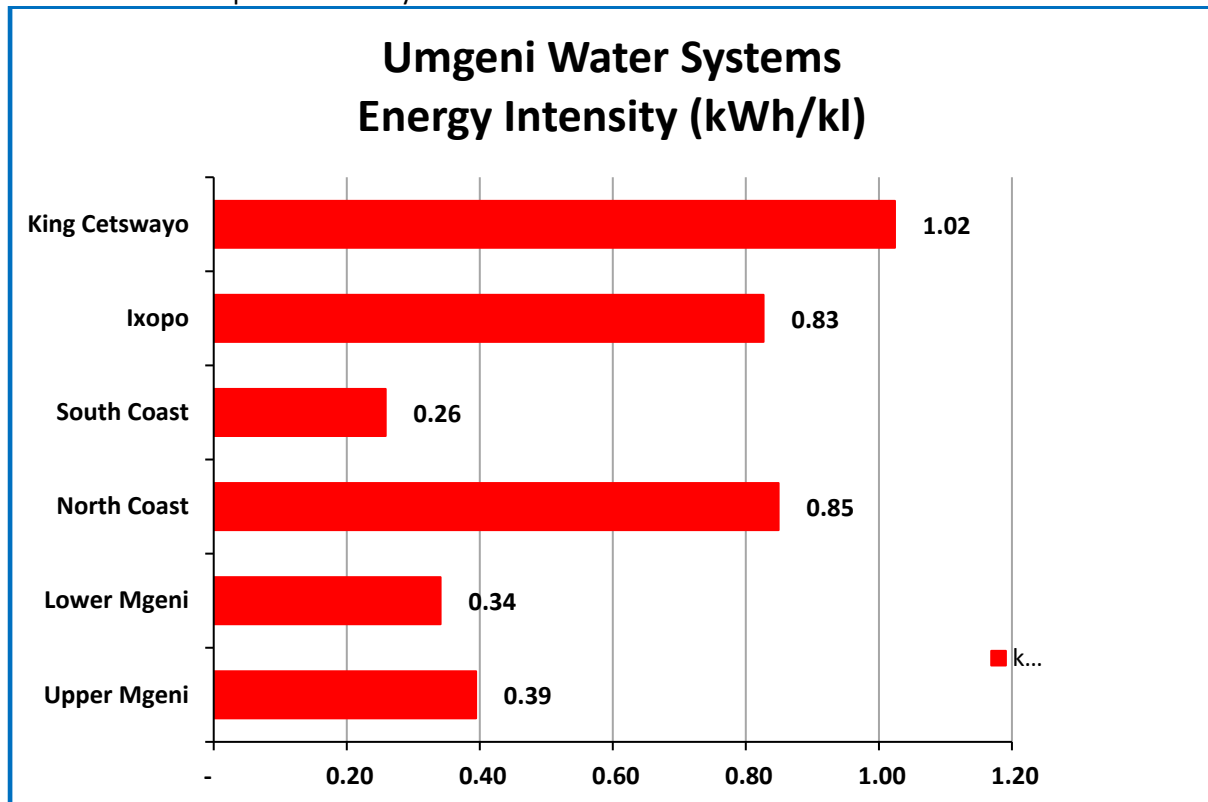


Figure 5. represents the different power intensity rates for the Umgeni Water systems. The average energy requirement is 0.39 kWh/kl i.e. the power used across the entire Umgeni Water supply area divided by the total volume produced or pumped. This value is a decrease of 4.88 % from the previous year. The King Chetswayo system is 2.62 times above the average and is by far the costliest system, in terms of energy intensity in the Umgeni Water supply area and this is based on five of the top eight supply schemes in the area. What must be borne in mind is that the KCDM area has 28 water supply schemes and 23 systems have no information to conduct a proper analysis on in terms of electricity usage.

The intensity has increased from previous years in the North Coast System due to an increase in the supply as mentioned above.

The upper Umgeni has decreased in intensity due to lower inter basin transfers.

