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UMGENI WATER

INFRASTRUCTURE MASTER PLAN 2019

2019/2020 – 2049/2050

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This Infrastructure Master Plan 2019 describes Umgeni Water’s infrastructure plans for the financial period 2019/2020 – 2049/2050. It is a comprehensive technical report that provides detailed information on the organisation’s current infrastructure and on its future infrastructure development plans. This report replaces the last comprehensive Infrastructure Master Plan that was compiled in 2018.

The report is divided into seven volumes summarised in Table i and shown schematically in Figure i.

<table>
<thead>
<tr>
<th>Focus Area</th>
<th>Purpose</th>
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<tbody>
<tr>
<td>Volume 1: Regional Overview</td>
<td>Volume 1 describes the most recent changes and trends within the primary environmental dictates that influence Umgeni Water’s infrastructure development plans (Section 2). Section 3 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 2017. Section 4 describes Water Demand Management initiatives that are being undertaken by the utility and Section 5 contains a high level review of the energy consumption used to produce the water volumes analysed in Section 3. Section 6 focuses on research into the impacts of climate change and alternative supply options including waste water reuse and desalination. Section 7 provides an overview of the water resource regions and systems supplied within these regions in Umgeni Water’s operational area.</td>
</tr>
<tr>
<td>Volume 2: Mgeni System</td>
<td>Volume 2 describes the current water resource situation and the water supply infrastructure in the Mgeni System (Section 8; shown in orange in the adjacent figure). Included is the status quo with regards supply to the area as well as recommendations on the development of infrastructure to meet future needs.</td>
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<td><strong>Volume 3: uMkhomazi System</strong></td>
<td>Volume 3 summarises the uMkhomazi System (Section 9; illustrated in purple in the adjacent figure) current water resource situation and water supply infrastructure, the status quo on supply to the area and provides recommendations on the development of infrastructure to meet future needs.</td>
</tr>
<tr>
<td><strong>Volume 4: South Coast System</strong></td>
<td>Volume 4 reports on the South Coast System (Section 10; shown in red in the adjacent figure) with regards to the current water resource situation and water supply infrastructure, the status quo on supply to the area and provides recommendations on the development of infrastructure meet future needs.</td>
</tr>
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</table>
Volume 5 provides a description of the North Coast System (Section 11; illustrated in green in the adjacent figure) water resource situation and water supply infrastructure, the status quo on supply to the area and recommendations on the development of infrastructure to meet future needs.

Volume 6 summarises the Upper uThukela System (Section 12; illustrated in pink in the adjacent figure) the current water resource situation and water supply infrastructure, the status quo on supply to the area and provides recommendations on the development of infrastructure to meet future needs.
Volume 7 describes the wastewater works currently operated by Umgeni Water (shown in pale brown in the adjacent figure) and provides plans for development of additional waste water treatment facilities.
Figure i  Umgeni Water Infrastructure Master Plan 2019/2020 report structure.
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 the relevant planning reports if more detail is sought. Since the primary focus of this Infrastructure Master Plan is on Umgeni Water’s existing bulk infrastructure supply network, 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 within Umgeni Water’s area of operation. 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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LIST OF ACRONYMS

AADD  Annual Average Daily Demand
AC    Asbestos Cement
ADWF  Average Dry Weather Flow
API   Antecedent Precipitation Index
AsgiSA  Accelerated and Shared Growth Initiative of South Africa
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
DFA   Development Facilitation Act (65 of 1995)
DM    District Municipality
DMA   District Management Area
DRDLR Department of Rural Development and Land Reform
DWA   Department of Water Affairs
DWS   Department of Water and Sanitation
DWAF  Department of Water Affairs and Forestry
EFR   Estuarine Flow Requirements
EIA   Environmental Impact Assessment
EKZN Wildlife Ezemvelo KZN Wildlife
EMP   Environmental Management Plan
EWS   eThekwini Water Services
EXCO  Executive Committee
FC    Fibre Cement
FL    Floor level
FSL   Full Supply level
GCM   General Circulation Model
GDP   Gross Domestic Product
GDPR  Gross Domestic Product of Region
GVA   Gross Value Added
HDI   Human Development Index
IDP   Integrated Development Plan
IFR   In-stream Flow Requirements
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
TBM  Tunnel Boring Machine
TLC  Transitional Local Council
TWL  Top Water Level
uPVC  Unplastici
es 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.

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

## LIST OF UNITS

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<tr>
<td>km²</td>
<td>square kilometres</td>
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</tr>
<tr>
<td>Mℓ</td>
<td>megalitre</td>
</tr>
<tr>
<td>million m³</td>
<td>million cubic metres</td>
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<tr>
<td>mcm</td>
<td>million cubic metres</td>
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### Water Use/Consumption/Treatment/Yield:

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<th>Unit</th>
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<td>ℓ/ν/day</td>
<td>litre per capita per day</td>
</tr>
<tr>
<td>kℓ/ν/day</td>
<td>kilolitre per day</td>
</tr>
<tr>
<td>Mℓ/day</td>
<td>megalitre per day</td>
</tr>
<tr>
<td>million m³/ν/annum</td>
<td>million cubic metres per annum</td>
</tr>
<tr>
<td>kg/hr</td>
<td>kilograms per hour</td>
</tr>
</tbody>
</table>

### Flow velocity/speed:

<table>
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<th>Symbol</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>m/s</td>
<td>metres per second</td>
</tr>
</tbody>
</table>

### Flow:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Unit</th>
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<td>cubic metres per second</td>
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<td>ℓ/ν/hr</td>
<td>litres per hour</td>
</tr>
<tr>
<td>m³/ν/hr</td>
<td>cubic metres per hour</td>
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</tbody>
</table>
1. **INTRODUCTION**

1.1 **Purpose**

“The time to repair the roof is when the sun is shining.”

John F. Kennedy

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, traditionally, six Water Services Authorities (WSAs), comprising one metropolitan municipality, four District Municipalities, and one Local Municipality (LM), within the province of KwaZulu-Natal (KZN). Towards the end of 2017 Umgeni Water signed an additional Bulk Supply Agreement with uThukela District Municipality (DM) with the anticipated date of operation being 1 July 2018. The extent of these seven WSAs, is shown in Figure 1.1.

![Figure 1.1 Locality of Umgeni Water’s area of operation.](image-url)
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 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 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. In addition, the Minister has also proposed (through Government Gazette No. 41237 which was published on the 10th November 2017) that Umgeni Water absorb Mhlathuze Water. Although, in July 2018 it was reported that the Minister of Water and Sanitation had further resolved “not to merge Mhlathuze Water and Umgeni Water”\(^2\).

This Infrastructure Master Plan (IMP) considers the planning for the seven WSAs supplied by Umgeni Water.

It is 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 inland portion of 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). Umgeni Water recently handed back the management of the small run of river and borehole schemes within iLembe DM to the municipality. In addition, the area north of the uThukela River is also managed by iLembe DM.

The 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.

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\(^1\) KZN Treasury 2018 after IHA Markit Regional eXplorer 1156 (2.6a)

\(^2\) Sunday Tribune, 15 July 2018
Umgeni Water’s supply footprint including uThukela DM.

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 economic up- and downturns 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 any organisation 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 2019 (IMP 2019) 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. 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** identifies the changes that have occurred in the external environment since the IMP 2016 that have had an impact on the provision of sustainable bulk potable water;
- **Section 3** presents a review of actual sales achieved in 2018 against the IMP 2018 forecast, and provides revised short-term (3 year) and long-term (30 year) water demand projections;
- **Section 4** describes Umgeni Water’s water demand management initiatives;
• **Section 5** analyses the energy used to produce the water volumes discussed in Section 3;
• **Section 6** provides an overview of Umgeni Water’s climate change; wastewater reuse; and seawater desalination initiatives;
• **Section 7** introduces the water resource regions and supply systems in Umgeni Water’s operational area;
• **Section 8** identifies the water resource and supply capacity constraints and the new infrastructure required to meet the projected water demands in the Mgeni System;
• **Section 9** identifies the water resource and supply capacity constraints and the new infrastructure required to meet the projected water demands in the uMkhomazi System;
• **Section 10** identifies the water resource and supply capacity constraints and the new infrastructure required to meet the projected water demands in the South Coast System;
• **Section 11** identifies the water resource and supply capacity constraints and the new infrastructure required to meet the projected water demands in the North Coast System;
• **Section 12** identifies the water resource and supply capacity constraints and the new infrastructure required to meet the projected water demands in the uThukela System; and
• **Section 13** describes and identifies the capacity constraints of the wastewater infrastructure.
1.2 Setting the Scene

The distribution of Umgeni Water’s infrastructure and the projects that have been commissioned since the publication of the IMP 2018 are shown in Figure 1.3. These changes are summarised in Table 1.1.

<table>
<thead>
<tr>
<th>Infrastructure</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>uMshwathi Bulk Water Supply Scheme – Phase 1</td>
<td>Completed in December 2018</td>
</tr>
<tr>
<td>uMshwathi Bulk Water Supply Scheme – Phase 2</td>
<td>Completed in August 2018</td>
</tr>
<tr>
<td>uMshwathi Bulk Water Supply Scheme – Phase 3</td>
<td>Completed in February 2019</td>
</tr>
<tr>
<td>Wartburg to Bruyns Hill</td>
<td>Completed in March 2019</td>
</tr>
<tr>
<td>Albert Falls Water Supply Scheme</td>
<td>Completed in December 2018</td>
</tr>
<tr>
<td>Wiggins Ozone Rehabilitation</td>
<td>Completed in November 2018</td>
</tr>
<tr>
<td>Durban Heights KwaDabeka Pump Station Transformer Relocation</td>
<td>Completed in February 2018</td>
</tr>
</tbody>
</table>
Figure 1.3 Changes in Umgeni Water's infrastructure (January 2018 – present).
2. SITUATIONAL ANALYSIS

2.1 Administrative Landscape

The “administrative landscape” (KZN Planning Commission 2011: 35) occurring within Umgeni Water’s area of operation changed as of 1 July 2018 as shown in Figure 2.1.

![Maps showing area of jurisdiction and elections](image)

Figure 2.1 Change in Umgeni Water’s area of operation (Gazette No. 4300 (14 June 1974), No. 114; Gazette No. 5367 (31 December 1976), No. 276; Gazette No. 7466 (6 March 1981), No. 40; Gazette No. 15428 (21 January 1994), No. 89; MDB 2019).

The constituent institutions are identified in Figure 2.2 (the Water Service Authorities for whom Umgeni Water is a bulk water service provider) and Figure 2.3.

The changing “human footprint” (after KZN PGDS 2011) within Umgeni Water’s area of operation is summarised in Figure 2.4. 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-OECD\(^3\) degree of urbanisation model using population as an input for the years 1975, 1990, 2000, and 2015” (GHS 2019: website).

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\(^3\) European Commission’s Directorate-General for Regional and Urban Policy and the Organisation for Economic Co-Operation and Development.
Figure 2.2  Institutional boundaries (DWS 2016; KZN DoT 2017; MDB 2016; Umgeni Water 2019).
Figure 2.3  WSAAs and their constituent local municipalities (KZN DoT 2017; MDB 2016; Umgeni Water 2019).
Figure 2.4 Change in the degree of urbanisation for four epochs, 1975; 1990; 2000; and 2015 (Global Human Settlements 2019).

The results are illustrated with the following three categories in Figure 2.4:

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 2.4 that 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 2.5 at a finer resolution. The building density (a Thiessen polygon analysis on Eskom’s 2013 Building Count dataset), as shown in Figure 2.6, correlates with the spatial distribution of urban areas as illustrated in Figure 2.5. 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 2.7.

The increasing trend in the transformation of the natural environment, with urban areas increasing, is shown in Figure 2.8.

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 2.5), Figure 2.6, Figure 2.7 and Figure 2.8 show that there is a concentration of people in the “shadow corridor” which runs parallel to the N2 highway.

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) 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 2.9.

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4 Inaccuracies may be present due to inconsistent scales between each land cover dataset.
Figure 2.5  Land cover (DEA and GTI 2015; KZN DoT 2017; MDB 2016; Umgeni Water 2019).
Figure 2.6  Thiessen polygon analysis showing proximity of buildings to one another (per m²) (after Eskom 2013; KZN DoT 2017; MDB 2016; Umgeni Water 2019).
Figure 2.7  Relationship between distribution of people and access using proximity of buildings to one another and national and provincial roads as proxies (after Eskom 2013, KZN DoT 2017, MBD 2016).

Figure 2.8  Change in urban category of land cover (2005 – 2013) (after EKZNW 2014; DEA and GTI 2015).
Figure 2.9 Settlement footprints (DRDLR 2015, eThekwin Municipality 2014, KZN DoT 2017, MDB 2016, Umgeni Water 2019).
It is shown in Figure 2.10 that whilst uThukela District Municipality has the largest surface area within Umgeni Water’s area of operation, it only contributes 9.51% (706 588 people) to the total number of people, whilst eThekwini 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 2.11. The change in the number of households per WSA for the period 2011 – 2016 is shown in Figure 2.12. 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 municipalities.

The average household size decreased in the eThekwini and iLembe WSAs for the period 2011 – 2016 (3.6 people to 3.3 people in eThekwini and 3.8 people to 4 people in iLembe) as shown in Figure 2.13. 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 2.13).

The change in the population growth rates (percentage per annum) for the periods 1996 – 2001, 2001 – 2011 and 2011 - 2016 is shown in Figure 2.14. This figure shows that whilst eThekwini WSA and Msunduzi WSA are still experiencing positive growth rates, Maphumulo Municipality in iLembe WSA and Impendle Municipality in uMgungundlovu have consistently experienced negative growth rates. Umzumbe Municipality in Ugu WSA further experienced negative growth rates in the periods 2001 – 2011 and 2011 – 2016. Both Maphumulo Municipality and Umzumbe Municipality had bulk water supply schemes commissioned in the 2011 – 2016 period (Maphumulo Bulk Water Supply Scheme discussed in Section 11 and Mhlabatshane Bulk Water Scheme discussed in Section 10) and both these schemes are demonstrating growth in water demand. A possible reason for the growth in water consumption, whilst experiencing a negative population growth rate, is that with an assured supply of water, the water service levels in the areas have increased. The growth rates for the two municipalities in uThukela WSA that experienced negative growth in the 2001 – 2011 period increased to positive growth in the 2011 – 2016 period.

The short-term mid-year population estimates per district municipality (2011 municipal boundaries) is presented in Table 2.1. It is anticipated that Stats SA will release the long-term mid-year population estimates per district municipality during 2019 and this will be discussed in the next version of the IMP.

---


<table>
<thead>
<tr>
<th>WSA Name</th>
<th>Area (sq. km) (MDB 2016)</th>
<th>Percentage Contribution per Area</th>
<th>Percentage Contribution per Number of People (CS 2016)</th>
<th>Number of People (CS 2016)</th>
</tr>
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<tbody>
<tr>
<td>eThekwini</td>
<td>25 559.46</td>
<td>6.12</td>
<td>49.85</td>
<td>3 702 231.00</td>
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<tr>
<td>iLembe</td>
<td>32 693.09</td>
<td>7.83</td>
<td>8.85</td>
<td>657 612.00</td>
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<tr>
<td>Msunduzi</td>
<td>7 511.92</td>
<td>1.80</td>
<td>9.14</td>
<td>679 039.00</td>
</tr>
<tr>
<td>uMgungundlovu</td>
<td>88 527.82</td>
<td>21.20</td>
<td>5.61</td>
<td>416 826.00</td>
</tr>
<tr>
<td>Ugu</td>
<td>47 917.17</td>
<td>11.48</td>
<td>10.14</td>
<td>753 336.00</td>
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<tr>
<td>Harry Gwala</td>
<td>103 906.84</td>
<td>24.89</td>
<td>6.88</td>
<td>510 865.00</td>
</tr>
<tr>
<td>uThukela</td>
<td>111 392.37</td>
<td>26.68</td>
<td>9.51</td>
<td>706 588.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>417 508.67</strong></td>
<td><strong>100.00</strong></td>
<td><strong>100.00</strong></td>
<td><strong>7 426 497.00</strong></td>
</tr>
</tbody>
</table>

**Figure 2.10** Contribution per number of people (Community Survey 2016) and surface area (MDB 2016) to UW’s operational area.
Figure 2.11  Change in number of people per WSA for 2011 and 2016 (Stats SA 2017).

