
# CHALLENGES OF WATER MANAGEMENT AT LOCAL GOVERNMENT MUNICIPAL LEVEL IN THE EASTERN CAPE OF SOUTH AFRICA

Kasonde Mulenga (Student No. 0700326J)

A research report submitted to the School of Civil and Environmental Engineering, University of the Witwatersrand, in partial fulfilment of the requirements for the degree of Master of Science in Engineering

Johannesburg, 2017

## AUTHORS DECLARATION

I, Kasonde Mulenga, hereby declare the work reported in this dissertation to be my own and that the dissertation has not previously been submitted in full or partial fulfilment of the requirements for another qualification.

Author's Signature: 

Date: 23rd October 2017.

## ACKNOWLEDGEMENT

The successful completion of this research would not have been possible without the support, assistance and encouragement of a number of individuals.

I wish to express my heartfelt thanks to my supervisor, Professor Akpofure Taigbenu of the School of Civil and Environmental Engineering at the University of the Witwatersrand for his guidance and motivation throughout this research.

I would also like to acknowledge my late father, George Kasonde Mulenga (1954-2007) whose love, support and encouragement helped in my life's journey.

I am also grateful to my family, especially my wife, Monica Mulenga, and my children, Walipalwa and Cisomo, for understanding and supporting me during the course of the study .I would further like to thank my friend John Fernandez for all the assistance rendered in the formatting of the document.

Finally, I would like to thank the Almighty God and my Lord and Saviour, Jesus Christ, in whom I live and move and have my being. It is He who gave me the strength, wisdom and knowledge to undertake and complete this study. To Him be all the glory, the honour and the praise.

## ABSTRACT

Human beings depend on water not only for life itself but also for their economic wellbeing. Water resources play a cardinal role in the creation of everything that human beings produce.

Post-apartheid South Africa is in the throes of incredible challenges. One of the more important challenges is access for all citizens to basic services. South Africa is doing this against a backdrop of strongly differential servicing that is its apartheid legacy, which has prompted many commentators to label South Africa a country of two worlds, more specifically, a developed world component and an impoverished developing world component. The challenge with respect to water is to ensure universal access in the context of the added hurdle of South Africa being a water-scarce country.

The local municipalities of the Eastern Cape have been facing a number of challenges in the provision of clean, portable water to their communities. This has resulted in inadequate provision of water, meaning that not all communities have access to clean water 24 hours a day

The overall objective for this study is to contribute to the body of knowledge available to the water sector about the management of sustainable water supply systems in municipalities, and determine the factors that have undermined the sustainability of water provision at a local government municipal level in the Eastern Cape Province of South Africa. In this research, the effectiveness of local governments, which act as water services authorities (WSA) and providers of water to the rural communities, is examined. To this end, a comprehensive literature review was conducted and data gathered to discover why there has been a failure in the provision of clean drinking water.

The results of the research illustrate that institutional incapacity in rural municipalities and widespread poverty serve to undermine the sustainability of the local government sector and lead to breakdowns in services delivery.

Measures are proposed that can be adopted to improve the current approaches of water supply in local municipalities.

## TABLE OF CONTENTS

## LIST OF ABBREVIATIONS

| | | |
|---|---|---|
| BDS | - | Blue Drop System |
| COGTA | - | Department of Cooperative Governance and Traditional Affairs |
| DWQ | - | Drinking water quality |
| DWS | - | Department of Water and Sanitation |
| FBS | - | Free basic services |
| GWP | - | Global Water Partnership |
| IAM | - | Infrastructure asset management |
| IDP | - | Integrated development plan |
| IWRM | - | Integrated water resources management |
| LSRWUA | - | Lower Sundays River Water Users Association |
| NRW | - | Non-revenue water |
| NWA | - | National Water Act |
| RDP | - | Reconstruction and Development Programme |
| SANS | - | South African National Standards |
| SRVM | - | Sundays River Valley Municipality |
| WCDM | - | Water conservation and demand management |
| WRM | - | Water resources management |
| WSA | - | Water Services Authorities |
| WSDP | - | Water Services Development Plan |
| WSP | - | Water services providers |
| WTW | - | Water Treatment Works |
| WWTW | - | Wastewater Treatment Works |
| SADC | - | Southern African |
| CMA | - | Catchment Management Agency |

## LIST OF FIGURES

## LIST OF TABLES

# Chapter 1.
# INTRODUCTION

## 1.1 Water Governance

More than one third of the world's population, about 2.4 billion people, are living in water stressed regions of the world. Approximately one in eight people lack access to safe drinking water. Less than 1% of the world's fresh water resources (about 0.007 of all water on the earth) are readily accessible for direct human use as shown in Figure 1.1**:**. While water is the most abundant resource on the earth, 97.5% of the water is too salty for human consumption and crop production. Much of the freshwater, an estimated 35 million $km^3$, cannot be accessed for use because it is locked up in the ice cover of the Arctic or Antarctic or in deep aquifers (Gleick 1993).

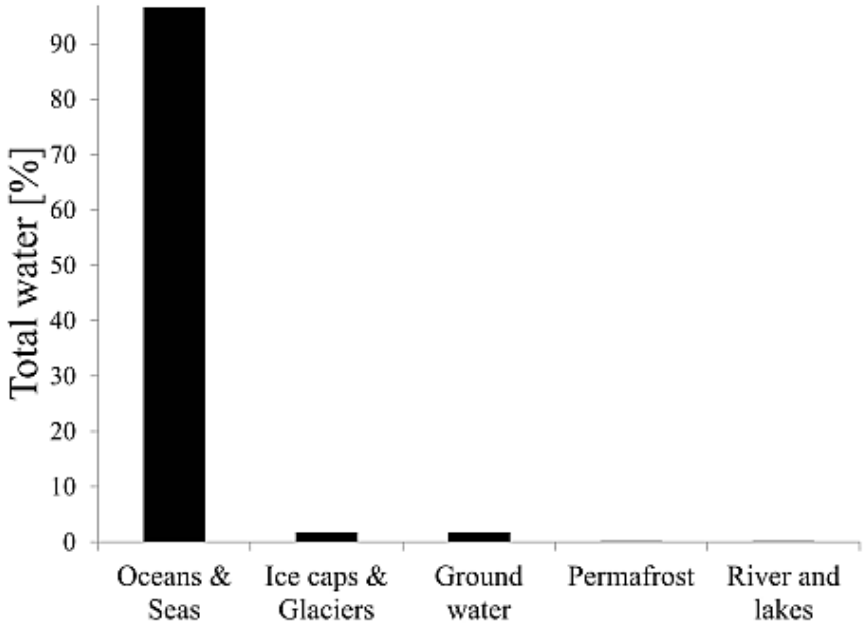



Figure 1.1: Percentage composition of total water in various reservoirs.

In July 2012, the General Assembly of the United Nations declared access to clean, safe water and sanitation a human right. A healthy human life demands sufficient and safe water (Nnadozie 2011). This human right was declared against a background of the world's population having increased threefold during the 20th century and a

consequent sevenfold increase in the water consumption. This has put considerable strain on the available freshwater resources.

As a reaction to the above-mentioned challenge, the United Nations Water Conference in Mar del Plata in 1977 resolved, in its assessment of water resources, that all efforts should be undertaken at national level to substantially increase financial resources for activities related to water resources assessment and to strengthen related institutions at national and regional levels. The International Conference on Water and the Environment in Dublin in 1992, also articulated and subsequently affirmed a set of principles for good water management. These are often referred to as the Dublin Principles. The first of these principles is the 'ecological principle', which requires that water be treated as a unitary resource within river basins, with particular attention to ecosystems. The principle states that water is a finite, vulnerable and essential resource that should be managed in an integrated manner. The second is the 'institutional principle', which recognizes that water management requires the involvement of government, civil society and the private sector, and the principle of subsidiarity is respected. The third principle states that women play a central role in the provision, management and safeguarding of water. The fourth principle recognizes that water has an economic value and should be viewed as an economic product, taking into account affordability and equity criteria (Environment 1992).

The importance of effective water governance, which refers to the range of political, social, economic and administrative systems that are in place to develop, manage and deliver water services at different levels of society, cannot be overemphasized (GWP, GWP 2003). Effective management of water resources demands a holistic approach, linking social and economic development with the protection of natural ecosystems. It links land and water use across the whole of a catchment area.

After thousands of years of human development in which water has been a plentiful resource in most areas, amounting to a virtually free product, the situation has now changed considerably, to the extent that, particularly in the more arid regions of the world, water scarcity has become the single greatest threat to food security, human health and natural ecosystems (Seckler 2010).

South Africa is a predominantly semi-arid country that could be described as water scarce because in many cases demand far outstrips the supply capability. Water underpins the socio-economic development of South Africa. A reliable supply of water in sufficient quantities at the desired quality is therefore critical to economic growth, social development and job creation (DWS 2013c).

## 1.2 Problem Statement

Water that is available in nature needs to be purified and requires being made safe for drinking before being conveyed to its points of consumption. The process of purification and distribution entails huge costs. Sustainable development of the water supply system thus calls for huge resource mobilisation (Majumdar 2007).

Post-apartheid South Africa is in the throes of incredible challenges. One of the more important challenges is access for all citizens to basic services. South Africa is doing this against a backdrop of strongly differential servicing that is its apartheid legacy, which has prompted many a commentator to label South Africa a country of two worlds, more specifically, a developed world component and an impoverished developing world component. The challenge with respect to water is to ensure universal access in the context of the added hurdle of South Africa being a water-scarce country. One of the important ways in which more water can be made available for this extended servicing is through the development and implementation of water-efficient practices in both reticulation and end use.

It remains difficult to address any resource issue in South Africa without first considering the impact of the past 300 years of its history in general and the past 50 years in particular. The formal apartheid years (1948-1994) and the preceding 250 years have left a legacy of inequitable access in the development of resources. The current profile of water access and servicing in South Africa can in large measure be explained by the policies adopted during the formal apartheid years. One of the key features of the current profile is differential domestic servicing within the paradigm of South Africa's unique class system based on race. The net result is that South Africa has reasonable reticulation efficiency in the white suburbs and quite the opposite in black townships where minimum night flows of greater than 60% are not at all uncommon. In addition, it is estimated that out of the population of approximately 55

million people, 9-12 million of do not have reasonable access to potable water (Naidoo 2010).

As part of government strategy to alleviate poverty in South Africa, a policy for the provision of free basic services (FBS) was introduced. Under this policy, an indigent person is entitled to 25 litres of water per day, which is a level sufficient to promote healthy living. This amounts to 6 kilolitres per household per month for a household of eight people (DWS 2007).This was designed to redress the imbalances of the past.

According to the Water Act of 1998, the national government of South Africa has overall responsibility and authority over water resources management (WRM), including the equitable allocation and beneficial use of water in the public domain. At rural community levels, this responsibility is taken on by local municipalities, which act as water services providers (WSP) in accordance with the Water Services Act.

South Africa's 1996 Constitution mandated a high degree of decentralization as part of the country's political settlement. So, while the water supply programme was driven and implemented by the national DWS for the first five years, the second five years were a period of decentralization during which new local government institutions were established following the local government elections of 2000.

In 2001, a decentralized fiscal system was established that integrated the financing of the national water supply and sanitation programme and required that attention be paid to supporting new municipalities so that they could exercise their responsibilities. While the water services functions were being decentralized, the water resource management functions were kept at central level. This helped to maintain the integrity of rivers as management units by establishing an institutional counterbalance between local government as water users and central government and its regional agencies as custodians of the resource.

Thus, an important aspect of the post-2001 water supply programme was to build the capacity of local government, not only to sustain the water services investment programme but also to ensure effective, ongoing operations and maintenance of the new water infrastructure. This required the establishment of financial systems to support the physical and operational planning of the water services, one element of which was the development of tariff and subsidy policies that would support the long-

term financial sustainability of the local governments.

The initial water and sanitation policy in 1994 was that central government would fund the infrastructure for basic water service provision in poor communities while the communities themselves would fund their operational costs. However, it became clear that in the poorer parts of the country, municipalities would require support to maintain even a minimum level of services (Muller 2008).

The local municipalities of the Eastern Cape have been facing a number of challenges in the provision of clean, potable water to their communities. This has resulted in inadequate provision of water, meaning that not all communities have access to clean water 24 hours a day. A number of reasons has been put forward why these municipalities fail in their mandate to provide clean drinking water to the communities (Cogta 2014a).

In addition to water scarcity, there are other water challenges, concerns and factors increasing water stress, which demand urgent attention and intervention. These include the following:

- A highly variable climate and associated run-off, flood and drought risks, and the need to respond to potential impacts of climate change;
- Deterioration of water resource quality and ecosystems due to pollution (eutrophication, salinisation, acid mine drainage and microbiological contamination) as well as developmental impacts on water habitats (DWS 2013c).

It is imperative that the underlying causes and associated enabling factors dictating and influencing successful delivery are identified and addressed in a holistic manner. Critical factors that must receive priority attention are the following:

- Inadequate financial resources and operating in a stressed economic environment;
- Ever-rising costs of water resource management with the associated implications;
- Inefficient governance, regulation, compliance monitoring and enforcement;
- Insufficient alignment with and appropriate responses to national development and growth strategies;

- Incomplete water management model and framework;
- Inadequate sector involvement and accountability;
- Skills shortage and limited institutional capacity;
- Deficient information and knowledge to manage a complex water business; and
- Inadequate integrated water investment framework.

It is against this background that municipalities are failing to meet their mandate of supplying clean drinking water to the communities under their jurisdictions. The failure has prompted discussions at the national and provincial levels of government, and it has been suggested that the mandate to provide water services should be taken away from local government and outsourced to private professional providers or state-owned, non-profit business enterprises accountable to the Minister of Water and Environmental Affairs, like Amatole Water, Rand Water, etc.

### 1.3 Consequences of the Problem

It costs the municipalities a great deal of money to extract water from its sources, treat it and pump it to the reservoirs from where it can flow to household consumers. This does not include the maintenance of the reticulation system. The recovery of full costs should be the goal of all water uses at local government level.

When a Water Services Provider (WSP) fails to meet its obligation of supplying clean water, communities become frustrated and lose confidence in the ability of the municipalities to deliver services. It is worth noting that the mass protests, demonstrations and violent confrontations that have taken place since 2005 are a direct result of the culmination of numerous frustrations that have built up over a long period.

The research organisation Municipal iQ, which has been collecting data since 2004, publishes the *Municipal Hotspots Monitor,* which covers ‘major’ community protests against local government service delivery. Between January and December 2015, it recorded 164 protests, down from 191 in 2014, which was the highest recorded number since 2004. It recorded 155 incidents in 2013 and 173 in 2012 (Municipal-IQ 2016).

COGTA in its *2014 Strategic Plan* acknowledges the role played by local government when discussing the risk of violent community protests. It lists several contributing factors, such as inadequate communication, feedback and responses to community issues, the poor attitude of public servants, disengaged public servants and negative perceptions about the government by the communities relating to maladministration, fraud and corruption. When the municipality looses the trust of the community, a culture of non-payment for services rendered sets in, and recovery of revenue by the municipality becomes difficult. Eventually, the water business of the municipality becomes unsustainable. The municipality then fails to meet its obligations as a WSP.

The result has been a dissatisfied clientele (consumers) who are not willing to pay for the water they are being provided. Due to the prevailing volatile political atmosphere, it is not easy for a rural municipality to successfully carry out water disconnections when community members do not pay their water bills. The consequence of poor performance of the municipalities as water services authorities is that the DWS can instigate legal action against consumers who fail to pay for services.

### 1.4 Rationale of the Study

The lack of reliable sources of water has hampered social and economic growth in the rural areas of the Eastern Cape Province of South Africa. Industries cannot be set up in areas where the water supply is unreliable. This has a ripple effect on unemployment because there are fewer industries where people can seek employment when the water supply is unreliable. Municipalities that fail to provide clean water in accordance with the World Health Organisation standards often subject consumers to water borne diseases resulting from pathogenic organisms like e-coli, which may be present in the water. The risk is even higher for infants and the elderly in the communities.

The overall objective for this study is to contribute to the body of knowledge available to the water sector about the management of sustainable water supply systems in municipalities, and determine the factors that have undermined the sustainability of water provision at a local government municipal level in the Eastern Cape Province of South Africa. Measures are proposed that can be adopted to improve the current approaches of water supply in municipalities.

Access to a safe, reliable, affordable, and easily accessible water supply is essential for good health and social and economic development. Challenges faced by more and more countries in their struggles for economic and social development are increasingly related to water. Water shortages and quality deterioration are among the problems that require greater attention and action. It is therefore important that local government entities that are set up to provide water to consumers are sustainable and up for the task. Since they were set up post-1994, local government entities have faced a number of challenges in meeting their mandates.

## 1.5 Research Question

This research is designed to address the following research question: Why are local government water governance institutions failing to meet their obligations of supplying clean, adequate drinking water to communities in rural areas of the Eastern Cape Province?

## 1.6 Objectives of the Study

The specific goals of the study are the following:

1. To review the concepts of the water governance, sustainability and integrated water resources management (IWRM) at municipal level in a rural setting in South Africa.
2. To conduct a holistic evaluation of the WRM framework and identify operational challenges to the provision of clean drinking water to rural communities.
3. To determine the factors that have undermined water provision in rural municipalities,
4. To propose recommendations to address the operational challenges of water governance in rural municipalities.

## 1.7 Research Outline

In Chapter 1, the idea of water governance was introduced and the background of the research provided by presenting an overview of importance of sustainable

development, management and use of water resources. The research question and the methodology for the research were also presented in the chapter.

In Chapter 2, the research methodology is explained, outlying the methods that were used in answering the research question

In Chapter 3, the literature about water resources is explored. A coherent discussion on water governance is presented and how it relates to water management and development demonstrated.

Chapter 4 is a presentation of the research findings, results and discussion.

In Chapter 5, the recommendations based on the research are outlined and the research concluded.

# Chapter 2.
# RESEARCH METHODOLOGY

Methodology is defined as the set of skills, tools and techniques the researcher uses to collect, capture, analyse and present findings or information. (Creswell 2013)

The research approach utilised in this research is predominantly abductive. Abduction refers to a creative inferential process aimed at producing new hypotheses and theories based on surprising research evidence (Timmermans et al. 2012). Instead of moving from theory to data, as is the case in the deductive approach or from data to theory as is the case in the inductive approach, a combination of both deduction and induction will be used. This approach has been chosen because the research problem emanates from an interesting, if not unexpected occurrence, i.e., local municipalities in the Eastern Cape Province have been failing by and large with respect to water governance issues. Plausible theories of how this has been occurring after 20 years of democracy will be explored.

The explanatory research design is better suited to answering the research question. It is a valuable means of asking and discovering what has been happening and gaining insight into the research topic. Sundays River Valley Municipality will be used as a case study because it is representative of the Eastern Cape municipalities and the author had ease of accessibility to the Municipality and municipal data. The case study approach was chosen because it is useful in answering 'How?' and 'Why' questions and in this role can be used for exploratory, descriptive or explanatory research. An important strength of case study is the ability to undertake an investigation into a phenomena in its context. Thus case studies are valuable way of looking at the world around us.(Rowley 2002).

The methodological choice used is the mixed method research design, which involves using quantitative and qualitative methods of data collection. Mixed research methods are, generally speaking, an approach to knowledge (theory and practice) that attempts to consider multiple viewpoints, perspectives, positions, and standpoints. It is a synthesis that includes ideas from qualitative and quantitative research. (Johnson et al. 2007). Qualitative methods will be used because they are designed to explore the

human element of any given topic, how individuals see and experience their environment.

This involved data collection techniques like administration of questionnaire to the municipal officials at the municipality who are involved directly with the water supply to the communities. Questionnaire's work best with standardised questions that you can be confident will be interpreted the same way by all respondents (Davies et al. 2014) . Also utilized were structured questions of the municipal strategic self-assessment that was developed by the Department of Water and Sanitation (DWS). Three municipal officials were interviewed based on a predetermined and standardised set of questions. Five questions per business area that cover 18 key business health attributes were asked and used to provide strategic vulnerability flags (Appendix A). The scores were translated into percentages and a dashboard was generated that presents a vulnerability snapshot of the overall water and sanitation business of the Municipality. The three respondents were managers from the Technical, Finance and Human Resources Departments. The interviews with municipal staff established valuable information regarding water services planning, Technical capacity (numbers), water conservation and demand management (WCDM) practices and infrastructure asset management (IAM), operations and maintenance of assets.

A qualitative analysis of the municipality's water business was conducted to establish the level of sustainability. This involved a review of the various components of the institution. Group Interviews were held with municipal officials who are involved in the operations and maintenance of the municipal water infrastructure using structured questions which generated unstructured answers. The conversations were recorded and transcribed. In-depth interviews can provide rich and in-depth information about the experiences of individuals. They are used to discover shared understandings of a particular group, in this case the municipal officials (DiCicco-Bloom et al. 2006).

Water quality concerns encompass a number of specific considerations, including pollution or contamination issues associated with different media such as surface water, groundwater water, and/or coastal water; and their associated consequences on water usage and deterioration of resource features, recreational usage and productivity. Many factors affect the perception of water quality as held by different

publics such as water quality experts, elected officials, and public interest groups (Canter et al. 1992). A better understanding of the processes that influence public perception can contribute to improvements in water management, customer services, acceptability of water reuse and risk communication (de França Doria 2010). In order to measure the customer satisfaction with regards to the water services delivered by the municipality and performance of the municipality in relation to the legislative prescripts, a water services survey was be conducted because the general public has emerged as an important actor in water management. The survey, using quantitative methods, was conducted on the beneficiaries of the water supplied by the municipalities, and it investigated their perceptions to the water services being received from the municipalities. The questionnaire is the most frequently used data collection tool for quantitative studies. Each respondent is required to answer the same set of questions that are pre-set in a particular order. Thus it is an efficient way of collecting data from a large sample. It enables data to be analysed easily and in a structured manner (Ong 2012). The questionnaire used in the survey consisted of thirteen questions related to the quality of the water services and specific aspects of the service delivery (Appendix F). A total number of 350 households was surveyed in the communities of Moses Mabida, Emsengeni, Aqua Park and Bergsig which covers ten percent of the total number of households in the area. The result of the quantitative analysis serve to describe and explain the phenomena that these observations reflect (Sukamolson 2007).

A group of five members of the Kirkwood community were engaged by the author to conduct the survey and explain the questions when administering the questionnaires. The houses were chosen in a random fashion along the streets of the four townships. The target was to have of ten percent of the total number of household's as respondents. Therefore in cases where a chosen random household was chosen and it was discovered that they were not available or not willing to answer the questions, that particular household was skipped and another was chosen to replace it.

The author reviewed a number of documents for the purposes of this study
These included relevant journal articles related to integrated water resources management and governance challenges. An analysis of publications from the local

government sector as well as the department of water and sanitation relating to water governance in South Africa was also done.

The financial assessment of the municipality was conducted to establish the long-term sustainability of water supply using the following documents:

(i) The integrated development plans (IDP)
(ii) The operating budget
(iii) The capital budget
(iv) The tariff policy and structure
(v) Approved tariffs
(vi) Financial statements
(vii) Auditor General's Report
(viii) Municipal Infrastructure Grant allocation and spending
(ix) Equitable share allocation to water services
(x) FBS policy and funding
(xi) Revenue collection (%)
(xii) Revenue collection policy and by-laws.

The data obtained from the interviews with the municipal officials and the household water survey were then recorded, evaluated, and analysed and inferences made in line with the existing literature and theories.

The technique of triangulation that facilitates validation of data through cross verification from two or more sources was be utilized this research. Triangulation refers to the application and combination of several research methods in the study of the same phenomenon. It is define triangulation as an attempt to map out, or explain more fully, the richness and complexity of a subject matter by studying it from more than one standpoint (Cohen et al. 2013). It can also be defined as a method of cross checking data from multiple sources to search regularities in the research data. (Ndanu et al. 2015; O'Donoghue et al. 2003; Wen et al. 2017) .

Based on the results of the research, recommendations are made, which if implemented, could contribute towards sustainable and robust approaches of water supply in rural municipalities.

# Chapter 3.

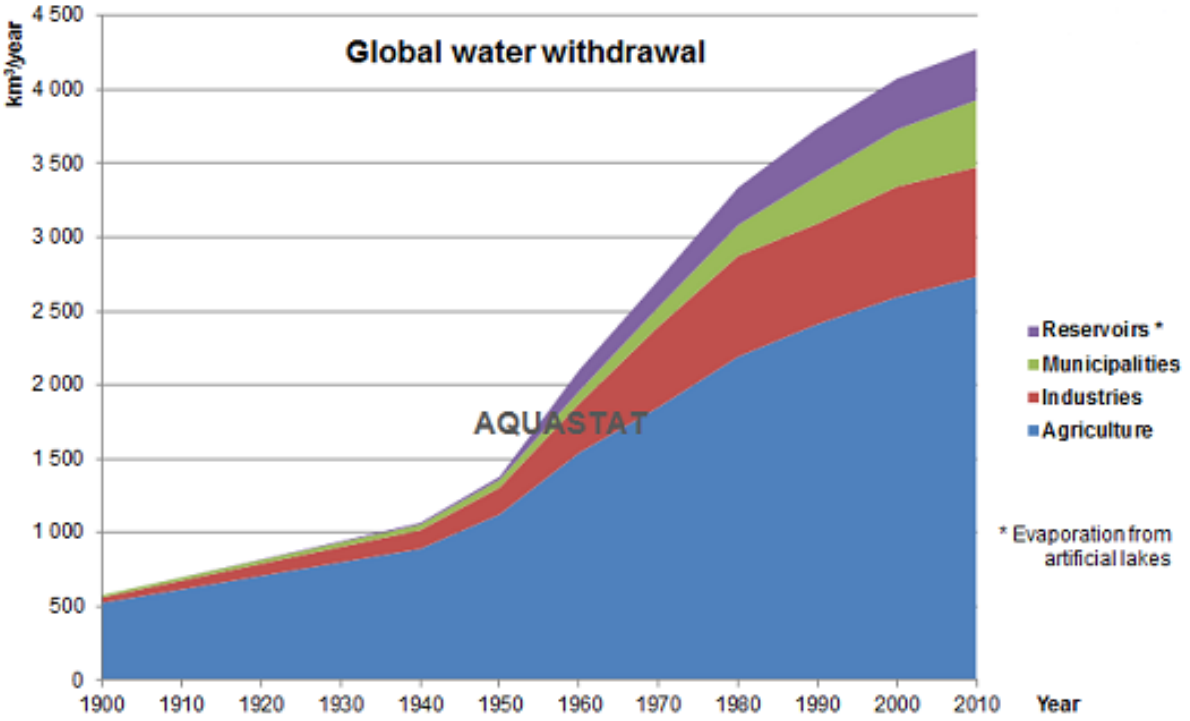
# LITERATURE REVIEW

## 3.1 Water as a Natural Resource

The total water available on planet earth amounts to 1 386 million km$^3$. However, not all these resources are potentially usable for humans. Agricultural, industrial, household, recreational and environmental activities, which constitute most of human water uses, require fresh water. Some 97% of the earth's water is salty, leaving only 3% fresh water, of which slightly more than two thirds (68, 9%) is frozen in glaciers and polar ice caps. The remaining unfrozen water is mainly found as groundwater (29, 9%), with only a small fraction present above ground (0, 3%) or in the air. Rivers account for 0, 0002% of total water or 0,006% of the fresh water, i.e., around 2 120 km$^3$ (Cassardo 2011).

Global water use has risen dramatically in the past 50 years due to population growth and the demands of irrigated agriculture as shown in Figure 2.1. There is growing recognition that increasing water scarcity threatens agricultural production, human health and political stability in many parts of the world. Current water use rates are not sustainable (Moe et al. 2006)

Figure 3.1: Global Water Withdrawal




Source: FAO: Auastat 2010

Humans depend on water not only for life itself, but also for their economic wellbeing. Water resources play a cardinal role in the creation of everything that human beings produce. On average, the body of an adult human being contains 60% water. Most of the water in the human body is contained inside the cells of the body. It can be argued that there are no substitutes for water. In both the domestic and public sphere, better water availability and quality equates to better health. Water is not renewable; there is a finite amount of water on planet earth. This has given rise to the common adage 'water is life'. In rural Africa, effective management of water resources in terms of access and water quality is one of the most important social and ecological issues faced by any government (Strauch et al. 2011).

Many people today are concerned about the potential for water scarcity in the face of increasing, mainly population-driven, water demands and its consequences for energy and food production. The Global Risk Perception Survey conducted among 900 recognized experts reports that the highest level of societal impact over the next 10 years will be from water crises (Forum 2015). The issue of water security – defined as an acceptable level of water–related risks to humans and ecosystems, coupled with the availability of water of sufficient quantity and quality to support livelihoods, national security, human health and ecosystem services – has been the object of increased academic and policy interest over the past decade (Bakker 2012). The United Nations characterises water security as the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustainable livelihoods, human wellbeing and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters and for preserving ecosystems of peace and political stability (UN-Water 2013a). Achieving water security in Africa presents an enduring and elusive challenge and opportunity for water institutions (Biermann et al. 2012).

In recent decades, the percentage increase in water use on a global scale has exceeded twice that of the population growth. This has led to more and larger regions in the world being subject to water stress where the current restricted rates of water use and consumption, let alone the desired rates, are unsustainable. Water demands and supplies are changing. What they will be in the future is uncertain, but what is certain is that they will change. Demands are driven in part by population growth and

higher per capita water consumption in growing urban, domestic, and industrial water sectors (Cosgrove 2015). Water is increasingly becoming a priority policy issue at the international level.

At the United Nations Sustainable Development Summit on 25 September 2015, world leaders adopted the 2030 Agenda for Sustainable Development. The Sustainable Development Goals, otherwise known as the Global Goals, are a universal call to action to end poverty, protect the planet and ensure all people enjoy peace and prosperity. In all there are 17 sustainable development goals to end poverty, fight inequality and injustice and tackle climate change by 2030. Because these goals are interconnected, the key to success for one often involves tracking issues more commonly associated with another. Goal Number 6 is specifically dedicated to water and aims to ensure access to safe and affordable drinking water for all by 2030. This is against a backdrop of more than 40% of the world's 7,4 billion population being affected by water scarcity currently (Griggs et al. 2013). Reducing this proportion presents a formidable challenges. While global targets are important, what matters most is reaching the MDG's country by country through massive expansion of service into unserved remote rural areas and densely populated urban slums. In order to fulfil the dream of universal access to improved water supply and sanitation, the focus must be on Sub-Saharan Africa and Asia. Within these areas, priority must be given to the ranks of the poor, therefore setting resource allocation parameters within countries (Lenton 2008).

Although Africa as a whole is only slightly below the world average in terms of available water resources per capita, and better off than Europe or Asia, it is beset by three critical groups of problems, one largely natural, the second very definitely man-made, the third somewhere in-between. The first centres on the distribution and reliability of resources. The second is related to the distribution and growth in human population. The third is the intimate link between water and disease in Africa, and the widespread lack of access to safe drinking water amongst the poorer communities. Much of the water that is theoretically available is either naturally dangerous for human health or else polluted by human activities – lack of sewerage treatment or pollution from agriculture, mining and industry. Over 300 million still lack access to safe water in sub – Saharan Africa (Jones et al. 2004).

Water is critical to the socio – economic development of the 14 southern African countries: Angola, Botswana, the Democratic Republic of Congo, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Tanzania, Seychelles, South Africa, Swaziland, Zambia and Zimbabwe. This is because of its importance to all sectors of the economy, but especially agriculture ( which uses over 80 % of the developed water resources) which supports most of the 200 million people in the region.(Hirji et al. 2002). The main water challenges that face the region as a whole include water scarcity due to the semi-arid and arid environment, watershed degradation caused by over cultivation, polluted water bodies caused by poor waste disposal systems and management of river basins which cross national borders.(Manzungu 2004a).

South Africa, like many parts of southern Africa, experiences limited water availability that is often of low quality. It is a largely water-stressed country, with an average annual rainfall of approximately 464 mm compared with a world average of 860 mm. This classifies South Africa as a semi-arid country. Besides the erratic rainfall pattern and low ratio of runoff, the average annual potential evaporation is higher than the rainfall in all but a few isolated areas where rainfall exceeds 1 400 millimetres a year (Dennis 2012).

The annual rainfall variability for 41 years (1970-2010) for nine stations at Amakhala reserve, Grahamstown, Bathurst, Port Alfred, Uitenhage and Port Elizabeth in the Eastern Cape Province, South Africa, was studied through trend and time series analysis and pointed to the fact that there have been climatic shifts in the region shown by changing rainfall patterns, temperatures and fire incidences. Given that the Eastern Cape Province experiences episodes of limited freshwater supply, a declining trend in rainfall in this area would be undesirable (Zengeni et al. 2016).

Climate change in South Africa will result in changing rainfall patterns; changes in the intensity of storms and extremes of droughts and floods; increasing evaporation; changes in soil moisture and runoff and thus water availability; changing water quality conditions (including the temperature of aquatic systems); and increasing climate variability (DWS 2013c).South Africa's climate is characterised by periods of wet spells, also called La Niña (years in which above-normal rainfall is received), and dry spells, also called El Niño (years in which below-normal rainfall is received). Scientific analysis of rainfall data has shown that South Africa experiences spells of either

predominantly wet years or spells of predominantly dry years, and these spells have not affected regions of the country exactly the same or equally. For instance, between 2009 and 2011, the Southern Cape Region was devastated by a severe drought while the rest of the country generally received above normal rainfall. The severity of the Southern Cape drought was implied by the interacting risk drivers that progressively escalated the risk of widespread water shortages. These drivers included greatly increased water consumption prior to the onset of meteorological drought conditions, both in agriculture and in rapidly growing coastal towns. Prior to the drought emerging in this region, water resource development had not kept pace with rising demand, there was no rigorous WCDM, and there was a lack of systematic drought risk-management planning. Climate variability and changing weather conditions were noted as key risk drivers, but there were no accompanying indicators that would have allowed for early signal detection and early action (Water Research Commision 2015).

Inadvertently, climate change has a bearing on the water security of the nation and involves the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustainable livelihoods, human wellbeing and socio-economic development; for ensuring protection against water-borne pollution and water-related disasters; and for preserving ecosystems of peace and political stability (UN-Water 2013b). These projected impacts pose severe challenges to municipalities. Hence, multiple and flexible adaptation measures and solutions are needed that take into account regional and local ecological, economic and social circumstances (Grecksch 2015).

Therefore, approaches to mitigate climate shifts should involve diversifying agricultural systems with an emphasis on reducing overreliance on rain-fed agriculture. Farming communities that depend on rain-fed agriculture must also tap into their indigenous knowledge systems that use drought-resistant crop varieties and other methods of coping with weather extremities. The policies governing water resources should also consider recent rainfall trends so that municipalities can direct resources towards preserving water and improving its quality by minimizing pollution of water bodies from urban and industrial wastes.

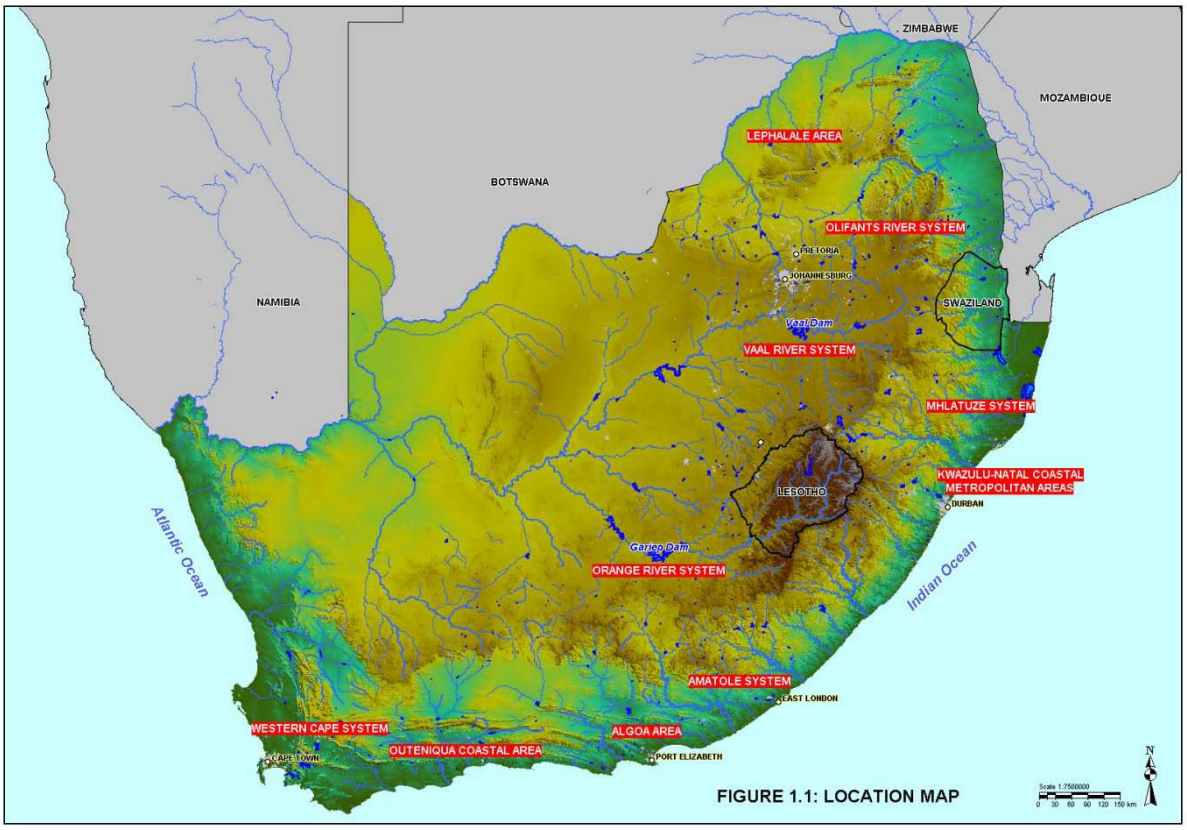
For some time now, South Africa has been approaching the full use of its fresh water resources while most of the remaining potential has been committed to development

(Hoffmann et al. 2014). This has been due to the fact that the population has been growing continuously together with increased economic and industrial growth. In some geographical areas of the country, the demand for water will increase beyond the potential for the fresh water resources available. In order to ensure continued availability of water, long-term planning and carefully considered strategies for water resources development will become necessary.

It is concluded that sufficient water can be made available to meet the future needs in all the major urban and industrial centres in South Africa, although at steeply increasing costs in most cases. The full use of fresh water will also not be reached at a common date throughout the country but at different dates over an extended period of time, depending on the situation pertaining to the respective areas. Water resources across the country will become even more inter-connected and inter-dependent in future.

The DWS commissioned a number of reconciliation studies of the water systems across the nation in order to reconcile future water needs with the available resources. South Africa has a total of 11 key water system growth areas spread out around the entire country as shown in Figure 3.2 (Van Rooyen et al. 2011). Table 3.1 highlights the different growth areas and the associated regions of supply. In terms of access to water, South Africa's 2011 Census revealed that 46.3% of households in South Africa have access to piped water and slightly over 85% have access to water that is acceptable in terms of the Reconstruction and Development Programme (RDP). However, these levels of access are not reflected across all provinces. In the Eastern Cape and Limpopo Provinces, for example, 31% and 27,2% of households have no access to water at a level acceptable to the RDP, respectively (Sershen et al. 2016).

Figure 3.2: Location map of key water systems growth areas in South Africa.




In 2002, the DWS “Free Basic Water” implementation strategy was launched in response to country-wide protests against water prices. This strategy guarantees each household a free minimum quantity of potable water, benchmarked at 6 kilolitres (6 kl, which is 6 000 litres) per household per month. Free basic water forms part of a government FBS package, which is supposed to be made available to poor households who cannot afford to pay for basic services. The FBS package includes rebates on water, sanitation, electricity and refuse removal to qualifying ‘indigent’ households, and it is the responsibility of the Department of Provincial Local Government to introduce the standards applicable to the implementation of FBS. The Department is meant to guide, coordinate and monitor national programs and regulate service provision as well as intervene where necessary, particularly where capacity is required. It also provides the required grants to municipalities to enable the delivery of FBS (DWS 2002).

Table 3.1: Water Systems Growth Areas of South Africa

| Key Growth Area | Area/Sector Supplied |
|---|---|
| Vaal River System | Urban, Industrial and mining developments in Gauteng and parts of Mpumalanga and North-West Provinces, as well as water supply to the Eskom power stations in Mpumalanga and the Free State Provinces. |
| Orange River System | Irrigation developments along the lower Orange River, the Fish-Sundays River irrigation areas and Port Elizabeth in the Algoa area. The system is linked to the Lesotho Highlands Water Project. |
| Lephalale Area | Several large coal-fired power stations and petrochemical industries are planned for this area, together with accompanying mining developments. |
| Oliphants River System | Witbank/ Middleburg area, irrigation and mining developments of the platinum group metals, as well as the Kruger National Park. |
| Mhlatuze System | Richards bay area, irrigation developments in the catchments. |
| KwaZulu-Natal Coastal Metropolitan Areas | Durban/ Pietermaritzburg area and environs. |
| Amatole System | East London area environs. |
| Algoa Area | Port Elizabeth (which receives water from local resources and Orange River via the Orange-Fish-Sundays transfer). |
| Outeniqua Coastal Area | Knysna, George and Mossel Bay urban areas. |
| Western Cape System | An integration of local and regional water resources to supply Cape Town, urban users, and irrigation along the Berg and Sonderend rivers. |
| Remainder of South Africa | Predominantly rural parts of South Africa |

## 3.2 The Concept of Water Management

Water governance has emerged as perhaps the most important topic of the international water community in the 21st century, and achieving “good” water governance is now a focus of both policy discourse and innumerable development projects (Lautze et al. 2011a).The *Oxford Hand book of Governance* opens with the following characterization: “Governance is said to be many things, including a buzzword, a fad, a framing device, a bridging concept, an umbrella concept, a descriptive concept, a slippery concept, an empty signifier, a weasel word, a fetish, a field, an approach, a theory and a perspective” (Levi-Faur 2012). There are many definitions of governance, and the concept is used for nearly everything related to issues of organizing collective action. Nevertheless, the idea of governance indicates one of the most important side-effects of modernization: Increased interdependency and the need for joint action. That is also what is needed in the domain of water, and

therefore, it is crucial to speed up understanding the essentials of water governance. Water governance refers to the political, social, economic and administrative systems in place that influence water's use and management. Essentially, who gets what water, when and how, and who has the right to water and related services, and their benefits.(Cleaver et al. 2010). It determines the equity and efficiency in water resource and services allocation and distribution, and balances water use between socio-economic activities and ecosystems.

Effectiveness depends on the actions of many stakeholders with different resources (knowledge, money, etc.) and on the interactions that emerge from actions. In this context, governments, sometimes forced by circumstances, give more room to stakeholders to influence decision-making. Governance then roughly points at situations where decision-making and implementation takes place in complex actor systems of public, private and semi-private actors. In these systems, governments increasingly use horizontal forms of steering to achieve results within these actor systems (Teisman 2013). Water is a governance challenge, which requires certain capacities to solve water problems in an effective, efficient and legitimate way (Edelenbos et al. 2010).

While water managers and water authorities, like water boards, are crucial actors for water, a range of other actors and their actions are important. Their actions and decisions have a considerable impact on the quality of the water and the challenges for the water managers and authorities. Governance embraces the way local communities and municipalities, regional and national governments and the networks of parties as well as international organizations and collaborative platforms deal with water as one of the most precious resources of the planet water and with flooding as one of the most dangerous side-effects of the existence of seas and rivers. In that sense, governments on several levels not only deal with the issue, but also with the interactions and interferences between these levels. Government also deals with several policy areas and deal with the interplay between government, private sector and citizen participation, as well as the many pitfalls and trade-offs of the interplay (Warner, JF 2006).

In the past, when water was plentiful and the rules of water sharing were relatively simple, water infrastructure and top-down, supply-led solutions dominated WRM. The

scarcity of water fragments and challenges the coordinated development of water resources and have brought about a realisation that approaches to water management have to be achieved differently. This has given rise to promulgation of IWRM, which is a process that promotes the coordinated development and management of water, land and related resources in order to maximize economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems (GWP 2000a). Integrated water resources management provides a set of ideas to help us manage water more holistically. These ideas have been formalized over time in what has now become, in capitals, Integrated Water Resources Management (Giordano et al. 2014). Arguably the most prominent feature of IWRM is the call for co-ordination which encompasses the integration of both natural and human systems amongst themselves and each other, in a way that allows a balance to be attained between resource use and resource protection.

An often cited early example of IWRM is the establishment of the Tennessee Valley Authority in 1933, which integrated the functions of navigation, flood control and power production, while addressing the issues of erosion control, recreation, public health and welfare. It incorporated elements of comprehensive planning of natural resources utilization combined with economic, social and even environmental objectives (Davis 2007). Such integrated water management then became the blueprint for developing countries as large scale water engineering projects became a means to drive national development strategies (Gain et al. 2013). Beginning in the 1940's, this approach mushroomed all over the world (Molle 2009). A growing perception developed amongst water professionals globally that a new paradigm was required to better reflect the multidimensional nature of water management (Biswas 2008).

The International Water Conference in Mar del Plata (1977) explicitly addressed the need for coordination in the water sector:

"Institutional arrangements adopted by each country should ensure that the development and management of water resources take place in the context of national planning and that there is real coordination among all bodies responsible for the investigation, development and management of water resources" ( Mar del Plata Action Plan: Recommendation No. 2 on Policy, Planning and Management).

The Mar del Plata Conference recommended expansion of irrigated agriculture: " if the future famines are to be avoided more land will have to be placed under irrigation" Apparently, high water demand and negative environmental impacts of irrigated agriculture were not yet recognized or not considered as sufficiently important. Other major concerns expressed like community water supply, pollution and shared water resources are however valid today.