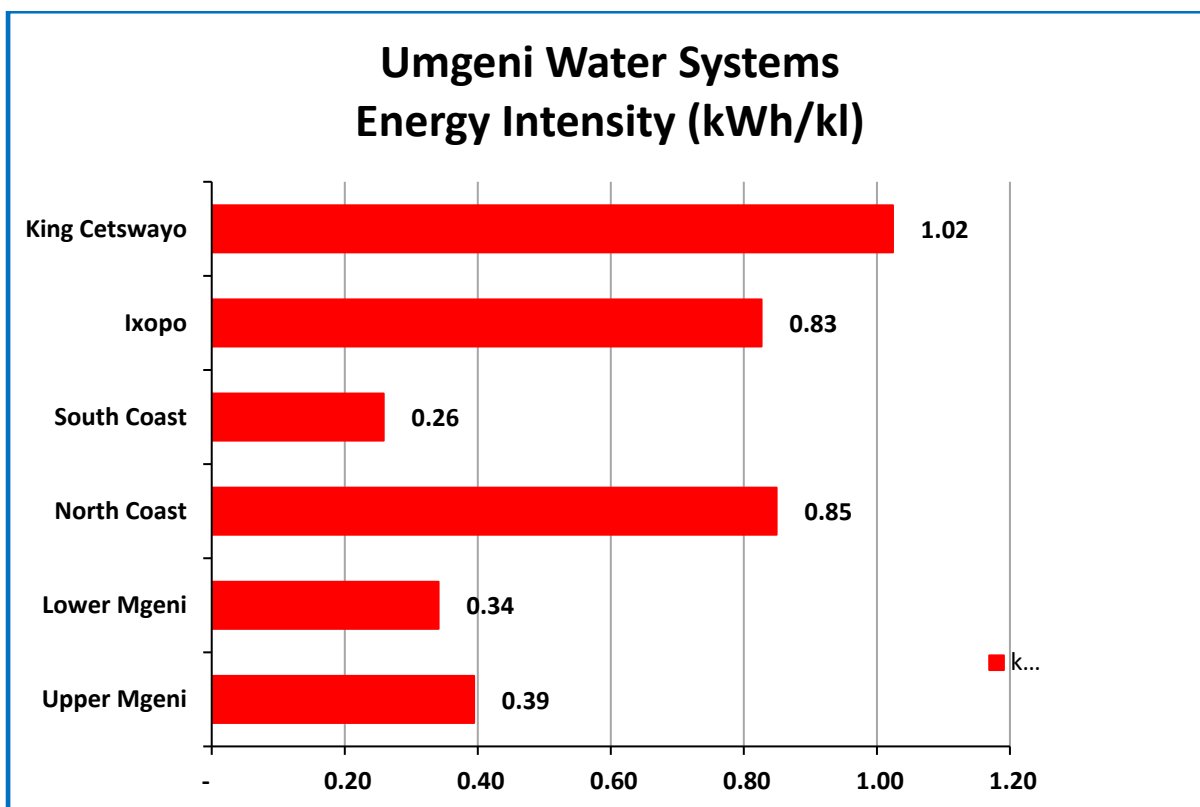


Figure 5.2 Energy requirement to supply water in Umgeni Water Systems 2021/22.

5.2 Energy Usage per Infrastructure Component

The analysis is further broken down per Umgeni Water’s individual infrastructure components (mainly WTP’s and Pump Stations) across the area of supply (Figure 5.2).

Figure 5.2 and Figure 5.3 show that the largest power consumers across all the Umgeni Water systems are the Durban Heights Shaft Pumps, with an annual consumption of approximately 25 000 MWh per annum followed by the Wiggins High Lift Pump Station. These are followed by Hazelmere WTP and Midmar WTP which have an annual usage from the lower to upper 16 000 MWh.

5.3 Energy Intensity per Supply Point

To further illustrate the power intensity usage across Umgeni Waters Supply area, the energy requirement was further analysed per supply point and is illustrated in Figure 5.4. This graph provides an indicative cost per kilolitre in terms of energy usage from source to supply point.

Figure 5.4 indicates the most expensive points of supply, in terms of energy usage, throughout all Umgeni Water’s Supply Areas. The average energy requirement across the 56 supply points (that is reported on) is 1.21 kWh/kl and 21 of the 56 supply points are supplied at a rate above the average.