Figure 2.12  Change in number of households per WSA for 2011 and 2016 (Stats SA 2017).
<table>
<thead>
<tr>
<th>WSA Name</th>
<th>Census 2011 Household Size</th>
<th>Change</th>
<th>CS2016 Household Size</th>
</tr>
</thead>
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<tr>
<td>eThekwini</td>
<td>3.6</td>
<td>↓</td>
<td>3.3</td>
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<tr>
<td>iLembe</td>
<td>3.8</td>
<td>↓</td>
<td>3.4</td>
</tr>
<tr>
<td>Msunduzi</td>
<td>3.8</td>
<td>=</td>
<td>3.8</td>
</tr>
<tr>
<td>uMgungundlovu</td>
<td>3.7</td>
<td>=</td>
<td>3.7</td>
</tr>
<tr>
<td>Ugu</td>
<td>4.0</td>
<td>↑</td>
<td>4.3</td>
</tr>
<tr>
<td>Harry Gwala</td>
<td>4.1</td>
<td>=</td>
<td>4.1</td>
</tr>
<tr>
<td>uThukela</td>
<td>4.5</td>
<td>=</td>
<td>4.5</td>
</tr>
</tbody>
</table>

Figure 2.13 Change in average household size per WSA for 2011 and 2016 (Stats SA 2017).
Figure 2.14 Change in population growth rate (percentage per annum) for 1996 – 2001\(^7\), 2001 – 2011\(^8\) and 2011 - 2016\(^9\) (Stats SA 2013; 2018).

Table 2.1 Short-term mid-year population estimates per district municipality\(^{10}\) (2019 – 2023) (Stats SA 2018: spreadsheet).

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>eThekwini</td>
<td>3 476 686</td>
<td>3 702 231</td>
<td>4 134 487</td>
<td>4 213 711</td>
<td>4 295 316</td>
<td>4 371 277</td>
<td>4 444 516</td>
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<tr>
<td>iLembe</td>
<td>606 809</td>
<td>657 612</td>
<td>675 199</td>
<td>680 852</td>
<td>686 779</td>
<td>692 182</td>
<td>697 440</td>
</tr>
<tr>
<td>uMgungundlovu</td>
<td>1 007 806</td>
<td>1 095 865</td>
<td>1 146 597</td>
<td>1 158 706</td>
<td>1 170 803</td>
<td>1 180 973</td>
<td>1 192 039</td>
</tr>
<tr>
<td>Ugu</td>
<td>689 051</td>
<td>753 336</td>
<td>711 183</td>
<td>707 648</td>
<td>704 427</td>
<td>702 146</td>
<td>699 374</td>
</tr>
<tr>
<td>Harry Gwala</td>
<td>467 292</td>
<td>510 865</td>
<td>506 702</td>
<td>509 622</td>
<td>512 444</td>
<td>514 834</td>
<td>517 066</td>
</tr>
<tr>
<td>uThukela</td>
<td>668 072</td>
<td>706 588</td>
<td>712 999</td>
<td>714 786</td>
<td>716 656</td>
<td>718 286</td>
<td>719 896</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6 915 716</strong></td>
<td><strong>7 426 497</strong></td>
<td><strong>7 887 167</strong></td>
<td><strong>7 985 325</strong></td>
<td><strong>8 086 425</strong></td>
<td><strong>8 179 698</strong></td>
<td><strong>8 270 330</strong></td>
</tr>
</tbody>
</table>

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\(^7\) 2011 municipal boundaries as presented in Stats SA 2013.
\(^8\) 2011 municipal boundaries as presented in Stats SA 2013.
\(^9\) 2016 municipal boundaries as presented in Stats SA 2018.
\(^{10}\) 2011 municipal boundaries.
2.2 Natural Environment

There are three distinct climatic zones within Umgeni Water’s operational area (Figure 2.15), namely:

- The Köppen classification Cwa 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 2.5).
- The Köppen classification Cwb which is the alpine-type climate found in and along the Drakensberg Mountains (see distribution of grassland in Figure 2.5).
- The Köppen classification Cfb which is the more temperate summer rain climate of the Midlands region (see distribution of forests in Figure 2.5).
- The Köppen classification Cfa which is the subtropical perennial rainfall characterising the areas along the coast (see distribution of thicket, bushland and scrub forest in Figure 2.5).

The mean annual precipitation (MAP) within the Umgeni Water operational area varies between 700 and 1000 mm (Figure 2.15) 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 2.15 drain into the catchments shown in Figure 2.16. These catchments encompass, and impact upon, Umgeni Water’s operational area. These catchments have been grouped into logical regions as shown in Figure 2.16.

The spatial distribution of evaporation is shown in Figure 2.15 (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 2.15).

Temperature distribution is shown in Figure 2.15. 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 2.15. 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 and groundwater resources occurring in the catchments of the Mvoti to uMzimkhulu are 433 million m³/annum and 6 million m³/annum, respectively.
Figure 2.15  Climatic variables (BEEH 2011; KZN DoT 2017; MDB 2016; Umgeni Water 2019; WR2012).
Figure 2.16 Quaternary catchments (KZN DoT 2017; MDB 2016; Umgeni Water 2019; WR2012).
The groundwater regions (commonly referred to as the Vegter regions) based on lithology and climatology are shown in Figure 2.17. 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 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 2.17  Groundwater regions (KZN DoT 2017; MDB 2016; Umgeni Water 2019; WR2012).
The notice for the classes of water resources and the resource quality objectives for the Mvoti to uMzimkhulu catchments were published on 8 December 2017 (Government Gazette No. 41306 No. 1386). The water resource classes are presented per “integrated units of analysis (IUA)” and “IUAs are classified in terms of their extent of permissible utilisation and protection” (2017: 215). The three classes are (Figure 2.18):

- **Class I**: High environmental protection and minimal utilisation;
- **Class II**: Moderate protection and moderate utilisation; and
- **Class III**: Sustainable minimal protection and high utilisation.

(2017: 215)
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 - 7) is shown in Figure 2.19.

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

<table>
<thead>
<tr>
<th>KZN Biodiversity Plan Area</th>
<th>Purpose of this Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical Biodiversity Areas: Irreplaceable</td>
<td>“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”.</td>
</tr>
<tr>
<td>Critical Biodiversity Areas: Optimal</td>
<td>“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)”.</td>
</tr>
<tr>
<td>Ecological Support Areas</td>
<td>“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 Ecosystem Services”.</td>
</tr>
<tr>
<td>Ecological Support Areas: Species Specific</td>
<td>“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”.</td>
</tr>
</tbody>
</table>

It is shown in Figure 2.19 that some of Umgeni Water’s existing infrastructure and recommended infrastructure are located within CBAs and ESAs. Similarly, it is shown in Figure 2.20 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 2.20) 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 2.20 that most of the transformed land is within Msunduzi WSA and eThekwini 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 2.19 KZN Biodiversity Plan Critical Biodiversity Areas and Ecological Supports Areas (EKZNW 2016; KZN DoT 2017; MDB 2016; Umgeni Water 2019).
Figure 2.20 Agricultural land categories (KZN DARD 2015; KZN DoT 2017; MDB 2016; Umgeni Water 2019).
The land use occurring on traditional areas (DRDLR 2012) is illustrated in Figure 2.21. A comparison of Figure 2.20 and Figure 2.21 shows that there are pockets of high-value agricultural land within traditional areas. There is a common perception that all traditional areas require a complete network in service provision. However, Figure 2.21 shows that the predominant land use within traditional areas is agriculture. Therefore, the assumption that a network is required for service provision may unintentionally compromise food security.

Figure 2.21  2010 land use on traditional areas (DRDLR 2012).
2.3 Existing Development Status

The Gross Domestic Product by Region (GDP-R) for the WSAs in Umgeni Water’s area of operation for the period 1996 – 2017 is shown in Figure 2.22 and the percentage contributions of municipal GDP-R to the total KwaZulu-Natal GDP-R for 2017 is illustrated in Figure 2.23.

Figure 2.22  GDP by WSA Contribution for the period 1996 – 2017 (KZN Treasury after Global Insight 2018; 2016 municipal boundaries).
Figure 2.23 Percentage contribution of municipal GDP to KZN GDP (2017) (KZN Treasury after Global Insight 2018).
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 Umgeni Water’s operational area is illustrated in Figure 2.24. A comparison between Figure 2.23 and Figure 2.24 shows that Umgeni Water’s existing infrastructure is predominantly located in the higher performing municipalities and that there are recommended projects in the lower performing municipalities.

![Figure 2.24 Municipal Infrastructure Investment Framework categorisation of municipalities (CoGTA 2009; MDB 2016; Stats SA 2018).](image-url)
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”\(^{11}\) and was updated 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 2.25.

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

<table>
<thead>
<tr>
<th>CSIR/SACN Settlement Typology Type</th>
<th>Definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>City Region</td>
<td>Population &gt; 1 million&lt;br&gt;Government and Economic Services Index &gt; 7</td>
<td>eThekwini City Region</td>
</tr>
<tr>
<td>City</td>
<td>Population 500 000 – 1 million&lt;br&gt;Government and Economic Services Index 2 - 5</td>
<td>Pietermaritzburg</td>
</tr>
<tr>
<td>Regional Centre 1</td>
<td>Population 300 000 – 500 000&lt;br&gt;Government and Economic Services Index 1 – 2&lt;br&gt;High population numbers and high economic activity</td>
<td>This type is not found within Umgeni Water’s area of operation</td>
</tr>
<tr>
<td>Regional Centre 2</td>
<td>Population 100 000 – 300 000&lt;br&gt;Government and Economic Services Index &gt; 0.3&lt;br&gt;High population numbers in densely settlement areas</td>
<td>KwaDukuza</td>
</tr>
<tr>
<td>Regional Centre 3</td>
<td>Population 40 000 – 100 000&lt;br&gt;Government and Economic Services Index &gt; 0.25&lt;br&gt;Low population numbers playing a key role in sparsely populated areas</td>
<td>This type is not found within Umgeni Water’s area of operation</td>
</tr>
<tr>
<td>Service Town</td>
<td>Population mostly &gt; 20 000&lt;br&gt;Significant role in hinterland (Service Index 0.065 – 0.25)</td>
<td>Mandini</td>
</tr>
<tr>
<td>Local or Niche Town</td>
<td>Population size varies widely&lt;br&gt;Service role in immediate surroundings (Service Index 0.001 – 0.065)</td>
<td>Mooi River</td>
</tr>
<tr>
<td>High Density Rural</td>
<td>Rural nodes in high density settlement areas – meso zones with &gt; 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. These areas typically have very little economic activity, no consolidated town centre/nodes, and a spread out morphological structure.</td>
<td>Ozzathini</td>
</tr>
<tr>
<td>Rest of South Africa</td>
<td>Less densely populated areas, sparsely populated areas, mountainous areas, national parks.</td>
<td></td>
</tr>
</tbody>
</table>

Figure 2.25 CSIR/SACN Settlement Typology (CSIR and SACN 2016; KZN DoT 2017; MDB 2016; Umgeni Water 2019).
It is noted in Figure 2.30 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 2009 study. The 2015 DRDLR settlement typology (Figure 2.26) 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 2.26 The 2015 DRDLR Settlement Typology structure hierarchy (Kahn in DRDLR 2015: 40).](image)

It is shown in Figure 2.27 that Umgeni Water’s infrastructure is predominated located in those settlements categorised as “urban” and “recreational” in the 2015 DRDLR Settlement Typology with the Maphumulo System (Section 11) the only system that is predominated located in settlements classified as “rural”. The Mhlabatshane System (Section 10) supplies settlements that were not identified by the 2015 DRDLR Settlement typology methodology i.e. these settlements are less than the thresholds used. The recommended projects will be supplying settlements categorised as both “urban” and “rural”.

---

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Figure 2.27 DRDLR 2015 Settlement Typology (DRDLR 2015; KZN DoT 2017; MDB 2016; Umgeni Water 2019).
\[ \text{2.4 Basic Needs} \]

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 2.28. The comparison of this figure with Figure 2.5, Figure 2.9 and Figure 2.28 shows that those with the highest social need are residing in the “shadow corridor”. A comparison with Figure 2.24 further shows that these municipalities are classified as “B3”; and “B4” and the comparison with Figure 2.25 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 2.29. It is illustrated in Figure 2.29 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 2.29 with Figure 2.23 shows that those areas which have relatively low SAMPI scores make a larger percentage contribution to the KZN GDP. A comparison of Figure 2.29 with Figure 2.30 shows that those areas with relatively high SAMPI scores are predominantly dependent on grants as a municipal source of income. 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. The information could also be inferred that areas with good access to water have the higher contribution to GDP.
Figure 2.28  KZN PGDS composite social needs (KZN Planning Commission 2016).
Figure 2.29 2011 SAMPI score per ward (Stats SA 2014).
Figure 2.30  Grants as a percentage of municipal total income (KZN DoT 2017; MDB 2016; Stats SA 2016: 7 after MDB 2012; Umgeni Water 2019).
The contribution of the weighted indicators to SAMPI 2011 in KwaZulu-Natal is shown in Figure 2.31. It is shown that sanitation is the third largest contributor at 8% and water and heating the fourth largest contributor at 7%.

![Figure 2.31 Contribution of weighted indicators to SAMPI 2011 in KwaZulu-Natal (Stats SA 2014b: 32).](image)

The distribution of the largest three weighted indicators to SAMPI 2011 per ward is shown in Figure 2.32.

A comparison of Figure 2.31 and Figure 2.32 shows that contribution of weighted indicators to SAMPI 2011 per ward follows a similar distribution to that of KwaZulu-Natal i.e. sanitation (shown in red in Figure 2.32) is the third largest contributor.
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).

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

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

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

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

<table>
<thead>
<tr>
<th>Whether (or not) service delivery complaints were made</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water services</td>
<td>40.8%</td>
<td>59.2%</td>
</tr>
<tr>
<td>Electricity services</td>
<td>29.1%</td>
<td>70.9%</td>
</tr>
<tr>
<td>Refuse disposal</td>
<td>19.1%</td>
<td>80.9%</td>
</tr>
<tr>
<td>Housing</td>
<td>34.0%</td>
<td>66.0%</td>
</tr>
<tr>
<td>Sanitation services</td>
<td>23.9%</td>
<td>76.1%</td>
</tr>
</tbody>
</table>
Table 2.7  Top five municipal services perceived as important by MIIF category in the KZN CSS 2018 (Stats SA 2018: 82).

<table>
<thead>
<tr>
<th>Highest Proportion</th>
<th>MIIF Category A</th>
<th>MIIF Category B1</th>
<th>MIIF Category B2</th>
<th>MIIF Category B3</th>
<th>MIIF Category B4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highest Proportion</td>
<td>Water Services</td>
<td>Water Services</td>
<td>Water Services</td>
<td>Water Services</td>
<td>Water Services</td>
</tr>
<tr>
<td>2nd Highest Proportion</td>
<td>Electrical Services</td>
<td>Electrical Services</td>
<td>Electrical Services</td>
<td>Electrical Services</td>
<td>Electrical Services</td>
</tr>
<tr>
<td>3rd Highest Proportion</td>
<td>Municipal Clinic Services</td>
<td>Municipal Clinic Services</td>
<td>Municipal Clinic Services</td>
<td>Affordable Housing</td>
<td>Municipal Clinic Services</td>
</tr>
<tr>
<td>4th Highest Proportion</td>
<td>Road Maintenance</td>
<td>Sanitation Services</td>
<td>Affordable Housing</td>
<td>Municipal Clinic Services</td>
<td>Affordable Housing</td>
</tr>
<tr>
<td>5th Highest Proportion</td>
<td>Sanitation Services</td>
<td>Affordable Housing</td>
<td>Sanitation Services</td>
<td>Road Maintenance</td>
<td>Road Maintenance</td>
</tr>
</tbody>
</table>

It is shown in Figure 2.33 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 2.33  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).
Figure 2.34 Percentage distribution of persons’ rating of the overall quality of water services per WSA as identified by the Community Survey 2016 (Stats SA 2017: database).

Figure 2.35 Percentage distribution of persons’ rating of the overall quality of water services per local municipality as identified by the Community Survey 2016 (Stats SA 2017: database).
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 2.36 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 2.36 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).
Figure 2.37  Percentage distribution of persons’ rating of the overall quality of sanitation services per WSA as identified by the Community Survey 2016 (Stats SA 2017: database).