The coordination within the water sector, as advocated by the Mar del Plata Conference, was largely seen as a task force for national governments. Its wasn't until much later that the importance of building institutional capacity by involving national experts and institutions was realized (Snellen et al. 2004).

At the 1992 Earth Summit in Rio de Janeiro, the need for coordination in the water sector was again given due attention:

"The holistic management of freshwater as a finite and valuable resource, and the integration of sectoral water plans and programmes within the framework of national economic and social policy, are of paramount importance for action in the 1990's and beyond. The fragmentation of responsibilities for water resources development among sectoral agencies is, however, proving to be an even greater impediment to promoting integrated water management than had been anticipated.'' (par. 18.6, Ch. 18, Agenda 21).

The water sector organized the International Conference on Water and the Environment, held in Dublin, Ireland 26-31 January 1992 at which 500 water experts from a hundred countries and 80 international intergovernmental and non-governmental organizations advocated for a new approach of integrated water management whose main features were:

- The carrying capacity of the natural environment as the logical starting point, rather than the traditional approaches in which deterioration of the environmental quality was seen as an unavoidable cost of economic development.
- Demand management, entailing the formulation and application of incentives aimed at limiting the demand for water by increasing efficiency and reducing waste.
- Integrated management in the new sense referring to the fact that water

resources should be management as an integral part of a nation's social and economic development.

This culminated in the Dublin statement which sets out recommendations for action at local, national and international levels to reduce the water scarcity.(Savenije, H et al. 2008). By the early 1990's, these views had been formalized into IWRM, although in reality it merely updated pre-existing integrated approaches with an emphasis on sustainable development through the inclusion of environmental protection, participation, efficiency and equity (Benson et al. 2015). Expansion of IWRM has evidently gone global with examples visible in many developing countries (Gallego-Ayala et al. 2011). This paradigm has emerged as the main guiding framework for water resources development and management (Gallego-Ayala 2013).

The GWP, among others, has developed and promoted IWRM over the past 25 years as a means of increasing water security. Many countries have already adopted this approach, at least in terms of planning and legislation, but few have taken the next step to implement it. While IWRM is disarmingly simple conceptually, implementation has not proved easy. There is no 'one-size-fits-all' strategy. Each country has its own unique set of physical, social, economic, political, and environmental circumstances that will determine how a country puts IWRM into practice. IWRM is also not without its critics, and those countries that have already moved from planning to implementation report mixed results. Some say it is successful while others have found many inadequacies and disappointments.

The IWRM concept has gradually gained prominence over the years as the demand and competition for limited water resources has increased, knowledge of water's impact on the environment has grown, and more complex institutions have developed to negotiate and coordinate water allocations among different users. IWRM now focuses attention on the natural environment, demand management, stakeholder participation, and the need to manage water resources as an integral part of a nation's social and economic development. It is shifting attention from integrated infrastructure development for maximising socio-economic benefits towards water governance and environmental protection (Shah 2016).

Implementation of IWRM is varied among the nations. Each country has its own set of unique circumstances that will determine their pathway toward attaining effective water management and access to water by its citizenry. There are many examples of the successful application of IWRM. For instance in November 2004, the California Department of Water Resources and the State Water Resources Control Board jointly released guidelines for the new IWRM Planning program. The program was funded by $ 500 million which was made available by various development agencies. The intent of the new model for water management was the encouragement of integrated regional strategies for management of water resources and provide funding, through competitive grants, for projects that protect communities from drought, protect and improve water quality and improve water security by reducing dependency on water imported from the Sacramento-San Joaquin Bay Delta and Colorado River. Funding for integrated planning and project implementation at regional level was a major component of the program, providing incentive for regions to engage in this new form of planning. The IWRM program has generated significant coordination among water management entities state-wide. Though imperfect, the program has evolved to better focus efforts and respond to common challenges faced by planning regions. Some of the key lessons learnt include the fact that adaptive management is key, different regions have different needs and that IWRM Planning yields significant benefits (Watson et al. 2011).

Yet another example of the implementation of IWRM on the global stage is in Bangladesh where Government intervention in water governance in Bangladesh can be traced back to 1959 (AK et al. 2012). The sole responsibility for water management was given to the East Pakistan Water and Power Development Board Authority (EPWAPDA). In 1964, the EPWAPDA prepared a 20-year Water Master Plan, which was the beginning of water-sector planning in East Pakistan (now Bangladesh).

Aimed at increasing agricultural production, the Master Plan was based on a strategy of massive flood control and drainage to be followed by irrigation projects. Moreover, emphasis was laid on the construction of embankments and polders over much of the country (Nowreen et al. 2014). After Bangladesh became independent in 1971, responsibility for planning and management of water resources was handed over to the newly created Bangladesh Water Development Board (BWDB). Currently, major

institutions involved in water resources planning and implementations are the National Water Resources Council (NWRC), Water Resource Planning Organization (WaRPO), the Ministry of Water Resources, the Bangladesh Water Development Board (BWDB), the Local Government Engineering Department (LGED) and the Bangladesh Agricultural Development Corporation (BADC) (Rouillard et al. 2014).The NWRC, consisting of 47 members including the Prime Minister, is the apex national body relating to water management, which facilitates the coordination of water-related policies. The WaRPO supports the activities of the Executive Committee of the NWRC (ECNWRC) and is responsible for developing national water policies. The Ministry of Water Resources is the executive agency responsible to the Government for all aspects of the water sector.

The Government of Bangladesh also formulated several policy documents for managing water resources of the country: the National Water Policy (NWPo), the National Water Management Plan (NWMP), and the National Water Act (Gain and Schwab, 2012; Rouillard et al., 2014). The NWPo, published in 1999, initiated the IWRM process, and outlines the main decision-making processes for water management in Bangladesh. The National Water Management Plan (NWMP), published in 2001, identifies the main national objectives and strategies for water management for 2000-2025. The National Water Act 2013 aims to better integrate the management, development, utilisation, and protection of water resources. Beside policy formulations, several organisations are responsible for implementing water-related projects and programmes. The BWDB is responsible for large-scale (greater than 1,000 ha) water projects, for example inland and coastal flood control, land reclamation and development works (e.g. irrigation), and rainwater harvesting. The LGED is responsible for the development and management of small-scale (1,000 ha and less) projects. The Bangladesh Agricultural Development Corporation (BADC) is responsible for farming, and is therefore involved in irrigation works. The government has adopted interdisciplinary approaches to the immense challenges that the country is faced with (Nowreen et al. 2011).

The promotion of IWRM in Southern Africa started in Maseru, Lesotho, in May 1997. It was only a year after the SADC Water Sector Co-ordination Unit has been established, and exactly at the same time that in New York, the Convention on the

Law of the Non-navigational Users of International Watercourses was adopted by the United Nations General Assembly. Water Ministers from SADC and the European Union met and discussed the challenges of sharing international rivers. Consensus was reached over the need for IWRM (Savenije, HH et al. 2000). There has clearly been a shift from centralised and state- driven natural resource management regimes of the colonial period towards decentralised and mainly community based management regimes. Government agencies and Non-governmental organisations are accordingly, reshaping their own functions away from direct involvement in management towards supportive and advisory roles (Nemarundwe et al. 2003).

Due to the significant institutional and legislative changes that took place, a new Strategic Framework for Water Services was published in order to take into account the changing role of DWS, municipalities and water boards, new national water policies (including an emphasis on sustainability) and a new financial framework. This was in recognition of the fact that Water issues cannot be solved by new water technologies in a top-down, hierarchical manner, but need to be addressed and approached through a bottom up, horizontal and multi-stakeholder way of working (Ward et al. 2013).

The powers and functions of the spheres of government are enshrined in the Constitution. In pursuit of the constitutional mandate of a developmental local government, the White Paper on Local Government was formulated in 1998, with the subsequent promulgation of a suite of local government legislation within a financial framework afforded by the annual Division of Revenue Act. The division of such powers and functions is developed upon in the Municipal Structures Act (Act No. 117 of 1998), the Municipal Systems Act (Act No. 32 of 2000) and the subsequent Amendment Act (Act No. 33 of 2000), particularly in respect of local government spheres (local and district municipalities). This suite of legislation further includes the Intergovernmental Relations Framework Act (Act No. 13 of 2005) the Municipal Demarcation Act (Act No. 27 of 1998), Local Government Finance Management Act (Act No. 56 of 2003), Local Government Property Rates Act (Act No. 6 of 2004) and the Disaster Management Act (Act No. 57 of 2002).

Given the cross-sectoral nature of water, all legislation has at least some application to water resources and service management. The National Environmental

Management Act (No. 107 of 1998) and the National Water Act direct the components of the municipal IDP, reviewed annually. The Integrated Waste Management Plan and the WSDP are subsets of the IDP. At present there is no statute that prescribes the duties of LG in terms of IWRM.

South Africa has experienced a significant transitional stage in its WRM strategy. The earliest piece of legislation on water use is the Irrigation Act of 1912 that was concerned with the regulation of water for agricultural use. With the increase in industrial development, the Water Act of 1956 was enacted in order to provide a more equitable distribution of water between the competing needs of industries and agriculture. The main thrust of the Act during this period was the allocation of available water supply to meet the needs of the more developed sectors. The interest of the broader South African population was largely ignored. By and large, the order of the day was water supply to farms. Water demand management did not enter mainstream concerns because there was no accurate information on the availability of water resources. In a nut shell, there existed a policy of water supply management. A thorough review of the Water Act of 1956 followed the elections of 1994, giving rise to the NWA of 1998.

In the South African Water Act, sustainability and equity are identified as central guiding principles in the protection, use, development, conservation, management and control of water resources. These guiding principles recognise the basic human needs of present and future generations, the need to protect water resources, the need to share some water resources with other countries, the need to promote social and economic development through the use of water, and the need to establish suitable institutions in order to achieve the purposes of the Act (Savenije, H et al. 2008).

National government, acting through the minister, is responsible for the achievement of these fundamental principles in accordance with the Constitutional mandate for water reform. Being empowered to act on behalf of the nation, the Minister has the ultimate responsibility to fulfil certain obligations relating to the use, allocation and protection of and access to water resources. The White Paper on a National Water Policy for South Africa and embedded document assign the responsibility for the provision of water services and the setting of tariffs to local government (DWS 2013b). This document addressed the full spectrum of water and sanitation services

(not only basic services) as well as the overarching policy issues pertaining to institutional, regulatory and financial frame-works, and integrated planning. It was informed by a set of guiding principles that reflect international best practice (Stephen 2003).

It identifies the following objectives of government for water services:

- Improving access to, and affordability and reliability of, water and sanitation services for both households and firms, with a special focus on sustainable access to safe and adequate clean water and sanitation for the poor;
- Improving governance of sector institutions;
- Mobilising government funds to focus on the pressing needs of the poor and increasing other investments by reducing risks associated with private sector financing;
- Building effective institutions and developing skills and knowledge for the effective and efficient operation of water and sanitation services; and
- Promoting community and user involvement in infrastructure construction, maintenance and management, especially in poor urban and rural areas, as part of establishing developmental local government.

The National Water Act (NWA) is the principal legal document governing WRM in South Africa, and is being incrementally implemented. It is supported by other legislation such as the National Environmental Management Act and other Acts. The NWA does away with some far-reaching concepts but introduces others, which have both economic and social features. South Africa has not only adopted the principles of water governance but has also embarked on the challenging task of implementation

The national water resource strategy is the implementation strategy for the NWA and provides the framework within which the water resources of South Africa will be managed in the future. All authorities and institutions exercising power or performing duties under the NWA must operate within the framework of the national water resource strategy. This strategy sets out policies, strategies, objectives, plans, guidelines, procedures and institutional arrangements for the protection, use, development, conservation, management and control of the country's water resources (DWS 2005).

The Water Services Act (Act No. 108 of 1997) sets out the regulatory framework for institutions responsible for supplying water services and makes provision for the establishment of different water services institutions. These provisions include the following:

- the water services authority (WSA), i.e., the responsible municipality and,
- the WSP, whose role it is to physically supply water and sanitation services to consumers.

The water sector does not have a distinct or independent regulator as outlined in the Table 3.2

Table 3:1: Institutional Framework

| **ENTITY** | **RESPONSIBILITY** |
|---|---|
| Department of Water and Sanitation (DWS) | • Custodian of water resources and overall policy maker and regulator (there is no independent regulator)<br>• Oversees the activities of all water sector institutions<br>• Responsible for national/international resource planning and allocation<br>• Licenses water use and discharges and collects extraction and discharge fees<br>• Manages water resources infrastructure (for example, dams) and also some water services infrastructure |
| Catchment Management Agencies | Water resource planning and management at the catchment level (where CMAs are not established, the DWS fulfils these functions) |
| Water services authorities | Provision of water services within their appointed areas. Includes metropolitan municipalities, many district municipalities and authorised local municipalities. May contract out service provision to external WSPs. |
| Water Services Providers (WSPs) | Operational water provision and/or sanitation services (as a bulk or retail service) |
| Water Boards | Regional or bulk WSPs sell water to, or accept wastewater from, other WSPs. As WSPs, the Boards are accountable to WSAs; as organs of state, the Boards are owned, controlled and regulated by the DWS and National Treasury under the terms of the Water Services Act, 1998 and the Public Finance Management Act, 1999. |

DWS has adopted an IWRM approach that currently consists of a gradual devolution of certain management functions to established catchment management agencies (CMAs) at WMA level. In South Africa, catchment management strategies, which are a legislative requirement, offer the opportunity to plan for complexity and to manage this through a strategic, adaptive process that embraces learning informed by practice Catchments comprise linked social and ecological systems. It is widely recognised that each of these systems is complex in their own right, and it can be appreciated that additional complexity is added once their interactions are considered. Within the context of water resource management in South Africa, the concept of complexity is not a new one. Indeed, South Africa's policies and statutes make specific reference to complexity and, as a corollary, to the need for integration (Pollard et al. 2008). At present, CMAs have been proclaimed for seven of South Africa's 19 WMAs; the remaining 12 CMAs will be promulgated over approximately the next decade. Each CMA is expected to progressively develop a catchment management strategy (CMS) for the protection, use, development, conservation, management and control of water resources in its particular WMA, in alignment with the national water resource strategy. Until such time as a CMA has been formally established in a WMA, however, the regional offices of DWS will continue to manage the water resources of their respective areas. Internal strategic perspectives (ISPs) have been developed to provide a framework for DWS water management actions until such time as the CMAs become fully operational. At the moment only 2 CMAs are fully functional, out of the 19 originally envisaged (and 6 more that have been gazetted) (Muller 2014). Figure 3.3 below shows the demarcation of the South African CMA.

Figure 3.3: Demarcation of the South African CMA.


Source: (DWA 2016)

In South Africa an example of the implementation of IWRM at catchment level is the Mhlatuze Catchment which is one of the catchments forming the greater Usuthu to Mhlatuze water management area. Parts of this catchment are relatively water-rich, with annual rainfall as high as 1500 mm per year – these are located mainly to the east of the Drakensberg escarpment. Elsewhere in the catchment, rainfall declines rapidly to about 600 mm per year. This is the case in the north-central area near the Lebombo Mountains, which are water-scarce. Potential evaporation varies between 1300 and 1500 mm per year. Economic activities in the WMA are very diverse and include commercial forestry, irrigation (mainly sugar cane), and rain-fed cultivation, as well as urban and industrial development that is concentrated at the towns of Richards Bay and Empangeni. Export-orientated industries are also located close to the deep-water harbour facilities at Richards Bay. Coal mining used to be a prominent activity in the upper part of the WMA, but most coal mines are now inactive. In its place,

extensive mineral-sands mining operations now occur in the coastal dunes. The Mhlatuze Catchment contains a large number of industries and the world's largest coal-export terminal. The water requirements for the catchment are considerable as the different water use sectors (mining, agriculture, industry and domestic) all require substantial amounts of water. Although the catchment has sufficient water to meet all requirements at present, the available resources have been over-allocated; this means that compulsory licensing and stricter control of all water uses will be needed to rectify the situation. It is uncertain how much water will be used in the Mhlatuze Catchment in future as demand is currently driven by industrial development which is difficult to predict in the long-term. Various stakeholders and water users have become closely involved in establishing the CMA and good progress has been made in widening the participation base to include all relevant sectors of society. Despite this progress, however, there is still a backlog because traditional leaders and civil society have not provided full support, while local government structures are still under-represented. Therefore, while IWRM is starting to emerge in the Usutu to Mhlatuze WMA, DWS should provide stronger leadership in the adoption of a united view on IWRM. The absence of strong leadership from DWS has resulted in various projects being conducted in an ad hoc and uneven manner, with inadequate cooperation between the different sections of DWS and few inputs are received from other regions or government departments. This delicate situation requires flexible management plans so that water managers will be able to cope with sudden increases in the demands for water without retarding development (Funke et al. 2007).

While national policies and statements of intent sound promising on paper, there is little evidence to indicate that IWRM is being implemented effectively in practice, particularly in the Mhlatuze Catchment. In particular, it appears that DWS is not coping sufficiently well with the water quality problems in the catchment and while these currently are not severe, they have the potential to worsen with future development. Part of the problem may be due to the fact that water quality data for the WMA are scattered across several DWS sub-directorates and regional offices (Water 2002). The DWS staff responsible for water quality management face serious challenges in the area because of staff shortages; staff members are overworked and do not have sufficient time to focus on the effective implementation of IWRM principles. In addition, problems of communication that exist within the DWS as an organisation, and between

the Department and external actors, have hampered integration. While attempts are made to incorporate all stakeholders when conducting environmental impact assessments (EIAs) for new developments, the sheer volume of work that DWS staff members have to deal with in the catchment makes it extremely difficult for DWS to deal with all developments in an integrated way (Funke et al. 2007).

The management structures within DWS therefore have a direct impact on the department's ability to identify and manage water quality issues, while the few available officials are only able to respond to various crises rather than planning, quantifying and monitoring the water quality situation of the WMA. There is also insufficient coordination between DWS and other government departments when it comes to developing new initiatives such as the industrial development zone (IDZ) that has been planned for the Richards Bay area, and which forms part of the national macro-economic policy to develop South Africa's manufacturing sector by encouraging investment in export-orientated industries, centred on beneficiation of the country's mineral resources (Karumbidza 2006). While the IDZ is an important and promising endeavour for economic development and investment in the area, the increased industrial activity will impact adversely on water resources and the environment and this presents a fundamental problem to the successful functioning of IWRM.

Research in the Inkomati Water Management Area shows Institutional integration and local level water access in the Inkomati water management area, the feasibility of integration and therefore the implementation of IWRM is an open question in South Africa (Denby 2013). The DWS, though in charge of implementing IWRM, has little control over other important processes and departments linked to water, such as those of agriculture and land reform (Woodhouse 2012). There are overlapping mandates between agriculture and water institutions and an inability or lack of political will to collaborate and integrate their activities to improve water access for small-scale and emerging farmers at the local level. At the institutional level, small-scale or emerging farmers lack knowledge of the National Water Act and the formal channels for accessing water. Participatory processes were found to be flawed: several key institutions with overlapping mandates did not actively participate in meetings and were unable to answer pertinent questions, further reflecting the lack of institutional

legitimacy and accountability to local water users. This lack of institutional cooperation, legitimacy and accountability has resulted in widespread mistrust and opposition amongst large- and small-scale water users in the Middle Komati. Power imbalances, the inability to effectively participate, cultural differences in relation to water, lack of knowledge of the formal water policy, the prevalence of 'silo thinking', and failed accountability and integration at the institutional level have all affected the most marginalized (historically disadvantaged) farmers' ability to access water at the local level. The case study reflects that 'integration' – in this particular context, understood as 'coordination' – is an important prerequisite to get institutions with overlapping mandates to work effectively with one another to facilitate water access for historically disadvantaged users. However, water allocation is a highly political issue, and regional coordination will require not only the setting of clear priorities at the national level but also the presence of political will to follow through on those priorities at the regional and local levels to ensure that access becomes more equitable (Mehta et al. 2014).

To achieve an excellent level of water service delivery a step-by-step approach for improvement is needed. Suggestions are offered on how to achieve such a phased approach. The approach takes into account the responsibilities that municipal officials already have as well as advocating greater overall integration of management systems. The Water Services Development Plan (WSDP) is a useful tool in WRM at municipal level. It deals with planning for water service provision, water demand management and wastewater treatment. To develop a strong plan, up-to-date information from the municipal records is required. Billing systems and associated records become critical. If the municipality does not have the capacity to draft a WSDP, the local municipality is responsible for providing information to the designated consultant drafting the plan and to the district municipality and the catchment management agency. The WSDP is essential for the completion of the province's IDP and must be aligned with this. Drafting a WSDP reveals the gaps and problems experienced in water service delivery, although it does not reflect information on solid waste management or planning procedures (Haigh et al. 2010).

The WSDP consists of 10 business elements that identify resources, systems, service, laws, and infrastructure already in the municipality. The business elements are the following:

1. Socio-economic profile: The social aspects of the population served by the municipality. This includes municipal demographics with income and employment patterns and the status of health services with respect to sanitation and waterborne diseases.
2. Service level profile: An overview of water and sanitation services in place as well as any plans for improvement. The following are required: An assessment of the quality and level of service reaching the people in the municipality, including management of all wastewaters; and the service and management for waste removal including dry waste from industry. Industries producing toxic effluent ('wet industries' such as tanneries) need special attention.
3. Water resources profile: The quality and quantity of water available to the municipality (both surface and groundwater).
4. WCDM: Quantities required, with programs required to set targets for the use and conservation of water. Conservation includes education of consumers, keeping track of leaks, metering water use, and controlling alien vegetation.
5. Water services infrastructure: Assessment, maintenance and management of water and sanitation infrastructure including water storage structures such as reservoirs and dams, an evaluation of the water service assets, and such related elements as staff expertise.
6. Water balance: The quantities of bulk water, including volumes treated for consumers, and volumes entering and being released as effluent from water treatment works (WTW).
7. Institutional arrangements: The laws and regulations that govern the management and allocation of water must be understood.
8. Consumer services profile: People are receiving the service to which they are entitled. People education, protective by-laws, and opportunities for consumer complaints are required.
9. Financial profile: The financing of the different water-related services.
10. List of projects: Lists of projects currently underway or planned in the future, and the means by which their development can be tracked.

For each business element, local authorities complete the following four processes:

1. A situation assessment: Infrastructure, available water, income and management are critical. The associated data collection system requires a person able to analyze the information.
2. Future trends and goal, particularly trends in terms of population growth and economic development. These should be aligned with the IDP.
3. Strategic gap analyses: Water service needs.
4. Implementation plans: How the needs will be addressed with priorities listed.

On the basis of its ability to address the integrated nature of managing complex water resource systems, few can argue against the value of an IWRM approach. Implementation of IWRM approaches should result in better water sharing between users, supporting economic and social objectives, while maintaining environmental ecosystems. Many cases illustrate that IWRM is effective in achieving these outcomes. However more needs to be done to speed up implementation so that benefits and successes can be more easily identified (Anderson et al. 2008).

A GWP survey in 2006 showed that two thirds of countries are at some stage of introducing IWRM as guiding principle for water management; however, much of this is related to establishing an enabling environment (including policy reform and institutional restructures) (Medema et al. 2008). Progress in widespread implementation is harder to gauge and will likely show fewer success stories. More effort is now required to demonstrate and monitor how implementation of IWRM is improving water management, specifically in relation to how the poor are benefiting. More analysis of the practical means of moving from a fragmented, sector-by sector approach to IWRM needs to be carried out for lower income countries, and these experiences disseminated. Imperfect legislation and institutional structures can no longer be used as an excuse for slow implementation. IWRM provides a promising approach but it also represents an unattainable ideal (Molle 2008). Perfect integration between all sectors, across the hydrological cycle and between all users is unlikely. Benefits must include increased access to water services, socio-economic empowerment, protection of ecosystems, improvement in water quality and overall poverty reduction. Unless we can effectively show that IWRM approaches assist in achieving some of these benefits, the concept of IWRM will

lose much of its promise in providing a more holistic and sustainable approach to managing scarce water resources (Grigg 2016).

There is little evidence to suggest that all the benefits of IWRM have been realised. The situation in developing counties is of particular concern. Those countries with mature of long – standing democracies tend to have a strong and well established base of multidisciplinary specialist who engage in management and other actions. In contrast, the same high levels of capacity and development are seldom found in developing countries and have had independent democratic systems of government for less than 25 years (Turton et al. 2007).

### 3.3 Non-Revenue Water Losses.

The preamble of the NWA of 1998 recognizes that water is a scarce and unevenly distributed national resource that occurs in many different forms, which are all part of a unitary, inter-dependent cycle. Although the resource belongs to all the people, national government has the overall responsibility for and authority over the water resource and its use including equitable allocation for beneficial use. The ultimate aim of WRM is to achieve the sustainable use of water for the benefit of all users as well as the protection of the resource. The integrated management of all aspects of the water resource and where appropriate the delegation of management functions to a regional or catchment level so as to enable everyone to participate is its mandate.

The biggest growth in water use is in the municipal, domestic and industrial sectors. This growth is ascribed to population growth, urbanization, increase in living standards and industrialization. It is estimated that in the next three decades, South Africa's water resources will be fully utilised. It is this dire prognosis that has fuelled calls for timely measures and appropriate instruments to be put in place to ensure sustainability of water resources in South Africa.

Continuous population and economic growth means that the requirements for fresh water are increasing. In some geographic areas of the country, the demand for water is projected to increase beyond the potential of fresh water resources that are available. Efficient management of water resources is therefore a growing necessity.

In the Eastern Cape of South Africa is the climate is arid, particularly in the interior regions with pockets that experience a wetter climate with annual rainfall in excess of 1,000 mm along the coastal zone. The annual rainfall ranges from less than 200 to 600 mm whereas annual evaporation ranges from 1,450 to 2,050 mm, which highlights the arid nature of the region. The South African Weather Bureau recorded a temperature of 50.3° C in Kirkwood in 1928, the highest temperature ever recorded in South Africa (Chase et al. 2007). This scenario puts extreme pressure on the available water resources.

The efficient management of water resources is therefore a growing necessity. Non-Revenue water is defined as the water that is produced and enters the distribution system but is never billed to customers because it is lost due to leakages or illegal connections (Tortajada 2008). Paradoxically, although people are aware of this need, non-revenue water is excessive in many cities in the world. The water sector has to improve the way it uses its available water resources significantly in order to deal with the challenges ahead. In the municipal sector, water productivity is less than optimal as the difference between water put into the distribution system and the amount of water billed to consumers (i.e., “on-revenue water”) tends to be large. For too many systems, high levels of non-revenue water (NRW) reflect huge volumes of water being lost through leaks (real losses) and drinking water not being invoiced to customers (apparent losses) and unbilled authorized consumption (Lambert et al. 2014). It is estimate that the total cost to water utilities caused by NRW worldwide is $141 billion per year (Liemberger et al. 2006). Non-revenue water data indicate that there is much room for improvement in water resource management in cities and they also suggest a lack of motivation to solve the problem in the short-term (González-Gómez et al. 2011).

The importance of water use efficiency, conservation and demand management is a key priority which are identified as core strategies to ensure sufficient water to meet South Africa’s needs in future. The need for monitoring and measuring the water supplied to water services authorities is important in order to gain a better understanding of the nature and extent of the challenges of water losses and how they are split between physical leakages and commercial losses.

Overall, the existing studies provide different explanations as to what impacts NRW.

A large number of mostly technical and environmental factors affect municipal leakage rates. These factors include the age of the systems, the length and type of networks, pressure in the systems, climate, soil conditions, traffic loading, and density of connections. Topography can explain regional differences in water losses between utilities (Skipworth et al. 1999). Though physical factors are important, considerable emphasis should be placed on management factors.
Poor management practices, poor materials and infrastructure, and local social, cultural, political, and financial factors are identified as NRW drivers.(Farley et al. 2005)

NRW comprised of three components:

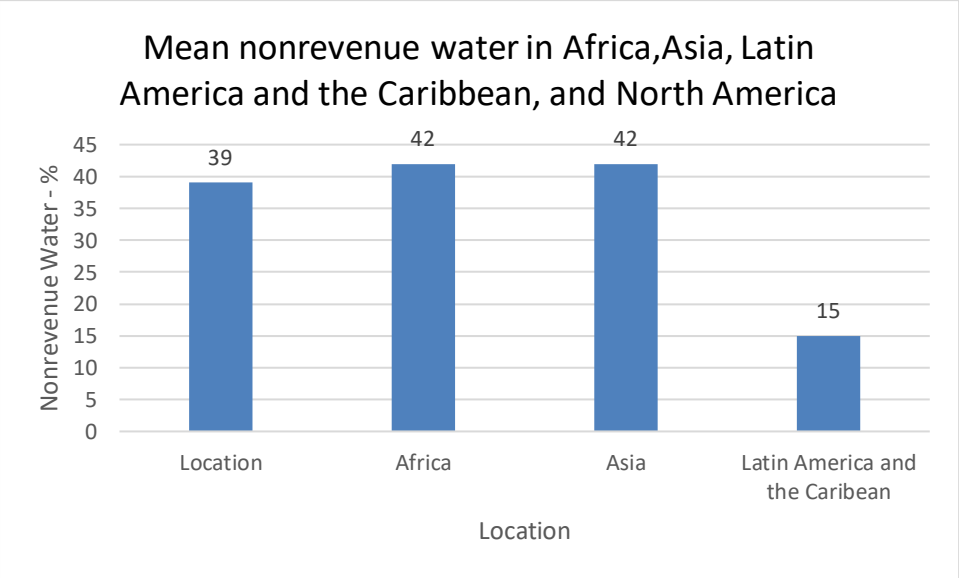
- Physical losses include leakage from all parts of the distribution system and overflows at the utility's storage tanks. They can be caused by poor operations and maintenance, the lack of active leakage control, and poor quality of underground assets;
- Commercial losses include customer meter under-registration, data-handling errors, and theft of water in various forms;
- Unbilled authorized consumption includes water used by the utility for operational purposes, water used for firefighting, and water provided for free to certain consumer groups. (van den Berg 2015)

The measurement of NRW is complicated. Many different indicators are used to measure NRW and virtually all of them have limitations and drawbacks. The most commonly used indicator is NRW defined as a percentage of water produced, although many authors have reservations about its use (Kanakoudis et al. 2013). The International Water Association (IWA) generally recommends alternative indicators, such as water losses per connection, water losses per main length, or the infrastructure leakage index (Winarni 2009).

In 2012, the Water Research Commission published a report entitled *Non-Revenue Water in South Africa.* The Water Research Commission gathered data from 132 of the possible 237 municipalities throughout South Africa representing over 75% of the total volume of municipal water supply. This study showed that the level of non-revenue water (NRW) estimated for the country, as a whole, is 36.8%. Of this 25.4%

is considered to be losses through physical leakages (real losses). This is similar to the estimated world average of 36.6% as shown in Figure 3.4 but is considered high in comparison to developed countries but low when compared with other developing countries.

Figure 3.4: Mean Non-revenue water




Source: WHO, 2000

The National Water Balance is presented in Table 3.3

Table 3:2: National Water Balance (2009/2010)

<table>
<tr><td>1</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td rowspan="4">System input volume<br><br>100%</td><td rowspan="2">Authorised consumption 68,2%</td><td>Billed authorised consumption 63,2%</td><td>Revenue water 63,2%</td></tr>
<tr><td>Unbilled authorised 5,0%</td><td rowspan="3">Non-revenue water 36,8%</td></tr>
<tr><td rowspan="2">Water losses 31,8%</td><td>Commercial losses 6,4%</td></tr>
<tr><td>Real or physical losses 25,4%</td></tr>
</table>

Extrapolated data from the NRW data for the country provides an estimated urban consumption of 4,292 million $m^3$ per annum and a national NRW volume of 1,580 million $m^3$ per annum. The results are outlined in Table 3.4

It was therefore deduced from the assessment by the Water Research Commission that the water loses in South Africa are in line with the world norms but have significant scope for savings, which is an important consideration in such a water scarce country. Reducing water loses represents an important issue when balancing future water requirements with the available resources.

Table 3:4: National Extrapolated Non-Revenue Water

| Category Municipality | Population | Input (mcm/a) | NRW (mcm/a) | RW (mcm/a) | % NRW | l/c/d |
|---|---|---|---|---|---|---|
| A | 17 420 512 | 1 849 091 117 | 634 192 022 | 1 214 899 095 | 34,3 | 291 |
| B1 | 7 756 187 | 683 667 320 | 282 585 164 | 401 082 156 | 41,3 | 241 |
| B2 | 3 882 070 | 325 623 095 | 99 407 207 | 226 215 889 | 30,5 | 230 |
| Urban Total | 29 058 769 | 2 858 381 532 | 1 016 184 393 | 1 842 197 140 | 35,6 | 269 |
| B3 | 3 845 279 | 230 642 568 | 85 229 869 | 145 412 699 | 37,0 | 164 |
| B4 | 4 245 736 | 101 138 956 | 73 334 514 | 27 804 442 | 72,5 | 65 |
| Rural Total | 8 091 015 | 331 781 524 | 158 564 383 | 173 217 141 | 47,8 | 112 |
| National Total | 37 149 784 | 3 190 163 056 | 1 174 748 776 | 2 015 414 281 | 36,8 | 235 |
| Extrapolated | 49 988 373 | 4 292 650 981 | 1 580 730 012 | 2 711 920 969 | 36,8 | 235 |

Source: The State of Non-Revenue Water in South Africa (2012)

The NRW for the entire country is one third of the water supplied and almost equal to the total Rand Water supply per annum. The financial Rand value is summarized in Table 3.6 using different production rates. It is estimated that the annual value is R 7 billion.

Table 3:5: Estimated Value of Non-Revenue Water per Municipal Category

| Municipal Category | Production Rate (R/kl) | Estimated cost to supply water ( R million/a) | Estimated value of NRW (R million/a) |
|---|---|---|---|
| A | R 5,00 | R 9 245,46 | R 3 170,96 |
| B1 | R 4,50 | R 3, 076,50 | R 1 271,63 |
| B2 | R 4,50 | R 1 302,49 | R 397,63 |
| Urban total | | R 13 624,45 | R 4 840,22 |
| B3 | R 3,50 | R 807,25 | R 298,30 |
| B4 | R 3,00 | R 303,42 | R 220,00 |
| Rural total | | R 1 110,67 | R 518,30 |
| National total | | R 14 735,12 | R 5 358,52 |
| Extrapolated total | | R 19 827,42 | R 7 210,38 |

Source: The State of Non-Revenue Water in South Africa (2012)

## 3.4 Challenges to Implementing Integrated Water Resources Management

Water management has been in a state of constant change since the first Rio conference in 1992. Water sectors across many countries have reacted to increasing risks and water crises by adopting new institutional frameworks, decentralizing water resources planning or developing new infrastructures.(Al-Saidi 2017). The United nations report prior to the Rio plus 20 conference in 2012 stated that, 82% of the 130 surveyed countries indicated the adoption of reforms to improve an enabling environment for IWRM, 79% changed their water policies, 65% have adopted Integrated Water Resources Management (IWRM) plans, and 71% facilitated water management at the basin level (Water, U 2012).

Such worldwide wave of restructuring and reforms has left its impact on the water sectors in terms of performance improvements in some countries and the emergence of an array of new water institutions like water ministries, basin agencies or regulatory bodies (Kadi 2014). While scarcity and crises represented the drivers of reforms, the ideological reasoning and implementation blueprint were provided by celebrated concepts such as water governance and IWRM. Both concepts have generated a great deal of attention and confusion among scientists and practitioners (Lautze et al. 2011b).

Water sector reforms have not, however, been an all-round success nor have they halted the water crisis. IWRM and water governance principles triggered serious

changes in terms of policies, laws and institutions. Water management reforms can fail for a multiple of broader socio-economic factors like lack of funding, political instability or the interference of global drivers like trade policies or droughts (Warner, BP et al. 2015).

Recent evidences continue to show mixed outcomes from IWRM implementation, for example in Bangladesh (Rouillard et al. 2014) Zimbabwe (Derman et al. 2016) and Tanzania (van Koppen et al. 2016). In the African context, there is emerging evidence that IWRM has not produced the anticipated socio-economic, political or ecological outcomes due to the uncertainty and complexity of river basins and the plural, overlapping and completing formal and informal legal and customary systems.

The implementation of IWRM in many developing countries has met serious resistance not only of the powerful agricultural interests related to the 'old' water resources development paradigm, but also among water sector practitioners. Evidence of such resistance can be retracted from a growing criticism of IWRM in the last years and documented cases of failures due to low participation and the missing perception of ownership – e.g. South Africa (Swatuk 2005); India (Shah et al. 2006); and Sri Lanka (Samad 2005). Resistance to reforms can lead to institutional conflicts and power games hindering reforms.

Despite these challenges, there are several reasons why IWRM is still necessary in South Africa. Water is not equitably distributed in the country, its availability is highly variable over time and, due to the relatively low average rainfall, large parts of the country are water-scarce. Furthermore, historical patterns of industrial and agricultural development as well as politically motivated social engineering have resulted in a mismatch between locations of concentrated demand for water and the available water resources. These physical and historical conditions provide an enormous challenge to realising sustainable social and economic development while redressing the inequalities caused by past political policies. In addition to reasons why it is necessary that IWRM should be implemented in South Africa from a climatic, political and historical perspective, people in South Africa have participated in a national democratisation process and now feel a growing need to participate in and contribute to decision-making processes. Whilst this may be partly as a result of their lack of trust in, and the lack of legitimacy of, previous delivery systems and social services, it is also important for people to be drawn into the planning and management aspects to

ensure that their concerns and requirements are met and that they receive appropriate delivery of resources (Gorgens et al. 1998).

Local community participation can also provide an important source of information, experience and ideas that could lead to practical, relevant, achievable and acceptable solutions to water-related problems. Another benefit to involving local communities in water resource management is that they often possess a particular knowledge of a resource – known as indigenous knowledge – which can help to generate new options when it comes to environmental protection, including proper water resource use and management (Dungumaro et al. 2003).

Continued fragmentation in the national approach to water resource management represents a particular problem for the effective implementation of IWRM in South Africa. While water and land both fall under the broader concept of natural resources and are inextricably linked to one another in terms of the way in which use of the one impacts on the other, South African environmental, water and land-use legislation and administration are administered by separate line function government ministries. Despite the comprehensive reforms of South Africa's water and environmental law, this fragmentation is likely to persist into the foreseeable future. While the Constitution of 1996 classes water management and certain land-use-related activities such as mining, energy and land affairs as central government competencies, other land-use-related activities, such as agriculture, nature conservation and the environment are considered to be provincial competencies. In fact, South Africa's DWS has little effective control over land-use activities beyond forestry and certain aspects of mining and solid waste disposal (Gorgens et al. 1998).

The present and future physical climate perspectives, the present economic climate, and logical and business management principles demand more effective and efficient management of scarce resources. Not only do water resources need to be stretched, but also, money and thus the infrastructure need to be stretched. This implies investment in improved planning, incorporation of financial management as a critical part of water management, and the commitment to focus on operations and management, including. To facilitate and enable new growth and development, the South African government must review its present approach towards water resource management and broaden the definition of water resources (Pollard et al. 2008).

One of the root causes of failure of community water supply is the failure to plan for maintenance of infrastructure in a systematic way, which has created a massive drag in meeting the Millennium Development Goal target for water and sanitation. To be sustainable, direct investment in water supply infrastructure also needs to address the issue of who will maintain it, and where the money will come from. Much of the water infrastructure is failing in Africa for a simple and avoidable reason: lack of maintenance. The water and sanitation foundation Fairwater estimates that there are 50,000 dysfunctional water supply infrastructure across Africa. This represents a failed investment of anything from US$ 215-360 million and impacts directly on livelihoods and health. If real and sustainable gains in total provision are to be made, the underlying causes of this systemic failure to promote a satisfactory and autonomous maintenance regime need to be addressed (Skinner 2009). Administrative and operational problems are a huge challenge, especially given the transaction costs involved in setting up new organisations. Many southern African countries are overly dependent on donors, and it is about time these countries put money where their water is! Governments could fund the water reforms but chose to use the money in other often questionable ways (Manzungu 2004b).

The numerous service delivery protests around the country point to service delivery inequalities and the common challenges faced by many municipalities, the most serious of which are the following:

- Incapacity of decision-makers and skills deficits within the water sector. There is an erosion of the skills base of the DWS which is “held captive” by a plethora of consultancy agencies that have monopolised the critical skills necessary to execute routine water management tasks (Mehta et al. 2014).
- Unrealistic political promises vs. expectations vs. reality (in relation to finance and infrastructure)
- Dysfunctional infrastructure
- Public expectations of government (including municipalities) have been unrealistic at times.
- Public trust in government institutions and the level of satisfaction with service delivery are also low.
- Citizens often do not recognise their roles and responsibilities in ensuring a safe

and adequate water supply, leading to a culture of dependency (Sershen et al. 2016).

The National Water Resources Strategy of July 2012 outlines a number of challenges that impact on water governance issues in local municipalities. These include the following:

- Highly variable climate and associated run-off, flood and drought risks, and the need to respond to potential impacts of climate change;
- Deterioration of water resource quality and ecosystems due to pollution (eutrophication, salinisation, acid mine drainage and microbiological contamination) as well as developmental impacts on water habitats. These include challenges with regard to the implementation and application of the ecological portion of the reserve; and,
- Focus on and application of sustainable water management including infrastructure asset and life cycle management.

The National Water Resources Strategy further points out that it is imperative that the underlying causes and associated enabling factors dictating and influencing successful delivery are identified and addressed in a holistic manner. Critical factors cited in the strategy that must receive priority attention are the following:

- Inadequate financial resources and operating in a stressed economic environment;
- Ever-rising costs of water resource management with associated implications;
- Inefficient governance, regulation, compliance monitoring and enforcement;
- Insufficient alignment with and appropriate responses to national development and growth strategies;
- Incomplete water management model and framework;
- Inadequate sector involvement and accountability;
- Skills shortage and limited institutional capacity;
- Deficient information and knowledge to manage a complex water business; and,
- Inadequate integrated water investment framework.

South Africa has made remarkable progress in reforming its national water law – now regarded as one of the most progressive in the world – thereby providing the enabling

environment to facilitate IWRM. The remaining challenge is to ensure that the two other pillars of IWRM – management and institutional capacity, both supported by good governance practices – are able to follow suit and become equally effective. While it is unlikely that IWRM will be fully realised in South Africa in the short- or even the medium-term, it is still an ideal that is worth aspiring to and attaining progressively through a series of gradual improvements to integrated water management structures and processes (Funke et al. 2007).

It is hoped that the data presented and conclusions drawn might add to the growing body of knowledge on the threats and approaches to water security in Africa. Most importantly, the challenges and knowledge gaps identified and recommendations made may potentially help inform the design of local and national water strategies within South Africa and the continent of Africa at large.

# Chapter 4.
# DESCRIPTION OF STUDY AREA

Municipalities in South Africa play a crucial role in propelling the agenda of development of the national government and ensuring the deepening of the democratic culture within the nation. The essence of the existence of the local sphere of government is to ensure easy delivery of services and to further promote the general well-being of the people living within the jurisdiction of a particular local government body.

The system of local government in South Africa is relatively new and thus its aim is to address the developmental dilemmas created by former apartheid era. South Africa is a unitary state, with some federal elements of self-governance in municipalities and provincial government, for instance municipalities and provinces have their own limited autonomy as per the Constitution of the Republic of South Africa of 1996.

Primarily, the role and functions of municipal governance are to create an environment for efficient and effective delivery of services to communities within a specific jurisdiction. In South Africa, municipalities play an important role in delivering basic services including potable water, sanitation, sustainable electricity provision and waste removal. In all, there are 257 municipalities in South Africa, comprising 205 local municipalities, 44 district municipalities and 8 metropolitan municipalities.

Municipal boundaries in South Africa were structured in accordance with the racial demographics of the population of a particular jurisdiction. For instance, in terms of the Group Areas Act of 1959, which is now repealed, a specific racial group was not allowed to reside in an area designated for people of a different race. However, since the advent of democracy in South Africa in 1994, much has changed. Since 1994, municipalities have been structured to be people-centred, accountable and democratic, with the goal of providing services to communities in a sustainable manner by the Municipal Demarcation Board.

Municipalities can belong to one of three categories: Metropolitan, district and local (referred to in the Constitution as categories A, B and C respectively) as shown in Table 4.1 below. Metropolitan (or Category A) municipalities represent large, densely

urbanised regions that encompass multiple cities and constitute a metropolis. In areas that are primarily rural, the local government is divided into district municipalities and local municipalities. District (or Category C) municipalities are the main divisions of South Africa's provinces; districts are subdivided into local (or Category B) municipalities.

Table 4.1: Classification of municipalities in South Africa

| Category | Description |
|---|---|
| A | Metropolitan municipalities: large urban complexes with populations over one million and accounting for 56% of all municipal expenditure in the country |
| B1 | Local municipalities with large budgets and containing secondary cities |
| B2 | Local municipalities with a large town as a core |
| B3 | Local municipalities with small towns, with relatively small population and a significant proportion of urban population but with no large town as a core |
| B4 | Local municipalities that are mainly rural with communal tenure and with, at most, one or two small towns in their area |
| C1 | District municipalities that are not water service authorities |
| C2 | District municipalities that are water service authorities |

Source: Adapted from Cogta (2009)

Local municipalities share authority with the district municipality under which they fall. Sundays River Valley is a Category B municipality and falls within the Sarah Baartman District Municipality. The Sarah Baartman District Municipality is situated in the western portion of the Eastern Cape Province and wholly surrounds the Nelson Mandela Bay Metropolitan area. It encompasses seven local municipalities, namely Kou-Kamma, Kouga, Dr Bayers Naude, Blue Crane Route, Sundays River Valley, Ndlambe and Makana.