The highest energy requirement per kilolitre of water supplied is the supply from Hazelmere WTP to the Ndwedwe area, with the highest intensity being the supply to Ndwedwe Reservoir 5 at 3.55 kWh/kl. The supply to Ndwedwe has a high intensity because of the low volumes pumped to high heads. The same applies for the supply to the Vulindlela area from the Midmar WTP with the supply to Vulindlela Reservoir 5 being 3.08 kWh/kl.

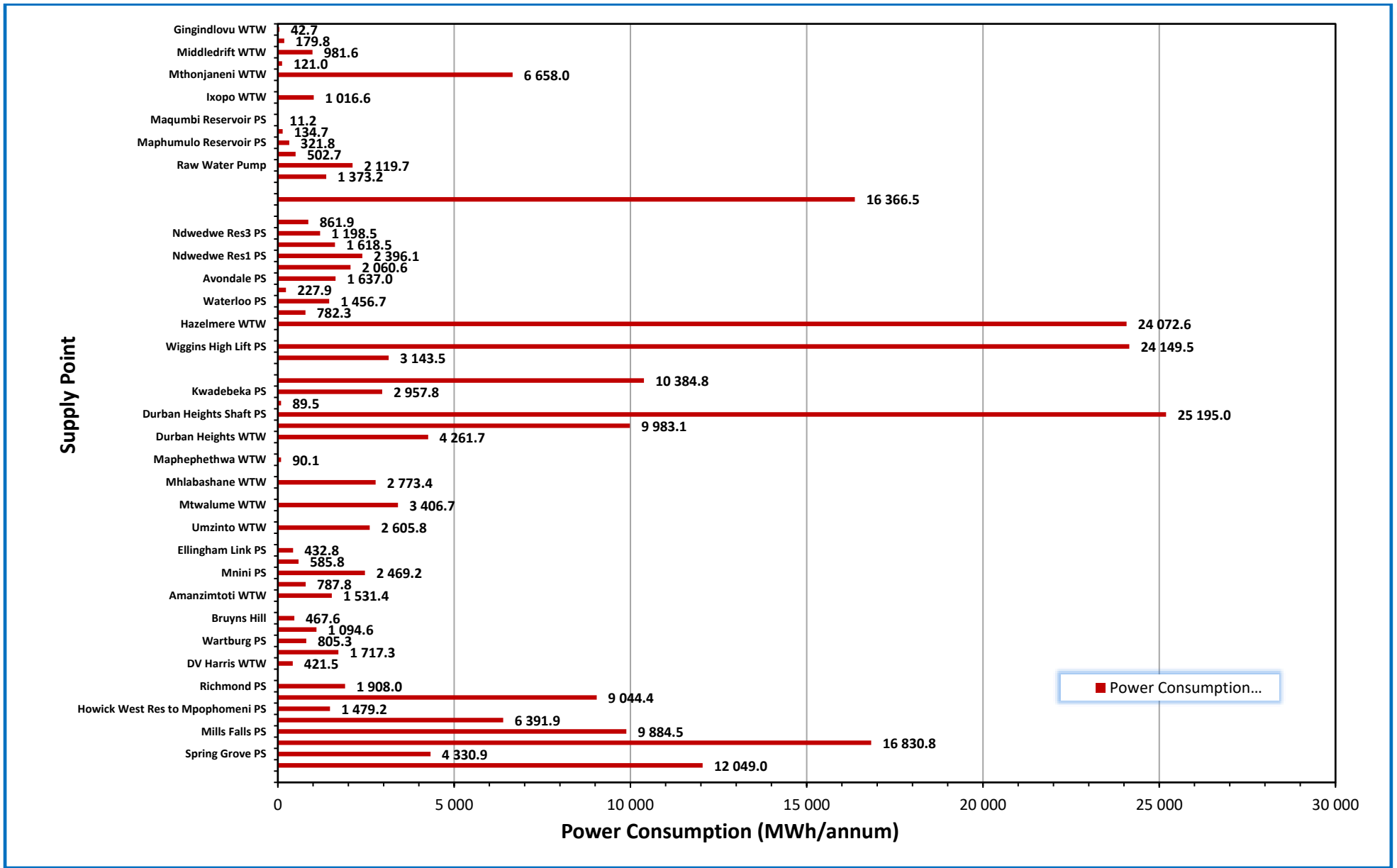


Figure 5.2 Annual Power Usage Comparison Umgeni Water Installations.