Figure 2.38  Percentage distribution of persons’ rating of the overall quality of sanitation services per local municipality as identified by the Community Survey 2016 (Stats SA 2017: database).
The total number of households with access to piped water, as per the Census 2011, is shown in Figure 2.39 per WSA. A proxy using the Census 2011 and EKZN-W’s land cover (2011) shows the spatial distribution of the number of people with access to piped water in Figure 2.40, the number of people per source of water in Figure 2.41 and the number of people with access to toilet facilities in Figure 2.42. The Community Survey 2016 results for access to water and sanitation are shown in Table 2.8 and Table 2.9.

![Figure 2.39 Census 2011 number of people with access to piped water per the 2016 WSA boundaries (Stats SA 2017; KZN Treasury after Global Insight 2018).](image-url)
Figure 2.40 Proxy showing access to piped water (after Census 2011 and EKZNW 2011).
Figure 2.41  Proxy showing source of water (after Census 2011 and EKZNW 2011).
Table 2.8 Community Survey 2016 access to water (Stats SA 2017).

<table>
<thead>
<tr>
<th>Percentage of people with access to safe drinking water supply service</th>
<th>eThekwini WSA</th>
<th>Msunduzi WSA</th>
<th>uMgungundlovu WSA</th>
<th>iLembe WSA</th>
<th>Ugu WSA</th>
<th>Harry Gwala WSA</th>
<th>uThukela WSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>92%</td>
<td>92%</td>
<td>76%</td>
<td>68%</td>
<td>82%</td>
<td>59%</td>
<td>73%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Main source of water for drinking with the highest percentage of people</th>
<th>eThekwini WSA</th>
<th>Msunduzi WSA</th>
<th>uMgungundlovu WSA</th>
<th>iLembe WSA</th>
<th>Ugu WSA</th>
<th>Harry Gwala WSA</th>
<th>uThukela WSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>60% with piped water inside house</td>
<td>39% with piped water inside yard</td>
<td>31% with piped water inside yard</td>
<td>26% with borehole in yard</td>
<td>38% with borehole in yard</td>
<td>25% with borehole in yard</td>
<td>32% with piped water inside yard</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Main source of water for drinking with the second highest percentage of people</th>
<th>eThekwini WSA</th>
<th>Msunduzi WSA</th>
<th>uMgungundlovu WSA</th>
<th>iLembe WSA</th>
<th>Ugu WSA</th>
<th>Harry Gwala WSA</th>
<th>uThukela WSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>27% with piped water inside yard</td>
<td>53% with piped water inside house</td>
<td>26% with piped water inside house</td>
<td>22% with borehole in yard</td>
<td>18% using public tap</td>
<td>24% using flowing water / river / stream</td>
<td>17% with piped water inside house</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Main source of water for drinking with the third highest percentage of people</th>
<th>eThekwini WSA</th>
<th>Msunduzi WSA</th>
<th>uMgungundlovu WSA</th>
<th>iLembe WSA</th>
<th>Ugu WSA</th>
<th>Harry Gwala WSA</th>
<th>uThukela WSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>8% with borehole in yard</td>
<td>4% with borehole in yard</td>
<td>15% with borehole in yard</td>
<td>18% with piped water inside house</td>
<td>17% with piped water inside house</td>
<td>21% with piped water inside yard</td>
<td>13% with borehole in yard</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Supplier of the main source of drinking water to the largest percentage of people</th>
<th>eThekwini WSA</th>
<th>Msunduzi WSA</th>
<th>uMgungundlovu WSA</th>
<th>iLembe WSA</th>
<th>Ugu WSA</th>
<th>Harry Gwala WSA</th>
<th>uThukela WSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>97% supplied by WSA</td>
<td>97% supplied by WSA</td>
<td>69% supplied by WSA</td>
<td>69% supplied by WSA</td>
<td>84% supplied by WSA</td>
<td>51% supplied by WSA</td>
<td>67% supplied by WSA</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Percentage of people travelling more than 200m to main source of water for drinking</th>
<th>eThekwini WSA</th>
<th>Msunduzi WSA</th>
<th>uMgungundlovu WSA</th>
<th>iLembe WSA</th>
<th>Ugu WSA</th>
<th>Harry Gwala WSA</th>
<th>uThukela WSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>4%</td>
<td>2%</td>
<td>19%</td>
<td>30%</td>
<td>33%</td>
<td>36%</td>
<td>26%</td>
<td></td>
</tr>
</tbody>
</table>
Table 2.9  Community Survey 2016 access to sanitation (Stats SA 2017).

<table>
<thead>
<tr>
<th>Main type of toilet facility used with the highest percentage of people</th>
<th>eThekwini WSA</th>
<th>Msunduzi WSA</th>
<th>uMgungundlovu WSA</th>
<th>iLembe WSA</th>
<th>Ugu WSA</th>
<th>Harry Gwala WSA</th>
<th>uThukela WSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>67% with flush toilet to public sewerage system</td>
<td>67% with flush toilet to public sewerage system</td>
<td>67% with flush toilet to public sewerage system</td>
<td>67% with flush toilet to public sewerage system</td>
<td>67% with flush toilet to public sewerage system</td>
<td>67% with flush toilet to public sewerage system</td>
<td>67% with flush toilet to public sewerage system</td>
<td></td>
</tr>
<tr>
<td>46% with flush toilet to public sewerage system</td>
<td>46% with flush toilet to public sewerage system</td>
<td>46% with flush toilet to public sewerage system</td>
<td>46% with flush toilet to public sewerage system</td>
<td>46% with flush toilet to public sewerage system</td>
<td>46% with flush toilet to public sewerage system</td>
<td>46% with flush toilet to public sewerage system</td>
<td></td>
</tr>
<tr>
<td>35% with VIP</td>
<td>35% with VIP</td>
<td>35% with VIP</td>
<td>35% with VIP</td>
<td>35% with VIP</td>
<td>35% with VIP</td>
<td>35% with VIP</td>
<td></td>
</tr>
<tr>
<td>25% with chemical toilet</td>
<td>25% with chemical toilet</td>
<td>25% with chemical toilet</td>
<td>25% with chemical toilet</td>
<td>25% with chemical toilet</td>
<td>25% with chemical toilet</td>
<td>25% with chemical toilet</td>
<td></td>
</tr>
<tr>
<td>42% with VIP</td>
<td>42% with VIP</td>
<td>42% with VIP</td>
<td>42% with VIP</td>
<td>42% with VIP</td>
<td>42% with VIP</td>
<td>42% with VIP</td>
<td></td>
</tr>
<tr>
<td>33% with VIP</td>
<td>33% with VIP</td>
<td>33% with VIP</td>
<td>33% with VIP</td>
<td>33% with VIP</td>
<td>33% with VIP</td>
<td>33% with VIP</td>
<td></td>
</tr>
<tr>
<td>34% with VIP</td>
<td>34% with VIP</td>
<td>34% with VIP</td>
<td>34% with VIP</td>
<td>34% with VIP</td>
<td>34% with VIP</td>
<td>34% with VIP</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Main type of toilet facility used with the second highest percentage of people</th>
<th>eThekwini WSA</th>
<th>Msunduzi WSA</th>
<th>uMgungundlovu WSA</th>
<th>iLembe WSA</th>
<th>Ugu WSA</th>
<th>Harry Gwala WSA</th>
<th>uThukela WSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>12% with chemical toilet</td>
<td>12% with chemical toilet</td>
<td>12% with chemical toilet</td>
<td>12% with chemical toilet</td>
<td>12% with chemical toilet</td>
<td>12% with chemical toilet</td>
<td>12% with chemical toilet</td>
<td></td>
</tr>
<tr>
<td>16% with VIP</td>
<td>16% with VIP</td>
<td>16% with VIP</td>
<td>16% with VIP</td>
<td>16% with VIP</td>
<td>16% with VIP</td>
<td>16% with VIP</td>
<td></td>
</tr>
<tr>
<td>23% with flush toilet to public sewerage system</td>
<td>23% with flush toilet to public sewerage system</td>
<td>23% with flush toilet to public sewerage system</td>
<td>23% with flush toilet to public sewerage system</td>
<td>23% with flush toilet to public sewerage system</td>
<td>23% with flush toilet to public sewerage system</td>
<td>23% with flush toilet to public sewerage system</td>
<td></td>
</tr>
<tr>
<td>23% with pit toilet</td>
<td>23% with pit toilet</td>
<td>23% with pit toilet</td>
<td>23% with pit toilet</td>
<td>23% with pit toilet</td>
<td>23% with pit toilet</td>
<td>23% with pit toilet</td>
<td></td>
</tr>
<tr>
<td>16% with flush toilet to public sewerage system</td>
<td>16% with flush toilet to public sewerage system</td>
<td>16% with flush toilet to public sewerage system</td>
<td>16% with flush toilet to public sewerage system</td>
<td>16% with flush toilet to public sewerage system</td>
<td>16% with flush toilet to public sewerage system</td>
<td>16% with flush toilet to public sewerage system</td>
<td></td>
</tr>
<tr>
<td>23% with pit toilet</td>
<td>23% with pit toilet</td>
<td>23% with pit toilet</td>
<td>23% with pit toilet</td>
<td>23% with pit toilet</td>
<td>23% with pit toilet</td>
<td>23% with pit toilet</td>
<td></td>
</tr>
<tr>
<td>22% with flush toilet to public sewerage system</td>
<td>22% with flush toilet to public sewerage system</td>
<td>22% with flush toilet to public sewerage system</td>
<td>22% with flush toilet to public sewerage system</td>
<td>22% with flush toilet to public sewerage system</td>
<td>22% with flush toilet to public sewerage system</td>
<td>22% with flush toilet to public sewerage system</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Main type of toilet facility used with the third highest percentage of people</th>
<th>eThekwini WSA</th>
<th>Msunduzi WSA</th>
<th>uMgungundlovu WSA</th>
<th>iLembe WSA</th>
<th>Ugu WSA</th>
<th>Harry Gwala WSA</th>
<th>uThukela WSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>8% with pit toilet</td>
<td>8% with pit toilet</td>
<td>8% with pit toilet</td>
<td>8% with pit toilet</td>
<td>8% with pit toilet</td>
<td>8% with pit toilet</td>
<td>8% with pit toilet</td>
<td></td>
</tr>
<tr>
<td>14% with pit toilet</td>
<td>14% with pit toilet</td>
<td>14% with pit toilet</td>
<td>14% with pit toilet</td>
<td>14% with pit toilet</td>
<td>14% with pit toilet</td>
<td>14% with pit toilet</td>
<td></td>
</tr>
<tr>
<td>12% with pit toilet</td>
<td>12% with pit toilet</td>
<td>12% with pit toilet</td>
<td>12% with pit toilet</td>
<td>12% with pit toilet</td>
<td>12% with pit toilet</td>
<td>12% with pit toilet</td>
<td></td>
</tr>
<tr>
<td>22% with VIP</td>
<td>22% with VIP</td>
<td>22% with VIP</td>
<td>22% with VIP</td>
<td>22% with VIP</td>
<td>22% with VIP</td>
<td>22% with VIP</td>
<td></td>
</tr>
<tr>
<td>15% with pit toilet</td>
<td>15% with pit toilet</td>
<td>15% with pit toilet</td>
<td>15% with pit toilet</td>
<td>15% with pit toilet</td>
<td>15% with pit toilet</td>
<td>15% with pit toilet</td>
<td></td>
</tr>
<tr>
<td>23% with chemical toilet</td>
<td>23% with chemical toilet</td>
<td>23% with chemical toilet</td>
<td>23% with chemical toilet</td>
<td>23% with chemical toilet</td>
<td>23% with chemical toilet</td>
<td>23% with chemical toilet</td>
<td></td>
</tr>
<tr>
<td>18% with chemical toilet</td>
<td>18% with chemical toilet</td>
<td>18% with chemical toilet</td>
<td>18% with chemical toilet</td>
<td>18% with chemical toilet</td>
<td>18% with chemical toilet</td>
<td>18% with chemical toilet</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location of main toilet facility with the highest percentage of people</th>
<th>eThekwini WSA</th>
<th>Msunduzi WSA</th>
<th>uMgungundlovu WSA</th>
<th>iLembe WSA</th>
<th>Ugu WSA</th>
<th>Harry Gwala WSA</th>
<th>uThukela WSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>61% with toilet in the house</td>
<td>61% with toilet in the house</td>
<td>61% with toilet in the house</td>
<td>61% with toilet in the house</td>
<td>61% with toilet in the house</td>
<td>61% with toilet in the house</td>
<td>61% with toilet in the house</td>
<td></td>
</tr>
<tr>
<td>54% with toilet in the yard</td>
<td>54% with toilet in the yard</td>
<td>54% with toilet in the yard</td>
<td>54% with toilet in the yard</td>
<td>54% with toilet in the yard</td>
<td>54% with toilet in the yard</td>
<td>54% with toilet in the yard</td>
<td></td>
</tr>
<tr>
<td>63% with toilet in the yard</td>
<td>63% with toilet in the yard</td>
<td>63% with toilet in the yard</td>
<td>63% with toilet in the yard</td>
<td>63% with toilet in the yard</td>
<td>63% with toilet in the yard</td>
<td>63% with toilet in the yard</td>
<td></td>
</tr>
<tr>
<td>56% with toilet in the yard</td>
<td>56% with toilet in the yard</td>
<td>56% with toilet in the yard</td>
<td>56% with toilet in the yard</td>
<td>56% with toilet in the yard</td>
<td>56% with toilet in the yard</td>
<td>56% with toilet in the yard</td>
<td></td>
</tr>
<tr>
<td>65% with toilet in the yard</td>
<td>65% with toilet in the yard</td>
<td>65% with toilet in the yard</td>
<td>65% with toilet in the yard</td>
<td>65% with toilet in the yard</td>
<td>65% with toilet in the yard</td>
<td>65% with toilet in the yard</td>
<td></td>
</tr>
<tr>
<td>82% with toilet in the yard</td>
<td>82% with toilet in the yard</td>
<td>82% with toilet in the yard</td>
<td>82% with toilet in the yard</td>
<td>82% with toilet in the yard</td>
<td>82% with toilet in the yard</td>
<td>82% with toilet in the yard</td>
<td></td>
</tr>
<tr>
<td>77% with toilet in the yard</td>
<td>77% with toilet in the yard</td>
<td>77% with toilet in the yard</td>
<td>77% with toilet in the yard</td>
<td>77% with toilet in the yard</td>
<td>77% with toilet in the yard</td>
<td>77% with toilet in the yard</td>
<td></td>
</tr>
</tbody>
</table>
The Community Survey results showing the number of people with the main source of water for drinking per WSA is shown in Table 2.10 and Figure 2.43.

### Table 2.10 Community Survey 2016 number of people with main source of water for drinking per WSA (Stats SA 2017).

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

The distance people travel on average to their main source of water for drinking per WSA is illustrated in Figure 2.44. The main supplier of drinking water per WSA is shown in Figure 2.45.

The main type of toilet facility per WSA is presented in Figure 2.46.

eThekwini Municipality is the predominant contributor of people to Umgeni Water’s operated area at 55% (Figure 2.10) and has the largest number of people with access to piped water inside their dwellings (Table 2.8) as well as with a flush toilet connected to a public sewerage system (Figure 2.46).

A comparison of Table 2.10, Figure 2.43, Figure 2.44, Figure 2.45 and Figure 2.46 with Figure 2.47 and Figure 2.48 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 Census 2021.
Figure 2.43 Community Survey 2016 number of people with main source of water for drinking per WSA (Stats SA 2017; KZN Treasury after Global Insight 2018).

Figure 2.44 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 2018).
Figure 2.45  Community Survey 2016 number of people per main supplier of drinking water per WSA (Stats SA 2017; KZN Treasury after Global Insight 2018).

Figure 2.46  Community Survey 2016 number of people per main type of toilet facility per WSA (Stats SA 2017; KZN Treasury after Global Insight 2018).
Figure 2.47 Norms and standards for water supply services (DWS 2017: 14).

Figure 2.48 Norms and standards for sanitation services (DWS 2017: 32).
2.5 Development Plans

The KZN Planning Commission summarises the alignment of the key strategic plans occurring at the different spheres in Figure 2.49.

Figure 2.49  Alignment between key strategic plans occurring at the different spheres (KZN Planning Commission 2018a: 5).

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 2.11.
Table 2.11 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).