The district covers approximately 58 242 $km^2$. The people living in the Sarah Baartman District speak isiXhosa (49%), Afrikaans (45%) and English (6%) as their home languages. The estimated population size is 412 000. Covering 34% of the entire Eastern Cape Province's geographical footprint, the District stretches from the Karoo areas in the north to the coastal belt of the Indian Ocean in the South, and includes areas that lie between the Bloukrans River in the West and the Great Fish River in the East (LGH 2014).

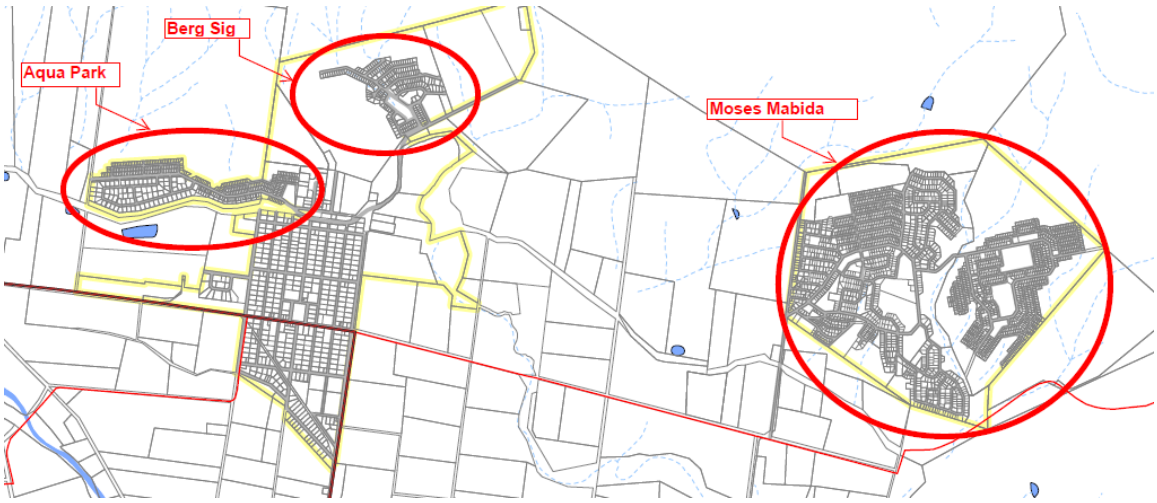
As directed by the Constitution, the Local Government: Municipal Structures Act 117 of 1998 contains criteria for determining when an area must have a Category A municipality (metropolitan municipalities) and when municipalities fall into Category B (local municipalities) or C (district municipalities). The Act also determines that Category A municipalities can only be established in metropolitan areas. Metropolitan areas are therefore a cluster of towns amalgamated into one large metropolitan government. The Sarah Baartman District Municipality is one District Municipality in the Republic of South Africa and is situated in the western portion of the Eastern Cape Province. Although it completely surrounds Nelson Mandela Bay, the two areas are independent entities serving different communities. The District covers 34% of the entire Eastern Cape Province's geographical footprint, making it the largest district municipality in the Province. The Sarah Baartman District Municipality comprises seven local municipalities: Dr. Beyers Naude, Blue Crane Route, Makana, Ndlambe, Kouga, Koukamma and the SRVM.

The SRVM has an area mass of 5 994 km². It is a Category B municipality situated approximately 50 km from the Coega Industrial Zone in the Nelson Mandela Bay Metro as shown in **Error! Reference source not found.**. The valley is characterised by h arsh climatic conditions, with summer temperatures rising in excess of 40° C. Rainfall is spread over the year and is between 250-500 mm per annum. The valley is also characterised by wide, fertile flood plains and is associated with low-lying land and steep, less fertile slopes. The area outside the Sundays River Valley includes the Paterson area, the coastal belt, and the west of Alexandria.

Figure 4.1: Location of Sundays River Valley Municipality.


The municipality boasts ecotourism and agricultural potential. The Addo Elephant National Park and citrus production are two important economic drivers in the SRVM. The main town is Kirkwood where the main economic sectors of trade, finance, agriculture, transport and construction are located. Figure 4.2 below shows the greater Kirkwood area.

Figure 4.2 Schematic outlay of the greater Kirkwood area

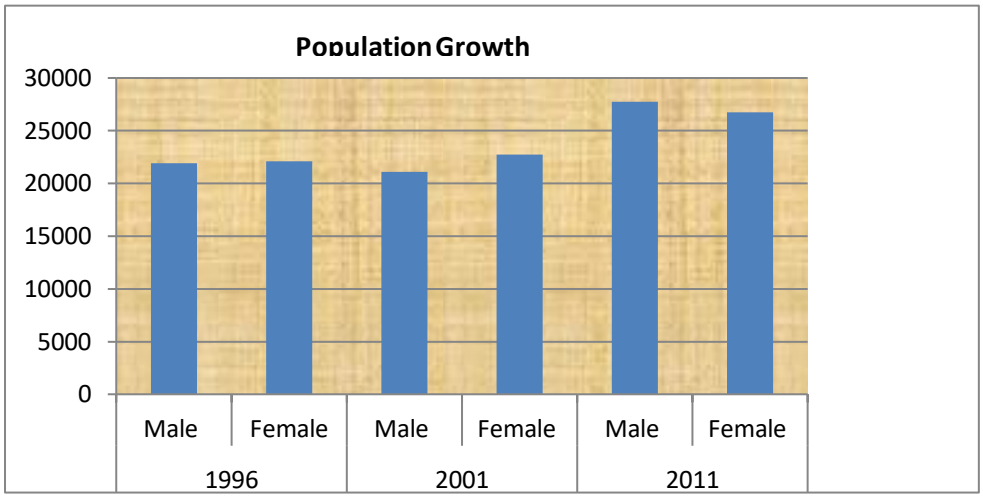


The other towns are Addo, Patterson and Enon- Bersheba. The Municipality also serves the towns of Kleinpoort and Glenconor, which were previously district management areas. The close proximity to the Coega Industrial Development Zone has led to Addo Tourism Development corridor and the Enon-Bersheba's 10 000 ha pristine communal land being increasingly sought after for tourism enterprise development and conservation opportunities.

The core services that local government provides, including clean drinking water, sanitation, electricity, shelter, waste removal and roads, are basic human rights, essential components of the right to dignity enshrined in the Constitution and Bill of Rights. The demographic trends for the SRVM were gleaned from Census 2011 data to reflect the municipal demarcations that took effect in August 2016. Historical information for disestablished municipalities is Census 2011 data. Table 4.3 provides critical information that determines the current socio-economic profile that may influence future development needs and the sustainability of the municipality for the provision of basic services that need to be financed.

According to Census 2011, the population of SRVM was approximately 54 504 people of whom 72% are Black African, 21% Coloured and 6% White. Between the years of 1996 and 2001, the population showed a slight decrease of 0.29% (127 of the population). However during the years of 2001 and 2011, the population had increased by 19% (10590 of the population) as illustrated in Figure 4.3

Figure 4.3: Population Growth.




Source: SRVM IDP - Population Growth

Table 4:2: Demographic Trends of Sundays River Valley Municipality

| | **2016** | **2011** |
|---|---|---|
| **Population** | 59 793 | 54 504 |
| **Age Structure** | | |
| Population under 15 | 29,1% | 26,7% |
| Population 15 to 64 | 66,5% | 68,0% |
| Population over 65 | 4,3% | 5,2% |
| **Dependency Ratio** | | |
| Per 100 (15-64) | 50,3 | 47,0 |
| **Gender Ratio** | | |
| Males per 100 females | 108,7 | 103,8 |
| **Population Growth** | | |
| Per annum | 2,10% | n/a |
| **Labour Market** | | |
| Unemployment rate (official) | n/a | 15,0% |
| Youth unemployment rate (official) 15-34 | n/a | 18,8% |
| **Education (aged 20 +)** | | |
| No schooling | 5,8% | 8,8% |
| Matric | 15,5% | 15,2% |
| Higher education | 1,5% | 3,8% |
| **Household Dynamics** | | |
| Households | 17 221 | 14 749 |
| Average household size | 3,5 | 3,5 |
| Female headed households | 34,8% | 34,9% |
| Formal dwellings | 84,2% | 84,6% |
| Housing owned | 30,5% | 44,3% |
| **Household Services** | | |
| Flush toilet connected to sewerage | 65,0% | 53,5% |
| Weekly refuse removal | 61,6% | 61,2% |
| Piped water inside dwelling | 30,9% | 32,3% |
| Electricity for lighting | 89,6% | 79,8% |

By and large, the vast majority of the population in the Sundays River Valley work in the citrus industry. The Valley is one of the major players in the South African citrus industry, consisting of about 150 citrus farms covering around 12 000 ha in total. Most

of the work opportunities are seasonal, giving rise to high numbers of indigent households who are unable to pay for services rendered by the municipality as shown in the Table 4.3

Table 4:3: Income Category per Person

| Income bracket per year | Male | Female | Total | % |
|---|---|---|---|---|
| No income | 8 063 | 11 030 | 19 093 | 37.72 |
| R 1 - R 4 800 | 5 095 | 5 148 | 10 243 | 20.24 |
| R 4801 - R 9 600 | 1 415 | 1 354 | 2 769 | 5.47 |
| R 9 601 - R 19 600 | 6 786 | 5 741 | 12 527 | 24.75 |
| R 19 601 - R 38 200 | 2 141 | 1 018 | 3 159 | 6.19 |
| R 38 201 - R 76 400 | 709 | 400 | 1 109 | 2.19 |
| R 76 401 - R 153 800 | 535 | 365 | 899 | 1.77 |
| R 153 801 - R 307 600 | 379 | 170 | 549 | 1.08 |
| R 307 601 - R 614 400 | 109 | 55 | 164 | 0.32 |
| R 614 001 - R 1 228 800 | 28 | 11 | 39 | 0.08 |
| R 1 228 801 - R 2 457 600 | 17 | 4 | 21 | 0.04 |
| R 2 457 601 or more | 30 | 15 | 46 | 0.1 |

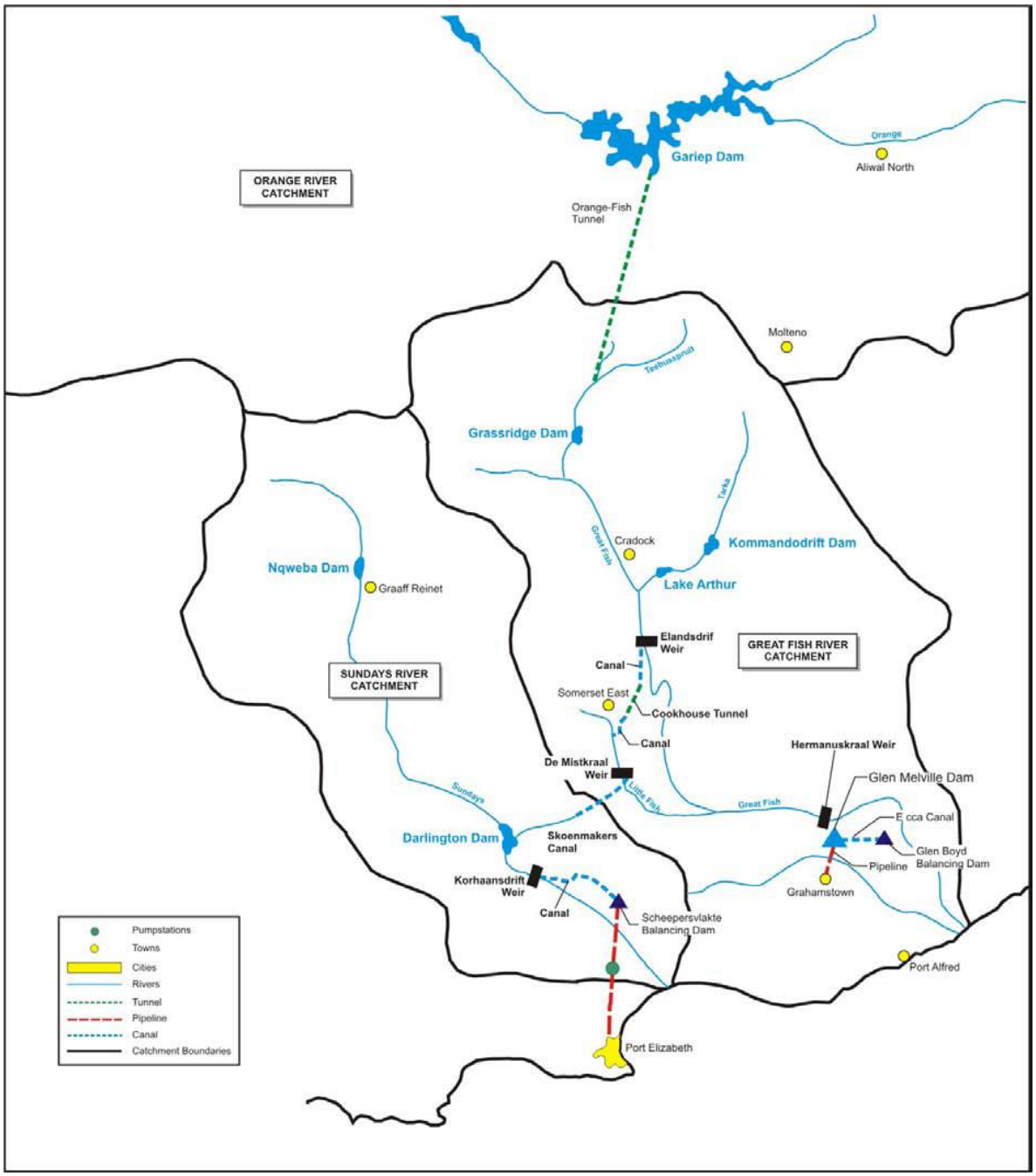
Source: Statistics South Africa, 06 March 2013

The strategy of the Municipality is to ensure that every consumer in the area is provided with a metered erf connection. As indicated above, water service level figures, approximately 11% of the consumers, are below the level of service of the RDP in terms of water.

The Municipality is dependent on the Lower Sundays River Water Users Association (LSRWUA) Canal as a source of its water supply. The Orange-Fish-Sundays water transfer scheme transfers water from Gariep Dam to the Great Fish River valley and thence to the Sundays River Valley ending up in the Caesars Dam, to supplement local water supply for irrigation and some urban use by local towns. Some water is also transferred to the Nelson Mandela Metropolitan Municipality via this system. A schematic diagram of the system is shown in Figure 4.4.

The scheme consists of the Grassridge and Darlington dams and various balancing dams, weirs, canals and tunnels. The Lower Fish River Scheme transfers water to Grahamstown and to irrigators along the lower Great Fish River. Separate irrigation schemes exist on the Tarka and Kat Rivers, with irrigation taking place from the Commandodrift Dam, Lake Arthur and the Kat River Dam. Nqweba Dam supplies water to Graaff Reinet.A schematic diagram of the system is shown with Figure 4.4.

Figure 4.4: Schematic diagram of the Orange-Fish-Sundays Transfer Scheme.




Source: Pedersen B, Madsen H, Skotner C, 2007. Real-Time Optimisation Of Dam Releases Using Multiple Objectives. Application to The Orange-Fish-Sundays River Basin, South Africa. Water Resources Department, Dhi Water. Denmark.

The raw water supply to the main town of Kirkwood is supplied from an irrigation canal operated by the LSRWUA which extracts water from the Darlington Dam, about 12 km from Kirkwood.

The LSRWUA operates the scheme in accordance with the delegation received from the Minister of Water Affairs. As part of the above, the LSRWUA must operate and maintain the infrastructure associated with the scheme. To comply with the latter, it is necessary to empty the canal system to do repairs and maintenance from time to time. To this end, the LSRWUA prepares a detailed schedule of planned interruptions, which is then distributed to all water users.

The LSRWUA would not be in a position to meet their obligations to maintain the scheme if they were not allowed to carry out repairs and scheduled maintenance. It is therefore imperative that they shut off the water supply for days at a time. The Municipality is therefore required to have at least nine days of raw water storage capacity in its reservoirs in order to meet the demand from the communities.

The SRVM is a water services authority and is therefore responsible for ensuring access to water services and drafting WSDP. It also operates as WSP, thereby obliging it to provide water services to consumers within the municipal boundary.

The WSDP indicates that the water infrastructure consists of more than 24 km of bulk pipelines, 14 reservoirs, 11 pump stations, 3 water treatment works (WTW) and 4 wastewater treatment works (WWTW).

The water resources profile of the SRVM consists of two sources (external and internal):

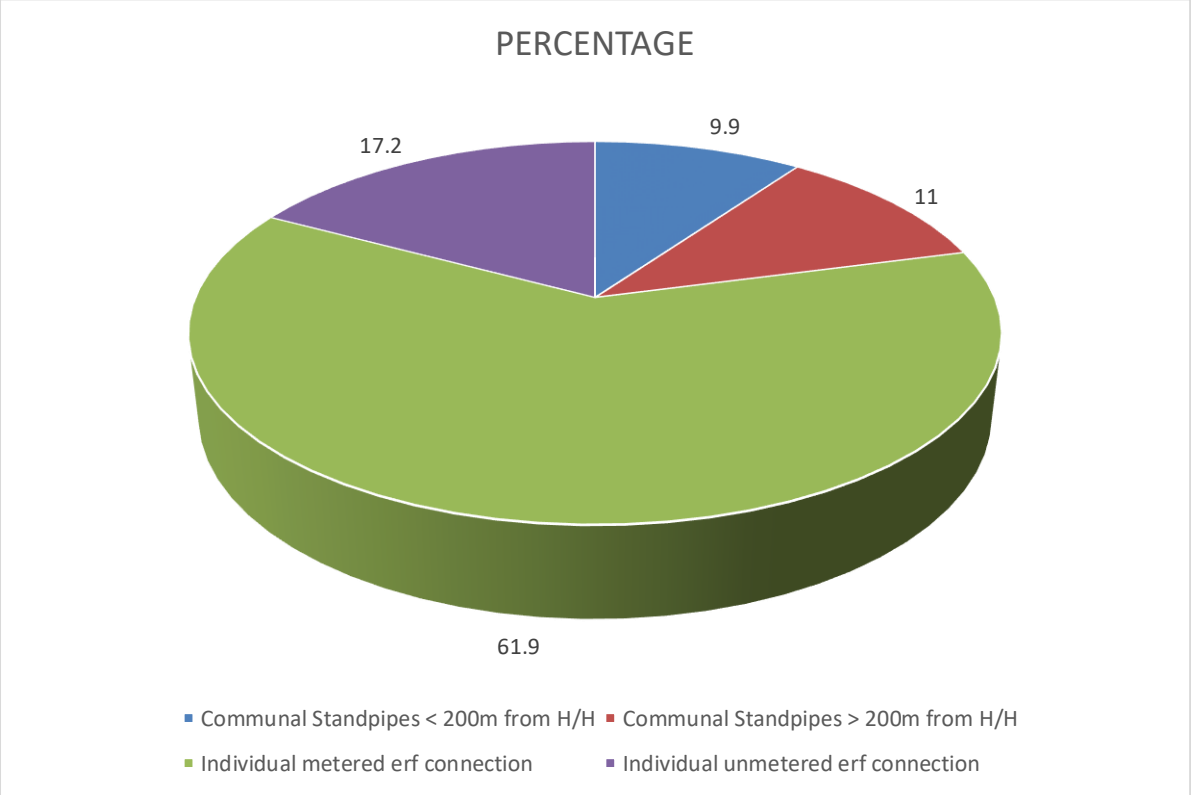
1. The lower LSRWUA Canal for the settlements of Kirkwood, Aqua park, Bersig, Addo, Enon Bersheba, Moses Mabida and Emsengeni.
2. Five boreholes for the area of Patterson.

The following are the existing water service levels in the SRVM as illustrated in figure 3.3:

- 9,9% of the consumer units are served with communal standpipes with a distance smaller than 200 m from households
- 11,0% of the consumers/households make use of communal standpipes, which are at a distance greater than 200 m from their houses/shacks
- 61,9% of the consumer are served with individual metered erf connections

- 17,2% of consumer units are served with individual unmetered erf connections.

Figure 4.5: Water Service Level




Source: SRVM WSDP.

The increase in number of households serviced as well as the raising of the service level profile (i.e., standpipes to domestic reticulation as well as ventilated improved toilets to water borne sanitation) has resulted in the sky rocketing of the demand of water in the valley while the capacity to extract and treat the water has been constant over the years.

# Chapter 5.
# RESULTS AND DISCUSSION

## 5.1 Governance Challenges

Institutions are considered to be key in sustainable livelihoods adaptation and water resources management in IWRM. They are often seen as central to successful policies implementation. However, this contrasts with the complex matrix of institutions in which people live their lives, and in which natural resource management spans across different resources and different institutions.

The collective action focus of IWRM tends to shift attention away from the fact that institutions by nature are beset with conflicts, social differences, and diverse interests as much as they can serve to enhance cooperation. Thus policy suggestions, under the rubric of IWRM often result in a focus on getting the institutions right in order to guarantee or stabilise uncertain human behaviour through such action as establishing a formal legal system and coded norms of behaviour.

The NWA provided for a dramatic shift in the management of water in South Africa. In particular, the Act promulgated the decentralisation of water resource management for the first time in the South African national water system. The new legislation establishes a three-level institutional system of management. In addition to the department responsible for water, the NWA provides for the creation of two new types of management bodies: the CMAs established at the level Water Management Areas (WMAs) and WUAs established at the local level.

The country was divided into WMAs in order to provide the jurisdictional boundaries within which catchment management agencies (CMAs) could be established. Only two CMA's are currently functional countrywide. The SRVM is located within the Lower Sundays River sub catchment in the Tsitsikamma to Keiskamma WMA. Due to the failure to establish a CMA in the Tsitsikamma to Keiskamma WMA, the Department of Water and Sanitation regional office located in Cradock and King Williams Town continue to play roles of conservation and protection of the resource, allocation and mediation that are expected of a CMA.

The water supply system in the Sundays River Valley is managed by the following institutions:

- Department of Water and Sanitation
- Lower Sundays River Water Users Association and
- the Sundays River Valley Municipality which act as both the Water Services Authority and Water Services Provider to the communicates of SRVM

These institutions each have different responsibilities in the water supply process to the communities of Sundays River Valley. The Department of Water and Sanitation manages the transfer scheme of the water from the Orange River 300 km up north. The Lower Sundays River Water User Association (LSRWUA) delivers untreated bulk water to municipality, farmers and other users like the citrus package industries in the valley. The Sundays River Valley Municipality is responsible for the treatment of the water and the supply to the inhabitants of the municipality.

The SRVM has not implemented the institutional separation between its water service authority (WSA) and its water services provider (WSP) functions that is required under the Water Services Act and the Strategic Framework for Water Services. This was resolved by the Municipal Council at a council meeting in mid-2009 where an internal review was conducted under Section 78 of the Municipal Systems Act (SRVM 2010). This was done in spite of the significant challenges that the municipality was facing in its water and sanitation provision. Consequently this institutional conflation has meant that the service provision and regulation roles of the SRVM have been conflated, with no service delivery agreement between the two parts of the organization. Institutionally, the absence of a distinct ‘water unit’ within the SRVM makes the SRVM’s water services reliant on the broader functioning (or lack thereof) of the municipality (Clifford-Holmes et al. 2016).

The LSRWUA performs a particular function for the SRVM, namely, acting as the agency that supplies raw water to the municipality. The LSRWUA is the bulk water service provider and in by default the WSP for the municipality. The municipality is the WSA, and according to the Water Act is therefore required to oversee the bulk-WSP function performed by the LSRWUA. This regulatory function should be performed according to a service level agreement (SLA) which has to be drawn and agreed upon

and signed by both parties. The LSRWUA has however refused to sign any service level agreement. They argue that according to the rules in their constitution, the SRVM is one of the district members of the LSRWUA like any other member and the relationship between both parties is governed by the constitution. This has resulted in the fractured relation between the two. As a result the SRVM does not attend the regular meetings that are held by members of the LSRWUA.

Municipalities face several challenges in meeting statutory requirements for the provision of water services. This raises the question as to whether the current level of decentralisation in water services provision and in local levels of regulation is appropriate, especially given the enduring municipal capacity constraints.

The blurring of lines between the water services authorities (WSAs) and water services providers (WSPs) at the local level has overlooked the importance of WSPs that are unable to explore external options to improve their performance. The ineffectual interpretation and implementation of the Section 78 process has contributed to municipalities primarily keeping the provision function in-house, even when the capacity to do so adequately is lacking. (Smith 2009). This has been the case for the SRVM.

The policy drafters at the time recognised that water services provision is actually very complex and requires high levels of specialist managerial and technical expertise. The emphasis on “ensuring” provision signalled that municipalities should call in reliable, effective and affordable assistance where required. In this way, they could focus on their policy and regulatory function. This led to the drafting of Section 78 of the Municipal Systems Act which spells out the criteria and process for deciding on mechanisms to provide municipal services. The Act requires that each WSA should first assess whether it is able to undertake service provision itself by reorganising its administration and developing the necessary human resource capacity. The municipality should consult with organised labour in this assessment.

If the municipality concludes that it has, or can develop, the capacity to provide the service internally, Section 78.2 permits it to exit the process. Most WSAs like the SRVM have taken this route, and have appointed or established their own internal technical services departments as the WSP. They have opted to avoid formal

outsourcing, preferring to keep jobs, funding and control in-house. It can be argued however that the SRVM has been struggling in its constitutional mandate to provide services for its communities.

On 23rd February 2010 the SRVM was placed under administration. According to the constitution of the Republic of South Africa the Provincial Executive has the authority to intervene in the affairs of municipalities where there is a failure to fulfil executive obligations in terms of section 139 (SRVM 2011). The municipal manager and the chief financial officer were both suspended and Administrator was appointed to monitor and oversee the intervention. Some of the reasons that necessitated the provincial administration where:

- political instability,
- non-compliance with rules and regulations;
- high staff vacancy rates,
- high levels of incompetency among staff
- low levels of capital budget spending and inappropriate spending of budgets,
- overall disregard for financial and supply chain management regulations,
- compromised service delivery,
- high level of community dissatisfaction resulting in protests; and
- absence of strategic and integrated planning.

The period 1994 – 2015 has seen ten municipalities in the Eastern Cape being placed under section 139 intervention from the Provincial Executive. Recent trends point to the fact that national and provincial government interventions in the local sphere of government in South Africa have become more commonplace. These trends can be seen, within the broader context of state dysfunction, to constitute a novel and discernible phenomenon, namely “interventionism”(Greffrath et al. 2016).

The SRVM has been struggling to operate and maintain their services infrastructure in a cost-effective and sustainable manner. This has resulted over time in the deterioration of the standards of the services that the municipality renders to the communities. Consequently service delivery protests have erupted over the years. In September 2014, residents of the Moses Mabida community went on a rampage and brought the central business district of Kirkwood to a standstill. Community

members burnt historical buildings and brought the town to a standstill. Municipal buildings, the African National Congress regional offices and fire engines were torched and shops were looted. The residents were unhappy about the R84.5 million the municipality has written off against irregular expenditure, while service delivery is inadequate. (SABC 2014).

A history of service delivery in South Africa illustrates that districts in poor rural provinces such as Kwazulu-Natal, Limpopo and the Eastern Cape have very low levels of service delivery. Planners in these poorer provinces, and their respective districts, are uniformly confronted by a lack of resources, infrastructure and skills across all municipalities in their area. A planning dilemma in these districts is caused by a lack of resources both locally and at provincial level. Conversely, good service delivery has been provided by districts in the richer, more industrialized provinces such as Gauteng and the Western Cape (Noble et al. 2013). Research conducted for the WRC also found that the majority of social protests associated with water service delivery tend to occur in middle and low income working–class urban and peri-urban communities that are characterised by

- Poverty, unemployment, inequality and unhappiness about perceived relative deprivation and/or marginalization.
- Dissatisfaction with water services delivery and delivery of related social services ( e.g. sanitation, housing, refuse removal and roads),
- Disjuncture (including communication breakdown) primarily between municipal authorities at local level and water users in the communities.
- Negative perceptions and governance in general and municipal governance in particular and
- Municipal capacity constraints in dealing. with longstanding backlogs for access to water and related social services (Tapela 2015)

Whilst it is understood that there are a whole host of issues that could be tackled to improve how municipalities are governed, it appears that by addressing these three key issue there would be a significant turn-around. These issues are:

- the ability to ensure effective regulation,
- the lack of accountability at a variety of levels, and

- the failure to engage the private sector and civil society actors in order to strengthen our management of water resources.

## 5.2 Water Services Quality Survey

A better understanding of the processes that influence public perceptions can contribute to improvements in water management, consumer services, acceptability of water reuse and risk contaminations, among others. A combination of different factors, including changes in the social role of science, complexity and uncertainty, contributed to the emergence of the general public as an actor in water management. The integration of perspectives from the general public can be challenging and pose difficulties for water professionals concerned with the implementation of optimal technical solutions, but ignoring such perspectives can lead to public discontentment and implementation problems (de França Doria 2010). Continuous deterioration of public confidence in water supply may ultimately lead to the disruption of supply services. On the other hand, a better understanding of the processes involved in public perceptions of water services quality, may provide a contribution to multi-stakeholders processes, help to improve consumer services and satisfaction, foster communication, promote cooperation and prevent conflict (Barraqué 2003).

The strategic Framework for Water Services of 2003 defines the basic household water services as 25 litres per person per day (or at least 6 kilolitres per household per month) and supplied according to the following criteria.

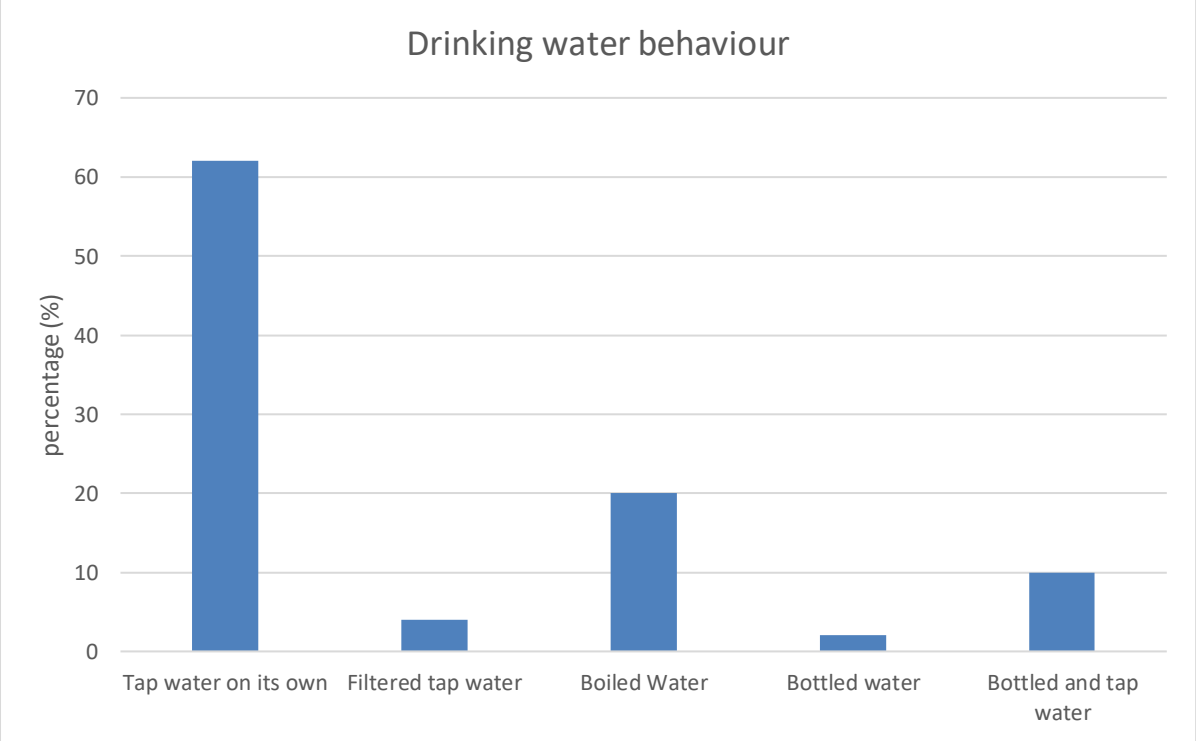
- Minimum flow rate of not less than 10 litres per minute.
- A standpipe within 200 metres of a household.
- Interruptions of less than 48 hours at any one time) and a cumulative interruption time during the year of less than 15 days and
- At a potable standard (SANS 241).

As indicated in the methodology a water services quality survey was commissioned to measure the customer satisfaction with regards to the water services delivered by the municipality and the performance of the municipality in relation to Legislative prescripts. It would be therefore be a barometer of the water services from the perspective of the consumer. A total number of 350 households in the communities of Moses Mabida, Emsengeni, Aqua Park and Bergsig were drawn which covers ten

percent of the total number of households in the area. Personal at-home interviews were conducted using a structured questionnaire with 13 questions related to water services provision in the municipality (Appendix D).

In response to Question 1 which inquired about the type of water that is consumed, the responses from the consumers indicated that 62 % of the people drink water directly from the tap, 4 % of the people filter the tap water, 20 % of the people drank boiled tap water, 2 % drank bottled water while 12 % drank both bottled and tap water as illustrated in the figure 5.1

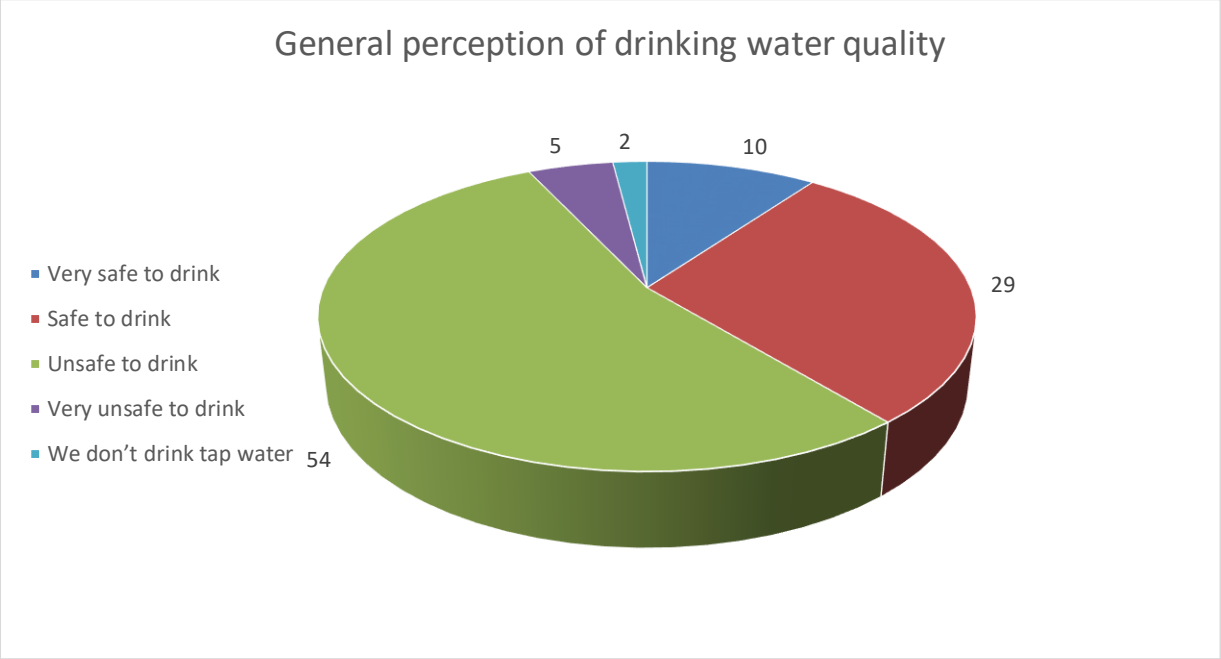
Figure 5.1: Drinking water behaviour




The reported drinking water behaviour seems to be a perception of drinking water quality and affluence. The less confident people are about how safe it is to drink their tap water, the more likely are they to boil or filter water or to use bottled water if they can afford it.

In response to Question 2, the study found that 39 % (10 + 29) of the consumers perceive the tap water the SRVM provides to be safe to drink as illustrated in the figure 5.2 below.

Figure 5.2: General perceptions of drinking water quality in SRVM




This result does not conform to the findings cited by the Water Research Commission study in 2015 which found that 88% of the urban South African perceive the tap water that the municipality provides to be safe to drink (WRC 2016). This seem to suggest that urban consumers in urban areas perceive the quality of the drinking water better that consumers in rural areas like the SRVM.

Consumer's perception of drinking water quality was further explored with two follow up questions number 3 and 4 about the reasons from their perceptions. The respondents were allowed to give multiple answers. The table 5.1 below compares the main drivers of the perception that tap water is safe to drink with the main drivers of the perception that water is unsafe to drink.

Table 5.1: SRVM drinking water drivers of perception.

| **Tap water is safe to drink because….** | **%** | **Tap water is unsafe to drink drink….** | **%** |
|---|---|---|---|
| The water looks clean | 55 | The water looks dirty | 66 |
| Nobody gets sick | 50 | The water tastes bad | 59 |
| The water tastes good | 42 | The water smells bad | 55 |
| The municipality cleans the water | 30 | Some people got sick from the water | 31 |
| The water smells good | 21 | The water smells of chlorine | 16 |
| The water smells of chlorine | 8 | The municipality does not clean the water | 15 |
| The municipality tests the water to see if it is safe to drink | 2 | The municipality does not tests the water to see that it is safe to drink | 11 |

Figures 5.3 and 5.4 and below compare the relative impact of these factors

Figure 5.3: Top 6 reasons why people think tap water is safe to drink.

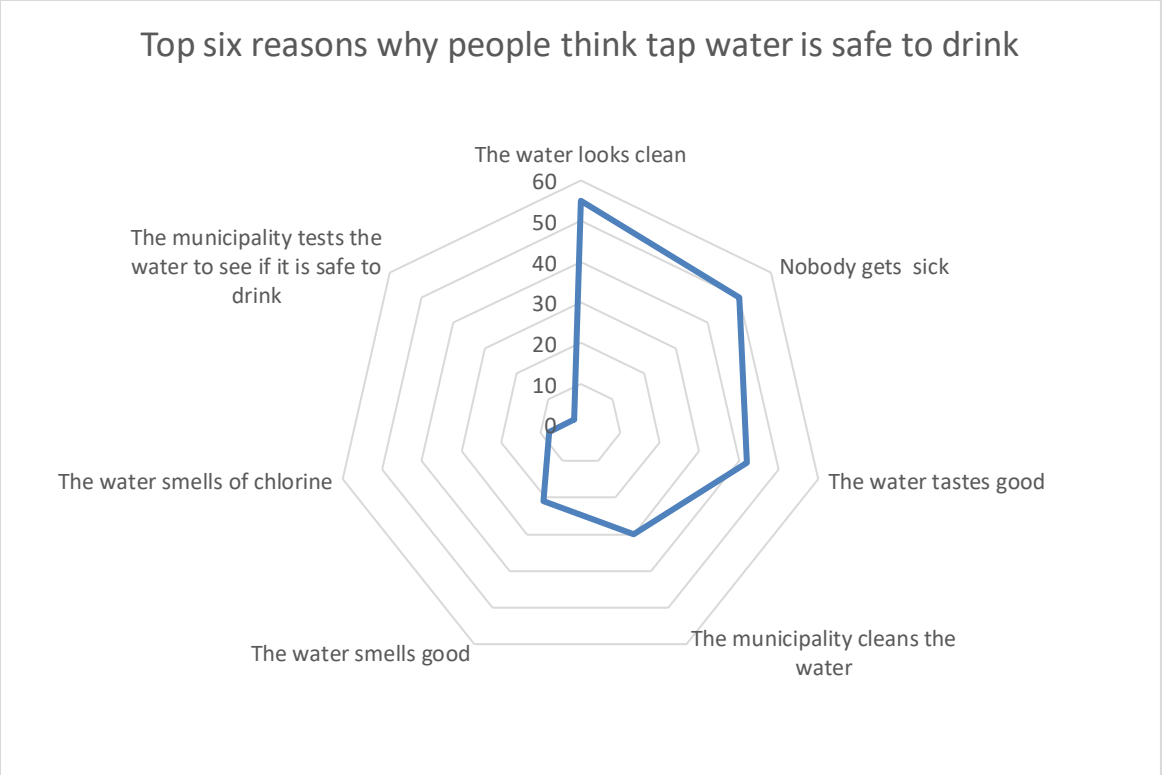
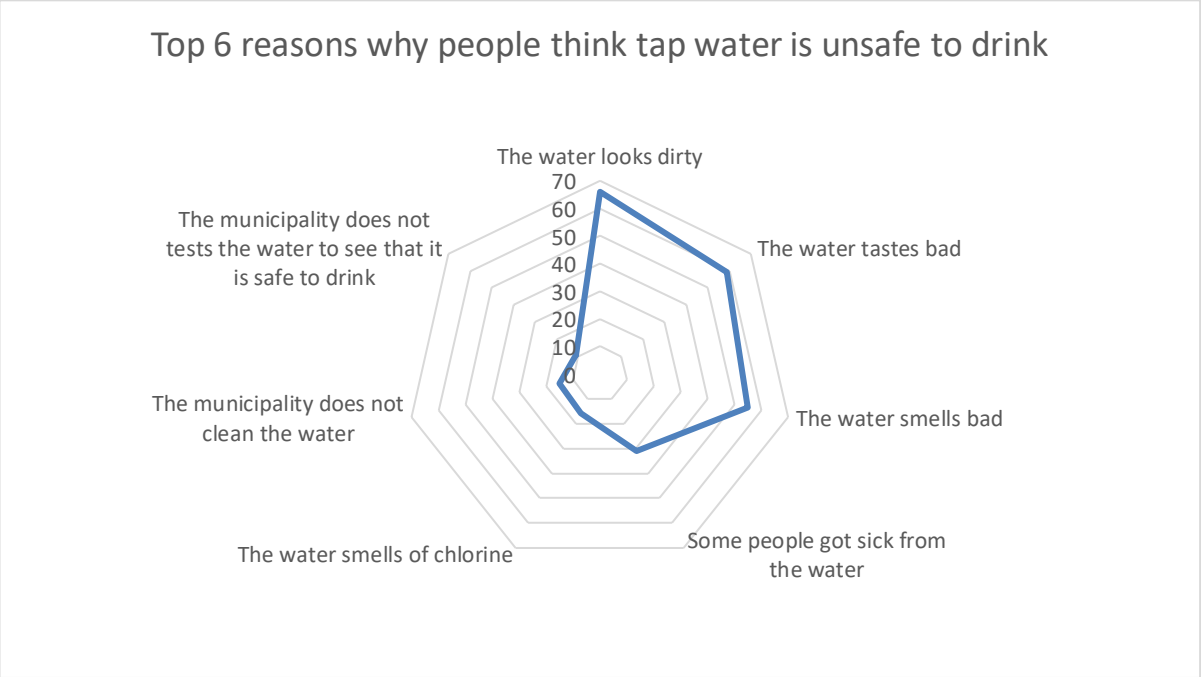


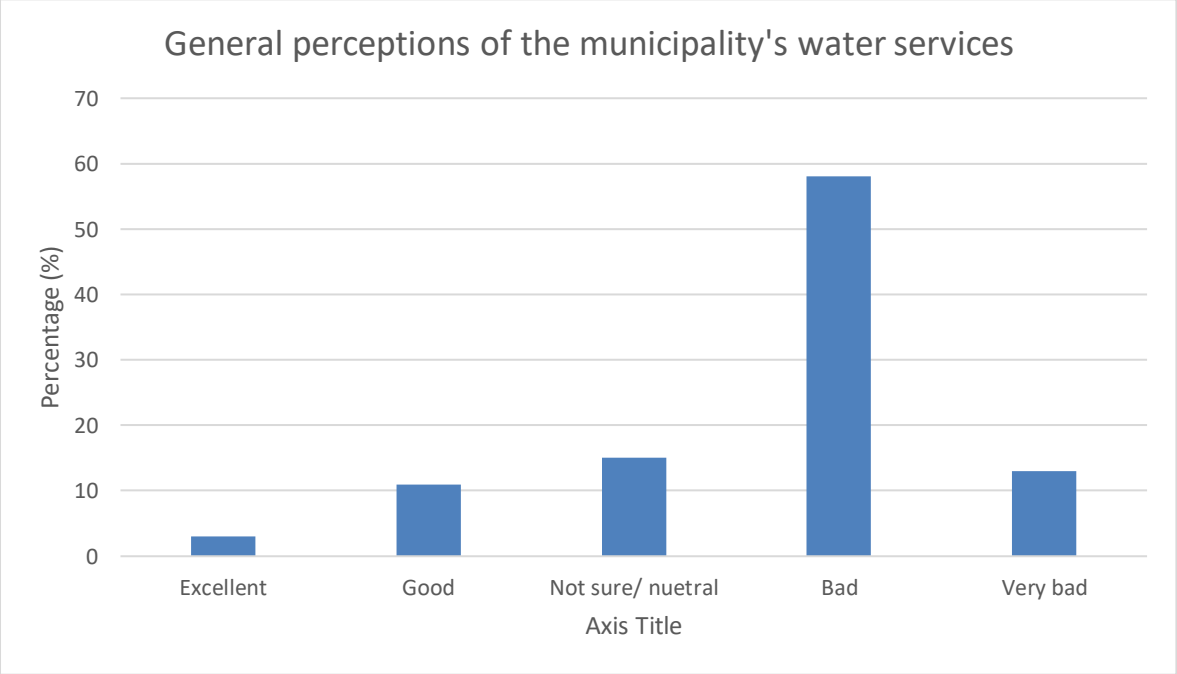
Figure 5.4: Top 6 reasons why people think tap water is unsafe to drink.