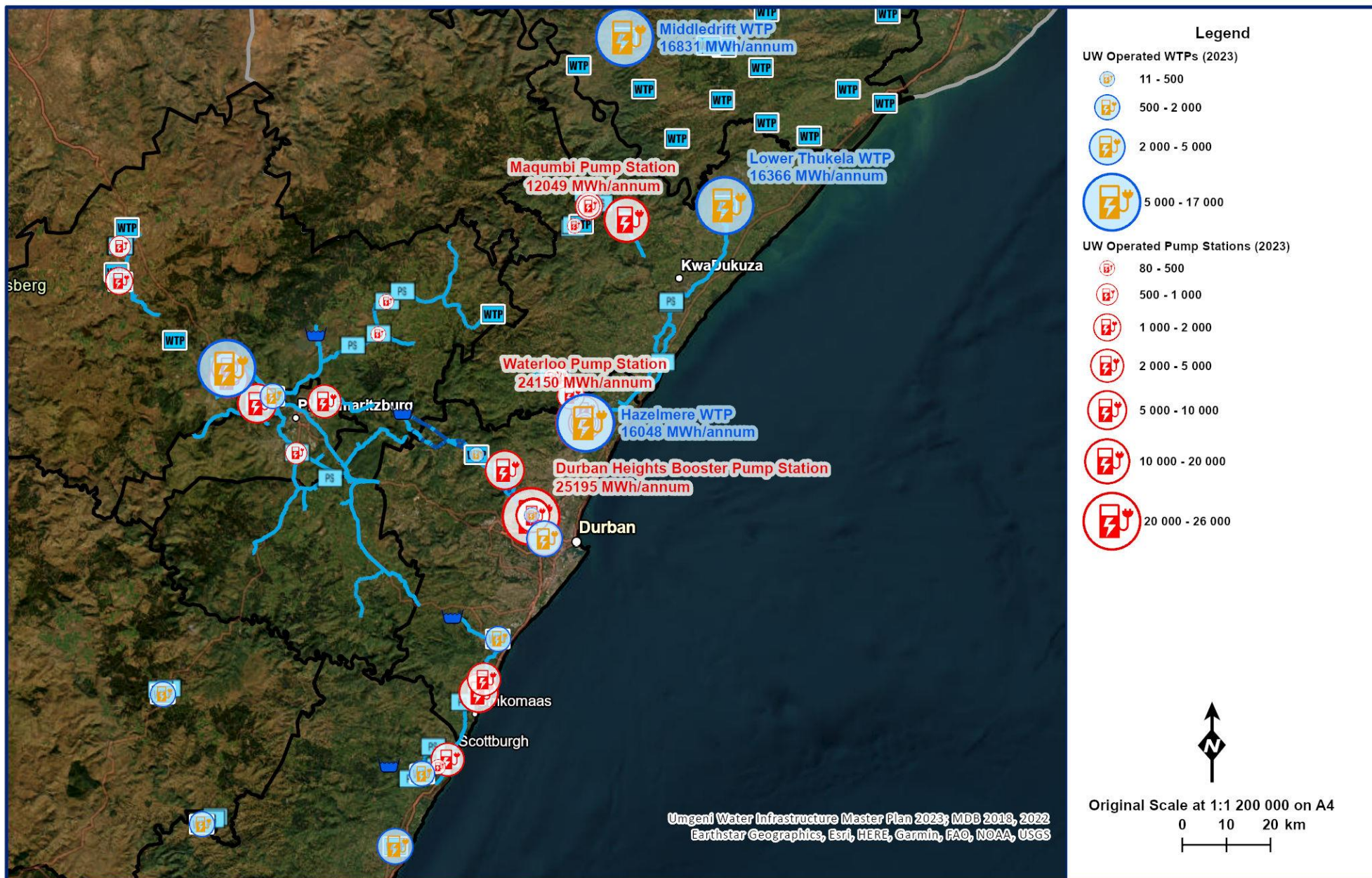


Figure 5.3 Distribution of the highest energy consumers.