<table>
<thead>
<tr>
<th>Targets</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all.</td>
<td>6.1.1 Proportion of population using safely managed drinking water services.</td>
</tr>
<tr>
<td>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.</td>
<td>6.2.1 Proportion of population using safely managed sanitation services, including a hand-washing facility with soap and water.</td>
</tr>
<tr>
<td>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.</td>
<td>6.3.1 Proportion of wastewater safely treated.</td>
</tr>
<tr>
<td>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.</td>
<td>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.</td>
</tr>
<tr>
<td>6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate.</td>
<td>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.</td>
</tr>
<tr>
<td>6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.</td>
<td>6.6.1 Change in the extent of water-related ecosystems over time.</td>
</tr>
<tr>
<td>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.</td>
<td>6.a.1 Amount of water- and sanitation-related official development assistance that is part of a government-coordinated spending plan.</td>
</tr>
<tr>
<td>6.b Support and strengthen the participation of local communities in improving water and sanitation management.</td>
<td>6.b.1 Proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management.</td>
</tr>
</tbody>
</table>

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 viz. SIP 18, Water and Sanitation. 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. The 18 SIPs and those which are applicable to KZN are illustrated in Table 2.12.
Table 2.12 Strategic Integrated Projects applicable to KZN (KZN Planning Commission 2013).

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

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

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 2.50. The regions identified by this study occurring in Umgeni Water’s area is summarised in Figure 2.51.

![Figure 2.50 “N3 Strategic Corridor Development Plan 2016” study area (KZN CoGTA 2016).](image-url)
A summary of the regional interventions required for water and sanitation as identified by this study is shown in Table 2.13. Those regional interventions identified by this study that are direct water users are summarised in Table 2.14. 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 2.13). 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 2.13 Summary of regional interventions required for water and sanitation (KZN CoGTA 2016: 258).

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Region 1 Industrial and Logistics Hub</td>
<td></td>
<td></td>
<td></td>
<td>Western Aqueduct.</td>
</tr>
<tr>
<td>Region 2 Durban Port City</td>
<td></td>
<td></td>
<td></td>
<td>Western Aqueduct.</td>
</tr>
<tr>
<td>Region 3 Aerotropolis</td>
<td></td>
<td></td>
<td></td>
<td>Northern Aqueduct Augmentation Project.</td>
</tr>
<tr>
<td>Region 4 Autotropolis</td>
<td></td>
<td></td>
<td></td>
<td>uMkhomazi-Mgeni Transfer Scheme.</td>
</tr>
<tr>
<td>------------------</td>
<td>-------------------</td>
<td>---------------------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Region 5 Agrotropolis</td>
<td><img src="image" alt="Map" /></td>
<td>87 Ml/day.</td>
<td>66 Ml/day.</td>
<td>Wagendrift Dam/Tugela River/Klip River</td>
</tr>
<tr>
<td>Region 6 Agri-Tourism and Lifestyle City</td>
<td><img src="image" alt="Map" /></td>
<td>55 Ml/day.</td>
<td>42 Ml/day.</td>
<td>Midmar Dam / Mearns Weir.</td>
</tr>
<tr>
<td>SIP 2 KZN Region</td>
<td>Agriculture Sector Development</td>
<td>AgriParks / Agri-Villages / Commercial Agrizones (Intensive Farming)</td>
<td>Manufacturing Sector Development</td>
<td>Tourism Sector Development (No. of Hotels up to 2045) (Short-Stay Accommodation)</td>
</tr>
<tr>
<td>------------------</td>
<td>--------------------------------</td>
<td>---------------------------------------------------------------</td>
<td>---------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Region 1 Industrial and Logistics Hub</td>
<td>Unleashing 10 000 ha of new agricultural land.</td>
<td>MKhambathini - AgriPark (Eston) / Agri-village / Commercial Agrizones potential. Msunduzi – Agri-Village / Commercial Agrizones potential. eThekwini – Commercial Agrizones (Intensive farming).</td>
<td>908 ha required by 2045.</td>
<td>10</td>
</tr>
<tr>
<td>Region 2 Durban Port City</td>
<td>Unleashing 600 ha of new agricultural land.</td>
<td>Commercial Agrizones (Intensive farming).</td>
<td>132 ha required by 2045.</td>
<td>12</td>
</tr>
<tr>
<td>Region 3 Aerotropolis</td>
<td>Unleashing 16 000 ha of new agricultural land.</td>
<td>AgriPark (DTP/Stanger) / Agri-village / Commercial Agrizones potential.</td>
<td>1 323 ha required by 2045.</td>
<td>13</td>
</tr>
<tr>
<td>Region 4 Autotropolis</td>
<td>Unleashing 2 000 ha of new agricultural land.</td>
<td>Agri-Village / Commercial Agrizones potential.</td>
<td>648 ha required by 2045.</td>
<td>6</td>
</tr>
<tr>
<td>Region 5 Agrotropolis</td>
<td>Unleashing 25 000 ha of new agricultural land.</td>
<td>uMtshezi - Agri-village / Commercial Agrizones potential. Othholombo - AgriPark (Bergville) / Agri-Village / Commercial Agrizones potential. Emnambithi/Ladysmith - Agri-village / Commercial Agrizones potential.</td>
<td>250 ha required by 20245.</td>
<td>7</td>
</tr>
<tr>
<td>Region 6 Agri-Tourism and Lifestyle City</td>
<td>Unleashing 7 000 ha of new agricultural land.</td>
<td>Msingi – AgriPark (Dargle / Cedara) / Agri-Village / Commercial Agrizones potential. Mqofoza – Agri-Village / Commercial Agrizones potential.</td>
<td>161 ha required by 2045.</td>
<td>2</td>
</tr>
</tbody>
</table>
In October 2018, DWS released Version 10.1 of the Draft 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 2.11).
- “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 2.52 and the alignment with other planning instruments’ timelines in Figure 2.53.

The NW&SMP shows that there is a 63% reliability of water and sanitation services in KZN (Figure 2.54). Section 4 and Section 13 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 8, 9, 10 and 11 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 2.56 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 8, 9 and 12. The NW&SMP summarises the inter-basin transfers in South Africa (Figure 2.57) and shows these water transfers out of the key strategic water source areas (Figure 2.58). It is shown in Figure 2.58 that the uThukela key strategic water source area, located within Umgeni Water’s operational area, supplies the Johannesburg economic hub. Figure 2.57 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 2.52 National Water and Sanitation Master Plan philosophy (DWS 2018: 7).

Figure 2.53 National Water and Sanitation Master Plan timelines relative to other planning instruments (DWS 2018: 2-2).
Figure 2.54  Reliability of water and sanitation services per province (DWS 2018a: 21).

Figure 2.55  Different types of water quality problems across South Africa (Ashton 2012 in DWS 2018a: 30).
Figure 2.56 “Strategic water source areas: the 10% of South Africa’s land that delivers 50% of our water” (DWS 2018a: 36).

Figure 2.57 Inter-basin water transfers in South Africa (DWS 2018b: 3-12).
The KZN Situational Overview 2016; the KZN Provincial Growth and Development Strategy (PGDS) and KZN Provincial Growth and Development Plan were reviewed in 2016 with the development of a 2035 Vision: “KwaZulu-Natal, a prosperous Province with a healthy, secure and skilled population, living in dignity and harmony, an acting as gateway to Africa and the world” (KZN Planning Commission 2018: 13). It is noted that the KZN Situational Overview 2016 briefly summarised the information on the water resource regions from the Umgeni Water 2015 IMP. This information is updated in Section 8, Section 9, Section 10, Section 11 and Section 12 of this report.

The seven long term goals shown in Figure 2.59 are identified in the KZN PGDS 2016 to “guide policy making, programme prioritisation and resource allocation” (KZN Planning Commission 2018b: 8).

The KZN PGDS Sustainability Framework is illustrated in Figure 2.60.

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 2016 KZN PGDS and the SDG Goals to which Umgeni Water contributes is summarised in Table 2.15.
Figure 2.59 The KZN PGDS Vision 2035, Goals and Strategic Objectives (KZN Planning Commission 2018b: 8).
Figure 2.60 KZN PGDS Sustainability Framework (KZN Planning Commission 2018b: 6).

Table 2.15 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).

<table>
<thead>
<tr>
<th>AU Agenda 2063 Goals</th>
<th>KZN PGDS 2016</th>
<th>SDG Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>12. Ensure sustainable consumption and production patterns.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13. Take urgent action to combat climate change and its impacts.</td>
</tr>
<tr>
<td>10. World class infrastructure criss-crosses Africa.</td>
<td>4. Strategic Infrastructure.</td>
<td>6. Ensure availability and sustainable management of water and sanitation for all.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7. Ensure access to affordable, reliable, sustainable and modern energy for all.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9. Build resilient infrastructure, promote inclusive and sustainable industrialisation, and foster innovation.</td>
</tr>
</tbody>
</table>
The indicators and the interventions for Strategic Objective 4.4 identified in the KZN PGDS 2018 are listed in **Table 2.16**.

**Table 2.16  Indicators and interventions for Strategic Objective 4.4 (KZN Planning Commission 2018a: 128).**

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

The KZN PGDP 2018 elaborates on the interventions listed in **Table 2.16** and further identifies targets for the indicators shown in **Table 2.16** (see pgs. 128 – 131 in the **KZN PGDP 2019**).

The KZN PGDP 2019 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” as shown in **Figure 2.61**.
The KZN PSDF 2016 is shown in Figure 2.62 and Umgeni Water’s infrastructure and recommended projects in relation to the KZN PSDF 2016 is shown in Figure 2.63. 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 are predominately located in those areas identified as “priority intervention areas”.

Figure 2.61 Composite map of priority intervention areas in KZN (KZN Planning Commission 2018a: 23).
Figure 2.62 KZN PSDF 2016 (KZN Planning Commission 2018a: 25).
Figure 2.63 Umgeni Water’s infrastructure in relation to the KZN PSDF 2016 (KZN DoT 2017; KZN Planning Commission 2018; MDB 2016; Umgeni Water 2019).
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 2.64. Umgeni Water engages with the KZN-IMP through Action Work Group (AWG) 14 (Figure 2.65) and the Provincial Infrastructure Co Ordination Work Group12.

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

![Diagram showing the KZN-IMP institutional framework.]

**Figure 2.64** The KZN-IMP institutional framework (KZN Planning Commission 2018a: 181).

<table>
<thead>
<tr>
<th>Executive Council Cluster</th>
<th>Cluster receives reports from</th>
<th>Responsible for the following Strategic Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWG No.</td>
<td>Convening Dept</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>DARD</td>
<td>1.1 Develop and promote Agricultural Potential</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.2 Enhance sectoral development through trade investment and business retention</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.3 Enhance spatial economic development</td>
</tr>
<tr>
<td>2</td>
<td>DEDTEA</td>
<td>1.4 Improve the efficiency, innovation and variety of government-led job creation programmes</td>
</tr>
<tr>
<td>3</td>
<td>DPW</td>
<td>1.5 Promote SMME and entrepreneurial development</td>
</tr>
<tr>
<td>4</td>
<td>DEDTEA</td>
<td>1.6 Enhance the knowledge economy</td>
</tr>
<tr>
<td>5</td>
<td>DEDTEA</td>
<td>2.1 Development of seaports and airports</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.2 Develop road and rail networks</td>
</tr>
<tr>
<td>12</td>
<td>DOT</td>
<td>3.1 Develop Information and Communications Technology (ICT) Infrastructure</td>
</tr>
<tr>
<td>13</td>
<td>DEDTEA</td>
<td>3.2 Enhance resilience of ecosystem services</td>
</tr>
<tr>
<td>14</td>
<td>COGTA</td>
<td>3.3 Adapt and respond to climate change</td>
</tr>
<tr>
<td>15</td>
<td>DEDTEA</td>
<td>4.1 Ensure availability and sustainable management of water and sanitation for all</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.2 Ensure access to affordable, reliable, sustainable and modern energy for all</td>
</tr>
<tr>
<td>16</td>
<td>DEDTEA</td>
<td>4.6 Enhance KZN waste management capacity</td>
</tr>
</tbody>
</table>

**Figure 2.65** Action Work Groups reporting to the Economic Sector and Infrastructure Development Cluster of the KZN Executive Council and the PGDP Technical Committee (KZN Planning Commission 2017: 13).

The KZN-IMP is summarised in **Figure 2.66**.
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 2.67.

Umgeni Water’s infrastructure in relation to the 2016 PSEDS is shown in Figure 2.68. It is shown in this figure that Umgeni Water’s existing infrastructure and recommended projects align with the proposed nodes and corridors of the PSEDS 2016.
Figure 2.67 The PSEDS 2007 and 2016 (KZN EDTEA 2017: database).
Figure 2.68 Umgeni Water’s infrastructure in relation to the KZN PSEDS 2016 (KZN DoT 2017; KZN EDTEA 2017; MDB 2016; Umgeni Water 2019).
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 competiveness 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 2.69) with a scoring system and a sensitivity analysis to identify focus areas for human settlements.

Figure 2.69  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 recommended projects is shown in Figure 2.70.
Figure 2.70 Umgeni Water’s infrastructure in relation to the KZN Human Settlements Master Spatial Plan 2016 Focus Areas (KZN DHS and HDA 2016; KZN DoT 2017; MDB 2016; Umgeni Water 2019).
Emanating from the KZN Cabinet Resolution of 5 December 2018 on the KZN Human Settlements Master Spatial Plan, it is anticipated that the implementation plan for the Human Settlements Master Plan will be finalised in the 2019/2020 financial year and that there will be two preliminary declarations of Priority Housing Development Areas (PHDAs) introduced to the KZN Cabinet (KZN HDA 2019: Slide 2). 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)

There are five proposed PHDAs identified in KZN, four of which are located in Umgeni Water’s operational area (Figure 2.71). Two of the proposed PHDAs viz. the eThekwini Inner City PHDA and the Edendale PHDA are supplied by the Mgeni System (Section 8) and the remaining two viz. the eThekwini Northern Regional Development PHDA and the Shakaskraal, Tinley Manor and Ballito PHDA are supplied by the North Coast System (Section 10). The proposed Edendale PHDA could be supplied by the Darvill WWW (Section 13). Umgeni Water does not operate the wastewater infrastructure supplying the remaining proposed PHDAs.

A summary of the municipal Spatial Development Frameworks (SDFs) is presented in Figure 2.72. It is shown in this figure that Umgeni Water’s existing and proposed infrastructure align with the nodes and corridors identified by the municipalities.
Figure 2.71 Proposed Priority Housing Development Areas located in Umgeni’s operational area (KZN HDA 2019: slides 15, 16, 17, 19).
Figure 2.72 Municipal SDFs (eThekwini 2018; Harry Gwala 2016; iLembe 2016; KZN DoT 2017; MDB 2016; Umgeni Water 2019; Ugu 2016; uMgungundlovu 2018; uThukela 2018).
Umgeni Water initiated a project in 2018 to capture the development applications lodged with the local municipalities (it is the mandate of local municipalities to decide on whether a development application may proceed or not). The purpose of this project is the identification of the planned land use activities identified by the private sector to assist with water and wastewater demand projections. The study area consists of the iLembe, uMgungundlovu, Msunduzi, Ugu and Harry Gwala WSAs and the start date for the capture of the lodged applications was 2015 i.e. when the Spatial Planning and Land Use Management Bylaws became operational in the different local municipalities. This project is currently in the data verification phase and will be concluded in 2019. The applications captured to date are shown in Figure 2.73. The application types have been simplified into four categories as shown in Figure 2.73:

- “Land Use Change” – This category is for applications that are commonly referred to as “rezoning”. These types of applications suggest that there could be a change in the water and wastewater demand on the respective application sites and therefore require further interrogation.
- “Densification” – This category is for applications that are sub division and/or consolidation applications. These types of applications do not commonly include a land use change component and therefore do not readily indicate if there will be a change in the water and wastewater demands. However, this type of application is important to monitor in infrastructure planning as it shows densification trends and the cumulative impact of these applications on water and wastewater demands.
- “No Impact” – This category consists of applications that do not have an impact on water and wastewater demands e.g. applications for the removal of restrictive conditions, the closure of roads and open spaces etc.
- “To Be Confirmed”. This category is for applications where details still have to be verified.

It is shown in Figure 2.73 that most of the applications lodged are along the “T-Junction” and that Umgeni Water’s existing and proposed infrastructure is aligned with “the location of private sector developments”.