These results confirm findings from other countries that the public perceptions of drinking water quality is based on a combination of several factors. These results show that drinking water quality perceptions is mainly guided by the appearance of the water. The taste and odour of the tap water are second and third sensory drivers respectively of the perceptions about the safety of tap water. This differs from the results of studies in other countries internationally which found taste to be the main driver that water is safe to drink (de França Doria 2010). A study done in South African rural water services found that also found that consumer rely on physical qualities as well as availability of water when evaluating a water service (Kolanisi 2005). The municipality needs to carry out an awareness drive to sensitise the communities that they treat the water according to SANS 241 guidelines. It is imperative the test results of the water from the laboratories are published on their website and disseminated during public meetings so that the information is available for all to see and interrogate. This will over time inadvertently build trust from the community in the ability of the municipality to treat the water. The Laboratory chemical test results from the municipality are presented in Appendix G.

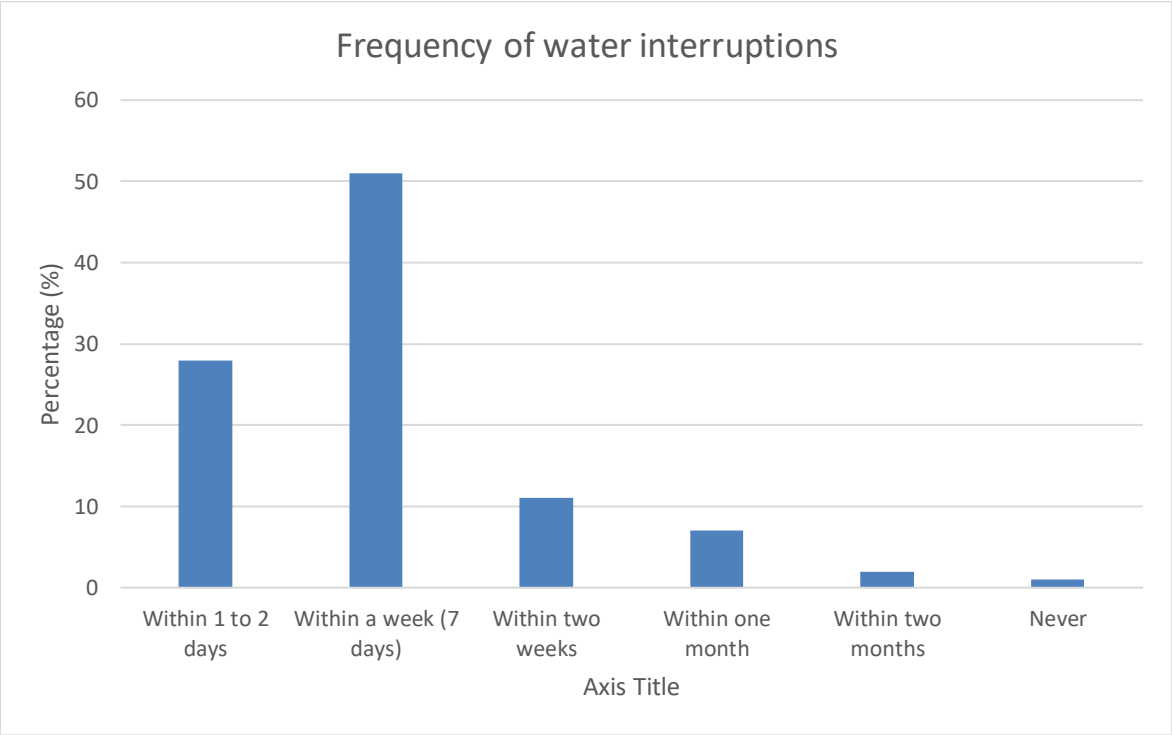
The respondents were asked in Question 5 how they would describe the municipality's water services provision to their households. The results differs from the WRC study cited above that was done in 2015. 58 % of the respondents indicated that the municipality's services was bad and 13 % say the services are very bad as illustrated in figure 5.5 below.

Figure 5.5: General perceptions of the municipalities water services.




Question 6 inquired on the consumers experiences with the reliability of the water supply. Over 50% of the respondents say the water supply was interrupted within a 7 day period. This indicated that the municipal water supply is erratic at best and results in a lot of frustrations. This collated with the findings in Question 5 that the vast majority of the consumers rate the water services provision as bad as shown in Figure 5.6.

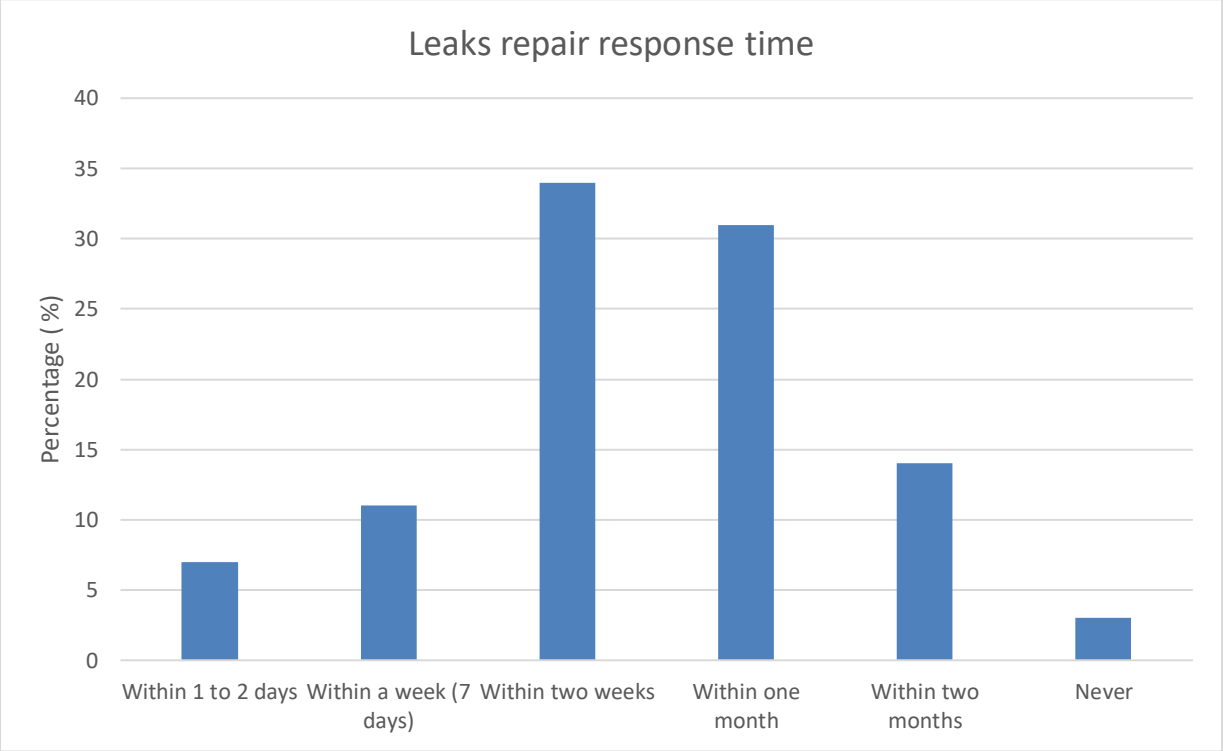
Figure 5.6: Frequency of water interruptions




The respondents were asked in Question 7 if they had complained to the municipality about water related services. 73 % of the respondents indicated that they had complained to the municipality. However a the follow up question to for those who had complained to the municipality to ascertain if the municipality had been responsive to their complaints revealed that 33 % of these consumers said that the municipality always responded, while 15 % said the municipality never responded. The vast majority of the respondents (52%) felt that the municipality only responded occasionally. Among those who didn't complain to the municipality about water related issues, the vast majority (83%) thought the municipality would not respond even if they complained. None of these respondent's thought the municipal service was excellent while the rest (17%) said they had not seen any reason to make complaints known to the municipality. This indicated the need for the municipality to set up a customer care unit in the municipality as well as a hot line where consumers needs can be heard and addressed.

Question 10 sought to find out the length of time the municipality takes to repair the leaks when they are reported. The results are presented in the figure 5.7 below.

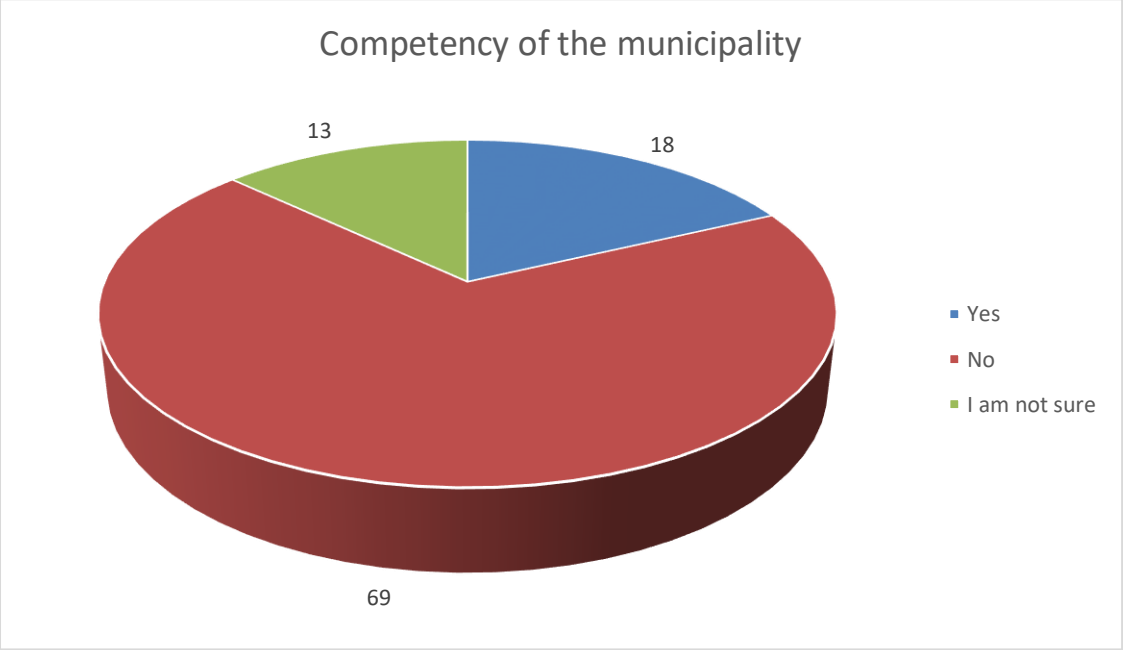
Figure 5.7: Leaks repair response time




The vast majority of the respondents (34 %) said they response time it within two weeks while 31 % said the response time was within one month of reporting. Only 7 % of the people said they response time was with two days.

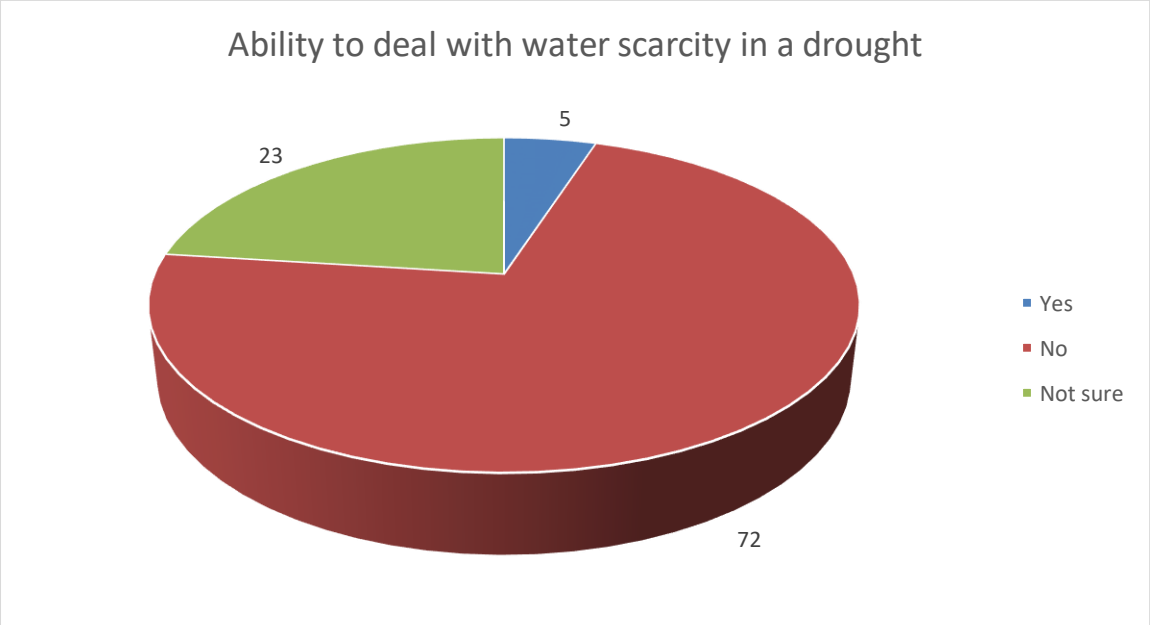
Question 11 asked the consumers what they think the competency of the municipality to deliver good water services. 69 % of the consumers believe the municipality is not competent to deliver a good water service in normal circumstances as illustrated in Figure 5.8 below.

Figure 5.8: Competency of the municipality



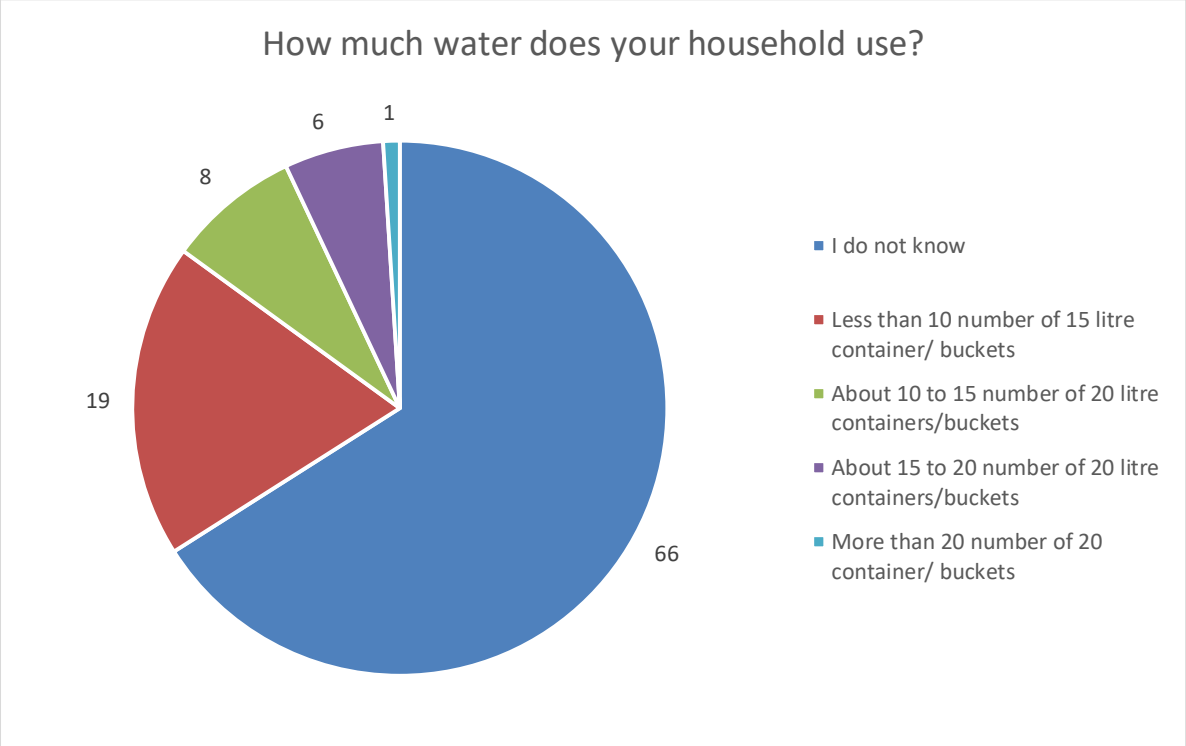

They consumers are even more sceptical about the municipality's ability to deal with extraordinary circumstances like a drought. Only 5% believe the WSP/ WSA would be able to deal with water scarcity in the event of a drought as shown in Figure 5.9

Figure 5.9: Ability to deal with water scarcity in a drought



The questionnaire included a question to establish if consumers know how much water they use per month. 66% of the people admitted that they do not know how much water they use per month (figure 5.9). Only 19% use 200 litres of water. These responses indicate that the consumers are not actively engaged in water conservation and demand management as shown in figure 5.10

Figure 5.10 : How much water does your household use




Overall the survey that was conducted shown that the communities are by and large not satisfied with the level of water services they receive from the municipality. Water security is therefore a major issue in SRVM. Similar sentiments were expressed in a community survey that by the conducted by the Statistics South Africa in 2016. The survey included a question that asked households what they considered to be the main problem or difficulty they were facing in their municipality presently. As shown in Table 5.2 below, overall, households listed the (1) lack of a safe and reliable water supply, (2) lack of or inadequate employment opportunities, (3) the cost of electricity, (4) inadequate housing and (5) violence and crime as the main challenges that they presently faced in their municipality.

Table 5.2: Five leading challenges facing municipalities as perceived by households

| Top-5 challenges | Main challenge/difficulty in municipality | Number |
|---|---|---|
| Challenge 1 | Lack of safe and reliable water supply | 2 683 048 |
| Challenge 2 | Lack of or inadequate employment opportunities | 1 963 104 |
| Challenge 3 | Cost of electricity | 1 706 313 |
| Challenge 4 | Inadequate housing | 1 199 692 |
| Challenge 5 | Violence and crime | 867 155 |

The main findings of the survey confirm the results found in similar studies done in other countries. Providing safe water and basic sanitation to meet the MDGs will require substantial economic resources, sustainable technological solutions and courageous political will (Moe et al. 2006).

## 5.3 Water Conservation and Demand Management

The author conducted field investigations during the course of the research in order to assess the status of the existing water infrastructure. Valuable information was collected concerning the infrastructure and the constraints that are being experienced.

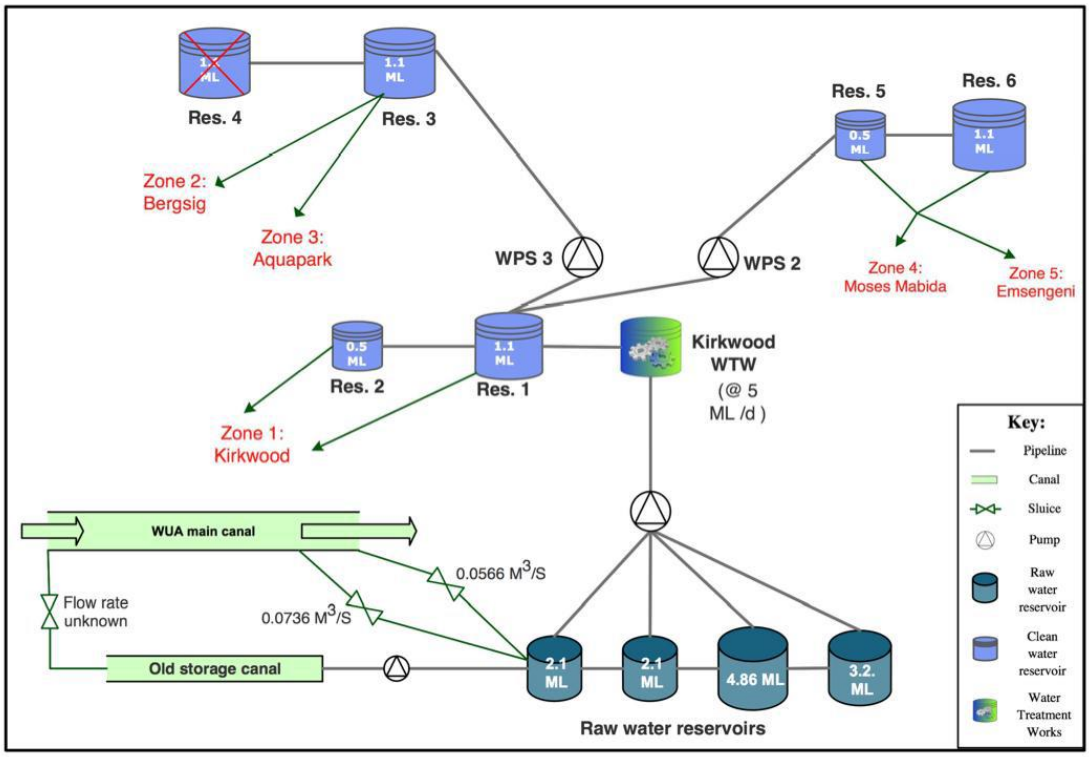
Kirkwood and surrounding areas currently experience water supply interruptions caused by scheduled maintenance of the irrigation canal which is the source of raw water supply. Bulk water is metered and stored at reservoirs, tanks, and pressure towers, before distributing to the network in the municipality. The raw water source for Kirkwood is the irrigation canal from the Korhaansdrif Weir.

The Municipality has an existing lawful use of 1.3 Mm3/year for domestic use, which must be licensed. A further 189 hectares of agricultural water has been allocated to the municipality. The 189 ha x 9000 m3/ha/year = 1.701 Mm3/year of irrigation water plus the 1.3 Mm3/year are both charged by the irrigation board and paid by the municipality at the domestic rate. This amounts to 3.46 Mm3/year at domestic rates.

There are two existing water abstraction points as shown in Figure 5.11:

- A canal with sluice gate diverting water to the lay dams, and
- A pumped abstracting water at the canal at the top of Market Street.

Figure 5.11**:** Layout of water supply system in Kirkwood.




The total amount of water available is calculated as follows:

1. Old Canal: The old canal located at Market Street is trapezoidal cross section in shape. It is 1 293 m long and 7 m wide, and the average depth is 1, 2 m. The volume of water in this canal is ½ (7 + 12) x 1.2 x 1,293 = 14,740 $m^3$.
2. Ponds 1 and 2: Ponds 1 and 2 have similar dimensions. 27, 5 m x 36, 8 m. The depth is 2 m. The total volume for the two ponds is 2 x 27, 5 m x 36, 8 m x 2 m = 4 048 $m^3$.
3. Pond 3: Pond 3 has dimensions of 59 m length x 29 m width x 2 m depth. The total volume of Pond 4 = 59 x 29 x 2 = 3 422 $m^3$.
4. Pond 4: Pond 4 has dimensions of 69, 7 m length x 34, 4 m depth x 2 m depth. The total volume of Pond 5 is = 69, 7 x 34, 4 x 2 = 4 795, 36 $m^3$.

Therefore the total volume of water available is 27 005, 36 $m^3$.

The water demand is determined based on the following key parameters:

- Stats SA 2011 Census population data (Table 5.3).
- Average unit consumption figures of 250 l/c/day for erf connections;
- Average unit consumption figures of 130 l/c/day for RDP or less supply;

- Summer peak factor for dry conditions of 1.5.

Table 5.3 Population of Kirkwood.

| AREA | POPULATION (2014) |
|---|---|
| Kirkwood | 1 995 |
| Aqua-Park | 1 926 |
| Bergsig | 1 694 |
| Moses Mabida | 6 282 |
| Emsengeni | 2 494 |
| TOTAL | 14,393 |

Source: WSDP SRVM (2012)

The theoretical water demand is shown in Table 5.4

Table 5.4:Theoretical Water Demand

| TOWN | UNIT CONSUMPTION l/c/day | POPULATION (2014) | CONSUMPTION PER TOWN l/c/day |
|---|---|---|---|
| Kirkwood | 250 | 1 995 | 498 750 |
| Bergsig | 130 | 1 694 | 220 220 |
| Aqua-Park | 130 | 1 926 | 250 380 |
| Moses Madida | 130 | 6 283 | 816 790 |
| Emsengeni | 130 | 2 494 | 324 220 |
| **GRAND TOTAL CONSUMPTION** | | | **2 110 360** |

The theoretical total water consumption is therefore 2,110,360 litres per day or 2,1 M l/day. Using a peak factor of 1.5, the consumption is 1,5 x 2,1 M l/day = 3,15 M l/day. The total volume of raw water available in Kirkwood is 27 M litres. Theoretically, this is enough for 27 Ml/ (3, 15 M l/day) = 8, 57 days. This amounts to approximately 9 days of supply of water.

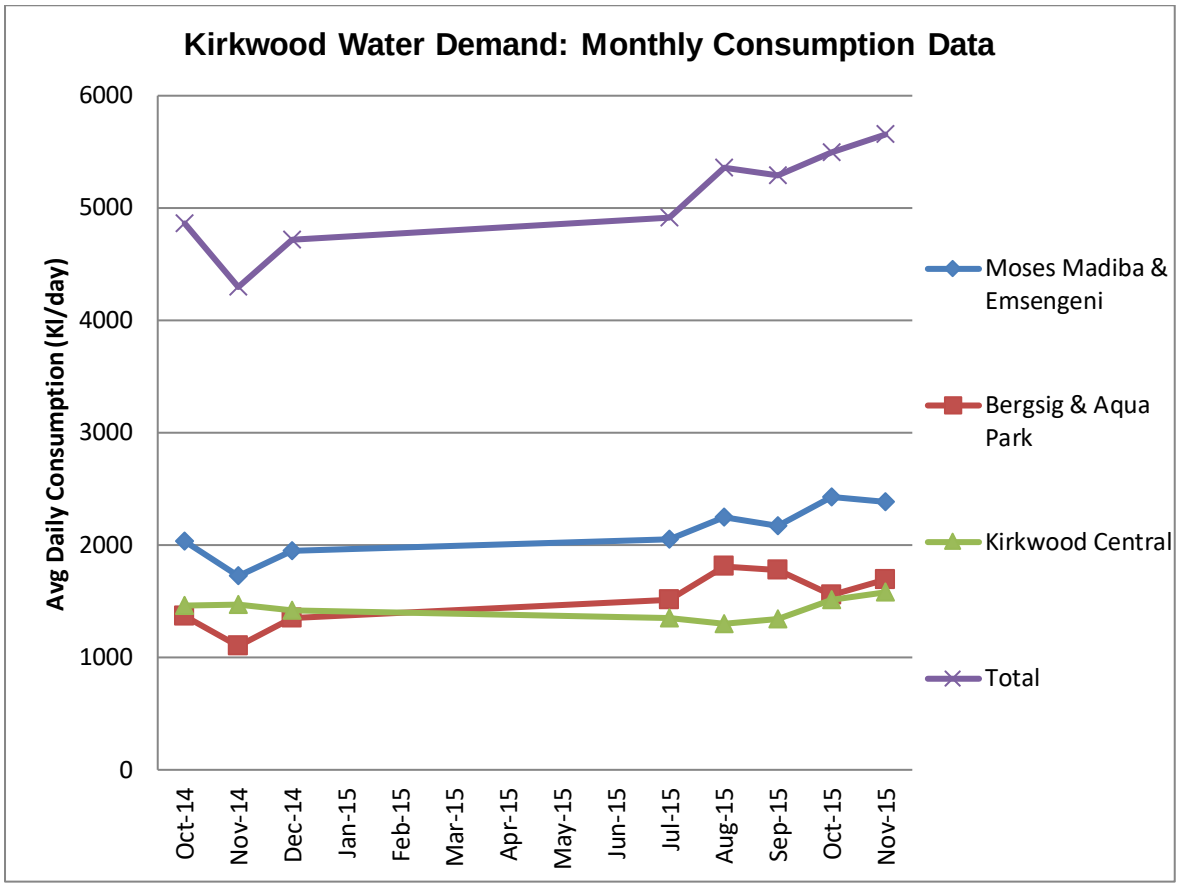
Water demand data was collected from the WTW in Kirkwood over a period of eight months in order to establish the average consumption. The plant is a conventional treatment plant with a design capacity of 5 M l/day. The average daily consumption for the three settlement communities of Kirkwood Central, Bergsig/Aqua Park and Moses

Mabida/Emsengeni is summarized in Table 5.5 and illustrated in Figure 5.12

Table 5.5**:** Kirkwood Water Demand: Monthly Consumption Data

| **Kirkwood Bulk Consumption (Meter readings taken at WTW)** | | | | |
|---|---|---|---|---|
| | **Average Daily Consumption (kl/day)** | | | |
| **Month** | **Moses Mabida & Emsengeni** | **Bergsig & Aqua Park** | **Kirkwood Central** | **Total** |
| Oct -14 | 2 032,5 | 1 369,4 | 1 460,8 | 4 862,7 |
| Nov-14 | 1 725,0 | 1 101,6 | 1 470,6 | 4 297,1 |
| Dec -14 | 1 949,1 | 1 350,3 | 1 419,2 | 4 718,5 |
| Jul – 15 | 2 050,4 | 1 512,0 | 1 354,9 | 4 917,3 |
| Aug – 15 | 2 248,4 | 1 809,2 | 1 299,9 | 5 357,5 |
| Sep -15 | 2 170,1 | 1 782,3 | 1 340,2 | 5 292,5 |
| Oct – 15 | 2 428,5 | 1 557,4 | 1 509,6 | 5 495,5 |
| Nov – 15 | 2 383,1 | 1 691,5 | 1 579,8 | 5 654,3 |
| **Average** | **2 123,38** | **1 521,71** | **1 426,4** | **5 071,50** |
| | | | | |
| Population per Area | 8 908 | 3 674 | 2 025 | 14 607 |
| Consumption per capita (l/day),based on 8 months measured, loses included | 238 | 414 | 704 | 347 |

Figure 5.12 : Kirkwood Water Demand




It is clear from this data that the actual average water demand of 5 071, 50 kl/day is way above the theoretical demand of 3 150 kl/day using a peak factor of 1,5. This implies that 1 921, 5 kl/day is the total amount of water lost.

A leak detection assessment exercise in Kirkwood revealed that most households have leakages at the taps, water meters and toilet cisterns. Further investigations at manholes and inlet chambers at the Moses Mabida WWTW revealed that the sewer water is clear. Night flows at the WWTW were also high, indicating that major water loses were from the toilet cisterns of the households.

In order to quantify the water loses, an analysis was done for the month of September 2015 as shown in Table 5.6. The total amount of water supplied over a 24 hour period was 5, 2 ML. This is above the design capacity of the WTW, which is 5 ML, and well above the theoretical demand of 3,15 ML/day.

Table 5.6: Kirkwood Bulk Water Supply: Quantifying Losses

| Actual consumption | Water supply over 24 hours per supply zone (kl/day) | | | | |
|---|---|---|---|---|---|
| | **Date** | **Moses Mabida** | **Bergsig** | **Kirkwood Town** | **Total** |
| | Average | 2 170,1 | 1 782,3 | 1 340,2 | 5 292,5 |

| Theoretical Demand | Current Theoretical Demand based on Population | | | | |
|---|---|---|---|---|---|
| | **Area** | **Moses Mabida** | **Bergsig** | **Town** | **Total** |
| | Population (2014) | 8 908 | 3 674 | 2 025 | 14 607 |
| | Per capita water demand: RDP (l/person/day) | 130 | 130 | 250 | _ |
| | AADD (kl/day), losses excluded | 1,158 | 478 | 506 | 2,142 |
| | | | | | |

| Losses | Water Loses per area (kl/day) | | | | |
|---|---|---|---|---|---|
| | **Area** | **Moses Mabida** | **Bergsig** | **Town** | **Total** |
| | kl/day | 1,012 | 1,304 | 834 | 3,150 |
| | UAW as % of total demand | 47% | 73% | 62 % | 60% |

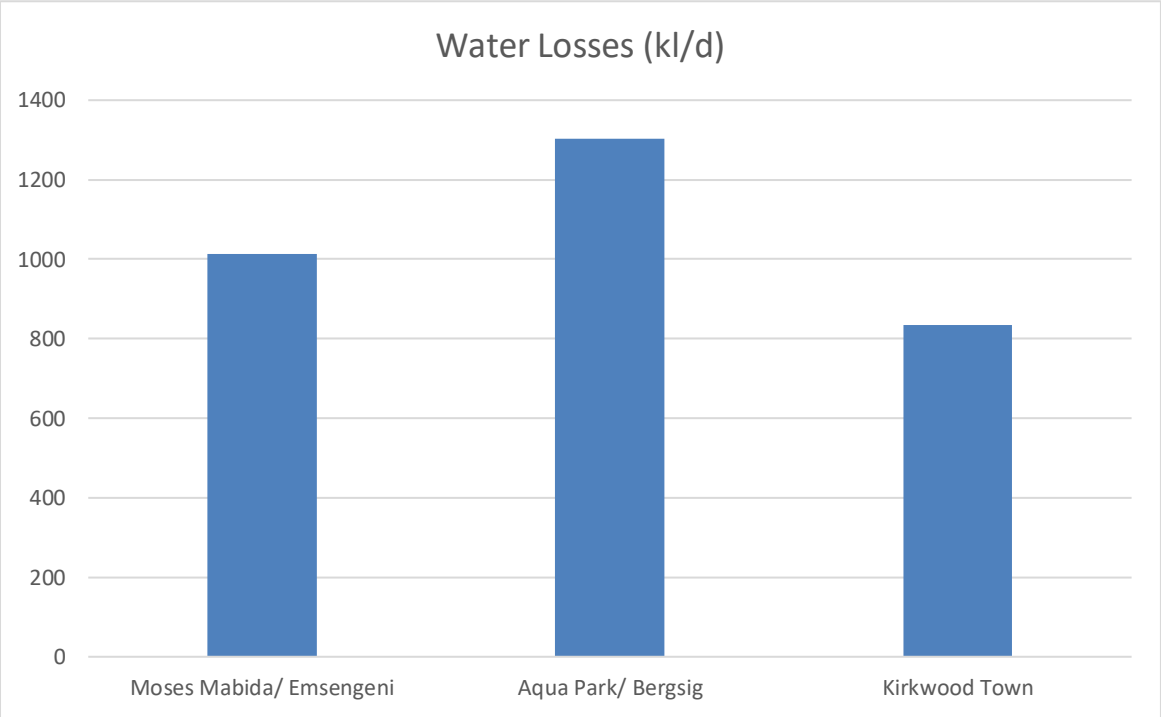
| Water Usage per area (l/person/day) | | | | |
|---|---|---|---|---|
| **Area** | **Moses Mabida** | **Bergsig** | **Town** | **Total** |
| **Theoretical** | 130 | 130 | 250 | 170 |
| **Actual** | 244 | 485 | 662 | 362 |

From this analysis the percentages of water losses was found to be as follows. This is illustrated in Figure 5.12 below.

- Kirkwood Town – 47%
- Bergsig/Aqua Park – 73%
- Moses Mabida/Emsengeni – 62 %

The average unaccounted water loss as a percentage of the total demand is 60%.

Figure 5.13: Water Loses




The author performed a qualitative evaluation of the municipality's water business using a questionnaire (APPENDIX F) that was completed by field workers at the municipality who are involved in the delivery of water to the communities. Some of the potential risks with regard to the implementation of WC/WDM that were identified are the following:

- Insufficient capacity to implement and spend allocated budgets;
- Inadequate political will to support WC/WDM;
- Inadequate tariffs which do not support WC/WDM; and
- Inadequate billing and metering.
- The pervasive limitation in institutional capacity and technical skills to embark on WC/WDM programmes in the municipality

This scenario has rendered the water business in the Municipality unsustainable. The Municipality is unable to adequately carry out water leak detection and repair operations because of limited budget to carry out operations and maintenance on the

aging infrastructure.

Payment levels (revenue collection) for the water supplied by the municipality is 43%. This inadvertently has a major influence on the NRW because there is little incentive to save water when the user has no intention of paying for it.

In the SRVM, there are joint responsibilities concerning the water governance where both the Technical and Finance Departments have certain responsibilities. There is a ‘silo” mentality where the two departments work on the same water issue but with two different approaches. The water balance can only be completed using information provided by both the Technical Department and Finance Department. This creates many problems because the Technical Manager is often held accountable for the water losses in the system while he/she is effectively not responsible for billed consumption, which represents a major part of the balance. The authorised consumption and water loses in the reticulation system is governed by the Technical Department, which is responsible for the operation and maintenance of the system. Though the metering of consumers households is the responsibility of the Technical Department, the billing of consumers is handled by the Finance Department. The entire water balance therefore spans between both the Technical Department and Finance Department, which often results in some form of discrepancy because it is difficult to ensure proper accountability with split responsibility.

The Municipality is in a continuously crisis management mode with limited management information and poor decision-making processes and financial and technical management. Funding for asset management, operations and maintenance and WCDM is not prioritized. Metering, billing and cost recovery are major problems that need urgent attention.

Implementation of the Water Conservation and Water Demand Management Strategy is a fundamental step in promoting water use efficiency and is consistent with the National Water Act (Act 36 of 1998) which emphasises effective management of our water resources.
The management of water resources and the provision of water services in South Africa call for a new approach in which Water Conservation and Water Demand Management (WC/WDM) are expected to play a crucial role to ensure environmental

sustainability, social equity and economic development. The opportunity for WC/WDM in rural areas can contribute to the sustainability of the services once they have been developed. Although total water use in rural areas is only 4% of the total demand of South Africa, a strategic intervention of WC/WDM will add to the economic and financial viability of water services to rural communities. WC/WDM must, therefore, promote responsible community-based management of water services. The implementers of a WC/WDM programme or activity in the rural areas must be able to show the benefits by documenting reduced water wastage through minimising/eliminating running standpipes, leakage and vandalism.

Some of the common constraints preventing or restricting the implementation of WC/WDM in the Water Services sector include:

- Financial constraints: Although the economic benefits in implementing various WC/WDM measures can be easily justified, WSIs are often financially constrained and may not have adequate financial resources to invest in such measures. As an example, low cost housing projects resort to the cheapest fittings (e.g. toilets and taps) without regard to operating and running costs;
- Planning constraints: Current planning practices in the Water Services sector are often focused on supply-side management and only consider infrastructure development as an option;
- Institutional constraints: There is sometimes a lack of co-ordination among the various role-players in the water supply chain during the planning process (including the Department, bulk water suppliers and local authorities). There has been inadequate clarity on institutional arrangements Capacity constraints: There is often limited technical and managerial capacity available to plan, implement and maintain WC/WDM measures;
- Technical constraints: There is a lack of appropriate WC/WDM planning tools and guidelines available and no adequate standards and enforcement for plumbing products; and
- Social constraints: In certain areas, there is a low level of payment for services. Water wastage can be attributed to the lack of awareness of the benefits of water conservation and demand management. In other instances,

WC/WDM measures are also only perceived as drought relief mechanisms (DWS 2004)

It is estimated that, by implementing effective distribution management measures, the Unaccounted-for Water (UAW) can be reduced to 11%, which will result in a saving of 15% of total demand. This can be achieved through adequate and technically correct operating and maintenance measures of the reticulation network system. Pipe network replacement or rehabilitation should also be undertaken. An accepted general norm is to replace the reticulation network every 50 years but this can vary with circumstances. WSPs can undertake the following measures to reduce distribution leaks:

i. Leak detection and repair;
ii. Pressure management;
iii. Effective zoning of the distribution system;
iv. Repair of visible and reported leaks;
v. Pipe replacement / management programme;
vi. Cathodic protection of pipelines;
vii. Meter management programme; and
viii. Unauthorised connection programme.(McKenzie et al. 2012)

### 5.4 Blue Drop and RPMS Assessment for the Municipality

The Constitution of South Africa assigns the responsibility of provision of water services to local government whilst the oversight and performance monitoring duties are delegated to provincial and national governments. The DWS is responsible for the regulation of water services by Section 62 of the Water Services Act (No. 108 of 1997).

In South Africa, the regulation of public utilities and, in particular, water and sanitation services carry huge economic and social importance, as they are essential to the development and cohesion of society. This function is undertaken by the DWS, and it has introduced a robust water services regulation strategy for the water sector.

According to the *Blue Drop Handbook Version 1*, the DWS chose a regulatory strategy appropriate for the South African water sector that was multi-facetted and had a programmatic approach, which enables the progressive implementation of regulations

appropriate to the maturity of the sector while supporting achievement of the developmental local government objectives (DWS 2011). One of the approaches is that of incentive-based regulation, which was introduced to the water sector on 11 September 2008 at the National Municipal Indaba in Johannesburg by the Minister of Water Affairs. The concept was defined by two programmes: The Blue Drop Certification Programme for Drinking Water Quality Management Regulation; and the Green Drop Certification Programme for Wastewater Quality Management Regulation.

This incentive-based regulation programme was locally developed for uniquely South African challenges within drinking water quality (DWQ) management. The programme is structured to proactively manage and regulate DWQ management through the introduction of excellence requirements based upon legislated norms and standards, as well as international best practice. A municipality in its entirety cannot be awarded Blue or Green Drop status, but rather a drinking water supply system or wastewater system is awarded Blue or Green Drop status according to the performance of that specific system.

The water services institutions are thus compelled to provide the necessary information required to undertake a proper analysis on the quality of water services and performance, and it remains illegal for water services authorities and WSPs to refuse, withhold or provide false information as specified in the Water Services Act.

The objectives of the Blue Drop Certification are the following:

- Introduce incentive-based regulation of DWQ management
- Promote transparency and subsequent accountability
- Provide realizable and consistent information to the public.
- Facilitate closer relationships between water services authorities and water service providers
- Introduce an element of excellence to conventional regulation.

The Blue Drop Report Card and Scoring Criteria consists of assessments that are carried out by personnel consisting of a qualified DWQ professional who acts as the lead inspector, two assessors and a learner assessor who also coordinates the logistical arrangements of the assessments. Members of the team are examined to ensure that they are competent in the subject matter.

The DWS sends the scorecard two months before the assessment is to be conducted. The following scorecard outlines the key elements of the Blue Drop Assessment and indicates the Portfolio of Evidence that is required by each municipality to calculate a Blue Drop score per water supply system that is sent to water services authorities. The percentage allocation for each of the four elements is also given below.

- Water safety planning: 35%
- DWQ process management control: 8%
- DWQ verification: 30%
- Management, accountability and local regulation: 10%

The above four requirements are composed of different aspects of the water business that the municipality has to deal with in the provision of clean drinking water. The composition is as shown in Appendix B

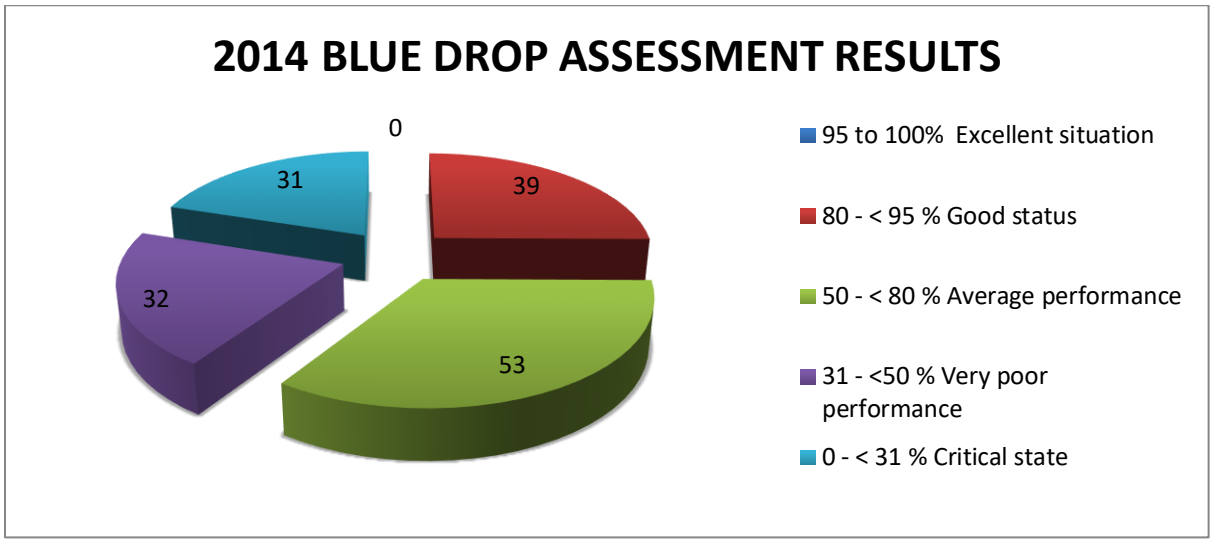
Water services delivery is performed by 17 water services authorities in the Eastern Cape via 163 drinking water supply systems. The WSPs in the Eastern Cape are the local municipalities and the Amatola Water Board. In the Sarah Baartman District Municipality, all the seven local municipalities are both water services authorities and WSPs. There are 16 WSAs in the Eastern Cape Province supplying drinking water through 155 systems. According to the Blue Drop Certification, the general water service provision in the Province declined in 2014 with 10% compared to 2012 from 82% to 72% in 2014 with 63 systems achieving scores of less than 50%, 53 systems displaying average performance whilst 39 systems displayed good performance. Figure 2 below provides the overall performance within the Province.
The ultimate objective of the water services authorities is to provide safe drinking water that complies with SANS 241 (2006, 2011) throughout the reporting period and score above 95% on the adherence to Blue Drop requirements. Table 5.7 shows the BDS trends for all the water use authorities in the Eastern Cape over a four-year period from 2010.