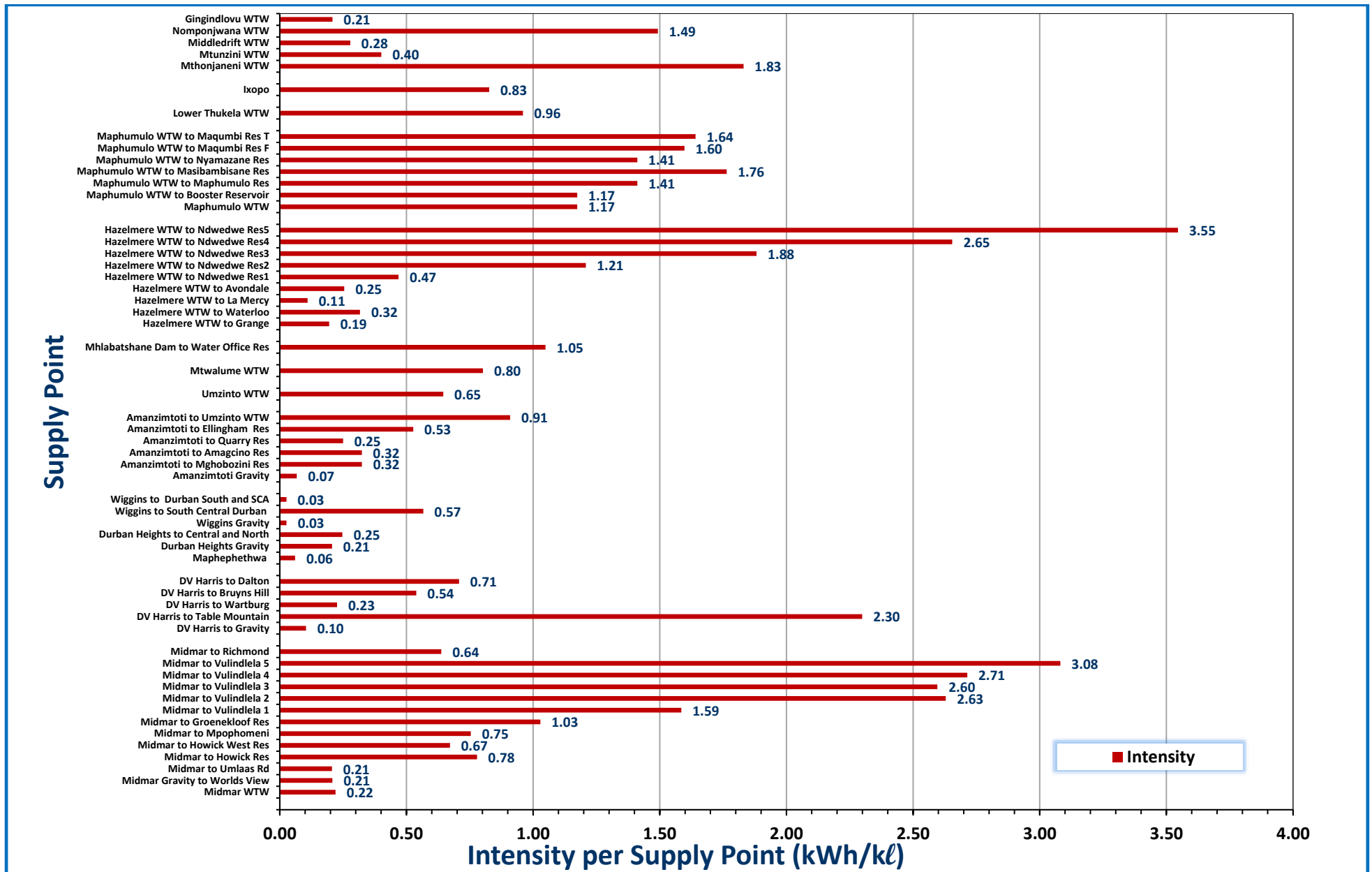


Figure 5.4 Annual Energy Intensity per Supply Point.

5.4 Observations and Recommendations

The two most energy intensive sub-systems are the supply to the Vulindlela area from Midmar Dam and the supply to the Ndwedwe area from the Hazelmere Dam. There seems to be a decrease in some usage and intensity and that can be as a result of the load shedding being increased throughout the country.