A comparison of Figure 2.63, Figure 2.68, Figure 2.70, Figure 2.72 and Figure 2.73 shows that there is alignment between the different public sector plans and the location of private sector development. 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  Development applications lodged under the respective Spatial Planning and Land Use Management Bylaws (KZN DoT 2017; MDB 2016; Municipal Applications Registers 2018; Umgeni Water 2019).
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 2019).
Sanitation system/technology types may be categorised as those shown in Table 2.17.

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

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”.
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):

- 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 8, 9, 10, 11 and 12).
- 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 sewered 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 sewered system. It is shown in this figure that when the sanitation technology changes from septic tank to that of a sewered system, there will still be “gaps” between the sewered 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 13.
Figure 2.76 Public sector planned densification areas (KZN DHS and HDA 2016; KZN EDTEA 2017; KZN Planning Commission 2018; MDB 2016).

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 2016).
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 2016).

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

As shown in the previous section, the municipalities of eThekwini 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 2.63 and Figure 2.68, the Provincial Growth and Development Strategy (PGDS) (KZN Provincial Planning Commission 2018) and the PSEDS 2016 identifies eThekwini 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 2.63).

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 2.50 and Figure 2.51). It was further shown in Figure 2.57 and Figure 2.58 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 Sanitation13 (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 Authorities. The roles and responsibilities of these institutions in this regard vary, with some overlap in certain instances.

13 At the time the study was published, the department was called the Department of Water Affairs and Forestry (DWAF).
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 uMgeni River to supply primarily the northern and central parts, and to a lesser extent the western part, of eThekwini 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 uMgeni River to supply primarily the central and southern parts, and to a lesser extent the northern part, of eThekwini 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 uMgeni River to supply the Msunduzi Local Municipality (Pietermaritzburg), the western part of the eThekwini 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. $3.2 \text{ m}^3/\text{s}$ is abstracted from Mearns Weir; and
   b. $1.3 \text{ m}^3/\text{s}$ from Spring Grove Dam;

5. When the Mearns Weir is less than 60% of full supply capacity then $4.5 \text{ m}^3/\text{s}$ 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 eThekwini Municipality and the northern coastal strip of iLembe District Municipality as far north as the town of KwaDukuza.

7. Water is abstracted from the uThukela River to supply the southern coastal areas of Mandini LM and the northern coastal areas of KwaDukuza LM as far south as the town of KwaDukuza.

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 Ekuveni 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.

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 eThekwini-Msunduzi region. A 98% level of assurance (i.e. a 1:50 year risk of failure) is currently required for the 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).

The recent commissioning of Phase 1 of the Lower Thukela Bulk Water Supply Scheme and the raising of Hazelmere Dam Wall have increased the yield of the system to greater than the anticipated 30 year projected demand.

Umgeni Water have only recently become the bulk water supplier to uThukela District Municipality and in particular to Ezakheni and Ekuveni. 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
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.

eThekwini Municipality is in the process of constructing the Western Aqueduct Pipeline and this will extend the existing pipeline system that runs from Midmar Dam to the western area of eThekwini. The Western Aqueduct will be able to supply parts of the central and northern areas of the municipality. This project will create an important modification to the current bulk water supply strategy and is being sized to cater for future demand growth (Arrow 3 in Figure 2.84).
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 currently 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 eThekwini 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 13 in Figure 2.84);
- The Department of Water and Sanitation is currently implementing 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 eThekwini Municipality and the northern coastal strip by an additional 20 Mℓ/day excluding Reserve requirements (Arrow 6 in Figure 2.84). This project will be completed in 2019;

- 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 Stanger. 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 if needed;

- 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 14 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 eThekwini Municipality and southwards to the northern areas of Ugu Municipality. Reliance on the Mgeni system (2) to supply this area could then be 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 2023 (Arrow 15 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:

- eThekwini 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 eThekwini 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 eThekwini 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 eThekwini region, particularly making use of the new Western Aqueduct infrastructure (3) which is scheduled to be completed in 2018. 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 2028, whilst a more realistic date is likely to be around 2030. 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 2024 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 instructed 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 (15) is the preferred option for augmenting supply on the South Coast. The detailed design of the scheme began in 2018 and a five year implementation programme is expected for the project.
2.7 Universal Access Plan (UAP)

In 2016, Umgeni Water in partnership with DWS and KZN CoGTA completed Phase 2 of the Universal Access Plan (UAP; see Section 2.7 of IMP 2015 for a summary on UAP Phase 1). The objectives of the UAP Phase 2 study were to review and update the UAP Phase 1 study reports in order to improve the following:

- The Phase 1 study focused on small, localised schemes for universal access in the near future, however, these proposed schemes are not necessarily sustainable,
- The proposed schemes were largely designed in isolation and took little cognisance of other water planning studies and recommendations,
- Many of the Water Services Development Plans were being updated during the course of the Phase 1 study, and had to be incorporated into UAP Phase 2.

The study area (eThekwini Municipality was excluded from the study) and the recommended pipelines; water treatment plants (WTPs) and dams from the UAP Phase 2 study are shown in Figure 2.85.

A summary of the recommended project costs is presented in Table 2.18.

<table>
<thead>
<tr>
<th>District Municipality</th>
<th>Backlog (%)</th>
<th>Population (Census 2011)</th>
<th>Backlog (Population)</th>
<th>Future Demand (Ml/day)</th>
<th>Infrastructure Cost (Billion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amajuba (incl. Newcastle LM)</td>
<td>14</td>
<td>499 627</td>
<td>69 948</td>
<td>160.6</td>
<td>R 2.36</td>
</tr>
<tr>
<td>uThukela</td>
<td>32</td>
<td>668 533</td>
<td>213 931</td>
<td>177.16</td>
<td>R 2.05</td>
</tr>
<tr>
<td>uMkhanyakude</td>
<td>49</td>
<td>625 846</td>
<td>306 665</td>
<td>131.2</td>
<td>R 3.38</td>
</tr>
<tr>
<td>uMgungundlovu</td>
<td>11</td>
<td>1 017 763</td>
<td>111 954</td>
<td>335</td>
<td>R 2.18</td>
</tr>
<tr>
<td>Ugu</td>
<td>34</td>
<td>722 442</td>
<td>245 630</td>
<td>141.7</td>
<td>R 4.51</td>
</tr>
<tr>
<td>Mhlathuze LM</td>
<td>5</td>
<td>334 459</td>
<td>16 723</td>
<td>396.1</td>
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</tr>
<tr>
<td>Zululand</td>
<td>38</td>
<td>803 576</td>
<td>302 145</td>
<td>133.97</td>
<td>R 3.07</td>
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<tr>
<td>Harry Gwala</td>
<td>44</td>
<td>461 423</td>
<td>203 026</td>
<td>95.23</td>
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<td>iLembe</td>
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<td>606 810</td>
<td>188 111</td>
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<td>uMzinyathi</td>
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<td>510 840</td>
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<td>140.73</td>
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<td>uThungulu</td>
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<td>573 063</td>
<td>212 033</td>
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<td>6824382</td>
<td>2100043</td>
<td>2135.89</td>
<td>R 78.04</td>
</tr>
</tbody>
</table>

An additional phase has now been commissioned to extend the UAP to include secondary bulk supply (the pipelines, pump stations and reservoirs needed to provide water to terminal reservoirs). The UAP Phase 3 will be completed in 2020.
Figure 2.85 UAP Phase 2 study area and recommended projects (MDB 2016; Umgeni Water 2016; WR2012).
3. **Demand Forecasts**

This section documents Umgeni Water’s water demand forecast review that was completed in September 2018. This process:

- Reviewed the figures for the financial year ending in June 2018 (2017/2018).
- Assessed and revised the short-term forecast for the financial year ending in June 2019 (2018/2019);
- Compiled short-term forecasts for the financial years ending in June 2020 (2019/2020), June 2021 (2020/2021) and June 2022 (2021/2022); and
- Extended these short-term forecasts to a long-term forecast (30-year forecast) to the end of June 2049 (2048/2049)

All data presented has been updated to include the November 2018 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 2018.

### 3.1 Review of 2017/18 Sales

The initial forecasted water sales value for the financial year ending in June 2018 (2017/18), as determined in September 2016, was 1 191 Mℓ/day. In September 2017 this figure was revised to 1 100 Mℓ/day after updated discussions with customers and as a consequence of the drought and curtailments introduced to reduce demand in the Mgeni System. Total sales recorded for the 2017/18 financial year averaged 1 192 Mℓ/day (434 988 Mℓ). This was 8.3% higher than the September 2017 projection and can mainly be attributed to the increased sales following the lifting of restrictions in the Mgeni Catchment as well as increased sales from the Lower Thukela Bulk Water Supply Scheme.

Total average water sales for the 2016/17 financial year was 1 124 Mℓ/day, and hence the 2017/18 sales were 6.0% year-on-year higher than the 2016/17 financial year. As discussed above, this increase in demand was as a result of increased sales following the lifting of restrictions in the Mgeni System and increased sales from the Lower Thukela Bulk Water Supply Scheme. Demand is expected to increase further over the next year and is likely to increase to pre-drought figures by June 2019. **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 eThekwini Municipality constituted by far the largest percentage (74.4%) of Umgeni Water’s total water sales for 2017/18. Their proportion of the total sales increased slightly from the previous year (72.8%). The Msunduzi Municipality is Umgeni Water’s second largest customer, accounting for 15.2% 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 2017/18.
Figure 3.1  Umgeni Water Total Average Daily Sales.

Figure 3.2  Distribution of Sales Volumes for 2017/2018.
3.2 2018 Short-Term Bulk Water Sales Forecasts

Curtailments were lifted in the Mgeni System in April 2018. This resulted in an increase in demands and these are expected to continue to increase to pre-drought figures by June 2019. Increased growth is also expected on the Lower Thukela Bulk Water Supply Scheme and this, coupled with Umgeni Water’s expansion into uThukela District Municipality means that a steady growth in demand is expected over the next few years. This demand growth is projected to 1 233 Mℓ/day for the 2018/2019 financial year following which demand growth is expected to increase to 1 333 Mℓ/day in 2019/2020, 1 385 Mℓ/day in 2020/2021 and 1 402 Mℓ/day in 2021/2022 (Figure 3.3).

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

3.2.1 eThekwini Municipality

In the 2017/2018 financial year, the year-on-year growth in sales to eThekwini Municipality increased by 4.78%. The increase in sales is attributed to the lifting of curtailments in the Mgeni System during the first half of 2018. The growth in sales is shown in Figure 3.4, where the twelve-month moving average of sales increased from 810 Mℓ/day in July 2017 to 854 Mℓ/day in June 2018.

Proposed developments and the associated demand required to supply these developments were discussed with eThekwini during August 2018. The subsequent demand projection includes increases related to the relaxation of the recent drought curtailments and observed consumer behaviour over the previous quarter.
The official ENSO forecast Probabilities for weather outlook suggests a 70% chance of an EL Nino effect over the ensuing six months. Whilst this does not look promising in respect of above-average rainfall, the Mgeni System storage has increased to levels consistent with a system that does not require restrictions (greater than 70% at the beginning of May).

As a result, eThekwini Municipality have predicted a demand scenario by growing the historical demands observed over the past 4 months by 1% for the next year, with an additional 20 Mℓ/day growth for demand taken up in the Western Aqueduct in 2020. Beyond June 2020 an organic growth in demand of 0.5% was assumed until June 2022. The growth figure is inclusive of the likely effect from the NRW interventions currently being implemented. There is a predicted increase in demand from 855 Mℓ/day to 885 Mℓ/day over the 2018/2019 financial year. This is then anticipated to increase to 910 Mℓ/day in 2019/2020 (pre-drought demand). The historical sales and future demand projection for eThekwini Municipality are presented in Figure 3.4.

![Figure 3.4 eThekwini Municipality Total Volumes - Annual short-term forecast.](image)

3.2.2 The Msunduzi Municipality

The water sales to Msunduzi Municipality increased by 7.6% from 171 Mℓ/day in the 2016/2017 financial year to 184 Mℓ/day in 2017/2018. Projected demands for 2018/2019 were determined in consultation with the municipality and it was agreed that, since water restrictions had been lifted, the demand would increase to 195 Mℓ/day.

Msunduzi Municipality's council have approved low cost to medium income housing development in the Shenstone/ Ambleton area over the next two years. The bulk of this new demand will be taken up during this financial year. Also, the Pietermaritzburg tourism portfolio envisage a major drive to increase tourism in the Edendale area around the Henley Dam Hotel and this will increase demand in this area.
Msunduzi Municipality has just completed a masterplan to realise a sustainable water supply to ward 39 off Vulindlela Res 10 and they plan to implement the recommendations over the next 4 years. Additionally, as a result of budgetary constraints, Msunduzi have indicated that they would like to cap the total demand, to the municipality, at 195 Mℓ/day for this financial year. The majority of the supply to the municipality will be from the Midmar WTP. The yr-on-yr growth, thereafter, is estimated at 1.5%.

The Msunduzi Municipality is implementing water demand management (WDM) initiatives within the Vulindlela area. It is estimated that savings from these initiatives will offset the growth in sales in the area in the short term.

The projection for Msunduzi Municipality is reflected in Figure 3.5.

![Figure 3.5 Msunduzi Municipality Total Sales Volumes - Annual short-term forecast.](image)

### 3.2.3 uMgungundlovu District Municipality

The water sales to uMgungundlovu District Municipality (UMDM) decreased slightly from 54 Mℓ/day in the 2016/2017 financial year to 52 Mℓ/day in 2017/2018. This was as a result of both improved savings during the drought and process improvements to the small WTPs management by Umgeni Water.

The projected demands for 2017/2018 were determined in consultation with the municipality and it was agreed that the demand would increase to 63 Mℓ/day for the short term forecast. It is envisaged that growth in housing development will be experienced in the Mid Illovo area over the
next two years that will increase the demand in this area. Additionally, UMDM is planning to improve the level of service in the Greater Richmond area to yard connections and plan to install water-bourne sewerage systems in this area. This project will start at the beginning of the 2020/2021 financial year.

An increase in housing development in the Lion Park/Manyavu area is also planned towards the end of the 2018/19 financial year and is likely to extend over the next 3 years. Uncontrolled building regulations have also resulted in high growth in the Vulindlela area and a high increase in water demand is foreseen in this area over the next 4 years.

It is expected that the uMshwati BWSS will be fully commissioned and operational by the end of March 2019 and increases in supply to Cool Air, Dalton and Swayimana are expected. There are also plans to supply the Efaye and Oswathini areas from the existing network whilst the secondary bulk supply system in being implemented.

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.](image)

3.2.4 iLembe District Municipality (including Sembcorp Siza Water)

Sales to iLembe District Municipality can be described as follows:

- Sales to the Coastal Area of iLembe through Sembcorp Siza Water.
• Sales to the Coastal Area of iLembe through iLembe District Municipality.

Historical demand has been gradually increasing over the past year. This is after the declining demands of the prior years due to the drought conditions. This is reflected in Figure 3.7 and Figure 3.8.

It is predicted that Sembcorp Siza Water’s demand will grow at a rate of approximately 2%. The balance of the demand, to take it up to pre-drought demands, will be made up using waste water recycling. Sembcorp Siza Water has implemented a waste water recycling plant that injects up to 3 ML/day into its potable water system. The demand for Sembcorp Siza Water is expected to be 10.0 ML/day in 2018/2019, 10.3 ML/day in 2019/2020 and 10.6 ML/day in 2020/2021. The historical and future predicted increase in demand for the company is presented in Figure 3.7.

iLembe District Municipality intends operating the Mvoti WTP to supply approximately 10 ML/day to KwaDukuza. This reduction in sales is reflected in the sharp decline in demand in July 2018. A recent upgrade of the pump stations in the Ndwedwe Supply Area will result in an increase in supply into Ndwedwe. This is reflected in the stepped increase of the projection in December 2018. The demand for iLembe District Municipality is expected to be 37.9 ML/day in 2018/2019, 40.5 ML/day in 2019/2020 and 42.0 ML/day in 2020/2021. Delays in implementing municipal secondary bulks on the Lower Thukela System means that the anticipated demand increases are unlikely to materialise as previously predicted. 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.](image)
3.2.5 Ugu District Municipality

Total sales to the Ugu District Municipality remained “constant” during the 2017/2018 financial year. The growth in sales to Ugu DM includes those sales transferred to the other WSA’s following the change in municipal boundary demarcation legislation.