Table 5.7**:** Blue Drop Provincial Performance Log: Eastern Cape

| **Water Services Authority** | **Provincial Blue Drop Log Position** | **Blue Drop Score 2014** | **Blue Drop Score 2012** | **Blue Drop Score 2011** | **Blue Drop Score 2010** |
|---|---|---|---|---|---|
| Buffalo City (+ Amatola Water) | 1 | 72,79 | 92,55 | 91,28 | 95,2 |
| Nelson Mandela | 2 | 72,43 | 90,04 | 90,11 | 95,1 |
| Joe Gqabi (+ Amatola Water + WSSA) | 3 | 74,79 | 85,18 | 83,49 | 55 |
| Chris Hani | 4 | 83,42 | 75,23 | 73,47 | 53,1 |
| Amatole (+ Amatola Water) | 5 | 80,41 | 74,62 | 65,21 | 68,2 |
| Makana | 6 | 70,83 | 71,90 | 55,07 | 55,07 |
| Alfred Nzo | 7 | 62,87 | 64,37 | 52,54 | 26,2 |
| Kouga | 8 | 51,83 | 60,69 | 74,93 | 60,5 |
| Blue Crane Route | 9 | 35,10 | 59,05 | 39,51 | 30 |
| Camdeboo | 10 | 61,01 | 51,65 | 32,95 | 37,4 |
| Ndlambe | 11 | 49,47 | 42,37 | 20,93 | 37,8 |
| Baviaans | 12 | 26,47 | 35,09 | 24,18 | 52,6 |
| Sundays River Valley | 13 | 35,10 | 25,37 | 35,55 | 46,9 |
| OR Tambo | *14* | 48,71 | 22,70 | 43,69 | 22,2 |
| Ikwezi | 15 | 14,51 | 7,91 | 26,55 | 6,5 |
| Koukamma | 16 | 25,77 | 5,60 | 14,36 | 15,8 |
| | | | | | |

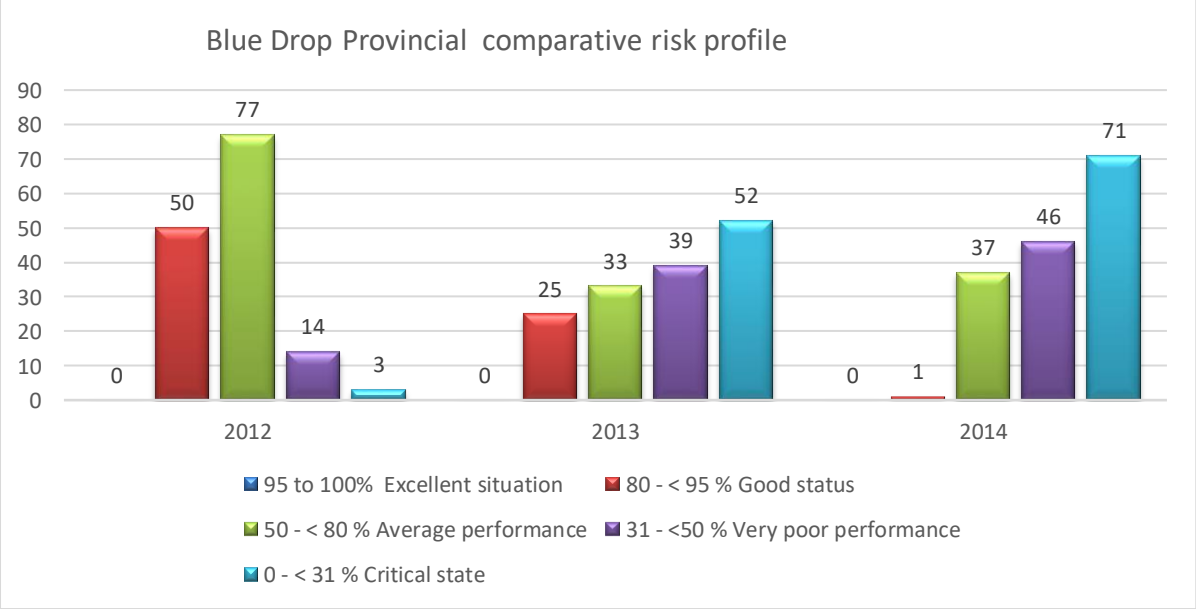
Figure 5.14 below shows the overall performance of the WSA's in 2014. The vast majority achieved average and poor performance scores.

Figure 5.14: Overall performance of the WSA's




The assessment found that focused attention on drinking water quality and asset management is needed as 61 and 48 systems are in critical state in these two assessment criteria respectively. Also, the fact that the BDRR associated with drinking water quality increased from 27% in 2012 to 44.6% in 2014 indicates the need for the implementation of proper mitigation measures. Another area requiring intervention is Water Use Efficiency and Water Loss Management as 102 systems displayed below average performance and 95 systems in a critical.

Figure 5.15: Blue Drop Provincial comparative risk profile



The figure 5.15 shows that the performance of the Eastern Cape WSA's has steadily deteriorated. In the 2014 assessment, only one WSA had an excellent score, while 25 WSA had an excellent score in the 2013 assessment.

Like other WSA's, SRVM has consistently performed poorly over the years. The municipality has five different settlements, which are served by five different WTWs. The WTWs are located in the following towns

- Kirkwood, which includes Kirkwood Town, Moses Mabida, Emsengeni
- Aqua Park and Bergsig
- Enon-Bersheba
- Addo
- Patterson

The overall score for Sundays River for the 2014 Blue Drop assessment is 35,96% as shown in Table 5.8. This was an improvement from 25,96%, but is still not acceptable. According to the Blue Drop assessment recommendations, the municipality lost points on the following;

- Lack of compliant water safety plans for the treatment plants.
- Process controllers without the necessary training.
- Inability of the municipal officials to upload information on the BDS.
- The final treated water is not constantly chlorinated due to chlorine shortages.
- A number of plants did not have operations and maintenance manuals.
- Luck of funds to adequately conduct structured and scheduled operations and maintenance on the municipal infrastructure.

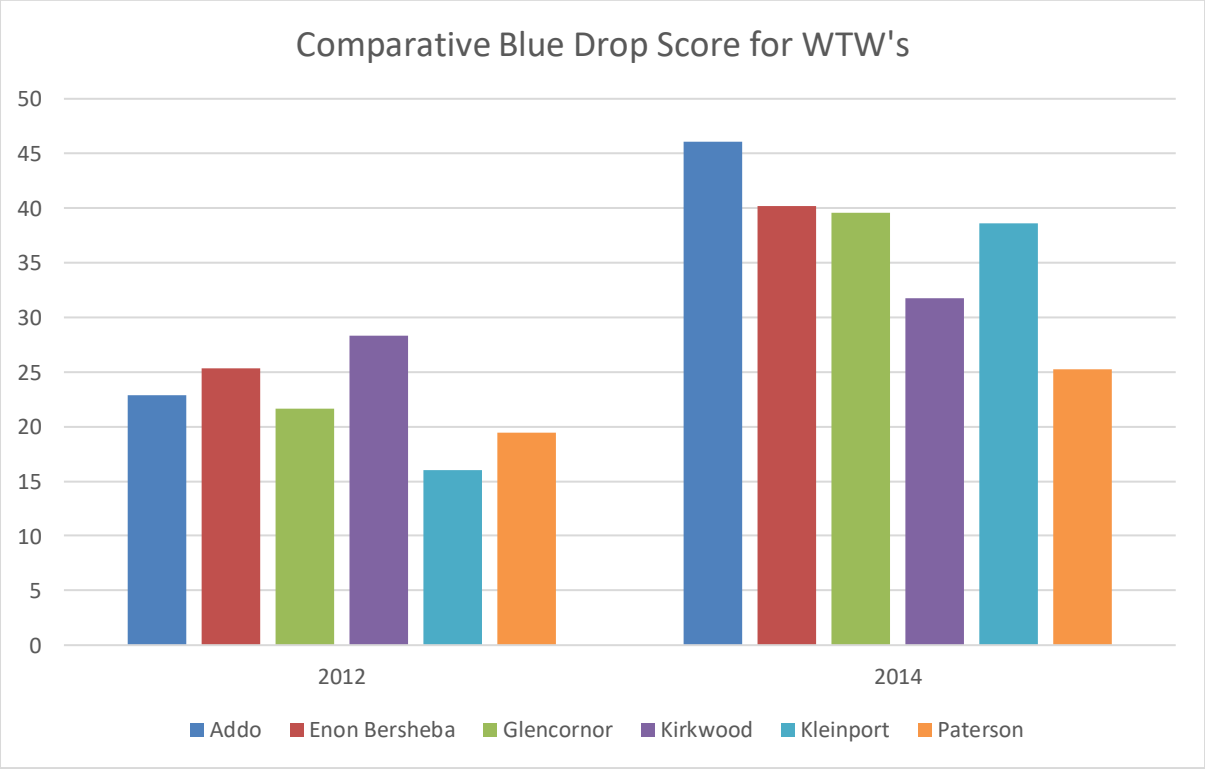
It was noted in the 2014 Blue Drop Report that although the some positive improvements in water supply management were attained, the municipality still has a number of water governance challenges that need to be attended to in order to improve their Blue Drop scores to a more favourable level.

Table 5.8**:** Blue Drop Performance Log – Sundays River Valley Municipality

| YEAR | SUNDAYS RIVER VALLEY LOCAL MUNICIPALITY | | | | | |
|---|---|---|---|---|---|---|
| **WATER TREATMENT PLANT** | **ADDO SUPPLY** | **ENON BERSHEBA SUPPLY** | **GLENCONOR** | **KIRKWOOD** | **KLEINPOORT** | **PATTERSON** |
| Trend | | | | | | |
| 2014 | 46,09% | 40,18% | 39,57% | 31,73% | 38,58 | 25,26% |
| 2012 | 22,9% | 25,33% | 21,6% | 28,33% | 16,04% | 19,44% |
| 2011 | 33,67% | 38,92% | Not accessed | 38,78% | Not accessed | 8,61% |
| 2010 | Not accessed | 47,5% | Not assessed | 49,5% | Not assessed | Not assessed |

As the figure 5.16 shows, there was a steady improvement in the Blue Drop Scores for the WTW in SRVM. This improvement however was not impressive enough as the WTW with the highest score scored 45 %.

Figure 5.16: Comparative Blue Drop Score for WTW's



Some of the highlighted problems listed in the Blue Drop assessment include the following:

- Chemical monitoring and recording.
- Sampling frequency is too low.
- Housekeeping and plant tidiness
- Record keeping, operational monitoring including removing sludge and incident log.
- Sufficient chemical and chlorine stocks required.
- Clean out algal growth in the settling tanks.
- Operators do not understand the reasons activities are preformed and therefore operate blindly.
- Dosing rates are not optimized and monitored by jar testing. This requires operator training.
- Luck of standby dosing and chlorination equipment.

The score is an indication of inadequate DWQ management, which includes treatment and planning efficiency levels. Urgent intervention is required by the municipal institutional management to ensure drastic improvement towards the point where the public and the DWS could have confidence in the manner the DWQ is being managed. At the current level of performance, an extremely low level of confidence prevails.

The DWS developed a tool called the Regulatory Performance Measurement System (RPMS) which is tailored at regulating local government effectively in the areas of water services. The web-based system measures WSA's against 11 key performance indicators derived from the Strategic Framework for Water Services and from the National Water Services Regulatory Strategy. The objectives of RPMS are as follows.

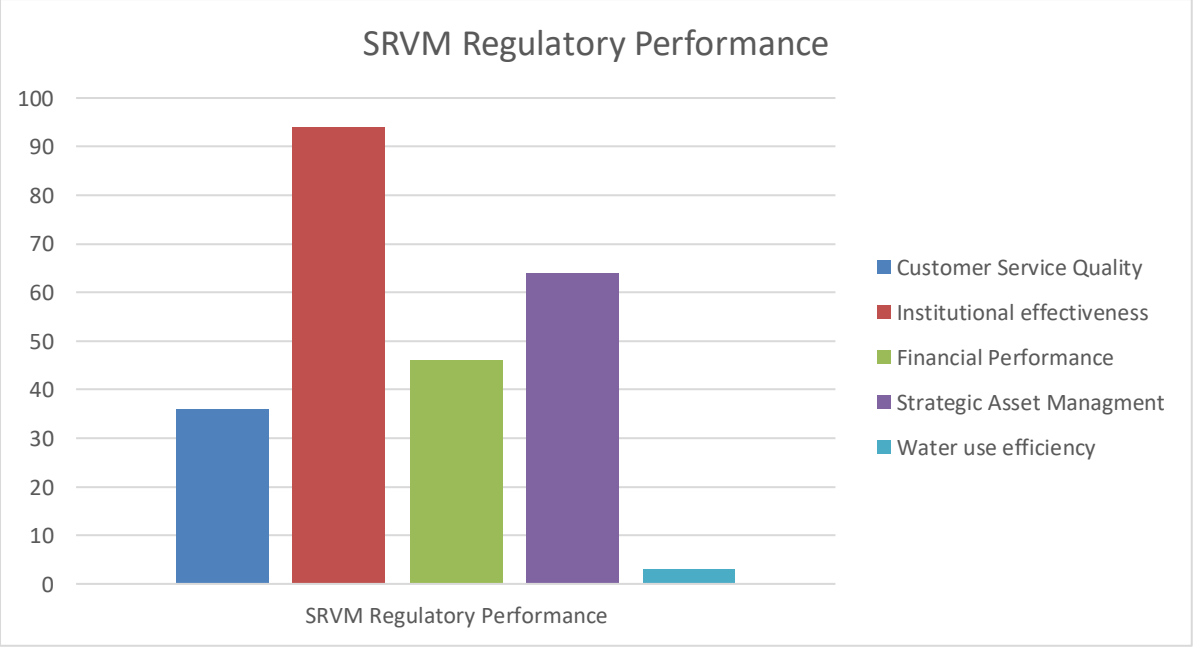
- To improve business practice with regard to water services delivery in local government.
- To improve local government compliance with national norms and standards.
- To improve the impact of DWS regulatory processes by ensuring that responses to non- compliance are uniform and standardized across South Africa; and
- To ensure that the data submitted by local government is verifiable, accurate

and useful to other processes, and will improve local government's capacity to deliver services through strategic feedback on problem areas.

RPMS is used by DWS to measure performance against key areas of business and determine performance trends with the intention of promoting best practice in the water sector.

The RPMS results for 2015 indicate that the SRVM has met regulatory requirements on institutional effectiveness and asset management. Asset management is an area of strength. Effective planning is evidenced through the existence of a well-developed asset infrastructure register and the drafting of an asset management plan. The municipality is however failing short in areas of customer services, financial performance, and water use efficiency as illustrated in figure 5.17. The area of the most critical concern was financial performance. The assessment found that unless the municipality implements an urgent turn-around strategy to reduce the current debt, the prospect for good water services provision is at risk. The results on water use efficiency confirm the findings in the water loss calculation.

Figure 5.17: SRVM Regulatory performance



## 5.5 Cost Recovery for Water Supplied

Many of the failures in WRM are due to the fact that water has been and still is viewed as a free product. In many instances, the full value of water is not really appreciated. The full cost of providing water includes the full economic cost and the environmental externalities associated with public health and ecosystem maintenance. The full economic cost consists of (a) the full supply cost due to resource management, (b) operating and maintenance expenditures and capital charges, (c) the opportunity costs from alternative water uses, and (d) the economic externalities arising from changes in economic activities of indirectly affected sectors (GWP 2000b). The principle of managing water as an economic and social product entails that the full recovery of costs be the goal of all water uses.

It is pertinent for WSAs and WSPs to ensure that they have adequate resources to be fiscally independent in order to ensure that they are well run. The full cost of water services should therefore be recovered in order to ensure sustainability of investments. In South Africa's developmental local government setting, exorbitant costs and social concerns have resulted in the application of subsidies in order to accommodate indigent portions of the population. Table 5.9 below gives a summary of the responsibilities for tariff setting in the water value chain.

Table 5.9: Responsibilities for Tariff Setting

| **Tariff / charge** | **Responsibility for setting tariff and source of authority** | **Responsibility for regulating the tariff and comments** |
|---|---|---|
| WRM charge (recovers the cost of water resource management). | Catchment management agency in terms of NWA DWS (where there is no catchment management agency). | DWS.<br>DWS (self-regulation). |
| Water resource development charge (also called raw water infrastructure tariffs). | DWS in terms of the national water resource pricing strategy (but only for DWS owned schemes). | DWS (Note: Raw water tariffs are also implicitly set by WSAs and water boards where these manage raw water systems). |
| Bulk water and wastewater tariffs (recovers the cost of conveying and treating bulk water and wastewater). | Negotiation between water board and water services authority in the case of a water board.<br>Water services authority where bulk function is undertaken itself or by an entity owned by the water services authority. | DWS (direct regulation of water boards).<br><br>Water services authority.<br><br>No regulation. |

| | | |
|---|---|---|
| | Negotiation between water services authority and external provider of service. | |
| Retail water tariff and sanitation charges (Includes the bulk water and wastewater tariff and recovers the retail costs). | Water services authority in terms of the Water Services Act and Municipal Systems Act. | Water services authority (self-regulation). |
| Waste discharge charge (a water resource charge based on the “polluter pays” principle). | Catchment management agency in terms of NWA. | DWS. Where there is no catchment management agency, DWS both sets and regulates the tariff (self-regulation). |

Tariffs should be set while taking into account equity and sustainability considerations as well as principles of proportionality. Applicable subsidies should be fully disclosed. There is a tremendous amount of pressure on municipalities to contain charge increases below inflation, and this has resulted in final charges being progressively pegged to below full cost recovery level. The result is the inability of the water institutions to adequately maintain and operate water infrastructure.

Due to the imbalances of the past, the national government of South Africa provides subsidies for infrastructure investment in basic municipal services through the municipal infrastructure grant, which is administered by COGTA and the regional bulk infrastructure grant, which is administered by the DWS. These conditional grants make up a reasonable contribution to infrastructure spending on basic services infrastructure, especially in rural municipalities like the SRVM.

In order to support provision of affordable basic services to indigent households, the national government also provides the local government equitable share subsidy. This is an unconditional grant and amounts to about 12% of the total operational income from the water services in municipalities.

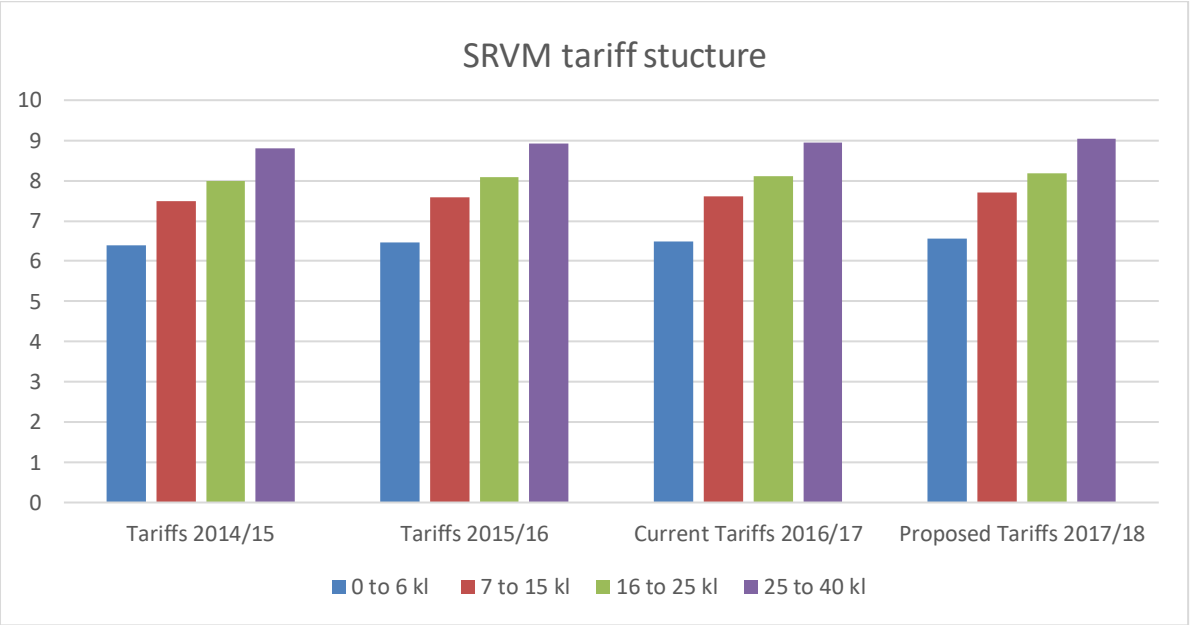
Currently, the SRVM does not follow a structured process when setting tariffs. What happens in practice is that the municipality applies an inflationary adjustment to the tariffs of the previous years as shown in Table 5.10 and Figure 5.18. As a result, the municipal tariffs do not reflect the full cost of providing services and cannot generate sufficient revenue to cover these costs. Another downside is that the existing tariff setting process is not well documented and current tariffs are not transparent, which leads to consumers of the services not understanding the cost of water.

Economic theory indicates that a product tariff is revenue sufficient in order to ensure that services can be provided sustainably, economically and efficiently so that it reflects accurately the cost incurred in providing the service (Walsh 2012). Revenue stability is especially important for municipalities like Sundays River Valley because the town of Kirkwood is a holiday town where water services use fluctuates significantly throughout the year, peaking during the holiday month of December.

Table 5.10: Sundays River Valley Tariff Structure

| **Water Metered Water (rising block)** | **Tariffs 2014/15** | **Tariffs 2015/16** | **Current Tariffs 2016/17** | **Proposed Tariffs 2017/18** |
|---|---|---|---|---|
| 0 to 6 kl free (FBS and indigent subsidy) | 6,40 | 6,47 | 6,49 | 6,56 |
| 7 to 15 kl | 7,50 | 7,59 | 7,61 | 7,70 |
| 16 to 25 kl | 7,98 | 8,08 | 8,10 | 8,19 |
| 25 to 40 kl | 8,81 | 8,92 | 8,94 | 9,04 |
| 41 kl and greater | | | 0,00 | 0,00 |
| 41 to 55kl | 9,51 | 9,62 | 9,65 | 9,76 |
| 56 to 70 kl | 9,82 | 9,94 | 9,97 | 10,08 |
| 70 to ....kl | 10,08 | 10,20 | 10,23 | 10,34 |
| | | | 0,00 | 0,00 |
| Water Sport fields per kl | 4,01 | 4,05 | 4,06 | 4,11 |
| Unmetered Water (standpipe) | 40,06 | 40,54 | 40,65 | 40,10 |
| Water availability charge monthly | 27,11 | 27,43 | 27,51 | 27,82 |
| Water availability charge annually | 325,27 | 329,17 | 330,07 | 333,78 |
| All households receive 6 kl water free per month as part of FBS | | | | |

Figure 5.18: SRVM tariff Structure




In the assessment that was done of the WCDM status quo (Appendix H) it became apparent that municipal officials have difficulty understanding the water demand. They know the type of consumers in the municipality and the level of service to which they have access, but there are no accurate records on the current levels of consumption at household level. The customer profile consists of 11,453 consumers who all have access to the free 6 kl of FBW. Communities in Moses Mabida, Aqua Park, Bergsig, Emsengeni, Enon-Bersheba, Addo and Patterson have straight connections for the municipal reticulation. They are therefore billed a flat rate at 14 kl, even though they may consume more or less than this amount. The total volume of the services used by each consumer type is not known accurately. The municipality has bulk meters at the WTW, which measure the volume of water pumped to the different areas, but most households do not have domestic water meters to measure individual household consumption. Having an accurate measure of the total volume of the service consumed by each consumer type is the basis of good tariff setting.

Second, the municipality has no accurate measure of the cost for providing the service. The direct costs incurred consist of employee related costs, bulk purchases, repairs and maintenance and contracted services. The cost of purchasing the water from the Lower Sundays River Water Users Association (LSRWUA) is known. The cost of bulk purchases on an annual basis is R 4 099 823, 08. The salaries and social contributions

amounts to R 4 228 060, 00. The municipality, however, does not know how much has been used for operations and maintenance over the year specifically for water services. The share of the overheads associated with running the municipality as a whole is known, but have to be apportioned between services in a clear, structured way. These proportions are not known. The cost to provide water services also includes capital financing costs, which include the costs to expand and manage the water infrastructure. The municipality does not have adequate provision for capital financing costs to ensure service provision sustainably in the long term.

It is therefore not surprising that the municipality has not been able to set the primary baseline water tariffs instead of relying on inflationary adjustments to the tariffs based on the previous years, which have no bearing on the actual cost of provision of this valuable resource.

The SRVM is not operating in a manner that is financially sustainable. The municipality does not generate enough income to cover the cost that is incurred to provide services. The budget for operations and maintenance of infrastructure is cut often in order to balance the budget. Consequently, the asset value deteriorates rapidly, thereby preventing the institution from continuously providing acceptable services to the community.

Over the past decade, many municipalities have become less sustainable as they are confronted by escalating, uncollectible consumer debt and service delivery backlogs. The municipal revenue business models need to focus on maximizing revenue collection, reducing inefficiency and costs, and reducing uncollectible debt.

In February 1995, the South African government launched Operation Masakhane, or “let’s build together.” A key component of this operation was urging residents to pay for services such as water, electricity, sewerage and refuse removal. During the days of apartheid, many residents heeded the call of the ANC to make the country ungovernable. A central tactic for advancing this call was withholding payment to un-elected and unrepresentative black local authorities and Bantustans. As a result, millions of residents simply stopped paying bills for rates and services in what was called a rates boycott. With the advent of democracy in 1994, the crisis of legitimacy ended, and municipalities expected people to pay for services that were rendered to

them. Yet despite the millions of Rand being spent to hire advertising gurus Saatchi to promote Masakhane, the financial yields were minimal. In some cases, payment rates for municipal services actually declined (Deedat et al. 2009).

Yet another reason for the non-payment is related to issues of affordability and quality of services. At the time of elections in 1994, roughly two-thirds of households were surviving on an income of less than R 1 500, 00 per month. It is therefore not surprising that most poor households were perennially in debt (Pope 2002). This is the conundrum that rural municipalities like SRVM have inherited. There exists a culture of non-payment for services, which has makes these institutions unsustainable. The municipality has incurred millions of Rand in debt because non-payment of services by the consumers. A major financial problem in many municipalities in South Africa is the inadequate collection of service charges due to widespread non-payment. The prevailing view is that non-compliance is caused by poverty and the existence of an 'entitlement culture'(Fjeldstad 2004)

Access to safe, sufficient and affordable water in rural Africa will not increase unless sustainable financing strategies are developed which ensure the sustainability of existing water services. There is a strong need for international donors and national governments to confront the true costs associated with sustained service provision in order to develop practicable long-term financing mechanisms (Harvey 2007).

South African municipalities have a responsibility to deliver services to communities in a fast and efficient manner. For these services to be delivered, there is a need for adequate financial resources and institutional capacity. However, there are challenges that South African municipalities face in terms of revenue collection. A fundamental problem exists in the municipalities' finances, namely the gap between available financial resources and municipal expenditure needs. SARS, on the other hand, is a success story in that it is a well-performing government entity in revenue collection In terms of section 75A of the Municipal Systems Act 32 of 2000, it allows the municipalities to levy and recover fees, charges or tariffs in respect of municipal service delivery functions and to recover collection charges and interest on any outstanding amounts. In order for the municipalities to fund the constitutionally mandated responsibilities, they rely on two main sources of revenue, namely own revenue and intergovernmental transfers (Chauke et al. 2016)

## 5.6 Water Services currently in planning.

The majority of capital investments in water resource infrastructure were made in the 1970s and 1980s. Given that there has generally been a history of underinvestment on maintenance and renewal of assets in the water sector as a whole, it is now critical that appropriate investments be made to upgrade existing infrastructure, as many of these assets are approaching the end of their useful lives (National-Treasury 2011)

The Eastern Cape Province still faces a huge water services backlog – not only in providing all consumers within its area of jurisdiction with access to water supply according to its WSA duties, but also in ensuring sustainable water services of existing supply. There are an estimated 386 000 households do not have access to some form of formalized water supply infrastructure and 571 000 households do not have access to basic sanitation (Stats-SA 2015).

Furthermore, there are areas where the existing water supply infrastructure as well as water source, are insufficient to meet current and projected future water requirements. New developments and urbanisation put further strain on existing supplies and resources.

The existing grant funding for the municipal capital projects and operating subsidies for water services are the Municipal Infrastructure Grant (MIG), Regional Bulk Infrastructure Grant (RBIG) and the Municipal Water infrastructure Grant (MWIG). The main objective of MIG is to assist WSAs by providing grant funding in removing the backlog concerning basic municipal services to poor households. RBIG focusses on the infrastructure required to connect or augment the water resource with internal bulk and reticulation systems or any bulk supply infrastructure that may have a significant impact on water resources in terms of quantity and quality. Based on all the current funding streams available to the Province over the MTEF period, it will take a minimum of 28 years for the Province to address their water services requirements (Munnik 2016).

The funding streams available for infrastructure development over the next three years for the Eastern Cape amount to approximately R 11, 8 billion as shown in Table 5.11.

Table 5.11: Grant Funding Streams

| Grant Funding Programme | No of Projects | FY 2016/17 | FY 2017/18 | FY 2018/19 | Total MTEF |
|---|---|---|---|---|---|
| 23DM/MWIG | 126 | R 137 799 220 | R 98 386 050 | R 23 000 000 | R 259 185 270 |
| ACIP | 68 | R 85 145 000 | R 58 000 000 | R 200 000 | R 143 345 000 |
| MIG | 629 | R 1 836 007 027 | R 1 754 061 766 | R 1 320 464 023 | R 4 910 532 815 |
| Other | 148 | R 939 807 149 | R 544 964 354 | R 299 500 652 | R 1 784 272 155 |
| Own-Muni | 203 | R 58 426 007 | R 73 063 015 | R 64 788 371 | R 196 277 393 |
| RBIG | 109 | R 1 529 169 529 | R 1 527 849 121 | R 891 741 064 | R 3 948 759 714 |
| WSIG | 94 | R 56 607 360 | R 98 775 000 | R 68 355 000 | R 223 737 360 |
| | 1377 | R 4 642 961 292 | R 4 155 099 306 | R 2 668 049 110 | R11 466 109 707 |

However, the existing total cost requirement for water services for the Eastern Cape is estimated at R 63,5 billion. The current average annual allocation is R 3,822 billion for water services and this would result in the Province taking at least 16 years to address their total water services infrastructure needs.

The SRVM is planning to implement 37 water projects and no sanitation projects over the next three years. These projects will be funded by the MIG, RBIG or the Accelerated Community Infrastructure Program (ACIP). The WSA requires a total amount of R 238, 8 million to address water supply requirements (SRVM 2010).

The current average annual allocation for water supply is R 11, 9 million and R 0 million for sanitation. This would result in the WSA taking at least 20 years to address their water supply requirements.

## 5.7 Skills Availability at the Water Services Authority

Skills and capabilities are fundamental to effective integrated infrastructure planning and implementation of the developmental mandate of municipalities. Apart from the metros, the majority of municipalities face challenges in this respect. Lack of proper project planning and preparation is a key reason why municipalities are not able to spend their budgets and deliver basic services to their communities.

The average municipal manager remains in his/her post for three years and possesses only nine years of relevant work experience, whilst the technical manager has 11 years of experience. Half of the technical managers are under-qualified and unable to adequately manage their infrastructure. There is an ongoing chronic shortage of municipal engineers and a high management turnover, with 25% of management posts being vacant for more than three months. One in six managers exit the municipality in the course of a year (DWS 2013a).

The Eastern Cape Province has the second highest vacancy rates for managerial positions in municipalities, as shown in Table 5.12, which is based on Statistics South Africa's non-financial census of municipalities for the year ending 30 June 2015.

Table 5.12: Managerial Positions by Province According to Section 57 of Local Government Municipal System Act, 2000 (Act No. 32 of 2000): 2014 and 2015

| Province | Fulltime | | | | Part time | | | | Vacant posts | | Total (including vacancies) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Male | | Female | | Male | | Female | | | | | |
| | 2014* | 2015 | 2014* | 2015 | 2014* | 2015 | 2014* | 2015 | 2014* | 2015 | 2014* | 2015 |
| Western Cape | 113 | 115 | 21 | 19 | 12 | 9 | 0 | 0 | 19 | 22 | 165 | 165 |
| Eastern Cape | 162 | 160 | 58 | 68 | 0 | 0 | 0 | 0 | 50 | 52 | 270 | 280 |
| Northern Cape | 84 | 74 | 24 | 27 | 7 | 15 | 1 | 2 | 39 | 38 | 155 | 156 |
| Free State | 78 | 73 | 26 | 33 | 2 | 0 | 3 | 0 | 15 | 20 | 124 | 126 |
| KwaZulu-Natal | 296 | 276 | 87 | 98 | 1 | 6 | 0 | 1 | 53 | 54 | 437 | 435 |
| North West | 109 | 96 | 45 | 31 | 2 | 1 | 0 | 0 | 16 | 38 | 172 | 166 |
| Gauteng | 139 | 151 | 86 | 71 | 0 | 0 | 0 | 0 | 8 | 14 | 233 | 236 |
| Mpumalanga | 74 | 84 | 22 | 26 | 0 | 0 | 0 | 0 | 31 | 21 | 127 | 131 |
| Limpopo | 91 | 87 | 51 | 34 | 1 | 7 | 0 | 3 | 43 | 57 | 186 | 188 |
| South Africa | 1 146 | 1 116 | 420 | 407 | 25 | 38 | 4 | 6 | 274 | 316 | 1 869 | 1 883 |

Source: Statistics South Africa (2015). *Non-Financial Census of Municipalities for the Year Ending 30 June 2015.*

Research carried out in 2005 for the publication *Numbers and Needs* (Lawless 2005) highlighted the fact that municipalities were short of civil engineers, technologists and technicians, with 28% of municipalities having no in-house civil engineering capacity at all. Lawless found that the civil engineering capacity (expressed as civil engineering professionals per 100 000 people) in local government is too low to deliver, operate and maintain local government infrastructure in a sustainable manner. Even when compared with neighbouring countries, the number of engineering staff was less than half that required for optimal operations.

In 2005, when the population of South Africa was 47,6 million, with an approximate 11 754 million households, the distribution of engineering staff in municipalities was as follows:

- 1 875 civil engineers, technologists and technicians
- 82 municipalities with no civil engineering staff.
- 56 municipalities with no female engineering staff
- 126 municipalities with no engineers

Subsequent research carried out in 2015, when the population of the nation had grown to 54 432 million with a corresponding 16 122 million households, the numbers of engineering staff in technical departments was as follows:

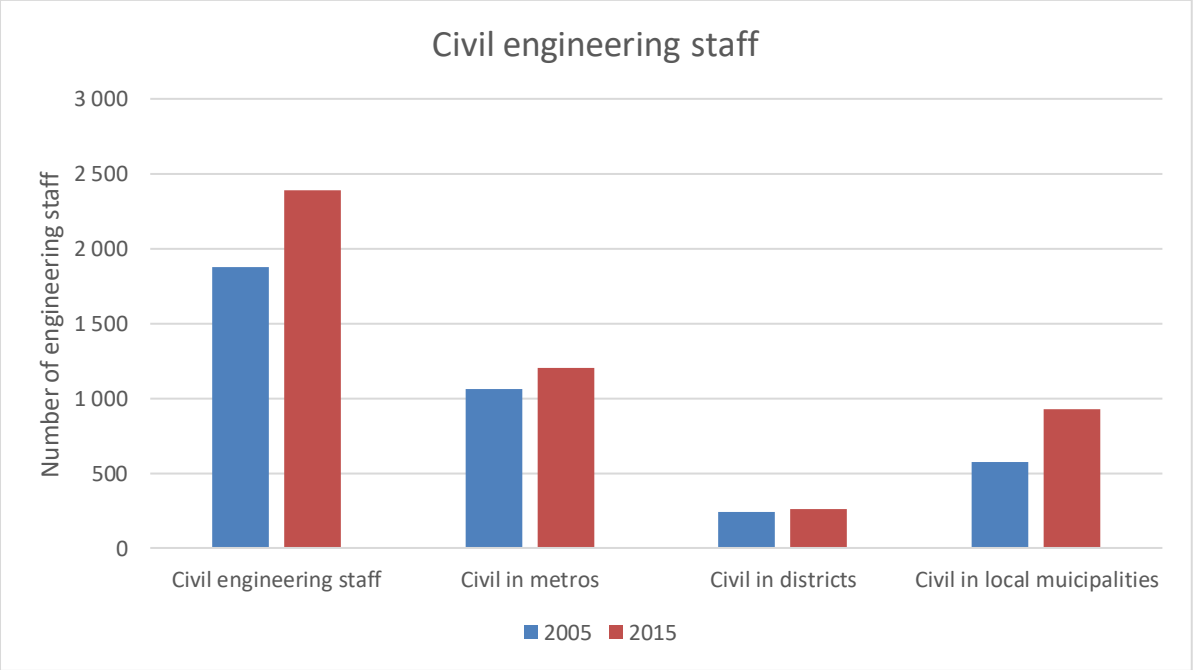
- 2 387 civil engineers, technologists and technicians
- 28 municipalities with no civil engineering staff
- 153 municipalities with female civil engineering staff
- 202 municipalities with no engineers

The comparison between number of civil engineering professionals in 2005 and 2015 is reflected in the Table 5.13 and illustrated in Figure 5.19

Table 5.13: Civil Engineering Metrics 2005 Compared with 2015

| Totals | 2005 | 2015 | | Number of municipalities with | 2005 | 2015 |
|---|---|---|---|---|---|---|
| Civil engineering staff | 1 875 | 2 387 | | No civil engineering staff | 82 | 28 |
| Civil in metros | 1 059 | 1 201 | | No civil engineers | 126 | 202 |
| Civil in districts | 240 | 260 | | One civil engineering staff member | 60 | 41 |
| Civil in locals | 576 | 926 | | Only civil engineering technician | 95 | 81 |
| Population | 47 640 million | 54 432 million | | Female civil engineering staff | 56 | 153 |
| Households | 11 754 million | 16 122 million | | Registered civil engineering staff | 85 | 56 |

Figure 5.19: Number of engineering staff in municipalities.

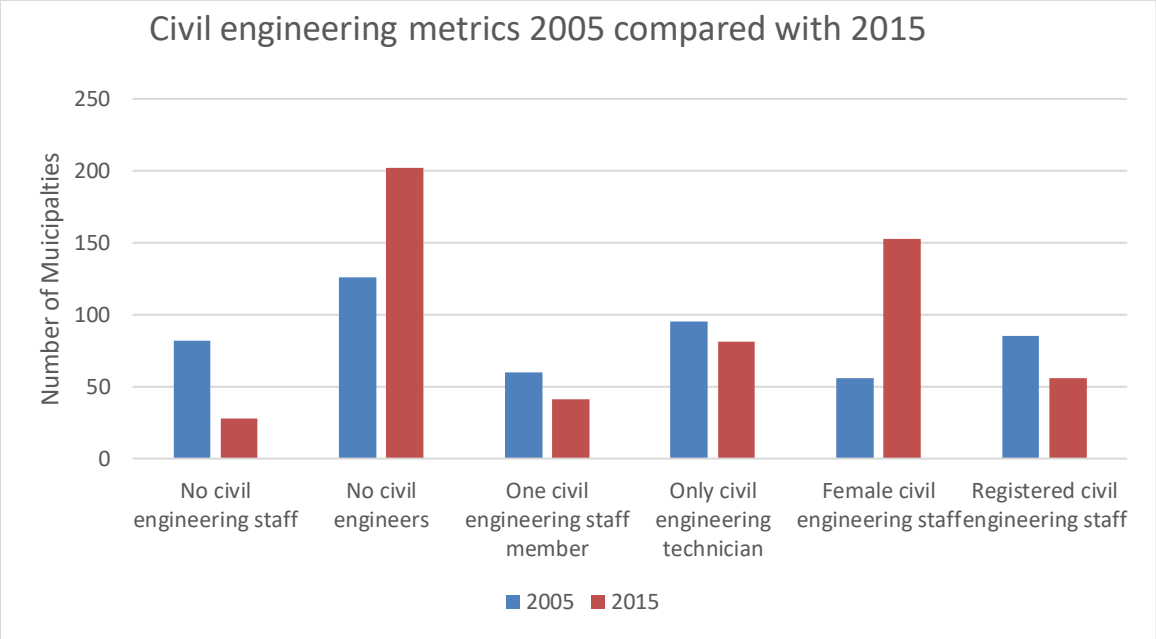



Every municipality was contacted and asked to furnish the details of each civil engineering staff member, including age, race, gender, engineering category (engineer, technologist or technician) and professional registration status. Of the 278 municipalities, only 18 did not respond. In such cases, neighbouring municipalities were contacted to establish whether their neighbours had civil engineering staff or not. Where they did have staff, data was imputed using staff profiles of similarly sized municipalities. The bulk of responses were received in the second half of 2015 and

early 2016. Because staff turnover is inevitable, the numbers are not exact but are very close to the current reality.

Of significance is the fact that there are now over 500 more civil engineering staff and the number of women has increased, as has the number of black civil engineering staff. The number of municipalities without any civil engineering staff has reduced from 82 in 2005 to 28, the number with only one from 60 to 41 as shown in Figure 5.20 and the overall ratio of civil engineering staff per 100 000 population has increased from 3,9 in 2005 to 4,4 %.

Figure 5.20: Civil engineering metrics 2005 compared with 2015




Unfortunately, although there has been an increase in the number of civil engineering staff, there has also been a massive increase in the number of households to be serviced (37% increase in households versus 14% increase in population). The number of municipalities with no civil engineers on their staff has increased from 126 to 202. 28 have no civil engineering staff at all, and in the remaining 174, 81 have only technicians, 17 technologists and 76 have a mixture of technicians and technologists. The number of engineers registered with the Engineering Council of South Africa has decreased from 455 to 294, while the number of non-registered staff has increased from 1 420 to 2 094, and the average age of civil engineering staff has dropped from 46 to 38. This implies that there is a reduction in the number of experienced, registered

professionals to manage, supervise and train a growing number of inexperienced staff. With the increase in numbers, the experienced engineers find it more difficult to train and prepare the inexperienced staff to ultimately register professionally. It was found that generally the rural local municipalities experienced a concerning reduction in engineering staff because of urbanisation over the period.

The approved staff compliment for SRVM is 210. However, due to financial constraints, only 172 posts are filled. Provision has been made for 22 vacancies in the operating budget and 51 vacancies are not funded. There has been budget provision for five vacancies in water and two in sewerage, although these have not been filled. The Technical Department as a result operates with a 40% vacancy rate. The position of Technical Director is filled by a technician who is not registered with the Engineering Council of South Africa.

The Water and Sanitation Division is run by two Superintendents who report directly to the Technical Director. Based on the assumption that the Director spends some 60% of his time on Water and Sanitation, this equates to 0.3 management positions per 5 000 households, which is clearly very low for effective management.

There are three Foremen (1 x Addo, 1 x Paterson, 1 x Kirkwood) with maintenance teams and vehicles. This equates to 1, 2 maintenance teams per 5 000 households. Interviews conducted at the Water and Waste Water treatment plants indicated that although the operators were keen and seemed interested in their work, they were unqualified and had received little ‘on the job’ training. Their knowledge and understanding of the treatment processes, plant mechanics and dynamics were limited in spite of the National Qualifications Framework training.

Several of the current WTW operators are casual employees whose employment status gives them no secure future or continuity with the municipality. They have also received no in-depth training into the operational and maintenance requirements of plants or the duties of a qualified and trained operator. Nevertheless, they are expected to shoulder the responsibilities of total control and operation of the plants. There is limited capacity in the department. Process controllers are however being trained now. As a result of these staffing challenges at the municipality, there is limited in-house expertise for design or management of consultants’ work and contracts

management when interacting with contractor.

Central to a functional, well-performing municipality is sound political leadership at national, provincial and local government. Politically, each Council, through its committees, make staff appointments, approve budgets and support the municipal officials with public interactions regarding policies, by-laws and debt recoveries. This role is often crippled by changes in portfolio councillors and chairpersons after each municipal election cycle.

The political leadership needs to illustrate a strong commitment to the principles of good governance. The role of politicians can become destructive in two ways:

a) An “over involved” Council (or members of Council), i.e., when a political outcome is considered more important than a good service outcome. Typical examples are that an appointment for a vacancy could be made based on that person’s family or political connections, rather than the relevant experience and qualifications. Once the appointment has been made, underperformance will result in poor service delivery, and this situation can only be rectified when the position becomes vacant again. Consequently, funding or budget items to ensure safe and quality water and sanitation services could receive less priority than, for example, road repairs or surfacing.
b) An “under involved” Council (or members of Council) typically includes members involved with the Technical/Engineering Services portfolio electing not to visit the WTW and WWTW sites to gain understanding of the importance of safe and quality water supply, etc. This lack of understanding could result in projects and budgets not being approved for key improvements and positions.

In 2013, more than 750 officials from municipalities, the media and the construction industry at large attended the 77$^{th}$ Annual Continuous Personal Development Accredited Institute of Municipal Engineering of South Africa Conference during October in the city of Port Elizabeth. The theme for the 2013 Conference was “Municipal Engineering: Meeting People’s Needs”, which saw a strong focus on turn-around strategies aimed at tackling issues such as unlawful strikes, failures in water supply, sewerage conveyance and treatment systems and poor road maintenance conditions. A survey was conducted among the participants who included 152 municipal officials and 89 engineering consultants to identify the probable reasons for

poor service delivery in municipalities in order of priority. Nine probable reasons for poor service delivery were identified and listed on the questionnaire. The respondents were asked to rank them in order priority. The results of the opinion poll are presented in Table 5.14.