The highest energy use per annum are the high lift pump stations that deliver raw water to the systems. This is generally the case where the WTP is not situated close to the resource, or where raw water is transferred to another basin.

Monitoring of the energy usage throughout the organisation is conducted by the Operations Division and detailed records are kept in the majority of the areas. There is however, room for improvement in this regard.

It must be noted that receiving of timeous bills with correct readings from power suppliers within the area of supply is an ongoing issue. Certain bills are received once every 6 months and there are no check meters in place to verify readings. There also seem to be corrections applied to bills whereby negative readings are recorded to “pay back” customers and this makes monitoring energy usage difficult, especially when there is no check meter in place.

Certain installations, such as Hazelmere WTP, receive a consolidated billing account. This cannot be used to accurately measure the cost of supply to the various areas supplied by this WTP.

Errors in recording of information of power consumption have been encountered in some instances, which can be attributed to human error. Data capturers are encouraged to interrogate information prior to submitting as these records are relied upon for reporting purposes.

Umgeni Water will have to invest in electrical sub-meters to ensure the accurate recording of energy per sub system, and to assist in vetting billed power consumption (as received from Eskom and municipalities).

The following recommendations are made to better monitor and improve the energy usage throughout the supply area:

- Electrical and flow meters be installed and monitored in/at all Umgeni Water’s pump stations.
- The electrical meters can be used as check meters as there is no means to currently verify the readings supplied by the power suppliers.
- Monitoring of the energy usage will provide an early warning sign to mechanical wear on pumps and maintenance can be planned timeously.
- Umgeni Water should investigate the use of power saving technology to reduce its carbon footprint and operational costs thereby creating a more cost effective product for the end user. A typical example is the fitment of variable speed drives (VSDs) which will also reduce the occurrence and severity of water hammer (transient pressures).
- UW to invest in smart meters, which can be monitored and operated online and remotely.

6. OVERVIEW OF SYSTEMS

6.1 Overview of Systems

All existing water resources and water supply infrastructure, as well as the proposed infrastructure, has been categorised into a number of **primary systems** in order to assist with better describing and understanding the dependencies and interconnectivity between the many components (refer to **Figure 6.1**). Each of these systems is defined by the catchment which forms the primary, or original, source of water for a particular bulk supply network. The catchments are grouped in logical regions as shown in **Figure 6.1**. The exception here is the South Coast where a number of small adjacent catchments provide the necessary water resources, and hence have been grouped together. It is further noted that whilst the Mgeni and Mooi Systems are primary systems, with the Mooi-Mgeni Transfer Scheme, these two systems work concurrently and therefore the Mooi System is discussed with the Mgeni System in **Section 7**.

For further clarity, the larger primary systems have been divided into **secondary systems** as shown in **Figure 6.2** for Umgeni Water's operational area.

Within a primary system, and where applicable a secondary system, logical networks of water supply infrastructure have been classified as **sub-systems**. The larger networks can contain a number of sub-systems.

Whilst each water supply system is generally self-contained, in most cases there is interconnectivity between the various systems. Linking the various supply systems such that they can receive potable water from more than one source is important to ensure that a sustainable supply of water can be provided within each system at all times. These linkages therefore form part of the long-term planning processes undertaken by Umgeni Water.

Figure 6.2 illustrates all the existing and proposed water system configurations and linkages (within the Umgeni Water Operational Area), and provides a point of reference for **Section 7**, **Section 8**, **Section 11**, **Section 12** and **Section 13** of the IMP 2023.