The expected growth in sales to the Municipality is estimated at 10% in the 2018/2019 financial year and 1.2% in 2019/2020 (Figure 3.9). The current water resources are insufficient to meet the projected water demands. Furthermore, the water requirements exclude an estimated 25 Mℓ/ 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. The increase in supply forecast assumed the construction and commissioning of Phase 2B of the South Coast Pipeline during 2018/2019.

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 from 2017 until the LUBWSS is implemented.

Figure 3.8  iLembe 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 2017 and June 2018 were approximately 2.4 Mℓ/day. There was an increase in the monthly sales from July 2017 to June 2018 due to the recovery of the Home Farm Dam and the lifting of restrictions. The demand in Ixopo has subsequently increased to pre-drought levels. The Harry Gwala Municipality has agreed that a growth of 1% is appropriate for demand projections over the next four years for this area (Figure 3.10).
3.2.7 uThukela District Municipality

The projected demands for 2017/2018 were determined in consultation with the municipality as per historical trends and flow measurement data captured by previous studies conducted in the area. There is a difficulty in obtaining accurate forecast data for the area as most treatment plants do not have functional meters either at the inlet or outlet of the plants.

Umgeni Water have started installing meters on 1) the bulk lines which are operated and maintained by the organisation and 2) on the secondary and industry pipelines operated by the municipality. The three water treatment plants which are currently operated and maintained by Umgeni Water (viz Ezakheni, Olifantskop and Tugela Estates) have a total plant design capacity 44 Mℓ/day and average sales of 28 Mℓ/day (after one month of metered flow).

Umgeni water have started implementing projects to reduce water losses and there is an expectation that the volume of supply could decrease. However, once a reliable supply of water is realised, then the municipality may reticulate to other previously un-serviced areas and this may cause a corresponding increase in demand. A better estimate of demand and forecast information will be available in the 2020 Infrastructure Master Plan.
### 3.3 Long-Term Forecast

The 30-year long-term sales forecast for Umgeni Water’s supply area (Figure 3.11) takes into account reduced sales as a result of the recent drought, new supply to the uThukela District Municipality, 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 2048/2049. This growth rate has been agreed to by the major water users in the region and is considered acceptable for this long-term forecast as it closely matches the forecast that was independently derived as part of the “Water Reconciliation Strategy Study for the KwaZulu-Natal Coastal Metropolitan Areas” undertaken by DWS, which used a population projection technique to estimate demand forecasts.

![Figure 3.11 Umgeni Water Long-Term Bulk Water Sales Forecast.](image-url)
4. 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 elaborate on the WDM initiatives that Umgeni Water is undertaking to assist the Department of Water and Sanitation (DWS) and 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 water supply systems that it operates (Sections 8, 9, 10, 11 and 12) to determine the approximate 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 Upper Thukela System which is a new growth area/region. Umgeni Water is committed to reducing or maintaining the average water loss below this level 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 balances.
- Meter accuracy testing.
- Monitoring and reduction of turn-around time to repair leaks and bursts.
- Water education programme / communication.

The above practices contribute to the achievement of Umgeni Water’s WDM objectives summarised in Table 4.1.
### Table 4.1 Water Demand Management objectives for Umgeni Water (2013: 10).

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

### 4.3 Assisting WSA’s in Reducing Non-Revenue Water

Umgeni Water, as a Bulk Water Services 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 and the lack of 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 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.

Umgeni Water established a WDM Unit in 2016 to provide support to WSA’s in curbing water losses in their systems. This 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 WC/WDM master plans.
(ii) **Tactical** – provision of specialist technical assistance and engineering advice for WC/WDM 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.
(iv) **Financial** – not direct funding support, but assistance in preparation of business plans and funding applications etc.

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/Water Demand Management projects were also defined.
In 2017/2018 financial year Umgeni Water committed to supporting the above requirements by commissioning a study with the following objectives:

(i) Ensure that all WSA’s have a current, valid and approved WC/WDM Master Plan.
(iii) Provide technical advice and guidance to all KZN WSAs on implementation of WC/WDM projects.
(iv) Ensure that water balances are undertaken to the International Water Association (IWA) Modified Standard within 95% confidence limits. These water balances can then be produced on a regular basis at a WSA, town and water supply system basis through the development of a customized WC/WDM Handbook for KZN WSAs.
(v) Improve monitoring and reporting on WC/WDM activities and quantification of water demand reduction across all WSAs through provision of training and mentorship.
(vi) Ensure “value for money” for new WC/WDM projects through the development of a WC/WDM funding application assessment tool.

In support of the overall programme objectives, seven Key Support Areas (KSA’s) were identified:

(i) KSA 1: WC/WDM Master Plans
(ii) KSA 2: KZN WCWDM State of the Province Report
(iii) KSA 3: DWS Reporting Assistance
(iv) KSA 4: Development of a KZN WCWDM Handbook
(v) KSA 5: WSA WCWDM Mentorship
(vi) KSA 6: Development of WCWDM Funding Application Assessment Tool
(vii) KSA 7: Programme Support

This study has now been completed and an update of the Non-Revenue Water state in the Province has been prepared to highlight any changes in water supply conditions. The figures used in The State of Non-Revenue Water report for the 2017/18 financial year have been based on information provided by the WSA’s in terms of their regular reporting to DWS. It has not been possible to verify the accuracy of the data provided – where relevant, comments on the validity of the submitted data have been raised.

The full report therefore presents the following:

i) A summary review of the status of Non-Revenue Water in KwaZulu-Natal for the 2016/17 financial year;
ii) The status of Water Conservation/Water Demand Management Master Plans in the Province;
iii) An assessment of the status of Non-Revenue Water in KwaZulu-Natal for the 2017/18 financial year, as well as a comparison to the 2016/17 financial year;
iv) A review of historical trends of water balances in the Province, dating from the 2013/14 financial year (pre-drought conditions);
v) Challenges experienced by the WSA’s;
vi) Cautionary notes; and
vii) Recommendations for continued assistance, monitoring and evaluation.

14 http://www.leakssuite.com/concepts/iwa-water-balance
In the spirit of intergovernmental relations, a partnership between DWS, Umgeni Water and the Department of Cooperative Governance and Traditional Affairs (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.

4.4 Update of Relevant Water Supply Scheme Information

A comparison of the 2016/2017 data with the 2017/2018 data identified the following:

- The total length of pipes/mains was reported as being 46 804km. This is an increased in total length of 2 584km when compared to the length reported in 2016/17. The increase is not only attributed to new pipes that have been laid but rather a result of improved system information and accuracy. The accuracy of the data reported in 2017/18 could not be verified at the time of drafting this report;
- The number of connections was reported as being 1 369 015. This is 148 751 more than that recorded in 2016/17 and represents a 12.2% increase from the previous year. A number of errors have been identified from the data submitted by the WSA’s, including confusion on what constitutes a connection. It is evident that the reported numbers are higher than the actual number of connections;
- Average supply pressure has not changed from a Provincial perspective, although a number of individual WSA’s did make significant improvements in reducing pressure during the year. There is still confusion and uncertainty from the WSA’s in the process of calculating average pressure and the importance thereof – this will be addressed in the next phase of the Umgeni Water Provincial Support Programme;
- Percentage time pressurised in the networks was not accurately completed by the WSA’s – each of the WSA’s reported a 100% pressurized system for the financial year, which is not the case in reality. An approximation of percentage time pressurized using the service provider’s knowledge was used for the 2017/18 financial year. On average, the population/consumers in the province served by the WSA’s received water for 6.3 days per week, with the highest assurance of supply being the City of uMhlathuze (6.9 days per week) and lowest assurance of supply being iLembe (5.2 days/week).

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 (Table 4.2) 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.
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.

The following is noted in terms of the change in water balance components across the Province from the 2016/17 to 2017/18 financial years:

- Conservatively, a total of 1 857 Mℓ/day is supplied to the Province’s served population, with only 1 075 Mℓ/day of that being billed to consumers. That indicates that 782 Mℓ/day is being lost to Non-Revenue Water, of which 480 Mℓ/day is lost to leaks;
- The average Infrastructure Leakage Index (ILI) in the Province is 5.0, which means that leakage is, on average, 5.0 times higher than the theoretical best it could be;
- Water Supplied (System Input Volume) into reported water supply systems increased by 5.9%. It is still noted that many WSA’s are not correctly or accurately reporting the Water Supplied volumes, particularly from standalone or borehole-supplied schemes;
- Authorised Consumption increased by 11.6% year-on-year. However, Billed Metered Consumption only increased 0.4% while Billed Unmetered Consumption increased by 304.9%. This indicates that the WSA’s are transferring consumption previously recorded as either Unbilled Authorised Consumption or Unauthorised Consumption into Authorised Consumption, to make NRW performance appear better;
- Potential Revenue Water (volume only, not revenue as measured in monetary terms) increased by 6.9% year-on-year;
Unbilled Authorised Consumption increased to 46.9% between the 2016/17 and 2017/18 financial years. This have been previously recorded as Unauthorised Consumption, which decreased 14.5% year-on-year;

Apparent Losses decreased by 6.9% year-on-year, and Real Losses (leakage) decreased by 4.0% from 2016/17 to 2017/18 financial years;

Non-Revenue Water volumes increased 4.5% year-on-year.

4.6 Non-Revenue Water Economics

The unit cost of water increased 10.3% from a provincial average of R5.32/kℓ to R5.87/kℓ excluding VAT, while the lowest average sales tariff for domestic consumers increased by 13.2% from a provincial average of R9.83/kℓ to R11.14/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 2017/18 financial year:

- The annual estimated cost of Water Supplied across the province increased 16.8% from R3 406 263 332 in the 2016/17 financial year to R3 979 943 542 in the 2017/18 financial year;
- The annual estimated cost of Non-Revenue Water across the province increased 13.9% from R1 500 369 012 in the 2016/17 financial year to R1 709 545 500 in the 2017/18 financial year;
- The annual estimated equivalent lost revenue from Non-Revenue Water across the province increased 18.6% from R2 686 396 906 in the 2016/17 financial year to R3 186 444 047 in the 2017/18 financial year;
- The annual estimated equivalent lost revenue from Unbilled Authorised Consumption across the province increased 69.6% from R481 071 161 in the 2016/17 financial year to R815 942 918 in the 2017/18 financial year; and
- The annual estimated cost of Real Losses (Leakage) across the province increased 3.7% from R986 568 044 in the 2016/17 financial year to R1 023 509 220 in the 2017/18 financial year.

The following high-level, provisional assessment of the economics of non-Revenue Water reduction in the Province of KwaZulu-Natal is presented below:

i) The total 5-year investment required for the reduction of Non-Revenue Water is R6 496 329 776 excluding VAT, of which R6 387 642 262 is Capital Expenditure (Capex) and R3 108 687 515 is Operating Expenditure (Opex);

ii) The total 5-year investment required for billing improvement is R1 483 935 964 excluding VAT;

iii) The total 5-year investment required for leakage reduction is R7 622 393 812 excluding VAT;

iv) The current cost of Non-Revenue Water in the province is R1 709 545 400 excluding VAT. This would provide a Return On Investment (ROI) of 5.6 years on the total required NRW investment budget;

v) The current cost of leakage in the province is R1 023 509 220 excluding VAT and this would provide a ROI of 7.4 years on the total required leakage reduction budget;

vi) The current cost of equivalent lost revenue (unbilled authorized consumption, illegal connections and meter under-registration) in the province is R1 380 627 154 excluding VAT and this would provide a ROI of 1.4 years on the total required leakage reduction budget.
The budgets presented in this report exclude the budget requirements for the installation of bulk water meters to accurately record Water Supplied in all water supply schemes. This is estimated to be in the order of R100 000 000 excluding VAT.

4.7 KZN WSA Non-Revenue Water Trends

A comparison for the period 2016/17 – 2017/18 for the KZN WSA’s is summarised below.

The length of mains, as reported 2017/18, was 2 584 km greater than that recorded in 2016/17 (Figure 4.1). This was not a physical increase in pipeline length but is rather a result of improved system information and accuracy. The accuracy of the data reported in 2017/18 could not be verified at the time of drafting this report.

![Figure 4.1 WSA length of mains (2016/2017 vs 2017/2018) (Bigen/Joat 2018).](image)

The number of connections increased by 148 751 between 2016/17 and 2017/18 (Figure 4.2). This represents a 12.2% increase from the previous year. A number of errors have been identified from the data submitted by the WSA’s, including confusion on what constitutes a connection in the first place. It appears as though the reported numbers are higher than the actual number of connections.

Percentage time pressurised in the networks was not accurately estimated by the WSA’s – each one of the WSA’s reported a 100% pressurized system for the financial year. This is not the case in reality. An approximation of percentage time pressurised using the service provider’s knowledge was used for the past financial year (Figure 4.3).
A total of 1 857 ML/day (compared to 1 753 ML/day the previous year) is supplied to the province’s served population. Only 1 075 ML/day of this water is being billed to consumers. This means that
782 Mℓ/day (up from 748 Mℓ/day) is assumed Non-Revenue Water with 480 Mℓ/day of this being lost to leaks. There is an upward trend in terms of NRW (Figure 4.4 and Figure 4.5).

**Figure 4.4** WSA non-revenue water by volume (2016/2017 vs 2017/2018) (Bigen/Joat 2018).

**Figure 4.5** Historical NRW comparison between KZN WSAs by volume (2013/2014 – 2017/2018) (Bigen/Joat 2017).
Non-Revenue Water by Volume Percentage improved marginally from 42.7% to 42.1% year-on-year (Figure 4.6 and Figure 4.7). However, the use of percentages as a performance measure is not considered international best practice and is actively discouraged. The performance measure is therefore only presented for compliance purposes for the Department of Water and Sanitation.

**Figure 4.6**  WSA non-revenue water by percentage (2016/2017 vs 2017/2018) (Bigen/Joat 2018).

**Figure 4.7**  Historical NRW comparison between KZN WSAs by percentage volume (2013/2014 – 2017/2018) (Bigen/Joat 2018).
The annual estimated cost of Real Losses (Leakage) across the province increased by 3.7%, from R986 568 044 in the 2016/17 financial year to R1 023 509 220 in the 2017/18 financial year (Figure 4.8 and Figure 4.9).

Figure 4.8  WSA annual cost of real losses (2016/2017 vs 2017/2018) (Bigen/Joat 2018).
Figure 4.9  Comparison of non-revenue water by volume (Bigen/Joat 2018).
4.8 Future WC/WDM Projects

Umgeni Water will continue to support of the programme in the 2018/19 financial year, with further improvements based on lessons learned and WSA requests. In support of the overall programme objectives, six Key Support Areas (KSA’s) have been identified. These are summarised as follows and will form part of the 2018/19 financial year project:

- KSA 1: WC/WDM Master Plans
- KSA 2: Development of Revenue Improvement Strategies
- KSA 3: Determination of True Cost of Water
- KSA 4: DWS Reporting Assistance
- KSA 5: WSA WCWDM Mentorship
- KSA 6: Program Support

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
   - 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 or replaced.

(ii) System Stabilisation
   - During this process, areas of intermittent water supply will be identified in each WSA. Special projects will then be motivated to address these intermittent supply problems.
   - Pressure management areas should also be identified within each WSA and motivations done to ensure that the average zone pressure is approximately 50 m.

(iii) On-going Monitoring and Evaluation
   - Preparation of quarterly water balances.
   - Preparation of water savings reports.
   - No drop assessment improvement reports.

4.9 Way Forward

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

- A common vision regarding water efficiency;
- 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.
5. **SYSTEMS ENERGY ANALYSIS**

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 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 8)
- uMkhomazi System (Section 9)
- South Coast System (Section 10)
- North Coast System (Section 11)

This section focuses on the period July 2017 to June 2018 and for areas where information was not available, the closest full year cycle was used. Values indicated in this section are an indication of power use and some values have been averaged due to the lack of available meter readings.

Figure 5.1 indicates the power usage per system. An average of 213 835MWh was used across all systems within Umgeni Water to supply approximately 234 326 ML per annum. The two systems with the highest power usage are the Upper and Lower Mgeni Systems and their combined systems account for 82.87% of water produced and 85.6% of total power usage. The majority of water produced by these systems supply the uMgungundlovu and eThekwini municipalities with a smaller percentage being supplied to the southern and northern coastal area.

Table 5.1 shows a 5 % increase in the energy consumption across the company, with the largest increase (in percentage terms) being the North Coast System and the Ixopo system.