Table 5.14: Results of Opinion Pole

| Importance | Municipal (152) | Consultant (89) |
|---|---|---|
| 1 | Political Interference | Political Interference |
| 2 | Inefficient procurement system | Poor leadership |
| 3 | Lack of training/experience/ qualifications | Lack of training/ experience/qualifications |
| 4 | Poor leadership | Lack of accountability |
| 5 | Lack of ethics/discipline | Lack of ethics/discipline |
| 6 | Understaffed technical departments | Inefficient procurement system |
| 7 | Lack of accountability | Understaffed technical departments |
| 8 | Funding shortage/poor debt collection | Mismanagement of funds |
| 9 | Mismanagement of funds | Funding shortage/ poor debt collection |

For both the 152 municipal officials and 89 consulting engineers, the number one reason for poor service delivery by municipalities in South Africa was political interference. This includes instances where municipal officials used party political processes to subvert council procedures. Party political factionalism also impacts on the stability and effectiveness of local government. The Municipal Structures Act (1998) and the Local Government: Municipal Systems Amendment Act (2011), amongst others, were designed and promulgated to remedy some of the failings of local government emanating from political interference and sets out mechanisms to enable the professionalization of local government. The Act's intention is to prevent undue influence by political officials or political parties over the administrative function of a municipality. However implementation of the Act has proved a challenge in certain municipalities as it has become clear that there limitations to the extent to which

legislative provisions can address political culture and behaviour.

## 5.8 Municipal Financial Management

Financial management in municipalities involves the management of revenue, planning and budgeting, cash and expenditure management, asset management, monitoring and reporting. The financial year of South African municipalities runs from 1 July of each year to 30 June the following year. Municipalities are required to prepare budgets for each financial year, which municipal councils must approve before the new financial year begins. This is done after proper planning and consultation with ward committees and other stakeholder groups in their areas of jurisdiction. Effective financial management practices are pertinent to the sustainability of any organization. It is against this backdrop that the Municipal Finance Management Act (2003) was promulgated to set a sound financial base and provide a number of mechanisms and guidelines for strengthening accountability to ensure the sustainability for service delivery in municipalities.

The Auditor-General of South Africa audits municipal financial statements. The objective of an audit of financial statements is to express an audit opinion on whether the financial statements fairly present the financial position of audited municipalities at financial year-end and the results of their operations for that financial year. An analysis conducted by South African Local Government Association reveals that the factors that contribute to unfavourable audit opinions are the following:

- Non-compliance with the applicable accounting standards,
- Inadequate preparation of asset registers,
- Poor systems of internal control,
- Weaknesses in accounting processes/reconciliations, and
- Valuation and completeness of assets and liabilities. (Salga 2010)

The annual audits examine the following aspects:

- Fair presentation and absence of material misstatements in financial statements.
- Reliable and credible performance information for purposes of reporting on predetermined performance objectives.
- Compliance with all legislation governing financial matters.

The audited institution can achieve a clean audit when their financial statements are unqualified, with no reported audit findings in respect of either reporting on predetermined objectives or compliance with legislation.

According to the Auditor General's Report of 2016, over the past five years, from the period 2010-11 to 2014-15, municipalities in South Africa have reported a steady improvement in audit outcomes, with 53% having improved, while 13% regressed and 34% remained unchanged. The audit outcomes of six of the eight metro councils, 21 (49%) district municipalities and 116 (52%) local municipalities have improved.

The expenditure budget for the municipal sphere in 2014-15 totalled R 347 billion. Municipalities with clean audit opinions represent R 134 billion (39%) of this amount, while those with unqualified opinions with findings represent R 143 billion (41%). Municipalities with qualified audit opinions made up R 49 billion (14%) of the total budget, while those with adverse and disclaimed opinions represented R 20 billion (6%). The municipalities with outstanding audits constitute R 1 billion of the total expenditure budget. A detailed analysis of the financial status quo of the SRVM was conducted using the financial statements shown in Table 5.15 using the financial statements of the municipality.

Table 5.15: Financial Information for Sundays River Valley Municipality

| **All values: R 000** | **2015/16** | **2014/15** | **2013/14** | **2012/13** |
|---|---|---|---|---|
| **AUDIT OUTCOME** | Qualified opinion | Disclaimer of audit opinion | Disclaimer of audit opinion | Disclaimer of audit opinion |
| **FINANCIAL PERFORMANCE** | | | | |
| Property rates | 13 800 | 28 889 | 13 933 | 13 051 |
| Service charges | 24 934 | 55 181 | 45 233 | 38 645 |
| Investment revenue | 840 | 470 | 549 | 288 |
| Transfers recognised – operational | 41 690 | 53 881 | 50 327 | 42 607 |
| Other own revenue | 11 606 | 32 718 | 12 715 | 7 362 |
| **Total Revenue (excluding capital transfers and contributions)** | **92 871** | **171 139** | **122 756** | **101 953** |
| Employee costs | 42 315 | 41 132 | 37 667 | 31 949 |
| Remuneration of councillors | 9 664 | 5 369 | 5 519 | 4 930 |
| Depreciation & asset impairment | - | 28 989 | 19 310 | 267 |
| Finance charges | 1 009 | 2 849 | 328 | 2 720 |
| Materials and bulk purchases | 28 533 | 23 612 | 26 551 | 18 117 |
| Transfers and grants | 757 | - | 8 043 | 11 200 |
| Other expenditure | 46 404 | 83 627 | 61 919 | 33 361 |
| **Total Expenditure** | **128 682** | **185 576** | **159 337** | **102 543** |
| **Surplus/(Deficit)** | **(35 812)** | **(14 438)** | **(36 580)** | **(590)** |

| | | | | |
|---|---|---|---|---|
| Transfers recognised – capital | 36 616 | 36 377 | 22 390 | 24 065 |
| Contributions recognised – capital & contributed assets | - | - | - | - |

| | | | | |
|---|---|---|---|---|
| **Surplus/(deficit) after capital transfers & contributions** | **804** | **21 939** | **(14 190)** | **23 474** |
| Share of surplus/(deficit) of associate | - | - | - | - |
| **Surplus/(deficit) for the year** | **804** | **21 939** | **(14 190)** | **23 474** |
| **CAPITAL EXPENDITURE & FUNDS SOURCES** | | | | |
| **Capital expenditure** | **36 588** | **43 421** | **15 139** | **45 944** |
| Transfers recognised – capital | 34 457 | 33 950 | 18 170 | 42 362 |
| Public contributions & donations | - | - | (6 476) | - |
| Borrowing | 566 | 2 582 | 3 133 | 2 375 |
| Internally generated funds | 1 564 | 6 889 | 314 | 1 207 |
| **Total sources of capital funds** | **36 588** | **43 421** | **15 139** | **45 944** |
| **FINANCIAL POSITION** | | | | |
| Total current assets | 262 140 | 43 688 | 17 809 | 45 100 |
| Total non-current assets | 549 606 | 517 424 | 395 711 | 383 936 |
| Total current liabilities | 24 758 | 50 537 | 38 274 | 45 894 |
| Total non-current liabilities | 261 204 | 38 999 | 17 288 | 11 776 |
| **Community wealth/equity** | **525 783** | **471 577** | **357 957** | **371 366** |
| **CASH FLOWS** | | | | |
| Net cash from (used) operating | 40 580 | 67 388 | 16 264 | 237 |
| Net cash from (used) investing | (40 080) | (43 069) | (15 139) | (1 200) |
| Net cash from (used) financing | (750) | (4 368) | (416) | 437 |
| **Cash/cash equivalents at the year end** | **362** | **20 512** | **6 999** | **1 120** |
| **UNAUTHORISED, IRREGULAR, FRUITLESS & WASTEFUL EXPENDITURE** | | | | |
| Unauthorised expenditure | n/a | 11 297 | 64 800 | n/a |
| Irregular expenditure | 179,9 | 72 363 | 112 986 | n/a |
| Fruitless & wasteful expenditure | n/a | 692 | 496 | n/a |
| **SOURCE** | S71 Unaudited | S71 Audited | S71 Audited | S71 Audited |

The latest audit opinion released in 2016 for the SRVM was an adverse opinion. This implies that the municipal financial statements are misrepresented, misstated and do not accurately reflect the municipalities financial performance and health. It indicated underlying issues of wrongdoing and is a red flag for investors. This was, however, an improvement from the previous three consecutive years when the municipal audits were disclaimer opinions.(Auditor-General 2015). This implied that the Auditor-General did not have all of the underlying documentation needed to determine an opinion based on the financial statements presented by the municipality. The lack of underlying documentation and the amounts in question may have been so great so that it is impossible to give any opinion on all.

The Auditor General's reports further stated that the leadership of the municipality was not able to implement effective human resources management to ensure that adequate and sufficiently skilled resources were in place, performance was monitored and consequence management was applied where necessary. This contributed to the material misstatements identified in the financial statements and the non-compliance with laws and regulations. The municipality did not prepare regular, accurate and complete financial reports and did not perform daily and monthly processing and reconciliation of transactions throughout the financial year. It did not have proper record management system to ensure that complete, relevant and accurate information was accessible and available to support financial and performance reporting. Review processes to monitor compliance with all applicable laws and regulations within the municipality were non-existent. Consequently, non-compliance with laws and regulations was not effectively identified or prevented and municipal officials were not held accountable for transgressions in this regard.
The Section 71 reports from the municipality indicated that total outstanding debt amounted to R 216 million as at end of September 2016. Debtors that are older than 90 days amounted to R 188 million and were constant at 94% of the total debt owed.

Of the total debt owed R 176, 3 million (88%) was owed by households, followed by 'Businesses' at R 13,8 million (6,9%) and Government departments at R 10,2 million (5,1%). The National Department of Public Works is listed amongst the top 10 debtors at the end of September, owing the municipality R 3,97 million. Provincial Treasury assists the municipality in collecting outstanding government department debt.

The net debtors' days' ratio for 2015/16 revealed a collection of 105 days, well above the norm of 30 days, highlighting poor enforcement of the credit control policies. Collection of debt outstanding over 90 days is evidently a challenge. The Municipality did not have a documented and approved procedure to instruct the technical department to disconnect electricity/water when accounts are outstanding.

As at 30 September 2016, the revenue collection rate of the Municipality was 31%. It was found that the municipality did not have systems to account for revenue and ensure that it was completely recorded. It is therefore impractical to determine the full extent of the understatement of revenue. This has led to the Municipality's inability to carry out basic operations and maintenance in a proactive manner because of luck of

finances.

In the 2014/15 financial year the Municipality incurred R 11 297 million unauthorised expenditure, which implied that expenditure was over the budget; and R 72 363 million irregular expenditure where municipal supply chain processes were not adhered to. This amount increased to R 179,9 million in the 2015/16 financial year. A further R 692 000 was lost to fruitless and wasteful expenditure. This increased to R 7,4 million in the 2015/16 financial year. This included payment of interest to service providers, which was not budgeted for due to late payment of accounts.

The Municipality did not comply with legislation with regard strategic planning and performance management. The adopted IDP did not reflect and identify financial plan and key performance indicators and targets, as required by the municipal planning and performance. The local community was not afforded the opportunity to comment on the final draft of the IDP before adoption. The performance system and related controls were inadequate as they did not describe and represent the process of performance planning, monitoring, measurement, review, reporting, improvement, and how it was conducted as required by Regulation 7 of the municipal planning and performance management regulations.

In order to ensure financial sustainability, it is important that politicians utilize municipal public accounts committees to drive, oversee and entrench good financial oversight. Credible information needed to achieve clean audits will only start to emerge with committed leadership and oversight. A fundamental mind shift is needed in many municipalities. Public funds must be managed in a rigorous transparent and accountable manner.

### 5.9 Municipal Survey and Assessment of Water Service Delivery

The ministry of COGTA conducted a review of South Africa's 278 municipalities in 2014, which revealed that rural municipalities in South Africa are by and large not sustainable. The ratings criteria was based on the following five pillars of the Back to Basics programme which was launched to address the declining provision of core services that local government provides, namely, clean drinking water, sanitation, electricity, shelter, waste removal and roads, which are basic human rights and

essential components of the right to dignity enshrined in the Constitution and Bill of Rights: The five pillars are the following:

- Putting people and their concerns first and ensuring constant contact with communities through effective public participation platforms thereby establishing a bottom up approach to planning and development;
- Creating conditions for decent living by consistently delivering municipal services to the right quality and standard. This includes planning for and delivery of infrastructure and amenities, maintenance and upkeep, including the requisite budgeting to do this, and ensuring that there are no failures in services, and where there are, restore services with urgency;
- Being well governed and demonstrating good governance and administration, which includes cutting wastage, spending public funds prudently, hiring competent staff, and ensuring transparency and accountability;
- Ensuring sound financial management and accounting, and prudently management of resources so as to sustainably deliver services and bring development to communities; and
- Building and maintaining sound institutional and administrative capabilities, administered and managed by dedicated and skilled personnel at all levels. (Cogta 2016).

In the review, the top third of municipalities were found to have the basics right and were performing their functions at least adequately. Within this group, there are a small group of top performers that are doing extremely well. In these municipalities, there were innovative practices to ensure sustainability and resilience. This small core represents the desired (ideal) state for all the municipalities.

The middle third of municipalities are fairly functional, and overall performance is average. While the basics are mostly in place and the municipalities can deliver on the main functions of local government, some areas of poor performance or decline found are worrying signs.

The bottom third of municipalities are frankly dysfunctional, and significant work is required to have them function properly. Among others are found endemic corruption, councils which do not function, no structured community engagement, and poor

financial management leading to continuous negative audit outcomes. There is a poor record of service delivery and functions such as fixing potholes, collecting refuse, maintaining public places or fixing street lights are not performed. While most of the necessary resources to render the functions or maintain the systems are available, the basic mechanisms to perform these functions are often not in place. It is in these municipalities that are failing people dramatically, and where intervention is required urgently in order to correct the decay in the system. (Cogta 2014b). The SRVM was found to be dysfunctional in 2014. The situation has improved as subsequent reviews have indicated, but the Municipality still remains unsustainable.

Since 2005, Department of Water affairs (DWA): Water Services – Planning and Information has also conducted a “Strategic Gap Analysis of Water Services” survey (also known as the “Strategic Self-Assessment (SSA)” survey) at all WSAs in South Africa. To-date, this survey has been completed on-line using the electronic Water Quality Management System (eWQMS), and aims to generate a sustainability risk profile which assists WSAs to identify any gaps in ensuring effective and sustainable municipal water services. Information gathered provides an indication of the overall business health of WSAs, and assists DWA to identify critical municipal areas that require support. This is important considering that the data and information informs the National Turnaround Strategy for Local Government.

Structured interviews with three municipal officials using the Municipal Strategic Self-Assessment (MuSSA) survey based on a predetermined and standardised set of questions were conducted. Five questions per business area that cover 18 key business health attributes were asked and used to provide strategic vulnerability flags. The scores were translated into percentages and a dashboard was generated that presents a vulnerability snapshot of the overall water and sanitation business of the Municipality. The three respondents who hold managerial positions were from the Technical, Finance and Human Resources Departments.

The Questionnaire Responses (Questions and Answers) from the SRVM are presented in Appendix A

The vulnerability index is as follows:

- 0 – 50% ( Extreme vulnerability)

- 50 – 60% (High vulnerability)
- 60 – 75 % ( Moderate vulnerability)
- 75 – 100 % ( Low vulnerability)

The questionnaire has structured questions which had four answers. Each of the answers were given a weighing of vulnerability as illustrated above. The answers to the questions are given a shade of blue in Appendix A

Based on the assessment, the top areas of vulnerability for the SRVM are the following:

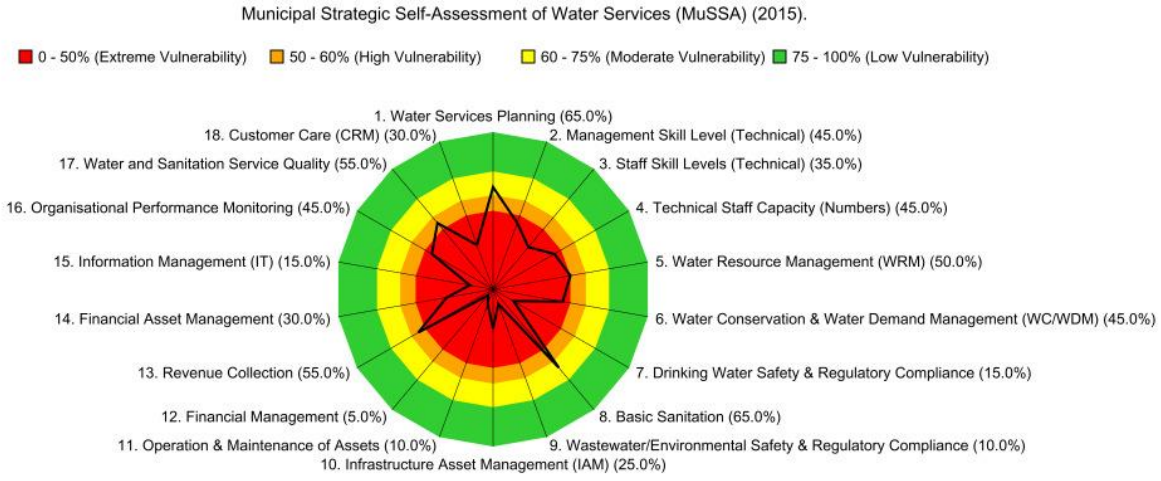
• Management skill level (technical) (45.0%)
• Staff skill levels (technical) (35.0%)
• Technical stuff capacity (numbers) (45.0%)
• WCDM (45.0%)
• Drinking water safety and regulation compliance (15.0%)
• Wastewater/environmental safety & regulation compliance (10.0%)
• IAM (25.0%)
• Operation and maintenance of assets (10.0%)
• Financial management (5.0%)
• Financial asset management (30.0%)
• Information management (IT) (15.0%)
• Organisational performance monitoring (45.0%)
• Customer care management (CRM) (30.0%)

The results of the municipal survey of the water business are presented in Table 5.16 and Figure 5.21 below indicating the vulnerability of the different components and the associated back to basics pillar.

Table 5.16**:** Results of Municipal Survey on the Water Business

| Back to Basic Pillar | Water Business Health Attribute | Vulnerability Index |
|---|---|---|
| Putting people first | Water and sanitation service quality | High |
| | Customer care management (CRM) | Extremely high |
| Basic service delivery | Water services planning | Moderate |
| | Water resources management (WRM) | High |
| | Water conservation and demand management (WCDM) | Extremely high |
| | Drinking water safety and regulation compliance | Extremely high |
| | Basic sanitation | Moderate |
| | Wastewater/ environmental safety and regulatory compliance | Extremely high |
| | Infrastructure asset management (IAM) | Extremely high |
| | Operations and maintenance of assets | Extremely high |
| Good governance | Information technology (IT) | Extremely high |
| | Organizational performance monitoring | Extremely high |
| Sound financial management | Financial management | Extremely high |
| | Revenue collection | High |
| | Financial asset management | Extremely high |
| Building capable local government institutions | Management skill level (technical) | Extremely High |
| | Staff skills level (technical) | Extremely High |
| | Technical staff (numbers) | Extremely High |

Figure 5.21: MuSSA assessment results



The microbiological drinking-water quality compliance for *E.coli* (or faecal coliforms) for the communities that were monitored for in the last 12 months were all complaint (Appendix G). However the municipality wasn't compliant in previous years. The water supply schemes, WTWs, process controllers, monitoring programmes, sample points, laboratories, results, procedures, protocols, etc. are not all registered/frequently updated with the Regulator via the Blue Drop System (BDS) of the DWS. This resulted in the vulnerability score of 15%.

The municipality doesn't have a maintenance workshop/store that is secure and stocked with essential equipment (e.g. spare parts) and tools. Appropriate water and sanitation services infrastructure/equipment planned/preventative maintenance schedules are not developed. As a result the municipality is not carrying out operations and maintenance at optimal levels. The score operation and maintenance of assets is 10% which is highly vulnerable.

The Staff Skill Levels vulnerability score is 35%. This is because some of the WTWs are operated by staff with the correct skills/qualifications and experience (as per Regulation 2834). This also applies to the WWTW's. The Water and sanitation system plumbers, millwrights, mechanics and electricians do not have the correct skills/qualifications and experience. The municipality sends their staff to attend appropriate water and sanitation services skills development/training (including safety) (e.g. ESETA courses) on a regular basis.

The municipality doesn't have sufficient technical management staff (appropriate number of staff - e.g., at least 5 posts per 100,000). Technical management staff have the correct skills/qualifications and experience as per Job Description requirements but some of the posts are vacant. However none of the staff are not registered with professional bodies like Engineering Council of South Africa.

The WSA has a council approved Water Conservation and Water Demand Strategy which includes a standard water balance. However the municipality is not implementing appropriate intervention programmes to reduce NRW (e.g. minimisation of night flows through pressure management, removal of unlawful connections, leak detection and repairs, consumer education/awareness).As a result the vulnerability score for WCDM was 45%.

Water meters in the municipality are read on a monthly basis. WSA does not have fully cost reflective Water and Sanitation tariffs (which take into account cost of maintenance and renewal of purification plants and networks, and the cost of new infrastructure). The revenue collection rate is less than 50%. This has resulted in the municipality being grant dependant like the equitable share from national government.

It is clear from the above findings of the MuSSA survey that the municipal water services provision is highly vulnerable and as a result unsustainable. Realistic actions by the municipality and effective support by key stakeholders to mitigate the identified vulnerabilities and improve water services performance should be identified and initiated.

# Chapter 6.
# CONCLUSION AND RECOMMENDATIONS

## 6.1 Conclusion

In this research, the following research question was addressed: Why are local government water governance institutions failing to meet their obligations of supplying clean, adequate drinking water to communities in rural areas of the Eastern Cape?

The aim of the study was the following:

- Reviewing the concepts of the water governance, sustainability and IWRM at municipal level in a rural setting in South Africa.
- Conducting a holistic evaluation of the WRM framework and identifying operational challenges to the provision of clean drinking water to rural communities.
- Determining the factors that have undermined water provision in rural municipalities
- Proposing recommendations to address the operational challenges of water governance in rural municipalities.

The holistic management of freshwater as a finite and valuable resource, and the integration of sectoral water plans and programmes within the framework of national economic and social policy, are of paramount importance for action in the 1990's and beyond. The concepts of water governance, sustainability and IWRM at rural municipal level were reviewed and articulated in Chapter 3 and a holistic evaluation of the WRM framework done to identify the challenges to the provision of clean drinking water to rural communities.

The local municipalities of Eastern Cape have been facing a number of challenges in the provision of clean portable water to their communities. In this research, the root causes of the failure of local government institutions in their mandate as water services authorities and providers were critically analyzed. The results gathered in the research illustrate that institutional incapacity in rural municipalities and widespread poverty have undermined the sustainability of the local government sector, leading to a considerable breakdown in services delivery.

There is a mounting body of anecdotal evidence that suggests a growing, and indeed severe, condition of dysfunction in South African municipalities as the organizational entities in the local sphere of government. Recent trends point to the fact that national and provincial government interventions in the local sphere of government in South Africa have become more commonplace. For instance On 23rd February 2010 the SRVM was placed under administration (SRVM 2011). According to the constitution of the Republic of South Africa the Provincial Executive has the authority to intervene in the affairs of municipalities where there is a failure to fulfil executive obligations in terms of section 139.The municipal manager and the chief financial officer were both suspended and Administrator was appointed to monitor and oversee the intervention. The service delivery protests are a reflection of community frustration with these failures, especially in economically marginalised communities that experience real or perceived indifference from government officials and politicians.

The key findings which constitute challenges at the SRVM in the provision of water to the communities are the following:

- A collapse in core municipal infrastructure services of communities, which has resulted in services either not being provided at all or provided at unacceptably low levels. For instance, the SRVM has no services agreement with its communities and therefore members of the community have found it difficult to hold the municipal officials accountable for the low level of service delivery. The water services quality survey revealed that only 39 % of the consumers perceive the tap water the municipality provides to be safe to drink. Most of the consumers described the municipality's water services provision to their households as poor**.** 69 % of the consumers believe the municipality is not competent to deliver a good water service in normal circumstances let alone during drought conditions. Water conservation and demand management is not implemented as 66% of the households admitted that they do not know how much water they use per month. A qualitative status quo assessment of the Water Conservation and Demand Management at the municipality pointed to the fact that the municipality isn't practicing WCDM.
- Slow or inadequate responses to service delivery challenges are, in turn, linked to the breakdown of trust in the institutions and councillors by communities. The

customer services centre is not fully established as has been established by the MuSSA survey.

- Social distance on the part of public representatives is a major cause for concern. This reflects inadequate public participation and poorly functioning ward councillors and committees. The top down development and planning approach has, by and large, been practiced, and as a result, communities feel left out.
- The municipality is not driven by appropriately skilled personnel. There are far too many instances both of inappropriate placements and skills not measuring up to requirements.
- Lack of adequate managerial capability to address complex service delivery requirements is apparent. This was established by the MuSSA survey that was conducted to assess the vulnerability of the municipality to fulfil their mandate of water services among others.
- A predominance of open-ended challenges (compared to challenges with definitive solutions) is evident.Inadequate use of conventional business high performance drivers, e.g., market/customer orientation, managerial incentives, and performance accountability is apparent.
- The viability of municipalities is a key concern. The low rate of collection of revenue continues to undermine the ability of municipalities to deliver services to communities. The MUSSA Assessment (Appendix A) study that was conducted at the municipality indicated that the revenue collection is below 50%. Payment levels for municipal services at the municipality are low. Without appropriate funding, it becomes difficult for local government to render services. Consequently the capacity to deliver regular and constant services becomes compromised.
- In general, the number of registered poor households more or less correlates with the poverty indexes. These households receive Free Basic Services (FBS), which are funded from the Equitable Share fund. However, the Equitable Share Fund allocations from national government to the municipality far exceed the cost of FBS. There is, however, a problem with consumption of water in excess of the free portion for which poor households are being billed but find difficult, unaffordable, or impossible to pay, and this adds to the increasing amount of

outstanding debt. The water quality survey found that the vast majority of the consumers do not know how much water they are using. Because the rates and service charges of the majority of poor households are being paid for from Equitable Share Fund through the FBS system, rates and service charges are not the main reason for the increasing arrear debt situation (except for the portion of water consumption in excess of the FBS allocation). It can therefore be concluded that the growth in arrear debt is mainly due to non-payment by ratepayers who do not qualify for FBS, and who should, technically speaking, be able to pay.

- The municipality has had governance issues that negatively impact or delay service delivery. This resulted in the municipality being placed under administration in 2011.

## 6.2 Recommendations

The sustainability of the water and sanitation services is not something that can be addressed in isolation by municipalities, and municipalities' abilities to perform are severely affected by mainly technical and funding capacity. To address these challenges WSAs have to improve on service delivery by doing the following:

- providing a mixture of self-actuated internal mechanisms
- strengthening of internal financial and technical management, and
- Involving the private sector.

These approaches are not mutually exclusive and combinations thereof will have varying affects.

Based on the research findings, the following recommendations emanate from the empirical study and literature review:

- Managerial autonomy: Strengthen empowered decision-making with sound technical management improves efficiency of services and supporting aspects, including operations and maintenance.
- Performance accountability: Regular performance review and accountability is a key to improved service delivery, and both success and failure must be viewed

in a positive manner to learn from and to improve strategies and implementation.

- Strong leadership: Committed and aligned top management that provides clear leadership is a strong enabler, which can be used to address and overcome poor performance. It also allows creativity which requires pro-active benchmarking to cross-fertilize best practice and build a desire for peer excellence.
- There is a need for local government to improve its capacity and enhance and professional development. The training processes of the past have been lost, and the gap between the demand for service delivery and available capacity is growing. Assuming that an applicant with a tertiary engineering qualification can grow into any post without working in a community of expert practice is a fallacy.

  Instead of restructuring, structures should be rebuilt. Instead of politicising appointments, they should be professionalized. Professional judgment should be highly valued. In the medium to long term, selection based on professional registration and experience is essential. Where suitably qualified people cannot currently be found, staff should be sought through secondment and by tapping into the pool of retirees who are willing to offer their expertise until such time as in-house staff are adequately trained.
- Political support: Political support is a necessary enabler without which reforms cannot be implemented swiftly and efficiently. It is, therefore, imperative that political stakeholders and community leaders are informed regularly on both progress and challenges facing the delivery of services.
- Use of incentives: Adopted by some WSA, incentives linked to key performance areas can support enhanced performance (recognition, awards, cash rewards, etc.).
- Accurate meter reading and the processing thereof are the first and most important steps in the rendering of a municipal bill. If the integrity of the meters, the accuracy of the readings and the general composition of the municipal bill are under suspicion and questioned, ratepayers are reluctant to pay, and this results in increased arrear debt. Municipalities should ensure that meter reading is done in a robust and transparent manner.

- Revenue enhancement through encouraging a culture of payment for services rendered may resolve the issue of non-payment for services, which is one of the most serious threats for survival and sustainability of municipalities in general. Non-payment results in financial constraints and cash flow problems that negatively impact on service delivery and improvements and maintenance of assets, which again give rise to low payment levels. Because of cash flow problems, municipalities are forced to curtail spending on service delivery improvements and specifically on routine maintenance.
- It is critical that municipalities ensure that municipal debt is collected within the stipulated time according to financial legislation. This is because arrear debts are increasing rapidly at most municipalities and have accumulated to millions of Rand, which could pay for improved infrastructure maintenance and service delivery in general (and reduce tariffs).
- It is important that municipal managers and senior managers improve financial and performance management by implementing audit action plans to address the audit findings as well as the root causes of the audit findings. Record keeping at the municipalities also requires improvement to ensure that the basic controls around transactions and reconciliations are in place. Monitoring and oversight through regular and credible reporting on important matters such as supply chain and contract management would prove helpful.
- Well-functioning audit committees and the support of internal audit units might serve to enhance governance at these municipalities. It is important that Councils and municipal management implement the recommendations of the audit committees and use the internal audit units to identify risks and the controls that can be implemented to mitigate such risks.

# REFERENCES


AK, G & Schwab, M 2012, 'An assessment of water governance trends: The case of Bangladesh', *Water policy*, vol. 14, no. 5, pp. 821-40.

Al-Saidi, M 2017, 'Conflicts and security in integrated water resources management', *Environmental Science & Policy*, vol. 73, pp. 38-44.

Anderson, A, Karar, E & Farolfi, S 2008, 'Synthesis: IWRM lessons for implementation', *Water SA*, vol. 34, pp. 665-9.

Auditor-General 2015, 'Auditor-General Report 2015. '.

Bakker, K 2012, 'Water security: research challenges and opportunities', *Science*, vol. 337, no. 6097, pp. 914-5.

Barraqué, B 2003, 'Past and future sustainability of water policies in Europe', in *Natural Resources Forum*, vol. 27, pp. 200-11.

Benson, D, Gain, A & Rouillard, J 2015, 'Water governance in a comparative perspective: From IWRM to a'nexus' approach?', *Water Alternatives*, vol. 8, no. 1.

Biermann, F, Abbott, K, Andresen, S, Bäckstrand, K, Bernstein, S, Betsill, MM, Bulkeley, H, Cashore, B, Clapp, J & Folke, C 2012, 'Navigating the Anthropocene: improving earth system governance', *Science*, vol. 335, no. 6074, pp. 1306-7.

Biswas, AK 2008, 'Current directions: integrated water resources management–a second look', *Water International*, vol. 33, no. 3, pp. 274-8.

Canter, LW, Nelson, DI & Everett, JW 1992, 'Public perception of water quality risks-influencing factors and enhancement opportunities', *Journal of Environmental Systems*, vol. 22, no. 2.

Cassardo, C 2011, 'Maanging Water in a Charging World', *Water*, vol. 3, no. 2, pp. 618 - 28.

Chase, BM & Meadows, ME 2007, 'Late Quaternary dynamics of southern Africa's winter rainfall zone', *Earth-Science Reviews*, vol. 84, no. 3, pp. 103-38.

Chauke, KR & Sebola, MP 2016, 'Revenue collection in South Africa: a comparative analysis of South African Revenue Services and the South African municipalities', *Journal of Public Administration*, vol. 51, no. 3, pp. 423-35.

Cleaver, F & Hamada, K 2010, ''Good'water governance and gender equity: a troubled relationship', *Gender & Development*, vol. 18, no. 1, pp. 27-41.

Clifford-Holmes, JK, Palmer, CG, Chris, J & Slinger, JH 2016, 'Operational manifestations of institutional dysfunction in post-apartheid South Africa', *Water policy*, vol. 18, no. 4, pp. 998-1014.

Cogta 2014a, 'Corpotative Governance and Traditional Affairs (Cogta) 2014 Cogta Strategic Plan 2014 - 2019

'.

—— 2014b, 'The Presidential Local Government Summit- Back to Basics - Corpotative Governance and Traditional Affairs (Cogta)'.

—— 2016, 'Cooperative Governance Annual Performance Plan-Corpotative Governance and Traditional Affairs (Cogta)'.

Cohen, L, Manion, L & Morrison, K 2013, *Research methods in education*, Routledge.

Cosgrove, DPLaWJ 2015, 'Water Managment: Currrent and future challenges and research directions', *Water Resources Research*, vol. 51, pp. 4823 -39.

Creswell, JW 2013, *Research design: Qualitative, quantitative, and mixed methods approaches*, Sage publications.

Davies, MB & Hughes, N 2014, *Doing a successful research project: Using qualitative or quantitative methods*, Palgrave Macmillan.

Davis, MD 2007, 'Integrated water resource management and water sharing', *Journal of water resources planning and management*, vol. 133, no. 5, pp. 427-45.

de França Doria, M 2010, 'Factors influencing public perception of drinking water quality', *Water policy*, vol. 12, no. 1, pp. 1-19.

Deedat, H, Cottle, E, Xali, M & Pape, J 2009, *Cost Recovery and the Crisis of Service Delivery in South Africa*.

Denby, K 2013, 'Institutional integration and local level water access in the Inkomati water management area, South Africa', Norwegian University of Life Sciences, Ås.

Dennis, I 2012, 'Climate change vulnerability index for South African aquifers', *Water SA*, vol. 38, no. 3.

Derman, B & Manzungu, E 2016, 'The complex politics of water and power in Zimbabwe: IWRM in the Catchment Councils of Manyame, Mazowe and Sanyati (1993-2001)', *Water Alternatives*, vol. 9, no. 3, p. 513.

DiCicco-Bloom, B & Crabtree, BF 2006, 'The qualitative research interview', *Medical education*, vol. 40, no. 4, pp. 314-21.

Dungumaro, EW & Madulu, NF 2003, 'Public participation in integrated water resources management: the case of Tanzania', *Physics and Chemistry of the Earth, Parts A/B/C*, vol. 28, no. 20, pp. 1009-14.

DWS 2002, 'Free Basic Water Policy - Department of Water and Sanitation (DWS)'.

—— 2004, 'Water Conservation and Water Demand Managment Strategy for the Water Services Sector'.

—— 2005, ' Internal Strategic Perspective Fish to Tsitsikamma Water Management Area - Department of Water and Sanitation (DWS)'.

—— 2007, 'Free Basic Water Implementation Strategy: Consolidation and Maintening Version 4 - Department of Water and Sanitation ( DWS) '.

—— 2011, 'Introduction to the Blue Drop Programme & Handbook - Department of Water and Sanitation (DWS)'.

—— 2013a, 'Department of Water and Sanitation (DWS) Strategic Overview of the Water Sector in South Africa 2013'.

—— 2013b, 'National Water Policy. Department of Water and Sanitation (DWS)'.

—— 2013c, 'National Water Resources Stratregy. Water for an Equitable and Sustainable Future . June 2013 Second Edition. Department of Water and Sanitatioin (DWS)'.

Edelenbos, J, Steijn, B & Klijn, E-H 2010, 'Does Democratic Anchorage Matter?: An Inquiry Into the Relation Between Democratic Anchorage and Outcome of Dutch Environmental Projects', *The American Review of Public Administration*, vol. 40, no. 1, pp. 46-63.

Environment, ICoWat 1992, 'The Dublin Statement and the Conference on Water and the Environment: Development Issue for the 21st Century. 26th - 31st January'.

Farley, M & Liemberger, R 2005, 'Developing a non-revenue water reduction strategy: planning and implementing the strategy', *Water Science and Technology: Water Supply*, vol. 5, no. 1, pp. 41-50.

Fjeldstad, O-H 2004, 'What's trust got to do with it? Non-payment of service charges in local authorities in South Africa', *The Journal of Modern African Studies*, vol. 42, no. 4, pp. 539-62.

Forum, WE 2015, 'Global Risks 2015 10th Edition, World Economic Forum'.

Funke, N, Oelofse, S, Hattingh, J, Ashton, P & Turton, A 2007, 'IWRM in developing countries: Lessons from the Mhlatuze Catchment in South Africa', *Physics and Chemistry of the Earth, Parts A/B/C*, vol. 32, no. 15, pp. 1237-45.

Gain, AK, Rouillard, JJ & Benson, D 2013, 'Can integrated water resources management increase adaptive capacity to climate change adaptation? A critical review'.

Gallego-Ayala, J 2013, 'Trends in integrated water resources management research: a literature review', *Water policy*, vol. 15, no. 4, pp. 628-47.

Gallego-Ayala, J & Juízo, D 2011, 'Strategic implementation of integrated water resources management in Mozambique: An A'WOT analysis', *Physics and Chemistry of the Earth, Parts A/B/C*, vol. 36, no. 14, pp. 1103-11.

Giordano, M & Shah, T 2014, 'From IWRM back to integrated water resources management', *International Journal of Water resources Development*, vol. 30, no. 3, pp. 364-76.

Gleick, PH 1993, 'Water and Conflict: Freash Water Resources and International Security', *International Security*, vol. 18, no. 1, pp. 79-112.

González-Gómez, F, García-Rubio, MA & Guardiola, J 2011, 'Why Is Non-revenue Water So High in So Many Cities?', *International Journal of Water resources Development*, vol. 27, no. 2, pp. 345-60.

Gorgens, A, Pegram, G & Uys, M 1998, *Guidelines for catchment management to achieve integrated water resources management in South Africa*, University of Cape Town.

Grecksch, K 2015, 'Adaptive capacity and water governance in the Keiskamma River Catchment, Eastern Cape Province, South Africa', *Water SA*, vol. 41, pp. 359-68.

Greffrath, W & Van der Waldt, G 2016, 'Section 139 interventions in South African local government, 1994-2015'.

Grigg, NS 2016, 'Economic and Decision Tools for IWRM', in *Integrated Water Resource Management*, Springer, pp. 291-318.

Griggs, D, Stafford-Smith, M, Gaffney, O, Rockstrom, J, Ohman, MC, Shyamsundar, P, Steffen, W, Glaser, G, Kanie, N & Noble, I 2013, 'Policy: Sustainable development goals for people and planet', *Nature*, vol. 495, no. 7441, pp. 305-7.

GWP 2000a, 'Integrated Water Resources Management. Technical Committee Background Paper No. 4. Global Water Partnership (GWP), Stockholm, Sweden. '.

—— 2000b, 'Tehnical Advisory Committeee (TAC) Background Paper No.4. Global Water Partnership ( GWP)'.

GWP, GWP 2003, 'Integrated Water Resources Managment ,Technical Advisory Committee (TAC) BAckground Papers No.7'.

Haigh, E, Fox, H & Davies-Coleman, H 2010, 'Framework for local government to implement integrated water resource management linked to water service delivery', *Water SA*, vol. 36, pp. 0-.

Harvey, PA 2007, 'Cost determination and sustainable financing for rural water services in sub-Saharan Africa', *Water policy*, vol. 9, no. 4, pp. 373-91.

Hirji, R, Mackay, H & Maro, PS 2002, *Defining and mainstreaming environmental sustainability in water resources management in Southern Africa: a summary*, SADC Environment and Land Management Sector (ELMS).

Hoffmann, T, Todd, S, Ntshona, Z & Turner, S 2014, 'Land degradation in South Africa'.

Johnson, RB, Onwuegbuzie, AJ & Turner, LA 2007, 'Toward a Definition of Mixed Methods Research', *Journal of Mixed Methods Research*, vol. 1, no. 2, pp. 112-33.

Jones, J & Van der Walt, I 2004, 'Challenges for water sustainability in Africa', *GeoJournal*, vol. 61, no. 2, pp. 105-9.

Kadi, A 2014, 'Integrated Water Resources Management (IWRM): The international experience', *Integrated Water Resources Management in the 21st Century: Revisiting the paradigm*, p. 1.

Kanakoudis, V, Tsitsifli, S, Samaras, P, Zouboulis, A & Banovec, P 2013, 'A new set of water losses-related performance indicators focused on areas facing water scarcity conditions', *Desalination and Water Treatment*, vol. 51, no. 13-15, pp. 2994-3010.

Karumbidza, JB 2006, *A study of the social and economic impacts of industrial tree plantations in the KwaZulu-Natal province of South Africa*, Fundación Movimiento Mundial por los Bosques Tropicales.

Kolanisi, U 2005, 'A south african study of consumers perceptions and utilization of a rural water service : http://hdl.handle.net/10394/788 '.

Lambert, A, Charalambous, B, Fantozzi, M, Kovac, J, Rizzo, A & St John, SG 2014, '14 years experience of using IWA best practice water balance and water loss

performance indicators in Europe', in *Proceedings of IWA Specialized Conference: Water Loss*.

Lautze, J, de Silva, S, Giordano, M & Sanford, L 2011a, 'Putting the cart before the horse: Water governance and IWRM', *Natural Resources Forum*, vol. 35, no. 1, pp. 1-8.

—— 2011b, 'Putting the cart before the horse: Water governance and IWRM', in *Natural Resources Forum*, vol. 35, pp. 1-8.

Lawless, A 2005, 'Numbers and Needs: Addressing imballances in the Civil Engineering Proffesion. SAICE, Midrand'.

Lenton, R 2008, 'Water, sanitation and the millennium development goals', *Journal of International Affairs*, pp. 247-58.

Levi-Faur 2012, 'The Oxford Handbook of Governance, Oxford: Oxford University Press,' p. 4.

LGH 2014, 'Local Government Handbook (LGH)- South Africa. A complete guide to municipalities in South Africa. 4th Edition', p. 82.

Liemberger, R & Marin, P 2006, 'The Challenge of Reducing Non-Revenue Water in Developing Countries--How the Private Sector Can Help: A Look at Performance-Based Service Contracting'.

Majumdar, C 2007, 'The Debate over Municipal Water Pricing : Evidence from kokata,India ', *International Journal of Water resources Development*, vol. 23, no. 4, pp. 571 -82.

Manzungu, E 2004a, *Water For All*

*Improving Water Resource Governance in Southern Africa*, International Institute for Environment and Development.

—— 2004b, *Water for all: improving water resource governance in Southern Africa*, International Institute for Environment and Development.

McKenzie, RS, Siqalaba, Z & Wegelin, W 2012, *The state of non-revenue water in South Africa (2012)*, Water Research Commission.

Medema, W, McIntosh, B & Jeffrey, P 2008, 'From premise to practice: a critical assessment of integrated water resources management and adaptive management approaches in the water sector', *Ecology and Society*, vol. 13, no. 2.

Mehta, L, Alba, R, Bolding, A, Denby, K, Derman, B, Hove, T, Manzungu, E, Movik, S, Prabhakaran, P & van Koppen, B 2014, 'The politics of IWRM in Southern Africa', *International Journal of Water resources Development*, vol. 30, no. 3, pp. 528-42.

Moe, CL & Rheingans, RD 2006, 'Global challenges in water, sanitation and health', *Journal of water and health*, vol. 4, no. S1, pp. 41-57.

Molle, F 2008, 'Nirvana concepts, storylines and policy models: Insights from the water sector', *Water Alternatives*, vol. 1, no. 1, p. 131.

—— 2009, 'River-basin planning and management: The social life of a concept', *Geoforum*, vol. 40, no. 3, pp. 484-94.

Muller, M 2008, 'Free Basic Water - A sustainab;e instrument for a sustainable future in South Africa', *Environment and Urbanisation*, vol. 20, no. 1, pp. 67 - 87.

—— 2014, '11. Allocating power and functions in a federal design: the experience of South Africa', *Federal rivers: Managing water in multi-layered political systems*, p. 179.

Municipal-IQ 2016, *Municipal IQ, Briefing 608: Final protest tally for 2015; off 2014 record*, viewed 15th May 2016 2016, <http://www.municipaliq.co.za/index.php?site_page=press.php>.

Munnik, S 2016, 'Provincial Water Services Master Plan for the Eastern Cape'.

Naidoo, GCD 2010, 'Integrated Approaches to Efficient Water Use in South Africa', *Interntional Journal of Water Resources Development*, vol. 16, no. 1, p. 155 64.

National-Treasury 2011, 'Local Government Budgets and Expenditture review '.

Ndanu, MC & Syombua, MJ 2015, 'Mixed Methods Research: The Hidden Cracks of the Triangulation', *Name: General Education Journal*, vol. 4, no. 2.

Nemarundwe, N & Kozanayi, W 2003, 'Institutional arrangements for water resource use: A case study from southern Zimbabwe', *Journal of Southern African Studies*, vol. 29, no. 1, pp. 193-206.

Nnadozie, R 2011, 'Acces to Adequate Water in post -apartied South Africa: An overview of numeric trends', *Water SA*, vol. 37, no. 3, pp. 339-48.

Noble, M & Wright, G 2013, 'Using indicators of multiple deprivation to demonstrate the spatial legacy of apartheid in South Africa', *Social Indicators Research*, vol. 112, no. 1, pp. 187-201.

Nowreen , S, Jalal, MR & Khan, MSA 2014, 'Historical analysis of rationalizing South West coastal polders of Bangladesh', *Water policy*, vol. 16, no. 2, pp. 264-79.

Nowreen, S, Khan, S & Huq, H 2011, 'Development of an operational IWRM framework in a selected small scale water resources development sector project in Bangladesh', *South Asian Water Studies*, vol. 2, no. 2, pp. 6-26.

O'Donoghue, T & Punch, K 2003, *Qualitative educational research in action: Doing and reflecting*, Routledge.

Ong, SF 2012, 'Constructing a survey questionnaire to collect data on service quality of business academics'.

Pollard, S & du Toit, D 2008, 'Integrated water resource management in complex systems: how the catchment management strategies seek to achieve sustainability and equity in water resources in South Africa', *Water SA*, vol. 34, pp. 671-9.