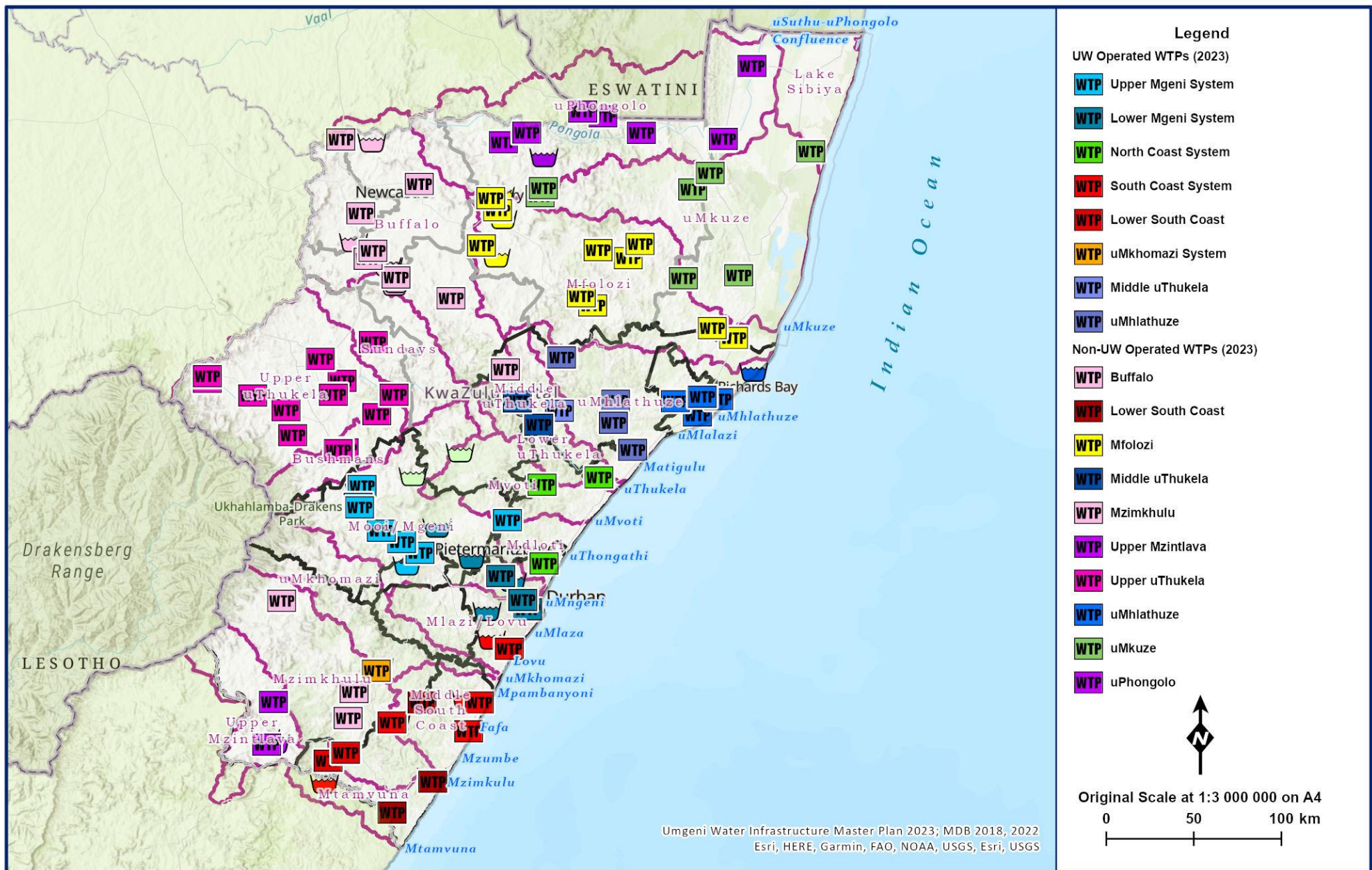


Figure 6.1 KZN primary systems.