The large increase (70%) in the electricity usage in the North Coast System is attributed to the commissioning of the Lower Tugela Bulk Water Supply System. The area supplied 54.68 % more potable water than the previous year thereby increasing the energy usage. (It must be noted that the total energy use in the previous IMP (2017/2018) contained an error in the total energy usage for the North Coast system and is corrected in the table below).

The significant increase in the energy usage in the Ixopo System is partially due to the adjustments made by Eskom to correct billing errors in the previous years and the change in the raw water pumping system. Investigations into the increase in power usage will be carried out internally. (It must also be noted that the total power used in the previous IMP (2017/2018) was incorrect and is corrected in the table below)

The South Coast System has seen a growth in sales of 21 % which had a corresponding increase in the energy usage of approximately 13.7 %. This is as a result of the supply settling back to its pre-drought volumes.
Table 5.1  Yearly comparison on power usage.

<table>
<thead>
<tr>
<th>System</th>
<th>2017</th>
<th>2018</th>
<th>% Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>kWh/annum</td>
<td>kWh/annum</td>
<td></td>
</tr>
<tr>
<td>Upper Mgeni</td>
<td>57,444,556</td>
<td>60,191,456</td>
<td>4.78</td>
</tr>
<tr>
<td>Lower Mgeni</td>
<td>123,843,078</td>
<td>122,846,580</td>
<td>-0.80</td>
</tr>
<tr>
<td>North Coast</td>
<td>8,870,279</td>
<td>15,114,568</td>
<td>70.40</td>
</tr>
<tr>
<td>South Coast</td>
<td>12,748,572</td>
<td>14,496,025</td>
<td>13.71</td>
</tr>
<tr>
<td>Ixopo</td>
<td>739,849</td>
<td>1,185,893</td>
<td>60.29</td>
</tr>
<tr>
<td>Total</td>
<td>203,646,334.33</td>
<td>213,834,521.60</td>
<td>5.00</td>
</tr>
</tbody>
</table>

Figure 5.1  Total Energy Consumption for Umgeni Water Systems 2017/18.

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

Figure 5.2 represents the different power intensity rates for the Umgeni Water systems. The average energy requirement is 0.49 kWh/Kℓ i.e. the power used across the entire Umgeni Water supply area divided by the total volume produced. This value is an increase of 6.5% from the previous year. The Ixopo system is 2.7 times above the average and is by far the costliest system, although there may be reasons, as previously mentioned, as to the perceived increase in power usage.
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 5.3).

Figure 5.3 and Figure 5.4 show that the largest power consumers across all the Umgeni Water systems is the Durban Heights Shaft Pumps, with an annual consumption of approximately 24 600 MWh per annum, followed by the Inanda Pump Station, Wiggins High Lift Pump Station and then the Spring Grove Pump Station.

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 5.5. This graph provides an indicative cost per kilolitre in terms of energy usage from source to supply point.

Figure 5.5 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 50 supply points is 1.31 kWh/kl and 17 of the 50 supply points are supplied at a rate above the average.

The highest energy requirement per kilolitre of water supplied is the supply to Ndwedwe Reservoir 5 from Hazelmere WTP at 4.43 kWh/kl followed by the Midmar supply to Vulindlela Reservoir 5 with an energy requirement of 4.42 kWh/kl.
Figure 5.3  Annual Power Usage Comparison Umgeni Water Installations.
Figure 5.4  Distribution of the highest energy consumers.
Figure 5.5  Annual Energy Requirement 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.

Apart from Durban Heights WTP, the highest energy use per annum is from the high lift pump stations that deliver raw water to the systems.

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.

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.

Umgeni Water will have to invest in electrical meters to ensure the accurate recording of energy per sub system.

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 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.
- The Ixopo System be investigated to determine the circumstances of the increase in the energy usage.
6. RESEARCH AND DEVELOPMENT PROJECTS

6.1 Climate Change

There is scientific evidence to show that Climate Change is a reality. The National Climate Change Response White Paper (2013) presents South Africa’s vision for an effective climate change response and the long term transition to a climate resilient and lower carbon economy and society. South Africa’s climate change response is intended to promote adaptation and mitigation measures that encourage sustainable development. Emanating from the National Climate Change Response White Paper is the Climate Change Bill (2018). The Bill aims to communicate and implement an effective nationally determined climate change response and includes both mitigation and adaptation actions that represent South Africa’s fair contribution to the global climate change response. The Bill is applicable to all South African Organs of State as defined in Section 239 of the Constitution of the Republic of South Africa (1996) and failure to comply with the requirements of the Bill will result in the penalties stipulated in Clause 19.

The National Water Resources Strategy (2013) indicates that water is the primary medium through which the impacts of climate change are going to be felt in South Africa. The Strategy continues to state that climate change in South Africa will result in changing rainfall patterns, the intensity of storms and the extremes of droughts and floods, increasing evaporation, changes in soil moisture and runoff and thus water availability, changing water quality conditions (including temperature of aquatic systems) and increasing climate variability.

Even though the White Paper identifies the water sector as one of the key sectors for climate change adaptation, the NWRS (2013), the Climate Change Bill (2018) and the Carbon Tax Bill (2018) acknowledges that the water sector is not only vulnerable to the impacts of climate change, but it is also a significant contributor to greenhouse gas emissions. It is, therefore, required to incorporate control measures for both adaptation and mitigation in its planning process. Furthermore, the Carbon Tax Bill lists wastewater treatment and discharge under Schedule 2 as an activity that is liable to pay a carbon tax if it results in the emission of greenhouse gases that exceed the allowed threshold. Details on the impacts of the Climate Change Bill and the Carbon Tax Bill are discussed in Section 6.1.1.

This section of the IMP presents Umgeni Water’s initiatives for climate change adaptation and mitigation in alignment with the national goals.

6.1.1 Climate Change Interventions Relevant to Umgeni Water

(a) National Adaptation Interventions

The Climate Change Bill (2018) aims to build South Africa’s effective response and the long-term transition to a climate-resilient and lower-carbon economy and society. This will be done in the context of an environmentally sustainable development framework. The Bill requires all organs of state, including Umgeni Water, to align with national mitigation and adaptation actions. Clause 7 of the Bill requires every organ of state to co-ordinate and harmonise their various policies, plans, programmes and decisions relating to climate change, in order to ensure that the risks of climate change impacts and associated vulnerabilities are taken into consideration and to give effect to the national adaptation and mitigation objectives set out in the Bill.
Clause 10 deals with the national adaptation to the impacts of climate change. This clause empowers the Minister, in consultation with the relevant sector national departments and provinces, to develop adaptation scenarios which anticipate the likely impacts of climate change in the Republic over the short, medium and longer term. According to this clause, adaptation scenarios must inform the development of the national adaptation objectives, National Adaptation Strategy and support decision-making under the Act.

In alignment with the Climate Change Bill (2018), the Department of Environmental Affairs (DEA) provides for a Long Term Adaptation Scenario (LTAS) programme as mitigation to possible climate change. This flagship programme aims to develop the long term adaptation strategies for multiple sectors in South Africa. During its first Phase (completed in June 2013), fundamental climate modelling and related sector-based impacts and adaptation scoping were conducted and synthesised. This included an analysis of climate change trends and projections for South Africa compared with model projections for the same period, and the development of a consensus view of scenarios for three time periods (short-, medium- and long-term). This modelling and scoping provided a basis for the cross-sectoral and economic assessment that was used to develop plausible adaptation scenarios in Phase 2 (DEA, DWA, GIZ and SANBI 2013).

The LTAS - Climate Change Implications for the Water Sector in South Africa (DEA 2013) summarises climate change adaptation interventions with reference to South Africa’s water planning framework in Figure 6.1. Umgeni Water, as a water board, contributes to “coherent planning and flexible Institutions” and “prioritisation and resource allocation” whilst ensuring alignment with all water sector role-players.

Figure 6.1 Climate adaptation interventions with reference to South Africa’s water planning framework (DEA 2013: 32).
The LTAS further identifies the relationship between different role-players at different scales and how they address resilience to climate change in the water sector (Figure 6.2). It is shown in Figure 6.2 that Umgeni Water’s main contribution is to “water resilience”, which is defined as “water resilience builds on integrated planning and is based on water management that responds to hydrological variability” (DEA, DWA, GIZ and SANBI 2013: 2).

![Figure 6.2 Distinction between medium and long-term planning for water, development and climate (DEA 2013: 35).](image)

Clause 10(9)(b) of the Climate Change Bill (2018) requires that the Minister responsible for a sector department and any State Owned Entity, for which that sector department is responsible, develop and implement a climate change response implementation plan within two years after the date of the Climate Change Act becoming operational. A Minster responsible for a national sector department is also responsible for the submission of progress reports on the implementation of the climate change response implementation plan. This implies that the water sector will be required to develop a climate change implementation plan which will then inform the sector’s state owned entities climate change implementation plans. Umgeni Water will therefore be required to align with the Water Sector’s climate change implementation plan.

In alignment with Clause 10 of the Climate Change Bill (2018), Chapter 10 of the National Water Resources Strategy, Second Edition discusses the current Climate Change Response Strategy for water resources in South Africa (DWS, 2013). Additionally, in 2017, DWS reviewed and finalised the Climate Change Response Strategy for water resources (DEA and GIZ 2016: 49). The Response Strategy sets out key strategic actions to be undertaken to address climate change in the water sector. These strategies are intended to build resilience and reduce vulnerability to the water related impacts of climate change.

In 2017, the KZN Department of Economic Development, Tourism and Environmental Affairs (EDTEA) in collaboration with the national DEA and KZN stakeholders updated the KZN Climate Change
Adaptation Action Plan. This plan incorporated the findings from the consolidated KwaZulu-Natal Provincial Climate Change Risk and Vulnerability Assessment (KZN CCRVA) and the recent information on adaptation priorities generated through national processes such as the development of the South African National Adaptation Strategy (NAS). The priority impacts identified for the water resources sector are:

- Changes in rainfall patterns and water availability (resource already under stress) severely threaten future advances in poverty alleviation and economic growth.
- Climate change worsens water poverty, impacts of droughts and floods, and creates water quality challenges in the former uThukela WMA, where irrigation agriculture is a major user.

The updated action plan identifies programmes and activities for each sector. The water resource sector programmes applicable to Umgeni Water are listed in Table 6.1.

The KZN Climate Change Adaptation Action Plan emphasises that there is a need to shift towards disaster risk reduction and strengthening of early warning systems and integrated disaster response, using cross-sectoral partnerships, capacity building and awareness-raising. The activities “provide technical support to municipal disaster management centres” (KZN EDTEA 2017: 14) and “promote strategic research collaboration and partnerships” identified in Disaster Management Sector Programmes 2 and 3 respectively are also applicable to Umgeni Water e.g. Umgeni Water’s initiatives in developing early warning systems for droughts and flood incidents.
<table>
<thead>
<tr>
<th>Programme 1:</th>
<th>Activity</th>
<th>Time-Frame</th>
<th>Lead/Support Institution</th>
<th>Scale/Location</th>
<th>Budget</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diversify water sources (e.g. rain water harvesting, utilisation of grey water)</td>
<td>Identification of alternative water sources: • Desalination. • Groundwater / boreholes. • Recycling of water (waste water). • Rainwater harvesting. • Fog / mist harvesting.</td>
<td>Review pre-existing studies therefore short(^1) term. Implementation of some alternative e.g. desalination will be medium(^2).</td>
<td>Lead: DWS as coordinator. Support: Local water boards (e.g. Umgeni Water); WSAs; CoGTA; DWS</td>
<td>Provincial-wide but occurs at a WSA level. District level: All rural districts (including eThekwini) e.g. Umgeni Water prefeasibility study of desalination plant on South Coast.</td>
<td>Small(^3) / medium(^4) / high(^5).</td>
</tr>
<tr>
<td>1.1</td>
<td>Research into advanced alternative activities.</td>
<td>Short(^1).</td>
<td>WRC; CSIR; higher education (universities).</td>
<td>Medium(^4).</td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>Increasing public awareness on using alternative water sources.</td>
<td>Short(^1).</td>
<td>Lead: DWS. Support: Local water boards.</td>
<td>Province-wide.</td>
<td>Small(^3).</td>
</tr>
<tr>
<td>Programme 2: Strengthen conservation and water demand management through systematic monitoring and awareness campaigns</td>
<td>Wetland conservation and rehabilitation.</td>
<td>Short(^1).</td>
<td>Lead: DWS. Support: DWS; DARD; local government; CoGTA; and water boards.</td>
<td>District and local municipalities.</td>
<td>Medium(^4).</td>
</tr>
<tr>
<td>2.1</td>
<td>Strengthen municipal infrastructure; water conservation and demand management.</td>
<td>Short(^1).</td>
<td>Lead: SALGA and CoGTA. Support: DWS; DARD; local government.</td>
<td>District and local municipalities.</td>
<td>Medium(^4).</td>
</tr>
</tbody>
</table>

\(^1\) Short time-frame: 1 – 2 years. 
\(^2\) Medium time-frame: 3 – 5 years 
\(^3\) Small budget: < R 500,000 
\(^4\) Medium budget: R 500,000 – R 5,000,000 
\(^5\) High budget: > R 5,000,000,000
(b) National Mitigation Interventions

The Climate Change Bill (2018) also specifies and guides the mitigation actions that are required of all organs of state. Clause 11 of the Bill empowers the Minister, in consultation with the Ministerial Committee on Climate Change, to determine a national greenhouse gas emissions trajectory for the Republic of South Africa. A national greenhouse gas emissions trajectory is binding on all spheres of government, organs of state and persons to the extent applicable.

Clause 12 empowers the Minister to determine sectoral emissions targets for greenhouse gas emitting sectors and subsectors on a five yearly basis. The sectoral emissions targets are reviewed every five years from the initial publication. This clause also places a legal obligation on Ministers responsible for sector departments to prepare a sector emissions reduction plan to be submitted to the Minister within six months after the publication of the sectoral emissions targets.

Clause 12 specifies that a sector emissions reduction plan must set out how the relevant sector and subsector will meet the sectoral emissions targets within five years of the publication, and must be reviewed and updated as and when the sectoral emissions targets are reviewed. This clause further requires the Ministers responsible for sector departments to annually report to the Presidency on progress on the implementation of the relevant sector emissions reduction plan and the achievement of the relevant sectorial emissions targets.

Clause 13 deals with carbon budgets and empowers the Minister to determine greenhouse gas emissions threshold for purposes of allocation of a carbon budget to a person. This clause also empowers the Minister to allocate a carbon budget to a person for a specified period. A person who has been allocated a carbon budget will be required to prepare and submit to the Minister a greenhouse gas mitigation plan.

The Carbon Tax Bill, adopted in February 2019, lists wastewater treatment and discharge under Schedule 2. Schedule 2 lists those activities that are liable to pay a carbon tax if the volume of greenhouse gases emitted exceed the allowed threshold. The Carbon Tax Act, 2019 comes into operation on 1 June 2019.

Umgeni Water will need to consider the following:

- The allowed threshold for domestic wastewater treatment and discharge is 2 million ℓ/day.
- The rate of carbon tax on GHG emissions will be imposed at an amount of R120/ton of carbon dioxide equivalent of the GHG emissions of a tax payer. This rate will increase each year by the amount of consumer price inflation (CPI) plus 2% up to 31 December 2022, and adjustments thereafter will be in line with inflation.
- The Bill provides for various tax-free "allowances", which enable a reduction in carbon tax liability of up to 100% for certain activities i.e. domestic wastewater treatment and discharges. These allowances provide a large degree of flexibility for taxpayers to significantly reduce their carbon tax liability.
- Taxpayers must submit environmental levy accounts and payments as prescribed in terms of the Customs and Excise Act, 1964 on an annual basis for every tax period.

The draft Carbon Offset Regulations, as part of the Carbon Tax Bill were published for comment on 12 November 2018. The Regulations govern the carbon offset allowance mechanism that is provided for in the Carbon Tax Bill. This mechanism enables companies to reduce their carbon tax liability by investing in GHG emission reduction projects. The Carbon Offset Regulations are anticipated to also come into operation on 1 June 2019.
6.1.2 Umgeni Water’s Adaptation Initiatives

DWS and Umgeni Water acknowledged the impacts of climate change on hydrological variability in 2010 in the KwaZulu-Natal Coastal Metropolitan Area Reconciliation Study (2010) although, at the time of that study, the “results of climate change could not be determined accurately” (DEA, DWS, GIZ and SANBI 2013:67). In 2010, Umgeni Water commenced with research into the impacts of climate change on hydrological variability viz. the Water Research Commission study on the potential impacts of climate change on the Mgeni System (2012). Unfortunately, the high variability of results meant that distinct conclusions could not be drawn on the subject, although the potential for an increase in extreme events (floods and droughts) seems possible.