Pope, DAMaJ 2002, 'Cost Recovery and the Crisi of Service Delivery in South Africa'.

Rouillard, JJ, Benson, D & Gain, AK 2014, 'Evaluating IWRM implementation success: are water policies in Bangladesh enhancing adaptive capacity to climate change impacts?', *International Journal of Water resources Development*, vol. 30, no. 3, pp. 515-27.

Rowley, J 2002, 'Using case studies in research', *Management research news*, vol. 25, no. 1, pp. 16-27.

SABC 2014, 'South African Broadcasting Corporation (SABC) : Eastern Cape residents protest over alleged municipal irregular expenditure. SABC. Retrieved Tuesday 23 September 2014 20:25, fromhttp://www.sabc.co.za/news/a/11882c8045948e09b3d6b390ca3f4715/E-Cape-residents-protest-over-alleged-municipal-irregular-expenditure-20140923'.

Salga 2010, 'National Analysis of Local Government Finances, Pretoria: South African Local Government Association (Salga).'.

Samad, M 2005, 'Water institutional reforms in Sri Lanka', *Water policy*, vol. 7, no. 1, pp. 125-40.

Savenije, H & Van der Zaag, P 2008, 'Integrated water resources management: Concepts and issues', *Physics and Chemistry of the Earth, Parts A/B/C*, vol. 33, no. 5, pp. 290-7.

Savenije, HH & Van der Zaag, P 2000, 'Conceptual framework for the management of shared river basins; with special reference to the SADC and EU', *Water policy*, vol. 2, no. 1, pp. 9-45.

Seckler, D 2010, 'Water Scarcity in the Twenty -fisrt Century', *International Journal of Water resources Development*, vol. 12, no. 1-2, pp. 29-42.

Sershen, Rodda, N, Stenström, T, Schmidt, S, Dent, M, Bux, F, Hanke, N, Buckley, C & Fennemore, C 2016, 'Water security in South Africa: Perceptions on public expectations and municipal obligations, governance and water re-use', *Water SA*, vol. 42, pp. 456-65.

Shah, T 2016, 'Increasing water security: the key to implementing the Sustainable Development Goals. Global Water Partnership (GWP) TEC Background Papers No.22'.

Shah, T & Van Koppen, B 2006, 'Is India ripe for integrated water resources management? Fitting water policy to national development context', *Economic and Political Weekly*, pp. 3413-21.

Skinner, J 2009, *Where every drop counts*

*tackling rural Africa’s water crisis*, International Institute for Environment and Development.

Skipworth, P, Saul, A & Machell, J 1999, 'The effect of regional factors on leakage levels and the role of performance indicators', *Water and Environment Journal*, vol. 13, no. 3, pp. 184-8.

Smith, L 2009, *Municipal compliance with water services policy: A challenge for water security*, Development Planning Division, Development Bank of Southern Africa.

Snellen, WB & Schrevel, A 2004, *IWRM: for sustainable use of water; 50 years of international experience with the concept of integrated water resources management; background document to the FAO/Netherlands conference on water for food an ecosystems, The Hague, 31 January-5 February 2005*, Alterra.

SRVM 2010, 'Water Services Development Plan : Sundays River Valley Municipality

January 2010 review. Internal report prepared by Engineering Advice and Services, Port

Elizabeth, for the Sundays River Valley Municipality. Kirkwood, South Africa

'.

—— 2011, 'Annual Report 2010 /2011 : SRVM'.

Stats-SA 2015, 'Millennium Development Goals 7: Ensure environmental sustainability 2015/ Statistics South Africa'.

Stephen, DA 2003, 'Reducing Water and Sanitation Backlogs in Rural Areas', *Greener Management International*, no. 42.

Strauch, AM & Almedom, AM 2011, 'Traditional water resource management and water quality in rural Tanzania', *Human Ecology*, vol. 39, no. 1, pp. 93-106.

Sukamolson, S 2007, 'Fundamentals of quantitative research', *Bangkok: EJTR*.

Swatuk, LA 2005, 'Political challenges to implementing IWRM in Southern Africa', *Physics and Chemistry of the Earth, Parts A/B/C*, vol. 30, no. 11, pp. 872-80.

Tapela, B 2015, 'Social protests water water service delivery in south africa, Water Research Commision'.

Teisman, G 2013, 'Water Governance : Facing the limits of managerialism, determinism, water -centricity, and technocratic problem-solving', *International Journal of Water Governance*, vol. 1, no. 1 - 11.

Timmermans, S & Tavory, I 2012, 'Theory construction in qualitative research: From grounded theory to abductive analysis', *Sociological Theory*, vol. 30, no. 3, pp. 167-86.

Tortajada, C 2008, 'Challenges and realities of water managment of megacities: The case of Mexico City MEtropolitan area', *Journal of International Affairs*, vol. 61, no. 2, pp. 147-66.

Turton, AR, Hattingh, J, Claassen, M, Roux, DJ & Ashton, PJ 2007, 'Towards a model for ecosystem governance: an integrated water resource management example', in *Governance as a trialogue: Government-society-science in transition*, Springer, pp. 1-28.

UN-Water 2013a, 'Water Security and the Global Water Agenda A UN-Water Analytical Brief. UN-Water, Geneva, Switzerland'.

—— 2013b, 'Water Security and the Global Water Agenda, A UN-Water Analytical Brief'.

van den Berg, C 2015, 'Drivers of non-revenue water: A cross-national analysis', *Utilities Policy*, vol. 36, pp. 71-8.

van Koppen, B, Tarimo, A, Manzungu, E, van Eeden, A & Sumuni, P 2016, 'Winners and Losers of IWRM in Tanzania', *Water Alternatives*, vol. 9, no. 3, p. 588.

Van Rooyen, J, Combrinck, A, Basson, T, Schroder, J & Rossouw, J 2011, 'Assessment of the ultimate potential and future marginal cost of water resources in South Africa', vol. 19, no. 5, pp. 12-4, via SA ePublications <http://reference.sabinet.co.za/webx/access/electronic_journals/civeng/civeng_v19_n5_a5.pdf>.

Walsh, K 2012, 'Tariff Setting : A guide for local government in South Africa, Namibia and Botswana'.

Ward, PJ, Pauw, WP, van Buuren, MW & Marfai, MA 2013, 'Governance of flood risk management in a time of climate change: the cases of Jakarta and Rotterdam', *Environmental Politics*, vol. 22, no. 3, pp. 518-36.

Warner, BP, Kuzdas, C, Yglesias, MG & Childers, DL 2015, 'Limits to adaptation to interacting global change risks among smallholder rice farmers in Northwest Costa Rica', *Global Environmental Change*, vol. 30, pp. 101-12.

Warner, JF 2006, 'More Sustainable Participation? Multi-Stakeholder Platforms for Integrated Catchment Management', *International Journal of Water resources Development*, vol. 22, no. 1, pp. 15-35.

Water 2002, 'Water quality issues in the Usutu–Mhlatuze: Review of water quality status and issues in the WMA', *Report Prepared for DWAF/DFIF Strategic Environmental Assessment*.

Water Research Commision, W 2015, ' Drought Factsheet 1 :Background to current drought situation in South Africa, 2015, Water Research Commision (WRC)

'.

Water, U 2012, 'Status report on the application of integrated approaches to water resources management', *United Nations Environment Programme: Nairobi, Kenya*.

Watson, A, Prickett, R, Taghavi, A & West, T 2011, 'California's IRWM Program: A Regional Framework for Integrated Water Resources Management', *Water Resources Impact*, vol. 13, no. 3, pp. 9-13.

Wen, B, Horlings, E, van der Zouwen, M & Van den Besselaar, P 2017, 'Mapping science through bibliometric triangulation: an experimental approach applied to water research', *Journal of the Association for Information Science and Technology*, vol. 68, no. 3, pp. 724-38.

Winarni, W 2009, 'Infrastructure leakage index (ILI) as water losses indicator', *Civil Engineering Dimension*, vol. 11, no. 2, pp. pp. 126-34.

Woodhouse, P 2012, 'Reforming land and water rights in South Africa', *Development and Change*, vol. 43, no. 4, pp. 847-68.

WRC , WRC 2016, 'Perceptions of municipal water and sanitation services '.

Zengeni, R, Kakembo, V & Nkongolo, N 2016, 'Historical rainfall variability in selected rainfall stations in Eastern Cape, South Africa', *South African Geographical Journal*, vol. 98, no. 1, pp. 118-37.

# APPENDIX A: MUSSA MUNICIPAL SURVEY QUESTIONNAIRE

| |
|---|
| 1. The worksheet contains context information and 90 statements (18 sections with 5 statements per section). |
| 2. Please select the most appropriate response to each statement. |

| Context Information | | Answers | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| a) | Municipality name | Sundays River Valley | | | | | | | | |
| b) | Date of completion | 2015 | | | | | | | | |
| c) | Municipality type | A - Metro | B1 - LM | B2 - LM | B3 - LM | B4 - LM | C2 - DM | | | |
| d) | Water service provider type | Internal (i.e. municipality) | External (e.g. Water Board, service provider) | Combination of internal and external | | | | | | |
| e) | Wastewater service provider type | Internal (i.e. municipality) | External (e.g. Water Care Company, service provider) | Combination of internal and external | | | | | | |
| f) | Water system maintenance | Internal (i.e. municipality) | External (e.g. service provider) | Combination of internal and external | | | | | | |
| g) | Wastewater system maintenance | Internal (i.e. municipality) | External (e.g. service provider) | Combination of internal and external | | | | | | |
| h) | The key staff (i.e. managerial) turnover in your WSA | High: > 25% (i.e. problematic, frequently lose staff) | Moderate: 10 - 25% (i.e. occasionally lose staff) | Low: < 10% (i.e. not an issue, good staff retention) | | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| i) | Your WSA has developed and implemented a scarce skills policy | Yes, developed and implemented | In development | No, not developed | | | | | | |
| j) | Your WSA is preparing for the impacts of pending and or new regulations (e.g. Regulation 17 (WTW and WWTW process controllers), municipal Standard Chart of Accounts (mSCOA)) | Yes, strongly agree | In process | No, disagree | Don't know | | | | | |
| k) | Your WSA actively provides required drinking water related data to the Regulator (e.g. Blue Drop participation) | Yes, strongly agree | In process | No, disagree | Don't know | | | | | |
| l) | Regular drinking-water quality monitoring and management (including boreholes) is performed for ALL communities/towns in the WSA | Yes, all (i.e. 100% of WSA population) | Most (i.e. >75% of WSA population) | Some (i.e. >50% of WSA population) | <50% of WSA population | None (i.e. 0% of WSA population) | Don't know | | | |
| m) | WTWs operational capacity as a function of total design capacity (***NOTE:*** Combine for ALL WTWs within your WSA) | >105% | >100% - 105% | >95% - 100% | 90% - 95% | <90% | Don't know | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| n) | Your WSA actively provides required wastewater related data to the Regulator (e.g. Green Drop participation) | Yes, strongly agree | In process | No, disagree | Don't know | | | | | |
| o) | Regular wastewater quality monitoring and management is performed for ALL wastewater systems in the WSA | Yes, all (i.e. 100%) | Most (i.e. >75%) | Some (i.e. >50%) | <50% | None (i.e. 0%) | Don't know | | | |
| p) | WWTWs operational flow capacity as a function of total design capacity (***NOTE:*** Combine for ALL WWTWs within your WSA) | >105% | >100% - 105% | >95% - 100% | 90% - 95% | <90% | Don't know | | | |
| q) | WWTWs operational COD load as a function of total design load (***NOTE:*** Combine for ALL WWTWs within your WSA) | >105% | >100% - 105% | >95% - 100% | 90% - 95% | <90% | Don't know | | | |
| r) | Your WSA actively provides required water conservation and water demand management related data to the Regulator (e.g. No Drop participation) | Yes, strongly agree | In process | No, disagree | Don't know | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| s) | Billing & accounts - With regards to water and sanitation bills, please indicate the frequency of billing and posting of accounts. | Actual billing and posting of accounts on a monthly basis | Actual billing and posting of accounts at least every 2nd month | Billing and posting of accounts at least on a quarterly basis | Billing and posting of accounts less frequently than quarterly | Don't know | | | | |
| t) | Development contributions - With regard to new developments, by-laws in your municipality require developers to adequately contribute towards construction of new bulk infrastructure (i.e. developers charges). | Yes, strongly agree | In process | No, disagree | Don't know | | | | | |
| u) | Council is stable with functional committees. | Yes, strongly agree (i.e. Council meetings are held at least quarterly) | Not ideal | No, disagree | Don't know | | | | | |
| v) | Your MuSSA was completed with appropriate inputs from senior officials within Technical Services, Finance and Human Resources (as a minimum these 3 departments should participate). | Yes, strongly agree (i.e. Technical Services HOD, Finance **AND** HR all participated) | Agree (i.e. Technical Services HOD and either Finance **OR** HR participated) | Only Technical Services HOD | Other Technical Services | Don't know | | | | |

| 1. Water Services Planning | | Answers | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1,1 | Your Water Services Development Plan (WSDP) and associated master planning processes includes appropriate Water and Sewage Master Plans, Water Safety Plans and a Wastewater Risk Abatement Plans (W2RAPs), and is aligned to the IDP and associated SDBIP targets. | Yes, WSDP developed and includes all required plans and alignment (i.e. 100%) | Yes, WSDP developed and contains most of the required plans and alignment (i.e. >75%) | Yes, WSDP developed and contains some of the required plans and alignment (i.e. >50%) | WSDP still in development | WSDP development not yet initiated | Don't know | | | |
| 1,2 | You are implementing an up-to-date and adopted WSDP. | WSDP up-to-date, adopted and implemented | WSDP adopted and implemented, but out-of-date (i.e. requires revision) | WSDP adopted but not yet implemented | WSDP not adopted but implemented | WSDP not adopted nor implemented | Don't know | | | |
| 1.3 | Your current project list addresses existing needs/shortcomings identified through the WSDP and associated master planning process. | Yes, all projects (i.e. 100%) | Most projects (i.e. >75%) | Some projects (i.e. >50%) | <50% of projects | None (i.e. 0%) | Don't know | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.4 | Project progress is monitored, tracked and reported to municipal top management/council and the Regulator (through the annual water and sanitation services report) | Yes, strongly agree (both to municipal top management/council and Regulator) | Only to municipal top management/council | Only to Regulator | No, disagree | Don't know | | | | |
| 1.5 | Projects identified through your various planning processes have been implemented in the last 3 years. | Yes, all implemented (i.e. 100%) | Most implemented (i.e. >75%) | Some implemented (i.e. >50%) | <50% implemented | None implemented (i.e. 0%) | Don't know | | | |

| 2. Management Skill Level (Technical) | | Answers | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 2,1 | Your council approved technical management organisational organogram meets your business requirements, and key posts are filled (e.g., Technical Director, Water Services Manager, Sanitation Services Manager). | Yes, and all posts filled (i.e., 100%) | Yes, and most posts filled (i.e., >75%) | Yes, but only some posts filled (i.e., >50%) | Yes, but <50% of posts filled | No, does not meet requirements | Don't know | | | |
| 2,2 | You have sufficient technical management staff (appropriate number of staff - e.g., at least 5 posts per 100,000 persons served). | Yes, 100% as per organogram | Mostly agree (i.e., >75% as per organogram) | Agree somewhat (i.e., >50% as per organogram) | <50% as per organogram | None (i.e., 0% as per organogram) | Don't know | | | |
| 2,3 | Technical management staff have the correct skills/qualifications and experience as per Job Description requirements (e.g., if Job Description requires PrEng, PrTech or CPM, the staff have these qualifications). | Yes, All (i.e., 100%) | Most (i.e., >75%) | Some (i.e., >50%) | <50% | None (i.e., 0%) | Don't know | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 2,4 | Managers regularly attend appropriate water and sanitation services skills development/training. | Quarterly (or more frequent) skills development/training | Bi-annual skills development/training | Annual skills development/training | Less frequent skills development/training (i.e. >1 year) | No skills development/training | Don't know | | | |
| 2,5 | Key technical managers (e.g. Section 56 and other Senior Management) have signed and monitored Performance Agreements. | Yes, all (i.e. 100%) | Most (i.e. >75%) | Some (i.e. >50%) | <50% | None (i.e. 0%) | Don't know | | | |

| 3. Staff Skill Levels (Technical) | | Answers | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 3,1 | WTWs are operated by staff with the correct skills/qualifications and experience (as per Regulation 2834). | Yes, All (i.e. 100%) | Most (i.e. >75%) | Some (i.e. >50%) | <50% | None (i.e. 0%) | Don't know | Not applicable | | |
| 3,2 | WWTWs are operated by staff with the correct skills/qualifications and experience (as per Regulation 2834). | Yes, All (i.e. 100%) | Most (i.e. >75%) | Some (i.e. >50%) | <50% | None (i.e. 0%) | Don't know | Not applicable | | |
| 3,3 | Water system plumbers, millwrights, mechanics and electricians have the correct skills/qualifications and experience. | Yes, All (i.e. 100%) | Most (i.e. >75%) | Some (i.e. >50%) | <50% | None (i.e. 0%) | Don't know | | | |
| 3,4 | Sewage system plumbers, millwrights, mechanics and electricians have the correct skills/qualifications and experience. | Yes, All (i.e. 100%) | Most (i.e. >75%) | Some (i.e. >50%) | <50% | None (i.e. 0%) | Don't know | | | |
| 3,5 | Staff regularly attend appropriate water and sanitation services skills development/training (including safety) (e.g. ESETA courses). | Quarterly (or more frequent) skills development/training | Bi-annual skills development/training | Annual skills development/training | Less frequent skills development/training (i.e. >1 year) | No skills development/training | Don't know | | | |

| 4. Technical Staff Capacity (Numbers) | | Answers | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 4,1 | Your council approved technical staff organisational organogram meets your business requirements, and posts are filled (i.e. Superintendent of WTWs/WWTWs and below). | Yes, and all posts filled (i.e. 100%) | Yes, and most posts filled (i.e. >75%) | Yes, but only some posts filled (i.e. >50%) | Yes, but <50% of posts filled | No, does not meet requirements | Don't know | | | |
| 4,2 | WTWs are operated by the appropriate number of staff (as per Regulation 2834). | Yes, 100% as per requirements | Mostly agree (i.e. >75% as per requirements) | Agree somewhat (i.e. >50% as per requirements) | <50% as per requirements | None (i.e. 0% as per requirements) | Don't know | Not applicable | | |
| 4,3 | WWTWs are operated by the appropriate number of staff (as per Regulation 2834). | Yes, 100% as per requirements | Mostly agree (i.e. >75% as per requirements) | Agree somewhat (i.e. >50% as per requirements) | <50% as per requirements | None (i.e. 0% as per requirements) | Don't know | Not applicable | | |
| 4,4 | You have sufficient water and sewerage/sanitation network operations and repair staff/plumbers (i.e. you have the appropriate number of staff). | Yes, 100% as per organogram | Mostly agree (i.e. >75% as per organogram) | Agree somewhat (i.e. >50% as per organogram) | <50% as per organogram | None (i.e. 0% as per organogram) | Don't know | | | |
| 4,5 | An active mentoring/shadowing programme is in place where experienced staff | Yes, strongly agree | In place, but not ideal | No, disagree | Don't know | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | train younger, inexperienced staff. | | | | | | | | | |
| **5. Water Resource Management (WRM)** | | **Answers** | | | | | | | | |
| 5,1 | The results from the Reconciliation Strategies (Large Systems/All Towns) have been incorporated into your WSDP, master planning and IDP processes. | Yes, strongly agree | In process | No, disagree | Don't know | Not applicable | | | | |
| 5,2 | The quantity of water available from the resources is sufficient for your current WSA needs (at the stipulated level of assurance of supply). | No shortage (i.e. sufficient water) | 1 - 10% shortage | 11-20% shortage | 21-30% shortage | 31-40% shortage | 41-50% shortage | >50% shortage | Don't know | Not applicable |
| 5,3 | The quantity of water available from the resources is sufficient for your future WSA needs (at the stipulated level of assurance of supply) (i.e. no shortage in 10 years). | No shortage (i.e. sufficient water) | 1 - 10% shortage | 11-20% shortage | 21-30% shortage | 31-40% shortage | 41-50% shortage | >50% shortage | Don't know | Not applicable |
| 5,4 | The source water quality is currently acceptable for its purpose. | Yes, strongly agree (i.e. all sources (100%) acceptable) | Mostly agree (i.e. >75% of sources acceptable) | Agree somewhat (i.e. >50% of sources acceptable) | <50% of sources acceptable | None (i.e. 0% of sources acceptable) | Don't know | Not applicable | | |
| 5,5 | The trend indicates a deteriorating source water quality. | Yes, all sources (100%) deteriorating | >50% of sources deteriorating | >25% of sources deteriorating | < 25% of sources deteriorating | No, no sources (0%) deteriorating | Don't know | Not applicable | | |

| 6. Water Conservation & Water Demand Management (WC/WDM) | | Answers | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 6,1 | Your WSA has developed a council approved Water Conservation and Water Demand Strategy which includes a standard water balance (e.g. modified IWA). | WC/WDM Strategy and water balance developed | Only WC/WDM Strategy developed | Only water balance developed | None developed | Don't know | | | | |
| 6,2 | Please indicate your percentage Non-Revenue Water (NRW) as per the modified IWA water balance. | Less than 20% | Less than 30% | Less than 40% | Less than 50% | 50% or more | Don't know | | | |
| 6,3 | System input volumes (bulk) to the WSA are accurately monitored using bulk meters (e.g. check metering). | Yes, All (i.e. 100%) | Most (i.e. >75%) | Some (i.e. >50%) | <50% | None (i.e. 0%) | Don't know | | | |
| 6,4 | Please indicate what percentage of all connections are metered and billed (residential and non-residential (commercial, industrial, etc.)). | >98% | 75% - 98% | 50% - 75% | <50% | No metering | Don't know | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 6,5 | Your WSA is implementing appropriate intervention programmes to reduce NRW (e.g. minimisation of night flows through pressure management, removal of unlawful connections, leak detection and repairs, consumer education/awareness). | Yes, strongly agree (i.e. 100% implementation) | Mostly agree (i.e. >75% implementation) | Agree somewhat (i.e. >50% implementation) | <50% implementation | No implementation (i.e. 0%) | Don't know | | | |

| 7. Drinking Water Safety & Regulatory Compliance | | Answers | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 7,1 | Please indicate your microbiological drinking-water quality compliance for *E.coli* (or faecal coliforms) for the communities you are monitoring for the last 12 months. | 99% - 100% | 97% - <99% | 95% - <97% | < 95% | Don't know | | | | |
| 7,2 | ALL your supply schemes, WTWs, process controllers, monitoring programmes, sample points, laboratories, results, procedures, protocols, etc. are registered/frequently updated with the Regulator (e.g. via the BDS). | Yes, strongly agree (i.e. 100% registered/updated) | Mostly agree (i.e. >75% registered/updated) | Agree somewhat (i.e. >50% registered/updated) | <50% registered/updated | None registered/updated (i.e. 0%) | Don't know | | | |
| 7,3 | Council have been made aware of all water safety plan related issues (including those identified via the Blue Drop Certification programme) and issues have been actioned (where applicable). | Yes, strongly agree (i.e. all (100%) tabled) | Mostly agree (i.e. >75% tabled) | Agree somewhat (i.e. >50% tabled) | <50% tabled | Issues noted but none tabled (i.e. 0%) | Not applicable (no issues requiring council resolution exist) | Don't know | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 7,4 | Sufficient funds have been made available to address all these identified water safety related issues. | Yes, strongly agree (i.e. 100% of required funds) | Mostly agree (i.e. >75% of required funds) | Agree somewhat (i.e. >50% of required funds) | <50% of required funds | Issues noted but no funds (i.e. 0%) | Not applicable (no issues requiring funding exist) | Don't know | | |
| 7,5 | Required corrective actions/remedial measures to address all these identified water safety related issues have been successfully implemented. | Yes, strongly agree (i.e. 100% implementation) | Mostly agree (i.e. >75% implementation) | Agree somewhat (i.e. >50% implementation) | <50% implementation | Issues noted but no implementation (i.e. 0%) | Not applicable (no issues requiring corrective actions exist) | Don't know | | |

| 8. Basic Sanitation | | Answers | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 8,1 | You have formal housing areas that are not fully serviced with sanitation infrastructure | No, all formal areas are fully serviced (i.e. no bucket sanitation service) | Yes, but these are new households that will be serviced within 2 years | Yes, still trying to meet formal backlog but >90% are serviced | Yes, still trying to meet formal backlog 60 - 90% are serviced | Yes, still trying to meet formal backlog with <60% serviced | Don't know | | | |
| 8,2 | You have informal housing or rural areas that are not fully serviced with sanitation infrastructure | No, all informal and rural areas are fully serviced | We have no informal areas and rural areas are serviced | Yes, but these are new households that will be serviced within 2 years | Yes, still trying to meet informal or rural backlog but >90% are serviced | Yes, still trying to meet informal or rural backlog with 60 - 90% serviced | Yes, still trying to meet informal or rural backlog with <60% serviced | Don't know | | |
| 8,3 | You have a detailed plan and programme to provide safe sanitation to all households (including health and hygiene education and user awareness including Water, Sanitation and Health (WASH) aspects) | Yes, strongly agree (i.e. 100% implementation) | Mostly agree (i.e. >75% implementation) | Agree somewhat (i.e. >50% implementation) | <50% implementation | No implementation (i.e. 0%) | Don't know | Not applicable | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 8,4 | Your sanitation budget is appropriate for required sanitation programmes (implementation and O&M) | Yes, strongly agree (i.e. 100% of required funds) | Some shortfall (i.e. >75% of required funds) | Disagree, significant shortfall (50-75% of required funds) | Serious underfunding (<50% of required funds) | No funds (i.e. 0%) | Don't know | Not applicable | | |
| 8,5 | You are servicing your pit latrines and maintaining your sewers and wastewater treatment facilities as per safe sanitation requirements (healthy, environmentally safe, structurally sound, regularly maintained). | Yes, 100% as per requirements | Mostly agree (i.e. >75% as per requirements) | Agree somewhat (i.e. >50% as per requirements) | No, we only manage to service <50% of the sanitation infrastructure | No, we have serious shortfalls in the servicing of sanitation infrastructure (i.e.<20 %) | Don't know | Not applicable | | |

| 9. Wastewater/Environmental Safety & Regulatory Compliance | | Answers | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 9,1 | Please indicate your treated wastewater effluent compliance for COD for your (or your service provider's) WWTWs for the last 12 months. | >95% | 90% - 95% | 80% - <90% | <80% | Don't know | | | | |
| 9,2 | ALL your WWTWs, process controllers, monitoring programmes, sample points, laboratories, results, procedures, protocols, etc. are registered/frequently updated with the Regulator (e.g. via the GDS). | Yes, strongly agree (i.e. 100% registered/updated) | Mostly agree (i.e. >75% registered/updated) | Agree somewhat (i.e. >50% registered/updated) | < 50% registered/updated | None registered/updated (i.e. 0%) | Don't know | | | |
| 9,3 | Council have been aware of all W2RAP related issues (e.g. pollution incidents, Green Drop deficiencies) and issues have been actioned (where applicable). | Yes, strongly agree (i.e. all (100%) tabled) | Mostly agree (i.e. >75% tabled) | Agree somewhat (i.e. >50% tabled) | < 50% tabled | Issues noted but none tabled (i.e. 0%) | Not applicable (no issues requiring council resolution exist) | Don't know | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 9,4 | Sufficient funds have been made available to address all identified wastewater and environmental safety related issues. | Yes, strongly agree (i.e. 100% of required funds) | Mostly agree (i.e. >75% of required funds) | Agree somewhat (i.e. >50% of required funds) | < 50% of required funds | Issues noted but no funds (i.e. 0%) | Not applicable (no issues requiring funding exist) | Don't know | | |
| 9,5 | Required corrective actions/remedial measures to address all identified wastewater and environmental safety related issues have been successfully implemented. | Yes, strongly agree (i.e. 100% implementation) | Mostly agree (i.e. >75% implementation) | Agree somewhat (i.e. >50% implementation) | <50% implementation | Issues noted but no implementation (i.e. 0%) | Not applicable (no issues requiring corrective actions exist) | Don't know | | |

| 10. Infrastructure Asset Management (IAM) | | Answers | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 10, 1 | You have an appropriate and up-to-date water and sanitation services Asset Register (includes asset name, location, condition, extent, remaining useful life, performance and risk). ***NOTE:*** This does only not refer to GRAP17 asset register requirements. | Yes, strongly agree (e.g. advanced asset register) | Yes, agree (e.g. basic asset register - i.e. not all aspects included) | Not ideal (e.g. outdated asset register) | No, disagree (i.e. no asset register) | Don't know | | | | |
| 10, 2 | You have developed an appropriate Infrastructure Asset Management (IAM) Plan for your WSA. | Yes, strongly agree | In place, but not ideal | No, disagree | Don't know | | | | | |
| 10, 3 | You are implementing the IAM outcomes | Yes, strongly agree (i.e. 100% implementation) | Mostly agree (i.e. >75% implementation) | Agree somewhat (i.e. >50% implementation) | < 50% implementation | No implementation (i.e. 0%) | Don't know | | | |
| 10, 4 | Budget allocated to implement IAM outcomes is sufficient and is being effectively spent. | Yes, strongly agree (i.e. 100%) | Mostly agree (i.e. >75%) | Agree somewhat (i.e. >50%) | < 50% | No (i.e. 0%) | Don't know | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 10, 5 | You conduct annual technical assessments of your water and wastewater related systems (including sources, WTWs, WWTWs, pump stations, network, etc.) and implement required follow-up actions. | Yes, all systems (i.e. 100%) | Most systems (i.e. >75%) | Some systems (i.e. > 50%) | < 50% systems | No systems (i.e. 0%) | Don't know | Not applicable | | |

| 11. Operation & Maintenance of Assets | | Answers | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 11, 1 | A maintenance workshop/store that is secure and stocked with essential equipment (e.g. spare parts) and tools is available. | Yes, strongly agree | In place, but not ideal | No, disagree | Don't know | | | | | |
| 11, 2 | Appropriate water and sanitation services infrastructure/equipment planned/preventative maintenance schedules are developed. | Yes, strongly agree | In place, but not ideal | No, disagree | Don't know | | | | | |
| 11, 3 | Appropriate planned/preventative maintenance is performed at all WTWs and associated reservoirs, pump stations, distribution network. | Yes, All (i.e. 100%) | Most (i.e. >75%) | Some (i.e. > 50%) | < 50% | None (i.e. 0%) | Don't know | | | |
| 11, 4 | Appropriate planned/preventative maintenance is performed at all WWTWs and associated collection system, pump stations. | Yes, All (i.e. 100%) | Most (i.e. >75%) | Some (i.e. > 50%) | < 50% | None (i.e. 0%) | Don't know | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 11, 5 | Please indicate your infrastructure repairs and maintenance costs as a function of total operating expenditure (%). | <5% | 5% - <8% | 8% - <10% | 10% - <15% | 15% or more | Don't know | | | |

| 12. Financial Management | | Answers | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 12, 1 | Financial controls - With regard to your last audit report on the financial statements, please state the audit opinion. | Clean audit outcome (i.e. unqualified with no findings) | Financially unqualified audit opinion (with findings) | Qualified audit opinion | Disclaimer of audit opinion | Adverse audit opinion | Don't know | | | |
| 12, 2 | Cash flow status - Please state your Cash/Cost Coverage Ratio (excluding Unspent Conditional Grants) | > 90 days | 60 - 90 days | 30 - 60 days | < 30 days | Don't know | | | | |
| 12, 3 | Your actual operating expenditure closely reflects your budgeted operating expenditure (i.e. Operating Expenditure Budget Implementation Indicator) | 95% - 100% | 90% - <95% | 85% - <90% | 80% - <85% | <80% | Don't know | | | |
| 12. 4 | Your actual revenue closely reflects your budgeted operating revenue (i.e. Operating Revenue Budget Implementation Indicator) | 95% - 100% | 90% - <95% | 85% - <90% | 80% - <85% | <80% | Don't know | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 12, 5 | Liabilities (Creditors) - Money is owed by your municipality to major/critical service providers (e.g. ESKOM, Water Board, largest contractors, etc.) for more than 30 days from receipt of invoice (***NOTE***: Ignore disputed invoices) | Never | Once per year | Twice per year | Once per quarter | More frequently than quarterly | Don't know | | | |

| 13. Revenue Collection | | Answers | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 13, 1 | Please indicate the frequency of actual meter readings. | Actual meter reading on a monthly basis | Actual meter reading at least every 2nd month | Meter reading at least on a quarterly basis | Meter reading less frequently than quarterly | Don't know | | | | |
| 13, 2 | Net Surplus/Deficit - Please state your net surplus/deficit from water services activities for the last 12 months (**NOTE:** This question tests whether your WSA currently has fully cost reflective Water and Sanitation tariffs (which take into account cost of maintenance and renewal of purification plants and networks, and the cost of new infrastructure). | Surplus (i.e. >0%) | Breakeven (i.e. = 0%) | Net deficit (i.e. <0%) | Don't know | | | | | |
| 13, 3 | Revenue collection - Please state the revenue collection rate in respect to Water & Sanitation Services (%) | <50% | 50% - <70% | 70% - <80% | 80% - <95% | 95% or more | Don't know | | | |
| 13, 4 | Revenue Growth - Please state your Water and Sanitation Services revenue growth for the last 12 months (%). | >CPI | Equals CPI | <CPI, but >0% | Negative growth (-ve) | Don't know | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 13.5 | Grant dependency - Actual operating revenue less operational grants/subsidies (e.g. equitable share) sufficiently covers actual operating expenditure. | Yes, All (i.e. 100%) | Most (i.e. >75%) | Some (i.e. > 50%) | < 50% | None (i.e. 0%) | Don't know | | | |

| 14. Financial Asset Management | | Answers | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 14, 1 | Capital Expenditure (Municipal) - Please state your municipal Capital Expenditure as a percentage of Total Expenditure (i.e. Total Operating Expenditure + Capital Expenditure) | <5% | 5% - <10% | 10% - <15% | 15% - <20% | 20% or more | Don't know | | | |
| 14. 2 | Capital Expenditure (Water Services) - Please state your Capital Expenditure on Water and Sanitation Services as a percentage of Total Capital Expenditure (Capital Expenditure (Municipal)) | <25% | 25% - <50% | 50% - <75% | 75% or more | Don't know | | | | |
| 14, 3 | Asset Renewal - Please state your Asset Renewal investment as percentage of Depreciation costs | 100% | >90% | >75% | >50% | <50% | None (i.e. 0%) | Don't know | | |
| 14. 4 | Repairs and Maintenance - Please state your Repairs and Maintenance expenditure as a percentage of Property, Plant and Equipment, | <5% | 5% - <8% | 8% - <10% | 10% or more | Don't know | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Investment Property (Carrying Value) | | | | | | | | | |
| 14.5 | Grant funding of capital expenditure - Please state your reliance on grant funding | >90% | > 75% | >50% | <50% | Don't know | | | | |

| 15. Information Management (IT) | | Answers | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 15, 1 | You have a developed, approved and implemented IT Master Systems Plan (e.g. covering 3 - 5 years) that addresses your IT business requirements. | Yes, developed, approved and being implemented | Developed and approved, but not yet implemented | Developed but not yet approved or implemented | In development | No, disagree | Don't know | | | |
| 15. 2 | You have a developed, approved and implemented ICT Technology Master Plan that addresses your current and future IT infrastructure requirements. | Yes, developed, approved and being implemented | Developed and approved, but not yet implemented | Developed but not yet approved or implemented | In development | No, disagree | Don't know | | | |
| 15. 3 | You have IT systems that support your full range of water and sanitation services business requirements (e.g. billing, GIS, customer care, O&M, asset management). | Yes, strongly agree (i.e. 100% of required systems) | Mostly agree (i.e. >75% of required systems) | Agree somewhat (i.e. >50% of required systems) | < 50% of required systems | None (i.e. 0% of required systems) | Don't know | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 15, 4 | ICT service continuity - Adequate IT security exists with off-site back-ups/archiving of operation critical applications, databases, data, etc. routinely performed in terms of an IT Disaster Recovery Plan. | Yes, strongly agree (i.e. All (100%) in place) | Mostly agree (i.e. >75% in place) | Agree somewhat (i.e. >50% in place) | < 50% in place | Nothing in place (i.e. 0%) | Don't know | | | |
| 15, 5 | You have sufficient budget and staff to keep key IT systems stable and up-to-date as per IT policies and procedures. | Yes, strongly agree (i.e. 100%) | Mostly agree (i.e. >75%) | Agree somewhat (i.e. >50%) | < 50% | No (i.e. 0%) | Don't know | | | |

| 16. Organisational Performance Monitoring | | Answers | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 16, 1 | Appropriate plans, policies and procedures to address Disaster Management/emergencies and other issues (safety, public participation, communication, etc.) are developed and implemented. ***NOTE:*** Although Disaster Management is a district function, LMs need to ensure they are aware of their associated roles and responsibilities. | Yes, developed and implemented | Developed but not yet implemented | In development | No, disagree | Don't know | | | | |
| 16, 2 | An organisational performance management system is developed and implemented (i.e. effectively measure, monitor and track water and sanitation services performance indicators). | Yes, developed and implemented | Developed but not yet implemented | In development | No, disagree | Don't know | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 16, 3 | A municipal risk management framework is developed and implemented and includes monitoring and tracking of water and sanitation related risks. | Yes, developed and implemented and includes water and sanitation related risks | Yes, developed and implemented but does not include water and sanitation related risks | Developed but not yet implemented | In development | No, disagree | Don't know | | | |
| 16, 4 | Effective administration support is available to technical staff to assist with processing work orders, providing order numbers, handling correspondence, etc. | Yes, strongly agree (i.e. 100% effective) | Mostly agree (i.e. >75% effective) | Agree somewhat (i.e. >50% effective) | < 50% effective | No, completely ineffective (i.e. 0%) | Don't know | | | |
| 16, 5 | "Access to Basic Water and Sanitation Services" progress reports are frequently produced and presented to council for discussion, action and follow-up. | At least quarterly | At least bi-annually | At least annually | Less frequently (i.e. > 1 year) | No, never | Don't know | | | |

| 17. Water and Sanitation Service Quality | | Answers | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 17,1 | Critical business databases and documents (e.g. as-built drawings, records, manuals, agreements, billing/revenue collection, project and scheme management data, etc.) are current, maintained and stored in secure locations (on-site and off-site, both paper and electronic). | Yes, strongly agree (i.e. 100% in place) | Mostly agree (i.e. >75% in place) | Agree somewhat (i.e. >50% in place) | < 50% in place | Nothing in place (i.e. 0%) | Don't know | | | |
| 17,2 | Customers have adequate access to water (at least basic services and no backlogs, sufficient quantity and flow, good quality, minimal interruptions). | Yes, all have a functional service (i.e. 100%) | At least 90% have a functional service | Most have a functional service (i.e. >75%) | Some have a functional service (i.e. > 50%) | < 50% of customers have a functional service | None have a functional service (i.e. 0%) | Don't know | | |
| 17,3 | Customers have adequate access to sanitation (at least basic services and no backlogs, no blockages, minimal impact on environment). | Yes, all have a functional service (i.e. 100%) | At least 90% have a functional service | Most have a functional service (i.e. >75%) | Some have a functional service (i.e. > 50%) | < 50% of customers have a functional service | None have a functional service (i.e. 0%) | Don't know | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 17,4 | All consumers served experience interruptions of less than 48 hours (at any given time) and a cumulative interruption time during the year of less than 15 days. | Yes, All (i.e. 100%) | >90% of households | >75% of households | >50% of households | <50% of households | None (i.e. 0%) | Don't know | | |
| 17,5 | Households in your WSA experience water pressure problems (no flow/partial flow less than 10 litres/minute) (not to be confused with interruption to supply). | No, None (i.e. 0%) | >10% of households | > 25% of households | > 50% of households | All (i.e. 100%) | Don't know | | | |

| 18. Customer Care (CRM) | | Answers | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 18, 1 | A functional customer service system manned by appropriate customer services representatives and using a complaints register, is in place to address complaints and appropriately inform customers of service interruptions, contamination of water, boil water alert, etc. | Yes, strongly agree | In place, but not ideal | No, disagree | Don't know | | | | | |
| 18, 2 | Regular customer satisfaction surveys are conducted to determine customer satisfaction levels and inform the Customer Care Management Plan | Bi-annual (i.e. twice per year) customer satisfaction surveys | Annual customer satisfaction surveys | Biennial (i.e. every 2nd year) customer satisfaction surveys | Less frequent awareness campaigns (i.e. > 2 years) | No customer satisfaction surveys | Don't know | | | |
| 18, 3 | Please indicate what percentage of the reported water related complaints/callouts are responded to within 24 hours. | All (i.e. 100%) | Most (i.e. >75%) | Some (i.e. > 50%) | < 50% | None (i.e. 0%) | Don't know | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 18, 4 | Please indicate what percentage of the reported. wastewater/sanitation related complaints/callouts are responded to within 24 hours. | All (i.e. 100%) | Most (i.e. >75%) | Some (i.e. > 50%) | < 50% | None (i.e. 0%) | Don't know | | | |
| 18, 5 | A comprehensive customer awareness programme (informing customers of water and wastewater system O&M activities, water quality, resource protection/pollution, reporting incidents/security concerns, etc.) is in place and implemented. | Yes, strongly agree | In place, but not ideal | No, disagree (i.e. no awareness programme) | Don't know | | | | | |

# MuSSA Questionnaire Responses (Questions and Answers) from the SRVM

SECTION: Context Information

a) Municipality name: *Sunday River Valley Municipality*

b) Date of completion: *09 October 2015*

c) Municipality type: *B2 – LM*

d) Water service provider type: *Internal (i.e., municipality)*

e) Wastewater service provider type: *Internal (i.e., municipality)*

f) Water system maintenance: *Internal (i.e., municipality)*

g) Wastewater system maintenance: *Internal (i.e., municipality)*

h) The key staff (i.e., managerial) turnover in your WSA? *Moderate: 10 - 25% (i.e., occasionally lose staff)*

i) Your WSA has developed and implemented a scarce skills policy? *No, not developed*.

j) Your WSA is preparing for the impacts of pending and or new regulations (e.g., Regulation 17 (WTW and WWTW process controllers), municipal Standard Chart of Accounts (mSCOA)? *In process*

k) Your WSA actively provides required drinking water related data to the Regulator (e.g., Blue Drop participation)? *In process*

l) Regular drinking-water quality monitoring and management (including boreholes) is performed for all communities/towns in the WSA? *Most (i.e., >75% of WSA population)*

m) WTWs operational capacity as a function of total design capacity (NOTE: Combine for all WTWs within your WSA)? *>100% – 105%*

n) Your WSA actively provides required wastewater related data to the Regulator (e.g., Green Drop participation)? *In process*

o) Regular wastewater quality monitoring and management is performed for ALL wastewater systems in the WSA? *Most (i.e., >75%)*

p) WWTWs operational flow capacity as a function of total design capacity (NOTE: Combine for all WWTWs within your WSA)? *>95% – 100%*

q) WWTWs operational COD load as a function of total design load (NOTE: Combine for all WWTWs within your WSA)? *90% – 95%*

r) Your WSA actively provides required water conservation and water demand

management related data to the Regulator (e.g., No Drop participation)? *In process*

s) Billing & accounts: With regards to water and sanitation bills, please indicate the frequency of billing and posting of accounts. *Actual billing and posting of accounts on a monthly basis*

t) Development contributions: With regard to new developments, by-laws in your municipality require developers to adequately contribute towards construction of new bulk infrastructure (i.e., developer's charges). *In process*

u) Council is stable with functional committees? *Yes, strongly agree (i.e., Council meetings are held at least quarterly)*

v) Your assessment was completed with appropriate inputs from senior officials within Technical Services, Finance and Human Resources (as a minimum these 3 departments should participate): *Yes, strongly agree (i.e., Technical Services HOD, Finance and HR all participated)*

SECTION: 1. Water Services Planning (see Appendix A)

1. Your WSDP and associated master planning processes includes appropriate Water and Sewage Master Plans, Water Safety Plans and a Wastewater Risk Abatement Plans, and is aligned to the IDP and associated Service Delivery and Budget Implementation Plan targets: *Yes, WSDP developed and contains some of the required plans and alignment (i.e., > 50%)*

2. You are implementing an up-to-date and adopted WSDP. *WSDP adopted but not yet implemented*

3. Your current project list addresses existing needs/shortcomings identified through the WSDP and associated master planning process. *Yes, all projects (i.e., 100%)*

4. Project progress is monitored, tracked and reported to municipal top management/council and the Regulator (through the annual water and sanitation services report) *only to municipal top management/council.*

5. Projects identified through your various planning processes have been implemented in the last 3 years. *Most implemented (i.e., > 75%)*

SECTION: 2. Management Skill Level (Technical)

1. Your council approved technical management organizational organogram meets your business requirements and key posts are filled (e.g., Technical Director, Water Services Manager, Sanitation Services Manager):*Yes, and most posts filled (i.e., > 75%)*

2. You have sufficient technical management staff (appropriate number of staff, e.g., at least 5 posts per 100,000 persons served: < *50% as per organogram*

3. Technical management staff have the correct skills/qualifications and experience as per job description requirements (e.g., if job description requires PrEng, PrTech or CPM, the staff have these qualifications): *Some (i.e., > 50%)*

4. Managers regularly attend appropriate water and sanitation services skills development/training: *Annual skills development/training*

5. Key technical managers (e.g., Section 56 and other Senior Management) have signed and monitored performance agreements: < *50%*

SECTION: 3. Staff Skill Levels (Technical)