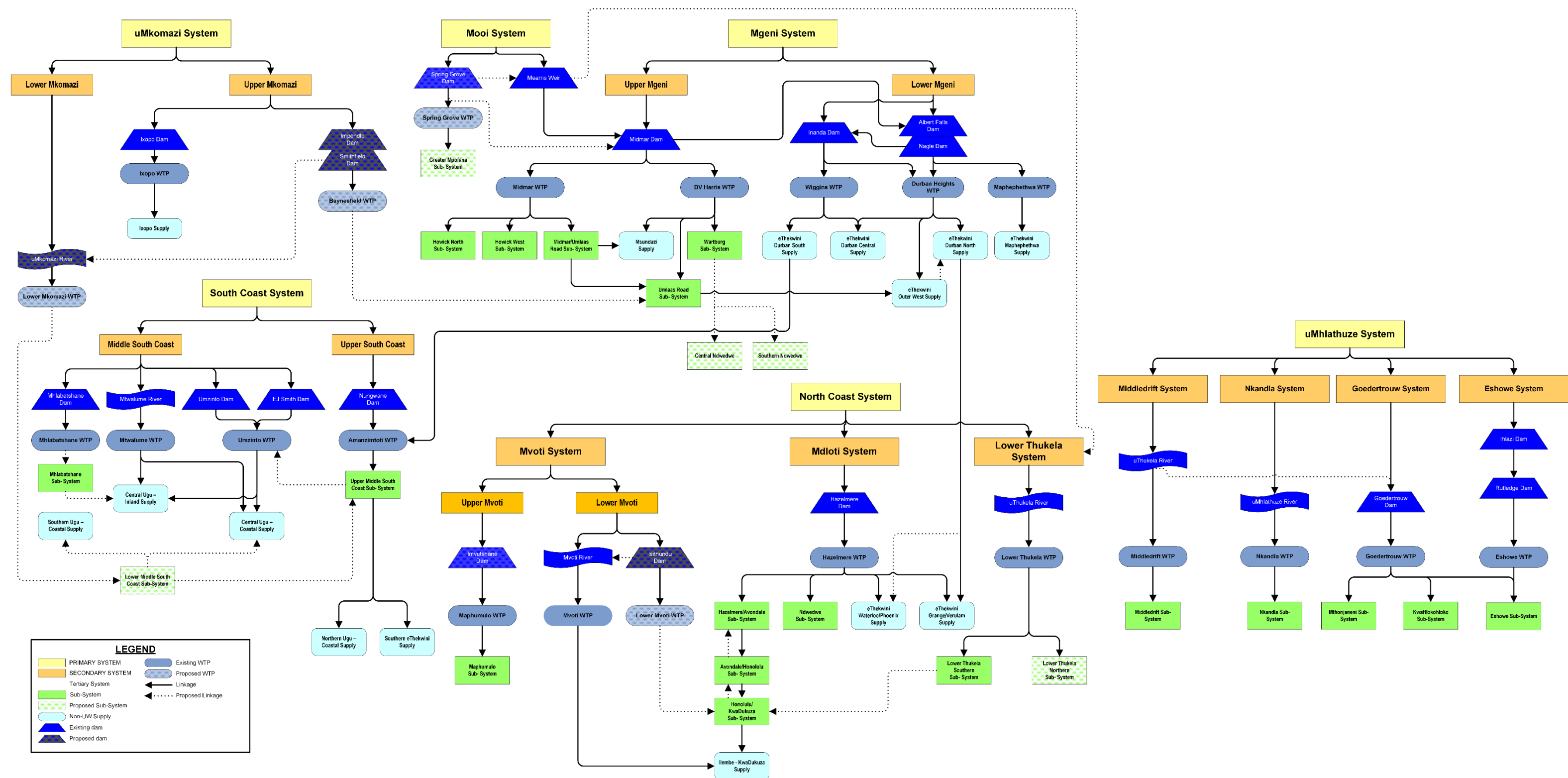


Figure 6.2 Water infrastructure system configurations and linkages.

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- Alka Ramnath (Planner) Project management, Section 2, Spatial information, Research and input to all volumes
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- Vernon Perumal (Planning Engineer) Infrastructure on the uMkhomazi, Upper uMzintlava, Upper uMzimkhulu and the uMhlathuze and Middle uThukela Systems and compiling the Energy Section
- Mark Scott (Planning Engineer) Infrastructure on the Mgeni Inland, uMfolozi, uMkhuze, uPhongolo and Lake Sibiyi Systems
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- Sakhile Hlalukane (Hydrologist) Water resources of the North Coast, South Coast and Upper uThukela Systems
- Sandile Sithole (Hydrologist) Water resources of all systems excluding the North Coast, South Coast and Upper uThukela Systems
- Mlungisi Shabalala (Hydrologist) Water resources of the Middle uThukela, uMhlathuze, uMfolozi, uMkhuze, uPhongolo and Lake Sibiyi Systems
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