The upgrade of Umgeni Water’s Water Resources Management System (WRMS) to a user-friendly decision-support system with improved functionality (Water Resources Management Decision Support System, commonly referred to as WRMDSS) was completed in 2017. The purpose of the upgrade was to improve the monitoring of hydrological information so that effective monitoring of the systems could take place. This is a precursor to response strategies that may be needed with changing climatic conditions.

In alignment with the 2017 KZN Climate Action Adaptation Plan Programmes 2 and 3 regarding the need to further develop existing early warning systems, Umgeni Water together with the South African National Biodiversity Institute (SANBI) and uMgungundlovu District Municipality (UMDM) are undertaking a project to develop a flood forecasting and early warning system at three pilot sites located within UMDM. The duration of this project is three years and the deliverable is to provide a real-time flood forecasting and early warning system to alert communities of impending flood events. The design of this system commenced in May 2017 and the project is anticipated to be completed in April 2020.

In alignment with the 2017 KZN Climate Action Adaptation Plan Activity 1.1 regarding the need to identify alternative water sources, Umgeni Water is investigating wastewater reuse (Section 6.2) and desalination as viable water sources (Section 6.3).

(a) Results of the 2018 Climate Change Impacts Study

Umgeni Water is currently undertaking a study to investigate the potential impacts of climate change on future water supply. The study is an update of the study that was undertaken in 2012 on the potential impacts of climate change on relevant water resources related issues in the Mgeni and surrounding catchments using outputs of recent Global Circulation Models (GCMs) as inputs to appropriate hydrological models. The GCMs used are from the latest Intergovernmental Panel on Climate Change (IPCC) and are models called Coordinated Regional Climate Downscaling Experiments (CODEX) GCMS. Five CODEX models, recommended by the World Meteorological Organization and South African Weather Service for the Umgeni Water Operational Area, were used. The models originate from various countries and use two time frames, namely the present (running from 1976 to 2005), and the immediate future (2016-2045). The first set of results for the study have been obtained and include results on impacts of climate change on reference potential evaporation, rainfall, stream flow.
(i) Impact of Climate Change on Potential Evaporation

The evaporation results in Figure 6.3 indicate that more evaporation will occur on inland areas rather than in the coastal areas due to high relative humidity in coastal areas. According to the results, the high evaporation is predicted to occur over the Lower Mooi River and the mid-Mgeni system. This suggests that Spring Grove Dam and Mearns Weir may not be affected by the projected change.

![Maps showing potential evaporation](image)

Figure 6.3 Historical annual changes vs projected change on potential evaporation (Schulze and Schütte 2018: 16 and 17).

The results also indicate that the high lying areas of the Mkhomazi River Catchment and the Mgeni River Catchment will experience low evaporation. According to the results, the highest change in
potential evaporation will be in the western part of Umgeni Water’s operational area rather than on the east and the highest change will occur in hot years rather than in the cool years.

The results also show that evaporation will be highest in summer and lowest in winter as expected. This is due to the higher temperature in summer which accelerates the rates of evaporation and, again, the Mkhomazi catchment will experience the least evaporation in winter months.

(ii) Impacts of Climate Change on Rainfall

There is high variability in the projected changes of rainfall (Figure 6.4). Some areas are likely to have increased rainfall whilst other areas are likely to have less. This is very important for Umgeni Water to take into consideration when planning. Another important consideration for Umgeni Water is that the upper catchments such as the Drakensberg Mountains, which are where most runoff is generated, are likely to experience a decrease in rainfall.

Annual rainfall is likely to have less variability when against specific seasons (Figure 6.4), with winter having the highest variability among the seasons and summer having the lowest variability. Furthermore, the results show that summer is the highest rainfall season as expected. Spring and autumn have relatively consistent/similar rainfall and winter, as expected, has the lowest rainfall. The highest predicted seasonal change is likely to take place in spring and autumn is expected to be low. High variability is also predicted for the winter seasons. Historical rainfall variability shows that annual rainfall is less variable when compared to winter rainfall.

Figure 6.5 indicates that in future there are likely to be areas of less variability and other areas of high variability (the areas of less variability are shown in blue and the areas of high variability are illustrated in brown). Of particular importance to Umgeni Water is that in spring and autumn there is a projected increase in variability in the head water catchments. A confidence index was prepared for these sets of results and this is shown in Figure 6.6.

In Figure 6.6, the results with a higher confidence are shown in shades of green. It is noted that the higher the rainfall year, the more confidence there is in the results whilst there is a lower confidence in the lower rainfall years. Notably, there is less confidence in the results in winter than in the other seasons.
Figure 6.4  Projected change in rainfall looking at ratio change, mm change and % change (Schulze and Schütte 2018: 22)
Figure 6.5 Rainfall variability: historical (left) and projected change (right) (Schulze and Schütte 2018: 28)
Figure 6.6 Rainfall: Confidence in results showing projected changes (Schulze and Schütte 2018: 30)
(iii) Impacts of Climate Change on Accumulated Streamflow

The historical and projected changes in accumulated streamflow for the 1:10 year low, the median and a 1:10 year high are shown in Figure 6.7. The results show that higher accumulated streamflows can be expected along the Mkhomazi and Mgeni Rivers. The results also show that there are some areas with proposed increases and others with decreases in expected runoff. Notably, even though the rainfall confidence is generally high, the confidence in the streamflow results appears to be low.

Figure 6.7 Accumulated annual streamflows: historical, projected changes and confidence in results showing projected changes (Schulze and Schütte 2018: 37).
6.1.3 Umgeni Water’s Mitigation Initiatives.

The National Development Plan (2012) indicates that, while adapting to climate change, industries and households have to reduce their negative impact on the environment. This includes water utilities. Umgeni Water’s business activities are associated with some level of greenhouse gas emissions and the organisation is undertaking a number of initiatives to reduce greenhouse gas emissions.

Realising the company’s contribution to greenhouse gas emissions through electricity consumption related to UW activities, a baseline energy audit was undertaken in the financial year 2010/2011. This study was a separate study to the Systems Energy Analysis provided in Section 5. The purpose of Section 5 is to show the energy “cost” of regional and local water supply. The objectives of the 2010/2011 energy audit were to establish baseline energy consumption for UW with the view of setting energy conservation targets and to identify energy efficiency opportunities for implementation with a preliminary analysis of the proposed energy efficiency plans. These objectives were achieved through assessing energy usage data for a 12 month period. The main outputs of the audit included the energy use process maps for all audited sites, energy use survey results as well as lighting use survey results. The energy audit recommended that an energy conservation and demand management strategy should be developed to inform future infrastructural planning and design in order to incorporate energy conservation and efficiency interventions.

In 2016, a Professional Service Provider was appointed to develop an Energy Conservation and Demand Management Strategy in response to the recommendation in the energy audit. The energy demand strategy is anticipated to provide Umgeni Water with a framework for implementing energy demand management and conservation practices in compliance with the National Energy Act No. 34 of 2008. However, it should be noted that currently, the organisation is not able to implement some of the energy conservation and demand management interventions that may be proposed for the current operational sites as these were not incorporated in the original design of the infrastructure. As a result, the proposed energy conservation and demand management strategy is intended for incorporation into all UW future infrastructural designs in order to ensure the implementation of energy conservation and demand management practices in their operational phase. The implementation of the strategy will assist the organisation in minimising the potential increases in energy consumption and, at the same time, reduce the associated carbon emissions. The energy demand strategy has been finalized by the service provider and will be presented to relevant key internal stakeholders and implemented thereafter.

In addition to the energy conservation and demand management strategy, Umgeni Water has an ongoing green buildings initiative which started in 2014. This project is aimed at transforming the organisation’s business activities to achieve environmental sustainability. Resource efficiency assessments to determine the status quo were carried out at three office sites; Umgeni Water Head Office, Mkhondeni and Pineside Regional Offices. Eleven Water Treatment Plants (WTPs) and Waste Water Works (WWWs) were also assessed. The assessments entailed a review of the current processes and the associated energy usage, waste generation and disposal as well as water usage patterns within processes and office space. This included undertaking an analysis of available options for improvement. An Umgeni Water Design Guide (Green Building Planning and Design Guidelines Manual) was also developed as part of the project scope. These guidelines are intended to inform decision making with respect to the built environment at Umgeni Water. The guidelines are also intended to provide practical information on energy-efficient technologies, design criteria and appropriate materials and solutions that can inform the planning and design of UW infrastructure.
and buildings. The long term plan for the project is to implement its recommendations in a phased manner.

In alignment with the national goal to monitor carbon footprints, Umgeni Water has developed a carbon footprint mapping tool. This tool will be used to identify the potential opportunities for reducing carbon emissions. The site specific carbon footprint mapping tool is currently developed for three sites namely, Durban Heights WTP, Darvill WWW and Umgeni Water Head Office. Sources of greenhouse gas emissions have been identified and existing data from these sources is being analysed using site-specific carbon footprint tools. The long term plan is for the tool to be applied to all UW sites by the internal team. The project began in February 2017, and the final report, with the results from all UW sites, will be finalised by June 2019.

Finally, Umgeni Water has researched the possibility of implementing biodiversity offsets. Biodiversity offsets are interventions specifically implemented at one location to counterbalance adverse environmental impacts (land-use change, resource use, discharge emissions or any other activity) at another location. A service provider will be appointed to conduct an assessment of what offsets are available and this biodiversity study will commence in June 2019.

6.2 Wastewater Reuse

The 2015 to 2018 drought has highlighted the value of water and the need for conserving or optimising all water resources. Increasing demand requires new and innovative solutions to the water supply problem. Water resource recovery has been identified by the Department of Water and Sanitation (DWS) in the National Water Resources Strategy 2 (2016) as a priority. Umgeni Water views water resources recovery as one of a number of opportunities to diversify the water resources portfolio thereby improving the organisation’s capability to cope with variability, such as drought.

One of Umgeni Water’s current projects includes an investigation into the feasibility of water resource recovery. This involves the construction of a new 2 Mℓ/day water resource recovery plant as part of the Darvill WWW upgrade (Section 12.4.1). This water resource recovery plant will be used to provide the water as wash water on the main plant, for high pressure cleaning (approximately 1 Mℓ/day). The remainder will undergo tertiary treatment, to potable standards, to produce drinking water. The plant represents a major investment in water resource recovery research and development and provides an indication of Umgeni Water’s strategic intent.

The water resource recovery plant has been designed based on local and international experience in water resource recovery and makes use of the multi-barrier approach to treatment. This approach comprises the use of a series of advanced treatment technologies to ensure the safety of the water produced.

The 2Mℓ/day water resource recovery plant consists of a conventional water treatment works (Figure 6.8) followed by an advanced treatment process (ATP). The ATP plant has been designed with treatment flexibility to accommodate two process trains that enable a by-pass of the conventional plant in favour of receiving final effluent directly from Darvill WWW.
In Process Train No. 1 (Figure 6.9), the filtered water from the conventional water treatment process (feed water to the ATP) is pumped to Ultra-filtration (UF) membranes followed by an advanced oxidation process (AOP). An innovative reactor design ProMix system is used for AOP followed by Granular Activated Carbon GAC filtration and onsite electrolytic chlorination (OSEC) to produce treated water. The AOP has advantages of oxidizing difficult organics while reducing bromate formation.

In process train No. 2 (Figure 6.10), AOP and Granular Activated Carbon / Biological Activated Carbon GAC/BAC filtration precedes the UF and OSEC units.

The water resource recovery plant will be used to:

- Investigate the reliability of the treatment process to produce drinking water of a quality compliant with the national potable water standards;
- To provide valuable information on the treatment of emerging chemicals of concern;
- To assess overall lifecycle costs;
- To investigate the effectiveness and efficiency of different treatment configurations;
- To develop national water quality guidelines (regulation/limits) for potable water obtained from treated waste water; and
- To educate the public and improve their perceptions of reuse technology as a potable water source.
Included in the construction of the demonstration plant is a visitor’s centre. Interior designers were instructed to design the centre to meet a number of objectives. Foremost of these is to project an image of a clean and naturally pure environment. The aim is to inspire confidence in the potential future users of recovered water. The intention is for the centre to become a hub for water resource recovery education in the country promoting sustainability and alternative water resources. Construction of the visitor’s centre was completed in November 2018.

The water resource recovery plant is still under construction with completion anticipated in October 2019.

6.3 Seawater Desalination

6.3.1 Large Scale Desalination

Umgeni Water completed a detailed feasibility study, of two 150 Mℓ/day seawater desalination plants, in July 2015. The study investigated the potential implementation of desalination along the east coast of KZN at two potential sites, one located at Tongaat (north of Durban) and one at the Lovu River Estuary (south of Durban). These sites are located on either side (north and south) of the Mgeni Supply Area and would have the ability to sufficiently augment the Mgeni, South Coast and North Coast Systems in the medium-term with supply to areas in eThekwini Municipality, Ugu District Municipality and iLembe District Municipality.

The capacity of these plants was based on the capacity of existing and proposed bulk water supply infrastructure in these areas, and which could be utilised to convey potable water from the desalination plants to the various distribution points. Comprehensive geotechnical, oceanographic, bathymetric and environmental studies were completed as part of the Detailed Feasibility Studies and an extensive water quality sampling programme was conducted by the Council for Scientific and Industrial Research (CSIR) over a period of one year. Sea water samples were taken at a variety of points both near shore and far shore as well as at different depths. Preliminary analyses and interpretation of the sea water results indicated that the nutrient rich east coast waters contained high concentrations of algae. Some of these algae are very small and are known as “pico-plankton”. These “pico-plankton” are considered to be potentially hazardous to membrane based treatment processes and they may result in fouling.

It was thus proposed, as part of the detailed feasibility study, to conduct a pilot study using various pre-treatment technologies. Pilot investigations will allow four suitable pre-treatment technologies to be tested to establish their ability to provide protection for the downstream Reverse Osmosis (RO) membranes. It is essential that the RO membranes are protected as their replacement is very costly and any reduction in their performance due to fouling must be avoided as far as possible.

The four pilot plants to be tested are:

- **Plant 1**: Rapid gravity tri-media filter. Flocculation takes place in a flocculation tank prior to feeding the filter.
- **Plant 2**: Two-stage dual media filters. The first stage is a rapid gravity filter. This stage also serves as the flocculation step in the coagulation process. The second stage is a Pressure Filter.
- **Plant 3**: Dissolved Air Flotation followed by a dual media rapid gravity filter.
- **Plant 4**: Ultrafiltration (UF) membrane pilot plant.
The construction of the pilot plant is now complete and is based at Scottburgh. The pilot plant will be operated for a period of 12 months to determine the most appropriate pre-treatment process for desalination along the KwaZulu-Natal Coastline. The plant was commissioned in January 2018 although trials are only expected to start later in 2019 as a result of delays in waste discharge permits.

With the Lower Thukela Bulk Water Supply Scheme now operational (Section 11.2) and the proposed uMkhomazi Water Project (Section 8.5.2 (a)) being planned by DWS, the North Coast Desalination Plant is unlikely to be implemented in the short to medium term. Similarly, the Lower uMkhomazi Bulk Water Supply Scheme (Section 10.7.3 (d)), would be able to supply the same area on the South Coast and, with a better return on investment, is the preferred choice for implementation.

The East Coast Desalination Plants will, hence, be considered as possible long term augmentation options for both the North and South Coast.
7. **OVERVIEW OF SYSTEMS**

7.1 **Overview of Systems**

All existing water resources and water supply infrastructure utilised by Umgeni Water, 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 7.1). 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 Table 7.1 and Figure 7.2. 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 8.

For further clarity, the larger primary systems have been divided into *secondary systems*.

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 7.1* illustrates all the existing and proposed water system configurations and linkages, and provides a point of reference for Section 8, Section 9, Section 10, Section 11 and Section 12 of the IMP 2019.
Figure 7.1 Water infrastructure system configurations and linkages.
### Table 7.1  Distribution of surface water resources.

<table>
<thead>
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<th>Region</th>
<th>Quaternary Catchments</th>
<th>Major Rivers</th>
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Figure 7.2 Water resource regions in Umgeni Water’s operational area (KZN DoT 2017; MDB 2016; Umgeni Water 2019; WR2012).
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Kevin Meier,
PLANNING SERVICES MANAGER