1. WTWs are operated by staff with the correct skills/qualifications and experience (as per Regulation 2834): *Some (i.e., > 50%)*

2. WWTWs are operated by staff with the correct skills/qualifications and experience (as per Regulation 2834): *Some (i.e., > 50%)*

3. Water system plumbers, millwrights, mechanics and electricians have the correct skills/qualifications and experience: < *50%*

4. Sewage system plumbers, millwrights, mechanics and electricians have the correct skills/qualifications and experience: < *50%*

5. Staff regularly attend appropriate water and sanitation services skills development/training, including safety (e.g., ESETA courses): *Less frequent skills development / training (i.e., > 1 year)*

SECTION: 4. Technical Staff Capacity (Numbers)

1. Your council approved technical staff organizational organogram meets your business requirements, and posts are filled (i.e., Superintendent of WTWs/WWTWs and below). *Yes, and most posts filled (i.e., >75%)*

2. WTWs are operated by the appropriate number of staff (as per Regulation 2834): *Agree somewhat (i.e., > 50% as per requirements)*

3. WWTWs are operated by the appropriate number of staff (as per Regulation 2834): *Agree somewhat (i.e., > 50% as per requirements)*

4. You have sufficient water and sewerage/sanitation network operations and repair staff/plumbers (i.e., you have the appropriate number of staff*): Agree somewhat (i.e., >5 0% as per organogram)*

5. An active mentoring/shadowing programme is in place where experienced staff train younger, inexperienced staff: *No, disagree.*

SECTION: 5. Water Resource Management (WRM)

1. The results from the Reconciliation Strategies (Large Systems/All Towns) have been incorporated into your WSDP, master planning and IDP processes: *In process*
2. The quantity of water available from the resources is sufficient for your current WSA needs (at the stipulated level of assurance of supply):*1 – 10% shortage*
3. The quantity of water available from the resources is sufficient for your future WSA needs (at the stipulated level of assurance of supply) (i.e., no shortage in 10 years): *21–30% shortage*
4. The source water quality is currently acceptable for its purpose: *Agree somewhat (i.e., > 50% of sources acceptable)*
5. The trend indicates a deteriorating source water quality: < *25% of sources deteriorating.*

SECTION: 6. Water Conservation and Water Demand Management (WCDM)

1. Your WSA has developed a council-approved WCDM strategy that includes a standard water balance (e.g., modified IWA): *Only WCDM strategy developed*
2. Please indicate your percentage non-revenue water (NRW) as per the modified IWA water balance: *50% or more*
3. System input volumes (bulk) to the WSA are accurately monitored using bulk meters (e.g., check metering): *Most (i.e., > 75%)*
4. Please indicate what percentage of all connections are metered and billed (residential and non-residential, e.g., commercial, industrial, etc.): < *50%*
5. Your WSA is implementing appropriate intervention programmes to reduce NRW (e.g., minimization of night flows through pressure management, removal of unlawful connections, leak detection and repairs, consumer education/awareness): *Mostly agree (i.e.,> 75% implementation)*

SECTION: 7. Drinking Water Safety and Regulatory Compliance

1. Please indicate your microbiological drinking-water quality compliance for E.coli (or faecal coliforms) for the communities you are monitoring for the last 12 months:
*< 95%*

2. All your supply schemes, WTWs, process controllers, monitoring programmes, sample points, laboratories, results, procedures, protocols, etc. are registered/frequently updated with the regulator (e.g., via the BDS): < *50% registered/updated*

3. Council have been made aware of all water safety-plan related issues (including those identified via the Blue Drop Certification programme) and issues have been actioned (where applicable): *Issues noted but none tabled (i.e., 0%)*

4. Sufficient funds have been made available to address all these identified water safety related issues: < *50% of required funds*

5. Required corrective actions/remedial measures to address all these identified water safety related issues have been successfully implemented: < *50% implementation*

SECTION: 8. Basic Sanitation

1. You have formal housing areas that are not fully serviced with sanitation infrastructure: *Yes, still trying to meet formal backlog but > 90% are serviced*

2. You have informal housing or rural areas that are not fully serviced with sanitation infrastructure: *Yes, still trying to meet informal or rural backlog but > 90% are serviced*

3. You have a detailed plan and programme to provide safe sanitation to all households (including health and hygiene education and user awareness including water, sanitation and health aspects): *Mostly agree (i.e., > 75% implementation)*

4. Your sanitation budget is appropriate for required sanitation programmes (implementation and operations and maintenance): *Disagree, significant shortfall (50-75% of required funds)*

5. You are servicing your pit latrines and maintaining your sewers and wastewater treatment facilities as per safe sanitation requirements (healthy, environmentally safe, structurally sound, regularly maintained): *Agree somewhat (i.e., > 50% as per requirements)*

SECTION: 9. Wastewater/Environmental Safety & Regulatory Compliance

1. Please indicate your treated wastewater effluent compliance for COD for your (or your service provider's) WWTWs for the last 12 months: < *80%*

2. ALL your WWTWs, process controllers, monitoring programmes, sample points, laboratories, results, procedures, protocols, etc. are registered/frequently updated with the regulator (e.g., via the Green Drop System): < *50% registered/updated*

3. Council have been aware of all W2RAP related issues (e.g., pollution incidents, Green Drop deficiencies) and issues have been actioned (where applicable): *Issues noted but none tabled (i.e., 0%)*
4. Sufficient funds have been made available to address all identified wastewater and environmental safety related issues: *< 50% of required funds*
5. Required corrective actions/remedial measures to address all identified wastewater and environmental safety related issues have been successfully implemented: *Issues noted but no implementation (i.e., 0%)*

SECTION: 10. IAM
1. You have an appropriate and up-to-date water and sanitation services asset register (includes asset name, location, condition, extent, remaining useful life, performance and risk). NOTE: This does only not refer to GRAP17 asset register requirements. *Yes, agree (e.g., basic asset register, i.e., not all aspects included)*
2. You have developed an appropriate IAM plan for your WSA: *In place, but not ideal*
3. You are implementing the IAM outcomes: *No implementation (i.e., 0%)*
4. Budget allocated to implement IAM outcomes is sufficient and is being effectively spent: *No (i.e., 0%)*
5. You conduct annual technical assessments of your water and wastewater related systems (including sources, WTWs, WWTWs, pump stations, network, etc.) and implement required follow-up actions: *No systems (i.e., 0%)*

SECTION: 11. Operation & Maintenance of Assets
1. A maintenance workshop/store that is secure and stocked with essential equipment (e.g., spare parts) and tools is available: *No, disagree*
2. Appropriate water and sanitation services infrastructure/equipment planned/preventative maintenance schedules are developed: *No, disagree*
3. Appropriate planned/preventative maintenance is performed at all WTWs and associated reservoirs, pump stations, distribution network: *None (i.e., 0%)*
4. Appropriate planned/preventative maintenance is performed at all WWTWs and associated collection system, pump stations: *None (i.e., 0%)*
5. Please indicate your infrastructure repairs and maintenance costs as a function of total operating expenditure (%): *5% – <8%*

SECTION: 12. Financial Management

1. Financial controls: With regard to your last audit report on the financial statements, please state the audit opinion: *Disclaimer of audit opinion*

2. Cash flow status: Please state your cash/cost coverage ratio (excluding unspent conditional grants): < *30 days*

3. Your actual operating expenditure closely reflects your budgeted operating expenditure (i.e., Operating Expenditure Budget Implementation Indicator): < *80%*

4. Your actual revenue closely reflects your budgeted operating revenue (i.e., Operating Revenue Budget Implementation Indicator): < *80%*

5. Liabilities (creditors): Money is owed by your municipality to major/critical service providers (e.g., ESKOM, Water Board, largest contractors, etc.) for more than 30 days from receipt of invoice (NOTE: Ignore disputed invoices): *More frequently than quarterly*

SECTION: 13. Revenue Collection

1. Please indicate the frequency of actual meter readings: *Actual meter reading on a monthly basis*

2. Net surplus/deficit: Please state your net surplus/deficit from water services activities for the last 12 months (NOTE: This question tests whether your WSA currently has fully cost reflective water and sanitation tariffs (which take into account cost of maintenance and renewal of purification plants and networks, and the cost of new infrastructure): *Net deficit (i.e., < 0%)*

3. Revenue collection: Please state the revenue collection rate in respect to water & sanitation services (%): < *50%*

4. Revenue growth: Please state your water and sanitation services revenue growth for the last 12 months (%): > *CPI*

5. Grant dependency: Actual operating revenue less operational grants/subsidies (e.g., equitable share) sufficiently covers actual operating expenditure: *Most (i.e., > 75%)*

SECTION: 14. Financial Asset Management

1. Capital expenditure (municipal): Please state your municipal capital expenditure as a percentage of total expenditure (i.e., total operating expenditure + capital expenditure): *20% or more*

2. Capital expenditure (water services): Please state your capital expenditure on water and sanitation services as a percentage of total capital expenditure (capital expenditure (municipal): < *25%*

3. Asset renewal: Please state your asset renewal investment as percentage of depreciation costs: *None (i.e., 0%)*

4. Repairs and maintenance: Please state your repairs and maintenance expenditure as a percentage of property, plant and equipment, investment property (carrying value): < *5%*

5. Grant funding of capital expenditure: Please state your reliance on grant funding: > *90%*

SECTION: 15. Information Management (IT)

1. You have a developed, approved and implemented IT master systems plan (e.g., covering 3-5 years) that addresses your IT business requirements: *No, disagree*

2. You have a developed, approved and implemented ICT technology master plan that addresses your current and future IT infrastructure requirements: *No, disagree*

3. You have IT systems that support your full range of water and sanitation services business requirements (e.g., billing, GIS, customer care, operations and maintenance, asset management): < *50% of required systems*

4. ICT service continuity: Adequate IT security exists with off-site back-ups/archiving of operation critical applications, databases, data, etc. routinely performed in terms of an IT disaster recovery plan: < *50% in place*

5. You have sufficient budget and staff to keep key IT systems stable and up-to-date as per IT policies and procedures: < *50%*

SECTION: 16. Organisational Performance Monitoring

1. Appropriate plans, policies and procedures to address disaster management/emergencies and other issues (safety, public participation, communication, etc.) are developed and implemented. Note: Although disaster management is a district function, local municipalities need to ensure they are aware of their associated roles and responsibilities: *Developed but not yet implemented*

2. An organizational performance management system is developed and implemented (i.e., effectively measure, monitor and track water and sanitation services performance indicators): *In development*

3. A municipal risk management framework is developed and implemented and includes monitoring and tracking of water and sanitation related risks: *Developed but not yet implemented*

4. Effective administration support is available to technical staff to assist with processing work orders, providing order numbers, handling correspondence, etc.: *Mostly agree (i.e., > 75% effective*)

5. "Access to Basic Water and Sanitation Services" progress reports are frequently produced and presented to council for discussion, action and follow-up: *Less frequently (i.e., > 1 year)*

SECTION: 17. Water and Sanitation Service Quality

1. Critical business databases and documents (e.g., as-built drawings, records, manuals, agreements, billing/revenue collection, project and scheme management data, etc.) are current, maintained and stored in secure locations (on-site and off-site, both paper and electronic): < *50% in place*

2. Customers have adequate access to water (at least basic services and no backlogs, sufficient quantity and flow, good quality, minimal interruptions): *Most have a functional service (i.e., > 75%)*

3. Customers have adequate access to sanitation (at least basic services and no backlogs, no blockages, minimal impact on environment): *Most have a functional service (i.e., > 75%)*

4. All consumers served experience interruptions of less than 48 hours (at any given time) and a cumulative interruption time during the year of less than 15 days: *Yes, all (i.e., 100%)*

5. Households in your WSA experience water pressure problems (no flow/partial flow less than 10 litres/minute) (not to be confused with interruption to supply): *> 50% of households.*

SECTION: 18. Customer Care (CRM)

1. A functional customer service system manned by appropriate customer services representatives and using a complaints register is in place to address complaints and appropriately inform customers of service interruptions, contamination of water, boil water alert, etc.: *No, disagree*

2. Regular customer satisfaction surveys are conducted to determine customer

satisfaction levels and inform the customer care management plan: *No customer satisfaction surveys*

3. Please indicate what percentage of the reported water related complaints/callouts are responded to within 24 hours: *Most (i.e., > 75%)*

4. Please indicate what percentage of the reported wastewater/sanitation related complaints/callouts are responded to within 24 hours: *Most (i.e., > 75%)*

5. A comprehensive customer awareness programme (informing customers of water and wastewater system operations and maintenance activities, water quality, resource protection/pollution, reporting incidents/security concerns, etc.) is in place and implemented: *No, disagree (i.e., no awareness programme*

# APPENDIX B: BLUE DROP ASSESSMENT SCORECARD

1. Water safety planning

1.1 Water safety planning process (10%)

a) The water safety planning process is steered by a group of people, which includes the technical, financial, and management staff of the municipality. Where a WSP arrangement exists, the WSA and WSP should partake in this process.
b) There should be clear indication that the water services institution conducted a water safety planning process and not only drafted a document.
c) There should be clear reference to the specific water supply system at hand and not only global risk management measurements.

Bonus points under this section are awarded if the water services authority can prove that it has provided the following:

d) Proof training of samplers or sampling quality control measures (rate of sampling, training course, duration, service provider and detail of attendees);
e) Evidence of relevant sampling training that will ensure credibility of the sampling process; or
f) Evidence of control measures to ensure sampling credibility;
g) Communication on the incident-management protocol process with all relevant staff within the municipality.

1.2 Risk Assessment (35%)

a) The risk assessment must cover catchment, treatment and reticulation
b) The water services institution must provide information on findings of the risk assessment (and detail risk prioritization method followed) for the specific water supply system including water resource quality. The format is not important, but it should be proven not to be a desktop study.
c) The water safety planning process must include (adequate) control measures for each significant hazard or hazardous event identified.
d) A water quality analyses conducted for at least 95% of the South African

National Standards (SANS) 241 list of determinants (min 80%) (SANS, 2006, 2011). This is to verify whether treatment technology is adequate to treat the raw water to comply with national standard limits.

e) The water services institution should provide proof of implementation of mitigation measures from previous water safety plans.

1.3 Monitoring Programme (30%)

a) Prove operational monitoring is informed by the risk assessment
   - Required sites to monitor raw water, after filtration (per process unit) and final water
   - Determinants (minimum): pH, turbidity and disinfectant residual
   - Frequency of analyses should be at least every 8 hours
   - Equipment used plus calibration records

b) Prove compliance monitoring involves the following:
   - Informed by the risk assessment and SANS 241 compliant
   - Monitoring programme is registered on the Blue Drop System (BDS)
   - Actual monitoring occurs according to registered BDS monitoring programme (> 80%)
   - Required sites to monitor: Water works final and distribution network plus frequency of analyses: Water works final according SANS 241; distribution network according SANS 241.
   - Coverage of population served must be at least 80%.

1.4 Credibility of DWQ data (15%)

a) Certificate of Accreditation for applicable methods or *z*-score results (*z*-scores of ≥ –2 & ≤ –2 are acceptable in a recognized proficiency testing scheme)

b) DWQ data credibility on the BDS (Blue Drop certified data).

1.5 Incident Management (10%)

a) Protocol to specify:
   - Alert levels
   - Response times
   - Required actions
   - Roles and responsibilities
   - Communication vehicles/methods, and

- Responses on possible risks identified in the risk assessment of the water safety planning process.

b) The incident register includes the following:
   - Date, location and description of incident
   - Action taken and date of resolution
   - Outcome of cause investigation

2. Drinking water management and control (8%)

2.1 Works classification compliance (15%)

Treatment works are classified according the requirements of Regulation 2834, and only the classification as it appears on BDS will be used. Supporting evidence to allow the correct classification is to be loaded on BDS, and water services institutions remain accountable for correctness of information/classification. The certificate is to be displayed at the treatment works (confirmed during on-site assessments).

2.2 Process control registration compliance (50%)

a) Process control staff must be registered according to Regulation 2834 with the Department of Water Affairs. Water services institutions are to prove per treatment works that process control staff comply with the legislative requirements of
   - Number of process controllers
   - Required classification levels

b) The supervisor must comply with legislative requirements. Information as it appears on BDS will be used; water service institute test to ensure correct classification of all staff per treatment plant.

2.3 WTW logbook

a) A logbook is in place to record all incidents and observations at the WTW treatment works.
b) Evidence is presented that the logbook process (i.e., communication medium between process controllers and shifts) is being implemented. It is not required to be implemented for the entire assessment period.

3. DWQ verification

3.1 Microbiological DWQ compliance (50%)

The microbiological quality of the water supply must comply with the South African National Standard (specifically, the 2014 Blue Drop limits that have been derived from SANS 241 (2006, 2011) as per the excellent requirements set by the Blue Drop programme. (*E coli*) (97% for < 100 000 population) and (99% for > 100 000 population)

3.2 Chemical DWQ compliance (45%)

The chemical quality of the water supply must comply with the excellent requirements set by the Blue Drop programme for all chemical-health determinants listed in the SANS (the 2014 Blue Drop limits, derived from SANS 241 [2006, 2011])

Chemical-health (acute and chronic):

- Excellent compliance (95% for < 100 000 of the population and 97% for > 100 000 the population).
- Good compliance (93% for < 100 000 of the population and 95% for > 100 000 of the population)

3.4 Operational compliance (5%)

The compliance of operational determinants must comply with the 2014 Blue Drop excellence limits set by the Blue Drop programme:

- Excellent compliance (93% for < 100 000 of the population and 95% for > 100 000 of the population).
- Good compliance (90% for < 100 000 of the population & 93% for > 100 000 of the population).

4. Management, accountability and local regulation (10%)

4.1. Management commitment.

Management's commitment to effective DWQ operations and management should be portrayed by proof of signature approval of the following:

a) Water safety plan.
b) DWQ monitoring programme.
c) Water treatment plant logbook
d) Operations and maintenance budget.
e) WSDP.

4.2 Publication of performance (25%)

Evidence should be provided on the various means of DWQ information made public to the constituencies supplied with drinking water from this specific water supply system.

Forms of publication:

- Newspaper publication
- Municipal billing
- Community radio
- Annual report
- Posters and pamphlets
- Population and promotion of "My Water"
- Electronic webpage

Water services institutions must provide evidence of adequate marketing of existing Blue Drop certified water supply systems.

4.3 Service level agreement/performance (15%)

Should there be an institutional arrangement between the water services authority and the WSP, it is essential that the legislatively required contract (Section 19 of the Water Services Act) stipulate the service level agreements between the two entities. A copy of this document is required,

OR

Should the water services authority fulfil the function of WSP as per Section 78 arrangements, it is required that the responsible manager (official) have a performance agreement (work-plan) in place which stipulates DWQ management responsibilities.

4.4 Submission of DWQ data (30%)

a) 12 months of data had been submitted on the BDS. (DWS will only consider data available on the BDS)

c) All compliance monitoring test results are required to be submitted

d) As per a requirement of the Water Services Act (Section 62, Section 9 Regulations), compliance data submission occurred monthly (measured as

BDS submission compliance).

5. Asset management (14%)

5.1 Annual process audit (20%)

Process audit report on technical inspection/assessment of treatment facility and evidence of implementation of findings: This process assessment should be done within the 12-month assessment period.

5.2 Asset management (15%)

The institution must present a complete asset register. The asset register must include the following:

a) Details of relevant equipment and infrastructure

b) Asset description

c) Location

d) Condition (remaining life)

e) Replacement value.

5.3 Availability and competence of maintenance team (15%)

a) The institution must present evidence of a competent maintenance team (in form of organogram, contract or invoice). A logbook with maintenance entries will serve as adequate evidence (for mechanical, electrical, instrumentation and civil work)

b) Additional proof required on team competency (e.g., qualification and experience and trade-test).

5.4 Operations and maintenance manual (15%)

The operations and maintenance manual should contain the following:

a) Civil, mechanical, electrical detail/drawings of plant

b) Design capacity of plant

c) Operational schedules and maintenance schedules

d) Process detail and control

e) Mechanical and electrical equipment specification

f) Fault finding

g) Monitoring.

5.5 Operations and maintenance budget and expenditure (20%)

The institution must present credible evidence of the following:

a) Maintenance budget (as part of operations budget)

b) Maintenance expenditure (as part of the operations expenditure)

c) Maintenance expenditure should be more than 5% of the operations expenditure in total for the preceding financial year

d) Financial expenditure to apply as per municipal budget year.

5.6 Design capacity vs. operational capacity (15%)

a) Proof to be submitted of the documented design capacity and documented daily operating capacity over the past 12 months.

b) Groundwater defendant systems must have an acceptable plan, which stipulates extraction patterns that will prevent aquifer damage.

c) Flow meters must be calibrated at least annually.

# APPENDIX C: RESEARCH ETHICS CLEARANCE CERTIFICATE

Research Office

**HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)**
R14/49 Mulenga

| | |
|---|---|
| **CLEARANCE CERTIFICATE** | **PROTOCOL NUMBER: H16/11/27** |
| **PROJECT TITLE** | Challenges of water management at local government level in the Eastern Cape of South Africa |
| **INVESTIGATOR(S)** | Mr K Mulenga |
| **SCHOOL/DEPARTMENT** | Civil and Environmental Engineering/ |
| **DATE CONSIDERED** | 18 November 2016 |
| **DECISION OF THE COMMITTEE** | Approved |
| **EXPIRY DATE** | 19 January 2020 |

**DATE** 20 January 2017 **CHAIRPERSON** J. Knight

(Professor J Knight)

cc: Supervisor : Professor A Taigbenu

**DECLARATION OF INVESTIGATOR(S)**

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University. Unreported changes to the application may invalidate the clearance given by the HREC (Non-Medical)

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we ~~undertake~~ to resubmit the protocol to the Committee. **I agree to completion of a yearly progress report.**

Signature

24, 01, 2017
Date

**PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES**

## APPENDIX D: WATER QUALITY SURVEY QUESTIONARE

### WATER SERVICES QUALITY SURVEY

The purpose of the survey is twofold:

- To measure the customer satisfaction with regards to the water services delivered by the Municipality
- To measure the performance of the Municipality in relation to the Legislative prescripts

1. **What type of water do you drink?**

| | |
|---|---|
| Tap Water on its own | |
| Filtered Tap Water | |
| Boiled Tap Water | |
| Bottled Water | |
| Bottled and Tap water | |

2. **Please rate the quality of water (taste, color, smell) delivered by the municipality**

| | | |
|---|---|---|
| 4 | Very safe to drink | |
| 3 | Safe to drink | |
| 2 | Unsafe to drink | |
| 1 | Very unsafe to drink | |
| N/A | We don't drink tap water | |

3. **What is the reason for the answer to Question 2 ( only if rating 4 and 3 in Question 2)**

| | |
|---|---|
| Nobody gets sick | |
| The water looks clean | |
| The water smells good | |

| | |
|---|---|
| The water smells of chlorine | |
| The water tastes good | |
| The Municipality cleans the water | |
| The Municipality tests the water to see that it is safe to drink | |

**4. What is the reason for the answer to Question 2 ( only if rating 2 and 1 in Question 1)**

| | |
|---|---|
| Some people got sick from the water | |
| The water looks dirty | |
| The water smells bad | |
| The water smells of chlorine | |
| The water tastes bad | |
| The Municipality does not cleans the water | |
| The Municipality does not tests the water to see that it is safe to drink | |

**5. How do you describe the municipality's water services provision to your household?**

| | |
|---|---|
| Excellent | |
| Good | |
| Not sure/nuetral | |
| Bad | |
| Very Bad | |

**6. How often do you expirience water supply interruptions?**

| | |
|---|---|
| Within 1 to 2 days | |
| Within a week ( 7 days) | |
| Within two weeks | |
| Within one month | |
| Within two months | |
| Never | |

**7. Have you complained to the municipality about water related issues?**

| | |
|---|---|
| Yes | |
| No | |

**8. If your answer to Question 6 above is "Yes" what has been the response of the municipality?**

| | |
|---|---|
| Always Responded | |
| Occasionally responded | |
| Never Responded | |

**9. If your answer to Question 6 above is "No", what is the reason for the answer?**

| | |
|---|---|
| Municipal Service is excellent | |
| Municipal Service is poor but I do not think the municipality will respond | |
| Have not seen the reason to make complaints known to the municipality. | |

**10. How long does the municipality take to repair the leaks when you report them?**

| | |
|---|---|
| Within 1 to 2 days | |

| | |
|---|---|
| Within a week ( 7 days) | |
| Within two weeks | |
| Within one month | |
| Within two months | |
| Never | |

**11. Do you think the municipality is competent to deliver good water services**

| | |
|---|---|
| Yes | |
| No | |
| Not sure | |

**12. Will the municipality be able to deal with a water scarcity in the event of a drought?**

| | |
|---|---|
| Yes | |
| No | |
| Not sure | |

**13. How much water does your household use per day or per month, on average.**

| | |
|---|---|
| I do not know | |
| Less than 10 number of 20 litre container/buckets | |
| About 10 to 15 number of 20 litre containers/buckets | |
| About 15 to 20 number of 20 litre container/buckets | |

| | |
|---|---|
| More than 20 number of 20 litre containers/buckets | |

## APPENDIX E: WATER QUALITY CHEMICAL LAB ANALYTICAL REPORT

## APPENDIX F: WC/WDM STATUS QUO

| ITEM | CATEGORY | STATUS QUO | ANALY | STRATEGY | PRIORITY |
|---|---|---|---|---|---|
| 1 | INSTITUTIONAL REVIEW | | | | |
| 1.1 | **Water and Sanitation department structure** | | | | |
| 1.1.1 | Is there an approved organogram for the Water and Sanitation Department? | There is an approved organogram in place. There are however Gaps in the Organogram Provision is made for the WSP not the WSA. | O | Review the existing organogram and ensure that it incorporates WC/WDM personnel and adequate O&M staff. | 1 |
| 1.1.2 | What is the vacancy rate in the department and is it a problem? | 40% vacancy rate. There are gaps particularly in<br><br>Management. The WSA, WSP staff dichotomy needs to be resolved. | T | Advertise and fill the identified critical vacant posts | 1 |
| 1.1.3 | Does the department have the correct technical skills for the correct posts. | No training-taking place, there is limited capacity in the department. Process controllers are however being trained now. | T | Increase management, and O&M capacity through new human resources and support it with WC/WDM training | 2 |
| 1.1.4 | Is training and capacity building being done? | Training not taking place but it is being included in the business plan particularly for the treatment plant process controllers. | O | Institute a mandatory WC/WDM training programme for technical staff. Invest in team building and workshop sessions incorporating the councillors and municipal management to boost staff morale. | 2 |
| 1.1.5 | Are there sufficient support structures, vehicles, equipment, materials etc.? | There are not enough materials to do the work. The condition of some of the working vehicles is very poor. The procurement of material is | T | Engage with the Department of Finance and allocate an adequate budget for the critical spares. Allocate a specific person who | 2 |

| | | | | | |
|---|---|---|---|---|---|
| | | currently problematic due to the financial administration that the Municipality underwent. | | will be responsible for expediting equipment orders and managing quality control in terms of the procurement processes. Purchase additional vehicles. Obtain a suitable vehicle tracking<br><br>system for the municipal vehicles and request a<br><br>dedicated individual for fleet management. | |
| 1.1.6 | Does the municipality own any water loss control equipment such as loggers, listening sticks, etc.? | No water loss equipment is available. | O | It is recommended that loggers and simple leak<br><br>detection equipment be purchased to improve water loss monitoring and management in the system. | 3 |
| 1.2 | **Municipal support** | | | | |
| 1.2.1 | Describe the working relationship with other departments such finance, planning, housing etc.? | Planning and housing are part of the technical department so access to these departments is good. The relationship with the finance department is not very good. Finance is not prioritizing water service (Technical). Prioritisation after administration was skewed towards social services. | O | Establish an NRW steering committee comprising<br><br>representatives from the technical and finance<br><br>departments to strengthen communication and<br><br>access to information. | 1 |
| 1.2.2 | Are the politicians supporting the department? | The politicians are supportive figuratively speaking but in action it does not translate. Training for the politicians is required to help the politicians gain a better understanding of the water business | O | Undertake a WC/WDM councillor induction<br><br>programme to support the councillors with the<br><br>knowledge to increasingly participate in driving | 2 |

| | | | | | |
|---|---|---|---|---|---|
| | | | | WC/DM in the communities. | |
| 1.3 | **Public Private Partnerships** | | | | |
| | Is there any major industrial or institutional role player in the area and is there co-operation? (i.e.<br><br>Mines or industries that impacts | The Sundays River Valley Citrus Company (SRCC) is a possible big role-player. | S | Identify any other additional role players through the top consumer monitoring and conduct courtesy visits as a first phase of the programme. Establish a monthly forum where these partnerships can be nurtured to obtain additional assistance from these major role players. | 1 |
| 1.3.2 | If yes, what does the co-operation involve and can it be expanded? | Does the municipality have a customer service charter? | | | |
| 1.4 | **Legislation and bylaws** | | | | |
| 1.4.1 | Does the municipality have a customer service charter? | The municipality doesn't have one in place but the municipality is in the process of developing one. | 0 | Develop a customer service charter to ensure the<br><br>customers are aware of the municipalities<br><br>commitment and their responsibilities as consumers. | 3 |
| 1.4.2 | What is the status and age of the existing bylaws and do they address water loss management? | There are bylaws in place, which are approximately 4 years old, but they don't address demand management. | O | Review the bylaws and utilise the process to ensure that WC/WDM issues are captured and addressed by the bylaws | 2 |
| 1.4.3 | Are bylaws enforced and if not, why not? | The bylaws are enforced to a limited extent, however the personnel or capacity for enforcement is lacking. | O | Develop partnerships with the credit control and legal departments as well as the SAPS and put appropriate bylaw enforcement | 2 |

| | | | | | |
|---|---|---|---|---|---|
| | | | | mechanisms in<br><br>place. Identify a person on the technical team or<br><br>appoint additional resources who will drive the bylaw enforcement in the municipality. | |
| 1.4.4 | What is the status and age of Water Services Development Plan? | There is an approved WSDP in place but its in the old format (UWP) was commissioned by DWA to change the WSDP into the new format | O | Continue to update and submit the WSDP on an<br><br>annual basis to aid coherent planning. Ensure that<br><br>the WSDP is approved by Council | 2 |
| | | | | | |

| ITEM | CATEGORY | STATUS QUO | SWOT | STRATEGY | PRIORITY |
|---|---|---|---|---|---|
| 2 | FINNACIAL REVIEW | | | | |
| 2.1 | Financial Department | | | | |
| 2.1.1 | What is your opinion of the Finance Department's ability to perform metering and billing | Not enough meter readers and they were not trained. There is<br><br>an electronic system in place but there are challenges with this<br><br>system. A lot of the billing is based on estimation as the<br><br>meters are not being read regularly. Some training was done on meter tampering and plumbing but it was not sufficient. No audits or quality control is being done with regards to the meter readings. There is something being done | T | Appoint additional meter readers and provide and<br><br>extended annual WC/WDM training programme for the meter readers to improve their competence and morale. | 1 |

| | | | | | |
|---|---|---|---|---|---|
| | | recently on this. | | | |
| 2.1.2 | Is training and capacity building being done? | | | | |
| 2.1.3 | What is the state of the municipal metering and billing system? | The meter readers don't provide any exception reports. No bills have been sent out over the past 8 months due to changes in the billing system and the financial administration that the municipality has undergone. New housing projects are not metered and are not paying for their water. About 11 000 connections are metered and billed some of them on the flat rate and 1800 connections are unbilled unmetered and 2800 (<br><br>Moses Mabhida) are billed unmetered. | T | Obtain a more suitable system for the metering and billing function or appoint an individual or service provider to get the existing system operational as a matter of priority. Focus on metering and billing all formal connections where practicable and work on consistently sending bills to the consumers to increase their confidence in the municipal billing system. | 1 |
| 2.1.4 | What is your primary source of funding? | Equitable share. MIG and RBIG for infrastructure. | O<br><br>T<br><br>W | Focus on improving metering and billing and cost recovery where practicable once water treatment challenges have been resolved to reduce dependency on grant funding | 2 |
| 2.2 | **Tariffs** | | | | |
| 2.2.1 | Who prepares the water tariffs and what is it based on? | The CFO prepares the tariffs with inputs from the technical department. A consultant was previously requested to review the tariffs but no result was obtained from this. Generally, a percentage escalation is applied annually on the tariffs | O<br><br><br>W | Resolve all outstanding issues with regards to the appointment of the service provider and undertake the tariff review. Continue to ensure that the technical department makes inputs into the tariff setting | 2 |

| | | | | | |
|---|---|---|---|---|---|
| 2.2.2 | What is the tariff structure and does it promote WCWDM? | A rising block or step tariff is in place but its not sufficient to<br><br>promote demand management. | O | Review the existing tariffs and ensure that the rising block tariff is sufficiently differentiated in cost at each level to promote WC/WDM, with the highest tariff at least twice the amount of the lowest tariff | 2 |
| 2.2.3 | Do the customers consider the water supplied affordable? | The consumers generally feel the water is affordable. | O | Continue ensuring that the tariffs remain affordable particularly for the efficient and low-income water users. Closely monitor the water quality and establish the reasons for the dissatisfactory quality | 2 |
| 2.3 | **Meter Reading and Billing** | | O | | 2 |
| 2.3.1 | Who performs the water meter readings, frequency and accuracy? | The municipal meter readers perform the meter reading but the accuracy is questionable. | T | Provide WC/WDM training for the meter readers on an annual basis, particularly on site training based on feedback from the consumers. | 2 |
| 2.2.2 | Are the meter readers trained and can they report leakage when encountered on site? | Meter readers are not trained. | | | |
| 2.3.3 | Is the water bill understandable and informative? | The water bill shows one months consumption and seldom<br><br>shows water conservation information. | 0 | Consider including water conservation tips and<br><br>information in the water bill. It is also recommended<br><br>to display 6 months graphical consumption data on<br><br>the bill to aid consumers in effectively monitoring<br><br>water use | 3 |
| 2.3.4 | Describe the relationship between customers and the | The relationship with the customers is 40 % good, 60 | T | Engage with the customers through the | |

| | | | | | |
|---|---|---|---|---|---|
| | municipality and the reasons? | % bad in terms of reporting. The satellite offices are also available for this purpose | | councilors and gain their support and cooperation. Build on the relationship with all the consumers and strengthen it through community awareness campaigns | |
| | | | | | |
| 2.4 | **Credit Control** | | | | |
| 2.4.1 | Is credit control being implemented and by whom? | Finance Department implements credit control. | O | Through the legal department, develop appropriate credit control enforcement mechanisms to improve revenue recovery. Also involve National Treasury in terms of how internal departments should be dealt with in order to recover the cost of supplying water to<br><br>them | 3 |
| 2.4.2 | What is the current level of non-payment? | 30% payment of services. | O | Focus on promoting payment for services in the metered areas through the councillors and education<br><br>and awareness. | 2 |
| 3 | **SOCIAL REVIEW** | | | | |
| 3.1.1 | **Customer profile** | | | | |
| 3.1.2 | Describe the general consumer profile i.e. Income levels, indigence, unemployment, literacy | Approximately 4000 people are on the indigent list. People generally don't want to register as an indigents and the people who can afford to pay also don't want to pay. Most of the population is low income and most of the high income people live on the farms and don't get services from the | O | Focus on educating the indigent population on<br><br>efficient water use and the importance of the free basic allocation as well as its limitations and the<br><br>higher income groups on the importance of payment for services to improve service delivery. | 2 |

| | | | | | |
|---|---|---|---|---|---|
| | | municipality. | | Bylaw enforcement should also take root. | |
| 3.2 | Customer awareness | | | | |
| 3.2.1 | Are consumers informed regarding the value of water? | Consumers are not informed regarding the value of water? They do not conserve water. | T | Budget and undertake a continuous annual<br><br>education and awareness campaign focusing on promoting water use efficiency | 2 |
| 3.2.2 | What is the level of leakage reporting by the community and what method do they use? | The levels of reporting are about 40%. There are satellite offices are also available but a lot of the consumers report<br><br>problems at head office particularly financial queries. Reporting of leakage is very high especially in the areas that have been on water restrictions. | O | Publicise the customer care services and satellite reporting offices through the councilors, pamphlets<br><br>attached to water bills and local media to promote reporting of leakage. | 2 |
| 3.2.3 | What are the most prominent consumer behavioural challenges encountered by the municipality? | Garden watering is prominent in some of the township. | T | The community awareness campaign should be<br><br>tailored to address these problems. The councilors should be encouraged to make these issues an genda at all public meetings held in the different wards | 2 |
| 3.2.4 | Is xeriscaped gardening and rain water harvesting encouraged? | Rain water harvesting is promoted especially in Pattison however due to political issues this intervention never took root in Pattison. | O | As part of a community awareness campaign,<br><br>encourage consumers to harvest rain water and utilise it for garden irrigation and cleaning to reduce the demand for potable water. Ensure that the councillors are the first point of training in this regards and obtain their | 2 |

| | | | | | |
|---|---|---|---|---|---|
| | | | | support before continuing with the programme | |
| 3.2.5 | Are radio campaigns, bill board, pamphlets, informative billing used to inform and educate customers? | No | O | Develop simple visual material in the form of<br><br>pamphlets to be attached to the water bill which can be used to educate consumers on efficient water use. Once the initial communication has been established, consider periodically publicizing water tips on local media such as radio stations and newspapers | 2 |
| 3.3 | **Schools awareness** | | | | |
| 3.3.1 | Number of primary and secondary schools? | | | | |
| 3.3.2 | Frequency and scope of schools awareness campaigns? | There are no schools campaigns currently taking place. | O | Establish a relationship with schools. Monitor their consumption on a monthly basis and undertake education and awareness. Huge benefit can be derived from this. The section 21 schools in particular should be visited, monitored and encouraged to fix leakage as the O&M budgets are operated by the school management for this category of schools. | 2 |
| 3.3.3 | Are goals and objectives monitored and controlled? | N/A | | | |
| 3.4 | **Customer Care Centre** | | | | |
| 3.4.1 | Does the municipality have a CCC and who operates it? | The municipality is currently embarking on a customer care centre. There is a lady at head office who is heading this | O | Establish the customer care centre and support the personnel with WC/WDM training to ensure that they are | 2 |

| | | | | | |
|---|---|---|---|---|---|
| | | up. | W | equipped to efficiently and competently assist the consumers. | |
| 3.4.2 | How and to whom are billing queries referred? | Finance office in Kirkwood. | O | Obtain an electronic system to capture and monitor the queries referred and to track the resolution of the queries | 2 |
| 3.4.3 | To whom are the leak reports referred and do consumers have confidence in the reporting system? | The leak reports go to the Kirkwood office and then to the technical department. The system is manual, no job card system is in place | O | Obtain an electronic system to capture and monitor the queries referred and to track the resolution of the queries. | 2 |
| | | | | | |

| ITEM | CATEGORY | STATUS QUO | SWOT | STRATEGY | PRIORITY |
|---|---|---|---|---|---|
| 4 | TECHNICAL REVIEW | | | | |
| 1.1 | **Measurement and control** | | | | |
| 4.1.1 | Is the system input volume measured, monitored and controlled? | Pattison uses boreholes, which are metered. All the potable water is metered. | S | Read bulk meters on a monthly basis and continue to monitor input volumes | 1 |
| 4.1.2 | Is the water supply system sectorised into zones and districts? | The network is sectorised and metered. | S | Monitor zone discreteness on an annual basis. | 3 |
| 4.1.3 | Are the supply to the zones and districts metered? | The zones are metered | S | and captured on a spread sheet. Ensure that | 2 |

| | | | | | |
|---|---|---|---|---|---|
| | | | | operation of the boundary valves is well understood by all O&M personnel to ensure the zones are kept discrete and functioning properly. | |
| 4.1.4 | Is the system monitored through a telemetry system? | The meters are read physically. There is not telemetry system | W | | |
| 4.1.5 | What is the Frequency and detail of your water balance calculation? | No water balance. The Cooperatives are currently collecting the data for this. The non revenue water is estimated to be less than 10% | O<br>W | Develop an NRW water balance which must be<br>updated on a monthly basis to monitor water losses. | 3 |
| 4.1.6 | Are minimum night flows, consumption trends and logging used to monitor the system? | No MNF analysis is taking place. | O | Obtain and install logging equipment periodically on the bulk meters and conduct MNF analysis to<br>determine leakage levels and areas experiencing | 1 |
| 4.1.7 | Are monthly management reports prepared and key performance indicators measured? | No monthly reports are being compiled. | W | Consolidate the available data from the water<br>treatment works(capacity of the water treatment<br>works) and department of finance and compile a<br>monthly NRW report with the relevant KPI's | |
| 4.2 | **Physical leakage** | | | | |
| 4.2.1 | What is the average age of the network, pipe material, replacement programme? | No replacement programme. Pattison and Kirkwood are the<br>oldest areas and the pipes are all asbestos. Parts of valentia<br>and eons also have asbestos pipes. | T | Set aside 5% of the CAPEX budget for the<br>replacement of the network. | 2 |

| | | | | | |
|---|---|---|---|---|---|
| 4.2.2 | Number of burst pipes reported and repaired per week / month and the average response time? | Pipe bursts are not a significant problem but most of the bursts happen on the asbestos pipes. Connections leaks range 7-8 per month. | O | Undertake an infrastructure refurbishment programme. Also consider further pressure management where practicable to reduce the number of connection bursts and leakage | 2 |
| 4.2.3 | What is the primary cause of burst pipes? | Old infrastructure. | T | Allocate a proper budget for replacement and refurbishment. Budget a minimum of 5% of the infrastructure value for this purpose to reduce the risk of system failure | 2 |
| 4.2.4 | Are active leak detection programmes conducted? | No active leak detection. | O<br><br>W | Undertake active leak detection on the network on an annual basis. Select appropriate areas for the leak detection exercise based on the district meter readings. This can be done through the meter readers. | 2 |
| 4.2.5 | How often and for how long do reservoirs overflow? | Reservoir overflows are not a problem. | S | Continue to monitor the reservoirs on a monthly<br><br>basis | 3 |
| 4.2.6 | Are water losses from treatment processes (backwash, etc.) monitored and minimised? | Generally the backwash losses are not very significant. They only become significant when desludging is taking place (approximately 15% losses). | T | Consider undertaking an extended and coordinated leak repair programme on indigent properties to rapidly and drastically decrease water losses. | 1 |
| 4.2.7 | Is leakage on private properties a problem and if so, why? | Leakage on private properties is a problem especially because most of the population is low income. | T | Undertake an internal leak audit in critical areas to accurately determine the extent of water losses and do a cost benefit analysis to assess the merit of carrying out a coordinated annual leak repair | 1 |

| | | | | | |
|---|---|---|---|---|---|
| | | | | programme for indigent consumers | |
| 4.2.8 | Are leaks on indigent private properties repaired and removal of wasteful devices encouraged? | The municipality fixes leaks on indigent households on an ad hoc basis | T | | 2 |
| 4.3 | **Pressure management and control valves** | | | | |
| 4.3.1 | What is the average and maximum system pressure? | Pressures range from 1.8 - 3.6 bars | S | Maintain the satisfactory operating pressure and ensure that operating pressures never exceed the DWA regulatory standard of 9 bar | 3 |
| 4.3.2 | Is basic or advanced pressure management being implemented? | There are PRV's in Moses Mabhida. | S | Proactively maintain and service the PRV's on an annual basis. | 3 |
| 4.3.3 | Are control valves pro-actively being maintained to prevent overflowing reservoirs? | The control valves are currently broken. | W | Replace the broken control valves. Undertake an<br><br>annual control valve audit to assess the condition of the control valves and ensure that they are in proper working order | 1 |
| 4.4 | **Consumer metering** | | | | |
| 4.4.1 | Are domestic and non-domestic consumers metered and which type of meter is used? | Most of the consumers are metered with the exception of Moses Mabhida. | T | Meter and bill 100% of non domestic connections as a priority and increasingly meter and bill the domestic consumers where practicable. | 1 |
| 4.4.2 | What is the condition, age and accuracy of water meters? | 2000 prepaid meters. There are meters older than 10 years in Pattison but most are less than 10 years. | T | Allocate a significant budget and implement a meter replacement programme in areas where the meters are older than 10 years, particularly for bulk and non domestic consumers as a first phase of | 1 |

| | | | | | |
|---|---|---|---|---|---|
| | | | | replacement | |
| 4.4.3 | Are the top consumers pro-actively monitored on a monthly basis? | Finance monitors the top consumers. The technical<br><br>department does have access to the information and are generally called to look at the readings and see if they agree with them. Sometimes finance requests and audit. | O | Initiate monthly monitoring of top non domestic consumers. Undertake a top consumer audit and<br><br>ensure that all connections are metered and billed. | 2 |
| 4.4.4 | Describe the water quality and its impact on consumer water meters? | | | | |
| 4.5.5 | What is the prevalence and control of illegal connections? | Illegal connections are not a major problem. | O | Actively monitor illegal connections and periodically undertake an audit on the meters. This can be conducted by the meter readers. | 3 |
| 4.5 | **Management information** | | | | |
| 4.5.1 | Does the Municipality have an asset register and asset management programme? | Yes. The WSA is GRAB compliant. The status of the asset management programme is uncertain. It appears that there is no programme in place. | | Review the asset register system in place. Maintain and update the asset register on an annual basis. Ensure that the asset register provides critical technical information such as the age, value and replacement date of the assets. | 2 |
| 4.5.2 | What is the status and age of as-built drawings? | No as built drawings are available for the areas that were inherited from the Western District. There are also no drawings for Pattison. The drawings were lost when their office burnt down. The municipal building were burnet in | | Develop electronic as built drawings for the whole network. | |

| | | | | | |
|---|---|---|---|---|---|
| | | Sept 2014, and the drawings that were available were burnt | | | |

# APPENDIX G: LAB RESULTS